Governance and Competition

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Abstract

When groups compete against each other in contests or tournaments they typically differ with regard to the way they are organized and how decisions within groups are determined. In this paper, I experimentally investigate the impact of a group's organizational structure on inter-group contests. My results show that letting group members decide autonomously leads to significantly lower levels of competition compared to when groups are organized democratically or autocratically. Contrary to my theoretical predictions, I observe no differences between democratically and autocratically organized groups. One reason for this finding is that many individuals in the role of autocratic decision-makers do not use their power to fully exploit their subordinates. Despite this, I find that when giving group members the choice, most individuals prefer the democratic regime, which guarantees them participation in the decision-making process and protects them from exploitation.

Keywords: Conflict, competition, organizational style, voting, groups, experiment

JEL Classification Numbers: D74; C72; C92.

1 Introduction

Competition between groups is ubiquitous in nature and exist at all levels in human society. Firms competing for market shares, political parties and lobbyist groups competing for power and influence, and research groups competing for third-party funding and the development of new products are all examples of inter-group contests in which the involving parties spend scarce and costly resources to get ahead of the rivaling party. Such contests also occur within firms and organizations, which often use performance-contingent payment schemes, such as paying bonuses to the best performing team to increase productivity (Nalbantian and Schotter, 1997; Bandiera et al., 2013). The involved groups are thereby typically not created equal but differ with regard to the way they are organized and how decisions within groups are determined. For example, while some groups or organizations are best characterized by steep hierarchical structures, others have adopted rather flat hierarchies with few or no levels of management. Similarly, while some teams are led by autocratic leaders who allow only for minimal participation of others in the decision-making process, some others are led by managers who apply a more democratic leadership style that actively involves team members by asking for their advice and trying to reach consensus.

There is a common and widespread view that the way groups are organized is of vital importance for their success. Such views are confirmed by empirical studies showing that good management practices can have positive effects on organizational performance, worker motivation, and job satisfaction (e.g. Bloom and Van Reenen, 2007; Bloom et al., 2013; Bass, 2009). Yet, so far little is known about how an organization's structure and, more specifically, the decision-making process within groups affect the behavior and performance of groups when facing a situation in which they have to compete with others. Given the prevalent nature of competitive environments in everyday life, understanding the effects of the organizational form on inter-group contests is of major importance.

Studying this question imposes some challenges as real-world situations of group competition are notoriously complex with the involved parties differing along a variety of dimensions. Furthermore, the organizational styles of real groups typically have evolved endogenously, rendering a clean identification of the effect they have on competition difficult. To circumvent these problems, in the current study I make use of a controlled laboratory experiment. The major advantage of this approach is that it allows to exogenously manipulate a group's organizational form, while at the same time holding all other variables constant. This not only facilitates deriving causal evidence on the importance of the organizational structure for competition, but also allows to analyze the underlying behavioral mechanisms in great

detail, something that is hard to achieve in the field.

As a workhorse for studying the role of a group's organizational structure on competition, I use an adaption of the classic Tullock contest model (Tullock, 1967), applied to a context in which two groups compete for a prize that is divided equally among all members of the winning party (Katz et al., 1990). The probability of winning the contest for each group is equal to the proportion between its own investment and the total investments by both groups. Within this simple setup, I compare three types of organizational forms commonly observed in the field. I thereby sharply focus on the effects they have on the decision-making process within groups, and abstract from other important factors that define the specifics of real-world groups, such as an organization's corporate culture, communication, group composition and the heterogeneity of workers, and a manager's personality and charisma (see, e.g., House and Howell, 1992; Conger and Kanungo, 1998; Hamilton et al., 2003; Antonakis et al., 2004; Kotter, 2008; Fallucchi et al., 2021).

The first organizational form I consider is that of a flat or horizontal hierarchical structure under which each individual has full sovereignty to decide on their own level of investment. Such structure is quite common especially in small organizations and can further be found in teams that are led by managers who adopt a so-called laissez-faire leadership style, which is characterized by managers taking on a passive role by providing full freedom to their subordinates (Lewin et al., 1939; Rotemberg and Saloner, 1993). In my experiment, this is operationalized by letting each group member individually decide how much of their resources to invest into the competition. The second organizational structure I consider represents a situation in which all group members jointly decide on their level of investment by voting. Voting is a widespread mechanism in management boards and committees. It is further related to teams that are led by managers who adopt a so-called democratic leadership style, which actively involves all group members into the decision-making process (Gastil, 1994). In my experiment, this is implemented by letting each group member make a proposal about their preferred level of investment. Subsequently, the median proposal within each group is implemented for all members. Finally, the third organizational structure is that of a steep hierarchy in which one individual (e.g., the CEO or manager) is in charge of determining the group's strategy. Such hierarchical structure is not only common in many large organizations, but can also be found in smaller teams that are led by autocratic leaders who allow for no or only little input from their subordinates. In my experiment, I model this situation by giving one group member the power to decide on each group members' level of investment.

My experimental design consists of two parts. In the first part, I randomly assign organizational forms to groups and, subsequently, let two groups of the same type compete

against each other in a repeated contest. In the second part, groups can choose themselves which organizational style to adopt. Hence, in contrast to the first part, organizational forms in this part are chosen endogenously rather than assigned exogenously. Furthermore, since groups are randomly matched into pairs, both symmetric contests between two groups of the same type, as well as asymmetric contests between two groups with different organizational forms could occur.

Several findings emerge from my study. First, I document that the way groups are governed has a significant impact on the degree of competition. In particular, in line with my theoretical predictions (see Section 2), I find that relative to the case in which group members can decide autonomously on their level of investment, competition significantly intensifies under both the democratic and the autocratic organizational structure. Contrary to my benchmark predictions, however, I find no significant differences in the degree of competition between the latter two regimes. Individual-level analysis reveals that one reason for this is that only a minority of participants in the role of the dictator use their decision-making power to fully discriminate between themselves and their group members.

Second, I find that when giving individuals the option to choose which organizational structure to adopt, the democratic style is by far the most popular one, followed by the autonomy and the two types of autocracies. An analysis of individual voting patterns suggests that this can be explained by individuals exhibiting a preference for autonomy, i.e., the ability to choose own contest engagement in a self-determined way, and fairness, i.e., the idea that each group member should contribute equally to the group's success. The democratic group structure combines both of these features as it allows all group members to actively participate in the group's decision-making process and protects them from exploitation by others. Evidence in support of this comes from an online survey, which reveals that (i) fairness and an active involvement in the decision-making process of the group are two features participants deem important, and (ii) that these features are particularly pronounced under the democratic and autonomous organizational style.

Finally, when analyzing the different type of contests that emerge from these voting patterns, I find that a group's investment into competition not only depends on the own organizational style but also on that of the opponent. In particular, in line with my results from the first part of the experiment, I find that investments into competition are significantly lower under the autonomy than under the other organizational forms. In addition, I find that groups adjust their investment according to the competitor's type; holding constant the own group type, I find that investments are always lowest in case the other group is organized autonomously. The results from this second part also suggest that whether a particular

organizational style is assigned exogenously or adopted endogenously does not seem to have a strong impact on investment decisions.

My paper contributes to the long-standing literature in economics and social psychology on inter-group conflicts (Sherif et al., 1961; Tajfel and Turner, 1979; Bornstein, 2003; Garfinkel and Skaperdas, 2007; Böhm et al., 2020; Kimbrough et al., 2020). This literature has focused on various determinants of conflict, including the group size, the production function, heterogeneity of players, and the contest success function (see Konrad (2009) for an overview of the theoretical literature and Sheremeta (2018) for an overview of the experimental literature). Up until now, however, only few studies have investigated how the internal organization of groups affects competition. The focus of these studies is thereby on very different group characteristics, such as the presence or absence of punishment (Abbink et al., 2010; Sääksvuori et al., 2011) and communication (Sutter and Strassmair, 2009; Cason et al., 2012; Leibbrandt and Sääksvuori, 2012; Eisenkopf, 2014; Cason et al., 2017), different sharing rules among group members (Bornstein and Gneezy, 2002; Kugler et al., 2010; Kurschilgen et al., 2017; Doğan et al., 2018), or the effects of leading-by-example (De Dreu et al., 2016; Loerakker and van Winden, 2017; Heine and Riedl, 2019; Eisenkopf, 2020). I add to this literature by demonstrating how three common, but so far unexplored, organizational styles affect behavior in inter-group contests. I further provide evidence on which organizational structures are preferred in such contexts. As such, my study provides important new insights into the understanding of behavior in many naturally-occurring contests in which groups differ in the way they are organized and how decisions within groups are formed.

The rest of the paper is organized as follows. In Section 2, I explain the general decision situation and derive benchmark predictions for the expected level of competition. Section 3 explains my experimental design and procedures. In Sections 4, 5 and 6, I report my findings of how the different organizational styles affect competition, and which of them are preferred when giving individuals the possibility to choose among them. Section 7 concludes.

2   Model and predictions

The basic decision situation.   To model competition between groups, I use an adaption of the classical Tullock contest model (Tullock, 1967). I apply this model to a situation in which two groups ($j = 1, 2$) of $n = 3$ players each compete for a prize that is shared equally among the members of the winning group (Katz et al., 1990). The prize thus constitutes a public good, with an individual valuation of v. Initially, each player is endowed with the same amount of scarce resources (e.g., time, money), ω, which they can either keep for

themselves (i.e., use for private activities) or invest into the contest. While investments are costly for the individual, they increase the chance of the own group winning the contest. Formally, let $x_{i,j}$ denote the investment by player i in group j. A group's performance is determined by the sum of all investments, $X_j = \sum_{i=1}^{n} x_{i,j}$, i.e., investments are perfect substitutes. The probability of winning the contest depends on the relative investments of both groups. Following Tullock (1980), I use the following contest success function:

$$p_j(X_1, X_2) = \begin{cases} \frac{X_j}{X_1+X_2} & \text{if} \quad X_1 + X_2 > 0 \\ \frac{1}{2} & \text{otherwise} \end{cases} \tag{1}$$

The expected payoff of player i in group j is thus given by

$$\pi_{i,j}(x_{i,j}, X_1, X_2) = \omega - x_{i,j} + p_j(X_1, X_2) \cdot v \tag{2}$$

Group structure. Within this basic setup, I analyze three different types of organizational forms, determining the way groups decide on their investments to competition. I thereby sharply focus on the effects the organizational structure has on the decision-making process, while abstracting from many other factors that might be important in real-world contests such as communication, heterogeneity among players, and personal characteristics.

The first organizational form I consider is that of a flat or horizontal hierarchical structure under which each individual has full sovereignty to decide on their own level of investment. Such structure is quite common especially in small organizations, and can also be found in teams that are led by managers who adopt a so-called laissez-faire leadership style, which is characterized by managers taking on a passive role by providing full freedom to their subordinates (Lewin et al., 1939; Rotemberg and Saloner, 1993). In my experiment, I model this as a situation in which all group members decide simultaneously and independently from each other how much of their resources (between 0 and w units) to invest into the contest. Each unit not invested automatically remains on an individual's private account. In the following, I refer to this situation as *Autonomy*.

The second organizational structure I consider represents a situation in which all group members jointly decide on their level of investments by voting. Voting is a widespread mechanism in management boards and committees. It can also be found in teams that are led by managers who adopt a so-called democratic leadership style that includes actively involving all group members into the decision-making process (Gastil, 1994). In my experiment, this organizational style is modeled by letting each group member first making a proposal by submitting a common investment level $\tilde{x}$. Subsequently, the median proposal within each

group is implemented for each member.[1] As a consequence, investment levels (and payoffs) are the same for all members within a group. In the following, I refer to this situation as *Democracy.*

The third organizational structure I consider is that of a steep hierarchy in which one individual (e.g., the CEO or manager) has full control and sets the strategy for the whole group. Such hierarchical structure is not only common in many large organizations, but can also be found in smaller teams that are led by autocratic leaders who allow for no or only little input from their subordinates. In the following, I model such a situation by assigning one group member, henceforth the *dictator*, full decision power over the groups' contest investment. I consider two versions of such an autocratic regime. In the first, the dictator is forced to implement the same investment level for each group member, i.e., $x_i = x_k = x_l$, where $x_i, x_k, x_l \in [0, \omega]$ are the investment levels of the dictator themselves (i), group member k, and group member l. In the second, the dictator can implement any possible vector of investment levels, $\mathbf{x} = (x_i, x_k, x_l)$. Hence, in contrast to the first case, dictators now have the possibility to discriminate between themselves and the other group members. As I will explain in more detail below, while the latter case is more natural, the former serves as an important control condition with regard to the expected levels of competition. I refer to these situations as *Restricted Autocracy* and *Autocracy*, respectively. In both cases, the other group members are passive players who have no task but to follow the dictator's decision.

Benchmark predictions. In the following, I provide a brief summary of the theoretical predictions for each of the different organizational styles (see Appendix B for a full description). I derive these predictions for the specific parameters of my experiment, which are $n = 3$, $v = 100$, and $\omega = 100$ (see below). Under the assumption that players are risk-neutral and only motivated by their own monetary payoffs, under the autonomy the unique symmetric Nash equilibrium prediction in the stage game stipulates that total group investments are equal to $X_1 = X_2 = \frac{v}{4} = 25$.[2] This is derived as follows: By substituting equation

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[1]See, e.g., Bernard et al. (2013) for a similar procedure in a different context. As in their case, I chose this aggregation rule for two reasons. First, given that in my experiment there were 101 different possible investment levels (see below), majority rule oftentimes might have failed to pick a winner. In this case, one either would need to decide on a rule for tie resolution, or allow for multiple rounds of voting, which is very time-consuming. Second, under the assumption of single-peaked preferences, a reasonable assumption in our setup, theory predicts that the median voter's choice would ultimately be implemented. Therefore, I decided to implement the median vote straight away as a reasonable shortcut. Note that if preferences are single peaked, under this mechanism individuals have a weakly dominant strategy to state their true preferences, i.e., to vote sincerely.

[2]See, e.g., Katz et al. (1990) and Abbink et al. (2010) for an analysis of the case with risk averse agents, and Leibbrandt and Sääksvuori (2012) and Fallucchi et al. (2021) for an analysis of cases in which agents have other-regarding preferences.

(1) into (2) and taking the first derivative with respect to $x_{i,j}$ I obtain $(X_1 + X_2)^2 = v \cdot X_2$ for members of the first group, and $(X_1 + X_2)^2 = v \cdot X_1$ for members of the second group. Due to the symmetry of the first-order conditions, in equilibrium I must have $X_1 = X_2$. Therefore, the equilibrium group investment must solve $(X_1 + X_1)^2 = v \cdot X_1$ and $(X_2 + X_2)^2 = v \cdot X_2$, which yields $X_1^* = X_2^* = \frac{v}{4}$. The best response functions are displayed in the left panel of Figure 1.

Note that while this prediction is unique with regard to the overall investments within a group, it remains silent about how group members share the burden of contributing to the group's success; any combination of individual investments that add up to a total of 25 constitutes an equilibrium (compare Katz et al., 1990; Baik, 1993; Konrad, 2009; Münster, 2009). This is due to the fact that group members have identical prize valuations and that marginal costs of investments are constant. As a result, given the equal-sharing rule within groups, the prize constitutes a local public good and, thus, group members face the typical free-rider problem inherent in many social dilemma problems (Hardin, 1968; Olson, 1965; Ostrom et al., 1994).

