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# Simulating social dilemmas:

# Promoting cooperative behavior through imagined group discussion

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## Abstract

A robust finding in social dilemmas research is that individual group members are more likely to act cooperatively if they are given the chance to discuss the dilemma with one another. The authors investigated whether imagining a group discussion may represent an effective means of increasing cooperative behavior in the absence of the opportunity for direct negotiation amongst decision makers. Five experiments, utilizing a range of task variants, tested this hypothesis. Participants engaged in a guided simulation of the progressive steps required to reach a cooperative consensus within a group discussion of a social dilemma. Results support the conclusion that imagined group discussion enables conscious processes that parallel those underlying the direct group discussion and is a strategy that can effectively elicit cooperative behavior. The applied potential of imagined group discussion techniques to encourage more socially-responsible behavior is discussed.


**Keywords:** social dilemmas, cooperation, mental simulation, group discussion.

# Simulation Social Dilemmas:

# Promoting Cooperative Behavior Through Imagined Group Discussion

Many of the most challenging problems we face, from the interpersonal to the international, arise from a conflict between individual and social rationality. Widespread concerns from environmental degradation, to restoration of the budget deficit, to over-population, serve as compelling reminders of the urgent need to encourage individuals to sacrifice self-interest in favor of more socially-responsible behavior. One of the most robust and important findings from research exploring these issues is the positive impact of task-related discussion on group cooperation. Yet, face-to-face discussion is sometimes at best difficult, or at worst, impossible to establish. This is especially the case for some of the most decisive dilemmas we face, such as energy conservation or recycling, representing national-level concerns that rely in individuals' behavior change. In this research we investigate a potential solution to these problems of practical implementation; in particular, whether the benefits associated with group discussion can be achieved *indirectly* through strategies of mental simulation.

## Social Dilemmas

Situations where individuals must decide between behavior that benefits the self and behavior that benefits the collective are known as social dilemmas. The dilemma arises because individuals are always better off when they choose the personally-rewarding, non-cooperative choice. Yet if all individuals defect, everyone will end up worse off than if they all choose the collectively rational, cooperative choice (Dawes, 1980). Such social dilemmas are a ubiquitous aspect of everyday life and can be found at every level of social interaction. Individuals sometimes face an *interpersonal* social dilemma, for instance, when dining out with friends and agreeing to split the bill evenly. If individuals act out of self-interest, they

can enjoy an extravagant meal for a bargain price. However, if everyone reasons accordingly, the group will end up with an extremely large bill and everyone is worse off than if they had all ordered modestly. Other dilemmas, such as issues of environmental protection, concern the entire international community. For instance, it is individually rational for people to take their cars on short trips rather than walk or use public transport. Yet if the majority of society does what is individually convenient, everyone will ultimately suffer the collective cost of escalating carbon emissions.

A number of solutions to increase cooperative behavior within social dilemmas have been advanced (for review see Komorita & Parks, 1994). Some of the most established solutions include the conversion of public goods into privately owned resources (e.g. Messick & McClelland, 1983), appointing an agent who has authority over the provision of a common resource (e.g. Samuelson & Messick, 1995) supplementing incentives for cooperation (e.g. Wit & Wilke, 1990), and likewise, imposing sanctions for defection (e.g. Kerr et al. 2009). Among solutions most conductive to cooperation, however, is *group discussion*.

## The Group Discussion Effect

It is well-documented that individual group members are more likely to act cooperatively if they are given the chance to discuss the dilemma with one another (for a review see Meleady, Hopthrow & Crisp, *in press*). In the earliest investigation of the effectiveness of group discussion, Deutsch (1958) found that participants cooperated on 71% of trials of a prisoner's dilemma game when they could communicate with their partner, compared to only a 36% cooperation rate on trials where communication was prohibited. Since this seminal work ample research has gone on to confirm the strength and reliability of the group discussion effect across task variants (e.g. Braver & Wilson, 1986; Caldwell, 1976; Dawes, McTavish & Shaklee, 1977; Liebrand 1984; Ostrom & Walker, 1989; Rapoport, 1974). In fact, a meta-analysis reviewing 35 years of social dilemmas research concluded that

task-related communication was the strongest and most reliable predictor of cooperative behavior, increasing the proportion of cooperation, on average, by 40% (Sally, 1995).

The most widely accepted explanation of the group discussion effect suggests that group discussion facilitates cooperation by offering group members the opportunity to develop, and become committed to, a perceived group consensus to cooperate (Bouas & Komorita, 1996; Hopthrow & Abrams, 2010; Hopthrow & Hulbert, 2005; Kerr & Kaufman-Gilliland, 1994). While it was originally argued that this consensus must be unanimous amongst group members (Orbell, van de Kragt & Dawes, 1988), it now appears that a *perceived* consensus is sufficient to elicit cooperation (Bouas & Komorita, 1996; Braver & Wilson, 1986). This coordination of behavior is said to reduce the fear of exploitation and risk associated with the cooperative choice (Bouas & Komorita, 1996), as well activating a commitment norm prescribing that the individual should carry out those actions to which they have committed themselves, even when it is personally costly to do so (Kerr & Kaufman-Gilliland, 1994; Kerr, Garst, Lewandowski & Harris, 1997).

**Implementing Group Discussion: Some Practical Constraints**

Examples of how the pursuit of self-interest can lead to disastrous outcomes for the collective are easy to find. For instance, England is currently facing its worst droughts in more than 30 years. In attempt to reduce the strain on water reserves Thames Water recently launched a river awareness campaign. A representative for the company stated that the aim of the campaign is to communicate to users that "we're all in this together, we need everyone to value water and use a little bit less" (BBC News, 2011). This plea was an attempt to avert a contemporary 'tragedy of the commons' (Hardin, 1968); failing to conserve water *would* create a shortage. Identifying ways of promoting cooperative behavior in social dilemmas is therefore more than just a theoretical issue; it is critical that the group discussion effect,

representing the most reliable predictor of cooperation (Sally, 1995), is applied to increase socially-responsible behavior in real-world situations of interdependence (see Meleady et al., *in press*).

A practical problem arises, however, because although the group discussion effect is robust amongst laboratory groups, the applicability of this solution beyond the laboratory is uncertain. As we have seen, many *real-world* dilemmas are not faced by small, face-to-face groups, but by large and often faceless groups, extended in both space and time. Direct communication among all decision makers is therefore often not a feasible solution to the problem (Messick & Brewer, 1983). Indeed, even if group sizes are small enough to allow direct communication amongst all decision-makers, (i.e. dilemmas restricted to local communities) providing the space and time for such communication represents a public goods dilemma in itself (Bicchieri & Lev-On, 2007). To prevent the benefits of group discussion remaining unrealized we investigate the potential of *indirect* discussion - a new perspective on this paradigm that may help to promote more cooperative behavior through the use of *mental simulation*.

## Mental Simulation

Mental simulation can be defined as the "imitative representation of some event or series of events" (Taylor, Pham, Rivkin & Armor, 1998, p.430). The benefits of mental simulation for a wide range of psychological and behavioral phenomena have been documented within nearly every domain of psychology (for review, see Crisp, Birtel & Meleady, 2011). For instance, within health psychology, mental simulation has been employed to foster the achievement of health-related goals (Anderson, 1983; Greitemeyer & Würz, 2006). Consumer researchers have employed mental simulation techniques to improve attitudes and facilitate purchase intentions towards advertized products (Escalas & Luce, 2003; 2004). Clinicians have incorporated mental simulation into relapse prevention

techniques (Marlatt & Gordon, 1985). The beneficial use of mental simulation in sports settings to improve both performance and motivation is also supported by a large body of compelling research (Feltz & Landers, 1983). Recent research has even found the benefits of simulation strategies to extend to efforts to reduce prejudice (Crisp, Husnu, Meleady, Stathi & Turner, 2010, Crisp & Turner, 2012) and in the groups domain, Garcia, Weaver, Moskowitz and Darley (2002) found that participants who imagined going out for a meal with ten others were less likely to exhibit helping behavior, demonstrating diffusion of responsibility in an *imagined* group.

