Behavioural Game Theory: An Investigation Into The Relationship Between Experience in Social Dilemmas and Social Preferences

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Abstract:

Our society faces complex problems that can only be solved if individuals work together. These problems, also called social dilemmas, include the broad issues of dealing with climate change, sustainable future and pollution and local issues like marriage and partnerships. In a social dilemma, an individual must allocate a given resource between himself and another player, often through investing in one or several other players. Social preference is the degree to which a player is concerned about his own well-being and the well-being of others. This paper links an individual's experience in a social dilemma to his social preference.

This study focuses on the level of cooperation in the social dilemma. This is because the individual's contribution is considered to be a substantial part of his experience. Social dilemmas were modelled using the Public Goods Game and the Trust Game. These are called experimental games. The Ring Measure of Social Value Orientation was used in order to measure social preferences. This method places the subjects on a continuum from self-interested to altruistic.

Subjects were divided into three groups: The control group verified the short-term stability of the test for social preference. The second group played the Public Goods Game whilst the third group played the Trust Game. The two last groups were tested using the Ring Measure of Social Value Orientation after playing. Social preferences and cooperation were compared by representing both through an index called altruism ratio.

Results showed a positive correlation between altruism ratios in the experimental games and Social Value Orientation. Non-cooperative behaviour between players in the same group was particularly well reflected in social preferences. This demonstrates that an attitude is created through exposure to social dilemmas.

An important difference between social preference and cooperation in social dilemmas is the trust element situated by the investment situation. This makes the correlation less accurate (more so in the Public Goods Dilemma due to the group size) so models of cooperation should be extended to include a measure of trust.

Contents

1. Introduction

> "The health and vitality of relationships, groups, and society at large is strongly challenged by social dilemmas or conflicts between short-term self-interest and long-term collective interest. Pollution, depletion of natural resources, and inter- group conflict can be characterized as examples of urgent social dilemmas"[1].

In a social dilemma, the participant, who we call the player, must choose between a selfish short-term benefit and an altruistic long-term benefit of the public. Social dilemmas exist both at the level of individuals, communities and as global social issues. Examples of global social dilemmas include the issues of dealing with climate change, sustainable future and pollution of our environment. Negotiation processes amongst nations and global organisations are also examples of global social dilemmas.

Personal social dilemmas include the issues of dealing with marriage, friendship and other social relations. The relevance and importance of social dilemmas is evident as we face them each day.

Humans have throughout history been searching for solutions to societal issues such as poverty, pollution and inter-group conflicts. Complex compromises have been made between nations to reduce emissions of green house gases or to aid less economically developed areas. These compromises are in fact only attempts to balance self-interest and the interest of the collective. Self-interest obstructs individual humans, or unified groups of humans, from contributing to the public good.

Utopia, the optimal society for every individual, may simply be said to be a product of mutual cooperation between humans. The reason why this has not been achieved is due the absence of our ability to comprehend social issues and relate to the fact that a small individual contribution, combined with an equal contribution of other individuals, may initiate a process, which eventually may bring us to the optimal society.

It is thus hypothesised that enhancing inter-human cooperation solves our social issues, whether at the level of the individual or that of society. This eliminates the impediment situated by self-interest.

Game Theory becomes relevant in this, as it is an approach used in describing the phenomena of social dilemmas and predicting their outcomes and respective usefulness. In this paper, 'outcome' is denoted *payoff* and 'usefulness' is denoted *utility*. Game Theory unifies social dilemmas through the language of mathematics. This allows us to understand the mechanisms involved in social dilemmas to a greater extent, and model them through representations known as *experimental games*. In these, the player is faced with an ethical problem in which he must allocate a (potential) payoff between himself and others. By observing behaviour in experimental games, we may understand how humans behave when facing real social dilemmas. This creates the foundation of the field known as *Behavioural Game Theory*.

This empirical study employs a measure known as Social Value Orientation (SVO) in order to measure the concept *cooperation* in a social dilemma. Social Value Orientation is the degree to which a player is concerned about his or her own payoff and the payoff of the collective, and is hypothesised to be equal to cooperative abilities in a social dilemma. It is a linear model utilising a player's *preferred* self/other distribution of a resource by graphically representing the distribution on a Cartesian plane. Social Value Orientations are often categorised in four profiles: A) cooperative orientation, B) individualistic/proself orientation, C) competitive orientation and D) aggressive orientation. These will be explained in 2.3.

The games used in this study are the Public Goods Game and the Trust Game (see 2.4).

1.1. Research Objective

The aim of the research is to investigate the link between experience in a social dilemma and social preferences.

In considering the concept *experience*, there is a principle focus on the individual player's cooperation and contribution as this is considered an integral part of the player's experience.

The research question to ask is hence:

To what extent is it possible to predict an individual's social preferences based on his experience in a social dilemma?

The study also maps a player's experience in a social dilemma in terms of the different situations he faces, i.e., being exploited, exploiting or cooperating in their games, and links this to the structural parameters of the experimental games.

1.2. Hypotheses

The Public Goods Game is played in groups of five with anonymous players, where the individual player's payoff from the public good is a function of the *all the players'* contributions to the public good. This means that exploitation and non-contribution to public goods are 'distributed' across more players and reputation building does not occur to the same extent as in a two-player game, such as the Trust Game.

This gives reason to believe the winners and losers will be less defined ('winners' and 'losers' are defined by the situation they face in the experimental game, i.e., being exploited, exploiting or cooperating in their games). This also means that it becomes easier to not contribute in the Public Goods Game, as it is difficult for other players to see whether or not you are contributing. This behaviour is known as *free-riding*.

Null hypothesis h_1:

There is no relationship between cooperation/experience in social dilemmas and the social preferences of the players.

Null hypothesis h_2

Winners and losers appear equally clear in the Trust Game and the Public Goods Game.

Null hypothesis h_3

There is no difference in levels of cooperation in the Public Goods Game and the Trust Game.

2. Methodology

2.1. Procedure

In order to investigate cooperation and experience in social dilemmas, it was necessary to model these using experimental games. The Public Goods Game and the Trust Game model a resource dilemma and a trust dilemma respectively. The games are explained in 2.4.

Social preferences (attitudes), that is, preferred self-to-other utility distributions, were operationalised using the Ring Measure of Social Value Orientation as explained in 2.3.

The experimental design was divided into three separate sessions containing three different groups of subjects.

The subjects in the control group were given questionnaires to test Social Value Orientation. The aim of this was simply to test the stability and reliability of the method assigned to test social preferences. Samples were given the questionnaire twice. The order of the options was changed between the questionnaires to prevent them from copying decisions from the previous questionnaire by filling in responses in the same order. Sudoku was used as a distraction task between the two questionnaires so that subjects would begin the second questionnaire with a clear working memory. Sudoku was not expected to have any effect on the subjects' SVO.

Subjects in the Trust Game Group played the Trust Game. After playing, they were given questionnaires to test SVO.

The subjects in the Public Goods Game group played the Public Goods Game and were hence given questionnaires to test SVO.

None of the participants in this experiment were paid. Participants are sometimes paid in experiments within this field. This is either done as a reward for participating in the experiment, or alternatively as the players' payoffs in the games. As this research project is not funded and does not operate on a budget, it was not possible to pay the participants in any of the activities.

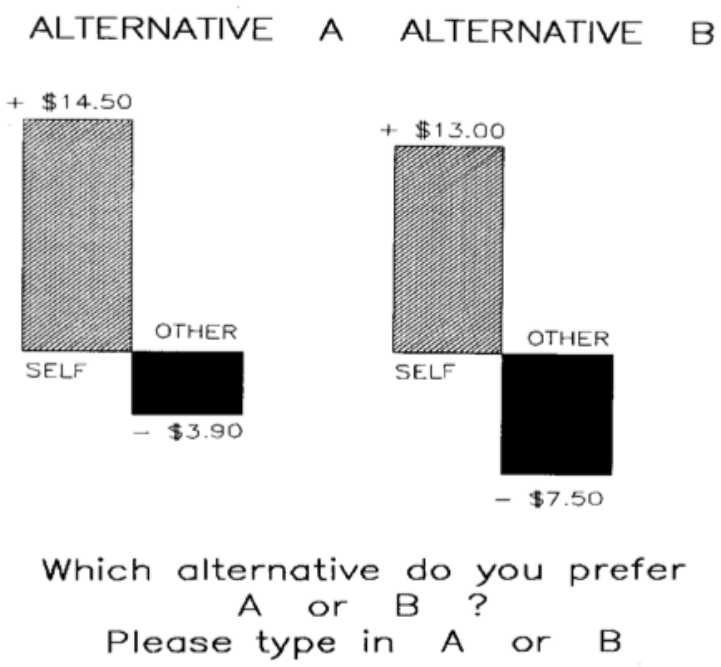
2.2. Samples

The sample size of the experiment is 43 students, all volunteers from St Olav Videregående Skole. The age of the samples is 16-19 years.

