Journal of Experimental Child Psychology 226 (2023) 105551

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

Why do young children overestimate their task performance? A cross-cultural experiment

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ARTICLE INFO

Article history:
Received 19 January 2022
Revised 31 August 2022
Available online 21 September 2022

Keywords:
Overestimation
Motivation
Cognitive immaturity
Cross-cultural comparison

ABSTRACT

Young children are generally overconfident in their abilities and performances, but the reasons that underlie such self-overestimation are unclear. The current cross-cultural experiment aimed to address this issue, testing the possibility that young children's overconfidence in task performance is, at least in part, motivated. We tested 89 Chinese children (49 % girls) and 104 Dutch children (50 % girls) aged 4 and 5 years and asked them to estimate how well they would perform on both a motor test and a memory task. They were randomly assigned to either an experimental condition (in which they were promised a reward for providing accurate performance estimates) or a no-incentive control condition, and then they performed the task. The incentive lowered Chinese (but not Dutch) children's performance overestimation on the motor task. Unexpectedly, children did not overestimate their performance on the memory task. Thus, this study supports the view that young children's self-overestimation can be motivated (rather than due to cognitive immaturity alone) but also reveals task contingencies and cultural differences.

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Introduction

Compared with older children and adults, young children are generally overconfident in their abilities, understanding, and knowledge. At least before 7 or 8 years of age, they tend to overestimate their

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https://doi.org/10.1016/j.jecp.2022.105551
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performance on various tasks and activities. For example, they believe that they are more capable of completing motor tasks than they actually are, they overestimate their abilities when performing cognitive tasks, they are overconfident of the decisions they make, and they believe to have higher peer status than reality warrants (Boulton & Smith, 1990; Lipko et al., 2009; Mills & Keil, 2004; Piehlmaier, 2020; Plumert, 1995). Although this phenomenon has been well established, the reasons why young children tend to overestimate themselves are not well understood. The current cross-cultural experiment addressed this issue; specifically, it tested the possibility that children's self-overestimation is motivated. We considered self-overestimation to be motivated if children are able to estimate their performance more accurately (e.g., when accuracy is incentivized) than they typically do. We tested this possibility by conducting a between-participants experiment using a motor and a memory task in samples of children growing up in a Western country (the Netherlands) and a non-Western culture (China).

Metacognitive immaturity and incorporation inconsistency

One explanation that has been offered for young children's self-overestimation emphasizes that young children still lack the (meta)cognitive ability that would allow them to develop more accurate self-perceptions. Thus, according to this account, self-overestimation is a manifestation of "(meta)cognitive immaturity" (reviewed in Bjorklund & Green, 1992; Schneider, 1985). Metacognition refers to individuals' knowledge of their own cognition and the factors that affect it (Bjorklund & Green, 1992). It involves awareness of one's abilities, the use of learning or performance strategies, and the evaluation and monitoring of problem solving (Bjorklund, 1997). Children's metacognitive abilities develop and improve gradually over time (Coutinho et al., 2005; Krueger & Mueller, 2002). Accordingly, the cognitive immaturity explanation holds that young children tend to self-overestimate because they are not yet fully capable of monitoring, realistically perceiving, or retaining information on their performances and abilities (Schneider, 2008)—a form of cognitive immaturity that has been labeled "monitoring deficiency" (Schneider, 1998).

However, some studies have found that young children persist in self-overestimation even if they have the cognitive abilities that should enable them to hold more accurate self-views. For example, even 4-year-old children are able to accurately remember their performance on a previous trial when asked to make a postdiction (i.e., to recollect their performance shortly after engaging on a task), and yet they remain overconfident when predicting their performance on the next trial (Lipko et al., 2009; Schneider, 1998). Other studies have shown that even when young children persist in overestimating their task performance across trials, they sometimes do show signs of using their previous experiences with the task. For example, Lipko-Speed (2013) found that when 4- and 5-year-old children were provided with exactly the same stimulus material on a memory task, they overestimated their performance on a second trial significantly less than they did on the first trial. Adding to this evidence, research has shown that slightly older children, from 6 years of age, are able to use social information to provide more accurate estimates of their ability. For example, children who watched a same-aged peer fail on a set of physical tasks subsequently made more conservative estimates of their own abilities as compared with their counterparts who saw the peer succeed (Plumert & Schwebel, 1997).

Together, these findings suggest that cognitive immaturity (i.e., lack of ability) is not the sole explanation for children's self-overestimation: Even if young children are able to monitor and accurately process their own (as well as their peers') performance, they somehow fail to consistently or fully incorporate this information into their performance estimates. Indeed, we have previously suggested that not "monitoring deficiency" but rather "incorporation inconsistency" characterizes young children's overestimation (Xia et al., 2022).

Motivation and wishful thinking

A second and potentially complementary explanation for young children's self-overestimation emphasizes motivational processes, especially those related to wishful thinking. According to this account, young children tend to make performance estimates based on how well they would want to perform rather than on how well they are actually able to perform (Lipko-Speed, 2013;

Schneider, 1998; Stipek et al., 1984). Young children's self-overestimation, then, is assumed to be due to their desire for performing well or, more generally, to their desire to be competent individuals.

