Supporting Information

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Experimental Instructions (Translated from German/Italian)

Note: Italic font is used for the instructions to the experimenter (CTR, control treatment; TPP, third-party punishment treatment).

Assign child to treatment CTR or treatment TPP according to the randomization list.

Today I prepared a game for you. In this game you can earn tokens. You can buy presents in our shop with these tokens. Bigger presents cost more than smaller ones. The presents are different from last time.

Treatment CTR

In this game you can earn these white tokens (*show tokens*). Could you please repeat the rules for the tokens? (*Child must repeat that it can select presents with the tokens and that bigger presents are more costly than smaller presents*).

There are two meeples: a yellow and a white meeple (*place meeples on table; the yellow meeple must be placed directly in front of the child*). You are the yellow meeple (*point at yellow meeple*). The white meeple is a child whom we will select randomly. This child attends the *x* grade of a German (Italian) school here in Merano just like you, but it attends a different school (*adapt explanation to grade and school-language; place white meeple on school-card*). This child can be a boy or a girl, but you don't know whom exactly you are playing with. This is a secret. Your partner doesn't know who you are either. Could you please repeat this part? (*Child must repeat all of the information of this paragraph. If it misses some parts, ask explicitly.*)

Stage 1: Prisoner's Dilemma Without Punishment.

The game works like this: (*place decision-sheet "COOP" in front of the child*). At the beginning you and your partner receive 2 tokens each (*place tokens in front of yellow and white meeple*). Both of you must decide whether to send ZERO or BOTH tokens to the partner. It is important to note that I have tokens as well (*show tokens*). If you send your tokens to your partner, I will add 2 more tokens for your partner (*show physically: shove the subject's tokens toward its partner and double the tokens upon arrival; restore original distribution after illustration*). If your partner decides to send you his/her tokens, I will double them as well (*show physically*). You must decide between sending ZERO and sending BOTH tokens on this sheet (*point at the respective box on the decision sheet*). Your partner has the same options as you: he/she can either send you ZERO or BOTH tokens. Let's go through some examples now (*The child must handle tokens in the examples*).

i) What happens if you tick this box here (*point at box with ZERO tokens*) and your partner sends you ZERO tokens? (*Answer: no tokens will be sent and the experimenter does not add any tokens.*) And how many tokens will you earn in this case? (*Answer: 2*) And how many tokens will your partner earn? (*Answer: 2*)

ii) What happens if you tick this box here (*point at box with BOTH tokens*) and your partner sends you BOTH of his tokens? (*Answer: the child and its partner send both tokens to one another and the experimenter doubles each transaction.*) And how many tokens will you earn in this case? (*Answer: 4*) And how many tokens will your partner earn? (*Answer: 4*)

iii) What happens if you tick this box here (*point at box with ZERO tokens*) and your partner sends you BOTH of his tokens? (*Answer: the child does not send tokens to partner, but the partner sends his/her tokens to the child. The experimenter doubles the transaction from the partner to the child.*)

And how many tokens will you earn in this case? (*Answer: 6*) And how many tokens will your partner earn? (*Answer: 0*)

iv) What happens if you tick this box here (*point at box with BOTH tokens*) and your partner sends you ZERO of his tokens? (*Answer: the child sends both tokens to partner, but the partner sends no tokens to the child. The experimenter doubles the transaction from the child to the partner.*) And how many tokens will you earn in this case? (*Answer: 0*) And how many tokens will your partner earn? (*Answer: 6*)

Do you already know how many tokens your partner sends you? (*Answer: No*) Exactly. Likewise, your partner does not know how many tokens you sent him when he decides on how many tokens to send you. Could you please repeat how the game works? (*Child must exhaustively repeat the rules of the game. If it misses some parts, ask explicitly.*)

We don't know yet the exact number of tokens you will earn in this game. You receive the tokens which you keep and those which your partner sends you. Since we don't know yet how many tokens your partner will send you, you will receive the tokens from this part not today but only when we visit you next time. It is very important that your decision in this game is secret: the other children will never know how many tokens you sent.

