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Cooperation and norm enforcement differ strongly across adult generations

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ABSTRACT

Cooperation of different generations is crucial to meet many important societal challenges, including climate change or the sustainability of the welfare state. Little is known, however, about different generations' ability to cooperate in social dilemma situations, and their willingness to enforce social norms of cooperation. We present an experiment with two generations – juniors in their 20ies, and seniors who are 50 years or older, with an average age of 67. They play a repeated prisoner's dilemma (PD) game with third-party punishment. The third party is either a person from the same generation as the players in the PD game or from the other generation, and this is common knowledge. We find that seniors cooperate twice as much as juniors do, irrespective of the generation of the third-party. Moreover, seniors are much stricter as third parties and punish norm violations much more frequently than juniors do. However, the cooperation levels of both generations react hardly to third party punishment, which means that both generations differ strongly in their attempts to enforce norms of cooperation and in their reaction to norm enforcement. These differences across generations may pose a serious threat for the solution of intergenerational problems.

1. Introduction

Many societal challenges – like fighting climate change or the Covid-19 pandemic, or sustaining the welfare systems – can only be met if all members of society cooperate. While humans possess, in general, a remarkable ability to cooperate even among genetically unrelated strangers (e.g., Fehr and Fischbacher, 2004a; Richerson and Boyd, 2005; Melis and Semmann, 2010), cooperation within and across societies is often limited because of opposing interests of different members of society. This is in particular true when different generations need to cooperate to solve pressing problems, for instance when younger generations have been requested to follow social distancing rules to protect vulnerable elderly people in the Covid-19 pandemic, or when older generations are expected to support political change for environmental protection to save our planet for future generations to come.

Cooperation of different generations is therefore important for the well-being of societies. In fact, evolutionary models point out that the intergenerational transmission of social values like cooperative norms is a fundamental pillar of establishing and maintaining large-scale cooperation in societies (Henrich and Boyd, 1998; Henrich et al., 2015). Empirical evidence supports the existence of an intergenerational transmission of non-cognitive skills (Falk et al., 2021; Chowdhury et al., 2022; Brenoe and Epper, 2022). Yet, despite

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positive correlations across generations, there is only little evidence about how cooperation levels of younger and older generations compare to each other in size, and in particular there is no evidence about whether younger and older generations differ in their willingness to enforce social norms of cooperation within and across generations.

Several papers have found a positive correlation between age and cooperative behavior (e.g., Charness and Villeval, 2009; Gutierrez-Roig et al., 2014; Grimalda et al., 2016). While there exists a sizable literature on third-party punishment as a precondition of norm enforcement through impartial punishment by an unrelated bystander (e.g., Fehr et al., 2002; Boyd et al., 2003; Fehr and Fischbacher, 2004b; von Rohr et al., 2012; Riedl et al., 2012; Carpenter and Matthews, 2012; Leibbrandt and Lopez-Perez, 2012), there is only little evidence on how age is related to the willingness to enforce social norms. Dickinson et al. (2015) is an important exception. They compare police officers (aged 23–48) and their reward and sanctioning behavior in a cooperation game, finding that older and more experienced officers were more likely to sanction low contributions than younger subjects. We aim to contribute to this scarce literature on the relation of age to norm enforcement, and in particular we go beyond the age range covered in Dickinson et al. (2015) by having an older generation being 50 years and older (with an average of 67 years). While there is quite some evidence about the development of social preferences (including cooperation behavior and third-party punishment) in pre-adults (see the survey by Sutter et al., 2019, on economic behavior of children and adolescents), there is hardly any evidence about economic behavior of older subjects, in particular those in retirement (age).[1] For this reason our paper also adds to the literature by looking at economic decision making of a generation about which little is known in experimental economics.

2. Experimental design

We designed a novel lab-in-the-field experiment including two different generations as participants: "juniors" who were students in their 20ies (with an average age of 22 years), and "seniors" who were drawn from the general population (of age 50 and older, with an average of 67 years). The experiment was conducted between March and July 2016 with a total of 180 subjects, 94 juniors and 86 seniors. The median year of birth in juniors and seniors was 1993 (22 years) and 1948 (67 years), respectively, and was similar to the mean year of birth in both subsamples (1992 for juniors and 1949 for seniors).