There is some evidence consistent with the wishful thinking account. For example, studies have found that children's overestimation of performance is limited to their own performance, and when they estimate the performance of a peer (for whom they are less likely to desire good performance), their estimates can be more accurate (Lipko et al., 2009; Schneider, 1998; Stipek et al., 1984; Stipek & Hoffman, 1980). Moreover, when children are promised a reward for the good performance of a peer (so that good performance of the peer becomes more desirable), they tend to provide more inflated estimates of their peer's performance (Stipek et al., 1984). Importantly, some inconsistent findings have been obtained as well, suggesting that wishful thinking may account for self-overestimation on some tasks more than on others and in some cultures more than in others (Boseovski, 2010; Xia et al., 2022). Still, the body of literature is consistent with the view that young children make overly optimistic performance estimates to the extent that good performance is desirable—and, thus, that their self-overestimation may be motivated rather than due to cognitive immaturity per se. A direct test of the possibility that young children can estimate their own performance more accurately if they want to, however, is still lacking.

The development of self-representations across cultures

Children's self-perceptions are socially constructed and vary across cultures (Brummelman & Thomaes, 2017; Q. Wang, 2006). The content and valence of children's self-representations are shaped by the sociocultural context in which they grow up (Harter, 1998; Q. Wang, 2004). Research has shown that cultural socialization is embedded in the daily interactions between children and their social environments. For young children, parents play a central role as socializing agents such as in the context of family conversations, parent-directed meaning making, and disciplinary practices. Such exchanges convey culturally specific norms and beliefs to children, which shape their self-representations over time (Brummelman & Thomaes, 2017; Fung & Chen, 2001; Ng et al., 2019; Q. Wang, 2001).

In Western cultures, social norms emphasize the importance of positive distinctiveness and personal success (Markus & Kitayama, 1991; Sedikides et al., 2015). Children are exposed, from a young age, to messages that suggest it is desirable to be unique, to be self-reliant, or to stand out (Gürel & Brummelman, 2020; Thomaes et al., 2017; Young-Eisendrath, 2008). Conversely, in Eastern Asian cultures, social norms more often emphasize the importance of interpersonal cohesion and harmony—of "fitting in" rather than "standing out" (Markus & Kitayama, 1991). For example, notwithstanding within-cultural differences (Cai et al., 2012; Zhang et al., 2017), Chinese children are more often socialized to exercise restraint in how favorably they present themselves to others or how they communicate about their good performances (Luo et al., 2013; Y. Wang & Ollendick, 2001; Wu et al., 2002; Xu et al., 2005). Indeed, the traditional cultural norm of modesty, which is socialized from a young age, shapes the way in which children present themselves to others in Eastern Asian cultures (Kim et al., 2010; Q. Wang, 2004; Yamagishi et al., 2012).

Despite these cultural differences, our previous work in fact found important similarities in how Western (i.e., Dutch) and Eastern (i.e., Chinese) preschoolers and kindergarteners estimate their task performance; children from both countries overestimated their task performance to a similar extent and largely continued to do so even after obtaining performance feedback (Xia et al., 2022). Yet, whether the reasons why children self-overestimate are also similar across cultures is still unknown.

The current experiment

In the current cross-cultural, between-participants experiment, we addressed the overarching question of whether young children's self-overestimation is motivated. We tested whether young children estimate their task performance more accurately when they are promised a reward for accuracy. Such a finding would suggest that their self-overestimation is at least partly motivated and not due to cognitive inability alone. This would help to explain previous evidence that even when children are able to accurately monitor their performance, they do not reliably incorporate this information into the estimations of their future performance; it may often be more appealing or rewarding for them to be overly optimistic about their performance.

As in our earlier work, we invited Chinese and Dutch children to work on both a cognitive task and a motor task, and we tracked their estimated and actual performances across trials. We hypothesized that (1) children would overestimate their performance on both tasks, (2) children in the reward condition would overestimate themselves less than children in the control condition (an effect that may become progressively stronger across trials), and (3) the association between children's performance on one trial and their performance estimate for the next trial would be stronger for children in the reward condition than for those in the control condition. For each of the hypotheses, we explored potential differences between Chinese and Dutch children.

We preregistered our hypotheses, design, targeted sample size, and analysis plan with aspredicted.org *[As Predicted: "Can children make accurate performance estimates?" (#59771)].*

Method

Participants

We tested 104 children from the Netherlands (50 % girls) and 89 children from Mainland China (49 % girls). Participants were 4 and 5 years of age. We recruited participants for both samples in the same way. We contacted (pre)schools to ask whether they were interested in taking part in the study. If they were, we shared informed consent forms among parents of children aged 4 or 5 years. We conducted the study in the spring of 2021 in both countries. The study was approved by the ethics board of the Faculty of Social and Behavioural Sciences at Utrecht University.

