Spillover effects of cooperative behaviour when switching tasks: the role of gender

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Abstract

A worker within a firm, or a researcher within the academia, is required to both cooperate with colleagues in team-projects and to compete with them for career progressions. However, males and females may differently adapt when switching between tasks characterized by different levels of competitiveness and cooperativeness, affecting their labour market outcomes. In this paper we experimentally study individuals' spillovers of cooperative behaviour when playing indefinitely repeated Prisoner's Dilemmas, distinguished by two different levels of the competitiveness-cooperativeness index (CCI, Demuynck et al., 2022). Additionally, we investigate whether making the cooperative dimension of the strategic environment more salient affects males' and females' behaviour. The analysis is based on 240 participants organized into 24 independent matching groups.

Besides supporting the efficacy of the CCI in assessing the competitiveness of an environment, our results provide evidence that females are more likely than males to spill over their cooperative behaviour when switching from a relatively low competitive environment to a relatively high competitive one, informing on how gender diversity within offices might affect individual and organizational outcomes. Finally, our choice architecture intervention is associated with higher cooperation when incentives to cooperate are relatively weak, although this effect does not persist over the entire interaction, while being irrelevant when the context is already favourable to cooperation.

Keywords: gender, spillover effects, competitiveness-cooperativeness, framing effects, choice architecture, laboratory experiment.

JEL: J16; C73; C92.

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1 Introduction

Consider a situation in which a worker cooperates with colleagues on a team-project, while at the same time seeking to demonstrate her leadership skills to her employer. Similarly, employees within the same office might both compete for career advancements and cooperate to win a prize for being the company's best department. These examples highlight that in (highly paid) labour market environments, competitive, cooperative and individual dimensions often coexist, and workers are required to adjust their behaviours when switching between tasks characterized by different levels of competitiveness and cooperation. The ability to quickly adapt to different duties is a characteristic increasingly valued by employers (Peterson and Behfar, 2022). However, this requirement may affect workers differently depending on their personal characteristics, such as gender, thereby contributing to differences in men's and women's labour market outcomes.

Starting from the seminal paper by Niederle and Vesterlund (2007),[1] the gender gap in the labour market has been experimentally studied as a dichotomous choice, in which participants are asked to decide which labour market environment they would like to work in, having the opportunity to self-select into either a competitive or a piece-rate payment scheme when performing a task. At the same time, cooperation in labour markets has been extensively investigated within the experimental literature on social dilemmas, such as the Prisoner's Dilemma and Public Goods Games, which examine how individuals balance private incentives against collective outcomes. Evidence on gender differences in cooperative behaviour within these settings is, however, mixed, with some studies finding higher cooperation rates among women than men (e.g., Charness and Rustichini, 2011; Molina et al., 2013), while others report no systematic differences (Balliet et al., 2011; Kuhn and Villeval, 2015; Dal Bó and Fréchette, 2018; Furtner et al., 2021). These two strands of literature have largely developed separately: the former mainly focuses on self-selection into competitive environments, while the latter studies cooperative behaviour independently of competitive incentives (see, for example, Charness and Villeval, 2009). Yet, actual workplace interactions often involve opportunities both to cooperate and to compete with others. Therefore, the main goal of this work is to experimentally investigate whether there are differences between males and females in the way they adapt their behaviour across tasks characterized by different combinations of competitive and cooperative incentives.

To answer our research question, we use infinitely repeated Prisoner's Dilemma games. Specifically, Demuynck et al. (2022), building on the work of Kalai and Kalai (2013), introduce the competitiveness-cooperativeness index (CCI) to measure the degree of competitiveness and cooperativeness across a large number of games. The CCI allows to easily classify different games depending on their unique decomposition into a common-interest game, or cooperative component, and a zero-sum game, or competitive component, resulting in an index that ranges from 0 (purely cooperative game) to 1 (purely competitive game).
Our choice of the experimental design and the specific repeated game framework was motivated by two main factors. First, economic social dilemma games such as the Prisoner's Dilemma easily apply to many real-life situations, including work organizations, because of the trade-off between the self

[1] The main motivations highlighted so far rely on differences in risk preferences (Croson and Gneezy, 2009; Dohmen and Falk, 2011; Charness and Gneezy, 2012; Lozano and Reuben, 2022), in performance (Gneezy et al., 2003; Dohmen and Falk, 2011; see Hoyer et al., 2020, for a complete review), in self-confidence (Kamas and Preston, 2012a; Kamas and Preston, 2012b; Comeig et al., 2016; Kamas and Preston, 2018; Van Veldhuizen, 2022), and in the competitiveness trait (Niederle, 2017).

and the common interest. Second, the CCI builds on robust theoretical and experimental evidence on the emergence and stability of cooperation in this class of games (Demuynck et al., 2022).[2] Using the CCI, we calibrate two environments characterized by different combinations of competitive and cooperative incentives. In particular, the CCI_L environment provides a higher return to mutual cooperation than the CCI_H environment, making cooperative outcomes easier to sustain. For this reason, we refer to CCI_L as a relatively more cooperative (and less competitive) environment and to CCI_H as a relatively more competitive (and less cooperative) environment. These frameworks resemble situations in which individuals repeatedly interact under changing incentive schemes while the underlying interaction structure remains broadly similar. For example, academics may collaborate with colleagues on joint research projects and later compete with them for grants or tenures. In such contexts, the underlying interaction structure may remain largely unchanged, while the balance between cooperative and competitive incentives varies over time. However, we acknowledge that, in real organizations, switching from more competitive to more cooperative tasks often involves changes in several dimensions beyond incentives, such as team structure, information, or objectives. Our experimental design does not aim to reproduce the full complexity of these environments, but rather to isolate the role of competitive and cooperative incentives in shaping behavioural adaptation across tasks.

In our *Baseline treatment* we consider three stages of an indefinitely repeated Prisoner's Dilemma game in which we vary the order in which two Prisoner's Dilemmas, CCI_H or CCI_L, are played. More specifically, in the $CCI_H \rightarrow CCI_L$ condition, participants first play the CCI_H Prisoner's Dilemma, characterized by a relatively higher level of competitiveness and, second, the CCI_L Prisoner's Dilemma, characterized by a relatively lower level of competitiveness. Reversely, in the $CCI_L \rightarrow CCI_H$ condition, participants first play the CCI_L Prisoner's Dilemma and, second, the CCI_H Prisoner's Dilemma.

As suggested by Niederle (2017), institutions can differ in the importance they place on competitiveness and cooperation and, besides attracting or discouraging females from entering an organization, they may contribute to gender differences in economic outcomes, "an open area of behavioural market design" (Niederle, 2017, page 1). Motivated by this perspective, in our *Decomposition treatment*, we examine whether framing the decision-making environment differently, without altering its underlying incentives, affects men and women's cooperation rates (Pruitt, 1967; Dufwenberg et al., 2011). Specifically, the only difference with respect to the *Baseline treatment* is that the two Prisoner's Dilemmas, CCI_H and CCI_L, are presented to participants in their *decomposed form*, namely as the sum of a zero-sum game (the competitive component) and a common interest game (the cooperative component), thereby making the cooperative dimension of the strategic environment more salient.

The experiment involves 240 participants organized into 24 independent matching groups, corresponding to 12 matching groups per treatment condition. Throughout the paper, statistical inference is therefore based on the matching group as the relevant unit of independence, and

[2] Specifically, Demuynck et al. (2022) show that the index is consistent with experimental findings in Prisoner's Dilemma games, All-pay auctions, Tullock contests, and Public Good games in the sense that more cooperative and less competitive behavior is associated with lower values of the index. Additionally, as explained in Section 3.1, we implement an ex post validation exercise based on the Prisoner's Dilemmas studied in Dal Bó and Fréchette (2011): we compute the CCI for their games and find that the ordering induced by the index is consistent with the observed ordering of cooperation rates across treatments, with lower CCI values associated with higher levels of cooperation.

marginally significant results should be interpreted with caution given the limited number of independent observations.

As expected, we find that both males and females cooperate significantly more when playing the CCI_L indefinitely repeated Prisoner's Dilemma than when playing the CCI_H indefinitely repeated Prisoner's Dilemma. However, no gender differences are observed in cooperation rates in either the more competitive or the less competitive environment, corroborating the hypothesis that males and females behave similarly when performing non-stereotypical tasks in which gender is not made salient.
Notwithstanding, the choice architecture intervention has a different effect depending on whether the Prisoner's Dilemma is more competitive (CCI_H) or more cooperative (CCI_L). Specifically, when the payoff matrix is presented in decomposed rather than standard form, cooperation increases in the more competitive environment (CCI_H) but not in the more cooperative one (CCI_L). The choice architecture intervention may therefore promote cooperative behaviour in more competitive environments, where incentives to cooperate are weaker, while having little effect when incentives to cooperate are already strong.

Addressing our main research question, we observe that when moving from the less competitive Prisoner's Dilemma (CCI_L) to the more competitive one (CCI_H), females cooperate significantly more than males. However, we find no gender differences in the cooperation rate when moving in the opposite direction, from CCI_H to CCI_L. These results are not driven by whether the Prisoner's Dilemma is presented in standard or decomposed form. Women appear to sustain relatively higher cooperation levels when moving to more competitive environments. While our design does not allow us to disentangle whether such behaviour may be driven by persistence in cooperative norms, heterogeneous responsiveness to competitive incentives, or broader adaptation mechanisms across tasks, our findings highlight that exposure to different combinations of competitive and cooperative incentives shape subsequent behaviour differently for males and females in labour-market relevant environments.

2 Related literature

There is a vast experimental literature on analysing the motives and consequences of the gender gap in job market related environments initiated by Niederle and Vesterlund (2007) and followed by many applications in the laboratory (see Niederle and Vesterlund, 2011 and Markowsky and Beblo, 2022 for a more complete review). Using a novel experimental paradigm in which participants chose the payment scheme they want to be applied when performing an arithmetic task, Niederle and Vesterlund (2007) show that women are more reluctant than men in self-sorting into competitive environments, suggesting males' higher level of overconfidence than females and gender differences in preferences for competition as the main causes of such a gender gap.
The work of Kamas and Preston (2012a) corroborates the hypothesis that women enter competitive environments less often than men mainly because of differences in confidence, with exposure to female competitive role model significantly increasing the number of best performing women entering the competition (Meier et al., 2020). However, Dohmen and Falk (2011) and Lozano and Reuben (2022) both suggest instead gender differences in risk preferences as a major factor in explaining the gender gap in self-selection.

These studies all focus on binary choices between entering competitive and non-competitive settings. However, work environments are often characterized by a tension between cooperation and competition. The first novelty of our approach is therefore to examine males and females (spillovers of) cooperative behaviour when switching between settings characterized by different degrees of competitiveness. Saccardo et al. (2018), in their laboratory experiment, ask participants to choose what proportion of the compensation for their performance should be determinded by a tournament and what proportion by a piece-rate payment scheme, showing an even greater gender gap for top performers. Cassar and Rigdon (2021) also move beyond the tradition one-dimensional payoff structure. They show that when winners of a tournament have the option to share some of the prize with one of the losers, women decide to enter competition as much as men, highlighting the potential role of other-regarding preferences in economic behaviour (see also Kamas and Preston, 2015). While their objective is to isolate the effect of adding a prosocial aspect on the reward mechanism, their analysis still relies on a binary choice between entering competitive and non-competitive settings, our experimental design studies behaviour across environments characterized by different combinations of competitive and cooperative incentives, as captured by different values of the CCI. Additionally, our experimental design allows us to assess males' and females' cooperative behaviour in indefinitely repeated social dilemmas, where repeated interaction is one of the key features of cooperation within organizations, while ruling out, by design, potential confounding factors such as gender-stereotypical tasks (Günther et al., 2010; Kamas and Preston, 2012b).
Our study also contributes to the understanding of how individual differences and task characteristics affect the cooperation-competition trade-off within organization, a relevant issue in the management literature (see Beersma et al., 2003; Charness and Villeval, 2009; Kosfeld, 2011; Puck and Pregernig, 2014; Wood et al., 2023; Homburg et al., 2024).

The second stream of literature we contribute to focuses on how different manipulations of the Prisoner's Dilemma affect cooperative behaviours. While Charness et al. (2016) observe that the mutual cooperation parameter positively impacts cooperation rates[3], Gächter et al. (2021), when varying the three payoff indices (or incentives), *temptation*, *risk*, and *efficiency*, introduced by Mengel (2018)[4], find that the reduction of cooperative play is mainly driven by an increase in the *temptation* incentive, rather than an increase in the *risk* incentive.
Besides Mengel (2018), other studies have constructed and used indices to study individuals' cooperative behaviours in social dilemmas (Murnighan and Roth, 1983[5]). For example, Simpson (2003) manipulates the *fear* and *greed* incentives[6] of a Prisoner's Dilemma to study gender differences in behaviour. He finds that women cooperate more than men do when the *greed* incentive is high and there is no *fear* incentive. On the contrary, women and men have the same cooperation rate when both the *fear* incentive is high and there is no *greed* incentive and when both incentives are present. Differently, Molina et al. (2013) observe that the average cooperation rate of males is lower

[3] These results are observed also by Engel and Zhurakhovska (2016) in a similar study. They manipulate the mutual defection payoffs of one-shot Prisoner's Dilemmas and find that the cooperative rate monotonically decreases in the defection parameter.
[4] The three indices proposed by Mengel (2018) to predict cooperation in Prisoners' Dilemma games are: the *temptation* index – i.e., the percentage a player gets when she defects against a co-operator; the *risk* index – i.e., the percentage a player loses when she cooperates against a defector; and the *efficiency* index– i.e., the percentage a player gets when she coordinates with the opponent on the cooperative equilibrium rather than the defection equilibrium. Moreover, LiCalzi and Mühlenbernd (2022) extended these indices to other games such as the Stag Hunt one.
[5] See also Mengel (2018)'s review in section 3 and the paper of Böörs et al. (2022).
[6] Notice that when Simpson (2003) eliminates either the *fear* or the *greed* incentive, the game is no more a Prisoner's Dilemma.

than that of females when playing a repeated Prisoner's Dilemma – i.e., a social game with both the *fear* and the *greed* incentives. However, while both Simpson (2003) and Molina et al. (2013) assess gender differences within a Prisoner's Dilemma with fixed parameters, our objective is to test whether males and females differ in transferring cooperative behaviours across environments that vary in the level of competition—that is, from highly to less competitive indefinitely repeated Prisoner's Dilemmas, and vice versa.

More closely related to our work, Peysakhovich and Rand (2016) run an experiment where participants first play an indefinitely repeated Prisoner's Dilemma in which both payoff parameters and continuation probability are manipulated to obtain either a social norm of cooperation or a social norm of defection. Then, in a second phase, subjects play different one-shot games – i.e., public goods game, trust game, ultimatum game, and dictator game. They find that subjects who experienced the indefinitely repeated Prisoner's Dilemma that promotes cooperation behave more pro-socially in the subsequent one-shot games as compared to participants who experienced the indefinitely repeated Prisoner's Dilemma that promotes defection. Rather than studying how behaviour carries over from indefinitely repeated Prisoner's Dilemmas to one-shot games,[7] we are interested in studying whether working environments characterized by different degrees of competitiveness and cooperativeness generate behavioral spillovers, and whether these spillovers differ between females and males.

Furthermore, our study responds to Dal Bó and Fréchette's (2018) call for further research aimed at identifying "for personal characteristics that would help us predict who will attempt to establish cooperative relationships [in infinitely repeated games]".

In our *Decomposition treatment*, exploiting the decomposition proposed by Kalai and Kalai (2013), participants are shown the same Prisoner's Dilemmas implemented in the *Baseline treatment* as the sum of a zero-sum game (the competitive component) and a common-interest game (the cooperative component). Psychological and experimental literature has shown that the framing of a game's reward structure can significantly affect individual decision-making. For example, Pruitt (1967) finds that presenting Prisoner's Dilemmas in decomposed form, such that a player can separately focus on her own payoff and that of her opponent, leads to higher cooperation rates than presenting the same games in standard form. Dufwenberg et al. (2011) manipulate the framing of both one-shot and repeated public goods games and show that framing affects both first- and second-order beliefs as well as contributions. Furthermore, Kendall (2022) decomposes a Stag Hunt game[8] into three components (strategic, behavioural, and kernel) and finds that the behavioural component correctly predicts coordination decisions. Similarly, Garcia-Galocha et al. (2022) experimentally test the direct-sum decomposition of Candogan et al. (2011)[9] in a 3×3 Prisoner's Dilemma and show that varying the non-strategic component affects cooperative behaviour. Unlike these studies, we consider a Prisoner's Dilemma decomposed into a zero-sum game and a common-interest game. To define the CCI_H and CCI_Lenvironments, we manipulate the payoff structure so that only the common-interest component changes. Moreover, whereas Kendall (2022) and Garcia-Galocha et al. (2022) display games only in standard form, we present the CCI_H and CCI_LPrisoner's Dilemmas either in standard

[7] There is also a related extended literature that experimentally studies spillover effects across multiple games or coordination games (Van Huyck et al. (1991); Huck et al. (2010); Cason et al. (2012); Mengel (2012); Grimm and Mengel (2012); Bednar et al. (2012)). In contrast to this literature, we consider spillover effect in indefinitely repeated Prisoner's Dilemma with different degree of competitiveness-cooperativeness.

[8] Kendall (2022)'s decomposition can be applied to any games with finite strategy space and finite number of players.

[9] See also Böörs et al. (2022) for a complete classification by decomposition of 2x2 symmetric games.

form (Baseline treatment) or in decomposed form (Decomposition treatment). By altering the salience of the common-interest component of the game, we aim to test whether modifying the choice architecture is sufficient to stimulate cooperation and the spillover of cooperative behaviour among males and females.

3 Experimental design and hypotheses

3.1 Experimental Design

In our experiment, participants play a Prisoner's Dilemma game (see Table 1), whose degree of competitiveness and cooperativeness is measured by the Competitiveness–Cooperativeness Index (*CCI*) introduced by Demuynck et al. (2022). [10] In particular, in our *Baseline treatment*, we start from the following game:

Table 1 – 2x2 symmetric game.

		Player 2	
		X	**Y**
Player 1	**X**	b, b	d, e
	Y	e, d	f, f

that is a Prisoner's Dilemma if $e > b > f > d$. [11] Then, we consider the formula of the CCI value for the Prisoner's Dilemma game (Demuynck et al., 2022):

$$CCI = \frac{2(d-e)^2}{(b-d)^2 + (b-e)^2 + (b-f)^2 + (d-e)^2 + (d-f)^2 + (e-f)^2}$$

By manipulating the parameters of the game, we obtain two Prisoner's Dilemmas (Table 2). Table 2a shows the Prisoner's Dilemma with a relatively high CCI, $CCI_H = 0.9$[12], while Table 2b presents the Prisoner's Dilemma with a relatively low CCI, $CCI_L = 0.7$. To ensure comparability across

[10] The experimental design and hypotheses were pre-registered in AsPredicted (AsPredicted #112174, https://aspredicted.org/1S5_7J1). For further details, see also the hypotheses section.

[11] We further impose that $2b > d + e$ so that mutual cooperation maximizes the players' joint payoff. This assumption is consistent with the labour-market environments we have in mind, where organizational performance is maximized when all workers cooperate. Moreover, Mengel (2018) distinguishes between studies that satisfy this condition and those that do not (see Table B10 in Online Appendix B.2), suggesting that this feature may affect behaviour.

[12] In order to have a benchmark, the payoff parameters of Table 2a are the same as those employed by Duffy and Fehr, (2018) in their PD30-SH10 treatment.

treatments, we set the payoff parameters of the Prisoner's Dilemma with relatively low CCI in order to i) only vary the mutual cooperative play, so to allow only one modification with respect to the Prisoner's Dilemma with a relatively high CCI, and to ii) keep the risk index (Mengel, 2018) equal to 1 in both Prisoner's Dilemmas.[13]

Importantly, the variation in the CCI between Prisoner's Dilemmas should be sufficient to allow observing significant differences in cooperative play. To assess this, we computed the CCI of the Prisoner's Dilemmas used by Dal Bó and Fréchette (2011), which are $CCI_{32} = 0.959$, $CCI_{40} = 0.863$ and $CCI_{48} = 0.710$. We use their study as a calibration benchmark because i) they also vary only the payoff of the mutual cooperative play – i.e., they use parameters $b \in \{32, 40, 48\}, d = 12, e = 50, f = 25$, and ii) they find significantly higher cooperation rates in the Prisoner's Dilemma with $CCI_{48} = 0.710$) than in the Prisoner's Dilemma with $CCI_{40} = 0.863$. This suggests that differences in CCI of the magnitude considered in our design should be sufficient to generate significant differences in cooperation.

