An Eye-Tracking Study of Geological and Physiognomic Process Trace Tourism Resources: Gender and Age

Fu Gang and Fan Zeyu
School of Economic and Management, Yanshan University, Qinhuangdao, China
fugang@ysu.edu.cn, 497702885@qq.com

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Abstract: As tourism market becoming increasingly competitive, finding the right segment market and attract target audience's attention is critical. This study used the eye-tracking technology which included several eye movement indexes. Different age and gender participants were recruited to view 15 photographic images that depicted geological and physiognomic process trace tourism resources. As main result, male participants show more interests in this kind of tourism resource than female, youth participants show more interests than teenagers and middle-aged people. This study fills the void in the attraction research of geological and physiognomic process trace tourism resources and presents a novel approach to find the potential tourists to specific tourism resources.

1 INTRODUCTION

Tourism resource is the basis of the development of the tourism industry and there are large amount kinds of tourism resources in China. The academics always try to explore new ways to develop and marketing them more scientifically.

The eye-tracking technology plays an significant role in the study of psychology (Nielsen, 2011). Academics began to apply this approach to tourism industry recent years, make a big contribution to the study of the target market. A recent research found that Chinese show more interest than Australian when viewing the natural environment images, the author put the tourism images into a quadrant model (natural environment, build environment, low arousal and high arousal), it turned out that Australian have more fixation counts and fixation time than Chinese (Wang, 2014). Other research is about tourists exploring a city panorama, which is a empirical outdoor eye tracking study without a time limit, this research tell us that the number of areas of interest revisited was found to be a good predictor for the total exploration duration (Kiefer, 2014). Two subject groups (Chinese and Australian) had a photographic stimuli using the eye-tracking technology, the result showed clearly that there are significant difference between the two ethnics (Chua, 2005). The difference between ethnicity attracts another research, the Chinese prefer to natural environment or somewhere with water, while Canadian like exotic adventure more (Dewar, 2007). Chinese shows more interest in passive activity, something like sightseeing or walk on the beach; but the western prefer to activities with adventure, such as riding and hunting (Han, 2006; Mohsin, 2008; Xu, 2009). Other eye movement study focus on the landscape. The afforest landscape of the city have different eye movement characters (Zhang, 2009). The eye movement apparatus recorded the data when participants viewing one of the buildings of Nanjing University, finally we know the mechanics of mental activities of the people (Li, 2011). In one study of Danxia Landform, eye-tracking data were compared to the data obtained from the same participants with questionnaires, the results showed that we can use this eye-tracking technology to measure the quality of some specific landscape and it is much more accurate than the traditional approaches (Wang, 2011).

In this paper, we investigate the following research question: what difference can we find between the ages and genders when participants viewing the geological and physiognomic process trace tourism resources. We describe an eye-tracking study of 60 participants (different age and gender) viewing 15 types of the tourism resources without a time limit (section 2). Based on the 48 participants we analyzed so far, our data indicate that male

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participants show more interests in this kind of tourism resource than female, youth participants show more interests than teenagers and middle-aged people. The results are discussed in section 3 and we conclude our work in section 4.

2 METHOD

This research using eye-tracking technology to measure tourism attraction of 15 basic types of geological and physiognomic process trace tourism resources (Protruding Mountain, Single Mountain, Clustered Mountain, Stone Forest, Soil Forest, Fancy and Shapely Rock, Rock Fill Cave, Ravine, Dune Field, Cliff and Crack, Rocky Cavity and Grotto, Gorge Segment, Danxia Landform, Yardang and Shore). All the 15 images were chosen from the official website of the Chinese National Geography, which is the most authoritative source in China.

2.1 Participants

Sixty people participated in the study. Twenty were teenagers which from a educational counseling agency in Qinhuangdao, (10 males and 10 females), twenty youth (10 males and 10 females) and twenty middle-aged (10 males and 10 females) participants were graduate students and teachers from Yanshan university in China. All the participants had normal (or corrected to normal) vision and had never seen these images before.

2.2 Apparatus

An SMI RED Eye Tracker from Germany, integrated into a 19-inch monitor,was used for the eye-movement task. The working procedure is to use the infrared camera to get the subject's eye image. The SMI Eye Tracker contains three software: the experiment center set the display length and order of the image; the iView X record the fixation time and position of the subjects; the BeGaze can analysis the data and also has several functions such as focus map and heat map. The SMI is considered accurate and has a tracking resolution of 0.1deg.

2.3 Procedure

Before engaging in the eye-tracking task, participants were informed they would be viewing 15 images about geological and physiognomic process trace tourism resources by the instruction. The images were presented randomly to reduce any order effects of images. The display duration time of each image was controlled by the subject itself using a space key. Adjust the seat to the right place and let the subjects sat in front of the screen at 60 cm. Start the experiment task when the correcting meet the standard (X,Y<1). The experiment lasts at most 5 minutes and each participant got a gift when they left.

2.4 Data Analysis Approach

We analyzed the eye-movement data for images on the basis of 7 indexes: Fixation Number, Fixation Average Time, Fixation Frequency, Saccade Frequency, First Fixation During Time of AOI (area of interest), Regression Count of AOI，Proportion of AOI Fixation Time. All of the indexes can reflect the attraction of the tourism resource images to the participants positively or negatively. Due to some unavoidable reasons such as tired or astigmatism of the eyes, we collected 48 participants' eye-movement data. Divided into 2 or 3 big groups and 6 small groups on average according to the age and gender, each small group has 8 people.

