A cooperation advantage for theory of mind in children and adults

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Study 1: Scripts

Counterbalance order of task: half get Stickers task first, half get Day-Night first

Competition **Condition – 4 stickers**

You like stickers, right? Well, E2 likes stickers, too. Let me tell you about this game. Ok (child's name), here is the game. The goal of the game is to get as MANY stickers as you each can. You try and get as many as you can, and she'll try and get as many as she can. You and E2 both like these stickers, but in this game, only ONE person can win stickers at a time.

To play the game, I'll ask E2 to close her eyes, and then you can hide this sticker in one of these cups. You can put the sticker in this cup or in this cup, in any cup you like! Now, after you hide the sticker while E2 can't see you, I will tell E2 she can open her eyes, and she will ask you a question about where the sticker is, and you can tell her this cup [points left] or this cup [points right], whatever cup you want. Then E2 will guess where the sticker is.

Now here's how the game goes. If E2 guesses the wrong cup, then YOU get to keep the sticker, but if E2 guesses the right cup, then SHE gets to keep the sticker! Get it?

So we'll play the game the same way every time—you always get to hide the sticker and E2 will ask you a question and then guess where the sticker is. Ok, just to make sure you understand the rules: If E2 guesses right, who gets to keep it? If she guesses wrong, who gets to keep it?

Great, ok. Remember, the goal of the game is to win as many stickers as you can! You can take home all the stickers you win.

E1 to E2: Ok E2, close your eyes! No peeking!
E1 to child: ok, hide the sticker! Did you hide it?
E1 to E2: Ok E2, you can open your eyes and ask (child's name) a question!
E2 to child: ok (child's name), now I'm going to ask you, can you show me where the sticker is? [if they don't respond in the expected way] Can you pick one for me?
E2: [ponders] I think the sticker is in this cup [points to the cup that the child pointed at]
If sticker is in the cup, E1: "E2 guessed right! Since she found the sticker, she gets the sticker!" and gives it to E2.
If the sticker is not in the cup, E1: "Huh, no sticker", find the sticker and gives the sticker to the child, "E2 guessed wrong! Since she didn't find the sticker, this time the sticker goes to you!"
E1: Great! Ok, remember, we want to have as many stickers to take home at the end of the game!

Question at the end:

Alright, we are done with this game. I just have one question for you:
[memory] Which was the last cup that E2 pointed to?

Cooperation **Condition – 4 stickers**

You like stickers, right? Well, E2 likes stickers too. Let me tell you about this game. Ok (child's name), here is the game. The goal of the game is to get as MANY stickers as you each can. You try and get as many as you can, and she'll try and get as many as she can. You and E2 both like these stickers, and in this game, you can BOTH get stickers at the same time.

To play the game, I'll ask E2 to close her eyes, and then you can hide two stickers in one of these cups. You can put the stickers in this cup or in this cup, in any cup you like, but both stickers have to go in the same cup! Now, after you hide the stickers while E2 can't see you, I will tell E2 she can open her eyes, and she will ask you a question about where the stickers are, and you can tell her this cup [points left] or this cup [points right], whatever cup you want. Then E2 will guess where the stickers are.

Now here's how the game goes. If E2 guesses the wrong cup, then each of you gets to keep one sticker! But if E2 guesses the right cup, then NEITHER of you gets any stickers and they go back in the box! Get it?

So we'll play the game the same way every time—you always get to hide the stickers and E2 will ask you a question and then guess where they are. Ok, just to make sure you understand the rules. If E2 guesses right, who gets to keep them? If she guesses wrong, who gets to keep them?

Great, ok. Remember, the goal of the game is to win as many stickers as you can! You can take home all the stickers you win.

E1 to E2: Ok E2, close your eyes! No peeking!
E1 to child: ok, hide the stickers! Did you hide them?
E1 to E2: Ok E2, you can open your eyes and ask (child's name) a question!
E2 to child: ok (child's name), now I'm going to ask you, can you show me where the stickers are?
[if they don't respond in the expected way] Can you pick one for me?
E2: [ponders] I think the sticker is in this cup [points to the cup that the child pointed at]
If stickers are in the cup, E1: "E2 guessed right! Since she found the stickers, no one gets any stickers!"
If the stickers are not in the cup, E1 "Huh, no stickers", find the stickers and give stickers to the child and E2, "E2 guessed wrong! Since E2 didn't find the stickers, this time you both get a sticker!"
E1: Great! Ok, remember, we want to have as many stickers to take home at the end of the game!

Question at the end:

Alright, we are done with this game. I just have one question for you:
[memory] Which was the last cup that E2 pointed to?

