Advanced Review

Are groups more rational than individuals? A review of interactive decision making in groups

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Many decisions are interactive; the outcome of one party depends not only on its decisions or on acts of nature but also on the decisions of others. Standard game theory assumes that individuals are rational, self-interested decision makers—that is, decision makers are selfish, perfect calculators, and flawless executors of their strategies. A myriad of studies shows that these assumptions are problematic, at least when examining decisions made by individuals. In this article, we review the literature of the last 25 years on decision making by groups. Researchers have compared the strategic behavior of groups and individuals in many games: prisoner's dilemma, dictator, ultimatum, trust, centipede and principal–agent games, among others. Our review suggests that results are quite consistent in revealing that group decisions are closer to the game-theoretic assumption of rationality than individual decisions. Given that many real-world decisions are made by groups, it is possible to argue that standard game theory is a better descriptive model than previously believed by experimental researchers. We conclude by discussing future research avenues in this area.

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INTRODUCTION

People make decisions all the time. Furthermore, they make decisions in which outcomes depend not only on what they do or on acts of nature, but also on the decisions of others. Such decisions are called interactive decisions, and economists refer to them as games. If a student sells her old bike to her friend, she plays a price bargaining game. When drivers maneuver their car in heavy traffic, they play a route selection game. If one lends money to a coworker upon request, one plays a trust game. Traditional game theory, the science of rational behavior in interactive settings,[1] makes a few assumptions—mostly based on the concept of the *homo economicus*. First, it assumes that people have complete, exact knowledge of their interests and preferences.[2] Second, rational human beings are assumed to possess the ability to flawlessly calculate what actions would best serve these interests.[3] The third assumption is that people are self-interested, in the sense that they care only about their own material payoff.[4–6] A final assumption in game theory is that of common knowledge; each player knows the rules of the game, that others are also rational and selfish, and that everybody knows that everybody knows the rules, and so on and so forth.[7,8]

If one accepts these assumptions, comparing the behavior of individual decision makers and the behavior of unitary groups[a] seems almost dull. When there is a unique game-theoretic equilibrium or optimal choice, both individuals and unitary groups should follow the normative prediction, and their choices should not differ at all.[b] It is therefore not surprising

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that researchers in economics have traditionally overlooked the study of group decision making. For example, the *Handbook of Experimental Economics Results*,[9] devotes no attention to how groups make decisions, *despite* the fact that interactive decisions in the real world are often made by groups. Boards of directors (not individual managers) decide on corporate strategy; congresses (not individual legislators) declare war on other countries; families (not individual family members) decide about budget allocation; and work design in organizations is evolving from an individual task to a group task.[10,11]

Considering the enormous recent body of literature on individual behavior in interactive contexts, it becomes clear that, while traditional game theory is still very useful as a normative theory, it fares less well as a descriptive tool. If game theory is expected to provide a realistic account of human behavior, its assumptions have to be adjusted. One should take into account heterogeneity in levels of rationality,[12–14] different extents of other regarding preferences,[15–18] and different forms of uncertainty attitudes among decision makers.[19] Once these assumptions are integrated into classical game theory, the analysis of unitary group decision making becomes interesting and important. Therefore, investigating group decisions in games has slowly picked up in the late 1990s and after the turn of the century, leading Camerer[20] in his widely used textbook on *Behavioral Game Theory* to conclude that the study of group decisions making is among the top 10 research programs in behavioral and experimental economics.

The main purpose of this review article is to survey the existing results on differences between individuals and groups in interactive tasks. The review reveals that groups tend to behave in these environments in a way that is more rational (as defined by the game-theoretic assumptions described above) than individuals do. Often related to this, groups seem to be more strongly motivated by payoff maximization—although we also refer to the cases where this is not so. Finally, groups seem to be more competitive than individuals—a behavioral tendency that can backfire in certain classes of decision settings.

The remainder of the article is structured as follows. We first discuss briefly some classical comparisons between group and individual decisions in non-strategic situations (games against nature). Next, we center our attention on the focus of this article: a review comparing individual and group decisions in interactive settings. Finally, we discuss the findings and their implications for behavioral game theory, and provide some avenues for future research.

