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The Effect of Group Decision Making on Cooperation in Social Dilemmas

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A robust finding in social dilemma research is an increase in individual cooperative choice following group discussion about the dilemma. To elaborate the idea that this effect arises from the development of within-group consensus, groups of six made explicit group decisions about their subsequent individual choice. Perceived demonstrability of cooperativeness in the dilemma was manipulated through changes both to instructions and the incentives of the dilemma. As demonstrability decreased, so did the proportion of groups deciding to cooperate, leading to a reduction in the group discussion effect. Social decision scheme analysis supported the demonstrability-group decision hypothesis. The interaction between demonstrability, individual opinions and group process is proposed to explain the group discussion effect.

KEYWORDS cooperation, group decision-making, group discussion, social dilemmas

THE CONSEQUENCES of personal decisions often depend upon behaviours of other group members. An example is a decision about whether or not to drive the car to work or to use public transport. It is individually rational (faster, more comfortable, convenient) to drive. However, if everyone makes the *individually* rational choice, the outcome for the group will be more traffic congestion and worse pollution that affects the situation for all. Thus using public transport is the *collectively* rational choice.

Situations where group members must decide between two choices that conflict in this way are called social dilemmas (Dawes, 1980). Although social dilemmas have many different variants (see Messick & Brewer, 1982), they are all identical in two regards (Dawes, 1980). First, individuals receive a higher payoff after choosing non-cooperatively (in the above case, taking the car to work) than if he or she cooperates (i.e. uses public transport). Second, everybody in the group is better off if everybody cooperates than if everybody does not cooperate.

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Table 1. Examples of points matrices used in experimental social dilemmas research. Tables show the number of points received by someone choosing 'C' or 'D' (rows) as a function of how many others in the six person group choose 'C' (columns).

Table 1a: High demonstrability matrix

	Number of C&D choices in the group						
Participant's choice	0C/6D	1C/5D	2C/4D	3C/3D	4C/2D	5C/1D	6C/0D
C	n/a	194	197	200	203	206	209
D	200	204	208	212	216	220	n/a

K' = 0.346

Table 1b: Low demonstrability matrix

	Number of C&D choices in the group						
Participant's choice	0C/6D	1C/5D	2C/4D	3C/3D	4C/2D	5C/1D	6C/0D
C	n/a	140	170	200	230	260	290
D	200	240	280	320	360	400	n/a

K' = 0.346

To study social dilemmas in the laboratory, researchers usually offer participants a choice between a cooperative choice (labelled as 'C' choice) and a non-cooperative choice ('D' choice). The individual's choice in combination with the other persons' choices determines the amount of reward (e.g. points, money, school supplies) each person receives. The rewards given for each pattern of choices are structured to fulfil Dawes's (1980) criteria. Table 1 shows examples of two matrices that can be used to create a social dilemma among six group members. The table shows the number of points a group member receives as a function of, first, whether they have chosen C (the columns) or D (the rows) and, second, how many other people in the group have chosen C . For instance, in Table 1a, if a person chooses C, and none of the others choose C, the person gets 194 points. However, the five group members who choose D in this case each receive 204 points. No matter how many choose C, a person is better off after choosing D. However, if all follow this rule and choose D, they will all receive 200 points, which is less than if they had all chosen C (209 points).

There have been several excellent reviews of social dilemmas research (e.g. Dawes, 1980; Messick & Brewer, 1982; Komorita & Parks, 1995). Recently research has focused on a number of different aspects, including leadership (e.g. De Cremer & VanVugt, 2002), fairness (Hertel, Aarts, & Zeelenberg, 2002), cultural factors (Hulbert, Correa da Silva, & Adegboyega, 2001; Parks & Vu, 1994; Probst, Carnevale, & Triandis, 1999) and social values (Kortenkamp, 2001; Parks & Rumble, 2001; Van Lange, 1999), as well as behaviour in applied versions of social dilemmas (Gaerling, Kristensen, Backenroth-Ohsako, Ekehammar, & Wessells, 2000; Joireman, Van Lange, Van Vugt, Wood, Leest, & Lambert, 2001; Van Lange, Van Vugt, & De Cremer, 2000).