Firstly, we put the 7 indexes together and use the Entropy method to get the comprehensive value of each group and then we know the attraction of every picture. Secondly, we use the ANOVA to find if there is a significant differences between the groups.

3 RESULTS

Analysis began with eye-tracking measures of attention, including 7 index. Thanks to the Entropy method we can know how much of each group like the image. For each dependent variable we conducted a 15 (type) ×3 (age) ×2 (gender) mixed-design analysis of variance (ANOVA), with the type of picture being within subjects, age and gender between subjects.

3.1 Attraction from the Entropy

Different gender subjects have different eye movement characteristics when they watching the geological and physiognomic process trace tourism resources, different age is also the same. That means each of the images have a different attraction to the different groups. We can see from table 1 and table 2, for most of the type of geological and physiognomic process trace tourism resources, male participants show more interests than female, youth participants

55

Table 1: The comprehensive entropy of gender to the tourism attraction.

Type of Tourism Resources	Male	Female	Type	Male	Female
Protruding Mountain	0.232	0.231	Dune Field	0.226	0.230
Single Mountain	0.245	0.234	Cliff and Crack	0.218	0.226
Clustered Mountain	0.258	0.248	rocky Cavity and Grotto	0.246	0.234
Stone Forest	0.267	0.244	Gorge Segment	0.240	0.250
Soil Forest	0.266	0.232	Danxia Landform	0.258	0.225
Fancy and Shapely Rock	0.240	0.231	Yardang	0.241	0.251
Rock Fill Cave	0.248	0.249	Shore	0.271	0.225
Ravine	0.232	0.221			

Table 2: The comprehensive entropy of age to the tourism attraction.

Type of Tourism Resources	Teenager	Youth	Middle-aged	Type	Teenager	Youth	Middle-aged
Protruding Mountain	0.201	0.252	0.242	Dune Field	0.185	0.257	0.241
Single Mountain	0.199	0.266	0.254	Cliff and Crack	0.175	0.270	0.222
Clustered Mountain	0.198	0.315	0.248	Rocky cavity and grotto	0.197	0.284	0.238
Stone Forest	0.192	0.309	0.267	Gorge Segment	0.205	0.306	0.224
Soil Forest	0.205	0.289	0.253	Danxia Landform	0.222	0.285	0.216
Fancy and Shapely Rock	0.212	0.257	0.239	Yardang	0.205	0.283	0.249
Rock Fill Cave	0.213	0.280	0.252	Shore	0.208	0.287	0.249
Ravine	0.185	0.270	0.224				

show more interests than teenagers and middle-aged people.

3.2 Analysis of Variance

We use the ANOVA to find if the difference from different age and gender to the 15 images is significant.

3.2.1 Gender

The significant test of 15 types of geological and physiognomic process trace tourism resources are as the followings: only the Shore ($F=4.306$, $Sig.=0.049<0.05$) have a significant difference between male and female, the other 14 types have no significant difference. We can see the details from table 3.

3.2.2 Age

The significant test of 15 types of geological and physiognomic process trace tourism resources are as the followings: Clustered mountain, Stone Forest, Ravine, Dune Field, Cliff and Crack, Rocky Cavity and Grotto, Gorge Segment, Danxia Landform and Shore have a significant difference to the tourism atraction between ages, the other 6 types have no significant difference. We can see the details from table 4.

Table 3: Main effect test of gender.

Type of Tourism Resources	F	Sig.	Type	F	Sig.
Protruding Mountain	0.003	0.960	Dune Field	0.036	0.851
Single Mountain	0.218	0.645	Cliff and Crack	0.341	0.565
Clustered Mountain	0.176	0.679	Rocky Cavity and Grotto	0.211	0.650
Stone Forest	0.517	0.479	Gorge Segment	0.125	0.727
Soil Forest	1.572	0.223	Danxia Landform	2.171	0.154
Fancy and Shapely Rock	0.321	0.577	Yardang	0.3663	0.551
Rock Fill Cave	0.001	0.976	Shore	4.306	0.049
Ravine	0.295	0.592			

Table 4: Main effect test of age.

Type of Tourism Resources	F	Sig.	Type	F	Sig.
Protruding Mountain	1.500	0.239	Dune Field	3.76	0.035
Single Mountain	3.153	0.057	Cliff and Crack	6.861	0.004
Clustered Mountain	5.891	0.007	Rocky Cavity and Grotto	3.953	0.030
Stone Forest	5.129	0.012	Gorge Segment	4.958	0.014
Soil Forest	2.247	0.123	Danxia Landform	4.061	0.027
Fancy and Shapely Rock	3.153	0.057	Yardang	3.195	0.055
Rock Fill Cave	2.639	0.088	Shore	5.163	0.012
Ravine	4.626	0.018			

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4 CONCLUSIONS

The study yielded three main findings and contributions. First, we present a novel approach to measure and calculate the attraction of the tourism resources. In this study, we focus on the geological and physiognomic process trace tourism resources and in the future research we can focus on other type of tourism resources, such as water area landscape and biology landscape. This new approach make a significant contribution to the government and some tourism enterprise when make some tourism policies or do some tourism development. Secondly, we use age and gender two population variable of the tourism market and know their different preference to each images. Following up to this study, take some other factors into account, such as income and occupation, so that we can make the tourism segment market more accurate to the specific type of tourism resources, have more pertinence when designing the landscape, making the enterprise more competitive. Finally, for this empirical research, we know that male has more interest in geological and physiognomic process trace tourism resources, but almost have no significant differences between them, youth show more interests than teenagers and middle-aged people and have a significant differences for 9 type of the tourism resources.

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