Dutch children's mean age was 5 years 1 month (*SD* = 5.8 months, range = 48–71 months). They lived in central regions in the Netherlands, predominantly in suburban areas. Participants were recruited from the first two grade years of five primary schools. These schools serve communities that are relatively homogeneous in ethnicity (White) and middle class. The informed consent rate was 57.9 %. Education in the first two grade years in the Netherlands aims to help children adapt to school and mainly involves structured and collaborative play.

Chinese children's mean age also was 5 years 1 month (*SD* = 3.9 months, range = 52–71 months). They lived in the urban area of Suzhou City, Jiangsu Province. Participants were recruited from a preschool that serves communities that are homogeneous in ethnicity (Han Chinese) and middle to upper class. The informed consent rate was 51.0 %. Similar to the early grade years in Dutch primary schools, preschool education in Mainland China is mainly organized around structured and collaborative play as the main activity and is aimed at helping children adapt to the school system.

We excluded the data of seven participants on the motor task and the data of four participants on the memory task (all from China) from the pertaining analyses. Following our preregistered protocol, we excluded data either because participants in the experimental group failed to pass the control question after two attempts (n = 1 for both the motor and memory tasks), because they provided incomplete data (n = 2 for the memory task), or because one or more of their estimated or actual performance scores deviated more than three standard deviations from the mean (n = 5 and n = 1 for the motor and memory tasks, respectively). Thus, we analyzed motor task data of n = 103 Dutch children and n = 84 Chinese children[1] and memory task data of n = 104 Dutch children and n = 85 Chinese children[2].

[1] The composition of the final sample for the motor task was similar to the original sample (Dutch children: 51% girls, M_{age} = 5 years 1 month, *SD* = 5.8 months, range = 48–71 months; Chinese children: 52% girls, M_{age} = 5 years 1 month, *SD* = 3.9 months, range = 52–71 months).

[2] The composition of the final sample for the memory task was similar to the original sample (Dutch children: 50% girls, M_{age} = 5 years 1 month, *SD* = 5.8 months, range = 48–71 months; Chinese children: 51% girls, M_{age} = 5 years 1 month, *SD* = 4.0 months, range = 52–71 months).

Procedure

All participants performed the motor task first and then performed the memory task later the same day, with at least one hour between the two tasks. We administered the motor and memory tasks in a fixed order because our pilot study showed that it is easier for children of this age to meaningfully estimate their memory performance if they have experience with similar performance estimation tasks. Thus, we decided to start with the motor task, which was perceived as easier and more familiar. Participants were randomly assigned to either the experimental or control group. The experimenters spoke participants' native language (i.e., Dutch or Mandarin). All task instructions and responses to potential questions were standardized, translated, and back-translated from English by bilingual speakers.

Motor task

We modeled the procedures and instructions for the motor task after a task that we developed previously (Xia et al., 2022). In the current study, we implemented an experimental manipulation in the context of the task.

We tested children individually in a spacious place on their school grounds. We told them that the task would involve throwing a ball as far as possible. We invited children to stand in front of the starting line of a 4-m long and 1-m wide throwing field. The experimenter handed the ball (11 cm in diameter and 1 kg in weight) to the children and said, "Here you go. You can briefly hold the ball, so you know a bit how it feels." The experimenter then took the ball back and asked children to place a green flag on the throwing field to estimate how far they thought they could throw the ball. At this point, the experimenter told children in the experimental condition, "If you put the flag in the right place, so if you tell me precisely where the ball will land, you will get a surprise gift!" Children in the control condition were not given this instruction.

To ensure that the children in the experimental condition understood the instruction, we asked them a control question. The experimenter introduced a hypothetical child of about the same age, sex, and nationality who had performed the same task. The experimenter placed a green flag on the ground to index the peer's estimated performance and a blue flag on the same spot to index the peer's actual performance. The flags were placed away from the actual throwing field. Then the experimenter said, "[Name of hypothetical child] put the flag where he/she thought he/she would throw the ball. Then he/she threw the ball as far as possible, and the ball landed here. Do you think [name of hypothetical child] got a gift?" Children who answered incorrectly were given an explanation, and they then answered the question again with the flags placed at a different spot. Only the data of children who passed the question in two attempts (99.5 %) were included in the analyses.

Next, we registered the distance from the starting line to the green flag that children had placed to estimate their performance (i.e., Motor Estimate 1) and removed the flag immediately. We then asked children to return to the starting line and lift the ball over their heads. The experimenter instructed children, "When I count to three, you will throw the ball as far as possible, okay? Now, one, two, three." The experimenter observed where the ball first landed, placed a blue flag on the spot to provide children with performance feedback, and recorded the distance from the starting line (i.e., Motor Performance 1).

Next, with the blue flag still present, we asked children to place the green flag again to estimate their performance on the next trial (i.e., Motor Estimate 2). The experimenter then removed both flags, asked children to throw the ball as far as they could, and placed the blue flag where the ball landed (i.e., Motor Performance 2). We repeated this procedure until participants had made four estimates and we had recorded three ball-throwing distances. Note that we included an estimate after the last ball throw to be able to test whether children learn from their previous performance and adjust their estimates. The experimenter reminded participants in the experimental condition of the reward for accuracy each time they made a performance estimate.