RESEARCH ON GROUP DECISION MAKING IN NON-INTERACTIVE SETTINGS

A significant amount of research has been conducted on decisions against nature (decisions in non-interactive situations). Understanding differences of decisions made by individuals and by groups in non-interactive situations is a prerequisite for discussing differences in interactive settings. However, the literature is so vast that we can only discuss certain important aspects. Many of the studies in non-interactive contexts show that individuals make choices that differ from normative models.[21] This departure from normative models is systematic: decisions made by individuals are routinely biased, as demonstrated convincingly by the heuristics and biases research program.[22] On the basis of this framework, a number of researchers examined whether groups exhibit stronger or weaker biases than individuals do, with mixed findings.[23,24]

Groups tend to do better than individuals in many domains, such as the *hindsight bias* (also known as the 'I-knew-it-all-along' effect[25]), where the bias is significantly smaller for groups compared with individuals,[26] or the *overconfidence* effect,[27] the tendency to be more confident in judgments than what accuracy warrants, where group interaction has been found to reduce the standardized overconfidence effect by 24%.[28] Groups also make fewer errors than individuals in certain *risky choices*,[29] faster and better decisions in uncertain environments,[30] earn more in *risky portfolio decisions*,[31] exhibit less *myopic loss aversion*,[32] and are less prone to *information cascades*.[33] On the other hand, groups are more prone to biases such as the *decoy effect*[34] and *escalation of commitment* (sunk cost fallacy[35]). In some other domains no differences are found between individual and group decisions (*expected utility maximization*[36]; *fund management performance*[37]; *stock market performance*[38]).

The general question of whether groups make riskier choices than individuals is unresolved. Early literature provided evidence that groups tend to polarize individual attitudinal judgment—an effect that is known as the *risky shift*.[39] It contrasts the intuitive conjecture that groups tend to moderate extreme positions and was initially demonstrated in many different settings.[24] More recent research, however, shows inconclusive results. While some find evidence supporting the risky shift,[40,41] other studies found that group decisions are more risk averse than individual decisions,[42–44] or found no differences.[45,46]

A distinction that is particularly useful in the context of non-interactive decisions is the one between *intellective tasks* and *judgmental tasks*.[c] Intellective tasks have a clear ex post evaluation criterion for the quality of performance, whereas judgmental tasks do not. Intellective tasks can be further differentiated with respect to their *demonstrability*,[47] the degree to which the knowledge of the solution to the task is recognized by group members once it is voiced in the group discussion (also referred to as *truth wins*). In intellective tasks, groups typically perform better than individuals.[48,49] This is particularly the case for decision tasks that are easily demonstrable (*eureka* tasks[50]).

There have been several attempts in the literature to identify differences in process that lead to differences in decisions. For example, the concept of *groupthink*[51–53] proposed that, in order to minimize conflict and maintain cohesiveness, group members are less critical in analyzing or assessing ideas. This, in turn, leads to defective decision making. Despite its popularity and intuitive appeal, findings supporting groupthink are sparse.[54–57] Similarly, it has been argued that *group polarization*[58] results during group discussion from self-categorization, group membership, social comparison, or persuasive argumentation.[59–63]

Having briefly reviewed some results in group decision making in non-interactive tasks—with a focus on decisions making under uncertainty—as well as studies on how groups tend to come to their decisions, we now turn our attention to the main part of the paper—a review of empirical studies on group decision making in interactive (strategic) settings.

REVIEW OF STUDIES ON INTERACTIVE DECISION MAKING IN GROUPS

We structure this part of the review around four subsections. In the first, we examine findings in prisoner's dilemma (PD) games, which have been extensively researched. We then present results from ultimatum and dictator games. Next, we examine trust games and other lesser known sequential games. We end this section by reviewing simultaneous games other than the PD game.

PD Games

Insko, Schopler, and their colleagues first examined group behavior in PD games, perhaps because of this game's enormous popularity in previous decades. Nearly all of their studies show that groups defect in PD games more often than individuals.[64–70] The authors identify two primary motives for groups to compete more in a PD game.[71] The *social support of shared self-interest* (or, *greed*) hypothesis argues that groups are greedier than individuals because group members provide each other with support for acting in a selfish, ingroup-oriented way. The *schema-based distrust* (or, *fear*) hypothesis postulates that in contrast to individuals, groups *expect* their opponents to act greedily, and therefore want to protect themselves against the possibility of being exploited. If indeed groups have more negative expectations regarding the behavior of the group that they are interacting with than the individuals' expectations regarding other individuals, then groups are less likely than individuals to cooperate in hope that the opponent will cooperate as well (behavior that results in higher payoff for both players[d]).