2.3. Social Value Orientation

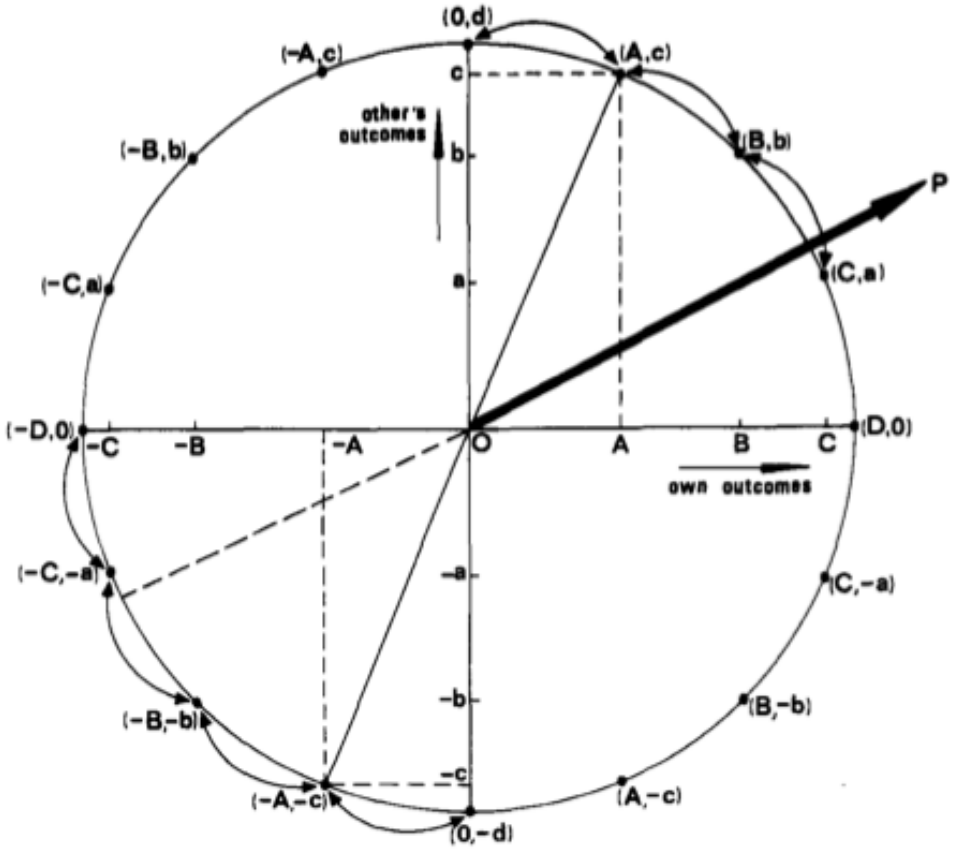
Social Value Orientation provides a measure of social preferences on a continuum from selfish (individualistic) to altruistic. The method used to test Social Value Orientations is known as the Ring Measure of Social Value Orientation[2-3], also called the 'decomposed game technique'. The test is a multiple-choice questionnaire where one chooses between outcomes for oneself versus outcomes of others. Together, these choices constitute an item known as a *decomposed* game (see Figure 1 below). The decomposed games used in the Ring Measure of Social Value Orientation only have two alternatives, meaning that each item contains one outcome pair, where the subject must chose between alternative A or B.

Figure 1 – A decomposed game in the computerised version of the Ring Measure of Social Value Orientation (taken from *European Journal of Personality*, Vol. 2, 1988, p 223).



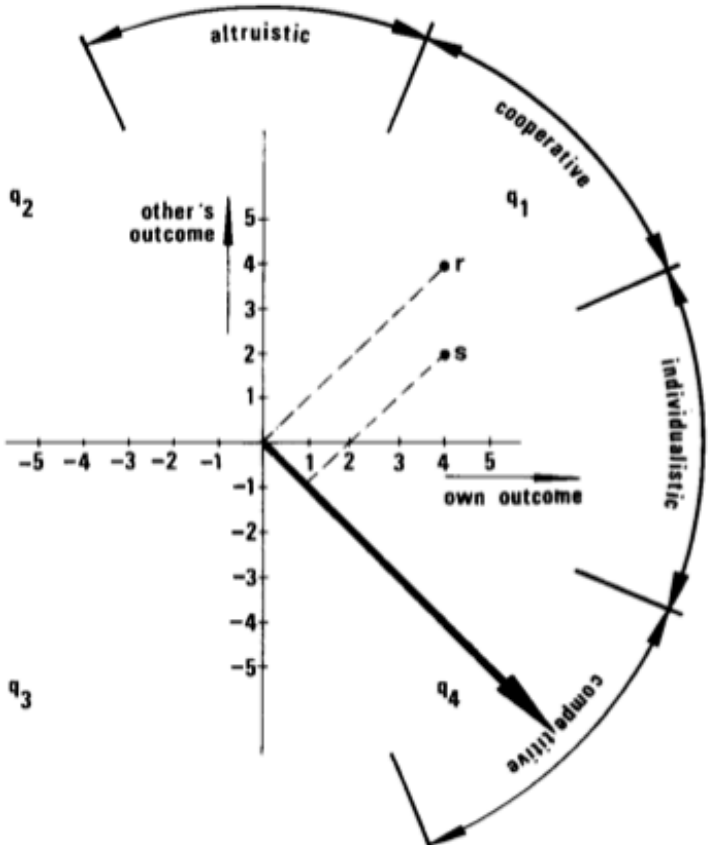
The questionnaire used contains 48 decomposed games[4]. Figure 2 shows how the pairs of outcomes are represented on a Cartesian self-to-other outcome plane featuring a circle with radius *d* (*d* in the Y-axis, D in the X-axis) and centre at the origin. The different pairs of outcomes lie equally spaced from each other on the circumference of this circle in all of the four quadrants. In each decomposed game, the two alternatives lie adjacent to each other on the circle (the figure shows 16 pairs, this questionnaire employs a circle with 48 pairs). The X-axis represents outcomes directed to oneself, and the Y-axis represents outcomes to the other (see Figures 2 and 3 below).

Figure 2 – The different pairs of outcomes represented as points on the circumference of the circle (taken from *European Journal of Personality*, Vol. 2, 1988, p 222).



The different pairs of outcomes each have an opposite pair represented on opposite side of the circle. An example of this is (C, a) and (-C, -a) as may be seen in Figure 2 above.

Figure 3 – The self-to-other outcome plain showing the four quadrants, q_1 to q_4 (taken from *European Journal of Personality*, Vol. 2, 1988, p 219).



When determining the Social Value Orientation of a subject, the values directed to self versus other are summed up to produce a vector extending from the origin. Alternatives A and B given in the decomposed games lie adjacent to each other on the circle and the consistent player will always select the option closest to his preferred coordinate on the circle. The preferred outcome (this is shown as the coordinate (C, a) in Figure 2) should hence be chosen twice and the opposite of the preferred outcome (-C, -a) should never be chosen. In Figure 2, the player is not consistent and therefore the vector does not go through (C, a) but is only close to it.

If *playing consistently*, all alternatives except (C, a) would cancel each other out when they were summed up, as they all have an opposite alternative. An example of this is (B, b) cancelling (B, -b).

(C, a) will not be cancelled, being chosen twice, and so this determines the direction and length of the vector that extends from the origin to (2C, 2a). Note that the distance between this coordinate and the origin is equal to twice the radius of the circle.

A vector length of twice the radius of a circle will only occur if the player is completely consistent in his decision-making strategy. Vector P in Figure 3 does not extend to this coordinate, as the player's decisions were not completely consistent.

The vectors seen in Figures 2 and 3 show the Social Value Orientation of the subject. The final direction of the vector is the sum of all 48 decomposed games. The angle between the final vector and the X-axis is used to classify the vector into different social profiles (altruistic, cooperative, individualistic, competitive – see Figure 3).

All directions of vectors between 112.5 and 67.5 (North = 90; East = 0 degrees) were classified as altruistic; those between 67.5 and 22.5 degrees were classified as cooperative; those between 22.5 and -22.5 degrees as individualistic, and vectors between -22.5 and -67.5 degrees as competitive.