The predictions are less clear for the democracy; any profile in which all players in a group make the same proposal is a Nash equilibrium, because the median vote will not change if any single player changes her vote. As a result, there is a vast range of symmetric Nash equilibria, including one in which all players propose zero investments and one in which all members propose maximum investments. In addition, there are also multiple asymmetric equilibria in which proposals are the same within but not between groups. Given this multiplicity of equilibria, predictions are not straightforward as players face a non-trivial coordination problem. This changes, however, if as a refinement criterion I assume that individuals within groups coordinate on an investment level that is Pareto efficient from a group's point of view, that is, if I only focus on those equilibria which are robust against joint deviations from a coalition of players within the same group. This refinement criterion is related to the concepts of strong Nash equilibrium (Aumann, 1959) and coalition-proof Nash equilibrium (Bernheim et al., 1987), and has previously been applied to related contexts (see, e.g., Gürtler, 2008). To illustrate the intuition behind this refinement, imagine the situation in which all players in both groups propose an investment level of zero. This situation constitutes a Nash equilibrium as no player has an incentive to deviate unilaterally. Yet, all group members would prefer to jointly deviate to a different strategy profile, where, again, no player has an incentive to unilaterally deviate. For instance, if the rivaling group invests nothing, all individuals in the other group would be strictly better off when jointly deviating from a strategy profile of zero (in which case they would win the contest with probability 0.5) to, e.g., a strategy profile of one, in which case the group would win the contest with
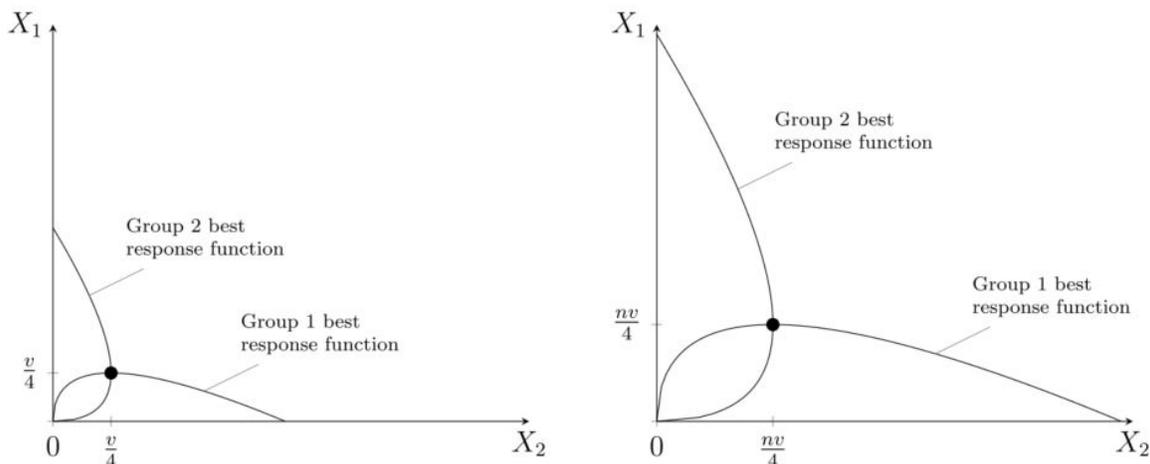
Figure 1: Nash equilibrium and best response functions under the autonomy (left panel) and the restricted autocracy (right panel).

certainty.

Applying this logic to both groups, it follows that the only remaining Nash equilibria are the ones in which total investments in both groups are equal to $X_1 = X_2 = \frac{nv}{4} = 75$. The intuition for this result is straightforward. When deviating jointly and increasing the proposed investment level by one unit, a group's total investment level increases by n units (each of the n group members has to follow the binding vote and increase their investment by one unit). Yet, each individual only bears a share of $\frac{1}{n}$ of the total investment costs. As a result, given the group size of $n = 3$, the prediction for the total group investments is three times higher than in the situation in which each individual decides autonomously. Note, however, that while this prediction is unique with regard to a group's total investment, similar to the case of the autonomy, there are multiple equilibria with regard to the individual proposals. Specifically, any combination of proposals for which the median proposal is equal to 25 constitutes an equilibrium. Furthermore, given the vast range of possible equilibria, a priori it is not clear whether individuals manage to coordinate on this or a different equilibrium, especially because in my experiment there was no straightforward tool for coordination such as communication (see below). The answer to this is ultimately an empirical question, one I can test with my data.

Next, I consider the predictions for the restricted autocracy in which the dictators cannot discriminate between themselves and their group members. In this case, the incentives are similar to a coalition of players in the democracy, or a single player who knows with certainty that they are pivotal; in both cases the coalition/individual can enforce an one-unit increase of investments by all group members while only having to pay a fraction of $\frac{1}{n}$ of the total

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investment costs. Hence, similar to the logic of the refinement criterion of group Pareto efficiency (see above), it thus follows that in equilibrium total investment levels under the restricted autocracy are equal to $X_1 = X_2 = \frac{nv}{4} = 75$ (see the right panel of Figure 1 for the best response functions). Note, however, that in contrast to the democracy, here this Nash equilibrium is unique. The reason is that while individuals under the democracy face strategic uncertainty with regard to their group members' voting behavior and, thus, whether the will be pivotal or not, dictators under the restricted autocracy know for sure that they are pivotal as they are the only group members with decision power.

Finally, under the autocracy it is obvious that if dictators are purely self-interested, they should always invest the whole endowment of the two group members, irrespective of the other group's investment. The reason is that any unit invested into the contest by other group members increases the group's chance of winning (and hence the dictator's expected benefit) without causing any material costs to the dictator. As a result, given the endowment level of $\omega = 100$, total group investments should be equal to $(n - 1) \cdot \omega = 200$, at a minimum. Of course, dictators are free to further increase these investments by using their own endowment. Given the non-linearity of the contest success function (see equation (1)), however, it turns out that this is not optimal. This is because at the point where both groups each invest 200 units, the marginal costs of increasing the group investment even further outweigh the marginal benefits. Formally, dictators would only be willing to invest themselves if $\omega < \tilde{\omega} = \frac{v}{4(n-1)}$, i.e., if the total investments by the other group members are sufficiently small. In my setup, dictators would only be willing to invest themselves if the total investments of both other group members are lower than 25, the optimal level under the autonomy. Hence, given the parameters of my experiment, dictators have a unique optimal strategy that is independent of the other group's investment (the best response functions are straight lines). Thus, $X_1 = X_2 = 200$ with $X_j(x_i, x_k, x_l) = (0, 100, 100)$ is the only Nash equilibrium under the autocracy.

3   The experiment

Experimental design.   My experiment consists of two parts, Part 1 and Part 2. At the beginning of Part 1, groups of $n = 3$ players were randomly formed. Two groups were then randomly matched into pairs to compete for 20 identical periods using a partner matching protocol, capturing the dynamic pattern of group competition inherent in many real-world situations. Importantly, participants were only exposed to one organizational form (*between-subjects design*). That is, the organizational form was the same in both competing

groups (*symmetric contests*) and remained constant throughout the twenty periods. In the autocratic treatments, at the beginning of the experiment one participant in each group was randomly assigned the role of the dictator, and this participant remained in this role for all twenty periods. In each period, participants received an endowment of $\omega = 100$ points, and the group could win a prize of $nv = 300$. In case of success, each participant of the winning group received an equal share of $v = 100$, irrespective of their own investment. At the end of each round, participants received detailed feedback about the individual decisions in their own group, as well as aggregate information about the decisions in the opponent group. After that, a new period started.

At the beginning of Part 2, groups were dissolved and participants were randomly re-matched into new groups. They then received a detailed description about each of the four organizational forms, described to them in neutral language (see Appendix C for an English version of the instructions). After that, participants had to decide which organizational form to adopt for their own group. To determine a group's organizational style, each group member had to state for each option whether they want to support it or not.[3] Before the start of the voting procedure, it was explained to participants that the option with the highest number of votes within their group would be implemented (ties were broken at random), and that they then had to compete under this organizational style against another randomly selected group for twenty periods. Given that the voting procedure only determined the organizational structure within the own group, it was also made clear that the structure of the own and the opponent's group could differ. Thus, in contrast to Part 1 in which only symmetric contests between two identical groups were possible, in Part 2 *asymmetric contests* between groups with different organizational forms could emerge. After the voting procedure, participants were informed about which organizational style their own and the opponent group adopted. In case one of the autocratic organizational styles was chosen, groups were also informed about which member was randomly assigned the role of the dictator. Groups then played the repeated inter-group contest game as described above. Table 1 provides a summary of my experimental treatments including the number of observations in each treatment as well as the theoretical predictions as derived above.

Procedures. At the beginning of the experiment, participants were informed about the two-part nature of the experiment. Participants were then introduced to the basic decision

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[3]This voting mechanism is known as approval voting (Brams and Fishburn, 1978). Approval voting has been previously used both in the lab (e.g., Sutter et al., 2010) and the field (e.g., Laslier and Van der Straeten, 2008), and it is easily understood and well accepted by voters (Laslier and Van der Straeten, 2008). See Weber (1995) for a theoretical analysis and Brams and Fishburn (2007) and Laslier and Sanver (2010) for an overview of the literature.

Table 1: Experimental treatments

Treatments	# Participants (Groups)	Benchmark predictions	
		Investments	Avg. exp. earnings
Autonomy	84 (28)	25	141.67
Democracy	90 (30)	75	125
Restricted Autocracy	90 (30)	75	125
Autocracy	90 (30)	200 (0, 100)	83.33 (150, 50)

Notes: Benchmark predictions show the predicted level of total group investments and average expected earnings in the stage game. Given that the number of periods was common knowledge, the prediction of the stage game coincides with the subgame-perfect Nash equilibrium of the finitely repeated game. For the democracy treatment, the prediction is derived using the additional assumption that group members coordinate on the equilibrium in which no coalition within a group has an incentive to jointly deviate. For the autocracy treatment, the first number in brackets correspond to the predictions for the dictators and the second number corresponds to the other group members.

situation and the details of Part 1. After that, participants had to successfully complete a comprehension test consisting of several questions about the rules and the comparative statics of the game (see Appendix C for a copy of the control questions). Only after all participants answered all control questions correctly, Part 1 began. After the end of Part 1, participants received instructions about the details of Part 2. At the end of the experiment, participants received an overview of their earnings, which were determined by the sum of their payoffs from all periods from both parts. After that, participants were asked to fill in a short questionnaire. On average, participants earned around €13 (including a €4 show-up fee) for sessions that lasted around one hour and twenty-five minutes. I ran twelve sessions with a total of $n = 354$ students (autonomy: $n = 84$, democracy: $n = 90$, restricted autocracy: $n = 90$, autocracy: $n = 90$), recruited from various disciplines using the online recruiting software ORSEE (Greiner, 2015).[4] The experiment was computerized using z-Tree (Fischbacher, 2007).

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[4]I confirm that in this paper I report the data from all conditions of the experiment. No additional treatments were conducted and no observations are excluded. Given that this is the first study that investigates the effects of organizational structure on group competition, ex-ante, no reliable estimates about the expected effect sizes were available. As a consequence, I did not conduct an ex-ante power analysis. Instead, the sample size was determined based on related experimental studies investigating group contests.

4   Results

4.1   The effects of organizational style on competition

I start by describing the effects of the different organizational styles on competition at the aggregate level. My main results are summarized in Figure 2. The left panel depicts, for each treatment, the mean group contest investments, averaged over all twenty periods in Part 1 (see Figure A1 in Appendix A for the full distribution of all investment decisions). The results show that the intensity of competition significantly differs across treatments (Kruskal-Wallis test, $p = 0.001$).[5] A closer look reveals that this result is mainly driven by the autonomy treatment, in which I observe the lowest levels of investment. Groups under this organizational form invest on average 94.4 points into the contest, which is significantly less than in any of the other organizational forms (pairwise Mann-Whitney U tests, all $p < 0.008$). In the remaining three treatments, in contrast, investments are remarkably similar. While under autocracy investment levels are highest reaching an average of 154.9, the differences compared to the democracy (146.7) and the restricted autocracy (138.9) are rather small and statistically insignificant (pairwise Mann-Whitney U tests, all $p > 0.271$).

To put these investment levels into perspective, I can compare them to the benchmark predictions derived in Section 2 (see Table 1). For the autonomy, democracy, and restricted autocracy I observe investments that are significantly higher than what is predicted under standard assumptions, a pattern that is commonly observed in these type of experiments (see, e.g., Chowdhury et al., 2014; Chowdhury and Moffatt, 2017; Sheremeta, 2018). In particular, investments exceed the theoretical predictions by 278% (autonomy), 85% (democracy), and 77% (restricted autocracy; Signrank tests, all $p < 0.002$).[6] For the autocracy, in contrast, I

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[5]When using non-parametric tests, I collapse my data such that there is one observation per contest pair as observations within a contest of two competing groups are not independent. This leaves me with $n = 14$ independent observations in the autonomy treatment and $n = 15$ in the remaining three treatments.

[6]Recall that for the autonomy treatment, standard theory remains silent about how total investments should be distributed among group members. When agents care about equality, however, they have an incentive to match their group members' investments as payoff equality within groups can only be achieved if all members invest the same amount into the contest (see Fallucchi et al. (2021) for a formal analysis of inequity concerns in group contests). When looking at my data, I find that participants share the burden of investing into the contest relatively equally. Using average investments over all periods, I find that the top contributors within groups account for 39.1% of the total group investments, compared to 34.6% and 26.4% for medium and low contributors, respectively. Furthermore, when analyzing behavior across rounds, I find that group members adjust their investments towards those of their peers; participants who in the last period invested the lowest amount adjust their investments upwards (by +10.3 units, t-test, $p < 0.001$), while those who previously invested the highest amount adjust their investments downwards (by -10.1 units, t-test, $p < 0.001$). Medium contributors, in contrast, hold their investments relatively constant, with a slight but insignificant upward adjustment of 1.4 units (t-test, $p = 0.299$).
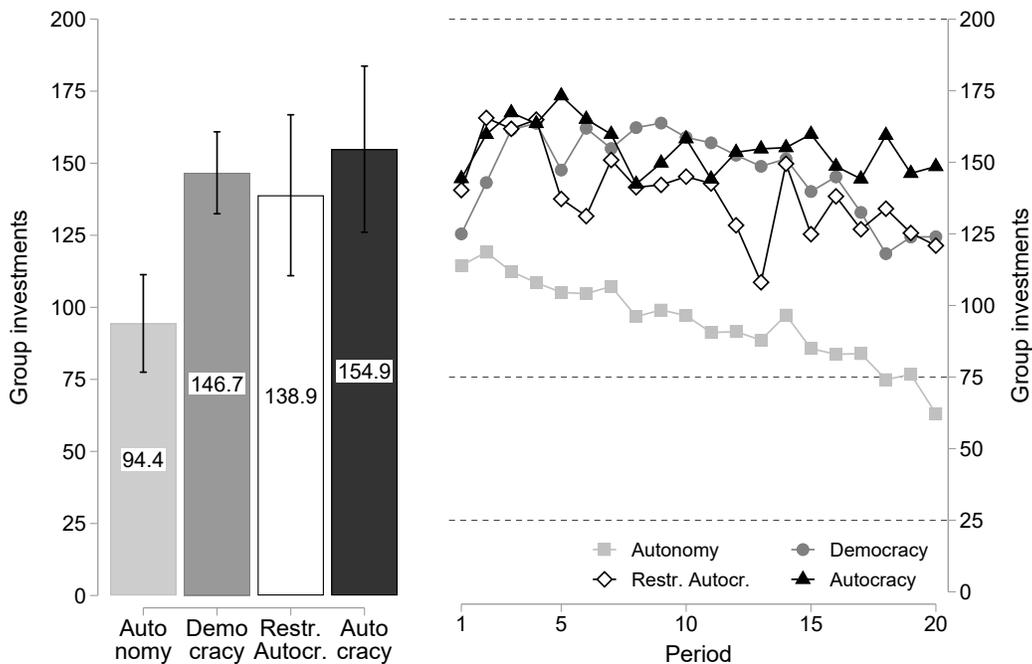
Figure 2: Left panel: Group investments by treatment, averaged over all periods (error bars correspond to 95% CI). Right panel: Development of investments over time. Dashed lines indicate predicted investment levels for the autonomy (25), democracy and restricted autocracy (both 75), and autocracy (200).

find investments to be significantly lower than what is predicted by standard theory (-25%, Signrank test, $p = 0.013$), an observation I will come back to in the next section.

