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Abstract

Studies have shown that intergroup conflict may result from two distinct human motives: the desire to obtain personal retributions from conflict (*egoism*), and the desire to sacrifice for the benefit of the ingroup (*parochial altruism*). Yet, the relative strength of these motives is open to debate. In this study, we compare behaviors in two Intergroup Prisoner's Dilemmas (IPD), which respectively capture altruistic and egoistic motives to generate conflict. Egoistic motives result in about 40% more conflicts than altruistic motives. Yet, parochial altruism generates more conflict when three conditions are gathered: i) other ingroup members are parochial altruists, ii) the outgroup is aggressive and iii) the outgroup is rich. Implications regarding the diverging structural causes of terrorism and civil wars are discussed.

Keywords

parochial altruism, egoism, intergroup prisoner dilemma, intergroup conflict, terrorism, civil war

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"What works best, what pushes people most violently to surpass themselves, is still the pure and simple need for money."
Michel Houellebecq

Introduction

Intergroup conflict can arise due to different motivational forces. Individual participation to conflicts may result from egoistic motives, in the form of material incentives received by fighters – either financial (Collier and Hoeffler 2004) or reproductive rewards (Chagnon 1988; Glowacki and Wrangham 2013, 2015). Individual participation can also be due to altruistic motives, that is the individual motivation to sacrifice for the benefit of the ingroup over the outgroup, commonly referred as "parochial altruism" (Atran et al. 2014; Ginges and Atran 2009; De Dreu et al. 2014; Halevy et al. 2008; Choi and Bowles 2007; Whitehouse 2018). Although both motives are well identified by research, their relative strength remains open to debate.

On the one hand, various clues accredit the preeminence of parochial altruism in explaining intergroup conflict. Various studies suggest that altruism and warfare emerged jointly and reinforced each other throughout human evolution (Choi and Bowles 2007; Bowles 2009). In this line, studies on different conflict areas indicate that individual self-identification with the group is a key determinant of willingness to fight in intergroup conflicts (in Libya, Whitehouse et al. 2014; in Iraq, Gómez et al. 2017). Studying respondents from West Bank and Gaza, Ginges and Atran (2009) found that individuals tended to view as taboo monetary incentives – such as financial compensations to the family – for individual commitment into political violence (see also Atran et al. 2018). The authors conclude that:

> "Participation [in political violence] is more a function of 'parochial altruism' or collective commitment than selective incentives" (Ginges and Atran 2009, p. 116).

On the other hand, fighting for money is often considered as the main determinant of engagement in civil war (Collier and Hoeffler 2004; Jakobsen et al. 2013). Several case studies on specific conflict zones, based on different methods able to grasp individuals motives, confirm that egoism is the primary reason of engagement in violent conflicts (in

Liberia, Hegre et al. 2009; in Nigeria, Oyefusi 2008; in Sierra Leone, Humphreys and Weinstein 2008; and in Chad, Debos 2011).

The question of the relative strength of human motives behind inter-group conflict has given rise to a large amount of research based on economics experiments (for an overview, see De Dreu et al. 2020). The experimental approach allows to separate the specific contribution of motives all other things being equal, while field studies only allow to indirectly infer belligerents' motives, and do not offer clean counter-factual data to compare the relative strength of conflict motives across different contexts.

Within the experimental literature, a classic game modeling inter-group conflict is the Intergroup Prisoner's Dilemma (IPD) (Bornstein 1992; Bornstein et al. 1994; Halevy et al. 2008, 2010, 2012; Goren and Bornstein 2000). In the IPD, individuals may choose to spend money for the benefit of the ingroup by withdrawing money to an outgroup. The decision to spend money (here referred as *attack*) reflects a parochial altruistic motive for conflict, while the individual decision to keep money either reflects egoist or universalist motives for peace. Comforting the importance of parochial altruism, previous studies indicate that subjects spend large amount of money in the IPD: in the first empirical study of the IPD subjects spent about twice than in a normal Prisoner's Dilemma (PD) where defecting does not hurt an outgroup (Bornstein and Ben-Yossef 1994).

Various research has investigated the underlying mechanisms of parochial altruism based on the IPD paradigm. Halevy et al. (2008) introduced a modified version of the IPD – the IPD-Maximizing Difference (IPD-MD) – in which individuals may choose to spend money in one of two pools. In the first (*between-group*) pool, the money benefits to the ingroup at the cost of the outgroup (as in the classic IPD) while in the second (*within-group*) pool, the money benefits to the ingroup without any cost to the outgroup. Initial results indicated that subjects generally spend more money in the within-group pool, suggesting that attacking behaviors in the IPD is mostly due to ingroup love (i.e. parochial cooperation) rather than outgroup spite (Halevy et al. 2008). However, subsequent research has demonstrated that the relative strength of parochial cooperation and outgroup spite depends on several conditions. For instance, individuals from relatively disadvantaged groups are more likely to spend money in

the between-group pool, indicating a stronger out-group spite (Halevy et al. 2010). Besides, the framing of the game plays a significant role in subjects' decisions in both the IPD and the IPD-MD. Contrasting with the initial results from (Bornstein and Ben-Yossef 1994), Weisel and Zultan (2016) found that attacks in the IPD are *lower* than in the normal IPD when payoffs are explained to subjects as a direct function of individual choices rather than framed at the group level. In the IPD-MD, Weisel and Zultan (2021) found that the importance of outgroup spite can become as strong as parochial cooperation when the game is framed at the group rather than individual level.

Much less attention has been given to egoist motives and their conditions of emergence in the experimental literature on intergroup conflict. Importantly, understanding the relative importance of egoist motives may help elucidate the question of the difference between aggression and defense in intergroup conflicts (see De Dreu and Gross 2019, for an overview of the debate). Recent studies have analyzed the intergroup aggressor–defender conflict (IADC) game (De Dreu et al. 2016, 2021). In this game, subjects are divided in two groups: the aggressor and the defender. Subjects of the aggressor group may contribute money to spoil subjects of the outgroup, while subjects of the defender group can contribute money to prevent the aggressor group from stealing their money. The aggressor group succeeds and spoils the remaining money of the defender group if the amount of money contributed by aggressors outweighs the contribution of defenders. The gain from successful attacks is equally distributed among subjects of the aggressor group. Results indicate that individuals are willing to contribute more and better coordinate with other ingroup members to defend the ingroup against an outgroup aggression rather than to conduct aggressive action against an outgroup for the benefit of the ingroup (De Dreu et al. 2016). This fits with empirical records showing that individuals are more likely to commit extreme self-sacrifice for ingroup defense rather than aggression (Rusch 2013). In this line, subjects are more likely to identify with other ingroup members when facing a threat from an outgroup, while subjects' involvement in aggressive actions is not positively related with their identification with the ingroup (see De Dreu and Gross 2019). According to De Dreu et al. (2016), this asymmetry between aggression and defense would result in a higher rate of success of defensive actions as compared

to aggressive actions – although other studies dispute this (see Buckner and Glowacki 2019).

Thus, parochial altruism plays a key role in defensive action. In contrast, the reason why people participate in aggressive action at all currently remains unclear. Egoist motives may here play a central role. In a recent experiment, Doğan et al. (2018) found that asymmetric division of gains from aggression within the ingroup increases involvement in conflict from privileged ingroup members. Thus, the view that individuals invest more in defense than in aggression may be partly due to the fact that existent games do not incorporate private rewards from conflict into account. As stressed by Buckner and Glowacki (2019), "expanding on the advantages of the attack (...) may help reconcile the empirical record of high success of attack with De Dreu and Gross (2019)'s prediction of easier coordination (...) while defending."

We experimentally study the relative strength of egoistic and altruistic motives in the genesis of intergroup conflicts based on the IPD paradigm. In the present study, we contrast an iterated IPD (Goren and Bornstein 2000; Bornstein et al. 1994; Halevy et al. 2012) with an alternative version of the game capturing egoism in intergroup conflict. The two games are identical except for the payoff allocation. In the alternative game, subjects directly benefit from withdrawing money to an outgroup, without any benefit for the ingroup. Hence, in the IPD, the reason for subjects to attack an outgroup is parochial altruism, while in the alternative game it is egoism.

It is worth noticing that an inherent feature of the IPD is that each individual attack occurs unconditionally of actions of other players, unlike in several other contest games (see for instance De Dreu et al. 2016; Doğan et al. 2018; Abbink et al. 2018). There is no need for coordination across subjects for an attack to take place. As such, this feature of the IPD may be subject to discussion, since in many cases in human conflict attacks require coordination to be effective at all (De Dreu et al. 2016). However, for the purpose of the present article, this feature is convenient because it ensures a strict comparability between the Egoistic and Altruistic treatments. Although subjects are uncertain about the decisions of other subjects because of simultaneity and secrecy of decisions, they are certain in both treatments about the net effect of their own decisions on their payoff and the payoffs of other subjects (both of their ingroup and outgroup)[1].

The comparison between the number of attacks in the respective games allows us to assess the impact of egoism and altruism on participation into intergroup conflict. Our results reveal that egoistic motives are preeminent, but that altruistic violence increases when the other members of the ingroup are parochial altruists, the outgroup is aggressive and the outgroup is rich. Under these specific conditions, altruistic attacks slightly outweigh egoistic attacks.

In the next section the theoretical background is developed. The method and the data are described in section three and the results displayed in section four. In section five, we offer a discussion on the external validity of the results and on the implications for conflict studies.

Theoretical background

Our main aim is to compare the relative strength of altruistic and egoistic motives to explain intergroup conflict; in addition, we offer insights about the conditions that determine whether altruistic and egoistic motives are predominant over one another. We develop three main hypotheses based on previous experimental studies on intergroup conflict.

Intra-group level

At the intra-group level, when deciding whether or not to engage in intergroup conflict for altruistic motives, individuals face a classic prisoner dilemma (Bornstein 1992). If all members of the ingroup engage in parochial altruistic behaviors, all members are collectively better off. Yet, individual members are better off if they abstain from entering conflict and benefit from the action of the other ingroup members. This leads to a classic free-rider problem. In this situation, one key strategy is for individuals to condition their decision to enter conflict to the previous behaviors of the members of the ingroup. Such ”tit for tat” strategy has already been observed in experiments on intergroup conflict. In an iterated IPD game, Goren and Bornstein (2000) observed that subjects contribute significantly more in attacks if the other members of the ingroup did so during previous round. Similarly, in a contest game between two groups in which individuals can spend money to reduce the payoff of the outgroup, Abbink et al. (2018) found that individuals abstain from contributing if other members of the ingroup did so in the past.

In contrast, individuals do not face such a dilemma at the intra-group level when deciding whether or not to engage in intergroup conflict for egoistic motives. In this case, individuals have no reason to condition their decision to the behavior of the other ingroup members. As a consequence, one may expect that attacks for altruistic motives only emerge in bonded groups, in which all members contribute in attacks, while attacks for egoistic motives should not be affected by other ingroup members' behavior.

Hypothesis 1. *Subjects condition their attacks for altruistic motives to the contribution of the other members of the ingroup while they do not for egoistic motives.*

Intergroup level

At the intergroup level, when deciding whether or not to engage in intergroup conflict for altruistic motives, individuals face another prisoner dilemma. At this level, cooperation means abstaining from attacking and defection means attacking. Indeed, if all groups abstain from attacking, then all groups are collectively better off. Yet, groups are better off if their members attack while members of the other groups do not. To promote intergroup cooperation, groups should engage in a "tit-for-tat" strategy consisting in that case in punishing the outgroup for its previous attacks through retaliation. In doing so, the group sends the message to the other group that any benefit from an attack will be lost because of retaliation. In this line, anthropological data indicates that revenge is the most frequent expressed motive for intergroup conflict (Gat 2008; Beckerman et al. 2009; Chagnon 1988); groups abstaining from retaliating being subject to a loss in reputation resulting in more abuses from other groups (see for instance Chagnon 1988, 986-987).

