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The Heterogeneous Endowment Effect on Team Performance: A Social Behavior Experiment

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ABSTRACT The researchers designed three human behavior experiments involving public good games and recruited 126 students from the Central South University in China to participate in this experiment. The researchers studied the effect of introducing heterogeneity of initial resource endowment on team performance in a laboratory setting. The results showed that it is practical to achieve the cooperative goal by the means of alliance for a cooperating project. The differences of total resource investment and average resource sharing proportion between teams with heterogeneous resource endowment show a decreasing trend. The individuals' cooperative decision-making not only depends on their own resource endowment, but also on others' resource endowment in the cooperation of public goods supply. Additionally, individuals with richer resource endowments have lower willingness to cooperate, while the ones with poorer resource endowments are more willing to cooperate. Furthermore, the deviation of average resource sharing proportion is going to be less.

INTRODUCTION

With the rise in behavioral economics and experimental economics, a growing number of economists began to study team cooperation in the voluntary provision of public goods under the experimental method (Samek and Sheremeta 2014; Masuda et al. 2014). Through reasonable designed experiments and appropriate program control, preference characteristics and behaviors in team cooperation can be revealed. Empirical researchers have reported that free ride motivation of team members is limited, and voluntary provision of public goods can be stable.

Many factors affect the voluntary cooperation of public goods, such as initial resource endowment (Antinyan et al. 2015), social preferences (Fischbacher and Gächter 2010; Corazzini and Tyszler 2015; Mustafa and Kursat 2015), punishment mechanism (Yuling et al. 2015), capability and valuation (Kölle 2015), time allocation (Atsue and Koichi 2015), and so on. However, this paper focuses on the effect of heterogeneous endowment on team performance by analyzing the contributions in public goods. In fact, the most important points are to know how initial resource endowment affects team cooperation in provision of public goods.

Some earlier experimental researches involve unequal (but publicly known) endowments in the following four areas:

1. *The impact of heterogeneous resource endowment on team contribution*

There is a viewpoint that in a linear public good experiment, comparing the teams with asymmetric resource endowment, to teams with symmetric resource endowment, supplies more to the public good (Isaac and Walker 1988). In a threshold public good game, teams with resource heterogeneous endowments reach less frequently the threshold than teams with resource endowments homogeneity (Rapoport and Suleiman 1993).

2. *The impact of heterogeneous resource endowment on individual contributions*

Through experiments, Rapoport (1989) found that participants with high resource endowment are inclined to supply to the public good, and this result can however be predicted using standard non-cooperative theory. Rapoport and Suleiman (1993) tested the effect of wealth heterogeneity on contribution behavior in 5-player groups. The main results for the purpose are that (a) heterogeneity drives down success rates and (b) players supply the same resource endowment sharing proportion across wealth levels. Buckley and Croson (2006) found that in a linear pub-

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lic good game, low-endowment participants supply the same absolute amount than high-endowment participants in a public good experiment.

3. The positive influence of endowment heterogeneity

Chan et al. (1999) considered that heterogeneity increases with voluntary contributions to a public good. Through several laboratory experiments, Cherry et al. (2013) found that shared expectations might emerge to improve coordination and increase efficiency because heterogeneity exists in the ability to contribute and the benefits received from the good in most real world best shot public good situations. They also concluded that significant behavioral responses to heterogeneity that improve efficiency, but not always from increased coordination.

4. The negative influence of endowment heterogeneity

Cherry et al. (2005) indicated that if cooperative members have large differences in initial resource endowment, it will bring difficulties for the supply of public goods. However, Fung and Au (2014) found that homogeneous teams cooperated more than heterogeneous teams, and teams with larger resource inequality cooperated less than teams with equal resources.

From the above, the researchers see that resource endowment heterogeneity usually appears in the people's life wherein they would volunteer to contribute to the public. The voluntary contribution to the public good was the focus of previous studies. However, there are still a lot of works to be done on the effect of resource endowment heterogeneity on team performance by the way of individual contributions to a public good. Therefore, more and more scholars begin to pay close attention to the influence of resource endowment on cooperation performance of public goods supply (Buchholz et al. 2014; Alberti 2015). Thus, it is necessary to study heterogeneous endowment effects on team performance by analyzing the contributions in public goods.

