

ISSN 0819-2642
ISBN 0 7340 1701 4



THE UNIVERSITY OF MELBOURNE
DEPARTMENT OF ECONOMICS

RESEARCH PAPER NUMBER 760

JULY 2000

**ALTRUISM AND VOLUNTARY
PROVISION OF PUBLIC GOODS**

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Abstract

We study how people's predisposition towards altruism, as measured by tools developed by psychologists, affects their behavior in a voluntary contributions public good experiment. Earlier experiments provide evidence against the strong free rider hypothesis; however, contributions to the public good decrease with repetition. We investigate whether a high level of contributions can be sustained in groups of subjects who have been pre-selected on the basis of their altruistic inclinations. In the first stage of the experiment, each subject responds to a psychology questionnaire that measures various dimensions of one's personality. The subjects are then matched in groups according to their altruism scores, and engage in a voluntary contribution game. We consider whether the levels and dynamics of group contributions differ significantly between the groups with altruists and non-altruists. We find that subjects' altruism has a weak but positive effect on group behavior in the public good game.

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^b Dowling, Ma and Sherstyuk gratefully acknowledge the financial support by the Australian Research Council. We would like to thank Jim Dang and Quy Tran for their IT support. Ma thanks Yanson Ching for his help with the data analysis.

1. Introduction

We study how people's predisposition towards altruism,¹ as measured by tools developed by psychologists, affects people's behavior in voluntary contributions public good experiments. The voluntary contribution mechanism (VCM) has been widely used to study the provision of public goods. The parameter profile in a typical VCM experiment is set so that it is Pareto optimal for all players to contribute everything to the public good, but the dominant strategy for each player is to free-ride and contribute nothing toward the public good provision. However, the strong free-rider hypothesis is commonly rejected by experimental evidence. Researchers find that on average participants contribute 40-60% of their total endowments (Davis and Holt, 1993; Ledyard, 1995). Bohm (1972) was one of the first studies to suggest that people might be willing to contribute to the public good despite the strategy conflicting with their self-interest. Research that followed shows that a large portion of cooperative behavior cannot be explained by people's confusion with the game and should be attributed to their taste for cooperation (Andreoni, 1995; Palfrey and Prisbrey, 1997). Further, evidence from both economic and psychological VCM experiments indicates that there are substantial differences in subjects' attitudes towards contributing to the public good (Offerman, Sonnemans and Schram, 1996).

Another robust finding from VCM experiments is that the level of contributions declines with repetition (Davis and Holt 1993; Ledyard, 1995). It is still an open question, however, whether the decline is due to subjects learning their dominant strategies, or because cooperative behavior by some individuals is not reciprocated by others. Andreoni (1995) suggests that the movement towards the equilibrium in the later periods of experiments is due to people's frustrated attempt at cooperation, rather than learning the free-riding incentives. Offerman et al. (1996) note that according to the triangular hypotheses in psychology, cooperators dislike being the "sucker" and adapt their preferred cooperative behavior to selfish behavior after a while, when they are confronted by selfish behavior. Their study provides some experimental support for the hypothesis in the context of step level public good games.

¹ Here we do not distinguish between "altruism" (utility-interdependency) and "warm-glow" (utility from the act of contributing). We use the term altruism to denote people's general taste for cooperation, referred to as "kindness" by Andreoni (1995).

This paper aims to answer two questions of interest. One is whether people who may be classified by psychologists as altruists contribute more in the VCM experiments than selfish individuals, when matched into groups of people with similar predisposition towards altruism. The second question is whether altruists' groups can avoid the decline in the levels of contributions that has been observed in the groups composed of individuals with heterogeneous value orientations.

A number of recent studies consider the underlying preferences or values that might lead an individual to be more or less likely to contribute. Offerman et al. (1996) use financial incentives to measure subjects' value orientations, and then study how value orientations relate to people's behavior in step-level public goods (SLPG) experiments. They find that individuals with cooperative value orientations contribute more often in SLPG experiments than individualists do. However, incentives to contribute are quite different between a traditional public good and a SLPG games, as in the SLPG game there is a Nash Equilibrium which coincided with a Pareto optimum. This difference in incentive structures may translate into different dynamics of group contributions; in the experiments reported by Offerman et al, the level of contributions did not decline with time in two out of three treatments considered.

