Beliefs, learning, and personality in the indefinitely repeated prisoner's dilemma

Online Appendix

David Gill, Department of Economics, Purdue University
Yaroslav Rosokha, Department of Economics, Purdue University

Web Appendix I   Screenshots from the experiment

Welcome!

Today's experiment will last about 60 minutes.

You will be paid a show-up fee of $5 together with any money you accumulate during this experiment. The amount of money you accumulate will depend partly on your actions and partly on the actions of other participants. This money will be paid at the end of the experiment in private and in cash.

It is important that during the experiment you remain **silent**. If you have a question or need assistance of any kind, please **raise your hand, but do not speak** - and an experiment administrator will come to you, and you may then whisper your question.

In addition, please **turn off your cell phones and put them away now**. Please do not use or place on your desk any personal items, including pens, paper, phones etc. Please do not look into anyone else's booth at any time.

Anybody that breaks these rules will be asked to leave.

Agenda:

- Questionnaire and test
- Experimental Instructions
- Experiment

Next

Figure A.1: Introductory screen

How Matches Work

The experiment is made up of **25 matches**.

At the start of each match you will be randomly paired with another participant in this room.

You will then play a number of rounds with that participant (this is what we call a "match").

Each match will last for a random number of **rounds**:

- At the end of each round the computer will roll a four-sided fair dice.
- If the computer rolls a 1, 2, or 3, then the match continues for at least one more round (75% probability).
- If the computer rolls a 4, then the match ends (25% probability).

When the match ends, you will again be randomly paired with another participant for the next match.

Choices and Payoffs

In each round of a match, you will choose A or B. The participant you are matched with will also choose A or B.

The table below describes the payoffs from the four pairs of choices that are possible in each round of a match.

These payoffs are in **points**.

My Choice in Round X	A	A	B	B
Other's Choice in Round X	A	B	A	B
My Payoff in Round X	32	12	50	25
Other's Payoff in Round X	32	50	12	25

In words:

- If you choose A, and the participant you are matched with chooses A, then your payoff for the round will be 32 points, and the other's payoff will be 32 points.
- If you choose A, and the participant you are matched with chooses B, then your payoff for the round will be 12 points, and the other's payoff will be 50 points.
- If you choose B, and the participant you are matched with chooses A, then your payoff for the round will be 50 points, and the other's payoff will be 12 points.
- If you choose B, and the participant you are matched with chooses B, then your payoff for the round will be 25 points, and the other's payoff will be 25 points.

At the end of the experiment, your total points will be converted into cash at the exchange rate of 200 points = $1. In addition, you will be paid your show-up fee of $5.

Next

Figure A.2: Description of matches, choices and payoffs

Practice Matches

To get some practice with the choices, you will now play 10 practice matches.

In these practice matches you are not yet matched with another participant and you will not earn any money.

In these practice matches you will make choices both for yourself and for the other participant.

Practice Match #2 of 10

The table below describes the payoffs from the four pairs of choices that are possible in each round of a match.

My Choice in Round X	A	A	B	B
Other's Choice in Round X	A	B	A	B
My Payoff in Round X	32	12	50	25
Other's Payoff in Round X	32	50	12	25

Remember that at the end of each round the computer rolls a four-sided fair dice. The match ends when the computer rolls a 4.

Dice Roll		2	1
Round	3	2	1
My Choice		B	A
Other's Choice		A	A
My Payoff		50	32
Other's Payoff		12	32

My Choice in Round **3**

A B

Other's Choice in Round **3**

A B

Figure A.3: Practice matches: Choice screen

Practice Matches

To get some practice with the choices, you will now play 10 practice matches.

In these practice matches you are not yet matched with another participant and you will not earn any money.

In these practice matches you will make choices both for yourself and for the other participant.

Practice Match #2 of 10

The table below describes the payoffs from the four pairs of choices that are possible in each round of a match.

My Choice in Round X	A	A	B	B
Other's Choice in Round X	A	B	A	B
My Payoff in Round X	32	12	50	25
Other's Payoff in Round X	32	50	12	25

Remember that at the end of each round the computer rolls a four-sided fair dice. The match ends when the computer rolls a 4.

Dice Roll	4	2	3	2	1
Round	5	4	3	2	1
My Choice	A	B	A	B	A
Other's Choice	B	B	A	A	A
My Payoff	12	25	32	50	32
Other's Payoff	50	25	32	12	32

Practice Match #2 Summary
Match duration: **5** rounds
My total payoff: **151** points
Other's total payoff: **151** points

Next

Figure A.4: Practice matches: Summary screen

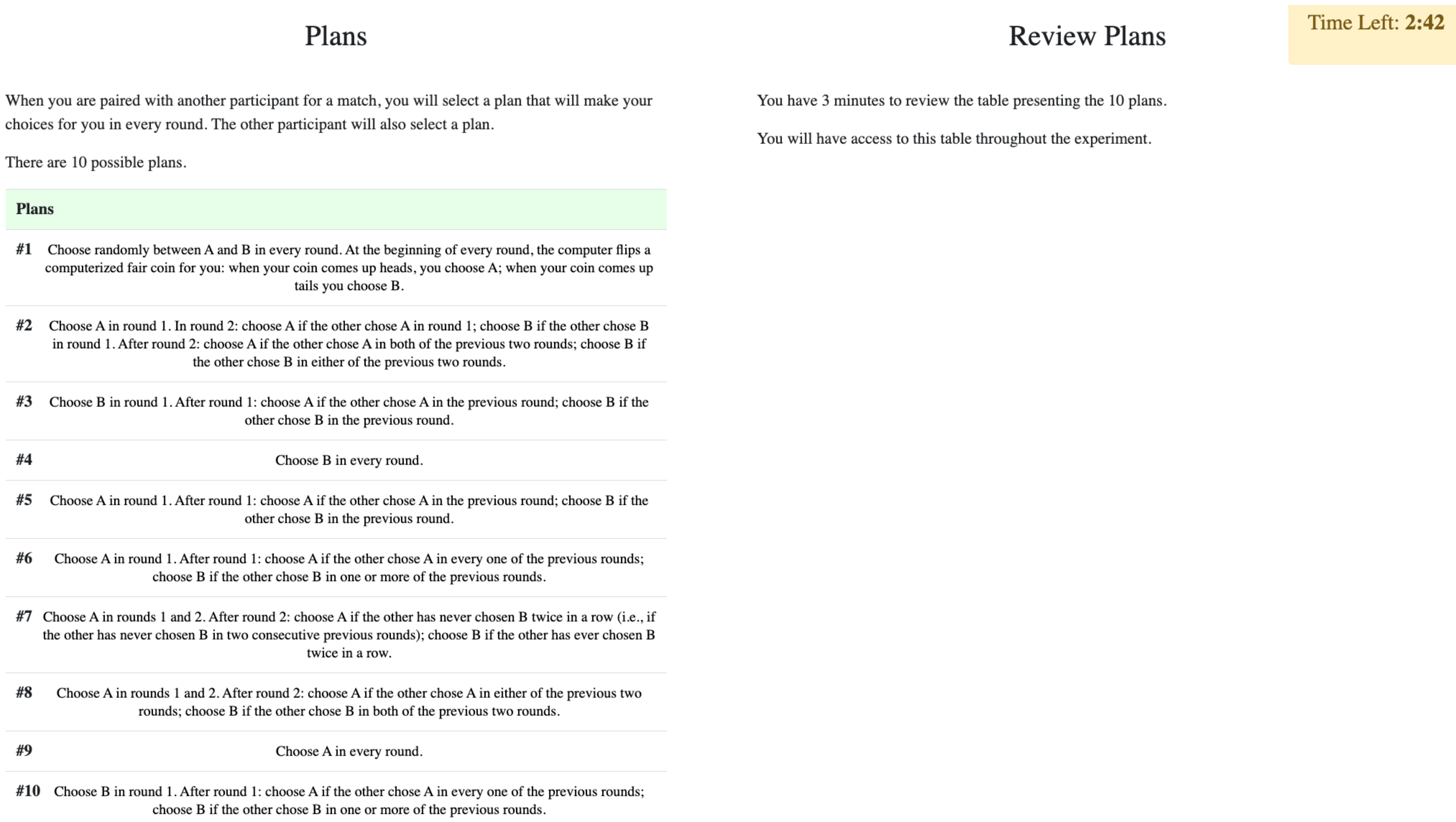


Figure A.5: Review of strategies

Notes: The order that the ten strategies appeared on the subject's screen was randomized across subjects (see Web Appendix III.2). In this example, the order of the strategies is: RAND; 2TFT; DTFT; AD; TFT; G; G2; TF2T; AC; DG.

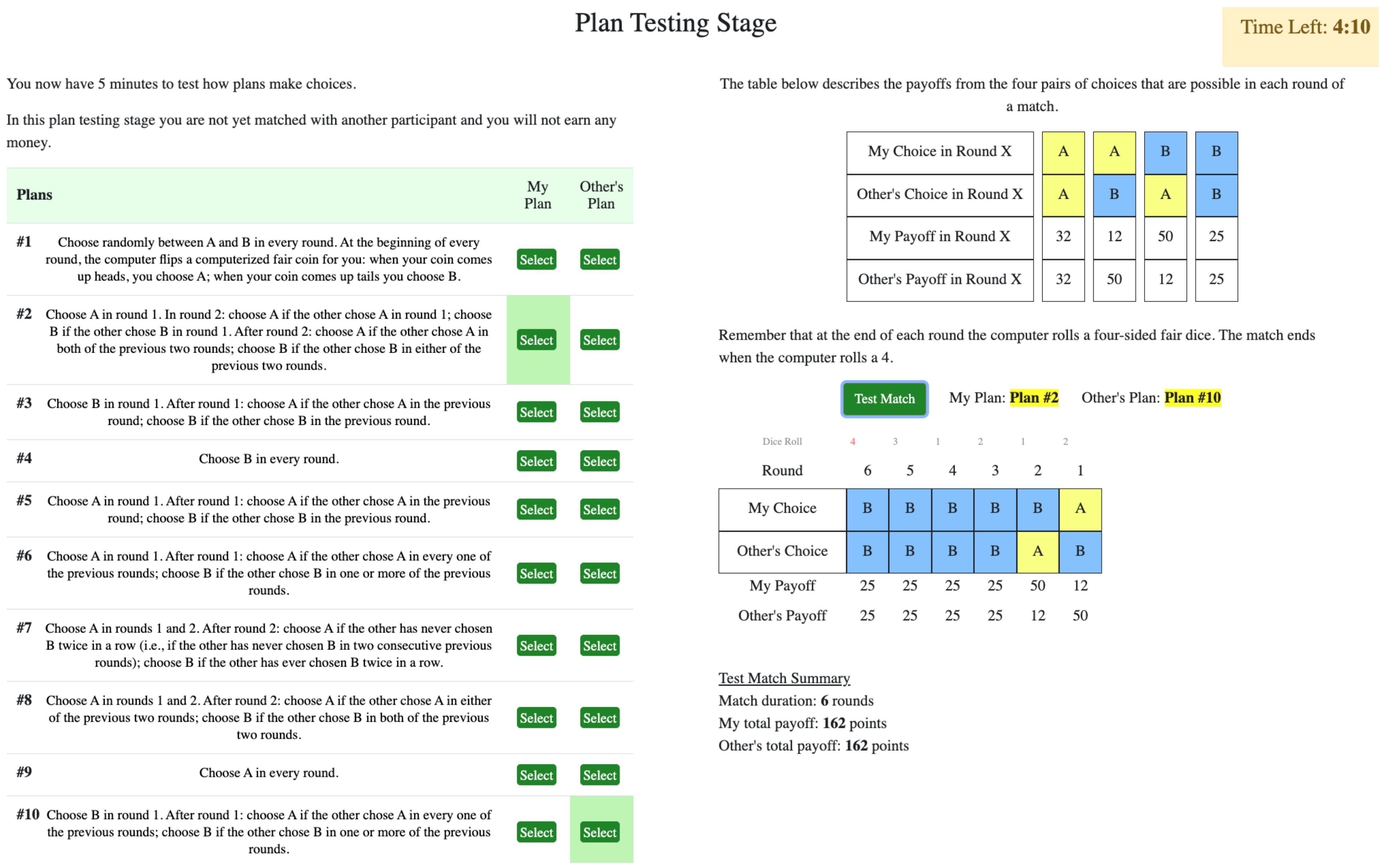


Figure A.6: Testing strategies: Summary screen

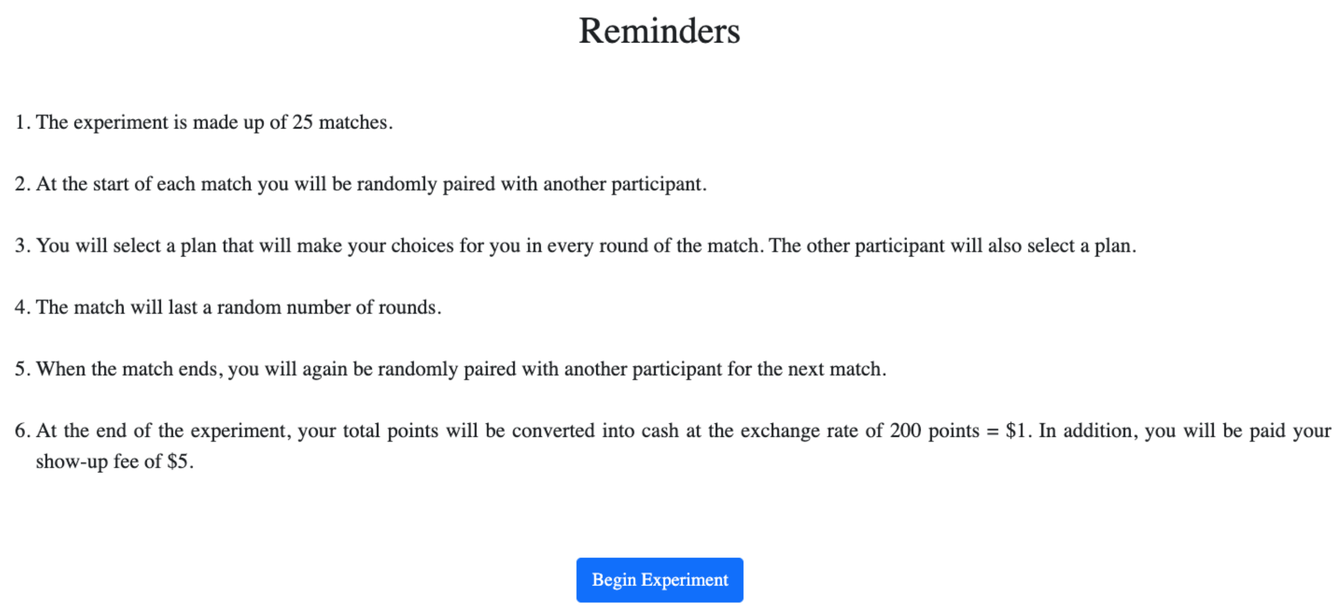


Figure A.7: Reminder screen

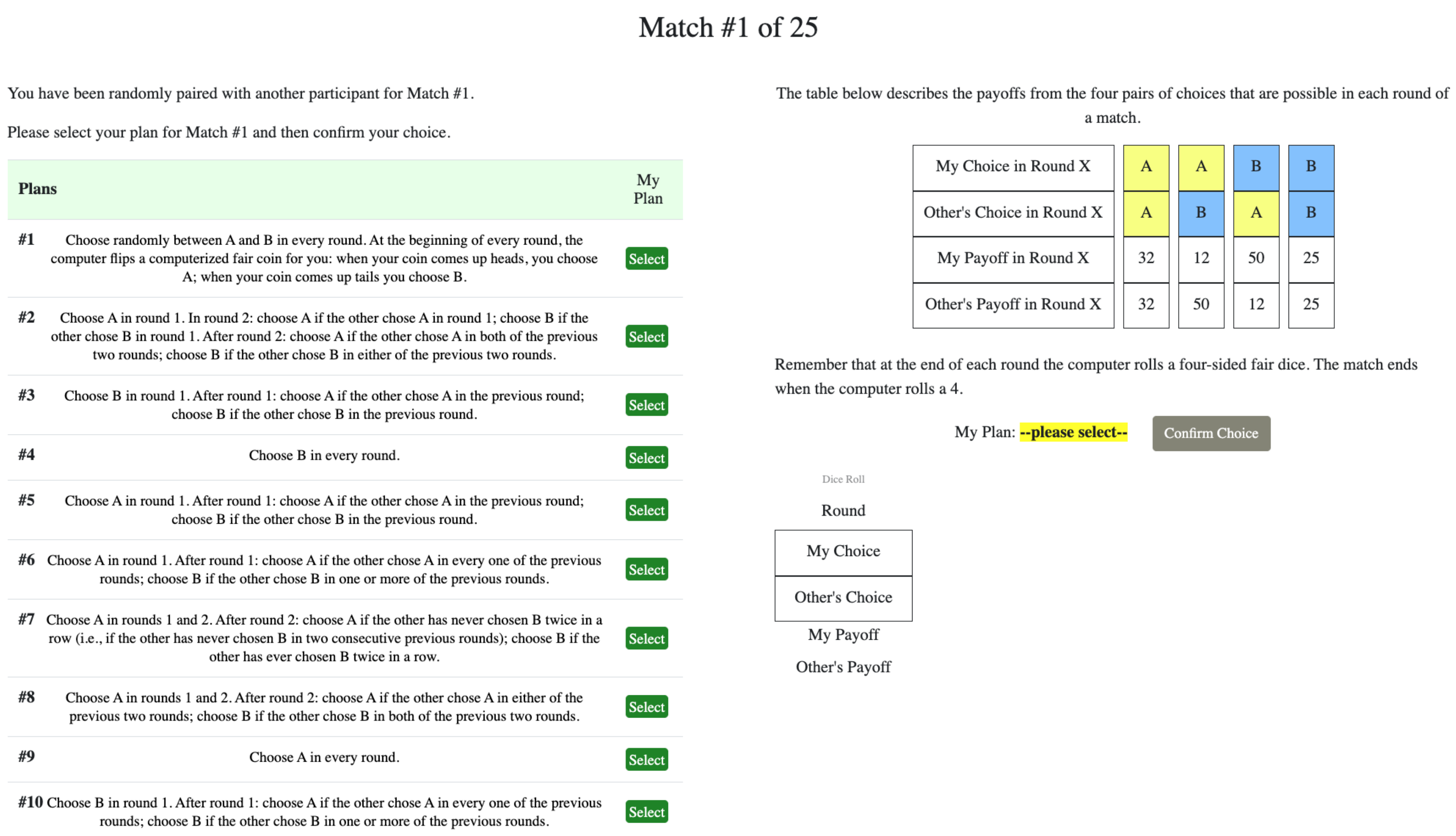


Figure A.8: Supergame 1: Choice screen

Question Before We Implement Your Plan in Match # 1

Before we implement your plan in Match #1, **on the next screen we will ask you what you think the chances are that the other participant chooses each of the ten plans.**

In other words, we will ask you how many times out of 100 you think the other participant in Match #1 would choose each of the ten plans.

Of course, the other participant chooses his/her plan for Match #1 only once (just like you), not 100 times. But you can think of the question as a way of asking how likely the other participant is to choose each of the plans.

You will be paid according to the accuracy of your answer. You will make the most money on average if you answer truthfully what you think the chances are that the other participant chooses each of the plans.

You will not be paid for your answer until the end of the experiment. Your answer will not be shown to any other participant. Your answer will not affect the experiment in any way.

You do not need to understand the details of how the payment works. If you are interested, the details follow below. If you are not interested, you can stop reading this screen now.

Details of how the payment works:

> *For this task, you start with 400 points and you will then be penalized for inaccuracy. The total penalty can never be more than 400 points. Your payment for this task will be 400 points minus the total penalty.*
>
> *For each of the ten possible plans, the penalty will be calculated as follows.*
>
> 1. *If that plan is chosen by the other participant, then the penalty will be smaller the higher your answer about the chances that the other participant chooses that plan. In that case, the penalty is calculated as follows:*
>   *(100 − Your Answer) × (100 − Your Answer) × (0.02 points)*
> 2. *If that plan is not chosen by the other participant, then the penalty will be smaller the lower your answer about the chances that the other participant chooses that plan. In that case, the penalty is calculated as follows:*
>   *(Your Answer) × (Your Answer) × (0.02 points)*

Next

Figure A.9: Supergame 1: Belief elicitation information

Question Before We Implement Your Plan in Match # 1

Plans		Other's Plan (Chance, %)
#1	Choose randomly between A and B in every round. At the beginning of every round, the computer flips a computerized fair coin for you: when your coin comes up heads, you choose A; when your coin comes up tails you choose B.	
#2	Choose A in round 1. In round 2: choose A if the other chose A in round 1; choose B if the other chose B in round 1. After round 2: choose A if the other chose A in both of the previous two rounds; choose B if the other chose B in either of the previous two rounds.	
#3	Choose B in round 1. After round 1: choose A if the other chose A in the previous round; choose B if the other chose B in the previous round.	
#4	Choose B in every round.	
#5	Choose A in round 1. After round 1: choose A if the other chose A in the previous round; choose B if the other chose B in the previous round.	
#6	Choose A in round 1. After round 1: choose A if the other chose A in every one of the previous rounds; choose B if the other chose B in one or more of the previous rounds.	
#7	Choose A in rounds 1 and 2. After round 2: choose A if the other has never chosen B twice in a row (i.e., if the other has never chosen B in two consecutive previous rounds); choose B if the other has ever chosen B twice in a row.	
#8	Choose A in rounds 1 and 2. After round 2: choose A if the other chose A in either of the previous two rounds; choose B if the other chose B in both of the previous two rounds.	
#9	Choose A in every round.	
#10	Choose B in round 1. After round 1: choose A if the other chose A in every one of the previous rounds; choose B if the other chose B in one or more of the previous rounds.	
	The sum must add up to 100: Check Sum	

What do you think the chances are that the other participant chooses each of the ten plans?

In other words, how many times out of 100 do you think the other participant in Match #1 would choose each of the ten plans?