In this study, through a series of well designed experiments, which related to public good games and recruiting a number of undergraduates and postgraduates, the public good games experiments of realizing the team cooperation were conducted by recruiting people to participate in the simplified simulation team. The researchers received data from the above experiment. By analyzing the situation of resource investment led by a cooperation of team alliance composed of three individuals with three different initial resource states, the paper studies which influences will be generated by the initial resource endowment upon the change of cooperative behavior and the corresponding level of cooperation on public product supply for individuals and teams. Unlike the traditional public good games, the researchers' experiments limit the resource inputs of team alliance to achieve public project cooperation successfully, so that the result will be more accurate.

MATERIAL AND METHODS

Experiment Area and Stages

The study recruited 126 students from the School of Business at Central South University in China. These students participate in the experimental study in their spare time in the Behavioral Sciences Laboratory, which contains 21 computers at the School of Business at Central South University. The experiments include three separate stages.

In the first stage, 126 participants were divided into six groups, and each group has 7 teams. All students were noticed to fulfill a questionnaire about personal information including sex, age and grade distribution. In particular, they were asked about their family's monthly salary regarding their different spending habits.

In the second stage, every three anonymous participants formed a randomized team. All individuals, who provided a strategy on how to contribute his/her initial resource endowment, participated in three public good experiments.

In the third stage, the participants obtained their experimental reward. As soon as they complete all of the above requested experimental tasks, the computer would calculate cash remuneration according to experimental ultimate yield for everyone. Then, the participants left the laboratory with an envelope, which contains their rewards. The amount of reward in the envelope is secret to other participants.

Three Experiments

The experiment consists of three computer-based experiments involving three treatments about public goods game (see Table 1). Every three individuals (Player A, B and C) form a team.

Table 1: Design on initial resource endowment of each member of team alliance

Resource combinations	*Resource characteristic*	*Player A*	*Player B*	*Player C*
LRC	More lower recourse endowment	24	24	40
HRC	More higher resource endowment	24	40	40
ERC	Equal resource endowment	40	40	40

Each player has a different initial resource endowment, which is insufficient to achieve a public project. To successfully implement a public project, players A, B, C must form a temporary alliance and the sum of the alliance's resource endowment must be greater than or equal to 60 tokens. If the player did not contribute all his/her initial resource endowment to the public project, he/she could retain the rest part. After the completion of each individual contribution of the respective resource endowment, individuals were informed about the sum resource endowment of the team.

In experiment one, both players A and B have an initial resource endowment of 12 tokens, and player C has an initial resource endowment of 20 tokens, namely resources combination (24, 24, 40). In this experiment, most players (A and B) have a lower level of resource endowment (12 tokens), so the researchers named this combination LRC (Low Resource Combination). The players decide the amount of their respective endowment to supply in a public project.

In experiment two, player A has an initial resource endowment of 12 tokens, both players B and C have an initial resource endowment of 20 tokens, namely resources combination (24, 40, 40). The researchers named this combination HRC (High Resource Combination) because most players (B and C) have a higher level of resource endowment (20 tokens).

In experiment three, all three players have an initial resource endowment of 20 tokens, namely resources combination (40, 40, 40). Because they have the equal initial resource endowment, the researchers named this combination ERC (Equal Resource Combination).

Each treatment will last for four rounds wherein the initial resources endowments remain the same. In each round, all participants do not know the resources sharing values of other members in the same team until making their own resources endowment decisions, after that, the results of the projects will be announced. According to the resource input of all team members in previous round and the project result, either success or failure, the participants will make decision for the next round. The remained resources from previous rounds were not allowed to be used in the next round.