A reliable finding that is relevant to our current interests is the group discussion effect. When given the opportunity to discuss a social dilemma before having to make their personal decisions, group members show a higher rate of cooperative choices than those group members who do not have the opportunity of discussion (Caldwell, 1976; Rapoport, 1974; Van de Kragt, Orbell, Dawes, Braver, & Wilson, 1986). This effect does not appear to depend on the presence of social norms within the group that require group members to behave cooperatively regardless of what others do (Orbell, van de Kragt, & Dawes, 1988). Nor does the effect stem from the fact that a period of discussion allows members to share information and reach a better understanding of their task (Kerr & Kaufman-Gilliland, 1994).

Rather, research has identified two broad processes as causes of the group discussion effect. The social identity explanation (Dawes, McTavish, & Shaklee, 1977) argues that group discussion bolsters social identity within the groups. Enhanced social identity is presumed to increase the value placed on the welfare of others in the group and thereby to increase the level of cooperative choice in the group. In contrast, the perceived consensus explanation argues that the period of group discussion gives participants the opportunity to develop and become committed to a consensus as to the best course of action to take within the group (Bouas & Komorita, 1996; Kerr & Kaufman-Gilliland, 1994; Orbell et al., 1988). This research suggests that the development of perceived consensus to cooperate during group discussion underlies the group discussion effect.

The group identity and consensus explanations of the discussion effect in social dilemmas are at different ends of a spectrum of ideas about group processes. The group identity explanation de-emphasizes individual group members' choice preferences and suggests that discussion serves to increase the importance of others' welfare. However, the perceived consensus explanation focuses on the importance of individual preference, supposing a consensus develops without attempting to explain how or even if this consensus is reached.

As far as we are aware, groups engaged in intragroup experimental social dilemmas have never been asked to render an explicit consensus decision about how to choose following discussion. Given the idea that the group discussion effect is the result of an unobserved implicit or explicit group consensus for mutual cooperation, the first aim of our experiment was to show that groups that opt for mutual cooperation will have higher levels of subsequent individual cooperative choice relative to groups that do not decide to cooperate (e.g. Orbell et al., 1988).

In addition to demonstrating the importance of consensus in this regard, we used this opportunity for the group to make an explicit group decision to allow us to explicate more carefully the group process that underlies the group discussion effect. For instance, even under the assumption that an organic consensus process leads to the group decision to choose cooperatively, there is disagreement within the literature as to how many people are needed to form this consensus. Orbell et al. (1988) argued that consensus is reached when members' opinions are unanimous. Bouas and Komorita (1996) took a less stringent view and argued that a simple majority is sufficient. However, these hypothesised group process rules require a sizeable number of people pre-disposed to choose cooperatively before the group would develop a consensus for cooperation. Thus, the hypothesis that consensus for mutual cooperation would follow from either a majority or unanimous opinion is not plausible, given the robustness of the group discussion effect.

Instead, given the robustness of the effect, it is more plausible that the group would agree to cooperate as long as some fraction (perhaps much smaller than a majority) privately preferred cooperation prior to group discussion. The effect would be very strong if this sufficient fraction were small – one or perhaps two group members. Following the terminology developed in the group problem-solving literature (e.g. Davis, 1969; Laughlin, Kerr, Davis, Halff, & Marciniak, 1975; Steiner, 1972), we call the corresponding social decision schemes (see Davis, 1973) C-wins and C-supported-wins respectively. In sum, if during group discussion about a social dilemma the group reaches a consensus as determined by rules such as C-wins or C-supported-wins, then a robust group discussion effect would be expected.[1]

