Comments Welcomed
First draft started: January, 1995
Printed: Friday, May 21, 2010
Revised Draft Submitted to J Ec Behavior & Org
(published, v. 35, 1998: 389-403)

Some Consequences of E-mail vs. Face to Face Communication in Experiments[1]

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keywords: Prisoners' dilemma, experiments, communication, impartial reasoning, cooperation.

Abstract: As more and more social science experiments are being run on computers, the question of whether these new laboratory instruments affect outcomes is increasingly important. We examine whether the mode of communication in experiments has any effect on the choices made by individuals. We find that the effects of 'e-mail' vs. face to face communication vary with the nature of the decisions and may depend upon the complexity and content of what needs to be communicated.

1/ We would like to thank the Social Sciences and Humanities Research Council of Canada for their support of this research. We also wish to thank Avery Cook for research assistance in running the experiments and James Gimpel, Piotr Swistak, and Keith Dougherty for their helpful comments on an earlier draft of this paper.

Table of Contents

Tables and Figures

Some Consequences of E-mail vs. Face to Face Communication in Experiments

Over the past few decades experimental methodology has radically changed the research strategies of the social sciences (Friedman and Sunder (1994), Kagel and Roth (1995), Plott (1990)). The relatively recent revolution in micro-computer capabilities has quickly been integrated into experimental methodology. A shift began in the mid 80's, in part, because computerized experimental research has many advantages (Oppenheimer and Winer, 1988) and by now, computers have become a primary platform for behavioral scientists, especially in experimental economics.[1]

In 1989, two articles by Kiesler (1989) and Parker (1989) analyzed the effects of different modes of communication in organizations. The authors reported that e-mail (vs. face to face communication) changed the content of discussions. The electronic platform altered the degree of cooperation and disagreement between people. It induced honesty. This happened, they argued, because an electronic forum produces a more egalitarian communication environment. Although those authors were not concerned about experimental methodology, their findings clearly raise the possibility that different communication platforms can substantially affect behavior and outcomes. If this is so in the "field" it ought to be visible in experimental laboratories as well.

Beyond these journalistic reports, there are no published tests of the effects of electronic laboratory environments on experimental outcomes in the social sciences. The new instrumentation has never been subjected to a systematic test in which the same experiment is conducted on two different communication platforms to test for reactivity. This paper begins that process.

We have previously run variants of prisoners' dilemma games (hereafter referred to as PD's) both with and without communication, (Frohlich and Oppenheimer 1995 and 1996). We here report the comparative results of replications of these games using both face to face and e-mail communication.

Conjectured Effects of Different Modes of Communication

We hypothesize two types of effects from changing the modes of communication. First we conjecture that face to face communication may work better than electronic communication in moving towards optimal results in prisoners' dilemmas (or promoting contributions towards public goods). Second we posit that face to face communication can be expected to lead to a greater sense of community and hence leave stronger residual trails of cooperative behavior.

It is well established (though not well explained) that communication makes a substantial difference in the level of cooperative behavior in the basic PD game.[2] The communication problem in such games is relatively straightforward: it is to motivate individuals to forego purely self-interested behavior to improve the outcome for all. The problem is one which underlies many political problems and has been well explored.

Research Design

Subjects, were undergraduates at the University of Manitoba, each of whom participated only once. The experimental unit was a 5 person group which stayed together for 15 rounds, divided

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1/ A number of papers have been written on the use of computers in experimental research (c.f. Petry, 1990; and Cain et. al., 1995).

2/ For summaries of the standard findings and some of their caveats, see the chapters by Roth (1995, esp. pp. 26 - 35) and Ledyard (1995) on prisoners' Dilemma, both in Kagel (1995).

into 2 phases. The first phase consisted of eight rounds of a PD game. There were two variants of the PD and each was run under 3 communication conditions. The second phase was always the same: seven rounds of a 5 person prisoners' dilemma game with no communication. The two games with three different communication conditions comprise six different treatments (see Table 1). The communication conditions were either no communication, face to face communication, or e-mail.[3] Communication (when it was allowed) took place in each of the eight rounds of Phase 1 prior to subjects' entering their decision. One game was a standard 5 person PD. The other, the "Impartial PD", had the same payoff matrix, but payoffs were randomly assigned to the players after they had made their decisions. The specific characteristics and parameters of the games will be discussed below.