The rules of the experiment are as follows. If the public projects succeed, alliance members will own certain remuneration individually according to the rest of the resources. If the projects fail, they earn nothing in this particular round. The cumulative remuneration along with appearance fee is distributed at the end. The incentive rules above mean that the more the resources contributed by participants, the less the remaining resources will be, which results in less personally as the final experiment rewards. But, the public project is more likely to succeed. On the contrary, the less the resources contributed by participants, the more the remaining resources will be gained. But, the public project is more likely to fail, which results in total deduction of resources. The success of the public project depends on not only individual participants, but also on the teamwork effort. Therefore, the individual members will be trapped in the "Social Dilemma". On the one hand, the individual wants to reduce personal investment as much as possible using the free riding strategy for short-term incentives, while on the other hand, the individual must at least invest something to guarantee the success of the public project due to the excessive free riding behavior.

Experimental Rewards Design

According to the above experiment process design, none of the players A, B, and C can use their own initial resource endowment to achieve public projects separately. Three individuals had to build an alliance and guarantee that the sum of resource input is greater than or equal to 60 units, which is indispensable for achieving a public project. Once the public project was successfully achieved, each member of the alliance would get certain remuneration according to the

rest of the resources in the experiment. If the project failed, three members would get nothing in this round. After the whole experiment, participants earned cumulative remuneration along with experiment appearance fee.

The participants got real money in a ratio of 0.2, that is, one could earn 20 RMB for 100 units of resources, which he earned in the experiment. Each one earned additional 10 RMB for his/her participation and focus on the experiment. In order to avoid jealousy or altruism psychology resulting from differently actual payment, each participant only knew his/her own eventual cash rewards. Because the benefits, which the participants obtained in each round, were automatically calculated by the computer and then the organizers paid each participant, using an enclosed envelope.

Experimental Variables Description

The relevant variables and index for data analysis in the experiment are as follows.

1. The average resource inputs of team alliance.

It refers to the average resource inputs of each team member in the team cooperation under each particular combination of resource.

2. Individual revenue function.

Assuming the input that individual i makes is p_i unit, therefore the total input of all individuals is $T=\sum_{i=1}^{n} p_i$ the piecewise function, which represents the revenue of individual i are as follows:

$$U_i=\begin{cases} y_i\text{-}P_i, & T_i > 60 \\ 0\ T_i, & < 60 \end{cases}$$

Among this piecewise function, y_i is the initial resources endowment of individual, and $i \in 1,2,3$ representing as A, B, C in specific experiment.

3. Average resource sharing proportion.

It includes the average resource combination in the cooperation project for individuals as well as for the team. The former refers to the ratio of total amount of resource inputs during the process of cooperation to the initial resources endowment of a team, which reflect the intensity of willingness of team cooperation. The formula is $Ratio=T/O$ that is $Ratio=\sum_{i=1}^{n} p_i / \sum_{i=1}^{n} y_i$ *Ratio* stands for the resource sharing proportion of team alliance, T stands for the total amount of input of the resource a team alliance made, *O* stands for the total amount of initial resource endowment of the team alliance, and *i* stands for the number of different individuals ($i \in 1,2,3$). The latter refers to the ratio of total amount of resources endowment to the initial knowledge resource endowment of an individual during the process of cooperation, which reflects the intensity of willingness to participate for individuals in cooperative innovation. The formula is $Ratio_i=p_i/y_i$, $Ratio_i$ stands for the average resource combination in cooperation project for individuals.

4. Success rate in team cooperation.

It refers to the ratio of the team number, which the total input of resources in each round () is equal to or greater than the limited value of public project success 60, to the total number of teams that is, 7. It represents the success rate in team cooperation. The formula expression is, that is. represents the success rate in team cooperation.

5. Resource inputs variation.

It includes the resource inputs variation in the cooperation project for individuals as well as for the team. The former use the standard deviation of total resource inputs of the team ($T=\sum_{i=1}^{n} p_i$) to represent the deviation of the team. If the standard deviation is large, it shows that there is a big difference in the total amount of resources put among team alliance. On the contrary, if the standard deviation is small, it indicates that there is a little difference of the total amount of resources put among team alliance. Individuals can use the same marginal revenue ratio as a standard of resource sharing.