**Simulating Social Dilemmas**

The research noted in the preceding section suggests that mental simulation influences behavior by enhancing beliefs in likely outcomes (Brown, MacLeod, Tata & Goddard, 2002; Hirt, Kardes & Markman, 2004; Sanna, Schwarz & Stocker, 2002; Sherman, Cialdini, Schwartzman & Reynolds, 1985). It has been reliably demonstrated that imagining a hypothetical scenario increases individuals' judgements of the likelihood of the scenario depicted actually occurring (Anderson, 1983; Pham & Taylor, 1999; Sherman & Anderson, 1987; Sherman, Skov, Hervitz & Stock, 1981). Gregory, Cialdini and Carpenter (1982), for example, asked participants to imagine being arrested for a crime or winning a competition. In each case, participants came to believe more strongly that the event would happen to them after imagining the scenario. Similarly, Carroll (1978) assigned participants to imagine either Jimmy Carter or Gerald Ford winning the 1976 U.S. presidential election. Participants who imagined Jimmy Carter as the victor subsequently predicted he was more likely to win than participants who had imagined Gerald Ford's success, despite differences in prior beliefs regarding the frontrunner in the elections.

Such findings are interpreted in terms of the availability heuristic (Tversky & Kahneman, 1973). It is argued that once an individual imagines a hypothetical event, the

event becomes more cognitively available and consequently individuals come to believe more strongly that the event would befall them. Individuals fail to recognise that availability is based only on the fact that they were recently induced to access the information (Carroll, 1978). Accordingly, within the social dilemmas domain, we argue that mentally simulating the formation of a cooperative group consensus within a group discussion may serve to heighten participant's judgements of the likelihood of such a consensus within their group. In this way, imagined group discussion will serve to indirectly establish the key process underlying the established direct group discussion effect - *a perceived cooperative consensus*.

**Summary**

To summarise, while the group discussion effect is robust amongst laboratory groups, many real-world dilemmas are not faced by small, face-to-face groups, but by large, faceless groups extended in both space and time. This research aimed to provide a proxy for group discussion in the form of imagined group discussion. It was anticipated that mentally simulating a group discussion regarding a social dilemma would activate concepts normally associated with direct group discussion, thereby enabling its established benefits. In five experiments we tested this hypothesis.

## Study 1

The aim of Study 1 was to provide an initial test of the hypothesis that a simulation focusing an individual's imagination on the progressive steps required to reach a cooperative consensus within a group discussion with five nominal group members would increase subsequent cooperation relative to a no discussion control condition. Due to its indirect nature, this more pragmatic solution may, however, be expected to exert a weaker effect than direct, face-to-face discussion (Fazio, Powell & Herr, 1983). In Study 1, we tested this proposition.

A further aim of Study 1 was to provide a test of the proposed underlying mechanism. We propose that imagined group discussion indirectly achieves a perceived cooperative consensus by increasing the cognitive availability of this outcome. In line with the availability heuristic (Tversky & Kahneman, 1973) individuals are expected to interpret the cognitive availability of this outcome as a basis for the judgement that a cooperative consensus is likely within their group. Such expectations of a cooperative consensus represent the key factor underlying the direct group discussion effect, functioning to reduce the risk of the exploitation and activating a personal commitment to honor this consensus (Bouas & Komorita, 1996; Kerr & Kaufman-Gilliand, 1994). To assess the veracity of this availability explanation we measured participants' subjective likelihood ratings of a cooperative consensus within their group.

## Method

### Participants

Eighty-one, 20 male and 61 female undergraduate students, aged between 17 and 44 ($M$ = 19.91, $SD$ = 4.01) were recruited as part of an introductory psychology class.

### Design

A one factor (discussion type: control vs. imagined group discussion vs. face-to-face discussion) between subjects design was employed. The dependent variable was cooperative behavior, operationalized as the proportion of cooperation in a non-iterative prisoner's dilemma game. Table 1 shows the specific payoff matrix used, adapted from Hopthrow and Hulbert (2005). Participants were required to make a single binary choice between cooperation and non-cooperation. To avoid norm-laden terms, the cooperative choice was labelled J and the non-cooperative choice, P. The matrix indicates the payoff participants receive as a function of their choice and the distribution of preferences within their six-person

group. The first column denotes the participant's individual choice between J and P, and the subsequent columns demonstrate the possible outcomes dependant on the distribution of preferences within the group. Points are structured such that an individual is always better off by choosing J than P, however, if everyone chooses to defect, they will receive less points (20) than if everyone had chosen to cooperate (29).

**Procedure**

Participants initially reported to a large seminar room. After providing informed consent, they were briefed about the format of the experiment and randomly assigned to smaller groups of six to take part in a "group decision-making task". The sample actually consisted of 12 groups of 6, one group of 5, and one group of 4. Confederates joined these incomplete groups to ensure that the 6-person prisoners' dilemma game was applicable to all groups.

Participants were given a detailed set of instructions explaining the structure of the prisoner's dilemma game, emphasising that their points outcome would depend on their choice, as well as the choices of their other five group members. Several examples of possible outcomes were presented to aid understanding of the nature of dilemma. To increase the significance of payoffs, participants were told that after their group decisions were tabulated, the points they earned would be individually converted into stationary supplies on the completion of the experiment (the more points they earned, the more stationary they would receive).

To check and bolster participant's understanding, comprehension questions were administered. After successfully completing the comprehension questions, participants were randomly assigned to their six-person groups. Each group of six was taken to their own room where they sat together for the duration of the experiment.

**Discussion type.**

***Control condition***. Before indicating their choice preference, the groups of six were randomly allocated to conditions of the independent variable. In the no-discussion control condition, participants were given five minutes to write down all the reasons they could think of for selecting the cooperative choice. Specifically, participants were instructed:

> Thinking about the scenario you have just read, I would like you to take 5 minutes to write down below all the reasons you can think of for choosing J. This should be done without talking to the other members of your group.

***Imagined group discussion.*** In previous research demonstrating the impact of simulation on likelihood estimates, the events that participants are required to simulate are already familiar and easy to imagine (Carroll, 1978; Husnu & Crisp, 2010; Sherman & Anderson, 1987; Sherman et al., 1981), or when this is not the case, participants are led through the simulation by use of a structured scenario (Gregory et al., 1982; Pham & Taylor, 1999). In contrast, when individuals find it *difficult* to imagine a scenario, the subjective likelihood of the event *decreases* (Tversky & Kahneman, 1973). Without explicit awareness of how everyday societal problems fulfil the theoretical structure of a social dilemma, it is unlikely that individuals have an existing schema of the processes involved in group discussion, and therefore find it hard to imagine this scenario (e.g. Ladbury & Hinsz, 2009). Accordingly, a *structured* imagery script was designed to ensure that imagined group discussion was perceptually fluid and subjectively easy to envisage.

The guided simulation was designed to incorporate the main phases of group discussion regarding a social dilemma according to previous research. While none of the stages are said to independently be sufficient to enable a robust communication effect, each stage is said to form a necessary element of a sequence enabling an incrementally stronger

effect (Meleady et al., *in press*). These stages include establishing a common understanding of the general structure of the dilemma, debating alternative actions that appeal to competing individual and collective interests, agreeing on appropriate social behavior as a consensus for mutual cooperation is reached and making commitments to honor this consensus within individuals' private binding choices. Specifically, participants were instructed:

> Thinking about the scenario you have just read, I would like you to take five minutes to imagine a group discussion with your five other group members regarding the scenario. Please imagine and describe:
> How the group will establish a common understanding of the general principles of the game.
> Imagine the different viewpoints of the best solution to the problem that you and your group members would put across.
> Imagine you and your group members discussing the risks involved in the various ways to address the problem.
> Imagine you and your group members reaching a consensus that the best solution to the problem would be to all choose J.
> Imagine you and group members each assuring the rest of the group that they can be trusted to follow up on their commitment to choose J.

Participants were asked to write a few lines to describe what they had imagined after each instruction in order to reinforce each stage of the simulation.

***Face-to-face discussion.*** Participants in the face-to-face discussion condition were given five minutes to discuss the dilemma as a group with the aim of reaching a consensus to choose cooperatively. Participants were simply instructed:

> Thinking about the scenario you have just read, I would like you to take 5 minutes to discuss the dilemma with your 5 other group members. As a group you should aim to reach a consensus to all choose J.

