

Exploring the Influencing Factors of Cooperative Behavior Based on Social Value Orientation and Reward Approach Perspective

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Abstract. This study deploys a public goods game experiment using oTree's online behavioural experimental research platform to investigate the effects of introducing different types of rewards on the cooperative behaviour of two types of groups. There are four types of experimental categories. In the public goods game experiment, subjects were first required to perform a triple response matrix to determine the social attributes of individuals, and then to conduct four different types of investment decision experiments in turn. The results of the experiment showed that subjects with different social attributes showed different investment decision behaviours in teamwork, and different types of rewards also influenced the subjects' performance in cooperative behaviour, but the interaction between individual social attributes and reward types did not find significant evidence of an effect on cooperative behaviour at present. After further regression analysis, the present study found that material rewards had a more significant effect on changing subjects' behaviour than mental rewards and that both continuous and fixed interval material rewards had a significant positive effect on subjects' cooperative behaviour. The results in this study suggest different reward methods and the response of team members to the reward methods, and how to establish a positive link between reward incentives and cooperation to facilitate the achievement of cooperative goals.

Keywords: Social attributes, Public goods game experiment, oTree, Reward type

1. Introduction

1.1. Research Background

Cooperation means that there are consistent goals between individual and individual, group and group, and to act together with each other to achieve the goal together. In many fields such as social interaction, science and technology and economy, cooperation and competition are widespread, and cooperation is the basis for the stable and sustainable development of human society and economic system. However, the social dilemma of maximizing individual interests and collective interests' maximization still exists.

1.2. Study purpose and significance

This study will use the behavioral experimental model of public goods to introduce different types of "reward" mechanisms under the variables based on social value orientation and to study the interaction of reward types in different dimensions in the process. The first aim was to explore students with different social value orientation types and whether they influence their willingness to cooperate after the introduction of reward mechanisms. Then produce what degree and what type of impact. The second research purpose is to explore the type of reward mechanism that can better promote the willingness and results of students with different social value orientations based on influence, and finally achieve "mutual benefit and win-win" through the introduction of mechanism.

1.3. Innovation point

Few scholars can continue to subdivide these factors into different types and study the interaction combination of different types or the interaction between factors under a single factor. This experiment will combine different social value orientation variables with the interaction types under different dimensions of reward and explore whether the cooperative behaviour after adding the mechanism is improved through the behavior experiment of public goods.

When oTree cooperates with online micro-course research, the subjects can conduct experiments anytime and anywhere through electronic devices such as mobile phones and tablets, reducing the difficulty of experiments.

2. Literature review

Through research, Luo Xinrong et al. (2019), the gift exchange game experiment based on punishment and reward confirmed that this external factor can influence people's cooperative behavior, and in the combination of punishment and reward, people's effort has the greatest impact on income.

Wang Pei et al. (2011) Combined with the internal factors of social value orientation (individual and social value orientation), the punishment behavior will have a negative impact on cooperation, especially for people with prosocial orientation.

And Ernst Ferh and Simon Gächter (2000) Through the analysis of cooperation and punishment in public goods experiments, people in cooperation are willing to punish those who take riders even if they must pay a high price. Michael Kosfeld, Akira Okada and Arno Riedl (2009) The fair mechanism through experiments play a vital role in overcoming group benefits and maximizing group interests in free riding and social difficulties. When a sanction organization is established within the player to punish individuals who do not contribute to the group, it helps to make each participant a profit. Urs Fischbacher and Simon Gächter (2010) investigated the role of social preferences and beliefs on voluntary cooperation.

3. General conception of the experiment

In Experiment 1, we used the "triple response matrix" to classify the subjects into pro-social and pro-ego value orientations, which provided the conditions for Experiment 2 to explore the interaction. Experiment 2 was modelled after the basic behavioural experiment, with material and emotional rewards set as meal card amounts and virtual ratings, respectively.

The first phase of the experiment was a control with the basic experimental group to explore the ability of reward styles to influence cooperative behaviour.

The second phase of the experiment was a comparison between the four different types of rewards to further investigate which rewards would lead to optimal cooperative behaviour. Each of the four types of rewards was measured on a different scale.