Table 1: Phase 1 Treatment Conditions & Number of Groups in Each Treatment

Communication Condition	*Game Treatment*	
	PD	**Impartial PD**
No communications	5	5
Face to Face Communications	6	5
E-mail Communications	6	6

The three communication treatments in Phase 1 permit testing for immediate effects of communication on decisions. The absence of communication in Phase 2 allows us to test for any lingering effects of the mode of prior communication on subsequent cooperative behavior. Moreover, the use of two different games, one fundamentally simpler to deal with than the other, allows us to examine whether there is any interaction between the *type* of decisions over which communication occurs and both the immediate efficacy of the communication mode and its lingering effects.

The Prisoners' Dilemma Game

A prisoners' dilemma game is characterized as follows:

1) all players have a dominant strategy: a choice which yields them the best personal outcome for each contingent choice of the other players. The outcome of such choices is a (Nash) equilibrium.

2) The outcome which results from all players choosing their dominant strategy is, itself, suboptimal: there exists some other outcome which players *unanimously* prefer.

3) There is a core to the game. That is, there is a set of outcomes such that no subset of players could guarantee themselves a better outcome by acting alone.

The standard PD embodies a classic confrontation of narrowly self-interested and group oriented values and incentives. Individuals in such situations can see that if each merely does what is best for him or herself the entire group, which of course includes them, is worse off then they need be. (see Table 2 below). Nevertheless, given the dominant strategy, theoretically one would expect a suboptimal outcome. However, empirically, communication is known to facilitate better outcomes.

3/ All e-mail communications could have multiple addresses. Virtually all items were "broadcast." This replicates the n-person communication modes which dominated face to face communications. Under both conditions no "bilateral," or "private" communications were observed.

Research Design Details for the Conventional PD Treatments[4]

A group of five subjects was introduced to a conventional five-person PD using the interactive software package C&C (Oppenheimer and Winer). Subjects were seated at a computer while the instructions appearing on their screens were read to them. They were told that they could explore the implications of different strategic choices on the built-in worksheet screen.

Subjects were informed that in each round their payoffs would be calculated by the computer and displayed. For the first eight rounds, communication of a specified type was allowed before the decision was entered. Eight sets of decisions were recorded. The second phase was identical in each treatment, consisting of seven rounds without communication. The subjects were unaware of how many rounds would be played in either phase and were unaware that Phase 2 would follow Phase 1.

The game in this experimental condition, was a linear 5-person PD. (See Hardin, 1971 for a simple, yet general discussion). Table 2 presents the parameters used. Each individual had a budget of 10 units, and could either keep the 10, or put any proportion of it into what is called a "bonus fund".[5] Every unit contributed to the bonus fund yielded .4 units to each person in the game. Since a contribution of any quantity, **x**, by a player resulted in a loss of **x** plus a gain of .4**x** it is clear that it is individually rational to contribute nothing at all. For example, when others contribute 10 units in total, if the row player gives nothing se[6] will receive 4 out of the bonus fund (as a result of the 10 units given by others) and, combined with the 10 se kept, will have a net return of 14. Contributing 10 units would reduce hes yield to only 8 units: the result of 20 units contributed to the bonus fund. A similar calculus applies under each contingency of others' contributions. A single player is best off contributing nothing and so if everyone is individually rational, no contributions will be forthcoming, yielding a total group payoff of 50: the Nash outcome.

On the other hand, if all were to give their full 10 units, 50 units would be in the bonus fund and that would generate a payoff of 40% of 50 or 20 units for each player (a group payoff of 100).[7] Thus individual rationality yields the theoretical prediction of complete defection and a Pareto inferior result.

4/ **Full protocols may be obtained from the authors.**

5/ For ease of explanation the table displays only a discrete representation of the game, but it is conceptualized and implemented as a continuous game with the strategy choice domain being the closed interval [0,10] and the payoffs [4,26].

6/ We introduce "se" (pronounced see) as a gender non-specific subjective third person pronoun. The equivalent possessive pronoun is "hes" and the objective pronoun is "hirm".

