

Research Article

What Factors Contribute to Higher Travel Happiness? Evidence from Beijing, China

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Travel happiness has drawn increasing attention in recent years. However, the empirical research in developing countries' context is very limited, and few studies consider both cognitive and affective evaluations during traveling. This study uses web-based survey data collected in Beijing, China, and applies multiple regression analysis to examine impacts of sociodemographic attributes, travel characteristics, residential environment, mode consonance, self-evaluation, and health conditions, on travel happiness. Satisfaction with Travel Scale (STS) is used to measure travel happiness. Results show that for trips using active travel modes, traveling by walking has higher travel happiness than by nonmotor vehicles. For those trips traveling by motor vehicles, company shuttle bus trips have the highest travel happiness ratings, followed by automobile trips and public transport trips. Transport mode consonance is significantly positively correlated with travel happiness. Residential environment, self-reported optimism, and daily happiness have great positive impacts on travel happiness. Living in suburban areas is more satisfying for walking and car trips, but travel frequency, travel duration, and perceived travel time length have significant negative effects on travel happiness. Public transport use with friends is enjoyable, but unpleasant with work partners. More happiness when listening to music/radio or reading during traveling is demonstrated. Finally, policy implications and potential extended research topics are recommended.

1. Introduction

Subjective well-being (SWB) is generally used in psychology to describe people's overall satisfaction with life. It includes how people "feel" and "think" about their quality of life from both affective evaluation and cognitive judgement [1]. Quite a number of studies have demonstrated that high subjective well-being is beneficial to health, work, and social relations, as well as brings more social benefits [2–4]. As an important branch of SWB, travel-domain well-being (hereafter called "travel happiness") is of great significance for mode choice and activity participation. People who have positive cognitive and affective experience while traveling on a certain transport mode have a greater probability of continuing to use it [5] and of participating in more out-of-home activities [6]. With serious traffic congestion and emission, possible ways of shifting car users to the public transportation

become an important issue. However, it is hard to attract travellers to use public transport voluntarily if they do not get positive experiences when getting on buses or subways. In response, some studies have been conducted on how to enhance public transport travellers' happiness and the relation between travel happiness and travel behaviour change [7–10]. It needs to be emphasized that scholars usually use two terms "travel satisfaction" or "travel happiness" to describe travellers' evaluations for their trips, but travel satisfaction mostly refers to the cognitive evaluation of the trip, while travel happiness includes affective dimension as well. The affective dimension describes people's emotions (e.g., stressed and relaxed) experienced during traveling, and cognitive dimension refers to an evaluation of a trip (e.g., low standard and high standard).

Present research about travel happiness is mainly conducted in developed countries such as Europe and America

[11]. In developing countries such as China, most research only investigates travel satisfaction. Few studies focus on the affective evaluation during traveling. Very limited studies consider both cognitive and affective evaluations during traveling. According to literature search results of travel happiness research conducted in China, seven research articles related with both cognitive and affective dimensions of travel happiness [12–18] were found, and seven articles were all published between years 2017–2020. Travel happiness was measured with Satisfaction with Travel Scale (STS) [19] in the research by Ye and Titheridge [12–14]. Xi'an, China was chosen as the case study to analyse the determinants of commute happiness in low-income population [12], the association of travel time dissonance and commute happiness [13], and the effects of mode choice, built environment, and attitudes on commute happiness [14]. Wang et al. [15] used the five-item scale developed by Bergstad et al. [20] to measure travel happiness and investigated how residential relocation affected travel happiness. The influence of road connectivity and public transport accessibility on travel happiness was examined [16]. The role of built environment, travel attitude, and travel characteristics played in commute happiness were explored in a study by Wei et al. [17]. The Satisfaction with Travel Scale (STS) was applied to assess the travel happiness in research [16, 17]. Jia [18] analysed how travel happiness can be used to improve traffic engineering planning. Six questions related to travel service quality were used to measure cognitive dimensions of travel happiness. Two-item positive and four-item negative emotions were used to evaluate affective dimensions of travel happiness. The above limited studies were focused on commuting trips. Trips for other purposes such as entertainment and school were not included. Moreover, the effects of travel characteristics such as travel companion and activities during traveling on travel happiness have not been investigated extensively.

In this study, aiming to answer the following questions, travel happiness models for different transport modes, considering different travel purposes, travel companion and activities, mode consonance, etc., will be established. Important factors that affect travel happiness will be interpreted, and policy implications will be addressed:

Q1: what are the differences of travel happiness for different modes using the STS measurement method in China's context?

Q2: how do travel characteristics, personal characteristics, residential environment, travel mode consonance, self-evaluation, and health conditions affect travel happiness using the STS measurement method in China's context?

Q3: how to enhance travel happiness?

The remainder of this study first reviews previous studies and then presents the methodology which includes research design and data collection. It then goes on to results' analysis. The next section reports conclusions and policy implications. It concludes with study limitations and future research.

2. Previous Research

Previous studies are reviewed in terms of methods of measuring travel happiness, influencing factors, and modelling methods of travel happiness.

2.1. Measurement Methods of Travel Happiness. Travel happiness research began in about 2009 and was mainly conducted in developed countries such as Sweden, Netherlands, and United States. Developing countries such as China did not pay attention to it until recently. Since travel happiness describes travelling experiences from both cognitive and affective dimensions, methods were developed to measure cognitive judgement and affective evaluation separately, or measure these two aspects simultaneously. Table 1 summarizes the main methods of measuring travel happiness.