Competition **Condition – Day-Night**

OK, (child's name)! Let's play a game where you try to get as many of these cards as you can! Your goal is to get more cards than E2, who already played this game before! At the end of the game, if you get *more* than E2, *you* get to keep a sheet of 4 stickers! If you get *less* than E2, *E2* gets to keep a sheet of 4 stickers!

Here are the rules!
When you see this card [night], I want you to say 'day'. Can you say 'day'?
When you see this card [day], I want you to say 'night'. Can you say 'night'?

[For the rest of the task, do NOT say the words 'night' or 'day']

Practice trials:

Alright, let's do some practice so we can make sure you understand the rules!

[There are two practice trials: one for day and one for night. Show the day card and then the night card (counterbalance the order). For each card, show without instructions. If child hesitates, say "What do you say for this one?"]

[If correct] Great!

[If child gets any of them incorrect] Remember the rules! When you see this card [night], I want you to say 'day', and when you see this card [day], I want you to say 'night'!

[If child gets 3rd set of practice trials wrong, end task and mark data for this task as unusable]

Test trials:

OK, let's play the game!

[16 trials with no feedback]
[If child hesitates, say "What do you say for this one?"]

End:

[if child receives equal to or greater than 8 cards] You got more than E2! That means you get a sheet of 4 stickers!
[if child receives less than 8 cards] You got less than E2! That means E2 gets a sheet of 4 stickers.

Cooperation **Condition – Day-Night**

OK, (child's name)! Let's play a game where you try to get as many of these cards as you can! Your goal is to get more cards than E2, who already played this game before! At the end of the game, if you get *more* cards than E2, *you* get a sheet of 4 stickers and E2 will *also* get a sheet of 4 stickers! If you get *less* than E2, no one gets anything!

Here are the rules!
When you see this card [night], I want you to say 'day'. Can you say 'day'?
When you see this card [day], I want you to say 'night'. Can you say 'night'?

[For the rest of the task, do NOT say the words 'night' or 'day']

Practice trials:

Alright, let's do some practice so we can make sure you understand the rules!

[There are two practice trials: one for day and one for night. Show the day card and then the night card (counterbalance the order). For each card, show without instructions. If child hesitates, say "What do you say for this one?"]

[If correct] Great!

[If child gets any of them incorrect] Remember the rules! When you see this card [night], I want you to say 'day', and when you see this card [day], I want you to say 'night'!

[If child gets 3rd set of practice trials wrong, end task and mark data for this task as unusable]

Test trials:

OK, let's play the game!

[16 trials with no feedback]
[If child hesitates, say "What do you say for this one?"]

End:

OK, that's the end of the game! Let's count the number of cards you got!

[if child receives equal to or greater than 8 cards] You got more than E2! That means you each get a sheet of 4 stickers!
[if child receives less than 8 cards] You got less than E2. That means you don't get *any* stickers.

Study 1: Participant information

The final sample consisted of 120 participants (Table S1). Of the 146 participants that were recruited for Study 1, 26 were excluded due to: participant not wanting to continue (10), parental interference (5), participant not understanding the rules (3), experimenter error (3), participant having a hearing disability (1), participant having a neurodevelopmental disorder (1), participant not paying attention to the task (1), participant being too shy to respond (1), and rain, which cut the test session short (1).

Table S1. Final sample breakdown by age, gender, and condition for Study 1

	Female	Male	Total
Cooperation	37	23	60
Competition	29	31	60
Grand Total	**66**	**54**	**120**

Table S2. Study 1 exclusions, broken down by criteria and condition

	Total Excluded	Competition	Cooperation
Did not want to continue	10	4	6
Did not understand the rules	3	1	2
Has hearing disability	1	0	1
Has neurodevelopmental disorder	1	1	0
Experimenter error	3	1	2
Parental interference	5	3	2
Did not pay attention to the task	1	0	1
Was too shy and didn't respond	1	0	1
Weather-related	1	0	1
Total	**26**	**10**	**16**