An idea from the group problem-solving literature suggests just when a group might use a rule like C-wins or C-supported-wins to reach consensus. Specifically, Laughlin and his colleagues (e.g. Lauglin & Ellis, 1986; Laughlin, Bonner, & Miner, 2002; Laughlin, Kerr, Munch, & Haggarty, 1976) have demonstrated that rules like these are used by groups to the extent that one alternative response is demonstrably correct. Laughlin (1980) calls a task that has no demonstrably correct alternative response (e.g. 'Nature or nurture?') a purely judgmental task. A group's choice in such a judgment is likely to depend on social consensus and be that alternative which most group members (e.g. a majority or unanimity) favours. A task with a demonstrably correct alternative (e.g. 'What is 5 + 4?') is called a purely intellective task – that is, the answer can be shown to be correct to a group member who is doubting but capable (Laughlin & Ellis, 1986). A group may be expected to choose this correct alternative as long as it contains one (or, if demonstrability is not so clear, perhaps two) member(s) who can successfully solve the problem and demonstrate the correctness of that alternative (here, '9') to the rest of the group.

A fundamental aspect of social dilemmas is that they are dilemmas. Arguments in favour of mutual cooperation or non-cooperation are always answerable. On the other hand, demonstrability is a perception, and tasks can vary in demonstrability independently of their objective solvability. Therefore, in addition to showing that the group discussion effect occurs because, during discussion, groups develop a consensus for mutual cooperative choice, a second aim of our experiment was to show that this decision is rendered because groups perceive cooperation as demonstrably correct. However, because we assume that the group discussion procedure increases this perception, tests of this idea would logically involve attempts to decrease this perception when groups discuss the dilemma. Thus in this experiment we sought to manipulate the participants' perceptions of the demonstrable correctness of the mutually cooperative solution.

One way we attempted to do this was by (falsely) instructing participants that either the social dilemma in fact does or does not have a correct solution. Thus, even in the context of the group discussion, this instruction might change how decision makers evaluate the cooperative and non-cooperative solutions, leading to a greater chance that a group would decide according to the C-wins or C-supported-wins rules.

In addition, we attempted to vary the perceived demonstrability of the mutually cooperative solution by manipulating the relative strengths of the group and individual incentives embodied in the dilemma. Consider the two six-person dilemmas shown in Table 1. Values of K' (Komorita, 1976) are shown for both of these two matrices. K' is an extension of Rapoport's (1967) index of cooperation, applicable to an N-person dilemma. As can be seen, both dilemmas have equal K' parameters (K' = 0.346), and, in this sense, are rationally equivalent. To the degree that K' captures the relative attractiveness of cooperation (vs. defection), this suggests that the amount of cooperative choice observed in both dilemmas will not differ. However, even though the structure of group and individual incentives in both matrices is similar, the differences between incentives for cooperation vs. defection are all ten times higher in the second matrix.

The change in size of the incentives is illustrated in Figure 1, which graphs the reward structures of the two matrices in the same coordinate system. The low demonstrability dilemma differs from the high demonstrability dilemma in that the dominance of the non-cooperative choice (represented by the difference between the C and D curves of a game) is much greater in the low demonstrable game. We suggest that this makes the defecting choice more attractive and obscures the value of mutual cooperation for avoiding the trap of mutual defection. As a result, although an isolated individual would be mindful of the personal benefits of defection in either dilemma (given their similar structure, and hence equal K' parameters), groups would be less likely to decide for mutual cooperation in the low relative to the high demonstrability dilemma.