Roelofs and Sigler (1998) study cultural values in traditional public goods experiments. They use a management survey to measure people's positions on the individualism/collectivism scale. An individualist defines the self as a single person while a collectivist defines the self as a member of a group. Roelofs and Sigler find no direct effects between subjects' individualism/collectivism survey scores and their contributions in the VCM. It is hard to say whether these results indicate that cultural values as measured by the survey have no effect on behavior, or that collectivists switched to free-riding because they were discouraged by the observed behavior of individualists.

In this study we use a psychological questionnaire that measures various dimensions of one's personality to evaluate people's predisposition to altruism. We then sort subjects in groups according their altruism scores, and study the differences in group contributions between the groups of altruists and non-altruists. We consider whether the level and dynamics of group contributions differ significantly between the two types of groups.

2. Experimental Design

The experiment consisted of two parts. In the first part, the participants completed the Personal Meaningful Profile (PMP) questionnaire developed by Wong (1998). The questionnaire is composed of 57 questions that measure one's personality along seven dimensions: (1) achievement; (2) relationship; (3) religion; (4) self-transcendence; (5) self-acceptance; (6) intimacy; (7) fair treatment. Each question is measured on 7-point scale, from 1 (not at all) to 7 (a great deal). The following nine questions were used to calculate each person's score for relationship, which was used as a proxy for the level of altruism:

- 10 I care about other people
- 18 I relate well to others
- 27 I have a number of good friends
- 28 I am trusted by others
- 32 I am highly regarded by others
- 41 I am altruistic and helpful
- 42 I am liked by others
- 45 I bring happiness to others
- 50 I contribute to the well being of others

The PMP is a relatively new instrument, but it has been shown to be high in both reliability and validity (see Wong, 1998). For the relationship subscale used in this study, the reliability coefficient (Cronbach's Alpha) is .81. While no validity studies have been done on the subscales independently, the relationship subscale is high in content validity for altruism. The instrument allows for an unobtrusive assessment of altruism, as well as other personality factors that are potentially relevant to selfless actions.

In the second part of the experiment, the subjects were matched into groups of five based on their altruism scores and participated in a standard VCM game. There were 20 periods in the VCM game plus two practice periods at the start (no money was earned during practice periods). In each period each participant was endowed with 50 tokens which they had to allocate between a private and a public fund. The return to the private account was 0.01 while the return of each tokens in the group

account was 0.02, and was divided evenly among all five group members. Thus the marginal per capita return (MPCR) was set at 0.4.²

3. Procedures

A total of eight experimental sessions were conducted. Two sessions had 10 participants, where the five top scoring participants from the questionnaire were matched in the "altruistic" group and the remaining 5 were considered the "non-altruistic" group. The third session had only eight participants divided into two four-person groups at the second stage of the experiment; the parameters in the VCM were adjusted correspondingly to keep MPCR at 0.4. The remaining five sessions were conducted with 15 subjects, divided into three 5-person groups at the second stage according to their altruism scores. This modification was to increase the difference in scores between the altruistic and non-altruistic group. Participants were all undergraduates from the University of Melbourne with no prior experience in public good experiments; most were recruited from first year commerce subjects. Participants received \$5 for punctual participation in addition to what they earned during the public good experiment. The average total pay out per participant was \$19. All payments were in Australian dollars. The experiment was computerized.³ Participants first sat at separate terminals and completed the questionnaire. They were then assigned into groups according to the ranking of their scores and moved to assigned VCM subject terminals. No explanation was given on how the subjects were matched in groups. The layout of the room was such that participants from the same group were at least one terminal apart. Strictly no communication was allowed during the experiment. Participants were paid at the end of the session.

Experimental instructions that supplemented computerized instructions are given in the appendix.