The recruitment process of junior participants followed the commonly applied procedure. We used the existing subject pool of the Innsbruck Laboratory for Economic Research using hroot (Bock et al., 2014).[2] In addition, we had to set up a new subject pool for senior participants because the existing one did not include participants of this generation. Our recruitment strategy was three-pronged. First, we visited the largest fair for elderly people in North Tyrol, SenAktiv, in November 2015. This fair is void of any religious or political views. Second, we used the contacts of the university sports center which offers courses for active senior citizens. Third, we contacted non-profit adult education organizations which offer courses for senior citizens.

For our junior participants, we restricted the sample to students who had participated not more than three times before in economic experiments at the University of Innsbruck, and most had never participated in an experiment before. It was also made sure that junior participants had no previous experiences with similar types of experiments (e.g., public goods games, prisoner's dilemma games, and games including third-party punishment). Seniors had never participated in an economic experiment before, but they were given extensive information about the methodology (as we also inform students about that).

In Tables A1 and A2 in the online appendix we provide further details about our subject pool. Gender composition is close to 50 % in both generations, which is comparable to the overall Austrian mean. Table A2 shows the educational background of our senior participants and compares it to the Austrian general population of age 50 and above. It is clear from this comparison that our sample of senior participants is better educated than the representative Austrian population of this age group. For instance, 34 % of senior participants have a university degree, while this is true only for 12 % of the Austrian population above 50 years. This means we have a very well-educated sample of senior participants. Yet, the same holds true also for our junior participants. They are all enrolled at a university, while currently only 48 % of each age cohort that finishes high-school in Austria enter tertiary education (Statistik Austria, 2022). Hence, both of our generations are above average in their level of education, and as such both generations share a common feature.[3]

In our experiment, subjects were either assigned the role of a player in a repeated, two-person prisoner's dilemma (PD) game or the role of a third party. These roles were fixed through the experiment. The prisoner's dilemma game is shown in Panel A of Fig. 1. Subjects in the role of players played the PD game against another player of their age group for 20 periods. Subjects in the role of a third party observed the choices of the two players and the respective outcomes in each period and could choose to punish the players at a cost. To this end, third parties received 200 points in each period and punishment was a binary decision to deduct 50 points from a player at a cost of 20 points to the third party. Third parties had to make their punishment decision for each player separately (see Panel B of Fig. 1). Note that third parties had no material interest in the outcome of the PD game. It was a dominant strategy for third parties not to punish any player, as punishment was costly, but did not yield any material benefits to third parties.

At the beginning of the experiment, players and third-parties were randomly assigned to a matching group of six participants which

[1] Bellemare and Kröger (2007) and Sutter and Kocher (2007) study different adult generations and find at best small differences across different age groups in their experimental trust games.

[2] While we did not collect the fields of study of our junior participants, the experimental pool at the University of Innsbruck consists to about 50 % of students in the fields of management and economics, and the other 50 % originate mainly from engineering, math, medicine, and humanities.

[3] We do not have any data on income or wealth of our participants. Most likely, our senior participants are much wealthier than our junior participants, which may constitute a potential limitation of our study.