7/ This is what was called the cooperative, or core outcome, see properties "2)" and "3)" above.

Table 2: 5 Person Prisoners' Dilemma (Showing Payoffs Only to The Row Player)					
Exemplary Strategies for subjects: allocating resources to a group project	**Amount Given by Others**				
	40	**30**	**20**	**10**	**0**
give 0	26	22	18	14	10
give 10	20	16	12	8	4

Results from the Conventional Prisoners' Dilemma Game

We present results from the three communication treatments in the conventional PD described above reserving for later discussion of the treatments involving the less conventional impartial PD.

Phase 1: As noted earlier, communication enhances the level of contributions in PD's. The simplest measure of the effect of communication on behavior is the total amount contributed to the bonus fund by the group[8] averaged over the 8 rounds of Phase 1.[9] Without communication, the groups gave an average of 14.44 francs of a possible 50 to the bonus fund (about 29% of the holdings). When communication was allowed contributions were much higher: 43.89 (87% of total holdings). There is a clear and significant effect of communication on cooperative behavior - consistent with the findings in the field. The ability to communicate changed the group's behavior substantially and improved their joint outcome.

Having established that communication matters, we examine the potentially different effects of the mode of communication on contributing behavior by groups (see Table 3).[10]

8/ Unless otherwise specified, the mean contribution of each group in each phase of the experiment will be considered an observation. At other times, our focus will be on the *individual decisions*, and then we will focus on the average decisions made by the individual in Phase 1 and Phase 2. The two levels of analyses are obviously interdependent, and although the differences change the N's, and hence some of the statistics, none of the measures of significance vary seriously as a function of the level of analysis reported.

9/ To avoid an initial learning curve over the first round, we had a practice round which introduced all the subjects to the conditions prior to play. The curves displayed in the graphs still appear to display some learning effects.

10/ We report Kruskal-Wallis tests when the underlying distributions are not normal. K-W tests are non-parametric: changing the amount donated to a rank score. It then reports the probability that the rankings could have come from samples from identically distributed populations. Our conjecture yields a natural ranking of face - to - face, e-mail, and no-communications in decreasing order. Here the literature leads us to conjecture donations are higher with any form of communications. The Mann-Whitney U test statistic (similar to the Kruskal-Wallis with only two groups) is 2, $p < 0.003$, with a Chi-square approximation of 8.93 with 1 DF.

Table 3: Average Group Contribution: Phase 1, Regular PD				
Communication	**No. of groups**	**Mean Units Contributed**	**Mean % Contributed**	**Standard Deviation (units)**
None	5	14.44	29.0	6.310
Face to face	6	49.95	99.9	0.127
E-mail	6	37.83	75.7	13.812
Statistical Significance	**Kruskal-Wallis Test Statistic = 11.945 (p < 0.003 assuming a Chi-square distribution with 2 DF)**			

And the mode of communication makes a significant difference. Face to face communication led to virtually complete cooperation (49.95 units on average) while E-mail had a less pronounced but still sizeable effect (37.83 units). It was significantly less effective than face to face communication.[11] The mode of communication affects behavior in the PD.

Phase 2: This phase, consisting of the next seven rounds without communication, was designed to test for the existence of any lingering effects of communication on subsequent behavior. In this phase all subjects were faced with seven rounds of the prisoners' dilemma game described in Table 2. Only their prior history (the conditions they were faced with in Phase 1) differed.

There was a large and significant difference in behavior due to the existence of prior communication in Phase 1. Without prior communication an average of only 10.71 units were contributed in each group. With prior communication 25.12 units were contributed. This is a difference of more than 135%. Table 4) shows the corresponding results at the individual level.

Table 4): Average Individual Contributions: Phase 2, by the Existence of Communication in Phase 1			
Communication	**N**	**MEAN**	**SD**
None	25	2.142	2.216
Some	60	5.037	3.788
Significance:	**Mann-Whitney U test statistic = 431; (p < .002) assuming a Chi-square distribution with 1 DF**		

As before, we ask whether the *mode of communication* had a differential affect on later behavior? Prior e-mail and face to face communication were *not* statistically significant different in their impact on increasing the contributions in later rounds ($p > .29$). Face to face communication left groups with contributions of 53% of the optimal amount while e-mail generated contributions of just a bit less than 48%.