4. Results

The total of 103 subjects in 8 sessions participated in the experiment. The individual altruism scores ranged from 36 to 63, with a mean of 49.15, and a standard

² See Ledyard (1995) for a detailed explanation of MPCR.

deviation of 5.96. Individual contributions to the public fund ranged from 0 (no contributions) to 50 tokens (full contribution), with a mean per period per subject of 19.58 tokens, and a standard deviation of 17.51 tokens.

Figures 1 to 3 display the dynamics of group contributions in the VCM game for each session, and pooled across the 2-group and 3-group sessions.

FIGURES 1-3 HERE

Tables 1 and 2 contain descriptive statistics of the group level data. Table 1 summarizes the 2-group sessions, numbered from 1 to 3, with the “altruistic” groups indexed by “A”, and “non-altruistic” groups indexed by “B”. Table 2 summarizes the 3-group sessions, numbered from 4 to 8, with the most “altruistic” groups indexed by “A”, intermediate score groups indexed by “B”, and the least “altruistic” groups indexed by “C”. The tables show mean, minimum and maximum scores from the questionnaire for each session as well as within each group. Each group’s mean contribution is recorded along with the total contribution in the first period. To study the effect of experience on contributions, we also present the average contribution in the first ten and the last ten periods of the VCM game. Average per period rates of change in contributions (in percentage points) are also displayed.

	Session score			Group score			Group contribution, %				
	Mean Score	Min. score	Max. score	Mean score	Min.	Max.	Mean	First period	First 10 periods	Last 10 periods	Rate of change
Group 1a	48.4	39	60	53.4	47	60	20.1	40.4	31.0	9.3	-1.64
Group 1b				43.4	39	47	26.1	28.8	31.1	21.0	-0.52
Group 2a	51.5	36	59	56.8	55	59	64.3	73.2	74.9	53.7	-1.60
Group 2b				46.2	36	55	47.7	88.0	66.6	28.7	-4.04
Group 3a	48.1	38	57	52.8	49	57	23.7	41.5	35.7	11.7	-2.17
Group 3b				43.5	38	48	46.4	54.0	50.8	42.0	-1.45
Group A pooled	49.3	36	60	54.3	47	60	36.0	51.7	47.2	24.9	-1.80
Group B pooled				44.4	36	55	40.1	56.9	49.5	30.6	-2.00

Table 1. Summary of experimental results, 2-group sessions.

From the graphs and the tables, we first observe that the general levels and dynamics of VCM games are consistent with previous experimental evidence.

³ We are grateful to Jim Dang for developing a computerized version of the PMP questionnaire. The

Average per session contributions across all groups ranged from 17.7% to 64.3%, with the mean of 39.1%. Also in accordance with previous findings, group contributions declined from the first ten to the last ten periods in 19 out of 21 groups.

Consider the relationship between the “altruism” scores and levels of contribution in VCM. A quick inspection of table 1 and figures 1(I) and 2 shows that, in the 2-group sessions, there were no observable differences between the behavior of “altruistic” and “non-altruistic” groups. In fact, the contributions in session 3 in most periods were higher for the “non-altruistic” than for the “altruistic” group.