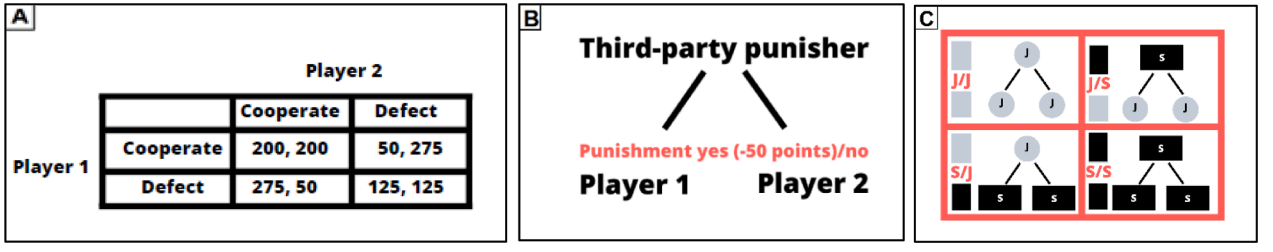

Fig. 1. ***Panel A*** illustrates the Prisoner's Dilemma Game. Player 1 and Player 2 choose simultaneously and independently whether to "Cooperate" or "Defect" (we used a neutral framing in the instructions). The socially optimal outcome would be "mutual cooperation". This outcome would lead to a joint payoff of 400 tokens, i.e. 200 tokens for each player. However, both players have an incentive to choose "Defect" which is the dominant strategy for both players. Hence, "mutual defection" constitutes the Nash-equilibrium. This outcome would lead to a joint payoff of 250 tokens, i.e. 125 tokens for each player. ***Panel B*** shows the role of the third-party punisher. She learns the outcome of the players' choices and can decide whether she wants to punish none, one or both players. Punishment is a binary choice (yes or no) and results in the deduction of 50 points from the punished player's payoff at a cost of 20 points per deduction for the third party. The third-party punisher receives an initial endowment of 200 points per period from which to pay the costs of punishment. ***Panel C*** gives an overview of the four treatments, i.e., J/J (players and third-party are juniors), J/S (players are juniors and third-party is a senior), S/J (players are seniors and third-party is a junior), and S/S (players and third-party are seniors).

included four players and two third-parties. The assignment to one specific matching group for a participant was fixed for the entire 20 periods of the Prisoner's Dilemma game. We ran 20 periods in order to be able to examine potential learning or convergence effects across both generations. Note that it was common knowledge that players were always of the same generation and that third parties were either from a junior or a senior generation. At the beginning of a period, participants of a matching group were randomly assigned into subgroups. A subgroup consisted of two players and one third-party. Hence, a matching group had two subgroups in each period with three players each. After players had made their choices, they were asked in each period about the expected choice of the other player and whether the third party would punish them or not. These beliefs were not incentivized, however. Moreover, belief elicitation came as a surprise, as it was not announced in the experimental instructions for the following reasons. If we had announced that we would ask for beliefs after each period, we were afraid that this might have already confounded participants' decisions, as reflecting about beliefs might influence actions (but need not, as Costa-Gomes and Weizsäcker, 2008, have shown). We were primarily interested in actions, for which reason we wanted to keep them as unconfounded as possible, at least in period 1. While players stated their expectations in each period, third parties were informed about the decisions of both players and decided about potential punishment. At the end of a period, players received information about the other player's choice and the decisions of the third party.

In total, we have 8 matching groups in both treatments with junior players and 7 matching groups in both treatments with senior players. A matching group constitutes our independent unit of observation for our non-parametric tests of cooperation.

Concerning procedures, at the beginning of each session, the experimenter in charge read the instructions aloud in front of the participants. It is worth noticing that we did not use the usual form of payoff matrices to explain the game. Instead, we described the payoff structure in words (see the instructions in the online appendix). We chose this method because we could not take familiarity with payoff matrices for granted. Before the start of the Prisoner's Dilemma game, each participant had to answer six control questions correctly. Subjects were not allowed to proceed until they had answered all questions correctly. We computerized the experiment using zTree (Fischbacher, 2007). The control questions were shown on two screens, with three questions each. The participants had to select the correct option for all three questions of the first screen to proceed to the second screen. In the online appendix, we show that the number of trials needed to answer the control questions had no systematic influence on the decisions of an individual (see Table A4). A session lasted on average 75 min.[4] Participants received on average 26.3 Euros from the prisoner's dilemma experiment, plus additionally 5 Euros as a show-up fee (the exchange rate from the experiment was 100 points = 0.80 Euro).