**Individual choice.** Participants were then re-presented with the points matrix and asked to indicate their private and anonymous preference for the cooperative (J) or non-cooperative choice (P). Participants made their decision individually, without communicating to their other group members.

**Perceived cooperative consensus.** To assess participants' perception of the likelihood of a cooperative group consensus, participants were simply asked to rate, between 0 and 100, how likely they thought it was that everyone in the group will have chosen J (the more likely this outcome is, the larger the value).

To conclude the experiment, participants provided demographic information and completed Rubin and colleagues' perceived awareness of research hypothesis measure (PARH, Rubin, Paolini & Crisp, 2010). Participants were told that the amount of stationary supplies they received was actually not dependent on the number of points they had earned, but that they could take as many as they liked. Participants were then thanked and debriefed.

## Results and Discussion

No participants successfully determined the experimental hypotheses and thus all participants' data was included in the analysis.

### Cooperation

Percentage of cooperation as a function of discussion type is shown in Table 2. We analysed the effect of discussion type on cooperation rates with a multi-level regression model. The logit-link function was used to account for the dichotomous nature of the

outcome variable (cooperation vs. non-cooperation) at the individual level of the analysis, and the nesting of participants within 6-person groups was accounted for by modelling regression intercepts as random effects that vary between groups. Indicator coding was used to explore cooperation rates relating to the three discussion conditions. The control condition was coded as the reference group and was compared with imagined group discussion (D1) and direct discussion conditions (D2) separately.

First, we modelled the effect of the discussion condition on the group-level latent mean of the decision to cooperate. Results revealed a significant effect of face-to-face discussion on cooperation (D2), $B$=1.90, $p$<.001 (one-tailed). Cooperation rates were also significantly higher in the imagined group discussion condition relative to the control (D1), $B$=0.77, $p$=.03 (one-tailed). Odds ratios show that cooperation was 2.17 times more likely in the imagined group discussion condition relative to the control, and 6.67 times more likely in the face-to-face discussion condition.

**Perceived Cooperative Consensus**

Second, we tested a mediational model where the total effects of the discussion conditions on the latent group means of cooperation decision are broken down into the direct effects (modelled as in the simple regression model above) and the indirect effect – namely, the effect of the perception of a cooperative consensus on the decision to cooperate. Mean perceptions of a cooperative group consensus as a function of discussion condition are shown in Table 2. A 2-1-1 multilevel structural equation model (MSEM) was employed to test this hypothesis, within which discussion condition, is assessed at the group level, while the mediator, perceived cooperative consensus, and the outcome variable, cooperative behavior are sampled at the individual level (Krull & MacKinnon, 1991; 2001; MacKinnon, 2008; Pituch & Stapleton, 2008; Raudenbush & Sampson, 1999)[1]. Results for this multi-level

model (see Figure 1) demonstrated that both the imagined group discussion and face-to-face discussion condition significantly predicted higher group ratings of the subjective likelihood of a cooperative group consensus (relative to the control) which then exerted a significant within-subjects effect on cooperation (see Figure 1). The significant indirect effects of the subjective likelihood of a cooperative group consensus for both the imagined discussion condition (D1, when controlling for control vs. face-to-face group discussion, D2), and the face-to-face discussion condition (D2, when controlling for control vs. imagined group discussion, D1) is confirmed by the lack of the presence of a zero within both 95% confidence intervals (LLCI= 0.297 , ULCI=1.953, and LLCI=0.467, ULCI=3.71, respectively). When controlling for the effect of subjective likelihood ratings of a cooperative group consensus the direct effect of both imagined group discussion and face-to-face discussion lost significance.

Study 1 provides an initial demonstration of the effectiveness of *imagined* group discussion as a proxy for direct discussion manipulations. Previous research has established that the beneficial effects of mental simulation are contingent upon positive direction within the simulation instructions. Stathi and Crisp (2008), for instance, established that improvements in intergroup attitudes after imagined contact manipulations are dependent on individuals being directed to imagine a *positive* encounter with a member of a relevant outgroup. We incorporated this stipulation within our imagined group discussion manipulationsand, in order to ensure comparability between conditions, both the control and direct discussion manipulations also directed participants towards the cooperative choice. Consequently, the face-to-face discussion condition within the present investigation is not directly comparable to standard manipulations surrounding the group discussion effect, which typically include no such instruction. We may therefore reasonably expect this instruction to

have supplemented typical direct discussion effects. If this is the case however, we can be even more optimistic of the comparative potential of indirect, discussion-based techniques.

Study 1 found the effects of direct discussion and imagined group discussion on cooperative behavior to be driven by individuals' expectations of a cooperative consensus within their group. While individuals in both the imagined group discussion and face-to-face discussion conditions did not anticipate *unanimous* cooperation amongst their group members, results suggest, in line with previous research, that a generalized cooperative perception was sufficient to elicit cooperation (Bouas & Komorita, 1996). We suggest that in the absence of discussion, face-to-face or imagined, the dilemma is well defined, but appropriate social behavior is not. Imagined group discussion serves to clarify the nature of the social problem by rendering a cooperative group consensus an accessible source of diagnostic information. In this way, imagined group discussion serves to establish the cognitive groundwork for a cooperative choice.

## Study 2

In Study 2 we aimed to conceptually replicate the effectiveness of imagined group discussion within a public goods dilemma, allowing us to have more confidence that effects will persist under different framing conditions.

We also introduced the individual difference variable, social value orientation (SVO) into our investigation within Study 2. Individuals can be classified within one of four broad orientations, providing a reliable indication of their preferences for the distribution of resources between the self and others, independent from any aspect of the situation (for review see Balliet, Parks & Joireman, 2009). *Cooperators* prefer to maximise joint welfare, *altruists* strive to maximise the others outcomes, *individualists* aim to maximise their individual outcome, and *competitors* strive to maximise the difference between their own and

others outcomes (McClintock, 1978). Study 2 aimed to ascertain that imagined group discussion represents an effective means of encouraging cooperation regardless of an individual's prior motives.

Research has shown that while prosocial individuals have diverse expectations of others, proself individuals robustly expect others to exhibit competitive behavior. This finding is known as the "Triangle hypothesis" (Iedema & Poppe, 1994; 1995; Kelley & Stahelski, 1970; Van Lange, 1992). According to this reasoning, simulating a cooperative group consensus within imagined group discussion manipulations will necessitate individuals of a proself orientation to inhibit their natural instincts in order to simulate a contrasting perspective. This self-regulatory ability requires executive attention, a limited cognitive resource (Engle, 2001). Engagement in one task that requires executive resources impairs performance on subsequent tasks tapping the same resource (Baumeister, Muraven & Tice, 2000). Accordingly, Study 2 measured Stroop interference in order to tap the expected temporary depletion of executive resources within proself individuals in the experimental condition as a result of the self-regulation required by imagined group discussion.

We expect proself individuals to be able to acknowledge and generate arguments in favor of the cooperative choice, without having to personally endorse them, with relatively the same ease as prosocial individuals. Accordingly, we did not anticipate greater depletion within proselfs after completing the control manipulation. Rather, in line with previous research, we expect it is the simulation of *other's* universally cooperative behavior entailed by imagined group discussion manipulations to be cognitively depleting for individuals of a proself orientation.

# Method

## Participants

Fifty-five female undergraduate participants, aged between 18 and 28 ($M$ = 20.85, $SD$ = 2.49) were recruited. Participants received £3 reimbursement for their participation.

## Design

A 2 (discussion type: control vs. imagined) X 2 (SVO: prosocial vs. proself) between subjects design was employed. Two dependent variables were measured, cooperation and cognitive depletion. Cognitive depletion was operationalized as Stroop interference in a standard colour Stroop task. Cooperation was operationalized as the number of pence contributed to the central fund within a step-level, six-person public goods dilemma with continuous contribution (De Cremer & Van Vugt, 1999; Experiment 2). Specifically, participants were asked to imagine that they had each been given an endowment of 300 pence. Participants were told that they were free to contribute any proportion of this endowment to a central fund. It was explained that if 1200p or more was invested in the central fund by the group as a whole, a bonus of 500p per group member will be obtained, which would be distributed to all group members regardless of whether they had invested in the central fund. Participants were informed that they would also keep any of their remaining endowment that they did not invested in the central fund, but if the provision point were not reached, any money invested in the central would be lost.