Study 1: Supplemental Results

Relationship between Condition, Age, and Time

We provide the figure below to show the interaction between Condition and Age for each trial. We note that we tested, in a post-hoc manner, the three-way interaction between Condition, Age, and Trial. This three-way interaction was not significant ($\chi^2(3) = 3.821$, $p = 0.28$), suggesting that the Condition by Age interaction holds across trials.
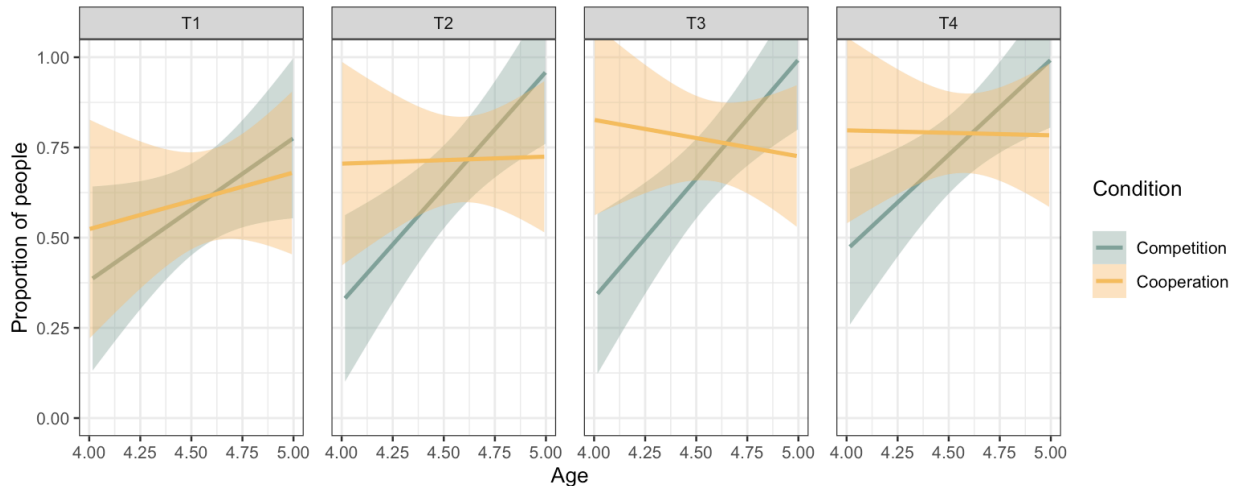

Figure S1. Performance on the Stickers task by Age, Condition, and trial number.

Relationship between the three measures (Stickers task, Day-Night task, memory question)

We tested how well performance on the memory question and on the Day-Night task could predict performance on the Stickers task. Neither were significant predictors (Day-Night: $\chi^2(1) = 0.057$, $p = 0.81$; memory: $\chi^2(1) = 0.052$, $p = 0.82$).

Preliminary study prior to Study 1

We conducted an earlier version of Study 1 with three-, four-, and five-year-olds. One large limitation of this study was that we did not have comprehension questions that ensured that participants could understand the rules of the task. Because of this large flaw, we made the decision to not include this study in the main text. For full disclosure, we included details of the study here.

Methods

Participants were recruited from a community-based science center and tested in a soundproof room dedicated to behavioral science research in British Columbia, Canada. A legal guardian provided informed consent for all children.

The final sample consisted of 541 participants: 166 three-year-olds (89 females), 251 four-year olds (130 females), and 124 five-year-olds (54 females). Of the 662 participants that were recruited for Study 1, 121 were excluded due to: age outside our age range of interest (30), incompletion of the task or declining to do the task (21), parental/other interference (11), insufficient understanding of English (9), lack of understanding of the task (9), lack of attention to the task (6), experimenter error (6), indications of not following task instructions (5), participant having previously seen or completed the task (3), invalid consent forms (2), participant having a developmental disorder (2), fussing out (2), being a part of experimenter pilot/training (2), or having data noted by the experimenter as unusable (13).

Table S3. Sample breakdown by age, gender, and condition for the preliminary study

	Female	Male	Total
Competition			
three	48	38	**86**
four – 4 stickers	26	26	**52**
four – 8 stickers	39	30	**69**
five	27	34	**61**
Cooperation			
three	41	39	**80**
four – 4 stickers	35	30	**65**
four – 8 stickers	30	35	**65**
five	27	36	**63**
Grand Total	**273**	**268**	**541**

Table S4. Comparing ages across Cooperation and Competition conditions for each age group in the preliminary study

	t	df	p
three	-0.013	161.96	0.990
four	-0.557	248.99	0.578
five	-0.900	121.95	0.370

Table S5. Exclusions broken down by criteria and condition for the preliminary study

Preliminary Study	Total Excluded	Competition	Cooperation
Age outside of age of interest	30	9	21
Incompletion or declining to do the task	21	9	12
Insufficient understanding of English	9	7	2
Parental / other interference	11	4	7
Lack of understanding of the task	9	3	6
Lack of attention to the task	6	3	3
Experimenter error	6	2	4
Indications of not following task instructions	5	5	0
Participant previously saw or completed the task	3	1	2
Invalid consent forms	2	1	1
Has a developmental disorder	2	2	0
Fussed out	2	1	1
Data marked as unusable but reason was unspecified	13	3	10
Total	**119**	**50**	**69**

