



Payoff Matrix's Effect on Trust Game Paradigm

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How to cite this paper: Li, Z.H., Ran, S., Huang, Z.H., Yang, S.M. and Pu, R.R. (2021) Payoff Matrix's Effect on Trust Game Paradigm. *Open Access Library Journal*, 8: e7439.

<https://doi.org/10.4236/oalib.1107439>

Received: April 22, 2021

Accepted: May 23, 2021

Published: May 26, 2021

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Abstract

This report first sorted out the definition of trust and found that researchers did not have a unified definition of trust. But trust includes two core characteristics: dependence and risk. Then we introduce the measurement methods of trust, including the trust game paradigm and its variants, in which the binary trust game paradigm and the three parameters in the payoff matrix of trust game paradigm are introduced; those three parameters are cost, benefit and temptation. Since previous studies exploring the influence of these three parameters on people's trust behavior in the trust game paradigm have inconsistent results, some researchers reported that it is because the absolute values of these three parameters are used when analyzing the results. Therefore, based on these three parameters, some researchers proposed a risk index, a temptation index and a cooperation index, and found that the three standardized parameters can predict people's trust behavior better.

Subject Areas

Psychology, Social Decision-Making

Keywords

Trust Game, Binary Trust Game, Payoff Matrix

1. Definition of Trust

The Nobel Literature Prize Laureate Arrow describes trust as the "lubricant of the social system". From countries and organizations to institutions and individuals, mutual trust has become an important prerequisite for social activities and the cornerstone of the prosperity and stability of modern society. Because of the existence of trust, harmonious and stable relationships can be established

between people; enterprises can specialize and complement each other; countries can develop peacefully without arm racing.

For the specific definition of trust, different researchers have given different definitions.

The Oxford Dictionary defines trust as: a belief that someone or something is good, sincere, honest, etc.; someone will not harm you or tease you. McAllister (McAllister, 1995) [1] concluded predecessors' definition of trust and put forward that (Barber, 1983 [2]; Cook and Wall, 1980 [3]; Deusth, 1973 [4]; Luhmann, 1979 [5]; Porter, Lawler and Hackman, 1975 [6]; Shapiro, 1990 [7]): Trust is the degree to which a person has confidence in another person's words, actions, and decisions that this person is willing to act on it.

Boon and Holmes (Holmes and Rempel, 1989) [8] reported that trust is a positive and confident expectation of the motivations of others under risky conditions; Krueger *et al.* (Krueger and Meyer-Lindenberg, 2019) [9] documented that trust is a psychological process in which one party is willing to take certain risks based on the expectations of the other party's behavior in order to obtain positive results in the future; Rousseau *et al.* define trust as "a psychological state comprising the intention to accept vulnerability based upon the positive expectations of the intentions or behavior of another" (Rousseau *et al.*, 1998) [10].

Beldad (Beldad, de Jong and Steehouder, 2010) [11] summarizes the previous literature and reports that the definition of trust is mainly divided into two categories. One focuses on the confidence in the behavior of the interacting partner, and the other emphasizes trustor accepts vulnerability, that is taking risks. Balliet (Balliet and Van Lange, 2013) [12] also proposed a similar classification for the definition of trust in the review, which is mainly divided into two categories: one is represented by McAllister *et al.* (McAllister, 1995 [1]; Sitkin and Roth, 1993 [13]). They emphasized expectation, predictability, and confidence in the behavior of others; the other type is represented by Holmes *et al.* (Holmes and Rempel, 1989 [8]; Mayer, Davis and Schoorman, 1995 [14]; Rousseau *et al.*, 1998 [10]) who reported trust including the expectation that others will act in good faith when personal interests conflict with collective interests.

Researchers' different emphasis on trust research is a factor that causes inconsistencies in the definition of trust. However, despite the inconsistencies, all definitions of trust reported that trust can only exist in uncertain and dangerous situations, as Farolfi *et al.* (Alós-Ferrer and Farolfi, 2019) [15] explained in their article: Trust is generated when one party makes the initial sacrifice, that is to say, based on the reaction of another party, this behavior may damage the first party's own interests. From many definitions of trust, it can be concluded that trust includes two core characteristics: dependence and risk. Dependence is that when one party surrenders its own destiny to another party, the basis of this decision is to have a positive expectation of the other party's credibility, or trusting the other party. The risk is if the trusted party betrays the trust, the negative result for the first party. It is risk that creates the possibility of trust.