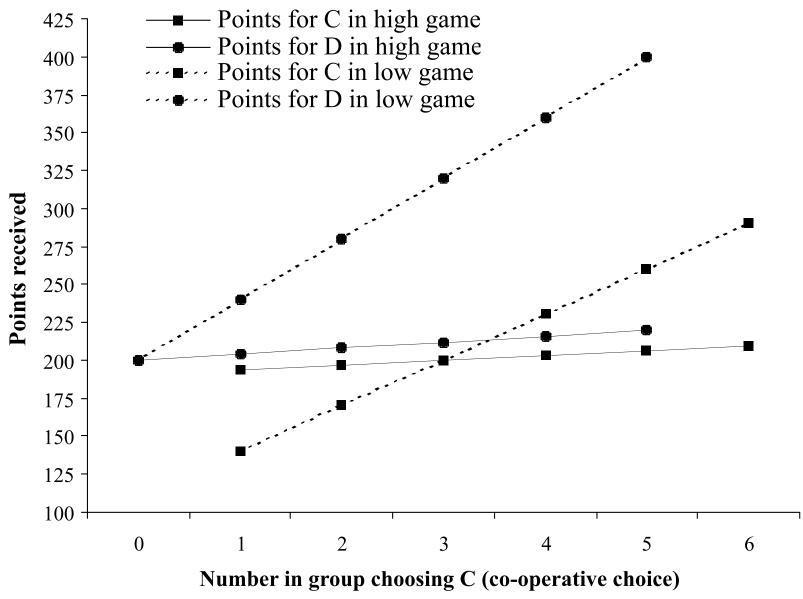

Figure 1. Reward structures for the High and Low Demonstrability matrices of the experiment.

An important and novel feature of this experiment was that groups were asked to make an explicit group decision about the social dilemma prior to private and binding individual cooperative or non-cooperative choices. Specifically, the groups chose between three alternatives: (C) all choose C; (D) all choose D; or (X) something in between these two options. By examining the group decisions made in the different conditions, we were able to test two of the important propositions underlying these ideas.

First, members of groups that decide for 'C' will be more cooperative following discussion relative to other groups (Hypothesis 1; see Orbell et al., 1988). Second, if the group discussion effect arises because participants perceive that the mutually cooperative solution is demonstrable, then there should be more 'C' group decisions (and thus more cooperative choice) in conditions designed to increase perceived demonstrability (i.e. given instructions that there is a correct answer, or in response to the high demonstrability matrix; Hypothesis 2). Finally, using social decision scheme analysis (Davis, 1973; Kerr, Stasser, & Davis, 1979), the group decision process in the high demonstrability conditions will be better described with a 'C-supported wins' rule whereas the process in the low demonstrability conditions will be better described by a 'majority-wins' group process (Hypothesis 3).

Method

Participants and design

One hundred and thirty-two students studying psychology took part in this experiment. All participants were over 16 years of age. They were randomly assigned to 22 six-person groups and conditions in a 2 (instruction type: intellective vs. judgmental, between participants) by 2 (demonstrability: high, low, within participants) mixed model design. A six-person prisoner's dilemma game was used, and participants were asked to discuss the dilemma and reach a group decision before making their choices.

Procedure

Groups of 20 to 40 participants arrived, during one of four sessions, at a central holding room. There they were briefed about the format of the experiment and about their right to withdraw and were told that they could leave the experiment at the outset. All agreed to participate. They were then randomly assigned to groups of six people and to an experimental condition before being taken to individual group rooms. Once seated, participants were assigned a group number and a seat number so that each could be anonymous but separately identified. Participants were then given an initial set of instructions, including a copy of the first points matrix (participants' matrix labelled the cooperative choices as 'J' and the non-cooperative choices as 'P'). For counterbalancing purposes, half the groups were given instructions and matrices for the high demonstrability dilemma, and half for the low demonstrability dilemma. In any given group all members received the same points matrix.

They were asked to read along with tape-recorded instructions, which explained the nature of the social dilemma, the procedure for the experiment and two example outcomes. No norm-laden terms such as 'cooperation' were used. They were instructed that they would be able to exchange the points they earned for pens and pencils at the end of the experiment, and their goal was to 'get as many points as possible'. Once instructions were completed, the experimenter re-entered the room and gave the participants the opportunity to ask any questions regarding clarification of the task and procedure. Experimenters couched their answers in terms of the already read instructions.

