

# Groups Make Better Self-Interested Decisions<sup>†</sup>

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A decision maker in an economics textbook is usually modeled as an individual whose decisions are not influenced by any other people, but of course, human decision-making in the real world is typically embedded in a social environment. Households and firms, common decision-making agents in economic theory, are typically not individuals either, but groups of people—in the case of firms, often interacting and overlapping groups. Similarly, important political or military decisions as well as resolutions on monetary and economic policy are often made by configurations of groups and committees rather than by individuals. Economic research has developed an interest regarding group decision-making—and its possible differences with individual decision-making—only rather recently. Camerer (2003) concludes his book on *Behavioral Game Theory* with a section on the top ten open research questions for future research, listing as number eight “how do teams, groups, and firms play games?” Potential differences between individual and group decision-making have been studied over the past ten to 15 years in a large set of games in the experimental economics literature.

In this paper, we describe what economists have learned about differences between group and individual decision-making. This literature is still young, and in this paper, we will mostly draw on experimental work (mainly in the laboratory) that has compared individual decision-making to group decision-making, and to individual

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<sup>†</sup>To access the Appendix, visit <http://dx.doi.org/10.1257/jep.26.3.157>.

decision-making in situations with salient group membership.<sup>1</sup> In a nutshell, the bottom line emerging from economic research on group decision-making is that groups are more likely to make choices that follow standard game-theoretic predictions, while individuals are more likely to be influenced by biases, cognitive limitations, and social considerations. In this sense, groups are generally less “behavioral” than individuals. An immediate implication of this result is that individual decisions in isolation cannot necessarily be assumed to be good predictors of the decisions made by groups. More broadly, the evidence casts doubts on traditional approaches that model economic behavior as if individuals were making decisions in isolation.

We focus on three main lessons in this paper. First, the use of rationality as a useful assumption for studying real-world economic behavior may not be as problematic as some have argued. In this context, what we mean by rationality is that cognitive limitations (in the sense of bounded rationality) apply less to groups and that groups engage in more self-interested behavior than do individuals. In fact, we find that such rationality applies pretty well to group decisions, and we argue that groups are at least an element in most decisions. People always belong to some groups (for instance, males or left-handed people, and the like) and their behavior may well be affected when a sense of group membership is present. In addition, many important economic decisions—including decisions where consequences affect individual decision units, such as buying a home or choosing a health insurance plan—are made after some consultations with others, even if they are not explicitly part of a group decision-making process. Thus, while the behaviorist critique of deviations from the rational paradigm is important and has many applications, we should be careful about how we describe economic agents in our models.<sup>2</sup> If we were to specify that most of these agents are acting in social or group contexts, then the claim that they are rational actors would be strengthened.

A second lesson is that, from a social point of view, group decision-making may be a method for individuals to try to protect themselves from the consequences of their own behavioral irrationalities or limitations. Suppose an individual is very present oriented and so has great difficulties in saving for retirement. Perhaps through participation in groups at work or in one’s social, political, recreational, or religious life, one can achieve at least a modicum of success in assuring a retirement income. As another example, perhaps one does not have the self-discipline to exercise on one’s own but will do so with regularity if one forms or joins a group of people who jog together or meet to play tennis. In a business environment, one might find it personally nearly impossible ever to fire anyone, even if the result is that one’s business goes bankrupt. But it might be possible to achieve this end by being part of a committee that makes such decisions. In short, group membership

<sup>1</sup> The evidence from laboratory experiments has the advantage of allowing for a clean and controlled analysis of group decision-making and group membership effects because subjects are randomly assigned to making a choice individually or as a group member. This is more difficult with field data, but not impossible, as Lesson 2 below will confirm.

<sup>2</sup> See Levitt and List (2007) for an account of the behaviorist critique.

and group participation can facilitate people doing things that they wish (on some important level) to do, but might be unable to do without the support of a group.

The third lesson is that in some environments—for example, in cases where trust and cooperation lead to improved social welfare—it might make sense to have individuals making decisions, and in other cases—for example, when deeper levels of insight or analytical problem-solving and coordination are especially valuable—it might make sense to have groups making decisions. For example, a considerable body of experimental literature suggests that, perhaps because individuals are unselfish or socially oriented, they are able to reach welfare, socially efficient outcomes in situations like the prisoner’s dilemma or a “trust game.”<sup>3</sup> In these settings, group decision-making/membership presumably leads to lower social welfare (in the sense of the total social material payoffs), because the element of trust or cooperation is sharply reduced. However, we will explore a number of other settings where group decision-making is more sophisticated and effective. Thus, researchers can start groping toward a provisional taxonomy concerning where and when it is optimal to have a group process or an individual one.

We discuss these three lessons in the following sections. We intersperse the discussions with evidence, primarily experimental, for the story being told.<sup>4</sup> Building on this evidence, we then discuss the major sources for differences in decisions made by individuals and groups before we conclude with an outlook on promising avenues for future research on group decision-making.

## Lesson One: Groups are More Cognitively Sophisticated

We look first at experiments that compare individual and group decisions where each player is only concerned with making the best selfish decision without regard to social considerations.<sup>5</sup> This category includes investment or portfolio decisions, tournaments, and tasks where the ability to reason through the problem is important due to some cognitive limitation or psychological bias that typically affects the outcome.