The right panel of Figure 2 depicts the dynamics of competition over time. As can be seen, investments differ across treatments already at the very start of the game, with the autonomy exhibiting the lowest and the autocracy exhibiting the highest investments. This suggests that participants correctly understood and anticipated the effects the different incentives across the four organizational forms have on investments. Furthermore, in line with previous results (e.g., Abbink et al., 2010; Fallucchi et al., 2013), in the autonomy treatment I observe a significant downward trend of investments over time, which can be explained by the free-rider incentives inherent in this organizational form. No such trend is observed in the remaining treatments in which investment levels remain relatively constant throughout the course of the game. As a consequence, the differences between the autonomy and the other organizational forms become particularly pronounced towards the end of the game, after participants gained some experience in the game. The results further reveal that the non-existence of pronounced differences between the democracy and the two types of autocracies is not an artifact of

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aggregating the data across rounds, but that these organizational structures cause a similar degree of competition across all periods.

These results are confirmed by multilevel linear mixed-effects regressions that take into account the inter-dependency of observations (repeated observations of individuals that are nested within a contest of two competing groups). The results are shown in Table A1 in Appendix A. They reveal that (i) investments are significantly lower in the autonomy relative to all other treatments, (ii) that in the former there is a significantly steeper downward trend in investments, and (iii) that the differences across treatments are already significant in the very first period.[7] I summarize these findings in my first result.

> **Result 1:** *Compared to the case in which group members can decide autonomously on their contest engagement, competition significantly intensifies when investments are determined by voting or by a single group member, with no pronounced differences among the latter.*

A few remarks about this result are noteworthy. First, I note that the pronounced difference in investments between the autonomy and the democracy is not due to a simple mechanical effect caused by the different aggregation mechanisms, but due to systematically different investment decisions. As shown in Figure A2 in Appendix A, I find pronounced and significant differences in the minimum, median, and maximum (proposed) investment within groups across the two treatments. As a result, if one would implement the median investment in the autonomy treatment to all group members, hypothetical group investment would amount to 93.3, which is still significantly lower than the 146.7 I observe under the democracy (Mann-Whitney U test, $p < 0.001$).

Second, I note that the democracy and restricted autocracy are not only comparable in terms of aggregate investments, but also with regard to individual-level behavior. This is shown by Figure A3 in Appendix A, depicting the distribution of proposals under the democracy together with the decisions implemented by the dictators under the restricted autocracy. The figure reveals that the two distributions overlap considerably, suggesting

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[7]In Table A2 in Appendix A, I report additional regression analyses investigating the dynamics of investment decisions across periods. The results reveal that in all treatments, groups positively react to the opponent's investment in the previous period, although under the restricted autocracy this effect is not significant. The coefficient of the opponent's lagged investments squared is negative, but not significantly different from zero (except for the autocracy). This suggests that in contrast to the U-shaped best-response function as illustrated in Figure 1, group investments are increasing in the other group's investments beyond the point at which it is optimal from a standard economic point of view, a finding that has been reported before (see, e.g., Cason et al., 2012).

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that knowing whether one's own (proposed) investment will be implemented or not had no systematic effect on individual behavior.[8]

Finally, I note that given the structure of the Tullock contest, higher investments are inevitably associated with lower earnings for the participants. From their point of view, the highest earnings are reached when neither group invests anything into the contest (in this case the winner is determined by a coin flip). Yet, while attractive, such a collusive outcome is very fragile as incentives to invest are highest if the other group does not invest anything. Given the ranking of investments across treatments, it is clear that payoffs are highest under the autonomy and lowest under the autocracy; average individual earnings amount to 118.5, 101.1, 98.4, and 103.7 in the autonomy, democracy, autocracy and restricted autocracy, respectively. The differences between the autonomy and the other treatments are all significant (pairwise Mann-Whitney U tests, all $p < 0.008$), while differences among the remaining treatments are all statistically insignificant (pairwise Mann-Whitney U tests, all $p > 0.271$). Hence, in contrast to research on collective action that has found voting to increase cooperation and overall efficiency (e.g., Walker et al., 2000; Bernard et al., 2013; Hauser et al., 2014), here I find that democratic decision processes lead to lower payoffs compared to the case in which individuals can decide autonomously.

4.2   Why does the autocracy not escalate competition?

One of the most surprising findings from above is that, contrary to the theoretical predictions, competition does not escalate under the autocracy. To understand this result, in the following I take a closer look at the decisions of the dictators. Recall that dictators in this treatment could implement any vector $\mathbf{x} = (x_i, x_k, x_l)$, where $x_i, x_k, x_l \in [0, 100]$ are the investment levels of the dictator himself (i), group member k, and group member l. Further recall that if dictators are purely self-interested, there is a unique equilibrium in which $x_i = 0$ and $x_j = x_k = 100$ (compare Section 2).

Figure 3 provides a summary of the dictators' behavior. It shows, for each period, the proportion of cases in which dictators decided that the other two group members had to invest on average more (top, lightgray-shaded, area), the same (middle, white-shaded, area),

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[8]Recall that both treatments share the feature that, by design, no inequality within groups is possible. They are further comparable with regard to the incentives of the decisive group member, i.e., the median voter and the dictator, respectively. Yet, while dictators under the restricted autocracy know with certainty that their decision will be implemented, participants under the democracy face strategic uncertainty with regard to their group members' proposals and, thus, do not know whether they will be pivotal or not. As a result, while (without additional assumptions) in the democracy treatment participants face a coordination problem as there exists a vast range of possible Nash equilibria, this is not the case for the restricted autocracy as the Nash equilibrium is unique (see Section 2).
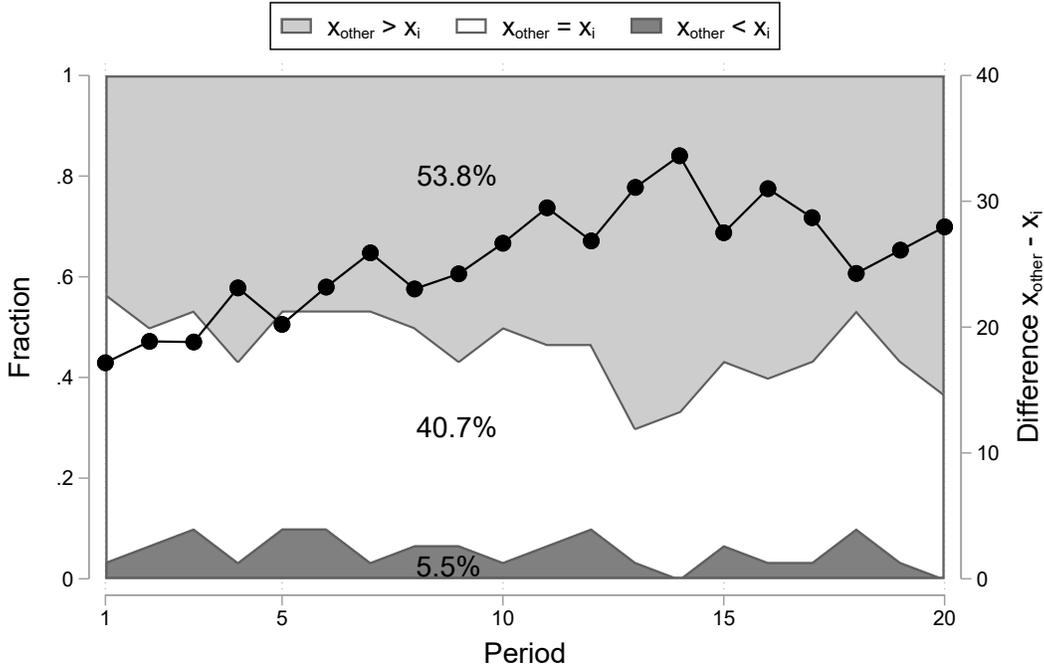
Figure 3: Fraction of decisions in which dictators decide to contribute less, the same, or more than their group members (left *y-axis*). Mean level of discrimination (right *y-axis*).

or less (bottom, darkgray-shaded, area) to the contest than themselves.[9] The results reveal that dictators use their power to exploit the other group members in only slightly more than half of the cases. Instead, in about 40% of the cases they implement the exact same level of investment for all group members (including themselves), and in about 5% of the cases, dictators even choose an own investment level that exceeds the one they implement for their group members. The figure further depicts the average degree of discrimination as measured by the difference between the other two group members' mean investment (x_{other}) and the dictator's own investment (x_i). It reveals that the degree of discrimination significantly increases over time — from 17.2 in the first period to 28.0 in the last period (Signrank test, $p = 0.034$) — indicating that dictators make more and more use of their discriminatory power the longer the game lasts. Yet, averaged over all periods, the implemented difference amounts to only 25.4, which is much lower than the theoretical benchmark of 100 if all dictators were purely self-interested (Signrank test, $p < 0.001$).

Of course, these results may mask important differences at the individual level, especially because previous literature has shown that there is pronounced heterogeneity with regard to

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[9]I use the average of the other two group members as in 94% of the cases, the dictator did not discriminate between the two.

people's degree of other-regarding concerns (see e.g., Sobel, 2005; Fehr and Schmidt, 2006; Cooper and Kagel, 2016, for overviews of the literature), which could explain why some but not all dictators use their discriminatory power. In particular, if dictators are inequity averse (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000) they have an incentive to equalize investments among group members, while when they are selfish they prefer to free-ride on others' investments. To uncover this heterogeneity, in the following I investigate dictators' behavior at the individual level.

As I show in Figure A4 in Appendix A, investment behavior differs markedly across dictators, both with regard to the frequency and the intensity of discrimination. Broadly speaking, there are three different types of dictators: *Benevolent*, *Moderate*, and *Selfish*. Benevolent types are those who never or only very rarely implement a situation in which they favor themselves by investing less than their group members. Moderate types use the option to discriminate between themselves and their group members relative frequently, but the degree of their discrimination is, on average, rather moderate. Finally, selfish dictators are those who discriminate not only very frequently but also quite intensively. When looking at the relative frequency of these types (see Figure A4 in Appendix A for further details on the classification), I find that roughly 40% of all dictators can be classified as benevolent, 33% as moderate, and 27% as selfish. To demonstrate how much these types differ with regard to their contest behavior, in Table A3 in Appendix A I provide some summary statistics of their investment decisions. The table reveals that while benevolent dictators invest around 51% of both their own and others' endowment into the competition, selfish dictators use only 18% of their own endowment but 89% of the endowment of others. As a consequence, the latter achieves significantly higher payoffs for themselves (131.7 vs. 98.6), which, however, comes at the cost of lower overall earnings and increased inequality within the group.

Taken together, these findings reveal that many participants in the role of the dictator do not fully follow the prediction of full discrimination, a finding reminiscent of the one by Van der Heijden et al. (2009) who find that many leaders in a team production environment with the possibility of ex-post redistribution forgo the temptation to exploit their peers. Instead, I find that many dictators put in their equal share, which is consistent with explanations based on other-regarding concerns such as fairness or equity. This, in turn, can explain why overall investment levels are significantly lower than what is predicted under the assumption of complete selfishness, and why investment levels do not differ between the autocracy, the democracy, and the restricted autocracy. I summarize these findings in my second result.

Result 2: *Participants in the role of dictators only partly use their power to*

discriminate between their own and their group members' investments, but there is pronounced heterogeneity. The largest share of individuals can be classified as benevolent, who implement the same level of investment for themselves and others.

5   Choice of organizational style

So far, I have analyzed how different organizational styles affect competition between groups when these have been assigned exogenously. In the following, I turn to the second part of my experiment in which participants were given the opportunity to choose which organizational style to adopt. I first show the results of the voting patterns. After that, I provide a discussion of the potential underlying determinants.

5.1   Which organizational styles are supported?

Recall that in the voting stage, participants were asked to state for each possible organizational form, whether they want to support it or not. The aggregate results of this voting procedure are summarized in Table 2. On average, participants approved 1.88 out of the four possible organizational forms, with the large majority supporting either one (27%) or two (60%) options while rejecting the other ones. The results reveal that the democracy is by far the most popular option, being supported by 71% of all participants. The second most favored option is the autonomy (58%), followed by the restricted autocracy (43%) and the autocracy (16%). The differences in support across organizational styles are all highly statistically significant (Signrank tests, all pairwise comparisons $p < 0.002$).

Importantly, the support for the different organizational styles does not depend on which type participants experienced in the first part of the experiment. That is, I find no statistical differences in voting behavior across treatments, indicating that having gained experience under a particular organizational form did not affect preferences over the possible options (χ^2-tests, all $p > 0.177$). Regression analyses further reveal that voting behavior is not affected by how well participants performed in Part 1 of the experiment. Specifically, for none of the four treatments I find average payoffs in the first part to have an effect on the likelihood of supporting any of the four organizational forms (see Table A5 in Appendix A). Overall, these results suggest that there are very little spillover effects from participants' experience in Part 1 to their voting behavior at the beginning of Part 2.[10]

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[10]In Table A6 in Appendix A, I report additional exploratory analyses investigating the role of demographics (gender, age) the field of studies, political attitudes, as well as other self-reported attitude measures

Table 2: Support of organizational styles

Organizational style Part 1	Mean number of approvals	Fraction support			
		Autonomy	Democracy	Restr. Autocr.	Autocracy
Autonomy	1.88	0.52	0.77	0.46	0.12
Democracy	1.91	0.63	0.69	0.42	0.17
Restricted Autocracy	1.97	0.63	0.71	0.41	0.21
Autocracy	1.78	0.51	0.68	0.43	0.16
Total	1.88	0.58	0.71	0.43	0.16
χ^2-tests	$p = 0.393$	$p = 0.178$	$p = 0.510$	$p = 0.907$	$p = 0.432$

At the individual level, I find all but one out of the $2^4 = 16$ possible voting patterns. The most frequent pattern (24.9%) supports the autonomy and the democracy, but rejects the two types of autocracy. In the second most frequent voting pattern (22.6%), participants support the democracy and the restricted autocracy. On rank three, four, and five, I find voting patterns that support only the autonomy (13.0%), only the democracy (9.0%), and all but the discriminatory autocracy (6.8%). Overall, these voting patterns account for 76% of all observations. The remaining patterns all occurred in less than five percent of the cases (see Table A4 in Appendix A for the full distribution). I summarize these findings in my third result.