Table 2 – Payoff matrices of the two Prisoner's Dilemmas.

		Player 2	
		X	**Y**
Player 1	**X**	20, 20	0, 30
	Y	30, 0	10, 10

Table 2a – 2x2 Prisoner's Dilemma with $CCI_H = 0.9$

		Player 2	
		X	**Y**
Player 1	**X**	29, 29	0, 30
	Y	30, 0	10, 10

Table 2b – 2x2 Prisoner's Dilemma with $CCI_L = 0.7$

In addition to varying the value of the CCI, we vary the order in which these two indefinitely repeated Prisoner's Dilemmas are played. In the $CCI_H \rightarrow CCI_L$ *condition,* participants first play the indefinitely repeated Prisoner's Dilemma with $CCI_H = 0.9$, then the one with $CCI_L = 0.7$, and finally return to the indefinitely repeated Prisoner's Dilemma with CCI_H. In the $CCI_L \rightarrow CCI_H$ *condition,* participants first play the indefinitely repeated Prisoner's Dilemma with $CCI_L = 0.7$, then they play the one with $CCI_H = 0.9$, and finally return to the indefinitely repeated Prisoner's Dilemma with $CCI_L = 0.7$. Thus, within each experimental session, the value of the *CCI* changes twice. This structure increases the number of observations available for the analysis of spillover effects by allowing each matching group to experience both transition directions. In addition, it reflects the fact that individuals often face repeated changes in their working environment rather than a single one-off transition.

[13] This is calculated as the percentage a player loses when she cooperates against a defector: $RISK = \frac{(f-d)}{f}$. Holding the risk index constant allows us to control for one of the key determinants of cooperation identified in the literature. At the same time, changes in the payoff associated with mutual cooperation may affect behaviour through channels not captured by the risk index alone.

In our *Decomposition treatment*, the only difference relative to the *Baseline treatment* concerns the way in which the Prisoner's Dilemma payoff matrix is presented to participants. Specifically, we use the unique decomposition of a game introduced by Kalai and Kalai (2013), on which Demuynck et al. (2022) build to construct the Competitiveness–Cooperativeness Index (CCI).[14]

In Table 3, we display the two Prisoner's Dilemmas as presented to the subjects in the *Baseline treatment* (left-hand side of the equation) and in the *Decomposition treatment* (right hand side of the equation).[15]

Table 3 – The two Prisoner's Dilemmas decomposed.

$$\begin{bmatrix} 20,20 & 0,30 \\ 30,0 & 10,10 \end{bmatrix} = \begin{bmatrix} 0,0 & -15,15 \\ 15,-15 & 0,0 \end{bmatrix} + \begin{bmatrix} 20,20 & 15,15 \\ 15,15 & 10,10 \end{bmatrix}$$

Table 3a – decomposed Prisoner's Dilemma with $CCI_H = 0.9$

$$\begin{bmatrix} 29,29 & 0,30 \\ 30,0 & 10,10 \end{bmatrix} = \begin{bmatrix} 0,0 & -15,15 \\ 15,-15 & 0,0 \end{bmatrix} + \begin{bmatrix} 29,29 & 15,15 \\ 15,15 & 10,10 \end{bmatrix}$$

Table 3b – decomposed Prisoner's Dilemma with $CCI_L = 0.7$

3.2 Experimental procedures

At the beginning of each experimental session, subjects are randomly assigned to groups of 10, and group composition remains constant throughout the session. Instructions are read aloud to all participants to facilitate understanding of the experimental task. Since the Baseline and Decomposition treatments rely on different instructions and payoff representations, treatment assignment is implemented at the session level. Each experimental session consists of three stages and in each stage, participants play either an indefinitely repeated Prisoner's Dilemma with CCI_H or one with CCI_L. Depending on the condition, the first stage consists of either the indefinitely repeated Prisoner's Dilemma with CCI_H (in the $CCI_H \rightarrow CCI_L$ *condition*) or the indefinitely repeated Prisoner's Dilemma with CCI_L (in the $CCI_L \rightarrow CCI_H$ *condition*). In turn, each stage is composed of an indefinitely number of sequences, and each sequence consists of an indefinitely number of rounds. In every round, subjects are randomly and anonymously re-matched within the group of 10 people. The experiment therefore consists of 24 independent matching groups (240 participants in total), corresponding to 12 independent observations per treatment condition. We acknowledge that this procedure implies a positive probability of interacting more than once with the same individual, which

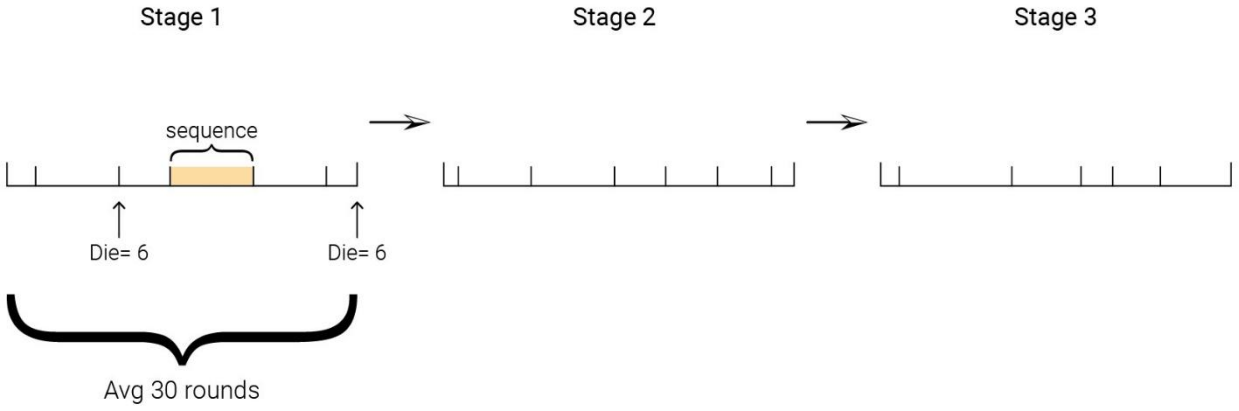
[14] A simplified illustration of this decomposition is provided in Appendix A.
[15] In figure B.1 (Appendix B), we show the screenshot of the decomposed Prisoner's Dilemma with CCI_H, as visualised by participants.

may affect expectations and cooperation dynamics over time. To account for potential dependence in observations within matching groups, all regressions cluster standard errors at the matching-group level.

To implement an indefinite time horizon, we follow the procedure used by Duffy and Fehr (2018) and Roth and Murnighan (1978). Each stage is characterized by a given value of the CCI (e.g., CCI_H). Within a stage, subjects play an indefinite number of sequences of the repeated Prisoner's Dilemma under that same CCI value. Each sequence consists of an unknown number of rounds. After submitting their choices in a given round, subjects are informed of both their own and their opponent's choice, as well as of their own payoff. A virtual die is then rolled, and its outcome is revealed to participants. If the outcome is a number between 1 and 5, the sequence continues: players are randomly rematched within the same group and play another round under the same CCI value. If the outcome is a 6, the sequence ends. At that point, depending on the treatment and the stage reached in the experiment, subjects either begin a new sequence under the same CCI value or move to the next stage.

Figure 1 shows the flowchart of the experiment.

Figure 1 – Timeline of the experiment



Before the beginning of each experimental session, participants were informed about the random matching procedure. They were also shown the two possible payoff matrices they could encounter during the experiment and were told that the game could change only when a sequence ended—that is, when the die roll was a 6. To ensure that participants understood the procedure and the rules of the game, they were required to correctly answer a set of comprehension questions before starting the

first stage.[16] Once the experiment was over, participants completed a post-experimental questionnaire.[17]

Participants were recruited through the ORSEE platform (Greiner, 2004) and we conducted all the experimental sessions at the VERALabEx, the laboratory of experimental economics at Ca' Foscari University of Venice (Italy)[18]. We ran 8 experimental sessions, balanced by gender,[19] but this was not made salient to participants. More specifically, while participants could easily notice that the number of males and females was equal while waiting before entering the laboratory, neither the gender of their opponents nor the gender composition of their matching group was ever revealed during the experiment. This design choice was intended to avoid potential confounds arising from participants' expectations about the probability of being matched with a man or a woman, an issue that we believe deserves further investigation in future research.

The experiment was computerized using z-Tree (Fischbacher, 2007) and each session lasted approximately 90 minutes. While the number of rounds of each stage game is the same when considering groups participating in the same experimental session, it varies across sessions, as shown in Table 4.

[16] Following a referee's suggestion, we further investigated participants' understanding of the experimental procedures. Unfortunately, due to a programming issue, the software did not record the number of incorrect attempts before a correct answer was provided. Nevertheless, participants could not proceed to the experiment until all comprehension questions had been answered correctly. Accordingly, we examined the time spent completing the comprehension questions: participants assigned to the Decomposition treatment spent significantly more time completing the comprehension stage than participants in the Baseline treatment (239 vs. 155 seconds on average; Welch's t-test: $p < 0.001$; Mann–Whitney test: $p < 0.001$), consistent with the decomposed format being more demanding to process. To further assess whether the additional complexity of the Decomposition treatment translated into poorer understanding, we conducted two supplementary online studies using the same instructions and comprehension questions. The two validation studies were conducted on Prolific (N = 120 each, balanced by gender) in June 2026. Participants were asked to read the same instructions and complete the same comprehension questions used in the laboratory experiment. In the first study, comprehension questions were not incentivized and participants received a fixed payment of £3. In the second study, participants received a fixed payment of £2 plus a £0.10 bonus for each correct answer (maximum bonus £1.30). While participants in the Decomposition treatment made significantly more errors when comprehension questions were not incentivized (22.0 vs. 7.2 on average, Mann–Whitney test – $p < 0.001$), this difference was no longer significant in the incentivized study (9 vs. 3.5 on average, Mann–Whitney test – $p = 0.407$), suggesting that, when accuracy is not rewarded, the higher error rate is more likely to reflect lower effort in engaging with a more demanding format than a genuine inability to understand the instructions.

[17] In Appendix C, Table C.1 shows the descriptive statistics of the variables constructed from the questionnaire and used in the analysis presented in Section 4.

[18] Among the participants, 118 were students at Ca' Foscari University in Venice, either from economics (71) or other tracks (47). The other 2 subjects were not students. As indicated in the pre-registration, we ran a pilot session to test the experimental procedures. Since no changes to the design, instructions, or procedures were required, the data from the pilot session were included in the final dataset (Baseline $CCI_H \rightarrow CCI_L$, table 4 line 1). The pilot session was conducted on November 7, one day before the start of the remaining experimental sessions.

[19] In order to get the same number of males and females in each experimental session, we first set up two distinct randomized invitation processes, each corresponding to an experimental sub-session: one reserved to females, and one reserved to males. In particular, we allow 18 females (15 participants and 3 reserves) and 18 males (15 participants and 3 reserves) to register for each of the sub-sessions. The sub-sessions were scheduled at the same time of the same day and invitations to register to each sub-session were sent contemporaneously. Participants were not aware about the above-described process and about the session's partition: they only received a link to register to a specific sub-session, which remained active until there were available spots. As shown in table 4, in 2 sessions out of 8, because of some invited individuals did not show up, we have slightly unbalanced sessions, with respectively 16 and 14 females participating.

Table 4 – Details of the experimental sessions.

Treatment	Condition	Date	Num. Subjects	Num. of groups	Num. of females	Num. of sequences (num. of rounds)		
						Stage 1	Stage 2	Stage 3
Baseline	$\boldsymbol{CCI_H \rightarrow CCI_L}$	07.11.22	30	3	15	4 (26)	6 (40)	7 (19)
Baseline	$\boldsymbol{CCI_L \rightarrow CCI_H}$	08.11.22	30	3	16	5 (33)	5 (21)	2 (23)
Baseline	$\boldsymbol{CCI_H \rightarrow CCI_L}$	09.11.22	30	3	14	3 (30)	6 (31)	4 (26)
Baseline	$\boldsymbol{CCI_L \rightarrow CCI_H}$	10.11.22	30	3	15	4 (37)	7 (27)	5 (27)
Decomposition	$\boldsymbol{CCI_H \rightarrow CCI_L}$	08.11.22	30	3	15	3 (20)	7 (25)	5 (23)
Decomposition	$\boldsymbol{CCI_L \rightarrow CCI_H}$	09.11.22	30	3	15	3 (32)	5 (26)	7 (28)
Decomposition	$\boldsymbol{CCI_H \rightarrow CCI_L}$	10.11.22	30	3	15	10 (45)	7 (35)	4 (30)
Decomposition	$\boldsymbol{CCI_L \rightarrow CCI_H}$	11.11.22	30	3	15	5 (28)	7 (31)	5 (25)
All	**Tot**		240	24	120	4.6 (31.4)	6.3 (29.5)	4.9 (25.1)

At the end of each experimental session, participants were privately paid in cash. Each subject was paid the sum of all rounds of all stages in euro cents. Average earnings were 13.18€, including a show-up fee of 3€.

3.3 Hypotheses

Our experiment is designed to assess whether men and women respond differently when moving from a more competitive to a less competitive task, and vice versa. However, before testing our core hypotheses, we want to examine whether participants in our experiment cooperate more when playing the $\boldsymbol{CCI_L}$ indefinitely Prisoner's Dilemma than when interacting in the CCI_H indefinitely Prisoner's Dilemma. Therefore, our first hypothesis concerns the efficacy of the competitive-cooperative index.

Hypothesis 1 *When comparing the average cooperation rate in each first stage of the experiment, both in the Baseline and in the Decomposition treatment, women and men cooperate more when playing a Prisoner's Dilemma with* CCI_L *than when playing a Prisoner's Dilemma with* CCI_H.

We analyse this hypothesis by comparing the average cooperation rates in the first stage of the $CCI_L \rightarrow CCI_H$ *condition* with the first stage of the $CCI_H \rightarrow CCI_L$ *condition*. We only consider the first stage of

the experiment because we want to test the efficacy of the index, ruling out any possible spillover effect.

Additionally, we aim to test whether a choice architecture intervention affects individuals' cooperative behaviour. Specifically, we expect that participants in the *Decomposition treatment* will focus more on the common-interest component of the game than on the zero-sum component, as it shows only non-negative outcomes (loss avoidance; Cachon and Camerer, 1996), so that, anything equal, participants should cooperate significantly more than those in the *Baseline treatment*. This prediction was specified ex ante in our pre-registration and constitutes one dimension of our 2×2 experimental design. As noted by Devetag and Ortmann (2007), "there is some evidence (albeit by no means undisputed, see e.g., List 2004; Plott and Zeiler 2005) that framing outcomes as gains or losses is not neutral with respect to behavior. […] if people follow loss avoidance, they should avoid playing strategies that result in certain losses if strategies leading to potential gains are available" (p. 339). However, we have no clear predictions regarding whether the *Decomposition treatment* affects men and women differently. We therefore formulate our second hypothesis as a prediction that cooperation will be higher in the *Decomposition treatment* than in the *Baseline treatment*, without making specific predictions regarding its impact on gender differences in the spillover of cooperative behaviour when switching tasks.

Hypothesis 2 *The level of cooperation in the Decomposition treatment is higher than in the Baseline treatment.*

We investigate this hypothesis by analysing cooperation rates in the first stage of the *Baseline treatment* and of the *Decomposition treatment*, separately for the $CCI_H \rightarrow CCI_L$ *condition* and the $CCI_L \rightarrow CCI_H$ *condition*. We also examine whether the effect of the choice architecture intervention differs between men and women.

According to what has been mainly observed in the literature, men and women differ in their preferences for competition (Croson and Gneezy, 2009), with men being more likely than women to self-select into competitive environments rather than fixed-pay payment schemes (Niederle and Vesterlund, 2011 and Markowsky and Beblo, 2022). At the same time, studies investigating gender differences in cooperative behaviour have produced mixed results (Balliet et al., 2011; Kuhn and Villeval, 2015; Dal Bó and Fréchette, 2018; Furtner et al., 2021). Within this literature, Charness and Rustichini (2011) and Molina et al. (2013) report that women cooperate significantly more than men in Prisoner's Dilemma games. We therefore expect women to exhibit higher cooperation rates than men when the game provides stronger incentives to cooperate (CCI_L).

Hypothesis 3 *In both the Baseline Treatment and the Decomposition Treatment, when playing the Prisoner's Dilemma with CCI_L, women cooperate significantly more than men.*

To assess this third hypothesis, we test for differences in the average cooperation rates of men and women when playing, in the first stage, either the CCI_L Prisoner's Dilemma or the CCI_H Prisoner's Dilemma.

Hypotheses 1, 2 and 3 are preliminary with respect to our main predictions, since they are meant to check for the consistency of our results with previous evidence on gender differences in cooperation, and to test the efficacy of the *CCI*. In addition to analysing the role of the choice architecture intervention in shaping cooperative behaviour, our two core hypotheses focus on gender differences

in generating spillover of cooperative behaviour across tasks characterized by different combinations of competitive and cooperative incentives. Specifically, we investigate whether women transfer their cooperative behaviour when moving from a more cooperative Prisoner's Dilemma to a more competitive one. We predict that, when playing the first round of a more competitive (CCI_H) Prisoner's Dilemma after having interacted in the more cooperative one (CCI_L), women will exhibit higher cooperation rates than men. In Section 4.2, we test this prediction using a within-subject approach, by measuring cooperation in the first round of the more competitive Prisoner's Dilemma (CCI_L) after subjects have previously interacted in the less competitive one (CCI_L). In the pre-registration, Hypothesis 4 was instead formulated using a between-subjects comparison between participants directly exposed to (CCI_H) and those who first experienced the highly cooperative Prisoner's Dilemma (CCI_L) before playing highly competitive Prisoner's Dilemma (CCI_H). We departed from the pre-registered analysis because between-subject comparisons may be affected by initial cooperation differences arising in the first stage of the interaction. Since our research question focuses on behavioural adaptation across environments, we believe that the within-subject approach provides a more appropriate test of the hypothesis. This approach is also consistent with the methodology adopted by Duffy and Fehr (2018). The same reasoning applies to Hypothesis 5.

Hypothesis 4 *When playing the more competitive (CCI_H) Prisoner's Dilemma after having experienced the more cooperative (CCI_L) Prisoner's Dilemma, women cooperate more than men.*

Similarly, we test whether men preserve their competitive attitude when moving from a more competitive Prisoner's Dilemma to a more cooperative one. We expect that, in the first round of the Prisoner's Dilemma with stronger cooperative incentives (CCI_L) following interaction in the Prisoner's Dilemma with stronger competitive incentives (CCI_H), men will exhibit lower cooperation rates than women.

Hypothesis 5 *When playing the more cooperative (CCI_L) Prisoner's Dilemma after having experienced the more competitive (CCI_H) Prisoner's Dilemma, men cooperate less than women.*

4 Results

In this section, we first test hypotheses 1, 2 and 3, focusing on i) the first round, ii) the first five rounds, and on iii) all rounds of the first stage. Then, we test for gender differences when switching between indefinitely repeated Prisoner's Dilemmas characterized by different levels of competitiveness, in both directions.