6. Average resource sharing variation.

It includes the average resource sharing variation in the cooperation project for individuals as well as for the team. The former uses the standard deviation of resource sharing variation of the team to represent the deviation of the team (). Similarly, if the standard deviation is large, it shows that there is a big difference in the resource sharing proportion among team alliance. On the contrary, if the standard deviation is small, it indicates there is little difference. The latter refers to the use of the standard deviation of resource sharing variation of individuals to represent the deviation of individuals *($Ratio_i=p_i/y_i$)*, *($Ratio=\sum_{i=1}^{n} p_i / \sum_{i=1}^{n} y_i$)*.

RESULTS AND DISCUSSION

The study aims to investigate the effect of introducing heterogeneity of initial resource endowment on team performance. The recent re-

searches have found that heterogeneous endowment not only exerts a positive effect on public goods provision (Cherry et al. 2013), but also exerts a negative effect (Fung and Au 2014; Weng and Carlsson 2015). This paper will analyze the different effects of heterogeneous endowment on team cooperation and performance.

The behavior experiments recruited 126 undergraduate and graduate students. The participants, who came from different grades, classes, and professions, comprised of forty-eight percent males and fifty-two percent females. They were fifty-nine percent undergraduates and forty-one percent graduates. They were divided into six groups and finished every experiment in about 60 minutes using the z-Tree software (Fischbacher 2007). The experiment was completed by participants with an average earning of 23.80 RMB in their spare time. Experimental economic requirements were followed for an orderly completion of all experimental procedures, and the data processing was mainly via the non-parametric matlab 2013a test.

Overall Distribution of Data

The researchers examine the overall distribution of the experiments from two aspects—the average resource inputs of the team and the success rate in the public project cooperation.

1. Average Resource Inputs

Table 2 shows the average resource inputs of each team under different treatment of resource combinations in each of the different experiment rounds, from which the researchers can acquire, in a dynamic way, the cooperation level of each team in the experiment. In most cases, the average resource inputs of each team are on the rise, but in some groups, they might drop in the final round. For example, in the third treatment ERC (40, 40, 40), the average resource inputs in round 2, which is 60.14 is lower, than average resource inputs of round 3, which is 60.86.

From Table 2, the researchers calculate the average resource inputs under all treatments of resource combination. Round 1 is 54.67, round 2 is 58.19, round 3 is 60.76, and round 4 is 61.90. By contrast, round 2 is 3.52 higher than that of round 1, round 3 is 2.57 higher than that of round 2, and the final round is very close to that of round 3. In addition, it is worth noting that the figures in round 3 and round 4 both are above 60, which is greater than the limit value of public project success.

The analysis above shows that although the trend of the average resource inputs varies, under different rounds in different projects of resource combination, in general, average resource inputs are on the rise.

2. Success Rate in the Public Project Cooperation

The average success rate of team cooperation is shown in Table 3. The average success rate of team cooperation (78.6%) is higher than other treatments in the third treatment ERC (40, 40, 40). In the first treatment LRC (24, 24, 40), the success rate of team cooperation is 53.6 percent. Finally, in the second treatment HRC (24, 40, 40), the average success rate of team cooperation (50%) is the lowest.

However, the moment of success varies. In the first round, success rate of ERC (40, 40, 40) in team cooperation (71.4%) is the highest, and both success rates of LRC (24, 24, 40) and HRC (24, 40, 40) in team cooperation are 14.3 percent. So, under different treatments of resource combina-

Table 2: The average resource inputs of each team

		Rounds			
	Treatments	*1*	*2*	*3*	*4*
LRC	88=(24,24,40)	51.14	56.71	61.00	62.71
HRC	104=(24,40,40)	54.14	58.57	60.43	61.57
ERC	120=(40,40,40)	60.86	60.14	61.57	60.71

Table 3: Success rate in team cooperation

		Rounds			
	Treatments	*1*	*2*	*3*	*4*
LRC	88=(24,24,40)	14.3%	42.9%	57.1%	100.0%
HRC	104=(24,40,40)	14.3%	42.9%	57.1%	85.7%
ERC	120=(40,40,40)	71.4%	57.1%	85.7%	100.0%

tion, the timing to implement the "free rider" strategy varies. In fact, the "free rider" phenomena effect on team performance were always to be observed in the public goods provision (Patel et al. 2010; Weng and Carlsson 2015).