2. Trust Game Paradigm

At present, there are questionnaires and game paradigms to measure trust. However, because the reliability and validity of questionnaires is still in question, researchers often use the trust game paradigm to measure trust.

The trust game paradigm proposed by Berg *et al.* (Berg, Dickhaut and McCabe, 1995) [16] is also known as the BDM paradigm and investment game (see **Figure 1(A)**). The experiment procedure is to randomly match two subjects into a group. First, give the two subjects the same initial fund M ($M = \$10$). Then, the trustor chooses to give a portion of the money $p \cdot M$ ($0 \leq p \leq 1$) to the trustee. If $p = 0$, it means trustor gives zero to the trustee; if $p = 1$, it means trustor gives all money to trustee. For the money $p \cdot M$ given by the trustor, the experimenter will multiply the money by K ($K = 3$) times, That is, $p \cdot M \cdot K$, and then give it to the trustee. Finally, the trustee chooses to return $q \cdot p \cdot M \cdot K$ from the $p \cdot M \cdot K$ to the trustor ($0 \leq q \leq 1$). In the whole experiment, the subjects are anonymous to each other, and there is only one interaction between any two subjects.

In the BDM paradigm, regardless of the funds that the trustor gives to the trustee, or the funds that the trustee returns to the trustor, it is an arbitrary amount, which can be an integer or a decimal. This is too complicated for the experimenter to process, and the cognitive load for the subjects is also relatively large. Therefore, some researchers have proposed other variants based on the BDM paradigm.

Some researchers' constraint the amount of money shared by trustor and trustee can only be integer. A variant mentioned by Farolfi *et al.* (Alós-Ferrer and Farolfi, 2019) [15] in the article is: the initial funds to the subjects are all 2. For the funds transferred from the trustor to the trustee, the researcher will double the amount, and then transfer it to the trustee. The trustee decides how much to return to the trustor. For example, if trustor chooses to transfer 1 token to the trustee, after double the token by the experimenter, trustee will get 2 tokens, trustee can transfer maximum of 2 tokens to the trustor (see **Figure 1(B)**).

Some researchers combined the Prisoner's dilemma game paradigm and BDM paradigm to propose the Binary Trust Game paradigm (see **Figure 1(C)**). Similar to the prisoner's dilemma, before making a decision, the subjects clearly knew the specific amount of funds allocated, according to the decision by themselves

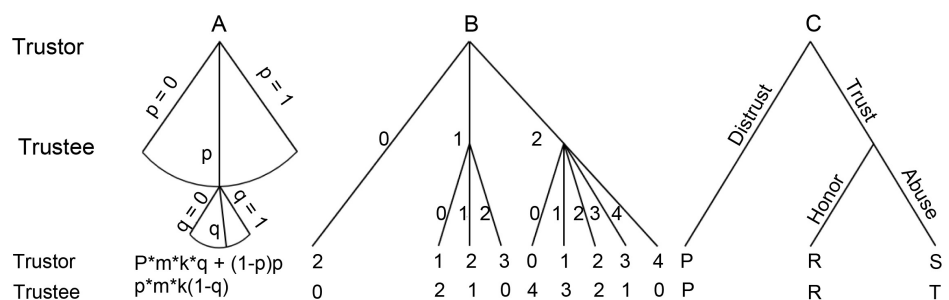


Figure 1. Three different types of trust game paradigm.

and their partner. The choice for the trustor and the trustee is binary. The trustor has to choose between trusting the trustee or no. If the trustor chooses not to trust the trustee, then both the trustor and the trustee get the funds of P . If the trustor chooses to trust the trustee, then the final allocation of funds between the trustor and the trustee is determined by the trustee. The trustee has to make binary choices between reciprocity and temptation. If the trustee chooses reciprocity, that is to respect the trust of the trustor, then both the trustor and the trustee get the funds of R ; if the trustee chooses temptation, that is, abuses the trust of the trustor, then the trustor receives the funds of S , and the trustee receives the funds of T . The relationship of these funds is $S < P < R < T$, and $2R = T + S$.

