Understanding Consumer's Satisfaction to Online Hotel Review Systems: Quality Perception and Usability

Quan Xiao[1], Shun Li[1], Xing Zhang[2], Minjuan Zhong[3]

[1] School of Information Management, Jiangxi University of Finance and Economics, China
[2] School of Management, Wuhan Textile University, China
[3] School of Information Technology & Management, Hunan University of Finance and Econimics, China
xiaoquan@foxmail.com, lishun1209@foxmail.com, zhangxing1981@126.com, lucyzmj@sina.com

Abstract

Online hotel reviews get intensive attentions in the disciplines of hospitality and tourism. However, studies on online hotel review system (OHRS), where online hotel reviews are generated, viewed and replied are far from adequate. A variety of OHRS with different features are available online, but there is currently a lack of studies deconstructing OHRS from a consumer satisfaction standpoint, this study aims to provide an in-depth understanding on consumer's satisfactions to OHRS from a design feature perspective. Primary design features of OHRS are identified and classified based on an improved Kano method to depict consumer's quality perceptions. After quantitatively measuring the importance of design feature, we combine their implementation level to capture the overall usability of OHRS. The effectiveness of the proposed methods are verified by applying it to the evaluation of OHRS in six well-known online travel platforms. Compared with prior studies, the current study provides insights into consumers' asymmetric perceptions toward design features of OHRS and its usability structure, improves the deficiencies of the traditional Kano model, as well as provides valuable reference for online hotel vendors to optimize the design of OHRS to foster consumer's satisfaction.

Keywords: Online hotel review system, Quality perception, Usability evaluation, Consumer satisfaction, Kano model

1 Introduction

Various online travel platforms markedly facilitate consumers' querying, screening and comparing hotel information at anytime and anywhere, as well as the final completing of reservation currently [1]. Along with the prosperity of sales of online hotel products and services, the online reviews on online travel platforms have also accumulated dramatically [2-3]. The user-generated online reviews have become important references assisting consumers to make decisions as well as knowledge repertories for hotels to develop business strategies [4-6]. Although much extant literature have studied the antecedents and consequences of online hotel reviews from multiple perspectives [7-8], studies on OHRS have been few in number. Indeed, as a common subsystem of online travel platform, OHRS takes on the tasks of generating, displaying and communicating with the online hotel review information, the importance of which is not less than the business or transaction subsystem. However, most previous works regard OHRS as given and an already established situation to examine the drivers and impacts of online hotel reviews [9], consumer's attitudes toward the OHRS itself has not yet been well studied.

As a tool for consumers to share experiences and learn about products or services [10-11], OHRS should be designed to meet consumer expectations [12]. Usability of OHRS affects consumers' quality perception toward online hotel products or services, which in turn determines their decisions, behaviors and satisfactions. Therefore, it is crucial for online travel platforms to figure out how to capture consumer's quality perceptions to OHRS and measure its usability [5]. Extant literature on system usability built index systems or dimensions regarding the characteristics of the target system to derive the overall usability [13]. Different from websites or information systems in the general sense, a microscopic insight for OHRS is needed. Consumers are the main user of OHRS, but very few studies investigate OHRS from the perspective of consumers regarding their satisfactions and perceptions with the microscopic components, i.e., design features, which are defined as the collection of human interface elements that users see, hear, touch, or operate [14], of OHRS.

In terms of describing the relationship between product or service design and consumer's satisfaction, the Kano model is a classic approach [15]. As consumer's expectations vary among afforded

*Corresponding Author: Xing Zhang; Email: zhangxing1981@126.com
DOI: 10.53106/160792642021112206009

functionalities of OHRS, Kano model is appropriate to depict the asymmetric and nonlinear relationship between design feature and user satisfaction [16-18]. Kano model classifies products or services based on the level of user satisfaction regarding their quality perceptions [19], which has been adopted in multidisciplinary areas such as hotel services [20], airline services [21], design of website [22] and mobile applications [23], etc. However, we address inadaptabilities exist when directly applying Kano model to the current context, i.e., "maximum proportion principle", "dualistic treatment of performance" and "redundant measurement of importance", which will be elaborated in the following subsections.

This study aims to fill the gaps in extant research by proposing an improved approach for analyzing consumer's quality attributes perceptions and classifying design features of OHRS. Through quantitatively measuring the importance of design features, a method for evaluating the usability of OHRS is then proposed. Based on our method, the usability of OHRS of six representative online travel platforms are measured. Our study not only provide insights into consumers' asymmetric perceptions of design features when using OHRS as an auxiliary decision tool, but also contribute to literature on the designing and optimizing of OHRS for online travel platforms.

2 Literature Review

2.1 Design of OHRS

A typical online review system is composed of a series of design features such as volume of reviews (VOR), characteristics of reviewers, granular report, review summarization (RS) and review filtering and ordering, etc. (see Figure 1).