Procedure

In this preliminary study, participants were introduced to a two-person game involving stickers, where the goal of the game was to get as many stickers as possible. Each participant was assigned to either the *Competition* condition or the *Cooperation* condition (see complete script in Supplementary Material). For both conditions, the participant was instructed to hide two stickers in one of two cups while a second player (a second experimenter, hereafter referred to as E2) had her eyes closed. The participant was instructed to respond however he or she wanted (e.g., by pointing to either Cup #1 or Cup #2) when E2 opened her eyes and asked the participant where the stickers were. E2 would then make a guess as to where the stickers were solely based on the participant's response. In the *Competition* condition, only one person won stickers at a time: if E2 guessed correctly, she kept both stickers, but if she guessed incorrectly, the participant got to keep both stickers. In the *Cooperation* condition, both players could win stickers at the same time: if E2 guessed correctly, neither player got any stickers, but if she guessed incorrectly, the participant and E2 each got to keep one of the two stickers. In order to succeed on either task, the

participant would have to plant a false belief in E2's mind. Each participant played four rounds of this game; thus, the participant had the opportunity to win up to 8 stickers in the *Competition* condition and up to 4 stickers in the *Cooperation* condition.

We included two additional conditions for the 4-year-old group to address a potential concern: that any difference in performance between the *Competition* and *Cooperation* conditions could be driven by the difference in the maximum number of stickers that could be won (8 stickers in the *Competition* condition versus 4 stickers in the *Cooperation* condition). Participants could be more motivated to do well (to plant a false belief in another's mind), with a larger possible prize on the line (in this case, more stickers). Thus, we included a condition in which participants had the opportunity to win up to 4 stickers in the *Competition* condition and another in which participants could win up to 8 stickers in the *Cooperation* condition. In total, we had 4 conditions: *Competition-8 stickers*, *Cooperation-8 stickers*, *Competition-4 stickers*, and *Cooperation-4 stickers* (see scripts in Supplementary Material). Because we expected any potential difference to emerge around 4 years of age, as predicted by prior work, we recruited only 4-year-olds for these two additional conditions.

For the 3-year-olds, we introduced an additional control condition (*Pompom* condition) to address the concern that poor performance on this task among this age group could be attributed to difficulties with pointing. In this condition, 3-year-olds were instructed to place pompoms in front of one of the two cups (in lieu of pointing to the cup) when responding to E2's question of where the stickers were (see script in Supplementary Material). No difference in performance was found for the pompom versus non-pompom condition ($\chi^2(1) = 0.140$, $p = 0.71$), indicating that the added step of pointing does not negatively affect performance on this task. In our main analyses, we include data from both the *Pompom* and *Non-Pompom* conditions.

Analyses

Analyses were conducted in R (version 3.3.3; R Core Team, 2015). Responses were analyzed using Generalized Linear Models with proportion data. We were primarily interested in whether the proportion of stickers won depended on age and condition; our full model included the following predictor variables: Condition (cooperation or competition), Age Category (three, four, or five), and Gender (male or female). We also examined the two-way interaction between Condition and Age Category. To assess the importance of our predictors of interest, we performed likelihood ratio tests (LRTs) and examined whether the model including a given term provided a significantly better fit to the data than the model without that term.

<div align="center">

Results

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Analyses revealed no interaction between Condition (cooperation or competition) and Age Category ($\chi^2(2) = 3.5864$, $p = 0.1664$), suggesting that the effect of Condition did not vary across age group. Unsurprisingly, there was a significant main effect of Age Category ($\chi^2(2) = 242.25$, $p < 0.001$): the log odds of winning stickers were greater among older versus younger age groups. More importantly, and central to the present hypotheses, we found a significant main effect of Condition ($\chi^2(1) = 4.4441$, $p = 0.035$): the log odds of winning stickers were greater for the *Competition* condition than for the *Cooperation* condition. Entering age as a continuous variable

revealed the same pattern of results: significant main effects of Condition ($\chi^2(1) = 6.2352$, $p = 0.013$) and Age ($\chi^2(1) = 233.08$, $p < 0.001$).