- Please use only whole numbers for your answer.
- You will be paid according to the accuracy of your answer. You will make the most money on average if you answer truthfully what you think the chances are that the other participant chooses each of the plans.
- You will not be paid for your answer until the end of the experiment.
- Your answer will not be shown to any other participant.
- Your answer will not affect the experiment in any way.

Figure A.10: Supergame 1: Belief elicitation

Match #1 of 25

Plans		My Plan
#1	Choose randomly between A and B in every round. At the beginning of every round, the computer flips a computerized fair coin for you: when your coin comes up heads, you choose A; when your coin comes up tails you choose B.	Select
#2	Choose A in round 1. In round 2: choose A if the other chose A in round 1; choose B if the other chose B in round 1. After round 2: choose A if the other chose A in both of the previous two rounds; choose B if the other chose B in either of the previous two rounds.	Select
#3	Choose B in round 1. After round 1: choose A if the other chose A in the previous round; choose B if the other chose B in the previous round.	Select
#4	Choose B in every round.	Select
#5	Choose A in round 1. After round 1: choose A if the other chose A in the previous round; choose B if the other chose B in the previous round.	Select
#6	Choose A in round 1. After round 1: choose A if the other chose A in every one of the previous rounds; choose B if the other chose B in one or more of the previous rounds.	Select
#7	Choose A in rounds 1 and 2. After round 2: choose A if the other has never chosen B twice in a row (i.e., if the other has never chosen B in two consecutive previous rounds); choose B if the other has ever chosen B twice in a row.	Select
#8	Choose A in rounds 1 and 2. After round 2: choose A if the other chose A in either of the previous two rounds; choose B if the other chose B in both of the previous two rounds.	Select
#9	Choose A in every round.	Select
#10	Choose B in round 1. After round 1: choose A if the other chose A in every one of the previous rounds; choose B if the other chose B in one or more of the previous rounds.	Select

The table below describes the payoffs from the four pairs of choices that are possible in each round of a match.

My Choice in Round X	A	A	B	B
Other's Choice in Round X	A	B	A	B
My Payoff in Round X	32	12	50	25
Other's Payoff in Round X	32	50	12	25

Remember that at the end of each round the computer rolls a four-sided fair dice. The match ends when the computer rolls a 4.

My Plan: **Plan #4**

Dice Roll	4	1	3	2
Round	4	3	2	1
My Choice	B	B	B	B
Other's Choice	B	B	A	A
My Payoff	25	25	50	50
Other's Payoff	25	25	12	12

Match # 1 Summary
Match duration: **4** rounds
My total payoff: **150** points
Other's total payoff: **74** points

Next

Figure A.11: Supergame 1: Summary screen

Web Appendix II Details referred to in notes

Web Appendix II.1 Details referred to in footnote 4

Li and Liu (2017) find a weak relationship between group identity and beliefs in the first round of their first indefinitely repeated prisoner's dilemma game. Dreber et al. (2014) find that cooperation in indefinitely repeated prisoner's dilemma games with mistakes in implementation is correlated with beliefs (measured after the games) about the likelihood that defections were due to mistakes. When subjects play a sequence of indefinitely repeated prisoner's dilemma games where they are randomly rematched after every round within a supergame: (i) Duffy and Ochs (2009) find that cooperation is low and can be predicted well using threshold strategies elicited in an earlier one-shot prisoner's dilemma together with subjects' round-by-round forecasts of how many others in the matching group of fourteen will cooperate in that round; and (ii) Duffy and Fehr (2018) elicit beliefs about how many others in the matching group of ten will cooperate in the first round of each supergame, finding that beliefs and behavior are correlated and that beliefs respond to experience in an earlier stag hunt game.

Web Appendix II.2 Details referred to in footnote 5

In one-shot prisoner's dilemmas, see: Messé and Sivacek (1979); Croson (2000); Miettinen and Suetens (2008); Charness et al. (2016); Engel and Zhurakhovska (2016); Ridinger and McBride (2017); Peeters and Vorsatz (2018); Heuer and Orland (2019); and Sutter and Untertrifaller (2020). Croson (2000) also finds that eliciting beliefs lowers cooperation (but see footnote 7 in the main text), while Charness et al. (2016) also find that beliefs change with the payoff from joint cooperation. In Miettinen and Suetens (2008), beliefs are more cooperative when both players send a message expressing a desire for mutual cooperation.

Web Appendix II.3 Details referred to in footnote 8

In one-shot or finitely repeated prisoner's dilemmas, Haesevoets et al. (2018) find that a survey measure of trust predicts cooperation, Emonds et al. (2014) find that a survey measure of trust predicts cooperation among prosocial subjects, while Acedo-Carmona and Gomila (2014) find that subjects cooperate more when they are matched with people they know and trust personally, although Ahn et al. (2003) find no effect of a survey measure of trust. Papers that correlate survey measures of trust with contributions in one-shot or finitely repeated linear public goods games mostly find a positive effect of trust (Sato, 1988, 1989; Anderson et al., 2004; Gächter et al., 2004; Thöni et al., 2012; Peysakhovich et al., 2014), while Mulder et al. (2006) find that experiencing a treatment with sanctions undermines contributions of high trust subjects. Finally, in a real-effort game, Proto and Rustichini (2014) find that trust predicts whether subjects choose effort consistent with believing that others are cooperative.

Web Appendix II.4 Details referred to in footnote 10

Proto et al. (2019) find that when subjects are matched according to their level of conscientiousness, high conscientiousness subjects cooperate less in the indefinitely repeated prisoner's dilemma. Furthermore, this reduction in cooperation is driven by the cautiousness facet of conscientiousness. However, when subjects are not matched according to conscientiousness, Proto et al. (2019) find that conscientiousness does not have a statistically significant effect on cooperation (and cautiousness was not measured in this treatment): as they state: "the presence of two highly conscientious players – rather than one individual – seems a necessary condition for the trait to have a measurable impact on outcomes." Thus, in our setting in which subjects are not matched by traits, our result that cautiousness does not predict cooperation is consistent with Proto et al. (2019) (recall that we measured the cautiousness facet of conscientiousness but not conscientiousness itself).

Proto et al. (2019) also find that agreeableness has a transitory effect on cooperation: Proto et al. (2019) mention that trust and altruism are facets of agreeableness, but they do not study the effects of these facets on cooperation. Finally, Proto et al. (2019) do not find any systematic effect of the other Big Five personality measures (extraversion, openness and neuroticism) on cooperation in the indefinitely repeated prisoner's dilemma.

When studying cooperation in the indefinitely repeated prisoner's dilemma, Proto et al. (forthcoming) include the Big Five personality measures as controls, without matching subjects by personality or discussing any results on personality. Table 3 in Proto et al. (forthcoming) reports the effects of personality on cooperation in the very first round of the experiment, with an effect of agreeableness at the ten-percent level and no statistically significant effects of the other measures.

Web Appendix II.5 Details referred to in the notes to Table 2

For simplicity, we use linear regressions to estimate parameters; Table A.20 in Web Appendix X shows that our results in Table 2 are robust when instead we use Probit regressions. 'Round 1 coop in Supergame t' is a variable taking value 1 if the relevant subject cooperated in the first round of Supergame t, and taking value 0 if not, where the cooperation decision was determined by the subject's chosen strategy. 'Optimism in Supergame t' is the optimism of the relevant subject's beliefs in Supergame t (optimism is defined in Section II.A). 'Length of Supergame t' is the number of rounds that Supergame t lasted for. N is in multiples of 390 because four subjects did not complete the demographic questionnaire

Web Appendix II.6 Details referred to in the notes to Table 3

Table A.22 in Web Appendix X shows that our results in Table 3 are robust when we do not control for personal traits or demographics. 'Strategy coop in Supergame t' is the strategy cooperation of the relevant subject's chosen strategy in Supergame t (strategy cooperation is defined in the text), while 'Strategy coop in Supergames 1 to 24' is the mean over the first 24 supergames. 'Optimism in Supergame t' is the optimism of the relevant subject's beliefs in Supergame t (optimism is defined in Section II.A). 'Length of Supergame t' is the number of rounds that Supergame t lasted for, while 'Length of Supergames 1 to 24' is the mean over the first 24 supergames. N is in multiples of 390 because four subjects did not complete the demographic questionnaire.

Web Appendix III Details on experimental design

Web Appendix III.1 Further details on procedures

All participants gave informed consent after reading the participant information sheet. The VSEEL subject pool is administered using ORSEE (Greiner, 2015). We excluded subjects who had participated in the related repeated prisoner's dilemma experiments reported in Romero and Rosokha (2018, 2019a,b) and Cason and Mui (2019). We ran three sessions (one for each treatment) on each of nine separate days. Session start times were constant across days, and we balanced start times across treatments. On the ninth day, one session did not fill up, and so we ran that session exactly one week later. The experiment was programmed in oTree (Chen et al., 2016).

Web Appendix III.2 Further details on choice of strategies

We randomly created sixteen orders of the ten strategies, one for each of the sixteen possible subjects in a session, such that every strategy appeared first in the order for at least one of the first twelve subjects (recall the minimum session size was twelve), and no strategy appeared first in the order for more than two subjects.

The round-by-round randomization for RAND was implemented in real time as play progressed. We included RAND as an option for subjects who had difficulty choosing among the other strategies (RAND is the equivalent of level-0 behavior in stage-game strategies). RAND also ensures that, despite the limited number of available strategies, subjects never perfectly learn their current opponent's deterministic strategy (the reason is that RAND replicates every deterministic strategy with positive probability): this increases external validity of the learning process about the population across supergames. Finally, RAND creates more behavioral separation between G-type strategies (DG, G, G2) and TFT-type strategies (DTFT, 2TFT, TFT, TF2T) since random defection(s) under RAND induce persistent punishment in the first case but not the second.

Fudenberg et al. (2012) call DTFT 'Exploitative Tit-for-Tat', while Dal Bó and Fréchette (2018, 2019) call it 'Suspicious Tit-for-Tat'; we use the neutral term 'DTFT' to avoid implying a motive for choosing this strategy.

Our strategy DG is not equivalent to Fudenberg et al. (2012, fn.25)'s D-Grim, which responds to a player's own first-round defection and so is behaviorally equivalent to AD in our setting without mistakes in implementation.

For simplicity, under our definition of G, a player does not defect unless her opponent has defected at least once; that is, the player does not respond to her own defections (the same is true for G2). In our setting without mistakes in implementation, our definitions of G and G2 are behaviorally equivalent to those in Fudenberg et al. (2012). We use the simpler definitions because: (i) they are easier to understand; and (ii) to avoid subject confusion about why a strategy specifies a response to a player's own unilateral deviation(s) that can never occur under that strategy. Similarly, Dal Bó and Fréchette (2019, p.3935) use the term 'Grim' to denote a memory-1 strategy that, in the absence of mistakes in implementation, is behaviorally equivalent to Grim as defined in Fudenberg et al. (2012).

Web Appendix III.3 Strategy categories

We find it useful to categorize our ten supergame strategies, as illustrated in Figure A.12.

Along the horizontal axis, we categorize strategies according to when they first defect. The three 'unfriendly' strategies (AD, DG, DTFT) defect in the very first round. The three 'provocable' strategies (G, 2TFT, TFT) start by cooperating but defect immediately in response to the opponent's first defection. The three 'lenient' strategies (G2, TF2T, AC) start by cooperating and do not defect immediately in response to the opponent's first defection.[31]

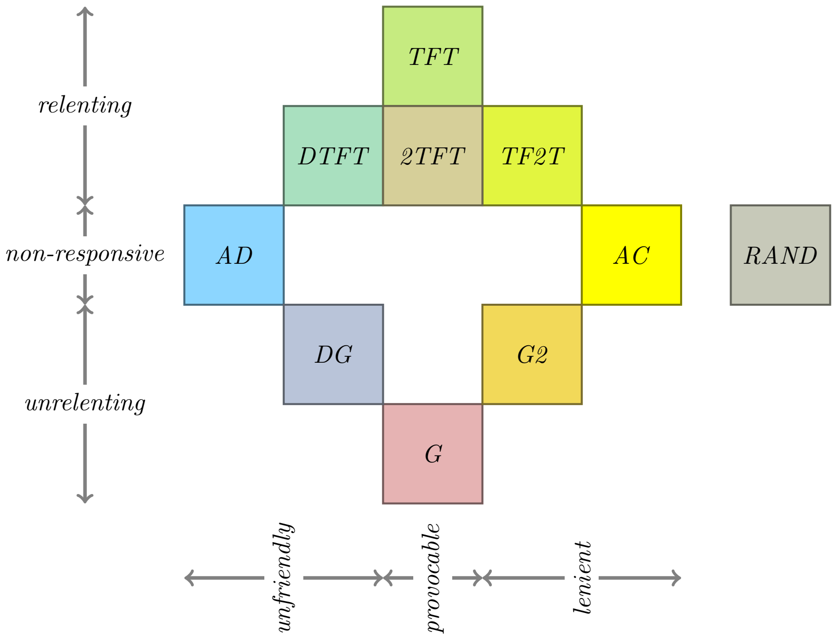


Figure A.12: Strategy categories

Along the vertical axis, we categorize strategies according to whether they punish a rival's defection forever or whether, after punishing a rival's defection, they eventually relent and cooperate if the opponent cooperates. The three 'unrelenting' strategies are the G-type strategies (DG, G, G2). The four 'relenting' strategies are the TFT-type strategies (DTFT, 2TFT, TFT,

[31]Fudenberg et al. (2012) categorize strategies as lenient in the same way that we do in Figure A.12. According to Fudenberg et al. (2012)'s terminology, our unfriendly strategies are 'fully noncooperative', while our 'provocable' strategies are 'fully cooperative' but not lenient.

TF2T).[32] The three 'non-responsive' strategies (AD, RAND, AC) never respond to a rival's defection.

Web Appendix III.4 Further details on supergames with strategy elicitation

We randomly drew the lengths of the 25 supergames in advance. In particular, we randomly drew nine sequences of 25 supergame lengths; that is, we drew a new sequence for each of the nine sessions of a particular treatment. To keep supergame lengths the same across treatments, we used the same nine sequences for each of the three treatments. Figure A.13 shows the nine sequences.

Supergame Number:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Realization #1:	2	3	2	2	5	11	8	1	3	7	1	11	1	5	1	5	4	6	3	4	2	1	6	1	2
Realization #2:	3	3	6	1	1	1	2	1	7	1	4	11	2	1	3	2	4	1	10	3	14	5	10	1	3
Realization #3:	17	5	3	7	4	1	2	3	9	3	5	5	7	1	1	6	6	2	6	6	4	6	2	2	1
Realization #4:	1	2	2	1	2	3	5	1	2	4	1	2	1	2	15	1	20	2	4	1	2	2	2	4	6
Realization #5:	1	4	13	5	3	1	1	2	4	6	7	1	3	6	5	3	2	1	6	7	13	6	4	10	4
Realization #6:	10	1	4	2	6	7	8	6	1	1	1	1	3	10	10	3	2	2	9	4	8	11	8	8	3
Realization #7:	8	7	3	3	2	1	1	4	2	4	2	16	6	6	1	3	3	1	1	3	1	9	7	1	6
Realization #8:	4	1	2	5	1	1	2	2	5	5	1	14	3	4	1	2	1	3	1	2	1	1	5	4	1
Realization #9:	4	1	4	6	7	1	15	5	1	9	1	4	6	10	2	3	7	6	6	2	1	1	2	10	11

Figure A.13: Sequences of supergame lengths

Previously chosen strategies did not act as defaults: subjects made an active choice of strategy at the beginning of each supergame.

Dal Bó and Fréchette (2011, 2019) also use random rematching. Dal Bó and Fréchette (2011, fn.4) provide evidence that random rematching does not induce repeated-game effects across supergames.

Web Appendix III.5 Strategy elicitation and one-shot games

As we describe in more detail in Section I.F, in our implementation of the indefinitely repeated prisoner's dilemma, at the beginning of each supergame each subject chooses one strategy to play the supergame, and then the subject's chosen supergame strategy and that of her opponent are played out round-by-round on the subject's screen. Thus, subjects in our experiment choose a strategy to which they are committed for the duration of the supergame: related work that also directly elicits supergame strategies in the indefinitely repeated prisoner's dilemma by making

[32]We use the term 'relenting' rather than 'forgiving' because Axelrod (1980)'s concept of forgiving in the prisoner's dilemma includes both relenting after a punishment and being lenient by not immediately punishing a defection.

subjects choose a strategy to which they are committed includes Romero and Rosokha (2018), Cason and Mui (2019) and Dal Bó and Fréchette (2019). Eliciting supergame strategies in the indefinitely repeated prisoner's dilemma is an example of the strategy method, under which subjects have no opportunity to deviate from their strategy as the game proceeds (see the survey by Brandts and Charness, 2011).

This implementation of the indefinitely repeated prisoner's dilemma is related to one-shot games. However, there are differences:

- Subjects are not directly given the ten-by-ten supergame strategy expected payoff matrix. Instead, they are given the payoffs for the stage game of the indefinitely repeated prisoner's dilemma, together with a description of each supergame strategy. We also note that the payoffs that arise from any pair of strategies are not deterministic because: (i) the game lasts an uncertain number of rounds; and (ii) the RAND strategy randomizes round-by-round.

- Relatedly, subjects see round-by-round feedback (choices made by the strategies, payoffs, and die rolls that determine whether the supergame continues to the next round), and each round lasts two seconds in order to mimic the feedback from direct-response play (where subjects choose their actions round-by-round).

- Unlike one-shot games with feedback, subjects do not directly observe the strategy chosen by their opponent, which preserves external validity because in real-world strategic interactions people usually do not directly observe others' strategies.

If we made our implementation more like one-shot games with feedback by allowing subjects to directly observe the strategy chosen by their opponent, we conjecture that this would change how subjects learn from experience. In our implementation, when learning from experience, subjects are uncertain about the strategy chosen by their opponents in previous rounds (because the same within-supergame history of play can arise from multiple strategies). If we removed this uncertainty by allowing subjects to directly observe strategies, we conjecture that subjects would respond more strongly to experience. As a result, the comparisons that we make in Section III.B to the effects of learning from experience in Dal Bó and Fréchette (2018)'s meta-data from round-by-round choices would become less informative.

Web Appendix III.6 Strategy elicitation and equilibrium

When $\delta = 0.75$ and $R \in \{32, 40, 48\}$, Dal Bó and Fréchette (2011) show that full defection and full cooperation are both equilibrium outcomes of subgame-perfect Nash equilibria; e.g., (AD,AD) and (G,G) are both equilibria. As we show below, in our setting with strategy elicitation, full defection and full cooperation remain equilibrium outcomes.

We build on recent work that directly elicits supergame strategies in the indefinitely repeated prisoner's dilemma (Romero and Rosokha, 2018; Cason and Mui, 2019; Dal Bó and Fréchette, 2019). As in that literature, subjects in our experiment choose a strategy to which they are committed for the duration of the supergame. Thus, equilibrium analysis checks whether strategies are best-responses to each other, ignoring the possibility of deviation once the supergame has started. In this sense, the equilibrium analysis is like that for one-shot games. Inspecting the expected payoff matrices (Tables A.16, A.17 and A.18 in Web Appendix X) gives the following:

- When $R = 32$, the set of symmetric pure-strategy Nash equilibria is:

  {(AD,AD), (G,G), (2TFT,2TFT)}.

- When $R \in \{40, 48\}$, the set of symmetric pure-strategy Nash equilibria is:

  {(AD,AD), (G,G), (2TFT,2TFT), (TFT,TFT)}.

- When $R = 32$, the set of asymmetric pure-strategy Nash equilibria is:

  {(DG,G2), (DTFT,TFT), (G,2TFT)}.

- When $R \in \{40, 48\}$, the set of asymmetric pure-strategy Nash equilibria is:

  {(DG,G2), (DG,TF2T), (DTFT,G2), (DTFT,TF2T), (G,2TFT), (G,TFT), (2TFT,TFT)}.

All ten strategies are rationalizable, since each strategy is a best-response to some belief.[33]

Web Appendix III.7 Further details on belief elicitation

We endeavored to keep the description of the QSR concise. The text of the second and third lines is similar to that used by Costa-Gomes and Weizsäcker (2008). Following Costa-Gomes and Weizsäcker (2008): (i) we told subjects that they would make the most money if they reported their true beliefs; but (ii) we also provided a complete description of the QSR.

Eliciting beliefs can potentially change behavior. For example, eliciting incentivized beliefs might change beliefs or make the importance of beliefs more salient, which in turn might affect behavior. Reassuringly, Costa-Gomes and Weizsäcker (2008) find that when using the QSR to elicit beliefs about a distribution over three strategies in one-shot games, the belief elicitation has a mostly insignificant effect on behavior.[34] More broadly, Schotter and Trevino (2014)'s survey

[33] Inspecting the payoff tables (Tables A.16, A.17 and A.18 in Web Appendix X), all ten strategies except RAND are always a best-response to at least one pure strategy, and when $R = 32$, RAND is also a best-response to a pure strategy. When $R = 40$, RAND is a best-respone to a 50-50 mix over TF2T and AC. When $R = 48$, RAND is a best-response to a 11-89 mix over TF2T and AC.

[34] Other papers that use the QSR to elicit beliefs about a distribution over three or more choices include Terracol and Vaksmann (2009), Danz et al. (2012), Hyndman et al. (2012) and Gee and Schreck (2018).

concludes that eliciting beliefs either has no effect on behavior or hastens learning, and so is mostly innocuous. Since we are specifically interested in learning, we designed our experiment to minimize contamination of strategy choices by eliciting beliefs only twice, in the first supergame and in the final supergame (and by eliciting beliefs in these supergames after subjects chose their strategy). By eliciting beliefs in the first and final supergames, we are able to study both initial beliefs and the change in beliefs from the beginning to the end of the experiment, while minimizing concerns that eliciting beliefs could change behavior. Eliciting beliefs only twice also reduces the cognitive complexity and length of our experiment.