Participants were then asked to indicate the choice that they intended to make after the discussion/decision period. This choice was placed in an envelope and collected by the experimenter before continuing to the next phase of the experiment. Participants were not given any feedback from this choice and it did not count towards their points total. They were then provided with a group decision-making sheet, outlining the instructions for the group discussion/decision phase. During this phase they were asked to discuss how to behave in the situation and come to a group decision between three options: 'all-C' (all choose C), 'all-D' (all choose D) or 'X' (a mixed decision). This sheet also included instructions explaining the second manipulation, namely instruction type. In the intellective condition the instructions informed the groups that there was definitely a correct way to solve the dilemma. In the case of the judgmental instructions groups were told that there was *no* definitively correct way to solve the dilemma.

Once this phase was completed participants were asked to make their individual choice privately and in silence and place their answers in the answer envelope. Anonymity of choice was also outlined in the initial briefing. The experimenter then collected the answers and upon returning announced the points received by those choosing cooperatively and those not doing so (without identifying specific members). The process of discussion, decision and individual choice was then repeated using the same matrix until 15 minutes from the end of the first trial. Participants were then asked to respond to a series of semantic differential questionnaires asking about their perceptions of the game, the process used by their group, and their motivations in making choices. These were collected before continuing to the next phase of the experiment.

Now, the first dilemma matrix (either high or low demonstrability) was replaced with the alternative one (low or high demonstrability respectively). Participants were asked to examine the new matrix and then record their pre-discussion choice about this dilemma. The procedure as for the first matrix was then repeated for the second matrix for another 15 minutes, except that post-choice questions concerned the second points matrix. Upon completion of the experiment, all participants were allowed to take as many of the school supplies as they wished. They were then led to the original gathering room and fully debriefed.

Although the design included demonstrability as a counterbalanced within-participants factor, we also were prepared to find that

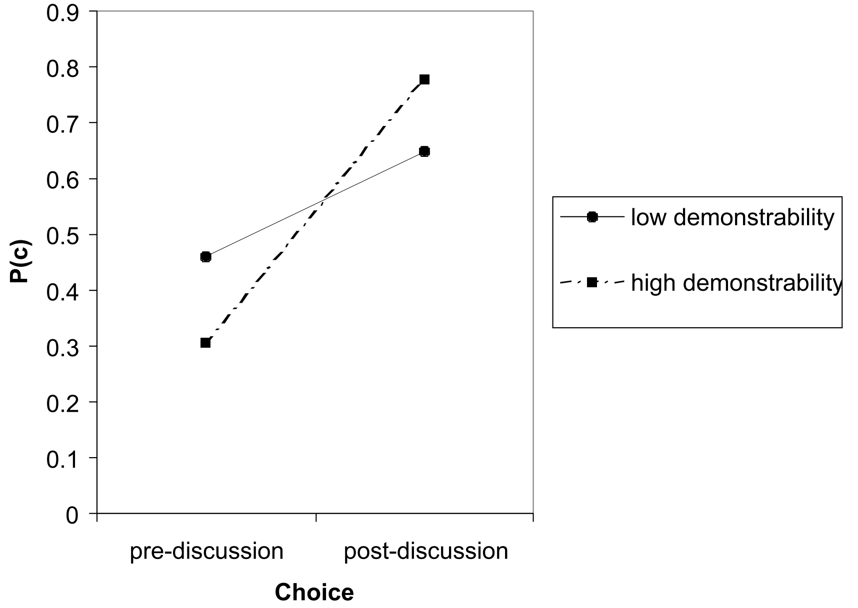

Figure 2. Interaction of Demonstrability and Pre/Post Discussion choice on mean proportion of cooperative choice.

variants in discussion processes might observably affect only the first trial. Effects of defection and norm violation on earlier trials might eliminate less proximal effects. As a result, we also analysed the first trial only, treating demonstrability as a completely between-participants variable.