On completion of the motor task, the experimenter told each participant in the experimental condition, "Because you could tell me so well how far you would throw the ball, you will receive a small gift!" and gave them a sticker. The experimenter told each participant in the control condition, "Because you worked so hard, you will receive a small gift!" and gave them a sticker as well. Next, we brought children back to their regular classrooms.

Memory task

We also modeled the procedures and instructions for the memory task after a task that we developed previously (Xia et al., 2022). However, in the current study, we simplified the task materials (i.e., the picture cards to be memorized) to shorten the task duration and ensure its equivalence to the motor task, and we implemented the experimental manipulation.

We tested participants individually in a quiet and private room at their school. We told them that the task would involve remembering as many picture cards as possible. We first laid out a set of 15 blank cards on the table and told children that in the actual task there would be pictures on the cards. The experimenter sat face to face with the children and said, "How many cards do you think you can remember? Just leave the number of cards that you think you can remember on the table. You can give the rest of the cards back to me." Here, the experimenter told participants in the experimental condition, "If the number of cards that you leave on the table is correct, so if you tell me precisely how many cards you will be able to remember, you will get a surprise gift!" Children in the control condition were not given this instruction.

The experimenter recorded how many cards children left on the table (i.e., Memory Estimate 1) and then removed all cards. Next, the experimenter showed a set of 15 picture cards. These cards had pictures of common objects that children this age are familiar with (e.g., fruits, animals, musical instruments, toys). The experimenter laid out the picture cards on the table one by one, read their names aloud (e.g., "cat," "pencil"), and asked children to repeat them. Only when children repeated the name of the picture correctly could they continue to the next card. Next, participants studied the picture cards, until the experimenter removed them after 15 s and said, "Now you can tell me the name of each picture that you remember." Each time a child recalled a picture correctly, the experimenter placed the pertaining picture card face down on the table. When children said that they could not recall any more pictures, or remained silent or distracted for more than 20 s, the experimenter ended the trial and recorded the number of correctly recalled picture cards (i.e., Memory Performance 1).

Next, with the correctly recalled face-down picture cards still on the table, children were asked to estimate their performance on the next trial (i.e., Memory Estimate 2). Again, the experimenter told children in the experimental condition (only), "Remember you will get a surprise gift later when you tell me precisely how many cards you will be able to remember." Note that each time we laid out cards on the table, we created a row with approximately equal distance between the cards to give children an intuitive understanding of how their estimate for the next trial related to their performance on the previous trial (thus, we did not need to rely on children's number sense). We used the same stimulus materials (i.e., the same set of 15 picture cards) and naming procedure throughout the experiment. Children were then asked again to study the cards and recall as many pictures as possible (i.e., Memory Performance 2). This procedure was repeated until participants had made four memory estimates and we had recorded three memory performances. Each time children in the experimental condition made a performance estimate, they were reminded of the reward.

On completion of the memory task, the experimenter prepared an array of small gifts (e.g., erasers, glitter pens) for participants to choose from. The experimenter told children in the experimental condition, "Because you could tell me so well how far you would throw the ball and how many pictures you would remember, you can pick a small gift!" The experimenter told children in the control group, "Because you worked hard at both tasks, you can pick a small gift!" After children chose a gift, we thanked them for their participation and brought them back to their regular classrooms.

Results

Analytic strategy

We first conducted a series of descriptive analyses, tested the equivalence of our samples and conditions, and explored potential sex and age effects for the main study variables.

To address Hypotheses 1 and 2 and the exploratory research question, for both tasks we conducted a 2 (Performance Index: estimated or actual) × 2 (Condition: experimental or control) × 3 (Trial: 1, 2, or 3) × 2 (Nationality: Dutch or Chinese) repeated-measures analysis of covariance (ANCOVA). We conducted follow-up analyses to interpret significant three-way interactions.

To address Hypothesis 3 and the exploratory research question, for both tasks we computed correlations between children's actual task performance and their performance estimations on subsequent trials. We compared the strength of the pertaining correlations between children in the accuracy reward and control conditions using the *cocor* program (Diedenhofen & Musch, 2015). To explore cultural specificity, we inspected the same pattern of correlations for children from the Netherlands and China separately.

The tests of the three hypotheses are confirmatory and were preregistered. The tests of cultural differences (and the descriptive analyses) are exploratory; this study provides the first cross-cultural test of the motivated nature of young children's self-overestimation.

Descriptive analyses

Tables 1 and 2 present the descriptive statistics for children's estimated and actual performances on the motor and memory tasks.

Children in both conditions did not differ in age or sex distribution (*ps* $\geq$.130), suggesting that random assignment to conditions was effective.

Children's estimates of performance were mostly unrelated to age, although on the motor task older children made more favorable estimates on Trial 3 (r =.17, p =.017, all other *ps* $\geq$.104). Older children performed better on both the motor task (*rs* $\geq$.20, *ps* $\leq$.007) and the memory task (*rs* $\geq$.15, *ps* $\leq$.045). We included age as a covariate in all subsequent analyses.