The results of the three treatments using a conventional PD can be caught at a glance in Figure 1 which displays the average amount given in each round of the phases of the PD under the 3 communication conditions. Note the vertical line between rounds 8 and 9 separates Phases 1 and 2 of the experiments: the point at which communication was terminated.

Summarizing our findings, the figure shows that:

11/ Again, using a Mann Whitney U test yields the statistical likelihood of such a difference in ranks of the outcomes: Mann-Whitney U a test statistic = 32.000, reflecting $p < .025$.

B. Communication about a particular decision makes a considerable difference in promoting cooperation.

C. The mode of communication also makes a difference in immediate behavior. Face to face discussion leads to more contributions in Phase 1 than does e-mail.

D. The existence of communication also creates some lingering differences in behavior after the communication is terminated.

but

E. The type of communication makes no difference in Phase 2. Face to face conversations and e-mail in Phase 1 have statistically equivalent effects on contributions in Phase 2.

All of these effects are evident when the particular decision focuses on the problems inherent in a conventional PD. Are these effects generalizable to other decision contexts? Below we transform the conventional PD and construct what we have elsewhere called an "impartial transform of the PD" to test whether the findings above are sensitive to changes in the game structure (and, therefore, the content which needs to be communicated to 'solve' the social or group problem).

The Impartial PD

Because the standard PD juxtaposes narrowly self-interested and group oriented values and incentives it is a useful model for many philosophical, political, and other problems. It creates a real dilemma: the conflict between individual rationality and group optimality. Philosophers have long argued that impartial reasoning is a justifiable method which can be used to escape the worst consequences of dilemmas such as these. Indeed, John Rawls (1971) introduced a hypothetical device (a veil of ignorance) which is useful in identifying a set of institutional arrangements which might generate both a fair and optimal set of outcomes. A careful examination of Rawls' work reveals that his veil of ignorance relies upon and institutionalizes impartial reasoning - a mode of inquiry that has ethical significance.

We introduce an institutional device to induce impartial reasoning over a PD problem. The device transforms the dilemma so that individuals must consider the consequences of each decision for every person in an evenhanded fashion. Such an alteration changes the incentive structure of the game and hence transforms the game. The device is simple: Each of the players in the game confronts a payoff table which appears to be identical to the conventional PD game (described above in Table 2). However, each makes a decision, knowing that a randomizing device will determine which player's payoff se will actually receive after the decision is made.[12]

If one starts with the game portrayed in Table 2, and randomly assigns payoffs to players after they have made their decisions, their expected payoffs and, presumably, their choices will change. The new payoffs are captured in Table 5.

To appreciate how the payoffs in Table 5 are generated via this randomization, consider one contingency. Imagine that one subject anticipates that only one other subject will contribute 10 units. We can then contrast the payoffs for either contributing or not contributing.

12/ The randomization is based on pulling chits out of a 'hat' to increase its credibility, over a computer based randomizing device.

Contributing 10 would produce 2 (out of possibly 5) contributors, and 3 non-contributors. *Each* player would then receive an expected payoff consisting of 2 out of 5 chances of being assigned to a position which had contributed and 3 of 5 chances of getting a position which had not contributed. From Table 2 we can see that in the conventional PD the payoff to an individual of being one of two individuals each contributing 10 is precisely 8, while if both of the contributing individuals are persons other than oneself the payoff is 18. But in the impartial game, choosing to contribute does not imply that you, yourself, will receive the proceeds of the contributor directly. Two subjects will get that payoff, but who they are will be determined randomly. Thus, in the impartial PD, the expectation from contributing when one other does would be (2/5)(8) + (3/5)(18) = 14 (see Table 5). That is the expected value of contributing when one other player is expected to contribute 10 units.