Individuals face a similar dilemma when deciding whether or not to engage in intergroup conflict for egoistic motives: all individuals would collectively be better off if no one attacks, but individuals have a personal interest in attacking and favor their own wealth over intergroup cooperation. Hence, individuals could also engage in retaliatory attacks for egoistic motives, in order to deter members of the outgroup from attacking them again. However, in an egoistic game, this strategy is less effective. Indeed, when retaliating against an outgroup, an individual inflicts a cost to all its members, irrespective of whether they have benefited from

previous attacks of their own group. Such indiscriminate punishment can blur the message, since those who have not benefited from an attack by a member of their group could not perceive the counter-attack as a ”punishment” and could decide, in turn, to punish the assailant. In fact, benefiting from attacks undertaken by members of one's own group is likely to play a central role in perceived outgroup ”entitativity” – i.e. the perception of a group as a single entity (Riek et al. 2006). In this line, studies on vicarious retributions – i.e. retaliatory aggression from non-victim members of a victim group against non-offending members of the offending group – indicate that perceived outgroup entitativity is a key factor in vicarious retribution (Lickel et al. 2006; Stenstrom et al. 2008). Therefore, we expect that when the attack from the outgroup is due to individuals pursuing egoistic motives, subjects should be less inclined to inflict an indiscriminate punishment – including individuals who did not benefit from the attacks.

As presented in the Introduction, experimental studies indicate that subjects are more cooperative with other ingroup members for defense than aggression (De Dreu et al. 2016). This observation is primarily drawn from the one-shot IADC, in which one group is the aggressor while the other is the defender. Contributions in the defender group are only aimed at avoiding the outgroup aggression and do not hurt the outgroup. However, as stressed by Rusch and Böhm (2019), when groups are considered over time in sequential interactions, the ”the roles of attacker and defender are blurred and blended”. In such interactions, one of the major ways in which subjects contribute to defend their group is retaliatory attacks (see Böhm et al. 2016). Such behavior has already been observed in experiments on intergroup conflicts. In sequential team games, subjects contribute significantly more in attacks if the outgroup attacked in the previous round (Goren and Bornstein 2000; Böhm et al. 2016; Abbink et al. 2018). Following the view that cooperation is more intense in defense that in aggression, one can expect that subjects are more likely to attack in retaliation from previous attacks for altruistic motives than to engage in first strikes.

In contrast, although retaliation could also occur for egoistic motives, it should be less poignant since subjects keep an incentive to engage in first strikes. In a contest game between natural groups in Ethiopia, Doğan et al. (2018) tested whether contribution to collectively attack

outgroups depend on pre-existing story of intergroup conflictual or peaceful interactions. They found that, under equal sharing of conflict gains, subjects contribute more in conflict when facing a outgroup with pre-existing conflictual relationships as compared to another group with pre-existing peaceful relationships. This indicates a classic sequence of attacks and counterattacks, that we presented before. Importantly, they found that the pre-existing intergroup relationship no longer matters when the conflict gains are no longer equally distributed within the ingroup. In this case, privileged members of the ingroup – that obtain a larger share of the conflict gains – tend to attack more, and unpriviledged members to attack less, irrespective of the nature of pre-existing intergroup relationships. This suggests that, when egoistic motives enter into account, past history of conflict has less importance in the individual decision to attack.

Hypothesis 2. *Subjects are more likely to attack in retaliation of previous attacks from a given outgroup for altruistic motives than for egoistic motives.*

Distributional issues

In a simplified situation of destructive war – as represented in our game – each subject is placed in a negative sum game in which, when no attacks occur, the global wealth is maintained and each attack reduces global wealth. While binding agreements and explicit bargaining are not possible among the players, a peaceful situation should progressively take place. However, unequally distributed endowments break this equilibrium because richer groups are more effective in their attacks and are tempted to ruin poorer groups in one-to-one duels. This provides incentives for poorest groups to pre-emptively attack the richest group, that is the only one that has an incentive to initiate a fight unilaterally (Garfinkel and Syropoulos 2020). Such pre-emptive first strikes are, along with retaliatory aggression presented in the previous section, another well-identified cause of outgroup aggression for defensive motivations (Böhm et al. 2016; Halevy 2017). Thus, in a configuration of unequal distribution of resources war is almost unavoidable (De Luca and Sekeris 2013) and poor groups systematically initiate attacks against the rich (Halevy et al. 2010; Varaine et al. 2021). Interestingly, when there are more than two groups, the only possible coalition is that against the richest group, because it is the only

that offers an opportunity for peace once the coalition has won (Skaperdas 1998). This led us to expect that individuals are motivated to attack outgroups that have more resources.

However, it is less clear whether this effect is the same in egoistic vs altruistic games. In altruistic games, groups can be almost considered as individuals because each individual earns the same amount from an attack and loses the same amount when the group is attacked. When the members of a group cooperate, the group will conform to the strategy described above. In the egoistic game, attacking increases only the resources of the individual who attacks and does not benefit the group as a whole. Each individual, not only those from rich groups, now has an incentive to initiate a fight unilaterally, whatever the distribution of resources. Each individual may still be motivated to attack the richest (i.e. the most dangerous) group, but the destruction of the richest group will not produce an opportunity for peace, unlike in altruistic games. Therefore, since altruistic violence relies on group identification (in the sense that members of the same group have the same preferences), it should be more sensitive to inter-group inequality than egoistic violence.

Hypothesis 3. *Subject are more likely to attack outgroups with more resources for altruistic motives than for egoistic motives.*

Material and methods

Design of the experiment

Altruistic versus Egoistic treatment Altruistic motives for intergroup conflict – i.e. parochial altruism – are generally captured through the Intergroup Prisoner's Dilemma (IPD) (Bornstein 1992). In the classic version of this game, subjects are divided in 2 groups of 3 players. Each subject receives a fixed initial amount of resources in points that the subject either chooses to keep or to contribute to attack the outgroup. For each point kept, the subject gains 1 point. For each point contributed to attack the outgroup, each subject of the ingroup gains 0.5 point and each subject of the outgroup loses 0.5 point. Decisions are made simultaneously. Table 1 presents the actions and payoffs in this original version of the IPD, which we now refer to as the "Altruistic treatment".

Table 1 shows that at the individual level, the Nash equilibrium is for each subject to keep. Indeed, a subject loses 0.5 points when attacking. However, at the group level, the best strategy is to attack: the marginal gain

Table 1. Actions and payoffs in the Altruistic treatment (original IPD)

	Effect on					
	Ingroup members			*Outgroup members*		
	Self	Others				
Keep	+1	0	0	0	0	0
Attack	+0.5	+0.5	+0.5	-0.5	-0.5	-0.5

Note. The table is adapted from Weisel and Böhm (2015). It illustrates the effect of the subject decision to contribute one point to attack another out-group on the subject payoff, the payoff of each of two other in-group members, and that of the three out-group members.

of the other ingroup members is 1 points if the subject attacks whilst they gain no point if the subject keeps. Yet again, the best collective strategy is for all subjects to keep their points. If all subjects attack, no subject gains any points as the gains form the ingroup's attacks are offset by the losses from the outgroup's attacks. In short, the best strategy is the same for egoistic subjects who do not cooperate with anyone and for universalist subjects who cooperate with everyone: to keep. Only parochial altruists, who cooperate with the ingroup and not with outgroup members, have to attack.

To capture egoistic motives for intergroup conflict, we designed an alternative version of the game, called the "Egoistic treatment". In this treatment, subjects may now attack an outgroup in order to increase their personal rather than their ingroup resources. For each point kept, the subject still gains 1 point. However, for each point contributed to attack the outgroup, the subject gains 1.5 point and the other subjects of the ingroup gain no points. Hence, the overall gain resulting from an attack stays the same than in the Altruistic treatment (1.5 points), but its allocation differs: while it is equally distributed to all ingroup members in the Altruistic treatment, it only benefits the attacker in the Egoistic treatment. This allows us to compare altruistic and egoistic motives all other things being equal. The consequences of an attack for the outgroup members remain unchanged: each subject of the outgroup loses 0.5 point. Table 2 presents the actions and payoffs in this treatment.

In the Egoistic treatment, there is no more pooling of gains from attacks which reduces the inter-dependency between ingroup members. This reflects the fact that a group of egoists is not really a group in the

Table 2. Actions and payoffs in the Egoistic treatment

	Effect on					
	Ingroup members			*Outgroup members*		
	Self	Others				
Keep	+1	0	0	0	0	0
Attack	+1.5	0	0	-0.5	-0.5	-0.5

Table 3. Best strategies in the Altruistic and Egoistic treatments

	Best strategy from the perspective of...		
	Individual	Other ingroup members	Society
Altruistic	keep	attack	keep
Egoistic	attack	indifferent	keep

positive sense. Yet, the treatment still implies a pooling of losses due to attacks from the outgroups. Indeed, in a purely egoistic inter-group conflict, fighters act for their own benefit in a conflict that may nonetheless negatively affects all members of their group. For instance, when fighting a civil war, mercenaries of a given group may commit indiscriminate violence against another group (e.g. massacres of civilians, destruction of public infrastructure, hostage taking), which often result in retaliations affecting in turn all members of the first group.

The two treatments differ in their best strategies at the individual and group level (see Table 3). The individual dominant strategy is to keep in the Altruistic treatment, whilst it is to attack in the Egoistic treatment. The best strategy in order to maximize the payoff of the other ingroup members is to attack in the Altruistic treatment, whilst attacking has no direct benefit for them in the Altruistic treatment. The collective - i.e. all ingroup and outgroup members taken together – best strategy is to keep in both treatments, because attacks cause a net collective loss.

Iteration and resources To test Hypotheses 1, 2 and 3 about the conditions under which altruistic and egoistic motives gain prevalence over one another, we rely on an extended version of the classic IPD described in Varaine et al. (2021). First, subjects play a repeated IPD game over a finite number of rounds (see also Halevy et al. 2012; Bornstein et al.

1994). Subjects stay in the same group for all rounds. We keep the payoff structure unchanged. As previous studies (e.g. Böhm et al. 2016; Halevy et al. 2010; Weisel and Zultan 2021), we opted for a continuous – rather than a binary – contribution choice: subjects have an initial endowment in points, and they must choose for each point either to keep or to contribute it in attacks. Decisions about each point have the effect on payoffs presented in Tables 1 and 2. Endowments are path-dependent: the number of points of a subject at the end of each round determines the resources in points with which the subject will start the next round. The iterated game allows to test the effect of previous attacks of ingroup members (Hypothesis 1) and previous attacks from the outgroup (Hypothesis 2). The subjects' endowment in point at the start of each round is determined by the number of points at the end the previous round. At each round, in addition to their points inherited from the end of the previous round, subjects receive a (small) additional random endowment[2]. This additional endowment is not of interest in the present paper[3]. In order to ensure that altruism and egoism are well distinguished, in both games the number of iterations is finite. This theoretically avoids that cooperative equilibria emerge for egoist motives (Axelrod and Hamilton 1981) and guarantees that attacks in the Altruistic treatment remain purely altruistic. Indeed, the finite number of rounds does not affect the dominant individual strategies in both the Altruistic and Egoistic treatments assuming rationality and common knowledge of rationality. The dominant individual strategy in the last round is for subjects to keep in the Altruistic treatment and to attack in the Egoistic treatment, whatever the history in the game. By backward induction, the same strategy is dominant in all the previous rounds. Similarly, in order to ensure that we measure genuine individual motivations for egoistic and altruistic attacks, we did not include the possibility for subjects to inflict costs to members of the ingroup. Indeed, in public good games in general (Fehr and Gächter 2002), and in IPD games more specifically (Rebers and Koopmans 2012), subjects tend to costly punish ingroup members that do not contribute to the ingroup welfare. As a consequence, ingroup members contribute more to avoid personal loss from punishment. As we wish to identify purely altruistic (or egoistic) motivation to attack, we do not include the possibility to punish ingroup members, since it would alter the personal incentive to contribute in attacks.

To test Hypotheses 2 and 3 about the choice made by subjects in the targets of attacks, we increase the number of groups. Each subject may attack different outgroups simultaneously. When deciding to contribute, subjects have to choose which outgroup/s to attack. The consequences for the ingroup and the subject stay the same.