Affective Balance Scale, Swedish Core Affect Scale, Positive Affect and Negative Affect Scale, and Net Affect Score are methods to measure affective evaluations during traveling. The Net Affect Score is a comprehensive index which is derived from all positive and negative emotions. For cognitive evaluation, the general method is to ask respondents questions about specific assessment contents. Respondents answer with totally disagree to totally agree. On the basis of the Satisfaction with Life Scale [28], Bergstad et al. [20] proposed the Satisfaction with Travel Scale to measure travel-specific domain well-being. However, this scale mainly consists of cognitive items, and only one affective item is included. It is limited in measuring emotional feelings. Ettema et al. [19] improved this method and developed an improved Satisfaction with Travel Scale (STS). The improved STS extended the existing STS in affective evaluation, which is presented as follows.

2.1.1. Cognitive Evaluation (CE).

- (i) Travel was worst-best I can think of
- (ii) Travel was low-high standard
- (iii) Travel worked poorly-worked well

2.1.2. Affective Evaluation (AE).

- (i) Time pressed-relaxed
- (ii) Worried I would not be in time-confident I would be in time
- (iii) Stressed-calm
- (iv) Tired-alert
- (v) Bored-enthusiastic
- (vi) Fed up-engaged

The improved STS have been widely used because of their comprehensive and clear evaluation for traveling activities. Scholars usually make some changes for the improved STS methods to make respondents better understand or reduce the burden of respondents. In this study, the

TABLE 1: Measurement methods of travel happiness.

Measurement methods	Descriptions	Application examples	Measurement type	
			Cognitive	Affective
Affective Balance Bcale [21]	Includes 5-item positive and 5-item negative components	Morris and Hirsch [22]		√
Swedish Core Affect Scale [23]	Includes four aspects valence, activation, pleasant activation-unpleasant deactivation, and unpleasant activation-pleasant deactivation. Each aspect includes three items	Bergstad et al. [20]		√
Positive Affect and Negative Affect Scale [24]	Covers 10 descriptors for positive and 10 for negative emotions	Huang et al. [25]		√
Net Affect Score	Is a comprehensive index and calculated by the average positive affect minus the average negative affect	Fan et al. [26]		√
Satisfaction with Travel	Describes how do people agree or disagree with some questions in specific aspects	Abenzoza et al. [27]	√	
Satisfaction with Travel Scale	Includes 4-item cognitive evaluations and 1-item affective evaluation	Bergstad et al. [20]	√	√
Satisfaction with Travel Scale*	Includes 3-item cognitive and 6-item affective evaluations	Ettema et al. [19]	√	√

*To differentiate the Satisfaction with Travel Scale by Bergstad et al. [20].

improved STS is used to measure travellers' happiness. To reduce the burden and the similarities of some items after translating into Chinese, we drop the three items "travel was low-high standard," "bored-enthusiastic," and "time pressed-relaxed."

2.2. Influencing Factors of Travel Happiness. A growing number of studies have investigated the connection between travel characteristics and travel happiness and found significant associations between them [11, 14, 19, 29–32]. For example, using data collected in twelve neighbourhoods in the Belgian city of Ghent, De Vos et al. [29] found that participants using active modes are the happiest, especially by walking. Public transit trips were perceived as the least happy. Based on smartphone-based data in Minneapolis, US, Fan et al. [26] found that trip companion had significant impact on travel happiness. Traveling with family or friends was happier than traveling alone or with coworkers. Trips on weekends were generally happier, and trips earlier than 6 am or later than 7 pm were perceived as less happy. Moreover, they found that people relaxing and talking during traveling were happier than those reading, working, or doing nothing.

When it comes to personal characteristics, age, gender, and income have important effects on travel happiness [33]. Female, young, and high-income commuters perceived their travel more negatively. Those who were optimistic and felt happy every day reported greater commute happiness. Overall health condition was positively related with travel happiness.

Besides travel and personal characteristics, travel-related attitudes [14, 29, 34, 35], built environment [29], residential location [29, 32, 35], and travel mode consonance [34] also have significant impacts for travel happiness. De Vos et al. [29] compared travel happiness between dwellers in the suburban and urban neighbourhood in Ghent. It was found that suburban dwellers perceived more positive feelings than urban dwellers when traveling. People who thought traveling brings utility felt more positively for commute trips than

those who thought traveling was wasting time. Also, environment-friendly people were more satisfied with their commute trips [14]. The built environment affected availability and convenience of different travel modes and further influenced travel satisfaction [29].

In this study, travel characteristics, personal characteristics, residential environment, travel mode consonance, self-evaluation, and health conditions are included.

2.3. Modelling Method of Travel Happiness. Table 2 lists details of papers related to travel happiness modelling. In most cases, the Likert Scale is used to quantify the extent of travel happiness, and thus, travel happiness is an ordinal variable, and the ordered logistic regression is usually a choice to analyse the relation between travel happiness and influencing factors. After averaging the ratings of each item of travel happiness, the dependent variable becomes continuous, and a linear regression model such as multiple linear regression or linear mixed regression can be applied to reveal the effects of independent variables on travel happiness. In addition, when there are latent variables such as travel attitudes, structural equation modelling is considered. In this study, multiple linear regression analysis is applied because the dependents are continuous variables after averaging different cognitive and affective items.

3. Methodology

3.1. Research Design. Figure 1 presents the research framework. Travel happiness is measured based on the improved STS which includes six detailed items. Travel happiness models for different transport modes are developed, with personal characteristics, travel characteristics, residential environment, travel mode consonance, self-evaluation, and health conditions as independent variables.

3.2. Data Collection. The data were derived from a web-based survey conducted by a professional questionnaire

TABLE 2: Summary of travel happiness modelling methods.