> **Result 3:** *When given the choice, a large majority of individuals prefers a democratic or autonomous organizational form. Autocratic structures, in contrast, are supported only by a minority of individuals.*

5.2 Determinants of organizational choice

What can explain these voting patterns? First of all, participants might vote for a particular organizational style for strategic reasons. Recall that given the nature of the Tullock contest, higher investments inevitably lead to lower payoffs for the competitors. Hence, based on the theoretical predictions as discussed in Section 2, it is clear that from a

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on voting behavior. The regression results are reported in Table A6. The results suggest that females are more (less) likely than men to support the democracy (autocracy). For self-reported political attitudes, I find that more conservative participants are more (less) likely to support the autonomy (restricted autocracy). Furthermore, those who self-report that they try to fulfill the expectations of others are more likely to vote for the democracy and the restricted autocracy. Other self-reported attitude measures such as risk as well as the field of studies, in contrast, have no discernible effect on voting behavior.

purely monetary perspective, the autonomy is most beneficial for the participants as expected payoffs are highest. Note, however, that these predictions are based on the assumption that the contest is symmetric. As I show in detail in Appendix B, when the contest is asymmetric different predictions arise. The reason is that optimal investments not only depend on the own organizational style, but also on that of the opponent. For instance, when facing a "stronger" opponent (in terms of predicted investments) such as one governed by the autocratic regime, autonomous groups are predicted to perform worse than their counterparts as the latter are predicted to invest more and, hence, have higher chances of winning the contest. The intuition for this result is similar to the discouragement effect arising in uneven contests between groups or players of different abilities (see e.g., Fonseca, 2009). Similar predictions can be derived for the other organizational styles as, compared to the case of a symmetric contest, they all benefit from competing against a "weaker" opponent in asymmetric contests but suffer when the opponent is stronger (compare Table B1 in Appendix B).

Besides these purely strategic considerations, participants might also consider other, non-pecuniary, aspects when deciding on which organizational style to adopt. Here, I concentrate on two important dimensions that characterize the different organizational styles: *autonomy* and *inequality*. Autonomy (or self-governance) can be described as an individual's capacity to act according to their own values and convictions, and to make informed and uncoerced decisions in the absence of any manipulative or distorting external forces (Christman, 2008). Autonomy plays a central role in theories of moral and political philosophy (Rawls, 1971; Feinberg, 1978; Young, 1982), and recent economic studies have demonstrated that individuals value decision rights intrinsically, beyond their mere instrumental benefit (Bartling et al., 2014). In social psychology, autonomy is a key component in self-determination theory, and is thought to be essential for people's motivation, social development, and personal well-being (Ryan and Deci, 2000). When considering the four organizational styles, it is clear that the degree of self-determination is high under the autonomous regime in which individuals can freely decide on their contest investments, and low under the two autocratic regimes in which no one except the dictator can make self-determined decisions.[11] The democratic regime arguably lies somewhere in between these two extremes. While ultimately the proposal of one group member will be implemented for everyone, each member is actively participating in the group's decision-making process by making a proposal that may affect the final investment.

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[11] I note, however, that given that the roles in the two autocratic treatments were assigned at random at the beginning of the experiment, from an ex-ante point of view, these treatments might still be perceived as procedurally fair (see, e.g., Bolton et al., 2005).

The second dimension that distinguishes the different organizational styles is whether inequality within groups is possible or not. Previous studies have demonstrated that many people are not only motivated by their own material payoffs, but that they also care about the well-being of others. While such other-regarding concerns come in various forms and shapes (see e.g., Sobel, 2005; Fehr and Schmidt, 2006; Cooper and Kagel, 2016, for overviews of the literature), one fundamental underlying psychological element incorporated in many theories of social preferences is that of fairness. According to these theories, there are many people who dislike inequity, i.e., situations in which their own payoff exceeds or falls short the payoff of a reference group (e.g., Loewenstein et al., 1989; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). In symmetric situations like the one considered in this experiment in which all agents are homogeneous with regard to their income, abilities, and costs of investing, equality is seen as a good proxy for equity (Konow, 2003). As a result, unequal payoffs among group members might create disutility from inequity. While such inequity concerns should play no role under the democracy and restricted autocracy (inequality within groups is ruled out by design in these cases), it might matter in the autonomy and autocracy. While in the latter the degree of inequality lies entirely in the power of the dictator, in the former group members can avoid inequality by coordinating their investments.

These considerations (among others) can help explain why the democracy appears to be the most attractive organizational form as it combines the two desirable features of self-determination and equality.[12] Furthermore, the most common voting pattern of only approving the autonomy and the democracy is consistent with the interpretation of participants exhibiting a strong preference for self-determination, as these are the only two organization styles under which all group members can actively participate in the decision-making process. Similarly, the second most prevalent voting pattern — support of only the democracy and the restricted autocracy — is consistent with the interpretation that participants exhibit a strong aversion against inequity, as these are the only two organizational styles under which payoff equality within groups is guaranteed. Finally, the fact that only very few participants approve of the autocracy despite their potential strategic advantage (see above) can be explained by the fact that this organizational form lacks autonomy and potentially creates inequality.

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[12]Another reason for the popularity of the democracy might be that participants think that there is a norm to approve this organizational style because many participants have been raised under a democracy and, therefore, might have learned to appreciate it. The autonomy and democracy might further be appealing because in contrast to the two types of autocracies, participants under these regimes receive information about the behavior of their group members. Such information might be valuable to participants who care about relative earnings or who are unsure about the optimal strategy.

5.3 Survey evidence

To provide some evidence that these factors might indeed motivate individuals' preferences over the different organizational styles, I conducted an online survey with a new set of $n = 91$ participants who did not take part in my main experiment. In this survey, participants were asked for their opinions and perceptions of the four organizational forms. To this end, they were first introduced to the general decision situation of the Tullock contest and to the four possible organizational styles. After that, to ensure that participants carefully read and understand the setup, they had to answer a set of control questions. Only after answering all questions correctly, participants proceeded to the main part of the survey in which they were first asked to rank the four organizational styles from their most to their least preferred option, and to state some motives/reasons for their ranking. After that they were asked to state for each organizational style whether they think that (i) group members have a high degree of autonomy, (ii) the way investments into the contest are determined is fair, and (iii) that compared to the other organizational styles there exists a strategic advantage with regard to winning the contest. Answers were given on a scale from 1 ("do not agree at all") to 4 ("agree fully"). Finally, I asked participants to rate on a scale from 1 ("do not agree at all") to 10 ("agree fully") whether they agree that (i) it is important that all group members contribute the same amount to the success of the group, (ii) it is important that all group members actively participate in the decision-making process, and (iii) the most important thing is winning the contest, everything else being secondary. See Appendix D for further details on the procedures and an exact wording of these questions.

Despite the fact that the participants of the survey are impartial spectators who have no skin in the game, their responses are very consistent with my findings from above. In particular, with regard to the attractiveness of the different organizational styles, I find that the most preferred option is the democracy with a mean rank of 1.81, followed by the autonomy (2.03), the restricted autocracy (2.57), and the autocracy (3.58). The differences in the ranking across organizational styles are all statistically significant (Signrank tests, all pairwise comparisons $p < 0.006$), except the one between the democracy and the autonomy (Signrank test, $p = 0.203$). When asked about the reasons for their ranking, 60% of the participants mentioned fairness or equality concerns, 57% mentioned motives related to self-determination and having control over own investments, 31% mentioned issues concerning the exploitation of others, 24% mentioned democratic decision processes, and another 20% mentioned strategic or monetary aspects (see Appendix D for further details).

The results on how participants perceive the four organizational styles are summarized in Table 3. In line with my argumentation above, I find that the autonomous organizational

Table 3: Perception of organizational styles

	Autonomy		Fairness		Strategic advantage	
	Mean	% agree	Mean	% agree	Mean	% agree
Autonomy	3.98	98/2/0/0	3.25	46/35/17/2	2.16	15/12/46/26
Democracy	2.71	9/60/24/7	3.35	44/48/7/1	2.58	8/48/38/6
Restricted Autocracy	1.43	0/4/34/62	2.57	16/34/40/10	3.05	36/36/24/3
Autocracy	1.30	1/4/18/77	1.47	2/7/27/64	2.80	23/41/30/7

Notes: Answers to each question were collected on a scale from 1 to 4, where 1 corresponds "do not agree at all", 2 corresponds to "disagree somewhat", 3 corresponds to "agree somewhat", and 4 corresponds to "agree fully".

style scores highest in terms of perceived autonomy/self determination, followed by the democracy and the two types of autocracies. The differences across the four organizational styles are thereby all statistically significant (Signrank tests, all pairwise comparisons $p <$ 0.023). With regard to the perceived fairness of the decision-making process, I find that the democracy and the autonomy score highest; the mean scores amount to 3.35 and 3.25, respectively (Signrank test, $p = 0.387$), which are both significantly higher than the ones obtained for the two types of autocracies (Signrank tests, all pairwise comparisons $p <$ 0.001). Finally, I find that participants attribute the highest degrees of strategic advantage to the two types of autocracies, followed by the democracy and the autonomy (all pairwise comparisons are statistically significant $p < 0.008$, except the one between the autocracy and the democracy $p = 0.111$).

With regard to the perceived importance of these factors, I find that participants strongly agree with the statements that equal contributions and an active participation in the decision-making process are important; the mean scores amount to 8.03 (sd: 2.36) and 8.02 (sd: 2.04) out of 10, respectively. In contrast to that, I only find moderate agreement to the statement that winning the contest is most important; the mean score amounts to 6.45 (sd: 2.67), which is significantly lower than the ones for the other two statements (Signrank tests, both $p < 0.001$).

Overall, these results suggest that fairness and an active involvement in the decision-making process of the group are two features participants deem important, and that these features are particularly pronounced under the democratic and autonomous organizational style. The results from the ranking exercise further suggest that the revealed preferences over the different organizational styles are robust to different elicitation techniques.

6   Competition under endogenously adopted organizational styles

As a result of the voting patterns in the second part of the experiment, 36 out of the 118 newly formed groups (31%) implemented the autonomy, 58 (49%) implemented the democracy, 22 (19%) implemented the restricted autocracy, and 2 (2%) adopted the autocracy. After adopting their own organizational form, groups were randomly cross-matched into contest pairs. As a consequence, both symmetric contests among two groups with the same structure, as well as asymmetric contests between two groups who adopted different organizational forms emerged. In total, I have 18 symmetric contests (autonomy–autonomy: $n = 3$, democracy–democracy: $n = 13$, Restricted autocracy–restricted autocracy: $n = 2$) and 41 asymmetric contests (autonomy–democracy: $n = 22$, democracy–restricted autocracy: $n = 10$, Autonomy–restricted autocracy: $n = 7$, autonomy–autocracy: $n = 1$, and restricted autocracy–autocracy: $n = 1$).

Figure 4 summarizes the contest behavior in these newly formed groups. It shows, averaged over all twenty rounds, the mean group investments for each combination of organizational forms in the own and the opponent's group (except for the autocracy, which is omitted because of the insufficient number of observations). The first set of bars displays the average group investments made by groups who adopted the autonomy. The second and third set of bars show the same data for groups who adopted a democracy and restricted autocracy, respectively. Within each set, the first bar shows contest investments for the case in which the opponent was an autonomy, while the second and third bar show contest investments in case the other group adopted the democracy and restricted autocracy, respectively.

Confirming the results from Part 1, the figure reveals that the organizational style of the own group has a significant impact on the level of competition. Averaged over all opponents' types, total group investments under the autonomy amount to 71.3, which is much lower than the investments observed under the democracy (135.6) and the restricted autocracy (146.9). The results from Figure 4 further demonstrate that contest investments also crucially depend on the opponent's group type. In particular, holding constant the own organizational style, group investments are always lowest in case the other group is an autonomy; average group investments in this case amount to 102.2, compared to 125.2 if the opponent group is a democracy and 123.9 if it is a restricted autocracy.

To test the significance of these results, I run multilevel linear mixed-effects regressions that take into account the inter-dependency of observations (repeated observations of individuals that are nested within a contest of two competing groups). As the dependent variable
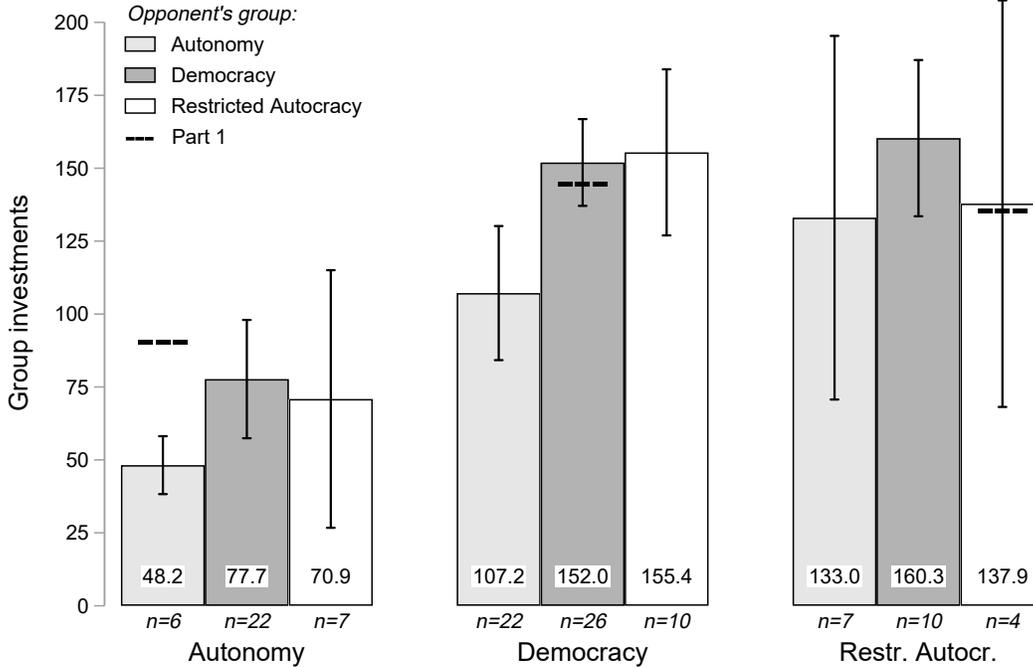
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Figure 4: Group investments in Part 2, separated by the own and the opponent's organizational style (error bars correspond to 95% CI). Number of groups are on the $x - axis$.

I use an individual's contest investment. As explanatory variables I use indicator variables for the different organizational styles in the own and the opponent's group. The results are shown in Table 4. They confirm the findings from above that groups who adopt the autonomy invest significantly less into competition than groups who adopt the democracy (my baseline category) or the restricted autocracy (Wald tests, both $p < 0.001$). No significant differences are observed between the latter two types (Wald test, $p = 0.391$). A similar pattern holds when comparing the effects of the opponent's type. Whenever the other group is an autonomy, contest investments are significantly lower than when it is any of the other two organizational styles (Wald tests, both $p < 0.005$), while there is again no difference between democratic and restricted autocratic groups (Wald test, $p = 0.664$). These results are thereby very robust over time, as shown by the similar estimates reported in models (2) and (3), which use data from the first ten and last ten periods, respectively. This indicates that learning and experience effects do not interfere with my overall results (see also Figure A5 in Appendix A). I summarize these findings in my fourth result:

> **Result 4:** *In asymmetric contests, the intensity of competition depends on the organizational style of both the own as well as the opponent's group.*

Table 4: Contest investments by own and the opponent's organizational style

Dependent variable:	Individual investment$_t$		
	(1)	(2)	(3)
Own group:			
Autonomy	-24.076***	-22.198***	-25.957***
	(3.270)	(3.246)	(3.703)
Restr. Autocracy	3.220	3.502	2.938
	(3.752)	(3.810)	(4.222)
Opponent group:			
Autonomy	-12.931***	-11.480***	-14.389***
	(3.297)	(3.285)	(3.729)
Restr. Autocracy	-1.582	0.685	-3.819
	(3.641)	(3.645)	(4.117)
Constant	50.370***	49.104***	51.634***
	(3.007)	(2.957)	(3.407)
Observations	6000	3000	3000

Notes: Multilevel linear mixed-effects model with random intercepts at the contest, group, and individual level. The omitted reference category is the democracy. Model (1) uses data from all periods. Model (2) uses data from periods 21 - 30, while model (3) uses data from periods 31 - 40. Numbers in parentheses indicate standard errors. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Given these results, it is clear that from a purely monetary perspective, the autonomy is the most attractive organizational form for participants as payoffs are highest under this regime. Averaged over all types of contests, groups who adopted an autonomy earn on average 117.8 points, compared to 106.4 under the democracy and 110.8 under the restricted autocracy. This effect is most pronounced in symmetric contests in which the other group also adopted an autonomy. In this case, average payoffs amount to 133.8, compared to 99.4 and 104.1 when two democracies and two restricted autocracies compete against each other. For the asymmetric cases, in contrast, I find that in line with my theoretical predictions (see Table B1 in Appendix B), the democracy and the restricted autocracy have a comparative advantage against groups that are organized autonomously. The reason is that the former two compete more aggressively by investing more into the contest (compare Figure 4). As a result of these uneven investments, autonomous groups win the contest in only 43% of the cases when competing against a democracy and in only 30% of the cases when competing against a restricted autocracy. As a consequence, while saving on costly investments, autonomous

groups end up earning less than their counterparts when competing against a democracy (117.1 vs. 121.3) or a restricted autocracy (106.4 vs. 125.7).