The QSR is incentive compatible (Selten, 1998), which means that money-maximizing (risk-neutral) subjects are incentivized to report their true belief. Given that we elicit a belief about a distribution over ten strategies, we wanted to keep the belief elicitation procedure as simple as possible. In this respect, the QSR has the advantage that it is deterministic: that is, the subject's payoff depends deterministically on their reported belief and the realized state. Schlag and van der Weele (2013) show theoretically that all deterministic scoring rules impair truth-telling incentives for risk-averse subjects. However, in our setting, we judged that introducing an element of randomization would make the belief elicitation procedure too complicated.[35] Furthermore, in our setting with ten strategies, the bias toward flattening the reported distribution is unlikely to be important: Harrison et al. (2017) find that for empirically plausible levels of risk aversion, the bias is small unless the set of events over which beliefs are elicited is binary or close to binary.

We do not expect hedging due to risk aversion to be a significant concern in our complex setting. Schlag et al. (2015, p.481)'s survey summarizes evidence that hedging across actions and beliefs is more of a problem in simple environments. For example, Blanco et al. (2010) find hedging in a coordination game with obvious hedging incentives, but find no hedging in a more complicated prisoner's dilemma game. As noted above, Costa-Gomes and Weizsäcker (2008) use the QSR to elicit beliefs about a distribution over three strategies, and they find no evidence of hedging.

Finally, Schlag et al. (2015, p.479)'s survey finds no consensus on whether beliefs are influenced by first making a choice.

[35]Furthermore, even if our subjects could understand the mechanics of a belief elicitation procedure with randomization, they might still not understand why the randomization gives the incentive to report truthfully with risk aversion. Schlag et al. (2015, p.482)'s survey discusses the contradictory evidence on whether randomized payments induce risk neutrality even in simple settings.

Web Appendix III.8 Further details on personality questionnaire

We included forgiveness, kindness and trust because we judged that these measures linked well to the strategy categories described in Web Appendix III.3 (unfriendly, provocable, lenient, and relenting/unrelenting); indeed, the questions underlying the forgiveness measure relate to aspects of leniency and of being relenting, and thus this measure captures the spirit of Axelrod (1980)'s concept of 'forgiving' (see Web Appendix III.3). We included manipulativeness because the underlying questions capture a willingness to exploit others. We included anxiety because we conjectured that anxiety might affect the ability to perform in strategic interactions.[36] Finally, we included cautiousness because Proto et al. (2019) find a negative association between this facet of conscientiousness and cooperation in an indefinitely repeated prisoner's dilemma.

We carefully read through the questions underlying a large number of personality measures. By design, we selected short directed measures of personality rather than longer measures that confound different concepts. For this reason, our three measures that come from the Big Five (John et al., 2008) capture specific facets of the five broader personality measures: anxiety is one of six facets that make up neuroticism; cautiousness (sometimes called 'deliberation') is one of six facets that make up conscientiousness; and trust is one of six facets that make up agreeableness. The anxiety, cautiousness and trust measures include ten questions each; the questions come from the 300-item IPIP-NEO (see Goldberg, 1999, and Johnson, 2014) and are at: `https://ipip.ori.org/newNEOFacetsKey.htm`. The manipulativeness measure includes six questions and is one of thirty-three scales from the Computerized Adaptive Test of Personality Disorder (CAT–PD); the questions come from the 212-item CAT–PD–SF (see Simms et al., 2011, and Wright and Simms, 2014) and are at: `https://ipip.ori.org/newCAT-PD-SFv1.1Keys.htm`. The forgiveness and kindness measures include eight questions each and are two of the twenty-four character strengths from the Values in Action Inventory of Strengths (VIA-IS); the questions come from the 192-item VIA-IS-R (see Peterson and Seligman, 2004, and McGrath, 2017) and for research purposes are available on request from the VIA Institute on Character (`https://www.viacharacter.org`).

We randomly drew the order of the 52 questions, subject to the constraint that no two consecutive questions could come from the same personality measure (subjects all faced the same order). We told subjects that their answers would not affect the experiment in any way. All 52 questions use a five-point Likert scale. For consistency, we presented all questions in the form 'I ...', and we used the introductory wording and response categories recommended by IPIP at: `https://ipip.ori.org/New_IPIP-50-item-scale.htm`. The 52 questions were split into

[36] Anxiety is an important facet of neuroticism. Gill and Prowse (2016) find a negative association between neuroticism and performance in a repeated p-beauty contest game, Al-Ubaydli et al. (2016) find that neuroticism negatively predicts joint cooperation in a finitely repeated prisoner's dilemma, while DeYoung et al. (2010) find that neuroticism correlates with volume in areas of the brain associated with threat and punishment.

five screens of ten questions and a final screen of two questions. Subjects could change their answers on a particular screen until they submitted their answers for that screen. Subjects were allowed to submit incomplete sets of answers, but were asked to confirm that they wanted to do so. We replaced missing responses by the sample average of nonmissing responses to that particular question.

We included the personality questionnaire at the beginning of the experiment because we were concerned that experience and earnings in the prisoner's dilemma could affect subjects' answers to the personality questions. We were less concerned that answering a personality questionnaire would affect behavior: as explained above, we randomized the order of the 52 questions, and our personality questionnaire is neutral in the sense that some questions are framed positively (e.g., "I trust what people say") while others are framed negatively (e.g., "I am wary of others"). Placing the personality questionnaire at the beginning of the experiment before subjects play games also follows recent practice in, e.g., Gill and Prowse (2016) and Proto et al. (2019, forthcoming), while Fréchette et al. (2017) measure personality before studying choice under risk and uncertainty.

Web Appendix III.9 Further details on personality factors

We undertook a principal factor analysis using maximum likelihood factoring and Varimax rotation, implemented to give factors that are uncorrelated with each other (see Luo et al., 2019). Before rotation, five factors have eigenvalues above one, and so these were retained in the rotation; retaining factors with eigenvalues above one is a standard criterion for choosing the number of factors due to Kaiser (1960).

Each factor's loadings are highest for the questions underlying one of the personality measures, and so we name each factor after that personality measure. The ten highest loading questions underlying the trust factor are the ten questions that measure trust. The nine highest loading questions underlying the anxiety (cautiousness) factor come from the ten questions that measure anxiety (cautiousness). The six highest loading questions underlying the kindness factor come from the eight questions that measure kindness. The four highest loading questions underlying the manipulativeness factor come from the six questions that measure manipulativeness (and the other two questions also appear among the ten highest loading questions); the raw factor loads negatively on manipulativeness, and so to create the manipulativeness factor we changed the sign of all the factor loadings.

Web Appendix III.10 Further details on cognitive ability test

We used the eleven-question matrix reasoning test developed by the International Cognitive Ability Resource Team (ICAR), which is similar to the Raven Progressive Matrices test (Raven et al., 2000) and measures fluid intelligence.[37] For each question, subjects have to identify (among six choices) the missing element that completes a visual pattern. For research purposes, the questions are available on request from ICAR (`https://icar-project.com`; see Condon and Revelle, 2014, for more about ICAR).

We gave subjects seven minutes to complete the test (the screen showed a countdown clock). We told subjects that their answers would not affect the experiment in any way. Following the convention in the psychometric literature, we did not provide monetary incentives for completing the test, and we did not tell subjects anything about their performance.

Web Appendix III.11 Further details on demographics

We asked subjects whether: (i) they were aged 'under 20' or '20 and over'; (ii) they were 'male' or 'female'; (iii) their major was in 'Economics or Management', 'STEM (Science, Technology, Engineering, Math)', 'Liberal Arts' or 'other'; (iv) they went to high school 'in US' or 'outside of US'. In each case, the subject could report 'prefer not to say'. Four subjects did not complete the questionnaire (answering 'prefer not to say' to one or more questions), and so we exclude those subjects from regressions that control for demographic characteristics. Those regressions also use a binary major categorization ('STEM' or 'not STEM').

[37]Fluid intelligence is "the ability to reason and solve problems involving new information, without relying extensively on an explicit base of declarative knowledge" (Carpenter et al., 1990). Matrix reasoning tests have been used in economics by, e.g., Burks et al. (2009), Charness et al. (2018), Gill and Prowse (2016), Fe et al. (forthcoming) and Proto et al. (2019).

Web Appendix IV Further analysis of initial beliefs and behavior

Web Appendix IV.1 Introduction

Web Appendix IV.2 discusses our measure of optimism. Web Appendix IV.3 shows that the accuracy of beliefs increases as the return to joint cooperation goes up. Web Appendix IV.4 provides support for good responding as a useful measure and shows that the frequency with which subjects good respond interacts with their optimism. Web Appendix IV.5 finds that earnings increase with the accuracy of beliefs and with the ability of subjects to good respond to their beliefs.

Web Appendix IV.2 Discussion of our measure of optimism

As described in Section II.A, our measure of optimism measures how often a subject expects others to cooperate: specifically, 'Optimism' measures the expected cooperation rate of a subject's belief distribution playing against itself. We used this definition of optimism because it measures how often a subject expects the population of subjects (excluding herself) to cooperate when they play against each other; we find this intuitive, and furthermore this definition allows a direct comparison of beliefs to the level of cooperation in the population.

We prefer this definition to an alternative measure of optimism based on the level of cooperation that the subject's own strategy achieves against her belief distribution. The reason is that we want our measure of optimism to be independent of the subject's behavior, so that we can study cleanly the relationship between optimism and behavior.

We could have used a simpler measure of optimism that sums up the belief weights on cooperative strategies (where cooperative strategies are defined to be those that always cooperate when played against themselves). We call this simpler measure 'OptimismSimple'. This measure is cruder than ours since it weights beliefs on strategies like AC and G the same, even though such strategies cooperate differently against AD. It turns out that OptimismSimple is highly correlated with Optimism: see Figure A.14. Furthermore, when we replace Optimism in Figure 5 with OptimismSimple we get very similar results: compare Panels I and III of Figure 5 with the equivalent panels in Figure A.15 here.

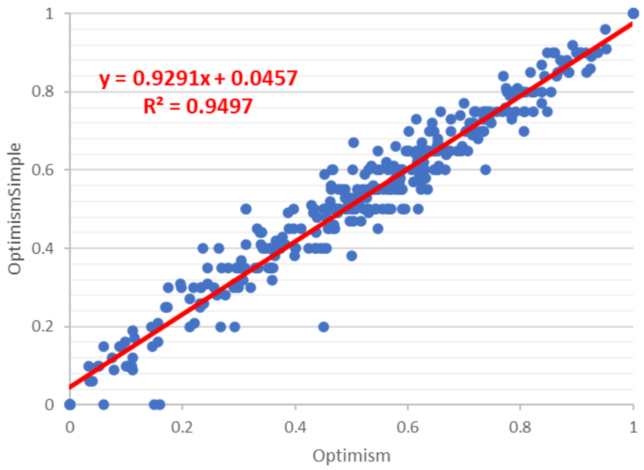


Figure A.14: Scatterplot of OptimismSimple vs. Optimism in Supergame 1

Notes: See the preceding paragraph for the definition of OptimismSimple.

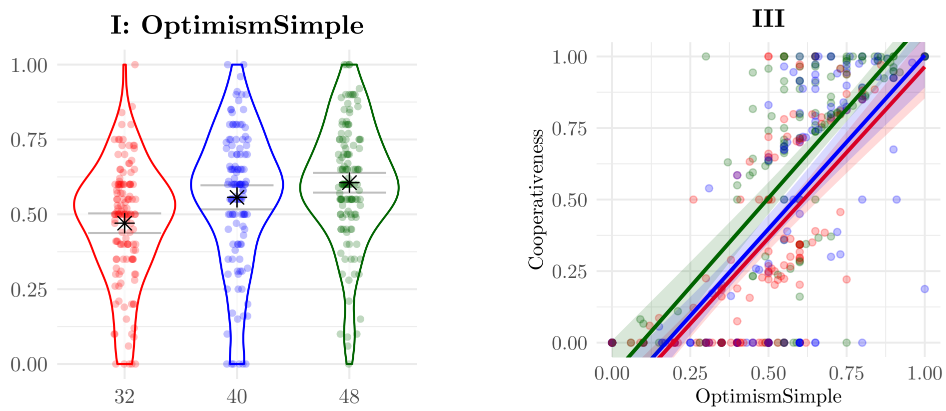


Figure A.15: Panels I and III of Figure 5, using OptimismSimple instead of Optimism

Web Appendix IV.3 Accuracy

Figure 4 suggests that the accuracy of beliefs increases as the return to joint cooperation goes up. To test this, we construct a measure of accuracy of beliefs about the within-treatment level of cooperation, and then regress this measure of accuracy on the treatment. We base our measure on the absolute value of OptimismRelTruth, which captures the deviation from the truth of the subject's expectation about how much others cooperate (Section II.A defines OptimismRelTruth). In particular, we define accuracy to be the negative of the absolute value of OptimismRelTruth; we take the negative so that accuracy increases (toward zero) as beliefs become more accurate.

We find that accuracy does indeed increase as the return to joint cooperation goes up, with the effect statistically significant at the one-percent level. In particular, we ran a linear OLS regression of accuracy in Supergame 1 on the treatment, controlling for the five personality factors, demographic characteristics and standardized cognitive ability (see Section I.H), and using heteroskedasticity-robust standard errors and two-sided tests of significance. The positive effect of $R = 48$ relative to $R = 32$ is significant at the one-percent level. Column 1 of Table A.12 in Web Appendix VIII presents the full set of estimates from this regression.

Web Appendix IV.4 Analysis of good responding

Data from the first supergame support good responding as a useful measure. First, a payoff loss of up to 3.15 percent is small relative to the range of losses across subjects: Figure 6 in Section II.B shows the cumulative distribution function of payoffs relative to best responding. Second, good responding matters for outcomes: in Web Appendix IV.5 we show that good responding is a strong predictor of earnings.[38,39] Third, good responding changes with beliefs: as we show below in this section, the frequency of good responding varies with the optimism of subjects' beliefs.

R	*AD*	*DG*	*DTFT*	*RAND*	*G*	*2TFT*	*TFT*	*G2*	*TF2T*	*AC*
32	0.97	0.37	0.34	0.03	0.13	0.13	0.12	0.10	0.09	0.04
40	0.33	0.17	0.16	0.02	0.58	0.56	0.55	0.75	0.75	0.45
48	0.07	0.09	0.09	0.01	0.34	0.33	0.31	0.94	0.94	0.60

Table A.1: Frequency each strategy is a good response in Supergame 1

Notes: For each strategy, the table shows the proportion of subjects for whom that strategy is in the subject's set of good responses (given the subject's beliefs), split by treatment. Good responding is defined in the second paragraph of Section II.B. Table A.14 in Web Appendix X replicates the table for best responding.

Table A.1 shows the frequency with which each strategy is a good response to subjects' beliefs, split by treatment. When the return to joint cooperation is low ($R = 32$), the unfriendly strategy AD is a good response for almost all subjects (97 percent), while DG and DTFT are good responses for around 35 percent of subjects. When $R = 40$, the lenient strategies G2 and TF2T are good responses for around 75 percent of subjects, while the provocable strategies G, 2TFT and TFT are good responses for around 55 percent, and AC is a good response for around 45 percent. When the return to joint cooperation is high ($R = 48$), the lenient strategies G2 and TF2T are good responses for almost all subjects (94 percent), and AC is a good response

[38] The relationship between good responding and earnings is not immediate, since good responding is defined relative to subjects' beliefs, while earnings depend on realized choices of others.

[39] If subjects' beliefs were completely wrong, then we would not expect good responding to predict earnings. In that case, our measure of good responding would remain valid while becoming less useful.

for around 60 percent; perhaps surprisingly, when $R = 48$ the provocable strategies G, 2TFT and TFT are good responses for only around 35 percent of subjects.[40]

The frequency with which subjects good respond to their beliefs interacts with optimism in an interesting way. Recall from Section II.A that optimism measures how often a subject expects others to cooperate. We find that optimism is unhelpful when the return to joint cooperation is low ($R = 32$), in the sense that optimism reduces the probability that subjects good respond to their beliefs, while optimism is helpful when the return to joint cooperation is high ($R = 48$).[41] As evidenced by Table A.15 in Web Appendix X: (i) when the return to joint cooperation is low, optimists good respond less frequently because they often fail to understand that the unfriendly strategy AD is a good response to their (relatively) optimistic beliefs; and (ii) when the return to joint cooperation is high, pessimists good respond less frequently because they often fail to understand that the lenient strategies G2 and TF2T are good responses to their (relatively) pessimistic beliefs.

Web Appendix IV.5 The determinants of earnings

In this section, we analyze the determinants of earnings. In particular, we want to understand how earnings in the first supergame depend on subjects' initial beliefs and behavior given those beliefs. Earnings in Supergame 1 are noisy, since they depend on the behavior of the specific opponent that a subject is matched with. To reduce this noise, we analyze subjects' expected earnings given their choice of strategy and how others behave within-treatment (recall that subjects had not yet interacted with each other when we elicited strategies and beliefs in the first supergame).

To put our analysis in context, Panel I of Figure A.16 shows expected earnings in the first supergame by treatment, while Panel II shows expected earnings as a proportion of the maximum available (from choosing the strategy that performs best in expectation given how others actually behave). The first panel shows that, unsurprisingly, expected earnings increase with the return to joint cooperation. The second panel shows that subjects generally leave little money on the table: on average, subjects achieve expected earnings of around 95 percent of the maximum.[42]

[40]Compared to lenient strategies, provocable strategies provide more protection against AD. However, unlike lenient strategies, provocable strategies never achieve mutual cooperation against DG and DTFT, which matters most when $R = 48$.

[41]We ran the regression described in Web Appendix IV.3, replacing accuracy as the dependent variable with an indicator taking value 1 if a subject chose a good response to her beliefs in Supergame 1, and further including optimism (defined in Section II.A) and the interaction of optimism with the treatment. Setting $R = 32$ ($R = 48$) as the omitted category, we find a negative (positive) effect of optimism on the probability of good responding, statistically significant at the one-percent (one-percent) level. We also find that the effect of optimism when $R = 48$ is significantly different to that when $R = 32$, again at the one-percent level.

[42]A subject who achieved expected earnings of 100 percent of the maximum would still leave money on the table relative to the best response to the specific strategy chosen by her randomly

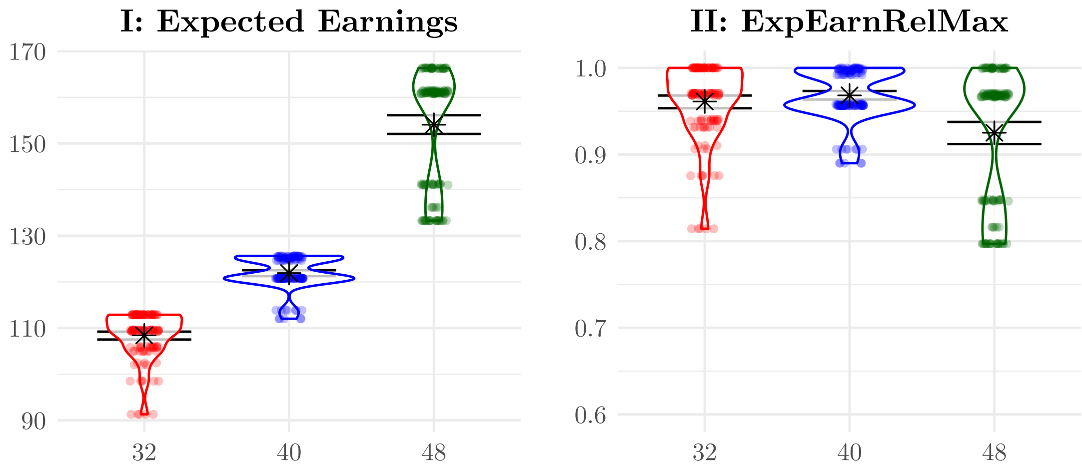


Figure A.16: Earnings in Supergame 1: Violin plots

Notes: We define 'Expected earnings' to be the expected earnings in points of a subject's chosen strategy playing against the treatment-level strategy distribution (excluding the subject's own choice); we derive Expected earnings using analytical calculations of payoffs for every possible combination of strategies (see Tables A.16 to A.18 in Web Appendix X). We define 'ExpEarnRelMax' to be Expected earnings as a proportion of the expected earnings from the best response to the treatment-level strategy distribution (excluding the subject's own choice). In the violin plots, stars are means and horizontal bars are 95 percent confidence intervals, calculated using non-parametric bootstrapping.

We now turn to our analysis of the determinants of earnings. Table A.2 reports the results of regressions of expected earnings in Supergame 1 on the variables of interest; throughout, the omitted category is $R = 32$. Confirming Figure A.16, the first two rows of Table A.2 show that expected earnings increase with the return to joint cooperation. More interestingly, the table tells us that expected earnings depend on both the accuracy of subjects' beliefs and the ability of subjects to choose well given those beliefs.

The third row of Table A.2 shows that expected earnings increase with the accuracy of beliefs about the level of cooperation (Web Appendix IV.3 introduces our notion of accuracy).[43] Thus, the quality of subjects' initial beliefs helps to determine how much they earn in the first prisoner's dilemma supergame. Furthermore, the fourth row shows that expected earnings are higher for subjects who good respond to their beliefs (Section II.B introduces our notion of good responding). Thus, the ability of subjects to select strategies that perform well given their beliefs also helps to determine how much they earn; this relationship between good responding and earnings is not immediate, since good responding is defined relative to subjects' beliefs, while earnings depend on the actual choices of others. Table A.19 in Web Appendix X shows

selected opponent.

[43] To help interpret the effect size, note that our measure of accuracy is defined from -1 to 0. In Web Appendix IV.3 we define accuracy to be the negative of the absolute value of OptimismRelTruth; Figure 4 shows the distribution of OptimismRelTruth.

that our results are robust when we replace our binary measure of good responding with a continuous measure of the proximity of a subject's strategy to the best response to her beliefs (based on expected payoffs relative to those from best responding).