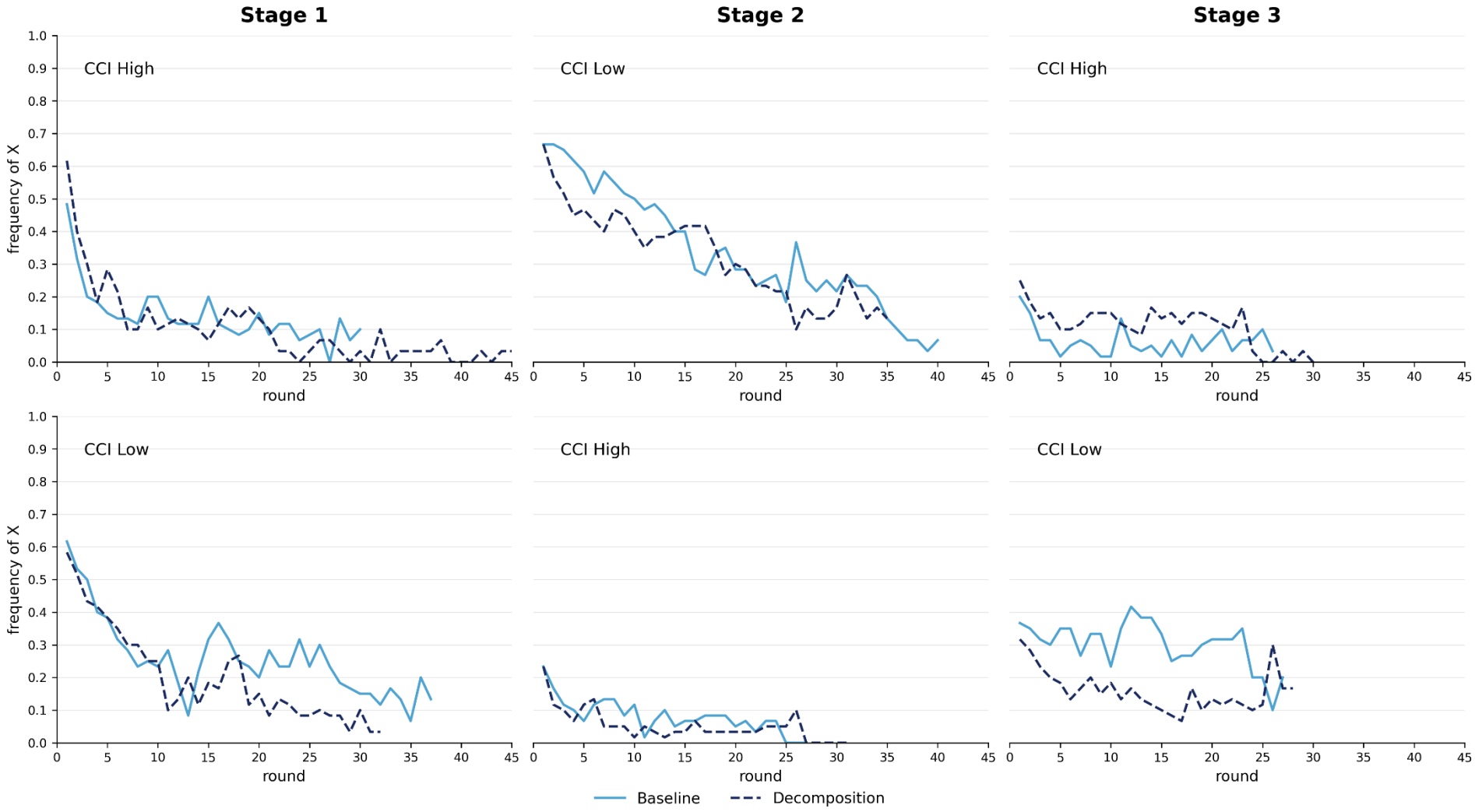
4.1 Efficacy of the CCI, choice architecture, and gender difference in cooperative behaviour

Figure 2 presents the average cooperation rates in each round of a stage – i.e., the choice of X – in both the *Baseline treatment* (solid blue line) and the *Decomposition treatment* (dashed black line), separately for the $CCI_H \rightarrow CCI_L$ *condition* (top panel) and the $CCI_L \rightarrow CCI_H$ *condition* (bottom panel).[20] The horizontal axes reports the round number within a stage, so that round 1 corresponds to

[20] In Table C.2 (Appendix C) we report the average cooperation rates of each group across the first round, the first five rounds and all rounds in a stage, along with the weighted averages in the respective treatment and condition.

the beginning of a new stage – i.e., the first round following a change in the payoff matrix. Because we conducted two experimental sessions for each condition within each treatment, the average duration of stages varied across groups in the same treatment and condition (refer to Table 4 for details). Therefore, the aggregate frequencies in the last rounds of a stage (see Figure 2) may not include observations from all groups assigned to the same treatment and condition.

Figure 2 – Aggregate frequency of cooperation in both the *Baseline treatment* (solid blue line) and the *Decomposition treatment* (dashed black line)



Overall, cooperation decreases over time in both treatments, consistent with the pattern reported by Duffy and Fehr (2018).[21] As participants gain experience with the game, cooperative behaviour gradually declines. In both treatments, the cooperation rate in the first stage of the $CCI_H \rightarrow CCI_L$ *condition* sharply drops toward 0 within a few rounds, whereas cooperation in the first stage of the $CCI_L \rightarrow CCI_H$ *condition* exhibits a more gradual decline toward 0.1. Therefore, cooperation appears to be more sustainable in the CCI_L Prisoner's Dilemma than in the CCI_H one, even though the frequency of cooperation decreases over time in both conditions.

We test our first hypothesis by pooling the *Baseline treatment* and the *Decomposition treatment* and comparing behavior in the first round of the first stage across the two conditions. The difference between the average cooperation rate in the first round of the first stage of the $CCI_L \rightarrow CCI_H$ *condition* (0.60) and that of the $CCI_H \rightarrow CCI_L$ *condition* (0.55) is not significantly different (Fisher's exact test[22]: $p = 0.514$). As shown in Figure 2, cooperation is relatively high in the first round of the first stage in both conditions and treatments. However, as subjects play the following rounds, the cooperation rate drops down in the $CCI_H \rightarrow CCI_L$ *condition*, while it gently decreases in the $CCI_L \rightarrow CCI_H$ *condition* (in both treatments). To further investigate this, we use the Mann-Whitney U-test (MW thereafter)[23] to compare cooperative behaviour in the first five rounds of the first stage across the two conditions. Again, we pool together the *Baseline treatment* and the *Decomposition treatment*. The MW rejects the null hypothesis that the distribution of cooperative behaviour in the first five rounds of the first stage is the same in the $CCI_L \rightarrow CCI_H$ *condition* (0.48) and in the $CCI_H \rightarrow CCI_L$ *condition* (0.31) (MW: $p = 0.0042$). Similarly, when considering all rounds of the first stage of both treatments, the distribution of cooperative behaviour in the $CCI_L \rightarrow CCI_H$ *condition* (0.24) is significantly higher than that in the $CCI_H \rightarrow CCI_L$ *condition* (0.15) (MW: $p = 0.053$).

These results support hypothesis 1: participants cooperate more in the less competitive Prisoner's Dilemma (CCI_L) than in the more competitive Prisoner's Dilemma (CCI_H). Note that in testing our first hypothesis we pool observations from the *Baseline* and *Decomposition* treatments. We now want to investigate whether the choice architecture intervention affects cooperative behaviour. Specifically, we examine whether the effect of presenting the Prisoner's Dilemma in standard form (*Baseline treatment*) or decomposed form (*Decomposition treatment*) depends on the degree of competitiveness characterizing the environment, that is, whether participants interact in the more competitive (CCI_H) or more cooperative (CCI_L) Prisoner's Dilemma.

In Table 5, we report the results of a Linear Probability Model with robust standard errors clustered at the matching group level, in order to account for potential dependence in observations arising from repeated interaction within fixed matching groups.[24] While in specification 1 and 2 we consider only

[21] For a complete review on the determinants of cooperation in infinitely repeated Prisoner's Dilemmas see Dal Bó and Fréchette (2018).

[22] The Fisher exact test is calculated by treating each group as a single observation.

[23] When performing the MW, we average the data within a group and treat each group as a single observation. While conservative, this approach makes the power of all tests possibly low. To account for these limitations, we run a permutation test (provided by the "permute" package in Stata) that looks at the distribution of the test statistic under all possible rearrangements of the data across the two conditions (the $CCI_H \rightarrow CCI_L$ *condition* and the $CCI_L \rightarrow CCI_H$ c*ondition*), allowing us to assess whether the observed difference is likely to have occurred by chance. In the main text, we report the results of the MW test, unless the permutation test provides different outcomes.

[24] Because the asymptotic properties of the cluster-robust variance estimator (CRVE) depend on the number of clusters (Cameron and Miller, 2015), and we have few of them – i.e., 24 - statistical validity concerns might be raised. For these reasons, we test the linear hypotheses about the parameter of our main independent variables in specifications 2, 4 and 6

the first round of the first stage, in specification 2-3, and 4-5 we account for, respectively, the first five rounds of the first stage and all rounds of the first stage Furthermore, specifications 1, 3, and 5 do not include the interaction term between *Decomposition* and CCI_L, while specifications 2, 4, and 6 do. The binary dependent variable *Cooperation* takes value 1 when the participant cooperates. Our main independent variables of interest are *Decomposition*, CCI_L, and their interaction ($Decomposition \times CCI_L$). *Decomposition* takes value 1 if the Prisoner's Dilemma is presented in decomposed form (*Decomposition treatment*) and 0 when it is shown in standard form (*Baseline treatment*). CCI_L takes value 1 when the Prisoner's Dilemma corresponds to the less competitive environment and 0 when it corresponds to the more competitive environment (CCI_H).
We further include some control variables. Specifically, *Others experiment* takes value 1 if the subject has previously participated in other experiments and 0 otherwise. *Game theory* is a categorical variable that takes value 0 if the subject never had a game theory course and takes value 1 or 2, respectively, if she took a basic or an advanced game theory course. We also consider a set of independent variables to measure individuals' preferences (Falk et al**.,** 2018**),** based on the subjects' answers in the post-experimental questionnaire. *Risk lover*[25] takes value between 0 ("completely unwilling to take risks") and 10 ("very willing to take risks"); *Trust* takes value between 0, when the individual does not trust at all others, and 10, when she completely trusts others. *Negative reciprocity* is constructed as the weighted average of three self-assessment questions and ranges between 0, when the subject is completely unwilling to negatively reciprocate, and 10, when she is completely willing to reciprocate. Furthermore, we include two subscales' measures derived from the Competitiveness Index (Houston et al., 2005): *Enjoyment of competition*, which measures the individual's attitude toward competition, and *Contentiousness*, which measures individual's conflict avoidance behaviour. Finally, we add round fixed effects to control for unobserved variables that vary over time but remain constant across units, which could otherwise bias the estimated effects. Indeed, as shown in Figures 2, 3, and 4, there are noticeable peaks corresponding to the beginning of new sequences: round fixed effects allow us to account for these minor restarting effects by including a dummy variable for each round in the estimation sample. Thus, identification relies on variation across individuals within the same round, rather than on variation across rounds.

Table 5 shows that the positive association between CCI_L and cooperation is robust across almost all specifications, suggesting that stronger cooperative incentives increase cooperation regardless of how the game is presented. By contrast, the evidence regarding the *Decomposition treatment* is more sensitive to model specification and should therefore be interpreted more cautiously, also considering the limited number of independent observations. Specifically, in the first round and in the first five rounds of the first stage, individuals in the *Decomposition treatment* cooperate more than those in the *Baseline treatment*, if interacting in the Prisoner's Dilemma characterized by stronger competitive incentives (CCI_H) than in the one characterized by stronger cooperative incentives (CCI_L).

In addition, specifications 1, 2 and 5, 6 of Table 5 show that cooperative behaviour is positively affected by individuals' risk seeking attitude. Finally, when considering all rounds together, we find a positive and significant effect of trust and enjoyment of competition on individuals' willingness to

of Table 5 estimating a wild cluster bootstrap inference. The wild cluster bootstrap analysis supports the results observed in Table 5 (see Appendix D, Table D.1).

[25] We consider only qualitative subjective self-assessment as it has been shown to be a sufficient instrument to predict individuals' risk-taking behaviour (see Falk et al., 2018, page 1655).

cooperate.[26] This finding is in line with Thöni et al. (2012), who show that standard survey measures of trust explain cooperative behaviour and provide experimental evidence that trust captures the preference-based component of cooperation.

Table 5 – The effect of the choice architecture intervention.

Cooperation	*(1)* *First round*	*(2)* *First round*	*(3)* *Five rounds*	*(4)* *Five rounds*	*(5)* *All rounds*	*(6)* *All rounds*
Decomposition	0.062	0.142*	0.040	0.096*	-0.030	0.008
	(0.0546)	(0.0726)	(0.0442)	(0.0492)	(0.0315)	(0.0403)
CCIL	0.070	0.146*	0.175***	0.228***	0.111***	0.145***
	(0.0564)	(0.0735)	(0.0452)	(0.0652)	(0.0315)	(0.0419)
CCIL ×		-0.159		-0.110		-0.071
Decomposition		(0.1174)		(0.0950)		(0.0653)
Other experiment	-0.058	-0.038	-0.051	-0.037	-0.028	-0.020
	(0.0674)	(0.0725)	(0.0505)	(0.0528)	(0.0284)	(0.0279)
Game theory	0.004	0.002	-0.006	-0.007	-0.023	-0.024
	(0.0466)	(0.0478)	(0.0296)	(0.0292)	(0.0179)	(0.0172)
Risk lover	0.039**	0.038**	0.011	0.011	0.017***	0.017***
	(0.0162)	(0.0163)	(0.0077)	(0.0080)	(0.0055)	(0.0058)
Trust	0.002	0.004	0.010	0.011	0.010**	0.010**
	(0.0140)	(0.0145)	(0.0073)	(0.0077)	(0.0043)	(0.0044)
Negative reciprocity	-0.019	-0.020	-0.001	-0.001	0.002	0.002
	(0.0161)	(0.0161)	(0.0078)	(0.0078)	(0.0053)	(0.0053)
Enjoyment competition	-0.009	-0.009	-0.007	-0.007	-0.004*	-0.004*
	(0.0088)	(0.0088)	(0.0052)	(0.0052)	(0.0022)	(0.0023)
Contentiousness	0.001	0.002	0.003	0.004	-0.002	-0.001
	(0.0099)	(0.0101)	(0.0063)	(0.0064)	(0.0032)	(0.0032)
Constant	0.622**	0.562*	0.370**	0.328**	0.185***	0.156**
	(0.2807)	(0.3036)	(0.1397)	(0.1518)	(0.0655)	(0.0720)
Round FE			✓	✓	✓	✓
R-squared	0.046	0.052	0.092	0.084	0.119	0.115
N	240	240	1200	1200	7530	7530

Note: * p<0.10; ** p<0.05; *** p<0.01. LPM with robust s.e. clustered at the matching group level in parenthesis. The sample is restricted to observations from Stage 1.

When focusing on our hypothesis 2, our results point to a possible role of the choice architecture intervention in shaping cooperative behaviour. In particular, presenting the payoff matrix in a decomposed form (*Decomposition treatment*) rather than in a standard form (*Baseline treatment*), is associated with a higher level of cooperation when individuals interact in a highly competitive setting (CCI_H). The estimated coefficient is, however, marginally significant and, given the limited number of independent observations, this evidence should be interpreted with caution. In this environment, cooperation in the *Baseline treatment* is very low. One possible interpretation is that presenting the game in decomposed form makes the common-interest component more salient than the zero-sum

[26] Because cooperation is a binary outcome, in the pre-registration we specified probit regressions as the primary estimation method. However, in the main text, we report Linear Probability Models estimated using reghdfe because several specifications include interaction terms and round fixed effects. This allows us to present the estimated effects directly in probability terms while maintaining a consistent fixed-effects framework across specifications. The corresponding probit estimates are reported in Appendix D (Table D.4) and are qualitatively consistent with the results presented here.

component, since only non-negative outcomes are displayed separately. In the less competitive Prisoner's Dilemma, cooperation is already relatively high in the *Baseline treatment*, which may explain why our manipulation does not further increase cooperative behaviour. However, since we do not directly measure subjects' attention or reasoning, this interpretation remains speculative. An alternative interpretation is that presenting the game in decomposed form increases the cognitive demands of the task, making it harder for participants to process the strategic environment correctly, thereby increasing decision errors or random responding. However, the pattern of results observed in Table 5 does not appear to be consistent with a simple increase in decision noise. In particular, the treatment increases cooperation in the highly competitive environment, while having no significant effect in the highly cooperative one. While we cannot completely rule out this possibility, the available evidence points to a more nuanced picture. Presenting the game in decomposed form does appear to be more cognitively demanding: participants in the *Decomposition treatment* spent significantly more time completing the comprehension stage, and, in the supplementary online study in which comprehension questions were not incentivized, they also made significantly more errors. However, this additional demand does not appear to translate into systematically poorer understanding when participants have an incentive to engage with the task: in the second online study, using the same instructions and comprehension questions, the difference in comprehension performance was no longer statistically significant once correct answers were rewarded. This is arguably the more relevant benchmark for our laboratory experiment, where participants could not proceed until all comprehension questions had been answered correctly and their earnings depended on their subsequent choices. We nonetheless acknowledge that the greater cognitive demands of the decomposed format may themselves influence behaviour, in ways that our design does not allow us to fully disentangle from the salience mechanism discussed above. In particular, for some participants, greater cognitive demands may result in poorer understanding and increased decision noise, while for others they may induce more strategic responses to the trade-off between the relatively risky cooperative action and the safer defection option, including hedging based on accumulated earnings. However, cumulative earnings were not displayed during the experiment, making this channel difficult to assess in our setting.

So far, we have tested the efficacy of the CCI and we analysed the effect of the choice architecture intervention. However, we have not yet investigated the role of gender. In the next paragraphs, we study whether men and women differ in their cooperative behaviour when interacting in Prisoner's Dilemmas characterized by different combinations of competitive and cooperative incentives, namely CCI_H and CCI_L – i.e., hypothesis 3. Figures 3 and 4 display the aggregate frequencies of cooperation of both men (blue line) and women (red line) in the $CCI_H \rightarrow CCI_L$ *condition* (top panel) and in the $CCI_L \rightarrow CCI_H$ *condition* (bottom panel), respectively, in the *Baseline treatment* and in the *Decomposition treatment.*[27] As for Figure 2, the horizontal axes of Figures 3 and 4 report the numbering of rounds within a stage, and round 1 marks the start of a new stage game.

As for hypothesis 1, we test hypothesis 3 by pooling the *Baseline treatment* and the *Decomposition treatment* and comparing the average cooperation rates of men and women in the first round, in the first five rounds, and in all rounds of the first stage of the $CCI_L \rightarrow CCI_H$ *condition*. Additionally, even if not stated in hypothesis 3, we also perform the same analyses when considering the $CCI_H \rightarrow CCI_L$

[27] In Appendix C, we report the average cooperation rates of men and women of each group across the first round, the first five rounds and all rounds in a stage, in the *Baseline treatment* (Table C.3) and in the *Decomposition treatment* (Table C.4).

condition.[28] According to a Fisher's exact test, the frequencies of cooperation of men and women in the first round of the first stage are not significantly different, neither in the $CCI_L \rightarrow CCI_H$ *condition* (men = 0.61 vs women = 0.59; Fisher's exact test: $p = 0.854$) nor in the $CCI_H \rightarrow CCI_L$ *condition* (men = 0.49 vs women = 0.61; Fisher's exact test: $p = 0.205$). Similarly, no statistically significant difference is found when comparing the distribution of cooperative behaviour of males and females in the first five rounds of the first stage of the $CCI_L \rightarrow CCI_H$ *condition* (men = 0.48 vs women = 0.47; MW: $p = 0.707$), nor in the first five rounds of the first stage of the $CCI_H \rightarrow CCI_L$ *condition* (men = 0.27 vs women = 0.36; MW: $p = 0.193$). Finally, the distribution of cooperative choice of men in all rounds of the first stage is not significantly different from that of women in all rounds of the first stage, neither in the $CCI_L \rightarrow CCI_H$ *condition* (men = 0.24 vs women = 0.24; MW: $p = 0.564$), nor in the $CCI_H \rightarrow CCI_L$ *condition* (men = 0.11 vs women = 0.16; MW: $p = 0.402$).
Overall, we find no support for the hypothesis that women are more cooperative than men when playing the Prisoner's Dilemma characterized by stronger cooperative incentives (CCI_L). Similarly, we observe no gender difference in cooperation rates when subjects interact in the Prisoner's Dilemma characterized by stronger competitive incentives (CCI_H).