A few cautionary words are warranted regarding the interpretation of these results. First, I note that since the order in which participants played the two parts of the experiment was not counterbalanced, experience effects could affect behavior in the second part. To test for this, I conduct a regression analysis in which I regress participants' investment decisions in Part 2 on the experienced treatment as well as participants' earnings in Part 1. The results from this analysis are reported in Table A7 in Appendix A. I find little evidence for spillover effects across parts, suggesting that the experience from Part 1 had no systematic effect on behavior in Part 2.

A second difference between the two parts of the experiment is that while in the first part organizational forms are assigned exogenously, in the second part they are adopted endogenously. As demonstrated by some previous studies, the way in which institutions and rules are implemented can affect subsequent behavior (Kosfeld et al., 2009; Dal Bó et al., 2010; Sutter et al., 2010; Markussen et al., 2013). To check whether this had a systematic effect on participants' investment decisions, I compare behavior across parts for the three types of symmetric contests. This is illustrated by the horizontal dashed lines in Figure 4, depicting the average contest investments from the first part of the experiment. For the democracy and the restricted autocracy, I find that contest investments are very similar to, and not significantly different from, the levels observed in the first part of the experiment (democracy: 146.7 vs. 152.0, Signrank test, $p = 0.439$; restricted autocracy: 138.9 vs. 137.9, Signrank test, $p = 1.000$). For the autonomy, in contrast, I observe significantly lower investments compared to Part 1 (48.2 vs. 94.4; Signrank test, $p = 0.028$). While this difference could be interpreted as an "endogenous adoption effect", it could also be explained by a continuation of the significant downward trend of investments as observed in Part 1.[13]

Overall, these results show that contest behavior is quite consistent across the two parts, suggesting that whether a certain organizational style was assigned exogeneously or adopted endogenously had little systematic impact on behavior in my context. Finally, I note that some of my results from this second part are based on a relatively small number of observations. While the differences between the autonomy and the other two organizational forms are still significant (compare Table 4), more research is needed to test the robustness of these results. In particular, to provide a clean test of competition in the different types of asymmetric contests, one would need to run a new set of experiments in which organizational

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[13]Investments in the autonomy treatment in Part 1 decrease from 114.0 in period 1 to 62.3 in period 20. Following this trend, in the first period of Part 2 (period 21) investments start at 59.3 and further decrease to 36.8 in period 40.

forms are assigned exogenously, and in which participants have no prior experience in any of these forms.

7 Concluding remarks

Competition between groups is ubiquitous in nature and exists at all levels in human society, ranging from firms competing for market shares to political parties and lobbyist groups competing for power and influence to research groups competing for third-party funding and the development of new products. Previous literature in economics and related disciplines has provided valuable insights into the determinants of behavior in such inter-group conflicts (see Konrad (2009) for an overview of the theoretical literature and Sheremeta (2018) for an overview of the experimental literature). I contribute to this literature by demonstrating that the way groups are organized crucially affects the intensity of competition, a factor that has received relatively little attention so far. In particular, my results reveal that letting group members decide autonomously leads to significantly lower contest investments and, thus, higher earnings to participants compared to when groups are organized democratically or autocratically. Furthermore, while investments are quite similar between democratically and autocratically organized groups, in the latter many individuals in the role of dictators investment significantly less than their subordinates, leading to ex-post inequality in earnings. At the same time, I find that a considerable share of dictators who do not fully exploit their discriminatory power by putting in their own fair share. Despite this, I find that when giving individuals the choice which organizational style to adopt, the most preferred style is the democratic one, followed by the autonomy and the autocracy. Using a survey study, I show that one reason for the high popularity of the democratic structure is that it allows everyone to actively participate in the decision-making process and it protects group members from exploitation by others, two factors people deem important.

The findings from this study may provide important insights into the understanding of behavior in naturally-occurring group contests. For instance, my result that most individuals prefer an autonomous or democratic over an autocratic organizational form can shed light on situations in which individuals can self-select into different groups (e.g., when applying for jobs in different companies) as individuals may take into account the organizational structure as one important dimension for their decision. My results thereby bear some resemblance with evidence from the field showing that autocratic management and leadership styles can lead to lower job satisfaction, higher worker turnover, and a destabilization of groups (e.g., Miller and Monge, 1986; Yukl, 1998; Van Vugt et al., 2004; Bass, 2009). My results further

suggest that the advantageousness of a particular organizational form may be context-specific and dependent on the type of competitor one is facing.

Of course, the current study only constitutes a first step into the understanding of the influence of a group's organizational structure on competition. In particular, in my experiment I only considered very stylized representations of organizational structures. The upside of this approach is that it allowed me to derive clean causal evidence on the impact of a group's decision-making process on competition. The downside is that I had to abstract from many important aspects that might affect behavior in the field. For instance, while in many real-world settings group members have the possibility to communicate and coordinate their actions, in my experiment explicit communication was absent. Similarly, while in my democracy and restricted autocracy treatment equal investments by all group members were enforced automatically, in reality such enforcement might be more difficult, especially when individual investments are not observable or non-contractible. Furthermore, while in my experiment dictators in the autocratic regimes were assigned at random, in most natural groups leaders and managers come from a highly selected group of individuals with a specific set of personal characteristics, and evidence from previous studies in psychology and organizational economics suggest that a manager's personality and charisma can have a strong impact on followers' behavior (see, e.g., Antonakis et al., 2004).[14] Given these limitations, it is clear that more research is needed to test the robustness of my results, especially with regard to more complex and rich environments like in natural field settings. Given the relevance of my research question to many important economic contexts, I see this as a promising avenue for future research.

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[14]Some evidence along these lines comes from an exploratory analysis of participants' responses in the post-experimental questionnaire. I find that relative to the other two dictator types, benevolent dictators score significantly lower on a self-reported scale of competitiveness and a scale measuring their willingness to take risks. At the same time, benevolent dictators score (weakly) significantly higher on questions measuring their willingness to meet the expectations of others, as well as a measure of trust in others. Other factors such as gender, political attitudes, or the field of study seem to not correlate with dictator type (see Table A8 in Appendix A for details). Note that while these results can provide some suggestive evidence that personal characteristics might indeed differ across different dictator types, given the relatively small number of dictators in my sample, these results should be interpreted with some caution.

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Appendix (for online publication only)

A Additional Tables and Figures

Table A1: Contest investments by treatment

Dependent variable:	Individual investment$_t$	
	(1)	(2)
Democracy	17.424***	13.747***
	(4.942)	(5.079)
Restr. Autocracy	14.826***	12.427**
	(4.942)	(5.079)
Autocracy	20.156***	14.016***
	(4.942)	(5.079)
Period		-0.789***
		(0.080)
Period × Democracy		0.350***
		(0.111)
Period × Restr. Autocracy		0.228**
		(0.111)
Period × Autocracy		0.585***
		(0.111)
Constant	31.471***	39.752***
	(3.554)	(3.652)
Observations	7080	7080
F-tests:		
Democracy = Restr. Autocracy	$p = 0.593$	$p = 0.791$
Democracy = Autocracy	$p = 0.574$	$p = 0.957$
Autocracy = Restr. Autocracy	$p = 0.272$	$p = 0.750$

Notes: Multilevel linear mixed-effects model with random intercepts at the contest, group, and individual level. The dependent variable is an individual's investment into the contest in period t in Part 1 of the experiment. The omitted category is the autonomy. Numbers in parentheses indicate standard errors. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Contest investments depending on investments in the previous period

Dependent variable:	Investment own group$_t$			
	Auto-nomy	Demo-cracy	Rest. Autocr.	Auto-cracy
Investment own group$_{t-1}$	0.539***	0.405***	0.129***	0.371***
	(0.037)	(0.038)	(0.042)	(0.038)
Investment other group$_{t-1}$	0.259**	0.343***	0.121	0.678***
	(0.110)	(0.127)	(0.137)	(0.129)
Investment other group$^2_{t-1}$	-0.001	-0.001	-0.000	-0.002***
	(0.001)	(0.000)	(0.000)	(0.000)
Period	-0.967***	-1.214***	-1.655***	-0.403
	(0.237)	(0.411)	(0.464)	(0.380)
Constant	35.750***	65.655***	130.616***	47.105***
	(7.242)	(12.380)	(16.472)	(14.452)
Observations	532	570	570	570

Notes: Multilevel linear mixed-effects model with random intercepts at the contest and group level. The dependent variable is a group's investment into the contest in period t in Part 1 of the experiment. Numbers in parentheses indicate standard errors. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Dictator types and their performance.

Type	Investments			Payoffs			Inequality
	Own	Others	Total	Own	Others	Total	
Benevolent ($n = 12$)	51.39	51.28	153.94	98.61	98.72	98.69	1.54
Moderate ($n = 10$)	28.31	47.33	122.96	122.19	103.17	109.51	11.66
Selfish ($n = 8$)	17.66	89.26	196.19	131.71	60.11	83.98	41.40
Kruskal-Wallis tests:	$p < 0.001$	$p < 0.001$	$p = 0.007$	$p = 0.013$	$p < 0.001$	$p = 0.017$	$p < 0.001$

Notes: Inequality is calculated as the standard deviation of payoffs within a group. If dictators were completely self-interested, they should set $x_i = 0$ and $x_j = x_k = 100$, leading to the maximum possible level of inequality equal to 57.735.

Table A4: Voting patterns (sorted by frequency of occurrence)

N (%)	Autonomy	Democracy	Restricted Autocracy	Autocracy
88 (24.9%)	✓	✓	x	x
80 (22.6%)	x	✓	✓	x
46 (13.0%)	✓	x	x	x
32 (9.0%)	x	✓	x	x
24 (6.8%)	✓	✓	✓	x
15 (4.2%)	✓	x	✓	x
13 (3.7%)	✓	x	x	✓
11 (3.1%)	x	x	✓	x
10 (2.8%)	✓	✓	✓	✓
8 (2.3%)	x	x	x	✓
8 (2.3%)	x	x	✓	✓
7 (2.0%)	✓	✓	x	✓
7 (2.0%)	x	✓	x	✓
4 (1.1%)	x	✓	✓	✓
1 (0.3%)	✓	x	✓	✓
0 (0%)	x	x	x	x

Notes: Checkmarks indicate that an organizational style was approved, and x's indicate that it was not approved.

Table A5: Voting behavior depending on income and experienced treatment in Part 1

Dependent variable:	Option supported (*1 if yes, 0 otherwise*)			
	Auto-nomy	Demo-cracy	Restr. Autocr.	Auto-cracy
Democracy in Part 1	0.902	-3.534	0.774	3.079
	(2.531)	(2.746)	(2.393)	(3.603)
Restr. Autocr. in Part 1	3.325*	-2.305	-2.411	-0.031
	(1.982)	(2.746)	(1.996)	(3.192)
Autocracy in Part 1	2.358	-2.618	-1.247	0.047
	(1.816)	(2.355)	(1.844)	(3.085)
Avg. payoff Part 1	0.015	-0.008	-0.008	0.002
	(0.014)	(0.018)	(0.014)	(0.024)
Avg. payoff Part 1 × Democracy	-0.002	0.029	-0.011	-0.026
	(0.024)	(0.024)	(0.022)	(0.032)
Avg. payoff Part 1 × Restr. Autocr.	-0.026	0.018	0.020	0.007
	(0.017)	(0.021)	(0.017)	(0.027)
Avg. payoff Part 1 × Autocracy	-0.021	0.020	0.010	0.003
	(0.016)	(0.020)	(0.016)	(0.026)
Constant	-1.686	2.156	0.837	-2.277
	(1.632)	(2.196)	(1.664)	(2.927)
Observations	354	354	354	354

Notes: Logistic regressions. The dependent variable takes value 1 if the organizational style was supported and 0 otherwise. The omitted category is the autonomy. Numbers in parentheses indicate robust standard errors. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: Other determinants of voting behavior

Dependent variable:	Option supported (*1 if yes, 0 otherwise*)			
	Auto-nomy	Demo-cracy	Restr. Autocr.	Auto-cracy
Female	0.355	0.578**	0.003	-0.774**
	(0.254)	(0.288)	(0.260)	(0.359)
Business/Economics	0.363	-0.401	-0.155	0.151
	(0.247)	(0.272)	(0.249)	(0.336)
Age	0.025	-0.061**	-0.050*	0.029
	(0.023)	(0.027)	(0.027)	(0.021)
Conservatism	0.107*	-0.057	-0.121*	-0.032
	(0.061)	(0.063)	(0.062)	(0.079)
Risk	-0.013	0.121*	-0.039	0.071
	(0.058)	(0.070)	(0.058)	(0.090)
Trust in others	0.013	-0.116	0.090	-0.434
	(0.201)	(0.254)	(0.205)	(0.314)
Expectations of others	0.092	0.576***	0.343**	-0.238
	(0.142)	(0.169)	(0.151)	(0.196)
Competitiveness	0.078	-0.110	0.014	0.102
	(0.058)	(0.069)	(0.058)	(0.082)
CRT score	-0.046	0.081	0.100	-0.050
	(0.098)	(0.111)	(0.101)	(0.141)
Constant	-1.821*	0.704	-1.011	-0.974
	(1.072)	(1.221)	(1.107)	(1.305)
Observations	354	354	354	354

Notes: Logistic regressions. The dependent variable takes value 1 if the option was supported and 0 otherwise. Business/Economics is a dummy variable that takes the value 1 if the subject studies business or economics and 0 otherwise. Conservatism was elicited on a scale from 0 (Left) to 10 (Right). Risk attitudes were elicited on a scale from 0 (not at all willing to take risks) to 10 (very willing to take risks). Competitiveness was measured on a scale from 0 (not at all competitive) to 10 (very competitive). Trust in others is an average index, measured on a scale from 1 to 4, combined over all three statements. Expectation of others is an average index, measured on a scale from 1 to 5, combined over all three statements. The CRT score corresponds to the number of correct answers in the three questions of the CRT test (see Appendix C for an exact wording of these questions). Numbers in parentheses indicate robust standard errors. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: Contest investments in Part 2 depending on income and experienced treatment in Part 1