Even though the interaction between Condition and Age Category was not significant, we nevertheless performed contrasts examining the difference between Conditions at each Age Category. These preplanned contrasts revealed a greater difference for competition versus cooperation among 4-year-olds ($z = 2.489$, $p = 0.0128$), but no difference between cooperation and competition among 3-year-olds ($z = 1.299$, $p = 0.1940$) or 5-year-olds ($z = 0.031$, $p = 0.9753$) (Fig. S2a). To examine whether performance in the task among 4-year-olds could be predicted by alternative factors such as the total possible number of stickers a participant could win (4 versus 8), we examined the effects of Condition and Total Number of Possible Stickers by analyzing just the data with 4-year-olds (Fig. S2b). We did not see a significant effect of total possible number of stickers ($\chi^2(1) = 2.4572$, $p = 0.117$), and, more importantly, we still found a marginal effect of Condition after controlling for Total Number of Possible Stickers ($\chi^2(1) = 3.3141$, $p = 0.069$).
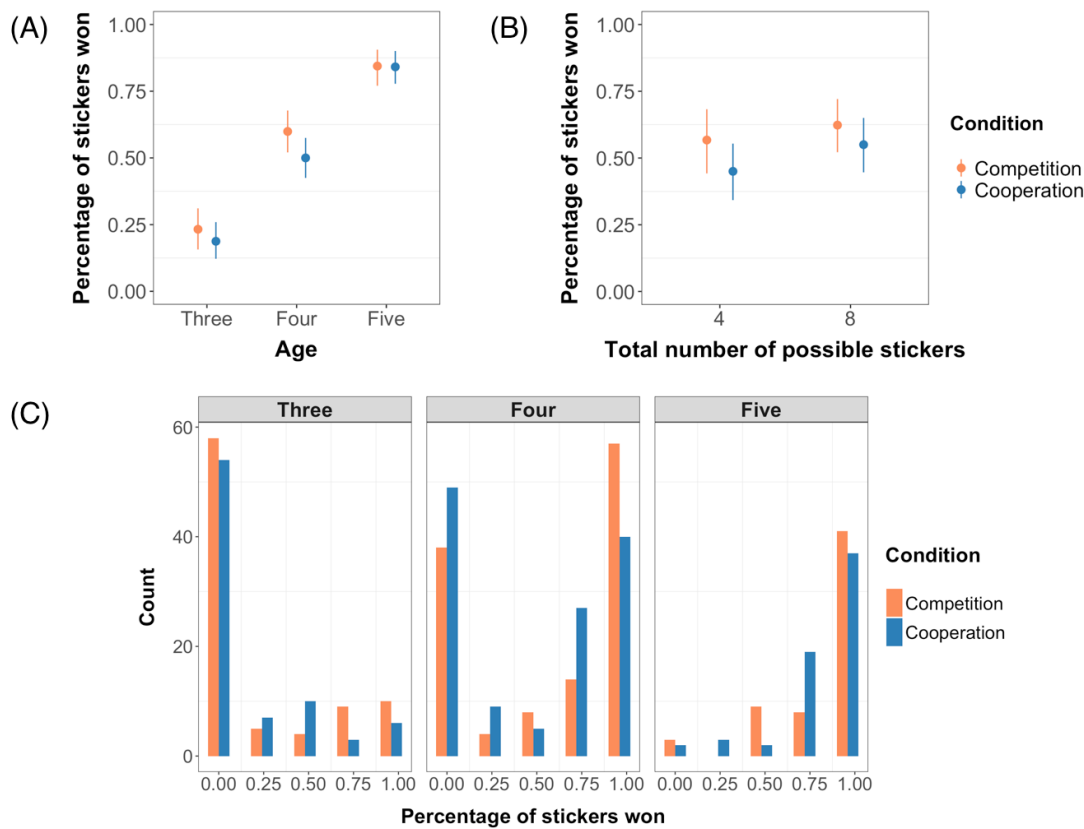

Figure S2. Performance on the Stickers game in Study 1. Proportion of stickers won, (A) broken down by Age Category and Condition, (B) broken down by Condition and Total Number of Possible Stickers for the 4-year-old age group, and (C) depicted as a histogram broken down by Age Category and Condition. Note that the sample size of 4-year-olds is much larger than other groups due to the inclusion of two additional conditions, which makes it difficult to compare bar sizes across age groups. Error bars denote 95% CIs.

Discussion

Unfortunately, this study had one large flaw that precluded us from seriously considering the results of this study: the rules for the *Cooperation* condition ("If E2 guesses wrong, then each of you gets to keep one sticker! But if E2 guesses right, then NEITHER of you gets any stickers and they go back in the box!") may have been more difficult to understand than the rules for the *Competition* condition ("If E2 guesses wrong, then YOU get to keep both the stickers, but if E2 guesses right, then SHE gets to keep both the stickers!"). While deception for benign or cooperative reasons does exist and children demonstrate the ability to understand it (e.g., masking true feelings so that others' feelings don't get hurt, telling white lies or throwing surprise parties; Davis, 2001; Hadwin & Perner, 1991; MacLaren & Olson, 1993; Wellman & Banerjee, 1991), deception for cooperative reasons may still occur less frequently than deception for competitive reasons. Planting a false belief in someone's mind for cooperative reasons may have been unintuitive and unrealistic for our participants. We cannot rule out the possibility that participants who completed the task did not entirely understand the rules of the game, given the relatively unintuitive nature of deception in the name of cooperation. If so, by ensuring that participants understood the rules with comprehension checks we can reduce the concern that participants performed worse in the *Cooperation* condition because they had more difficulty understanding the rules for the *Cooperation* condition.