This study only uses 4 profiles of Social Value Orientation as no other angles were obtained.

The length of the vector is derived by finding the distance between the origin and the coordinate representing the sum of outcomes directed to other versus self, this may be done through Pythagoras' theorem. The length of vector is used to show the consistency of the decision-making, and vector lengths below 60 percent of twice the radius of the circle are considered inconsistent.

Subjects were told that they were playing against someone else doing the same test and that the payoff of both was dependent on a combination of their own decision and the other player's decision. This is not true but was done in order to make the setting more realistic.

The time limit constraint of two and a half minutes was not followed for the questionnaires testing Social Value Orientation. It was not realistic and difficult to manage, as subjects did not begin the test simultaneously. Subjects were given time to finish; the average time used was 6-8 minutes.

The questionnaire and instructions used are given in Appendix D and B respectively.

2.4. Experimental games

This section explains the experimental games used in this experiment.

2.4.1. Trust Game

The Trust Game is an experimental game played by two players, the Investor and the Trustee. The game is used in order to measure trust and trustworthiness and models real social dilemmas such as non-binding contracts or informal agreements, in which pure trust is required. The Trust Game is an excellent model of sequential exchanges without binding contracts, e.g. buying from sellers on eBay.

Trust is a highly relevant phenomenon in social dilemmas, as a substantial number of these are based on more or less significant elements of trust and the anticipation of how the other player(s) will play.

The parameters of the game are described below:

The Investor is endowed an amount X from which he invests an amount T in the Trustee. T must be such that $0 \leq T \leq X$. The investment is multiplied by a scale factor r, so that the Trustee receives rT. The Trustee then has to allocate this investment between himself and the Investor, and returns Y such that $0 \leq Y \leq rT$. The Trustee then keeps and earns $rT - Y$ whilst the Investor earns $X - T + Y$.

In this game, the amount invested, T, is used to measure trust whilst the amount returned, Y, is used to measure trustworthiness[5].

2.4.2. Public Goods Game

The Public Goods Game is recognised as a classical experimental social dilemma.

In the Public Goods Game, a group of people use a public resource. If enough players contribute to the resource, this will give a payoff to the individual player that is greater than the resources contributed by the player. However, if the public contributions are inadequate, the payoff returned from contributing is less than the resources contributed.

Consequently, the Public Goods Game models real social dilemmas that are important in our society, such as climate change, sustainable future and pollution of the environment. In all of these, one (or a small number of) player's individualistic actions exploit innocent cooperative parties and counteract their contributions. For example a polluting industry would counteract contributions to preserving the environment from a number of people.

Within Game Theory, this situation is known as the *free rider problem*, where some players use the resource without contributing to it.

The Public Goods dilemma is described in mathematical terms below:

Each of n players can invest resources c_i from their endowment e_i into a public good that is shared by everyone. By doing so, they automatically invest resources $(e_i - c_i)$ into a private exchange that earns a guaranteed fixed payoff given by the linear function $f(e_i - c_i)$, which passes through the origin. Even though the last option is chosen, the player still has the benefit of the public good.

The total value of the public good per player is given to be m. Player i earns $e_i - c_i + m(c_i + \sum c_k) / n + f(e_i - c_i)$ in the game, where $\sum c_k$ represents the sum of the investments made in the public good by all other players than i.

Raising the marginal return m increases contribution to the public good[6]. If $c_i*m/n > f(c_i)$, the player's investment in the public good provides a greater payoff (*by itself)* than the same investment made in the individual exchange, and the dominant strategy is always to contribute to the public good. The game thus loses meaning unless $c_i*m/n < f(c_i)$.

2.5. Experimental design

2.5.1. Trust Game

The Trust Game was administered by dividing subjects into two groups, one at each end of a room. Even though the term 'group' is used to describe distribution of the subjects, all members of the 'group' played individually without any form of communication.

All 14 players were identified using sample numbers, each of which were paired up with another number in a matchmaking system before the experiment. The identification number of the players in each pair was recorded on a sheet of paper on which the subjects were asked to record their decisions, allowing the experimenter to distribute the decisions correctly between the players. Subjects were also informed about their sample number in the game-play instructions that they were given.

Sample numbers were arranged so that Investors had a number below 10 and Trustees had a number above 10. In this way, player 1 (Investor) was paired with player 11 (Trustee), player 2 with player 12 etc. until player 7 and 17.

After the instructions had been made clear to the players, the Investors were asked to record their preferred investment on the sheet they were given. The experimenter hence transferred the sheet on which the investment was recorded to the Trustee with which the Investor was paired. After the Trustees had allocated the tripled investment between themselves and the Investor, the decisions were transferred back to the Investor so that all the players were aware of their payoff.

The Investor was given a fictional 100 NOK in the beginning of the game and the return rate r was 3, meaning that the Trustee received triple the value of the Investor's investment[7]. Fictional money was used instead of points in order to make the setting more realistic. The experimental design was inspired by that of Berg, Dickhaut and McCabe (1995)[8].

The Social Value Orientation test was run after the games had finished. The instructions given to the subjects and the sheets used for recording decisions are included in Appendix B and C respectively.

2.5.2.Public Goods Game

The Public Goods Game was also administered using pen and paper. All of the 15 participants were in the same room and were assigned a subject number. This number was used in the matchmaking, in this way players were not aware of who they are playing against.

Matchmaking was done in such a way that players were playing in groups of five. Each player was endowed with 60 points. They chose between investing in a private exchange or a public exchange. As the marginal return *m* was 2.5, the public exchange yielded £ 0.5 to every player for each point invested by any player and the private exchange yielded £ 1 for each point. All points had to be invested in order to turn them into 'fictional cash'.

Groups and sample numbers assigned for matchmaking are shown in Table 1, below. Note that matchmaking was done in such a way that players sitting next to each other were not in the same group.

Table 1 – Matchmaking of players showing the different groups with their assigned sample numbers.

	Sample numbers				
Group 1	1	4	7	10	13
Group 2	2	5	8	11	14
Group 3	3	6	9	12	15

The method used in conducting the experiment and the parameters of this version of the Public Goods Game were inspired by Andreoni (1995) [9].

2.6. Variables

2.6.1. Independent

The independent variables of the experiment are the structural parameters of the experimental games. Group size varies between the Trust Game and the Public Goods Game. The payoff-mechanisms are also different, where the decision of the individual player is hidden in the overall group payoff in the Public Goods Game. In the questionnaire testing SVO, the subjects were informed that they were paired with another player and that they would not learn the decisions of the other player until after the experiment had been completed.

2.6.2. Dependent

The players' experiences in the experimental games are expected to depend on the structural parameters of the games; experience also includes the clarity of the meaning of the payoff. 'The clarity of the meaning of the payoff' is used to describe how clearly players are able to link their payoff to their investment.

The hypothesis is that the players' scores of Social Value Orientation depend on their experience from the experimental games. In this way, experience is an independent variable at the same time as being indirectly manipulated by manipulating the game parameters. Experience is expected affect the 'attitude' (social preferences given by SVO) of the subjects.

In this way, the independent and semi-independent variables are manipulated with the dependent variables being observed in order to investigate the relationship between cooperation and experience in experimental games and Social Value Orientation.

3. Results

3.1. Short-term stability of Social Value Orientation

The deviations 27.4 and 35.2 degrees were omitted in the calculation of mean and standard deviation as these were considered extreme and unrepresentative values.

Deviations in scores of Social Value Orientation between first and second questionnaire were found to have a mean of 10.52 degrees (SD = 5.61 degrees). This is 1.44 times greater than the angle between two items that lie adjacent to each other on the circle. The mean deviation in length of the vector was observed to be 12.51 % (SD = 5.00 %), where percentage is used to show the actual length of vector divided by the maximum length of the vector. The overall mean vector length was found to be 85.0 % (SD = 10.61 %). The test of Social Value Orientation may thus be considered reliable and stable. The validity of the test was justified using family members and matching their scores to their personality.

This Ring Measure of Social Value Orientation is a recognised and well-established method of testing social preferences within Behavioural Game Theory[2].

The results are shown in Table 2 below:

Table 2 – Showing scores of Social Value Orientation and vector lengths.

