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The response of domestic tourist in tourism city when encounter the haze weather: a case study of Xi'an, China

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Abstract. Under the background of the haze's influence to tourism, this study takes Xi'an, China as a case to explore the response characteristics of domestic tourists to the haze weather in tourism cities, and draws the conclusion as follows. First, although the suddenly severe haze weather will causes the inconvenience of travel and the decline of tourism quality, but the tourists still take the urban public transport to go on their trip by the negative ways, such as changing the tourism destination or ignoring the haze's influence. When the tourists face the destination choice, they generally prefer the indoor tourism destinations which are less affected by haze weather, but the juvenile and low-educated tourists still prefer outdoor and suburban tourism destinations even if encountering the haze in their trip; Second, the tourists are very dissatisfied with the tour in the haze weather, and the degree of haze's influence on tourists' perception is generally showed as "photograph > vision > experience > mood", but the tourists with different characteristics have different perceptions to the haze; Last, the tourists' attention rate has increased significantly after experiencing haze weather in this tour, but the tourists with different characteristics have a significant differences in the growth rate of haze's attention.

1. Introduction

The haze is a disastrous weather, which refers to the atmosphere pollution of all kinds of suspended particles (PM_{2.5}) in the air, and forms by the interaction of specific climate and human activities. The haze had appeared in the United States, Britain, France and others, and had been observed in China since 2013. The large-scale haze weather will lead to the decline of air quality and visibility, and has a great influence on the tourism landscape, tourism experience, tourist satisfaction, tourist health, tourism traffic and so on, and further harms to tourism economy and image of tourism destination. So it is necessary to focus on the impact of haze on tourism development and tourists.

According to the literature review, we found that the former research focuses on the haze's influence to tourism economy and tourists' perception to the haze. On the aspect of the haze's influence to tourism economy, Sajjad [1] and Kasmo [2] believed that the haze weather had a significant negative impact on regional tourism. Tang's research shows that the haze will cause the shrinkage of inbound tourism and the decline of tourism economy, but these influences will come later than the haze [3]. Anaman [4] found that the haze had caused the reduction of tourist about 28.7%, and the direct economic loss about 8 million Brunei dollars to Brunei in 1997 to 1998. Yan's research shows that the spatial distribution of the inbound tourists' loss and the degree of the haze's pollution in



31 provinces of China was coincided in 2013 [5]; On the aspect of tourists' perception to the haze, Zhang's study had found that the tourists' risk perception to the haze was shown as "body's risk > function's risk > psychological risk > cost's risk" [6]. Li [7] believed that the haze and risk perception exert negative impact on tourist loyalty indirectly, and the haze's perception of foreign tourists was lower than these of Chinese tourists. Zhang [8] believed that the tourist will consider the haze's influence and even cancel travel plans when they make the tourism decision. Cheng [9] found the haze could be an important factor which influences tourist destination choice. It is found by Peng [10] that the Mainland Chinese residents have a strong perception of the potential travel risk caused by haze in Beijing.

It can be found from the literature review that the scholars have made a great deal on the research of the haze's influence to tourism and tourist, and laid a theoretical foundation for the later related research. However, few scholars have paid attention to the characteristic and formation mechanism of tourist's behave and perception when they encounter the haze in tourism city. So this study takes Xi'an as a case to explore the scope and extent of haze's impact on tourist's activities, and analyze the formation mechanism of tourist's behavior, perception and attention rate when there occurs the haze weather in tourism cities.

2. Material and Methods

2.1. Case Introduction

This study takes Xi'an as a case. Xi'an is the capital city of Shaanxi Province in China, and also a world famous historical and cultural city, the first excellent tourism cities, the best tourism destination in China which must be visited by most domestic and foreign tourists. In 2016, Xi'an has received 150 million tourists who came from home and abroad, and achieved the tourism income of 121.3 billion Yuan [11]. But in recently years, owing to the rapid and low efficiency industrial development of Guanzhong areas of Shaanxi Province and the coal-based energy structure of heat-supply, the haze weather has frequently appeared in Xi'an in winter. According to the monitoring data from Xi'an Environmental Protection Bureau, the haze weather in Xi'an was 65 days from January 1 to March 19 in 2016 [12]. The frequently occurred haze weather has a great impact on the tourism industry in Xi'an, which further aggravates the tourism seasonality of Xi'an. Therefore, Xi'an is a typical and representative place to explore the tourists' characteristic of response to the haze weather.