We made five main changes to Study 1 based on this earlier version: (1) We added comprehension checks to make sure that participants understood the rules of the game before continuing on with the task. We did this to address one major concern: that children may have performed worse in the *Cooperation* condition because the instructions for the *Cooperation* condition were more difficult to understand. That is, the rules for the *Competition* condition were relatively straightforward: "If E2 guesses wrong, then YOU get to keep both the stickers, but if E2 guesses right, then SHE gets to keep both the stickers!". In contrast, the rules for the *Cooperation* condition may have been less intuitive and hence more difficult to understand: "If E2 guesses wrong, then each of you gets to keep one sticker! But if E2 guesses right, then NEITHER of you gets any stickers and they go back in the box!" In the earlier version, no systematic check of rule comprehension was provided for the task, and so, in Study 1, we added this component. (2) We fixed the number of stickers that participants could potentially win to be four stickers for both the *Cooperation* and *Competition* conditions. (3) We focused solely on 4-year-olds, given that this age group showed the biggest difference in ToM between cooperation and competition in the preliminary study. (4) We added the Day-Night task (Gerstadt et al., 1994), which assesses response inhibition in children. (5) We added a memory question to the Stickers task. We included the Day-Night task and memory question to test the possibility that the difference in ToM across cooperation and competition could be due to a difference in executive functioning or memory, respectively, across the two conditions, given prior work showing contributions of executive functioning and memory to ToM (Carlson et al., 1998; Carlson & Moses, 2001; Carlson et al., 2002; Carlson et al., 2004; Gordon & Olson, 1998; Hughes, 1998). A positive finding for ToM and a negative finding for memory and executive functioning would provide initial evidence that any difference in ToM across cooperation and competition may be specific to ToM.

Script for the preliminary study

Competition **Condition – 8 stickers**

You like stickers right? Well, E2 likes stickers too. Let me tell you about this game. Ok (child's name), here is the game. The goal of the game is to get as MANY stickers as you each can. You try and get as many as you can, and she'll try and get as many as she can. You and E2 both like these stickers, but in this game, only ONE person can win stickers at a time.

To play the game, I'll ask E2 to close her eyes, and then you can hide two stickers in one of these cups. You can put the stickers in this cup, in this cup or in this cup, in any cup you like, but both stickers have to go in the same cup! Now, after you hide the stickers while E2 can't see you, I will tell E2 she can open her eyes, and she will ask you a question about where the stickers are, and you can tell her whatever you want to. Then E2 will guess where the stickers are.

Now here's how the game goes. If E2 guesses wrong, then YOU get to keep both the stickers, but if E2 guesses right, then SHE gets to keep both the stickers! Get it? If SHE finds the stickers, SHE gets to keep them, but is she DOESN'T find the stickers, then YOU get to keep them!
So we'll play the game the say way every time- you always get to hide the stickers and E2 will ask you a question and then guess where they are. Ok, just to make sure you understand the rules. If E2 finds the stickers, who gets to keep them? If she doesn't find the stickers, who gets to keep them?

Great, ok. Remember, the goal of the game is to win as many stickers as you can! You can take home all the stickers you win.

E1 to E2: Ok E2, close your eyes! No peeking!
E1 to child: ok, hide the stickers! Did you hide them?
E1 to E2: Ok E2, you can open your eyes and ask (child's name) a question!
E2 to child: ok (child's name), now I'm going to ask you, can you show me where the stickers are?
If stickers are in the cup, E1: "there are the stickers!" and gives them to E2. "This time the stickers go to E2!"
If the stickers are not in the cup, E1: "Huh, no stickers", find the stickers and give stickers to the child, "This time the stickers go to you!"
E1: Great! Ok, remember, we want to have as many stickers to take home at the end of the game!

Cooperation **Condition – 4 stickers**

You like stickers right? Well, E2 likes stickers too. Let me tell you about this game. Ok (child's name), here is the game. The goal of the game is to get as MANY stickers as you each can. You try and get as many as you can, and she'll try and get as many as she can. You and E2 both like these stickers, and in this game, you can BOTH get stickers at the same time.

To play the game, I'll ask E2 to close her eyes, and then you can hide two stickers in one of these cups. You can put the stickers in this cup, in this cup or in this cup, in any cup you like, but both

stickers have to go in the same cup! Now, after you hide the stickers while E2 can't see you, I will tell E2 she can open her eyes, and she will ask you a question about where the stickers are, and you can tell her whatever you want to. Then E2 will guess where the stickers are.

Now here's how the game goes. If E2 guesses wrong, then each of you gets to keep one sticker! But if E2 guesses right, then NEITHER of you gets any stickers and they go back in the box! Get it? If SHE finds the stickers, no one gets ANY stickers, but if she DOESN'T find the stickers, then you EACH get to keep one!

