Impact Mechanism of Tourism Risk Perception Based on Psychological Theory and Brain Cognitive Science

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ABSTRACT

In recent years, people's living standards are increasing continuously and people are paying more and more attention to leisure activities. As one of the most important ways of leisure activities, the tourist market is developing rapidly, which poses more stringent requirements for the improvement of problems and risk in tourism market. Based on psychological theory and brain cognitive science, this paper studies the mechanism of tourism risk perception through EEG experiments. The research results show that according to hypothesis 1 and hypothesis 2, the main effect between individuals preparing to travel and tourism decision-making behavior is significant due to personal preference, whether time is convenient or time preference. Based on the results of LPP data analysis, the hypothesis 3 can be verified. Those people who travel frequently are less capable of perceiving risks, which can also verify hypothesis 4. People believe those places with more perfect facilities are safer, so they have worse perception of risk. The research conclusions of this people are conducive to reducing tourism risks of tourists and can also help tourism agencies provide more appropriate and caring services for tourists.

Key Words: Psychology, Brain Cognition, Tourism Risk, Perception Impact

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Introduction

In recent years, people have become increasingly demanding about tourism and they have traveled more and more frequently. People now can travel to more extensive areas, but they are also confronted with more and more risks in tourism. Tourism risk refers to the possible negative effects or results perceived by tourists when performing travel activities (Fischer *et al.*, 1991; Huang, 2015). When choosing the place of travel, the local security level will be their first consideration. However, in fact, security is the factor that cannot be quantified (Suddle, 2009), so the combination of safety with risk is one of the necessary steps in the study of tourism risks (Lepp and Gibson, 2003). From the perspective of constructivism, the overall social risk is now greater than before (Beck, 2012). Meanwhile, people's perception and feelings about risks have also gradually increased. The perception of tourism risks is the subjective judgment made by the traveler during the journey and the uncertainty of the final structure. When tourists are engaged in tourism activities, though it is possible to find the objective quantitative realities of the existence of risks, the impact of subjective perception of risks is more significant (Cater, 2006). Different visitors have different thresholds for the perception of tourism risks. Once the threshold is exceeded, tourists' resistance to risks will reach the point of explosion and thus they will take some measures to reduce the risk. When it comes to actual tourism activities, this measure can be reflected in the choice of travel

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destinations, travel modes, and the impact on travel motivation.

Tourism is basically a kind of consumption activity, whose risks generally refer to the time when services are performed or the products cannot meet the expectations of tourists. Sometimes the uncontrollable time and factors in the travelling consumption are also considered to be the tourism risk. Because the public have different understanding about the concept of risk, tourism risks are generally understood as the aggregate concept of "various accidents or damages that are encountered by tourists during the journey" (Jurowski, 2010) and "the negative results when tourists are not able to make good decision about travelling" (Shenghshiung *et al*., 1997). The research on tourism risk perception started from the 1990s. Bauer added the concept of risk perception to consumer behavior research for the first time and defined risk perception as people's emotional attitude and direct sensory judgment towards risks (Kozak *et al*., 2007).

In summary, the literature shows that the current research on tourism risk perception is based on an objective perspective and the assessment model for tourism risk perception can be mainly divided into two types: conceptual model and factor model. The conceptual model emphasizes the "uncertainty" of morality and "dangerousness of consequence" that visitors' intuitive feelings about tourism services, which is called a two-factor model. The factor model considers various subjective and objective factors of risks that may occur during the journey, and then uses a weighted model for comprehensive evaluation (Schneider *et al*., 2006). This paper mainly describes the background and significance of the research on the impact of tourism risk perception in the introductory part and also introduces the existing research results at home and abroad. It can be seen from current existing research fields of tourism risk perception mechanism are all relatively objective researches and the impact of individual differences on researches is not strictly controlled. Therefore, this paper builds a model on tourism risk perception based on actual EGG experiment data from the perspective of psychology and brain cognitive science. After corresponding data processing, its mechanism is analyzed.