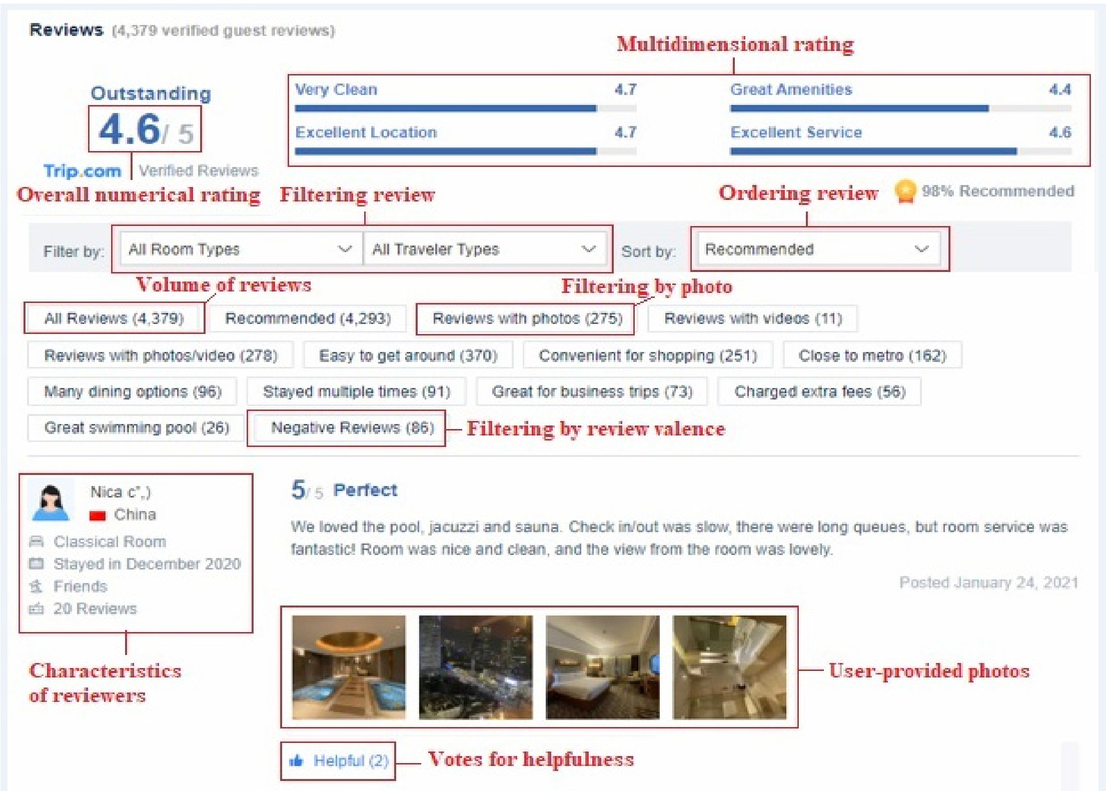


Figure 1. Design features in an OHRS

Previous studies have examined the impact of some of these design features. For example, Shen et al. [24] investigated the online review systems of Amazon and Barnes & Noble and found that the reviewer ordering mechanism would affect the behavior of reviewers. As it is time consuming to read the large number of user-generated online reviews with different writing styles, tactical designs of online review system can promote the quality of online reviews and provide consumers with more credible and representative references through a laboratory study [25]. Hence, in OHRS, design features with appropriate presenting, filtering and ordering of online reviews are conducive to the judgement and decision of consumers. However, most related studies regard online review systems as given [9] and are bent on either analyzing the content of online reviews or examining the impact of a single design feature of online review system. Compared with various efforts for designing and improving OHRS in practice field, academic realm has paid inadequate attention to systematic analysis of the design features of OHRS, especially from the viewpoint of consumers.

2.2 Usability of IT Product

Usability is an important indicator of the quality of an interactive IT product, reflecting the extent to which a task can be easily and quickly performed by the users [26]. Belanche et al. [27] believed that website usability could affect consumer satisfaction, and further influence the intention to use. Lee and Kozar [28] indicated that high-usability websites could promote the positive attitude of consumer, increase the number of visits as well as duration of stay, and further foster sales. Moreover, in terms of hotel website usability, Au Yeung and Law [29] applied the modified heuristic evaluation technique to evaluate the usability of hotel website, and found the website usability of chain hotels to be better than their independent hotels. Essawy [30] evaluated the usability of hotel websites using a protocol analysis method. In another study evaluating the usability of hotel websites in Hong Kong, Au Yeung and Law [31] showed that minor problems of usability existed on the hotel websites, and no significant difference was found among luxury, mid-priced, and economy hotels. In the study of Li et al. [32], the usability of economy hotel websites was found to be a predictor of online consumer trust which in turn affected consumers' online booking intentions.

In terms of research methodology, there emerge various approaches to evaluate the usability of websites or information systems in previous literature, such as multi-criteria decision methods [33], heuristic approaches [34], data envelopment analysis [35], etc. Most of these methods, however, fail to evaluate the usability of IT products from the microscopic perspective regarding the concrete built-in design features. Consequently, there are still inadequate investigations into the extent to which different design features affect the overall usability of IT products. This study complements the extant research by examining the specific design features of OHRS and further evaluating its usability, which provides more precise and operable understandings for the design and improvement of OHRS in a finer granularity.

2.3 Kano Model

Inspired by Herzberg's two-factor theory, Japanese quality management guru Noriaki Kano proposed the Kano model in 1984. The model divides quality attributes into five categories according to the relationship between performance of quality attributes and consumers' feelings, namely, must-be, one-dimensional, attractive, indifferent, and reverse [17-18]. The impacts of the implementation level of these quality attributes on consumer satisfaction are shown in Figure 2. Extant literature based on Kano model generally falls into two streams. The first one attempts to improve or optimize Kano model methodologically, including the fuzzy approach [36], the analytical Kano model [37], moderated regression model [38], moderated dummy variable regression method [39], etc. The second stream is the applying of Kano model empirically. For example, Qi et al. [40] applied the Kano model to the analysis of online reviews to develop appropriate product improvement strategies. Go and Kim [21] grouped travelers based on their annual flying frequency to investigate the differences of in-flight negative customer-to-customer interaction components between groups. Ilbahar and Cebi [22] evaluated the usability of e-commerce websites based on Kano model, and Taimouri et al. [41] employed a fuzzy Kano method to assess the usability of online food ordering websites. Based on previous studies of Kano model in related fields, it is believed that Kano model is potentially a feasible approach in the area of the current study, where the entire online hotel review system can be deemed as the information product that constitutes of critical quality attributes.

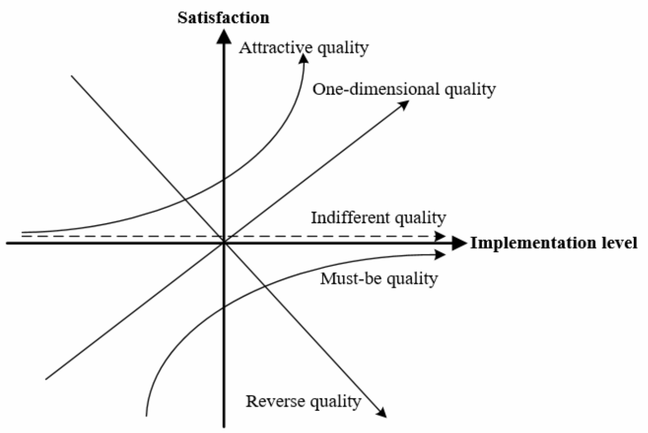


Figure 2. Traditional Kano model

Through a review of the existing research based on Kano model, three aspects of limitations are identified that prevented it from being adopted directly to capture consumers' satisfaction to OHRS. We name the first limitation as "maximum proportion principle". Traditional Kano model determines the type of quality attribute based on the Kano category with the largest frequency, the representation of which may be controversial [39]. In fact, there are cases that no significant difference exists between Kano categories. The second limitation is "dualistic treatment of performance", that is traditional Kano questionnaires only consider the presence or absence status of quality attributes, and such a duality may result in imprecise usability measures. The third one is "redundant measurement of importance". Most studies on quality evaluation based on Kano model require an additionally survey on the importance of quality features, but actually, the self-reported data of Kano questionnaire already reflect the respondents' preferences to each quality attribute. We try to improve these problems of the Kano model in this study.

3 Research Methodology

The proposed method for capturing consumer's satisfaction to OHRS in terms of quality perception and usability consists of three stages: preparation, quality classification (preliminary and mixed), and usability evaluation.

3.1 Preparation: Scoping of Design Features and Survey Design

The impacts of design features of online review systems have been investigated by previous studies, including votes for helpfulness (VFH), RS, ordering review by type (ORBT), VOR, etc. In addition, through the analysis of main online tourism platforms in practice, we obtain additional design features such as multidimensional rating (MR), filtering by review valence (FBRV), filtering by photo (FBP), and review content searching (RCS). Finally, the 16 extracted design features from literature and current OHRSs form the object pool to be investigated (See Table A.1 in Appendix).

In line with the paradigm of Kano model, the Kano questionnaires for 16 design features are designed subsequently, including both pros and cons aspects. The two-dimensional questions capture the perceived satisfaction of respondent with the presence (functional) or absence (dysfunctional) of a design feature in OHRS on five levels, i.e., "like", "must-be", "neutral", "live-with", and "dislike". The 16*2 questions take up the main part of the questionnaire. Demographic questions such as gender, age, education level, experience of online hotel booking, and the dependency on online reviews are also be included in the questionnaire.