Before moving to the results, it is important to stress that a key feature of our design is the fact that both players and the third party were fully informed about the age composition of players and third-parties. This is important because previous research has shown that humans condition prosocial behavior on the age of the interaction partner and perceive actions differently dependent on the age of a person (e.g., Romano et al., 2021). We made it explicit that the experiment had two generations, because our main research interest was the interaction of different generations with one another, motivated by the urgent need of between-generations cooperation to solve pressing problems that cannot be solved by one generation alone. For this reason, and in order to keep conditions identical across treatments, we also disclosed in the sessions where only one generation was present that the whole study had two generations.[5] More precisely, we implemented four combinations of age composition. In the first one, both players and the third party was from the "junior" generation (called J/J in the following, where the first letter stands for the players' generation, and the other letter for the third party's generation). The second one has a senior third party matched with junior players, i.e., J/S. The third one reverses the second composition, with senior players and a junior third party (S/J). The fourth one has only senior subjects in both roles (S/S). Panel C of Fig. 1 illustrates all four experimental treatments. We deliberately paired only players from the same generation so that third parties would have to face either players from the opposite generation or players from the same generation. This allows the cleanest possible identification of how norm enforcement across generations is executed by the different generations. In case of different generations as players, the intergenerational interaction might confound the third party's decision for norm enforcement as one generation of players may have influenced the other generation of players, which makes norm enforcement more ambiguous.

3. Results

3.1. Cooperation rates

Fig. 2 shows the average cooperation rates across the four treatments. The two bars on the left indicate cooperation rates of juniors, and the two bars on the right those of seniors. The differences are striking and highly significant, with cooperation rates of 30.16 % by

[4] At the end of a session, we ran two tasks. The first task was the social value orientation of van Lange et al. (1997) to measure social preferences (in a non-interactive and non-incentivized situation). The other task was an incentivized risk elicitation (a simple choice list with a lottery of 5 Euro or 0 Euro with equal probability, versus a fixed amount that increased in 0.50 Euro steps from 0.50 Euro to 5 Euro). We had included these tasks as we wanted to measure a kind of general prosociality with the social value orientation test, and the willingness to take risks (since cooperation in groups always entails an element of risk).

[5] Making this salient in all treatments may have influenced behavior and expectations, yet it seems unlikely that this would differ systematically across generations and treatments.

juniors and of 60.89 % by seniors ($p = 0.002$, two-tailed Wilcoxon rank-sum test). For both generations, cooperation rates do not depend on the generation of the third party (J/J vs. J/S, $p = 0.674$, S/J vs. S/S, $p = 0.847$; two-tailed Wilcoxon rank-sum test). However, any pairwise comparison of treatments with different generations of players yields significant differences (J/J vs. S/J: $p = 0.048$; J/J vs. S/S: $p = 0.036$; J/S vs. S/J: $p = 0.028$; J/S vs. S/S: $p = 0.011$, two-tailed Wilcoxon rank-sum tests).[6] So, independent of the generation of the third party, juniors cooperate always only about half as often as seniors.

The diamonds in Fig. 2 display the average expectations about the other player's cooperation. For the first and the fourth bar – which denote homogeneous treatments where both players and the third party are from the same generation – show a remarkable coincidence between expectations and actual cooperation rates ($p > 0.100$, Wilcoxon signed-rank matched-pairs tests).[7] Interestingly, expectations and actual cooperation rates are much less aligned in heterogeneous treatments J/S and S/J. In fact, expectations are significantly higher than cooperation rates in J/S ($p = 0.050$), while the reverse is true in S/J ($p = 0.022$, Wilcoxon signed-rank matched-pairs tests). The latter differences in J/S and S/J suggest that third parties from a different generation have an impact on expectations. Juniors expect other juniors to cooperate more when the third party is a senior. Such an expectation is consistent with juniors expecting more norm enforcement from seniors (which might then drive up the other player's cooperation). The reverse effect is visible in S/J: seniors are less optimistic about the other (senior) player's cooperation rates when a junior is the third party. This could be rationalized by an expectation of less third-party punishment by junior third parties. Actual punishment rates confirm these interpretations.

Before looking in more detail into the behavior of third parties, we present in Fig. 3 the evolution of cooperation across the 20 periods. We see that the difference in cooperation rates of juniors and seniors prevails already in the very first period (when no experience of potential punishment is yet available), and persists over all 20 periods. For both generations, there is a well-known decline over periods, however this decline is much smaller – and in the second half of the experiment no longer significant – for senior players (see Tables A3 and A4 in the online appendix for the regressions showing this result).[8] This means that cooperation rates stabilize much better with senior players than junior players, and this leads to a growing gap in cooperation rates of juniors and seniors across periods.