Research hypothesis

The research problem of this experiment is the impact of tourism risk perception. Due to different individual attributes of tourists, there are huge differences in the cognition of different tourists, which are more likely to give rise to cognitive errors; in order to regulate this kind of uncertainties, researchers need to be investigate and regulate the influencing factors produced by cognitive errors. Based on this, this paper proposes the following four hypotheses.

Hypothesis 1: Each individual prefers to go to his or her favorite scenic spots when selecting the destination, thereby reducing the risk perception of this location.

Hypothesis 2: Travelling time is also a critical factor that determines whether tourists will choose to travel or whether there are potential risks in travelling.

Hypothesis 3: People who travel frequently often have poor perception of tourism risks.

Hypothesis 4: In places where facilities are relatively complete, people are less aware of their risks when travelling.

EEG Process and Data Results

Experimental Purposes

This paper selects and uses the research methods of event-related potentials to truly and comprehensively simulate the process and psychological changes of tourists' tourism risk assessment behavior through experimental paradigms related to key tasks to further discover the inherent laws and connections of individual neural mechanisms when formulating travelling plans. In this experiment, a start-detection experiment paradigm is used. Because the individuals' physical health may have an irreversible effect on the experiment, 17 individuals with relatively good physical condition will be selected when selecting the experimental subjects and the above assumptions will be verified through EEG researches.

Methods

EEG experimental research is a controlled test method. Through controlling one or various factors of different individuals, the special effect of different factors is evaluated. The experimental results of this study are suitable for verifying the causality of different differences between individuals, which is mainly to manipulate control variables through screening individual characteristics. And then, different influences of this variable are observed. In this experiment, 17 individuals who were in good physical condition are randomly selected and the proposed hypotheses are verified through EGG experiment. Before conducting the experiment, the students participating in the experiment need to read the experiment procedure according to the regulations and sign the letter of consent that they are voluntary and informed to participate in this experiment.

Experimental methods

(1) Experimental subjects

The subjects selected for the experiment are 17 tourists and they have the ability and conditions to make independent decisions on travelling. They are between the ages of 20 and 25. They have no mental illness and are in good mental state; and they are healthy and have no disease, so they are capable of participating in this EEG experiment.

(2) Experimental Materials

Everyone involved in the experiment is in a quiet experimental environment and is arranged in comfortable chairs served by the tester. A computer is placed 90 cm in front of them. And subjects need to wear an electrode cap and apply conductive paste. Meanwhile, the experimental subjects need to carefully read the experimental instructions. In order to allow the experimental subjects to better participate in the experiment, it is necessary to conduct the pre-experiment, enabling them to adapt to and be familiar with the experimental situation. The pre-experiment stage needs to be completed before the formal experiment. At the beginning of the experiment, an "Experiment Start" prompt will appear on the screen in front of the subjects, indicating that the experiment has officially started and the subjects will adjust their mental state; before making the travelling decision, the brain electricity data of the students will be collected and recorded; there are five questions on the screen affecting travelling decisions. The students who participate in the experiment respond by pressing several keystrokes to simulate the decision process and the EEG data of the experimental subjects are collected and recorded the. Meanwhile, there are some problems related to tourism but not related to the hypothesis serving as interference information. The EEG data before and after the experiment need to be recorded as key information; finally, when the subject completes the questionnaire, the EEG data of the subject are collected and recorded as cognitive assessment data for later experiment.