Table 5: Derived Expectation of Payoffs in the Impartial 5- Person Prisoners' Dilemma (Row Player's Payoffs Only)

Exemplary Strategies for subjects allocating resources to a group project	**Amount Given by Others**				
	40	**30**	**20**	**10**	**0**
give 0	18	16	14	12	10
give 10	20	18	16	14	12

On the other hand, contributing nothing under the same presumption leaves only one contributor and 4 non-contributors. Under that contingency, *each* individual has 1 out of 5 chances of getting the contributor's payoffs and 4 of 5 chances of getting a non-contributor's payoff. The expected value of that strategy is then (1/5)(14) + (4/5)(14) = 12. In the impartial PD the value of contributing is always greater than the value of not contributing. In other words, the transformed game has a dominant strategy of contributing 10 rather than contributing nothing.

A moment's reflection reveals the underlying behavioral incentives induced by the transformation. Each player shares, *ex ante,* the fate of every other player in a probabilistic fashion. Each must explicitly consider what might be the fate of every player in the game and weigh those outcomes evenly. That is the essential component of impartial reasoning: weighing everyone's interests evenly. The conclusion follows that the imposition of an impartial reasoning decision framework can be used to generate a better outcome. Moreover, if we take the motivational characteristics of impartial reasoning as a foundation for ethical reasoning, this outcome can also be claimed to be a fair outcome. Frohlich, (1992); and Frohlich and Oppenheimer, (1995) and (1996) show how this procedure results in transforming the original PD game to make cooperation the strategy which conforms to the self-interested choice

The transformation clearly changes the relationship between the payoffs the individuals receive and their decisions. The transformed game shares two of the properties identified with the PD game: each player has a dominant strategy, and the game still has a core. But the conflict between individual and group values has been eliminated: the game no longer has property number 2. Instead, the game now is characterized by property 4:

4) The outcome resulting from each player's choosing the dominant strategy is, itself, 'optimal.' No other outcome is *unanimously* preferred by all players,

Individuals making decisions in this impartial PD have substantially less need for communication in order to convince one another of their best (and right) course of action. There is no tension between the ethical and the selfish course of action. Communication under these circumstances may have different effects than it does in the conventional PD situations. But it is extremely important to note that communication may still be required in such a game. Players, in

making their decisions, confront the payoff matrix in Table 2. They never see the derived payoffs in Table 5. The value of the game to them is determined by the payoffs in Table 2 combined with their randomization to positions after their decisions. So, although the best course of action is determinate it is not necessarily transparent to the average subject.

Research Design for The Impartial PD

As with the conventional PD there were three communication conditions: no communication, face to face communication, and e-mail. The only difference between these and the former treatments was the randomization of payoffs. In the first phase (Rounds 1 - 8) subjects were informed that after all players had entered decisions into their computers, the controlling computer would calculate payoffs and a random drawing of computer numbers would reassign them to one of the five computers. They would receive the payoff associated with the decision made by the former occupant of that computer. This procedure was repeated for eight rounds and eight sets of decisions were recorded. In the second phase all communication was terminated and all other details of the research design were identical to those in the conventional PD implementation. As before, the groups played seven rounds of a conventional PD game in Phase 2.

Results from the Impartial Prisoners' Dilemma Game

Again we can test for both the Phase 1 and (Phase 2) effects of the different communication modes.

Phase 1: From Table 6((and Figure 2) it is clear that, again, communication matters. In Phase 1, with communication 47.1 units are contributed, without, 37.17: a significant difference.

Table 6(: Average Group Contributions: Phase 1, Impartial PD's by the Existence of Communication

Communication	N	MEAN	SD
None	5	37.13	4.212
Some	11	47.41	4.420

Significance: Mann-Whitney U Test Statistic = 3.0 ($p < 0.005$ Chi-square approximation = 7.76 with 1 DF)

On the other hand, changing the decision context changes the relative impact of the two modes of communication. The *type* of communication makes no statistically significant difference in the level of contributions. A Mann-Whitney U test merely confirms the obvious: comparing the two means of what individuals gave (e-mail = 9.435 and face to face = 9.536) yields an insignificant difference. This contrasts with the effect in the standard PD (see Table 3). There face to face communication in Phase 1 had a substantially greater impact on contributions than did e-mail.