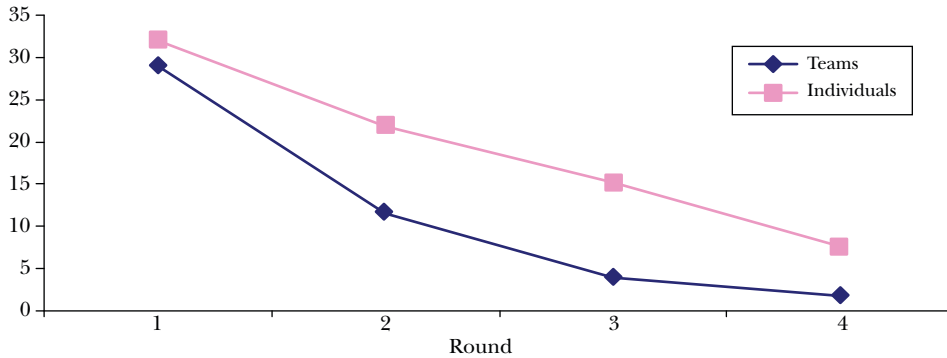
One well-known example is the beauty-contest game (also known as “the guessing game”). In this simultaneous move game, a set of  $n$  decision makers chooses a number from the interval  $[0, 100]$ , and the winner is the decision maker whose

<sup>3</sup> It may also be possible that an individual’s social concerns are directed at one’s group in the case of group membership. We shall take up this point later.

<sup>4</sup> While we only discuss a few studies in each section, we present a brief description of the most important other studies supporting our conclusions in an online Appendix available with this paper at (<http://e-jep.org>).

<sup>5</sup> We focus here on results from experimental economics, with less emphasis on psychological research: see Levine and Moreland (1998) for an account of small-group research in psychology. From our perspective, the research in experimental economics has two particular advantages: 1) the ubiquitous use of financial incentives, a condition that is often not met in experimental research in the field of psychology; and 2) the use of simpler paradigms that allow for benchmarking behavior to standard game-theoretic predictions. Psychological paradigms are often much more complex, thereby making it more difficult to characterize general patterns of behavioral differences between individuals and groups.

Figure 1

**Median Number Chosen by Groups and Individuals in a Beauty-Contest Game**

Source: Kocher and Sutter (2005).

Note: In this simultaneous move game, a set of  $n$  decision makers chooses a number from the interval  $[0, 100]$ , and the winner is the decision maker whose number is closest to  $p$  times the average chosen number, with  $p$  being some fraction less than 1.

number is closest to  $p$  times the average chosen number, with  $p$  being some fraction less than 1. The name of the beauty-contest game comes from the Keynes (1936) analogy between beauty contests and financial investing in the *General Theory*: “It is not a case of choosing those which, to the best of one’s judgment, are really the prettiest, nor even those which average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practice the fourth, fifth and higher degrees.” Similarly, in a beauty-contest game, the choice requires anticipating what average opinion will be.

However, since  $p < 1$ , the rational equilibrium choice will be zero. For example, a player might begin by asking what the right choice will be if all other players choose randomly over the interval between 0 and 100 with  $p = 2/3$ , a standard value in the experimental literature. In this case, the expected value of the average of a random choice would be 50. If one anticipates that people are guessing randomly, the best response (assuming one’s own guess does not distort matters) is 33.3. However, if one anticipates that everyone else will anticipate and also best-respond to random choice, the best response is 22.2. Continuing this pattern of inference through multiple iterations, the equilibrium choice is zero.

Several studies show that in the beauty-contest game, groups choose systematically lower numbers, thus suggesting that they are reasoning more deeply about the strategy of the game and are expecting the other parties to reason more deeply as well (Kocher and Sutter 2005; Kocher, Strauss, and Sutter 2006; Sutter 2005). Kocher and Sutter (2005) find that groups think one step ahead of individuals, leading them to quicker convergence towards equilibrium play, as is shown in Figure 1, which presents the median number chosen by groups (of three subjects

Figure 2  
An Urn Experiment

	Left Urn	Right Urn
Up ( $p = .5$ )	●●●● ○○	●●●● ●●●●
Down ( $p = .5$ )	●● ○○○○	○○○ ○○○

Source: The experiment is from Charness, Karni, and Levin (2007).

each) and individuals across four rounds. When groups and individuals compete against each other (rather than groups competing against groups, or individuals against individuals), groups outperform individuals significantly by earning under the rules of the game roughly 70 percent more than individuals (Kocher and Sutter 2005; Kocher, Strauss, and Sutter 2006).<sup>6</sup> One possible explanation why groups choose lower numbers is that the groups, in thinking through the situation, also expect other groups to think more deeply than individuals.

Two papers by Charness, Karni, and Levin (2007, 2010) specifically examine deviations from rational behavior (by looking at error) rates in tasks involving violations of first-order stochastic dominance, and in a task involving the well-known conjunction fallacy described in Tversky and Kahneman (1983). In these studies, comparisons are made among the error rates for different group sizes.

Charness, Karni, and Levin (2007) set up a situation (see Figure 2) with a left urn and a right urn, where the state of the world is “up” or “down” with equal probability; this state is fixed for two periods. A person draws a ball, observes the color, and the ball is replaced. In the “up” state, there are four black balls and two white balls in the left urn, and in the “down” state there are two black balls and four white balls in the left urn. The right urn contains six black balls in the “up” state and six white balls in the “down” state. The most interesting case is when the first draw is from the left urn, as is required in some periods. In the original set-up, black balls pay and white balls don’t. With a “good” draw (black ball) one should switch to drawing from the right urn, while with a “bad” draw (white ball) one should stay with the left urn.<sup>7</sup> Of course, this violates the common “win-stay, lose-shift” heuristic and is thus counterintuitive. In another treatment, subjects do

<sup>6</sup> In all comparisons, the per-capita incentives were kept constant across conditions, meaning that for an identical set of decisions in a particular game, the payoffs per head were identical for individuals and each single group member.