Please make your decision now. Take as much time as you need. In the meantime I will turn around so that I don't disturb you. Just call me when you are done. (*Hand over the pen to the child so that it can decide. Turn around and wait until the child signals that it has finished.*)

Thank you for your decision. You ticked this box (*point at the respective box*). Could you please explain what that means? [*Child must explain what the (possible) consequences of its decision are.*]

I still have another question for you. What do you think your partner will decide? If your guess is correct (meaning that your partner really does what you think), you will receive one extra token. If your guess is not correct, you don't earn an additional token. What do you think, will your partner send you ZERO or BOTH of his/her tokens? (*Register answer of the child in the computer.*) Thank you for your decision. This game is over now. (*Put away the materials of this stage.*)

Stage 2: Punishment Decision.

(*Place two white meeples in front of the child and put orange tokens on the table.*) Here I prepared a second game for you. In this game you can observe the play of two other children in a game, which works just like the one we played before. These children attend the *x* grade of a German (Italian) school here in Merano just like you, but they attend a different school (*adapt explanation to grade and school-language; place white meeples on school-cards*). We selected these children randomly and both are new children (that is, none of them is your partner from before). You are the observer of one of these children (*point to the left meeple from the subject's point of view*). You do not know yet how this child will decide in this game, but there are two possibilities: This sheet (*place explanation sheet 1 in front of the child*) shows the first option the child has. Can you tell me how many tokens this child would send to its partner (*Answer: 0*). On this sheet (*place explanation sheet 2 in front of the child and to the right of explanation sheet 1*) you see the second option the child has. Can you tell me how many tokens this child would send to its partner (*Answer: 2*). As an observer you have the option to deduct tokens from the child if it does not send the tokens to its partner (*point at explanation sheet 1*). Deducting tokens from the child works like this [*place orange-token-card (left) and deduction card (right) in front of the child*]: You can

either pick the card with the orange token (*point at orange-token card*) or the deduction card (*point at the deduction card*). If you pick the card with the orange token (*point at orange-token card*), this token is yours and with this token you can select a present which costs 1 token when we visit you next time. In this case, the child you observe can keep all its tokens. If you pick the deduction card instead (*point at deduction card*), you don't receive the orange token but we will deduct all of the tokens from the child whom you observe. In this case, these tokens are lost and nobody gets them. This means that the child receives zero tokens in the game. If the child chooses to send the tokens to its partner (*point at explanation sheet 2*) you will receive the orange token and we will not deduct the tokens from the child no matter which card you picked. This means that you can only deduct points from a child who does not send its tokens.

It is important that the child knows at the time of deciding that you might deduct its tokens if it does not send them. The partner of the child you observe (*point at right meeple*) has an observer of its own and this observer can deduct the tokens of the partner if he/she does not send the tokens. In the game you played before nobody had the possibility to deduct your tokens. Could you please repeat how the game works? (*Child must exhaustively repeat the rules of the game. If it misses some parts, ask explicitly.*) It is very important that your decision in this game is secret: the other kids will never know which card you picked. The other children really exist and you can really deduct the tokens of a child who sends nothing by picking the deduction card.

Now you may choose between the two cards. Please leave the card which you want to pick on the table as it is so that I can see its picture, and turn the other card upside down. If you pick the card with the orange token, just flip the deduction card (*demonstrate*). In this case you will receive the token in any case and we don't deduct the tokens from the child in any case. In contrast, if you pick the deduction card, flip the card with the orange token (*demonstrate*). In that case you will not receive the orange token and we will deduct the child's tokens if it doesn't send it. If it sends its tokens, you will receive the orange token and we don't deduct any token from that child. Please make your decision now. Take as much time as you need. In the meantime I will turn around so that I don't disturb you. Just call me when you are done. (*Turn around and wait until the child signals that it has finished. Then register answer of the child in the computer.*)

Thank you for your decision. You picked this card (*point at the respective card*). Could you please explain what that means [*Child must explain what the (possible) consequences of its decision are*].