Author	Year	Study nation	Measurement methods	Modelling methods	Measurement type	
					Cognitive	Affective
Fan et al. [26]	2019	Minneapolis, US	Happy, meaningful, tired, stressful, sad, and pain	Linear mixed-effect model		√
Chen et al. [36]	2019	US	Travel Happiness Index	Factor analysis and analytic hierarchy process		√
Zhu and Fan [11]	2018	US	Happy, meaningful, tired, stressful, sad, and pain	OLR		√
Zhu and Fan [33]	2018	Xi'an, China	Happy	OLR		√
Song [37]	2018	China	Life satisfaction and happiness	Ordered probit regression	√	√
De Vos [34]	2018	Ghent, Belgium	STS	Basic statistical analysis	√	√
Ye and Titheridge [14]	2017	Xi'an, China	STS	SEM	√	√
Mao et al. [31]	2016	Beijing, China	Trip satisfaction	Multilevel regression modelling	√	
Wu [38]	2016	China	Happiness	OLM		√
De Vos and Witlox [39]	2016	Ghent, Belgium	STS	Basic statistical analysis	√	√
De Vos et al. [29]	2016	Ghent, Belgium	STS	MLR	√	√
Zhou [40]	2015	Suzhou, China	Happy and satisfaction	Route analysis and SEM	√	√
Taniguchi et al. [41]	2014	Värmland, Sweden	STS	MLR	√	√
Olsson et al. [42]	2013	Sweden	STS	MLR	√	√
Abou-Zeid et al. [7]	2012	Switzerland	Commute satisfaction	Basic statistical analysis	√	
Bergstad et al. [20]	2011	Sweden	STS	MLR	√	√

OLR: ordered logistic regression; SEM: structural equation modeling; MLR: multiple linear regression.

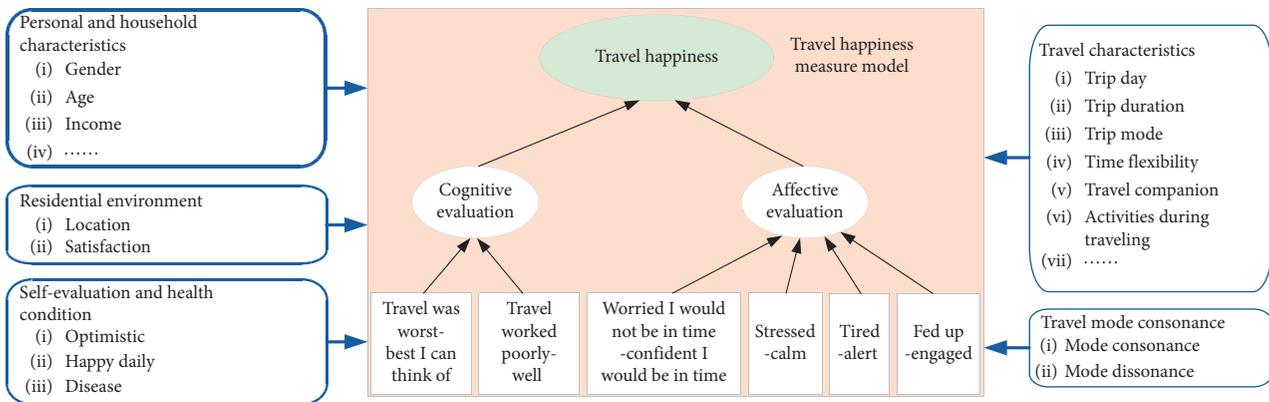


FIGURE 1: Research framework.

company from June 25 to July 9 in 2019 and May 18 to May 28 in 2020 (supplementary survey) in Beijing, China. The questionnaire consists of two parts. In the first part, respondents were asked to describe their sociodemographic attributes, household characteristics, residential characteristics, health conditions, self-evaluation, and mode preference. The second part asked the respondents to answer questions about the recent trip characteristics, cognitive evaluations, and affective feelings for the recent trip. The questionnaire was randomly issued to local residents in Beijing and permanent residents who live or work in Beijing for more than 6 months but without local household registration. The questionnaire company could help to select eligible participants that meet our requirements. Figure 2

shows the administrative map of Beijing and the samples' spatial distribution. There are a total of 16 administrative districts in Beijing, including six urban (shown in orange) and ten suburban districts (shown in green). Beijing has a population of 21.54 million by the end of 2019 and covers an area of 16, 410 km². Near 60% of the population live in the urban area. 1080 valid samples were obtained after filtering out incomplete questionnaires.

According to the survey results, most respondents are from the urban area and a few areas adjacent to it, including Changping, Fangshan, Daxing, and Tongzhou. The samples' spatial distribution is consistent with the population spatial distribution of Beijing, so the sample is representative in spatial distribution. To keep the representativeness of the