2.2. Data Acquisition

The data of this research includes two aspects. One is the tourists' demographic characteristics, such as gender, age, marriage, education and income. Another is the information of tourists' behavior and perception when encountering the haze weather in Xi'an, such as tourists' transport, travel arrangement, scenic preference, tourism perception, haze's attention rate, etc. All these data were obtained through questionnaires of tourists.

The survey was implemented in many famous scenic area of Xi'an, such as the Shaanxi History Museum, the Dayan Pagoda, and the Xi'an Ancient City Wall from December 26, 2016 to January 6, 2017. During the 12 days of the survey, the moderate and severe haze weather occurred for 9 days (Table 1), and resulted in the closure of primary and secondary schools twice. The Air Quality Index (AQI) of Xi'an was up to 483 in January 5, 2017, it is the most serious day of the haze weather in the history. The tourists in Xi'an had a in-depth experienced the haze's influence on their behavior and perception, so this survey results can effectively reflect the tourists' behavior and perception to the haze weather. A total of 480 questionnaires were collected and 450 questionnaires were valid, the effective rate is 93.75%. The statistical information on demographic characteristics of respondents is shown in Table 2. In order to ensure the scientificity and reliability of this study, it is necessary to analyze the reliability and validity of research data. The data analysis shows that the Cronbach coefficient is 0.836, the KMO is 0.891, the Butler spherical test is 188.659, and the correlation of data

is significant at the level of 0.000. It reveals that the reliability and validity of the research data are very high.

Table 1. The Air Quality Data of Xi'an during the Investigation Period

Month	December 2016						January 2017					
Day	26	27	28	29	30	31	1	2	3	4	5	6
Air Quality Degree	G	G	G	M	S	S	S	S	S	S	S	S
AQI	73	76	97	165	256	350	393	341	408	473	483	209
PM _{2.5} (µg/m ³)	37	46	71	125	205	299	346	290	366	467	490	170
PM ₁₀ (µg/m ³)	93	95	121	176	272	375	410	365	441	556	591	236

Note: the “G” refers to “good”, “M” refers to “moderate”, “S” refers to “serious”

Data Sources: <http://www.tianqihoubao.com/aqi/xian-201612.html>;

<http://www.tianqihoubao.com/aqi/xian-201701.html>

Table 2. Statistics of Tourist's Demographic Characteristics

Demographics	Index	sample size	percentage	Demographics	Index	sample size	percentage
Gender	male	234	52	Education	junior	69	15.3
	female	216	48		senior	147	32.7
Marriage	single	219	48.7		college	166	36.0
	married	231	51.3		graduate	72	16.0
	<18	33	7.3		≤1500	105	23.3
Age	18-25	144	32	Monthly income	1501-3500	66	14.7
	26-45	156	34.7		3501-4500	135	30.0
	46-60	66	14.7		4501-7500	108	24.0
	>60	51	11.3		>7500	36	8.0

2.3. Methods

This study obtains the information data of Chinese tourists' behavior and perception by the method of questionnaire survey under the background of haze weather in Xi'an, uses the methods of statistical analysis and comparative analysis to explore the characteristics of tourists' response to haze, analyses the formation mechanism of tourists' response to haze through the methods of logical analysis and Chi-square test.