<sup>7</sup> To see this, note that given the draw of a black ball, the probability that the state is “up” is 2/3. If it is “up”, then the probability of drawing a black ball is 2/3; if it is “down”, the probability of drawing a black ball is 1/3. Since  $(2/3 \times 2/3) + (1/3 \times 1/3) = 5/9$  and the probability of drawing a black ball from the right urn is 2/3, one should switch. By the same token, the probability of drawing a black

*Table 1*  
**Error Rates in an Urn Experiment in Which One Choice Stochastically Dominates the Other**

(*ABCD* refers to the treatment with affect, Bayesian updating, a compound lottery, and dominance, while *BCD*, *CD*, and *D* drop one condition in turn)

<i>Group size</i>	<i>ABCD</i>	<i>BCD</i>	<i>CD</i>	<i>D</i>
1	.375	.188	.302	.087
2	—	.154	.230	.030
3	—	.075	—	.000

*Source:* Charness, Karni, and Levin (2007).

*Notes:* The table shows error rates in an experiment in which the choice to draw from one urn first-order stochastically dominates the choice to draw from the other. (See text for a description of the experiment.) We only consider choices after a successful first draw, as we do not have observations for the *CD* and *D* cases after unsuccessful first draws.

not know before drawing which color will pay off, with the first draw (unpaid, informational only) made automatically from the left urn. In this way, there is no sense of success or failure (and corresponding emotions) upon observing the color of the ball drawn. Removing the psychological affect in this way was found to substantially reduce the error rate in Charness and Levin (2005). A third treatment performs the Bayesian updating for the subjects, a fourth treatment eliminates the compound lottery, and a fifth treatment only considers dominance (drawing from an urn with six good balls out of nine or an urn with five good balls out of nine). Table 1 shows the corresponding error rates.

Since first-order stochastic dominance is a very basic principle, it is clear that these refusals to switch are violations of rationality. In all cases, the error rate goes down as the number of people in the decision-making group increases. In the case of dominance, the rate goes to a flat zero.

Charness, Karni, and Levin (2010) consider the Linda paradox, where this question is asked:

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations. Which is more probable:

- (a) Linda is a bank teller.
- (b) Linda is a bank teller and is active in the feminist movement.

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ball from the left urn given that the first draw was a *white* ball is  $(1/3 \times 2/3) + (2/3 \times 1/3) = 4/9$ , while the probability of drawing a black ball from the right urn is only  $1/3$ .

Table 2

**Violations of the Conjunction Rule in an Experiment Undertaken with Individuals, Pairs, and Trios**

<i>Study</i>	<i>Details</i>	<i>Incorrect answers/ total sample</i>	<i>Error rate (percent)</i>
<i>Individuals</i>			
T&K, 1983	UBC undergrads, no incentives	121/142	85.2
CKL, 2010	UCSB students, singles, no incentives	50/86	58.1
CKL, 2010	UCSB students, singles, incentives	31/94	33.0
CKL, 2010	UCSB students, total singles	<b>81/180</b>	<b>45.0</b>
<i>Pairs</i>			
CKL, 2010	UCSB students, in pairs, no incentives	27/56	48.2
CKL, 2010	UCSB students, in pairs, incentives	5/38	13.2
CKL, 2010	UCSB students, total in pairs	<b>32/94</b>	<b>34.0</b>
<i>Trios</i>			
CKL, 2010	UCSB students, in trios, no incentives	10/39	25.6
CKL, 2010	UCSB students, in trios, incentives	5/48	10.4
CKL, 2010	UCSB students, total in trios	<b>15/87</b>	<b>17.2</b>

*Source:* Charness, Karni, and Levin (2010); Tversky and Kahneman (1983).

*Notes:* This question was asked in the experiment: Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations. Which is more probable: (a) Linda is a bank teller. (b) Linda is a bank teller and is active in the feminist movement. (Since condition *b* imposes an extra restriction, it quite clearly cannot be more probable than *a*.) UBC is the University of British Columbia; UCSB is the University of California, Santa Barbara.

Since condition *b* imposes an extra restriction, it quite clearly cannot be more probable than *a*. And yet Tversky and Kahneman (1983) report that 85 percent of respondents answer *b*. This seems a shocking violation of rational choice, no doubt due to cognitive limitations. The question was asked with and without incentives for a correct answer; people in groups consulted with each other, but then made individual decisions. Table 2 presents the data from the study for singles, pairs, and trios.

Once again, we see a clear pattern of reductions in the error rate as the number of people in the group grows. For example, without incentives the error rate drops from 58.1 percent with singles to 48.2 percent with pairs to 25.6 percent with trios. We also note that people do far better when they are provided with financial incentives, perhaps the more realistic case.

We close this section with two experimental results in games where the issue is cognitive ability. Cooper and Kagel (2005) study the “limit-pricing game” where one player acting as a market incumbent with either high or low costs of production has to decide on an output level before another player acting as a potential entrant makes a decision about market entry. In this setting, game-theoretic considerations suggest that the incumbent should choose the “limit-pricing” output with higher

quantities and thus lower prices than would otherwise prevail, in order to deter market entry of the potential entrant, which could lead to still-lower prices. Indeed, Cooper and Kagel find that groups (of two persons each) play strategically far more often and thus are more successful in deterring market entry. This is particularly true in situations where the market parameters (through cost functions) change, in which cases groups are faster in learning the new “limit-pricing” output to deter market entry.