	Session score			Group score			Group contribution, %				
	Mean score	Min. score	Max. score	Mean score	Min.	Max.	Mean	First period	First 10 periods	Last 10 periods	Rate of change
Group 4a	51.53	39	63	56.8	52	63	63.9	64.8	71.7	56.1	-0.76
Group 4b				52.4	49	55	50.2	62.0	50.0	50.4	-1.83
Group 4c				45.4	39	48	19.7	34.4	25.8	13.6	-0.86
Group 5a	46.8	42	55	50.8	48	55	47.8	41.6	48.6	47.0	-0.15
Group 5b				46.4	45	48	48.9	76.8	60.4	37.2	-2.04
Group 5c				43.2	42	44	26.5	38.8	37.2	15.8	-1.83
Group 6a	44.8	36	58	51.8	48	58	44.8	42.4	50.5	39.2	-1.36
Group 6b				43.4	42	45	37.0	61.2	47.6	26.4	-1.16
Group 6c				39.2	36	41	41.0	50.1	49.5	32.4	-2.25
Group 7a	52.2	38	58	56.2	55	58	29.4	33.6	34.1	24.6	-0.61
Group 7b				52	50	54	17.7	20.0	23.0	12.4	-0.93
Group 7c				48.4	38.4	49	45.0	48.8	53.2	36.7	-0.91
Group 8a	49.87	39	62	56	52	62	40.8	39.2	45.8	35.7	-0.76
Group 8b				49.6	47	51	18.3	24.4	24.7	12.0	-1.28
Group 8c				44	39	46	61.6	73.2	58.6	64.6	-0.17
Group A pooled	49.04	36	63	54.3	48	63	45.3	44.3	50.1	40.5	-0.73
Group B pooled				48.8	42	55	34.4	48.9	41.1	27.7	-1.45
Group C pooled				44.0	36	49	38.7	49.1	44.9	32.6	-1.20

Table 2. Summary of experimental results, 3-group sessions.⁴

One may conjecture that these results could be attributed to insufficient difference in scores between the “altruistic” and “non-altruistic” groups, or

Arizona Science Laboratory VCM software was used to conduct the second stage of the experiment.

⁴ In session 4, two of the subjects were assigned to groups “A” and “B” incorrectly. This explains why the minimal score in group 4a is below the maximal score in group 4b. Still, importantly, the gap in scores between the “A” and the “C” group remained positive.

insufficient homogeneity, with respect to scores, within the groups in the 2-group sessions⁵. It is therefore of interest to focus on the 3-group sessions, where composition within groups is more homogeneous, and there is a gap between minimal scores of “altruistic” groups “A” and maximal scores of “non-altruistic” groups “C”. From figure 1(II) and the summary row of table 2, we observe that, on average, contributions of “altruistic” groups “A” are above contributions of “non-altruistic” groups “C”. However, this relationship is not consistent across all sessions: while in sessions 4-6 the “altruists” contributed on average more than “non-altruists”, the opposite was true for sessions 7 and 8 (see table 2 and figure 3). According to the Mann-Whitney test, the average contributions in the “A” groups were higher than in the “C” groups at the significance level of 27.4% only (one-sided).⁶ We also note that, surprisingly, in 5 out of 8 sessions, (two 2-group sessions and 3 out of 5 3-groups sessions), the “non-altruistic” group first period contribution was greater than that of the “altruistic” group.

Although the groups were ranked by their scores within each session, a perfect ranking of “altruistic” and “non-altruistic” groups could not be guaranteed across sessions: for example, the mean score of the “intermediate” group 4b was higher than the mean score of the “altruistic” group 6a. To avoid this problem, we consider correlation between the group scores and group contributions, with each group considered as an independent observation (groups from both 2-group and 3-group sessions are included). The results are presented in table 3.

Number of obs: 21	Average contribution	1 st period contribution	First ten periods contribution	Last ten periods contribution	Per period rate of change
Average group score	0.118	-0.110	0.098	0.124	0.189
Min. group score	0.054	-0.196	0.009	0.091	0.271
Max. group score	0.154	-0.016	0.168	0.126	0.041

Table 3: Correlation between group scores and average per person contribution of a group

Generally there is a weak positive correlation between the scores (average, minimum and maximum) and the contribution, except for the observed first period contribution

⁵ From tables 1 and 2 observe, however, that the gap in the mean scores between the “A” and “B” groups in 2-group sessions (54.3 and 44.4, respectively) is as big as the gap between the corresponding scores in the “A” and “C” groups in the 3-group sessions (54.3 and 44.0, respectively). Yet, the composition within groups is more homogeneous in the 3-group sessions.