3. Research Results and Analysis

3.1. Characteristics of Tourists' Transportation Selection

The data statistics (Table 3) show that the tourists tend to choose public transport when they encounter the haze weather in tourism city, the proportion of tourists' transport selection represent as “urban public transport (i.e. city bus, subway) >tourism bus>taxi>bicycle>on foot”. It is also shown from the perspective of demographic characteristics that the proportion of male tourists choosing public transport is slightly higher than that of female tourists; the proportion of single tourists choosing public transport is higher than that of married tourists; the juvenile tourists (<18 years old) are mainly choosing urban public transport and taxi, the young and middle-aged tourists (18-60 years old) are mainly choosing urban public transport, while older tourists (>60 years old) are mainly choosing tourism bus and urban public transport; the tourists with different education and monthly income have

no significant difference in the choosing the transportation, and the urban public transport is the main means of their transportation. In summary, most tourists prefer to choose urban public transport as their traffic means when they encountered the haze weather in tourism city, and there is little difference in the choice of transportation among the tourists with different demographic characteristics. Analyzing the formation causes of tourists' transportation choice we can see, because the tourism cities have a sound traffic system and the scenic area in city may be conveniently arrived by the urban public transport, so choosing the urban public transport is the best choice for tourists under the background of travel inconvenience caused by the haze weather in tourism city. In addition, the winter which the haze occurred frequently is the off-season of tourism in Xi'an, and the individual tourists are much more than the group tourists, so the proportion of tourists who choose the tourism bus is fewer.

Table 3. Statistics of Tourism Transportation and Schedule from the Perspective of Demographic Characteristics (unit: %)

Demographics	Index	Tourism Transportation					Tourism Schedule			
		tourism bus	urban public transport	taxi	bicycle	on foot	staying in hotel	changed destination	shorten time	no change
Gender	male	26.92	43.59	19.23	3.85	6.41	0.00	38.46	20.51	41.03
	female	22.22	41.67	26.39	5.56	4.17	0.00	44.44	29.17	26.39
Marriage	single	16.44	49.32	26.03	5.48	2.74	0.00	39.73	27.40	32.88
	married	32.47	36.36	19.48	3.90	7.79	0.00	45.83	23.61	37.50
Age	<18	9.09	36.36	36.36	18.18	0.00	0.00	36.36	36.36	27.27
	18-25	18.75	56.25	16.67	4.17	4.17	0.00	45.83	18.75	35.42
	26-45	25.00	34.62	28.85	3.85	7.69	0.00	38.46	26.92	34.62
	46-60	27.27	40.91	27.27	4.55	0.00	0.00	36.36	22.73	40.91
	>60	47.06	35.29	5.88	0.00	11.76	0.00	47.06	29.41	23.53
Education	junior	26.09	43.48	13.04	13.04	4.35	0.00	43.48	17.39	39.13
	senior	20.41	44.90	24.49	4.08	6.12	0.00	38.78	30.61	30.61
	college	26.79	39.29	25.00	3.57	5.36	0.00	41.07	25.00	33.93
	graduate	27.27	45.45	22.73	0.00	4.55	0.00	45.45	18.18	36.36
	≤1500	14.29	54.29	25.71	5.71	0.00	0.00	34.29	25.71	40.00
Monthly income	1501-3500	27.27	40.91	13.64	4.55	13.64	0.00	63.64	13.64	22.73
	3501-4500	31.11	35.56	17.78	6.67	8.89	0.00	44.44	24.44	31.11
	4501-7500	22.22	47.22	25.00	2.78	2.78	0.00	38.89	25.00	36.11
	>7500	33.33	25.00	41.67	0.00	0.00	0.00	16.66	41.67	41.67
Total		24.67	42.67	22.67	4.67	5.33	0.00	41.33	24.67	34.00

3.2. Characteristics of Tourists' travel schedule

The data statistics (Table 3) show that there is no person to keep in the door when tourists encounter the haze weather in tourism city. That is to say, the haze weather can't stop tourists' trip. But the tourists will change their schedule to deal with the haze's influence, and their trip schedule change is shown as "changed tourism destination>no change>shorten the time". It is also shown from the perspective of demographic characteristics that the male tourists are less change their trip plan, and the female tourists tend to adjust the tourism destination when the haze weather occurred in tourism city; The single and married tourists mainly tend to change tourism destination when they encounter the haze in their trip, but the number of married tourists who don't change their trip plan are more than the single tourists; The juvenile tourists tend to adjust their tourism destination and shorten the travel time to reduce the haze's influence, the young tourists mostly tend to adjust their tourism destination, most middle-aged tourists' trip schedule is shown as "no change>changed tourism destination", and the

older tourists tend to change their destination to reduce the haze impact; the tourists with low or high income are mostly not to change schedule when they face the haze weather in their trip, but the others likely tend to change tourism destination. All in all, the tourists are not willing to use the passive behavior, such as keep in the hotel, to deal with the haze's influence in tourism city, but prefer to choice "adjusting the tourism destination" or "shortening the tour time" to actively complete their planned activities.