3.2 Preliminary Quality Classification of Design Features

Based on the collected Kano questionnaires, the classification of each design feature for each individual respondent can be obtained by means of the typical quality classification table of traditional Kano model (see Table 1). The traditional Kano method suggests the synthetic classification of a design feature to be the one with largest proportion when aggregating all individual typical quality classification results.

Table 1. Typical quality classification table of traditional Kano model

Customer Response		Dysfunctional Question				
		Like	Must-be	Neutral	Live-with	Dislike
Functional Question	Like	Q	A	A	A	O
	Must-be	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live-with	R	I	I	I	M
	Dislike	R	R	R	R	Q

Notes. M (must-be quality), O (one-dimensional quality), A (attractive quality), I (indifferent quality), R (reverse quality), Q (questionable quality).

Then we calculate the user satisfaction coefficient of design feature, and conduct classification based on coordinate plane division to achieve the preliminary classification of design features of OHRS. The extent of user satisfaction to the presence of design feature is measured by satisfaction index (SI) whereas the extent of user dissatisfaction to the absence of design feature is measured by dissatisfaction index (DSI) [42]. The absolute values of SI and DSI are between 0 and 1. The SI of design feature F_i is calculated as *Eq. 1*,

$$SI_i = \frac{A_i + O_i}{A_i + O_i + M_i + I_i} \quad \textbf{(Eq.1)}$$

where A_i, O_i, M_i, and I_i represent the aggregated count of individual typical quality classification in term of A (attractive quality), O (one-dimensional quality), M (must-be quality), and I (indifferent quality) respectively, of design feature F_i. The value of SI_i is usually positive, indicating that provision of the design feature in OHRS promotes user satisfaction.

The DSI of design feature F_i is calculated as *Eq.2*.

$$DSI_i = -\frac{O_i + M_i}{A_i + O_i + M_i + I_i} \quad \textbf{(Eq.2)}$$

DSI_i is usually negative, indicating a reduction of user satisfaction with the absence of the design feature. A value of DSI_i close to -1 demonstrates a strong reduction effect.

The averaged SI and averaged absolute value of DSI for all design features are calculated as *Eq.3* and *Eq.4*.

$$\overline{SI} = \frac{1}{n}\sum_{i=1}^{n} SI_i \quad \textbf{(Eq.3)}$$

$$\overline{|DSI|} = \frac{1}{n}\sum_{i=1}^{n} |DSI_i| \quad \textbf{(Eq.4)}$$

Bidimensionally, $\overline{SI}$ and $\overline{|DSI|}$ divide the coordinate plane constructed by SI and DSI into four quadrants. Each quadrant implies the relationship between quality of each design feature and the corresponding user satisfaction. Following the naming schema of Kano model, we name the four quadrants as attractive quadrant, one-dimensional quadrant, must-be quadrant and indifferent quadrant respectively. The rules for classification of design features based on coordinate plane is indicated by Figure 3. The quadrant corresponding to the design feature in the figure represents its preliminary classification.

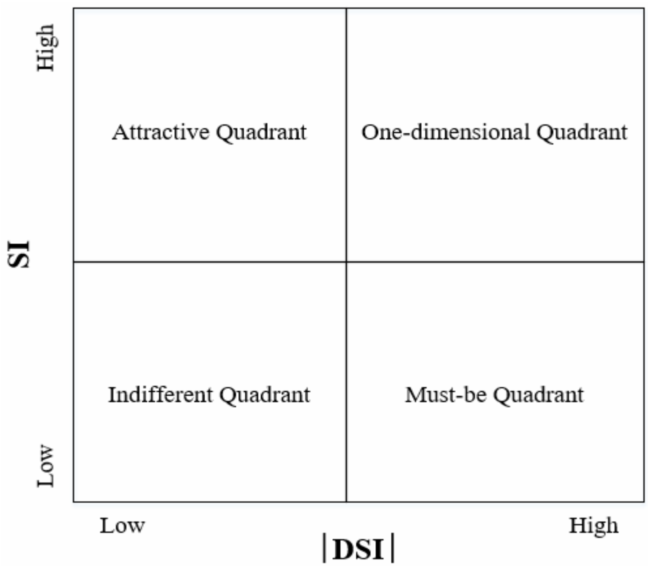


Figure 3. Coordinate-based classification

3.3 Determination of Mixed Categories

This study draws on the ideas of Lee and Newcomb [43] as well as Yao et al [44] to compensate the limitation of "maximum proportion principle" by conducting a mixed classification strategy (See Figure 4). Based on the idea of clustering in data mining techniques, the membership degree of each design feature to each preliminary classification is measured by the distance between each design feature and the center point of each cluster of preliminary classification. Thus, the mixed categories of design features are derived.

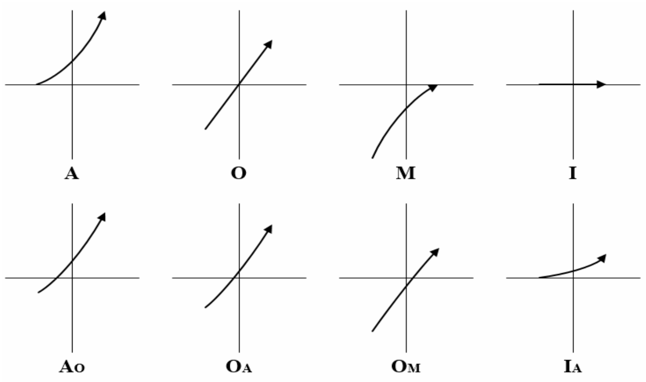


Figure 4. Mixed Kano model

The point with the minimal sum of Euclidean distances from all points in each quadrant *j* is taken as the quadrantal center, denoted as p_j , whose coordinates are calculated as *Eq.5*.

$$p_j : (\hat{x}, \hat{y}) = \underset{x,y}{argmin} \sum_{i=1}^{n_j} \sqrt{(x - |DSI_i|)^2 + (y - SI_i)^2}, \quad j \in \{A, O, M, I\} \quad \textbf{(Eq.5)}$$

where $\overline{|DSI_i|}$ and SI_i represents the abscissa and ordinate of point p_i respectively, and n_j is the number of points located in quadrant *j*.

The distance between the point p_i corresponding to design feature F_i and the center point p_j of preliminary classification quadrant *j*, denoted as $Distance_{ij}$, is computed as *Eq.6*. Then, the membership degree μ_{ij} of design feature F_i to the preliminary classification *j* is calculated as *Eq.7*.

$$Distance_{i,j} = \sqrt{(|DSI_i| - \hat{x}_j)^2 + (SI_i - \hat{y}_j)^2}, \quad j \in \{A, O, M, I\} \quad \textbf{(Eq.6)}$$

$$\mu_{i,j} = \frac{1/Distance_{i,j}}{(1/Distance_{i,j})}, J = \{A, O, M, I\}\# \quad \textbf{(Eq.7)}$$

On the basis of membership degrees of each design feature to each preliminary classification, a mixed classification for design features is conducted. The mixed classification rules are defined as: (a) if only one among the four membership degrees of a design feature F_i is greater than 0.25, the category (single) of the design feature is determined directly in accordance to its preliminary classification $C(F_i)$; (b) if there are two or more membership degrees of a design feature F_i greater than or equal to 0.25, the design feature has mixed categories denoting as $C_m(F_i)$, where the two classifications with the highest membership degree are respectively taken as the primary category $C_p(F_i)$ and the subcategory $C_s(F_i)$ of design feature F_i.