An additional motive for groups to compete more in a PD game is the *identifiability* hypothesis, which proposes that in interindividual interactions players assume that they are identifiable and thus can be held 'accountable' if they make a competitive or selfish choice.[72] In intergroup interactions responsibility for a choice is by its very nature obscured. Therefore, group membership provides a chance to evade accountability, and it thus makes it easier for group members to propose and make a competitive choice.

Insko, Schopler, and their colleagues also studied different variations of the PD game, identifying some factors that increase the magnitude of the discontinuity effect.[69] One such factor is (un)constrained communication—the possibility given to different parties to communicate with one another before making their decisions (i.e., allowing intergroup discussion in addition to intragroup discussion). Unconstrained communication is very effective in reducing competition between individuals.[73] However, the schema of distrust of out-groups makes communication less effective and credible, thus reducing its benefits in intergroup interactions.[66] A second factor is procedural interdependence, which refers to the interrelationship between own-group member choices and outcomes. For example, because in a majority rule group members' individual decisions are combined into a collective group decision, they cannot be traced back to the individual members. This creates procedural interdependence among group members. Wildschut and colleagues[74] found that groups that are procedurally interdependent are more competitive, because this feature creates a 'shield of anonymity', facilitating self-interested behavior. This finding is clearly related to the above-mentioned identifiability hypothesis.

The discontinuity effect in the PD game has been replicated and extended by others. Charness et al.[75] found that when group membership is made salient, group members become more competitive. Morgan and Tindale[76] reported that groups behave more competitively than individuals, and that a single group member wanting to defect caused the whole group to defect in over 50% of the cases. Both groups and individuals did not seem sensitive to whether the opponent in the game is a group or an individual. Takemura and Yuki[77] took a cross-cultural perspective and replicated the result in Japan, a society that is believed to be lower in trust than western societies.

Kugler et al.[78] reported a study designed to differentiate between fear and greed as motives for competitive behavior in the PD game. In addition to this game, they compared individual and group behavior in the chicken game and the stag hunt game. The two other games acted as controls, given that in the chicken game greed is a reason to compete while fear leads to cooperating; in contrast, in the stag hunt game only fear is a reason to compete, but greed should lead to cooperative behavior. They found that the discontinuity effect was present to similar extent in the two games that include only one motive for competitive behavior, but that it was significantly stronger when both motives are present (in the PD game). They also reported that the size of the discontinuity effect increases dramatically when individuals and groups are given the possibility to engage in between player (i.e., intergroup) free discussion before the decisions are made.

Ultimatum and Dictator Games

Bornstein and Yaniv[79] compare the behavior of individuals and three-person groups in the ultimatum game.[80] In this game, two players bargain over the allocation of a pie. It is meant to capture a simplified and stylized form of 'take it or leave it' bargaining. The first player (the proposer) proposes an allocation to the second player (the responder), who then gets to either accept the proposal, in which case the allocation takes place as proposed, or reject the allocation, in which case both players get nothing. The game-theoretic prediction (subgame-perfect equilibrium[81]) based on standard assumptions (payoff maximization) states that, given that the responder prefers any positive payoff over zero, and the proposer knows this, she will propose to keep almost everything for herself—offering only the minimal unit to the responder—and the responder will agree to this proposal. It is clear that behavioral findings from individual play do not support this prediction. Proposers offer on average 40% of the pie (with a median of 50%), and responders often reject offers lower than 30%.[82,83] Bornstein and Yaniv demonstrated that groups made and possibly accepted smaller proposals in this game—so group behavior was closer to the rational and selfish (game-theoretic) prediction than individuals. In a similar study, Robert and Carnevale[84] showed that groups made lower offers in the ultimatum game. Further, if group members had the opportunity to participate in the game again, this time as individuals, their offers remained lower. This suggests that the group process changed individual preferences or individual beliefs about the acceptance threshold of the opponents. They also found that the most competitive members of each group had the largest effect on the group's decision (i.e., the group offers were best predicted by the offer made by these individuals). The article focused only on the proposer and therefore the authors did not test whether group responders behaved differently than individual responders. Similar results in a structured voting environment without direct group interaction are provided by Elbittar et al.[85] These results are consistent with the *social support for shared self-interest* explanation and with the *groups are more rational* explanation.