(3) Experimental Process

The experimental sequence of 17 subjects was pre-arranged and subjects were invited to conduct experiments and clean the scalp. The specific experimental steps were as follows: 17 subjects entered the experimental environment in turn and conducted experiments; the subjects watched and understood the experimental instructions, and consulted with the experimental personnel in time when they were confused; the subjects sat in chairs and the experimental personnel helped them put on an electroencephalograph, and tested and calibrated; formal experiments began and problems would appear on the screen in front of the subjects. The subject chose the keystroke to answer the question, namely the number keys 1 to 5 (1 - very poor, 2 - relatively poor, 3 - normal, 4 - better, 5 - very good). They pressed the keyboard at the same time and answered the question truthfully. And then, they will move on to the next question until all four questions have been answered. Then, the entire experimental process would come to an end; when the experiment was over, the electroencephalograph stopped recording.

(4) Experiment Instruments

The Brain Amp64 EEG Recorder manufactured by EGI, USA.

(5) EEG Data Recording

In the experimental process, the EEG data was collected by an electrode cap. The electrode caps were arranged according to the international standard 10-20 system with 64 Ag/AgCl electrode points. One electrode was placed on the upper and lower sides of the left eye to record the blinking and vertical inspection and one was placed on the outer corner of the left and right eye to record the horizontal EOG. The Neuroscan Synamp2 Amplifier System was used to process and amplify the collected EEG data and the filter frequency is 0.05-100Hz. The sampling frequency is 1000Hz and the impedance should be kept at 5,000 ohms or lower to ensure the accuracy of the experimental data. Before the recording experimental data, the setting of “removing 50Hz interference” should be turned on to exclude the influence of the external environment.

Afterwards, relevant waveforms and ERP can be obtained. When performing data processing, the required experimental data was obtained through repeated measurement variance analysis to analyze the corresponding data results.

Behavioral Data Analysis

The so-called behavior data is the data corresponding to the behavior of the experimental subject. Specifically, the recording of behavioral data is actually the recording the key results of the experimental subjects and the reaction time to seeing the problems, and the measurement and evaluation of the response of the experiment to beliefs. The consent rate of different individuals on travel decisions=times of agreement keystroke/total number of keystroke (sum of agreement keystroke and disagreement keystroke). During the entire data processing process, the number of times when the subject did not press the button was deleted and the author regarded this situation as an invalid response. The reaction time of group decision-making investment behavior refers to the time from the emergence of problems until the subject made the decision on the problem and expressed the subjects' perception and understanding of this investment decision-making problem. On this basis, in-depth analysis and research were carried out. The analysis of the consent rate and response time of number of travelling, destination, personal preference and time preference in four situations was conducted. Based on the previous discussion, during the experiment, the experimental subjects expressed their ideas by pressing the button, which was their own recognition of the travelling plan. The consent rate of different individuals on travelling decisions = times of agreement keystroke /total number of keystroke (sum of agreement keystroke and disagreement keystroke), as is shown in Figure 1.

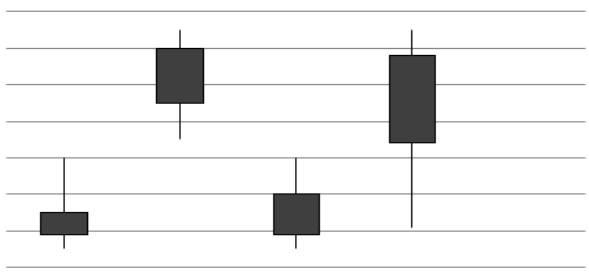

Figure 1. Bar Chart of Consent Rate in Four Occasions

The analysis of Figure 1 clearly showed the following conclusions: destination and time selection were more considered by individuals in their decision-making behavior. Specifically, when making decisions, the consent rate of investment decision-making individuals (mean=3.41%, standard deviation=3.01%); consent rate in individual decision-making in terms of destination (average=82.41%, standard deviation) =15.44%); consent rate in individual decision-making in terms of personal preference (mean=8.02%, standard deviation=7.33%); consent rate in individual decision-making in terms of time selection (mean=64.21%, standard deviation=27.05 %).