Dependent variable:	Individual investment$_t$		
	Auto-nomy	Demo-cracy	Restr. Autocr.
Democracy	-38.003	10.894	5.703
	(25.883)	(9.506)	(16.002)
Restr. Autocracy	-13.204	3.707	-6.012
	(21.756)	(8.283)	(13.606)
Autocracy	-2.956	-0.208	9.515
	(20.660)	(7.569)	(12.953)
Payoff in Part 1	-0.190	0.001	-0.001
	(0.146)	(0.033)	(0.070)
Payoff in Part 1 × Democracy	0.333	-0.005	-0.008
	(0.221)	(0.061)	(0.124)
Payoff in Part 1 × Restr. Autocracy	0.172	-0.004	-0.004
	(0.176)	(0.050)	(0.087)
Payoff in Part 1 × Autocracy	0.010	-0.004	0.002
	(0.166)	(0.039)	(0.080)
Constant	44.974**	41.354***	46.959***
	(18.654)	(5.892)	(10.484)
Observations	2100	3480	1260

Notes: Multilevel linear mixed-effects model with random intercepts at the contest, group, and individual level. The dependent variable is an individual's investment into the contest in period t in Part 2 of the experiment. The omitted category is the autonomy. Numbers in parentheses indicate standard errors. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: Questionnaire responses by dictator type

	Benevolent dictators ($n = 12$)	Selfish/Moderate dictators ($n = 18$)	t-test
Competitiveness	4.58	6.78	$p = 0.026$
Trust in others	4.75	2.26	$p = 0.026$
Expectations of others	4.02	3.72	$p = 0.069$
Risk lovingness	4.75	6.28	$p = 0.067$
CRT score	1.58	1.50	$p = 0.852$
Conservatism	3.50	4.17	$p = 0.402$
% female	0.50	0.61	$p = 0.563$
% studying business/economics	0.67	0.56	$p = 0.559$

Notes: Shown are mean scores. Business/Economics is a dummy variable that takes the value 1 if the subject studies business or economics and 0 otherwise. Conservatism was elicited on a scale from 0 (Left) to 10 (Right). Risk attitudes were elicited on a scale from 0 (not at all willing to take risks) to 10 (very willing to take risks). Competitiveness was measured on a scale from 0 (not at all competitive) to 10 (very competitive). Trust in others is an average index, measured on a scale from 1 to 4, combined over all three statements. Expectation of others is an average index, measured on a scale from 1 to 5, combined over all three statements. The CRT score corresponds to the number of correct answers in the three questions of the CRT test (see Appendix C for an exact wording of these questions).
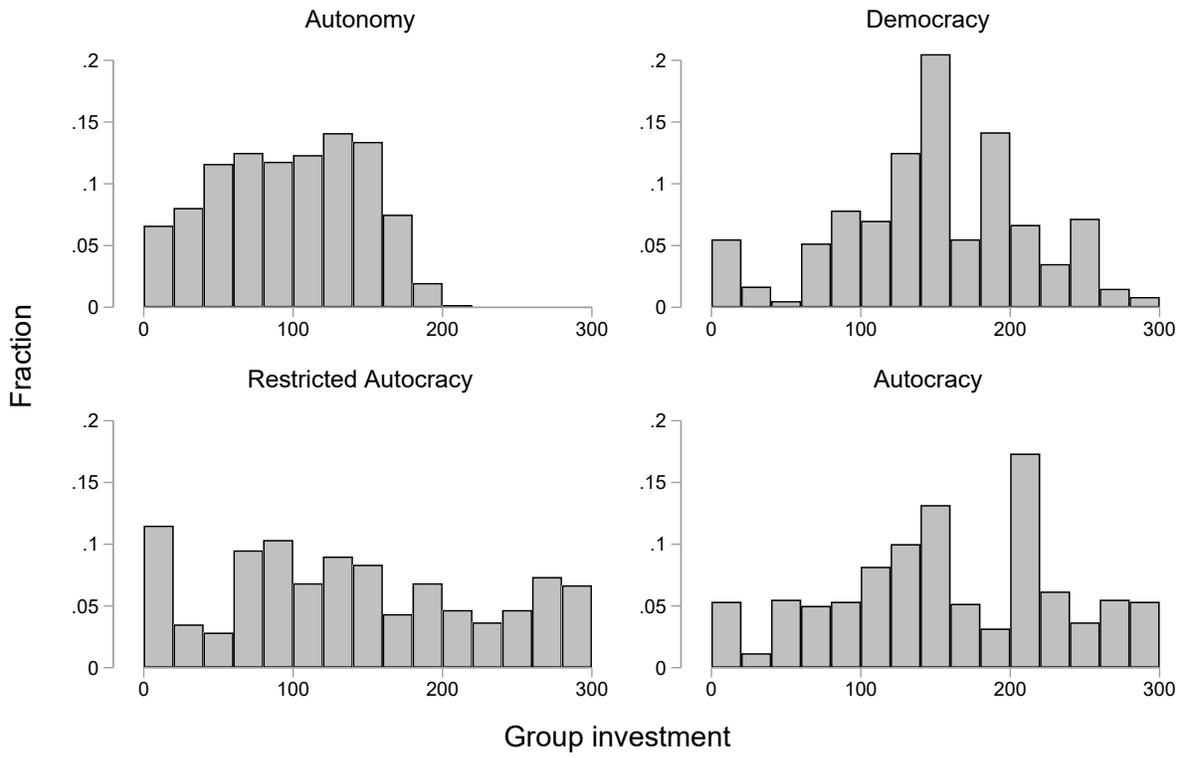
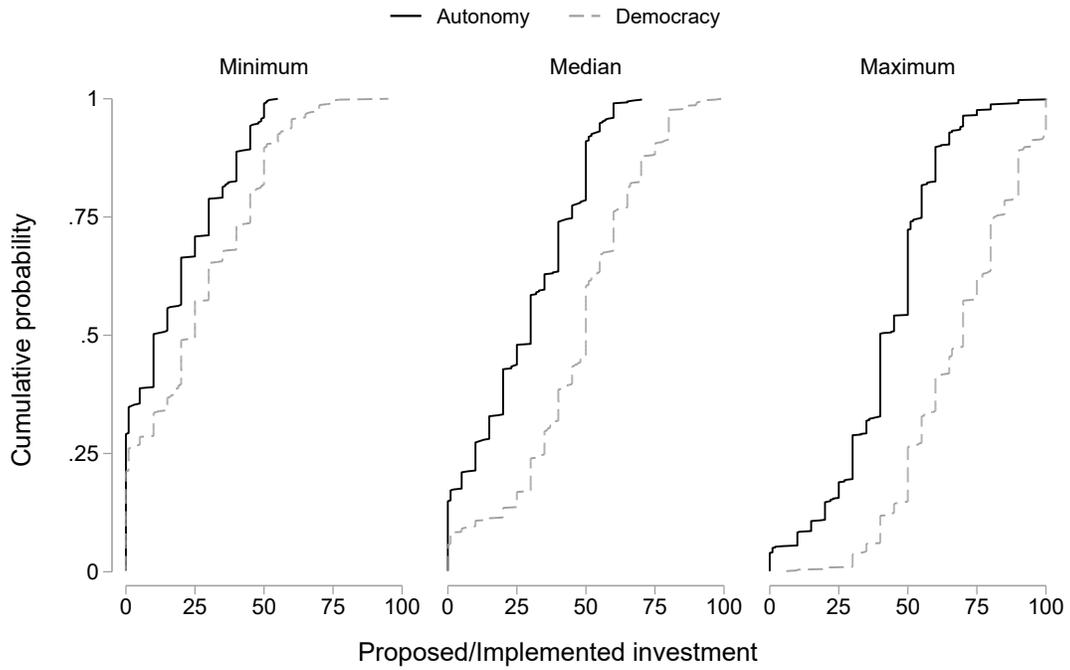**Figure A1:** Distribution of total group investments for each of the four treatments.

Figure A2: Distribution of the minimum, median, and maximum (proposed) investment level under the autonomy and democracy.
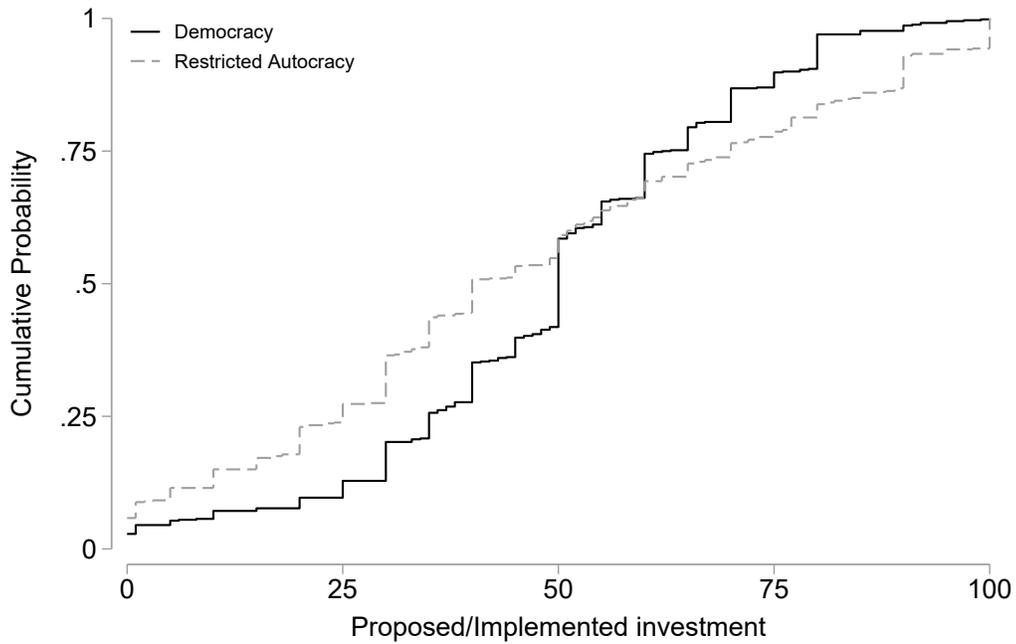

Figure A3: Distribution of proposed and implemented investment levels in the democracy and restricted autocracy treatment, respectively.
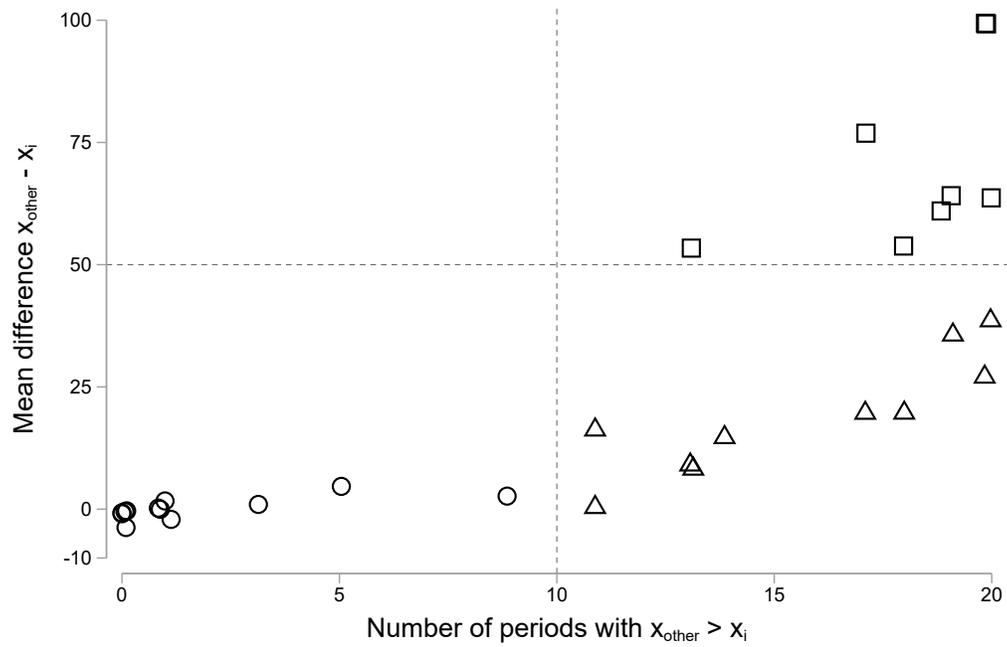
Figure A4: Heterogeneity of dictator behavior ($n = 30$). Dashed lines display cutoff values used for classifying types. As cutoff values, I use the midpoint of each scale (10 for the $x - axis$ and 50 for the $y - axis$), thus dividing the diagram into four quadrants, which allows for a rough but simple and intuitive classification. Circles correspond to benevolent dictators, triangles correspond to moderate dictators, and squares correspond to selfish dictators. Qualitatively similar results are obtained when using alternative ways of classifying types.
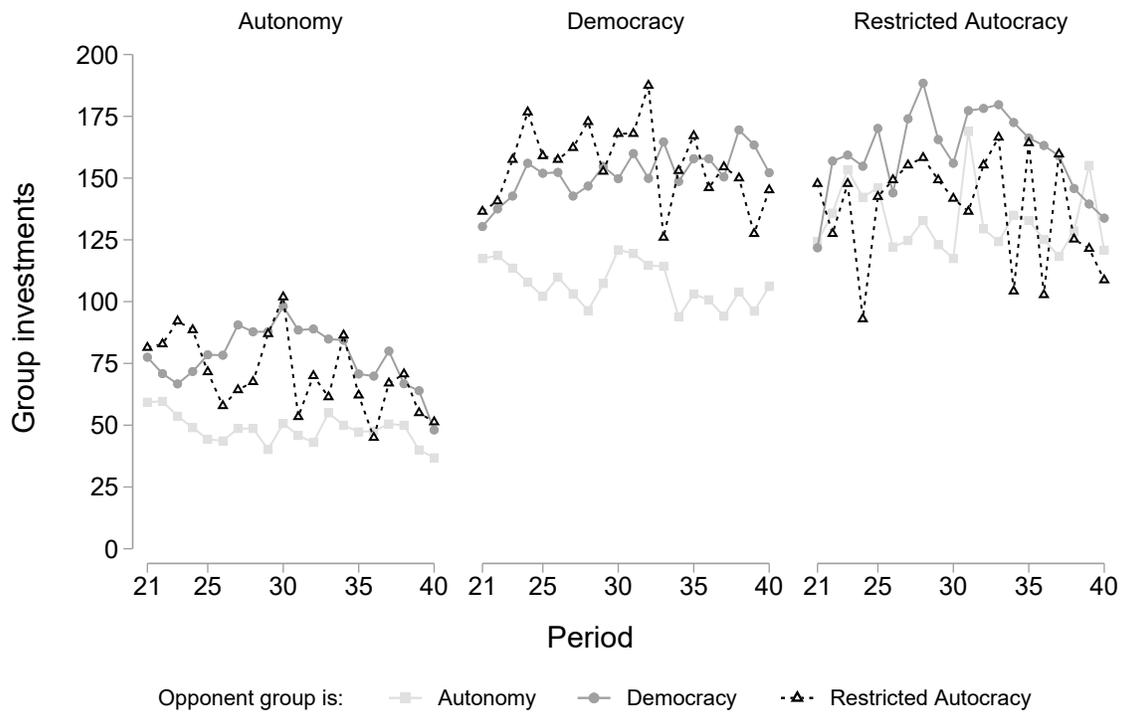
Figure A5: Contest investments in Part 2 by own and other's organizational style.