3.2. *Third party punishment*

Fig. 4 shows the average relative frequency with which third parties punish defectors. We distinguish between homogeneous and heterogeneous treatments with respect to the age composition of players and the third party. For homogeneous treatments (left hand side), we see a very striking difference that illustrates that third parties deal in very different ways with norm violations, contingent on the generation of the third party. While junior third parties punish junior defectors in only 11 % of cases, senior third parties punish defecting senior players in 51 % of cases ($p = 0.003$, two-tailed Wilcoxon rank-sum test). This indicates that seniors have a much larger willingness to enforce cooperation norms in PD games (even at own costs).

A totally different enforcement behavior emerges when the group composition is heterogeneous with respect to the involved generations (right hand side of Fig. 4). The third parties punish defectors at nearly identical rates of 34 % in S/J and 35 % in J/S ($p = 1.000$, two-tailed Wilcoxon rank-sum test). While the downward adjustment is insignificant for senior third parties ($p = 0.183$, two-tailed Wilcoxon rank-sum test), the upward adjustment of junior third parties is significant ($p = 0.026$, two-tailed Wilcoxon rank-sum test).

So, junior third parties are much stricter in norm enforcement against senior players, despite twice as high cooperation rates of senior players compared to junior players (compare S/J vs. J/J in Fig. 2). Juniors seem to consider norm violations of senior players as serious, while they are tolerated by them in 9 out of 10 cases when junior players defect. The pattern of senior third parties is reversed. They tend to be much more lenient against juniors when they defect, which may, in fact, be one reason why senior third parties (in J/S) fail in raising junior players' cooperation rates (in comparison to J/J).

A pattern similar to the one in Fig. 4 also emerges when we distinguish the punishment behavior of third parties into cases of (i) mutual defection of both players (black lines in Fig. 5), and (ii) one-sided defection of one player, while the other player cooperates (grey lines in Fig. 5). First, we note that the grey lines are clearly above the corresponding black lines. This means that both junior and

[6] Running first a Kruskal–Wallis-test to diagnose *any* treatment difference across all four treatments yields $p < 0.02$. Applying a Dunn-test and using the Benjamini–Hochberg procedure to account for multiple testing leaves all pairwise comparisons of treatments with different generations of players significant at $p < 0.05$, except for the pairwise comparison between J/J and S/S with $p = 0.068$. Further note that the exact p-value for the comparison J/J vs. S/J is $p = 0.05$, thus only weakly significant.

[7] Note that the exact p-value for the comparison between expectations and cooperation rates in J/S is $p = 0.0547$, thus only weakly significant. Throughout the paper, all Wilcoxon signed-rank matched-pairs tests report p-values that are non-exact. The exact p-values only affect the significance level in two cases, the one reported in this footnote and the one reported in the previous footnote.

[8] In the regression in Table A4 we also see that having been punished in the previous period increases the likelihood of cooperation in the current period. Yet, this reaction is mainly due to juniors in J/J, while in S/S we even see a negative interaction term of punishment of defection and the S/S treatment, meaning that seniors do not react in the expected way to having been punished for defection. Model 5 in Table A4 includes the risk task and the social value orientation as control variables. We see weakly significantly effects for both variables. More risk averse subjects (i.e., those with a lower certainty equivalent) are more cooperative, and subjects who choose more often the prosocial allocation in the social value orientation task are also more likely to cooperate. When including both control variables, the coefficient for treatments "S/S" is almost identical and is still significant, while the coefficient for treatment "S/J" is still positive, yet renders insignificant. Of course, the latter finding could be due to the smaller sample size because in Model 5 we had to exclude subjects with inconsistent choices in the risk-elicitation task.