Sample number	Other/self ratio$_1$	SVO angle$_1$ (degrees)	Vector Length$_1$	Other/self ratio$_2$	SVO angle$_2$ (degrees)	Vector Length$_2$	Deviation SVO angle (degrees)
1	15/158	5.4	79.4 %	68/184	20.3	98.1 %	14.90
2	62/124	26.6	69.3 %	84/130	32.9	77.4 %	6.20
3	93/164	29.6	94.3 %	145/132	47.7	98.0 %	18.10
4	116/111	46.3	80.3 %	89/161	29.0	92.0 %	17.30
5	168/57	71.3	88.7 %	121/81	56.2	72.8 %	15.10
6	49/143	18.9	75.6 %	74/173	23.2	94.1 %	4.30
7	103/171	31.1	99.8 %	104/129	38.9	82.9 %	7.80
8	18/133	7.4	67.1 %	111/160	34.8	97.4 %	27.40
9	112/126	41.6	84.3 %	79/126	32.1	74.4 %	9.50
10	(-10)/172	-3.3	86.1 %	1/140	0.4	70.0 %	3.70
11	(-10)/166	-3.4	83.1 %	101/163	31.8	95.9 %	35.20
12	65/126	27.3	70.9 %	69/184	20.6	98.3 %	6.70
13	59/153	21.1	82.0 %	98/118	39.7	76.7 %	18.60
14	(-9)/184	-2.8	92.1 %	4/199	1.2	99.5 %	4.00
Mean deviation							10.52
Standard deviation (of mean deviation)							5.61

3.2. Experimental Games

3.2.1. Trust Game

It appears from the results (see Table 3 and Figure 4) that the Trustees return more when the Investors display trust through larger investments (all Trustees returned 50% or more than the tripled investment when the Investor invested 50% or more). This also applies inversely to smaller investments (2/3 of the Trustees returned less than 50% when the Investor invested less than 50% in them).

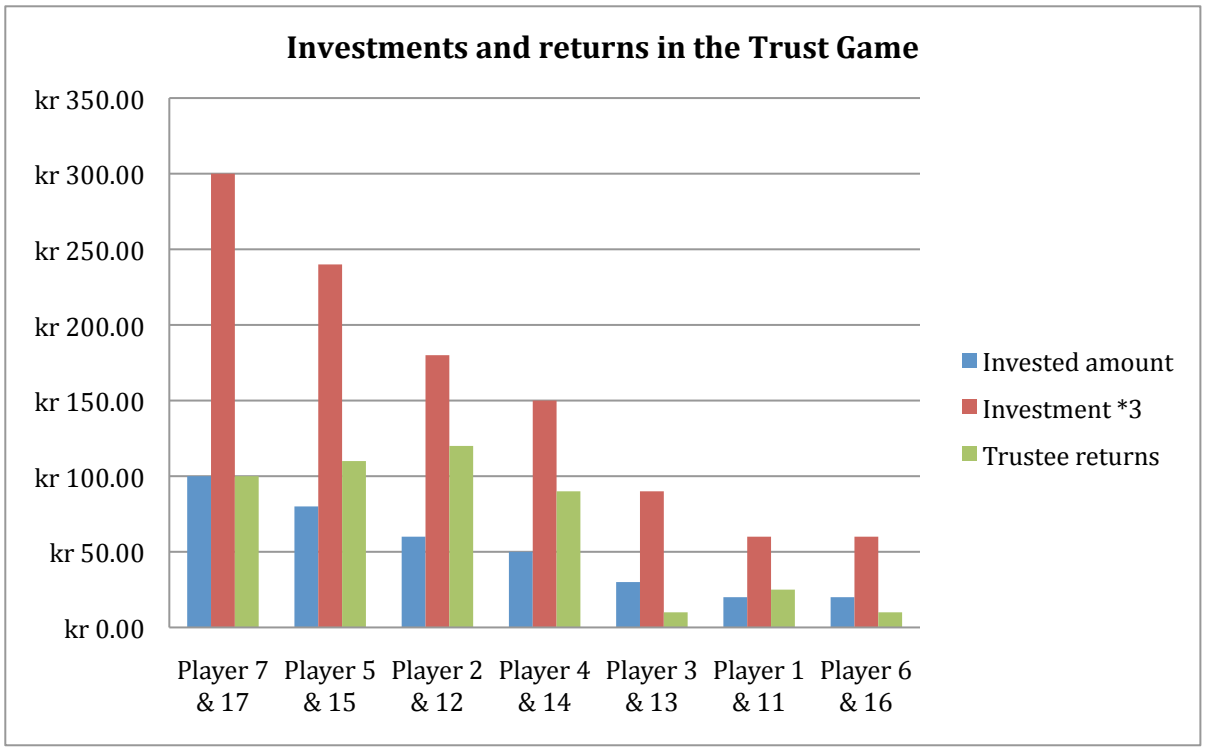
This trend is known as *positive reciprocity* (Trustees reciprocate decisions and return more as the Investment is larger) and has also been reported in more statistically representative and valid surveys described by Camerer and Ernst Fehr (2002)[10].

This means that the experience the individual player acquires from the game becomes clearer, as does the distinction between the 'winners' and 'losers' because players are rewarded for cooperating (see Figure 4).

Table 3 – Decisions in the Trust Game

Player Pair	Invested amount	Investment *3	Trustee returns	Investor SVO angle (degrees)	Trustee SVO angle (degrees)
Player 7 & 17	kr 100.00	kr 300.00	kr 100.00	46.7	2.3
Player 5 & 15	kr 80.00	kr 240.00	kr 110.00	46.8	48.3
Player 2 & 12	kr 60.00	kr 180.00	kr 120.00	N/A	43.5
Player 4 & 14	kr 50.00	kr 150.00	kr 90.00	43.4	-3
Player 3 & 13	kr 30.00	kr 90.00	kr 10.00	60.5	52.7
Player 1 & 11	kr 20.00	kr 60.00	kr 25.00	-12.9	24.3
Player 6 & 16	kr 20.00	kr 60.00	kr 10.00	-1.5	20.1

Figure 4 – Decisions in the Trust Game



Results for testing of SVO after the Trust Game, show that the subjects were consistent in their decision-making, where the mean vector length was 87.5 % and 86.2 % for the Investors and Trustees respectively. Only one (see Table A in Appendix A) player was not classified, this was due to insufficient consistency. The mean SVO angle was 30.5 degrees for the Investors and 26.9 degrees for the Trustees.

The correlation between SVO angle and contribution the Trust Game is calculated by representing both of these in through an index called altruism ratio. This is simply a ratio between a player's investment and the maximum value that the player could invest (allocation of points to the other player divided by the sum of own points and the other's points is used in SVO). These results are shown in Table 4 and graphed in Figure 5.

There was a positive correlation between altruism ratios in the Trust Game and SVO ($r = 0.59$). It is not very strong because the two measurements compared are very different.

An example to illustrate this is the investment of player 5, investing 80 % of his endowment in the Trustee. He had an SVO angle of 46.8 degrees. This angle corresponds to an altruism ratio of 52 % (see Table 4). This gives a deviation of 28 % when comparing the two, which is not valid as both were perfectly sensible cooperative strategies.

Another example is the investment of player 7 in the Trust Game, being 100% of the total points. This gives an altruism ratio of 100%. In SVO however, player 7 only showed an altruism ratio of 51 %. Player 7 demonstrated particularly cooperative behaviour in both activities, as investing all points does not necessarily mean that one is not *returned points*. However the altruism ratios still deviate by 49 %.

The Trustee's allocation of the investment between himself and the other Investor seems very similar to the activity performed in testing of SVO, thus it could be expected that these would have a very strong correlation. However, the phenomenon described earlier as positive reciprocity affects the players' decisions, where they feel more or less obliged to repay the Investor a certain amount, potentially 'disguising' the Trustees' Social Value Orientation.

Nevertheless, there is still a relationship between altruism ratio in the game and in SVO as may be seen in Table 4 and Figure 5. The above examples only aim at explaining the mathematical inaccuracies of the correlation.

The trend seems to be stronger for non-cooperative players, meaning that non-cooperative experience in the game is better reflected in the SVO than cooperative experience. This means that there is an evident increase in SVO altruism as the altruism in the game increases from 0-50%, whilst there is little change from 50% and onwards. The exception of this is the pair of players 3 and 13.

Players 7, 5 & 15, 12, 4, 6 & 16 may be considered to practice a closely related Social Value Orientation in both activities, even though some of their decisions may be more or less affected by the element of *risk* situated by the fact that they face an investment situation or by positive reciprocity (see Table 4).