So we'll play the game the say way every time- you always get to hide the stickers and E2 will ask you a question and then guess where they are. Ok, just to make sure you understand the rules. If E2 finds the stickers, who gets to keep them? If she doesn't find the stickers, who gets to keep them?

Great, ok. Remember, the goal of the game is to win as many stickers as you can! You can take home all the stickers you win.

E1 to E2: Ok E2, close your eyes! No peeking!
E1 to child: ok, hide the stickers! Did you hide them?
E1 to E2: Ok E2, you can open your eyes and ask (child's name) a question!
E2 to child: ok (child's name), now I'm going to ask you, can you show me where the stickers are?
If stickers are in the cup, E1: "there are the stickers! This time no one gets any stickers!"
If the stickers are not in the cup, E1 "Huh, no stickers", find the stickers and give stickers to the child and E2, "This time you both get a sticker!"
E1: Great! Ok, remember, we want to have as many stickers to take home at the end of the game!

***Cooperation-Sheet* condition for 4-year-olds – 8 stickers**
In the *Cooperation* condition, participants could win at most 4 stickers, whereas in the *Competition* condition, participants could win at most 8 stickers. To address the concern that the number of total stickers that a participant could win may influence how well participants performed in the game, we added a different version of the *Cooperation* condition in which the total number of stickers one could possibly win matches the total number of stickers one could possibly win in the *Competition* condition (8 stickers).

Do you like stickers? Can I please get you to pick out 8 sticker sheets from this box?

You like stickers right? Well, E2 likes stickers too. Let me tell you about this game. Ok (child's name), here is the game. The goal of the game is to get as MANY sheets of stickers as you each can. You try and get as many as you can, and she'll try and get as many as she can. You and E2 both like these sheets of stickers, and in this game, you can BOTH get sticker sheets at the same time.

To play the game, I'll ask E2 to close her eyes, and then you can hide two sheets of stickers in one of these cups. You can put the sticker sheets in this cup, in this cup or in this cup, in any cup you like, but both sticker sheets have to go in the same cup! Now, after you hide the sticker

sheets while E2 can't see you, I will tell E2 she can open her eyes, and she will ask you a question about where the stickers sheets are, and you can tell her whatever you want to. Then E2 will guess where the stickers sheets are.

Now here's how the game goes. If E2 guesses wrong, then each of you gets to keep one sticker sheet! But if E2 guesses right, then NEITHER of you gets any sticker sheets and they go back in the box! Get it? If SHE finds the sticker sheets, no one gets ANY sticker sheets, but if she DOESN'T find the sticker sheets, then you EACH get to keep one!

So we'll play the game the say way every time- you always get to hide the sticker sheets and E2 will ask you a question and then guess where they are. Ok, just to make sure you understand the rules. If E2 finds the sticker sheets, who gets to keep them? If she doesn't find the sticker sheets, who gets to keep them?

Great, ok. Remember, the goal of the game is to win as many sticker sheets as you can! You can take home all the sticker sheets you win.

E1 to E2: Ok E2, close your eyes! No peeking!
E1 to child: ok, hide the stickers sheets! Did you hide them?
E1 to E2: Ok E2, you can open your eyes and ask (child's name) a question!
E2 to child: ok (child's name), now I'm going to ask you, can you show me where the sticker sheets are?

If stickers are in the cup, E1: "there are the stickers! This time no one gets any sticker sheets!"
If the stickers are not in the cup, E1 "Huh, no sticker sheets", find the stickers and give stickers to the child and E2, "This time you both get a sticker sheet!"

***Competition-Four Stickers* condition for 4-year-olds – 4 stickers**
In the *Cooperation* condition, participants could win at most 4 stickers, whereas in the *Competition* condition, participants could win at most 8 stickers. To address the concern that the number of total stickers that a participant could win may influence how well participants performed in the game, we added a different version of the *Competition* condition in which the total number of stickers one could possibly win matches the total number of stickers one could possibly win in the *Cooperation* condition (4 stickers).

The script was the same as the one for *Competition* condition – 8 stickers, but instead of facing the possibility of earning 2 stickers per round, participants faced the possibility of earning 1 sticker per round.

***Pompom* condition for 3-year-olds**
Because we were concerned that difficulties with pointing among 3-year-olds could have affected their performance on the task, we introduced a control condition (*Pompom* condition) to a subset of 3-year-olds. Instead of pointing to the cup of their choosing, participants in this condition placed a pompom in front of the cup.

E1 to E2: Ok E2, close your eyes! No peeking!

E1 to child: ok, hide the stickers! Did you hide them?

E1 to E2: Ok E2, you can open your eyes and ask (child's name) a question!