It should be pointed out that researchers have designed many different trust game paradigms to study trust, such as dishonest salesman game, trading game, gift-exchange game, etc. The trust game paradigm listed in this article is only three relatively widely used.

For different trust game paradigms, some researchers have summarized the following four common characteristics: 1) The trust behavior of the trustee is spontaneous; 2) The trustor and the trustee make decisions successively; 3) The trustor makes mutual benefits or the prerequisite for the betrayal decision is that the trustee makes a trust decision; 4) If the trustee makes a betrayal decision, then the benefit to the trustee is lower than the benefit of the untrusted decision.

3. Variables Affect Trust

Researchers use the game paradigm by controlling some variables when studying trust, in order to discover the influence of different variable levels on the trust behavior of subjects. In the game paradigm about trust, the researchers mainly examine three types of variables: 1) Control the payoff matrix of the paradigm, mainly adjusting the amount of funds for the trustor and trustee, including amount at stake, receiver endowment, rate of return, etc.; 2) Control of experimenters, including both role, real players, anonymous, double blind, cultural background, etc.; 3) Control of experimental strategies, including random rewards, strategy method, iterated interaction, etc.

Noel *et al.* (Johnson and Mislin, 2011) [17] included amount at stake, receiver endowment, rate of return, both role, real players, random payment, strategy method, anonymity, double-blind, and student subjects to a meta-analysis based on the past 162 studies. It turns out that the trust behavior of the trustor, that is, the funds transferred to the trustee, is significantly affected by random rewards and real player; the trustee's behavior is mainly affected by the rate of return, both role, and student subjects.

When Balliet (Balliet and Van Lange, 2013) [12] explored the relationship between trust behavior and the size of conflicts of interest, they were concerned with 1) state trust and dispositional trust, 2) dilemma types (prisoner's dilemma, public goods game, resource game), 3) Conflict size (quantified conflict index, the value range of this article is: 0.16 - 0.95), 4) One-shot or iterated, 5) Between

or within groups, 6) Culture, 7) The number of participants, participants' income, and publication time, both are added to the meta-analysis. The results found that: a) The greater the conflict, the closer the correlation between trust and cooperative behavior; b) Compared to the interaction between groups, there are greater correlation between trust and cooperative behavior in individual's interaction; c) There are difference in trust level on different cultural backgrounds; d) One-shot or iterated have no effect on the relationship between trust and cooperation.

In the study of all variables that affect the trust game, researchers are paying more and more attention to the impact of payoff matrix on the behavior of subjects. As mentioned earlier, payoff matrix mainly includes amount at stake, receiver endowment, and rate of return.

3.1. Amount at Stake

In the BDM paradigm, the initial funds for the trustor and the trustee are fluctuating around \$10. Many studies have shown that when initial funds change, subjects' trust and reciprocity behaviors show inconsistent pattern (Hertwig and Ortmann, 2001 [18]; Ho and Weigelt, 2005 [19]; Smith and Walker, 1993 [20]).

Carpenter *et al.* (Carpenter, Verhoogen and Burks, 2005) [21] had used the Ultimatum game and Dictator game to explore the impact of initial funds on the behavior of subjects. In the experiment, they set up two experimental conditions of \$10 and \$100 initial funds. Under each experimental condition, the dictator's task is to choose one of the 11 given allocation plans. For example, in the \$10 condition, given the allocation plan of (0, 10), (1, 9); in the \$100 condition, the given allocation plan is (20, 80), (30, 70). In the ultimatum game, the recipient's task is to choose to accept or reject the dictator's plan. If accepted, then the dictator and recipient will get the funds according to the allocation plan selected by the dictator. If rejected, neither party will get any funds; in the dictator game, the recipient is only informed of the selected plan of the dictator. The results of the experiment found that, whether it is an ultimatum game or a dictator game, there is no significant difference in the proportion of funds allocated by the dictator to the recipient.