Finally, another example of how groups often see more deeply into a strategic situation is the two-person “company takeover game.” In this game, a seller has a single item to sell. The item has a specific value to the seller, which the seller knows. However, the item will be worth 50 percent more than that to the buyer, but the buyer knows only a distribution of potential values for the seller. If the bid is at least as large as the seller’s value, the buyer acquires the company after paying the bid. The optimal bid is zero, yet the vast majority of buyers fail to condition their bids on winning, and so select a positive bid (say, the expected value of that distribution).<sup>8</sup> An insightful bidder will recognize that potential values (seller values) above the bid are irrelevant, and so will condition her bid appropriately. This set-up is effectively a form of the “winner’s curse,” where the winner of an auction loses money. Casari, Zhang, and Jackson (2010) analyze group and individual behavior in this game. They find that groups fall prey to the “winner’s curse” of overbidding significantly less often than individuals do, by a margin of about 10 percentage points. A similar finding of less overbidding by groups (by reducing their bids in a contest by about 25 percent) is reported in Sheremeta and Zhang (2010). In both papers, groups learn to reduce their bids from communication inside the group, indicating that groups are better in learning rational bidding strategies than individuals.

These examples (and others in the online Appendix) are rather compelling in illustrating that group choices in decision-making environments characterized by cognitive limitations (bounded rationality) are closer to the predictions of standard theory than are individual choices. These findings let us conclude that groups are more rational decision makers in the sense that economists have defined.

## **Lesson Two: Groups Can Help with Self-Control and Productivity Problems**

Nearly everyone has self-control problems, such as procrastination, not exercising despite the lasting benefits of doing so, and being unable to control one’s spending to save money. A lack of self-control or even motivation is also often found in the workplace, so that productivity is far from optimal. People engage in

<sup>8</sup> It is easy to show that the optimal bid is zero. Suppose one bids  $x$  from the interval  $[0, 100]$ . Assuming a uniform distribution, the average relevant seller value is not 50, but is instead  $x/2$ , since values above  $x$  lead to no sale. Thus the expected value to the buyer conditional on acquiring the company is 50 percent more or  $3x/4$ , so one loses  $x/4$  on average, and choosing  $x = 0$  is best.



a wide variety of commitment mechanisms to cope with these issues. For example, researchers quite often employ the commitment device known as co-authorship. One does not wish to let down a co-author (who presumably produces!), so one works harder. In a sense, this form of production is enhanced by being in a group. In this section, we present evidence from experimental and empirical studies that suggest that group decision-making and group membership can help to alleviate these self-control problems.

The evidence in this embryonic area is limited. It is difficult to observe self-control problems in the laboratory, so the experimental evidence on this topic comes from field experiments.<sup>9</sup> One such experiment was conducted by Falk and Ichino (2006). They let subjects perform a real-effort task, which was to put letters into envelopes for a mass mailing. In one condition, subjects had to perform the task alone in a room, while in another condition there were two subjects in the room, and both could easily watch the performance of the other. Falk and Ichino find that in the condition where groups of subjects were working, average productivity was 16 percent higher than in the isolated condition, indicating that peer effects in the group had a positive impact on productivity. Mas and Moretti (2009) also report such positive spillovers in a supermarket chain where the introduction of high-productivity workers into shifts increased the average individual productivity. While in the previous two examples, the wages of subjects were independent of their coworkers, Hamilton, Nickerson, and Owan (2003) examined how productivity in a garment factory in California changed when the plant shifted from an individual piece-rate to a group piece-rate production system (where a group member's wage did depend on the other group members' performance). While the problem of free-riding in groups (Holmstrom 1982) might decrease average productivity, Hamilton, Nickerson, and Owan (2003) find that the adoption of a group payment scheme at the plant improved worker productivity by 14 percent on average, even after controlling for systematic selection of high-ability workers into work groups. Interestingly, their data also reveal that an increase in a group's heterogeneity in ability levels increases productivity.

Babcock and Hartman (2011) investigate peer effects at the level of individual connections, and leverage the approach to shed light on peer mechanisms. In a field experiment with college freshmen, they elicited friendship networks and offered monetary incentives in some treatments for using the recreation center. Their main findings are that treated subjects with treated best friends put forth significantly more effort toward the incentivized task than do treated subjects with control best friends. The peer effect is about 20 percent as large as the direct individual effect of the incentive. There is also clear evidence of a mechanism: subjects coordinate with

<sup>9</sup> List (2011) provides a taxonomy of field experiments. Broadly speaking, they can be categorized into artefactual experiments (real-world participants, perhaps from business or the public sector, brought into the laboratory setting), framed field experiments (real-world participants knowingly participating in experiments in a natural setting), and natural field experiments (real-world participants unknowingly participating in a real-world experimental setting).

best friends to overcome pre-commitment problems or reduce effort costs. Their results highlight subtle peer effects and other mechanisms that often go undetected.