Results

Data from 132 participants were collected and aggregated into 22 experimental groups to give a proportion of pre-discussion cooperative choices for each group on each trial, which we label as *P(c)*. The effects of conditions did not persist beyond the first trial in this experiment.[2] We ignore the repeated measures from herein and focus on the analysis of the first trial only. First, to assess the validity of the equal *K*' of the two matrices we analysed pre-discussion choice. Analysis of the pre-discussion choice did not include the Instruction Type variable as participants had not yet been exposed to those instructions. Consistent with expectations, no significant difference was found between high and low demonstrability of the task pre-discussion ($t(21) = -.055$, $p = .957$ (respective Means = .451 and 447)).

The data for the first trial only, were then analysed with a 2 × 2 × 2 (pre/post discussion choice by demonstrability by instruction type) ANOVA, with pre/post discussion choice as a repeated measures factor. There was a significant effect of group discussion. Post-discussion choices were significantly more cooperative than pre-discussion choices ($F(1,18) = 33.681$, $p < .001$ (respective Means = .714 and .381)). This finding replicates the group discussion effect. Also the interaction between pre/post discussion choice and demonstrability was significant ($F(1,18) = 6.186$, $p = .023$). Figure 2 shows that the effect of discussion on mean *P(c)* was greater for the high demonstrability matrix.

Hypothesis 1 was that individual choices following group discussion are made as a function of group decisions. First we classified group decisions as either 'all-C' or 'not all-C' (only one group on one trial decided that all

Table 2. Observed and predicted proportion of group decisions of all-C (P[all-C]) by condition and three different group decision rules, with results of Kolmogorov-Smirnov goodness of fit tests

		High Demonstrability		Low Demonstrability
PRE-DISCUSSION (individual C choice)		.306		.461
OBSERVED (group all-C choice)		.800		.273
SDS Model	Predicted P(all-C)	Dmax, $N = 10$	Predicted P(all-C)	Dmax, $N = 11$
MEQ	.171	.629	.427	.154*
C-supported wins	.593	.207*	.850	.577
C-wins	.888	.088*	.975	.703

Note: MEQ = majority opinion wins, equiprobable otherwise. Starred Dmax values indicate that the relevant model was not rejected ($p > .20$).

group members should choose D). One group did not make a decision, leaving 21 groups for this analysis. Eleven groups decided all-C and ten decided not-C. Group decisions were inserted into the previous $2 \times 2 \times 2$ model as a random factor. The results of this analysis showed that after the effect of group decision was included, the interaction between demonstrability and pre/post discussion choice was non-significant ($F(1,16) = .333$, $p = .572$). Moreover, the pre/post decision by group decision interaction was significant ($F(1,16) = 12.268$, $p < .003$). The increase in mean *P(c)* following discussion was larger for members of groups deciding all-C (from $M = .349$ to $M = .849$) relative to the increase for members of groups deciding not-C (from $M = .433$ to $M = .533$). Apart from the significant effect of pre/post discussion choice, these were the only significant effects in this analysis. Thus, consistent with the hypothesis, the group discussion effect depends upon cooperative group decisions.

Hypothesis 2 states that group decisions are affected by demonstrability. A logistic regression, using a backward stepwise (likelihood ratio) method using instruction type and demonstrability as predictors of group decisions, found only a marginal difference between the model with both predictors and the interaction and the constant model ($\chi^2(3) = 6.517$, $p = .089$). When terms were removed from the model the only term remaining was demonstrability, which significantly predicted the group decision ($Wald(1) = 5.172$, $p = .023$). In the low demonstrability condition 27.3% of groups (3/11) decided all-C compared to 80% of groups (8/10) deciding all-C in the high demonstrability condition. This simple cross-categorization between demonstrability and group decision showed a significant relationship ($\chi^2(1) = 5.838$, $p = .023$).