Ho and Weigelt (Ho and Weigelt, 2005) [19] used a multi-stage trust game paradigm. In their experiments, they expanded the funds by tenfold. They found that when the funds were expanded, the trust level and credibility of the subjects increased significantly compared to when the funds were not expanded. The study of Kuroda (Kuroda, Kamijo and Kameda, 2020) [22] also found similar results.

3.2. Receiver Endowment

The BDM paradigm constraints that the initial funds of the trustor and the trustee are both \$10. However, some subsequent researchers did not give the trustee the initial funds in the experiment.

According to the theory of inequality aversion, when the trustee has no initial

funds, it may arouse the trustee's unequal aversion, which makes the trustor feel pressure and sin, trustor's behavior in the experiment might be changed in such condition (Adams, 1965 [23]; Adams and Freedman, 1976 [24]). Some studies in experimental economics also indicate that the behavior of subjects will be affected by other-regarding preferences (such as fairness) (Bolton and Ockenfels, 2000 [25]; Charness and Rabin, 2002 [26]; Fehr and Schmidt, 2001 [27]).

The results of previous studies on the influence of the trustee's initial funds on the trustor's behavior are inconsistent. Johnson *et al.* (Johnson and Mislin, 2011) [17] then including variables that affect the trust game into meta-analysis, the initial funds of the trustee are marked as 1 if there are initial funds, otherwise, 0. The result of the meta-analysis shows that the behavior of the trustor does not change significantly as to whether the trustee has initial funds or not.

3.3. Rate of Return

The prerequisite for trust is that if one party chooses to trust, everyone will be in a better situation. Therefore, in the BDM paradigm, the funds from the trustor to the trustee will be tripled before being given to the trustee. How will changing the size of the multiple affect the trustor's behavior? The results obtained by previous researchers are not consistent.

Ackert *et al.* (Ackert, Church and Davis, 2011) [28] used trust games to explore the underlying factors of reciprocal behavior. The researchers set the multiples as 3 times and 6 times, they found that when the multiple is 6 times, the trustee returns significantly more money to trustor, but there is no significant difference in the funds transferred from trustor to trustee. Mislin *et al.* (Mislin, Williams and Shaughnessy, 2015) [29] set the multiples as 2 times and 4 times, and found similar results. However, Lenton *et al.* (Lenton and Mosley, 2011) [30] set the multiples as 2 times, 3 times and 4 times in the experiment, they found that the funds transferred from the trustor to the trustee are different under different condition, when the multiple increases, the trustor transfers greater proportion of funds to trustee.

4. Payoff Matrix

In recent years, due to the unstable experimental results, the experimental results of psychology have been increasingly questioned by researcher, which, in turn, makes psychology fallen into an unprecedented reproducibility crisis (Open Science Collaboration, 2015) [31]. There are many ways to solve the reproducibility crisis. From a statistical point of view, because statistical method of traditional psychological research is mainly based on the Null Hypothesis Test Theory (NHST), the new statistical analysis method might be a way to solve the reproducibility crisis, including methods based on Bayesian hypothesis, robust statistics, estimates-based statistics, etc. From the perspective of experimental reports, open, transparent and open research standards, including pre-registration, complete disclosure of research process and experimental results, open data and materials, might

also solve the reproducibility crisis to a certain extent (Hu *et al.*, 2016) [32]. From the perspective of experimental design, effective experimental paradigms and research variables might also be a robust way to solve the reproducibility crisis.

For trust game paradigm (BDM paradigm), traditional research is to explore the different levels of various variables that affect the trust game paradigm or the interaction between different variables. However, there is no consistent and stable result regardless of the size of the overall funds, the availability of funds for the trustee, or the size of multiples. Some researchers (Evans and van Beest, 2017) [33] use binary trust game according to the structure of the payoff matrix in the prisoner's dilemma paradigm. Due to the payoff matrix structure of the new paradigm, researchers are able to set new research variables to precisely manipulate the behavior of subjects.