Treatment TPP

In this game you can earn these white tokens (*show tokens*). Could you please repeat the rules for the tokens? (*Child must repeat that it can select presents with the tokens and that bigger presents are more costly than smaller presents*).

There are two meeples: a yellow and a white meeple (*place meeples on table; the yellow meeple must be placed directly in front of the child*). You are the yellow meeple (*point at yellow meeple*). The white meeple is a child whom we will select randomly. This child attends the *x* grade of a German (Italian) school here in Merano just like you, but it attends a different school (*adapt explanation to grade and school-language; place white meeple on school-card*). This child can be a boy or a girl, but you don't know whom exactly you are playing with. This is a secret. Your partner doesn't know who you are either. Could you please repeat this part? (*Child must repeat all of the information of this paragraph. If it misses some parts, ask explicitly.*)

Stage 1: Prisoner's Dilemma with Punishment.
The game works like this: (*place decision-sheet "COOP_PUN" in front of the child*). At the beginning you and your partner receive 2 tokens each (*place tokens in front of yellow and white meeple*). Both of you must

decide whether to send ZERO or BOTH tokens to the partner. It is important to note that I have tokens as well (*show tokens*). If you send your tokens to your partner, I will add 2 more tokens for your partner (*show physically: shove the subject's tokens toward its partner and double the tokens upon arrival; restore original distribution after illustration*). If your partner decides to send you his/her tokens, I will double them as well (*show physically*). You must decide between sending ZERO and sending BOTH tokens on this sheet (*point at the respective box on the decision sheet*). Your partner has the same options as you: he/she can either send you ZERO or BOTH tokens. Let's go through some examples now (*the child must handle tokens in the examples*).

i) What happens if you tick this box here (*point at box with ZERO tokens*) and your partner sends you ZERO tokens? (*Answer: no tokens will be sent and the experimenter does not add any tokens.*) And how many tokens will you earn in this case? (*Answer: 2*) And how many tokens will your partner earn? (*Answer: 2*)

ii) What happens if you tick this box here (*point at box with BOTH tokens*) and your partner sends you BOTH of his tokens? (*Answer: the child and its partner send both tokens to one another and the experimenter doubles each transaction.*) And how many tokens will you earn in this case? (*Answer: 4*) And how many tokens will your partner earn? (*Answer: 4*)

iii) What happens if you tick this box here (*point at box with ZERO tokens*) and your partner sends you BOTH of his tokens? (*Answer: the child does not send tokens to partner, but the partner sends his/her tokens to the child. The experimenter doubles the transaction from the partner to the child.*) And how many tokens will you earn in this case? (*Answer: 6*) And how many tokens will your partner earn? (*Answer: 0*)

iv) What happens if you tick this box here (*point at box with BOTH tokens*) and your partner sends you ZERO of his tokens? (*Answer: the child sends both tokens to partner, but the partner sends no tokens to the child. The experimenter doubles the transaction from the child to the partner.*) And how many tokens will you earn in this case? (*Answer: 0*) And how many tokens will your partner earn? (*Answer: 6*)

Do you already know how many tokens your partner sends you? (*Answer: No*) Exactly. Likewise, your partner does not know how many tokens you sent him when he decides on how many tokens to send you. Could you please repeat how the game works? (*Child must exhaustively repeat the rules of the game. If it misses some parts, ask explicitly.*)

I still have to explain something very important to you: There is yet another meeple (*place black meeple next to the yellow meeple*) and this meeple is your observer in the game. This child attends the *x* grade of a German (Italian) school here in Merano just like you, but it attends a different school (*adapt explanation to grade and school-language; place white meeples on school-cards*). We selected this child randomly and this is a new child (i.e., it is not your partner but another child). Your observer can see what you do in this game and he/she can deduct your tokens. This works as follows:

If you tick this box here (*point at box with ZERO tokens*) your observer can deduct all your tokens. The deduction works as follows: Your observer must choose between the card with the orange token (*show orange-token card*) and the deduction card (*show deduction-card*). If he/she goes for the orange token (*shove orange-token-card in front of the black meeple*) then he/she can use this token to buy a present in our shop for him/herself and you keep all your tokens. If however, he/she picks the deduction-card (*shove deduction-card in front of the black meeple*), he/she does not receive the orange token and we will deduct ALL your tokens. In this case, your tokens will be lost and nobody gets them. That is, you won't earn any tokens in this game. However,

your observer can only deduct your tokens if you don't send any to your partner. If you tick this box here (which means that you send both tokens to your partner), your observer can't deduct tokens from you and he/she receives the orange token for him/herself. In this game your partner (*point at the white meeple*) has a separate observer who chooses between the orange-token card and the deduction card. Could you please repeat how the game works? (*Child must exhaustively repeat the rules of the game. If it misses some parts, ask explicitly.*) What happens to the deducted tokens? (*Answer: they are lost and nobody gets them.*)

We don't know yet the exact number of tokens you will earn in this game. You receive the tokens which you keep and those which your partner sends you. If you don't send your tokens, your observer might deduct all your tokens. Since we don't know yet how the other children will decide you will receive the tokens from this part not today but only when we visit you next time. It is very important that your decision in this game is secret: the other children will never know how many tokens you sent.

Please make your decision now. Take as much time as you need. In the meantime I will turn around so that I don't disturb you. Just call me when you are done. (*Hand over the pen to the child so that it can decide. Turn around and wait until the child signals that it has finished.*)

Thank you for your decision. You ticked this box (*point at the respective box*). Could you please explain what that means? [*Child must explain what the (possible) consequences of its decision are.*]

I still have two more questions for you. What do you think your partner will do? If your guess is correct (meaning that the other child really does what you think), you will receive one extra token. If your guess is not correct, you don't earn an additional token. What do you think your partner will do? Remember that your partner has an observer who can deduct his/her tokens if he/she doesn't send you the tokens. Do you think that your partner will send you ZERO or BOTH of his/her tokens? (*Register answer of the child in the computer.*) Thank you for your decision.

Case 1: Subject did not send its tokens. And what do you think your observer will do? If your guess is correct (meaning that your observer really does what you think), you will get one extra token. If your guess is not correct, you don't earn an additional token. What do you think your observer will do? (*Register answer of the child in the computer.*)

Case 2: Subject sent its tokens. And what do you think your observer would do if you didn't send your tokens? If your guess is correct (meaning that your observer really does what you think), you will get one extra token. If your guess is not correct, you don't earn an additional token. What do you think your observer would do? (*Register answer of the child in the computer.*)

Thank you for your decision. This game is over now. (*Put away the decision sheet, the black meeple, the cards of the observer, and the white tokens.*)