3.4 Usability Evaluation of OHRS

In the current study, the importance value of design feature is obtained by calculating the information implicit in the existing Kano questionnaire to overcome the limitation of "redundant measurement of importance". As per definition, the larger the values of SI_i and $|DSI_i|$ are, the greater the impact of implementation level of design feature F_i generates on user satisfaction or dissatisfaction, hence the more important design feature F_i is to OHRS. Following the studies of [16] and [22], the importance of design feature F_i, noted as W_i, is calculated as *Eq.8*. A larger distance indicates a higher importance.

$$W_i = \sqrt{SI_i^2 + DSI_i^2} \quad \textbf{(Eq.8)}$$

As the "dualistic treatment of performance" limitation blurs the relationship between performance of design features and the overall usability of OHRS, in this study implementation level ranges from "none", "ordinary" to "good", and experienced users of online hotel booking are invited to rate the implementation level for each design feature. To coordinate by the "majority principle", the implementation level of each design feature can be determined.

The usability of each design feature is assessed first. The non-linear relationships between implementation level of design features and user satisfaction as shown in Figure 4 underlie the usability evaluation for design features. As presented in Table 2, we first provide usability score for each single category within three levels of implementation in accordance with previous studies. The usability score of mixed-categorial design feature F_i is calculated as *Eq.9*.

$$S(C_m(F_i)) = \frac{S(C_p(F_i)) \times 2 + S(C_s(F_i)) \times 1}{3} \quad \textbf{(Eq.9)}$$
$$C_p(F_i), C_s(F_i) \in \{A, O, M, I\}$$

Table 2. Usability score transformation matrix of design feature

Implementation level (k)	Single category				Mixed categories					
	A	O	M	I	A_O/O_A	A_M/M_A	A_I/I_A	O_M/M_O	O_I/I_O	M_I/I_M
none	0	-45	-75	0	-15/-30	-25/-50	0/0	-55/-65	-30/-15	-50/-25
ordinary	25	0	-25	0	16.67/8.33	8.33/-8.33	16.67/8.33	-8.33/-16.67	0/0	-16.67/-8.33
good	75	45	0	0	65/55	50/25	50/25	30/15	30/15	0/0

Finally, the overall usability score, denoted as *US*, of OHRS is calculated as *Eq.10*.

$$US = \sum_{k,i} W_i \times P_{ik} \quad \textbf{(Eq.10)}$$

where P_{ik} is the usability score of design feature F_i within the implementation level *k*.

4 Industrial Case Study

4.1 Data

According to the Kano method and related literature, the questionnaire was designed based on the 16 identified design features of OHRS as described in Section 3.1, including a series of paired questions in both functional and dysfunctional aspects for each identified design feature. To ensure the content of the questionnaire properly understood by the respondents, a pre-survey consisting of 25 participants who are familiar with online hotel review systems, including university faculties, graduate and undergraduate students, was conducted prior to the formal survey. From March 12 to March 28, 2019, the formal questionnaire was implemented online via "wjx.com" and the link of the questionnaire was distributed to the users who have used online hotel review systems through instant messaging software and social network service such as WeChat, Weibo and QQ to collect data in a snowball manner. Those respondents who had never experienced online hotel reservations, or had never used an online hotel review system were set not to proceed to the next step of the formal questionnaire.

A total of 316 questionnaires were collected, 303 of which were retained after excluding the questionnaires with incomplete answers, the selfsame answers and too short completion times, with an effective rate of 95.9%. The respondents are mainly between 18 and 39 years old and females account for 50.8%. Most of the respondents have more than one-year experience in online hotel booking, and over 80% of the respondents use online travel platforms as their primary channel for obtaining hotel information. Over 90% of the respondents usually refer to online reviews before booking, and over 60% read more than 10 reviews. The distribution characteristics of the sample in the study are generally consistent with the demographics of online hotel booking users in China [45]. The overall reliability of the Kano questionnaire, measured by Cronbach's α, is 0.914, the reliability of the functional and dysfunctional items are respectively 0.925 and 0.958, both above 0.9, indicating good reliability for further analysis. As far as validity is concerned, it refers to the degree of authenticity and accuracy of the survey research and is measured with KMO and Bartlett's sphericity test values. The results show that the KMO values of the functional and dysfunctional questions are 0.923 and 0.958 (both more than 0.7), respectively. Bartlett's sphericity test values are both 0.000 (Sig<0.001), so the questionnaire also has good validity.

Referring to the iiMedia [46] and Trustdata [47] online hotel industry reports, we select six representative online travel platforms in the industry to evaluate the usability of their embedded OHRSs, which include TripAdvisor.com, Booking.com, Ctrip.com, LY.com, Qunar.com, and Mafengwo.cn. We note that two remarkable platforms, i.e., Expedia and Meituan Ebooking, are not included in this study due to the functionally deficiency of their OHRSs. The OHRS of Meituan Ebooking contains only the ONR design feature concerned, and the OHRS of Expedia is also rather simple compared with other six platforms. In determining the implementation levels of design features in each OHRS, five professors, Ph.D. and graduate students major in tourism management and information management with more than three years of experiences in online hotels booking are invited. They evaluate the implementation level of 16 design features in OHRS for each of the six online travel platforms independently, rating as "none", "ordinary" or "good" respectively. According to the rules for coordinating the implementation level of design feature described in Section 3.4, the implementation levels of each design feature in each OHRS are determined, see Table 3.

Table 3. Implementation levels of design features across OHRSs

Design Feature	TripAdvisor	Booking	Ctrip	LY	Qunar	Mafengwo
VOR	good	ordinary	ordinary	good	ordinary	good
UPP	good	ordinary	good	good	good	good
RS	none	none	none	good	none	good
ONR	ordinary	good	good	good	good	good
MR	good	good	ordinary	none	none	good
DORV	good	none	ordinary	none	good	none
VFH	ordinary	ordinary	good	none	good	none
REL	none	none	good	none	ordinary	good
ORBT	none	good	ordinary	ordinary	good	none
FBRV	good	good	ordinary	ordinary	good	none
FBP	none	none	good	good	none	none
FBRS	none	good	none	good	none	good
FBEB	none	none	none	none	ordinary	none
FBRT	none	none	good	good	none	none
FBTT	good	good	good	good	none	none
RCS	good	good	good	none	none	none

4.2 Quality Classification of Design Features

The frequency distribution of typical quality classification for each design feature are shown in Table 4 (see columns A, O, M, I, R and Q). After calculation of SI and DSI of each design feature, the coordinate plane plot for preliminary quality classification of design features is drawn, as shown in Figure 5. The preliminary quality classification results are shown in column *C* in Table 4.

The membership degree of each design feature to each classification are shown in columns μ(A), μ(O), μ(M) and μ(I) in Table 4, and the results of mixed-categorial quality determination of design features are shown in column C_m , where non-mixed categorial design features take its preliminary classification C. A total of eight quality categories are obtained.