A similar 'game', the dictator game[86] helps distinguishing further between fear and greed as motives for group decisions. This allocation task is similar to the ultimatum game, except for the fact that the responder does not get to accept or reject the allocation offer (so strictly speaking, it is not a game). It is important to note that in this game fear of the opponent should not guide behavior of groups (or individuals), because responders cannot reject the allocation. Therefore, if groups allocate less to others, only selfishness (or greed) can explain the results.

Experiments using the dictator game yield mixed results. Cason and Mui[87] reported a tendency of groups to be more generous in giving than individuals, whereas Luhan et al.[88] found significantly smaller transfers by groups than by individuals playing the role of the dictator. Luhan and colleagues argued that the differences in these findings may be due to two reasons. First, these authors used groups of three members, whereas Cason and Mui used groups of two members. With fewer members per group, the 'shield of anonymity' explanation is reduced, and so is the 'social support of shared self-interest'. Second, Cason and Mui used a procedure where participants could be easily identified (i.e., groups were called to the front of a main room to receive feedback and payment and were then excused to the hallway). As this procedure was common knowledge, it reduced further the effects of the two motives above, and may have enhanced

a need to publicly obey social norms of generosity. Finally, while in Cason and Mui the discussion engaged by group members was face-to-face, in the study by Luhan and colleagues it was computer-mediated, increasing anonymity even further.

Trust Games and Other Sequential Games

The trust game,[89] also known as the investment game, is another two-player game that shares some similarities with ultimatum and dictator games. In this game, the first player (the trustor) receives an initial endowment and gets to choose how much of this endowment, if any, to send to a trustee. The amount sent to the trustee is multiplied by a commonly known factor (often tripled) before being given to the trustee. The trustee then gets to return any part of the money back to the trustor. Following a backward-induction logic, the trustee has no reason to return any of the money she receives. Knowing that, the trustor has no reason to send anything to begin with. This game captures a wide-spread definition of trust as 'a psychological state comprising the intention to accept vulnerability based on positive expectations of the intentions or behavior of another' (Ref 90, p. 395). Results from individual behavior indicated that despite the game-theoretic prediction, experimental trustors send on average half of the initial endowment, and trustees return slightly less than what was sent before tripling.[20]

Kugler and colleagues[91] showed that groups of three people sent on average lower amounts than individuals did. They also analyzed asymmetric interaction of individual trustors with group trustees and group trustors with individual trustees. However, the amounts that are sent to individual trustees do not differ significantly from those sent to group trustees. Cox[92] showed that trustees return smaller amounts in this game. Song[93] found that group trustors (using a consensus rule) exhibited lower *psychological trust*—expectations of reciprocity—than individuals, but higher *behavioral trust*—amount sent—when controlling for psychological trust. Song also found that group trustees sent back less money than individual trustees, thus replicating Cox's main result.

The centipede game[94] is a repeated trust game: two players repeatedly bargain over the allocation of an increasing pie. They alternate in deciding whether to stop the game or transfer the decision to the other player. In the standard version of this game, every time the decision is transferred, the size of the pie increases. However, if a player decides to transfer the decision, which could result in the other player stopping the game, then the first player will end up with a lower payoff than she would have gotten, had she stopped the game one step earlier. Given that the game has a finite number of steps, backward induction predicts that the game will stop on the first step, giving both players small payoffs and foregoing a much higher level of overall efficiency. McKelvey and Palfrey[95] reported that for individuals this is rarely the case: only 37 of the 662 games ended with the first player taking the money at the first decision node, while 23 games ended with both players transferring at every node. Bornstein et al.[96] showed that groups stopped the game significantly earlier than individuals do. Once again, this means that group behavior is closer to the game-theoretic prediction. Using a constant-sum variant of the centipede game, they also demonstrated that groups were less altruistic in the game and also less prone to reasoning errors.

The principal–agent game, sometimes called the gift-exchange game[97,98] is modeled to capture the problem of incomplete contracts in the labor market. In the game there are two players: a principal and an agent. The principal determines a wage. In return, the agent decides on an effort level. Effort is costly to agents, but results in increased efficiency and therefore a higher profitability for the principal. As the game is designed in a way that makes it impossible for principals to enforce effort levels, agents are expected to choose the lowest level of effort, once wage is determined. Therefore, principals have no reason to pay agents more than minimal wages.