Stage 2: Prisoner's Dilemma Without Punishment. Here I prepared a second game for you. You can earn these yellow tokens in this game (*show tokens*). It is important that you can't sum tokens of different colors. Apart from that, the same rules for the tokens apply.
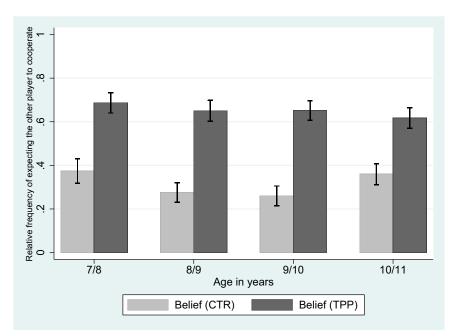
There are two meeples: a yellow and a white meeple. You are the yellow meeple (*point at yellow meeple*). The white meeple is again a child which we select randomly. This child attends the x grade of a German (Italian) school here in Merano just like you, but it attends a different school (*adapt explanation to grade and school-language; place white meeple on school-card*). This child can be a boy or a girl, but you don't know whom exactly you are playing with. This is a secret. Your partner doesn't know who you are either. It is important that this partner is a new child and not your partner or observer from the game we played before. Could you please repeat this part? (*Child must repeat all of the information of this paragraph. If it misses some parts, ask explicitly.*) This game works exactly the same as the one we played before. The only difference is that you don't have an observer now and thus, nobody can deduct your points if you decide not to send them. Your partner (*point at the white meeple*) has no observer either. Could you please repeat how the game works? (*Child must exhaustively repeat the rules of the game and mention the differences to the first stage. If it misses some parts, ask explicitly.*)
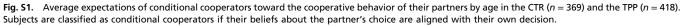
We don't know yet the exact number of tokens you will earn in this game. You receive the tokens which you keep and those which your partner sends you. Since we don't know yet how many tokens your partner sends you, you will receive the tokens from this part not today but only when we visit you next time. It is very important that your decision in this game is secret: the other children will never know how many tokens you sent.
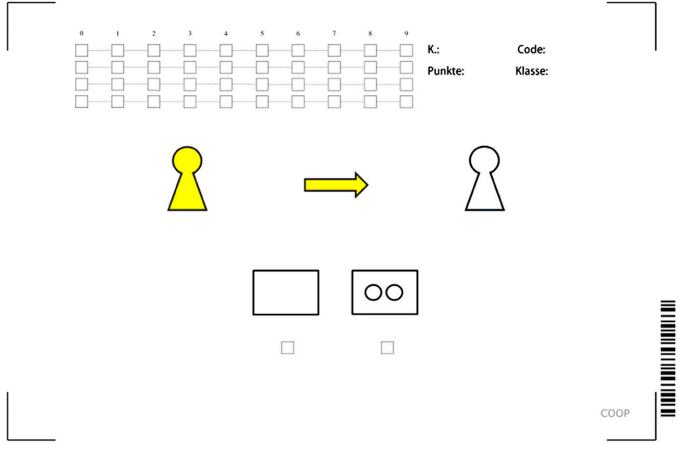
Please make your decision now. Take as much time as you need. In the meantime I will turn around so that I don't disturb you. Just call me when you are done. (*Hand over the pen to the child so that it can decide. Turn around and wait until the child signals that it has finished.*)
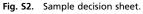
Thank you for your decision. You ticked this box (*point at the respective box*). Could you please explain what that means? [*Child must explain what the (possible) consequences of its decision are.*]

I still have another question for you. What do you think your partner will do? If your guess is correct (meaning that your partner really does what you think), you will receive one extra token. If your guess is not correct, you don't earn an additional token. What do you think, your partner will send you, ZERO or BOTH of his/her tokens? (*Register answer of the child in the computer.*) Thank you for your decision. This game is over now. (*Put away the materials of this stage.*)

Fig. S1. Average expectations of conditional cooperators toward the cooperative behavior of their partners by age in the CTR ($n = 369$) and the TPP ($n = 418$). Subjects are classified as conditional cooperators if their beliefs about the partner's choice are aligned with their own decision.

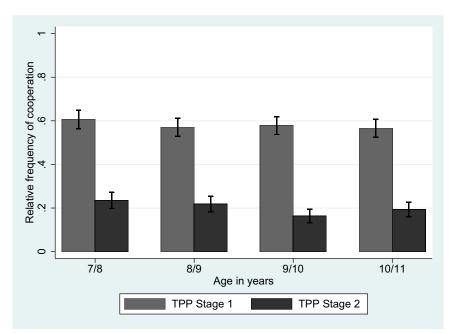

Fig. S2. Sample decision sheet.

Fig. S3. Average cooperation rates by age and stage in the TPP. Stage 1 with third-party punishment (reported in the main text); stage 2 without third-party punishment (not reported in the main text, $n = 566$). Error bars, mean $\pm$ SEM. Overall, 20% cooperated in stage 2 of the TPP without punishment, compared with 58% with punishment in stage 1 ($P = 0.000$ overall and in each cohort; McNemar exact tests). The cooperation rate in stage 2 is not significantly different from the rate in the CTR (compare Fig. 2; $P > 0.05$ overall and in each cohort, χ^2 tests).
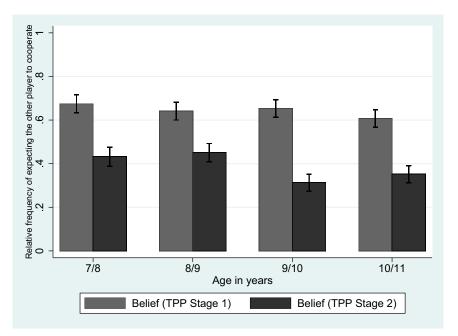