4.3 Usability Evaluation Results

To evaluate the usability of OHRS, the importance of each design feature is calculated first, as shown in column *W* in Table 5. The most important design feature is UPP (*W* = 0.853), while the lowest is VFH (*W* = 0.440). According to the mixed categories of design features and usability score transformation matrix, the usability scores of design features across implementation levels are calculated, as shown in Table 5.

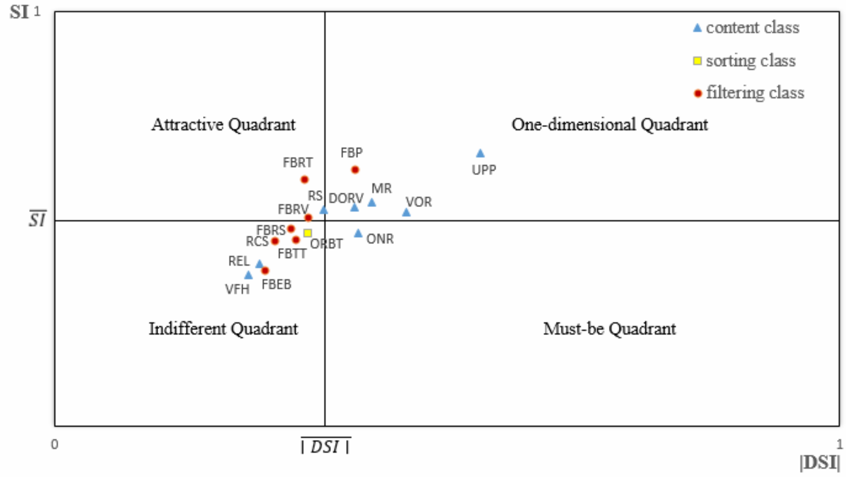


Figure 5. Coordinate plane for preliminary quality classification

Table 4. Classification determination table of design features

Design Feature	A	O	M	I	R	Q	*C*	μ(A)	μ(O)	μ(M)	μ(I)	C_m
VOR	66	82	46	92	5	12	O	0.192	0.425	0.265	0.118	O_M
UPP	62	121	30	65	11	14	O	0.247	0.329	0.244	0.180	O
RS	83	64	32	102	12	10	A	0.904	0.038	0.034	0.024	A
ONR	65	69	42	111	5	11	M	0.000	0.000	1.000	0.000	M
MR	78	74	40	90	4	17	O	0.001	0.997	0.001	0.001	O
DORV	72	77	31	103	2	18	O	0.267	0.454	0.190	0.089	O_A
VFH	68	32	36	139	4	24	I	0.201	0.157	0.213	0.429	I
REL	66	35	32	124	23	23	I	0.178	0.133	0.186	0.503	I
ORBT	73	54	34	112	11	19	I	0.254	0.141	0.239	0.366	I_A
FBRV	79	59	29	106	9	21	A	0.507	0.145	0.172	0.176	A
FBP	94	80	27	79	7	16	O	0.289	0.362	0.199	0.150	O_A
FBRS	88	49	37	112	4	13	I	0.278	0.137	0.188	0.397	I_A
FBEB	59	38	31	129	22	24	I	0.187	0.145	0.205	0.463	I
FBRT	107	61	28	85	4	18	A	0.364	0.269	0.191	0.176	A_O
FBTT	75	44	37	108	16	23	I	0.162	0.099	0.158	0.581	I
RCS	71	52	25	127	8	20	I	0.085	0.053	0.075	0.787	I

Table 5. Importance and usability score across implementation levels of design features

Design feature	C_m	*W*	none	ordinary	good
VOR	O_M	0.684	-55	-8.33	30
UPP	O	0.853	-45	0	45
RS	A	0.625	0	25	75
ONR	M	0.607	-75	-25	0
MR	O	0.674	-45	0	45
DORV	O_A	0.651	-30	8.33	55
VFH	I	0.440	0	0	0
REL	I	0.472	0	0	0
ORBT	I_A	0.566	0	8.33	25
FBRV	A	0.599	0	25	75
FBP	O_A	0.729	-30	8.33	55
FBRS	I_A	0.566	0	8.33	25
FBEB	I	0.463	0	0	0
FBRT	A_O	0.677	-15	16.67	65
FBTT	I	0.546	0	0	0
RCS	I	0.527	0	0	0

The usability scores of all design features in the OHRSs of the six online travel platforms and the overall usability scores are presented in Table 6. From high to low, the overall usability score of the six OHRSs are LY (173.86), Ctrip (141.89), TripAdvisor (122.75), Mafengwo (98.68), Qunar (65.21) and Booking (46.26).

Table 6. Usability score of design features and OHRSs

Design Feature	TripAdvisor	Booking	Ctrip	LY	Qunar	Mafengwo
VOR	20.52	-5.70	-5.70	20.52	-5.70	20.52
UPP	38.39	0	38.39	38.39	38.39	38.39
RS	0	0	0	46.87	0	46.87
ONR	-15.16	0	0	0	0	0
MR	30.31	30.31	0	-30.31	-30.31	30.31
DORV	35.80	-19.53	5.42	-19.53	35.80	-19.53
VFH	0	0	0	0	0	0
REL	0	0	0	0	0	0
ORBT	0	14.14	4.71	4.71	14.14	0
FBRV	44.92	44.92	14.97	14.97	44.92	0
FBP	-21.87	-21.87	40.10	40.10	-21.87	-21.87
FBRS	0	14.14	0	14.14	0	14.14
FBEB	0	0	0	0	0	0
FBRT	-10.15	-10.15	43.99	43.99	-10.15	-10.15
FBTT	0	0	0	0	0	0
RCS	0	0	0	0	0	0
US	122.75	46.26	141.89	173.86	65.21	98.68

To draw clearer insights on the relative contribution to the overall usability in terms of different quality types, we further decompose the overall usability score to each quality type to conduct comparisons between the platforms. For simplifying the results without losing representativeness, the mixed-categorial design features are merged to their primary categories. The distribution of usability scores for each OHRS within different quality types is presented in Figure 6.