Contrary to this prediction, Fehr and colleagues[98] find that principals award agents with 42% of the surplus (and payments significantly above the minimal wage), and the average effort chosen by the agents is significantly higher than the effort predicted by standard theory. Kocher and Sutter[99] reported that groups chose lower wages than individuals in the role of principals, but only when communication was computer-mediated—they failed to find differences between individuals and groups who discussed their decisions face-to-face. In terms of the agents' effort, there were no differences between groups whose discussion was computer-mediated and individuals, whereas groups who communicated face-to-face decided on higher effort levels than individuals.

Cooper and Kagel[100] examined group behavior in a signaling game. They showed that groups play more strategically than individuals do. The increased strategic play is a result of the ability of groups to put themselves in the position of another player, and therefore adjust their behavior to the other's strategies. This leads to positive learning transfers, an ability of groups to generalize their learning regarding the game

to similar situations with other parameters (i.e., the groups learn more than just the correct behavior, they learn the principles leading to this behavior, and can implement them in related situations). Individuals, on the other hand, exhibited less strategic play and no learning transfer.

Bosman et al.[101] investigated group behavior in the power-to-take game (a variant of the ultimatum game) and report no differences between individuals and groups. In this game, a taxing agency (take authority) decides how much of the endowment of another player (the responder) to take. The responder then gets to choose to agree, or burn his endowment or parts of it. This results in reduced or zero income for the responder and a smaller income for the take authority. Just like in the ultimatum game, game theory predicts that the taxing agency will take all the endowment except for a minimal unit, but experimental results show that takes are lower (on average, 58.5% of the whole endowment), and responders are willing to burn the endowment for large takes: when the taxing agency takes 80% or more of the endowment, the responder typically destroys most of her endowment (62.4% on average[102]). The finding by Bosman and colleagues[101] of no differences between individuals and groups is in contrast to most of the results surveyed above.

Müller and Tan[103] compared the behavior of individuals and groups in a sequential Stackelberg market game. In this game two players sequentially set quantities for production. Both have the same costs of production, and their total output is restricted by the market demand. Interestingly, this study reports behavior of groups to be farther away from the subgame-perfect equilibrium of the stage game than that of individuals. First-mover groups set quantities that are lower than first-mover individuals and lower than predicted by standard theory. There is also research on group versus individual behavior in common pool resource problems. These problems are characterized by the tragedy of the commons (i.e., by a tendency to be overused). Gillet et al.[104] showed that groups are less myopic than individuals in an isolated resource extraction problem, but are more competitive than individuals in a strategic setting, where other users can extract the same resource.

Simultaneous Games

With the exception of the PD game, all the games surveyed above are two-player sequential games (where one player chooses an action first, and the second player observes this action before making her choice). In contrast, Kocher et al.[105,106] and Sutter[107] investigated individual and group decisions in (simultaneous) beauty-contest games. In the beauty-contest game (named after a note by economist JM Keynes who likened the stock market to a beauty contest in one of his famous treatises; also referred to as the guessing game), decision makers simultaneously select a number from 0 to 100. The winner, who receives a fixed prize, is the player who chooses a number closest to p times the mean of the numbers chosen by all participants (p is known to all players beforehand and can range between 0 and 1). The game is then repeated a number of trials, which varies across studies. For $0 < p < 1$, the unique nash equilibrium of the game is zero, which can be obtained by a process of iterated elimination of weakly dominated strategies.[e] The beauty-contest game is commonly used to measure the depth of reasoning of a player and learning dynamics. Usually p is set at 2/3, and the game is repeated four times. The main finding of the papers on the beauty-contest game is that, although individuals and groups do not differ in their choices in the first round, groups choose lower numbers (i.e., closer to equilibrium) than individuals do in rounds 2, 3, and 4—so groups appear to converge to the equilibrium faster than individuals. Furthermore, they found that groups adapt much faster to the feedback regarding the choices of other players. When interacting with individuals, the authors found that groups outperform individuals in terms of payoffs (being able to guess correctly the choices of individuals). Furthermore, larger groups converge quicker to the equilibrium than smaller groups, and less able participants are more likely to select themselves into a decision making group. Nevertheless, despite adverse selection, groups learn faster than individuals also in the self-selection experiments.