On the motor task, boys made more favorable estimates (M = 257.8) than girls (M = 217.8), F(1, 185) = 12.71, p <.001, η_p^2 =.064, and boys also performed better (M = 169.1) than girls (M = 145.2), F(1, 185) = 8.10, p =.005, η_p^2 =.042. On the memory task, boys made more favorable estimates (M = 8.17) than girls (M = 7.05), F(1, 187) = 8.17, p =.005, η_p^2 =.042, but there was no sex difference in performance, F(1, 187) = 0.04, p =.837, η_p^2 <.001. We also included sex as a covariate in all subsequent analyses.

Does the accuracy reward reduce children's overestimation?

For the motor task, there was a significant main effect of performance index; children estimated that they would perform better (M = 234.7) than they actually did (M = 157.4), F(1, 181) = 9.64, p =.002, η_p^2 =.051. The hypothesized Performance Index × Condition interaction was significant, F(1, 181) = 4.47, p =.036, η_p^2 =.024, indicating that the accuracy incentive caused children to overestimate their performance less.

We also found cultural differences. The Performance Index × Nationality interaction was significant, F(1, 181) = 66.16, p <.001, η_p^2 =.268, indicating that Dutch children overestimated their performance more than Chinese children. Furthermore, and importantly, the effectiveness of the accuracy reward in reducing performance overestimation differed among children from the Netherlands and China (Fig. 1). The Performance Index × Condition × Nationality interaction was significant, F(1, 181) = 6.31, p =.013, η_p^2 =.034. We conducted follow-up analyses for children from both countries separately to interpret the interaction. For Chinese children, the accuracy reward led to reduced self-overestimation (i.e., M = 23.9 vs M = 62.6 in the experimental vs control conditions, respectively), F(1, 80) = 13.04, p =.001, η_p^2 =.140. For Dutch children, however, the accuracy reward did not lead to reduced self-overestimation (i.e., M = 113.0 vs M = 109.7 in the experimental vs control conditions, respectively), F(1, 99) = 0.07, p =.790, η_p^2 =.001 (Fig. 1).

For the memory task, surprisingly, we found no significant main effect of performance index, F(1, 183) = 0.82, p =.366, η_p^2 =.004. Thus, across countries and conditions, children did not estimate that they would perform better than they actually did. There was a significant interaction of Performance Index × Nationality, F(1, 183) = 26.99, p <.001, η_p^2 =.129, indicating that Dutch children overestimated more (M = 1.73; M_{Estimate} = 7.89, $M_{\text{Performance}}$ = 6.16) than Chinese children (M = $-$0.27; M_{Estimate} = 6.96, $M_{\text{Performance}}$ = 7.23) (Fig. 2). However, follow-up analysis, which repeated the analysis for the Dutch

Table 1
Children's estimates and performances on the motor task.

		All children		Experimental condition		Control condition		Dutch children		Chinese children	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Trial 1	Estimate	265.8	107.0	241.6	103.9	288.7	105.4	297.3	98.7	227.1	104.6
	Performance	151.2	62.0	144.6	59.5	157.4	64.0	145.7	63.7	157.8	59.6
Trial 2	Estimate	221.6	90.3	208.4	90.2	234.2	89.0	241.7	96.5	197.0	75.5
	Performance	158.6	63.6	146.2	61.6	170.3	63.7	148.6	60.8	170.8	65.3
Trial 3	Estimate	226.4	90.7	204.0	91.6	247.7	85.0	238.5	97.2	211.5	80.1
	Performance	160.7	69.8	143.5	69.1	177.0	66.8	149.4	70.9	174.6	66.3
Trial 4	Estimate	235.1	102.5	203.4	102.6	265.2	93.4	250.4	112.0	216.3	86.5

Table 2
Children's estimates and performances on the memory task.

		All children		Experimental condition		Control condition		Dutch children		Chinese children	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Trial 1	Estimate	7.22	3.92	7.34	4.24	7.09	3.61	7.96	4.11	6.31	3.50
	Performance	6.01	2.06	6.02	2.12	6.00	2.02	5.47	1.67	6.67	2.31
Trial 2	Estimate	7.53	3.46	7.51	3.63	7.56	3.31	7.78	3.58	7.24	3.30
	Performance	6.84	2.06	6.73	2.00	6.94	2.13	6.38	1.87	7.39	2.16
Trial 3	Estimate	7.67	3.43	7.09	3.34	8.23	3.44	7.93	3.43	7.34	3.41
	Performance	7.07	2.48	6.92	2.46	7.21	2.51	6.60	2.20	7.65	2.69
Trial 4	Estimate	8.00	3.51	7.67	3.51	8.32	3.50	8.12	3.39	7.86	3.66

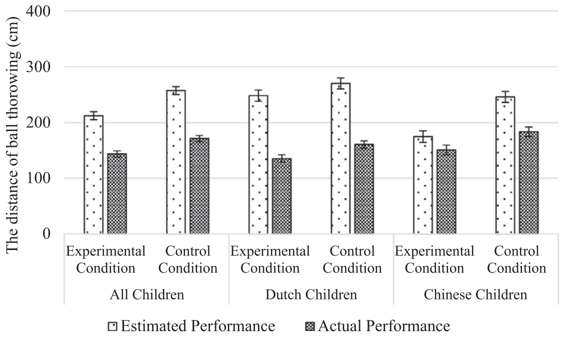

Fig. 1. Children's estimated and actual performances on the motor task in both conditions. Error bars represent standard errors.

sample only, found that even Dutch children did not significantly overestimate their performance, as indicated by a nonsignificant main effect of performance index, $F(1, 100) = 0.84$, $p = .363$, $\eta_p^2 = .008$.