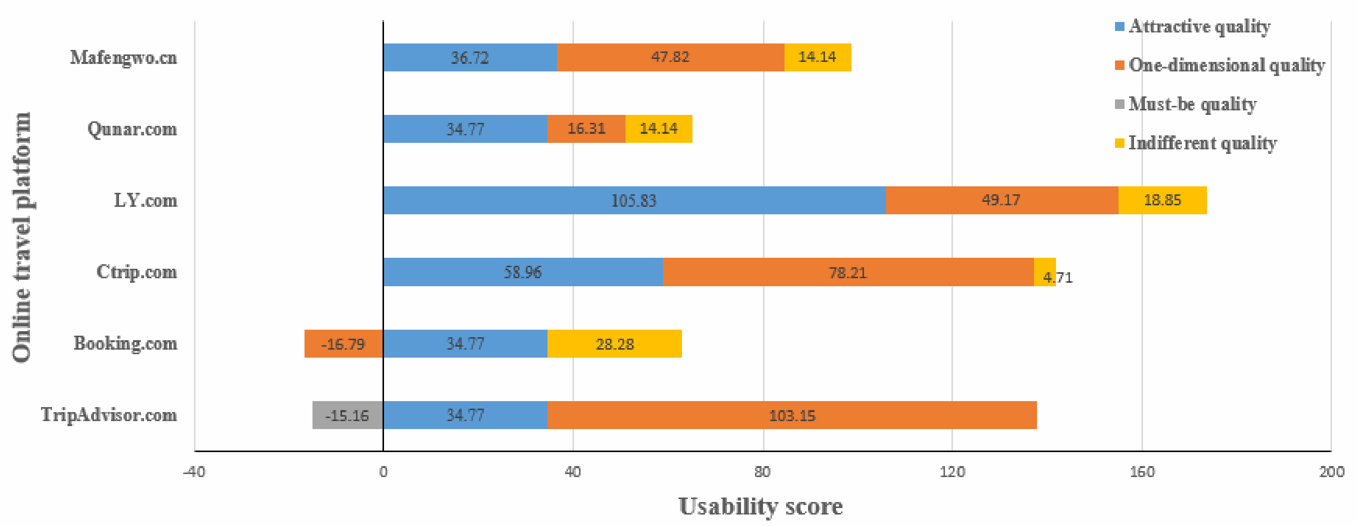


Figure 6. Usability scores of six representative OHRSs

4.4 Validity Check

This study makes some improvements to previous studies, the first is to propose a usability score metrics for OHRS based on a mixed-categorial Kano model, and the second is to measure the importance of design features based on the satisfaction and dissatisfaction coefficients calculated by the Kano questionnaire. Although these improvements are supported by some prior works (e.g., [17, 22-23]), their effectiveness for the issues of OHRS is yet to be verified. To examine the validity of the proposed method, an additional questionnaire experiment was conducted.

For the purpose of reducing the length of the questionnaire, instead of asking all respondents about the usability of each of the six OHRS and the importance of each design feature at the data collection stage, we approached 10 users who never participated in the pre-experiment and our previous survey, but who were familiar with booking hotels online and often read online reviews. They were instructed to make a two-by-two comparison of the usability of different systems after browsing the six OHRSs following the idea of Analytic Hierarchy Process (AHP) [48-49]. By calculating the constructed judgment matrix, a set of usability weights for each user was obtained. Averaging the 10 users' weight vectors yielded their aggregated weights and ranking of the overall usability of each OHRS. As shown in the red lines in the slope chart in Figure 7, the usability scores calculated based on the proposed method are consistent with the ranking obtained by the AHP method, which indicates the validity of this usability metric. Similarly, we performed an AHP-based weighting for the 16 design features. As can be seen from the blue lines in Figure 7, the weights calculated by our method of feature importance are also in good agreement with those calculated by the AHP method. For the top five and bottom four of these design features, both rank exactly the same, and the ranking of the other design features also showed good consistency, which reflects the validity of our treatment of the weights.

5 Discussion, Implication and Conclusion

As is shown in the results of empirical investigation based on the proposed methodology, sixteen design features of OHRS are divided into eight quality categories, including four single categories: attractive quality, one-dimensional quality, must-be quality and indifferent quality, along with four mixed categories: A_O, O_A, O_M and I_A. We also obtained usability scores for the OHRSs of six major online travel platforms and the score compositions on different quality categories. This study holds three main theoretical contributions. First, although the importance of online reviews to the hospitality industry is widely recognized, most of the previous related research treat online review systems as given [9]. This paper takes system design as the starting point to investigate consumers' satisfaction to OHRS from a unique perspective of design feature, which provides a comprehensive and microscopic understanding of OHRS. Secondly, this paper examines the contribution of design features to consumers' satisfaction based on the nonlinear and asymmetric consideration of the Kano model, and identifies limitations of existing studies based on traditional Kano model. The paper methodologically

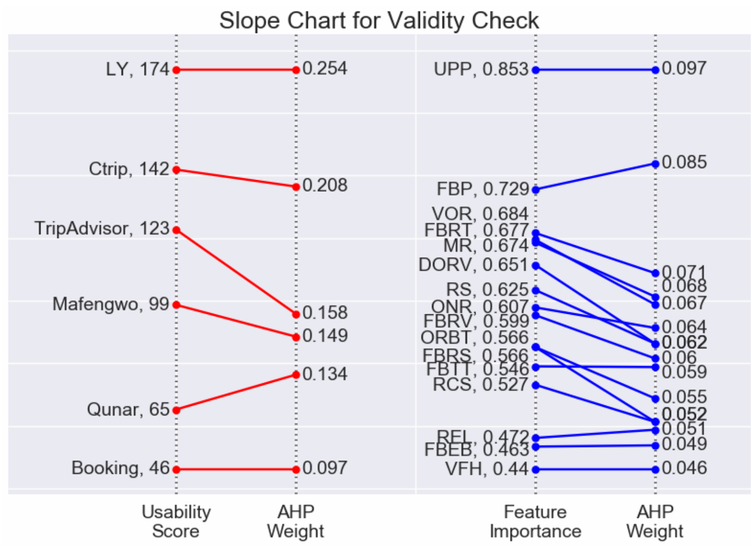


Figure 7. Result of validity check

addresses the limitations and further assesses consumer's quality perception and usability of OHRS by proposing an improved method, which is able to enhance the accuracy of design feature classification and usability evaluation. Additionally, most studies utilize question items in questionnaires to obtain the importance of object to be evaluated, which is often cumbersome and prone to subjective deviation. This paper quantitatively measures the importance of design feature by reusing of data from Kano questionnaire, which effectively avoids the workload of additional survey of importance.

The study offers practical implications for the management and design regarding online tourism platforms and hotel information systems. This study informs online travel platforms and online hotel vendors that while paying attention to the content of online reviews, they should also devote sufficient concern to the online review system itself, as it affects how consumers process online reviews, which in turn affects their satisfaction. The results of this study provide guidance for them to scrutinize and optimize the OHRS. For example, they are suggested to ensure the best implementation level of must-be design feature to avoid dramatical consumer dissatisfaction and focus on attractive and one-dimensional design features to increase consumer satisfaction and enhance system usability. Especially for the attractive design features, they should be good at leveraging emerging technologies to provide innovative capabilities to create a unique experience for consumers, thus significantly improve their satisfaction and differentiate themselves from competitors. Given the lowest priority to indifferent design features, it can be considered to reduce their visibility when there is a tight layout of the system interface.

The present study has some limitations, which provide possible directions for future research. For example, as the data is collected in China, if the results would be affected by cultural differences are not examined. Future research can complement multinational samples to test the generalizability of our results, where cross-cultural findings may be obtained. We do not differentiate hotel types (e.g., economic and luxury), star ratings, prices and cities, and consumer groups with different ages, genders, educations, and occupations may have differentiated needs for the information and features provided by OHRS. Future research can further integrate different hotel booking scenarios and consumer profiles to generate more contextualized strategies. Additionally, excess questions produced by the two-dimensional inquiry and self-report data would bias the results, therefore, objective data such as user behaviors logs and user-generated contents can be employed in future studies to simplify the data collection process and improve the objectivity of results, and the validity of our approach of using satisfaction and dissatisfaction scores to measure the importance of design features needs to be further examined.