Van Vugt et al.[108] investigated an n-person step-level public goods game, which is another example of a simultaneous game. Just like in the PD game, they find that groups cooperate less than individuals do. Cox and Hayne[109] tested the interesting case where rationality, as defined by the game-theoretic prediction, is teased apart from competitiveness. They look at common value auctions, where competitive behavior leads to overbidding (the *winner's curse*) and therefore lower payoffs, and find that groups are more prone to experiencing the winners curse. However, their result emerged only after participants had a chance to gain experience with the task, and only when group members shared the same information. Sutter et al.[110] analyzed laboratory license auctions (a combination of a private value and a common value

auction format) with individuals and groups, and their conclusion is similar. Groups are more likely to overbid than individuals. In contrast, Casari et al.[111] reported that in a company takeover experiment groups placed better bids than individuals and substantially reduced the winner's curse. Likewise, Sheremeta and Zhang[112] found less overbidding of groups in Tullock contests than individuals, and Cheung and Palan[113] provided evidence that groups are less prone to create bubbles than individuals on a stock market based on a double auction mechanism.

Another setting that is related to cooperation is coordination. Feri et al.[114] studied six different coordination games, where either individuals or teams interact with each other. They found that teams coordinate much more efficiently than individuals and, thus, are able to achieve higher levels of payoff. In a related coordination game, the stag hunt game, Charness and Jackson[115] showed that the voting rule in the group plays an important role in shaping group choices between the risk-dominant and the payoff-dominant equilibrium.

DISCUSSION

The main purpose of the article was to review a large set of studies on interactive decision making by unitary groups. On the basis of the literature surveyed here, it is fair to conclude that the majority of experimental findings reveal that group behavior in games is more in line with rational and selfish predictions than individual behavior is. Trying to understand the implications of this statement, let us have a closer look at the decision process in an interactive game.

The games used in the reviewed literature are laboratory decision tasks, and participants are not likely to have experience with them. Some of the games are complex, or require processing of substantial amounts of new information. Therefore, the first objective a decision agent faces is to get a full and coherent picture of the decision problem. It is not surprising that groups are superior to individuals in this aspect. Understanding the rules and structure of the game is often an intellective task, and groups are provided with better information processing capabilities, as well as opportunities to catch and correct errors of other group members through discussion—something not available to individuals. It is likely, therefore, that groups understand the structure and rules of the decision tasks better than individuals do.

Once the rules of the games are clear, players have to decide on a strategy. To do so, they first need to construct beliefs regarding the behavior of the other player (or players) in most games and in most roles. Note that this point is unique to interactive decisions, and constructing realistic beliefs is a crucial step in selecting the right strategy. Results supporting the schema-based distrust hypothesis point out that groups may have different beliefs regarding the behavior of other players and expect other players to be greedier. Therefore, fear of the opponent's behavior may cause groups to believe that other players will choose certain strategies. Individuals who are less afraid of the behavior of the other players may have a different probability distribution over the possible acts of others. Overall, the literature is vague regarding the construction of beliefs. Only few of the studies measure beliefs regarding the behavior of the other player explicitly. Kugler and colleagues[91] measured expectations of others' behavior in the trust game and showed that individuals expect higher returns than groups do. Song[93] found a similar result: individuals have higher expectations of others' trustworthiness (i.e., expectations of reciprocity) than groups. Wildschut et al.[116] found that groups are as affected by manipulations of opponents' expectations as individuals. Sutter et al.[117] studied strategic thinking and behavior of individuals and groups in a set of one-shot normal-form games, as well as explicitly elicit beliefs. They found that groups are more likely to play strategically than individuals.

A promising direction for future research is to conduct group experiments with mixed designs—-groups and individuals playing against each other. To the extent that players are sensitive to the nature of their opponents, and expect groups and individuals to behave differently, they should choose different behavioral strategies when facing groups or individuals. Thus one can infer beliefs from actions. For example, using a PD game, Wildschut and colleagures[116] found that of all possible combinations, actions are most competitive in the group-on-group condition; actions are least competitive in the indivdiual-on-individual condition; and group-on-indivdiual conditions are in between. They conclude that the discontinuity effect is a joint function of acting *as a* group and interacting *with a* group. However, both Kugler and colleagues,[91] and Morgan and Tindale[76] failed to find such an effect.