## Procedure

Each participant was tested individually in laboratory conditions. After providing informed consent the experiment was introduced as a study of individuals' perceptions of social issues.

**SVO**. To commence the study participants completed Murphy, Ackermann, and Handgraff's (2011) slider measure of SVO within which they are asked to make a series of decisions regarding the allocation of monetary amounts between themselves and a mutually anonymous other. The measure comprised of 6 joint payoff continuums for which participants marked a cross at the point that represented their preferred allocation point.

**Public goods dilemma**. Participants were then told they were going to take part in an "investment game" for which they had been randomly allocated to a "virtual group" of six people. They were provided with information about the rules of the public goods dilemma and examples of possible outcomes for themselves and the group. Participants were assured that their investment decision would be completely private; other members of their group would not know how much they personally choose to invest. To increase the significance of outcomes it was explained that at the end of the experiment one group of six people would be selected at random to receive actual payment of the money earned in this task.

Before indicating their investment decision, participants were randomly assigned to complete either the control or experimental manipulation. Participants in the control condition were given five minutes to write down all the reasons they could think of for investing their 300p in the central fund. The imagined group discussion task as used in Study 1 was adapted for use in a public goods dilemma (e.g. "imagine you and your group members reaching a consensus that the best solution to the problem would be to all choose J" was adapted to "imagine you and your group members reaching a consensus that the best solution to the problem would be to all donate their 300p to the central fund"). Again, participants were asked to write a few lines to describe what they had imagined after each instruction in order to reinforce the imagery instructions.

## Dependent Measures

**Investment decision**. Participants were asked how much of their endowment they would like to invest in the central fund. In order to remind participants that their decision was continuous (i.e. they could investment *any* amount of their endowment to the central fund), participants were asked to indicate how much they would like to invest by marking a cross along a scale between 0 and 300 pence and confirming the amount in writing.

**Stroop test**. After indicating their investment decision, participants completed the Stroop test. Following a fixation cross, participants were presented with stimulus colour words ("red", "green", "blue" & "yellow") one at a time on the screen. Participants were instructed to identify the colour in which the word was printed as quickly and accurately as they could. Responses were recorded by pressing the appropriate, colour-coded key on a standard keyboard. Participants completed a total of 40 trials, consisting of *congruent* trials, in which the font colour corresponded to the colour name (e.g. the word "red" appearing in red font), and *incongruent* trials in which the colour word appeared in a font colour other than its semantic meaning (e.g. the word "red" appearing in blue font). The order in which stimuli and trial types were presented was randomised across participants. Each stimuli was presented for a maximum of 2500ms. The inter-trial interval was 1500ms.

To conclude the experiment participants completed the suspicion probe (Rubin et al., 2010), provided demographic information, and were thanked and debriefed. Six participants were selected at random to form a nominal group for payment purposes.

## Results and Discussion

The data of 6 participants were removed after indicating that they had previously taken part in an experiment of a similar nature[2].

**Calculation of SVO Scores**

Participants' responses to the six slider measure items were computed in accordance with instructions from Murphy et al. (2011) to yield a single SVO score. The calculation yields an interpretable angle vector where payoffs to the self as represented on the *x* axis and payoffs to another on the *y* axis (Griestnger & Livingston, 1973). Individuals with an angle greater than 57.15 can be classified as altruistic. Those recording an angle between 57.15 and 22.45 are classified as prosocial. Individuals scoring between 22.45 and -12.04, are categorised as individualistic, while those scoring an angle less than -12.04 are classified as competitors. No altruistic participants and only one competitive participant were detected within the present sample. We therefore adopted the commonly used practice of collapsing altruistic and cooperative individuals into a category of *prosocial* and individualistic and competitors into *proself* (Van Lange & Liebrand, 1991), a categorization which functioned as the two-level independent variable of SVO for subsequent analyses. A total of 32 prosocial and 17 proself individuals were observed within our sample.

**Cooperation**

Means and standard deviations for investment decisions as a function of discussion type and SVO are displayed in Table 3. Levene's (1960) test indicated a level of heterogeneity of variance between conditions at $p$=.06. To be conservative we therefore employed the Welch-Satterthwaite adjustment (Satterthwaite, 1946; Welch, 1938) on our between subjects ANOVA which employs adjusted degrees of freedom and weighted variances to reduce the chance of a Type 1 error[3]. The analysis revealed a marginally significant main effect of discussion type whereby individuals in the imagined group discussion condition donated a greater amount of their endowment to the central fund ($M$ =239.29 $SD$= 80.60) than individuals assigned to the control condition ($M$=178.57 $SD$ = 102.14), $F(1, 11.3) = 3.80$, $p$=.07, $\eta_p^2$ = .12. The main effect of SVO was also approaching

significance, whereby prosocial individuals donated more of their endowment ($M$ = 230.00 $SD$ = 73.79) than proself individuals ($M$ =181.76 $SD$ = 120.84), $F(1, 11.3) = 2.66$, $p = .13$, $\eta_p^2 = .09$. No significant interaction between SVO and discussion type was observed ($F(1, 11.3) = <. 001$, $p$=.95).

**Stroop Interference**

Data for the analysis of Stroop interference was prepared by removing trials with incorrect responses and winsorizing statistical outliers greater than 2.5 standard deviations above the mean (1752 ms). Mean reaction times for congruent and incongruent trials were calculated for each participant from these trimmed reaction times. A Stroop interference score was then was calculated by subtracting mean reaction time for congruent trials from mean reaction times for the incongruent trials; greater values reflecting greater Stroop interference, and *worse* task performance. Mean Stroop interference scores as a function of discussion type and SVO are shown in Table 3[4].

A between subjects ANOVA on Stroop interference scores revealed a significant interaction between discussion type and SVO, $F(1, 41) = 7.12$, $p$=.011, $\eta_p^2 = .15$. No significant main effects of discussion type or SVO were observed ($F(1,41) = 0.58$, $p$=.45 & $F(1, 41) = 1.11$, $p$=.30 respectively). Planned comparisons revealed that while there was no significant difference in Stroop interference between the control and imagined discussion condition amongst prosocial individuals ($F(1,41) = 2.67$, $p$=.11), the predicted simple main effect of discussion condition was apparent within proself individuals, with those who completed the imagined group discussion recorded significantly greater cognitive depletion than those in the control condition, $F(1,41) = 4.46$, $p$=.04. Tests of the simple effects of SVO, revealed no significant difference in Stroop interference between prosocial and proself individuals in the control condition ($F(1, 41) = 1.13$, $p$=.29). There was however a significant

difference in the experimental condition, whereby prosocial individuals subsequently recorded lower Stroop interference than proselfs after engaging in the imagined group discussion manipulation, $F(1,41) = 8.18$, $p=.007$[5.]

Study 2 provides a conceptual replication of the effectiveness of imagined group discussion for eliciting cooperative behavior under public goods dilemma framing. While SVO did not moderate the effect of imagined group discussion on investment decisions, the cognitive depletion data demonstrate a differential experience of imagined group discussion for prosocial and proself inclined individuals. Results revealed, as hypothesized, that proself individuals randomly assigned to complete the imagined group discussion manipulation displayed greater subsequent cognitive depletion than those in the control condition. Additionally, a simple effect of SVO was apparent only within the experimental condition. These finding supports the conclusion that while proself individuals are able to generate arguments in favor of the cooperative choice, without having to personally endorse them, with relatively the same ease as prosocial individuals, it is the process of inhibiting their natural instincts in order to simulate universal commitment to a cooperative consensus, that is cognitive depleting for proself individuals. Combined with the behavioral data, Study 2 results suggest that while imagined group discussion is harder for individuals of a proself orientation, the simulation represents an effective means of encouraging cooperative behavior *across* the SVO continuum.

## Study 3

In Study 3 we aimed to extend replication to a public good dilemma with a different payoff function. Two types of public goods dilemma can be distinguished: step-level and continuous public goods (Abele, Stasser & Chartier, 2010; Komorita & Parks, 1994). Study 2 utilised a step-level public good (also known as a threshold public good) within which a group bonus is paid in an all-or-nothing fashion if a predefined minimum level of

contribution is reached. Continuous public goods, on the other hand, are provided in proportion to the contribution level, with no minimum contribution required.