To further assess whether participants perceived the two settings differently, we conducted two supplementary online studies on Prolific (N = 120 each, balanced by gender), as described in the experimental procedures section. Specifically, after reading the instructions and answering the control questions, participants were then shown the two payoff matrices (CCI_H and CCI_L) separately, in random order, and asked to evaluate each environment on a 1–10 scale ranging from competitive to cooperative. These measures capture perceived competitiveness vs cooperativeness of the two settings, rather than perceptions shaped by experience during the game. Across both studies, participants shown the payoff matrices in Standard form clearly perceived CCI_H as the more competitive environment (Wilcoxon signed-rank test: $p < 0.001$; 61.7% and 66.7% of participants ranked CCI_H as more competitive than CCI_L in the non-incentivized and incentivized studies, respectively). In the *Decomposition treatment*, by contrast, participants did not reliably distinguish the two environments: the difference is not significant in the non-incentivized study ($p = 0.596$), while in the incentivized study it is marginally significant ($p = 0.089$), and the share of participants ranking CCI_H as more competitive is not significantly different from one half (proportion test: $p = 0.606$). At the same time, participants in the *Decomposition treatment* rated both environments above the cooperative midpoint of the scale, indicating that the decomposed representation shifts perceptions in a more cooperative direction overall. This pattern speaks directly to the interpretation of the Decomposition effect proposed in our discussion of Hypothesis 2. In addition to the salience and cognitive-processing interpretations discussed there, these perception data point to a further reading of the results reported in Table 5. Participants in the decomposed format rate both environments as more cooperative overall; the higher cooperation observed under CCI_H may then reflect the greater absolute visibility of the common-interest component when the payoff matrix is larger, rather than a perception of CCI_H as distinctively competitive. Overall, these findings suggest that the decomposed representation may affect how participants perceive the cooperative component of the payoff structure, beyond their relative assessment of the competitiveness of the two environments. However, our interpretation does not rely on participants consciously labelling one environment as

[28] In hypothesis 3, we focus on the $CCI_L \rightarrow CCI_H$ *condition*, expecting a gender difference of cooperative behaviour to emerge when individuals move from a relatively more cooperative to a relatively more competitive environment. While we expect the same pattern to arise in the $CCI_H \rightarrow CCI_L$ *condition*, we anticipate the effect to be weaker, as cooperation is harder to sustain in the initial, more competitive environment.

"competitive" and the other as "cooperative". Rather, it relies on the fact that the two payoff structures generate systematically different behavioural responses in the incentivized laboratory experiment, consistent with the ordering implied by the Competitiveness–Cooperativeness Index.

We further investigate whether the choice architecture intervention differently affects the cooperative behaviour of men and women. In Table D.2 in Appendix D, we report the estimation results of a Linear Probability Model in which we study whether the cooperation behaviour of men and women is affected by the way the Prisoner's Dilemma is presented: standard form (*Baseline treatment*) or decomposed form (*Decomposition treatment*). In running this analysis, we separately consider the $CCI_H \rightarrow CCI_L$ *condition* and the $CCI_L \rightarrow CCI_H$ *condition* and we focus on the first round of the first stage, the first five rounds of the first stage, and all rounds of the first stage. Overall, the estimation results do not reveal a systematic pattern of gender differences in cooperation, nor robust evidence that the effect of the *Decomposition treatment* differs across genders.

Figure 3 – Aggregate frequency of cooperation of men (blue line) and women (red line) in the *Baseline treatment.*

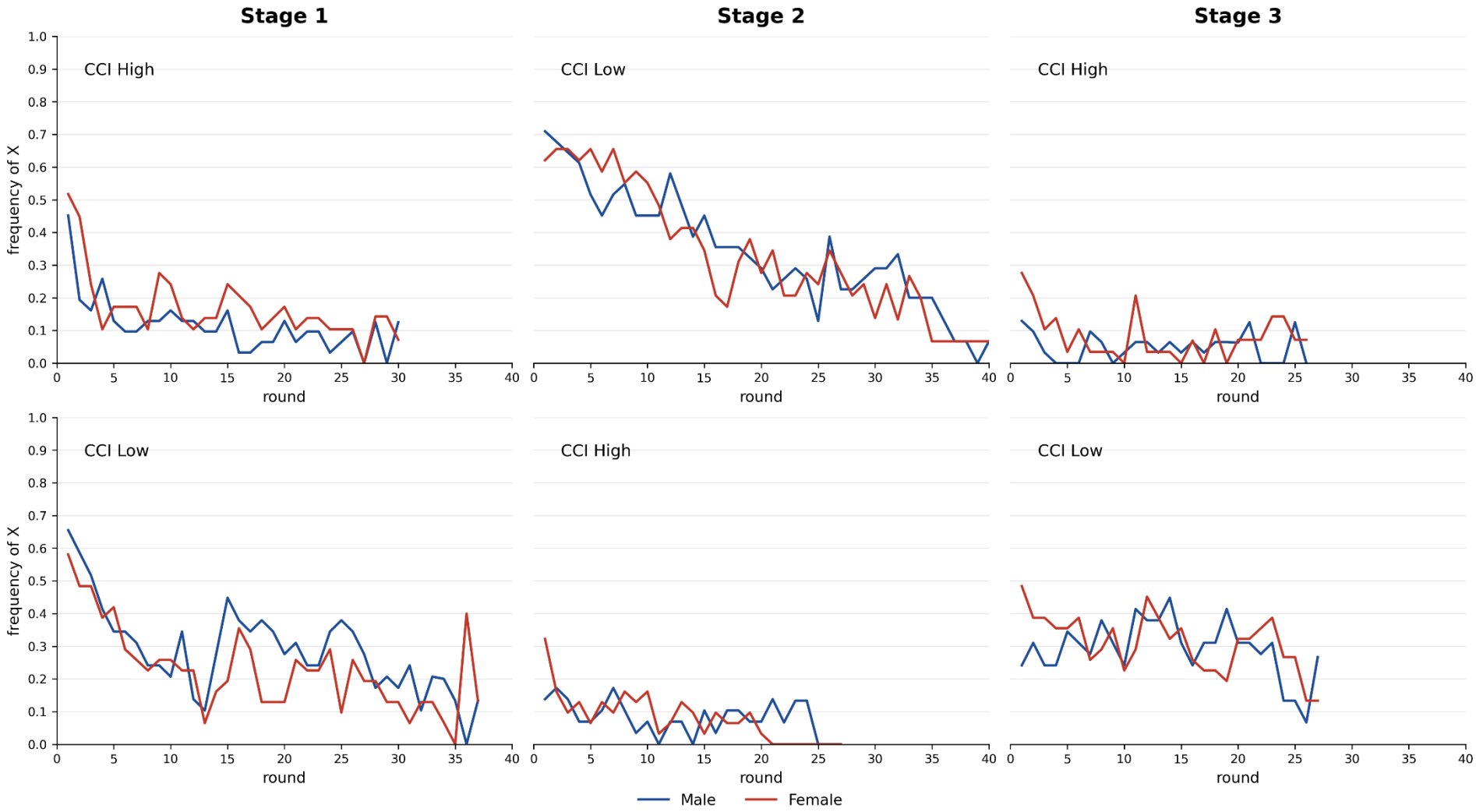
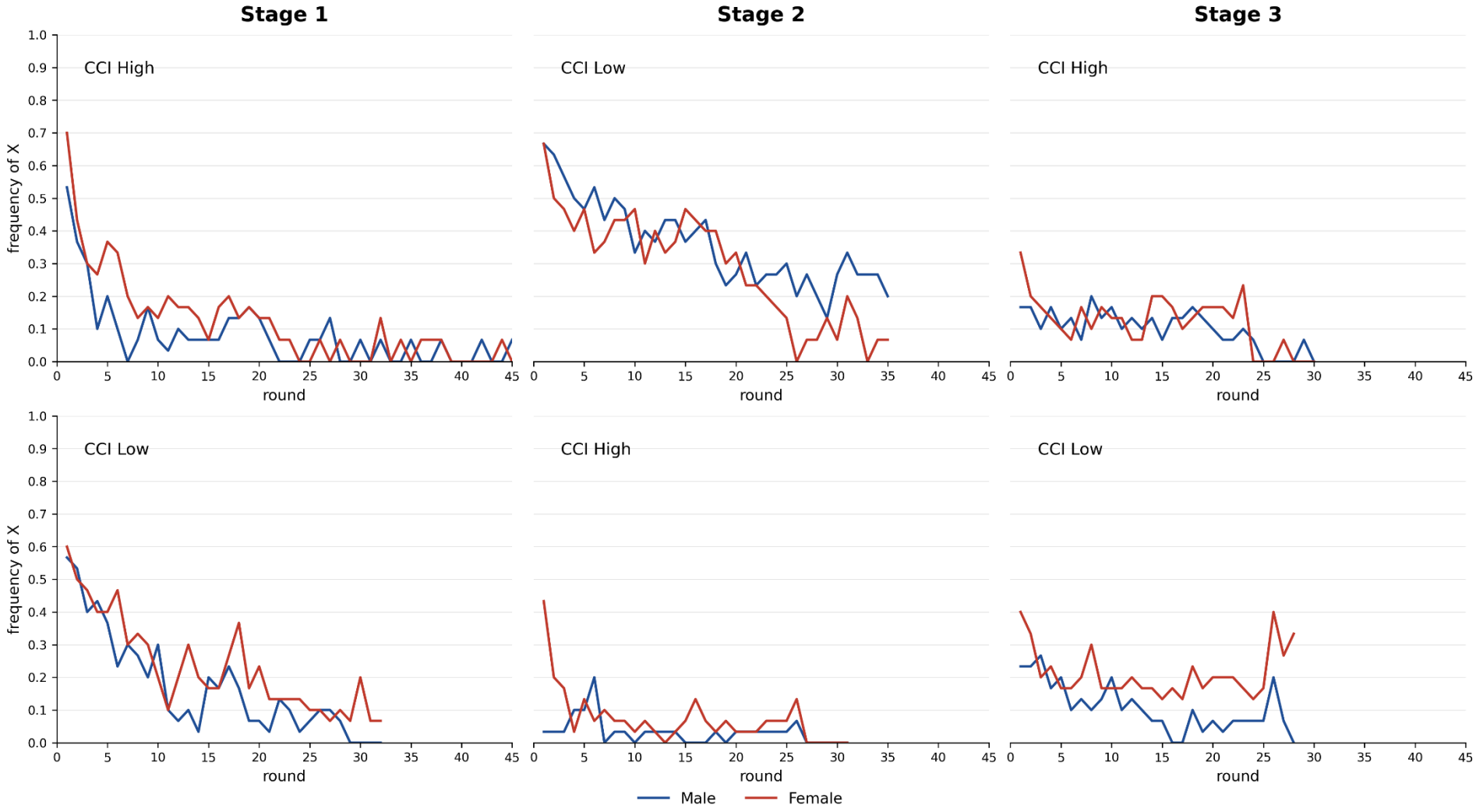


Figure 4 – Aggregate frequency of cooperation of men (blue line) and women (red line) in the *Decomposition treatment*.



4.2 Gender difference in spillover effects across tasks characterized by high vs. low competitiveness

In the following, we first analyse whether women cooperate more than men when playing the more competitive (CCI_H) Prisoner's Dilemma after having experienced the more cooperative (CCI_L) one (hypothesis 4). Then, we study whether men cooperate less than women when interacting in the more cooperative (CCI_L) Prisoner's Dilemma after having played in the more competitive (CCI_H) one (hypothesis 5). In order to further test our main hypotheses, in the following we perform a within subject analysis in which we investigate whether gender affects the average choice of cooperation in the first round after a game change.

In Table 6, we report the results of a Linear Probability Model with robust standard errors clustered at the matching group level.[29] Differently from Table 5, our independent variables of interest in Table 6 are *Decomposition*, *Female,* and their interaction (*Female* × *Decomposition*). We estimate four specifications of the determinants of the cooperative choice in the first round after a game change. In particular, the first two specifications focus on switching from the more cooperative (CCI_L) Prisoner's Dilemma to the more competitive one (CCI_H), specifications 3 and 4 focus on switching in the opposite direction.
In Table 6 we pool observations from both stage 1→2 and stage 2→3, following the approach adopted by Duffy and Fehr (2018). As a robustness check, Appendix D (Table D.6 and D.7) reports separate estimates for the two switch types. While the separate-switch estimates are qualitatively consistent with the pooled specification, splitting the sample reduces the number of independent matching groups from 24 to 12 and therefore substantially reduces statistical power, resulting in less precise estimates.

In Specification 1, we include as control variables *Cooperation 1st round*, which is a dummy variable that takes value 1 if the participant has cooperated in the first round of the first stage and zero otherwise, and *Others past cooperation*, which averages the cooperation rate of one's opponents in the previous stage.[30] In specification 2, we further add the control variables included in Table 5: *Others experiment*, *Game theory*, *Risk lover*, *Trust*, *Negative reciprocity*, *Enjoyment of competition*, and *Contentiousness*.
In specification 1, the coefficient on *Female* is positive and statistically significant, indicating that women cooperate more than men in the *Baseline treatment* when moving from CCI_L to CCI_H. A post-estimation lincom test further shows that the corresponding gender gap in the *Decomposition treatment*, measured by the linear combination Female + Female × Decomposition, is also positive and statistically significant (β = 0.277, p = 0.001). This effect is robust to the inclusion of control variables in specification 2, with *Trust* having a significant and positive impact on the decision to cooperate.
Differently, no gender differences in spilling over cooperative behaviour are observed when moving from the more competitive environment to the more cooperative one, in specifications 3 and 4.

[29] As for Table 5, statistical validity concerns might be raised due to the limited number of clusters. Therefore, we test the linear hypotheses about the parameter of our main independent variable (*Female*) in specifications 1-4 of Table 6 estimating a wild cluster bootstrap inference. The results of this analysis confirm the robustness of the findings reported in Table 6 (see Appendix D, Table D.3).

[30] *Cooperation 1st round* has mean 0.575 and s.d. 0.4954, while *Others past cooperation* has mean 0.114 and s.d. 0.1021. We use *Cooperation 1st round* as a proxy for participants' initial willingness to cooperate, as it is measured before any strategic interaction has taken place and is therefore unaffected by opponents' behaviour or learning dynamics. By contrast, *Others past cooperation* captures the social environment experienced in the stage preceding the switch by measuring the average cooperation rate of a participant's opponents, accounting for the possibility that exposure to more or less cooperative interaction partners in the previous stage may influence behaviour after the switch.

Exposure to an environment characterized by stronger competitive incentives does not generate positive spillovers when individuals subsequently interact in a less competitive setting. Interestingly, individuals who cooperated in round 1 of the more competitive setting are also more likely to cooperate in the first round following a game change, as shown by the coefficient of the variable *Cooperation 1st round* being significant and positive. This result suggests persistence in cooperative behaviour at the individual level, independently of the specific environment in which subjects subsequently interact.[31]

Table 6 – Determinants of the cooperative choice in the first round after a game change.

	$CCI_L \rightarrow CCI_H$		$CCI_H \rightarrow CCI_L$	
Cooperation	(1)	(2)	(3)	(4)
Decomposition	-0.031	-0.005	-0.030	-0.025
	(0.0605)	(0.0507)	(0.1304)	(0.1327)
Female	0.167**	0.157*	0.054	0.039
	(0.0786)	(0.0838)	(0.1027)	(0.1070)
Female X Decomposition	0.110	0.061	0.003	-0.010
	(0.1072)	(0.0974)	(0.1623)	(0.1731)
Cooperation 1st round	0.059	0.049	0.161**	0.170**
	(0.0546)	(0.0559)	(0.0617)	(0.0642)
Others past cooperation	0.041	0.024	0.530	0.485
	(0.1555)	(0.1411)	(0.3969)	(0.4310)
Other experiment		0.006		-0.045
		(0.0594)		(0.1041)
Game theory		0.005		-0.029
		(0.0377)		(0.0548)
Risk lover		-0.002		-0.012
		(0.0146)		(0.0202)
Trust		0.027***		-0.006
		(0.0094)		(0.0112)
Negative reciprocity		-0.004		0.019
		(0.0138)		(0.0121)
Enjoyment competition		-0.005		-0.007
		(0.0058)		(0.0076)
Contentiousness		0.001		0.002
		(0.0087)		(0.0072)
Constant	0.088	0.130	0.339**	0.573**
	(0.0632)	(0.2152)	(0.1263)	(0.2597)
R-squared	0.082	0.121	0.042	0.065
N	240	240	240	240

Note: * p<0.10; ** p<0.05; *** p<0.01. LPM with robust s.e. clustered at the matching group level in parenthesis.

To further illustrate the dynamics underlying the estimates reported in Table 6, Figure 5 plots the average cooperation rates in the rounds immediately before and after the stage change, separately for men and women. Specifically, Figure 5.A focuses on cooperative behaviour when moving from the more cooperative environment to the more competitive one, namely from CCI_L to CCI_H, while Figure

[31] As discussed for Table 5, the pre-analysis plan specified probit regressions. The corresponding probit estimates for Table 6 are reported in Appendix D (Table D.5) and lead to the same qualitative conclusions as the Linear Probability Models reported here.

5.B considers the opposite switch. Figure 5.A shows that cooperation rates are very similar across genders before the switch and diverge only at the moment of the game change. In particular, women increase their cooperative behavior immediately after entering the more competitive environment, whereas male cooperation remains substantially unchanged. This pattern is consistent with the regression results reported in Table 6 and suggests that the observed gender difference is associated with the change in environment rather than with pre-existing differences in cooperative behaviour. At the same time, the figure indicates that the effect is concentrated around the transition and does not persist for many rounds after the switch. By contrast, Figure 5.B shows no systematic gender differences around the switch from CCI_H to CCI_L. Cooperation increases sharply for both men and women immediately after the switch, reflecting the move to an environment characterized by stronger cooperative incentives. The similarity of the two trajectories is consistent with the null gender effect reported in specifications 3 and 4 of Table 6.

Figure 5 – Cooperation rates before and after the stage switch, by gender. Figure A refers to $CCI_L \rightarrow CCI_H$ while figure B refers to $CCI_H \rightarrow CCI_L$

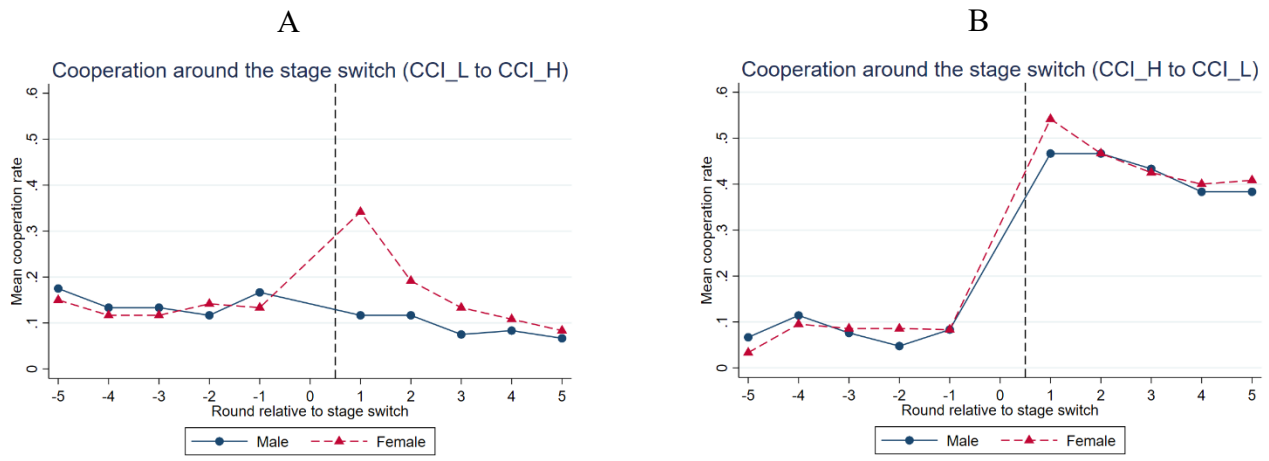


Figure 5 shows that the gender difference in cooperation emerges immediately after the switch and disappears within a few rounds. Thus, the spillover we observe is short-lived rather than persistent. Several mechanisms could account for this pattern, including the transfer of previously established cooperative behaviour, inertia in adjusting to the new incentive structure, or anchoring on the previous environment. However, Figure 5A shows that the gender difference emerges because women increase cooperation immediately after the switch, while men's cooperation remains unchanged. This pattern is also consistent with women being more willing to give cooperation a new chance when the strategic environment changes. At the same time, the rapid adjustment observed in our experiment should be interpreted in light of its feedback structure. Participants receive immediate feedback about their counterpart's behaviour after each round and can therefore quickly adjust when cooperation is not reciprocated. In settings where feedback about others' behaviour is less immediate, adjustment may be slower and the initial carryover may persist for longer. Our experiment does not allow us to assess this possibility, which provides a further avenue for future research.