	(1)	(2)	(3)
R40	13.02***	12.82***	12.61***
	(0.55)	(0.53)	(0.53)
R48	44.57***	46.59***	45.52***
	(1.18)	(1.03)	(1.07)
Accuracy of beliefs	12.09***		10.26***
	(2.66)		(2.68)
Good responder to beliefs		7.11***	6.86***
		(0.72)	(0.72)
Mean of dependent variable	128.15	128.15	128.15
N	390	390	390

Table A.2: Expected earnings in Supergame 1

Notes: Each column reports a linear OLS regression of expected earnings in Supergame 1, controlling for the five personality factors, demographic characteristics and standardized cognitive ability (see Section I.H), and with $R = 32$ as the omitted category. Expected earnings is defined in the notes to Figure A.16. Accuracy of beliefs is defined in Web Appendix IV.3. Good responding is a binary variable defined in the second paragraph of Section II.B. $N = 390$ because four subjects did not complete the demographic questionnaire. Heteroskedasticity-robust standard errors are shown in parentheses. ***, ** and * denote significance at the 1 percent, 5 percent and 10 percent levels (two-sided tests).

Web Appendix V Further analysis of the evolution of beliefs and behavior

Web Appendix V.1 Introduction

Web Appendix V.2 shows that as subjects learn over the course of the 25 supergames, their beliefs about how often others cooperate become more accurate. To help understand how experience changes cooperation, Web Appendix V.3 studies the factors that drive experimentation and strategy revisions, and Web Appendix V.4 studies transitions between strategies: for example, we find that when a subject's opponent in the previous supergame cooperated more, the subject is much less likely to change to an "unfriendly" strategy that defects for sure in the first round. Web Appendix V.5 describes the evolution of equilibrium behavior and beliefs, while Web Appendix V.6 describes the evolution of strategy choices and average beliefs. Web Appendix V.7 shows robustness of the results in Panel A of Table 3.

Web Appendix V.2 Evolution of OptimismRelTruth

Recall from Section II.A that 'OptimismRelTruth' measures optimism relative to how often others actually cooperate. Our finding from Table 3 that optimism responds to experience suggests that OptimismRelTruth moves toward zero over the course of the 25 supergames as beliefs about how often others actually cooperate become more accurate. Since subjects learn within their session, in Figure A.17 we measure OptimismRelTruth at the session level. Figure A.17 confirms that, on average, beliefs do indeed move toward the truth in all three treatments. Confirming our finding from Section II.A, when the return to joint cooperation is low ($R = 32$), subjects' initial beliefs are too optimistic relative to the truth; however, with experience OptimismRelTruth falls toward zero as this excess optimism declines. When the return to joint cooperation is high ($R = 48$), initial beliefs are slightly too pessimistic, and with experience OptimismRelTruth rises toward zero as this modest excess pessimism disappears on average.

Importantly, OptimismRelTruth captures accuracy in terms of beliefs about behavior. This avoids two disadvantages of an alternative measure of accuracy based on the distance between a belief distribution and the average strategy distribution in a session or a treatment. First, this alternative measure penalizes mistakes that have small implications for behavior as much as mistakes that have much larger implications: for example, G and 2TFT cooperate similarly (see Table A.13 in Web Appendix X), and so believing that others choose G when they actually choose 2TFT is a minimal mistake in terms of behavior, but the alternative measure penalizes this mistake as much believing that others choose G when they actually choose AD, which implies a much bigger mistake in terms of behavior. Secondly, and relatedly, this alternative measure does not tell us whether beliefs on average are too optimistic or pessimistic about the rate of cooperation, and therefore, for example, we could not use the alternative measure to analyze how excess optimism declines with experience when $R = 32$ (see the paragraph above).

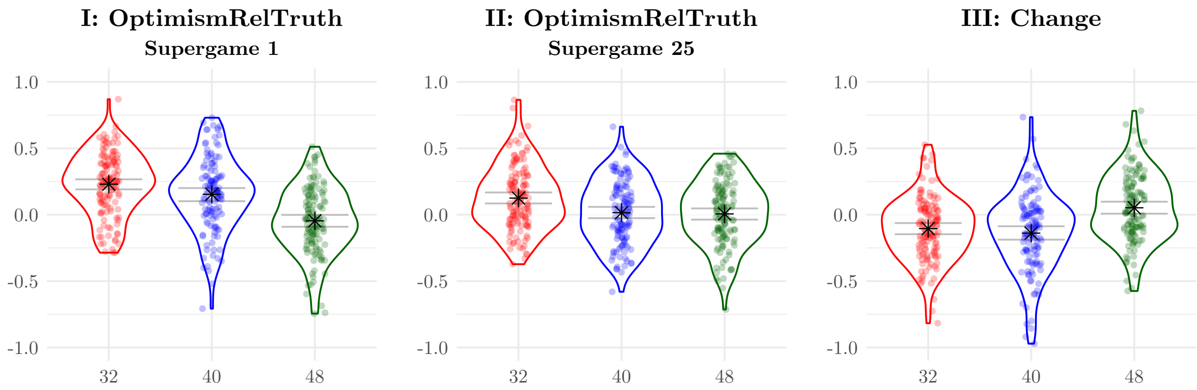


Figure A.17: Evolution of OptimismRelTruth at the session level: Violin plots

Notes: 'OptimismRelTruth' is defined as in Section II.A for Supergame 1, except that we now use the session-level strategy distribution (again excluding the subject's own choice) instead of the treatment-level distribution. In the violin plots, the unit of observation is an individual subject, stars are means and horizontal bars are 95 percent confidence intervals, calculated using non-parametric bootstrapping.

Alongside our finding that beliefs become more accurate with experience, we also find that updated beliefs account for 23% of the variance in cooperation in the final supergame, while initial beliefs account for 36% of the variance in cooperation in the first supergame (final paragraph of Section III.B). When interpreting these data, we note that considerable heterogeneity in beliefs and cooperation remains in the final supergame, both within and across treatment (Figure A.17 here and Figure A.22 in Web Appendix V.6). Table A.3 in Web Appendix V.3 shows that strategy revisions become less common as subjects gain experience: this implies less within-subject variation in cooperation across supergames but not less across-subject variation in cooperation in the final supergame.

Web Appendix V.3 Experimentation and strategy revisions

In this section we delve deeper into the evolution of behavior by studying the factors that drive experimentation and strategy revisions over the course of the 25 supergames. On average, subjects tried four of the ten available strategies at least once; furthermore, 33 percent of the time subjects changed their choice of strategy from one supergame to the next.

To help understand why subjects change their strategy from one supergame to the next, in Table A.3 we regress an indicator for changing strategy on the same variables that we analyzed in Panel A of Table 3 when studying learning from experience. To those variables, we add an indicator for good responding to beliefs in the first supergame, which we interpret here as a measure of quality of thinking given the beliefs that the subject has formed (Section II.B introduces our notion of good responding). We also add the quality of the strategy chosen by the subject in the previous supergame, which we measure by how well that strategy performs in expectation given the subject's experience. In particular, 'Quality of Supergame $t-1$ strategy' is proportional to the earnings of the strategy chosen in the previous supergame when it plays against the distribution of strategies chosen by the subject's opponents up to and including the previous supergame (the notes to Table A.3 provide the formal definition).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R40	0.014	0.036	0.014	0.009	0.019	0.057*	0.014	0.057*
	(0.032)	(0.032)	(0.033)	(0.033)	(0.032)	(0.031)	(0.032)	(0.032)
R48	-0.026	0.018	-0.028	-0.034	-0.034	0.103**	-0.026	0.076
	(0.035)	(0.035)	(0.037)	(0.034)	(0.035)	(0.044)	(0.035)	(0.046)
Length of Supergame $t-1$	-0.000							0.000
	(0.002)							(0.002)
Other's strategy coop in Supergame $t-1$		-0.209***						-0.176***
		(0.017)						(0.014)
Own strategy coop in Supergame 1			0.007					0.002
			(0.038)					(0.038)
Own optimism in Supergame 1				0.056				0.079
				(0.063)				(0.060)
Good responder to beliefs in Supergame 1					-0.073***			-0.067***
					(0.025)			(0.023)
Quality of Supergame $t-1$ strategy						-0.323***		-0.212***
						(0.060)		(0.054)
Supergame number							-0.005***	-0.005***
							(0.001)	(0.001)
Mean of dependent variable	0.332	0.332	0.332	0.332	0.332	0.332	0.332	0.332
N	9360	9360	9360	9360	9360	9360	9360	9360

Table A.3: Strategy changed from Supergame $t-1$ to Supergame t

Notes: Each column reports a linear OLS regression of a binary variable that takes value 1 if the subject changed her strategy from Supergame $t-1$ to Supergame t, and taking value 0 if not, controlling for the five personality factors, demographic characteristics and standardized cognitive ability (see Section I.H), and with $R = 32$ as the omitted category. 'Length of Supergame $t-1$', 'Other's strategy coop in Supergame $t-1$', 'Own strategy coop in Supergame 1' and 'Own optimism in Supergame 1' appear in Panel A of Table 3 (see the table notes for definitions). Good responding is a binary variable defined in the second paragraph of Section II.B. 'Quality of Supergame $t-1$ strategy' is proportional to the expected earnings of the subject's chosen strategy in Supergame $t-1$ playing against a distribution made up of the $t-1$ strategies chosen by the subject's opponents in Supergames 1 to $t-1$; each unit of quality corresponds to earnings of 100 points, and we derive this measure using analytical calculations of payoffs for every possible combination of strategies (see Tables A.16 to A.18 in Web Appendix X). N is in multiples of 390 because four subjects did not complete the demographic questionnaire. Heteroskedasticity-robust standard errors with clustering at the session level are shown in parentheses. ***, ** and * denote significance at the 1 percent, 5 percent and 10 percent levels (two-sided tests).

To summarize the main findings in Table A.3, subjects change strategy less frequently: (i) when their opponent cooperated more in the previous supergame; (ii) when the subject exhibits a higher quality of thinking; (iii) when the subject chose a higher quality strategy in the previous supergame; and (iv) when the subject has gained experience by playing more supergames.

In more detail, the third row of Table A.3 shows that the likelihood of changing strategy does not depend on the length of the previous supergame. The fourth row shows that the likelihood of changing strategy falls in the cooperation of the whole supergame strategy chosen by the subject's opponent in the previous supergame (we introduced the notion of 'strategy cooperation' in Section III.B when discussing the results from Panel A of Table 3). The seventh row shows that subjects who good respond to their beliefs in the first supergame, and so have a higher quality of thinking, are less likely to change strategy from one supergame to the next. The eighth row shows that subjects who chose a higher quality strategy in the previous supergame are less likely to change strategy. In the ninth row the coefficient on the supergame number is negative, and so subjects who have played more supergames tend to change strategy less frequently.[44] Just as in Panel A of Table 3, these results control for the subject's behavior and beliefs in the first supergame (fifth and sixth rows).

In Web Appendix V.4 we further study transitions from one strategy category to another. For example, this analysis shows that subjects are much less likely to change from provocable or lenient strategies to unfriendly ones when their opponent in the previous supergame cooperated more, which sheds light on the mechanism by which the opponent's cooperation in the previous supergame reduces the likelihood of changing strategy (Table A.3), while at the same time increasing the subject's own cooperation (Table 3).

Web Appendix V.4 Strategy transitions

In Table A.4 we study transitions from one strategy category to another (Web Appendix III.3 defines the strategy categories). Panel I uses the observations where the subject chose a strategy from the unfriendly category in the previous supergame, and we consider the factors that drive the subject to continue choosing an unfriendly strategy in the next supergame, to change to a provocable strategy, or to change to a lenient strategy. Panel II (III) repeats the exercise, using observations where the subject chose a strategy from the provocable (lenient) category in the previous supergame. The regressions reported in Table A.4 include the same independent variables as the regressions reported in Table A.3 (to save space we do not report the treatment coefficients).

[44]Related work also finds that strategy revisions become less frequent over time (Cason and Mui, 2019, across supergames; Romero and Rosokha, 2019a, within supergames; and Dal Bó and Fréchette, 2019, for non-binding strategies). Cason and Mui (2019) also find that subjects who earn more in one supergame are less likely to change strategy from that supergame to the next.

I: Unfriendly strategy in Supergame $t-1$

	(1) Stay unfriendly	(2) Change to provocable	(3) Change to lenient
Length of Sup. $t-1$	-0.006***	0.005***	0.002*
	(0.001)	(0.002)	(0.001)
Other's strategy coop in Sup. $t-1$	0.068***	-0.025*	-0.025**
	(0.017)	(0.014)	(0.011)
Own strategy coop in Sup. 1	-0.155***	0.109***	0.050*
	(0.040)	(0.026)	(0.027)
Own optimism in Sup. 1	-0.161***	0.048	0.100***
	(0.054)	(0.037)	(0.027)
Good responder to beliefs in Sup. 1	-0.004	-0.007	0.020
	(0.022)	(0.017)	(0.013)
Quality of Sup. $t-1$ strategy	-0.010	-0.025	0.006
	(0.084)	(0.070)	(0.037)
Supergame number	0.004***	-0.002**	-0.001***
	(0.001)	(0.001)	(0.000)
Mean of DV	0.827	0.102	0.045
N	4820	4820	4820

II: Provocable strategy in Supergame $t-1$

	(1) Change to unfriendly	(2) Stay provocable	(3) Change to lenient
Length of Sup. $t-1$	-0.009***	0.009***	-0.001
	(0.002)	(0.003)	(0.001)
Other's strategy coop in Sup. $t-1$	-0.236***	0.250***	-0.006
	(0.031)	(0.031)	(0.013)
Own strategy coop in Sup. 1	-0.175***	0.171***	0.023
	(0.040)	(0.058)	(0.022)
Own optimism in Sup. 1	-0.111*	0.079	0.029
	(0.057)	(0.073)	(0.029)
Good responder to beliefs in Sup. 1	-0.023	0.027	0.001
	(0.019)	(0.024)	(0.009)
Quality of Sup. $t-1$ strategy	-0.124	0.128	-0.020
	(0.076)	(0.087)	(0.026)
Supergame number	-0.003***	0.005***	-0.002***
	(0.001)	(0.001)	(0.001)
Mean of DV	0.185	0.746	0.052
N	2676	2676	2676

III: Lenient strategy in Supergame $t-1$

	(1) Change to unfriendly	(2) Change to provocable	(3) Stay lenient
Length of Sup. $t-1$	-0.002	-0.003	0.006*
	(0.003)	(0.002)	(0.003)
Other's strategy coop in Sup. $t-1$	-0.202***	-0.047	0.260***
	(0.046)	(0.032)	(0.042)
Own strategy coop in Sup. 1	-0.190***	-0.047	0.250***
	(0.049)	(0.049)	(0.076)
Own optimism in Sup. 1	-0.175	-0.004	0.183
	(0.114)	(0.092)	(0.151)
Good responder to beliefs in Sup. 1	-0.034	0.007	0.029
	(0.027)	(0.022)	(0.035)
Quality of Sup. $t-1$ strategy	-0.010	-0.117**	0.135
	(0.063)	(0.048)	(0.084)
Supergame number	-0.003*	-0.004***	0.006***
	(0.001)	(0.001)	(0.002)
Mean of DV	0.167	0.090	0.720
N	1495	1495	1495

Table A.4: Strategy category transitions from Supergame $t-1$ to Supergame t

Notes: Panel I uses all observations from Supergames 1 to 24 where the subject chose a strategy from the unfriendly category (Web Appendix III.3 defines the strategy categories). The first column of Panel I reports a linear OLS regression of a binary variable that takes value 1 if the subject continued to choose a strategy from the unfriendly category in the next supergame, and taking value 0 otherwise; note that the variable takes value 1 even if the subject changed strategy within the unfriendly category. The 2nd (3rd) column of Panel I reports a linear OLS regression of a binary variable that takes value 1 if the subject changed her strategy to one from the provocable (lenient) category in the next supergame, and taking value 0 otherwise. Panels II and III are constructed similarly. Transition probabilities do not sum to one because subjects can change to RAND, which is not included in the unfriendly, provocable or lenient categories. All regressions control for the five personality factors, demographic characteristics and standardized cognitive ability (see Section I.H), and the treatment (treatment coefficients are omitted to save space). The independent variables are the same as those in Table A.3; see the notes to that table. Heteroskedasticity-robust standard errors with clustering at the session level are shown in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels (two-sided tests).

The first row of Panels I-III of Table A.4 show that when the previous supergame was longer, subjects are less likely to stay unfriendly (first column of Panel I), and more likely to stay provocable and lenient (second column of Panel II and third column of Panel III). Furthermore, the increased likelihood of staying provocable comes at the expense of changes from provocable to unfriendly strategies (first and second columns of Panel II). These findings help us to understand why previous supergame length has no effect on the likelihood of changing strategy (Table A.3), while at the same time increasing cooperation (Table 3).

The second row of Panels I-III of Table A.4 show that when a subject's opponent cooperated more in the previous supergame, the subject is more likely to stay within the unfriendly, provocable and lenient categories (first column of Panel I, second column of Panel II, and third column of Panel III). Even though subjects are somewhat more likely to stay unfriendly, they are also much less likely to change from provocable or lenient strategies to unfriendly ones when their opponent in the previous supergame cooperated more (first columns of Panels II and III). These findings shed light on the mechanism by which the opponent's cooperation in the previous supergame reduces the likelihood of changing strategy (Table A.3), while at the same time increasing the subject's own cooperation (Table 3).

Although the effects are not individually statistically significant, the fifth and six rows of Panels I-III of Table A.4 show that quality of thinking and the quality of the strategy chosen in the previous supergame reduce the likelihood of staying unfriendly (first column of Panel I), but increase the likelihood of staying provocable and lenient by more (second column of Panel II and third column of Panel III). These findings help to explain how quality of thinking and the quality of the strategy chosen in the previous supergame reduce the likelihood of changing strategy (Table A.3). Finally, the seventh row shows that as subjects gain experience by playing more supergames, they are more likely to stay unfriendly, provocable and lenient; thus, the finding that subjects who have played more supergames change strategy less frequently (Table A.3) holds at the level of all three strategy categories.

Web Appendix V.5 Evolution of equilibrium behavior

Web Appendix III.6 describes the set of equilibrium strategies for each R. Figures A.18 and A.19 show that the proportion of chosen strategies that are equilibrium strategies and the weight that beliefs place on equilibrium strategies both show a modest tendency to increase from the first supergame to the final supergame, with the effect slightly larger in magnitude for beliefs.

For completeness, this analysis considers symmetric equilibrium strategies, asymmetric equilibrium strategies and their combination, although random rematching and the absence of feedback meant that subjects had no obvious way to coordinate their roles in an asymmetric equilibrium.

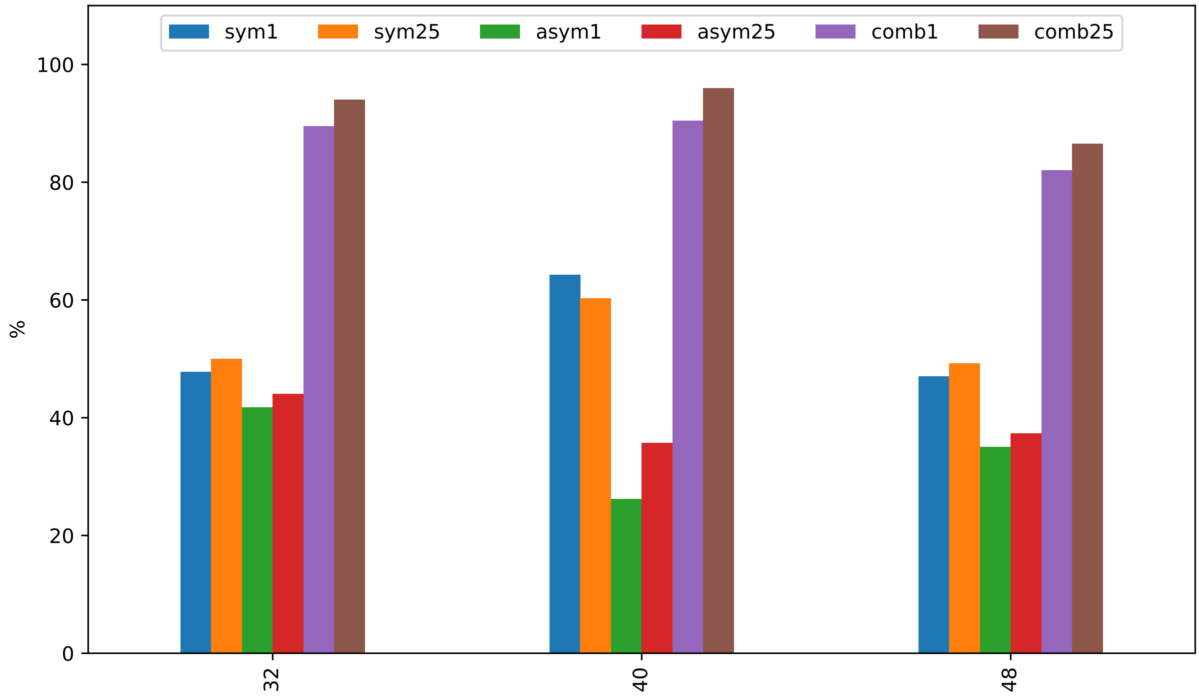


Figure A.18: Equilibrium strategies as proportion of chosen strategies in Supergame 1 vs. Supergame 25 (split by R)

Notes: 'sym1' ('sym25') is the proportion of symmetric equilibrium strategies among the strategies chosen in Supergame 1 (Supergame 25), 'asym1' ('asym25') is the proportion of asymmetric equilibrium strategies among the strategies chosen in Supergame 1 (Supergame 25), and 'comb1' ('comb25') combine the two. Web Appendix III.6 describes the set of equilibrium strategies. We say that a strategy is a 'symmetric equilibrium strategy' if that strategy is included in at least one symmetric pure-strategy Nash equilibrium, and we say that a strategy is an 'asymmetric equilibrium strategy' if it is included in at least one asymmetric pure-strategy Nash equilibrium, but is not included in any symmetric pure-strategy Nash equilibrium.