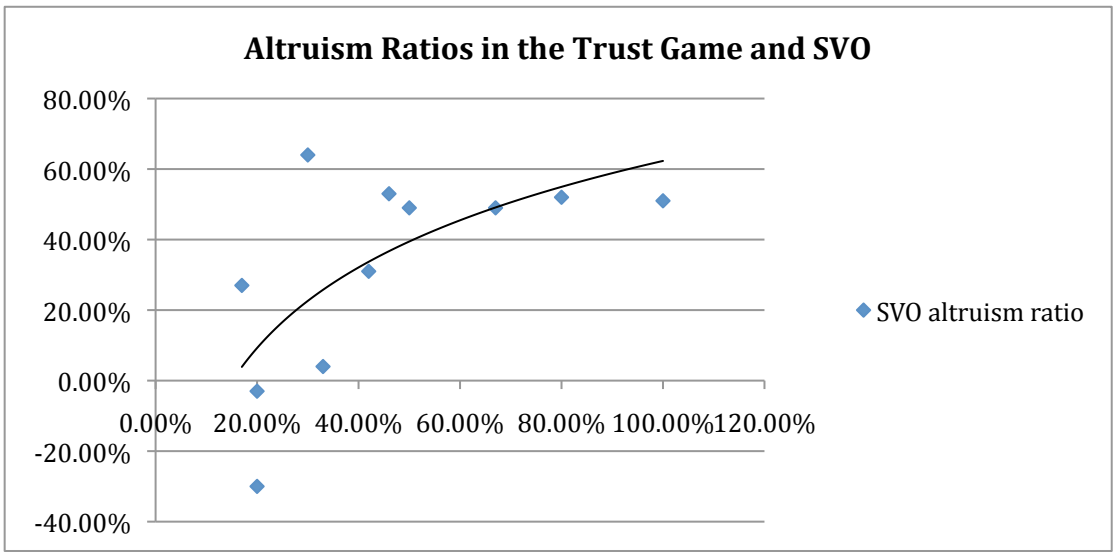
Table 4 – Altruism ratios in the Trust Game and SVO

Sample number	Altruism ratio in game	SVO altruism ratio
1	20.00%	-30.00%
3	30.00%	64.00%
4	50.00%	49.00%
5	80.00%	52.00%
6	20.00%	-3.00%
7	100.00%	51.00%
11	42.00%	31.00%
12	67.00%	49.00%
15	46.00%	53.00%
16	17.00%	27.00%
17	33.00%	4.00%
r = 0.59	*Mean = 0.46, SD = 0.27*	*Mean = 0.32, SD = 0.29*
2	Unclassified	Unclassified
13	0.11	0.57
14	0.60	-0.06

Note that players 13 and 14 were not included in the figure and the correlation coefficient. Player 14 was not included because his SVO altruism ratio was highly competitive and the altruism ratio he displayed in the game was cooperative, as was the rest of his game-play experience (being returned 60 % of his investment).

The same reasoning (yet inverse in values) applies to player 13, having a negative experience in the game and a highly cooperative SVO.

Figure 5 – Altruism ratios in the Trust Game and SVO. The X-axis and Y-axis show altruism ratios in the Trust Game and SVO after playing respectively.



3.2.2. Public Goods Game

Results for the Public Goods Game showed that the mean contribution to the public good was 32.7 points (out of 60), equating an altruism ratio of 54.50%, SD = 26.03 % (see Table B in Appendix A).

The SVO after playing was however far lower, where the mean angle was 21.22 degrees (the equivalent of an altruism ratio of 20.5%, SD = 38.88%) and the mean vector length was 88.15% of maximum length. The raw data may be seen in Table C in Appendix A.

The scores of SVO in the Public Goods Game are significantly lower than in the Trust Game (even more so if one takes into account the extreme competitive values of two players), even though the altruism ratio during game-play is similar. However, the non-cooperative attitudes created after playing support the empirical findings of declines in contributions after time in iterated Public Goods Games[10], as the non-cooperative attitudes affect the players in the next round of playing the game.

This confirms null-hypothesis h_3 in terms of contributions in the game, but falsifies it in terms of the general attitudes created through experience with these games – the general attitude created by exposure to the Public Goods Game and the Trust Game is less cooperative in the first mentioned.

There is a positive correlation between altruism ratios in Public Goods Games and SVO (r = 0.45). However, this correlation is weaker than in the Trust Game. Contribution in the Public Goods Game is a concept that is more different from SVO than the contribution in the Trust Game, as the 'trust' in the Public Goods Game is distributed across more players.

This falsifies null-hypothesis h_2 as findings suggest that the meaning of the payoff from the Public Goods Game was less clear than that of the Trust Game. Winners and losers are thus less pronounced in the Public Goods Game, as there is generally more uncertainty as to whether one is cooperation or being exploited.

The reason why this occurs is because a rational investment in the public good is based on an anticipation of what the rest of the group will contribute. This becomes a complex form of trust, with complex risks of being exploited. Therefore the individual player's SVO may be disguised through these, manifesting less evidently in the form of an investment. The player's altruism ratios in the Public Goods Game and SVO are shown in Table 5 and Figure 6.

The findings concerning the correlation between altruism ratio in SVO, the Trust Game and the Public Goods Game, falsify null-hypothesis h_1.

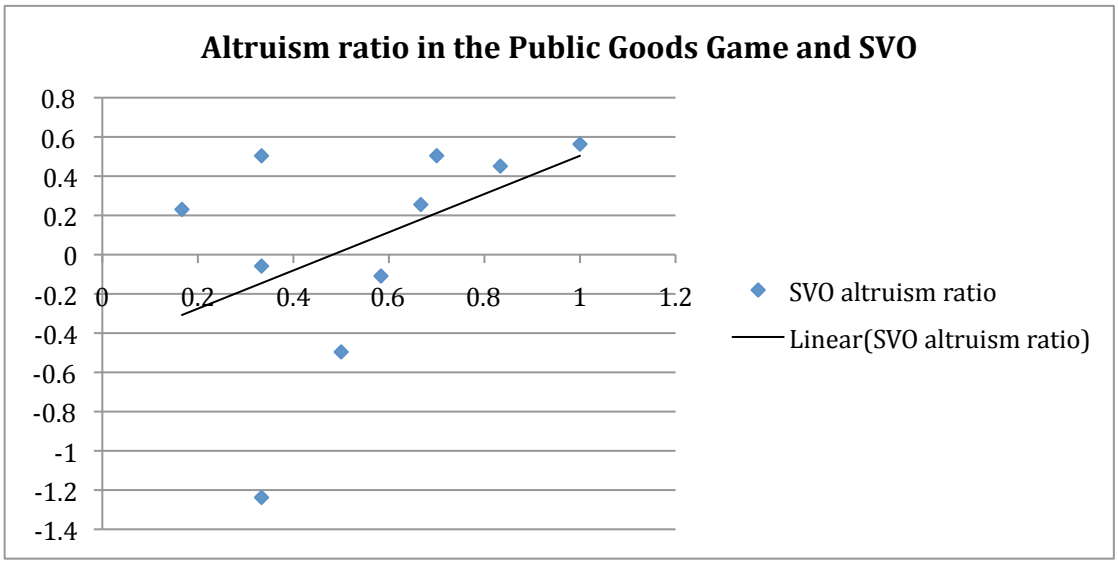
Table 5 – Altruism ratios in the Public Goods Game and SVO

Sample number	Altruism ratio PG game	SVO altruism
1	33.33%	50.38%
2	83.33%	45.10%
3	70.00%	50.42%
4	66.67%	25.53%
5	16.67%	23.04%
10	100.00%	56.32%
11	33.33%	-123.75%
12	50.00%	-49.59%
13	33.33%	-5.82%
14	58.33%	-10.91%
r = 0.45	*Mean = 54.5 %, SD = 26 %*	*Mean = N/A (strong positive skew)*
6	83.33%	-65.15%
7	58.33%	-41.79%
8	100.00%	-11.31%
9	33.33%	-350.00%

Note that samples 6-9 have not been included in the figure or the correlation coefficient. The Samples 6 and 7 had vector lengths below 60% and were thus not classified. Sample 8 is not consistent across both activities in his decision-making as he invests his entire endowment in the game (cooperative/altruistic orientation) whilst having a negative altruism ratio in SVO.

Player 9 demonstrated an extremely competitive orientation in SVO, whilst having an altruism ratio of 33.33% in the game. The altruism ratio in SVO (-350%) does not adhere to that of other players and is considered extreme.