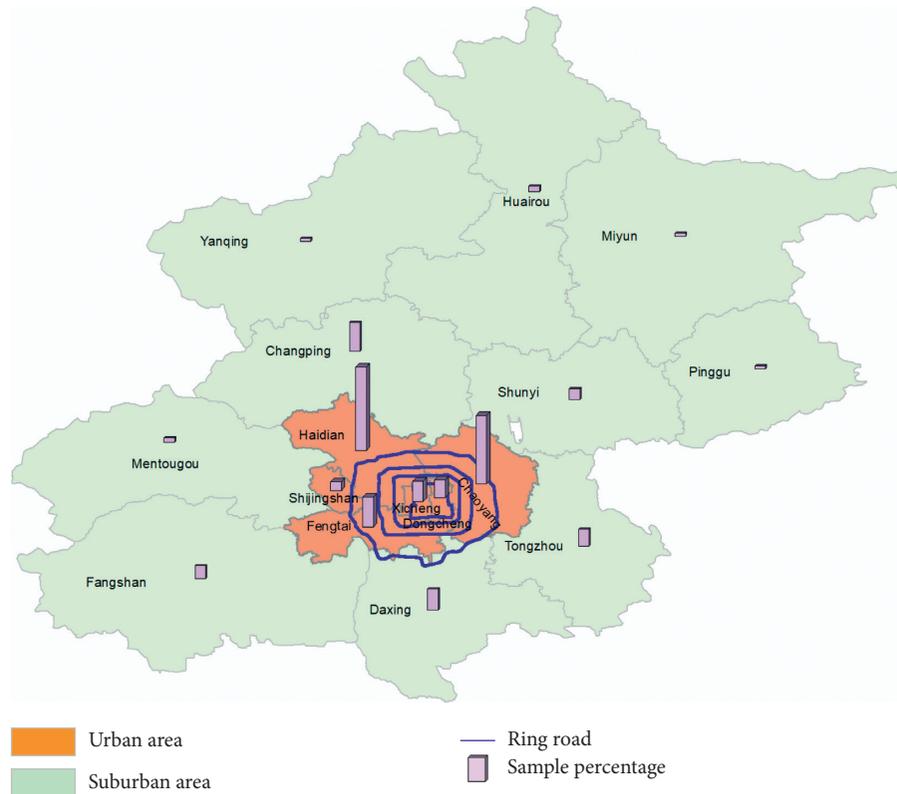


FIGURE 2: District map of Beijing and samples' spatial distribution.

total samples, the authors control the basic demographic statistical results (including the ratio of gender, age, work status, education, and monthly income) through the menu “data---select cases---random sample of cases” in SPSS software. Before the ratio control, we obtain 2160 valid samples (including samples collected in the supplementary survey). After the ratio control, only 1080 valid samples are kept finally.

The sample description is presented in Table 3. As can be seen from Table 3, 50.4% of the respondents are male. Half of them have Beijing Hukou (Hukou is a system of household registration in the mainland of China [43].) The sample is relatively young (59.7% under 35 years old) and well-educated (70.7% with college and above education). A great majority of the respondents have a full-time job (72.5%). Monthly income is distributed almost equally among different range levels except for the highest level (>15000 RMB). The majority of respondents live alone (22.7%) or with family (63.6%). Nearly 60% of the respondents have no access to a car or bike in their daily trip. Most respondents live in the urban area (66.9%), have a high evaluation for their residential environment (64.0% score over 7 on a scale of 0–10), feel quite optimistic and happy every day (72.3% and 61.4% score over 7 on a scale of 0–10, respectively), and have a good health condition (73.4% rated good–excellent for health condition). Surprisingly, 59.4% of the respondents prefer a sustainable travel mode, including active modes

(walking, bike, or e-bike/e-motorcycle) and the public transport (bus and subway).

According to the survey results, 86.5% of the respondents report they had their recent trip during the last two days. Most of these recent trips are for work, business, or school and are mainly taken on weekdays, during peak hours. The public transport mode share in the sample (61.9%) is higher than the actual public transport mode share in Beijing (about 50%). 69.1% of the respondents take 16–60 minutes for their trips, and 70% of the respondents perceive the trip duration as expected. 18.2% of these 1080 samples have no time flexibility. Over half of the respondents travel alone (61.1%), and the most common activities during the trip are listening to music/radio, reading to relax, talking, calling, and looking around. On the whole, respondents have positive cognitive and affective evaluations for their trips (the average score of each item is greater than 1.0). The highest average score is the cognitive evaluation “travel worked poorly: worked well.” One item of the affective evaluation “tired:alert” is rated relatively low, indicating that tiredness during a trip is the strongest feeling.

Based on the travel mode respondents use in the recent trip and the mode they prefer to use (promode in Table 3), we can determine if respondents travel with their preferred modes in the recent trip (referred as mode consonance or mode dissonance). According to the survey results, we can conclude that 69.5% of the respondents travel with their preferred modes and 30.5% do not. In the next section, we

TABLE 3: Sample descriptions (N = 1080).

Variable	%
<i>Sociodemographic attributes</i>	
<i>Gender</i>	
Female	49.6
Male	50.4
<i>Age</i>	
≤25	13.6
26–35	45.1
36–45	18.8
46–55	16.0
>55	6.4
<i>Beijing Hukou</i>	
Yes	51.1
No	48.9
<i>Marriage status</i>	
Single	50.5
Married	48.4
Divorced	1.1
<i>Work status</i>	
Student	19.7
Full time	72.5
Part time	3.8
Unemployed	1.3
Retired	2.1
Other	0.5
<i>Education</i>	
Low (lower than bachelor)	29.3
Middle (junior college/bachelor)	66.6
High (master or higher)	4.1
<i>Monthly income (RMB)</i>	
<3000	19.3
3001–5000	13.3
5001–8000	22.2
8001–10000	18.2
10001–15000	18.2
>15000	8.7
<i>Household characteristics</i>	
<i>Who do you live with?</i>	
Alone	22.7
Family	63.6
Friends	10.3
Both family and friends	1.2
Other	2.1
<i>Is there a car available in your daily trip</i>	
Yes	41.2
No	58.8
<i>Is there a bike available in your daily trip</i>	
Yes	42.2
No	57.8
<i>Recent travel characteristics</i>	
<i>Travel purpose</i>	
Work/business	53.6
School	6.4
Entertainment	38.5
Other	1.5
<i>Travel time</i>	
Morning peak	50.2
Evening peak	16.4
Off-peak hours	33.4
<i>Travel mode</i>	
Walk	5.3
Private bike	3.0
Public bike	2.8

TABLE 3: Continued.