Acknowledgements

This work was partially supported by the National Natural Science Foundation of China [grant numbers 71861014, 71974152, 71762017], and Science and Technology Project of Jiangxi Education Department [grant number GJJ60458].

References

[1] S. Park, Y. Huang, Motivators and inhibitors in booking a hotel via smartphones, *International Journal of Contemporary Hospitality Management*, Vol. 29, No. 1, pp. 161-178, January, 2017.

[2] E. Wong, S. M. Rasoolimanesh, S. P. Sharif, Using online travel agent platforms to determine factors influencing hotel guest satisfaction, *Journal of Hospitality and Tourism*

Technology, Vol. 11, No. 3, pp. 425-445, October, 2020.

[3] X. W. Liao, X. T. Xu, J. S. Pan, G. L. Chen, Detect online review spammers based on comprehensive trustiness propagation model, *Journal of Internet Technology*, Vol. 18, No. 3, pp. 637-644, May, 2017.

[4] M. Lee, Y. Cai, A. DeFranco, J. Lee, Exploring influential factors affecting guest satisfaction: Big data and business analytics in consumer-generated reviews, *Journal of Hospitality and Tourism Technology*, Vol. 11, No. 1, pp. 137-153, May, 2020.

[5] S. Lei, R. Law, Functionality evaluation of mobile hotel websites in the m-commerce era, *Journal of Travel & Tourism Marketing*, Vol. 36, No. 6, pp. 665-678, May, 2019.

[6] E. E. K. Kim, C. H. Lee, How do consumers process online hotel reviews? The effects of eWOM consensus and sequence, *Journal of Hospitality and Tourism Technology*, Vol. 6, No. 2, pp. 113-126, August, 2015.

[7] P. Phillips, S. Barnes, K. Zigan, R. Schegg, Understanding the impact of online reviews on hotel performance: an empirical analysis, *Journal of Travel Research*, Vol. 56, No. 2, pp. 235-249, February, 2017.

[8] J. H. Chang, C. Y. Tseng, Analyzing Google trends with travel keyword rankings to predict tourists into a group, *Journal of Internet Technology*, Vol. 20, No. 1, pp. 247-256, January, 2019.

[9] Y. Jiang, H. Guo, Design of consumer review systems and product pricing, *Information Systems Research*, Vol. 26, No. 4, pp. 714-730, December, 2015.

[10] Y. Chen, J. Xie, Online consumer review: Word-of-mouth as a new element of marketing communication mix, *Management Science*, Vol. 54, No. 3, pp. 477-491, March, 2008.

[11] X. Zhang, S. Liu, X. Chen, L. Wang, B. Gao, Q. Zhu, Health information privacy concerns, antecedents, and information disclosure intention in online health communities, *Information & Management*, Vol. 55, No. 4, pp. 482-493, June, 2018.

[12] S. E. Hahn, B. Sparks, H. Wilkins, X. Jin, E-service quality management of a hotel website: a scale and implications for management, *Journal of Hospitality Marketing & Management*, Vol. 26, No. 7, pp. 694-716, August, 2017.

[13] S. Roy, P. K. Pattnaik, R. Mall, A quantitative approach to evaluate usability of academic websites based on human perception, *Egyptian Informatics Journal*, Vol. 15, No. 3, pp. 159-167, November, 2014.

[14] S. H. Han, M. H. Yun, K. J. Kim, J. Kwahk, Evaluation of product usability: development and validation of usability dimensions and design elements based on empirical models, *International Journal of Industrial Ergonomics*, Vol. 26, No. 4, pp. 477-488, October, 2000.

[15] S. W. Liang, H. P. Lu, T. K. Kuo, A study on using the Kano two-dimensional quality model to evaluate the service quality of government websites, *Journal of Internet Technology*, Vol. 15, No. 2, pp. 149-162, March, 2014.

[16] J. W. Bi, Y. Liu, Z. P. Fan, J. Zhang, Exploring asymmetric effects of attribute performance on customer satisfaction in the hotel industry, *Tourism Management*, Vol. 77, Article ID. 104006, April, 2020.

[17] Q. Xiao, Understanding the asymmetric perceptions of smartphone security from security feature perspective: A comparative study, *Telematics and Informatics*, Vol. 58, Article ID. 101535, May, 2021.

[18] N. Kano, N. Seraku, F. Takahashi, S. Tsuji, Attractive quality and must-be quality, *Journal of the Japanese Society for Quality Control*, Vol. 14, No. 2, pp. 147-156, April, 1984.

[19] J. S. Lee, M. Choi, Examining the asymmetric effect of multi-shopping tourism attributes on overall shopping destination satisfaction, *Journal of Travel Research*, Vol. 59, No. 2, pp. 295-314, February, 2020.

[20] C. F. Chiang, W. Y. Chen, C. Y. Hsu, Classifying technological innovation attributes for hotels: an application of the Kano model, *Journal of Travel & Tourism Marketing*, Vol. 36, No. 7, pp. 796-807, February, 2019.

[21] M. Go, I. Kim, In-flight NCCI management by combining the Kano model with the service blueprint: A comparison of frequent and infrequent flyers, *Tourism Management*, Vol. 69, pp. 471-486, December, 2018.

[22] E. Ilbahar, S. Cebi, Classification of design parameters for E-commerce websites: A novel fuzzy Kano approach, *Telematics and Informatics*, Vol. 34, No. 8, pp. 1814-1825, December, 2017.

[23] S. Li, Q. Xiao, Classification and Improvement Strategy for Design Features of Mobile Tourist Guide Application: A Kano-IPA Approach, *Mobile Information Systems*, Vol. 2020, Article ID. 8816130, May, 2020.

[24] W. Shen, Y. Hu, J. R. Ulmer, Competing for attention: an empirical study of online reviewers' strategic behavior, *MIS Quarterly*, Vol. 39, No. 3, pp. 683-696, September, 2015.

[25] G. Askalidis, S. J. Kim, E. C. Malthouse, Understanding and overcoming biases in online review systems, *Decision Support Systems*, Vol. 97, pp. 23-30, May, 2017.

[26] J. Redish, Are we really entering a post-usability era?, *ACM SIGDOC Asterisk Journal of Computer Documentation*, Vol. 19, No.1, pp. 18-24, March, 1995.

[27] D. Belanche, L. V. Casaló, M. Guinalíu, Website usability, consumer satisfaction and the intention to use a website: The moderating effect of perceived risk, *Journal of Retailing and Consumer Services*, Vol. 19, No. 1, pp. 124-132, January, 2012.

[28] Y. Lee, K. A. Kozar, Understanding of website usability: specifying and measuring constructs and their relationships, *Decision Support Systems*, Vol. 52, No. 2, pp. 450-463, January, 2012.

[29] T. Au Yeung, R. Law, Extending the modified heuristic usability evaluation technique to chain and independent hotel websites, *International Journal of Hospitality Management*, Vol. 23, No. 3, pp. 307-313, September, 2004.

[30] M. Essawy, Testing the usability of hotel websites: the springboard for customer relationship building, *Information Technology & Tourism*, Vol. 8, No. 1, pp. 47-70, March, 2005.