5 Conclusion

Organizations are increasingly confronted with the call for gender equality, and, at the same time, they face the challenge of establishing and sustaining high levels of cooperation over time, while securing a competitive environment for innovations and promotions. While previous research has mostly focused on males' and females' willingness to self-select into competitive or non-competitive environments, our focus is on how they adapt when facing a tension between competitiveness and cooperativeness—a situation that more closely reflects (highly paid) jobs. Specifically, our paper aims at investigating whether men and women differ in the extent to which they spill over cooperative behaviour when facing environments characterized by different combinations of competitive and cooperative incentives.

We exploit the competitiveness-cooperativeness index (CCI) (Demuynck et al., 2022) to determine the parametrization of two indefinitely repeated Prisoner's Dilemmas and we built on the experimental design of Duffy and Fehr (2018) to investigate our research question. Unlike in our *Baseline treatment*, in our *Decomposition treatment*, we vary the way the Prisoner's Dilemmas are presented to subjects, namely as the sum of a zero-sum game and a common interest game (see the unique decomposition of a game introduced by Kalai and Kalai, (2013)), to further study whether the framing of the reward structure might affect individuals' (spillover of) cooperative behaviour (Pruitt, 1967; Dufwenberg et al., 2011).

Our laboratory experiment contributes to the literature on gender differences in labour market outcomes along three main dimensions.

First, our results indicate that while the frequency of cooperative behaviour is significantly higher in the less competitive (more cooperative) environment than in the more competitive one, no gender differences are observed when considering either setting. When women and men are not explicitly asked to self-select into a tournament nor to outperform others, but instead they have to interact in a *neutral* setting, where gender-stereotypical tasks are absent, they do not show different competitive behaviours.

Second, the framing of the payoff structure affects the cooperative behaviours of both men and women when interacting in more competitive tasks, as suggested by the role of our *Decomposition treatment*, although this effect does not persist over the entire interaction. Differences in cooperative behavior may depend not only on how incentives are structured, but also on how they are communicated to individuals. We speculate that presenting the payoff structure in decomposed form makes the cooperative component of the interaction more salient, especially in more competitive environments, although our design does not allow us to directly test this interpretation. An alternative interpretation, consistent with additional evidence from an additional online experiment, is that the decomposed representation increases the absolute visibility of the cooperative, common-interest component of the payoffs, making cooperation more likely regardless of the underlying level of competitiveness. We cannot, however, rule out that the decomposed format is also more cognitively demanding, and our design does not allow us to disentangle these channels or to test this interpretation directly.

Finally, we find evidence consistent with a gender difference in transferring cooperative behaviour when moving from an environment characterized by stronger cooperative incentives to one characterized by stronger competitive incentives, whereas no significant gender difference emerges when considering the opposite task switch. Women who initially interact in environments where the "rules of the game" make cooperation relatively easy tend to behave more cooperatively when subsequently facing environments in which cooperation is less attractive. By contrast, prior exposure to a more competitive environment does not appear to increase women's willingness to cooperate when they later move to a less competitive setting. While our experimental design does not allow to

disentangle whether these patterns reflect males and females' different persistence in cooperative norms, heterogeneous responsiveness to competitive incentives, or broader behavioural adaptation mechanisms, our findings could inform firms on how to structure their organizations in terms of gender diversity within offices. At the same time, our experimental setting abstracts from several dimensions characterizing real organizational transitions across tasks, such as changes in team composition, information flows, and task objectives. Although this necessarily simplifies workplace interactions, it allows us to isolate the behavioural effects associated with changes in competitive and cooperative incentives.

Our findings suggest that previous exposure to different combinations of competitive and cooperative incentives shapes subsequent behaviour differently across genders. Future research could investigate the role of public knowledge of the gender composition of the team in affecting these dynamics. Similarly, besides analysing how the payoff structure and the organization of the tasks within organizations affect the emergence of cooperative spillovers between tasks, it would be interesting to explore how the gender composition of the workforce affects men's and women's willingness to join it and their propensity to cooperate when performing workplace tasks.

Statements and Declarations

Data availability

The dataset generated and analysed during the current study is available at the following link**:** **https://data.mendeley.com/datasets/jwc5k2whzk/2**

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Compliance with Ethical Standards

We wish to confirm that there are no known conflicts of interest associated with the paper "Spillover effects of cooperative behaviour when switching tasks: the role of gender" and there has been no significant financial support for this work that could have influenced its outcome.
In this paper we implemented a set of laboratory experiments with human subjects run at VERALabEx, at Ca' Foscari University of Venice. The study did not involve any risk for participants.
Participation was voluntary and informed consent was obtained following the procedures of the laboratory at the Ca' Foscari University of Venice; Any possible consequences of the study were explained to all participants, who were free to quit the study at any time with no penalties.

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References

Balliet, D.; Li, N. P.; Macfarlan, S. J.; and Van Vugt, M.; (2011); "Sex differences in cooperation: a meta-analytic review of social dilemmas"; Psychological Bulletin, 137(6), 881–909.

Bednar, J., Chen, Y., Liu, T. X., and Page, S.; (2012); "Behavioral spillovers and cognitive load in multiple games: An experimental study"; Games and Economic Behavior, 74, 12–31.

Beersma, B.; Hollenbeck, J. R.; Humphrey S. E.; Moon, H., Conlon, D. E.; and Ilgen, D. R; (2003); "Cooperation, competition, and team performance: Toward a contingency approach"; Academy of Management Journal, 46(5), 572-590.

Böörs, M.; Wängberg, T.; Everitt, T.; and Hutter, M.; (2022); "Classification by decomposition: a novel approach to classification of symmetric 2×2 games"; Theory and Decision, 93, 463–508.

Cachon, G. P.; and Camerer, C. F.; (1996); "Loss-avoidance and forward induction in experimental coordination games"; The Quarterly Journal of Economics, 111(1), 165-194.

Cameron, C.; and Miller, D. L.; (2015); "A practitioner's guide to cluster-robust inference"; Journal of human resources, 50(2):317–372, 2015.

Candogan, O. I.; Menache, A.; Ozdaglar; and P. A., Parrilo; (2011); "Flows and decompositions of games: Harmonic and potential games" Mathematics of Operations Research 36(3), 474–503.

Cason, T. N.; Savikhin, A. C.; and Sheremeta, R. M.; (2012); "Behavioral spillovers in coordination games"; European Economic Review, 56, 233–245.

Cassar, L.; and Rigdon, M.; (2021). Prosocial incentives and entry into competition. Proceedings of the National Academy of Sciences, 118(45).

Charness, G.; and Gneezy, U.; (2012); "Strong evidence for gender differences in risk taking"; Journal of Economic Behavior & Organization, 83(1), 50–58.

Charness, G.; Rigotti, L.; and Rustichini, A.; (2016); "Social surplus determines cooperation rates in the one-shot Prisoner's Dilemma"; Games and Economic Behavior, Vol. 100, pp. 113-124.

Charness, G.; and Rustichini, A.; (2011); "Gender differences in cooperation with group membership"; Games and Economic Behavior, 72(1), 77-85.

Charness, G.; and Villeval, M. C.; (2009); "Cooperation and competition in intergenerational experiments in the field and the laboratory"; American Economic Review, 99(3), 956-978.

Comeig, I.; Grau-Grau, A; Iramillo-Guitérrez, A.; Ramírez, F.; (2016); "Gender, self-confidence, sports, and preferences for competition"; Journal of Business Research, Vol. 69, Issue 4; pp. 1418–1422.

Croson, R.; and Gneezy, U.; (2009); "Gender Differences in Preferences"; Journal of Economic Literature, 47:2, pp. 448–474.

Dal Bó, P.; and Fréchette, G. R.; (2011); "The Evolution of Cooperation in Infinitely Repeated Games: Experimental Evidence"; American Economic Review 101: 411-429.

Dal Bó, P.; and Fréchette, G. R.; (2018); "The Determinants of Cooperation in Infinitely Repeated Games"; Journal of Economic Literature; Vol. 56, No. 1, pp.60-114.

Demuynck, T.; Seel, C.; and Tran, G.; (2022); “An Index of Competitiveness and Cooperativeness for Normal-Form Games”; American Economic Journal: Microeconomics; Vol. 14, n. 2, pp. 215-39.

Devetag, G.; and Ortmann, A.; (2007); “When and why? A critical survey on coordination failure in the laboratory”; Experimental economics, 10, 331-344.

Dohmen, T.; and Falk, A.; (2011); “Performance pay and multidimensional sorting: productivity, preferences, and gender”; American Economic Review; Vol. 101, No. 2; pp. 556-590.

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

Dufwenberg, M.; Gächter, S.; and Hennig-Schmidt, H.; (2011); "The framing of games and the psychology of play"; Game and Economic Behavior, Vol. 73, Issue 2, pp. 459-478.

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.

Falk, A.; Becker, A.; Dohmen, T.; Enke, B.; Huffman, D.; and Sunde, U.; (2018); “Global Evidence on Economic Preferences”; The Quarterly Journal of Economics, Vol. 133, Issue 4, pp. 1645–1692.

Fischbacher, Urs; (2007); "z-Tree: Zurich toolbox for ready-made economic experiments"; Experimental Economics, 10; pp. 171-178.

Furtner, N. C.; Kocher, M. G.; Martinsson, P.; Matzat, D.; and Wollbrant, C.; (2021); “Gender and cooperative preferences”; Journal of Economic Behavior & Organization, 181, 39-48.

Gächter, S.; Lee, K.; Sefton, M.; and Weber, T. O.; (2021); "Risk, Temptation, and Efficiency in the One-Shot Prisoner's Dilemma"; CESifo Working Paper Series 9449, CESifo.

García-Galocha, A.; Iñarra, E.; and Iriberri, N.; (2022); “Do Nonstrategic Considerations Matter for Behavior in Games? An Experimental Study Informed by Direct-sum Decompositions of Game”; CEPR Press Discussion Paper No. 17578.

Gneezy, U., Niederle, M., Rustichini, A.; (2003); “Performance in competitive environments–Gender differences”; The Quarterly Journal of Economics, 118, 1049–1074.

Greiner, B.; (2004); “An Online Recruitment System for Economic Experiments.”; Published in: Forschung und wissenschaftliches Rechnen 2003. GWDG Bericht; Vol. 63, (2004): pp. 79-93.

Grimm, V.; and Mengel, F.; (2012); “An experiment on learning in a multiple games environment”; Journal of Economic Theory, 147, 2220–2259.

Günther, C.; Ekinci, N. A.; Schwieren, C.; and Strobel, M.; (2010); “Women can’t jump? An experiment on competitive attitudes and stereotype threat”; Journal of Economic Behavior & Organization, Vol. 75, Issue 3, pp. 395-401.

Homburg, C.; Schyma, T. R.; Hohenberg, S.; Atefi, Y.; and Ruhnau, R. C. M.; (2024); “’Coopetition’ in the presence of team and individual incentives: Evidence from the advice network of a sales organization”; Journal of the Academy of Marketing Science, 52(2), 306-328.

Houston, J. M., Harris, P. B., Moore, R., Brummett, R., and Kametani, H.; (2005); “Competitiveness among Japanese, Chinese, and American Undergraduate Students”; *Psychological Reports*, *97*(1), 205–212.

Hoyer, B.; van Huizen, T.; Keijzer, L.; Rezaei, S.; Rosenkranz, S.; and Westbrock, B; (2020); "Gender, competitiveness, and task difficulty: Evidence from the field"; Labour Economics, Vol. 64.

Huck, S.; Jehiel, P.; and Rutter, T.; (2010); "Feedback spillover and analogy-based expectations: A multigame experiment"; Games and Economic Behavior, 71, 351–365.

Kalai, A.; and Kalai, E.; (2013); "Cooperation in strategic games revisited"; The Quarterly Journal of Economics, pp. 917-966.

Kamas, L., & Preston, A. (2015). Can social preferences explain gender differences in economic behavior? Journal of Economic Behavior & Organization, 116, 525-539.

Kamas, L.; and Preston, A.; (2018); "Competing with confidence: The ticket to labor market success for college-educated women"; Journal of Economic Behavior & Organization, Vol. 155; pp. 231-252.

Kamas, L.; and Preston, A.; (2012a); "The importance of being confident; gender, career choice, and willingness to compete"; Journal of Economic Behavior & Organization 83, pp. 82– 97.

Kamas, L.; and Preston, A.; (2012b); "Are women really less willing to compete than men? Gender stereotypes, confidence, and social preferences, mimeo.

Kendall, R.; (2022); "Decomposing coordination failure in stag hunt games"; Experimental Economics 25, pp. 1109–1145.

Kosfeld, M.; Von Siemens, F. A; (2011); "Competition, cooperation, and corporate culture"; The RAND Journal of Economics, 42(1), 23-43.

Kuhn, P.; and Villeval, M. C.; (2015); "Are Women More Attracted to Co-operation Than Men?", The Economic Journal, 125(582), 115–140.

LiCalzi, M.; and Mühlenbernd, R.; (2022); "Feature-weighted categorized play across symmetric games"; Experimental Economics 25, pp. 1052–1078.

List, J. A.; (2004); "Neoclassical theory versus prospect theory: Evidence from the marketplace"; Econometrica, 72(2), 615–625.

Lozano, L.; and Reuben, E.; (2022); "Measuring preferences for competition"; Mimeo (NYU Abu Dhabi).

Markowsky, E.; and Beblo, M.; (2022); "When do we observe a gender gap in competition entry? A meta-analysis of the experimental literature"; Journal of Economic Behavior and Organization 198, pp. 139–163.

Meier, K.; Niessen-Ruenzi, A.; and Ruenzy, S.; (2020); "The impact of role models on women's self-selection in competitive environments"; Working Paper.

Mengel, F.; (2018); "Risk and Temptation: A Meta-study on Prisoner's Dilemma Games", The Economic Journal, 128, 3182-3209.

Mengel, F.; (2012); "Learning across games"; Games and Economic Behavior, Volume 74, Issue 2, pp. 601-619.

Molina, J.A.; Giménez-Nadal, J. I.; Cuesta, J. A.; Gracia-Lazaro, C.; Moreno, Y.; and Sanchez, A.; (2013); "Gender Differences in Cooperation: Experimental Evidence on High School Students"; PlosOne, Vol.8, Issue 12.

Murnighan, J.; and Roth, A.; (1983); 'Expecting continued play in prisoner's dilemma games'; Journal of Conflict Resolution, vol. 27(2), pp. 279–300.

Niederle, M.; (2017); "Gender Agenda: A Progress Report on Competitiveness"; American Economic Review: Papers & Proceedings, 107(5): 115–119.

Niederle, M.; and Vesterlund, L.; (2011); "Gender and competition"; Annu. Rev. Econ.; 3:601–30.

Niederle, M.; and Vesterlund, L.; (2007); "Do women shy away from competition? Do men compete too much?", The Quarterly Journal of Economics; *122*(3), 1067-1101.

Peysakhovich, A.; and Rand, D. G.; (2016); "Habits of virtue: Creating norms of cooperation and defection in the laboratory"; Management Science, 62, 631.

Peterson, R. S.; and Behfar, K. J.; (2022); "When to cooperate with colleagues and when to compete"; Harvard Business Review; https://hbr.org/2022/03/when-to-cooperate-with-colleagues-and-when-to-compete.

Plott, C. R.; and Zeiler, K.; (2005); "The willingness to pay-willingness to accept gap, the 'endowment effect', subject misconceptions and experimental procedures for eliciting valuations"; American Economic Review, 95, 530–545.

Pruitt, D. G.; (1967); "Reward structure and cooperation: The decomposed Prisoner's Dilemma game"; Journal of Personality and Social Psychology, 7(1, Pt.1), 21-27.

Puck, J.; and Pregernig, U.; (2014); "The effect of task conflict and cooperation on performance of teams: Are the results similar for different task types?"; European Management Journal, 32(6), 870-878.

Roth, A. E.; and Murnighan, J. K.; (1978); "Equilibrium behavior and repeated play of the prisoner's dilemma"; Journal of Mathematical Psychology, 17, 189-198.

Saccardo, S.; Pietrasz, A.; and Gneezy, U.; (2018); "On the Size of the Gender Difference in Competitiveness"; Management Science 64(4): 1541-1554.

Simpson, B.; (2003); "Sex, Fear, and Greed: A Social Dilemma Analysis of Gender and Cooperation"; Social Forces, September, 82(I):35-52.

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

Van Huyck, J. B.; Battalio, R. C.; Beil, R.; (1991); "Strategic uncertainty, equilibrium selection principles, and coordination failure in average opinion games"; The Quarterly Journal of Economics, 106, 885-910.

Van Veldhuizen, R.; (2022); "Gender differences in tournament choices: risk preferences, overconfidence, or competitiveness?"; Journal of the European Economic Association 2022 00(0):1–24.

Wood, S.; Leoni, S.; and Ladley, D.; (2023); "Comparisons of the effects of individual and collective performance-related pay on performance: A review"; Human Resource Management Review, 100982.

Appendix A – The decomposition of the game

In order to illustrate how the decomposition of the game works, consider again the payoff matrix shown in Table 1. This can be seen as the juxtaposition of two matrices: the payoff matrix of player 1, and that of player 2.

$A = \begin{bmatrix} b & d \\ e & f \end{bmatrix}$ payoffs matrix of player 1

$B = \begin{bmatrix} b & e \\ d & f \end{bmatrix}$ payoff matrix of player 2

Notice that both matrices A and B can be constructed as the sum of a zero-sum component and common interest component:

$A = \frac{A-B}{2} + \frac{A+B}{2}$:

1

$$\begin{bmatrix} b & d \\ e & f \end{bmatrix} = \begin{bmatrix} 0 & \frac{d-e}{2} \\ \frac{e-d}{2} & 0 \end{bmatrix} + \begin{bmatrix} b & \frac{d+e}{2} \\ \frac{e+d}{2} & f \end{bmatrix}$$

while $B = \frac{B-A}{2} + \frac{A+B}{2}$:

2

$$\begin{bmatrix} b & e \\ d & f \end{bmatrix} = \begin{bmatrix} 0 & \frac{e-d}{2} \\ \frac{d-e}{2} & 0 \end{bmatrix} + \begin{bmatrix} b & \frac{d+e}{2} \\ \frac{e+d}{2} & f \end{bmatrix}$$

Indeed, in both equations 1 and 2, the first term on the right-hand side is the zero-sum game while the second term is the common interest game. Therefore, by considering again the whole game, we obtain:

$$\begin{bmatrix} b,b & d,e \\ e,d & f,f \end{bmatrix} = \begin{bmatrix} 0,0 & \frac{d-e}{2},\frac{e-d}{2} \\ \frac{e-d}{2},\frac{d-e}{2} & 0,0 \end{bmatrix} + \begin{bmatrix} b,b & \frac{d+e}{2},\frac{d+e}{2} \\ \frac{e+d}{2},\frac{e+d}{2} & f,f \end{bmatrix}$$

where the first matrix on the right-hand side is a zero-sum game and the second matrix on the right-hand side is a common interest game.

Appendix B – Instructions and extra materials

[Below we present the instructions (originally in Italian) used in the experiment. The parts written in blue colour are the ones used only in the *Baseline treatment*, while those written in red colour are the ones used only in the *Decomposition treatment*.]

Welcome and thank you for taking part in this experiment.

The experiment will last about an hour and a half. You will receive 3 Euro for showing up and you will have the opportunity to earn more money depending on the decisions you make in the experiment. During the experiment, your gains will be expressed in points, and, at the end of the experiment, your total points will be converted into euro at the rate 150 points=1 Euro and you will be paid in cash and in private.

The experimenter will read the instructions aloud. If at the end of the reading or during the experiment you have any questions, press the help button that you see at the top right of your screen, we will come to answer your questions in private.

At the end of the reading of the instructions, you will have to answer a short comprehension test, to make sure that everything is clear to you. When all of you will have successfully completed the comprehension test, the experiment will start. During the experiment, it is not allowed to talk or communicate in any way with other participants. Please turn off your mobile phone.

Instructions

There are 30 participants in today's session. At the beginning of the experiment, the computer will randomly divide you and the other participants into 3 groups of 10 people. Your assignment to a group of size 10 will not change for the entire duration of the experiment. During the experiment, you will interact with the other 9 members of your group.