Variable	%
E-bike/e-motorcycle	2.3
Bus	19.4
Subway	41.5
Car driver	15.6
Car passenger	7.9
Company shuttle bus	1.6
Other	0.5
<i>Travel duration (minutes)</i>	
0–15	6.2
16–30	20.8
31–45	23.3
46–60	18.9
>60	30.9
<i>Trip day</i>	
Weekday	72.1
weekend	27.9
<i>Perceived trip duration</i>	
Shorter	4.6
Same as expected	72.2
Longer	23.2
<i>Arrival time flexibility</i>	
No flexibility	18.2
Slightly flexible	59.2
Very flexible	22.5
<i>Travel companion</i>	
Alone	61.1
Only with family	20.1
Only with friends	8.4
Only with work partners	5.9
With family and friends	1.9
With other combinations	2.6
<i>Activities during travelling</i>	
Listen to music/radio or read to relax	53.2
Talk/call	44.5
Look around	38.4
Play games or surf the internet	23.2
Rest	15.9
Work or study	11.9
<i>Residential characteristics</i>	
<i>Location</i>	
Located in the urban area	66.9
Located in the suburban area	33.1
<i>Scores of residential environment (0–10)</i>	
0–2	3.5
3–4	9.5
5–6	22.8
7–8	40.9
9–10	23.1
<i>Self-reported health, self-evaluation, and mode preference</i>	
<i>Health status</i>	
Poor	0.7
Fair	5.4
Average	20.5
Good	41.6
Excellent	31.8
<i>Scores of optimism (0–10)</i>	
0–2	3.0
3–4	6.6
5–6	18.1
7–8	43.5

TABLE 3: Continued.

Variable		
9-10	28.8	
<i>Scores of daily happiness (0-10)</i>		
0-2	4.4	
3-4	8.5	
5-6	25.6	
7-8	40.9	
9-10	20.5	
<i>Promode if they can choose freely</i>		
Active modes (proactive modes)	16.0	
PT (pro-public transport)	15.3	
Car (pro-car)	8.2	
Active modes and PT (pro-multimode)	28.1	
PT and car (pro-multimode)	8.9	
Active modes and car (pro-multimode)	4.7	
Active modes, PT and car (pro-multimode)	18.6	
Variable	Mean	Standard deviation
<i>Satisfaction with travel scale</i>		
<i>Cognitive evaluation (CE)</i>		
Travel was worst (-3): best I can think of (3)	1.44	1.139
Travel worked poorly (-3): worked well (3)	1.89	1.185
<i>Affective evaluation (AE)</i>		
Worried I would not be in time (-3): confident I would be in time (3)	1.62	1.523
Stressed (-3): calm (3)	1.68	1.519
Tired (-3): alert (3)	1.17	1.680
Fed up (-3): engaged (3)	1.29	1.392

PT – Public Transport.

will explore the relation between travel happiness and the influencing factors.

4. Results Analysis

The relation between travel happiness and travel mode is first analysed, followed by the impact of mode consonance on travel happiness. Then, multiple regression analysis is applied to understand the factors affecting travellers' happiness. Finally, the differences and correlations between cognitive judgement and affective evaluation are illustrated.

4.1. Travel Happiness and Travel Mode. Table 4 provides the average score of each item of travel happiness and overall average score of these items (STS average). It shows that, for trips using active travel modes, traveling by walking has higher travel happiness than by nonmotor vehicles such as riding a bike. For those trips with motor vehicles, company shuttle bus trips have the highest travel happiness ratings. Public transport (bus and subway) trips have the lowest travel happiness, and car (car driver and car passenger) trips lie between active travel modes and public transport. These findings are consistent with prior research studies [9, 11, 19, 29, 33].

From Table 4, we can see that compared with travellers by subway and company shuttle bus, bus travellers and car drivers/passengers worry more about not arriving on time. However, subway travellers tend to feel more tired and fed up by comparing it with travel happiness of other travel modes. In Beijing, traffic congestion is very serious, especially in peak hours. The travellers may experience congestion and delay if they take a bus or car. Most subway lines in Beijing are extremely crowded in

peak hours [44]. Thus, taking the subway, especially in peak hours, is really labour-consuming. Company shuttle bus is perceived fairly positively. It is usually provided by the employer. It costs more than regular public transport service but much less than taking a taxi and provides convenient door-to-door service.

4.2. Travel Happiness and Mode Consonance. Figure 3 illustrates the scores of different travel happiness items in both mode consonance and dissonance. The travel happiness score of each item with mode consonance is higher than for those with mode dissonance (the difference is significant at the level of $p < 0.01$). Only 27% of travellers with mode consonance have a preference for a single mode, and 73% have multimodal preferences. However, almost 68% of travellers with mode dissonance prefer a single mode. This result demonstrates that travellers with the multimodal preference are more likely to travel with their preferred modes and perceive more satisfied during a trip compared to those preferring a single mode (mono-modal preference). This is consistent with the results of De Vos [34].

4.3. Travel Happiness Models Based on Multiple Regression Analysis. Because respondents taking the company shuttle bus only account for small percentages of all samples (1.6%), they are excluded in the regression analysis. We also drop samples that choose "others" in some answers listed in Table 3, such as choosing "other" option for work status. There are 1019 samples left after filtering the data. For activities during the trip, because over half of the respondents have two or more activities, we reclassify the options into

TABLE 4: Travel happiness for different travel modes.

Travel mode	CE (worst-best)	CE (poorly-well)	AE (worried-confident)	AE (stressed-calm)	AE (tired-alert)	AE (fed up-engaged)	STS average
Walking	1.71	2.40	2.23	2.06	1.81	1.88	2.01
Nonmotor vehicle*	1.65	1.99	2.12	2.00	1.86	1.48	1.85
Bus	1.39	1.78	1.40	1.53	1.09	1.21	1.40
Subway	1.38	1.86	1.72	1.69	0.86	1.12	1.45
Car	1.46	1.87	1.41	1.57	1.36	1.42	1.53
Company shuttle bus	1.73	2.38	1.87	1.73	1.45	1.47	1.74

Note. CE worst-best, CE poorly-well, AE worried-confident, AE stressed-calm, AE tired-alert, and AE fed up-engaged are abbreviations of two cognitive dimensions “travel was worst-best I can think of” and “travel worked poorly-worked well” and four affective dimensions “worried I would not be in time-confident I would be in time,” “stressed-calm,” “tired-alert,” and “fed up-engaged” separately. *Nonmotor vehicle includes private bike, public bike, e-bike, and e-motorcycle.