Adele, Stasser and Chartier (2010) note that the presence of a provision point in step-level public good dilemmas provides participants with a focal point upon which they can coordinate contribution decisions so as to ensure the attainment of the provision point. (e.g. adopting equity principles; Stouten, De Cremer & Van Dijk, 2005). Within Study 2, we asked participants to stimulate a consensus to each invest 300p in the central fund. Although 300p represents the most cooperative choice within a step-level dilemma, allowing for the compensation of the possible defection from other group members, it can become an inefficient option as the provision point can be achieved with an equal 200p investment from each member. That is, if individuals believe all group members will cooperate, it becomes irrational to donate anymore than the equitable amount to the central fund, as donations exceeding the provision point are superfluous. It could therefore be argued that the high investments within the imagined group discussion condition in Study 2 actually reflect distrust, rather than a perceived *cooperative* consensus. In order to rule out this alternative interpretation, Study 3 was conducted to replicate the effectiveness of imagined group discussion within a continuous public good dilemma. Within these task parameters, an investment of 300p always represents an efficient cooperative act. We can therefore have more confidence that imagined group discussion effects are founded upon expectations of others' cooperation rather than defection.

## Method

### Participants

Fifty-five participants, 6 male and 49 female, aged between 16 and 32 ($M$ =18.49, $SD$ =3.71) were recruited from the University of Kent and a nearby sixth form college.

**Design**

A 2 (discussion type: control vs. imagined) X 2 (SVO: prosocial vs. proself) between subjects design was employed, as in Study 2. The dependent variable, cooperation, was operationalised as the number of pence contributed to the central fund within a *non-threshold*, six-person public goods dilemma with continuous contribution. Specifically, participants were asked to imagine that they had each been given an endowment of 300 pence. Participants were told that they were free to contribute any proportion of this endowment to a central fund. It was explained that any money in the central fund would be doubled and redistributed to all group members regardless of whether they invested in the central fund. Participants were informed that at the end of the task they would be left with any money remaining in their personal fund, and any money distributed from the central fund. To increase the significance of outcomes, as in Study 2, it was explained that one group of six people will be selected at random to receive actual payment of the money earned in this task.

**Procedure and Dependent Measures**

The procedure and experimental and control manipulations utilised in Study 3 were identical to that of Study 2, except for the exemption of the Stroop test in Study 3.

## Results and Discussion

All participants' data was included in the analysis as no participants reported an awareness of the experimental hypotheses.

Mean investments as a function of discussion type and SVO are shown in Table 4. A between subjects ANOVA revealed a significant main effect of discussion type, $F(1, 51) = 10.30$, $p=.002$, $\eta_p^2 = .17$, whereby individuals in the imagined group discussion condition donated a significantly greater amount of their endowment ($M = 235.86$, $SD = 78.72$) than individuals assigned to the control condition ($M = 170.38$, $SD = 88.97$). A significant main

effect of SVO was also detected, $F(1, 51) = 3.85$, $p = .05$, $\eta_p^2 = .07$, whereby prosocial individuals donated significantly more of their endowment ($M = 215.50$, $SD = 78.90$) than proself individuals ($M = 176.67$, $SD = 110.50$). The interaction between SVO and discussion type was non-significant ($F(1, 51) = 0.97$, $p = .33$).

The results of Study 3 directly replicate those of Study 2 whereby imagined group discussion successfully increased cooperative behavior regardless of individuals' prior motives. The fact that the effect of imagined group discussion persisted within a *non-threshold* dilemma allows us to have more confidence that the imagined group discussion effect is driven by a perceived cooperative group consensus, rather than compensatory behavior to account for others expected defection. The finding that both the effects of discussion condition and SVO became fully significant in Study 3 is consistent with Abele and Stasser's (2005) reasoning that the presence of a provision point provides an 'easy' or obvious solution and thus reduces the opportunity to observe the effects of other factors on behavior. Importantly, such findings demonstrate the importance of not blurring the distinction between step-level and continuous contribution public good dilemmas, but to employ a more differentiated examination of outcomes under both task demands (Abele et al., 2010).

## Study 4

Thus far in this investigation we have demonstrated the reliability of the imagined group discussion effect and provided support for role of a perceived cooperative consensus underlying effects. We next turned our attention to consider factors affecting the applicability of the technique beyond the laboratory.

In previously reported experiments participants in the experimental conditions received no explicit instructions regarding the task in which their fellow group members are

engaged. We cannot, therefore isolate the contribution of the presumed role of others to imagined group discussion effects. Crucially, if the knowledge that others are mentally simulating mutual cooperation contributes, or entirely accounts for imagined group discussion effects, in order to be successful, applications derived from the effect must not only persuade individuals to engage with the intervention themselves, but also convince targets that other members of their community are doing the same. Accordingly, the aim of Study 4 was to confirm that the imagined group discussion effect will persist even when individuals are told they are the only group member completing the simulation.

## Method

### Participants and Design

Fifty-one participants, 8 male and 43 females (1 individual did not indicate their gender) were allocated to a one factor between-subjects design with three levels (discussion type: control vs. standard experimental vs. individual experimental). Participants were aged between 18 and 49 ($M$ = 20.69, $SD$ = 5.57). Participants received partial course credit in exchange for their participation.

### Procedure

Cooperation was measured in the same non-threshold, six-person public goods dilemma used in Study 3. In an identical fashion to the previously presented experiments participants were informed that they would shortly be taking part in an "investment game" for which they had been randomly assigned to a "virtual group" composed of other participants recruited for the experiment. Participants assigned to the standard experimental condition engaged in the imagined group discussion manipulation without any further instruction. Embedded in the imagery instructions for those in the individual experimental condition was

the information that "you are the only person in your group who has been selected to complete this task".

Cooperative behavior was measured in an identical fashion to Study 2 and 3. After indicating their investment decision, participants in the individual experimental condition were asked to indicate how many of their other five group members completed the same task as them prior to making their investment decisions by way of a manipulation check.

## Results and Discussion

Three participant's data was excluded for failure of the manipulation check. No participants successfully determined the experimental hypotheses within the PARH (Rubin et al., 2010).

### Cooperation

Mean investments as a function of discussion condition are shown in Table 5. A univariate ANOVA conducted on invested decisions revealed omnibus effect of discussion condition, $F(2, 46) = 3.56$, $p=.037$, $\eta_p^2 = .13$. Planned pairwise comparisons revealed that cooperation was significantly higher than that of the control in both the standard experimental, $t(46) = 2.35$, $p=.023$, and individual experimental condition, $t(46)$, 2.24, $p=.030$. These latter two conditions did not differ ($t(46) = 0.03$, $p=.95$).

The present results demonstrate that increased cooperation following imagined group discussion is not driven solely by the knowledge that other group members are engaging in simulated mutual cooperation, but persist when the involvement of other group members is removed. In terms of application implications, results provide support for the pure efficacy of imagined group discussion techniques. Even when individuals are explicitly informed that they are the sole group member participating in imagined group discussion, this knowledge does not impede prosocial behavior.

## Study 5

As we have discussed, many real-world social dilemmas are not faced by small, face-to-face groups, but by large and often faceless groups, extended in both space and time. The aim of Study 5, therefore, was to test the efficacy of imagined group discussion for the resolution of social dilemmas within large-scale groups.

Previous research has demonstrated a robust negative relationship between the size of the group facing the dilemma and the proportion of cooperation (for review see Sally, 1995). Several explanations of this effect have been proposed, including diffusion of responsibility (Komorita, Parks & Hulbert, 1992) and reduced efficacy of the cooperative choice for ensuring collective welfare (Kerr, 1989). Whilst representing the strongest candidate intervention to negate the potentially disastrous consequences of this effect, the group discussion effect is inherently restricted in applicability to small, face-to-face groups. Accordingly, in Study 5 we investigated the potential of *simulated* group discussion to achieve what is unfeasible in reality and protect against the decline in cooperation in larger groups.