EEG Data Analysis

(1) Removal error

The original signals collected by the experiment include three kinds of spontaneous EEG signals, inducive EEG signals and other physiological interference signals. When there is no specific external stimulus (visual, auditory, and tactile), the spontaneous EEG signal is a potential change produced by the brain nerves; when the sensory organs are stimulated, the inducive EEG signal is a potential change produced by the induction of brain nerves; other physiological interference signals mainly include EOG, ECG/EMG and so on. The inducive EEG signals contain tourists' cognitive assessment information, so the inducive EEG signals need to be extracted and analyzed. The main steps are as follow: removal of physiological interference signals. The amplitude of EEG signal induced is about 2 ~ 10μV, which has a high sensitivity to time changes. Other physiological signals such as EOG, ECG and EMG may interfere with the actual EEG signal. Therefore, first of all, EEG, ECG and EMG signals should be removed; digital filtering and EEG signals are low-frequency signals, which are easily disturbed by other high-frequency noise signals. The digital signal filtering function of Neuroscan Synamp2 Amplifier software can eliminate the noise of EEG signals. The EEG data segmentation, since the EEG signal is induced for a period of time after stimulation, it is only necessary to process this signal when extracting the EEG signal. The EEG data is divided according to the time axis of the experiment. The experimental stimulus material 1 is presented at the beginning of time A and the time period during which the EEG signal is stimulated by stimulating material 1 is 1500 ms. The time B is the moment when the tester presses the score button, which is the time to present the stimulus material. The effective duration of the stimulus material 2 to induce brainwaves is 1500 ms; the time period CD and EF are the effective durations of the EEG signals caused by the stimulating materials 3 and 4 respectively; the correction of baseline. Because accuracy of the instrument itself is limited and there will be the interference of environmental noise and other physiological signal, problems like baseline drift may appear in the acquired EEG signal, which is manifested by irregular changes in the signal baseline. Therefore, it is necessary to remove the deviation of the brain and baseline through the baseline correction function in the software; the average amplitude. The amplitude of spontaneous EEG signal is within the range of tens of microvolts to several hundreds of microvolts, but the amplitude of inducive EGG signals is only 2 to 10μV. The inducive EEG signals are submerged by spontaneous EEG signals and thus cannot be observed directly. The average amplitude function can be used to average the EGG signals corresponding to the experimental stimulus used by all subjects. The spontaneous EEG signal is a random signal and the average value after the superposition is 0. The inducive EEG signal is a deterministic signal and is basically the same after superposition. After the average amplitude processing, the inducive EEG signal can be extracted.

(2) Analysis of Inducive Brain Waveforms
Electrodes for event-related potential (ERP) evaluation aesthetics include FZ, FCZ, CPZ and CZ electrodes. The components of the classic ERP mainly include P300, which refers to a positive wave with a position-related intermediate latency in the range of 200 ms to 600 ms. P300 is an ERP component related to cognitive assessment function, such as attention, recognition, decision making and memory. P300 is included within 1500 ms of the effective duration of EEG induction. The students participating in the experiment evaluate the four questions and the ERP data of the above ten electrodes will be different. Therefore, the EGG data of these ten electrodes need to be compared and analyzed. After the processing and extraction of the collected brain wave signals, the EEG data of different stimulation objects can be obtained. The EGG waveforms caused by four problems in FZ, FCZ, CPZ and CZ electrodes are shown in Figure 2.

By examining the comparative analysis diagram of inducive EEG, it can be seen that the peaks of brain waves of users in the aesthetic experience under four different programs are different. Table 1 shows the peaks of brain waves caused by four problems at F1-F8, FZ and FC1 respectively.