The analysis of this paper shows that on the one hand, the orders of the experiment have a significant impact on the decision of the participants and their behavior, showing a "Round Effect" on the success rate in team cooperation. The success probability of team cooperation with different initial resource endowment shows a rising trend, which means the success probability to achieve public project cooperation would be higher with more times of cooperation. On the other hand, the success rate in public project cooperation is much lower with the varied initial resource endowment. By contrast, the success rate in public project cooperation is higher with similar initial resource endowment.

In summary, from the two aspects (average resource inputs of the team and success rate in public project cooperation) in the experiment data above, one conclusion is that the alliance under different treatments of resource combination can all achieve the objectives of cooperating projects well, which means it is possible to achieve public project cooperation through alliance. The more rounds of the experiment one does, the more possibility that the team is able to achieve the goals of public project cooperation.

"Round Effect" in Resource Inputs

Based on the feasibility that alliance could achieve public project cooperation, the researchers can both observe the dynamic trend of individual and team resource inputs.

1. The Resource Inputs Variation of Individuals

Table 4 lists the standard deviation of resource inputs of the individual different rounds of cooperation. The researchers found that in different resource treatments, individuals have different dynamic trends of standard deviation. In the third treatment ERC (40, 40, 40), the standard deviation of the resources inputs for the individual generally tends to decline. However, in the first and second treatments of LRC (24, 24 40) and HRC (24, 40, 40), the standard deviation generally tends to rise. Through the above analysis, the researchers found the tendency of technology choice of the individual, but the standard deviation value still includes different trends. For example, in the second treatment HRC (24, 40, 40), the standard deviation value of individual's resource inputs is 6.608 in the round 3, bigger than 6.595 in the round 4.

The analysis of the data above shows that the behavior and decision of the individual might be affected by their different initial resource endowment levels and will present different trends. After more experimental rounds, the variation of resource inputs among individuals with equal or similar initial resources cooperating in one team could decline, while the variation of resource inputs among individuals with different initial resources will increase.

2. Variation of Resource Inputs in Team

Unlike individuals, the researchers found that resource inputs of teams present a common trend. For each team, the deviation of resource inputs is going to be less round by round.

Table 5 lists the standard deviation of the resource inputs among different teams under the

Table 4: The resource inputs variation of individual in different rounds

		Rounds			
	Treatments	*1*	*2*	*3*	*4*
Resources	treatment 1 (24,24,40)	6.040	5.219	2.944	2.628
allocation	treatment 2 (24,40,40)	5.610	3.910	3.823	2.149
Treatment	treatment 3 (40,40,40)	2.116	1.864	1.512	1.254

Table 5: Variation of resource inputs in team under different rounds

		Rounds			
	Treatments	*1*	*2*	*3*	*4*
LRC	88=(24,24,40)	8.304	6.803	3.352	2.795
HRC	104=(24,40,40)	6.473	4.577	3.976	2.309
ERC	120=(40,40,40)	2.545	2.992	2.138	1.574

different rounds. Table 5 also shows the differences in team resources inputs, the researchers can see that only in the third treatment ERC (40,40,40), the standard deviation of inputs in the first round is 2.545, which is smaller than that in round 2, which is 2.992. Both in the other two teams, the standard deviation of resource inputs present a downward trend.

The researchers consider that the trend is relevant with experiment design. Because after each cooperation round, each member knows everyone's resource shared and total amount of initial resources of each one. Other researchers mentioned the importance of the principle of fair endowment effects on team performance. Equity as an important factor will influence stability of cooperation in the public good (Buchholz et al. 2014).