In a related paper, Babcock, Bedard, Charness, Hartman, and Royer (2012) find evidence that pairing people helps to overcome problems with exercising and studying. In a field experiment involving studying and a field experiment involving exercise, large team effects operate through social channels. These experiments feature exogenous team formation and opportunities for repeated social interactions over time; one suspects that the effects would be substantially larger with endogenous group formation. In any case, in the pay-for-study intervention, people assigned to the team treatment frequented the study room considerably more often than people assigned to the individual treatment. The team-compensation system induced agents to choose their effort as if they valued a marginal dollar of compensation for their teammate from two-thirds as much to twice as much as they valued a dollar of own compensation. The paper concludes that the social effects of monetary team incentives can be used to induce effort at significantly lower cost than through direct individual payment.

Recent evidence from microfinance suggests that the frequency of meeting with others to discuss micro-loans is positively associated with repayment rates, thus helping to avoid self-control problems due to a wish for immediate gratification (Laibson 1997), which increases default risks. While the effects of group liability—where borrowers are organized in groups in which they are the guarantors of each other's loans—on default rates have been diverse (Armendariz de Aghion and Morduch 2005),<sup>10</sup> Feigenberg, Field, and Pande (2011) show that more frequent meetings of Indian microfinance borrowers lead to substantially lower default rates. People in a group that met once per month were 3.5 times more likely to default on a second loan than people in a group that met once per week. While this study does not provide direct evidence that people who met in groups default less frequently than people who did not (although extrapolation suggests that this is the case), it does appear that these meetings generated a form of economically valuable social capital that promoted more trustworthy behavior. In fact, there was considerably more external social interaction amongst members of the weekly group than amongst members of the monthly group. In this sense, organizing people into groups that meet frequently can enhance responsible behavior.

### **Lesson Three: Groups May Decrease Welfare Because of Stronger Self-interested Preferences**

In the first two lessons, we have argued that decision making in groups leads to choices that are closer to predicted choices under the standard assumptions of

<sup>10</sup> In a carefully controlled natural field experiment on group versus individual liability in microfinance credits in the Philippines, Giné and Karlan (2011) do not find a difference in repayment rates between group and individual liability contracts.

*Table 3*  
**Social Welfare in a Trust Game**  
*(as a fraction of the maximum possible payoff)*

		<i>Second-mover</i>	
		<i>Individual</i>	<i>Group</i>
First-mover	Individual	0.77	0.84
	Group	0.69	0.62

*Source:* This is a trust game described in Kugler, Bornstein, Kocher, and Sutter (2007).

*Note:* Social welfare is the actual payoff per person divided by the maximum possible payoff.

rationality and that help individuals to overcome or at least contain their behavioral biases. While all of this seems like a desirable influence of group decision-making, we have not yet addressed how group decision-making may affect social welfare as we have defined it above (as total social material payoffs). We attend to this issue here, showing that decision making in groups may, in fact, be detrimental for social welfare in specific situations, whereas it is good for social welfare in others. Because the evidence in this relatively young field of research is still emerging, we are not yet able to provide a definitive taxonomy of when group decision-making is good for welfare and when it is bad, but we can lay some cornerstones upon which such a taxonomy could be built in the future.

We start with evidence from a game originally termed “the investment game” but now more commonly known as “the trust game.” In this game, the first player can send an amount  $x \leq c$  to a second player. The second player receives  $3x$ , and can send back any (non-tripled) amount  $y \leq 3x$ , which finishes the game. In this setting, the standard game-theoretic prediction is that the first player won’t expect to get anything back, and so will send nothing. Given that an increase in the amount  $x$  is associated with higher social welfare (as the sum of payoffs for both players), the standard prediction is associated with the least efficient outcome.

Kugler, Bornstein, Kocher, and Sutter (2007) have run a trust game where either individuals, or groups of three subjects each, were in the role of first- or second-mover. They find that groups send significantly smaller amounts (by about 20 percentage points) as first-movers, and also return on average smaller amounts (although this second result was statistically insignificant). Hence, group choices are closer to the standard rationality paradigm. Table 3 shows social welfare in the four different conditions in the experiment as a fraction of the maximum possible payoff per subject. If first-movers are groups, social welfare is significantly smaller. Since second-movers are only making redistributive choices, they do not affect social welfare.<sup>11</sup>

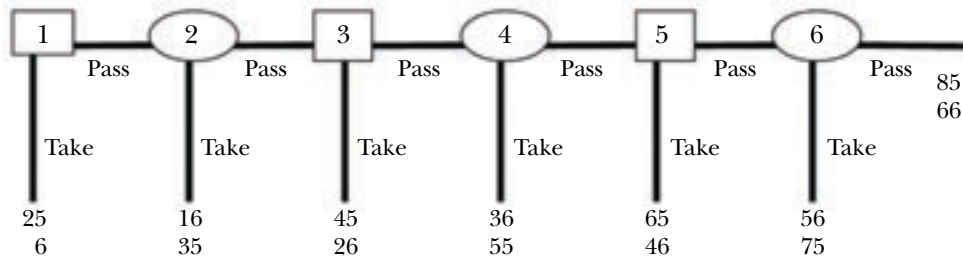
<sup>11</sup> Cox (2002) finds that groups as second-movers return significantly smaller amounts than individuals do. Again, this does not affect total social payoffs, since second-movers only redistribute money.

Instead of using group decision-making, Song (2008) has studied how group representatives make decisions on behalf of their group in a trust game. This means that the representative had to make a decision that determined the outcome of a three-person group. Song finds that group representatives send about 20 percent less as first-movers and return about 40 percent less as second-movers than individuals who decide only for themselves. These results support the earlier work of Kugler, Bornstein, Kocher, and Sutter (2007) on the negative effect of group decision-making on social welfare when trust is crucial to increase social welfare.