⁶ An alternative test is to compare the group contributions in 5 top ranking by score groups (across sessions) with those in 5 lowest ranking groups. According to the Mann-Whitney test, the null hypothesis of no differences is sustained at 42.1% significance level (one-sided).

there is a very weak negative correlation. The strongest (but still weak) relationship appears to be between the group contributions and the maximal score in the group. None of the correlation coefficients is statistically significant according to the *t*-test.⁷

Correlation was generated for the individual scores as well. As can be seen in table 4 the relationship here is also extremely weak; all correlation coefficients are insignificant.⁸

Number of obs: 103	Average contribution	1 st period contribution	First ten periods contribution	Last ten periods contribution	Per period rate of change
Individual score	0.082	-0.032	0.044	0.112	0.070

Table 4: Correlation between individual scores and contribution

We next turn to the relationship between the altruism scores and the dynamics of group contributions. The average per period rates of change in contributions and the corresponding correlation coefficients are displayed in the last columns of tables 1-4. Consistently with our conjecture, we observe that, overall, the contributions in “altruistic” groups declined slower than in “non-altruistic” groups; compare the summary rows for A-groups with B-groups in 2-group sessions (table 1), and A-groups with C-groups in 3-group sessions (table 2). Tables 3 and 4 indicate that there is a weak positive correlation between the scores and the rates of change in contributions. The relationship becomes more pronounced if only 3-group sessions are considered: The correlation coefficients between the rate of change in contributions and the average, minimal and maximal groups scores increase to 0.421, 0.268 and 0.420, respectively. The correlation between the rate of change in contributions and both average and maximal group scores is significant at 10% level according to the *t*-test (one-sided). The Mann-Whitney test shows that the rate of contributions decline in “altruistic” A-groups was lower than in “non-altruistic” C-groups at the 11.1% level (one-sided). We conclude that in 3-group sessions, the relationship between the scores and the rates of contribution change was noticeable overall, but there was still a significant heterogeneity in this respect across sessions.

⁷ If only groups from 3-group session are considered, then correlation between group scores and contributions increases but remains statistically insignificant.

⁸ The conclusions on significance should be treated with caution here since individual contributions in the same group may not be truly independent.

5. Discussion

The results show that there is only a weak relationship between people's altruistic predisposition, as measured by the PMP questionnaire, and their behavior in VCM public good games. We find that overall "altruistic" groups displayed a higher level of contributions than "non-altruistic" groups; however, the difference between the two types of groups was not statistically significant. "Altruistic" groups in 3-group sessions exhibited a slower rate of decrease in contributions than "non-altruistic" groups; still, contributions of all groups declined with repetition. In contrast with our conjecture, we find that higher altruism did not result in higher contributions in the first period of the VCM; this may be due to subjects' initial confusion with the game. The results suggest that, at least for inexperienced subjects, underlying values do not affect the level of contributions as such, but they influence the contribution dynamics.

There may be several reasons why altruism, as measured by the PMP questionnaire, did not prove significant in explaining behavior in the VCM game. First, this may be due to insufficient variance in altruism scores between "altruistic" and "non-altruistic" groups. Further research is necessary to investigate whether increasing the gap in altruism scores between altruist and non-altruist groups would result in a stronger relationship between underlying values and behavior in the VCM game. Second, it is possible that direct screening instruments, such as PMP questionnaire that we use, are less effective in predicting people's behavior than alternative indirect instruments. Offerman et al. (1996) use an incentive compatible instrument to measure subjects' value orientations, and find significant differences in the behavior of subjects with different values.⁹ Finally, Gunnthorsdottir et al. (1999) show that subjects may be effectively sorted into cooperators and free-riders not on the basis of their value orientations, but on the basis of their past contributions in VCM. These authors interpret cooperation as coming from self-interested reciprocity rather than altruism. It is quite possible that contributions in public good experiments are driven by self-interest at least as much as by underlying taste for cooperation.

⁹ Burks et al. (2000) report that in a trust game experiment, indirect measures of trust are better predictors of trust behavior than subjects' direct self-assessment on trust.

Appendix

The instructions:

Good Morning/Afternoon.

First of all I would like to thank you all for coming today.

Part One:

There are two parts to today's experiment. The first part is a questionnaire and the second part is participation in a market situation. I will tell you more about it when we get to that part.