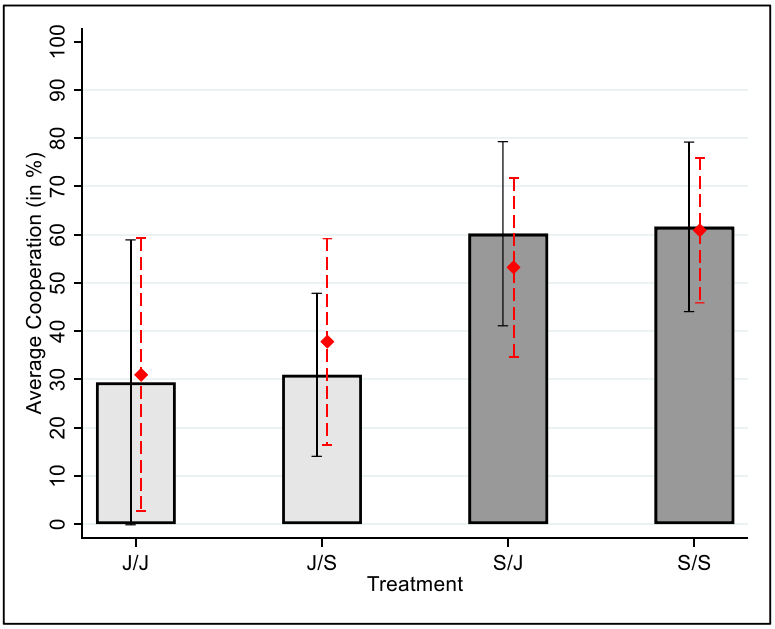

Fig 2. Bars show the average aggregated cooperation rates at the treatment level. Whiskers present 95 %-confidence intervals. The diamonds indicate the average expectations about the partner's behavior. Broken whiskers represent 95 %-confidence intervals for expectations about the partner's behavior. The confidence intervals are based on the average actions/expectations at the matching group level. The first letter in the treatment abbreviation indicates the generation of the players in the prisoner's dilemma game (J for juniors and S for seniors), the second letter the generation of the third parties.

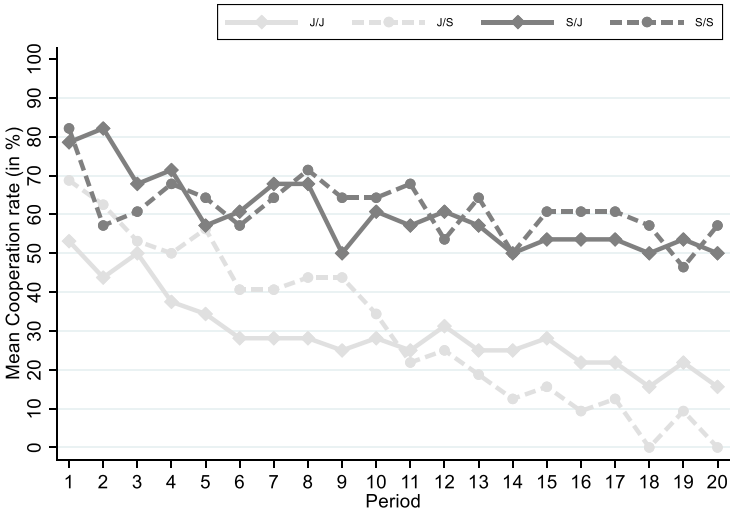

Fig. 3. The figure shows the average cooperation rates across the 20 periods of the experiment for the four different treatments. The black lines refer to the two treatments with seniors as players in the game (S/J and S/S), and the grey lines to the treatments with juniors as players (J/J and J/S).

senior third parties are much more likely to punish a single defector in the pair of players than if both players defect, even though the act of defection stays the same in both cases. Yet, one-sided defection (see grey lines) harms the cooperating player and is therefore most likely significantly more often punished by third parties from either generation. This result implies that norm enforcement is not unconditional, because in that case one should observe the same punishment rates of defectors for when the other player defects as well or when the other player cooperates. One could explain this asymmetry by an equity motive, because cooperating players are substantially worse off than defecting players, and third parties may want to use punishment as a way to reduce largely unequal outcomes for both players in such a case, while if both players defected third parties may see less reason to punish because both players earn the same amounts. Second, Fig. 5 shows again that in homogeneous groups with respect to the age of players and third parties, senior third