Besides, we introduce inequality across groups. This allows us to test the effect of the outgroup resources on the level of attacks (Hypothesis 3). Before playing the game, subjects perform a word-creation task akin to a Scrabble game (for details, see Varaine et al. (2021)). Each subject starts the game with resources proportional to the results of the word-creation game, and differences in skills generate considerable variance. The groups for the game are created based on the subjects' earlier performance: the three best subjects form a group, the three second best another, and so on. This generates endogenous intergroup inequality in the game. Moreover, inequalities are (loosely) meritocratic, inducing feelings of entitlement.

In sum, in the Altruistic treatment, at the end of a given round, the number of points p of a subject is a function of the number of points k the subject kept, the number of points a_i contributed in attacks by the subjects i of the ingroup, the number of points $a_{j \to ingroup}$ invested in attacks against the ingroup by the subjects j of the $n-1$ outgroups, and the subject's random endowment α:

$$p_{altruistic} = k + 0.5 \times \sum_{i=1}^{3} a_i - \sum_{j=1}^{3\times(n-i)} a_{j \to ingroup} + \alpha \tag{1}$$

In the Egoistic treatment, at the end of a given round, the number of points p of a subject is a function of the number of points k the subject kept, the number of points a contributed in attacks by the subject, the number of points $a_{j \to ingroup}$ invested in attacks against the ingroup by the subjects j of the $n-1$ outgroups, and the subject's random endowment α:

$$p_{egoistic} = k + 1.5 \times a - \sum_{j=1}^{3\times(n-i)} a_{j \to ingroup} + \alpha \tag{2}$$

In both treatments, the number of points p_t of a subject at the end of round t determines the resources in points p_{t+1} with which the subject will start the next round.

Participants

300 subjects were recruited from the Grenoble Applied Economics Lab subject pool in France. 61% of subjects were female. A majority was students (69.67%) the rest being workers (28.00%) or unemployed (2.33%). The mean age was of 27 ($SD = 11.11$), 12.67% of subjects completed less than high school, 27.00% had a high school diploma, 21.67% completed a bachelor's degree, 19.67% completed a master's degree and 19.00% a PhD.

Procedure and parameterization

The experiment took place at the Grenoble Applied Economics Lab in France. The experimental software was developed using oTree (Chen et al. 2016). We ran 20 sessions of 15 subjects, divided in 5 groups in the IPD game. Upon entering the lab, subjects were randomly assigned to individual computers. Instructions were read aloud and presented on overhead and individual screens. Clarification questions were answered collectively. Subjects received a 10 euros show-up fee, which was not at stake during the game.

Subjects first took part in the word-creation task (for details, see Varaine et al. (2021)). After completing the task, subjects were informed about their individual gains. Based on pre-tests, we estimated that subjects would start the IPD game with around 500 points on average. Subjects were then divided in groups labeled with colors – yellow, red, purple, blue and green – to be easily identified. Subjects played the IPD game for 15 rounds, putting at stake their individual gains from the first task. The endowment was thus earned and not assigned, raising feelings of entitlement.

Half of subjects played in the Altruistic, half in the Egoistic treatment. Data on the 10 sessions of the Altruistic treatment were drawn from the previous study of Varaine et al. (2021), collected in December 2018. Data on the 10 sessions of the Egoistic treatment were collected in February 2019. There was no significant differences in observable demographics between treatments[4].

During each round, subjects had information on: their individual resources in points, the total resources in points of each group – identified by their color – and a line plot of the variations of each group resources during the past rounds. In each round, subjects simultaneously decided

how much of their points to keep or to contribute to attack each outgroup. After each round, subjects had information on the variation of their individual resources, the number of points gained by the ingroup (or each ingroup member in the Egoistic treatment) due to the attacks made by each member of the ingroup, the number of points lost by the ingroup due to the attacks of the different outgroups – identified by their color – and the number of points gained/lost by the ingroup due to the random endowment. However, subjects do not have information on which specific outgroups the other members of the ingroup attacked. Besides, subjects only have aggregate information on attacks from each outgroup. They do not know the individual contributions of each outgroup members. This reflects the fact that in intergroup conflicts, individuals with egoistic motives may instrumentalize group identities and hide their egoistic actions behind group membership. In civil wars for instance, attacks, even if egoistically motivated, are generally committed in the name of whole groups, thus not allowing to track individual responsibility. Detailed instructions and screenshots of the interface are provided in the online appendix.

Finally, to avoid the possibility that subjects spend all their money in attacks during the first rounds, leading to a collective bankruptcy, we implemented a limit on the number of points subjects could contribute to attack outgroups at each round. The limit was fixed at 50 points in all sessions. However, this does not entirely avoid the possibility of bankruptcy – especially since multiple subjects from multiples groups may simultaneously target a given group. Bankruptcy occurs when a subject has a null payoff at the end of a round (we did not allow negative payoffs, which are simply computed as null). Subjects in bankruptcy can no longer contribute points to attacks in the following round, but keep receiving information about the decisions made by the other subjects. In the (unlikely) event that they recover from bankruptcy – for instance, if they receive a net positive amount of points thanks to attacks of the other ingroup members in the Altruistic treatment –, subjects can again contribute their points in the following rounds. When the three members of a group are in bankruptcy, the group is considered eliminated and its members do not participate in following rounds.

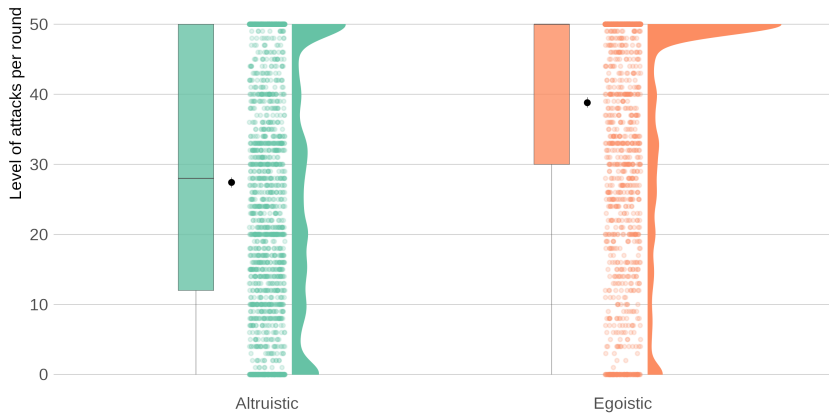
Results

Level of attacks

Did subjects spend more money in attacks in the Egoistic or the Altruistic treatment? First, there was no significant difference in initial endowments of subjects at the beginning of the game between the Egoistic (12.95€, st.dev. 3.88) and Altruistic (12.39€, st.dev. 3.53) treatments ($t_{(298)} = 1.3152, p = 0.189$): initial endowments cannot account for subsequent differences across treatments. In both treatments, subjects spent a large amount of money in attacks, resulting in a collective loss of money: the mean final payment at the end of the game was 3.55€ ($SD = 3.42$), which means that subjects on average lost 72.59% of their initial money due to their mutual attacks. However, subjects ended up with significantly less money in the Egoistic (final payoff 1.81€, st.dev. 2.00) compared to the Altruistic (5.28€, st.dev. 3.67) treatment ($t_{(298)} = 10.1759, p = .000$). Besides, bankruptcy was far more common in the Egoistic (38.7% of subjects) than in the Altruistic (6%) treatment (Fisher's exact, $p = .000$).

As subjects who were in bankruptcy could no longer contribute money in attacks, looking at payoffs at the end of the game is likely to lead to an underestimation of the mean contribution in attacks by round. To offer a clean comparison of conflict expenditures between treatments, we now focus on each subject level of attacks – i.e. the number of points contributed in attacks against all outgroups taken together – at a given round, excluding rounds in which the subject has less than 50 points in resources and rounds in which an outgroup is eliminated from the game[5]. Figure 1 shows the distribution of subjects' level of attacks at a given round depending on the experimental treatment. The mean level of attacks is 38.80 points ($SD = 16.16$) in the Egoistic treatment and 27.42 points ($SD = 18.13$) in the Altruistic treatment. Hence, the Egoistic treatment resulted in 41.49% more attacks than the Altruistic treatment. We tested the difference in the level of attacks by round across treatments based on a multilevel negative binomial regression model[6], with random effects computed at the subject level to account for dependency of observations from the same subject. Results from model (1) in Table 4 confirm that the level of attacks is significantly lower in the Altruistic treatment compared to the Egoistic treatment. Overall, results strongly indicate that egoistic motives generate more attacks that altruistic motives.

Figure 1. Distribution of the level of attacks by treatment. For each treatment, the Figure presents different visualizations of the level of attacks: boxplot, mean, raw data points (horizontally jittered) and violin plot. Looking at the boxplot, results show that the median level of attacks is 28 points in the Altruistic treatment (Interquartile range = 38) while it is 50 points (the maximum possible contribution) in the Egoistic treatment (Interquartile range = 20). Looking at the violin plot, results indicate that contributing all 50 points in attacks is a common decision in the Altruistic treatment, but that a high proportion of subjects choose intermediary levels of attacks; in contrast, contributing all 50 points in attacks is by far the most common decision in the Egoistic treatment, only a minority of subjects choosing intermediary levels of attacks.



Dynamics of attacks

How does the repeated game affect attacking behaviors in the Altruistic and Egoistic treatments? Figure 2 plots the mean level of attacks by round depending on the treatment. It indicates that attacks follow different dynamics across treatments. In the Altruistic treatment, the level of attacks overall decreases through the game. In contrast, the level of attacks remains high all along the game in the Egoistic treatment. This is confirmed by model (2) in Table 4: while the round has no significant effect on the level of attacks in the Egoistic treatment, there is a significant negative interaction effect between the round and the Altruistic treatment. This result is consistent with what is observed in other studies based on iterated IPD (Goren and Bornstein 2000; Halevy et al. 2012) – and more

Table 4. Standardized coefficients from multilevel negative binomial regression analyses of the level of attacks by a subject at round t

	(1)	(2)	(3)	(4)
Altruistic treatment	-0.419***	-0.423***	-0.374***	-0.373***
	(0.0731)	(0.0736)	(0.0669)	(0.0676)
Round		-0.0203		-0.0340
		(0.0175)		(0.0198)
Altruistic treatment		-0.0629**		-0.0372
× Round		(0.0235)		(0.0265)
Level of attacks by			0.0282	0.0220
other ingroup members $_{t-1}$			(0.0263)	(0.0265)
Altruistic treatment				
× Level of attacks by			0.219***	0.213***
other ingroup members $_{t-1}$			(0.0366)	(0.0368)
Constant	3.585***	3.579***	3.584***	3.582***
	(0.0519)	(0.0523)	(0.0480)	(0.0485)
$\ln(\alpha)$	-0.817***	-0.827***	-0.794***	-0.804***
	(0.0289)	(0.0290)	(0.0305)	(0.0305)
var(subject)	0.363***	0.367***	0.282***	0.289***
	(0.0373)	(0.0377)	(0.0320)	(0.0326)
Round fixed effect	No	No	No	No
Observations	4085	4085	3785	3785

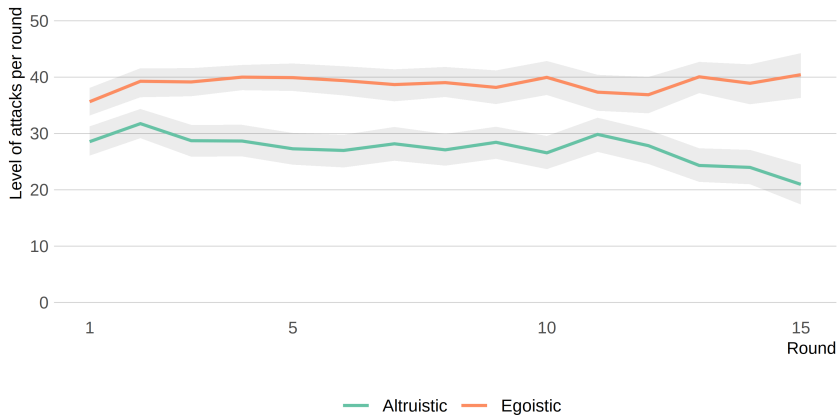
Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

generally in iterated public good games without possibility of intra-group communication and punishment (Andreoni 1988): subjects progressively withdraw cooperation and converge toward the Nash equilibrium.