Within the current investigation we have reported evidence supporting the conclusion that imagined group discussion facilitates cooperation by increasing participant's subjective likelihood ratings of a cooperative consensus amongst their group, the same factor underlying the direct group discussion effect (Bouas & Komorita, 1996; Kerr & Kaufman-Gilliland, 1994). According to the linear expectations hypothesis, cooperative commitments are more likely to be made, and kept, as individuals expect more others to do likewise (Orbell et al., 1988). Extending this logic, we hypothesize that not only will imagined group discussion serve to negate the negative relationship between group size and cooperation, but the effect of

imagined group discussion will actually *increase* in strength as the number of individuals contributing to the simulated cooperative group consensus increases.

## Method

### Participants

Seventy undergraduates at the University of Kent, 52 female and 18 male, aged between 17 and 26 ($M$ = 18.76, $SD$ = 2.78) received partial course credit in exchange for their participation.

### Design and Procedure

A one factor (group size: 6-person vs. 12-person vs. 24-person) between subjects design was employed. Participants were presented with the standard instructions concerning the "investment game" they would shortly be playing. On a random basis participants were told that their virtual group for this investment game contained either 5, 11 or 23 others. By way of a manipulation check, an additional comprehension question was added to this study asking participants to state how many members their virtual group for the investment game contained. The imagined group discussion manipulation and measurement of cooperative behavior were identical to that of Study 3. Before indicating their investment decisions, participants' sense of commitment to honor the simulated group consensus was measured with a single item "I feel committed to invest in the central fund" (1, *totally disagree* to 7, *totally agree*).

## Results and Discussion

The data from ten participants was removed from the analysis due to failure of the manipulation check. No participants successfully determined the experimental hypotheses within the PARH (Rubin et al., 2010).

**Cooperation**

Levene's (1960) indicated the presence of heterogeneity of variance in investment decisions between conditions (see Table 6 for means and standard deviations by condition). Accordingly the Welch-Satterthwaite adjustment (Satterthwaite, 1946; Welch, 1938) was employed on our between subjects ANOVA. This analysis indicated the presence of a significant main effect of group size on cooperation, $F$ (2, 36.96) = 3.94, $p$=.03, $\eta_p^2$ = .11. We decomposed this effect with polynomial contrasts accounting for the unequal spacing of our quantitative factor, which revealed a significant linear trend, $F$(1, 36.96) = 6.52, $p$=.01. We also tested for a quadratic trend between group size conditions, which was not apparent ($F$(1, 36.96) = 0.51, $p$=.48).

**Cooperative Commitments**

Levene's (1960) test again indicated the presence of heterogeneity of variance in cooperative commitments between conditions (see Table 6 for means and standard deviations by condition). A further ANOVA employing the Welch-Satterthwaite adjustment (Satterthwaite, 1946; Welch, 1938) revealed a significant effect of group size on cooperative commitments, $F$(2, 36.90) = 3.72, $p$=.03, $\eta_p^2$ = .09. In line with cooperation results, polynomial contrasts revealed a significant linear trend in cooperative commitments between group size conditions, $F$(2, 36.90) = 5.10, $p$=.03, and a non-significant quadratic trend, $F$(2, 57) = 0.58, $p$=.45.

Preacher and Hayes' (2008) bootstrapped procedure was employed to test the indirect effect of cooperative commitments on cooperation rates. The polynomial contrast coefficients testing for the linear trend were used to explore the mediation effects relating to the three group size conditions Results for the simple meditational model (see Figure 2) demonstrated a significant indirect effect of cooperative commitments on the linear effect of group size on cooperation, as indicated by the lack of the presence of a zero within the 95%

bias corrected and accelerated (Efron, 1987) bootstrapped confidence intervals (*LLCI* = 3.30, *ULCI* = 45.66). When controlling for the effect of cooperative commitments, the direct effect of group size on cooperation lost significance, indicating the presence of full mediation.

In line with the linear expectations hypothesis (Orbell et al., 1988) the results of Study 5 support the conclusion that as the number of individuals contributing to a simulated cooperative consensus increases, it becomes easier for individuals to personally commit to cooperate, resulting in greater subsequent cooperative behavior. While the applicability of face-to-face group discussion manipulations beyond the laboratory is uncertain, the present results support the conclusion that far from being a mere proxy for real experience, mental simulation represents a critical cognition exerting a powerful influence on behavior, diverging, and in this case, exceeding the potential afforded by reality.

## General Discussion

While group discussion represents an effective means of increasing cooperation in small, localised groups, its benefits remain unrealised outside of the laboratory (Meleady et al., *in press*). In line with findings that mentally simulating social situations can elicit the same responses as the real experience itself (Garcia et al., 2002; Stathi & Crisp, 2008; Turner, Crisp & Lambert, 2007), the present research investigated whether the benefits associated with group discussion can be achieved indirectly through *imagined* group discussion. Five experiments support the conclusion that when individuals imagine a group discussion with nominal group members they engage in conscious processes that parallel the crucial processes underlying face-to-face discussion, thereby eliciting cooperative behavior.

Study 1 provided an initial demonstration of the effectiveness of imagined group discussion as a proxy for direct discussion manipulations. The effects of face-to-face discussion and imagined group discussion were driven by a perceived cooperative group

consensus. Study 2 provided a conceptual replication of the effectiveness of imagined group discussion within a public goods dilemma and demonstrated that imagined group discussion successfully increased cooperation regardless of individuals' prior motives. Whilst effective, the self-regulation required by imagined group discussion within proself individuals lead to subsequent cognitive depletion. Study 3 replicated results within a non-threshold public good dilemma, providing more confidence that the imagined group discussion effects are founded upon a perceived cooperative consensus. Support for the pure efficacy of imagined group discussion techniques was provided by Study 4, as the removal of the presumed role of others was not found to impede prosocial behavior following imagined group discussion manipulations. Finally, in Study 5, we demonstrated how imagined group discussion can exceed the potential afforded by reality and reverse the typical negative relationship between group size and cooperative behavior.

Although imagined group discussion was found to exert a weaker effect on cooperative behavior than direct, face-to-face discussion, we suggest that imagined group discussion may represent an effective means of increasing individuals' inclination to seek out opportunities for face-to-face negotiation. Previous research has demonstrated that after imagining a hypothetical future behavior, not only do participants rating of the likelihood of the event increase, they also express greater *intentions* to engage in the activity (Carroll, 1978; Crisp et al., 2010; Husnu & Crisp, 2010; Pham & Taylor, 1999; Ross, Lepper, Strack & Steinmetz, 1977; Sherman, Zehner, Johnson & Hirt, 1983). Accordingly, we predict a secondary effect of imagined group discussion whereby imagery interventions serve to increase individuals' inclination to seek out opportunities for more powerful, face-to-face negotiation when opportunities are available, for instance by attending community meetings or focus groups. Advancing imagined group discussion interventions therefore represents an important agenda for future research.

A number of findings strengthen our ability to reject demand characteristics as an alternative explanation for imagined group discussion effects. Firstly, we have shown that the effect of imagined group discussion on cooperation reliably exceeds that of a control condition highly directive towards the cooperative choice, supporting that there is more at work within imagined group discussion manipulations than participants desire to appease the experimenter (Orne, 1962). Secondly, across all studies, not one participant successfully identified the experimental rationale, as assessed with Rubin and colleagues' (2010) PARH measure. It is not plausible that participants purposely acted in accordance with expectations of the experimenter if they are unable to identify these expectations. Moreover, Study 2 detected an effect of imagined group discussion on Stroop interference within proself individuals. We argue that the fact that individuals in the experimental and control conditions are found to react in different, predictable ways on this more implicit measure due to their personality eliminates the possibility that the basic task is transparent and responses are a result of mere compliance.

Furthermore, the beneficial effects of mental simulation within previous research are generally dependent on positive direction inherent in the simulation instructions. Within research reporting behavioral outcomes, whether achievement of health-related goals (Greitemeyer & Wurz, 2006), sports performance (e.g. Shaw & Goodfellow, 1997; Woolfolk, Parrish & Murphy, 1985) academic achievement (Pham & Taylor, 1999) or interview performance (Knudstrup, Segrest & Hurley, 2003), simulation scripts are not open-ended but explicitly direct individuals to imagine successfully achieving their goals. This positive direction inherent in the simulation scripts in previous research is not discounted as demand.