Before starting the questionnaire you will need to enter your name and ID number. Your ID number is the number on your terminal.¹⁰

When you finish please wait patiently and do not exit the program as it may delete your record. If you have any questions please raise your hand and I will come and assist you.

I ask that all mobile phones be switched off and that you do not talk during this experiment.

You may now begin.

Part Two:

We have now come to the second part of the experiment. You will now participate in a market situation.

You will be given two practice periods in which you will not earn any money; this will be followed by 20 rounds. I will pay you the amount that you earn during these 20 rounds in Australian dollars, not US dollars as indicated by the program. So feel free to earn as much as you can.

You will be asked to enter your name and some numerical details. Only your name is important. For your telephone number and social security number just enter the required number of digits.

I remind you that there is absolutely no communication in this part of the experiment. If you have any questions please raise your hand and I will come and assist you.

When you finish it is important that you wait patiently and do not exit the program, as it may delete your record and I won't be able to pay you the accurate amount.

¹⁰ Each terminal was labeled from 1-10 or 1-15 depending on the size of the session.

You have all been assigned a letter. Please now move to any terminal with the same letter.

I hope you all have fun and good luck.

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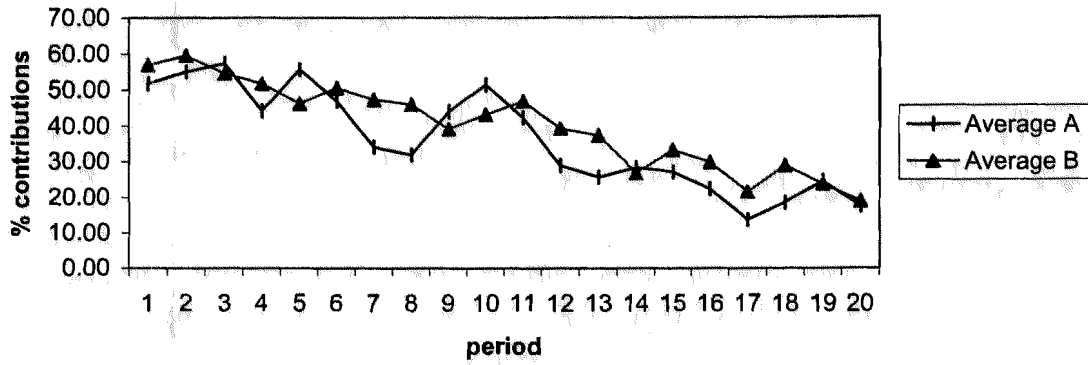
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I. 2-groups sessions pooled



ii. 3-group sessions pooled

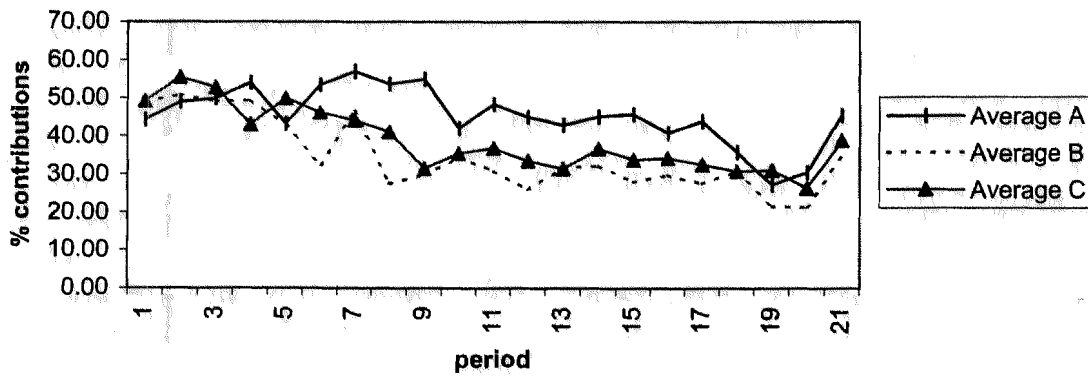


Figure 1: Dynamics of average group contributions in 2-group and 3-group sessions