Intra-group level

Do subjects condition their attacks to the contribution of the other ingroup members in the Altruistic as compared to the Egoistic treatment (Hypothesis 1)? Figure 3 plots the mean level of attacks of a subject at round t depending on the level of attacks by the other ingroup members at $t-1$. In line with Hypothesis 1, in the Altruistic treatment the level of attacks is positively related with previous attacks from other ingroup members, while there is no apparent relationship in the Egoistic treatment. This is confirmed by model (3) of Table 4. There is no significant effect of attacks by the other ingroup members at round $t-1$ on the level of attacks at t for the Egoistic, but there is a significant positive effect for the Altruistic treatment. As expected, subjects condition their attacks to the contribution of other ingroup members in the Altruistic but not

Figure 2. Mean level of attacks by round, with 95% confidence interval



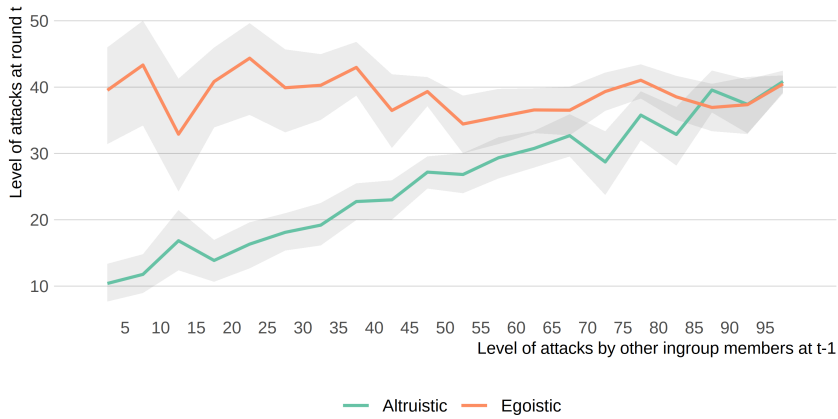
in the Egoistic treatment. Subjects behave as conditional altruists but unconditional egoists.

In model (4), we included both the interactions between the treatment and the round and between the treatment and the level of attacks by other ingroup members at $t-1$. Interestingly, the round interaction term is no longer significant when including the lag of attacks by other ingroup members. Conditional altruism explains the differences in dynamics across rounds observed in Figure 2. The decrease in attacks in the Altruistic treatment is due to the fact that subjects stop attacking when other members of the ingroup do so, while subjects do not condition their attacks to behaviors of the other ingroup members in the Egoistic treatment.

Inter-group level

Do subjects target outgroups in retaliation for previous attacks against the ingroup? To answer this question, we now focus on the level of attacks of a subject at time t against a given outgroup. That is, an observation is now a subject at a given round paired with a given outgroup[7]. Figure 4 plots the level of attacks of a subject against an outgroup at round t

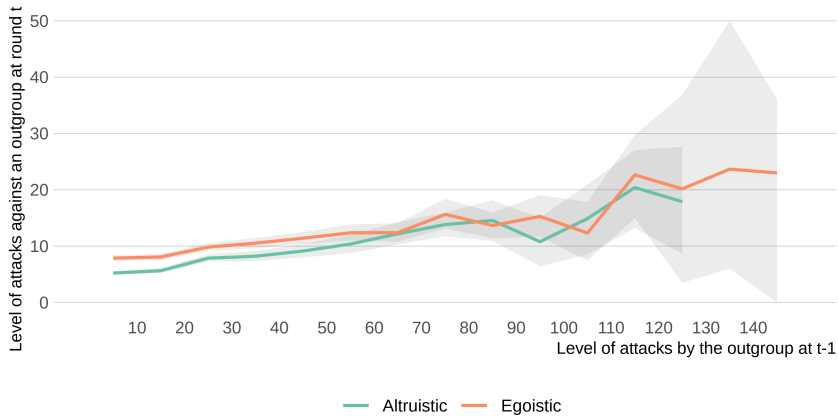
Figure 3. Mean level of attacks at round t depending on the level of attacks of other ingroup members at $t-1$, with 95% confidence interval



depending on the level of attacks by this outgroup against the ingroup at $t-1$. Overall, retaliations occur: subjects attack an outgroup more if the outgroup attacked the ingroup during the previous round. This is confirmed by model (1) of Table 5: the level of attacks against an outgroup at round t is significantly and positively related with the level of attacks from the outgroup at $t-1$. This confirms previous results from the iterated IPD game obtained by Goren and Bornstein (2000).

Is retaliation more important in the Altruistic than in the Egoistic treatment (Hypothesis 2)? Figure 4 suggests that it is: the slope of the relationship between the level of attacks against the outgroup at round t and the level of attacks by the outgroup at $t-1$ is slightly steeper in the Altruistic treatment. This is confirmed by model (1) in Table 5: there is a significant positive interaction effect between the level of attacks by the outgroup at round $t-1$ and the Altruistic treatment on the level of attacks against the outgroup at t. This supports Hypothesis 2 that subjects are more likely to attack in retaliation of previous attacks from a given outgroup for altruistic than for egoistic motives.

Figure 4. Mean level of attacks against an outgroup depending on the level of attacks from the outgroup at $t-1$, with 95% confidence interval



Distributional issues

Do subjects attack richer outgroups? Figure 5 plots the level of attacks against an outgroup depending on the outgroup resources in points. In both treatments, subjects tend to attack rich outgroups more. This is confirmed by model (2) in Table 5: the outgroup resources are positively and significantly related to the level of attacks against it. This result is similar to what was observed in a one-shot IPD in which some groups had a relative financial advantage over others (Halevy et al. 2010).

Do subjects attack richer outgroups more in the Altruistic than in the Egoistic treatment (Hypothesis 3)? Figure 5 suggests that it is the case: while the mean level of attacks against an outgroup is generally lower in the Altruistic than in the Egoistic treatment, it seems the gap gets smaller when the outgroup has more resources. Model (2) of Table 5 confirms that there is a significant positive interaction between the Altruistic treatment and the outgroup resources on the level of attacks against it. Hence, in line with Hypothesis 3, the outgroup resources is more important for altruistic rather than egoistic violence.

Table 5. Standardized coefficients from multilevel negative binomial regression analyses of the level of attacks by a subject against an outgroup at round t

	(1)	(2)	(3)	(4)
Altruistic treatment	-0.371***	-0.594***	-0.483***	-0.648***
	(0.0707)	(0.0771)	(0.0704)	(0.0757)
Level of attacks by the outgroup $_{t-1}$	0.208***		0.196***	0.189***
	(0.0223)		(0.0219)	(0.0218)
Altruistic treatment × Level of attacks by the outgroup $_{t-1}$	0.103**		0.0908**	0.0925**
	(0.0327)		(0.0319)	(0.0319)
Outgroup resources		0.158***	0.156***	0.413***
		(0.0222)	(0.0249)	(0.0330)
Altruistic treatment × Outgroup resources		0.194***	0.177***	0.159***
		(0.0324)	(0.0358)	(0.0361)
Level of attacks by other ingroup members $_{t-1}$			-0.00487	0.0193
			(0.0330)	(0.0335)
Altruistic treatment × Level of attacks by other ingroup members $_{t-1}$			0.238***	0.227***
			(0.0457)	(0.0460)
Constant	2.164***	2.217***	2.193***	2.639***
	(0.0504)	(0.0545)	(0.0507)	(0.0932)
$\ln(\alpha)$	1.133***	1.112***	1.109***	1.091***
	(0.0145)	(0.0139)	(0.0146)	(0.0146)
var(subject)	0.302***	0.376***	0.273***	0.320***
	(0.0367)	(0.0420)	(0.0362)	(0.0395)
Round fixed effect	No	No	No	Yes
Observations	15140	16340	15140	15140

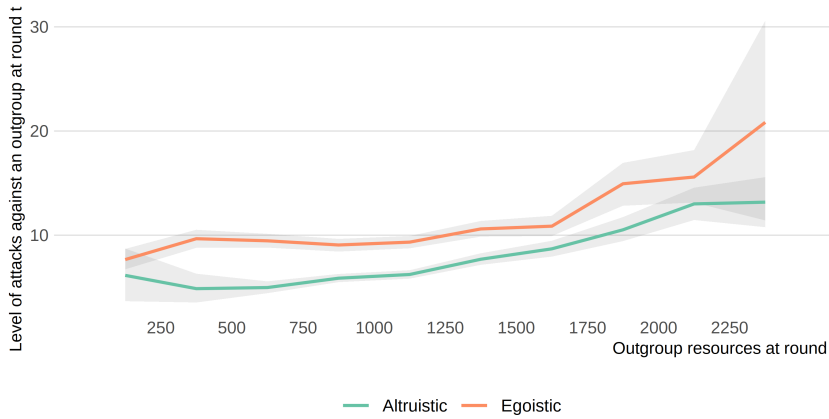
Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Combined analysis of the conditions

Model (3) includes the three variables relative to our hypotheses (and their respective interaction terms with the experimental treatment). The model confirms previous results. The level of attacks is generally higher in the Egoistic treatment. Only in the Altruistic treatment, the level of attacks is positively related to the level of contribution in attacks by the other ingroup members. In both treatments, subjects attack more outgroups that previously attacked the ingroup and that are rich. But both these effects are stronger in the Altruistic treatment. The results are unchanged when controlling for round fixed effects in model (4).

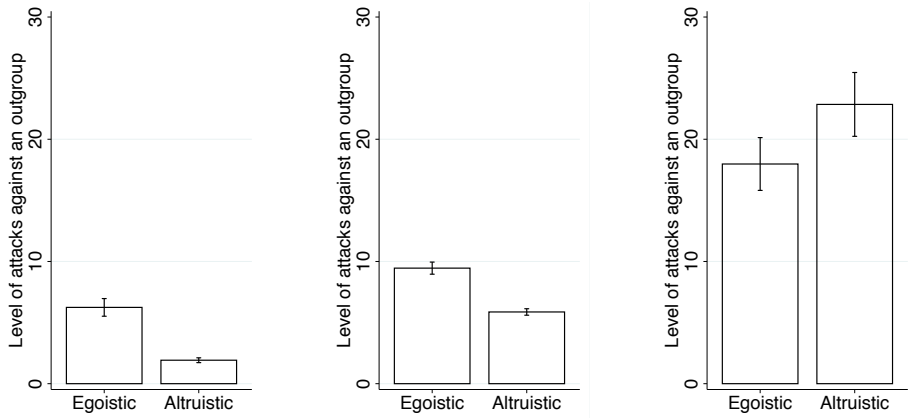
Based on model (4), we compute predictions of the level of attacks against an outgroup depending on these three variables. In Figure 7(a),

Figure 5. Mean level of attacks against an outgroup depending on the outgroup resources, with 95% confidence interval



we show the predicted level of attacks against an outgroup at round t in the Egoistic and Altruistic treatments at *lower decile* values for the level of attacks by other ingroup members at $t-1$, the level of attacks by the outgroup at $t-1$ and the outgroup resources. The predictions confirm that, in these conditions, the level of attacks against an outgroup is significantly higher in the Egoistic treatment. Figure 7(b) displays similar predictions based on *median* values for the three variables of interest. Again, the level of attacks is significantly higher in the Egoistic treatment. This suggests that, as a general rule, egoistic motives generate more conflict that altruistic motives. Finally, Figure 7(c) shows similar predictions at *upper decile* values for the three variables of interest. Now, the predictions indicate that, in these specific conditions, the level of attacks against an outgroup is significantly higher in the Altruistic treatment. This indicates that when the three conditions identified by our hypotheses are gathered – members of the ingroup contributed in attacks at t-1, the outgroup attacked the ingroup at t-1, and the outgroup is rich – altruistic motives generate more conflict than egoistic motives.