Social decision scheme analysis

Finally, social decision scheme model testing analysis was used to test Hypothesis 3. Since instruction type had no significant effects, the analysis compares only the first trial of groups deciding about the high demonstrability matrix with groups deciding about the low demonstrability matrix. Participants' pre-discussion choices were used to predict group decisions. Three decision schemes were tested: 'C-wins' (group chooses all-C if at least one member favours C prior to discussion), 'C-supported wins' (group chooses all-C if at least two members favour C), 'Majority equiprobable otherwise' (group chooses all-C if the majority favours C, not-C if the majority favours D or, if there is no majority, decides between the two randomly).

Table 2 shows the results of this analysis. Consistent with Hypothesis 3, the best-fitting decision scheme changed according to whether the dilemma was high or low demonstrability. According to Kolmogorov-Smirnov tests,[3] in the high demonstrability condition the majority equiprobable otherwise model was rejected whereas the C-supported wins and C-wins models were not (with the latter providing the better fit). For the low demonstrability matrix, the opposite pattern was observed.

Discussion

The aim of this experiment was to provide evidence in support of an elaboration of the perceived consensus explanation of the group discussion effect in social dilemmas (Bouas & Komorita, 1996; Kerr & Kaufman-Gilliland, 1994; Orbell, et al., 1988). We hypothesized that the group discussion effect on individual choice can be explained as the result of an implicit or explicit group decision to cooperate. Consistent with this idea, when, in this experiment, we asked groups to make an explicit decision about how members should choose, groups that did not decide to cooperate did not show the group discussion effect to the same extent as groups that decided to cooperate.

We hypothesized that the reason why a group's consensus is to cooperate, rather than not, is that the social situation inspires group members to perceive that the mutually cooperative solution to the dilemma is demonstrably correct, meaning that only one or two members who favour the cooperative solution will be able to carry the group to this conclusion (see Laughlin, 1980; Laughlin et al., 1975; 1976). To provide evidence in support of this idea, we attempted to manipulate the demonstrability of the cooperative solution for all discussion groups. Demonstrability had no effect on individuals' pre-discussion choices, but individual post-discussion cooperative choice increased significantly more in the high, relative to the low, demonstrability matrix. However, this effect was driven by more group decisions for cooperation in the high demonstrability condition. Similarly, 'C-wins' and 'C-supported wins' could not be rejected as descriptions of the groups' process in the high demonstrability condition while 'majority equiprobable otherwise' could not be rejected in the low demonstrability condition.

In sum, our results support the idea that when the perceived demonstrability of the cooperative solution is sufficiently high, groups make the cooperative decision if it is advocated by at least one or two of the group's members. Since the likelihood of a group containing two members advocating cooperation is higher than that of the group containing a majority, we see a higher proportion of groups deciding cooperatively when demonstrability is high. In this case we see that a larger proportion of groups decide for cooperation than the proportion of individuals who prefer cooperation. This latter empirical difference results in the group discussion effect.

As a novel concept in social dilemmas, demonstrability is as yet somewhat underspecified. We have argued that it is the salience of individual versus group interests that is the main factor. In this experiment we instructed participants to gain as many points as possible and we believe that high demonstrability makes the best solution for this outcome more easily obtainable. However, further work could examine the importance of outcome criteria such as this in the perception of demonstrability. Alternatively, demonstrability may be driven by the perception of morality of the cooperative choice and the lack of perception of power for the non-cooperative choice (Beggan, Messick, & Allison, 1988; Sattler & Kerr, 1991). However, when the demonstrability of the dilemma is low, this moral argument may be weakened by the very high perceived opportunity for self-gain.

