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Risk Decision and Social Comparison in Gambling among Non-gamblers and Gambling Disorder Patients

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Abstract: Previous studies have supported the view that gambling disorder is associated with impaired decision-making. While scholars try to explain it through neurobiological approaches, this study aims to investigate different explanations from the perspective of evolutionary psychology. Our research will mainly focus on the underlying malfunction of risk sensitivity mechanism and effect of social comparison. Participants consist of non-disordered people and gambling disorder patients selected from volunteers and patients from hospital. There are two different situations (visible and invisible) to identify the impact of social comparison. Participants are supposed to choose different risk levels to get higher scores. The expected result of this experiment will be under the combined influence of the mechanism malfunction and social comparison. For gambling disorder patients, the malfunction of risk sensitivity mechanism will lead to an extreme preference for high risk and scores, while non-gamblers will stop or choose a low risk level after obtaining enough or a high score. Affected by social comparison, both kinds of participants will manifest a tendency for higher risk. This study will contribute to explaining differential performance between individuals with gambling disorders and non-gamblers in the gambling scenario through the theory of evolutionary psychology.

Keywords: Evolutionary Psychology, Gambling Disorder, Risk-sensitivity Decision-making, Social Comparison

1. Introduction

Gambling is a cross-cultural activity with a long history[1], which is typically associated with entertainment while many people have engaged in gambling or related activities and may gradually become addicted to it, resulting in recurrent, maladaptive gambling behaviors, which are considered a kind of mental illness. Gambling disorder, also referred to as gambling addiction, is defined as a behavioral addiction according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [2]. Compared with non-gamblers, the behavioral performance and decision-making of problematic gamblers seem to be intricate and exhibits enormous disparity. Gamblers who performed worse in gambling task were claimed to possess impulsivity, which indicates personality traits of

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gamblers and their impulsive decision making [3]. Additionally, gambling disorder patients tend to make more impaired decisions while rules for gains and losses are explicitly given [4].

According to evolutionary psychology, the mechanisms existing in modern organisms can be considered as solutions for ancient adaptive problems [5]. The risk sensitivity theory is one of those mechanisms that are assumed to be optimal survival strategies in the past [6]. It illustrates that organisms tend to choose to take higher risk under the lack of survival resources; if organisms already obtained sufficient resources, they typically shift their risk preference to a much lower level [7]. As it is proposed in the theory of risk sensitive foraging, an organism will change the type of foraging strategy according to various environmental conditions, to meet net energy levels [8, 9]. It can be seen as an appropriate solution for the adaptive problem of gathering sufficient resources. With the changes of human society, the representative need for resources gradually shifts from food to money. However, this mechanism doesn't seem to function well for patients with gambling disorders in the context of gambling. Instead of switching back to the risk-aversion form, gamblers tend to maintain their high level of risk in betting after winning more. The irrational decision-making, which can be observed form gambling addicts, is similar to a phenomenon called hot hand.

The phenomenon of hot hand was first identified in the context of basketball, which describe the situation where people believe they have a higher chance to hit a shot after scoring a hit [10]. Moreover, according to previous researchers, it is also applied in the field of foraging. Barrett and Wilke proposed that hot hand is a pattern of default assumption, as well as an evolved psychological adaptation to clumped resources [11]. The resources being gathered not merely include food, but can refer to other objects that are related to payoffs. Affected by similar belief, gamblers falsely assume the winning probability of their next bet increases if they had won previous rounds.

The comparison theory could be one of the explanations of continuous gambling. Social comparison theory was proposed by Leon Festinger in 1954 [12], which suggests that people hold an innate drive to gain self-evaluations by comparing with others. Based on previous research, some scholars held that upward comparison was related to the decrease of self-regard, while downward comparison was supposed to exert positive effects on people's subjective well-being [13, 14]. Nevertheless, it was later considered that upward comparison could improve people's views of themselves and obtain more comprehensive self-evaluation by comparing with someone better off [15]. Meanwhile, some researchers considered that people care about social status, because it functions as a signal of non-observable abilities [16]. With regard to the context of gambling, people will face losses which refers to the changes of in-game status. Accordingly, gamblers are predicted to compare themselves with superior others and win more rewards to enhance their status.