E2 to child: ok (child's name), now I'm going to ask you, can you show me where the stickers are by placing the pompom in front of the cup where the stickers are?

If stickers are in the cup, E1: "there are the stickers! This time no one gets any stickers!"

If the stickers are not in the cup, E1 "Huh, no stickers", find the stickers and give stickers to the child and E2, "This time you both get a sticker!"

E1: Great! Ok, remember, we want to have as many stickers to take home at the end of the game!

Study 2a and 2b: Scripts

Note: The 4- and 8-total-stickers conditions in Study 2a slightly differ in wording, which we describe below. The wording in Study 2b is the same as the one used in the 4-total-stickers condition in Study 2a.

Competition **Condition**

You will play this game with another person. The goal of the game is to get as many stickers as you can. You try to get as many as you can, and the other player will try to get as many as he/she can. **However, in this game, only ONE person can win a sticker at a time.**

To play the game, you will hide one / two [depending on 4 or 8 total stickers for Study 2a] sticker in one of these cups. [show picture of sticker and cups] You can put the sticker(s) in Cup #1 or Cup # 2!

The other player will ask you where the sticker(s) is/are, and you can tell him/her whatever you want (Cup #1 or Cup #2). The other player will then guess where the sticker(s) is/are.

If the other player guesses incorrectly, then YOU get to keep the sticker, but if the other player guesses correctly, then HE/SHE gets to keep the sticker!

To make sure that you understand the rules of this game, please answer the following questions.

Cooperation **Condition**

You will play this game with another person. The goal of the game is to get as many stickers as you can. You try to get as many as you can, and the other player will try to get as many as he/she can. **In this game, you can BOTH get stickers at the same time.**

To play the game, you will hide two stickers / two sheets of stickers [depending on 4 or 8 total stickers for Study 2a] in one of these cups. [show picture of sticker and cups]. You can put the stickers in Cup #1 or Cup # 2!

The other player will ask you where the stickers are, and you can tell him/her whatever you want (Cup #1 or Cup #2). The other player will then guess where the stickers are.

If the other player guesses incorrectly, then each of you gets to keep one sticker / sheet of stickers! But if the other player guesses correctly, then NEITHER of you gets any stickers.

To make sure that you understand the rules of this game, please answer the following questions.

[from here onwards, participants from both conditions are presented with the same questions]

If the other player guesses correctly and finds the sticker(s), who gets to keep it/them?
- o Me
- o The other player
- o We each get to keep a sticker
- o Neither of us gets to keep any stickers

If the other player guesses incorrectly and **doesn't** find the sticker(s), who gets to keep it/them?
- o Me
- o The other player
- o We each get to keep a sticker
- o Neither of us gets to keep any stickers

Q1. Where would you like to hide the sticker? (Cup 1 or Cup 2)
Q2. The other player asks, "Where is the sticker?" Please make a response (Cup #1 or Cup #2).

The other player says, "I think the sticker is under Cup [response to Q2]!"

\# of stickers won this round:
You: [number of stickers won]
Other person: [number of stickers won]

[In Study 2b only]

You are now finished with the two games. Please answer the following questions about the games you just played.

Q1.   Which game would you rather play again? Game 1 or Game 2
Q2. Which person would you rather play a different game with? Person from Game 1 or Person from Game 2
Q3. What strategy did you use to play Game 1?
Q4. What strategy did you use to play Game 2?
Q5. Did you use different strategies for Game 1 and Game 2?
Q6. In **Game 1**, in order to successfully win a sticker, you had to click on the empty cup when responding to the other player's question. How did you feel about performing that action?

Extremely good	Moderately good	Slightly good	Neither good nor bad	Slightly bad	Moderately bad	Extremely bad

Q7. In **Game 2**, in order to successfully win a sticker, you had to click on the empty cup when responding to the other player's question. How did you feel about performing that action?

Extremely good	Moderately good	Slightly good	Neither good nor bad	Slightly bad	Moderately bad	Extremely bad

Study 2b: Trial-by-trial effects

There was a marginal interaction between Trial and Condition ($\chi^2(3) = 7.495$, $p = 0.06$), suggesting that while participants' performance improved over time, the rate of improvement differed for cooperation and competition. Post-hoc comparisons revealed, for both contexts, better performance on Trials 2, 3, and 4 than Trial 1, and better performance on Trial 4 than Trial 2, with no difference in performance between Trial 3 and Trial 4. The difference between Trial 2 and Trial 3, however, was significant for the *Cooperation* condition ($z = 2.793$, $p = 0.025$) but not for the *Competition* condition ($z = 1.591$, $p = 0.384$). However, we note our hesitation in interpreting this result given that the effect was marginal and that we did not see it consistently across studies.