The payoff matrix is the funds that the subjects can obtain in the experiment according to different choices made by the subjects. For example, in the prisoner's dilemma, the subject clearly knew that when he/she made a betrayal decision, if his/her partner also made a betrayal decision, then both of them would receive funds of P; if his/her partner made a cooperative decision, then trustee gets bonus of T, and trustor gets funds of S; if they both choose to cooperate, then they will both get funds of R. The payoff matrix of the binary trust game paradigm is simpler and clearer than the payoff matrix in the BDM paradigm.

This kind of payoff matrix setting with a clear description of the possible consequences according to the decision makes the participants more clear about the consequences when making decisions. What's more, it also allows the researcher to explore the impact of changes in the payoff matrix on participant's behavior by systematically adjusting the structure of the payoff matrix.

The research on the payoff matrix of the prisoner's dilemma game mainly includes two aspects: 1) Research on fear and greed (Engel and Zhurakhovska, 2016 [34]; Gong, Baron and Kunreuther, 2009 [35]; Insko, Wildschut and Cohen, 2013 [36]); 2) For cooperation Index research (Rapoport, 1967) [37]. The researchers introduced the two aspects of the research of the prisoner's dilemma game into trust game paradigm, which not only enriched the research on trust, but also deepened the understanding of trust.

4.1. Cost, Benefit, Temptation

The payoff structure of the binary trust game paradigm is exactly the same as the payoff structure of the prisoner's dilemma game paradigm. The only difference is that in the binary trust game, it is trustor who makes the first move, while in the prisoner's dilemma game the subjects make their decision at the same time. When investigating the influence of the structure of the payoff matrix on the cooperative behavior of subjects in the prisoner's dilemma game paradigm, the researchers proposed two parameters, fear and greed. In the trust game paradigm, fear is also called cost, greed is also called temptation, and the researchers put forward a third parameter—Benefit (see **Figure 2**).

In the prisoner's dilemma, the value of fear, or cost, is determined by the

value of P-S, which means that after participant A chooses to trust, participant B chooses to betray, this is the cost compared to participant A chooses distrust. T-R represents greed, which means that one participant chooses to trust, and the other participant's potential gains when choosing to betray; similarly. The value of R-P represents benefit, which means the benefit when both choose to betray compared to both choose cooperation. Social psychologists reported that subjects make their decisions based on the size of temptation and loss (Bonacich *et al.*, 1976 [38]; Komorita, Sweeney and Kravitz, 1980 [39]).

The findings of Zheng *et al.* (Zheng, Kendrick and Yu, 2016) [40] support that loss and temptation have an impact on participants' cooperative behavior. Using the prisoner game paradigm, the experimenter keeps the values of R and P constant, and controls the value of loss (P-S) and temptation (T-R) by adjusting the size of T and S. There are two levels of loss and temptation. The results of repeated measures analysis of variance showed that the main effects of loss and temptation were significant.

Evans *et al.* (Evans *et al.*, 2011) [41] have obtained similar results in the trust game paradigm. The experimenter is exploring the influence of cost (P-S), benefit (R-P), and temptation (T-R) on the behavior of trustors. In experiment one, the experimenter restricted $2R = T + S$ and making the value of P to be constant at 20, the potential values of S are 0, 5, 10, and 15, and the potential values of R are 25, 30, 35, and 40, so there are four values of cost and four values of benefit. It turns out that when the potential cost increased, trustor makes fewer trusting behaviors; when the potential benefit increased, trustor makes more trusting behaviors. According to the results of Experiment 1, the researchers took the potential cost of 5 and the potential gain of 15 as the low-risk scenarios, and the potential loss of 15 and potential gains of 5 as the high-risk scenarios, and explored the impacts of different level of temptation on cooperation behavior in the high and low risk scenarios. The results found that compared with high-risk scenarios, in low-risk situations, when the trustee's potential temptation becomes larger, the trustor's trust behavior also decreases.

Evans' experimental results show that for trust games, compared to the prisoner's dilemma, trustor may not only consider the risk of making trust decision, but also consider what the trustee's reaction in the current payoff matrix, like the possibility of betrayal.