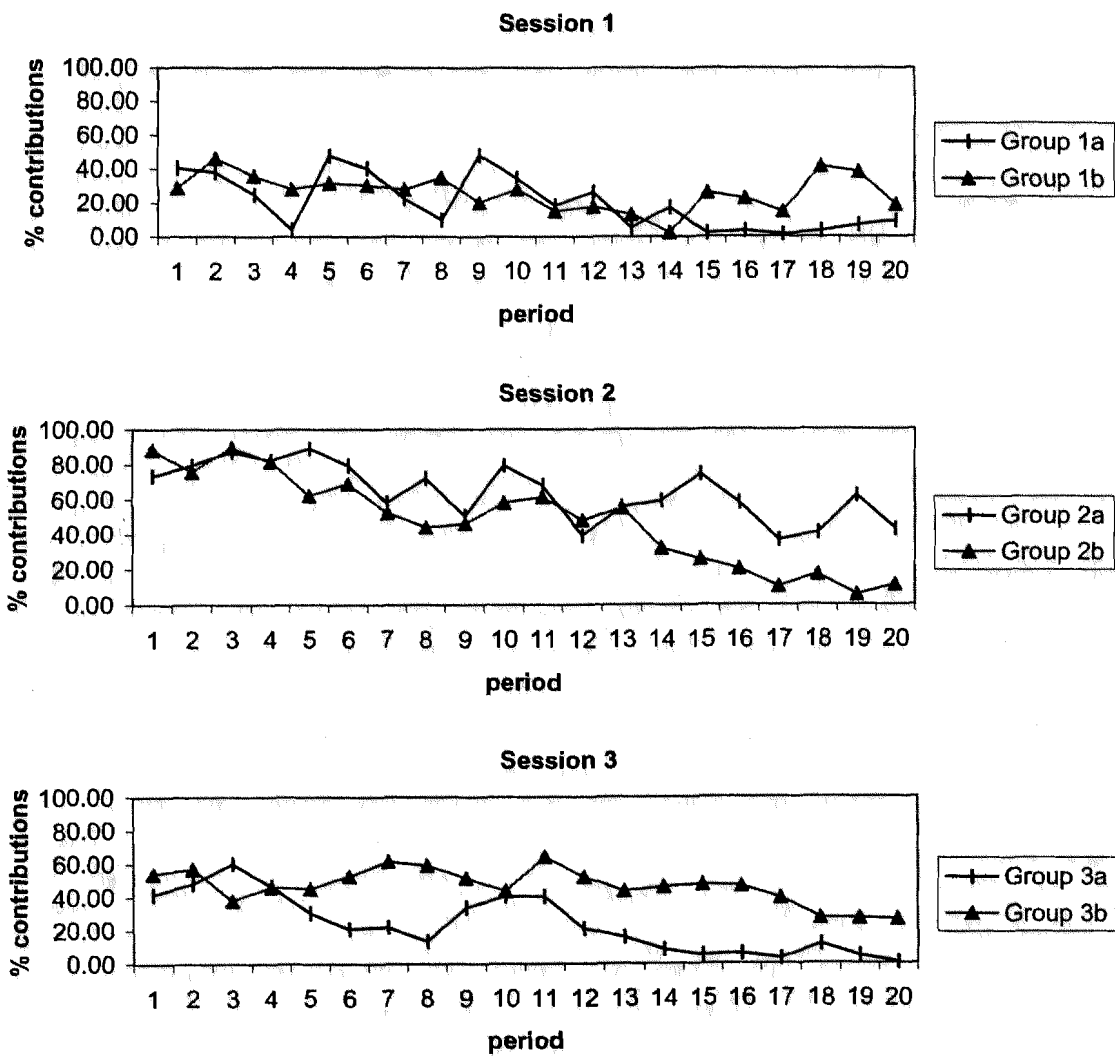


Figure 2: Dynamics of group contributions in 2-group sessions

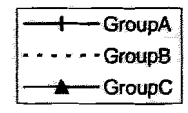
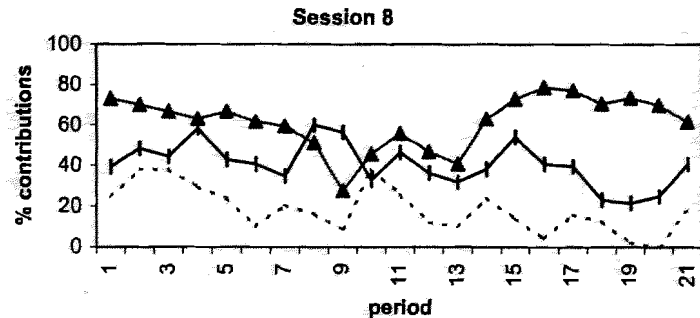
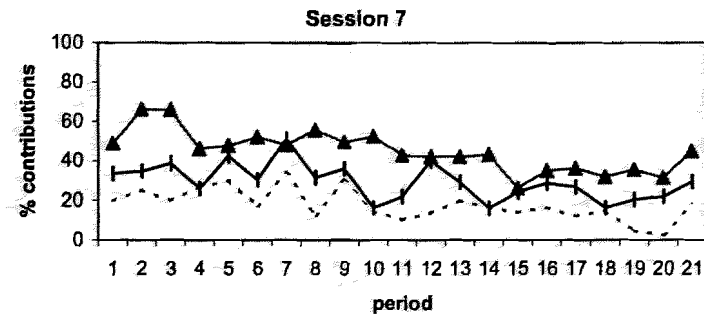