Our results support the conclusion that imagined group discussion clarifies the nature of the social problem by rendering acooperative group consensus an accessible source of diagnostic information, allowing individuals to form expectations about the behavior of their

group members and to establish beliefs that others expect them to honor this consensus (Bouas & Komorita, 1996; Kerr & Kaufman-Gilliland, 1994). In this way, we suggest that individuals' cooperative behavior after imagined group discussion is reflective of normative concerns of appropriate social behavior within their group, rather than the experimenters' appropriately defined behavior. As Kerr (1995) notes, the demonstration of the power of norms within social dilemmas research should not be confused or dismissed as an uninteresting response to demand characteristics. Rather, we believe our novel results to be both theoretically, and practically important.

**Theoretical Implications**

As we have seen, it is generally accepted that the critical process underlying the success of group discussion for eliciting cooperative behavior is the formation of a perceived cooperative consensus amongst group members (Bouas & Komorita, 1996; Hopthrow & Hulbert, 2005; Kerr & Kaufman-Gilliland, 1994; Orbell et al., 1988). The present research demonstrates that if a perceived consensus can be achieved *indirectly*, the same benefits can be enabled. The present findings suggest that mental simulation represents one, deceptively simple, means of achieving this aim.

The current findings also present implications for the broader mental simulation literature. Although mental imagery is an important phenomenon in a range of psychological domains, it has enjoyed very little *systematic* attention in the social psychological literature. Although the use of imagery techniques as a proxy for real behavior or experiences is commonplace within experimental social psychology (e.g. Cameron & Rutland, 2006; Shelton & Richeson, 2005), imagery is typically not employed as a *causal* factor expected to independently exert an impact on behaviors of interest. By replicating findings that mentally simulating social situations can elicit the same behavior responses as the real experience itself (Blair, Ma & Lenton, 2001; Garcia et al., 2002; Stathi & Crisp, 2008; Turner et al., 2007), the

present results support an emerging body of research demonstrating that mental simulating social situations represents a crucially important technique in its *own right* exerting a powerful affect on social cognition, affect and behavior.

**Practical Implications**

The present research has successfully developed an entirely new means to increase cooperative behavior, which, unlike direct group discussion, is utilisable within society's most imperative, social dilemmas, including issues of environmental degradation and enabling the balanced and equitable distribution of limited natural resources. With households and private transport accounting for 42% of carbon emissions, 50% of public water supply and 15% of controlled waste (Department for Environmental, Food and Rural Affairs [DEFRA], 2008) there is much interest amongst policymakers to find means to produce shifts towards "greener" lifestyles. In fact, harnessing insights from behavioral economics and social psychology to promote more responsible consumption was amongst the primary objectives outlined in the new UK government's coalition agreement (HM Government, 2010). with further research to refine the optimising conditions we suggest that imagined group discussion represents an intervention firmly grounded in a multidisciplinary research basis that can be readily applied to promote individual restraint within real world situations of interdependence.

## Conclusions

This research provides evidence that mentally stimulating a group discussion regarding a social dilemma successfully increases cooperative behavior. Across five experiments, results support the conclusion that when individuals imagine discussing a social dilemma with 'virtual' group members they engage in cognitive processes consonant with those underlying face-to-face group discussion, resulting in higher levels of cooperative behavior. Future research is needed to further refine the conditions under which imagined

group discussion is maximally effective. However, these initial findings leave us optimistic of the potential for imagined group discussion to be *applied* as a versatile and inexpensive strategy to encourage individuals to sacrifice self-interest in favour of more socially responsible behaviour.

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# Footnotes

[1] Employing a MSEM approach for testing multilevel mediation ensures the full separation of the between and within-group effects; so as to avoid the potential confounded estimates of mediation effects (Preacher, Zypher & Zhang, 2010; Zhang, Zyphur & Preacher, 2009).

[2] Six participants were excluded from the analyses in Study 2 for indicating having taken part one of our previous imagined group discussion experiments. Including these individuals in the analysis, we obtain the same pattern of results on cooperative behavior whereby the effect of both discussion, $F(1, 16.1) = 2.19$, $p=.16$, and SVO are observed, $F(1, 16.1) = 1.85$, $p=.19$ are approaching significance, but the interaction between the two factors is non-significant ($F(1, 16.1) = 0.04$, $p=.83$). Within the Stroop data, the simple effect of discussion within proself individuals becomes marginally significant, $F(1, 47) = 2.83$, $p=.09$, while the simple effect of discussion within prosocial individuals remains non-significant, $F(1, 47) = 2.74$, $p=.11$. The simple effect of SVO remains significant within the experimental condition, $F(1, 47) = 4.89$, $p=.03$, and non-significant within the control condition, $F(1, 47) = 1.43$, $p=.24$.

[3] If we employ a less conservative judgement of heterogeneity of variance at $p<.05$, effects within the between subjects ANOVA are fully significant. A significant main effect of discussion type is detected whereby individuals in the imagined group discussion condition donated a significantly greater amount of their endowment to the central fund ($M$ =239.29 $SD$= 80.60) than individuals assigned to the control condition ($M$=178.57 $SD$ = 102.14), $F(1, 45) = 6.12$, $p=.02$, $\eta_p^2 = .12$. A significant main effect of SVO was also found whereby prosocial individuals donated significantly more of their endowment ($M$ = 230.00 $SD$ = 73.79) than proself individuals ($M$ =181.76 $SD$ = 120.84), $F(1, 45) = 4.28$, $p = .04$, $\eta_p^2 = .09$. No significant interaction between SVO and discussion type was observed ($F(1, 45) = 0.007$, $p=.94$).

[4] The *N* for the Stroop data is slightly lower than that of the investment decisions within Study 2 due to technical problems with the Stroop test for some participants.

[5] Participants in both Study 2 and Study 3 completed a secondary, self-report measure of cognitive depletion after the discussion manipulation. Participants responded to a single item, "How difficult did you find the task you completed before you indicated your investment decision" (1, *not at all* to 7, *very much*). Within Study 2, a univariate ANOVA revealed a significant main effect of discussion whereby the imagined discussion condition (*M* = 4.37 *SD* = 0.36) was rated as significantly more difficult than the control condition, (*M* = 2.72. *SD* = 0.44, $F(1, 44) = 8.43$, $p=.006$, $\eta_p^2 = .16$. No significant main effect of SVO or interaction between SVO and discussion condition was observed ($F(1,44) = 0.43$, $p=.52$ & $F(1,44) = 1.65$, $p=.21$ respectively). Within Study 3, the main effect of discussion type was approaching significance with the imagined discussion condition beingrated as harder than the control, $F(1, 50) = 1.75$, $p=.19$, as was the main effect of SVO, with proself individuals rating the manipulations as harder than prosocials, $F(1, 50) = 2.00$, $p=.16$. The interaction between the two factors remained non-significant, $F(1, 50) = 0.09$, $p=.77$.

Table 1

*The prisoner's dilemma points matrix employed in Study 1*

| | Number of J&P choices in the group | | | | | | |
|---|---|---|---|---|---|---|---|
| You choose | **0J/6P** | **1J/5P** | **2J/4P** | **3J/3P** | **4J/2P** | **5J/1P** | **6J/0P** |
| **J** | no one chose J | 14 | 17 | 20 | 23 | 26 | 29 |
| **P** | 20 | 24 | 28 | 32 | 36 | 40 | no one chose P |

Table 2

*Percentage of cooperation and subjective likelihood estimates of a cooperative group consensus as a function of discussion type within Study 2.*

| | Proportion of cooperation | | Subjective likelihood of cooperative group consensus | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Control | 33.33% | 0.48 | 30.23 | 25.79 |
| Imagined group discussion | 52.00% | 0.51 | 50.96 | 29.24 |
| Direct group discussion | 77.92% | 0.43 | 70.96 | 34.14 |

Table 3

*Mean and standard deviations of dependent variables as a function of discussion type and SVO within Study 2.*

| | Control | | | | Imagined group discussion | | | |
|---|---|---|---|---|---|---|---|---|
| | Prosocial | | Proself | | Prosocial | | Proself | |
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Investment | 195.33 | 85.18 | 136.67 | 135.89 | 260.59 | 45.62 | 206.36 | 110.66 |
| Stroop interference | 79.51 | 85.14 | 32.32 | 78.06 | 23.57 | 91.31 | 132.56 | 109.11 |

Table 4

*Means and standard deviations for investments as a function of discussion type and SVO in Study 3.*

| Discussion condition | SVO | Investment | |
|---|---|---|---|
| | | *M* | *SD* |
| Control | Prosocial | 188.24 | 74.35 |
| | Proself | 113.33 | 111.65 |
| Imagined Discussion | Prosocial | 242.50 | 67.40 |
| | Proself | 188.00 | 102.57 |

Table 5

*Mean investment as a function of imagined group discussion condition in Study 4.*

| Group Size | Cooperation Rates |
|---|---|
| Standard experimental | 241.59 (20.10) |
| Individual experimental | 240.67 (21.33) |
| Control | 174.82 (20.10) |

*Note*: Standard deviations are shown in parentheses.