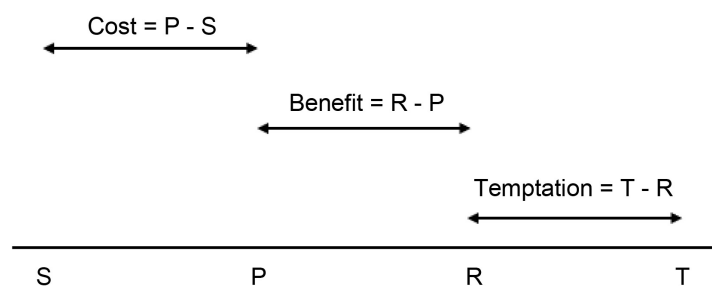


Figure 2. The calculation method of cost, benefit and temptation.

When Malhotra (Malhotra, 2004) [42] explored the impact of benefit and cost on participants' behaviors in the trust game paradigm, they manipulated the level of cost and benefit, and found that benefit have a significant impact on the participants' cooperative behavior. However, there is no significant main effect of cost.

Although there are many research results that support the influence of the absolute value of cost and temptation on participants' cooperative behavior, some researchers still question the stability of cost and temptation effects (Ahn *et al.*, 2001 [43]; Ho and Weigelt, 2005 [19]; Malhotra, 2004 [42]; Simpson, 2003 [44]).

When Ahn *et al.* (Ahn *et al.*, 2001) [43] explored the influence of cost and temptation on the behavior of subjects in prisoner's dilemma; they found that standardized cost and temptation are important factors in predicting the behavior of subjects in prisoner's dilemma. In the experiment, the experimenter controls the cost and temptation by changing the absolute values of T and S, but adding the absolute value of cost and temptation to logistic regression does not show significant results. However, using standardized cost and temptation values result significant results.

In view of this, some researchers reported that the absolute value of cost and temptation can only predict the participant's cooperative behavior to a certain extent. A more effective approach should be to use the standard value of cost and temptation to predict the behavior of the participant. Based on the study of the trust game paradigm, some researchers have proposed the "Index of Risk" and the "Index of Cooperation".

The value of the risk index is determined by the ratio of the cost ($P-S$) and benefit ($R-S$), that is the value when trustor making the distrust decision to avoid cost and the value when trustor making trust decision to get the potential benefit. The temptation index of the trustee is determined by the ratio of the extra benefit ($T-R$) when trustee making betray decision and the benefit got (T) when making betray decision.

$$\text{Index of Risk} = \frac{P-S}{R-S}$$

$$\text{Index of Temptation} = \frac{T-R}{T}$$

Subsequent researchers (Evans and van Beest, 2017 [33]; Snijders and Keren, 1999 [45]) supported this theory. In the experiment, Evans *et al.* manipulated risk level (low risk = 0.25, high risk = 0.75) and temptation level (low temptation = 0.16, medium temptation = 0.35, high temptation = 0.60), regression analysis results showed that both risk and temptation can significantly predict the behavior of subjects.

4.2. Index of Cooperation

When Rapoport (Rapoport, 1967) [37] explored the underlying variables that influencing people's decision in prisoner's dilemma, according to the payoff matrix in the prisoner's dilemma, combined with the limitation of the prisoner's dilemma

paradigm, the concept of cooperation index was put forward.

The index is determined by the ratio of the subject's personal benefit ($R - P$) when the subject makes a trusting behavior and the financial difference ($T - S$) when the subject is betrayed by the other party after making the trust behavior. It needs to be pointed out that the cooperation index is proposed for the prisoner's dilemma, where the two subjects making the decision at the same time. Because the simplified trust game has a similar payoff matrix to the prisoner's dilemma, the only difference is that the trustor makes the decision first. Therefore, for the trust game paradigm, the cooperation index is only valid for trustor.

$$\text{Index of Cooperation} = \frac{R - P}{T - S}$$

Balliet (Balliet and Van Lange, 2013) [12] conducted a meta-analysis of the factors influencing cooperative behavior and concluded that the cooperation index is a stable indicator for predicting the cooperative behavior of subjects. The results of Acevedo *et al.* (Acevedo and Krueger, 2005) [46] also verified the effectiveness of the cooperation index. In the experiment, the experimenter set three levels of cooperation index ($K = 0.83, 0.5, 0.17$), the results found that when the cooperation index increased, the subjects' trust behavior also increased.