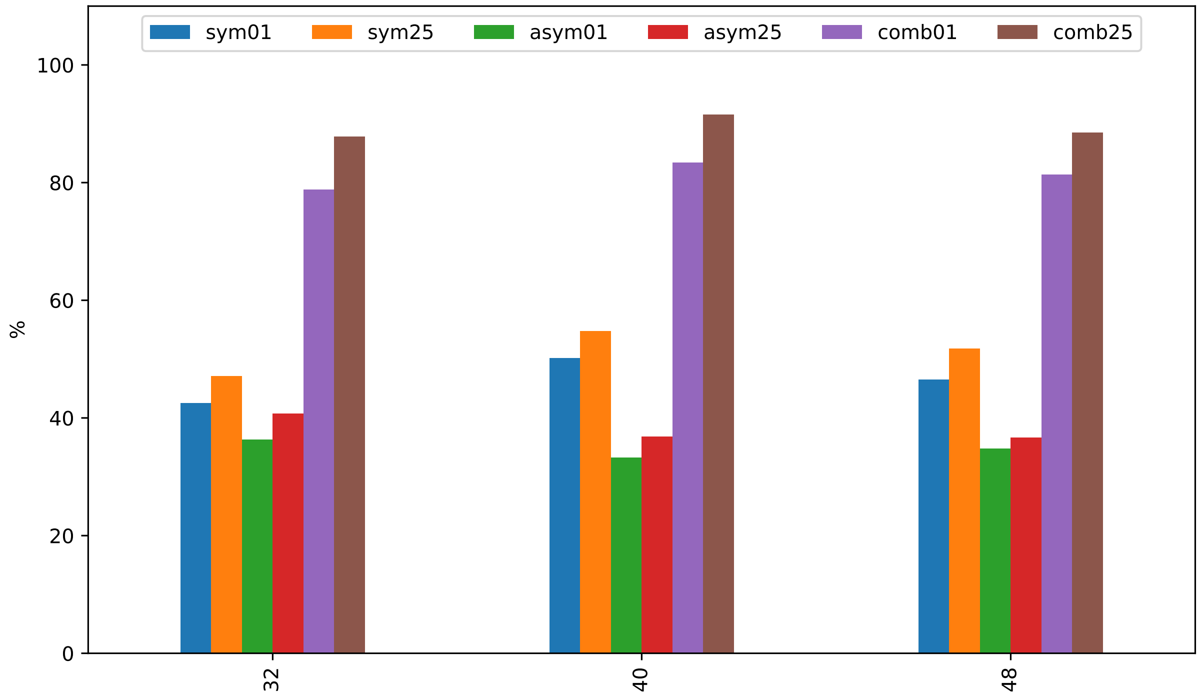


Figure A.19: Weight of beliefs on equilibrium strategies in Supergame 1 vs. Supergame 25 (split by R)

Notes: See the notes to Figure A.18. Here, we report the mean probability weight placed on equilibrium strategies across each subject's belief distribution.

We also find that strategy revisions depend on how well subjects are responding to experience. In Web Appendix V.3 we find that subjects whose chosen strategy in supergame $t-1$ performs well in expectation given the subject's experience up to supergame $t-1$ are less likely to change strategy in supergame t (this effect of 'quality of supergame $t-1$ strategy' is statistically significant at the one-percent level). Furthermore, the mechanism links to the provocable strategies (G, 2TFT, TFT) that immediately punish a defection, which from Web Appendix III.6 make up all of the symmetric equilibrium strategies except for AD. In particular, when a subject has chosen a provocable strategy in supergame $t-1$, she is more likely to continue to choose a provocable strategy in supergame t the better her chosen strategy in supergame $t-1$ performs in expectation given the subject's experience up to supergame $t-1$ (see Web Appendix V.4, although the effect is not quite statistically significant).

Finally, Figure A.20 shows that, conditional on a subject changing her strategy from supergame $t-1$ to supergame t, her strategy choice moves in the direction of the best-response to her opponent's $t-1$ strategy (with the pattern holding for all three values of R). Panel (a) uses the opponent's actual strategy at $t-1$; since this choice is not directly observed by the subject, Panel (b) instead uses the distribution of the opponent's $t-1$ strategies inferred by the subject from the round-by-round choices in supergame $t-1$ (assuming Bayesian updating from a uniform prior).

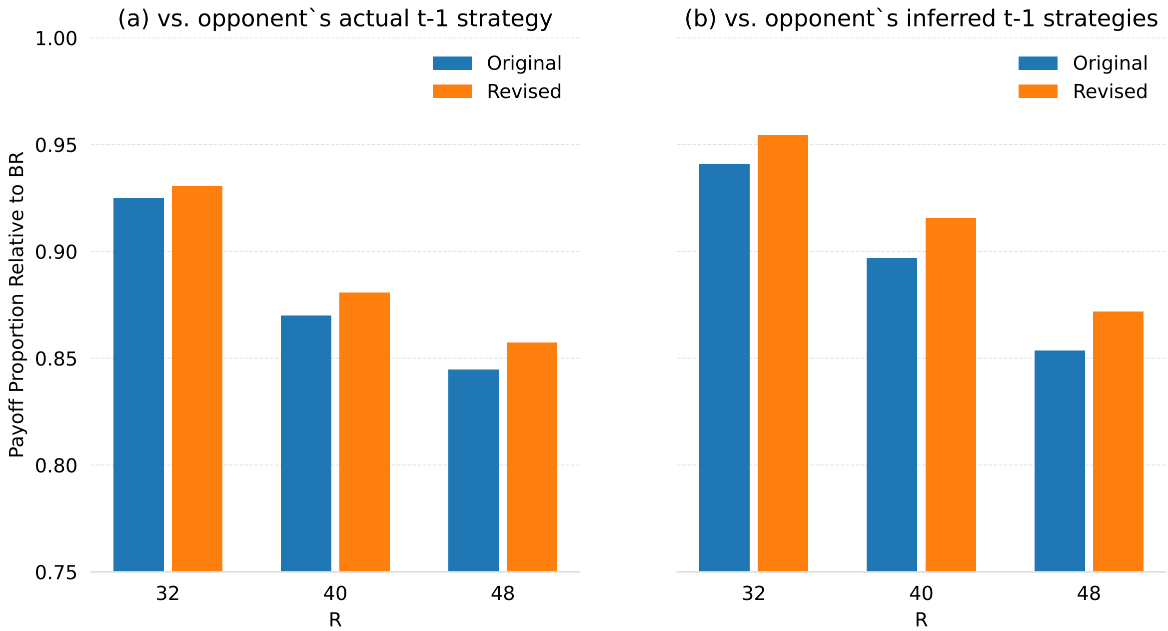


Figure A.20: Payoff of revised strategy at t (orange) and original strategy at $t-1$ (blue), playing against opponent's $t-1$ strategy (as proportion of payoff from best-response)

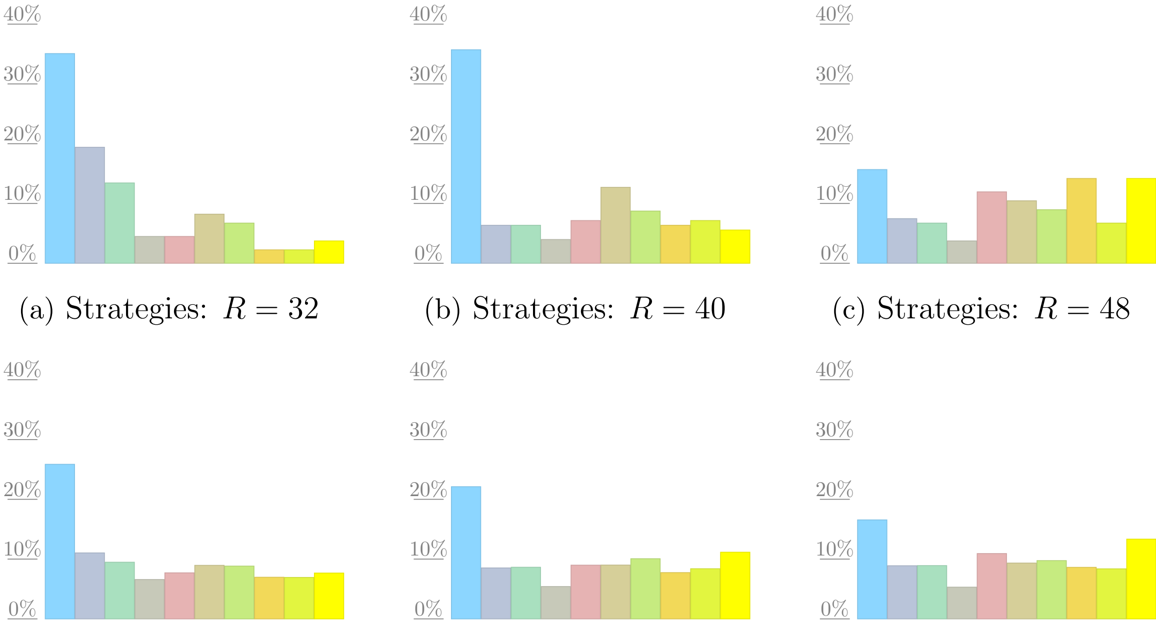
Notes: See the preceding paragraph for details.

Web Appendix V.6 Evolution of strategy choices and beliefs

Figure 3 in Section II.A shows strategy choices and average beliefs in the first supergame; for ease of reference, Figure A.21 here replicates that figure. Figure A.22 presents the same data for the final supergame. To make the comparison between Figures A.21 and A.22 clearer, Figure A.22 further includes the data from the first supergame as black horizontal bars.

When comparing strategy choices and beliefs in the final supergame to those in the first supergame, a few observations stand out:

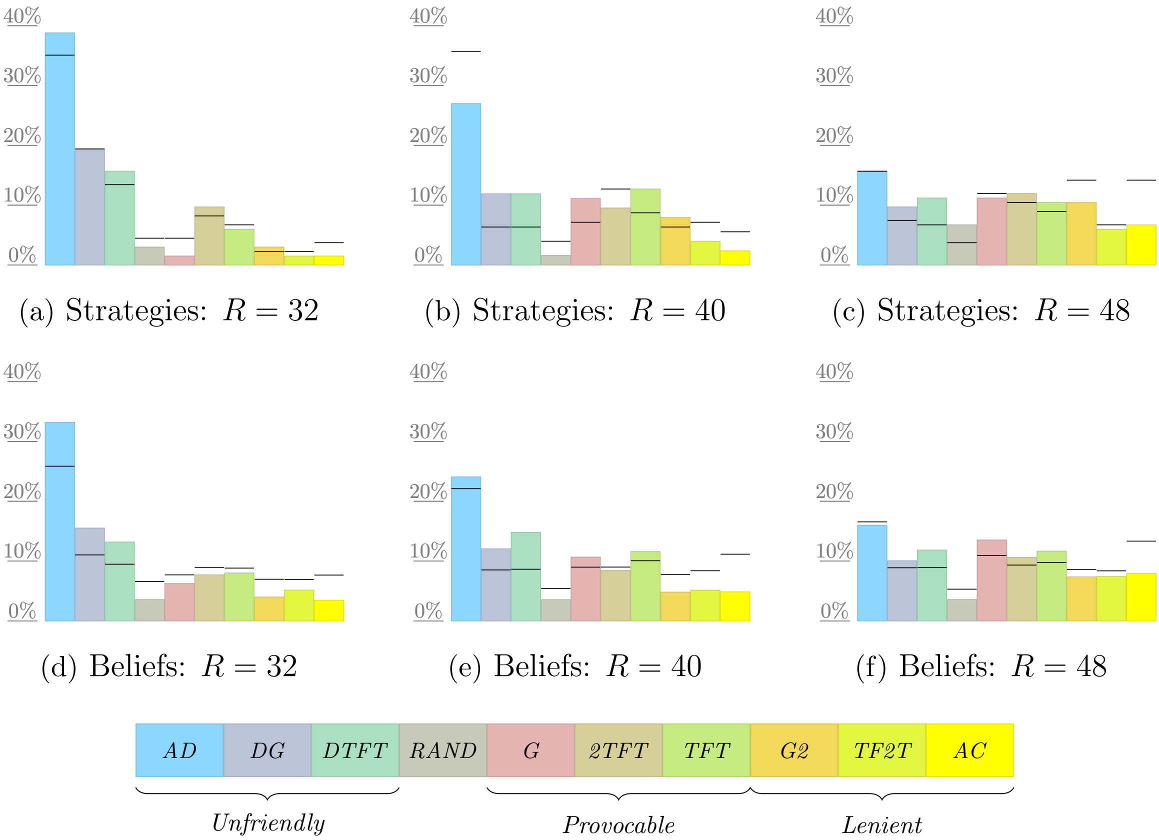
- In most of the thirty cases, the change in beliefs from the first to the final supergame is in the same direction as the change in the frequency of the corresponding strategy choice.
- In Section II.A we found that, in the first supergame, subjects are too optimistic about the level of cooperation when the return to joint cooperation is low ($R = 32$), and in Web Appendix V.2 we found that this excess optimism declines over time. Consistent with these findings, here we see that when $R = 32$: (i) in the first supergame, subjects' beliefs underestimate the proportion of unfriendly strategies and overestimate the proportion of lenient strategies; and (ii) comparing the final supergame to the first supergame, the beliefs about the proportions of unfriendly and lenient strategies become more accurate (unfriendly strategies are chosen more frequently, but the weight that beliefs place on unfriendly strategies increases by more; lenient strategies are chosen at around the same rate, while the weight that beliefs place on lenient strategies declines).
- In the final supergame, compared to the first supergame, the frequency of the most common strategy choice AD varies more in the return to joint cooperation R, as does the weight that beliefs place on AD.
- For all R, the frequency of DTFT (AC) and the weight that beliefs place on DTFT (AC) increase (decline) from the first to the final supergame.
- By the final supergame, average beliefs match the distribution of strategy choices quite closely.



(a) Strategies: $R = 32$ (b) Strategies: $R = 40$ (c) Strategies: $R = 48$

(d) Beliefs: $R = 32$ (e) Beliefs: $R = 40$ (f) Beliefs: $R = 48$

Figure A.21: Strategies & average beliefs in Supergame 1 (replicates Figure 3)



(a) Strategies: $R = 32$ (b) Strategies: $R = 40$ (c) Strategies: $R = 48$

(d) Beliefs: $R = 32$ (e) Beliefs: $R = 40$ (f) Beliefs: $R = 48$

Figure A.22: Strategies & average beliefs in Supergame 25 (black bars are Supergame 1)

Web Appendix V.7 Panel A of Table 3: Robustness

As we describe in Section III.B:

- Panel A of Table 3 studies cooperation at the level of the whole supergame strategy.
- In Panel A of Table 3 we cannot measure the cooperation of a strategy by its realized cooperation rate. If we did, we would create a confounding correlation between a subject's cooperation in Supergame t and her opponent's cooperation in Supergame $t-1$ (because a subject's own propensity to cooperate would influence the measurement of the cooperation of their opponent's strategy).
- Instead, we measure the cooperation of a strategy by how much the strategy cooperates on average against a uniform distribution over the ten available strategies. We call this measure 'strategy cooperation' for short.

As pointed out by a thoughtful referee in relation to Panel A of Table 3: "The cooperativeness of strategies will be different for beliefs that are not uniform, and most subjects do not have uniform beliefs." We address this potential problem by showing that the results in Panel A of Table 3 are robust when we measure cooperation without imposing distributional assumptions.

- First, Panel I of Table A.5 shows that our results in Panel A of Table 3 about how cooperation responds to experience are robust when we replace the dependent variable 'Strategy cooperation in Supergame t' with 'Cooperativeness in Supergame t'. Recalling from Section II.A that cooperativeness measures how often a subject expects her chosen strategy to cooperate given her beliefs about others, this measure uses the subject's actual beliefs instead of the uniform distribution.

- Second, Panel II of Table A.5 shows that our results in Panel I of Table A.5 are robust when we further replace the experience variable 'Other's strategy coop in Supergame $t-1$' with 'Other's Round 1 coop in Supergame $t-1$', which is independent of any distributional assumptions. Here, we use the other's Round 1 cooperation rather than the other's cooperativeness because the other's cooperativeness depends on the other's beliefs that are not observed by the subject.[45]

[45] Furthermore, we cannot use the subject's own beliefs when measuring the other's cooperation because beliefs affect behavior, and thus doing so would create a confounding correlation between the subject's cooperation in Supergame t and her opponent's cooperation in Supergame $t-1$.

I: Cooperativeness in Supergame t

	(1)	(2)	(3)	(4)	(5)
R40	0.132***	0.124***	0.062*	0.046	0.033
	(0.046)	(0.043)	(0.033)	(0.037)	(0.029)
R48	0.251***	0.234***	0.092***	0.122***	0.067**
	(0.035)	(0.032)	(0.031)	(0.029)	(0.026)
Length of Supergame $t-1$	0.004***				0.004***
	(0.001)				(0.001)
Other's strategy coop in Supergame $t-1$		0.079***			0.069***
		(0.019)			(0.014)
Own cooperativeness in Supergame 1			0.524***		0.310***
			(0.031)		(0.034)
Own optimism in Supergame 1				0.883***	0.517***
				(0.040)	(0.038)
Mean of dependent variable	0.452	0.452	0.452	0.452	0.452
N	9360	9360	9360	9360	9360

II: Cooperativeness in Supergame t

	(1)	(2)	(3)	(4)	(5)
R40	0.132***	0.123***	0.062*	0.046	0.032
	(0.046)	(0.043)	(0.033)	(0.037)	(0.029)
R48	0.251***	0.233***	0.092***	0.122***	0.066**
	(0.035)	(0.033)	(0.031)	(0.029)	(0.026)
Length of Supergame $t-1$	0.004***				0.004***
	(0.001)				(0.001)
Other's Round 1 coop in Supergame $t-1$		0.058***			0.050***
		(0.013)			(0.010)
Own cooperativeness in Supergame 1			0.524***		0.310***
			(0.031)		(0.034)
Own optimism in Supergame 1				0.883***	0.519***
				(0.040)	(0.038)
Mean of dependent variable	0.452	0.452	0.452	0.452	0.452
N	9360	9360	9360	9360	9360

Table A.5: Effect of experience on behavior (robustness)

Notes: The regressions reported here in Panel I are the same as those reported in Panel A of Table 3, except that we replace the dependent variable 'Strategy cooperation in Supergame t' with 'Cooperativeness in Supergame t' (for consistency, we also replace 'Own strategy coop in Supergame 1' with 'Own cooperativeness in Supergame 1'). Cooperativeness is defined in Section II.A; as there, we use Supergame 1 beliefs to measure cooperativeness (Supergame 25 beliefs depend on experience, and so using Supergame 25 beliefs would create a confounding correlation between a subject's cooperativeness in Supergame t and her opponent's cooperation in Supergame $t-1$). The regressions reported here in Panel II are the same as those reported here in Panel I, except that we replace 'Other's strategy coop in Supergame $t-1$' with 'Other's Round 1 coop in Supergame $t-1$' (this variable also appears in Table 2). In both panels, the coefficient on 'Own optimism in Supergame 1' increases compared to Panel A of Table 3: this is not surprising because cooperativeness and optimism are both measured using the same beliefs.

Web Appendix VI Further details on personality

Web Appendix VI.1 Further tables on personality

	(1) Strategy cooperation (Supergames 2-25)	(2) Strategy cooperation (Supergames 21-25)	(3) Optimism (Supergame 25)
Anxiety	-0.004	-0.023*	-0.005
	(0.009)	(0.013)	(0.012)
Cautiousness	-0.009	-0.011	-0.003
	(0.011)	(0.011)	(0.015)
Kindness	-0.004	-0.010	0.009
	(0.014)	(0.017)	(0.009)
Manipulativeness	-0.009	-0.005	-0.013
	(0.013)	(0.015)	(0.013)
Trust	0.021*	0.022**	0.024**
	(0.010)	(0.008)	(0.010)
Mean of dependent variable	0.467	0.461	0.430
N	9360	1950	390
Control for treatment	Yes	Yes	Yes
Control for beliefs in Sup. 1	No	No	No
Control for behavior in Sup. 1	No	No	No
Controls for experience	No	No	No

Table A.6: Effect of personality on behavior and beliefs (robustness)

Notes: The regressions reported here are the same as those reported in Table 4, except that they exclude the controls for experience and for Supergame 1 behavior and beliefs presented in rows three to six of Panel A of Table 3 (in relation to Columns 1 and 2 here) and of Panel B of Table 3 (in relation to Column 3 here); Columns 1 and 2 also exclude the supergame number control (not relevant to Column 3).

	(1) Strategy cooperation (Supergame 1)	(2) Strategy cooperation (Supergame 1)	(3) Optimism (Supergame 1)
Anxiety	0.009	0.017	-0.008
	(0.019)	(0.016)	(0.011)
Cautiousness	-0.002	0.000	-0.002
	(0.017)	(0.013)	(0.012)
Kindness	-0.022	-0.006	-0.017
	(0.017)	(0.014)	(0.011)
Manipulativeness	-0.027	-0.008	-0.020*
	(0.019)	(0.015)	(0.012)
Trust	-0.005	-0.010	0.005
	(0.018)	(0.013)	(0.012)
Mean of dependent variable	0.478	0.478	0.536
N	390	390	390
Control for treatment	Yes	Yes	Yes
Control for beliefs in Sup. 1	No	Yes	—
Control for behavior in Sup. 1	—	—	No
Controls for experience	—	—	—

Table A.7: Effect of personality on behavior and beliefs in Supergame 1

Column 1 (Column 3) reports a linear OLS regression of strategy cooperation (optimism) in Supergame 1 on the five personality factors, controlling for demographic characteristics and standardized cognitive ability (see Section I.H), and the treatment. The regression reported in Column 2 is the same as the one reported in Column 1, except that it further includes optimism in Supergame 1 as a control. 'Strategy cooperation' is defined in Section III.B and 'optimism' is defined in Section II.A. $N = 390$ because four subjects did not complete the demographic questionnaire. Heteroskedasticity-robust standard errors are shown in parentheses. ***, ** and * denote significance at the 1 percent, 5 percent and 10 percent levels (two-sided tests).