Figure 6 – Altruism ratio in the Public Goods Game and SVO shown on the X-axis and Y-axis respectively. An altruism ratio of 80 % equates one of 0.8



3.3. Sources of error

The sample size of the experiment is too small to obtain strong statistical support. A far larger sample size would be required in order to do so, although the resources available for this study were limited. However, some of the trends discussed in this paper have been described separately in prior research. Findings do nevertheless occur and are discussed and supported using scientific reasoning.

The fact that the time limit was not followed in the questionnaires that tested Social Value Orientation also means that the decision-making of the samples was not necessarily spontaneous. Hence their decision-making may have been less affected by the experience they had earned from the experimental game.

The design of the control subjects session may have made subjects suspect that the experiment was about detecting change in behaviour between the two questionnaires. This means that their Social Value Orientation may have varied more than it would have if this were not the case. The position of the Ring Measure of Social Value Orientation in Behavioural Game Theory research confirms the validity of the method, despite any unnecessary deviation caused by the above source of error.

The index designed to compare behaviour in the experimental games and SVO (altruism ratio) may not be accurate for negative values, as one can have a negative altruism ratio in SVO but not in the experimental games (it is not possible to invest a negative value).

Finally, the fact that participants were not paid means that the attitude and value of their payoff from the game may have been more diffuse. It is hypothesised that the correlation between experience in a social dilemma and social preference after playing would be stronger if participants had been paid.

4. Discussion

4.1. Correlations

The correlations between altruism ratios in experimental games and SVO show that exposure to experimental games created an attitude, particularly from non-cooperative experience in the games. There are inaccuracy issues with the index used to compare the two concepts, as only a few aspects of the game are measured numerically. No index was created for 'experience', although the situation of the subjects in the Trust Game was considered and players following an apparently similar Social Value Orientation in both the game and SVO test were identified in 3.2.1.

4.2. Winners and losers

As to the formation of winners and losers in experimental games, it has been observed that these are more evident in the Trust Game than in the Public Goods Game due to positive reciprocity in the former. The positive reciprocity has important practical applications, as it predicts that trustworthiness increases with the trust shown due to moral obligation of returning this. Showing high trust, for instance in a sequential exchange, increases one's chances of being repaid.

4.3. Group size

The interpretation of the slighter differentiation between winners and losers in the Public Goods Game is that it is due to the complexity linked to the group size in this game. The trust is distributed across more players and hence the players' moral obligation towards contributing is reduced, reducing the effect of positive reciprocity caused by each *individual* player's investment.

This is highly relevant for real Public Goods Dilemmas such as dealing with climate and sustainable future. A simplification of a situation illustrating this is that of a person deciding to take the bus to work once, as he would like to contribute to the reduction of emissions of greenhouse gases. The bus takes more time than he had expected and he is late for work on an important day. This certainly creates an attitude (far stronger than the one in this study) and the person may never take the bus to work again.

Making such a contribution is not in his self-interest, and generally not in other humans' self-interest either, as it does not pay off for the individual. Humans struggle to relate to the issue of climate change and sustainable future simply because it is difficult to relate to the problem and make one's way through the complexity of the great group size of this game.

Prior research has shown that cooperation declines as the group size increases[11]. This may be interpreted as a loss of group identity and moral obligation to contribute with increased group size. In real Public Goods Dilemmas, it is often difficult for an individual to understand the usefulness and meaning of his contribution.

In dealing with real Public Goods Dilemmas, such as important global issues of contemporary society, it is hence necessary to find schemes that allow individuals to relate to the problem, such as making humans cooperate for a better future through sharing responsibility in small collectives. We need to feel a sense of group identity and obligation towards contributing in order to function as a group. It is unreasonable to expect humans to contribute to the public good without them fully understanding the value of their contribution.

4.4. Attitudes

When it comes to the correlation between altruism ratios in experimental games and SVO, these may be interpreted as either being *attitudes* created by exposure to social dilemmas or decision-making that remained consistent throughout both activities. The fact that the correlation was more significant for non-cooperative experience suggests that aggressive attitudes could have been created as a consequence of experience in the games.

When considering scores of SVO found in Table 2, Table A and Table C (Appendix A) it is evident there are less angles in the interval $15 < \theta < 35$ after playing experimental games than after the control subjects test. This means that more angles are below 15 degrees or above 35 degrees in SVO scores after playing experimental games, meaning that attitudes are either more cooperative or more competitive. This suggests that an attitude was created through exposure to experimental games.

The duration and practical importance of the attitude created from a social dilemma may not be easily linked to the empirical findings from this study. This is simply due to the diversity of real situations and interpretations of a situation that an individual may face in a social dilemma. However it has been shown that the attitude indeed occurs. The fact that the attitude occurs means that the player's Social Value Orientation is affected, whether to a greater or smaller extent. This again demonstrates the importance of creating awareness of the mechanisms involved in social dilemmas.

Through repeated exposure to different types of experimental games, we may promote cooperative behaviour by making players consider the mechanisms of the dilemmas and minimise subjective decision-making in the real social dilemmas that we face every day. Training humans using experimental games is still a research topic but could prove to have important practical applications, such as allowing politicians to make better and more rational decisions. If training humans using experimental games promotes cooperation, these games may become an exceedingly effective approach to solving social dilemmas.

4.5. Findings concerning cooperation

The findings concerning the correlation between altruism ratio in the Trust Game and SVO show that there is a definite correlation between the two, even though the concepts are different. This has been interpreted as there being a relationship, yet still a difference, between preferred self-to-other outcome distributions and trust. However, both of these are essential components in cooperation. The models measuring cooperative abilities would gain accuracy by extending to include a measure of the player's *willingness* to practice his preferred self-to-other outcome distributions despite the risk of being exploited, this willingness is called *trust*.

Player 7 in the Trust Game was willing to invest his entire endowment, hoping to achieve a cooperative (not altruistic) return from the Trustee. This social preference was shown by his Social Value Orientation. Even though he demonstrated an altruism ratio of 100% in the game, he still only had a Social Value Orientation altruism ratio of 51% in the test. At the same time, an individualistic player could invest up to 40 % of his endowment and still be considered individualistic, as he was willing to invest 40 % in the hope of earning more.

The same principle naturally also applies to the Public Goods Game. The cooperative abilities of these players are not only given by their social preference, but in fact also by their trust.

These findings are highly relevant to the aim of the experiment and research question, as the contribution/investment of a player constitutes a substantial part of his experience in the experimental game. Thus it is also relevant to how Social Value Orientation reflects experience in the games.

5. Conclusions and summary

Exposure to social dilemmas has been shown to create attitudes towards preferred self-to-other outcome distributions, particularly for non-cooperative experiences in the dilemma. This attitude demonstrates the importance of exposing humans to experimental games in order to prevent the formation of non-cooperative subjective attitudes.

However, we observe that a player's cooperation in a social dilemma, constituting a substantial part of his experience, is not perfectly correlated with Social Value Orientation. Models of cooperative abilities such as the Ring Measure of Social Value Orientation may gain accuracy by extending beyond simply being a measure of a subject's social preferences, but also a measure of his willingness to practice this preference, despite the risk of being exploited. This again means that a player's social preference does not reflect his experience in a social dilemma in the most accurate way.

Consequently, any predictions of a player's social preferences based on his experience from a social dilemma may only be approximations at the level of categorising the player as being cooperative, competitive or altruistic. Even if an index of cooperative abilities based on trust and social preferences was to be derived, it would be necessary to acquire a measure of the trust of all players in order to accurately predict their social preferences.

Despite these reservations, this study was successful and met the goals I was trying to achieve.

5.1. Summary

Our society faces complex problems that can only be solved if individuals work together. These problems, also called social dilemmas, include broad issues of dealing with climate change, sustainable future and pollution and local issues like marriage and partnerships. In a social dilemma, an individual must allocate a given resource between himself and another player, often through investing in one or several other players. Social preference is the degree to which a player is concerned about his own well-being and the well-being of others. This paper links an individual's experience in a social dilemma to his social preference.

This study focuses on the level of cooperation in the social dilemma. This is because the individual's contribution is considered to be a substantial part of his experience. Social dilemmas were modelled using the Public Goods Game and the Trust Game. These are called experimental games. The Ring Measure of Social Value Orientation was used in order to measure social preferences. This method places the subjects on a continuum from self-interested to altruistic.

Subjects were divided into three groups: The control group verified the short-term stability of the test for social preference. The second group played the Public Goods Game whilst the third group played the Trust Game. The two last groups were tested using the Ring Measure of Social Value Orientation after playing. Social preferences and cooperation were compared by representing both through an index called altruism ratio.