Table 6

*Means and standard deviations for dependent variables as a function of group size within Study 5*

| Group Size | Cooperation Rates | | Cooperative Commitments | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| 6 person | 210.90 | 99.50 | 5.00 | 0.35 |
| 12 person | 247.93 | 66.53 | 5.74 | 0.33 |
| 24 person | 278.12 | 48.20 | 6.25 | 0.34 |

*Figure 1:* Multilevel model testing the relationship between discussion condition (using indicator coding) and cooperative behavior through subjective likelihood ratings of a cooperative group consensus within Study 1.

*Note:* **p*<.05, ***p*<.001. Squares denote observed variables, circles donate latent variables. Filled circle indicates that the observed Cooperative behavior variable is influenced by a random intercept that varies between groups; the random intercept is modelled as continuous latent variable at the group level.

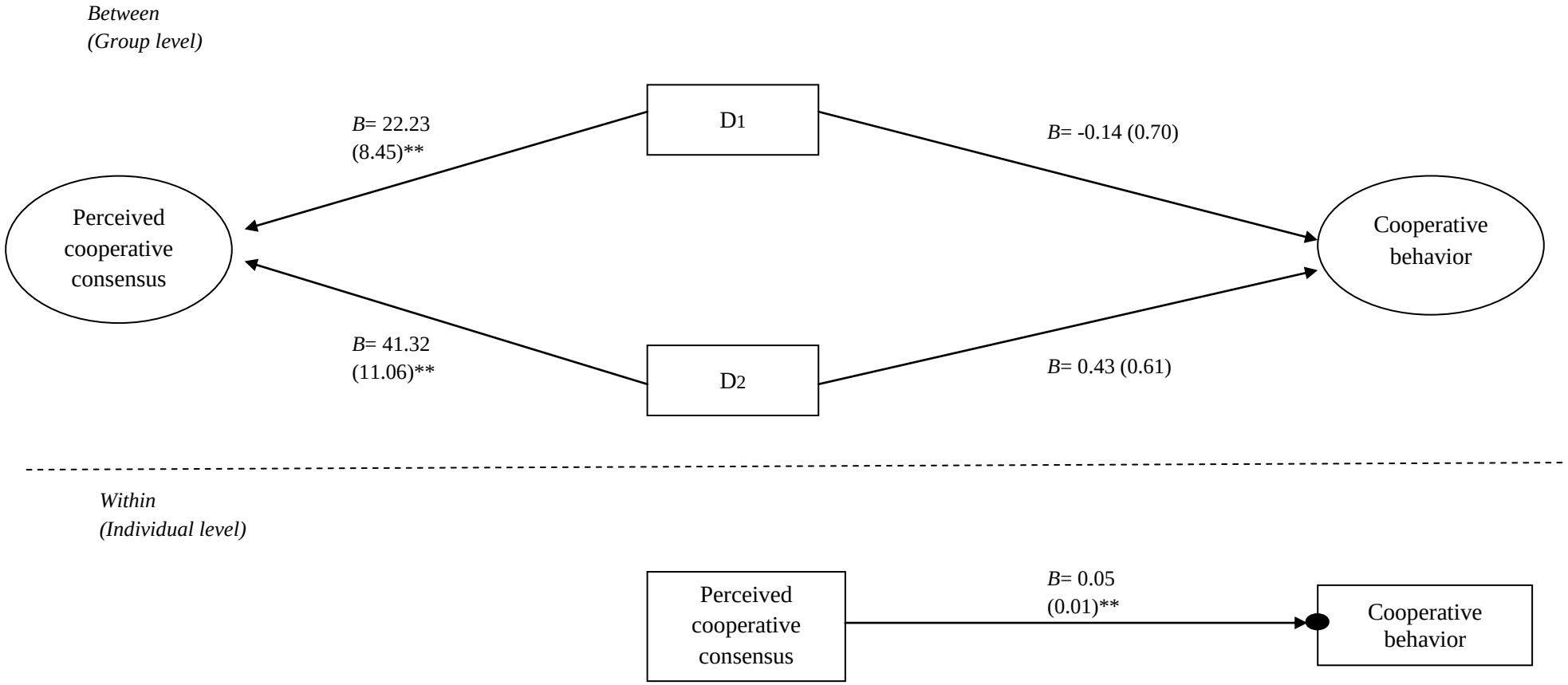
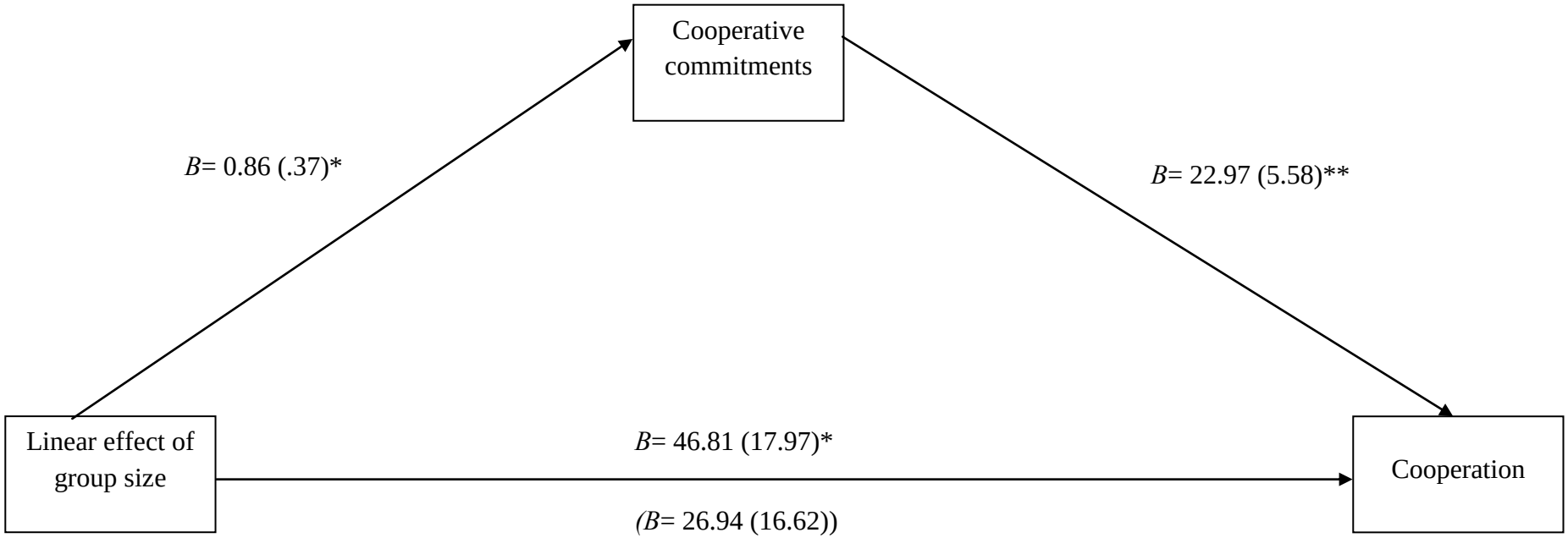


*Figure 2:* Simple mediation test of the relationship between group size conditionand cooperative behavior through cooperative commitments within Study 5.

*Note.* *$p$<.05, **$p$<.001




Adj $R^2$ = .29, $F(2,57)$ = 12.82, $p$ < .001