The measures of the four types of rewards are shown in the table below.

Table 1. Metrics for the reward approach

Type of reward method	Measurement Indicators
Continuous spiritual reward	Subjects who contributed to the public account at the end of each round received a bonus score from the organizer.
Continuous material reward	Subjects who contribute to the public account at the end of each round receive a meal card amount awarded by the organizer.
Intermittent spiritual rewards	Subjects who contribute to the public account after each i rounds receive a score awarded by the organizer.
Intermittent material rewards	The subjects who contributed to the public account at the end of each round receive a meal card amount from the organizer.

4. Experimental study

4.1. Subjects

A total of 40 college students were recruited from the Weihai campus of Beijing Jiaotong University to voluntarily participate in this study.

4.2. Experimental procedure

The experiment consists of 12 multiple-choice questions, each of which contains three options. The first option represents the pro-social value orientation, in which the personal gain and the gain of others add up to more than the other two options; the second option represents the pro-ego value orientation, in which the personal gain is greater than the other options; the third option represents the competitive value orientation, in which the personal gain is greater than the other option.

This game will have multiple rounds of investment, each round will give each group member 50. Each group has a public account, and each member can invest a certain number (0-50) of tokens into the public account as he/she wishes.

5. Results and Analysis

5.1. Results of the social value orientation experiment

Referring to Dreu and Mc-Cusker's criteria, student's value orientation can be confirmed only if he chooses a certain type of option more than 7 times out of 12 multiple-choice questions (as shown above). According to the statistical data, it was found that 92% of the college students were able to keep the same type of choice among the 12 options 7 times of the same type of choice, but 8% of college students showed social value orientation instability and could not be classified into a specific type of value orientation. Therefore, to ensure the validity of the experimental results, this paper will exclude the experimental data of college students with unstable value orientation from the research scope when conducting the subsequent experimental analysis.

5.2. Experimental Results of Public Goods Game

5.2.1 Data quality analysis

To analyze the reliability and practicality of the experimental results, this study conducted reliability tests on the results of the four types of experiments, and the analysis.

The Cronbach α coefficient is 0.905. When the alpha coefficient of the analyzed item has been deleted, the reliability coefficient will not increase significantly after any experimental item is deleted and therefore indicates that the type of experiment should not be deleted. The value of the reliability coefficient is 0.905 is greater than 0.9, which indicates that the quality of the study data reliability is high.

5.2.2 Game data analysis of public goods

To understand whether there are significant differences in the cooperation level of different social value orientations and punishment methods in the experimental stage, 2 (preference: personal attribute, prosocial attribute) \times 4 (reward method: continuous spiritual reward, continuous material reward, interval spiritual reward, interval material reward) factorial experimental analysis was conducted, in which social value orientation was the inter-group variable, reward method was the intra-group variable, the cooperation level of college students and graduate students in the public goods dilemma was as follows:

Through the analysis of the results of the factorial experiment, the main effect of social value orientation is significant, $F = 12.24$, $p < 0.01$; The main effect of the reward method was significant, $F = 6.44$, $p < 0.01$.

However, the interaction between social value orientation and reward style is not significant. By observing the experimental data, the contribution value of prosocial value orientation is significantly higher than that of personal value orientation. The contribution value of the group receiving continuous reward was significantly higher than that of the group receiving interval reward. The contribution value in the continuous spiritual reward mode was slightly higher than that in the continuous material reward mode, and the contribution value in the interval spiritual reward mode was like that in the interval material reward mode.

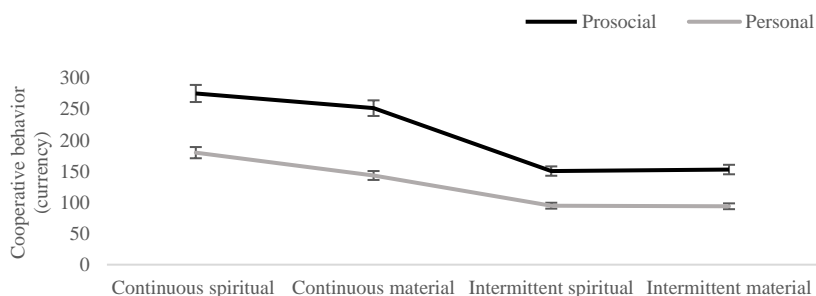


Figure 1. Cooperative behaviour with different value orientations and reward methods