Phase 2: All groups who which faced impartial PD in Phase 1 were faced with seven rounds of the same conventional PD game in Phase 2. Discussion during Phase 1 doesn't elicit increased contributions in Phase 2 (see Table 7' and Figure 2). Thus, the lingering effect, attributable to discussion in a conventional PD (see Table 3) does not manifest itself when communication has, as its focus, the impartial PD. Cooperative behavior induced by communication in Phase 1 does not persist into the second Phase in a significant manner. Moreover, the *type* of communication in Phase 1 (face to face or e-mail) makes no difference to the behavior in Phase 2 ($p > .23$).

Table 7: Average Individual Contributions: Phase 2, by the Existence of Communication in Phase 1, Impartial PD'S

Communication	N	MEAN	SD
None	24	2.41	2.39
Some	55	2.70	2.41

Significance: Mann-Whitney U test statistic = 600.000; p > 0.5, Chi-square approximation = 0.410 with 1 DF

These results can be seen at a glance in Figure 2 which shows how the groups playing the impartial PD allocated resources to the bonus fund under the three communication conditions. The findings can be summarized succinctly. When Phase 1 is an Impartial PD:

A. Communication in Phase 1 makes a difference in immediate behavior

but

B. Both modes of communication in Phase 1 are equally effective in inducing cooperative behavior.

and

C. Communication in Phase 1 induces no statistically significant difference in the behavior in Phase 2.

and further:

D. There are no differences between the two modes of communication in Phase 1 regarding their ineffectiveness in inducing cooperation in Phase 2.

What, then, are the comparative effects of different modes of communication when they are deployed in the two decision contexts we have created. Figure 1 and Figure 2 reveal the differences clearly. The different communication conditions make less of a difference in behavior in the impartial PD games than they do in the conventional PD games. But this effect is true only of behavior in Phase 1. The two communication modes' lingering effects on behavior do not differ. Both show a residual effect from Phase 1 in the conventional PD treatment and both fail to show an effect in the impartial PD.

Conclusions

A rather interesting picture emerges from these treatments. It comes as absolutely no surprise that communication improves immediate outcomes in a PD (conventional or impartial). Communication, whether it is face to face or electronic, can largely overcome the traditional dilemmas. But electronic communication is less helpful than face to face communication where cooperation is most problematic - in the conventional PD. By contrast, the lingering effects of communication are the same for face to face and e-mail in both the conventional and impartial PD.

What might account for the differences in the effects of the two modes of communication? Of course, one experimental result doesn't give us a great deal to go on, but let us venture some conjectures.

In a prisoners' dilemma there is a good deal of substance to communicate about. In particular, the communication tends to express the need to forego one's immediate self interest for the whole group to do better. This is a "moral exercise." By contrast, when the impartial reasoning device is in place, there is no longer a conflict between group and self interest. Communication becomes a simple co-ordination tool: to ensure that everyone understands in what direction their self-interest lies. There is no moral dilemma, no need for moral suasion, and no need for contractual type discussions. As Professor Steven Turnbull of Tsukuba University has said with regard to a similar experimental situation: "Subjects don't have to flex their ethical muscles."

A rough content analysis of computer messages sent in the regular as opposed to impartial treatments shows that on average eight normative references were made in each regular play treatment while only three on average were sent in each impartial play treatment. To illustrate the different tenor of messages in the regular vs. impartial plays of the game, excerpts from the first few rounds of two games are presented.[13]

Messages sent in the first few rounds of a regular game show ample evidence of normative content and even threats in response to less than full cooperation.

Round 1:

A: Hi, this is A! I have figured this out! If we all cooperate and put 1 into the bonus fund we will all be better off in the end!

E: I like that 1 dollar each thing. But we have to be certain that no one cheats.

A: Hi this is A! Everyone has the right idea now but how are we to know that no one will cheat! Can we trust each other!

Round 2:

E: Okay, some poo poo head didn't enter 1, that's not very nice. When I find out who it was, tee hee, I'll scratch her car; (yes, that's a threat).

Round 3:

C: I think the level of trust is drastically falling in here. We do have a problem. We need to regain our trust of each other somehow or we're all going to end up with low profits.