[31] T. Au Yeung, R. Law, Evaluation of usability: A study of hotel web sites in Hong Kong, *Journal of Hospitality &*

Tourism Research, Vol. 30, No. 4, pp. 452-473, November, 2006.

[32] L. Li, M. Peng, N. Jiang, R. Law, An empirical study on the influence of economy hotel website quality on online booking intentions, *International Journal of Hospitality Management*, Vol. 63, pp. 1-10, May, 2017.

[33] A. Akincilar, M. Dagdeviren, A hybrid multi-criteria decision making model to evaluate hotel websites, *International Journal of Hospitality Management*, Vol. 36, pp. 263-271, January, 2014.

[34] Z. Huang, M. Benyoucef, Usability and credibility of e-government websites, *Government Information Quarterly*, Vol. 31, No. 4, pp. 584-595, October, 2014.

[35] U. Bauernfeind, N. Mitsche, The application of the data envelopment analysis for tourism website evaluation, *Information Technology & Tourism*, Vol. 10, No. 3, pp. 245-257, 2008.

[36] Y. C. Lee, S. Y. Huang, A new fuzzy concept approach for Kano's model, *Expert Systems with Applications*, Vol. 36, No. 3, pp. 4479-4484, April, 2009.

[37] Q. Xu, R. J. Jiao, X. Yang, M. Helander, H. M. Khalid, A. Opperud, An analytical Kano model for customer need analysis, *Design Studies*, Vol. 30, No. 1, pp. 87-110, January, 2009.

[38] S. P. Lin, C. L. Yang, Y. H. Chan, C. Sheu, Refining Kano's 'quality attributes–satisfaction' model: A moderated regression approach, *International Journal of Production Economics*, Vol. 126, No. 2, pp. 255-263, August, 2010.

[39] L. F. Chen, A novel approach to regression analysis for the classification of quality attributes in the Kano model: an empirical test in the food and beverage industry, *Omega*, Vol. 40, No. 5, pp. 651-659, October, 2012.

[40] J. Qi, Z. Zhang, S. Jeon, Y. Zhou, Mining customer requirements from online reviews: A product improvement perspective, *Information & Management*, Vol. 53, No. 8, pp. 951-963, December, 2016.

[41] A. Taimouri, K. Emamisaleh, D. Mohammadi, Assessing the usability of online food ordering websites using a new fuzzy kano method: Implications for improvement, *International Journal of Business and Management*, Vol. 14, No. 10, pp. 87-100, October, 2019.

[42] C. Berger, R. Blauth, D. Boger, Kano's methods for understanding customer-defined quality, *Center for Quality of Management Journal*, Vol. 2, No. 4, pp. 3-36, Fall, 1993.

[43] M. C. Lee, J. F. Newcomb, Applying the Kano methodology to meet customer requirements: NASA's microgravity science program, *Quality Management Journal*, Vol. 4, No. 3, pp. 95-106, 1997.

[44] M. Yao, M. Chuang, C. Hsu, The Kano model analysis of features for mobile security applications. *Computers & Security*, Vol. 78, pp. 336-346, September, 2018.

[45] Trustdata, *Analysis report on the development of China's online hotel reservation industry in 2019-2020*, Retrieved on January 10, 2021 from http://www.itrustdata.cn/#publish.

[46] iiMedia.cn, *2019 China's hotel industry development monitoring and business investment decision analysis report*, Report No. 22, February, 2019. Retrieved on January 10, 2020 from https://www.iimedia.cn/c400/63683.html.

[47] Trustdata, *Report of China's online hotel reservation industry in the first half of 2019*, Retrieved on January 10, 2020 from http://itrustdata.com/#service.

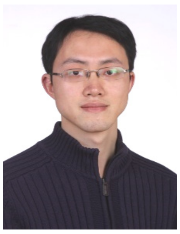
[48] Q. Xiao, A matter-element method for risk identification of technology innovation, *International Journal of System Assurance Engineering and Management*, Vol. 9, No. 3, pp. 716-728, June, 2018.

[49] J. Pang, R. Wang, Q. Xiao, F. Qin, A data-driven condition monitoring of product quality analysis system based on RS and AHP, *Technical Gazette*, Vol. 27, No. 2, pp. 382-390, February, 2020.

Biographies

Quan Xiao is an Associate Professor in the School of Information Management, Jiangxi University of Finance and Economics. He received his Ph.D. in information systems from Huazhong University of Science and Technology. His research interests include design of information systems, online review systems and online travel platforms.

Shun Li is a graduate student at Jiangxi University of Finance and Economics. He got his bachelor's degree from Zhengzhou University. His research interest is online tourism.

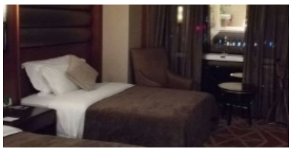


Xing Zhang is a professor at School of Management in Wuhan Textile University. His research interests focus on consumer behavior, social media and system design. His research has appeared in Information & Management, Telematics and Informatics, Computers in Human Behavior, and others.

Minjuan Zhong is an Associate Professor in the School of Information Technology and Management, Hunan University of Finance and Economics. She received her Ph.D. in information systems from Jiangxi University of Finance and Economics. Her research interests include online reviews, text mining and others.

Appendix

Table A.1 Main design features of OHRS

Design feature name (abbr)	Classification	Value thereof	Examples
Volume of reviews(VOR)	content	Reflects the popularity of the hotel	REVIEWS (3702)
User-provided photos (UPP)	content	Improves the quality of opinions and reduces consumer uncertainty	
Review summarization (RS)	content	Reflects the main content of reviews	grand brasserie peacock alley
Overall numerical rating (ONR)	content	Reflects the overall quality of the hotel	4.6/5
Multidimensional rating (MR)	content	Reflects the quality level of multiple dimensions such as hotel service, location, and cleanliness	Facilities 6.9 Cleanliness 8.0 Comfort 7.0
Distribution of review valence (DORV)	content	Reflects the number of the hotel's good, average, and bad reviews	Excellent 1,054 Terrible 163
Votes for helpfulness (VFH)	content	Reflects the quality level of reviews	Helpful | 3
Reviewer expert level (REL)	content	Reflects the ability of reviewers to write reviews and improves the quality of opinions	LV3
Ordering review by type (ORBT)	sorting	Improves speed of decision making	Sort reviews by: Recommended Recommended Date (newer to older) Date (older to newer) Score (higher to lower) Score (lower to higher)
Filtering by review valence (FBRV)	filtering	Improves speed of decision making	Excellent Good Average Poor Terrible
Filtering by photo (FBP)	filtering	Improves speed of decision making	Reviews with photos
Filtering by review summarization (FBRS)	filtering	Improves speed of decision making	grand brasserie peacock alley
Filtering by expert badge (FBEB)	filtering	Reflects the quality level of reviews and improves speed of decision making	Only see expert reviews
Filtering by room type (FBRT)	filtering	Improves speed of decision making	All room types Deluxe Room Premier Room Executive King ...
Filtering by travel type (FBTT)	filtering	Improves speed of decision making	Traveler type Families Couples Solo Business Friends
Review content searching (RCS)	filtering	Improves speed of decision making	Search reviews