5.3. Regression analysis

Based on the above findings, STATA was used to perform regression on the experimental data to explore the influence of social value orientation on the contribution value under different reward methods. In this regression, the social value orientation of college students is set as the independent variable, and the contribution value of college students under four different reward methods as the dependent variable is respectively regression. Since the social value orientation of college students is a categorical variable, dummy variables are introduced in this study, i.e., 1 for prosocial value orientation and 0 for personal value orientation. The regression results are as follows:

Table 2. Results of experimental regression analysis

	Continuous spiritual	Continuous material	Intermittent spiritual	Intermittent material	All spiritual	All material
regression coefficient	95.2	108.31	55.71	59.08	150.91	167.39
<i>t value</i>	2.2	2.77	1.33	1.57	1.95	2.45
<i>p value</i>	0.039	0.012	0.199	0.131	0.065	0.023

According to the T-test data, in this situation, under the 10% confidence interval, the social value orientation is significantly correlated with the contribution values of college students under all spiritual rewards (continuous spiritual rewards + intermittent spiritual rewards) and all material rewards (continuous mental rewards + intermittent substances), the t value= 1.95, $p < 0.10$, the t value = 2.45, $p < 0.05$. However, if the contribution value of college students under the four reward methods is respectively returned to the social value orientation, according to the obtained data, it can be found that the social value orientation is only related to the contribution value of college students under the continuous spirit and continuous material reward, but not significantly related to the contribution value of college students under the intermittent spirit and spaced material reward. That is, no matter what the social value orientation of college students is, there is no significant difference in the contribution value based on intermittent spiritual reward and intermittent material reward.

5.4. Explore the influence of other variables on regression

This experiment mainly explores whether the social value orientation of college students and different reward methods affect the monetary value contributed to the public account in each round of experiments. However, in the process of experimental data processing, the research ignored the possible influence of other variables except for independent and dependent variables on the contribution value of college students. Therefore, the research in this section mainly explores other variables that are most likely to affect the results of the experiment -- whether the contribution value of college students in this round is related to their total income in the previous round, that is, whether college students will make the decision on the contribution value of this round according to their total income in the previous round. It is assumed that the effect of rewards.

Table 3. Regression results of lagged first-period earnings on current contribution value

Lag earnings	P value	Lag earnings	P value	Lag earnings	P value	Lag earnings	P value
1	0.854	9	0.026	17	0.657	25	0.929
2	0.868	10	0.116	18	0.121	26	0.642
3	0.441	11	0.957	19	0.236	27	0.105
4	0.012	12	0.026	20	0.455	28	0.037
5	0.121	13	0.008	21	0.809	29	0.288
6	0.424	14	0.526	22	0.61	30	0.77
7	0.935	15	0.277	23	0.481	31	0.465
8	0.314	16	0.295	24	0.027	32	0.005

Use STATA to process each round of data while controlling for other variables. The regression results show that only a few of the last rounds of income in the data are related to the contribution value of the current round of college students. Therefore, in this study, the influence of the last round of income on the contribution value of the current round of college students will not be studied separately, and only the influence of social value orientation and four different reward methods on the contribution value of college students in each round will be considered.

6. Conclusion

College students with different value orientations have great differences in their contribution methods under the four reward methods. In the four rounds, the contribution value of the prosocial-oriented college students was significantly higher than that of the personal-oriented college students.

In each social value orientation, the relationship between the contribution value of the four reward methods is similar. The contribution value of the students who received continuous rewards was significantly higher than that of the students who received interval rewards. The contribution value in the continuous spiritual reward mode was slightly higher than that in the continuous material reward mode, and the contribution value in the intermittent spiritual reward mode was like that in the intermittent material reward mode.

College students with different social value orientations showed a strong correlation in the stages of continuous material, continuous spiritual reward, all material reward, and all spiritual reward, but the correlation was not significant in the stages of intermittent spiritual reward and intermittent material reward.

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