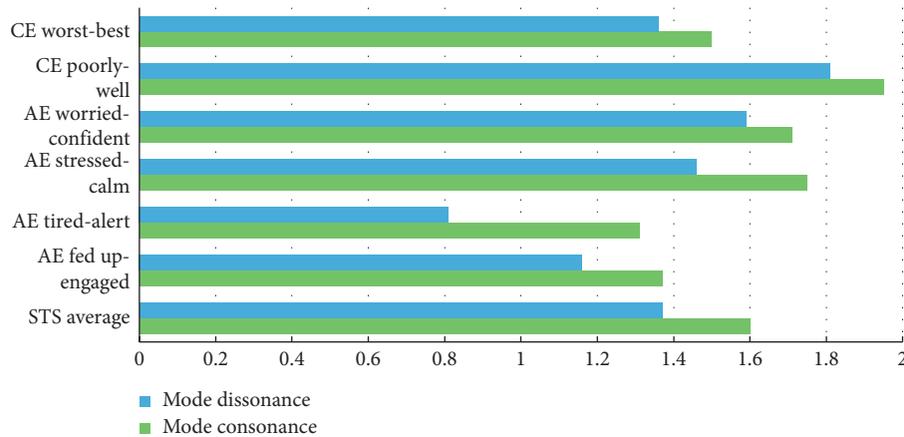


FIGURE 3: Mode consonance and travel happiness.

eight groups, including listening to music/radio and reading to relax, talking/calling, looking around, playing games or surfing the Internet, resting, working/studying, combo 2 (having two activities of the above list), and combo 3 (having three or more activities of the above list). Prior research has demonstrated that cognitive and affective evaluations of travel happiness need to be discussed separately because they are almost affected independently [16]. Therefore, in this study, multiple regression models with the average score of cognitive judgement (CE₋) and affective evaluation (AE₋) as dependent variables for four transport modes (walking, nonmotor vehicle, public transport, and car) are proposed individually.

The multiple regression results shown in Table 5 are obtained in STATA using robust standard errors. Socio-demographic attributes, residential characteristics, self-reported health condition, self-evaluation, mode consonance, and trip characteristics are included in the regression models. Table 5 only presents significant variables. According to the regression results, the constants for all modes are significantly positive. Walking is evaluated as the happiest, followed by nonmotor vehicle, car, and public transport when all influencing factors are not considered. Residential environment and daily happiness have positive effects on travel happiness of all modes, which is consistent with De Vos et al. [29] and Zhu and Fan [33]. If people are quite satisfied with their residential environment and feel

happy every day, they are more likely to enjoy the trip and have positive evaluations for their trips. As expected, optimistic people also easily feel happy during traveling.

For walking trips, living in the suburban area makes walking more satisfying. In the research results by De Vos et al. [29], it also demonstrated that suburban dwellers rated their walking trips more positively than the urban dwellers. As expected, walking frequently has negative influences on affective evaluation. People walking to school and walking with work partners give more negative affective evaluation. Listening to music/radio or reading to relax when walking helps to facilitate positive feelings. Studies conducted by Zhu and Fan [11] and Fan et al. [26] had come to similar conclusions, but the conclusions were obtained based on multiple travel modes, not aiming at walking trips only.

For the bike mode, bike trips during evening peak are perceived unhappy compared with that during off-peak hours. Travel companions or activities during the trip do not have significant influences on travel happiness. Previous studies showed that biking trips brought higher happiness than traveling with motor vehicles such as car, bus, and subway [11, 29, 33], but have not determined what factors had significant influences on travel happiness during biking trips.

For public transport trips, the aged people tend to perceive higher cognitive evaluations than the younger. The female rate their public transport trips lower than the

TABLE 5: Multiple regression results ($N = 1019$).