B Theoretical Considerations

The basic decision situation is an adaption of the classical Tullock contest model (Tullock, 1967), applied to a situation in which two groups ($j = 1, 2$) of $n = 3$ players each compete for a prize that is shared equally among the members of the winning party (Katz et al., 1990). The prize thus constitutes a public good, with an individual valuation of v. Initially, each player is endowed with the same amount of resources, ω. All players have to simultaneously and independently decide how much of their endowment they want to invest into the conflict. While investing is costly for the individual, it increases the chance of the own group winning the contest. The performance of the group thereby depends on the joint investments of all members, i.e., investments are perfect substitutes. Formally, let $x_{i,j}$ denote the investment by player i in group j. A group's performance is then determined by the sum of all investments, i.e., $X_j = \sum_{i=1}^{n} x_{i,j}$. The probability of winning the contest depends on the relative investment of both groups. Following Tullock (1980), I use the following contest success function:

$$p_j(X_1, X_2) = \begin{cases} \frac{X_j}{X_1 + X_2} & \text{if} \quad X_1 + X_2 > 0 \\ \frac{1}{2} & \text{otherwise} \end{cases} \tag{3}$$

The expected payoff of player i in group j is thus given by

$$\pi_{i,j}(x_{i,j}, X_1, X_2) = \omega - x_{i,j} + p_j \cdot v \tag{4}$$

Within this framework, I consider the following four group structures:

- **Autonomy**: Each group member decides individually and simultaneously about the own conflict investment.

- **Democracy**: Each group member first makes a proposal about a common investment level. After all proposals have been collected, the median proposal within each group is implemented for each group member.

- **Restricted Autocracy**: One group member determines common investment level, i.e., $X_j = n \cdot x_{i,j}$.

- **Autocracy**: One group member has full decision power over all group members' investments. Investment levels can differ across members.

In the following, I derive the Nash equilibrium predictions under the assumption that players are risk-neutral and only care about their own monetary payoff. Note that for reasons of exposition, the order in which the different organizational structures are discussed is slightly adjusted.

Symmetric contests

Autonomy

By inserting (3) into (4) and taking the first derivative with respect to $x_{i,j}$, for individual i in group $j = 1$ I obtain the following first-order condition:

$$\frac{\partial \pi_{i,1}}{\partial x_{i,1}} = \frac{X_2}{(X_1 + X_2)^2} \cdot v - 1 \tag{5}$$

By setting this equation equal to zero and solving for X_1 I obtain the following best-response function:

$$X_1 = \sqrt{vX_2} - X_2 \tag{6}$$

In symmetric contests between two identical groups, in the symmetric Nash equilibrium I have $X_1 = X_2 = X$, and thus:

$$X^* = \frac{v}{4} \tag{7}$$

Restricted Autocracy

The dictator determines a common investment level for all group members, i.e., $X_j = n \cdot x_{i,j}$. The objective function of dictator i in group $j = 1$ can thus be rewritten as:

$$\pi_{i,1}(x_{i,1}, X_2) = \omega - x_{i,1} + \frac{nx_{i,1}}{nx_{i,1} + X_2} \cdot v \tag{8}$$

By taking the first derivative of (11) with respect to $x_{i,1}$ I obtain the following first-order condition:

$$\frac{\partial \pi_{i,1}}{\partial x_{i,1}} = \frac{n \cdot X_2}{(nx_{i,1} + X_2)^2} \cdot v - 1 \tag{9}$$

By setting this equation equal to zero and solving for $x_{i,1}$ I obtain the following best-response function:

$$x_{i,1} = \frac{\sqrt{nvX_2} - X_2}{n} \tag{10}$$

In symmetric contests between two identical groups, in the symmetric Nash equilibrium I have $x_1 = x_2 = x$, and thus:

$$x^* = \frac{v}{4} \tag{11}$$

Given that $X_j = n \cdot x_{i,j}$, for the total group investments I thus get:

$$X^* = \frac{nv}{4} \tag{12}$$

Democracy

Under the democracy, contest investments are determined by voting. In particular, each group member can make a proposal by submitting a common investment level $\tilde{x}$. Subsequently, the median proposal within each group is implemented for all group members.

As a result of this aggregation method, there is a vast range of Nash equilibria, both with regard to the individual proposals as well as with regard to the group's total investment. For example, any profile in which all players in a group make the same proposal is a Nash equilibrium, because the median vote will not change if any single player changes her vote. As a result, there are multiple symmetric Nash equilibria in which both groups invest the same amounts into competition, including one in which all players propose zero investments, as well as one in which all members propose maximum investments. In addition, there are also multiple asymmetric equilibria in which proposals are the same within but not between groups.

To circumvent the issue of multiplicity of Nash equilibria, as a refinement criterion, I assume that players coordinate on an investment level that is Pareto efficient from the own group's point of view. That is, I only focus on those equilibria which are robust against joint deviations from a coalition of players within the same group. This refinement criterion is related to the concepts of strong Nash equilibrium (Aumann, 1959) and coalition-proof Nash equilibrium (Bernheim et al., 1987), and has been applied to similar contexts before (see e.g., Gürtler, 2008). To illustrate the intuition behind this refinement, imagine the situation in which all players in both groups propose an investment level of zero. This situation constitutes a Nash equilibrium as no player has an incentive to deviate unilaterally. Yet, all group members would prefer to jointly deviate to a different strategy profile, where, again, no player has an incentive to unilaterally deviate. In particular, if the rivaling group invests nothing into the contest, all members of the other group would be strictly better off when jointly deviating to, e.g., a strategy profile of one, in which case the group would win the contest with certainty (rather than with probability of 0.5 when sticking to the strategy profile of zero).

Applying this logic to both groups, it follows that in symmetric contests the only remaining Nash equilibria are the ones in which total investments in both groups are equal to $X^* = \frac{nv}{4}$. Note that this is the same prediction as in the restricted autocracy. The intuition for this is straightforward, as a coalition of players in the democracy effectively faces the same incentives as the dictator in the restricted autocracy: When deviating jointly and increasing the proposed investment level by one unit, a group's total investment level increases by n units (each of the n group members has to follow the binding vote and increase their investment by one unit). Yet, each individual only bears a share of $\frac{1}{n}$ of the total investment costs. As a result, when applying the refinement criterion of Pareto efficiency within groups, I obtain a unique prediction with regard to the group's total investments. Yet, similar to the case of the autonomy, there are multiple equilibria with regard to the individual proposals,

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as any combination of proposals where the median proposal is equal to $\frac{v}{4}$ constitutes an equilibrium.

Autocracy

Dictators determine a vector of investments $\mathbf{x} = (x_i, x_{-i})$, where $x_i, x_{-i} \in [0, \omega]$ are the investment levels of themselves and their group members. Purely self-interested dictators always invest the maximum possible amount of the other groups members, as any investment by others increases the groups's winning probability (and hence the dictators' expected payoffs) without causing them any costs. Hence, I have $x_{-i} = \omega$. The group's total investment can thus be rewritten as $X_j = x_{i,j} + (n-1) \cdot \omega$.

By taking the first derivative of the dictator's objective function with respect to $x_{i,j}$, for dictator i in group $j = 1$ I obtain the following first-order condition:

$$\frac{\partial \pi_{i,1}}{\partial x_{i,1}} = \frac{X_2}{(X_1 + X_2)^2} \cdot v - 1 \tag{13}$$

By setting this equation equal to zero and solving for $x_{i,1}$ I obtain the following best-response function:

$$x_{i,1} = \sqrt{v X_2} - X_2 - (n-1) \cdot \omega \tag{14}$$

In symmetric contests between two identical groups, in the symmetric Nash equilibrium I have $x_1 = x_2 = x$, and thus:

$$x^* = \frac{v}{4} - (n-1) \cdot \omega \tag{15}$$

Hence, dictators only invests themselves ($x^* > 0$), if $\frac{v}{4} > (n-1) \cdot \omega$, i.e., if the prize is sufficiently large and/or the endowment of the other group members is sufficiently small. Note that the threshold $\frac{v}{4}$ is identical to the unique Nash equilibrium under the autonomy. Intuitively, dictators are only willing to invest any positive amount themselves if the aggregated funds of the other group members are smaller than the investment amount which is optimal from an individual point of view when all group members decide autonomously.

Asymmetric contests

To derive the predictions for the asymmetric contests I can use and cross-match the best-response functions as derived above (see equations (6), (9), and (13)).

Autonomy vs. Restricted Autocracy

For the asymmetric contest between an autonomy ($j = 1$) and a restricted autocracy ($j = 2$), I have:

$$X_1^{Autonomy} = \sqrt{vX_2} - X_2$$

and

$$X_2^{Restr.Autocr.} = \sqrt{nvX_1} - X_1$$

By inserting these two best-response functions into each other and solving for $X_1^{Autonomy}$ and $X_2^{Restr.Autocr.}$, respectively, I obtain:

$$X_{Autonomy,Restr.Autocr.}^* = \frac{nv}{(n+1)^2} \tag{16}$$

and

$$X_{Restr.Autocr.,Autonomy}^* = \frac{n^2v}{(n+1)^2} \tag{17}$$

Note that for $n > 1$, in both cases the predicted investments are lower than the ones for the symmetric contests.

Autonomy vs. Autocracy

For the asymmetric contest between an autonomy ($j = 1$) and an autocracy ($j = 2$), I have:

$$X_1^{Autonomy} = \sqrt{vX_2} - X_2$$

and

$$x_2^{Autocracy} = \sqrt{vX_1} - X_1 - (n-1) \cdot \omega$$

Since a self-interested dictator always invests the maximum possible amount from his group members, it follows that $X_2^{DIC} \geq (n-1) \cdot \omega$. By inserting $(n-1) \cdot \omega$ into the best-response function of the autonomy, it is easy to see that members of the autonomy are only willing to invest any positive amount into the contest if $v > (n-1) \cdot \omega$, i.e., if the prize is sufficiently large and/or the disposable resources of the dictator's group members are sufficiently small.

For the parameters of my experiment ($n = 3, v = 100, \omega = 100$), this condition is not fulfilled. Hence, given the dictator's minimum investment of $(n-1) \cdot \omega = 200$, the members of the autonomy prefer to stay out of the competition and invest nothing. As a consequence, given that the dictator group will win the contest with certainty, the dictator has no incentive to invest anything himself. I thus have $X_{Autonomy,Autocracy}^* = 0$ and $X_{Autocracy,Autonomy}^* = 200$

as the unique Nash equilibrium.

Restricted Autocracy vs. Autocracy

For the asymmetric contest between a restricted autocracy ($j = 1$) and an autocracy ($j = 2$), I obtain:

$$X_1^{Restr.Autocr.} = \sqrt{nvX_2} - X_2$$

and

$$x_2^{Autocracy} = \sqrt{vX_1} - X_1 - (n-1) \cdot \omega$$

Similar to the case above, I know that the dictator in the discriminatory autocracy invests at least $(n-1) \cdot \omega$. Inserting this into the best reply function of the restricted autocracy, I find that the dictator under this regime is only willing to invest a positive amount if $nv > (n-1) \cdot \omega$. In my experiment this condition is fulfilled. In particular, given my parameters, I find that if the dictator in the discriminatory autocracy invests $(n-1) \cdot \omega = 200$, the best response of the dictator in the restricted autocracy is to invest $X_1^{Restr.Autocr.} = \sqrt{nv(n-1) \cdot \omega} - (n-1) \cdot \omega = \sqrt{60000} - 200 \approx 44.95$.

To check whether this can be part of an equilibrium, I need to check whether $(n-1) \cdot \omega$ is also a best reply for the dictator in the discriminatory autocracy. Given the parameter of my experiment, this is indeed the case. In general, a discriminatory dictator is only willing to invest anything himself if $v > \frac{((n-1)\omega+X_1)^2}{X_1}$. Given $X_1^{Restr.Autocr.}$ and given my group size of $n = 3$ and $\omega = 100$, in my case the dictator would be only willing to invest if $v > \frac{60000}{44.948974} \approx 1334.85$. Since in my experiment $v = 100$, the best reply of the dictator is indeed to not invest himself but to set $x_i = 0$ and $x_{-i} = 100$. I thus have $X_{Restr.Autocr.,Autocracy}^* = 44.95$ and $X_{Autocracy,Restr.Autocr.}^* = 200$ as the unique Nash equilibrium.

Asymmetric contests involving democracies

As before, without further assumptions, there is a vast range of equilibria for democracies also in asymmetric contests. Similar to the logic above, any profile in which all players in the group make the same proposal is a Nash equilibrium, because the median vote will not change if any single player changes her vote.

If, however, I again use the refinement criterion from above, assuming that players coordinate on those equilibria that are Pareto efficient from the own group's point of view (i.e., those equilibria which are robust against joint deviations from a coalition of players), the prediction for the group's total investments are the same as for the restricted autocracy. The intuition for this is the same as for symmetric contests. A coalition of players under the democracy faces the exact same incentives as a dictator in the restricted autocracy: When deviating jointly and increasing the proposed investment level by one unit, a group's total investment level increases by n units (each of the n group members has to follow the binding vote and increase their investment by one unit), but each individual only bears a share of $\frac{1}{n}$ of the total investment costs. It thus follows that when applying the refinement criterion

of Pareto efficiency within groups, the aggregated investments are predicted to be the same across both group structures.

Table B1 provides a summary of the predictions for both symmetric and asymmetric contests using the parameters from my experiment ($n = 3, v = 100, \omega = 100$).

Table B1: Benchmark predictions.

Own Group	Opponent	Group investment	Winning probability	Mean expected payoff
Symmetric contests				
Autonomy	Autonomy	25	0.5	141.67
Democracy	Democracy	75	0.5	125
Restr. Autocr.	Restr. Autocr.	75	0.5	125
Autocracy	Autocracy	200	0.5	83.33
Asymmetric contests				
Autonomy	Democracy	18.75, 56.25	0.25, 0.75	118.75, 156.25
Autonomy	Restr. Autocr.	18.75, 56.25	0.25, 0.75	118.75, 156.25
Autonomy	Autocracy	0, 200	0, 1	100, 133.33
Democracy	Restr. Autocr.	75, 75	0.5, 0.5	125, 125
Democracy	Autocracy	44.95, 200	0.18, 0.82	103.02, 115.33
Restr. Autocr.	Autocracy	44.95, 200	0.18, 0.82	103.02, 115.33

Notes: Under the autocracy, dictators are always predicted to invest 0, while the other two group members are predicted to invest 100. The predictions for the democracy are derived using the additional assumption that group members coordinate on the equilibrium in which no coalition within a group has an incentive to jointly deviate. For the asymmetric contests, the first number in each column refers to the own group, while the second refers to the opponent's group.

C Experimental Instructions (translated from German)

General Instructions

Welcome and thank you for your participation in this experiment. For your participation and punctual arrival, you receive € 4. You can earn an additional substantial amount of money in this experiment. The exact amount you will receive depends on your decisions and the decisions of the other participants. It is therefore very important that you read the following instructions carefully.

During the experiment, you are not allowed to communicate with other participants of the experiment or any person outside the laboratory. For this reason, all mobile phones must be switched off. If you have questions about the instructions or the study, please raise your hand. We will privately answer your question at your place. Disregarding these rule leads to the exclusion from this experiment and from all payments.

In this study all earnings are first calculated in points. You will receive the sum of your earnings in cash at the end of this study, using the following exchange rate:

$$10 \text{ Points} = 2.5 \text{ Eurocent}$$

The experiment consists of two parts (Part I and Part II). In the following we will first explain to you the rules of Part I. You will receive the instructions for Part II once Part I is finished.

Part I

Part I of this study consists of twenty (20) consecutive periods. The decision situation in each of the 20 periods is identical.