In this paper, in order to achieve the purpose of the cooperation, members will make comparisons between the resource inputs of other members and their own according to the previous round, and on the premise to achieve the target, each member will adjust their sharing proportion under the principle of reciprocity and fairness, which results in less deviation of resource inputs between each round.

According to the analysis of the deviation of resources inputs of the individuals and the teams, although individual resource inputs could be affected by their initial resource endowment level, the deviation will present different trends. With the increasing cooperation, the standard deviation of the total resources inputs in a team declines.

Impact of the Initial Resource Endowment Levels on the Average Resource Sharing Proportion

The researchers observe the dynamic trends of the average resource combination in the cooperation project for individuals and teams, which are finally proved to be equal.

Table 6 shows the average resource sharing proportion of individuals and teams with different initial resource combination treatments and in different experimental rounds. In order to achieve cooperation to realize the target of public project, individual/team's sharing resource distributions have almost reached above fifty percent. In different experimental rounds, comparing the average resource sharing proportion of individuals and teams, the order is LRC (65.3%) > HRC (56.4%) > ERC (50.6%). Additionally, with the proceeding of the rounds, the average resource sharing proportion generally presents an increasing trend.

As is shown in Table 6, the resource sharing of the team, which achieved the equal highest resource, is not larger than the teams, which have other two kinds of resources allocation treatments. The result might be owing to the transparent mechanism, which is made in the experiment. It is said that individuals should keep information transparent with other team members, and their relative resources should be the same. Regardless of initial resource endowment, individuals will not only focus on their initial resources endowment, but also the relative property of the resource with others. Then they will determine the amount of resources to input. Thus, they do not waste resources in the case of achieving the public project objectives. Therefore, when all team members have initial resource endowment 40 units, even if each individual invested only fifty percent of the initial resources, they can also ensure the achievement.

The participants with different resource endowments are significantly different in resource-input proportion. In fact, the heterogeneity of initial resource endowments, such as income, wealth and investment, would affect the voluntary provision of public goods (Yuan and Xia 2014). Of course, no matter what the state of initial resource endowment, the "free ride" phenomenon of members in the team league will occur to different extents. Recent researchers mainly focused on the relationship between punishment and the free rider phenomena (Patel et al. 2010; Weng and Carlsson 2015). This part of the re-

Table 6: The average resource combination

		Rounds			
	Treatments	*1*	*2*	*3*	*4*
LRC	88= (24,24,40)	56.8%	64.6%	68.5%	71.3%
HRC	104= (24,40,40)	52.1%	56.3%	58.1%	59.2%
ERC	120= (40,40,40)	50.7%	49.9%	51.3%	50.6%

search will be discussed in the issue of how the amount of initial resource endowments contribute to the free rider phenomena, which has generally been neglected.

There are still different performances by the members with different resources, for members who have higher resource endowments, more remaining resources means more profits so they tend to hitchhike. But for the members who have low resource endowment, first of all, only through ensuring successful cooperation can they achieve earnings, so they will pay resources as far as possible to achieve success. The individuals with low total amount resources have a higher sharing rate and strong willingness to participate in cooperative innovation. Others with high total amount resources have low sharing rates and weak willingness in the cooperative innovation. Of course it cannot be ruled out by the impact of public project difficulty.

Individuals fundamentally hope to gain more profits with less resource. There is higher willingness to participating in cooperation and more altruism for the individuals with poor resource endowment resources. But the individuals with rich resource endowment resource reflect more of a "free hide" effect. Of course, from the angle of egoism this may also explain the phenomenon that the individuals with poor resources hope to increase their own income by cooperating successfully and others with rich resources tend to achieve success by paying resources as little as possible.

The above analysis shows that the average resource sharing proportion is rising in the cooperation of team leagues, so that the individual has the willingness to cooperate. Given the relative size of resources between their own and other members, participants determine their cooperation behavior of public projects. The will participating in the public project cooperation of high initial endowment individuals is weak, while that of the low initial endowment individuals is strong.