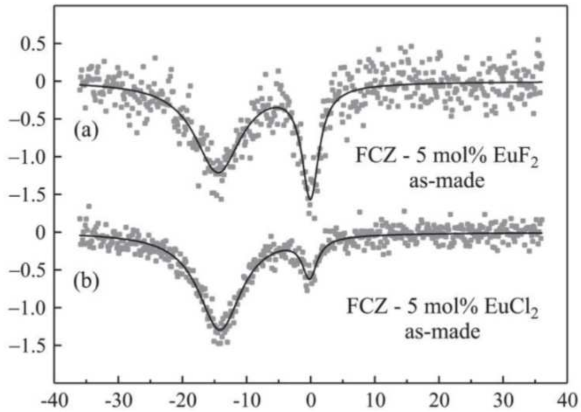

Figure 2. Computer Generated Inducive EGG waveforms

Table 1. Peaks of Brain Waves Induced by Different Electrodes in Four Problems μV

Inducive electrodes	Performance assessment simulated EEG study			
	Problem 1	Problem 2	Problem 3	Problem 4
FZ	3.3	8.1	2.3	8.1
FC1	5.2	4.5	1.4	9.3
F1	6.5	2.8	5.2	3.8
F2	7.2	4.7	3.0	3.5
F3	2.7	2.6	2.2	1.7
F4	4.5	3.5	2.2	3.3
F5	5.4	2.2	7.0	4.6
F6	3.6	5.8	9.4	7.8
F7	2.7	2.5	2.2	1.4
F8	6.2	7.4	5.7	2.1

(3) Analysis of Experimental Results
The Neuroscan Synamp2 Amplifier EEG recording and analysis system and alarm data obtained from off-line analysis are used for the analysis of the experiment data. The specific flow is as follows: merging data→processing and filtering interference data, deleting it→switching reference electrode→filter processing→ removing eye power→capture data analysis section→correcting baseline→removing artifacts →average coverage→coverage between subjects→statistics analysis.

Based on the above situations, the time history of the EEG data is 1000 milliseconds, from which it can be concluded that the subject is answering four questions in the EGG. Since time characteristics are ineligible factors in EEG data analysis, that is, the differences are only displayed within a specific time window. Thus, the author needs to obtain four brain wave modes through the experimental paradigm, analyze the N400 components, and use SPSS to analyze the variance.

The data in the time window of 300 ms-400 ms is selected and the average EEG voltage value is taken for the analysis. Based on previous researches, the radio waves of N400 components have great fluctuations in the front zone and the middle zone. Therefore, according to the actual situation, the author selects 9 electrodes for analysis, as is shown in Figure 3.

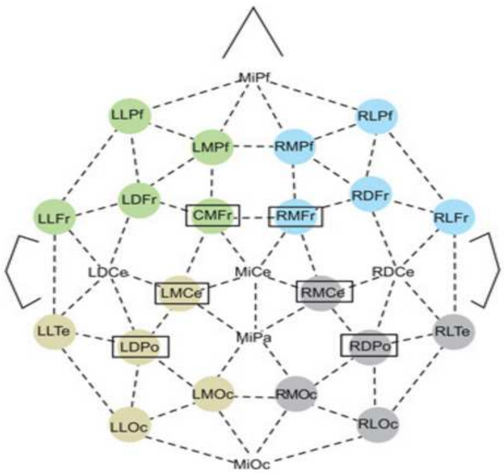

Figure 3. Electrode Points Used in the Overall Distribution of Electrodes and Component Analysis

According to the above figure, the average of the four questions is obtained by superposition of the average of the four question data. After repeated measurements and tests, the author found that all aspects of the conditions have a significant impact on N400 components combined with variance analysis results. Specifically, the main effect of the 9 electrodes tested and measured was F(8,8)=12.256, P=0.001<0.05, as is shown in Figure 4.

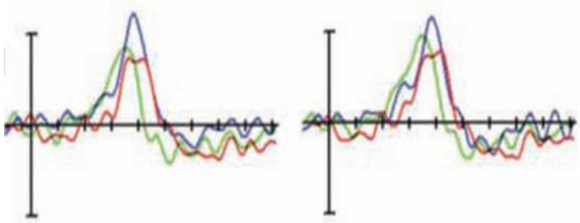

Figure 4. EGG Waveforms

The EEG waveforms are based on number of travelling, destination, personal preference and time preference, and four average lines are obtained through the averaging under the above conditions. Meanwhile, through repeated analysis of the results of the variance analysis, it is found that the number of travelling has a significant main effect on the LPP component, while the number of travelling has no significant main effect.