Analyzing the reasons of tourists' behavior when they encounter the haze weather in tourism city we can see, although the average travel rate of Chinese residents has reached 3.3 times in 2016, but the tourism for the most residents in China, especially for those who lived in the central and Western regions of China, are not a journey at their will, to travel needs many qualifications for people, such as plenty time, enough money and healthy body. As a result, once the tourists have all the qualifications to start their journey, they would prefer to reduce the tourism quality and continue to complete the planned trip, even if their willingness is reluctant to travel when the tourists encounter sudden non-catastrophic weather. In addition, the tourists who choose to travel to Xi'an in winter mainly focus on sightseeing and less on leisure and vacation, so they don't care much more about the quality of tourism experience, and tend to the tourism opportunities between the experience quality and tourism opportunities.

3.3. Characteristics of Tourists' Scenic Choice

When there occurs the haze weather in tourism city, the air quality of tourism destination is presented as "indoor tourism destination > suburban tourism destination > outdoor tourism destination", and the haze' influence to tourism attractions is shown as "outdoor tourism destination > suburban tourism destination > indoor tourism destination". The data statistics (Table 4) show that the tourists' scenic choice is manifested as "indoor tourism destination > suburban tourism destination > outdoor tourism destination", which agree well with the characteristics of air quality in tourism destination and attraction quality. It is also shown from the perspective of tourists' demographic characteristics that the male and female tourists prefer to indoor tourism destination when they encounter the haze in their trip, while the male tourists prefer suburban tourism destination slightly more than the female tourists; the juvenile tourists like to choose outdoor tourism destination and suburban tourism destination, the young and middle-aged tourists prefer to choose indoor tourism destination, and the older tourists choice the indoor tourism destination as much as 76%; The proportion of tourists' choice to indoor tourism destination is increased with the tourists' educational background, while the proportion of outdoor tourism destination is decreased correspondingly; From the perspective of monthly income, the tourists mainly prefer to indoor tourism destination, and more than 50% of tourists of middle-low and middle-high earning prefer to indoor tourism destination. Comprehensive analysis shows that, when the tourists encounter the sudden severe haze in tourism city, the tourists generally prefer to the destination which have better air quality and attraction quality, such as indoor tourism destination and not the outdoor one.

Analyzing the reasons of tourists' scenic choice when they encounter the haze weather in their travel we can see, owing to the main attractions of outdoor tourism destination in Xi'an are the well-known historical and cultural relics or the local folk culture, the main attractions of suburban tourism destination are the high-quality natural and cultural landscapes, so the outdoor and suburban tourism destination are the first choice to tourists. But the air quality and attraction of outdoor and suburban tourism destination are easily impacted by the haze. The attractions of indoor tourism destination in Xi'an are mostly historical and cultural relics which are more informative, interesting but less participation to tourists, so the indoor tourism destination have less attractive to most Chinese tourists, especially the young tourists, although the air quality and landscape quality of tourism attractions are less affected by haze weather than the others. As a result, many tourists have been forced to adjust their travel itineraries and choose the indoor tourism destination to carry out their travel after considering the impact of severe haze weather and the quality of tourism experience.

Table 4. Statistics of Tourists' Choice, Perception and Attention Rate from the Perspective of Demographic Characteristics