A: This is the round to cooperate!!!!! Since we all know how this game works lets get the most money we can for our time!!!!!!! Pleaseeeeeeeeeeeeeeeeeeeeee enter 1!!!!!!!!!!!!!

In the impartial version of the game, the tenor of the messages was much less emotionally / normatively charged. Note, however, that the normative concerns were voiced before the subjects realized that the randomization prevents a conflict between self and group interests.

Round 1:

E: I think we should all enter 1. That is the biggest pay-off and we all win.

13/ Readers may obtain copies of e-mail messages and descriptions of the protocol by contacting the authors.

C: If we get a new budget every round, then if we put 1 in the bonus fund every round we will all max profits

B: everybody, please be nice okay? No double crossing. everyone put a one!!!!!

C: Nobody will double-cross because they don't know what machine they will end up with in the next round.

Round 2:

C: So we'll all do the same?

D: everyone do the same thing again. this is going to be a breeze.

Turning to the differences between the efficacy of face to face and e-mail communication in Phase 1, it appears to us that there are two possible explanations. It may be that when there is substantial substance to communicate and debate because subjects face a complex decision, face to face interaction helps establish what both individual and group interests dictate. The act of talking with one another may reveal the underlying dilemma. Communication may help clarify a complex situation. But it may do more. It might establish the fact that everyone is serious and may help to develop the sense of community needed to 'substitute' for the 'binding agreements' required to support the cooperative solution (or core) to the problem in the face of the tug of individual rationality. E-mail communication may not be able to convey some of the subtler cues that may be needed to engender a cooperative atmosphere. But the additional cooperation engendered by face to face communication is fragile. Once a sense of community based on successful cooperation has developed, the effects linger after communication ceases, but they appear to show a tendency to decay, and the residual effects of both types of communication appear to be the same.

On the other hand, the impartial PD embodies a situation in which the substance of the communication is both less complex and ethically neutral, (and hence, is possibly less memorable). In that situation, neither form of communication had any lingering effect, even though the communication did help everyone choose their 'best' strategies in Phase 1

We conclude that the platform of communication matters, albeit not in a straightforward way. Our tests of the differential effects have been limited to two relatively simple contexts. We cannot conjecture exactly how different modes of communication might affect behavior in other more complex experimental environments but we have strong suspicions that they are likely to have different effects in varying contexts. Experimenters in the social sciences may have to become more sensitive to the potential effects of using computer platforms for their experiments. And this would be relevant if they hope to generalize their results to environments that either use or do not use computerized communications.