The experiment is made up of a number of "sequences". Each sequence consists of an indefinite number of "rounds". In each round you will be randomly and anonymously matched with one of the other 9 participants in you group of size 10 and asked to make a decision. The matching with one of the other 9 participants is equally likely, hence, in each round, you will have a 1/9 chance of being matched with any of the other 9 members in your group of 10 participants.

In each round, both you and the other member of your group of 10 participants with whom you have been randomly matched, will have to choose between two possible options labelled "X" and "Y": each of the two randomly matched group members will make its decision independently and without knowing each other decision.

To make a choice, you have to simply select one of the two options and then click on the "OK" button. At the end of each round, after all participants have made their choice, you will be informed of the decision made by the member of your group to which you have been matched. In the same way, the latter will know of your decision.

Your decision, together with the decision of the participant matched with you will determine one of four possible scenarios: (X, X), (X, Y), (Y, X) e (Y, Y). In each of these scenarios, the first letter in the brackets corresponds to your decision, the second letter in the brackets corresponds to that of the other member matched with you.

[only in the *Baseline treatment*]
The scenario that occurs determines your earnings in the round, according to two possible ways, and these are shown in the two Tables below: Table 1 and Table 2. Your gain in a round is given by the points you earned according to the Table, in the occurred scenario.
Let's make an example.

Suppose that you chose the letter X and the participant matched with you chose the letter X. The scenario that occurs is then the scenario (X, X).

- If Table 1 determines your earnings, your total gain for this round will be equal to what you get in the scenario (X, X), which is 20 points. Similarly, the total gain for this round of the other participant matched with you will be equal to what the other gets in the scenario (X, X) in Table 1, that is 20 points.
- If Table 2 determines your earnings, your total gain for this round will be equal to what you get in the scenario (X, X), which is 29 points. Similarly, the total gain for this round of the other participant matched with you will be equal to what the other gets in the scenario (X, X) in Table 1, that is 29 points.

Tabella 1

Table 1	Other's choice: X	Other's choice: Y
Your choice: X	Your gain: **20** Other's gain: **20**	Your gain: 0 Other's gain: 30
Your choice: Y	Your gain: 30 Other's gain: 0	Your gain: 10 Other's gain: 10

Tabella 2

Table 2	Other's choice: X	Other's choice: Y
Your choice: X	Your gain: **29** Other's gain: **29**	Your gain: 0 Other's gain: 30
Your choice: Y	Your gain: 30 Other's gain: 0	Your gain: 10 Other's gain: 10

Note that the gains of Table 1 and Table 2 are the same with the only difference given by the gain obtained in the scenario (X, X), that is, in the scenario in which both you and the other participant matched to you choose the option X, as indicated by the bold numbers.

Which table?

In all rounds of the same sequence ONLY ONE Table, either Table 1 or Table 2, will be used to determine earnings. The Table used to determine the earnings in all rounds of the same sequence is the same for all participants in the experiment and will be shown, at each round, before making any choice.
Each time a new sequence starts, the Table used to determine the gains COULD change with respect to the one used in the previous sequence (but it could also remain the same!). The Table can change ONLY at the beginning of a new sequence and will remain the same for all rounds of a sequence.
Each time you start a new sequence you will be informed, so that you can carefully check which Table will be used to determine the gains of all the rounds of the new sequence. The Table could in fact remain unchanged or change with respect to the one in the previous sequence.

When does a sequence of rounds end?

Each sequence consists of at least one round. At the end of each round, a virtual six-sided die will be rolled. If the die roll results in a 1, 2, 3, 4 or 5 being rolled, then the sequence will continue and a new round of the same sequence will start, and so the Table used to determine the gains will remain the same. If the die roll results in a 6 being rolled, then the sequence will end and a new sequence will begin. As mentioned above, at the beginning of a new sequence the Table used to determine earnings may change.
The total number of sequences is undefined and, at a certain point, at the end of a sequence, you will be told that the experiment is over.
To sum up, each sequence consists of an indefinite number of rounds in which the Table used to determine the gains will always be the same for the duration of the sequence. The number of rounds of each sequence depends on the roll of the virtual die: a sequence ends if the die roll results in a 6 being rolled. In this case a new sequence begins, and the Table used to determine the gains may change. Therefore, at each round, the probability that the sequence continues is 5/6 and the probability that the sequence ends is 1/6.

[only in the *Decomposition treatment*]

The scenario that occurs determines your earnings in the round, according to two possible ways, and these are shown in the two pairs of Tables below: Pair 1, formed by Tables 1a and 1b; and Pair 2, formed by Tables 2a and 2b.
Your gain in a round is given by the sum of points you earned in each of the two tables of the same pair, in the occurred scenario.

Let's make an example.

Suppose that you chose the letter X and the participant matched with you chose the letter X. The scenario that occurs is then the scenario (X, X).

- If Pair 1 determines your earnings, your gain will be equal to the sum of what you get in the scenario (X, X) in Table 1a, that is 0 points, and of what you get in the scenario (X, X) in Table 1b, that is 20 points. In total, your gain for this round is 20 points. Similarly, the gain of the other participant matched to you will be equal to the sum of what the other participant gets in the scenario (X, X) in Table 1a, that is 0 points, and of what the other gets in the scenario (X, X) in Table 1b, that is 20 points. In total, the gain of the other participant matched to you for this round is 20 points.

- If Pair 2 determines your earnings, your gain will be equal to the sum of what you get in the scenario (X, X) in Table 2a, that is 0 points, and of what you get in the scenario (X, X) in Table 2b, that is 29 points. In total, your gain for this round is 29 points. Similarly, the gain of the other participant matched to you will be equal to the sum of what the other participant gets in the scenario (X, X) in Table 2a, that is 0 points, and of what the other gets in the scenario (X, X) in Table 2b, that is 29 points. In total, the gain of the other participant matched to you for this round is 29 points.

Pair 1

Table 1a	Other's choice: X	Other's choice: Y
Your choice: X	Your gain: 0 Other's gain: 0	Your gain: -15 Other's gain: 15
Your choice: Y	Your gain: 15 Other's gain: -15	Your gain: 0 Other's gain: 0

Table 1b	Other's choice: X	Other's choice: Y
Your choice: X	Your gain: **20** Other's gain: **20**	Your gain: 15 Other's gain: 15
Your choice: Y	Your gain: 15 Other's gain: 15	Your gain: 10 Other's gain: 10

Pair 2

Table 2a	Other's choice: X	Other's choice: Y
Your choice: X	Your gain: 0 Other's gain: 0	Your gain: -15 Other's gain: 15
Your choice: Y	Your gain: 15 Other's gain: -15	Your gain: 0 Other's gain: 0

Table 2b	Other's choice: X	Other's choice: Y
Your choice: X	Your gain: **29** Other's gain: **29**	Your gain: 15 Other's gain: 15
Your choice: Y	Your gain: 15 Other's gain: 15	Your gain: 10 Other's gain: 10

Note that the gains of Table 1a of Pair 1 and those of Table 2a of Pair 2 are the same. The only difference between Table 1b of Pair 1 and those of Table 2b of Pair 2 consists in the gains obtained in the scenario (X, X), that is, in the scenario in which both you and the other participant matched to you choose the option X, as indicated by the bold numbers.

Which pair of tables?

In all rounds of the same sequence ONLY ONE Pair of tables, either Pair 1 or Pair 2, will be used to determine earnings. The Pair of tables used to determine the earnings in all rounds of the same sequence is the same for all participants in the experiment and will be shown, at each round, before making any choice.

Each time a new sequence starts, the Pair of tables used to determine the gains COULD change with respect to the one used in the previous sequence (but it could also remain the same!). The Pair of tables can change ONLY at the beginning of a new sequence and will remain the same for all rounds of a sequence.

Each time you start a new sequence you will be informed, so that you can carefully check which Pair of tables will be used to determine the gains of all the rounds of the new sequence. The Pair of tables could in fact remain unchanged or change with respect to the one in the previous sequence.

When does a sequence of rounds end?

Each sequence consists of at least one round. At the end of each round, a virtual six-sided die will be rolled. If the die roll results in a 1, 2, 3, 4 or 5 being rolled, then the sequence will continue and a new round of the same sequence will start, and so the Pair of tables used to determine the gains will remain the same. If the die roll results in a 6 being rolled, then the sequence will end and a new sequence will begin. As mentioned above, at the beginning of a new sequence the Pair of tables used to determine earnings may change.
The total number of sequences is undefined and, at a certain point, at the end of a sequence, you will be told that the experiment is over.
To sum up, each sequence consists of an indefinite number of rounds in which the Pair of tables used to determine the gains will always be the same for the duration of the sequence. The number of rounds of each sequence depends on the roll of the virtual die: a sequence ends if the die roll results in a 6 being rolled. In this case a new sequence begins, and the Pair of tables used to determine the gains may change. Therefore, at each round, the probability that the sequence continues is 5/6 and the probability that the sequence ends is 1/6.

Results

At the end of each round, you will see a results screen reporting on your decision, your gains, and the decision and gains of the participant matched with you.

Payments

At the end of the experiment the sum of points obtained in all rounds you have participated in will be converted into euros at the rate of 150 points = 1€. The € 3 for showing up in time will be added to this gain. Your total earnings will then be paid in cash and in private at the end of the experiment.

What happens now?

Now you will have to answer some comprehension questions to make sure that everything is clear to you. Please, read carefully each question and answer. In case of a wrong answer, an error message will appear, and you will have the opportunity to correct the given answer (even several times). If case of a correctanswer, no message will appear. As soon as all participants have answered the questionnaire, the first round of the experiment will begin.

If during the comprehension test or during the experiment you have any questions, press the help button that you see at the top right of your screen, we will come to answer your questions in private.

Comprehension test

- A change in the table (Table 1 or Table 2) [pair of tables (Pair 1 or Pair 2)], if it occurs, will only occur at the beginning of a new sequence.
  - **a. True**
  - b. False
- In all rounds of a sequence, I will be matched with the same other participant.
  - a. True
  - **b. False**
- Suppose it is round 3. The chance that the sequence continues on to round 4 is:
  - a. 1/6
  - b. 4/5
  - c. 1/5
  - **d. 5/6**
- Suppose it is round 3. The chance that the sequence continues on to round 4 is: 5/6. Would your answer change if we replaced "round 3" with "round 13" and "round 4" with "round 14"?
  - a. Yes
  - **b. No**
- In each round, how many choice/s will you make for each table [pair of tables]?
  - **a. 1**
  - b. 2

Suppose that Table 1 [Pair 1 (table 1a and table 1b)] is in effect.

- If you choose X and the other participant matched with you chooses Y, then your payoff is
  - **a. 0**
  - b. 10
  - c. 20
  - d. 30

  and the other participant's payoff is
  - a. 0
  - b. 10
  - c. 20
  - **d. 30**
- If you choose X and the other participant matched with you chooses X, then your payoff is
  - a. 0
  - b. 10
  - **c. 20**
  - d. 30

  and the other participant's payoff is
  - a. 0
  - b. 10
  - **c. 20**
  - d. 30

- If you choose Y and the other participant matched with you chooses Y, then your payoff is
    a. 0
    b. 10
    c. 20
    d. 30

  and the other participant's payoff is
    a. 0
    b. 10
    c. 20
    d. 30
- If you choose Y and the other participant matched with you chooses X, then your payoff is
    a. 0
    b. 10
    c. 20
    d. 30

  and the other participant's payoff is
    a. 0
    b. 10
    c. 20
    d. 30

Suppose that Table 2 [Pair 2 (table 2a and table 2b)] is in effect.

- If you choose X and the other participant matched with you chooses Y, then your payoff is
    a. 0
    b. 10
    c. 20
    d. 30

  and the other participant's payoff is
    a. 0
    b. 10
    c. 20
    d. 30
- If you choose X and the other participant matched with you chooses X, then your payoff is
    a. 0
    b. 10
    c. 29
    d. 30

  and the other participant's payoff is
    a. 0
    b. 10
    c. 29
    d. 30

- If you choose Y and the other participant matched with you chooses Y, then your payoff is
    a. 0
    b. 10
    c. 20
    d. 30

  and the other participant's payoff is
    a. 0
    b. 10
    c. 20
    d. 30
- If you choose Y and the other participant matched with you chooses X, then your payoff is
    a. 0
    b. 10
    c. 20
    d. 30

  and the other participant's payoff is
    a. 0
    b. 10
    c. 20
    d. 30

Post-Experiment Questionnaire

1. Have you ever participated in one or more economic experiments before today?
   a. Yes
   b. No
2. How old are you?
3. Gender?
   a. F
   b. M
4. Study course
   a. Economics and management
   b. Language and culture
   c. Science and technologies
   d. Arts and humanities studies
   e. Public and Social Politics
   f. International studies and globalization
   g. Conservation of Cultural Heritage and Performing Arts Management
   h. Other
   i. Not a student
5. Which year are you enrolled in?
   a. 1st (bachelor)
   b. 2nd (bachelor)
   c. 3rd (bachelor)
   d. 4th (only if a study course of four years- i.e., quadriennale)
   e. 1st (master)
   f. 2nd (master)
   g. I am not enrolled in a study course
6. Are you engaged in a paid job?
   a. No
   b. Occasionally
   c. Regularly
7. Are you engaged in voluntary activity?
   a. No
   b. Occasionally
   c. Regularly
8. Have you ever had experience with game theory?
   a. No
   b. Not much
   c. A lot
9. Do you participate in:
   - Political activity:
   a. No
   b. Occasionally
   c. Regularly
   - Religious activity:
   a. No
   b. Occasionally
   c. Regularly

- Cultural activity:

a. No
b. Occasionally
c. Regularly

10. Please tell me, in general, how willing or unwilling you are to take risks. Please use a scale from 0 to 10, where 0 means “completely unwilling to take risks” and a 10 means you are “very willing to take risks”. You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
11. How well do the following statements describe you as a person? Please indicate your answer on a scale from 0 to 10. A 0 means “does not describe me at all” and a 10 means “describes me perfectly”. You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
    - I assume that people have only the best intentions.
    - If I am treated very unjustly, I will take revenge at the first occasion, even if there is a cost to do so.
12. In the following, “willingness to act” indicates the following introduction: We now ask for your willingness to act in a certain way in four different areas. Please again indicate your answer on a scale from 0 to 10, where 0 means you are “completely unwilling to do so” and a 10 means you are “very willing to do so”. You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
    - How willing are you to punish someone who treats you unfairly, even if there may be costs for you?
    - How willing are you to punish someone who treats others unfairly, even if there may be costs for you?

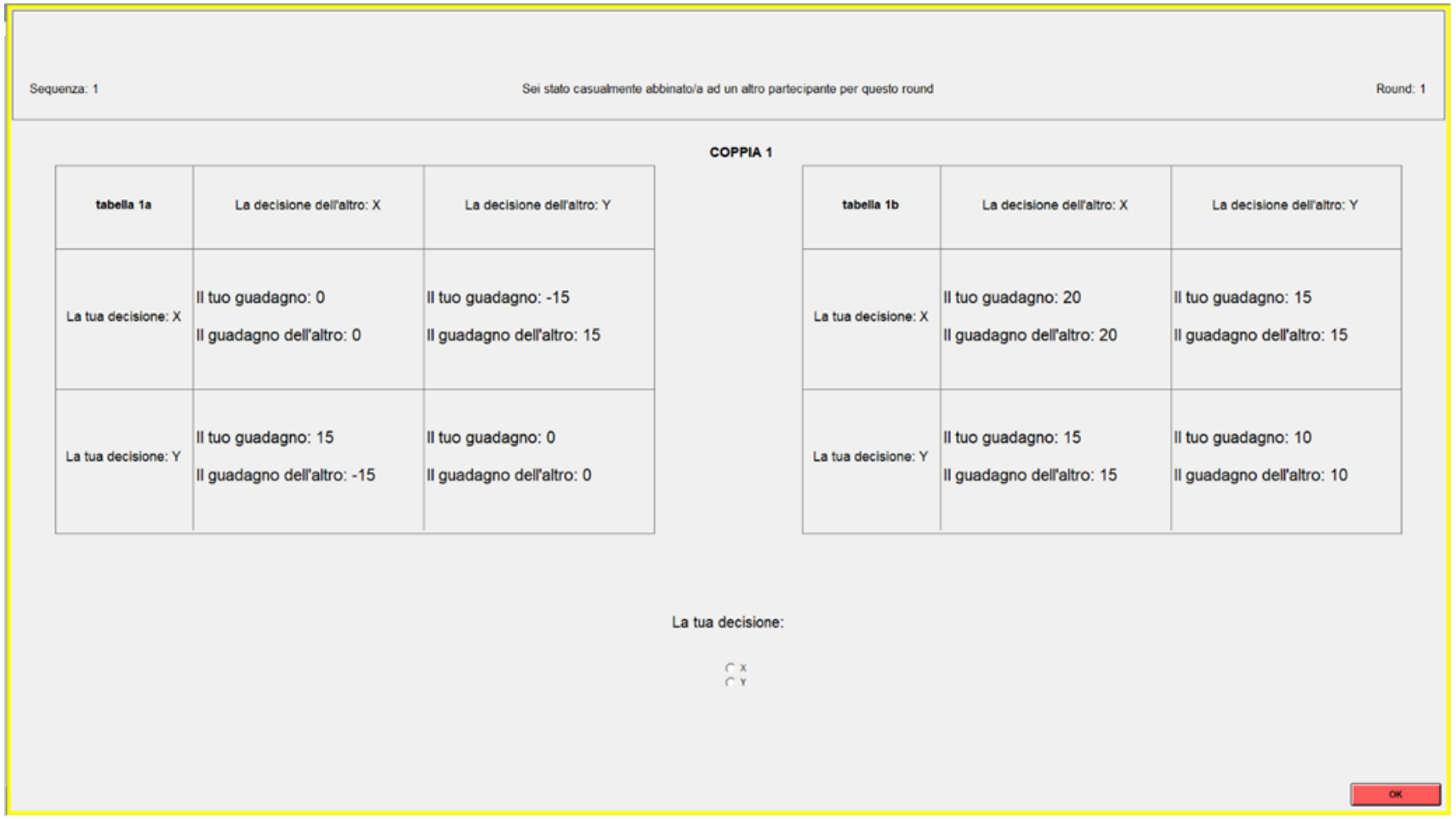
Competitiveness Index

13. I like competition.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
14. I am a competitive individual.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
15. I enjoy competing against an opponent.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
16. I don’t like competing against other people.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
17. I get satisfaction from competing with others.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
18. I find competitive situations unpleasant.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
19. I dread competing against other people.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
20. I try to avoid competing with others.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
21. I often try to outperform others.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
22. I try to avoid arguments.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
23. I will do almost anything to avoid an argument.

“1 (strongly disagree)", "2", "3", "5 (strongly agree)"

24. I often remain quiet rather than risk hurting another person.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
25. I don’t enjoy challenging others even when I think they are wrong.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"
26. In general, I will go along with the group rather than create conflict.
    “1 (strongly disagree)", "2", "3", "5 (strongly agree)"

Figure B.1 – Screenshot of the decomposed Prisoner's Dilemma with CCI_H visualised by participants on the PC screen.



Appendix C - Descriptive statistics and average cooperation rates

Table C.1 – Descriptive statistics of the variables constructed from the questionnaire.

Variable	Mean	Std. Dev.	Min	Max
Other experiment	0.4792	0.4999	0	1
Game theory	0.9625	0.8033	0	2
Risk lover	5.5583	2.2049	0	10
Trust	4.6458	2.7639	0	10
Negative reciprocity	4.3165	2.2112	0	9.687
Enjoyment competition	29.200	5.9034	15	42
Contentiousness	15.7792	3.9878	6	25

Table C.2 – Average cooperation rates in the first round, in the first five rounds and in all rounds of the *Baseline treatment* and of the *Decomposition treatment,* in both conditions ($CCI_H \rightarrow CCI_L$ condition and $CCI_L \rightarrow CCI_H$ condition*)*. Standard deviations are in parenthesis.