At the beginning of Part I, all participants are randomly matched into groups of three (3) participants. During the experiment, you will interact with the two other members of your group, as well as with another group of three participants. The composition of the groups remains the same across all 20 periods. This means that in Part I you will always interact with the same people. Neither during nor after the experiment you will learn the identity of the people you interacted with. All payments at the end of the study will therefore be made anonymously.

Competition for a prize

In each of the 20 periods, your group and the other group compete for a prize of 300 points. The chance of your group winning the prize thereby depend on how many points your group and the other group invest into a contest account.

Investing into the Contest Account*[Treatment specific]*

Autonomy treatment only: At the beginning of each of the 20 periods, each group member receives an endowment of 100 points. You can keep these points either for yourself or invest them (fully or partly) into the contest account of your group. That is, in each period you decide on how many points you want to invest into the contest account of your group. The total amount of points in the contest account of your group is determined by the sum of investments of all group members. Each point not invested into the contest account remains automatically on your private account, which will be added to your earnings in that period.

Democracy treatment only: At the beginning of each of the 20 periods, each group member receives an endowment of 100 points. You can keep these points either for yourself or invest them (fully or partly) into the contest account of your group. In each period, you can make a proposal of how many points each group member (including you) should invest into the contest account of your group. Your two group members each also make a proposal. After that, the proposals are sorted by size, and the middle proposal is implemented for all group members. This proposal thus determines how many points each group member must invest into the contest account. The total amount of points in the contest account of your group is determined by the sum of investments of all group members ($= 3 \times$ implemented proposal). Each point not invested into the contest account remains automatically on your private account, which will be added to your earnings in that period.

Autocracy treatment only: At the beginning of each of the 20 periods, each group member receives an endowment of 100 points. You can keep these points either for yourself or invest them (fully or partly) into the contest account of your group. Before the start of the first period, one group member will randomly be selected. In each period, this group member decides how many points each group member must invest into the contest account of your group. The investment into the contest account can thereby differ for each group member. The other two non-selected group members have no decision to make. At the beginning of the experiment you will be informed in which role you are. The total amount of points in the contest account of your group is determined by the sum of investments of all group members. Each point not invested into the contest account remains automatically on your private account, which will be added to your earnings in that period.

Restricted autocracy treatment only: At the beginning of each of the 20 periods, each group member receives an endowment of 100 points. You can keep these points either for yourself or invest them (fully or partly) into the contest account of your group. Before the start of the first period, one group member will randomly be selected. In each period, this group member decides how many points each group member must invest into the contest account of your group. The investment into the contest account thereby has to be the same for all group members. The other two non-selected group members have no decision to make. At the beginning of the experiment you will be informed in which role you are. The total amount of points in the contest account of your group is determined by the sum of

investments of all group members ($= 3 \times$ implemented investment decision of the selected group member). Each point not invested into the contest account remains automatically on your private account, which will be added to your earnings in that period.

The other group is in the exact same decision situation and decides on the investments into the contest account in the exact same manner as your group.

Determining the chance of winning

Once both groups have decided on how many points to invest into their contest account, the probability that your group and the probability that the other group will win the contest are determined.

The winning probability of both groups thereby depends on how many points your group and the other group invested into their respective contest account. In general:

The probability that your group wins the contest is

- The higher the more points your group invests into the contest account

- The lower the more points the other group invests into their contest account

The other group is in the analogues but reversed situation. That is, the probability that the other group wins the contest is

- The lower the more points your group invests into the contest account

- The higher the more points the other group invests into their contest account

The exact winning probability of your group is calculated as follows:

$$\frac{\text{Total amount of points invested in your group}}{\text{Total amount of points invested in both groups together}}$$

Examples:

1. If your group invests a total of 100 points into the contest account and the other group also invests 100 points into their contest account, then the total amount of invested points by both groups together is 200 points. The probability that your group wins the contest therefore is $\frac{100}{200} = \frac{1}{2} = 50\%$. The probability that the other group wins the contest is $\frac{100}{200} = \frac{1}{2} = 50\%$.

2. If your group invests a total of 40 points into the contest account and the other group invests 120 points into their contest account, then the total amount of invested points by both groups together is 160 points. The probability that your group wins the contest then is $\frac{40}{160} = \frac{1}{4} = 25\%$. The probability that the other group wins the contest then is $\frac{120}{160} = \frac{3}{4} = 75\%$.

Important:

- If one group does not invest any points into their contest account, then the other group wins the contest with certainty.

- If none of the two groups invest any points into their respective contest account, then the winner will be determined randomly.

Determining the winner of the contest

After the winning probabilities have been determined, a random draw of the computer based on these probabilities will determine, which group wins the contest in this period.

The prize in each period is 300 points. The prize is always allocated equally among the three group members of the winning team (irrespective of how many points each group member invested into the contest account). This means that the three members of the winning group each receive 100 points from the contest. The members of the other group receive 0 points from the contest in this period.

Your period income

Your income in a period is determined by the sum of earnings from your private account (= amount of points not invested into the contest) plus your earnings from the contest.

If your group wins the contest:

$$\text{Your income} = 100 \text{ - your invested points} + 100$$

If your group does not win the contest:

$$\text{Your income} = 100 \text{ - your invested points}$$

End of a period

At the end of each period, after all participants have made an investment decision, you will receive information about:

- The amount of points that each group member invested into the contest account of your group

- The total amount of points the other group invested into their contest account

- The resulting winning probabilities of both groups

- The winner of the contest

- The income of each member of your group

After that a new period starts. Each group member again receives an endowment of 100 points and your group can again win a prize of 300 points. Your total income from Part I is determined by the sum of your earnings from all 20 periods. You should therefore take your decisions in all periods seriously.

Control questions

Note: These questions are taken from the democracy treatment.

Please answer the following questions. The purpose of these questions is to ensure that all participants fully understand the instructions.

Assume that the proposals of the three members in your group are: 10, 40, and 100.

Question 1: What are the total investments into the contest account in your group?

Further assume that the proposals of the three members in the other group are: 0, 10, and 50.

Question 2: What are the total investments into the contest account in the other group?

What is the winning probability

- Question 3: In your group (in %)?

- Question 4: In the other group (in %)?

Question 5: What is the winning probability (in %) in your group if the proposals in the other group are 0, 40, and 90 instead of 0, 10, and 50 (as before)?

Assume that your group won the contest in this period and that the proposals of investments in your group were: You: 50, Group member 1: 20, Group member 2: 80.

Question 6: How many points do you have on your private account?

Question 7: How many points does group member 1 has on his/her private account?

Question 8: How many points does group member 2 has on his/her private account?

Question 9: How many points do you receive from the contest?

Question 10: How many points does group member 1 receive from the contest?

Question 11: How many points does group member 2 receive from the contest?

Question 12: What is your total income in this period?

Question 13: What is the total income of group member 1 in this period?

Question 14: What is the total income of group member 2 in this period?

Question 15: How many points do the members of the other group receive from the contest in this period?

Part II

Part II of this study also consists of a repeated contest between two groups of three participants each. The composition of groups in Part II is thereby different from the one in Part I. At the beginning of Part II all groups are first dissolved. After that, new groups are randomly formed. You therefore play with different participants in your group. Also the composition of participants in the other group is different.

In Part II there are twenty (20) consecutive periods. The new composition of groups remains the same across all these periods. Differently from Part I, each group can now determine according to which rule points can be invested into the contest account of the own group. You can choose between four different rules:

- Rule 1: Each group member can decide individually how many points to invest into the contest account of the group. The total investment of your group into the contest account is determined by the sum of the individual investments.

- Rule 2: Each group member makes a proposal of how many points each group member should invest into the contest account of your group. After that, the proposals are sorted by size, and the middle proposal is implemented for all group members. This proposal thus determines how many points each group member must invest into the contest account. This means that the investments of all group members are always the same. The total amount of points in the contest account of your group is determined by the sum of investments of all group members (= 3 × implemented proposal).

- Rule 3: Before the start of the first period, one group member will randomly be selected. In each period, this group member decides how many points each group member must invest into the contest account of your group. The investment into the contest account thereby has to be the same for all group members. The other two non-selected group members have no decision to make. The total amount of points in the contest account of your group is determined by the sum of investments of all group members (= 3 × implemented investment decision of the selected group member).

- Rule 4: Before the start of the first period, one group member will randomly be selected. In each period, this group member decides how many points each group member must invest into the contest account of your group. The investment into the contest account can thereby differ for each group member. The other two non-selected group members have no decision to make. At the beginning of the experiment you will be informed in which role you are. The total amount of points in the contest account of your group is determined by the sum of investments of all group members.

Deciding on the rule

Before the start of Part II, you can state for each of the four rules whether you support that rule or not. You can support as many rules as you want.

After all group members have made their decisions, we count, separately for each group, which rule received the largest amount of support. This rule will then be implemented for your group for all 20 periods in Part II. If there is more than one rule with the largest amount of support, one of the rules with the largest number of votes will be implemented at random.

The other group decides like your group about which rule to adopt. Please note that the other group might implement a rule that is different from the one implemented in your group. Before the start of the first period you will be informed about the rule that is implemented in your group and the rule that is implemented in the other group. After that, the 20 periods start.

Your total income

Your total income from Part II is determined by the sum of your earnings from all 20 periods. At the end of the experiment, your income from Part I and Part II will be added up and exchanged into Euros. At the end of the experiment, you will receive this amount plus the €4 show-up fee for your punctual arrival in cash.

Questionnaire Items

- **Risk**: How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid risks? Please tick a box on the scale, where the value 0 means: 'completely unwilling to take risks' and the value 10 means: 'completely willing to take risks'. With the values in between you can grade your assessment (compare Dohmen et al. (2012)).

- **Competitiveness**: How do you see yourself: Are you generally a competitive person or do you try to avoid competitions? Please tick a box on the scale, where the value 0 means: 'not at all competitive' and the value 10 means: 'very competitive'.

- **Trust in others**: To what extent do you agree or disagree with the following statements? (strongly agree, agree somewhat, disagree somewhat, strongly disagree; compare Dohmen et al. (2012)):

    - In general, one can trust people (a)
    - These days you cannot rely on anybody else (b)
    - When dealing with strangers it is better to be careful before you trust them (c)

- **Expectation of others**: To what extent do the following statements apply to you? (answers were elicited on a 5-point scale ranging from 1: "Does not apply at all", to 5 "applies fully"):

    - I always try to meet the expectations of other people (a)
    - It is important to me to not disappoint other people (b)
    - Other people's expectations of me are not important for my decisions (c)

- **Cognitive reflection test** (Frederick, 2005):

    - A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost? (a)
    - If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? (b)
    - In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? (c)

- **Political attitudes** (conservatism): Many people use the terms left and right when referring to different political attitudes. If you think of your own political views, where would you put them on a scale between 0 and 10? Please tick a box on the scale, where the value 0 means: 'Left' and the value 10 means: 'Right'. With the values in between you can grade your assessment.

D Details Online Survey

The survey was conducted online using the software platform Qualtrics. Student participants were recruited from various disciplines using the online recruiting software ORSEE (Greiner, 2015). Participation was restricted to participants who had not taken part in my main experiment. In total, I collected data from $n = 91$ participants. The survey lasted on average 16 minutes and participants earned a flat payment of € 5. In addition, among all participants who completed the survey one prize of € 50 was given away to one randomly selected participant.

At the beginning of the survey, participants were introduced to the basic decision situation of the Tullock contest as well as the parameters of my main experiment. The instructions were thereby (except for a few words) identical to the instructions of my main experiment (see Appendix C). After that, participants had to successfully complete a comprehension test consisting of several questions about the rules and the comparative statics of the game. Subsequently, they were introduced to the four different organizational styles. To not influence the participants, I simply referred to the different organizational styles as rules (as in the main experiment). To ensure that participants understood how the organizational styles differed from each other, they had to answer another set of control questions. Only after correctly answering all of these questions, participants proceeded to the main part of the survey. In this main part, they were asked (i) to rank the four organizational styles from their most to least preferred option (ii) to describe in a few short sentences the reasons/motives for their ranking (iii) to evaluate how they perceive the different organizational styles, and (iv) to state how important they think certain factors are (see below for an exact wording of these questions).

To classify the free-form answers under (ii), a first research assistant was asked to read all statements and propose a number of categories that can be used to classify the statements. Based on this, six broad categories emerged: (1) fairness/equity/equality, (2) autonomy/self-determination/control over own investments, (3) democratic decision-making process/all participants have influence, (4) avoid exploitation by others/avoid that only one member has decision power, (5) profit/winning/efficiency/strategic advantage, and (6) miscellaneous. A second independent research assistant was then asked to classify all statements based on these categories. Each statement could thereby be attributed to more than one category.

Prioritization of the rules

In the following, we ask you to put yourself in the role of a participant in the previous experiment. So imagine yourself as being part of a group of three and taking part in the experiment described above. How do you rank the four rules? Please assign each rule a rank between 1 and 4, where 1 means "most preferred" and 4 means "least preferred". You can assign each rank only once.

	1	2	3	4
Rule 1: Each group member can decide individually how many points to invest into the contest account of the group. The total investment of your group into the contest account is determined by the sum of the individual investments.	◯	◯	◯	◯
Rule 2: Each group member makes a proposal of how many points each group member should invest into the contest account of your group. After that, the proposals are sorted by size, and the middle proposal is implemented for all group members. This proposal thus determines how many points each group member must invest into the contest account. This means that the investments of all group members are always the same. The total amount of points in the contest account of your group is determined by the sum of investments of all group members (= 3 × implemented proposal)	◯	◯	◯	◯
Rule 3: Before the start of the first period, one group member will randomly be selected. In each period, this group member decides how many points each group member must invest into the contest account of your group. The investment into the contest account thereby has to be the same for all group members. The other two non-selected group members have no decision to make. The total amount of points in the contest account of your group is determined by the sum of investments of all group members (= 3 × implemented investment decision of the selected group member).	◯	◯	◯	◯
Rule 4: Before the start of the first period, one group member will randomly be selected. In each period, this group member decides how many points each group member must invest into the contest account of your group. The investment into the contest account can thereby differ for each group member. The other two non-selected group members have no decision to make. The total amount of points in the contest account of your group is determined by the sum of investments of all group members.	◯	◯	◯	◯

Explanation of the ranking

Please describe in a few short sentences the criteria you used to determine the ranking of the four rules. What factors/considerations played a role? What was important to you?

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Your assessment

Next, we ask you to answer a few questions about the different rules. We ask you to answer as honestly and conscientiously as possible.

1. "The way investments into the contest account are determined is fair and equitable"

2. "The individual group members have a high degree of autonomy, i.e., they can independently determine how much they want to invest."

3. "Compared to the other rules, there is a strategic advantage with regard to the likelihood of winning the contest."

The answers to these questions were given in a table like this:

	Agree fully	Agree somewhat	Disagree somewhat	Do not agree at all
Rule 1	○	○	○	○
Rule 2	○	○	○	○
Rule 3	○	○	○	○
Rule 4	○	○	○	○

Your assessment

When making a personal judgment about which rule to implement for one's own group, different factors can play a role. We have listed some possible factors below. We now ask you to indicate for each of the factors below whether you consider this factor important or rather unimportant.

For each of the following statements, please indicate how much you agree with the content of the statement on a scale from 1 (strongly agree) to 10 (strongly disagree).

	Agree fully							Do not agree at all		
It is important that all group members contribute equally to the success of the group.	○	○	○	○	○	○	○	○	○	○
It is important that all group members actively participate in the decision-making process in the group.	○	○	○	○	○	○	○	○	○	○
The most important thing is that your own group wins the competition. Everything else is secondary.	○	○	○	○	○	○	○	○	○	○