Do the effects of the accuracy reward become progressively stronger across trials?

Because children did not overestimate their performance on the memory task, we addressed this question for the motor task only. Here, we found a significant interaction of Performance Index × Trial, $F(1.74, 314.11) = 5.58$, $p = .006$, $\eta_p^2 = .030$. Specifically, children's self-overestimation decreased significantly from Trial 1 to Trial 2, $F(1, 181) = 4.68$, $p = .032$, $\eta_p^2 = .025$, but not from Trial 2 to Trial 3, $F(1, 181) = 1.29$, $p = .258$, $\eta_p^2 = .007$. We found no evidence that the self-overestimation of children in the experimental condition decreased more steeply across trials compared with children in the control condition (which would have indicated a learning effect, such that it would have taken some time for the effect of the reward to manifest). Neither the Performance Index × Trial × Condition

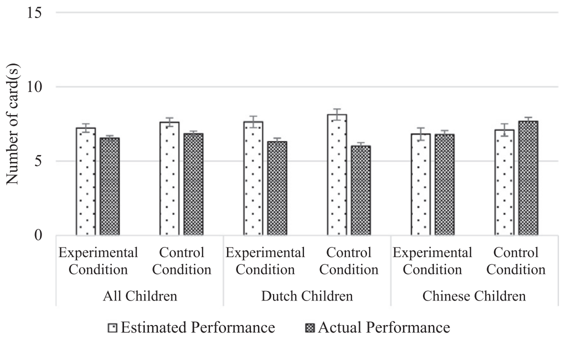

Fig. 2. Children's estimated and actual performance on the memory task in both conditions. Error bars represent standard errors.

interaction nor the Performance Index × Trial × Condition × Nationality interaction was significant ($ps \geq .079$).

Does the accuracy reward increase the strength of association between children's performance on a trial and their subsequent performance estimate?

To examine the extent to which participants incorporated performance feedback into the estimates of their future performance, we inspected the pattern of correlations between children's task performance and their performance estimates on later trials (with age and sex partialled out) for both tasks (Tables 3 and 4).

As for the motor task (Table 3), the correlations between children's actual performance on a trial and their performance estimate for the subsequent trial were strongly positive and significant. We found no differences in the strength of the pertaining correlations between children in the accuracy reward and control conditions ($ps \geq .114$).

As for the memory task (Table 4), the correlations between children's actual performance on a trial and their performance estimates for the subsequent trial were moderately positive and significant. Again, the strength of the correlations did not differ for children in the accuracy reward and control conditions ($ps \geq .096$).

Thus, across cultures, we found no indications that children were more likely to incorporate performance feedback into their performance estimations when they were rewarded for accuracy.

Next, we inspected the same pattern of correlations for children from the Netherlands and China separately. For Dutch children, we found no significant differences between the pertaining correlations in the accuracy reward and control conditions for both tasks. For Chinese children, we found two significant differences. On the motor task, the correlation between children's actual performance on Trial 3 and their estimated performance on Trial 4 was less strong in the control condition as compared with the accuracy reward condition (Fisher's $z = 2.58$, $p = .001$). Similarly, on the memory task, the correlation between children's actual performance on Trial 1 and their estimated performance on Trial 2 was less strong in the control condition as compared with the accuracy reward condition (Fisher's $z = 2.10$, $p = .035$). Thus, for Chinese children, we found some indications that children were more likely to incorporate performance feedback into their performance estimations when they were rewarded for accuracy.

Robustness analyses

Our main research questions can also be addressed by using an alternative analytical approach that relies on a single index of children's overestimation. Although we did not preregister this approach, we conducted the analyses nonetheless. The results are reported in the online supplementary material.

Specifically, we computed an overestimation index by dividing children's estimated performance by their corresponding actual performance. For the motor task, the results replicate the finding that

Table 3
Correlations between estimates and performances on the motor task.