Treatment	**Condition**	**Group**	**Choice X, round 1**			**Choice X, first 5 rounds**			**Choice X, all rounds***		
			Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
Baseline	$\boldsymbol{CCI_H - CCI_L}$	1	0.40 (0.52)	0.70 (0.48)	0.40 (0.52)	0.36 (0.48)	0.64 (0.48)	0.14 (0.35)	0.16 (0.37)	0.27 (0.44)	0.05 (0.22)
		2	0.50 (0.53)	0.70 (0.48)	0.00 (0.00)	0.22 (0.42)	0.60 (0.49)	0.06 (0.24)	0.08 (0.27)	0.34 (0.47)	0.04 (0.19)
		3	0.80 (0.42)	0.50 (0.53)	0.10 (0.32)	0.48 (0.50)	0.54 (0.50)	0.14 (0.35)	0.30 (0.46)	0.34 (0.47)	0.09 (0.29)
		4	0.50 (0.53)	0.70 (0.48)	0.20 (0.42)	0.16 (0.37)	0.64 (0.48)	0.04 (0.20)	0.05 (0.23)	0.26 (0.44)	0.02 (0.12)
		5	0.50 (0.53)	0.60 (0.52)	0.20 (0.42)	0.2 (0.40)	0.58 (0.50)	0.06 (0.24)	0.06 (0.24)	0.26 (0.44)	0.04 (0.20)
		6	0.20 (0.42)	0.80 (0.42)	0.30 (0.48)	0.18 (0.39)	0.82 (0.39)	0.16 (0.37)	0.23 (0.42)	0.76 (0.42)	0.14 (0.35)
		Avg.	**0.48 (0.50)**	**0.67 (0.48)**	**0.20 (0.40)**	**0.27 (0.44)**	**0.64 (0.48)**	**0.1 (0.30)**	**0.15 (0.35)**	**0.36 (0.48)**	**0.06 (0.24)**
Baseline	$\boldsymbol{CCI_L - CCI_H}$	7	0.70 (0.48)	0.10 (0.32)	0.80 (0.42)	0.54 (0.50)	0.06 (0.24)	0.7 (0.46)	0.30 (0.46)	0.06 (0.23)	0.73 (0.45)
		8	0.40 (0.52)	0.40 (0.52)	0.30 (0.48)	0.24 (0.43)	0.20 (0.40)	0.20 (0.40)	0.13 (0.33)	0.14 (0.35)	0.11 (0.32)
		9	0.60 (0.52)	0.20 (0.42)	0.20 (0.42)	0.58 (0.50)	0.18 (0.39)	0.22 (0.42)	0.32 (0.47)	0.12 (0.32)	0.28 (0.45)
		10	0.60 (0.52)	0.40 (0.52)	0.30 (0.48)	0.56 (0.50)	0.14 (0.35)	0.16 (0.37)	0.21 (0.40)	0.10 (0.30)	0.07 (0.25)
		11	0.70 (0.48)	0.00 (0.00)	0.50 (0.53)	0.54 (0.50)	0.14 (0.35)	0.54 (0.50)	0.32 (0.47)	0.08 (0.27)	0.54 (0.50)
		12	0.70 (0.48)	0.30 (0.48)	0.10 (0.32)	0.46 (0.50)	0.10 (0.30)	0.20 (0.40)	0.31 (0.46)	0.05 (0.21)	0.17 (0.38)
		Avg.	**0.62 (0.49)**	**0.23 (0.43)**	**0.37 (0.49)**	**0.49 (0.50)**	**0.14 (0.34)**	**0.34 (0.47)**	**0.26 (0.44)**	**0.09 (0.28)**	**0.31 (0.46)**

Table C.2 – continued

Treatment	Condition	Group	Choice X, round 1			Choice X, first 5 rounds			Choice X, all rounds*		
			Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3
Decomposition	$\boldsymbol{CCI_H - CCI_L}$	1	0.60 (0.52)	0.60 (0.52)	0.50 (0.53)	0.42 (050)	0.50 (0.51)	0.38 (0.49)	0.31 (0.46)	0.41 (0.49)	0.28 (0.45)
		2	0.60 (0.52)	0.70 (0.48)	0.20 (0.42)	0.42 (0.50)	0.54 (0.50)	0.08 (0.27)	0.14 (0.35)	0.42 (0.49)	0.16 (0.36)
		3	0.70 (0.48)	0.80 (0.42)	0.10 (0.32)	0.34 (0.48)	0.50 (0.51)	0.12 (0.33)	0.29 (0.46)	0.35 (0.48)	0.16 (0.36)
		4	0.70 (0.48)	0.70 (0.48)	0.30 (0.48)	0.30 (0.46)	0.72 (0.45)	0.10 (0.30)	0.07 (0.26)	0.42 (0.49)	0.08 (0.28)
		5	0.50 (0.53)	0.50 (0.53)	0.10 (0.32)	0.34 (0.48)	0.32 (0.47)	0.02 (0.14)	0.06 (0.24)	0.09 (0.29)	0.00 (0.06)
		6	0.60 (0.52)	0.70 (0.48)	0.30 (0.48)	0.32 (0.47)	0.62 (0.49)	0.28 (0.45)	0.08 (0.28)	0.44 (0.50)	0.10 (0.30)
		Avg.	**0.48 (0.50)**	**0.67 (0.48)**	**0.20 (0.40)**	**0.27 (0.44)**	**0.64 (0.48)**	**0.1 (0.30)**	**0.15 (0.35)**	**0.36 (0.48)**	**0.06 (0.24)**
Decomposition	$\boldsymbol{CCI_L - CCI_H}$	7	0.40 (0.52)	0.10 (0.32)	0.10 (0.32)	0.20 (0.40)	0.02 (0.14)	0.06 (0.24)	0.05 (0.22)	0.00 (0.06)	0.03 (0.18)
		8	0.60 (0.52)	0.50 (0.53)	0.50 (0.53)	0.70 (0.46)	0.26 (0.44)	0.46 (0.50)	0.41 (0.49)	0.15 (0.35)	0.49 (0.50)
		9	0.40 (0.52)	0.20 (0.42)	0.20 (0.42)	0.42 (0.50)	0.10 (0.30)	0.16 (0.37)	0.16 (0.37)	0.04 (0.19)	0.10 (0.30)
		10	0.80 (0.42)	0.30 (0.48)	0.40 (0.52)	0.44 (0.50)	0.12 (0.33)	0.14 (0.35)	0.18 (0.38)	0.06 (0.24)	0.04 (0.19)
		11	0.50 (0.53)	0.00 (0.00)	0.30 (0.48)	0.44 (0.50)	0.10 (0.30)	0.40 (0.50)	0.20 (0.40)	0.04 (0.19)	0.20 (0.40)
		12	0.80 (0.42)	0.30 (0.48)	0.40 (0.52)	0.60 (0.50)	0.16 (0.37)	0.24 (0.43)	0.27 (0.45)	0.05 (0.23)	0.07 (0.25)
		Avg.	**0.58 (0.50)**	**0.23 (0.43)**	**0.32 (0.47)**	**0.47 (0.50)**	**0.13 (0.33)**	**0.24 (0.43)**	**0.21 (0.41)**	**0.06 (0.23)**	**0.16 (0.36)**

*The average cooperation rate across all rounds of a stage within a treatment is weighted by the number of rounds played by groups within a stage (recall that the number of rounds of a stage varies across experimental sessions).

Table C.3 – Average cooperation rates in the *Baseline treatment* by gender in the first round, in the first five rounds and in all rounds of the $CCI_H \rightarrow CCI_L$ *condition* and in the $CCI_L \rightarrow CCI_H$ *condition*. Standard deviations are in parenthesis.

Condition	Number of rounds	Group	MALE*			FEMALE*			Freq. of female in the group
			Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
$CCI_H - CCI_L$	1st round	1	0.75 (0.50)	0.50 (0.58)	0.50 (0.58)	0.17 (0.41)	0.83 (0.41)	0.33 (0.52)	0.6
		2	0.38 (0.52)	0.75 (0.46)	0.00 (0.00)	1.00 (0.00)	0.50 (0.71)	0.00 (0.00)	0.2
		3	0.67 (0.58)	0.67 (0.58)	0.00 (0.00)	0.86 (0.38)	0.43 (0.53)	0.14 (0.38)	0.7
		4	0.40 (0.55)	0.80 (0.45)	0.20 (0.45)	0.60 (0.55)	0.60 (0.55)	0.20 (0.45)	0.5
		5	0.60 (0.55)	0.60 (0.55)	0.00 (0.00)	0.40 (0.55)	0.60 (0.55)	0.40 (0.55)	0.5
		6	0.17 (0.41)	0.83 (0.41)	0.17 (0.41)	0.25 (0.50)	0.75 (0.50)	0.50 (0.58)	0.4
		Avg.	**0.45 (0.51)**	**0.71 (0.46)**	**0.13 (0.34)**	**0.52 (0.51)**	**0.62 (0.49)**	**0.28 (0.45)**	**0.48**
$CCI_L - CCI_H$	1st round	7	1.00 (0.00)	0.00 (0.00)	1.00 (0.00)	0.63 (0.52)	0.13 (0.35)	0.75 (0.46)	0.8
		8	0.40 (0.55)	0.00 (0.00)	0.20 (0.45)	0.40 (0.55)	0.80 (0.45)	0.40 (0.55)	0.5
		9	0.71 (0.49)	0.29 (0.49)	0.14 (0.38)	0.33 (0.58)	0.00 (0.00)	0.33 (0.58)	0.3
		10	0.33 (0.58)	0.33 (0.58)	0.33 (0.58)	0.71 (0.49)	0.43 (0.53)	0.29 (0.49)	0.7
		11	0.80 (0.45)	0.00 (0.00)	0.40 (0.55)	0.60 (0.55)	0.00 (0.00)	0.60 (0.55)	0.7
		12	0.71 (0.49)	0.14 (0.38)	0.00 (0.00)	0.67 (0.58)	0.67 (0.58)	0.33 (0.58)	0.5
		Avg.	**0.66 (0.48)**	**0.14 (0.35)**	**0.24 (0.44)**	**0.58 (0.50)**	**0.32 (0.48)**	**0.48 (0.51)**	**0.52**
$CCI_H - CCI_L$	5 rounds	1	0.50 (0.51)	0.55 (0.51)	0.10 (0.31)	0.27 (0.45)	0.70 (0.47)	0.17 (0.38)	0.6
		2	0.18 (0.38)	0.63 (0.49)	0.03 (0.16)	0.40 (0.52)	0.50 (0.53)	0.2 (0.42)	0.2
		3	0.47 (0.52)	0.53 (0.52)	0.00 (0.00)	0.49 (0.51)	0.54 (0.51)	0.20 (0.41)	0.7
		4	0.12 (0.33)	0.68 (0.48	0.04 (0.20)	0.20 (0.41)	0.60 (0.50)	0.04 (0.20)	0.5
		5	0.24 (0.44)	0.56 (0.51)	0.04 (0.20)	0.16 (0.37)	0.60 (0.50)	0.08 (0.28)	0.5
		6	0.13 (0.35)	0.77 (0.43)	0.10 (0.31)	0.25 (0.44)	0.90 (0.31)	0.25 (0.44)	0.4
		Avg.	**0.24 (0.43)**	**0.63 (0.48)**	**0.05 (0.22)**	**0.30 (0.46)**	**0.64 (0.48)**	**0.15 (0.36)**	**0.48**
$CCI_L - CCI_H$	5 rounds	7	0.50 (0.53)	0.00 (0.00)	0.60 (0.52)	0.55 (0.50)	0.08 (0.27)	0.73 (0.45)	0.8
		8	0.20 (0.41)	0.00 (0.00)	0.20 (0.41)	0.28 (0.46)	0.40 (0.50)	0.20 (0.41)	0.5
		9	0.71 (0.46)	0.23 (0.43)	0.26 (0.44)	0.27 (0.46)	0.07 (0.26)	0.13 (0.35)	0.3
		10	0.53 (0.52)	0.20 (0.41)	0.13 (0.35)	0.57 (0.50)	0.11 (0.32)	0.17 (0.38)	0.7
		11	0.52 (0.51)	0.16 (0.37)	0.52 (0.51)	0.56 (0.51)	0.12 (0.33)	0.56 (0.51)	0.7
		12	0.49 (0.51)	0.06 (0.24)	0.14 (0.36)	040 (0.51)	0.20 (0.41)	0.33 (0.49)	0.5
		Avg.	**0.50 (0.50)**	**0.12 (0.32)**	**0.28 (0.45)**	**0.47 (0.50)**	**0.15 (0.36)**	**0.39 (0.49)**	**0.52**

Table C.3 – continued

Condition	Number of rounds	Group	MALE*			FEMALE*			Freq. of female in the group
			Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
$CCI_H - CCI_L$	all rounds	1	0.18 (0.39)	0.21 (0.41)	0.04 (0.20)	0.14 (0.35)	0.31 (0.46)	0.06 (0.24)	0.6
		2	0.08 (0.27)	0.33 (0.47)	0.03 (0.18)	0.08 (0.27)	0.39 (0.49)	0.05 (0.23)	0.2
		3	0.35 (0.48)	0.49 (0.50)	0.11 (0.31)	0.28 (0.45)	0.27 (0.44)	0.08 (0.28)	0.7
		4	0.03 (0.18)	0.26 (0.44)	0.02 (0.12)	0.07 (0.26)	0.26 (0.44)	0.02 (0.12)	0.5
		5	0.06 (0.24)	0.25 (0.43)	0.04 (0.19)	0.07 (0.25)	0.27 (0.45)	0.05 (0.21)	0.5
		6	0.14 (0.35)	0.69 (0.46)	0.08 (0.28)	0.36 (0.48)	0.87 (0.34)	0.22 (0.42)	0.4
		Avg.	**0.12 (0.32)**	**0.37 (0.48)**	**0.05 (0.21)**	**0.17 (0.38)**	**0.36 (0.48)**	**0.08 (0.27)**	**0.48**
$CCI_L - CCI_H$	all rounds	7	0.30 (0.46)	0.05 (0.22)	0.89 (0.31)	0.30 (0.46)	0.06 (0.24)	0.68 (0.47)	0.8
		8	0.06 (0.24)	0.05 (0.21)	0.11 (0.32)	0.19 (0.40)	0.23 (0.42)	0.11 (0.32)	0.5
		9	0.41 (0.49)	0.16 (0.36)	0.35 (0.48)	0.09 (0.29)	0.03 (0.18)	0.10 (0.30)	0.3
		10	0.25 (0.44)	0.17 (0.38)	0.04 (0.19)	0.19 (0.39)	0.06 (0.23)	0.08 (0.27)	0.7
		11	0.27 (0.45)	0.05 (0.22)	0.51 (0.50)	0.36 (0.48)	0.10 (0.31)	0.57 (0.50)	0.7
		12	0.38 (0.49)	0.04 (0.19)	0.20 (0.40)	0.16 (0.37)	0.07 (0.26)	0.11 (0.32)	0.5
		Avg.	**0.30 (0.46)**	**0.08 (0.28)**	**0.30 (0.46)**	**0.23 (0.42)**	**0.09 (0.29)**	**0.32 (0.47)**	**0.52**

* The average cooperation rate is weighted by the number of males (and females) within a group Moreover, the average cooperation rate across all rounds of a stage within a treatment is further weighted by the number of rounds played by groups within a stage (recall that the number of rounds of a stage varies across experimental sessions).

Table C.4 – Average cooperation rates in the *Decomposition treatment* by gender in the first round, in the first five rounds and in all rounds of the $CCI_H \rightarrow CCI_L$ *condition* and in the $CCI_L \rightarrow CCI_H$ *condition*. Standard deviations are in parenthesis.

Condition	Number of rounds	Group	MALE*			FEMALE*			Freq. of female in the group
			Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
$CCI_H - CCI_L$	1st round	1	0.60 (0.55)	0.60 (0.55)	0.40 (0.55)	0.60 (0.55)	0.60 (0.55)	0.60 (0.55)	0.5
		2	0.50 (0.55)	0.67 (0.52)	0.33 (0.52)	0.75 (0.50)	0.75 (0.50)	0.00 (0.00)	0.4
		3	0.75 (0.50)	0.50 (0.58)	0.00 (0.00)	0.67 (0.52)	1.00 (0.00)	0.17 (0.41)	0.6
		4	0.60 (0.55)	1.00 (0.00)	0.20 (0.45)	0.80 (0.45)	0.40 (0.55)	0.40 (0.55)	0.5
		5	0.20 (0.45)	0.60 (0.55)	0.00 (0.00)	0.80 (0.45)	0.40 (0.55)	0.20 (0.45)	0.5
		6	0.60 (0.55)	0.60 (0.55)	0.00 (0.00)	0.60 (0.55)	0.80 (0.45)	0.60 (0.55)	0.5
		Avg.	**0.53 (0.51)**	**0.67 (0.48)**	**0.17 (0.38)**	**0.70 (0.47)**	**0.67 (0.48)**	**0.33 (0.48)**	**0.5**
$CCI_L - CCI_H$	1st round	7	0.50 (0.55)	0.00 (0.00)	0.17 (0.41)	0.25 (0.50)	0.25 (0.50)	0.00 (0.00)	0.4
		8	0.75 (0.50)	0.25 (0.50)	0.00 (0.00)	0.50 (0.55)	0.67 (0.52)	0.83 (0.41)	0.6
		9	0.20 (0.45)	0.00 (0.00)	0.20 (0.45)	0.60 (0.55)	0.40 (0.55)	0.20 (0.45)	0.5
		10	0.80 (0.45)	0.00 (0.00)	0.60 (0.55)	0.80 (0.45)	0.60 (0.55)	0.20 (0.45)	0.5
		11	0.50 (0.55)	0.00 (0.00)	0.33 (0.52)	0.50 (0.58)	0.00 (0.00)	0.25 (0.50)	0.4
		12	0.75 (0.50)	0.00 (0.00)	0.00 (0.00)	0.83 (0.41)	0.50 (0.55)	0.67 (0.52)	0.6
		Avg.	**0.57 (0.50)**	**0.03 (0.18)**	**0.23 (0.43)**	**0.60 (0.50)**	**0.43 (0.50)**	**0.40 (0.50)**	**0.5**
$CCI_H - CCI_L$	5 rounds	1	0.44 (0.51)	0.60 (0.50)	0.40 (0.50)	0.40 (0.50)	0.40 (0.50)	0.36 (0.49)	0.5
		2	0.33 (0.48)	0.50 (0.51)	0.10 (0.31)	0.55 (0.51)	0.60 (0.50)	0.05 (0.22)	0.4
		3	0.25 (0.44)	0.45 (0.51)	0.00 (0.00)	0.40 (0.50)	0.53 (0.51)	0.20 (0.41)	0.6
		4	0.32 (0.48)	0.96 (0.20)	0.08 (0.28)	0.28 (0.46)	0.48 (0.51)	0.12 (0.33)	0.5
		5	0.28 (0.46)	0.44 (0.51)	0.00 (0.00)	0.40 (0.50)	0.2 (0.41)	0.04 (0.2)	0.5
		6	0.16 (0.37)	0.44 (0.51)	0.24 (0.44)	0.48 (0.51)	0.80 (0.41)	0.32 (0.48)	0.5
		Avg.	**0.30 (0.46)**	**0.57 (0.50)**	**0.14 (0.35)**	**0.41 (0.49)**	**0.50 (0.50)**	**0.19 (0.39)**	**0.5**
$CCI_L - CCI_H$	5 rounds	7	0.30 (0.47)	0.00 (0.00)	0.10 (0.31)	0.05 (0.22)	0.05 (0.22)	0.00 (0.00)	0.4
		8	0.65 (0.49)	0.15 (0.37)	0.00 (0.00)	0.73 (0.45)	0.33 (0.48)	0.77 (0.43)	0.6
		9	0.32 (0.48)	0.12 (0.33)	0.28 (0.46)	0.52 (0.51)	0.08 (0.28)	0.04 (0.20)	0.5
		10	0.40 (0.50)	0.00 (0.00)	0.20 (0.41)	0.48 (0.51)	0.24 (0.44)	0.08 (0.28)	0.5
		11	0.53 (0.51)	0.10 (0.31)	0.57 (0.50)	0.30 (0.47)	0.10 (0.31)	0.15 (0.37)	0.4
		12	0.65 (0.49)	0.00 (0.00)	0.05 (0.22)	0.57 (0.50)	0.27 (0.45)	0.37 (0.49)	0.6
		Avg.	**0.46 (0.50)**	**0.06 (0.24)**	**0.22 (0.42)**	**0.47 (0.50)**	**0.19 (0.40)**	**0.27 (0.44)**	**0.5**

Table C.4 – continued

Condition	Number of rounds	Group	MALE*			FEMALE*			Freq. of female in the group
			Stage 1	Stage 2	Stage 3	Stage 1	Stage 2	Stage 3	
$CCI_H - CCI_L$	all rounds	1	0.32 (0.47)	0.53 (0.50)	0.37 (0.48)	0.30 (0.46)	0.30 (0.46)	0.19 (0.40)	0.5
		2	0.12 (0.32)	0.37 (0.48)	0.12 (0.32)	0.18 (0.38)	0.49 (0.50)	0.22 (0.41)	0.4
		3	0.15 (0.36)	0.21 (0.41)	0.00 (0.00)	0.39 (0.49)	0.45 (0.50)	0.26 (0.44)	0.6
		4	0.10 (0.30)	0.68 (0.47)	0.11 (0.32)	0.04 (0.20)	0.17 (0.37)	0.05 (0.23)	0.5
		5	0.03 (0.17)	0.11 (0.32)	0.00 (0.00)	0.09 (0.29)	0.07 (0.26)	0.01 (0.08)	0.5
		6	0.04 (0.20)	0.34 (0.47)	0.08 (0.27)	0.13 (0.34)	0.54 (0.50)	0.13 (0.33)	0.5
		Avg.	**0.10 (0.30)**	**0.38 (0.49)**	**0.11 (0.31)**	**0.15 (0.36)**	**0.32 (0.47)**	**0.13 (0.34)**	**0.5**
$CCI_L - CCI_H$	all rounds	7	0.08 (0.27)	0.00 (0.00)	0.04 (0.20)	0.02 (0.12)	0.01 (0.10)	0.02 (0.13)	0.4
		8	0.25 (0.43)	0.06 (0.23)	0.05 (0.23)	0.51 (0.50)	0.21 (0.41)	0.77 (0.42)	0.6
		9	0.12 (0.32)	0.04 (0.19)	0.13 (0.34)	0.21 (0.41)	0.04 (0.19)	0.07 (0.26)	0.5
		10	0.19 (0.40)	0.06 (0.23)	0.06 (0.23)	0.16 (0.37)	0.06 (0.25)	0.02 (0.13)	0.5
		11	0.28 (0.45)	0.05 (0.23)	0.31 (0.47)	0.07 (0.26)	0.02 (0.13)	0.03 (0.17)	0.4
		12	0.21 (0.41)	0.00 (0.00)	0.01 (0.10)	0.32 (0.47)	0.09 (0.29)	0.11 (0.31)	0.6
		Avg.	**0.18 (0.39)**	**0.04 (0.18)**	**0.11 (0.31)**	**0.24 (0.43)**	**0.08 (0.27)**	**0.21 (0.40)**	**0.5**

* The average cooperation rate is weighted by the number of males (and females) within a group Moreover, the average cooperation rate across all rounds of a stage within a treatment is further weighted by the number of rounds played by groups within a stage (recall that the number of rounds of a stage varies across experimental sessions).