Demo- graphics	Index	Tourists' Scenic Choice (%)			Tourists' Perception					Attention Rate (%)	
		indoor destination	outdoor destination	suburban destination	vision	photo	mood	expe- rience	satisf- action	before travel	after travel
Gender	male	50.00	19.23	30.77	2.01	2.08	2.08	2.10	2.22	51.28	83.33
	female	50.00	25.00	25.00	2.11	2.03	2.24	2.04	2.21	55.56	86.11
Marriage	single	47.95	26.03	26.03	2.04	1.99	2.21	2.04	2.18	41.25	84.93
	married	51.95	18.18	29.87	2.08	2.12	2.10	2.10	2.25	58.75	84.42
Age	<18	9.09	54.55	36.36	2.09	2.09	2.45	2.18	2.18	18.18	63.64
	18-25	56.25	25.00	18.75	1.94	1.92	2.23	2.15	2.29	50.00	85.42
	26-45	46.15	21.15	32.69	2.21	2.19	2.23	2.00	2.23	61.54	82.69
	46-60	45.45	13.64	40.91	1.95	2.05	2.05	2.09	2.23	59.09	86.36
	>60	76.47	5.88	17.65	2.06	2.00	1.65	2.00	1.94	52.94	100.00
Education	junior	39.13	39.13	21.74	1.96	2.30	2.26	2.09	2.48	47.83	69.57
	senior	42.86	26.53	30.61	2.16	1.98	2.18	2.14	2.02	51.02	87.76
	college	58.93	10.71	30.36	2.11	2.02	2.13	2.11	2.21	58.93	87.50
	graduate	54.55	22.73	22.73	1.82	2.05	2.05	1.82	2.36	50.00	86.36
	≤1500	48.57	28.57	22.86	2.09	2.06	2.20	2.03	2.23	37.14	80.00
Monthly income	1501- 3500	63.64	22.73	13.64	2.09	2.00	2.23	1.95	2.23	54.55	86.36
	3501- 4500	44.44	17.78	37.78	2.13	2.02	2.20	2.24	2.04	53.33	97.78
	4501- 7500	52.78	22.22	25.00	1.92	2.19	2.06	2.00	2.36	63.89	77.78
	>7500	41.67	16.67	41.67	2.08	1.83	2.00	2.00	2.33	66.67	66.67
Total		50.00	22.00	28.00	2.06	2.05	2.15	2.07	2.21	53.33	84.67

3.4. Characteristics of Tourists' Perception

A survey of tourists' perception to their travel experience which influenced by haze weather by the Likert 5 shows that all the perception value (Table 4) is very low, while the satisfaction degree of tourists is only 2.21. That is to say, the tourists didn't satisfy with this travel, and the haze weather seriously affected their tourism experience. The haze's influence to the tourists' perception is shown as "photograph > vision > experience > mood", namely the haze weather has the greatest impact on the tourists' photography experience. It is also shown from the perspective of tourists' demographic characteristics that, the haze's influence to the vision and mood perception of female tourists is less than the male tourists; The married tourists' perception about photography, vision, experience and mood is slightly higher than that of single tourists; The young tourists (18~45) have a higher perception in this tour than the others; The juvenile tourists' perception to photography and tourism mood are higher than that of others; The middle-income tourists' perception to all aspect is highest, while the high-income groups' perception is lowest; Overall, although the different demographic groups have different perceptions to the haze's influence, the haze has seriously affected to the tourists' experience and perceptions, especially to the tourists' photography and tourism mood.

Analyzing the reasons of tourists' perception to their travel experience we can see, owing to the characteristics of tourist attractions in Xi'an and landscape in winter in north of China, the most tourists who choose to travel in Xi'an at this time are the sightseer. But the severe haze weather will directly affect the landscape quality, visual effect, photograph quality and tourists' mood in tourism activities through the significant reduction of air quality and visibility, and then reduce the tourists' comprehensive experience and form a lower degree of tourists' satisfaction finally. In addition, because the people with different gender and age have different sensibility to the same things, the tourists who have different physical characteristics will have the different perceptions to the haze weather which occurred in their travel. While the people's humanistic characteristics, such as marriage,

education and income, is the comprehensive reflection of individual experience, knowledge, cognition, economy and other information, so the tourists who have different experience, knowledge, cognition or economy also have the different perception and evaluation to the same thing, such as the haze weather.