Fig. S4. Average expectation of cooperative behavior of the partner by age and stage in the TPP. Stage 1 with third-party punishment (reported in the main text); stage 2 without third-party punishment (not reported in the main text, $n = 566$). Error bars, mean $\pm$ SEM. In the second stage of the TPP (without punishment) children have significantly and much lower expectations about their partner's likelihood to cooperate ($P < 0.01$ in all age cohorts; Mc-Nemar tests).

Table S1. A comparison of expected payoffs in the TPP, given beliefs about expected behavior and given actual behavior of the opponents

	Observer's probability to punish (P) (%)		Partner's probability to cooperate (C) (%)		Expected payoff (given behavior)*		Expected payoff (given beliefs)*	
Age (y)	Behavior	Beliefs	Behavior	Beliefs	Coop.	Defect	Coop.	Defect
7/8	7.5	53.8	60.6	67.4	2.42	4.09	2.70	2.17
8/9	9.1	53.5	57.0	64.1	2.28	3.89	2.56	2.12
9/10	7.3	52.4	57.8	65.3	2.31	4.00	2.61	2.20
10/11	7.8	44.8	56.6	60.7	2.26	3.93	2.43	2.44

*Calculation of expected payoff for cooperation (Coop): $C \times 4$, and for defection (Defect): $(1 - P) \times C \times 6 + (1 - P) \times (1 - C) \times 2$.

Table S2. Clustered probit regression on cooperation

Variable	Cooperation in the CTR	Cooperation in the TPP
Age (y)	0.011	0.001
	(0.015)	(0.020)
Female (=1)	−0.036	0.077
	(0.037)	(0.052)
German school (=1)	0.035	0.055
	(0.035)	(0.050)
Belief partner (1 = cooperation)	0.320***	0.416***
	(0.035)	(0.065)
Relative IQ[‡]	−0.061	0.015
	(0.103)	(0.127)
Number of siblings	0.001	0.007
	(0.020)	(0.023)
Altruism[§]	0.083***	0.065***
	(0.015)	(0.020)
Impatient (=1)[¶]	−0.051	−0.027
	(0.043)	(0.058)
Belief observer (1 = punishment)		0.379***
		(0.076)
Belief partner × Belief observer		0.114
		(0.106)
No Observations	489	488

The triple, double, and single asterisks denote significance at the 1%, 5%, and 10% level, respectively; robust SEs are in parentheses. Clustered on class level.

[‡]The IQ was measured with Raven's Colored Progressive Matrices. Consistent with the mean values of the norming sample of the Raven's Colored Progressive Matrices, the share of correctly solved matrices in our subject pool increases with age. Therefore, we measured the IQ relative to the respective age group to avoid confounding age and IQ effects.

[§]Number of tokens donated to a charity (0–6) in an independent experiment. We include this variable as a proxy for social intelligence, which is needed in social interactions [Kaukiainen et al. (1) find that social intelligence is significantly related to empathy].

[¶]Patience was measured in an independent experiment with three binary choice problems. If a child decided in all three choice problems not to wait for the higher payoff, the child was classified as being impatient.

1. Kaukiainen A, et al. (1999) The relationships between social intelligence, empathy, and three types of aggression. *Aggress Behav* 25:(2)81–89.

Table S3. Number of participants by age and sex, with the number of children not understanding the game in parenthesis

Age (y)	Sex	
	Female	Male
7/8	126 (5)	139 (9)
8/9	121 (1)	164 (2)
9/10	131 (2)	153 (1)
10/11	133 (0)	153 (1)
Total (n = 1,141)	511 (8)	609 (13)

In total, 21 children (10 in the CTR and 11 in the TPP) were excluded from the analysis because they did not understand the experiment.