Figure 6. Predicted level of attacks against an outgroup, with 95% confidence intervals



(a) At lower decile values for *previous attacks from other ingroup members*, *previous attacks from the outgroup* and *outgroup resources*

(b) At median values for *previous attacks from other ingroup members*, *previous attacks from the outgroup* and *outgroup resources*

(c) At upper decile values for *previous attacks from other ingroup members*, *previous attacks from the outgroup* and *outgroup resources*

Discussion

Our results state that egoistic motives produce about 40% more attacks than altruistic motives. In itself, this finding may not be such a surprise and confirms large evidence on the impact of opportunity costs in fueling civil wars (Collier and Hoeffler 2004; Jakobsen et al. 2013). The proportion found – egoistic motives are responsible for $3/5$ of violence – needs confirmations, since the experiment remains hard to generalize to real violence across the world. In particular, in order to distinguish "pure" altruistic and egoistic motives, our experiment does not include intragroup dynamics in the form of costly punishment of other ingroup members nor in the form of intragroup communication. Altruistic punishment has been shown to be an important cause of contribution in public good games in general (Fehr and Gächter 2002), including the IPD (Rebers and Koopmans 2012). In a similar vein, allowing intragroup communication has been shown to increase contribution in attacks in the IPD (Goren and Bornstein 2000). Hence, it is likely that taking in account intragroup dynamics would lead to a higher level of attacks in the Altruistic treatment. In contrast, as attacking in the Egoistic treatment triggers retaliation from

the outgroups, such behavior may be seen as a form of defection that is detrimental for the ingroup. Hence, we can expect that attacks in the Egoistic treatment would be reduced when including the possibility to punish other ingroup members and intragroup communication. This means that taking into account intragroup dynamics would presumably reduce the absolute difference in the levels of egoistic and altruistic attacks.

Conversely, the framing of the present experiment may have favored altruistic over egoistic attacks. Weisel and Zultan (2021) found that presenting the IPD as a function of aggregate group decisions favors parochial aggression, as compared to presenting the game at the individual level. Our game was clearly presented in a group-level perspective. In particular, subjects had detailed information on their group's aggregate resources, including a plot of progression of each group, which framed the game as a between-groups race (see the instructions and screenshots in the online appendix). Hence, it is possible that subjects would have attacked less in the Altruistic treatment if the game was framed at the individual level.

What is more interesting is that the experiment provides clues on the conditions that affect the likelihood of altruistic versus egoistic attacks to happen. In our experiment, while egoism systematically leads to high levels of attacks, parochial altruism leads to such levels of attacks only when all three specific conditions are met: i) when the other member of the group are also parochial altruists, ii) when the ingroup is attacked by an outgroup and iii) when the outgroup is rich. Once these three conditions are gathered, parochial altruism produces slightly more attacks than egoism. In all other situations, egoistic violence prevails. When none of these conditions are gathered, altruistic violence is almost nihil, while egoistic violence remains steadily high. Although intragroup dynamics and the framing of the experiment may affect the absolute difference between altruistic and egoistic violence, we have no reason to believe that these factors would affect the differential effect of the three conditions we identified.

Our results shed some light on the scientific debate about the difference between aggression and defense. Various studies – either based on experiments (De Dreu et al. 2016; Yang et al. 2020) or historical records from human warfare (Rusch 2013; De Dreu et al. 2016) – indicate that

individuals are more likely to cooperate and commit extreme sacrifice for ingroup defense than for aggression. Furthermore, simulation results indicate that altruism is more likely to evolve for defense than for aggression (Rusch 2014). This leaves open the question why individuals participate in aggression at all. Our results suggest that egoistic motives could play an important role in the explanation of aggression. We found that subjects are more likely to condition their attacks to previous attacks from outgroups in the Altruistic than in the Egoistic treatment. Thus, subjects are more likely to be involved in first strikes when they have egoistic incentives to participate in conflict. This matches with the finding from Doğan et al. (2018) that privileged individuals that benefit from conflict spoils are more likely to support aggression, irrespective of pre-existing intergroup relationships. The view that egoistic and altruistic motives are differently involved in aggression and defense matches with results about the biological processes at play during team contests (an overview of findings is presented in De Dreu et al. 2020). At the hormonal level for instance, results suggest that administration of oxytocin – a hormone associated with pair-bonding and cooperation – is related to defensive contributions in intergroup contests. In contrast, some studies indicate that testosterone – a hormone involved in status seeking – may relate with outgroup aggression.

The present experiment has several potential limitations. Firstly, are attacks in the Egoistic treatment only motivated by egoistic motives? In conceiving the Egoistic treatment, we relied on the assumption that, to be qualified as parochial altruistic, an individual must care for the welfare of other ingroup members. Following this assumption, attacks in the Egoistic treatment can hardly be considered as parochial altruistic since they have no net benefit to other ingroup members. One remaining possibility is that subjects commit attack for altruistic reasons in the Egoistic treatment in order to decrease the threat posed by outgroups to the ingroup. We cannot rule out this possibility. However, as this motivation is equally present in the Altruistic treatment (in addition to the net benefits to the other ingroup members), the higher level of attacks in the Egoistic treatment can only be due to egoistic motives.

Still, another assumption is to consider that a parochial altruistic subject cares about the ”average” welfare of the ingroup – including the subject. In this view, attacking in the Egoistic treatment can be considered as altruistic

since it has the same net effect on the ingroup's aggregate resources than attacking in the Altruistic treatment. However, this assumption is hardly tenable as it equates to considering that criminal actions committed during wars that only benefit the perpetrator such as extortion and rapes are altruistic in nature. Moreover, additional results presented in the online appendix indicate that subjects have understood the experiment the way we wanted. After the experiment, subjects were asked whether they perceived themselves as "cooperative" during the game. Results show that self-assessment of cooperativeness is positively related to overall contribution in attacks in the Altruistic treatment, while it is not in the Egoistic treatment. This indicates that: (a) subjects intuitively endorsed a parochial rather that universal approach to cooperation – they do not perceive harm inflicted to outgroups as a form of non-cooperativeness – and (b) subjects perceived attacks as good for the ingroup in the Altruistic treatment and indifferent for the ingroup in the Egoistic treatment, as we expected (see Table 3 about strategies in the game). This suggests that subjects endorse our vision of cooperativeness as behaviors that are beneficial to other ingroup members rather than to the "average" welfare of the ingroup.

Secondly, our experiment is complex. In particular, the game is repeated and payoffs are path-dependent. This has the benefit of reflecting the fact in real life groups are involved in sequential interactions which affect their future resources. Indeed, one the criticisms addressed to the IADC (De Dreu et al. 2016) is that it artificially separates aggressors from defenders (see for instance Rusch and Böhm 2019), and thus obliterates the fact that defensive strategies often rely on aggression. Repetition and path-dependency in our game precisely grasp this aspect. Repetitions allow for retaliatory aggression and path-dependency allows for pre-emptive strikes, which are two major forms of defensive aggression (Böhm et al. 2016). However, this comes with the cost of blurring the interpretations of results. Except the main treatments, the factors under analysis – contributions from other ingroup members, attacks from outgroups and outgroup resources – all evolve endogenously in the experiment. Since all these factors can interact, this makes the interpretations of the motivations of subjects less clear than if these factors were exogenously manipulated. Thus results should be confirmed by future experiments. In particular, future research could assess whether the

effect of the Egoistic (versus Altruistic) treatment on attacks is moderated by exogeneous conditions that have already proven to affect behaviors in the IPD – such as intra-group communication (Goren and Bornstein 2000), induced intergroup relative deprivation (Halevy et al. 2010), and sequential moves (Böhm et al. 2016).

Finally, control group data on the Altruistic treatment was drawn from the study of Varaine et al. (2021), which implies that there was no random assignment between the main treatments. This is, however, unlikely to affect the results. Indeed, experimental sessions with the Egoistic treatment took place just two months after the sessions of the Altruistic treatment, with the exact same recruitment procedure, location, software and instructors, but ensuring that no subject could participate in both treatments. As presented in the results, demographics of participants do not differ across treatments. Besides, behaviors were convergent across the different sessions of each treatment (see results in the online appendix), which suggest that findings are not driven by specific experimental sessions. Yet, it would be necessary to replicate the results in future experiments using random assignment between Egoistic and Altruistic treatments.

Relationship with studies on real-world conflicts

Are our experimental findings congruent with findings from real-world conflicts and what are their potential implications? Our results contrast with the findings of Ginges and Atran (2009) that parochial altruism prevails over personal incentives. Actually, our experiment suggests that these findings may be due to the specific study field of West Bank and Gaza, that gathers the three specific conditions breeding altruistic violence. Indeed, i) West Bank and Gaza have the highest popular support of suicide bombings in the world (Sharvit et al. 2015; Kohut and Bell 2013), which indicates a strong collective commitment to the Palestinian cause, ii) the Palestinian people is subject to expropriation and discrimination from Israeli authorities, iii) Palestinian insurgents are in an asymmetric position and fight against a rich outgroup. Hence, our results suggest that the finding from Ginges and Atran (2009) that parochial altruism prevails is in fact an exception that will not apply to most intergroup conflicts.

The three conditions for altruistic violence highlighted by our experiment resonate with previous studies on parochial altruism, which give credence to the external validity of our findings. The fact that subjects condition their contribution in altruistic violence to the contribution of other ingroup members clearly resonates with results from identity-fusion theory (Swann et al. 2012), indicating that a precondition for engagement in parochial altruism are visceral social bonds with their group (Whitehouse 2018). For instance, Whitehouse et al. (2014) find that, among Libyan revolutionaries in 2011, front-line fighters felt more close to their battalion than to their own family.

We also found that these cohesive groups are likely to engage in violence when they are attacked by another group and in an asymmetric position. The policies led in Germany and in Italy against the ”communist threat” in the 60s are an important element to explain why radical movements have chosen violent action (Della Porta 2006). Similarly, high levels of discrimination of Muslims associated to military involvement in Muslim countries are strong predictors of Islamic deadly attacks (McCauley 2018, Nesser 2019, Egger et al. 2020).

Egoism and altruism and the distinction between civil war and terrorism

More generally, our results bring clarity to the inconsistent results of empirical studies on terrorism and civil war. Terrorism is commonly defined as the use of violence by sub-national actors for achieving political aims (Krueger 2017). Civil wars are internal conflicts with more than 1,000 deaths in a single year involving a sub-national organization and the government (Collier and Hoeffler 2004, p. 565). As noticed by several scholars (Findley and Young 2012; Boulden 2009; Sánchez-Cuenca and De la Calle 2009), the two concepts seem largely overlapping, and could hence reflect a simple difference in degree – i.e. once terrorism reaches a certain scale, it is called a civil war. Yet, empirical studies indicate that they have very distinct structural causes, and thus that they capture phenomena of different nature.

On the one hand, a large empirical strand of literature compares the relative impact of ”greed” and ”grievances” in engagement in civil wars (Collier and Hoeffler 2004; Hoeffler 2011). Greed is a metaphor to designate engagement by private gains. It is the equivalent of what we called egoistic motives. Grievances in contrast refer to the public good aspect of rebellion. What we called altruistic motives are close to

this aspect[8]. Interestingly, studies on actual civil wars consistently find that greed prevails over grievances. In particular, poverty and resources available for extortion are a strong predictors of civil war (Collier and Hoeffler 2004; Fjelde 2015; Fearon and Laitin 2003) and of individual engagement in violence during civil war (Humphreys and Weinstein 2008). In addition, factors associated with grievances (e.g. low political rights, ethnic and religious fractionalization) have a low predictive power on civil wars.

On the other hand, the literature on terrorism shows that the level of poverty has no effect on terrorism (Krueger 2017; Piazza 2006; Sambanis 2008), and studies on terrorists' profiles indicate that most of them are not drawn from poor economic backgrounds (Krueger and Malečková 2003; Sageman 2004; Clark 1983; Speckhard and Ahkmedova 2006; Russell and Miller 1977), that is the main proxy for low opportunity cost. In contrast, factors associated with grievances, such ethno-political discriminations (Piazza 2011, 2012; Ghatak 2016; Ghatak and Gold 2017; Ghatak and Prins 2017; Ghatak et al. 2019; Mitts 2019), are of major influence. This maps with the view that involvement in terrorism generally results from altruistic motives (Krueger 2017).