	(1)	(2)	(3)
R40	0.039	0.039	0.039
	(0.029)	(0.030)	(0.029)
R48	0.068**	0.060**	0.060**
	(0.026)	(0.025)	(0.025)
Length of Supergame $t-1$	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)
Own strategy coop	0.334***	0.334***	0.334***
in Supergame 1	(0.036)	(0.036)	(0.036)
Own optimism	0.232***	0.231***	0.231***
in Supergame 1	(0.039)	(0.039)	(0.039)
Other's strategy coop	0.066***	0.085***	0.082***
in Supergame $t-1$	(0.014)	(0.023)	(0.024)
('Other's strategy coop		-0.037	-0.035
in Sup. $t-1$' $- x_R)_+$		(0.039)	(0.040)
Trust × Other's strategy			-0.054**
coop in Supergame $t-1$			(0.020)
Trust × ('Other's strategy			0.079**
coop in Sup. $t-1$' $- x_R)_+$			(0.037)
Mean of dependent variable	0.467	0.467	0.467
N	9360	9360	9360

Table A.8: Strategy cooperation in Supergame t

Notes: The regression reported in Column 1 is exactly the same as the one reported in Column 5 of Panel A of Table 3. The notes to Figure 8 describe how we run a piece-wise linear spline regression by further including $\max\{0, (\text{'Other's strategy coop in Supergame } t-1\text{'} - x_R)\}$, which for conciseness we label here as ('Other's strategy coop in Sup. $t-1$' $- x_R)_+$. Column 2 reports coefficients from this spline regression without interactions with trust, while Column 3 reports coefficients with interactions with trust. All regressions control for the five personality factors (including trust), demographic characteristics and standardized cognitive ability (see Section I.H), and the supergame number, with $R = 32$ as the omitted category. N is in multiples of 390 because four subjects did not complete the demographic questionnaire. Heteroskedasticity-robust standard errors with clustering at the session level are shown in parentheses. ***, ** and * denote significance at the 1 percent, 5 percent and 10 percent levels (two-sided tests).

Web Appendix VI.2 Robustness of the pattern in Figure 8

Figure A.23 and Table A.9 show that the pattern in Figure 8 in Section IV is robust when we simplify the underlying regression by excluding the control variables.

Furthermore, we find no statistically significant differences in the pattern across treatments. In particular, when we take the regression reported in Column 3 of Table A.8 in Web Appendix VI.1 and further include interactions of the treatment indicators (R40 and R48) with the interaction of trust and uncooperative evidence (penultimate row of Table A.8) and with the interaction of trust and cooperative evidence (final row of Table A.8), the coefficients on all four of these triple interactions are far from statistical significance (all $p > 0.5$).[46] Although we find no evidence that the pattern varies across treatments, we interpret these high p-values with caution because we are not well powered to identify how trust interacts with cooperative or uncooperative evidence within a particular treatment.

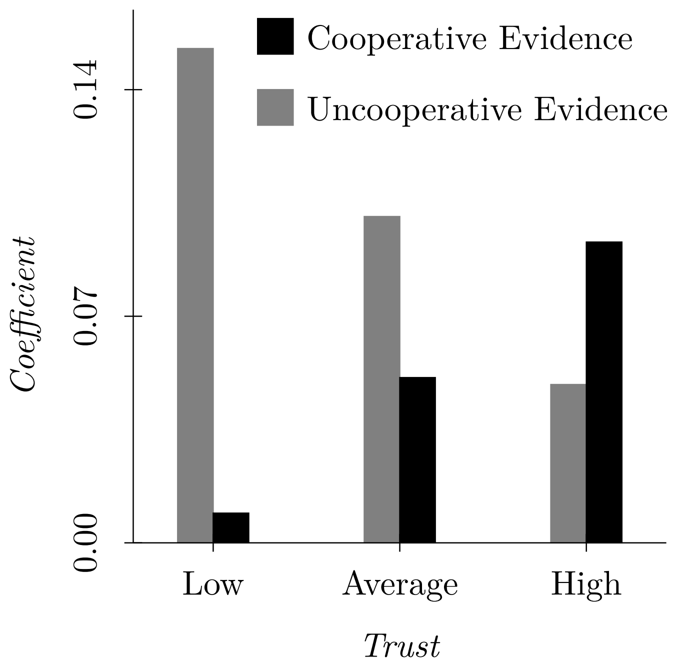


Figure A.23: Effect of opponent's strategy cooperation in Supergame $t-1$ on strategy cooperation in Supergame t (robustness)

Notes: See the notes to Figure 8. Here we use the coefficients from Column 3 of Table A.9 below (instead of Column 3 of Table A.8 in Web Appendix VI.1) that excludes the control variables from the underlying regression.

[46] This regression also includes interactions of the treatment indicators with: (i) trust; (ii) 'Other's strategy coop in Supergame $t-1$'; and (iii) ('Other's strategy coop in Sup. $t-1$' $- x_R)_+$.

	(1)	(2)	(3)
R40	0.100**	0.101**	0.100**
	(0.041)	(0.041)	(0.041)
R48	0.195***	0.185***	0.184***
	(0.033)	(0.034)	(0.034)
Trust	0.022**	0.023**	0.034**
	(0.010)	(0.010)	(0.013)
Other's strategy coop in Supergame $t-1$	0.078***	0.102***	0.101***
	(0.018)	(0.026)	(0.026)
('Other's strategy coop in Sup. $t-1$' $- x_R)_+$		-0.050	-0.050
		(0.045)	(0.047)
Trust × Other's strategy coop in Supergame $t-1$			-0.052**
			(0.024)
Trust × ('Other's strategy coop in Sup. $t-1$' $- x_R)_+$			0.094**
			(0.045)
Mean of dependent variable	0.467	0.467	0.467
N	9360	9360	9360

Table A.9: Strategy cooperation in Supergame t (robustness)

Notes: The regressions reported here are the same as those reported in Table A.8 in Web Appendix VI.1, except that they exclude the control variables (and therefore include only the variables listed above in the table). When we exclude the control variables, we continue to include the treatment indicators because the treatment is strongly correlated with 'Other's strategy coop in Supergame $t-1$'.

Web Appendix VI.3 Simulated dynamics of cooperation

In this appendix, we explore the impact of asymmetric responses to cooperative and uncooperative evidence by more and less trusting subjects (documented in Figure 8). In particular, we carry out two counter-factual simulations. The first simulation consists of sessions populated with agents whose standardized measure of trust is above zero, while the second consists of sessions populated with agents whose standardized measure of trust is below zero. Although both simulations started with the identical distribution of strategy cooperation in Supergame 1, we find that the cooperation trends diverged over the course of the 25 simulated supergames (with sessions populated by trusting subjects achieving high cooperation and sessions populated by non-trusting subjects achieving low cooperation). Figure A.24 presents the evolution of cooperation for the two simulations, and the notes to the figure describe the details of the simulations.

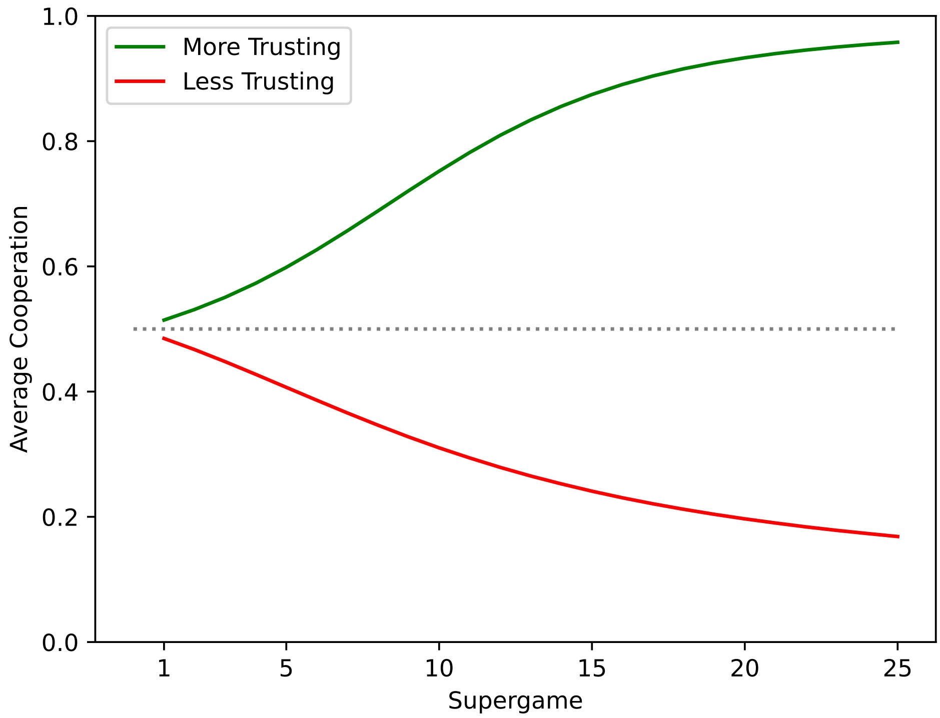


Figure A.24: Simulated dynamics of cooperation in more trusting and less trusting sessions

Notes: Each simulated session included 12 more trusting agents or 12 less trusting agents, and we average over 2,000 simulated sessions. Sessions were populated by drawing independently each agent's trust level from a standard normal distribution (recall from Section I.H that the trust factor is standardized by construction), and then randomly allocating agents with trust above (below) zero to a more (less) trusting session. Within session, agents were randomly rematched between supergames. Each agent's Supergame 1 cooperation level was drawn independently from a normal distribution with mean 0.50 and standard deviation 0.15. An agent's cooperation level changed from Supergame $t-1$ to Supergame t as a function of the cooperation level of the agent's opponent in Supergame $t-1$ according to the coefficients in the final four rows of Column 3 of Table A.8, setting $x_R = 0.5$.

Web Appendix VI.4 Further robustness

Subjects do not directly observe the strategy chosen by their opponent, and therefore we showed previously that the effects of experience reported in Table 3 in Section III are robust when we use a model in which subjects make inferences about the other's cooperation using actual round-by-round play of the supergame. Specifically, Table A.21 in Web Appendix X shows that the results in Table 3 are robust when we replace the other's strategy cooperation with the other's 'inferred cooperation', which is based on Bayesian updating from the actual round-by-round play (see Table A.21 and footnotes 25 and 26 for details).

Similarly, here we show that the effects of trust reported in Figure 8 in Section IV and Table A.8 in Web Appendix VI.1 are also robust when subjects make inferences about the other's cooperation using actual round-by-round play of the supergame (like in Table A.21, we replace the other's strategy cooperation with the other's inferred cooperation as the measure of experienced cooperation in the previous supergame). Specifically, Figure A.25 and Table A.10 show that as trust increases, the response to cooperative evidence becomes stronger, while the response to uncooperative evidence becomes weaker.

In this robustness analysis, we also make sure that the kink x_R that determines whether experienced cooperation is considered to be cooperative evidence or uncooperative evidence (see Figure 9 in Section IV) is not defined using treatment-level medians of others' strategy cooperation. Instead, we directly estimate x_R for each treatment from the data by choosing the x_R that gives the best model fit (when not including trust in the model; see the notes to Table A.10 for details).

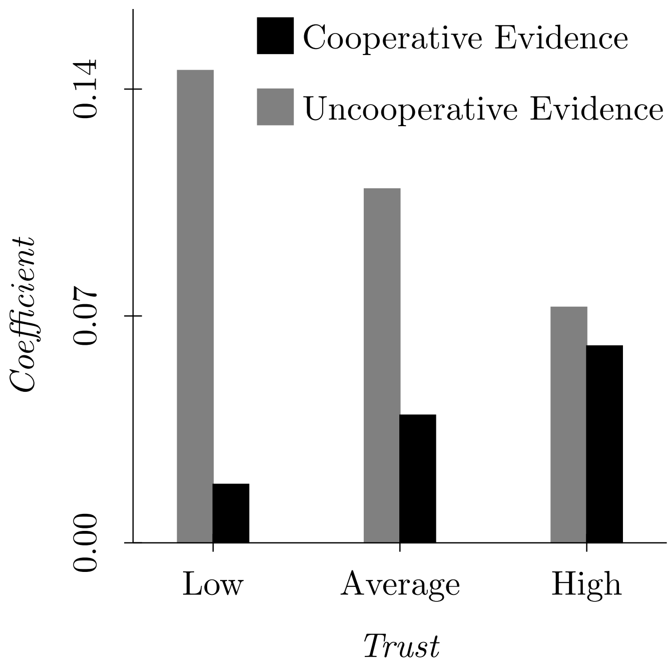


Figure A.25: Effect of opponent's inferred cooperation in Supergame $t-1$ on strategy cooperation in Supergame t

Notes: See the notes to Figure 8. Here we use the coefficients from Column 3 of Table A.10 below (instead of Column 3 of Table A.8 in Web Appendix VI.1): see the notes to Table A.10.

	(1)	(2)	(3)
R40	0.037	0.021	0.022
	(0.029)	(0.031)	(0.031)
R48	0.065**	0.047*	0.047*
	(0.025)	(0.027)	(0.027)
Length of Supergame $t-1$	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)
Own strategy coop in Supergame 1	0.333***	0.333***	0.332***
	(0.036)	(0.036)	(0.036)
Own optimism in Supergame 1	0.232***	0.233***	0.234***
	(0.039)	(0.039)	(0.039)
Other's inferred coop in Supergame $t-1$	0.088***	0.109***	0.109***
	(0.017)	(0.022)	(0.023)
('Other's inferred coop in Sup. $t-1$' $- x_R)_+$		-0.069*	-0.070*
		(0.034)	(0.034)
Trust × Other's inferred coop in Sup. $t-1$			-0.037***
			(0.013)
Trust × ('Other's inferred coop in Sup. $t-1$' $- x_R)_+$			0.058**
			(0.028)
Mean of dependent variable	0.467	0.467	0.467
N	9360	9360	9360

Table A.10: Strategy cooperation in Supergame t (robustness)

Notes: The regressions reported here are the same as those reported in Table A.8 in Web Appendix VI.1, with two differences. First, we replace the independent variable 'Other's strategy coop in Supergame $t-1$' with 'Other's inferred coop in Supergame $t-1$' (which is defined in the notes to Table A.21 in Web Appendix X). Second, the regressions in Columns 2 and 3 use estimates of x_R: specifically, before running the regressions reported in Columns 2 and 3, we estimate x_R for each treatment by choosing the x_R that gives the highest R^2 when running the regression from Column 2 in this table using only the data from that treatment (and using 201 grid points for the possible values of x_R).

Web Appendix VII Comparison to direct-response play

As we describe in the introduction, our experimental design with elicitation of supergame strategies allows us to study initial beliefs about the strategies chosen by others and the evolution of these beliefs with experience. Using this methodology, we replicate important features of the data from indefinitely repeated prisoner's dilemma games with direct-response play (where subjects choose their actions round-by-round instead of choosing a supergame strategy): the next paragraph summarizes this evidence. Unlike the data from direct-response play (e.g., Dal Bó and Fréchette, 2011), in our data cooperation is broadly stable over supergames when the return to joint cooperation is high. As we note in Section III.A, two features of our design help to explain this finding: (i) subjects could learn about the game during the two forms of training; and (ii) subjects were unable to experiment within supergame given that we elicited supergame strategies. The third and fourth paragraphs of this section discuss these two explanations in detail.

We replicate important features of the data from indefinitely repeated prisoner's dilemma games with direct-response play. For example:

- Dal Bó and Fréchette (2018)'s meta-study finds that cooperation varies in the parameters of the payoff matrix (Table 4). Similarly, we find that cooperation varies in the return to joint cooperation R (Column 1 of Table 2 and Column 1 of Panel A of Table 3, with the effects of $R = 48$ relative to $R = 32$ statistically significant at the one-percent level).

- Dal Bó and Fréchette (2018)'s meta-study (Table 9) finds that cooperation in Round 1 of a supergame depends on the length of the previous supergame (coefficient of 0.006), the Round 1 cooperation of the subject's opponent in the previous supergame (coefficient of 0.12) and the subject's own Round 1 cooperation in the first supergame (coefficient of 0.29). In Table 2, we find effect sizes that are close to those from Dal Bó and Fréchette (2018)'s meta-data, with all three effects statistically significant at the one-percent level.

Learning about the structure of the game and the properties of the supergame strategies during our two forms of training (described in Section I.E) can help to explain why, in our data, cooperation is broadly stable over supergames when the return to joint cooperation is high. Features of our data suggest that subjects learned during the training phase to vary their cooperation level with the return to joint cooperation R:

- Figure A.26 below shows that subjects varied the frequency with which they tested particular strategies with the return to joint cooperation R.

- In our data, even in the first supergame subjects cooperate more when $R = 40$ than when $R = 32$ (Panels I and II of Figure 7, and Column 1 of Table A.11 in Web Appendix VIII). By contrast, when $\delta = 0.75$ as in our data, with direct-response play Dal Bó and Fréchette

(2011) find a substantially smaller difference that is not statistically significant (top panel of Table 3), while the difference becomes larger and statistically significant after subjects learn from playing the game (bottom panel of Table 3).

- Relatedly, when R changes from 32 to 48, in the first supergame of our experiment subjects vary the frequency with which they choose each of the five key strategies in the same direction as found by Dal Bó and Fréchette (2011, 2019) after subjects learn from playing the game with direct-response play (when $\delta = 0.75$ as in our data).[47]

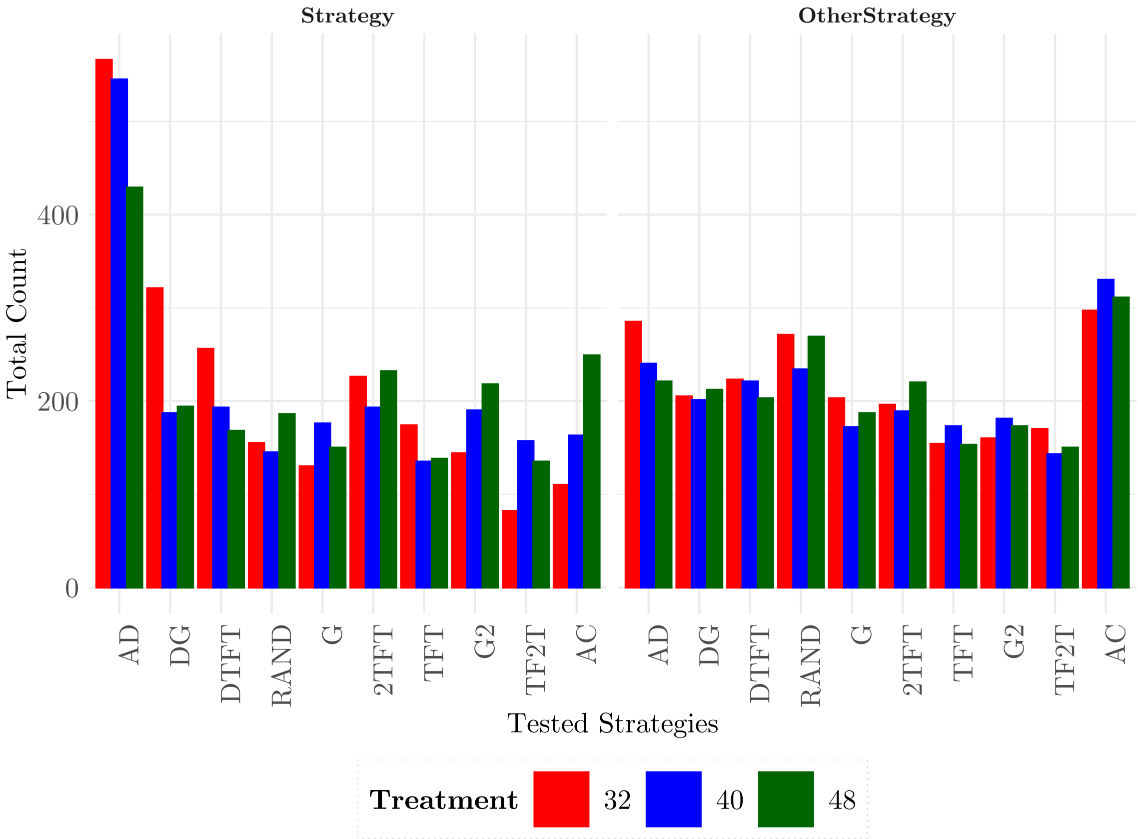


Figure A.26: Number of times each strategy was tested during the training phase

Notes: As described in Section I.E, in each 'test match' the subject chose one of the ten 'plans' for herself (labeled 'Strategy' here) and one of the ten for the 'other' (labeled 'OtherStrategy' here); see Figure A.6 in Web Appendix I for a screenshot.

[47]Table 10 of Dal Bó and Fréchette (2018) lists the five key strategies and reports the results from Dal Bó and Fréchette (2011, 2019), while Figures 3(a) and 3(c) show our results. In all three cases, the frequency of AC, G and TFT goes up, while the frequency of AD and DTFT goes down (with the exception that the frequency of DTFT does not vary in the data from Dal Bó and Fréchette, 2011).

We elicited supergame strategies, and so subjects were unable to experiment within supergame. Romero and Rosokha (2019a)'s results suggest that this feature of strategy elicitation can further help to explain why, in our data, cooperation is broadly stable over supergames when the return to joint cooperation is high. In particular, Romero and Rosokha (2019a) elicit supergame strategies in the indefinitely repeated prisoner's dilemma, but allow subjects to make strategy adjustments during the course of a supergame. When strategy adjustments are costless, Romero and Rosokha (2019a) find that cooperation increases over supergames, but when strategy adjustments are costly (so that subjects rarely adjust their strategy within supergame), Romero and Rosokha (2019a) find that cooperation tends to be flat over supergames.

Although cooperation remains stable at the aggregate level, we find substantial individual-level learning (see Section III.B). One aspect pertains to beliefs, whereby subjects whose opponents in Supergames 1 to 24 choose more cooperative strategies end up with more optimistic beliefs (see Panel B of Table 3). At the same time, subjects whose opponents in Supergames 1 to 24 choose less cooperative strategies end up with less optimistic beliefs. The heterogeneous experience and response are consistent with the stable aggregate level of cooperation: even as beliefs become more accurate with experience, considerable heterogeneity in beliefs and cooperation remains in the final supergame (see Web Appendix V.2 and Web Appendix V.6).