The “centipede game” can be viewed as a multistage version of the trust game. There are two stakes on the table: one large and one small. Players must decide either to pass the stakes to the other player, at which point both stakes increase in size, or end the game by taking the larger stake for themselves and giving the smaller stake to the other player. The payoffs are arranged such that if one passes the stakes in a particular stage and the opponent immediately ends the game in the next stage, one receives less than if one had taken the payoff and not passed the stakes. The centipede game is played for a limited number of rounds. Thus, backward induction suggests that players should end the game earlier, rather than run the risk of getting a lower payoff in the event that the other player “takes” at the next move. Figure 3 displays the centipede game used in a study by Bornstein, Kugler, and Ziegelmeyer (2004) in which they let individuals play against individuals, and groups (of three subjects each) against groups. They find that individuals’ median action is to “take” at node 5, while the median action of groups is to “take” at node 4. The difference is statistically significant and yields also significantly smaller payoffs for group members (50 on average) than for individuals (58 on average). Hence, the evidence shows a similar pattern as in the trust game: group play is more likely to conform to the rationality standard of game theory, but as a result, group play is also less likely to reap the potential efficiency gains.

As a final piece of evidence that group behavior may be bad for social welfare, we refer to a classic prisoner’s dilemma. Of course, a prisoner’s dilemma game is the familiar setting in which each of two players will find it a dominant strategy to defect, but if they can coordinate on cooperation, their combined payoff will be larger. Charness, Rigotti, and Rustichini (2007) study how individuals play this game on behalf of groups: that is, when they are making (individual) choices in front of their group members and when their actions influence the other group members’ payoffs (referred to as “payoff commonality”). They find that cooperation rates go down considerably and significantly when individuals play this game against an out-group member in front of their in-group and when payoff commonality applies. Hence, while defection is the self-interested choice here, group membership makes this choice more frequent, but as a consequence social welfare is reduced. In sum, the evidence summarized so far suggests that in trust games, centipede games, and prisoner’s dilemma games (all of which share the characteristic that they have a unique and socially inefficient, pure-strategy Nash equilibrium) group

Figure 3  
A Centipede Game



Source: Bornstein, Kugler, and Ziegelmeyer (2004).

Notes: Player 1's decision nodes are denoted by squares, and Player 2's by circles. At the start of this game, the large stake is 25 and the small stake is 6. Each time a player passes, both stakes are increased by 10. At each terminal node, the top number shows the payoff for Player 1 and the bottom for Player 2 if the game ends at that stage.

decision-making and group membership decrease social welfare, because groups show too little trust regarding cooperation from their interaction partners.

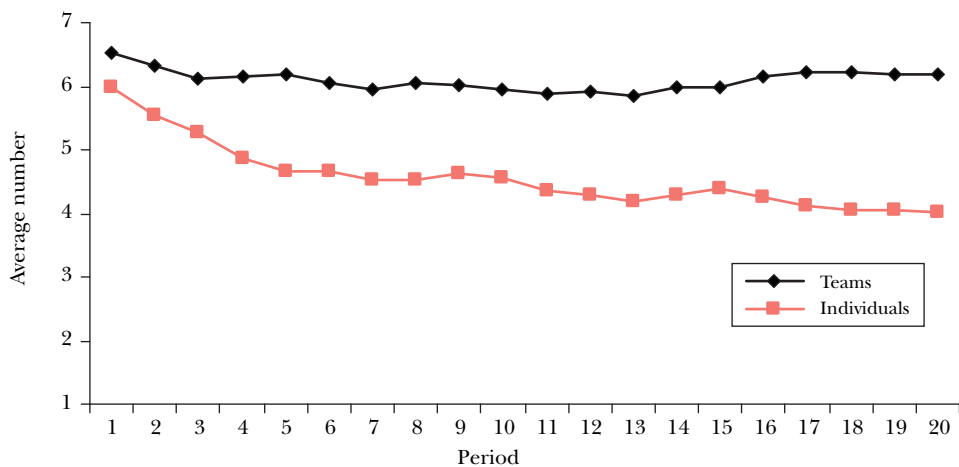
This negative effect of groups on social welfare does not generalize to all games, however. In particular, there is strong evidence that in games with multiple pure-strategy equilibria—commonly referred to as coordination games—group decision-making helps achieve efficient coordination, thus increasing social welfare.

Charness, Rigotti, and Rustichini (2007) consider a battle-of-the-sexes game. This is a  $2 \times 2$  game often described with a story like this one: A couple agrees to get together, but they cannot remember where they agreed to meet. Both parties know that the husband preferred to attend a certain sports event and the wife preferred to attend a certain play. Both parties receive higher benefits if they coordinate on a location, yet they cannot communicate with each other. This setting has two pure-strategy equilibria where both parties attend the same location, either the sports event or the play.<sup>12</sup> Efficiency in this game requires successful coordination (avoiding the outcomes in which the couple ends up in different places). Charness, Rigotti, and Rustichini (2007) show that *salient* group membership (one person in the pair plays in front of an audience of one's group members) significantly increases the rate of successful coordination compared to the rate in a situation without salient group membership. In this case, salient group membership leads to better social outcomes.