By the SPSS method, the voltage value of the N400 component can be obtained and the difference in the EEG data of the subjects in the four questions can be obtained. In addition, because the author also introduces the information interference factors, the subjects are interfered and their brains are attracted. Therefore, the brain topography map iss drawn so as to more intuitively see the influence of information interference.

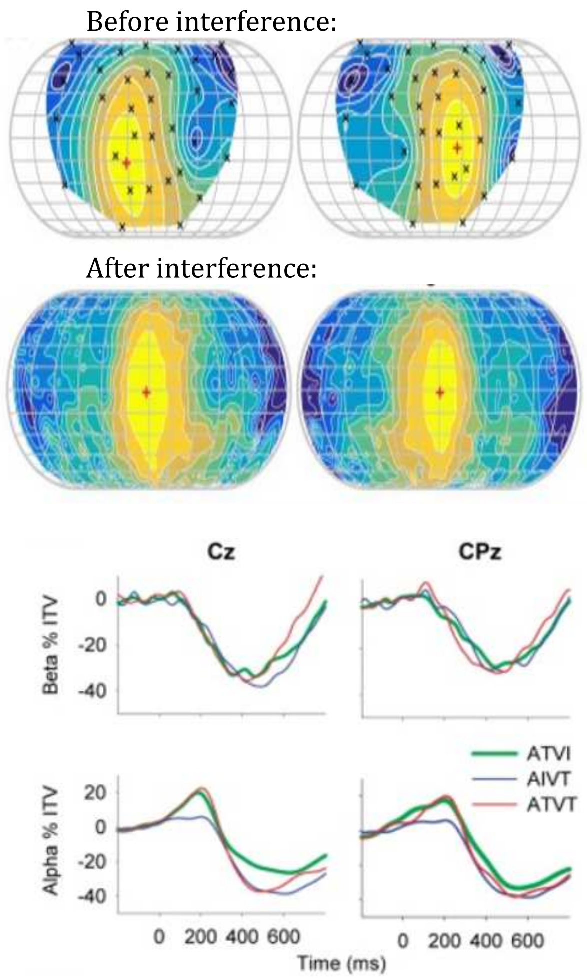

Figure 5. Electrode Point Stimulation Diagram as LPP Component

The analysis of LPP results during the experiment is also very important. LPP is the late

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component that we often mention, which has a specific latency, between 550ms and 650ms. The author has reviewed a large number of studies on LPP components and draw the brain waves using the obtained data. From a practical perspective, the time window of 450ms-600ms is chosen to calculate the average value of brain voltage. On the basis of previous studies, the amplitude of the LPP component has reached its maximum value in the top region. Therefore, the author selects nine electrode points as the object of LPP analysis. The electrode points are CP1, CPZ, CP2, P1 and PZ and P2, as is shown in Figure 5.

Conclusions

This paper analyzes the EEG data of 17 subjects after screening, and further explores the impact of travelling time, number of travelling, destination and personal preference on the individual's travelling decisions. Through EEG data, the impact of the above four factors on the individual's travelling decision-making is analyzed, and the previously mentioned four research hypotheses are verified. According to hypothesis 1 and hypothesis 2, the main effect between individuals preparing to travel and tourism decision-making behavior is significant due to personal preference, whether time is convenient or time preference. Based on LPP data analysis results, the hypothesis 3 can be verified: people who travel frequently often have poor perception of tourism risks. The hypothesis 4 can also be obtained: in places where facilities are relatively complete, people are less aware of their risks when travelling.

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