3.5. Characteristics of Tourists' Attention Rate to Haze

It is known to us that the haze weather not only endangers the tourists' health, but also reduces the tourists' experience quality. Therefore, after experiencing the influence of haze weather in this tour, the tourists will pay more attention to the haze in the future. The statistics (Table 4) show that, undergoing the severe haze weather in this travel, the tourists' attention rate to haze weather is greatly increased from 53.33% to 84.67%. It is also shown from the perspective of tourists' demographic characteristics that, the male tourists' attention rate to haze weather is increased quickly than that of female tourists, but the value of male tourists' attention is still lower than the female tourists; The single tourists' attention rate to the haze is increased quickly than the married tourists; The juvenile tourists' attention rate to the haze is increased fastest, and the elder tourists' attention rate have reached 100% after experiencing the haze weather in this travel; Although the junior tourists' attention rate to haze is 69.57% and have increased 22% than that in the before of this travel, but it is still lowest among the tourists; The low-income tourists' attention rate to haze have a largest increase, while the high-income tourists' attention rate have no change between the before and after this trip. In summary, the tourism experience which influenced by the severe haze weather will greatly enhance the tourists' attention to haze in the next trip, but the one who had the lower attention rate to haze before this tour will still have the lower rate in the future.

Analyzing the reasons of tourists' attention rate to haze we can see, because the resident currently have fewer tourism opportunities, and the tourists have experienced the haze's great influence to their travel, so paying attention to the haze weather and choosing the tourism destinations reasonably in the next travel will maximize tourists' experience effect. As a result, the tourists' attention rate to haze weather has increased significantly. In addition, as analyzed in the previous, the people with difference demographic have the different perceptions of haze's influence, so the tourists' haze attention rate will still keep difference. It is also shown that the tourists' future attention rate is positively correlated with their tourism satisfaction and attention rate in this travel at the significant level of 0.01 through the Chi-square Test (Table 5). That is to say, the tourists who are insensitive to haze are still less concerned about haze in the future than the others even though they have experienced the haze before.

Table 5. Result of Chi-square Test between the Attention Rate and Factors

	gender	marriage	age	education	monthly income	haze in hometown	attention rate before the tour	schedule change	satisfaction
Chi-square value	0.223	0.008	7.052	4.795	10.905	0.576	13.140	2.236	26.451
df	1	1	4	3	4	2	2	2	4
P	0.637	0.930	0.133	0.187	0.038*	0.750	0.001**	0.327	0.000**

Note: * is represents as significant correlation at 0.1 level (bilateral), and ** is represents as significant correlation at 0.05 level (bilateral).

4. Conclusion

Taking Xi'an as a case, this study explores the response characteristics of Chinese tourists to the haze weather in tourism cities. It can be seen that the haze weather not only has a great impact on tourists' behavior and perception, but also has a huge influence on tourists' destinations choice in the future. The detailed conclusions of this research are as follows:

(1) Aspect of the haze's influence on tourists' behavior. Although the suddenly severe haze weather will causes the decline of air quality and visibility in tourism cities, and further leads to the inconvenience of travel and the decline of tourism quality. But considering the tourism opportunities, costs and other factors, the tourists will not choose the negative ways, such as staying in hotel or ending the trip, to cope with the impact of haze weather. On the contrary, the tourists will change the tourism destination or ignore the haze's influence to continue their trip by the urban public transport. When the tourists face the destination choice, they generally prefer the indoor tourism destinations which are less affected by haze weather. But there are differences in the destination choice of tourists with different demographic characteristics, such as the juvenile and low-educated tourists still prefer outdoor and suburban tourism destinations when encountering the haze in their trip.

(2) Aspect of the haze's influence on tourists' perception. Because the haze weather has a great impact on the tourism activities, the tourists are very dissatisfied with the tour in Xi'an. From the perspective of perception dimension, the degree of haze's influence on tourists' perception is showed as "photograph > vision > experience > mood". That is to say, the haze weather has the greatest impact on the quality of photographs, while the haze has a least influence on tourists' mood. In addition, the tourists with different demographic characteristics have different perceptions to the haze.

(3) Aspect of the haze's influence on tourists' attention rate. Because the haze weather has a great impact on tourists' behavior, perception and tourism quality, the tourists' attention rate has increased significantly after experiencing haze weather in this tour, and some people's attention rate to haze has increased by 40%. However, due to the differences of sensitivity, the tourists with different demographic characteristics have significant differences in the growth rate of haze's attention.

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