Appendix D – Supplementary regressions

Table D.1 - Wild cluster bootstrap inference.

Cooperation	(*1st round*)	(*five rounds*)	(*all rounds*)
Decomposition	0.142*	0.096*	0.008
		[-0.008, 0.293]	[-0.006, 0.197]
CCI_L	0.146*	0.228***	0.145***
	[-0.006, 0.299]	[0.094, 0.363]	[0.058, 0.232]
CCI_L *X Decomposition*	-0.159	-0.110	-0.071
	[-0.402, 0.084]	[-0.306, 0.087]	[-0.206, 0.064]
Other experiment	-0.038	-0.037	-0.020
	[-0.188, 0.112]	[-0.146, 0.072]	[-0.077, 0.038]
Game theory	0.002	-0.007	-0.024
	[-0.097, 0.101]	[-0.068, 0.053]	[-0.060, 0.011]
Risk lover	0.038**	0.011	0.017***
	[0.005, 0.072]	[-0.005, 0.028]	[0.005, 0.029]
Trust	0.004	0.011	0.010**
	[-0.026, 0.034]	[-0.005, 0.027]	[0.001, 0.019]
Negative reciprocity	-0.020	-0.001	0.002
	[-0.053, 0.013]	[-0.017, 0.015]	[-0.009, 0.013]
Enjoyment competition	-0.009	-0.007	-0.004*
	[-0.027, 0.009]	[-0.018, 0.004]	[-0.009, 0.001]
Contentiousness	0.002	0.004	-0.001
	[-0.019, 0.023]	[-0.010, 0.017]	[-0.008, 0.005]
Constant	0.562*	0.509***	0.544***
	[-0.066, 1.190]	[0.176, 0.842]	[0.390, 0.698]
Round FE		✓	✓
R-squared	0.011	0.084	0.114
N	240	1200	7530

Notes: Wild cluster bootstrap linear regression with confidence intervals at 95% in brackets. The sample is restricted to observations from Stage 1.

Table D.2. - The effect of the choice architecture intervention on cooperative behaviour of males and females.

Condition	CCI_H	CCI_H	CCI_H	CCI_L	CCI_L	CCI_L
Cooperation	(*1st round*)	(*five rounds*)	(*all rounds*)	(*1st round*)	(*five rounds*)	(*all rounds*)
Decomposition	0.027	0.026	-0.014	-0.100	-0.038	-0.130**
	(0.1298)	(0.0616)	(0.0391)	(0.1166)	(0.0954)	(0.0514)
Female	-0.006	0.019	0.029	-0.077	-0.022	-0.062
	(0.1394)	(0.0529)	(0.0367)	(0.1090)	(0.0661)	(0.0585)
Female × Decomposition	0.155	0.082	0.021	0.144	0.008	0.112
	(0.1914)	(0.0805)	(0.0593)	(0.1108)	(0.0886)	(0.0701)
Other experiment	-0.161*	-0.118***	-0.045	0.057	0.042	0.012
	(0.0878)	(0.0378)	(0.0287)	(0.1291)	(0.0944)	(0.0476)
Game theory	0.012	0.010	-0.005	-0.011	-0.017	-0.038
	(0.0713)	(0.0339)	(0.0193)	(0.0643)	(0.0443)	(0.0269)
Risk lover	0.027	0.011	0.016**	0.058***	0.013	0.021*
	(0.0261)	(0.0107)	(0.0069)	(0.0188)	(0.0133)	(0.0108)
Trust	0.011	0.003	0.002	-0.007	0.021	0.016**
	(0.0192)	(0.0094)	(0.0056)	(0.0277)	(0.0136)	(0.0061)
Negative reciprocity	-0.002	0.003	0.003	-0.035	-0.001	0.003
	(0.0205)	(0.0106)	(0.0089)	(0.0253)	(0.0141)	(0.0074)
Enjoyment competition	-0.008	-0.006	-0.004	-0.007	-0.007	-0.004
	(0.0141)	(0.0065)	(0.0022)	(0.0095)	(0.0079)	(0.0037)
Contentiousness	-0.006	-0.001	-0.003	0.009	0.008	-0.000
	(0.0152)	(0.0066)	(0.0025)	(0.0128)	(0.0111)	(0.0059)
Constant	0.692	0.430*	0.192*	0.582	0.418*	0.259*
	(0.4291)	(0.1975)	(0.0898)	(0.3999)	(0.2247)	(0.1187)
Round FE		✓	✓		✓	✓
R-squared	0.088	0.103	0.104	0.076	0.023	0.107
N	120	600	3630	120	600	3900

*Notes: * p<0.10; ** p<0.05; *** p<0.01. LPM with robust s.e. clustered at the matching group level in parenthesis. The sample is restricted to observations from Stage 1.*

In Table D.2, we present the results of a Linear Probability model in which we estimate six specifications to analyse whether the choice architecture intervention has a different effect on the cooperative behaviour of men and women. Specifications 1, 2 and 3 consider the $CCI_H \rightarrow CCI_L$ *condition*, when focusing on, respectively, the first round of the first stage, the first five rounds of the first stage, and all rounds of the first stage. Specifications 4, 5 and 6 report the estimation results when subjects interact in, respectively, the first round of the first stage, the first five rounds of the first stage, and all rounds of the first stage in the $CCI_L \rightarrow CCI_H$ *condition*. The outcome variable is *Cooperation* that takes value 1 when participants choose to cooperate. While our main independent variables of interest in Table D.1 – i.e., *Decomposition*, *Female* and their interaction (*Decomposition* × *Female*) – are different from those in Table 5, the control variables are the same.

As anticipated, we find no difference in cooperative behaviour between men and women, both in $CCI_H \rightarrow CCI_L$ *condition* and in the $CCI_L \rightarrow CCI_H$ *condition*. In all rounds of the first stage under the $CCI_L \rightarrow CCI_H$ *condition,* we observe limited evidence suggesting that men exhibit higher cooperation levels in the *Baseline treatment* compared to the *Decomposition treatment*. Since this result emerges

only in one specification (specification 6) out of six, we believe that this finding should be taken carefully and would need further investigation.

Table D.3 - Wild cluster bootstrap inference.

	$CCI_L \rightarrow CCI_H$		$CCI_H \rightarrow CCI_L$	
Cooperation	(1)	(2)	(3)	(4)
Decomposition	-0.031	-0.005	-0.030	-0.025
	[-0.156,0.094]	[-0.110,0.100]	[-0.299,0.240]	[-0.299,0.250]
Female	0.167**	0.157*	0.054	0.039
	[0.005,0.330]	[-0.016,0.331]	[-0.158,0.266]	[-0.182,0.260]
Female× Decomposition	0.110	0.061	0.003	-0.010
	[-0.112,0.331]	[-0.140,0.263]	[-0.333,0.339]	[-0.368,0.348]
Cooperation 1st round	0.059	0.049	0.161**	0.170**
	[-0.054,0.172]	[-0.066,0.165]	[0.033,0.288]	[0.037,0.302]
Others past cooperation	0.041	0.024	0.530	0.485
	[-0.281,0.362]	[-0.268,0.316]	[-0.291,1.351]	[-0.407,1.377]
Other experiment		0.006		-0.045
		[-0.116,0.129]		[-0.260,0.170]
Game theory		0.005		-0.029
		[-0.073,0.083]		[-0.143,0.084]
Risk lover		-0.002		-0.012
		[-0.033,0.028]		[-0.054,0.029]
Trust		0.027***		-0.006
		[0.007,0.046]		[-0.030,0.017]
Negative reciprocity		-0.004		0.019
		[-0.033,0.024]		[-0.006,0.044]
Enjoyment competition		-0.005		-0.007
		[-0.017,0.007]		[-0.022,0.009]
Contentiousness		0.001		0.002
		[-0.017,0.019]		[-0.013,0.017]
Constant	0.088	0.130	0.339**	0.573**
	[-0.043,0.219]	[-0.315,0.575]	[0.077,0.600]	[0.036,1.110]
R-squared	0.063	0.074	0.022	0.015
N	240	240	240	240

Notes: Wild cluster bootstrap linear regression with confidence intervals at 95% in brackets.

Table D.4 - Probit Replication of Table 5.

Cooperation	(1) First round	(2) First round	(3) Five rounds	(4) Five rounds	(5) All rounds	(6) All rounds
Decomposition	0.164	0.367*	0.115	0.277*	-0.116	-0.081
	(0.143)	(0.188)	(0.119)	(0.146)	(0.125)	(0.205)
CCIL	0.183	0.377**	0.471***	0.623***	0.413***	0.442***
	(0.147)	(0.190)	(0.120)	(0.181)	(0.129)	(0.162)
CCIL × *Decomposition*		-0.404		-0.308		-0.061
		(0.305)		(0.252)		(0.255)
Other experiment	-0.153	-0.102	-0.144	-0.108	-0.146	-0.141
	(0.173)	(0.186)	(0.135)	(0.140)	(0.114)	(0.110)
Game theory	0.013	0.008	-0.013	-0.016	-0.101	-0.102
	(0.120)	(0.123)	(0.080)	(0.079)	(0.067)	(0.065)
Risk lover	0.101**	0.099**	0.032	0.031	0.072***	0.072***
	(0.042)	(0.042)	(0.021)	(0.022)	(0.021)	(0.021)
Trust	0.006	0.010	0.026	0.030	0.035**	0.036**
	(0.036)	(0.037)	(0.020)	(0.021)	(0.017)	(0.017)
Negative reciprocity	-0.050	-0.052	-0.002	-0.003	0.003	0.002
	(0.042)	(0.042)	(0.021)	(0.021)	(0.021)	(0.021)
Enjoyment competition	-0.023	-0.023	-0.019	-0.019	-0.016*	-0.016*
	(0.023)	(0.023)	(0.014)	(0.014)	(0.009)	(0.009)
Contentiousness	0.002	0.005	0.008	0.009	-0.005	-0.005
	(0.026)	(0.026)	(0.017)	(0.017)	(0.012)	(0.012)
A. Average marginal effects (No interaction)						
AME Decomposition	0.062		0.042		-0.030	
AME CCIL	0.069		0.174***		0.106***	
B. Conditional average marginal effects (Interaction)						
AME Decomp. | CCIH		0.140*		0.096**		-0.017
AME Decomp. | CCIL		-0.013		-0.012		-0.043
AME CCIL | Baseline		0.144**		0.228***		0.119***
AME CCIL | Decomp.		-0.010		0.120*		0.093*
Pseudo R²	0.034	0.038	0.035	0.038	0.047	0.047
N	240	240	1200	1200	7530	7530

*Notes: Columns (1), (3), and (5) report probit models without the interaction term. Columns (2), (4), and (6) report probit models including the interaction between Decomposition and CCIL. Robust standard errors clustered at the matching-group level in parentheses. AME = average marginal effects. * p<0.10; ** p<0.05; *** p<0.01. The sample is restricted to observations from Stage 1.*

Table D.4 reports the probit estimates corresponding to the specifications presented in Table 5. Columns (1), (3), and (5) report specifications without the interaction between CCI_L and the Decomposition treatment, considering respectively the first round, the first five rounds, and all rounds of the first stage. Columns (2), (4), and (6) report the corresponding specifications including the interaction term. Panel A reports probit coefficients, while Panels A and B report average marginal effects.

Without interaction, the average marginal effects of CCI_L is positive and significant in columns 3 and 5, confirming the Linear Probability Models (LPM) result. The probit estimates confirm that stronger cooperative incentives are associated with higher cooperation. This pattern emerges clearly in the *Baseline treatment* and is also present, although less precisely estimated, in the *Decomposition treatment* (see the average marginal effects of columns 2, 4 and 6). These findings are qualitatively consistent with the LPM results reported in Table 5.

Similarly, the probit estimates suggest that the positive association between the Decomposition treatment and cooperation is concentrated in the CCI_H environment. By contrast, no significant effect of the *Decomposition treatment* emerges in the CCI_Lenvironment. This pattern is consistent with LPM results, namely that any positive effect of the choice architecture intervention appears to be limited to the more competitive setting rather than representing a general increase in cooperation across environments.

Table D.5 - Probit Replication of Table 6.

Cooperation	$CCI_L \rightarrow CCI_H$		$CCI_H \rightarrow CCI_L$	
Decomposition	-0.172	-0.063	-0.077	-0.065
	(0.319)	(0.276)	(0.332)	(0.338)
Female	0.587**	0.598**	0.137	0.098
	(0.270)	(0.273)	(0.262)	(0.273)
Female ×	0.384	0.192	0.011	-0.018
Decomposition	(0.396)	(0.346)	(0.418)	(0.449)
Cooperation 1st	0.208	0.188	0.411**	0.438**
round	(0.203)	(0.210)	(0.159)	(0.167)
Others past	0.207	0.053	1.388	1.290
cooperation	(0.530)	(0.507)	(1.056)	(1.139)
Controls		Yes		Yes
AME Female	0.166**	0.162**	0.053	0.037
(Baseline)	(0.079)	(0.082)	(0.101)	(0.103)
AME Female	0.277***	0.218**	0.057	0.030
(Decomposition)	(0.074)	(0.085)	(0.125)	(0.130)
Pseudo R²	0.079	0.118	0.031	0.048
N	240	240	240	240

*Note: Robust standard errors clustered at the matching group level in parentheses. Controls include: previous experiment participation, game theory knowledge, risk attitude, trust, negative reciprocity, enjoyment of competition, contentiousness, cooperation in the first round of Stage 1, and average cooperation of opponents in the previous stage. *p<0.10; ** p<0.05; *** p<0.01.*

Table D.5 reports the probit estimates for all four specifications of Table 6. For each specification we report i) the probit coefficients for the key variables and ii) the average marginal effect (AME) of Female in the *Baseline treatment*, and the AME of Female in the *Decomposition treatment*.

The probit results are consistent with those of the LPM reported in Table 6 in the main text. In the $\mathrm{CCI_L} \rightarrow \mathrm{CCI_H}$ condition, the AME of Female is positive and statistically significant both in the *Baseline* and in the *Decomposition treatment*, indicating that women cooperate significantly more than men after transitioning from a cooperative to a competitive environment, regardless of how payoffs are presented. In the $\mathrm{CCI_H} \rightarrow \mathrm{CCI_L}$ condition, no significant gender difference is found in any specification, consistent with the LPM results.

Table D.6 - $CCI_L \rightarrow CCI_H$ - Switch stage 1→2 and 2→3.

Cooperation	Switch 1→2 Round 1	Switch 1→2 First 5 rounds	Switch 2→3 Round 1	Switch 2→3 First 5 rounds
Decomposition	-0.117	-0.054	0.046	0.089*
	(0.073)	(0.041)	(0.076)	(0.047)
Female	0.161	0.029	0.100	0.081*
	(0.141)	(0.077)	(0.101)	(0.043)
Decomposition	0.190	0.093	-0.040	-0.047
× Female	(0.138)	(0.080)	(0.124)	(0.041)
Controls	Yes	Yes	Yes	Yes
R^2	0.1837	0.0559	0.1401	0.0782
N	120	600	120	600
Clusters	12	12	12	12

*Notes: Columns (1) and (2) report the switch from stage 1 to stage 2; columns (3) and (4) report the switch from stage 2 to stage 3. Round 1 specifications are estimated using OLS. First 5 rounds specifications are estimated using LPM with round fixed effects (reghdfe). Standard errors clustered at the matching-group level (12 clusters) are reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.*

Table D.7 - $CCI_H \rightarrow CCI_L$ - Switch stage 1→2 and 2→3.

Cooperation	Switch 1→2 Round 1	Switch 1→2 First 5 rounds	Switch 2→3 Round 1	Switch 2→3 First 5 rounds
Decomposition	-0.028	-0.041	0.080	-0.054
	(0.108)	(0.105)	(0.128)	(0.106)
Female	-0.051	0.014	0.229**	0.106
	(0.137)	(0.087)	(0.079)	(0.078)
Decomposition	0.063	-0.122	-0.182	-0.100
× Female	(0.212)	(0.127)	(0.203)	(0.172)
Controls	Yes	Yes	Yes	Yes
R^2	0.0222	0.0470	0.2441	0.0880
N	120	600	120	600
Clusters	12	12	12	12

*Notes: Columns (1) and (2) report the switch from stage 1 to stage 2; columns (3) and (4) report the switch from stage 2 to stage 3. Round 1 specifications are estimated using OLS. First 5 rounds specifications are estimated using LPM with round fixed effects (reghdfe). Standard errors clustered at the matching-group level (12 clusters) are reported in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.*

Table 6 pools observations from both stage transitions (stage 1→2 and stage 2→3), following the approach adopted by Duffy and Fehr (2018). As a robustness check, Tables D.6 and D.7 report separate estimates for the two switch types. However, since each subsample contains only 12 independent matching groups, these estimates are less powerful than the pooled specification. Nevertheless, they lead to qualitatively similar conclusions. In particular, for the $\mathrm{CCI_L} \rightarrow \mathrm{CCI_H}$ condition, in Table D.6, we observe that the coefficients are generally larger and more precisely estimated for the stage 2→3 switch, while the stage 1→2 estimates are less precise. Importantly, however, the sign of the gender effect remains positive in both cases.

For the $\mathrm{CCI_H} \rightarrow \mathrm{CCI_L}$ condition, in Table D.7, while the Female coefficient is positive and statistically significant for the stage 2→3 switch in the first round, this effect disappears when considering the

first five rounds. Overall, the separate-switch analysis does not provide robust evidence of gender differences in the $\mathrm{CCI_H} \rightarrow \mathrm{CCI_L}$ condition.