5. Summary

Combining the above two aspects of research, it can be concluded that regardless of the calculation of cost, benefit, temptation, or the calculation of cooperation index, it's all depend on adjusting the value of payoff matrix. Some researchers' method (Evans *et al.*, 2011 [41]; Malhotra, 2004 [42]; Zheng *et al.*, 2016 [40]) is to directly calculate the value in the payoff matrix to obtain the absolute value of cost, benefit, and temptation, and then based on this absolute value to investigate participants' cooperative behavior changes. Other researchers (Ahn *et al.*, 2001 [43]; Evans and van Beest, 2017 [33]) found that using the absolute value of cost, benefit, and temptation cannot predict the participants' cooperative behavior. However, the standard value can significantly predict the participants' cooperative behavior. The proposal of the cooperation index also supports the standard value of cost, benefit, and temptation can predict subjects' cooperative behavior to a certain extent. Because the value of the numerator $R - P$ in the cooperation index is similar to the numerator $P - S$ in the risk index to a certain extent, and both their values are to measure the cost of trustors when choosing trust but are being betrayed. To a certain extent, it can be said that the cooperation index and the risk index are positively correlated.

Perhaps both the absolute value of cost, benefit, temptation or standard value can effectively predict participants' cooperative behavior. One possible explanation is Kahneman's prospect theory (Tversky and Kahneman, 1974) [47]: When the absolute value of gains increase, people's value to the income does not show a positive liner correlation with the increase in absolute value. That is to say, the absolute value of cost, benefit, and temptation can only effectively predict the

participant's cooperative behavior when the changes are large. However, the effect of the standard value of cost, benefit, and temptation is relatively stable, and can be unaffected by changes of absolute values to a larger extent.

Researchers have developed trust game paradigm based on the characteristics of trust, namely dependence and risk. On the basis of the trust game paradigm, they have begun to explore the variables that affect trust in order to deepen their understanding of trust. Previous experiments have explored variables that affect people's trust from different perspectives, such as cultural background, iteration, anonymity, etc., but most of these are from the perspective of the experimenter and experimental strategy mentioned above. However, more and more researchers (Balliet & Van Lange, 2013 [12]; Evans & Krueger, 2011 [41]; Evans & van Beest, 2017 [33]) began to explore the influence of the payoff matrix on the trust behavior of subjects, and achieved certain results, which further deepened people's understanding of trust.

6. Future Developments & Limitations

Whether it is the exploration of the payoff matrix structure, or the control of experimenters and experimental strategies, researchers want to explore the variables that affect the trust behavior of subjects in social dilemmas, and hope to confirm the influence of each variable and their interaction effect does on trust. Trust is the ubiquitous "lubricant" in society, but our understanding of trust is not enough. Existing studies cannot fully explain the variables that affect trust, and most of the existing studies are based on the BDM paradigm. Future researchers' research on trust can work on the following aspects:

6.1. Paradigm Perspective

6.1.1. New Paradigm or a Combination of Different Measurement Methods

The BDM paradigm is a classic paradigm to study trust proposed in 1995. Follow-up researchers use this paradigm and its variants to explore different variables that affect trust. However, the trend of contemporary psychology research is that the results from a single research paradigm is increasingly questioned, trust game paradigm is not an exception (Bolton and Ockenfels, 2000 [25]; Charness and Rabin, 2002 [26]). For example, in the BDM paradigm, trustors make trust behaviors in the hope that trustees can return the funds. However, some altruistic trustors may make trust decisions without concerning whether trustees return the funds or not. Therefore, researchers are increasingly inclined to use a combination of multiple methods when measuring trust to control irrelevant variables or cross-validate experimental effects, or to propose new variants based on the deficiencies of the BDM paradigm.