Figures

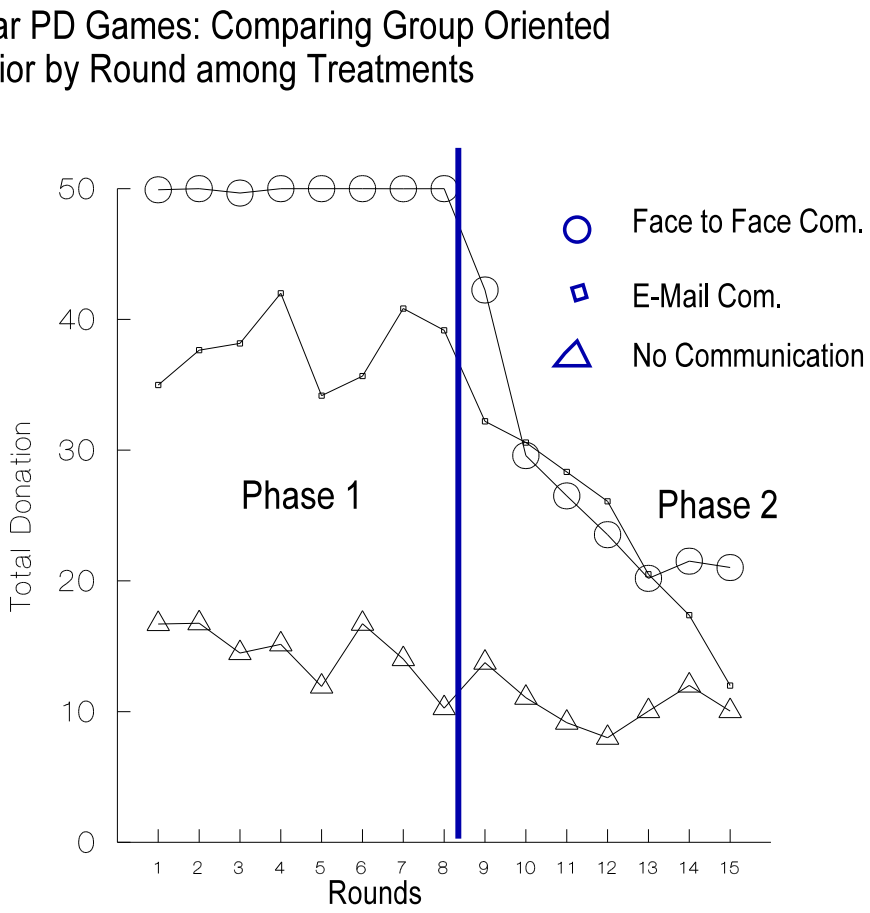

Figure 1: The pattern of giving to the group project, normal PD experiments, differentiated by Phase 1 treatment (non communication; face to face; and e-mail groups).

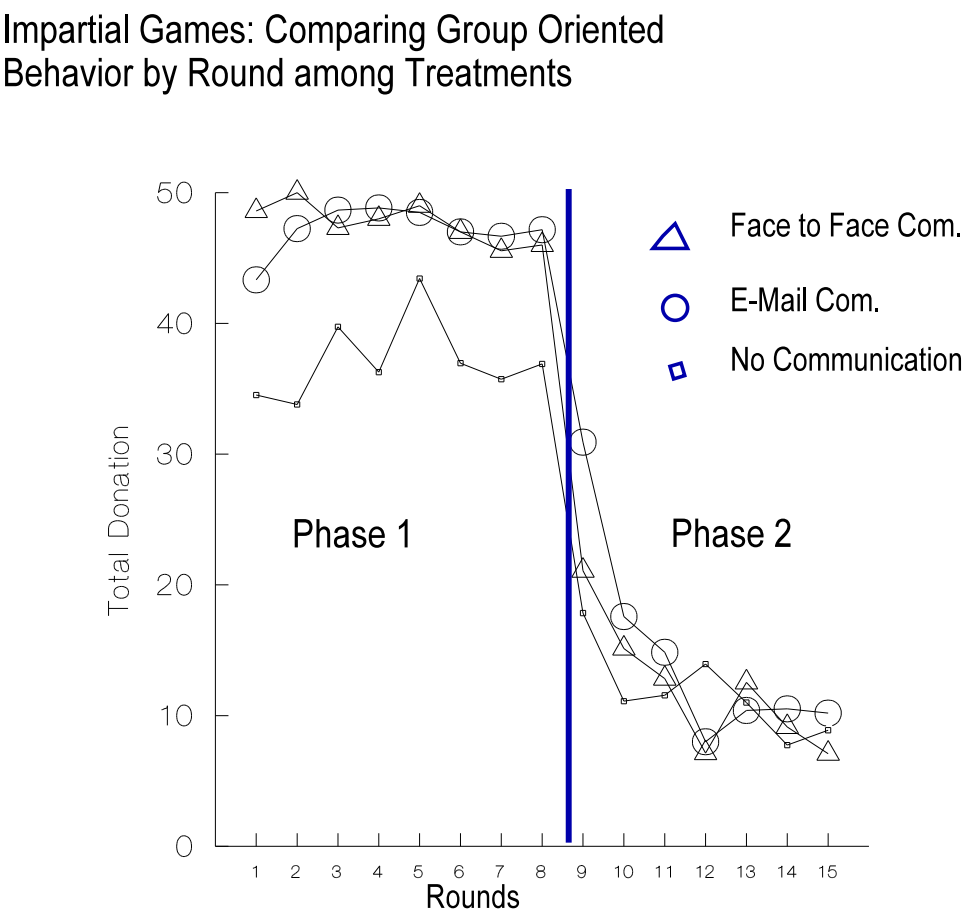

Figure 2: The pattern of giving to the group project, in impartial reasoning experiments, differentiated by Phase 1 treatment (face to face; e-mail; and non communication groups).

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