<table>
<tr><th></th><th>Estimate 2</th><th>Estimate 3</th><th>Estimate 4</th><th>Performance 1</th><th>Performance 2</th><th>Performance 3</th></tr>
<tr><td>Estimate 1</td><td>.49***
(.54***/.40***)</td><td>.37***
(.34**/.32**)</td><td>.36***
(.30**/.32**)</td><td>.30***
(.26*/.28**)</td><td>.21**
(.07/.23*)</td><td>.15*
(.07/.11)</td></tr>
<tr><td>Estimate 2</td><td></td><td>.68***
(.71***/.62***)</td><td>.52***
(.61***/.40***)</td><td>.53***
(.49***/.54***)</td><td>.48***
(.46***/.45***)</td><td>.38***
(.35**/.36***)</td></tr>
<tr><td>Estimate 3</td><td></td><td></td><td>.76***
(.84***/.64***)</td><td>.42***
(.35**/.45***)</td><td>.53***
(.48***/.52***)</td><td>.56***
(.59***/.45***)</td></tr>
<tr><td>Estimate 4</td><td></td><td></td><td></td><td>.34***
(.41***/.24*)</td><td>.45***
(.43***/.40***)</td><td>.60***
(.64***/.48***)</td></tr>
<tr><td>Performance 1</td><td></td><td></td><td></td><td></td><td>.70***
(.69***/.68***)</td><td>.57***
(.60***/.53***)</td></tr>
<tr><td>Performance 2</td><td></td><td></td><td></td><td></td><td></td><td>.75***
(.65***/.82***)</td></tr>
</table>

Note. Bold values are the correlations between performance on Trial n and estimate on Trial $n + 1$. Correlations under the experimental and control conditions, respectively, are reported in parentheses.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 4
Correlations between estimates and performances on the memory task.

<table>
<tr><th></th><th>Estimate 2</th><th>Estimate 3</th><th>Estimate 4</th><th>Performance 1</th><th>Performance 2</th><th>Performance 3</th></tr>
<tr><td>Estimate 1</td><td>.41***
(.37***/.49***)</td><td>.36***
(.36***/.39***)</td><td>.29***
(.28**/.31**)</td><td>.12
(.14/.10)</td><td>.18*
(.18/.19)</td><td>.11
(.16/.06)</td></tr>
<tr><td>Estimate 2</td><td></td><td>.45***
(.47***/.47***)</td><td>.48***
(.54***/.42***)</td><td>.25**
(.36**/.13)</td><td>.30***
(.41***/.20)</td><td>.04
(.10/-.01)</td></tr>
<tr><td>Estimate 3</td><td></td><td></td><td>.63***
(.61***/.64***)</td><td>.19*
(.29**/.10)</td><td>.40***
(.50***/.32**)</td><td>.25**
(.39***/.11)</td></tr>
<tr><td>Estimate 4</td><td></td><td></td><td></td><td>.19**
(.24*/.16)</td><td>.33***
(.28**/.39***)</td><td>.27***
(.27*/.28**)</td></tr>
<tr><td>Performance 1</td><td></td><td></td><td></td><td></td><td>.59***
(.53***/.65***)</td><td>.47***
(.34**/.58***)</td></tr>
<tr><td>Performance 2</td><td></td><td></td><td></td><td></td><td></td><td>.63***
(.59***/.66***)</td></tr>
</table>

Note. Bold values are the correlations between performance on Trial n and estimate on Trial $n + 1$. Correlations under the experimental and the control conditions, respectively, are reported in parentheses.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

the accuracy incentive causes reduced overestimation in Chinese children but not in Dutch children. For the memory task, the alternative approach does allow for evaluating effects of the accuracy incentive (because it does not hinge on children's actual and estimated performance being significantly different). Here, we found little evidence that the accuracy incentive influenced the degree to which Chinese and Dutch children overestimated themselves.

Discussion

This preregistered cross-cultural experiment examined to what extent young children's frequently observed overestimation of performance is motivated rather than due to cognitive inability alone. We did so by testing whether the promise of a reward for providing accurate performance estimates would reduce preschoolers' and kindergarteners' performance overestimation. On the motor task that we conducted, we found that it did, but only for Chinese children (not for Dutch children). Chinese children in the accuracy reward condition provided more accurate motor performance estimates than those in the control condition. Unexpectedly, on the memory task, children did not overestimate their performance to begin with, and so we were unable to examine the putative effects of the accuracy reward for this task using our preregistered approach.

Even if our experimental findings pertain to the motor task only and were not consistent across cultures, they indicate that young children's self-overestimation *can* be motivated. That is, Chinese children proved to be able to estimate their performance more accurately when it was desirable for them to do so. This is not what we would have found if they were unable to monitor their performances or calibrate their performance estimates altogether. Experts have argued that young children often engage in wishful thinking; their desires color their perceptions and beliefs about reality, which may lead them to overestimate their abilities and performances (Bernard et al., 2016; Stipek et al., 1984). They *want* to be able to perform well, and so they *think* they will be able to perform well. The current study suggests that this process is relatively malleable and shows that subsets of young children can estimate their performance more accurately when doing so is incentivized.

Our findings can be understood in light of the motive for self-enhancement—the universal tendency for individuals to view themselves favorably. The self-enhancement motive explains why individuals are often concerned with achieving well and earning social approval or acclaim; these experiences allow for experiencing oneself as a competent person worthy of approval (Alicke & Sedikides, 2009; James, 1950; Sedikides & Gregg, 2008). The motive for self-enhancement can be observed from a young age such as in children's drive for reputation management, tendency to make self-serving attributions, or sensitivity to experiencing failure (Kelsey et al., 2018; Thomaes et al., 2017; Trzesniewski et al., 2011). As such, we propose that the motivated nature of self-overestimation that we observed in Chinese children can be seen as a manifestation of self-enhancement; even if they are able to view themselves relatively accurately, the desire to view themselves favorably positively biases their performance estimation.