Previous studies on gambling disorder have mainly focused on cognitive processes and neurobiological mechanisms. It has been shown that gambling addicts exhibit abnormal activity in specific brain regions associated with reward and impulse control during decision-making [17]. In the mental processes, many unique cognitive features, like irrational cognitions, can be of great importance in gambling disorder and correlated with gambling behaviors [18]. Dopamine has been proved to be related with substance use and gambling disorders, but it’s important influence on gambling disorder remains controversial [18, 19]. However, the accurate relationships between neurochemistry mechanisms and gambling behaviors and gambling disorder still require further investigations.

Evolutionary psychology explains contemporary psychological phenomena by understanding the evolutionary roots of human behavior. According to evolutionary psychology theory, gambling behavior can be viewed as a strategy seeking high risk and high reward, which may have adaptive significance in environments with scarce resources and high uncertainty and therefore it may have made sense in ancient times. However, as society and environments change, some maladaptive

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symptoms can present in special contexts, such as gambling. Accordingly, this study aims to investigate gambling disorder and decision-making from the perspective of evolutionary psychology.

At present, there is a lack of systematic research on the effect of gambling disorder on risk decision-making from the perspective of evolutionary psychology. Studying this gap not only contributes to a more complete understanding of the causes of gambling disorder, but may also reveal new avenues of prevention and intervention. Statement of Research Purpose:

This study will explore the mechanisms behind gambling disorder and risk decision-making and setting up two scenarios—visible and non-visible, based on whether one could notice the data of others to explore the impact of social comparison within related contexts from the perspective of evolutionary psychology, aiming to fill the research gap in this field and provide new theoretical and empirical support for this field. The test objectives guiding this study are as follows:

(1) Risk-sensitivity decision-making theory is not applicable in the context of gambling.

(2) Patients with gambling disorder experience abnormalities in risk aversion.

(3) Social comparison is an influential factor in the context of gambling.

Hence, the hypotheses are as follows:

(1) If gambling disorder is caused by the breakdown of Risk sensitivity Decision making Theory, as resources accumulate, the risk associated with decisions made by ordinary people will gradually decrease or stop, while the risk associated with decisions made by people with gambling disorder will remain consistently high.

(2) If social comparison theory has an impact on decision-making, then compared to invisible situation, participants in the visible situation group have a higher risk of making decisions and will ultimately receive higher scores.

2. Methods

All participants are composed of volunteers, including college students and hospital psychiatric patients. The male to female ratio is 1:1 and the age range is 18-60 years old. All participants in the experiment are divided into two groups: one group consists of people without any mental illness, and the other group consists of patients diagnosed only with gambling disorders. Ensuring that all participants fully understand the experimental rules and that their participation is voluntary and protecting the privacy and data security of the participants. The experiment should be carried out with the approval of the ethics committee. Each participant will be paid after finishing the experiment.

To verify the impact of social comparison [12], this study designed two situations. One situation is the invisible situation which participants will only be aware of their own scores and another situation is the visible situation which is to establish a public ranking list, where participants can constantly watch the scores of other participants during the whole experiment. Based on the Iowa Gambling Task (IGT) paradigm [20], some simplifications were made on this basis. There are three game modes with different levels of risk. The risks, from low to high, are as follows:1. There are two options, one is correct. If you choose correctly, you can get 1 point. If you choose incorrectly, 1 point will be deducted. 2. There are four options, one is correct. If selected correctly, you can get 6 points. If selected incorrectly, 2 points will be deducted. 3. There are six options, one is correct. If selected correctly, 15 points can be earned. If selected incorrectly, 3 points will be deducted. The purpose to doing so is to make sure that all risk levels have same value of expectation. Because the purpose of the research is to observe the performance of participants after obtaining sufficient resources. To avoid the small probability of continuous loss and even loss all. To do that, the winning rate back of the experiment will be controlled. Regardless of the chosen risk or option, participants will always choose correctly. At the same time, in order to dispel participants' doubts about the authenticity of the experiment, a certain number of incorrectionswill be interspersed based on the number of times the participants make decisions. But in the pre-experiment, the winning rate depends on the rules. This

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is to observe whether they prefer high-risk or lower-risk options or stop in a timely manner after accumulating more points.