Some coordination games have multiple equilibria that are Pareto-ranked—that is, some equilibria are more efficient than others. For example, the “weakest link” game studied in Feri, Irlenbusch, and Sutter (2010) shares this feature, and it works like this: There are five players, which can be either individuals or groups with

<sup>12</sup> There is also a mixed-strategy equilibrium.

Figure 4

**Effort Levels of Individuals and Groups in a Weakest Link Game**

Source: Feri, Irlenbusch, and Sutter (2010).

Notes: This game, denoted *WL-BASE*, is described in Feri, Irlenbusch, and Sutter (2010). There are five players, which can be either individuals or groups with three members each. Each player (either an individual or a three-person group) chooses an effort level between 1 and 7. The payoff each player receives gets higher if they all choose to exert more effort, but it also gets lower—at a faster rate—the lower the minimum choice (or “weakest link”) of all players.

three members each. Each player (either an individual or a three-person group) chooses an effort level between 1 and 7 (group members may communicate briefly first). The payoff each player receives gets higher if they all choose to exert more effort, but it also gets lower—at a faster rate—the lower the minimum choice (or “weakest link”) of all players. In this setting, it turns out that any setting where all the players choose the same level of effort will be an equilibrium. The biggest payoffs for all players together will arise if everyone coordinates on a high level of effort. But the weakest-link dynamic tends to push toward coordinating on a lower level of effort. Feri, Irlenbusch, and Sutter find that the three-player groups not only play more efficient high-effort equilibria more often than individuals, but also are more successful in avoiding miscoordination (which in this case means picking different effort levels). Figure 4 shows the average effort levels across 20 periods for individuals and groups, indicating a large and significant difference in the ability to coordinate on more efficient outcomes. Social welfare is on average 24 percent higher when groups play this coordination game than when individuals make decisions.

In short, the effect of group decision-making on social welfare can go in either direction. The pattern emerging from the evidence seems to indicate that more rational choices of groups decrease social welfare when games have a unique pure-strategy equilibrium (with a dominant strategy, in fact), but that groups are more successful in coordinating on more efficient equilibria when a multiplicity of equilibria exist. The common denominator for these seemingly divergent effects of

group decision-making may be that groups put more weight on own payoffs than do individuals (something discussed also in the next section). Studying the learning of groups and individuals, Feri, Irlenbusch, and Sutter (2010) find that groups are more sensitive to the attractions of different strategies and take into account more strongly the potential payoffs of previously not-chosen strategies. These learning characteristics of groups imply that payoffs play a significantly larger role in determining their choice probabilities than they do for individuals, leading to a higher frequency of choosing dominant strategies in trust games (“do not trust”), centipede games (“take”), or prisoner’s dilemma games (“defect”), but also to a higher frequency of choosing more efficient equilibria in coordination games.

### **Sources of Differences in Individual and Group Decisions**

Why might groups behave in a more rational manner than individuals? We explore three possible reasons: 1) multiple brains are better at seeking answers; 2) multiple brains are better at anticipating the actions of other parties and thus better at coordinating behavior with what other parties are likely to do; and 3) groups may be more likely than individuals to emphasize monetary payoffs over alternative concerns, such as fairness or reciprocity towards another player.

Our first possible explanation for differences between individuals and groups is that groups can potentially benefit from having multiple brains. In some cases, this may lead to better decisions in the sense of avoiding errors. In addition to the examples given in Lesson One, consider an information cascade game. Here players receive a private signal and then announce a public belief in sequential order: for example, players might look at one marble drawn from a bag, and then announce their belief as to whether the bag is two-thirds white marbles or two-thirds black marbles. Later players must then compare their own private signal to the public beliefs of others. In an information cascade, players ought to disregard their private information and instead follow the belief being expressed by many others at some stage of the game. Fahr and Irlenbusch (2011) find that groups make fewer mistakes in an information cascade experiment than individuals (and thus earn more money).<sup>13</sup> Evidence from psychology supports the argument that social interaction improves the decision-making process. For instance, in letters-to-numbers problems, where a random coding of the letters A–J to the numbers 0–9 needs to be solved, groups do much better than individuals by taking about 30 percent fewer trials to solve the problems (Laughlin, Bonner, and Miner 2002). Likewise, in the “Wason selection task,” developed to test whether individuals employ the rules of formal logic when

<sup>13</sup> Also in information cascade experiments by Alevy, Haigh, and List (2007), professional traders were shown to be better able to discern the quality of public signals. One possible explanation for the superiority of professional traders over college students might be that professional traders are more used to being in a group, so they make better decisions, an interpretation that would be consistent with the findings by Fahr and Irlenbusch (2011).

testing conditional statements of the form “if  $p$ , then  $q$ ,” groups have solution rates of 50 percent while individuals have solution rates of 11 percent (Maciejovsky and Budescu 2007). The Wason selection task is an example of a “truth wins” problem: that is, a problem where the solution is difficult to reach without grasping a specific insight, but then the solution is easily explained to another individual. In such cases, groups can be expected to solve the problem with higher probability. Consider that a fraction  $p$  of all individuals has the specific insight to solve the problem, then the likelihood that a group with  $n$  members solves the problem is  $1 - (1 - p)^n$ , which is larger than  $p$  (if  $p < 1$ ). The likelihood  $1 - (1 - p)^n$  is often referred to as the “truth-wins benchmark.” While groups typically do better than individuals in such insight problems, they rarely meet or exceed the truth-wins benchmark.<sup>14</sup>

In an interesting experiment from the psychology literature, groups actually beat this benchmark. Michaelson, Watson, and Black (1989) grouped together students in a class (average group size of six) and asked them to answer questions based on assigned reading, with the scores counting towards the course grade. These tasks ranged from recalling specific concepts from the reading to ones requiring higher cognitive ability and a deeper understanding to being able to synthesize concepts. The key comparison was between the highest score of any individual in a group and the average score of the group on the task; the notion behind this comparison is to test the view that, in an organizational context, group decisions will be better than the decisions of the most knowledgeable group member. In fact, a remarkable 97 percent of all groups outperformed their best member. Each person first completed the task individually and then retook the test as a member of a group that could have internal discussions. Group scores were compared with the highest score for any individual in the group. In the economics literature, choices made in the Cooper and Kagel (2005) limit-pricing game and in the Maciejovsky and Budescu (2007) Wason selection task provide examples where groups do better than the truth-wins benchmark.