What explains why we observed motivated self-overestimation in Chinese children but not in Dutch children? We speculate that providing accurate (rather than excessively flattering) self-estimations of performance is compatible with the prevalent social norm of modesty in China. From a young age, Chinese children are aware of the norm for modest self-presentation, more so than children growing up in Western societies (Luo et al., 2013; Y. Wang & Ollendick, 2001; Wu et al., 2002; Xu et al., 2005). As such, it might not be surprising that they were more responsive than Dutch children to the incentive to estimate their performance accurately. Dutch children may have been less responsive to that incentive because of the social norm for positive distinctiveness that they are more familiar with (Gürel & Brummelman, 2020; Thomaes et al., 2017; Young-Eisendrath, 2008).

Importantly, although the accuracy reward reduced Chinese children's self-overestimation, it did not eliminate it entirely. One possible explanation is that the reward that we used to incentivize accuracy was not powerful enough to fully override the motivational appeal of providing favorable performance estimates. Another explanation, however, is that children's self-overestimation is only partly motivated. Of course, cognitive immaturity may still contribute to children's self-overestimation even if it does not fully account for it. Such cognitive immaturity effects may be especially pronounced for tasks that children are unfamiliar with and, thus, that require the allocation of limited mental resources. For example, engaging in a motor task and estimating how well one will perform is an unfamiliar and relatively effortful activity that might make the metacognitive information processing that is needed to form accurate performance predictions more challenging (Bjorklund & Green, 1992).

This may also account for why we found no overestimation on the memory task, which was relatively easy. Whereas in our previous work we asked participants to memorize new sets of pictures for each trial (Xia et al., 2022), in the current study we asked participants to memorize the same set of pictures for each trial. Not only did participants recall more pictures in the current study (i.e., an average difference of 2.6 cards), they also estimated their memory performance more accurately. This dovetails with previous evidence that children's performance overestimation is higher when they need to memorize new sets of pictures as compared with familiar ones (Lipko-Speed, 2013). Thus, the relative ease of the memory task that we used may explain why children did not self-overestimate on this task; it may have allowed children to more effectively engage in the metacognitive processing that is needed to form accurate performance estimations.

Strengths, limitations, and future research

Our research provides the first causal test of the psychological underpinnings of young children's self-overestimation. It did so by comparing samples of children who grow up in Western countries (i.e., the Netherlands) and non-Western countries (i.e., Mainland China), which allowed us to establish cultural differences. We used well-established performance prediction methodological paradigms and adopted behavioral assessments of estimated and actual performances to avoid language confounds and allow direct cross-cultural comparisons.

We also acknowledge limitations. We slightly adjusted our memory task as compared with the one we used in our previous work (Xia et al., 2022)—we used identical rather than different sets of picture cards for each trial—to make the memory and motor task procedures identical. This adjustment made the memory task easier, which may have been the reason why children did not overestimate their memory performance. This finding illustrates that although children often overestimate themselves, such overestimation is not absolute or unavoidable; in fact, task characteristics influence whether and to what extent children overestimate themselves.

We examined young children's overestimation of performance, assuming that they would not strategically adjust their actual performance to match their estimated performance. In other words, we assumed that children would always perform as well as they could. However, we found that, for the motor task, participants in the experimental condition did perform slightly worse than those in the control condition. Although we did not observe children in the experimental condition to deliberately perform worse than they could, we cannot rule out the possibility that some of them did. Thus, the results on the task should be interpreted with this caveat in mind. For future work, one approach to identify children's putative use of "opportunistic underperformance strategies" would be to measure their pre-manipulation task performance (i.e., their task performance before receiving experimental instructions that incentivize accurate performance estimates). This would allow researchers to detect improbable discrepancies between children's baseline and post-manipulation performance.

Finally, we administered the motor and memory tasks in a fixed order. Although the fixed order was necessary for our experiment, we do acknowledge the inherent downsides to such an approach. For example, we cannot rule out the possibility that, following the motor task, some children in the experimental condition realized that they were rewarded regardless of how well they did (i.e., some participants received a sticker even if their performance estimates had not been very accurate). This might have influenced how some participants approached the memory task. Future work could replicate the current study findings using a counterbalanced design.

Conclusions

Our research provides the first causal and cross-cultural evidence that young children's self-overestimation can be motivated. Chinese children (but not Dutch children) overestimated their motor performance less when they were incentivized to do so, which suggests that cognitive immaturity (i.e., lack of ability) is not the sole explanation for the self-overestimation in which young children often engage. Moreover, our findings demonstrate that young children's self-overestimation and its psychological underpinnings are not set in stone but rather are malleable and dependent on task characteristics and cultural differences.

Data availability

No data was used for the research described in the article.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jecp.2022.105551.

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