Web Appendix VIII Full set of estimates

In order to improve precision, our design included a short matrix reasoning test and four demographic variables that we use as controls in our regressions (Web Appendix III.10 describes the matrix test of cognitive ability; Web Appendix III.11 describes the four demographic variables). Since these variables were not the main focus of the paper, we do not include or discuss the corresponding estimates in the main text. For completeness, Table A.11 reports the full set of estimates for our regressions of cooperation and optimism presented in the main text (we also include Supergame 1 regressions from Table A.7 in Web Appendix VI.1):

- Column 1 of Table A.11 corresponds to Column 1 of Table A.7.
- Column 2 of Table A.11 corresponds to Column 3 of Table A.7.
- Column 3 of Table A.11 corresponds to Column 5 of Table 2.
- Column 4 of Table A.11 corresponds to Column 5 of Panel A of Table 3 and to Column 1 of Table 4.
- Column 5 of Table A.11 corresponds to Column 2 of Table 4.
- Column 6 of Table A.11 corresponds to Column 5 of Panel B of Table 3 and to Column 3 of Table 4.

Table A.11 shows that our matrix reasoning test does not predict cooperation or optimism. Table A.12 further shows that the matrix reasoning test predicts accuracy of beliefs in Supergame 25 but not in Supergame 1, while the matrix test does not predict good responding to beliefs.[48] When interpreting these results, recall that we included only a short eleven-question matrix reasoning test. By contrast, Gill and Prowse (2016)'s study of cognitive ability in the repeated beauty contest game used the much longer Raven test of matrix reasoning that includes 60 questions and took 30 minutes to complete (Fe et al., forthcoming, also use the 60-question Raven test to study how cognitive ability affects strategic behavior in children). Proto et al. (2019, forthcoming) find that cognitive ability predicts cooperation: because we elicit strategies, our design turns off the main mechanism that explains how cognitive ability affects cooperation in Proto et al. (2019, forthcoming), namely that more intelligent subjects make fewer errors in implementing their strategy.

Turning to the demographic variables, the results in Table A.11 provide some evidence that STEM majors, older subjects and males cooperate more; we interpret these effects with caution

[48]To help interpret the effect size, note that our measure of accuracy is defined from -1 to 0 (see Web Appendix IV.3). Since subjects learn within their session, in Supergame 25 we define accuracy at the session level instead of the treatment level: if we define accuracy of beliefs at the session level also in Supergame 1, the effect of the matrix test on accuracy in Supergame 1 remains statistically insignificant.

since the effects on cooperation are not always statistically significant at the 5% level and the effects on beliefs are never statistically significant at the 5% level. The effects of having attended an American high school are never statistically significant at the 5% level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Strategy		Round 1	Strategy	Strategy	
Dependent Variable:	cooperation	Optimism	cooperation	cooperation	cooperation	Optimism
Data from Supergames:	**1**	**1**	**2-25**	**2-25**	**21-25**	**25**
R40	0.105**	0.098***	0.040	0.039	0.067**	-0.016
	(0.044)	(0.028)	(0.043)	(0.029)	(0.031)	(0.024)
R48	0.280***	0.146***	0.113***	0.068**	0.084**	0.005
	(0.041)	(0.026)	(0.038)	(0.026)	(0.034)	(0.035)
Length of Supergame $t-1$			0.007***	0.004***	0.008***	
			(0.001)	(0.001)	(0.003)	
Length of Supergames 1 to 24						0.025*
						(0.013)
Other's Round 1 coop in Supergame $t-1$			0.080***			
			(0.016)			
Other's strategy coop in Supergame $t-1$				0.066***	0.076***	
				(0.014)	(0.018)	
Others' strategy coop in Supergames 1 to 24						0.760***
						(0.097)
Own Round 1 coop in Supergame 1			0.299***			
			(0.035)			
Own strategy coop in Supergame 1				0.334***	0.298***	0.069**
				(0.036)	(0.046)	(0.033)
Own optimism in Supergame 1			0.345***	0.232***	0.196***	0.411***
			(0.061)	(0.039)	(0.055)	(0.040)
Supergame number			-0.000	-0.000	-0.009***	
			(0.001)	(0.001)	(0.003)	
Anxiety	0.009	-0.008	0.002	-0.004	-0.022	0.003
	(0.019)	(0.011)	(0.013)	(0.009)	(0.014)	(0.010)
Cautiousness	-0.002	-0.002	-0.008	-0.009	-0.010	-0.008
	(0.017)	(0.012)	(0.012)	(0.008)	(0.012)	(0.012)
Kindness	-0.022	-0.017	0.003	0.008	0.001	0.017*
	(0.017)	(0.011)	(0.013)	(0.011)	(0.015)	(0.008)
Manipulativeness	-0.027	-0.020*	-0.001	0.004	0.006	-0.003
	(0.019)	(0.012)	(0.014)	(0.010)	(0.013)	(0.011)
Trust	-0.005	0.005	0.024**	0.021**	0.022**	0.017**
	(0.018)	(0.012)	(0.010)	(0.009)	(0.009)	(0.007)
Matrix Test (standardized)	0.014	-0.011	0.009	0.003	-0.001	-0.011
	(0.019)	(0.012)	(0.012)	(0.010)	(0.012)	(0.010)
STEM Major	0.048	0.045*	0.029	0.035**	0.040*	0.014
	(0.038)	(0.024)	(0.024)	(0.016)	(0.023)	(0.016)
Age Under 20	-0.066*	-0.005	-0.072***	-0.066***	-0.070**	-0.029
	(0.037)	(0.022)	(0.024)	(0.016)	(0.029)	(0.022)
High School in USA	-0.056	-0.028	-0.046*	-0.015	-0.008	0.005
	(0.039)	(0.027)	(0.023)	(0.017)	(0.022)	(0.019)
Male	0.027	-0.017	0.083***	0.038*	0.007	-0.019
	(0.040)	(0.024)	(0.027)	(0.021)	(0.026)	(0.019)
Intercept	0.352***	0.448***	0.001	0.094***	0.292***	-0.267***
	(0.045)	(0.028)	(0.037)	(0.029)	(0.072)	(0.063)
Mean of dependent variable	0.478	0.536	0.464	0.467	0.461	0.430
N	390	390	9360	9360	1950	390

Table A.11: Cooperation and optimism regressions: full set of estimates

Notes: The bullet points at the end of the first paragraph of Web Appendix VIII match each column to the corresponding regression reported in the paper: the notes to those regressions describe the regression and the variables. Section I.H describes the five personality factors. Web Appendix III.10 describes the matrix test of cognitive ability. Web Appendix III.11 describes the four demographic variables.

Dependent Variable:	(1) Belief Accuracy (vs. Treatment)	(2) Belief Accuracy (vs. Session)	(3) Good Responder To Beliefs	(4) Good Responder To Beliefs
Data from Supergames:	**1**	**25**	**1**	**25**
R40	0.022	0.009	0.066	-0.272***
	(0.019)	(0.018)	(0.062)	(0.070)
R48	0.102***	0.012	-0.111*	-0.387***
	(0.018)	(0.014)	(0.062)	(0.069)
Anxiety	-0.006	-0.002	0.015	0.002
	(0.008)	(0.009)	(0.027)	(0.029)
Cautiousness	0.014*	0.004	0.028	0.001
	(0.008)	(0.009)	(0.025)	(0.020)
Kindness	0.003	-0.007	-0.032	-0.042
	(0.007)	(0.006)	(0.026)	(0.025)
Manipulativeness	-0.005	-0.002	0.027	-0.019
	(0.008)	(0.005)	(0.026)	(0.025)
Trust	0.002	0.007	-0.043*	-0.029
	(0.008)	(0.008)	(0.025)	(0.021)
Matrix Test (standardized)	-0.011	0.021***	0.020	0.000
	(0.008)	(0.007)	(0.026)	(0.029)
STEM Major	-0.001	-0.010	-0.085	-0.044
	(0.016)	(0.012)	(0.054)	(0.047)
Age Under 20	0.026	0.023	-0.068	0.013
	(0.016)	(0.014)	(0.052)	(0.051)
High School in USA	-0.026	0.000	0.052	0.030
	(0.018)	(0.011)	(0.056)	(0.059)
Male	0.006	-0.020	0.069	0.065
	(0.016)	(0.020)	(0.054)	(0.063)
Intercept	-0.274***	-0.201***	0.541***	0.691***
	(0.019)	(0.016)	(0.066)	(0.063)
Mean of dependent variable	-0.228	-0.202	0.500	0.497
N	390	390	390	390

Table A.12: Accuracy and good responding: full set of estimates

Notes: Each column reports a linear OLS regression, with $R = 32$ as the omitted category. Accuracy of beliefs at the treatment level is defined in Web Appendix IV.3; we use this measure in Column 1, while in Column 2 we use the same measure but calculated at the session level (because subjects learn within their session). Good responding to beliefs is a binary variable defined in the second paragraph of Section II.B. Section I.H describes the five personality factors. Web Appendix III.10 describes the matrix test of cognitive ability. Web Appendix III.11 describes the four demographic variables. $N = 390$ because four subjects did not complete the demographic questionnaire. Heteroskedasticity-robust standard errors are shown in parentheses (with clustering at the session level for the second and fourth columns). ***, ** and * denote significance at the 1 percent, 5 percent and 10 percent levels (two-sided tests).

Web Appendix IX   Additional figures

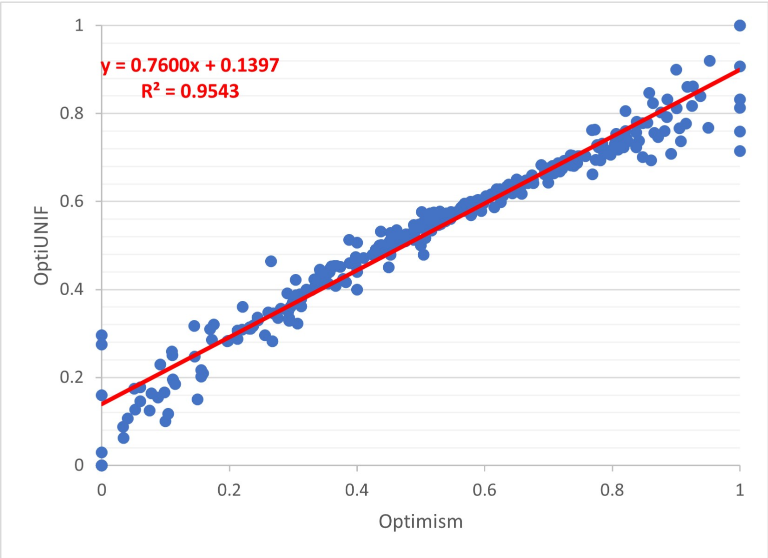


Figure A.27: Scatterplot of optiUNIF vs. optimism in Supergame 1

Notes: Optimism and optiUNIF are defined in Section II.A.

Web Appendix X Additional tables

	AD	*DG*	*DTFT*	*RAND*	*G*	*2TFT*	*TFT*	*G2*	*TF2T*	*AC*
AD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DG	0.0000	0.0000	0.0000	0.1500	0.1875	0.1875	0.1875	0.7500	0.7500	0.7500
DTFT	0.0000	0.0000	0.0000	0.3750	0.1875	0.1875	0.4286	0.7500	0.7500	0.7500
RAND	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
G	0.2500	0.2500	0.2500	0.4000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2TFT	0.2500	0.2500	0.2500	0.4844	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
TFT	0.2500	0.3906	0.5714	0.6250	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
G2	0.4375	1.0000	1.0000	0.7097	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
TF2T	0.4375	1.0000	1.0000	0.8594	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
AC	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table A.13: Cooperation rates

Notes: Each cell reports the expected cooperation rate of the strategy on the vertical axis when playing against the strategy on the horizontal axis. Expected cooperation rates measure the expected number of rounds of cooperation divided by the expected number of rounds, and are based on analytical calculations. In more detail, "the expected cooperation rate" of strategy σ_i playing against strategy σ_j is the expected proportion of rounds in which σ_i cooperates when the two strategies play each other over many supergames of randomly determined length. Letting $p_{i,t}(\sigma_i, \sigma_j)$ be the probability in round t of a supergame that strategy σ_i cooperates against strategy σ_j, conditional on the supergame reaching round t, and noting that $(0.75)^{t-1}$ is the probability that a supergame reaches round t, we calculate the expected cooperation rate of strategy σ_i playing against strategy σ_j using the following formula: $\frac{\sum_{t=1}^{\infty} p_{i,t}(\sigma_i,\sigma_j)(0.75)^{t-1}}{\sum_{t=1}^{\infty}(0.75)^{t-1}}$. For each pair of strategies, we verified the expected cooperation rate by simulating a large number supergames, calculating the empirical proportion of rounds in which σ_i cooperated in the simulated supergames, and comparing the empirical proportion to our analytical calculation.

R	*AD*	*DG*	*DTFT*	*RAND*	*G*	*2TFT*	*TFT*	*G2*	*TF2T*	*AC*
32	0.91	0.02	0.05	0.01	0.01	0.01	0.02	0.02	0.02	0.02
40	0.23	0.08	0.04	0.00	0.05	0.01	0.01	0.67	0.15	0.05
48	0.04	0.03	0.01	0.00	0.10	0.04	0.05	0.85	0.18	0.04

Table A.14: Frequency each strategy is a best response in Supergame 1

Notes: This table replicates Table A.1, but using best responding instead of good responding.

	R	*AD*	*DG*	*DTFT*	*RAND*	*G*	*2TFT*	*TFT*	*G2*	*TF2T*	*AC*
I: All	32	0.52	0.82	0.78	0.50	0.78	0.76	0.88	0.71	0.75	0.67
	40	0.76	1.00	1.00	1.00	0.71	0.72	0.70	0.55	0.55	0.61
	48	0.56	0.42	0.42	0.00	0.67	0.68	0.71	0.41	0.41	0.51
II: Pessimists	32	0.80	0.88	0.86	–	0.62	0.62	0.86	0.50	0.50	0.33
	40	0.84	1.00	1.00	–	0.62	0.64	0.57	0.34	0.34	0.12
	48	1.00	0.71	0.71	–	0.41	0.43	0.47	0.22	0.22	0.16
III: Optimists	32	0.26	0.71	0.67	0.50	0.90	0.89	0.89	0.88	0.88	1.00
	40	0.50	1.00	1.00	1.00	0.77	0.76	0.76	0.68	0.68	0.69
	48	0.00	0.00	0.00	0.00	0.91	0.91	0.91	0.60	0.60	0.61

Table A.15: Probability of good responding in Supergame 1
(conditional on each strategy being a good response)

Notes: For each strategy, the table shows the proportion of subjects who good respond to their beliefs, conditional on that strategy being in the set of good responses to the subject's beliefs. Good responding is defined in the second paragraph of Section II.B. Panels II and III split subjects according to whether they are above or below the median level of optimism within-treatment, where optimism is defined in Section II.A (subjects at the median are allocated to the above-median category).

	AD	*DG*	*DTFT*	*RAND*	*G*	*2TFT*	*TFT*	*G2*	*TF2T*	*AC*
AD	100.00	100.00	100.00	150.00	125.00	125.00	125.00	143.75	143.75	200.00
DG	100.00	100.00	100.00	140.70	115.25	115.25	129.31	146.00	146.00	146.00
DTFT	100.00	100.00	100.00	126.75	115.25	115.25	134.86	146.00	146.00	146.00
RAND	74.00	87.50	107.75	119.00	110.00	117.59	130.25	137.87	151.34	164.00
G	87.00	105.75	105.75	125.20	128.00	128.00	128.00	128.00	128.00	128.00
2TFT	87.00	105.75	105.75	119.97	128.00	128.00	128.00	128.00	128.00	128.00
TFT	87.00	98.44	113.14	111.25	128.00	128.00	128.00	128.00	128.00	128.00
G2	77.25	108.00	108.00	106.00	128.00	128.00	128.00	128.00	128.00	128.00
TF2T	77.25	108.00	108.00	96.72	128.00	128.00	128.00	128.00	128.00	128.00
AC	48.00	108.00	108.00	88.00	128.00	128.00	128.00	128.00	128.00	128.00

Table A.16: Payoffs when $R = 32$

Notes: Each cell reports the expected payoff in points of the strategy on the vertical axis when playing against the strategy on the horizontal axis. Expected payoffs are based on analytical calculations.

	AD	*DG*	*DTFT*	*RAND*	*G*	*2TFT*	*TFT*	*G2*	*TF2T*	*AC*
AD	100.00	100.00	100.00	150.00	125.00	125.00	125.00	143.75	143.75	200.00
DG	100.00	100.00	100.00	143.10	115.25	115.25	129.31	170.00	170.00	170.00
DTFT	100.00	100.00	100.00	132.75	115.25	115.25	134.86	170.00	170.00	170.00
RAND	74.00	89.90	113.75	127.00	116.40	125.34	140.25	149.23	165.09	180.00
G	87.00	105.75	105.75	131.60	160.00	160.00	160.00	160.00	160.00	160.00
2TFT	87.00	105.75	105.75	127.72	160.00	160.00	160.00	160.00	160.00	160.00
TFT	87.00	98.44	113.14	121.25	160.00	160.00	160.00	160.00	160.00	160.00
G2	77.25	132.00	132.00	117.35	160.00	160.00	160.00	160.00	160.00	160.00
TF2T	77.25	132.00	132.00	110.47	160.00	160.00	160.00	160.00	160.00	160.00
AC	48.00	132.00	132.00	104.00	160.00	160.00	160.00	160.00	160.00	160.00

Table A.17: Payoffs when $R = 40$

Notes: Each cell reports the expected payoff in points of the strategy on the vertical axis when playing against the strategy on the horizontal axis. Expected payoffs are based on analytical calculations.

	AD	*DG*	*DTFT*	*RAND*	*G*	*2TFT*	*TFT*	*G2*	*TF2T*	*AC*
AD	100.00	100.00	100.00	150.00	125.00	125.00	125.00	143.75	143.75	200.00
DG	100.00	100.00	100.00	145.50	115.25	115.25	129.31	194.00	194.00	194.00
DTFT	100.00	100.00	100.00	138.75	115.25	115.25	134.86	194.00	194.00	194.00
RAND	74.00	92.30	119.75	135.00	122.80	133.09	150.25	160.58	178.84	196.00
G	87.00	105.75	105.75	138.00	192.00	192.00	192.00	192.00	192.00	192.00
2TFT	87.00	105.75	105.75	135.47	192.00	192.00	192.00	192.00	192.00	192.00
TFT	87.00	98.44	113.14	131.25	192.00	192.00	192.00	192.00	192.00	192.00
G2	77.25	156.00	156.00	128.71	192.00	192.00	192.00	192.00	192.00	192.00
TF2T	77.25	156.00	156.00	124.22	192.00	192.00	192.00	192.00	192.00	192.00
AC	48.00	156.00	156.00	120.00	192.00	192.00	192.00	192.00	192.00	192.00

Table A.18: Payoffs when $R = 48$

Notes: Each cell reports the expected payoff in points of the strategy on the vertical axis when playing against the strategy on the horizontal axis. Expected payoffs are based on analytical calculations.

	(1)	(2)
R40	12.79***	12.58***
	(0.49)	(0.52)
R48	48.05***	46.99***
	(0.84)	(0.94)
Accuracy of beliefs		10.01***
		(2.71)
Proximity to best response	88.49***	87.14***
	(7.20)	(7.43)
Mean of dependent variable	128.15	128.15
N	390	390

Table A.19: Expected earnings in Supergame 1 (robustness)

Notes: The regressions reported here are the same as those reported in Columns 2 and 3 of Table A.2 except that we replace 'Good responder to beliefs' with 'Proximity to best response', which measures the expected payoff of a subject's chosen strategy given her beliefs as a proportion of the expected payoff of the best response to her beliefs. To help interpret the effect size, note that our measure of proximity to the best response is defined from 0 to 1. Figure 6 in Web Appendix IX shows the cumulative distribution function of proximity.

	(1)	(2)	(3)	(4)	(5)
R40	0.148***	0.135***	0.064	0.077	0.035
	(0.056)	(0.051)	(0.046)	(0.053)	(0.042)
R48	0.300***	0.275***	0.154***	0.199***	0.111***
	(0.042)	(0.038)	(0.043)	(0.045)	(0.038)
Length of Supergame $t-1$	0.007***				0.006***
	(0.001)				(0.001)
Other's Round 1 coop		0.087***			0.079***
in Supergame $t-1$		(0.019)			(0.016)
Own Round 1 coop			0.385***		0.286***
in Supergame 1			(0.036)		(0.034)
Own optimism				0.691***	0.353***
in Supergame 1				(0.073)	(0.064)
Mean of dependent variable	0.464	0.464	0.464	0.464	0.464
N	9360	9360	9360	9360	9360

Table A.20: Round 1 cooperation in Supergame t (robustness)

Notes: This table replicates Table 2, except that we use Probit regressions instead of linear OLS regressions. The table reports average marginal effects and heteroskedasticity-robust standard errors with clustering at the session level.