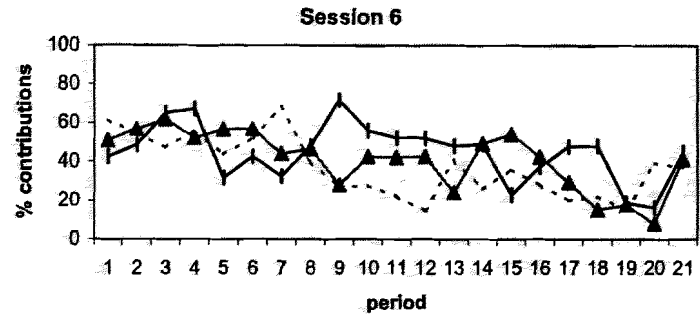
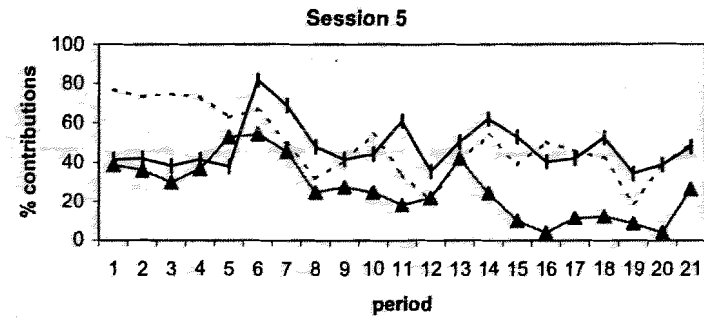
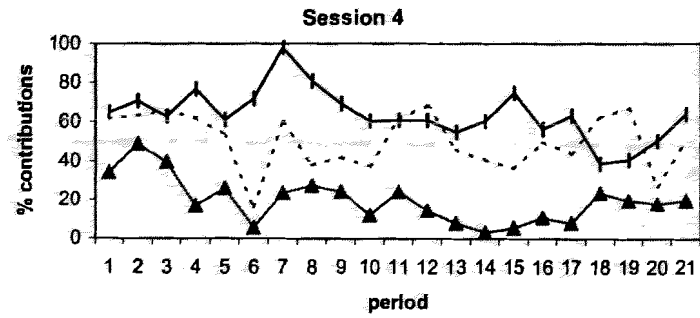


Figure 3: Dynamics of group contributions in 3-group sessions

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