Participants will be informed that the compensation they receive is proportional to their scores, to motivate their enthusiasm for the experiment. Each participant will go through the three game modes in both visible and invisible situations. At the beginning of the experiment, the initial score of the participants is 10 points, and then three risk levels will be displayed on the screen. The participants press the keys on the keyboard, with 1 corresponding to low risk level, 2 corresponding to medium risk level, and 3 corresponding to high risk level. After selecting the risk level, a corresponding number of cards will appear based on the selected level. The cards from left to right will be selected by pressing keys 1-6 on the keyboard. After each card selection, feedback will be given based on right or wrong, and the risk level selection will be entered again until the participant autonomously ends the experiment or reaches the highest score. The choice of risk level by the participants during the experiment and the final scores will be recorded every time.

This approach aims to provide insights into the decision-making processes and risk-taking behaviors of individuals with and without gambling disorders, considering both private and competitive social contexts. For the collected data, first a fixed score value (relatively high score value) will be set and observe the participants' choice of risk level after reaching this score. There is a horizontal Cartesian coordinate system with scores as the x-axis and risk levels as the y-axis will be set and observe how the trend of risk selection changes as scores accumulate. Due to the varying length of each subject's experiment, a fitting model was established within the participants to observe the trend curve of risk selection as scores changed. Then use SPSS to apply a unified fitting model to each participant for inter subject comparison and observe differences between groups. And compare the final scores of the two groups of participants in two different situations to demonstrate the impact of social comparison.

3. Results

This experiment mainly considers the influence of two factors, the risk-sensitive mechanism and social comparison. To assess the social comparison, the experiment will be divided into two situations, where participants can observe others, and one where they cannot. In Table 1, only consider of the effect of risk sensitive mechanism, the participants with gambling disorder tend to remain at high risk level or choose higher-risk level in visible and invisible situation as the scores increase. In contrast, the risk level which chosen by the non-gambling disorder participants will decrease as the increase of scores in both visible and invisible situation. And there are no significant differences between visible and invisible situation. In Table 2, with the influence only by social comparison, the risk level chosen by all participants will decrease. However, participants with gambling disorders are expected to exhibit the highest risk-taking behavior in the visible condition, while non-disordered participants will choose higher risk levels in the visible condition compared to the invisible condition, as illustrated in Figure 2. These results can be broadly categorized into two trends: a tendency to maintain high-risk decisions and a tendency to reduce the likelihood of taking high-risk decisions. Regardless of whether the risk remains unchanged or decreases, it is evident that individuals with gambling disorders are more likely to make risky decisions than those without the disorder.

Table 1: Expected results influenced by Breakdown of Risk Sensitive Mechanism

Experiment	Visible	Invisible
Gambling Disorder	Remain High or Higher;	Remain High
Non-Gambling Disorder	Decrease	Decrease

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Table 2: Expected results influenced by Social Comparison

Experiment	Visible	Invisible
Gambling Disorder	Decrease(Highest)	Decrease
Non-Gambling Disorder	Decrease but higher	Decrease

(1) If risk-sensitive mechanisms is solo factor at play and social comparison has no effect, then the results will consist of two lines in Figure 1. The blue line represents the risk level chosen by participants with gambling disorder while the orange line represents the risk level chosne by participants without gambling disorder. Whether in visible or invisible situation, they do not change their tendency which rules out the role of social comparison in gambling disorder. As a result, there are no distinct lines for the visible and invisible situations. This is one of the possible outcomes. In Figure 1, participants with gambling disorders consistently tend to make high-risk decisions regardless how many scores they accumulate. In contrast, participants without gambling disorders show a reduction in high-risk decisions as their scores increase. This result suggests that the reason participants with gambling disorders tend to consistently make high-risk decisions due to a malfunction in their risk-sensitive mechanisms.