I: Strategy cooperation in Supergame t

	(1)	(2)	(3)	(4)	(5)
R40	0.103**	0.094**	0.059*	0.049	0.037
	(0.041)	(0.038)	(0.032)	(0.037)	(0.029)
R48	0.209***	0.191***	0.090***	0.128***	0.065**
	(0.033)	(0.030)	(0.029)	(0.029)	(0.025)
Length of Supergame $t-1$	0.004***				0.004***
	(0.001)				(0.001)
Other's inferred coop in Supergame $t-1$		0.095***			0.088***
		(0.021)			(0.017)
Own strategy coop in Supergame 1			0.422***		0.333***
			(0.034)		(0.036)
Own optimism in Supergame 1				0.556***	0.232***
				(0.048)	(0.039)
Mean of dependent variable	0.467	0.467	0.467	0.467	0.467
N	9360	9360	9360	9360	9360

II: Optimism in Supergame 25

	(1)	(2)	(3)	(4)	(5)
R40	0.110**	0.011	0.086*	0.062	-0.028
	(0.045)	(0.023)	(0.042)	(0.043)	(0.023)
R48	0.244***	0.049	0.178***	0.171***	-0.014
	(0.043)	(0.033)	(0.045)	(0.041)	(0.033)
Length of Supergames 1 to 24	0.040				0.024**
	(0.024)				(0.012)
Others' inferred coop in Supergames 1 to 24		1.027***			0.947***
		(0.122)			(0.110)
Own strategy coop in Supergame 1			0.232***		0.061*
			(0.036)		(0.033)
Own optimism in Supergame 1				0.493***	0.419***
				(0.042)	(0.042)
Mean of dependent variable	0.430	0.430	0.430	0.430	0.430
N	390	390	390	390	390

Table A.21: Effect of experience on behavior and beliefs (robustness)

Notes: The regressions reported in Panel I are the same as those reported in Panel A of Table 3, except that we replace 'Other's strategy coop in Supergame $t-1$' with 'Other's inferred coop in Supergame $t-1$'. The regressions reported in Panel II are the same as those reported in Panel B of Table 3, except that we replace 'Others' strategy coop in Supergames 1 to 24' with 'Others' inferred coop in Supergames 1 to 24'. 'Other's inferred coop in Supergame t' measures the weighted average of the strategy cooperation of each of the ten strategies, where the weights come from the posterior distribution over the opponent's strategies after Bayesian updating from the realized sequence of play in Supergame t; the Bayesian update for Supergame t uses the uniform distribution as the prior, and so the Bayesian update for Supergame t does not use information from sequences of play in prior supergames. See Section III.B for the definition of strategy cooperation. 'Others' inferred coop in Supergames 1 to 24' is the mean of 'Other's inferred coop in Supergame t' over the first 24 supergames.

I: Strategy cooperation in Supergame t

	(1)	(2)	(3)	(4)	(5)
R40	0.110**	0.102**	0.064*	0.057	0.044
	(0.045)	(0.042)	(0.034)	(0.042)	(0.033)
R48	0.210***	0.193***	0.086***	0.130***	0.064**
	(0.036)	(0.033)	(0.030)	(0.032)	(0.027)
Length of Supergame $t-1$	0.003***				0.004***
	(0.001)				(0.001)
Other's strategy coop in Supergame $t-1$		0.079***			0.071***
		(0.019)			(0.015)
Own strategy coop in Supergame 1			0.434***		0.348***
			(0.035)		(0.034)
Own optimism in Supergame 1				0.564***	0.225***
				(0.053)	(0.041)
Mean of dependent variable	0.467	0.467	0.467	0.467	0.467
N	9360	9360	9360	9360	9360

II: Optimism in Supergame 25

	(1)	(2)	(3)	(4)	(5)
R40	0.110**	0.023	0.085*	0.064	-0.016
	(0.047)	(0.023)	(0.043)	(0.045)	(0.023)
R48	0.246***	0.068**	0.178***	0.174***	0.006
	(0.044)	(0.031)	(0.046)	(0.041)	(0.033)
Length of Supergames 1 to 24	0.037				0.021
	(0.024)				(0.014)
Others' strategy coop in Supergames 1 to 24		0.844***			0.771***
		(0.109)			(0.097)
Own strategy coop in Supergame 1			0.234***		0.066*
			(0.037)		(0.033)
Own optimism in Supergame 1				0.497***	0.417***
				(0.042)	(0.036)
Mean of dependent variable	0.430	0.430	0.430	0.430	0.430
N	390	390	390	390	390

Table A.22: Effect of experience on behavior and beliefs (robustness)

Notes: The regressions reported here are the same as those reported in Table 3, except that the regressions here do not include controls for the personality factors, demographic characteristics, or cognitive ability.

	(1)	(2)	(3)	(4)	(5)
R40	0.152**	0.138**	0.067	0.097*	0.045
	(0.060)	(0.055)	(0.048)	(0.057)	(0.043)
R48	0.304***	0.277***	0.153***	0.213***	0.116***
	(0.044)	(0.039)	(0.043)	(0.044)	(0.038)
Length of Supergame $t-1$	0.007***				0.007***
	(0.001)				(0.001)
Other's Round 1 coop in Supergame $t-1$		0.087***			0.080***
		(0.019)			(0.016)
Own Round 1 coop in Supergame 1			0.387***		0.315***
			(0.036)		(0.034)
Own optiUNIF in Supergame 1				0.837***	0.381***
				(0.102)	(0.082)
Mean of dependent variable	0.464	0.464	0.464	0.464	0.464
N	9360	9360	9360	9360	9360

Table A.23: Round 1 cooperation in Supergame t (robustness)

Notes: The regressions reported here are the same as those reported in Table 2, except that we replace optimism with optiUNIF (defined in Section II.A).

	(1) Strategy cooperation (Supergames 2-25)	(2) Strategy cooperation (Supergames 21-25)	(3) OptiUNIF (Supergame 25)
Anxiety	-0.005	-0.023	-0.002
	(0.009)	(0.013)	(0.007)
Cautiousness	-0.008	-0.010	-0.010
	(0.008)	(0.012)	(0.009)
Kindness	0.007	0.001	0.014**
	(0.011)	(0.015)	(0.006)
Manipulativeness	0.004	0.005	0.000
	(0.010)	(0.013)	(0.007)
Trust	0.021**	0.022**	0.017***
	(0.009)	(0.009)	(0.006)
Mean of dependent variable	0.467	0.461	0.476
N	9360	1950	390
Control for treatment	Yes	Yes	Yes
Control for beliefs in Sup. 1	Yes	Yes	Yes
Control for behavior in Sup. 1	Yes	Yes	Yes
Controls for experience	Yes	Yes	Yes

Table A.24: Effect of personality on behavior and beliefs (robustness)

Notes: The regressions reported here are the same as those reported in Table 4, except that we replace optimism with optiUNIF (defined in Section II.A).

I: Strategy cooperation in Supergame t

	(1)	(2)	(3)	(4)	(5)
R40	0.103**	0.096**	0.059*	0.057	0.043
	(0.041)	(0.038)	(0.032)	(0.037)	(0.029)
R48	0.209***	0.194***	0.090***	0.132***	0.069**
	(0.033)	(0.030)	(0.029)	(0.028)	(0.026)
Length of Supergame $t-1$	0.004***				0.004***
	(0.001)				(0.001)
Other's strategy coop in Supergame $t-1$		0.072***			0.066***
		(0.018)			(0.014)
Own strategy coop in Supergame 1			0.422***		0.340***
			(0.034)		(0.035)
Own optiUNIF in Supergame 1				0.704***	0.280***
				(0.069)	(0.054)
Mean of dependent variable	0.467	0.467	0.467	0.467	0.467
N	9360	9360	9360	9360	9360

II: OptiUNIF in Supergame 25

	(1)	(2)	(3)	(4)	(5)
R40	0.081**	0.018	0.061*	0.048	-0.011
	(0.035)	(0.017)	(0.031)	(0.031)	(0.014)
R48	0.175***	0.048**	0.119***	0.119***	-0.006
	(0.033)	(0.020)	(0.033)	(0.029)	(0.021)
Length of Supergames 1 to 24	0.025				0.015*
	(0.017)				(0.009)
Others' strategy coop in Supergames 1 to 24		0.605***			0.554***
		(0.067)			(0.056)
Own strategy coop in Supergame 1			0.197***		0.073***
			(0.026)		(0.026)
Own optiUNIF in Supergame 1				0.509***	0.405***
				(0.050)	(0.055)
Mean of dependent variable	0.476	0.476	0.476	0.476	0.476
N	390	390	390	390	390

Table A.25: Effect of experience on behavior and beliefs (robustness)

Notes: The regressions reported here are the same as those reported in Table 3, except that we replace optimism with optiUNIF (defined in Section II.A).

Unfriendly, provocable and lenient strategies

- Unfriendly: defects in the very first round.
- Provocable: starts by cooperating but defects immediately in response to the opponent's first defection.
- Lenient: starts by cooperating and does not defect immediately in response to the opponent's first defection.
- See Web Appendix III.3 for further details.

Optimism, Cooperativeness and OptimismRelTruth

- Optimism: how often a subject expects others to cooperate when they play against each other (measured by the expected cooperation rate of a subject's belief distribution playing against itself).
- Cooperativeness: how often a subject expects her chosen strategy to cooperate (measured by the expected cooperation rate of the chosen strategy playing against the subject's belief distribution).
- OptimismRelTruth: optimism relative to how often others cooperate (measured by the difference between optimism and the expected cooperation rate of the treatment-level strategy distribution (excluding the subject's own choice) playing against itself).
- See Section II.A for further details.

Good responding

- A subject good responds to her beliefs if she chooses a strategy that achieves an expected payoff within 3.15 percent of that from the best response (given the subject's beliefs).
- See the second paragraph of Section II.B for further details.

Strategy cooperation

- How much a strategy cooperates on average against a uniform distribution over the available strategies (measured by the expected cooperation rate of the strategy playing against the uniform distribution over the ten available strategies).
- See Section III.B for further details.

Cooperative evidence and uncooperative evidence

- A subject receives 'cooperative evidence' ('uncooperative evidence') when her opponent's strategy cooperation in the previous supergame was above (below) the treatment-level median.
- See Section IV for further details.

Table A.26: Summary of main definitions

References

Acedo-Carmona, C. and **Gomila, A.** (2014). Personal trust increases cooperation beyond general trust. *PloS ONE*, 9(8): e105559

Ahn, T.K., **Ostrom, E.**, **Schmidt, D.**, and **Walker, J.** (2003). Trust in two-person games: Game structures and linkages. In E. Ostrom and J. Walker, editors, *Trust and Reciprocity: Interdisciplinary Lessons from Experimental Research*, 323–51. Russell Sage

Al-Ubaydli, O., **Jones, G.**, and **Weel, J.** (2016). Average player traits as predictors of cooperation in a repeated prisoner's dilemma. *Journal of Behavioral and Experimental Economics*, 64: 50–60

Anderson, L.R., **Mellor, J.M.**, and **Milyo, J.** (2004). Social capital and contributions in a public-goods experiment. *American Economic Review: Papers & Proceedings*, 94(2): 373–376

Axelrod, R. (1980). Effective choice in the prisoner's dilemma. *Journal of Conflict Resolution*, 24(1): 3–25

Blanco, M., **Engelmann, D.**, **Koch, A.K.**, and **Normann, H.T.** (2010). Belief elicitation in experiments: is there a hedging problem? *Experimental Economics*, 13(4): 412–438

Brandts, J. and **Charness, G.** (2011). The strategy versus the direct-response method: a first survey of experimental comparisons. *Experimental Economics*, 14(3): 375–398

Burks, S., **Carpenter, J.**, **Goette, L.**, and **Rustichini, A.** (2009). Cognitive skills affect economic preferences, strategic behavior, and job attachment. *Proceedings of the National Academy of Sciences*, 106(19): 7745–7750

Carpenter, P., **Just, M.A.**, and **Shell, P.** (1990). What one intelligence test measures: A theoretical account of the processing in the Raven Progressive Matrices test. *Psychological Review*, 97(3): 404–413

Cason, T.N. and **Mui, V.L.** (2019). Individual versus group choices of repeated game strategies: A strategy method approach. *Games and Economic Behavior*, 114: 128–145

Charness, G., **Rigotti, L.**, and **Rustichini, A.** (2016). Social surplus determines cooperation rates in the one-shot prisoner's dilemma. *Games and Economic Behavior*, 100: 113–124

Charness, G., **Rustichini, A.**, and **Van de Ven, J.** (2018). Self-confidence and strategic behavior. *Experimental Economics*, 21(1): 72–98

Chen, D.L., **Schonger, M.**, and **Wickens, C.** (2016). oTree–An open-source platform for laboratory, online, and field experiments. *Journal of Behavioral and Experimental Finance*, 9: 88–97

Condon, D.M. and **Revelle, W.** (2014). The International Cognitive Ability Resource: Development and initial validation of a public-domain measure. *Intelligence*, 43: 52–64

Costa-Gomes, M.A. and **Weizsäcker, G.** (2008). Stated beliefs and play in normal-form games. *Review of Economic Studies*, 75(3): 729–762

Croson, R.T. (2000). Thinking like a game theorist: factors affecting the frequency of equilibrium play. *Journal of Economic Behavior & Organization*, 41(3): 299–314

Dal Bó, P. and **Fréchette, G.R.** (2011). The evolution of cooperation in infinitely repeated games: Experimental evidence. *American Economic Review*, 101(1): 411–29

Dal Bó, P. and **Fréchette, G.R.** (2018). On the determinants of cooperation in infinitely repeated games: A survey. *Journal of Economic Literature*, 56(1): 60–114

Dal Bó, P. and **Fréchette, G.R.** (2019). Strategy choice in the infinitely repeated prisoner's dilemma. *American Economic Review*, 109(11): 3929–52

Danz, D.N., **Fehr, D.**, and **Kübler, D.** (2012). Information and beliefs in a repeated normal-form game. *Experimental Economics*, 15(4): 622–640

DeYoung, C.G., **Hirsh, J.B.**, **Shane, M.S.**, **Papademetris, X.**, **Rajeevan, N.**, and **Gray, J.R.** (2010). Testing predictions from personality neuroscience: Brain structure and the Big Five. *Psychological Science*, 21(6): 820–828

Dreber, A., **Fudenberg, D.**, and **Rand, D.G.** (2014). Who cooperates in repeated games: The role of altruism, inequity aversion, and demographics. *Journal of Economic Behavior & Organization*, 98: 41–55

Duffy, J. and **Fehr, D.** (2018). Equilibrium selection in similar repeated games: experimental evidence on the role of precedents. *Experimental Economics*, 21(3): 573–600

Duffy, J. and **Ochs, J.** (2009). Cooperative behavior and the frequency of social interaction. *Games and Economic Behavior*, 66(2): 785–812

Emonds, G., **Declerck, C.H.**, **Boone, C.**, **Seurinck, R.**, and **Achten, R.** (2014). Establishing cooperation in a mixed-motive social dilemma. an fMRI study investigating the role of social value orientation and dispositional trust. *Social Neuroscience*, 9(1): 10–22

Engel, C. and **Zhurakhovska, L.** (2016). When is the risk of cooperation worth taking? The prisoner's dilemma as a game of multiple motives. *Applied Economics Letters*, 23(16): 1157–1161

Fe, E., **Gill, D.**, and **Prowse, V.** (forthcoming). Cognitive skills, strategic sophistication, and life outcomes. *Journal of Political Economy*

Fréchette, G.R., **Schotter, A.**, and **Trevino, I.** (2017). Personality, information acquisition, and choice under uncertainty: An experimental study. *Economic Inquiry*, 55(3): 1468–1488

Fudenberg, D., **Rand, D.G.**, and **Dreber, A.** (2012). Slow to anger and fast to forgive: Cooperation in an uncertain world. *American Economic Review*, 102(2): 720–49

Gächter, S., **Herrmann, B.**, and **Thöni, C.** (2004). Trust, voluntary cooperation, and socio-economic background: survey and experimental evidence. *Journal of Economic Behavior & Organization*, 55(4): 505–531

Gee, L.K. and **Schreck, M.J.** (2018). Do beliefs about peers matter for donation matching? Experiments in the field and laboratory. *Games and Economic Behavior*, 107: 282–297

Gill, D. and **Prowse, V.** (2016). Cognitive ability, character skills, and learning to play equilibrium: A level-k analysis. *Journal of Political Economy*, 126(4): 1619–1676

Goldberg, L.R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. De Fruyt, and F. Ostendorf, editors, *Personality Psychology in Europe*, volume 7(1), 7–28. Tilburg University Press

Greiner, B. (2015). Subject pool recruitment procedures: organizing experiments with ORSEE. *Journal of the Economic Science Association*, 1(1): 114–125

Haesevoets, T., **Reinders Folmer, C.**, **Bostyn, D.H.**, and **Van Hiel, A.** (2018). Behavioural consistency within the prisoner's dilemma game: The role of personality and situation. *European Journal of Personality*, 32(4): 405–426

Harrison, G.W., **Martínez-Correa, J.**, **Swarthout, J.T.**, and **Ulm, E.R.** (2017). Scoring rules for subjective probability distributions. *Journal of Economic Behavior & Organization*, 134: 430–448

Heuer, L. and **Orland, A.** (2019). Cooperation in the Prisoner's Dilemma: an experimental comparison between pure and mixed strategies. *Royal Society Open Science*, 6: 182142

Hyndman, K., **Ozbay, E.Y.**, **Schotter, A.**, and **Ehrblatt, W.Z.** (2012). Convergence: An experimental study of teaching and learning in repeated games. *Journal of the European Economic Association*, 10(3): 573–604

John, O.P., **Naumann, L.P.**, and **Soto, C.J.** (2008). Paradigm shift to the integrative Big Five trait taxonomy. *Handbook of Personality: Theory and Research*, 3(2): 114–158

Johnson, J.A. (2014). Measuring thirty facets of the Five Factor Model with a 120-item public domain inventory: Development of the IPIP-NEO-120. *Journal of Research in Personality*, 51: 78–89

Kaiser, H.F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, 20(1): 141–151

Li, S.X. and **Liu, T.X.** (2017). Group identity and cooperation in infinitely repeated games. *Mimeo, Texas A&M (dated 01/15/2017)*

Luo, L., **Arizmendi, C.**, and **Gates, K.M.** (2019). Exploratory factor analysis (EFA) programs in R. *Structural Equation Modeling: A Multidisciplinary Journal*, 26(5): 819–826

McGrath, R. (2017). The VIA assessment suite for adults: Development and initial evaluation. *Technical Report, VIA Institute on Character*

Messé, L.A. and **Sivacek, J.M.** (1979). Predictions of others' responses in a mixed-motive game: Self-justification or false consensus? *Journal of Personality and Social Psychology*, 37(4): 602–607

Miettinen, T. and **Suetens, S.** (2008). Communication and guilt in a prisoner's dilemma. *Journal of Conflict Resolution*, 52(6): 945–960

Mulder, L.B., **Van Dijk, E.**, **De Cremer, D.**, and **Wilke, H.A.** (2006). Undermining trust and cooperation: The paradox of sanctioning systems in social dilemmas. *Journal of Experimental Social Psychology*, 42(2): 147–162

Peeters, R. and **Vorsatz, M.** (2018). Simple guilt and cooperation. *University of Otago Economics Discussion Paper 1801*

Peterson, C. and **Seligman, M.E.** (2004). *Character Strengths and Virtues: A Handbook and Classification.* Oxford University Press

Peysakhovich, A., **Nowak, M.A.**, and **Rand, D.G.** (2014). Humans display a 'cooperative phenotype' that is domain general and temporally stable. *Nature Communications*, 5(1): 1–8

Proto, E. and **Rustichini, A.** (2014). Cooperation and personality. *Warwick Economic Research Paper 1045*

Proto, E., **Rustichini, A.**, and **Sofianos, A.** (2019). Intelligence, personality, and gains from cooperation in repeated interactions. *Journal of Political Economy*, 127(3): 1351–1390

Proto, E., **Rustichini, A.**, and **Sofianos, A.** (forthcoming). Intelligence, errors and cooperation in repeated interactions. *Review of Economic Studies*

Raven, J., **Raven, J.C.**, and **Court, J.H.** (2000). *Manual for Raven's Progressive Matrices and Vocabulary Scales.* San Antonio: Pearson

Ridinger, G. and **McBride, M.** (2017). Theory-of-mind ability and cooperation. *Mimeo, UC Irvine (dated 09/2017)*

Romero, J. and **Rosokha, Y.** (2018). Constructing strategies in the indefinitely repeated prisoner's dilemma game. *European Economic Review*, 104: 185–219

Romero, J. and **Rosokha, Y.** (2019a). The evolution of cooperation: The role of costly strategy adjustments. *American Economic Journal: Microeconomics*, 11(1): 299–328

Romero, J. and **Rosokha, Y.** (2019b). Mixed strategies in the indefinitely repeated prisoner's dilemma. *Mimeo, Purdue University*

Sato, K. (1988). Trust and group size in a social dilemma. *Japanese Psychological Research*, 30(2): 88–93

Sato, K. (1989). Trust and feedback in a social dilemma. *Japanese Journal of Experimental Social Psychology*, 29(2): 123–128

Schlag, K.H. and **van der Weele, J.J.** (2013). Eliciting probabilities, means, medians, variances and covariances without assuming risk neutrality. *Theoretical Economics Letters*, 3(1): 38–42

Schlag, K.H., **Tremewan, J.**, and **Van der Weele, J.J.** (2015). A penny for your thoughts: A survey of methods for eliciting beliefs. *Experimental Economics*, 18(3): 457–490

Schotter, A. and **Trevino, I.** (2014). Belief elicitation in the laboratory. *Annual Review of Economics*, 6(1): 103–128

Selten, R. (1998). Axiomatic characterization of the quadratic scoring rule. *Experimental Economics*, 1(1): 43–61

Simms, L.J., **Goldberg, L.R.**, **Roberts, J.E.**, **Watson, D.**, **Welte, J.**, and **Rotterman, J.H.** (2011). Computerized adaptive assessment of personality disorder: Introducing the CAT–PD project. *Journal of Personality Assessment*, 93(4): 380–389

Sutter, M. and **Untertrifaller, A.** (2020). Children's heterogeneity in cooperation and parental background: An experimental study. *Journal of Economic Behavior & Organization*, 171: 286–296

Terracol, A. and **Vaksmann, J.** (2009). Dumbing down rational players: Learning and teaching in an experimental game. *Journal of Economic Behavior & Organization*, 70(1-2): 54–71

Thöni, C., **Tyran, J.R.**, and **Wengström, E.** (2012). Microfoundations of social capital. *Journal of Public Economics*, 96(7-8): 635–643

Wright, A.G. and **Simms, L.J.** (2014). On the structure of personality disorder traits: Conjoint analyses of the CAT-PD, PID-5, and NEO-PI-3 trait models. *Personality Disorders: Theory, Research, and Treatment*, 5(1): 43–54