6.1.2. Variable Validity

For the BDM paradigm, previous researchers have proposed many different variables that affect trust, but the effects of some variables are not stable enough, and the conclusions of different researchers on the same variable occasionally

conflict. The reason for the inconsistent results may be that the experimenter manipulates the variables differently, or it may be that some variables that we think are effective have no effect in fact.

For example, in the payoff matrix, some studies support that amount at stake, receiver endowment, and rate of return can predict participants' trust behavior; however, some studies believe that the absolute value of cost, benefit, and temptations have predictive effects on participants' cooperative behavior; what's more, some researches pointed out that only the standard values of cost, benefit, and temptation can predict the participants' cooperative behavior.

In the future, researchers need to conduct systematic research on variables that affect trust to clarify to what extent these variables can stably reflect people's trust characteristics, whether some variables are only situation-dependent that their effects will not exist after being out of context.

6.1.3. Building Model

When investigating the influence of the payoff matrix on the trust behavior of subjects, the researcher proposed the risk index and temptation index. On this basis, some researcher (Evans *et al.*, 2011 [41]; Evans and van Beest, 2017 [33]) further added these two variables in the regression model, explore the extent to which these two variables affect people's trust behavior. Due to the characteristics of the payoff matrix, researchers can quantify the influence of those variables on trust behavior. The research on risk index and temptation index provides researchers with a new direction. With the help of model comparison methods, researchers can also set up multiple models to explore what combination of variables can better simulate people's trust behavior.

6.2. Individual Perspective

6.2.1. Individual Differences

The occurrence and development of trust are closely related to the environment in which the individual is located. Research by some researchers has shown that the trust levels of subjects of different cultural backgrounds are different. Even in the same cultural background, there is still difference between subjects. So which variables affect the differences in trust levels between individuals, and how do these variables affect individuals, those are interesting questions need to be answered.

6.2.2. Special Groups

The research on trust mostly takes normal groups as subjects, but there are a variety of different groups in our society, such as blind people, deaf-mute people, and patients with various mental illnesses. These special groups have also assumed an important role in our society, and research on them can also enrich our understanding of trust to a certain extent.

6.2.3. Cranial Nerves

Research on trust provides us with sufficient literature support for understand-

ing the nature of trust, but most of these literatures are the results from behavioral experiments. As mentioned earlier, the research results of behavioral experiments do not have uniform results for the variables that affect trust, so behavioral experiments may not be sufficient to measure the trust characteristics of individuals. But if trust is measured at the neural level, the results of people's trust traits may be more stable and reliable. Existing experiments have shown that oxytocin can have an effect on people's trust behavior. At the brain network level, studies have shown that the medial prefrontal cortex (mPFC) and the temporal parietal complex (TPJ) also have a stable effect on trust.

6.3. Limitations

The use of payoff matrix enables researchers to systematically control the experimental conditions of trust game. The introduction of cooperation index and temptation index enables researchers to control the experimental conditions in a higher dimension. However, the payment matrix can only affect the decision-making behavior of the subjects in the trust game to a certain extent. What's more, although the cooperation index and the temptation index are similar to standardized parameters, they are not standardized on the same dimension. Therefore, subsequent researchers can try to standardize these two coefficients in the same dimension.

7. Conclusions

Trust is a concept that cannot be ignored in human society, but trust is an overly complex concept, and people's understanding of trust is not comprehensive enough. The proposing of the trust game paradigm provides a relatively effective and reliable tool for people to study the nature of trust. However, due to the instability of experimental effects, more and more researchers have begun to question the validity of the trust game paradigm. So some researchers have proposed some new variants of trust game paradigm, in order to avoid some shortcomings of the trust game paradigm or to explore the essence of trust more effectively. The in-depth study of the payoff matrix enables researchers to quantitatively analyze the impact of funds on people's trust behavior, and build models on this basis to further analyze the degree of influence of different variables on people's trust behavior.

As far as the current research is concerned, the trust game paradigm is still a better way to measure trust. Improvements in analysis methods provide researchers with new and reliable methods. On this basis, future researchers should systematically explore how to improve the reliability and stability of the trust game paradigm.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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