Results showed a positive correlation between altruism ratios in the experimental games and Social Value Orientation. Non-cooperative behaviour between players in the same group was particularly well reflected in social preferences. This demonstrates that an attitude is created through exposure to social dilemmas.

An important difference between social preference and cooperation in social dilemmas is the trust element situated by the investment situation. This makes the correlation less accurate (more so in the Public Goods Dilemma due to the group size) so models of cooperation should be extended to include a measure of trust.

6. Further research

It would be useful to repeat this experiment with a larger sample size and paid participants in order to improve the reliability of the results.

Furthermore, it would be useful to investigate the effect of prolonged exposure to experimental games on cooperative abilities, thus whether or not these should be introduced to educational systems in order to enhance inter-human cooperation.

Researching new models of cooperation by creating and testing indices that combine trust and social preferences could also be interesting in improving our understanding of cooperation. By understanding better how cooperation works, we may also find ways to enhance inter-human cooperation, approaching social issues through Game Theory.

7. Acknowledgements

I wish to thank Dr Ion Juvina for introducing me to Game Theory and experimental games. The support and help from my friends Simon, Vigdis and Cecilie in testing the experimental games and collecting samples for the experimental sessions has been of vital importance. Thanks to my brother Andreas for reading out endless rows of subject decisions, and to my mother and father for supporting my work and giving me advice.

A special thanks to Dr Kim Damstra, your advice gave me a direction out of the confusion caused by the technical concepts of Game Theory. Finally, I would like to give a special thanks to Professor Ola Kvaløy for assisting me with the research aim and the experimental design.

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Appendix A – Data

Table A – SVO for Investors and Trustees after the Trust game

Sample number (Investors)	SVO angle	Vector	Altruism ratio
1	-12.9	85.10%	-0.3
2	N/A	N/A	Unclassified
3	60.5	92.50%	0.64
4	43.4	75.70%	0.49
5	46.8	100.00%	0.52
6	-1.5	77.50%	-0.03
7	46.7	94.80%	0.51
	Mean = 30.5	*Mean = 87.5*	*Mean = 0.3*

Sample number (Trustees)	SVO angle	Vector	Altruism ratio
11	24.3	90.00%	0.31
12	43.5	93.00%	0.49
13	52.7	100.00%	0.57
14	-3	94.10%	-0.06
15	48.3	93.10%	0.53
16	20.1	71.30%	0.27
17	2.3	62.10%	0.04
	Mean = 26.9	*Mean = 86.2 %*	*Mean = 0.3*

Table B – Decisions and payoffs in the Public Goods Game

Sample number	Individual exchange	Group exchange	Total group investment	Total payoff	Altruism ratio PG game
1	40	20	175	£127.50	33.33%
2	10	50	175	£97.50	83.33%
3	18	42	172	£104.00	70.00%
4	20	40	175	£107.50	66.67%
5	50	10	175	£137.50	16.67%
10	0	60	175	£87.50	100.00%
11	40	20	175	£127.50	33.33%
12	30	30	172	£116.00	50.00%
13	40	20	175	£127.50	33.33%
14	25	35	175	£112.50	58.33%
Without samples 6-9	*Mean 24.86*	*Mean = 32.7 SD = 15.6*		*Mean = £ 114.07*	*Mean = 54.5% SD = 26.03 %*
6	10	50	172	£126.00	83.33%
7	25	35	175	£112.50	58.33%
8	0	60	175	£87.50	100.00%
9	40	20	172	£126.00	33.33%

Table C – SVO after playing the Public Goods Game

Sample number	SVO angle (degrees)	Vector length	Altruism ratio
1	45.44	92.63%	50.38%
2	39.4	90.59%	45.10%
3	45.48	84.15%	50.42%
4	18.92	92.50%	25.53%
5	16.66	76.72%	23.04%
10	52.2	67.71%	56.32%
11	-28.95	102.28%	-123.75%
12	-18.34	96.92%	-49.59%
13	-3.15	100.15%	-5.82%
14	-5.62	91.94%	-10.91%
Without samples 6, 7, 8, 9 or 11	*Mean = 21.22*	*Mean = 88.15%*	*Mean = 20.50% SD = 35.88 %*
6	N/A	N/A	Unclassified
7	N/A	N/A	Unclassified
8	-5.8	93.98%	-11.31%
9	-37.87	96.91%	-350.00%

Appendix B – Instructions

Testing of Social Value Orientation:

This task deals with decision-making. As you will soon see, we'll be asking each of you to make choices in a series of decision problems. We fully expect that different people may have different preferences, and we are interested in knowing what choice YOU, as an individual, prefer most in each decision problem. So, during this task, please make the choices you think are best.

In the upcoming decision tasks, you have been randomly paired with another person whom we refer to simply as other. You will never knowingly meet or communicate with this other, nor will (s)he ever knowingly meet or communicate with you. In this decision task, both you and the other will be making choices by circling the letter A or B on your response sheet. Your own choices will produce money for yourself and the other. Likewise, the other's choice will produce money for him/her and for you. Therefore the TOTAL money you receive depends on your own choice and the other's choice as well. Similarly, the other's TOTAL money depends on his/her choices and your choices as well. An example of the decision task is displayed below.

	A	**B**
You Get	100	60
Other Gets	80	0

In this example, if you choose A you would receive 100 pounds for yourself and the Other would receive 80 pounds. If you choose B you would receive 60 pounds for yourself and the other would receive 0. So, you see that your choice influences both your own payoffs and the payoffs of the other person as well. Remember that the other person is also choosing between A and B. Look at the decision problem from his/her point of view. If (s)he chooses A, then (s)he receives 100 pounds for him/herself, and you receive 80. If (s)he chooses B, then (s)he receives 60 pounds for him/herself and you receive 0. So, you also see that the other person's choice influences both his/her own payoffs and your own payoffs as well.

Thus, you own TOTAL payoff, the total number of pounds you receive on each decision problem, is determined by your own choice in combination with the choice of the other person. Likewise, the other person's TOTAL payoff is determined by his/her own choice in combination with your choice.

In just a moment, we will ask you to make a series of decisions. Before you begin we want to ask you to imagine that the money involved with the decisions have value to you: specifically, the more of them you accumulate the better. Also, imagine that the other person feels about his/her own money the same way; the more of them (s)he accumulates, the better. For each decision, make the choice the YOU, for whatever reason, consider being the best. Please indicate your choice by circling A or B for each of the 24 decision tasks below. Choose the column [A or B] that YOU consider to be the best choice, for whatever reason.

Please note that you will only be given five complete this task. Wait for signal from the administrator to proceed to the task on the two next pages.

Trust Game:

You have been asked to participate in an economics experiment. Now that the experiment has begun we kindly ask you not to talk to anyone during the experiment. In this experiment, you will be playing the game that is described below. Please ask if you have any questions before or during the game-play session.

Game Parameters

Each of you will be paired with another person. You will not be informed who this person is either during or after the experiment. You will now be split into two groups; each of these will contain one player in each pair. One of the groups is called the Investors and the other is called the Trustees. The Investors are asked to imagine that they are given a sum of 100 NOK. Each member of this group is paired with ONE member of the other group and must decide on how much of these 100 NOK they wish to invest in this person.

The sum invested is hence tripled, meaning that the Trustee is left with three times the sum that the Investor invested in him/her. The Trustee now has to decide on how to distribute this sum between himself/herself and the Investor.

Note that the game only employs fictional money. You are asked to **imagine that the money is real** and that **they have a value to both YOU and the OTHER player**. Make the decision that YOU feel is the best, for whatever reason.

Recording Decisions

Note that you have been a sheet on which to record your decisions. **The first column** is already filled in with your player number and the player number of the person you are playing against. The second, third and fourth columns are to be filled in by the Investor. In the **second column**, the Investor must write down how much of the 100 NOK that he/she would like to invest in the Trustee. In the **third column**, the Investor must write down how much he/she is left with, out of the 100 NOK. In the **fourth column**, the Investor must write down the value of his/her investment when this is multiplied by three.

The Trustee fills out the last two columns. In the **fifth column**, the Trustee writes down how much he/she would like to return (out of the tripled investment). The **sixth column** should simply show how much the Trustee is left with after returning parts of the investment.

After you have made your decisions, notify the experimenter that you have finished. The experimenter will collect and manage your decisions.

Examples

The Investor decides to **invest 50 NOK** and thus keeps 100-50 = 50 NOK; the Trustee hence receives 3*50 = 150 NOK as the investment is tripled. The Trustee decides to **return 40 NOK** and therefore keeps 150-40 = 110 NOK. The Investor thus gains 50+40 = 90 NOK and the **Trustee gains** 110 NOK.