A second possible reason why groups make more rational decisions than individuals, especially in interactive games, is that group members are better able to put themselves into the shoes of their competitors when discussing their own strategy. It seems that the need to discuss the game with another group member often leads to a discussion regarding how the group members would play the game, making it a salient feature then to consider the other player’s available strategies and payoffs more extensively than individuals would do (Cooper and Kagel 2005). For this reason, groups can be better prepared to anticipate the actions of other players. From there, it is only a short step to think about the best reply to one’s own expectation about the opponent’s most likely strategy. As a consequence, group behavior is pushed towards the standard game-theoretic predictions. This insight is consistent with what has been observed in the limit-pricing game of Cooper and Kagel (2005). Further support is presented in Sutter, Czermak, and Feri (2010).

<sup>14</sup> Meaning that their solution rates stay below  $1 - (1 - p)^n$  but remain above  $p$ .



They let individuals and groups make choices in simple two-player games (with unique pure-strategy, Pareto-inefficient Nash equilibria). Groups play the Nash equilibrium in these games about 10 percentage points more frequently than individuals, and the main reason is that they expect their opponent to play the Nash equilibrium more frequently than individuals expect this from individuals. Accordingly, groups more often play the equilibrium as a best response to their own beliefs.

A third reason why groups may behave “less behaviorally” than individuals is that groups may be more concerned with their own group’s monetary payoffs and thus disregard more frequently the payoffs of the other player. Communication within groups may change an individual’s reference point for optimization. Instead of maximizing own payoffs, individuals may consider the joint payoff (or welfare) of those engaged in the discussion as the appropriate target for optimization. Psychologists have long been emphasizing such an effect of communication: Elster (1986, pp. 112–113), for instance, has suggested that it is “pragmatically impossible to argue that a given solution should be chosen just because it is good for oneself. By the very act of engaging in a public debate . . . one has ruled out the possibility of invoking such reasons. To engage in discussion can in fact be seen as one kind of self-censorship, a pre-commitment to the idea of rational decision.” By rational decision, however, Elster (1986) refers to decisions which are advantageous for the *group* of communicating subjects as a whole, but not necessarily aligned with (and sometimes even contrary to) the interests of other players in the opponent group. Such an argument links our discussion to the long-standing literature on in-group/out-group effects. (For an overview from an economic perspective, interested readers might start with Chen and Li 2009.) By design, group decision-making creates an in-group—one’s own group—and an out-group—with whom the own-group is interacting. Social psychology has coined the term “discontinuity effect” (for example, Schopler et al. 2001) to describe the fact that, typically, groups act more competitively and more selfishly when interacting with other groups than when individuals interact with individuals.

## Conclusion

The existing literature that compares group and individual decision-making provides considerable evidence that groups make choices that are more rational in a standard game-theoretic sense than those of individuals. As a result, group decision-making and being a member of a group can overcome cognitive biases and limitations. However, making decisions in groups does not always lead to increases in social welfare, which raises the question: Under which conditions is individual or group decision-making better for society as a whole? We have identified several games (with unique equilibria) where individual decision-making yields higher welfare, while in coordination games (with multiple equilibria), groups achieve more efficient outcomes.

Since group decision-making is present in a wide variety of economic environments, this issue has considerable practical relevance. Generally, decision making in groups seems to be most effective when there is a good degree of diversity in the group and when the environment is a participatory one in which diverse ideas can be expressed (rather than an environment with a dominant and intimidating personality). For example, any single individual group member could have an insight that sheds light on what would otherwise be a blind spot for the group; it pays to broaden the base. Still, it seems best to have groups of modest size, so that interior coordination problems and “social loafing”—in this case, reduced effort—are manageable. As Surowiecki (2004, pp. 190–91) wrote: “If small groups are included in the decision-making process, then they should be allowed to make decisions. If an organization sets up teams and then uses them for purely advisory purposes, it loses the true advantage that a team has: namely, collective wisdom.” It is noteworthy, however, that it remains to be determined what constitutes an ideal group size. A useful starting point here is Forsyth’s (2006) work on group size and performance. We suspect that the optimal size of the group will depend on factors such as the complexity of the decision, but more research is clearly needed here.

Some other open issues for future research include the influence of different communication media on group decisions. Do group dynamics change when video calls substitute for face-to-face communication? Another relatively unexplored area is the effect of internal conflicts on the rationality and character of group decisions: that is, what happens when the payoffs to members of a group are not identical? Groups can be a way of diffusing decision-making and avoiding responsibility, but they can also be a powerful force for more careful and productive decisions. Ultimately, the goal of comparing individual and group decision-making is to identify the contexts and types of decisions where each is likely to work best.

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