Hence, the differences in the causes of civil war and terrorism may be due to the fact that they generally imply different motives of intergroup conflict. In civil wars, actors are (mainly) involved for egoistic motives; while terrorists are (mainly) involved for altruistic motives. For that reason, terrorism is generally limited in scale. In this regards, in 2017, it is estimated that around 90,000 people died from political violence in 2017 – among which around 65,000 in civil wars (Pettersson and Eck 2018). The same year, about 27,000 deaths were due to terrorism (National Consortium for the Study of Terrorism and Responses to Terrorism (START) 2017).

When does terrorism lead to a civil war? What our results suggest is that for terrorist groups to reach a certain scale and longevity, and eventually lead to a civil war, they must provide egoistic incentives to their recruits. In this line various clues suggest that the preeminence of altruistic involvement becomes less true when looking at large terrorist groups that have means to offer incentives to their recruits. For instance, it has been noticed that members of the *Óglaigh na hÉireann* (Irish Republican Army, IRA) were disproportionately coming from the working class (Russell and

Miller 1977). This may be connected to the large financial means of the organization, relying on its links with organized crime (Woodford and Smith 2018). Similar observations have been made of the membership of large terrorist groups such as the *Fuerzas Armadas Revolucionarias de Colombia* (Revolutionary Armed Forces of Colombia, FARC), the *Demaḷa īḷām vimukti koṭi* (Liberation Tigers of Tamil Eelam, LTTE) and the *Partiya Karkerên Kurdistanê* (Kurdistan Workers' Party, PKK) (Hudson 1999). It seems not a coincidence that these groups have large financial capabilities: all three organizations were involved in drug dealing and other criminal activities to fund their struggle (Roth and Sever 2007; Norman 2018; Sahin 2001).

More recently, it has been noticed that European jihadists have much lower socio-economic backgrounds than usually observed in terrorism studies (Rekawek et al. 2018; Hegghammer 2016; Basra and Neumann 2016; Hecker 2018). Again, this is likely to be due to the capacities of jihadist groups operating in Syria and Iraq to offer incentives to recruits. On the top of it, *ad-Dawlah al-Islāmiyah fī 'l-'Irāq wa-sh-Shām* (Islamic State of Iraq and the Levant, ISIS) had large sources of revenues – at a first stage through bank theft, hostage taking and oil takeover; and at a second stage through antiquity sale, human trafficking, and taxation of local populations (Pagliery 2015) – and hence could promise salaries and commodities to its recruits. Comforting this view, the search for an employment and for fulfilling basic needs appear among the most common expressed motivations to join the group among former ISIS members, at a similar frequency than the group ideology (Speckhard and Ellenberg 2020). This may explain the relationship between national Muslim youth unemployment and the number of foreign fighters joining ISIS observed by some studies (Gouda and Marktanner 2019; Verwimp 2016).

Hence, it appears that the dominant motivations of recruits shift from altruistic to egoistic once terrorist groups attain a certain size and financial capacity. In turn, this growth in size of groups should lead to a decrease in altruistic involvement: the larger the group the less likely that family-like bonds emerge among all of its members. What this means is that altruism alone is not enough for violence to reach a certain scale. Altruism may well lead to the commission of spectacular illegal and violent acts in certain circumstances, but it may not lead – at least alone – to the onset of a civil war. Krueger (2017) summarizes this general view:

> ”Beyond a certain size, the additional recruits tend to be motivated more by pay and less by ideology; these tend to be people of lower socioeconomic status. For a civil war to occur, a terrorist or insurgent group must reach a certain scale. In this event, the organization is composed not only of those who care deeply about the cause but also mercenaries” (Krueger 2017, p. 47-48).

Notes

1. Uncertainty is slightly lower in the Egoistic treatment because each action does not directly affect the payoff of the other members of the ingroup.
2. The random endowment is determined by three economic conditions. Every five rounds, each group is randomly assigned to one of three economic conditions with equal probabilities: in the improving condition, subjects have an endowment of 6% of their resources in points by round; in the stable condition, subjects have an endowment of 2% of their resources in points by round; in the declining condition, subjects have a negative endowment of -2% of their resources in points by round. Groups draw a new economic condition every five rounds.
3. The endowment was implemented to test hypotheses about parochial altruism in a previous study, focusing only on the Altruistic treatment, see Varaine et al. (2021). We also implemented a random endowment in the Egoistic treatment to ensure strict comparability of the data from the Egoistic treatment with data of the Altruistic treatment taken from the previous study of Varaine et al. (2021). Note that controlling for the endowment assigned to subjects has no effect on the results of the present paper (see the online appendix).
4. Gender (Fishers's exact, $p = .478$), occupation ($\chi^2_{(3,N=300)} = 1.3805, p = .710$), age ($t_{(298)} = 0.3373, p = .736$) and education ($\chi^2_{(4,N=300)} = 8.3638, p = .079$)
5. Indeed, when subjects have resources lower than 50 points, this mechanically reduces their potential level of attacks. Besides, the elimination of a group may bias the level of attacks, since subjects of other groups have fewer potential targets. Over 4,500 observations (300 subjects $\times$ 15 rounds), we dropped 415 observations; thus in the next analyses $N = 4,085$. Note however that we obtain similar results when including all observations. Results can be sent by the authors upon request.
6. This type of regression is appropriate for the present data since the dependent variable is a count with over-dispersion (variance higher than the mean). Note however that we obtain similar results based on multilevel linear regression models.
7. The data thus include a total of 18,000 observations (300 subjects $\times$ 15 rounds $\times$ 4 outgroups), from which we dropped 1,660 observations (415 subjects at a given round $\times$ 4 outgroups) for reasons detailed in footnote 5; thus in the next analyses $N = 16,340$. Note again that we obtain similar results when including all observations in the analyses. Results can be sent by the authors upon request.
8. Even though, in the common meaning, grievances refer to hostility towards an outgroup, while altruism requires allegiance to the ingroup. Actually, our results suggest that altruistic attacks need both aspects. On the one hand, altruism motivates attacks when the ingroup is attacked by

an outgroup and when the outgroup is richer. These determinants can be associated to hostility towards an outgroup. On the other hand, altruistic attacks also increase when the members of the ingroup have already attacked, and this should be understood as a group allegiance, rather than associated with grievances.

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Egoism and Altruism in Intergroup Conflict

Online Appendix

1. Instructions of the experiment

Note: Instructions specific to the Altruistic treatment are highlighted in blue / instructions specific to the Egoistic treatment are highlighted in pink.

1.1. General instructions

Hello and thank you for your participation in our study.

In order to preserve anonymity during the session and when analysing the data, we have assigned you a code. No identifying data will be collected. It will be impossible to link your decisions to your name. The data will only be used for academic research purposes, always respecting anonymity.

Any communication between participants is strictly prohibited, as is any comment on what is appropriate or inappropriate to do during the experiment. Please turn off your cell phones. We ask you to stay focused on your own computer screen. During the session, you will have to make simple decisions. Nevertheless, if you face any problem, please do not hesitate to consult us.

During the session, you will have to perform several tasks. Three phases will take place: First, you will participate in a word creation game, then you will engage in an economic group game, and finally you will be asked to fill out a questionnaire. A new phase will only begin when all participants have finished the previous phase. We will give you instructions before the beginning of each phase. For everyone's understanding, these instructions will be read aloud. The duration of this session will not exceed two hours.

You have 10 euros in cash for your participation. You will find this amount in your personal envelope. This sum is yours. In addition to this amount and depending on the choices you make, you can earn more money throughout the games. You will be informed of your final earnings at the end of the session.

Do you have any questions?

1.2. First task

We will now begin the first phase: the word creation game.

[See instructions in Brüggemann, J., Crosetto, P., Meub, L., & Bizer, K. (2016). Intellectual property rights hinder sequential innovation. Experimental evidence. Research Policy, 45(10), 2054-2068.]

1.3. Intergroup prisoner dilemma

You have now completed the word creation game. Therefore, we are going to move on to the economic group game.

In this new game, you will be divided into 5 groups of participants depending on your ranking in number of points during the word creation game:

- The top three players will be in the yellow group.
- The next three in the red group.
- The next three in the purple group.
- The next three in the blue group.
- The last three players in the green group.

You will be part of the same group throughout the game.

In this new game, you have a number of individual points: your personal prize pool. At the beginning of the game, your prize pool contains 10 times the number of points you won during the word-creation game.

The game is composed of 15 successive rounds. In each round you must decide how many points you want to take from other groups to give them to your group.

Taking points from another group has a cost: to take 1.5 points from a group, you must spend 1 point of your personal prize pool. In that case :

- You take 1.5 points from the other group, that is 0.5 points per player from this group.
- You give 1.5 points to your group, that is 0.5 points per player in your group (including you).

- You take 1.5 points from the other group, that is 0.5 points per player from this group.
- You give 1.5 points to your personal prize pool.

There is a limit to the number of points you can spend to take points from other groups: you can not spend more than 50 points of your personal prize pool per turn.

[Show Figure 1a or Figure 1b]

Here is a capture of the game screen. The screen is framed by the colour of your group. In this example, you are part of the blue group. At the top of the screen, you see information about the situation of your group and the other four groups. At the top left, you see a graph that shows the number of points of each group in previous rounds. At the top centre, you have the total number of points of each group in the round being played. At the top right, you have the weather: I'll explain what it means a little later. In the middle of the screen, you see piles of coins. The pile on the left is your personal prize pool. You see that here you have 500 points. The piles on the right each correspond to another group from which you can take points. It is at the level of these piles that you will have to indicate your decisions. You must choose how much you want to take from each of the other groups to give to your own group. To do this, you must click on each of the piles corresponding to the other groups and decide how many points you want to take. It is imperative to click on each pile, even when you decide to take away zero points, in order to validate your decision. You have a limited time to choose how many points you want to take from each of the other groups: you have 45 seconds to indicate your choices. After this time, if you have not indicated a decision for one or more groups, the computer will randomly decide how much you take from each of them. It is therefore important to validate your decisions quickly. To help you, you have a little extra-time in the first round.

[Show Figure 2a or Figure 2b]

Let's see an example. Say you want to take 45 points from the red group to give them to your group. Say you do not want to take points from other groups. In practice, you have to click on each of the piles to select the amount you want to take from each group: zero for groups green, purple and yellow and 45 points for the red one. As you can see, your decision is summarized below: to take 45 points from the red group and give them to your group, you spend 30 points of your personal prize pool. The 45 points you take from the red group will be evenly distributed in your group: 15 points for you and 30 for the other

Figure 1: Screenshot Decision page 1

(a) Altruistic treatment



(b) Egoistic treatment

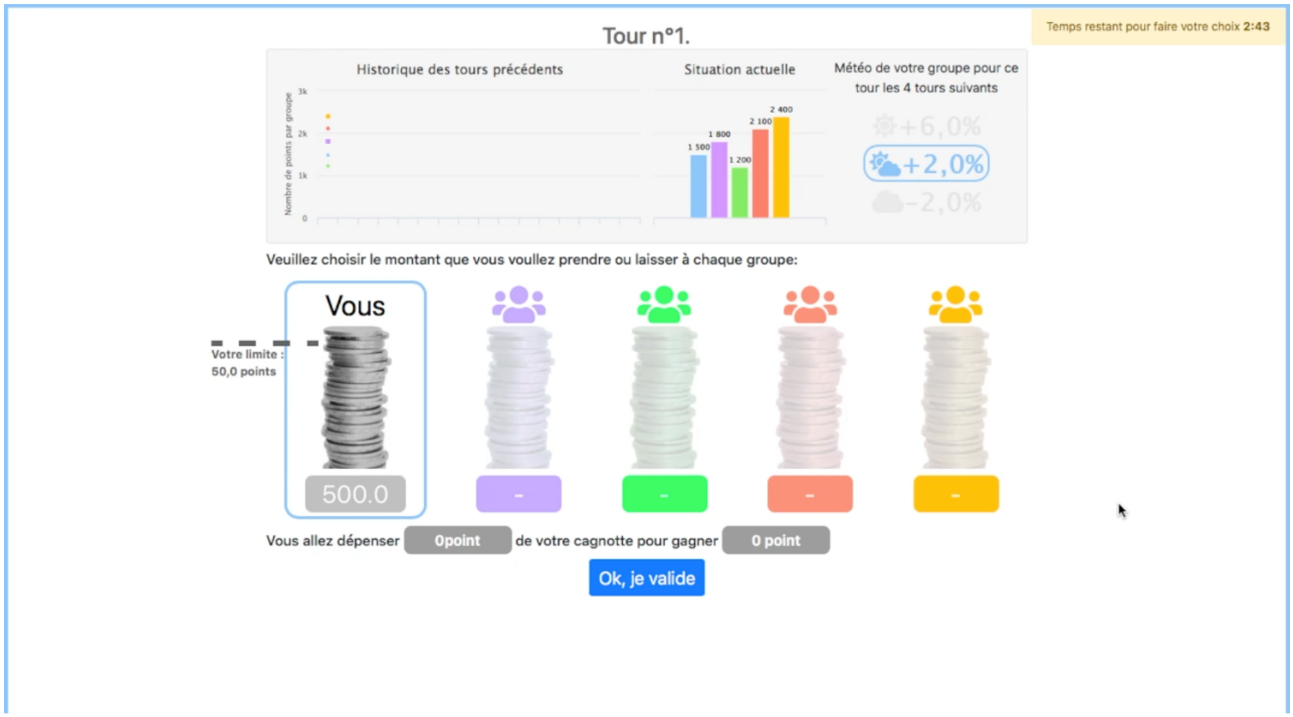


Figure 2: Screenshot Decision page 2

(a) Altruistic treatment



(b) Egoistic treatment



two players in your group. Once you have indicated your choices, you must click on validate.