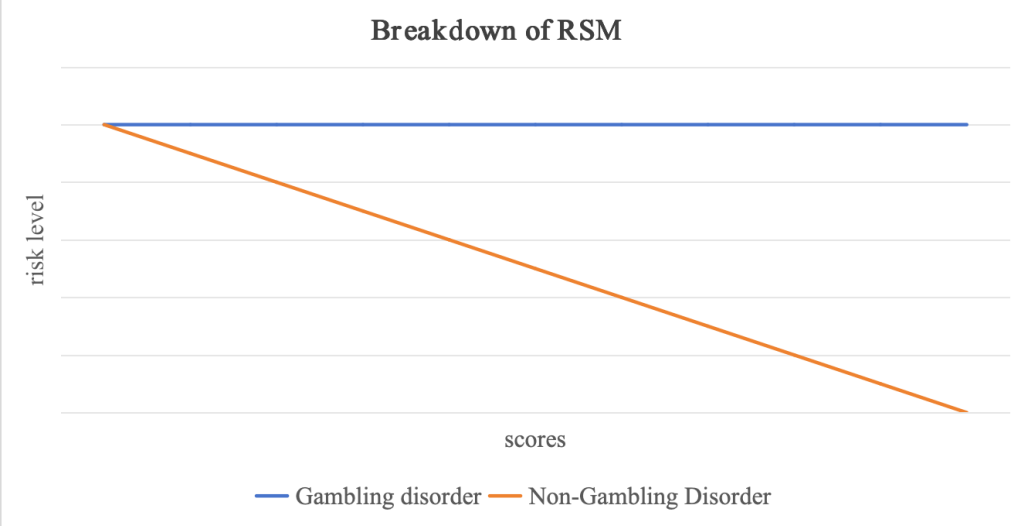

Figure 1: The breakdown of the risk sensitive mechanism as the only influencing factor results in the line chart

(2) If social comparison plays a role and the breakdown of risk-sensitive mechanisms has no effect, then Figure 2 will display four lines, all showing a decreasing trend in risk levels. Whether participants are in a visible or invisible situation determines the extent of the risk they choose, demonstrating the influence of social comparison on gambling behavior. This is one of the possible outcome. In Figure 2, the yellow line and green line show the choosing by participants with gambling disorder in visible and invisible situation, respectively. The blue line and the orange line show the choosing by participants without gambling disorder in visible and invisible situation. Although participants with gambling disorders tend to choose higher risk levels, they still exhibit a decreasing trend. Meanwhile, participants without gambling disorders also show a decrease in risk levels but tend to choose lower risk than those with gambling disorders. This result directly suggests that both participants with gambling disorders or without gambling disorders are influenced by social comparisons when they make risk decisions.

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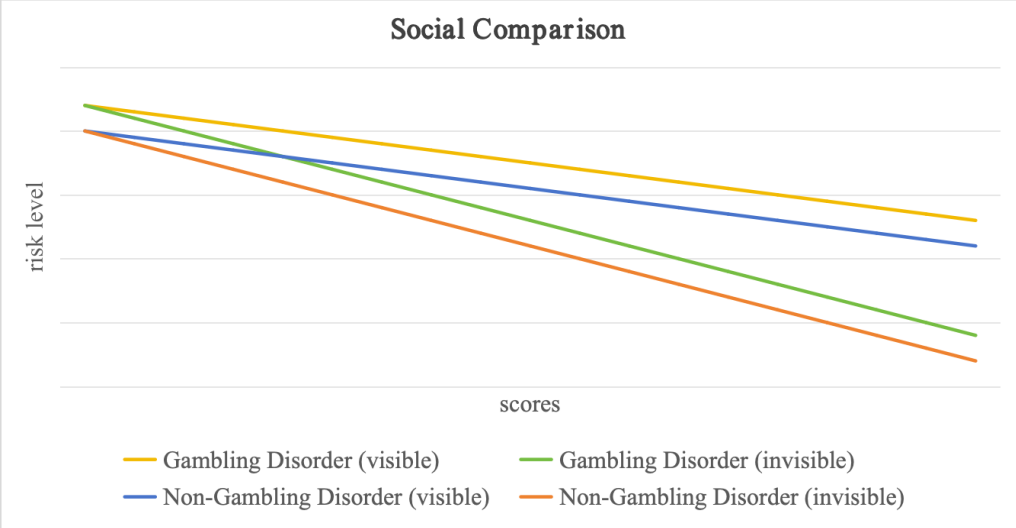

Figure 2: Social comparison factors as the only factors affecting the realization of the results of the line graph

(3) If risk-sensitive mechanisms and social comparison are at play, Figure 3 will show four distince lines. The blue line and the orange line respectively represent the results of experiments in participants with gambling disorders in visible and invisible situation. Participants with gambling disorder tend to make high-risk decisions, no matter how many scores they accumulate. In the visible condition, some may take even higher risks due to the influence of social comparison. And the yellow line and the green line represent the participants without gambling disorder in visibile and invisible situation, respectively. Participants without gambling disorders tend to make fewer high-risk decisions as they accumulate more scores. However participants in visible situation are more likely to take risks because of social comparisons. This result directly suggests that participants with gambling disorders tend to consistently make high-risk decisions because their risk-sensitive mechanisms are broken and social comparison factors will be the other factor to increase the choosing of risk level.