The Investor decides to **invest 80 NOK** and thus keeps 100-80 = 20 NOK; the Trustee hence receives 3*80 = 240 NOK as the investment is tripled. The Trustee decides to **return 150 NOK** and therefore keeps 240-150 = 90 NOK. The **Investor thus gains** 20+150 = 170 NOK and the **Trustee gains** 90 NOK.

Confidentiality

Also note that no that information about your decisions will not contain your name; each player remains anonymous throughout the experiment.

Public Goods Game:

You have been assigned to a group of 5 people. The members of the group will remain anonymous during the entire experiment, meaning that you do not know whom you are playing against either before or after the experiment. We kindly ask that do not discuss your decisions or the experiment itself with anyone else after the experiment has been completed.

You will be given an investment account with a total of 60 points in it, so will the other members of your group. These points are invested to turn them into fictional cash. You are asked to **imagine that the fictional money is real** and that **they are of value both to YOU and to the OTHER** members of the group.

All of the points must be invested in order to turn them into cash. Your task is simply to distribute them between an Individual Exchange and a Group Exchange. These work as follows:

Individual exchange:

> Every point you invest in the Individual Exchange will earn fictional £ 1.
>
> Example: Suppose you invested 55 points in the Individual Exchange, this would then provide a payoff of £ 55 **from the Individual Exchange.**
>
> Example: Suppose you invested 30 points in the Individual Exchange, this would then provide a payoff of £ 30 **from the Individual Exchange.**
>
> Examples: Suppose you invested 0 points in the Individual Exchange, this would then provide a payoff of £ 0 **from the Individual Exchange.**

Group exchange:

Your payoff from the Group Exchange depends on the **total number of points that you and the other members of the group** invest in the Group Exchange. The more the **group** invests in the exchange, the more **each individual group member** earns. The payoff of this exchange is best depicted through the following examples:

> *Example*. Suppose that you invested 0 points in the Group Exchange and that the total investment from your group in the Group Exchange was 100 points. Then your earnings **from the Group Exchange** would be £ 50. Everyone else in your group would also earn £ 50.
>
> *Example*. Suppose that you invested 40 points in the Group Exchange and that the other four members of your group invested a total of 80 points. This makes a total of 120 points. Your return **from the Group Exchange** would be £ 60.The other four members of the group would also get a return of £ 60.
>
> *Example*. Suppose that you invested 60 points in the Group Exchange, but that the other four members of the group invested nothing. Then you, and everyone else in the group, would get a return **from the Group Exchange** of £ 30.

As you can see, every point invested in the Group Exchange will earn fictional £ 0.5 for **every member of the group**, not just the person who invested it. It does not matter who invested the points in the Group Exchange. Everyone will get a return from every point invested – whether they invest in the Group Exchange or not. When making the decisions, remember to choose what YOU think is the best, for whatever reason. The fictional money that you accumulate is of value both to YOU and to the OTHER members of the group. The more you accumulate, the better for you. Likewise, the more the other players accumulate, the better for them.

Your decisions and corresponding payoffs are to be recorded on the form you have been given. You are to fill in the first two columns of the sheet, showing how you allocate your 60 points between the Individual Exchange and the Group Exchange. After you have done so, notify the experimenter that you have finished. He will hence collect your decisions and return your earnings/payoffs.

Appendix C – Forms used in Recording Decisions

Trust Game:

Player Number	Investor invests	Investor keeps	Investment multiplied by 3	Trustee returns	Trustee keeps
1 vs. 11					

Public Goods Game

Player Number	Investment in individual exchange (points)	Investment in group exchange (points)	Total investment in group exchange for all group members (points)	Payoff from group exchange (in £)	Payoff from individual exchange (in £)	Total payoff (in £)
1						

Appendix D – Questionnaire Used in Testing of SVO

		A	B			A	B
1	You Get	£ 38	£ 26	**13**	You Get	£ -79	£ -71
	Other Gets	£ -92	£ -97		Other Gets	£ 61	£ 71

		A	B			A	B
2	You Get	£ -71	£ -61	**14**	You Get	£ 92	£ 87
	Other Gets	£ 71	£ 79		Other Gets	£ -38	£ -50

		A	B			A	B
3	You Get	£ 79	£ 71	**15**	You Get	£ -97	£ -92
	Other Gets	£ -61	£ -71		Other Gets	£ 26	£ 38

		A	B			A	B
4	You Get	£ 61	£ 71	**16**	You Get	£ -13	£ -26
	Other Gets	£ 79	£ 61		Other Gets	£ -99	£ -97

		A	B			A	B
5	You Get	£ 0	£ -13	**17**	You Get	£ -79	£ -87
	Other Gets	£ -100	£ -99		Other Gets	£ -61	£ -50

		A	B			A	B
6	You Get	£ 92	£ 97	**18**	You Get	£ -38	£ -26
	Other Gets	£ 39	£ 26		Other Gets	£ 92	£ 97

		A	B			A	B
7	You Get	£ 99	£ 100	**19**	You Get	£ -26	£ -38
	Other Gets	£ 13	£ 0		Other Gets	£ -97	£ -92

		A	B			A	B
8	You Get	£ 61	£ 50	**20**	You Get	£ 0	£ 13
	Other Gets	£ -79	-£ 89		Other Gets	£ 100	£ 99

		A	B			A	B
9	You Get	£ 38	£ 50	**21**	You Get	£ 26	£ 38
	Other Gets	£ 92	£ 87		Other Gets	£ 97	£ 92

		A	B			A	B
10	You Get	£ -100	£ -99	**22**	You Get	£ -50	£ -38
	Other Gets	£ 0	£ 13		Other Gets	£ 87	£ 92

		A	B			A	B
11	You Get	£ 79	£ 87	**23**	You Get	£ 13	£ 0
	Other Gets	£ 61	£ 50		Other Gets	£ -99	£-100

		A	B			A	B
12	You Get	£ -50	£ -61	**24**	You Get	£ -38	£ -50
	Other Gets	£ -87	£ -79		Other Gets	£ -92	£ -87

		A	B			A	B
25	You Get	£ 71	£ 79	**37**	You Get	£ 97	£ 99
	Other Gets	£ 71	£ 61		Other Gets	£ 26	£ 13
		A	**B**			**A**	**B**
26	You Get	£ -13	£ 0	**38**	You Get	£ -61	£ -71
	Other Gets	£ 99	£ 100		Other Gets	£ -79	£ -61
		A	**B**			**A**	**B**
27	You Get	£ 50	£ 38	**39**	You Get	£ -99	£ -97
	Other Gets	£ -87	£ -92		Other Gets	£ 13	£ 26
		A	**B**			**A**	**B**
28	You Get	£ -92	£ -97	**40**	You Get	£ -97	£ -99
	Other Gets	£ -39	£ -26		Other Gets	£ -26	£ -13
		A	**B**			**A**	**B**
29	You Get	£ 87	£ 79	**41**	You Get	£ 97	£ 92
	Other Gets	£ -50	£ -61		Other Gets	£ -26	£-38
		A	**B**			**A**	**B**
30	You Get	£ -87	£ -79	**42**	You Get	£ -92	£ -87
	Other Gets	£ 50	£ 61		Other Gets	£ 38	£ 50
		A	**B**			**A**	**B**
31	You Get	£ -99	£ -100	**43**	You Get	£ 99	£ 97
	Other Gets	£ -13	£ 0		Other Gets	£ -13	£ -26
		A	**B**			**A**	**B**
32	You Get	£ 100	£ 99	**44**	You Get	£ 87	£ 92
	Other Gets	£ 0	£ -13		Other Gets	£ 50	£ 38
		A	**B**			**A**	**B**
33	You Get	£ 71	£ 61	**45**	You Get	£ -87	£ -92
	Other Gets	£ -71	£ -79		Other Gets	£ -50	£ -38
		A	**B**			**A**	**B**
34	You Get	£ 26	£ 13	**46**	You Get	£ -71	£ -79
	Other Gets	£ -97	£ -99		Other Gets	£ -71	£ -61
		A	**B**			**A**	**B**
35	You Get	£ -26	£ -13	**47**	You Get	£ -61	£ -50
	Other Gets	£ 97	£ 99		Other Gets	£ 79	£ 87
		A	**B**			A	B
36	You Get	£ 13	£ 26	**48**	You Get	£ 50	£ 61
	Other Gets	£ 99	£ 97		Other Gets	£ 87	£ 79