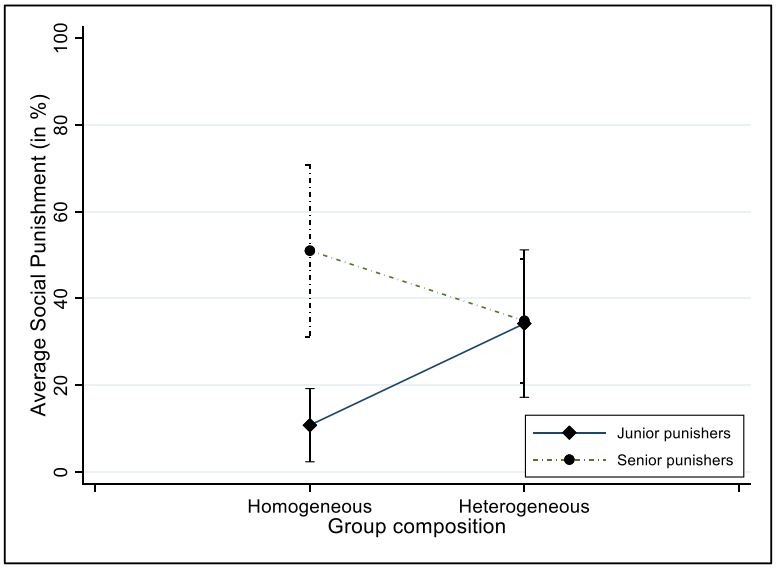

Fig. 4. Average third-party punishment of defectors in percent (of cases) at the treatment level, with the solid line representing junior third parties (in J/J and S/J) and the dashed line senior third parties (in J/S and S/S). On the left-hand side, punishment is shown in both homogeneous settings (treatments J/J and S/S) and on the right-hand side in both heterogeneous settings (treatments J/S and S/J). Whiskers represent 95 %-confidence intervals.

parties punish more often than junior third parties (see column "homogeneous", which includes J/J and S/S), but that in heterogeneous groups third parties from both generations converge to each other. Seniors become again more lenient when facing junior players, and juniors become stricter when facing senior players.[9]

3.3. Overall welfare

Before concluding with a discussion of the results, we look at the welfare implications of the different treatments by adding up earnings of players and third parties. This means that we consider both the welfare gains from cooperation, but then deduct from it the welfare losses from punishment of defection. It turns out that per capita earnings in treatments with senior players are about 10 % higher than in treatments with junior players. Although the former group of treatments has higher punishment rates overall than the latter group, the twice as large cooperation rates of seniors compared to juniors account for the significant welfare gains when seniors play the PD game, independent of the generation of the third party ($p = 0.001$, two-tailed Wilcoxon rank-sum test). The average number of tokens earned per person in the different treatments is 3227 in J/J, 3026 in J/S, 3485 in S/J, and 3398 in S/S.

4. Conclusion

Many major problems for societies, like fighting climate change or pandemics, require high levels of cooperation across generations (e.g., MacKay et al., 2015; Campos-Mercade et al., 2021). This is also true because past research has shown that many decision makers do not take into account the dynamic externalities of their actions in ongoing social dilemma situation and neglect that decisions today affect the action space and outcomes of other (often future) generations (e.g., Chermak and Krause, 2002; Fischer et al., 2004). Therefore, mutual cooperation and the enforcement of cooperation norms across generations are important prerequisites to meet major challenges for societies.

In our paper, we have seen, however, that both the level of cooperation and the willingness to enforce social norms of cooperation differ strongly between two adult generations, juniors in their 20ies and seniors with an average age of 67 years. Seniors are observed to be about twice as likely as juniors to cooperate in a prisoner's dilemma game, and they are much more willing to invest resources to punish free-riders. Interestingly, there is a stark asymmetry between juniors and seniors as third-parties. Seniors punish senior free-riders harder than junior free-riders, showing some degree of leniency towards norm violations of young people, but juniors punish senior free-riders harder than free-riders of their own generation. It seems that juniors are willing to tolerate norm violations by players of their own age, but much less so by seniors. This results in an overall higher punishment of senior free-riders compared to junior free-riders. A possible explanation might be the much higher level of cooperation of seniors, which makes defection all the more salient.

[9] Junior and senior third parties also differ in the degree of anti-social punishment, with which we mean the extent with which third parties punish cooperators. With junior third parties, this happens very rarely, namely in 1.9 % of cases in J/J, and 1.3 % of cases in S/J. With senior third parties, it is more frequent with 24.3 % of cases in J/S, and 8.3 % of cases in S/S.