Round Effect of Resource Sharing Proportions

The researchers observe differences changing by calculating the individual and team alliances' standard deviation of the average resources sharing proportion.

Tables 7 and 8 have listed the individual and team alliance's standard deviation of sharing proportion of investing public projects resources in different rounds. First, from Table 7 in the first treatment LRC (24, 24, 40), the researchers found that the standard deviation of individuals' resources sharing proportion (0.088) in the second round is higher than that (0.080) in the first round. In the second treatment HRC (24, 40, 40), the standard deviation of the individuals' resources sharing proportion (0.079) in the third round is higher than that (0.072) in the second round. Except the above two standard deviations increasing slightly, the remaining standard deviations of average resources sharing proportion show a downward trend. Buckley and Croson (2006) proposed that the subjects with less initial resource endowment give the same absolute amount as the subjects with more resource endowment in public good provision.

By observing the changing differences of team alliance's average resource sharing proportion, the researchers found that the standard deviation shows a downward trend. From these

Table 7: Differences changing of individual average resource sharing proportion

		Rounds			
	Treatments	*1*	*2*	*3*	*4*
LRC	88=(24,24,40)	0.080	0.088	0.078	0.072
HRC	104=(24,40,40)	0.082	0.072	0.079	0.071
ERC	120=(40,40,40)	0.046	0.035	0.027	0.025

Table 8: Differences changing of team alliance's average resource sharing proportion

		Rounds			
	Treatments	*1*	*2*	*3*	*4*
LRC	88=(24,24,40)	0.069	0.059	0.033	0.030
HRC	104=(24,40,40)	0.054	0.038	0.037	0.021
ERC	120=(40,40,40)	0.018	0.016	0.013	0.010

overall trend changes, the researchers also believe that it is related to experimental design in which the experimental test subjects knowing the last experimental results. Because at the end of each cooperation round, each team alliance member will know the resources share ratio of the other alliance members. To achieve the goal of public projects, members would compare their last round sharing proportion with other cooperators. Under the premise to achieve their goals, they will compare with each other and adjust their own sharing proportions with interactive fair psychology. Thus, the final result is that the difference of team alliance's resources share proportion decreases with the increasing of the round.

According to the above experimental data analysis, average resource share proportion of individuals and alliance teams show a common changing trend, which the standard deviation of average resource share proportion in cooperation is decreasing by round.

CONCLUSION

Experimental results show that individuals make decisions in the cooperation of public project not only based on their own resource endowments, but also on others' resource endowments. For the furtherance of cooperation, an individual would adjust his own resource inputs according to his own resource endowment under the principle of reciprocity and fairness. It is inevitable that ultimately, an individual wants to gain more profit with less investment. But it was likely for the ones with poor resource endowment to show an altruism tendency, which means to be more willing to cooperate, while the rich ones are more likely to be free riders. In a sense of egoism, it can also be explained, that the ones with poor resource endowment want to gain profits by promoting a successful cooperation, while the ones with rich resource endowment expect no more than promoting a success, with as less resource inputs as possible. Such contradiction, to some extent, dominates the result of the cooperation. The researchers observed that the team with less heterogeneity in resource endowment would always be more likely to achieve success, which means that an individual would love to cooperate with partners of similar endowment in the cooperation. In general, it is practical to achieve the cooperative goal by the means of alliance for a cooperating project. The inputs of each participant would be adjusted upon the relative level of the resource endowment between their own and their members. The heterogeneity of initial resource endowment would affect the willingness of individuals to cooperate, and even affect the success of their alliance.

RECOMMENDATIONS

The experimental study on individuals' behavior and decision-making in public project cooperation under the alliance condition here is still on its test stage. In the cooperation, individuals might show different patterns of behavior, and the preference and behavior of individuals in different areas might vary as well. Besides, the cooperation itself could contain multiple stages. Hence, there are much more to be studied in further work. Participants of varied professions and multistage cooperation should be considered, which could make the experimental study approximate the team alliance in reality.

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