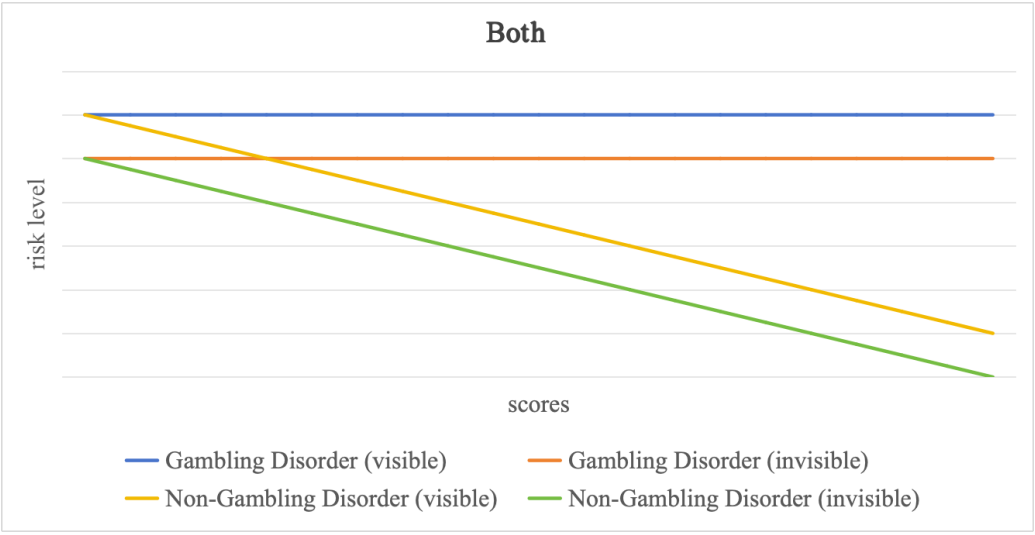

Figure 3: A line graph of the results achieved under the combined action of social comparison factors and damage risk sensitive mechanisms

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4. Discussion

Based on the Iowa Gambling Task (IGT) and design, experiments separate in the cases of visible and invisible, to explore the impact of the breakdown of risk-sensitive mechanism and social comparison on risk-taking behavior after gambling disorder patients and non-disordered people get certain resources. (Note that because the scores obtained by the participants in the experiment are directly proportional to their remuneration, the scores will be regarded as resources.)

In conclusion, this study predict that if the breakdown of risk-sensitive mechanism is the only influencing factor, whether visible or invisible, patients with gambling disorder will continue to make high-risk decisions, and non-disordered people will switch from high-risk decisions to low-risk decisions. If social comparison is the only influencing factor, both participants will switch from high-risk decisions to low-risk decisions in both cases (but the risk lever in visible situation is higher than in invisible situation). If the above two factors affect at the same time, the risk lever of both participants will reduce in both cases, but it in visible situation is higher than in invisible situation, and in each case, patients with gambling disorder are higher than non-disordered people.

The previous study and found that most of them were from the perspective of neurobiology to analyze the physiological mechanisms behind gambling disorder. This study broke this limited situation and tried to add the perspective of evolutionary psychology, this opens up a new direction for the study of gambling disorder, which may help people better understand the psychological mechanism of gambling disorder, so as to provide new ideas for the treatment of this mental illness. And through this experimental design, this study can help us better understand the decision-making process of different individuals in the face of risks and returns, and how resource conditions affect these decisions. This may be of great significance for understanding gambling disorder and its psychological mechanisms.

There are still some limitations in this study. One of the original ideas is to prove the gambling disorder was not a disorder in previous societies, it was beneficial to the survival and development of the human population and gradually became a disorder with the progress of society. However, according to the current experimental mechanism, this idea cannot be fully explained from the perspective of integrating evolutionary psychology and neurobiology. And there are too many possibilities for the experimental results, but this study can't list and explain all the situations.

5. Conclusion

Based on the results and discussions presented above, the conclusions are obtained as below:

(1) This illustrates the malfunction of the risk sensitivity theory in evolutionary psychology on patients with gambling disorders.

(2) It is shown that regardless of whether one has gambling disorder or not, due to the prevalence of social factors, people generally choose higher risks in visible situations than in non-visible situations.

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Zushen Wang and Sebastian Mao contributed equally to this work and should be considered co-first authors.

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