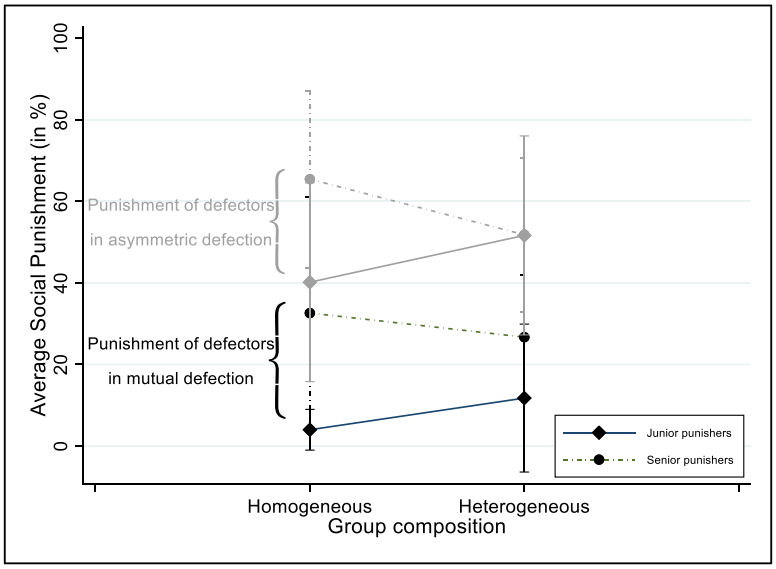

Fig. 5. Average rate of third-party punishment of defectors (in percent) at the treatment level, with the solid line representing junior third parties and the dashed line senior third parties. On the left-hand side punishment is shown in both homogeneous settings (treatments J/J and S/S) and on the right-hand side in both heterogeneous settings (treatments J/S and S/J). The black lines represent punishment of defectors in situations with both players being defectors and the grey lines represent punishment of defectors in situations where one player is a defector and the other player a cooperator. Whiskers represent 95 %-confidence intervals.

Another important observation is that although both generations anticipate a different cooperation rate, dependent on the generation of the third party – i.e. juniors expect more cooperation when the third party is a senior and seniors expect less cooperation when the third party is a junior – the generation of the third party does not affect the actual cooperation behavior. Thus, although the different generations seem to correctly anticipate the punishment behavior of the other generation, they do not seem to adapt their behavior accordingly.

The different patterns of norm enforcement may create tensions when addressing societal challenges that require cooperation across generations. For instance, given that seniors have double the cooperation rates of juniors, it might be irritating for them that junior generations with their much lower cooperation rates engage, nevertheless, in sizeable punishment of senior free-riding. Even more so, seniors might wonder why junior third parties are very rarely (in only 10 % of cases) willing to punish free-riding juniors, thus missing a chance to increase cooperation rates of juniors. Juniors, however, might be surprised about the stronger tendency of seniors to punish free-riders, irrespective of the players' generations.

Such tensions may make large-scale cooperation across generations more difficult. A first step to deal with them, however, is to provide empirical evidence about the patterns of cooperation and norm enforcement across different generations. The purpose of our paper was to take this initial step. Further steps will have to refine our current understanding even more, as each study, including ours, has its limitations. With regard to our subject pool, participants are on average better educated than the Austrian general public, thus we don't have a representative sample of the whole population. This holds for both generations in our experiment and also relates to potential student pool effects (Miragaya-Casillas et al., 2023). Our study also originates from a highly-developed country which raises issues of generalizability to other parts of the world. As regards our experimental design, we have restricted norm enforcement to simple binary decisions (to keep the environment as simple as possible). In reality, punishment of norm violations can take on many different forms and shades, and it can, in particular, be scaled continuously to allow for a finer grained reaction to norm violations. While we have seen strong differences across generations in the extensive margin of third-party punishment (yes or no), the two generations might also differ in their intensive margin of punishment (more or less). Studying continuous third-party punishment may therefore further improve our understanding of the norm interpretation and norm enforcement of different generations (Bicchieri et al., 2017).

Declaration of competing interest

None.

Data availability

Data will be made available on request.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.euroecorev.2023.104659.

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