Let's see an example. Say you want to take 45 points from the red group and add them to your personal prize pool. Say you do not want to take points from other groups. In practice, you have to click on each of the piles to select the amount you want to take from each group: zero for groups green, purple and yellow and 45 points for the red one. As you can see, your decision is summarized below: to take 45 points from the red group and add them to your prize pool, you spend 30 points from your prize pool. Once you have indicated your choices, you must click on validate.

At the end of each round, your personal prize pool will increase or decrease depending on your choices and those of other players. But not only ... Chance will determine a part of your gains and losses.

In practice, every 5 rounds, the chance will decide the weather of your group for the next rounds. You will be randomly assigned to one the following weather conditions: - Good weather: your prize pool will increase by 6% at the end of each round. - Average weather: your prize pool will increase by 2% at the end of each round. - Bad weather: your prize pool will decrease by 2% at the end of each turn.

Each turn, the weather will affect your prize pool after the calculations related to your choices and those of the other players.

[Show Figure 3a or Figure 3b]

Let's go back to the game screen. After validating your decision and once everyone has played, the results page is displayed. At the top of the screen, you still see information about the situation of your group and the other groups. This information has been updated based on the results of the tour that has just been played.

In the middle of the screen, you now see a summary of the gains and losses of your group of the round that has just been played. In this example, you see on the left that the green group has taken 30 points from your group overall - that is 10 points per player in your group, including you.

As for you, you have given 45 points to your group - 15 points per player - by taking them from the red group.

As for you, you have earned 45 points by taking them from the red group.

For that purpose, you spent 30 points of your personal prize pool.

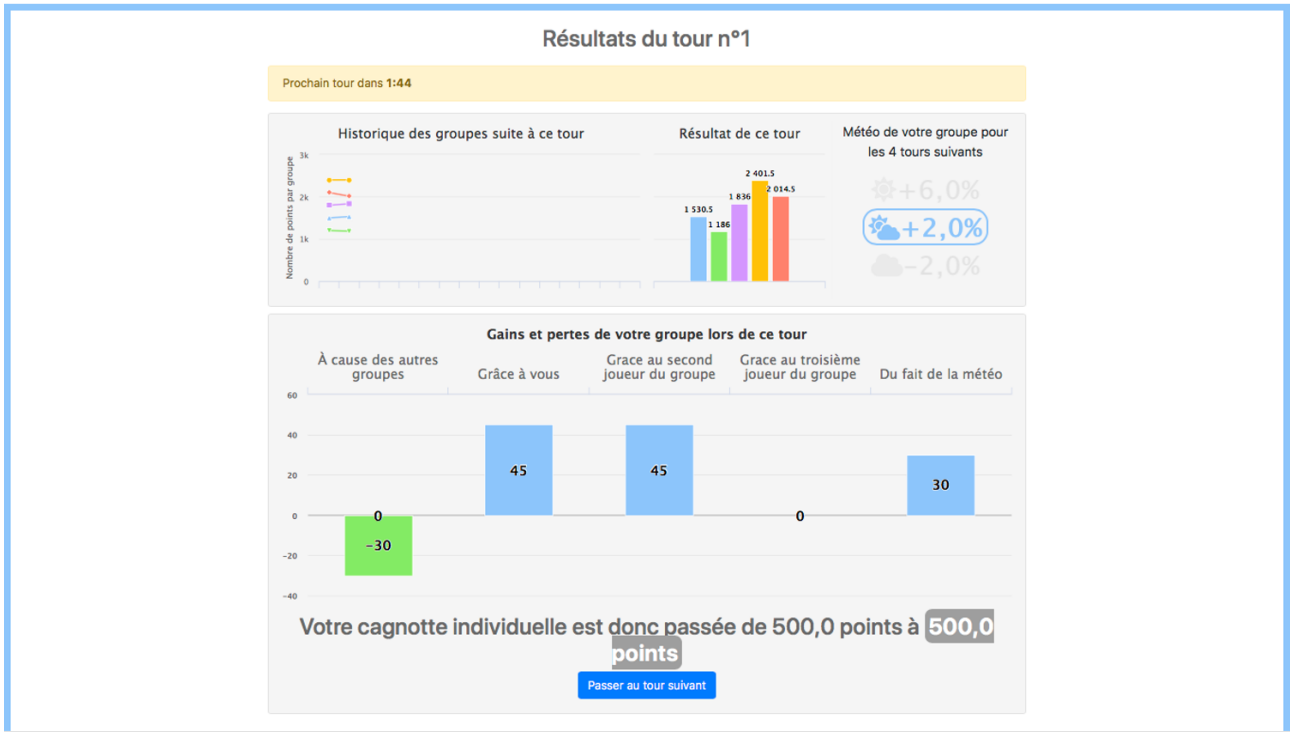
On the right, you see that another player in your group has also given 45 points to your group by taking them from another group. Then you see that the third player in your group has not brought points to your group by taking to other groups.

On the right, you see that another player in your group has also earned 45 points by taking them from another group. Then you see that the third player in your group has not taken points from other groups.

Finally, on the far right, you see that the weather, which is of +2% for your group, has brought 30 points to your group.

Figure 3: Screenshot Result page

(a) Altruistic treatment



(b) Egoistic treatment



Finally, at the end of this round, your personal prize pool after these different calculations is 500 points. Indeed, you spent 30 points to take points from the red group. You have gained 15 points from this action and 15 points thanks to another player in your group. This compensates. In addition, you have lost 10 points because of the green group and gained 10 points because of your weather. This also compensates. Therefore, you still have the same number of points.

Finally, at the end of this round, your personal prize pool after these various calculations is 515 points. Indeed you spent 30 points to take points from the red group. You have gained 45 points for this action. This gives you a profit of 15 points. On the other hand, you have lost 10 points because of the green group and gained 10 points because of your weather. This compensates. So you have gained 15 points in total, a new personal prize pool of 515 points.

At the end of the 15 rounds, you will see the number of points accumulated in your personal prize pool.

Thus, in this new part you put into play your gains of the word creation game.

At the end of the game, the number of points in your personal prize pool will be divided by ten, and this score will determine your final gains in Euros, at the conversion rate of 1 POINT = 0.25 Euros.

This final amount will be added to the 10 Euros in you envelope.

Do you have any questions?

1.4. Questionnaire and end of experience

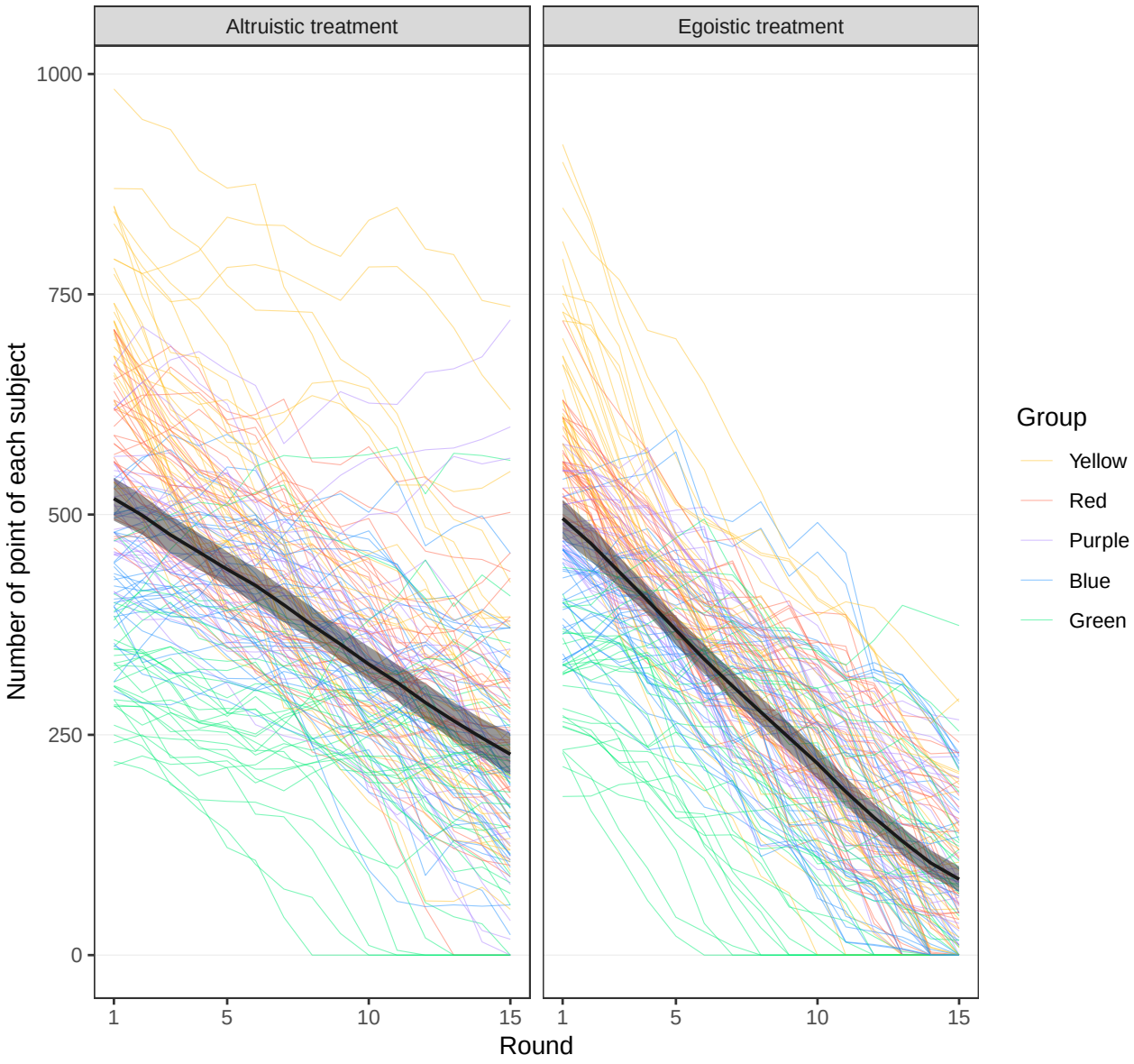
Now that you have completed the economic group game, we will ask you to complete a brief questionnaire.

Once this questionnaire is completed, we will call you to proceed to the payment.

We thank you for participating in this study.