Given all this, it is probably the case that an explanation of the group discussion effect must rely on the greater persuasive strength of cooperative relative to non-cooperative arguments when espoused by a minority of group members. In this vein, an alternative explanation may be derived from work on the influence of minority opinion per se. For instance, relative to majority influence messages, minority influence messages are subject to systematic or convergent processing (see for example Martin & Hewstone, 2003; Smith, Tindale, & Anderson, 2001). One could argue that the collective rationality of the cooperative choice in a social dilemma is less obvious and salient to most individuals than the individual rationality of the non-cooperative choice.

Thus, on balance, a minority attempt to persuade others to choose cooperatively might be more likely to introduce new and persuasive arguments than an attempt to persuade others to choose non-cooperatively. This effect could occur independently of, in addition to, or even in lieu of the effect of the notional variation in perceived demonstrability of mutual cooperation invoked in this experiment. Although clearly requiring further specification, future research might attempt to link the group discussion effect to such differences between minority and majority influence.

Interestingly, another body of research concerns a situation wherein group discussion does not promote increased cooperative choice (Insko et al., 1987; 1988). In this research, groups work together and make group decisions about the choices the group will make in a social dilemma against a different person or group. Perhaps because all the actors in the situation do not participate in the group's discussion, one possibility is that the mutually cooperative outcome is perceived as a less demonstrably correct alternative. As a result, groups might use a majority or even unanimity rule in deciding. Further research could examine rule-based decision-making within this paradigm and could test the hypothesis that increases in the demonstrability of the mutually cooperative solution might re-instate the cooperation-enhancing effects of group discussion.

Returning to consideration of the design of the current experiment, it is interesting that the effects of demonstrability were not evident in later trials. One possibility is that participants were influenced throughout the study by their initial choices based upon the initial matrix. Indeed, we would expect that a group decision would cause lasting opinion change as participants recognize the correctness of the C-choice. A different idea, however, is that over multiple trials processes relevant to group problem-solving (e.g. demonstrability) are perhaps superseded by phenomena associated with mixed-motive interactions. For instance, over time expressions of opinions in group discussions and actual choices might be influenced by strategic considerations.

We know already that there is little relationship between group members' choices in a social dilemma and what they have *pledged* to do under far more constrained communication procedures (Chen & Komorita, 1994). Future research should manipulate and/or measure the degree of agreement between group members' communications, the explicit or implicit group decision and individual choice. In addition to understanding the behaviour of groups that work on dilemmas over longer periods of time, such research would 'close the empirical circle' relevant to the group discussion effect.

Notes

1. Although the arguments for unanimity (Orbell et al., 1988) or majority (Bouas & Komorita, 1996) hold intuitive appeal, we can show that if these rules were used group discussion would actually result in a decrease in cooperative choice-making. Data from an earlier experiment (Hopthrow & Hulbert, 2001), in which a sample of 260 psychology students were asked to discuss or think about a dilemma in different size groups (two-person or six-person), illustrates this point. Participants were not instructed to make an explicit group decision. We can, however, model the implicit group decisions in the discussion groups using Davis's (1973) theory of social decision scheme analysis. In this experiment, 43% of individual group members indicated the cooperative choice when asked, prior to discussion, which was their preferred choice.

   The results of the simulation using the above baseline show that the proportion of cooperative choices in the group would only increase after discussion if an implicit or explicit decision is minority based. The minority-based rules show a proportion of post-decision cooperative choice of .81 and .966 for 'C-supported wins' and 'C-wins' respectively, whereas '2/3 majority equiprobable otherwise' shows no change in the level of cooperative choice in comparison to the sample population at .43.
2. The exception was a significant demonstrability by instruction type interaction ($F(1,20) = 6.622$,

p = .018), in responses to the question, 'Were your choices and outcomes strategic or spontaneous?' Details of this interaction are available from the authors.

3. In these analyses, models are null hypotheses, and so to be conservative, $\alpha = .20$ is used for significance testing as suggested by, for example, Davis, Hulbert, Au, Chen, and Zarnoth (1997).

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