Variables	Walking		Nonmotor vehicle		Public transport		Car	
	CE ₋	AE ₋	CE ₋	AE ₋	CE ₋	AE ₋	CE ₋	AE ₋
Constant	4.58**	7.15**	2.36**	1.59**	1.41**	0.98**	2.10**	1.34**
Age	0.55	0.46	1.01	0.43	0.24**	0.28	0.12	0.63
Gender (ref. = male)	0.11	0.12	0.25	0.34	-0.17*	-0.22	1.35	1.52
Location (ref. = suburban)	-0.34*	-0.58	-0.27	0.41	0.11	0.10	-0.09	-0.26*
Residential environment	0.20**	0.11*	0.22**	0.19**	0.10**	0.14**	0.16**	0.16**
Optimism	0.04	-0.09	0.19	0.18	0.05	0.03	0.16**	-0.02
Daily happiness	0.03	0.11*	0.21**	0.03	0.07**	0.14**	0.09**	0.17**
Consonance (ref. = dissonance)	0.51	0.39	0.41	0.64	0.26**	0.35**	-0.17	0.04
Frequency	0.06	-0.23**	0.05	0.12	0.01	-0.04	-0.14**	-0.09
Purpose (ref. = entertainment trip)								
Work/business	-0.59	-1.20	-0.07	0.80	-0.15	-0.06	-0.29**	-0.38**
School	-0.94	-1.37**	-0.41	1.77	0.08	0.23	-0.04	-0.23
Trip day (ref. = weekday)	-0.16	-0.56	0.16	0.36	0.09*	0.24**	0.08	-0.08
Travel time (ref. = off-peak)								
Morning peak	-0.29	0.46	0.38	-0.48	-0.13	-0.18	0.20	0.08
Evening peak	-0.06	0.38	-0.84*	-1.64	-0.15	-0.06	0.28	0.20
Trip duration	-0.24	-0.21	-0.16	-0.15	-0.05*	-0.12**	-0.02	-0.08
Perceived trip duration (ref. = shorter)	-0.11	-0.38	-1.01	-0.44	-0.56**	-0.64**	-0.58**	-0.83**
Travel companion (ref. = alone)								
Family	0.47	0.90	0.22	0.63	-0.08	-0.06	0.22	0.35
Friends	0.02	0.26	-2.07	-0.70	0.06	0.27*	0.24	0.36
Work partners	0.31	-0.97*	—	—	-0.002	-0.44*	0.31	0.26
Family and friends	-1.11	-0.81	-0.37	0.70	-0.11	-0.05	0.28	0.46
Other combinations	1.42	1.99	—	—	0.15	0.11	0.19	-0.10
Activities (ref. = work/study)								
Talk	0.37	0.07	0.91	0.79	0.06	-0.16	0.47	-0.18
Rest	—	—	—	—	-0.16	0.09	0.19	-0.02
Listen to music/radio or read to relax	0.84	0.68*	1.35	-0.02	-0.12	-0.07	0.73*	0.11
Play games or surf the Internet	-1.50	-1.77	—	—	-0.18	-0.06	0.71	0.31
Look around	0.86	-1.28	-1.21	0.81	0.03	-0.05	0.21	-0.17
Combo 2	0.56	-1.35	1.39	1.11	-0.19	-0.18	0.63	0.06
Combo 3	0.61	-1.13	1.29	0.97	-0.03	0.01	0.96*	0.38
Adjusted R^2	0.403	0.241	0.574	0.330	0.306	0.325	0.365	0.415

CE₋ and AE₋ represent the average score of two cognitive evaluation items and four affective evaluation items, respectively. Symbol “—” denotes that certain variable is not in the corresponding sample. For example, for the walk mode, there is no “rest” activity during the trip. * $p < 0.05$; ** $p < 0.01$.

male. Mode consonance has remarkably significant impacts on both cognitive and affective evaluations of public transport trips. In other words, if people do not like to use bus or subway and have to use it because of all kinds of restrictions, they will give negative impressions for public transport. Once they have alternative options, it is highly probable that they will give up using public transport. Trips on weekends tend to be perceived as more satisfying compared with those on weekdays. Travel duration has critical negative impact on travel happiness. Moreover, travel happiness is also influenced by perceived trip duration. If the trip duration is perceived as longer than expected, it causes worse evaluation for the public transport trip. A public transport trip with friends is enjoyable, but with work partners is unpleasant. Present studies from different countries consistently indicated that public transit trips were rated least unhappy compared with trips by walking, biking, driving, shuttle bus, etc., and addressed the importance of improving public transit travel happiness [11, 19, 29, 33, 42]. However, few

studies explored what are the critical factors to increase public transport travellers’ happiness.

For car trips, living in the suburban area brings more positive feelings than in the urban area. Listening to music/radio, reading to relax, or conducting multiple activities (combo 3) make trips more satisfying. Traveling frequently makes trips less satisfying. Work/business travel or traveling longer than expected makes travellers dissatisfied and unhappy. Because of serious problems (such as traffic pollution, traffic congestion, traffic accidents, and physical health problems) brought by rapid urbanization and motorization, more studies focusing on the travel behaviour change program were suggested to make car trips unattractive, make public transit trips happier, and thus attract more car users to travel by public transit [8, 45, 46].

From Table 5, we also find that some variables have inconsistent impacts on cognitive judgement and affective emotion. For example, walking with work partners is satisfying from the cognitive perspective but not so happy with respect to emotional feelings, although the impact of the

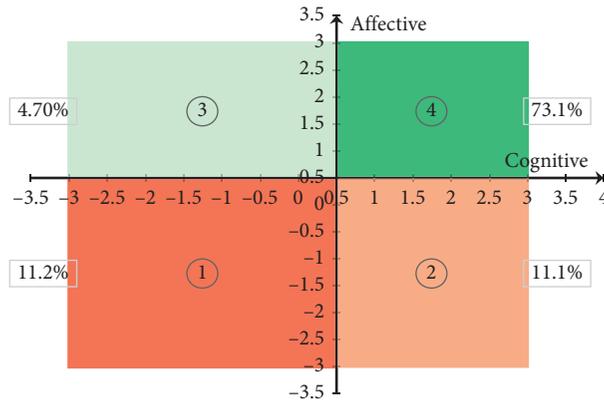


FIGURE 4: Correlation and inconsistency between cognitive and affective evaluation.

TABLE 6: Statistical results of main significant factors for four quadrants.

Quadrant	Residential environment (score: 0–10)	Optimism (score: 0–10)	Daily happiness (score: 0–10)	Mode consonance (%)	Mode share
(1)	29% ≥ 7	45% ≥ 7	30% ≥ 7	57.5	6.7% active modes 68.7% PT 23.9% car 0.7% company shuttle bus
(2)	49% ≥ 7	68% ≥ 7	39% ≥ 7	62.4	7.5% active modes 65.4% PT 25.6% car 1.5% company shuttle bus
(3)	46% ≥ 7	55% ≥ 7	45% ≥ 7	69.6	12.5% active modes 66.1% PT 21.4% car 0% company shuttle bus
(4)	75% ≥ 7	79% ≥ 7	70% ≥ 7	71.2	15.2% active modes 61.5% PT 21.5% car 1.8% company shuttle bus

work partner on cognitive judgement is not significant. In the next section, we will explore this inconsistency between the cognitive judgement and affective emotion.