Once players finished analyzing the game structure and considering the opponents' expected behavior and its consequences, they need to decide on their own strategy. At this point, groups differ from individuals not only in the information they accumulated and processed, but also in their aggregated preferences

(social or otherwise). The social support of shared self-interest hypothesis supplies one explanation to why groups may have different aggregated preferences than individuals. Specifically, it seems that the dynamics that lead to aggregation of individual preferences into group preferences allow group members to express more greed and less altruism toward the other players, thus making groups more similar to the normative player modeled by standard game theory—a player who cares only about her payoffs, and has no preferences regarding the payoffs of other players involved in the game. Kugler and colleagues[91] sketched a model based on individual social preferences. Specifically, they extended Fehr and Schmidt's[17] inequity aversion model to groups, and argued that based on this model groups are likely to be more selfish.

It is important to qualify the general conclusion that groups are more rational and selfish than individuals. Two exceptions make groups appear sometimes even less rational or selfish than individuals. First, if less selfish behavior can create large profits, and the worst-case payoff is not particularly low, the temptation to secure the larger payoff might take over, even at the risk of not succeeding, and groups might become less selfish. This can occur in games with high potential efficiency gains like the gift-exchange game.[99] However, Bornstein and colleagues[118] presented contrasting evidence in the centipede game, where higher efficiency gains are foregone by groups. Second, groups may become less rational than individuals in highly competitive settings. Auction fever and the proneness to the winner's curse are examples, and groups have indeed been shown to perform worse in auctions than individuals.

It is clear that there is still much that is not understood regarding the process that leads to groups (usually) behaving more rationally and selfishly than individuals in interactive tasks. Future research will have to systematically address many variables before we have a better understanding of the processes underlying this phenomenon. Specifically, we will need to address the impact of variables such as group size, testing whether two-person groups differ from groups of three or more, and what happens when groups are enlarged. They should also be aware of the higher costs of group decision making compared to individual decisions making. Further attention should be paid to within-group interaction and communication, examining the apparent differences between face-to-face communication and computer-mediated communication. Similar attention should be drawn to the official decision rules within groups, investigating whether groups vote, use unanimity rules or have no explicit rules. In addition, there is a need for a better classification of the decision tasks—differentiating between sequential or simultaneous games, two-player and *n*-player games, and other factors such as the complexity of the rules, whether the game requires substantial analysis and strategizing, whether it is played once or repeatedly, and whether there is a possibility to learn over time. Researchers will have to face the task of analyzing group discussion content in order to learn more about group dynamics, and find support for the theoretic claims presented in this section. Content analysis of group discussion is not a trivial task, and therefore not done in most of the studies. Finally, it will be important to develop theoretic models of the group interaction. Economic theory is surprisingly silent about decision making of unitary groups, but ultimately it will be crucial to rigorously model the decision making process of unitary groups.

CONCLUSION

Important decisions are often made by groups that have more previous experience, increased processing capabilities, the ability to monitor each other for mistakes, and share information regarding the task and the expected behavior of others. Therefore, groups (mostly) act as more rational and selfish players, which means that their behavior is more in line with the theoretic predictions. Game theory based on standard assumptions may be, after all, a much better descriptive theory than currently believed.

NOTES

[a]A unitary group is a group that has to come up with a joint decision and does not face any internal conflicts of interests in terms of payoffs.

[b]Naturally, there are situations with multiple equilibria where the type of the decision maker could, in principle, matter also according to traditional game-theoretic analysis, but that would confine the object of study to a very small subset of research questions.

[c]This distinction is more difficult to make for interactive settings, because they typically involve elements of judgmental as well as intellective tasks. For example, forming beliefs regarding the expected behavior of others is close to a judgmental task, while optimizing with respect to those beliefs is more intellective in nature. Therefore, a precise distinction is sometimes hard for games.

[d]We refer to 'players' as decision makers throughout the review in order to avoid confusion. Note that 'players' can either be individuals or groups.

[e]To illustrate this, imagine that a player believes all other players choose randomly over the range of options. She should then choose p times 50, the expected mean, to win the prize. If all players choose this strategy, then a sophisticated player should choose p^2 times 50, and so on, until the only strategy left is to choose zero.

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