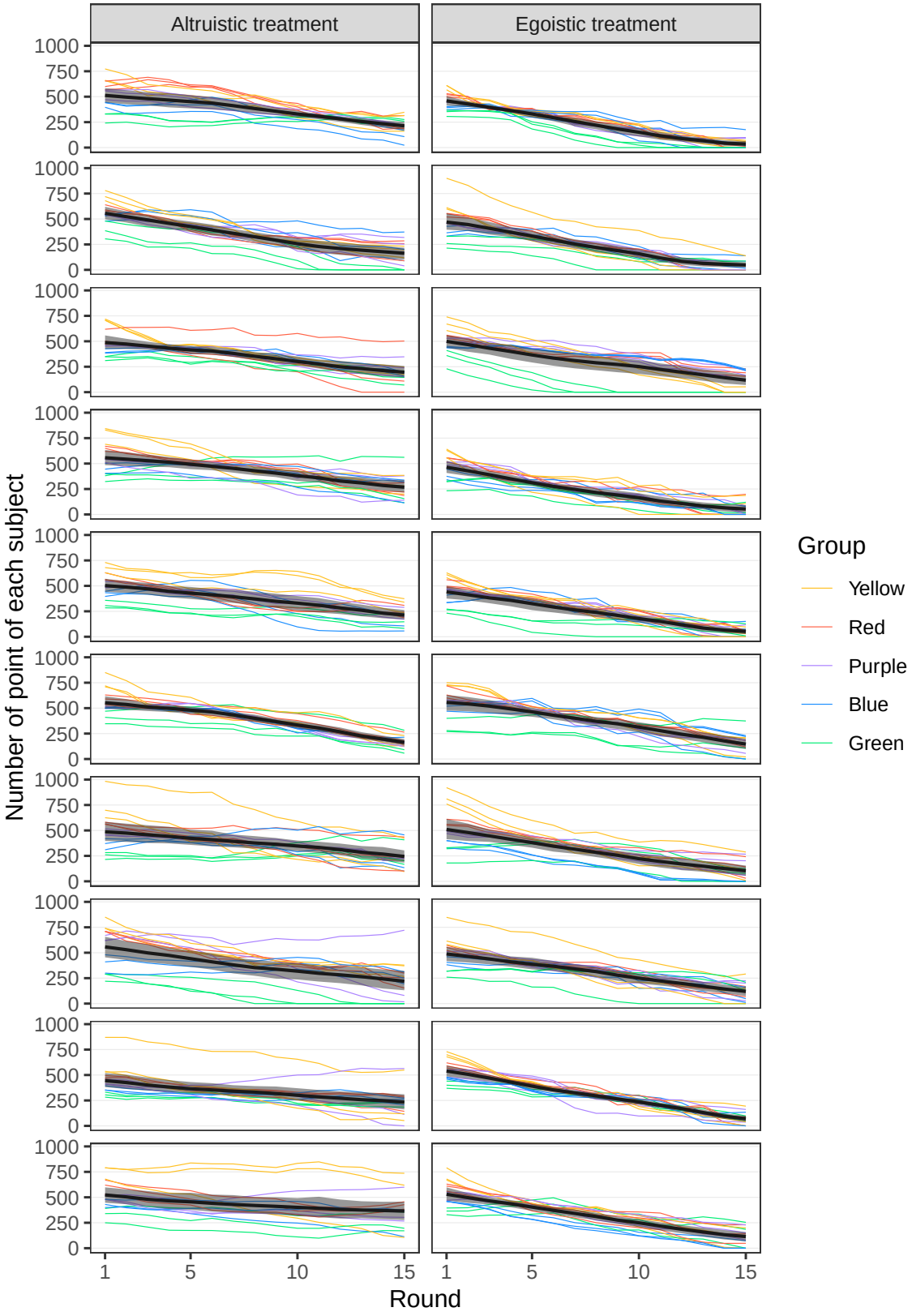
2. Variation of the resources in points of subjects during the game

Figure 4: Subjects' number of points by round, across treatments.



For each treatment, all sessions are pooled together. Each thin line represents the evolution of the resources in points of a given subject during the game. A line at zero on the Y-axis denotes a subject's bankruptcy. The lines are colored according to the group to which the subject belongs: as a reminder, in each session, subjects are divided in 5 groups of 3 subjects, depending on individual resources earned on a previous task (see the instructions). The thick black lines represents the average subjects' resources in point. The Figure shows that in both treatments, resources on average decline during the game, due to contributions in attacks. The decline is sharper in the Egoistic treatment, due to higher levels of attacks. Relatedly, bankruptcy is more common in the Egoistic treatment.

Figure 5: Subjects' number of points by round, across experimental session.



Same reading as Figure 4, except that each box represents an individual session. The Figure shows that trends are similar across sessions of each treatment. All sessions of the Egoistic treatment ended with an average level of individual resources lower than that of the Altruistic treatment.

3. Results controlling for subjects' resources and random endowment

Table 1: Standardized coefficients from mixed-effects negative binomial regression analyses of the level of attacks against an outgroup

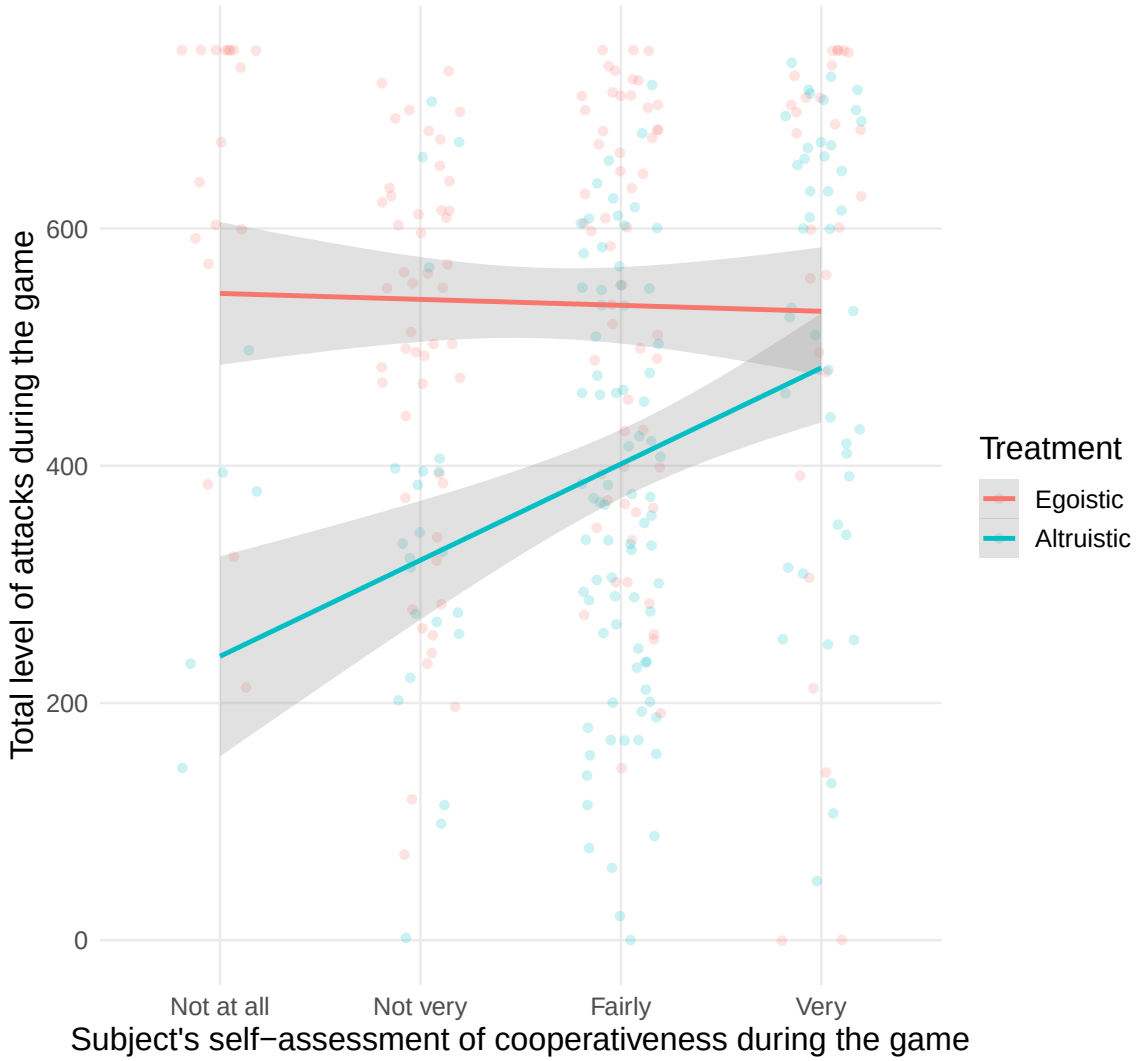
	(1)	(2)	(3)	(4)	(5)
Altruistic treatment	-0.638***	-0.638***	-0.646***	-0.622***	-0.610***
	(0.0786)	(0.0787)	(0.0761)	(0.0905)	(0.0927)
Level of attacks by the outgroup $_{t-1}$	0.188***	0.188***	0.189***	0.189***	0.189***
	(0.0219)	(0.0219)	(0.0219)	(0.0219)	(0.0219)
Altruistic treatment × Level of attacks by the outgroup $_{t-1}$	0.0933**	0.0933**	0.0917**	0.0918**	0.0928**
	(0.0320)	(0.0320)	(0.0320)	(0.0320)	(0.0320)
Outgroup resources	0.415***	0.413***	0.416***	0.416***	0.417***
	(0.0331)	(0.0399)	(0.0330)	(0.0330)	(0.0400)
Altruistic treatment × Outgroup resources	0.156***	0.158***	0.158***	0.158***	0.156***
	(0.0366)	(0.0470)	(0.0361)	(0.0361)	(0.0472)
Level of attacks by other ingroup members $_{t-1}$	0.0195	0.0194	0.0147	0.0132	0.0132
	(0.0335)	(0.0336)	(0.0336)	(0.0336)	(0.0337)
Altruistic treatment × Level of attacks by other ingroup members $_{t-1}$	0.229***	0.229***	0.224***	0.228***	0.231***
	(0.0462)	(0.0468)	(0.0461)	(0.0465)	(0.0471)
Subject's resources	-0.0170	-0.0152			-0.0209
	(0.0385)	(0.0499)			(0.0503)
Altruistic treatment × Subject's resources		-0.00317			-0.00175
		(0.0584)			(0.0589)
Random endowment (-2% as reference)					
+2%			0.0780	0.0812	0.0835
			(0.0435)	(0.0636)	(0.0640)
+6%			0.0754	0.111	0.112
			(0.0430)	(0.0634)	(0.0634)
Altruistic treatment × Random endowment					
+2%				-0.00440	-0.00602
				(0.0872)	(0.0875)
+6%				-0.0676	-0.0641
				(0.0867)	(0.0870)
Constant	2.619***	2.619***	2.591***	2.577***	2.551***
	(0.103)	(0.103)	(0.0961)	(0.0995)	(0.110)
lnalpha	1.091***	1.091***	1.090***	1.091***	1.091***
	(0.0147)	(0.0147)	(0.0147)	(0.0147)	(0.0147)
var(subject)	0.317***	0.316***	0.324***	0.323***	0.319***
	(0.0398)	(0.0406)	(0.0400)	(0.0400)	(0.0409)
Round fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	15140	15140	15140	15140	15140

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We test the final model of the paper – with all variables of interest – when including additional variables measuring subjects' resources in points and random endowment. As detailed in the paper, every five rounds, each group is randomly assigned to one of three additional endowment with equal probabilities: respectively adding to their resources 6%, 2% or -2% by round. Results reveal no significant effect of subjects' resources in point and random endowment on the level of attacks. No interaction effects with the experimental treatment are found. Besides, the inclusion of these variables do not change the results regarding the variables of interest of the paper.

4. Self-assessed cooperativeness and level of attacks in the game

Figure 6: Subjects' level of attacks in relation to self-assessed cooperativeness.



At the end of the experiment, subjects were asked whether they perceived themselves cooperative – using a four-point scale (from "not at all cooperative" to "very cooperative"). The Figure presents the total level of attacks of subjects during the game depending on their self-assessed cooperativeness. Regression lines indicate that subjects that perceived themselves as cooperative contribute significantly more points in attacks in the Altruistic treatment, while they did not contribute significantly more points in the Egoistic treatment. This suggests that: (a) overall, individuals do not consider inflicting harm to outgroup as a form of non-cooperation; (b) as expected, subjects perceived attacks as a form of cooperation in the Altruistic treatment, while they did not in the Egoistic treatment.