4.4. Inconsistency between Cognitive and Affective Evaluation.

We further classify cognitive and affective evaluation results into two groups according to their average scores. Because both of the average score range between -3 and $+3$, we define it as positive high-emotional feelings if $AE_ > 0.5$ and negative low-emotional feelings if $AE_ \leq 0.5$. In the same way, cognitive evaluation results are also grouped as positive high ($CE_ > 0.5$) and negative low ($CE_ \leq 0.5$). Crosstabs analysis shows moderate correlation between cognitive and affective evaluation (the correlation coefficient is 0.51). Figure 4 illustrates the correlation and inconsistency between cognitive and affective evaluation. The left lower quadrant ((1)) represents samples rating happiness lower in both cognitive and affective evaluations. 11.2% of respondents belong to this quadrant. Accordingly, the right lower quadrant ((2)) represents high cognitive judgement but low

affective evaluation (11.1%), the left upper quadrant ((3)) represents low cognitive judgement but high affective evaluation (4.70%), and the right upper quadrant ((4)) represents high cognitive and affective evaluations (73.1%). In some cases, cognitive judgement is not consistent with affective emotion. Next, we explore the inconsistency through statistical analysis of significant factors.

According to regression results in Section 4.3, residential environment, optimism, daily happiness, and mode consonance have significant impacts on travel happiness. Table 6 gives statistical results of these four significant factors for the four quadrants. Respondents belonging to quadrant (1) report the lowest percentage of high ratings for residential environment, optimism, and daily happiness. Only 57.5% travel with their preferred modes. Moreover, they have the lowest active mode share. To the contrary, quadrant (4) has the highest percentage of high ratings for residential environment, optimism, and daily happiness. Mode consonance reaches up to 71.2%. Mode share of active modes and company shuttle bus are greater than those in the other three quadrants.

For quadrant (2) and (3), there is an inconsistency in changes of the cognitive and affective evaluation: as one falls, another rises. People in quadrant (2) are more optimistic and have more access to company shuttle bus. However, those in quadrant (3) have more access to use active modes and experience happiness every day. According to quadrant (4), travel happiness can be increased through enhancing residential environment, providing more alternatives to achieve mode consonance, encouraging active mode use, or providing company shuttle bus service. Besides, it confirms that travel happiness is not only affected by factors during traveling such as trip duration. It is also partly determined by residential environment and self-evaluation, which are important determinants of subjective well-being. According to the moderate correlation between cognitive and affective evaluation, the improvement of the transport service level can facilitate both cognitive judgement and emotional feelings, while traveling.

5. Conclusions and Policy Implications

This study demonstrates that walking trips have higher happiness ratings than trips by nonmotor vehicles. For trips traveling by motor vehicles, company shuttle bus trips have the highest travel happiness ratings, followed by automobile trips. Public transport trips have the lowest reported travel happiness. The overall travel happiness by active modes is significantly higher than that by motor vehicle trips. According to these findings, various measures to facilitate active mode trips are necessary, for example, increasing land use diversity, enhancing shade coverage of sidewalk and bike lane, and providing public bicycle service. Through increasing proportion of active mode trips, the overall travel happiness evaluation will be higher.

Statistical results show that travellers by bus and car worry more about not arriving on time. Subway travellers feel more tired. Regression results demonstrate that travel duration has significantly negative impacts on travel happiness of public transport users. Establishing more bus lane and implementing reservation in the urban transportation system are encouraged to ensure bus reliability and avoid in-vehicle overcrowdedness during the peak period.

A few studies [33, 47] including this study confirm that company shuttle bus trips are more satisfying than the public transport and automobile. Developing customized bus service widely is an efficient alternative to attract car travellers and enhance travel happiness.

Transport mode consonance is significantly positively correlated with travel happiness. People with multimodal preferences are more likely to be mode consonant. Thus, guiding more people to be multimodal preference travellers is important to improve travel happiness.

We also find that residential environment, optimism, and daily happiness have great positive impacts on travel happiness. Creating better residential environment, including better connection between residential location and urban transportation system and safe and healthy living conditions, helps to promote travel happiness.

Traveling with friends is more pleasant than traveling alone and with the work partner. So, creating a built environment that supports more joint trips with friends is helpful to improve travel happiness. Listening to music or reading to relax during traveling contributes to higher happiness. Based on these considerations, quiet and uncrowded in-vehicle, walking, and cycling environments are necessary.

6. Study Limitations and Future Research

This study provides an important stepping stone to better understand travel happiness and its relations with different factors. However, there are some limitations to this research. The sample sizes are slightly small for company shuttle bus and e-cycling users. To the authors' knowledge, there is quite limited research about travel happiness of company shuttle bus and e-cycling. More samples in different cities are needed to better understand travel happiness of these mode users. Furthermore, influencing factors included in this study are limited. More factors such as the service level and built environment should be considered in the questionnaire.

Besides the above mentioned, future research can be expanded in the following aspects: (1) the multimodal preference helps to enhance travel happiness indirectly. Therefore, research about what determines multimodal preference and possible ways of changing people to be multimodal preference will be interesting and valuable; (2) inconsistency is found between cognitive judgement and affective emotion in travel happiness evaluation. It is worth examining more influencing factors on this inconsistency and what change is needed to make both cognitive and affective evaluations more positive; (3) furthermore, studies have shown that travel satisfaction positively influences customer loyalty [48, 49] and plays an important role in choice behaviour [7, 8, 50]. However, what level of travel happiness will keep customer loyalty? What level can facilitate mode change? More empirical research is needed to come up with travel happiness thresholds of keeping customer loyalty and facilitating mode change.

Data Availability

The data used to support the findings of this study are available from the first author upon request (Aihua Fan, 15114229@bjtu.edu.cn).

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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