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Abstract: Mobile fitness platforms are effective in promoting healthy behaviors but these platforms generally suffer from low retention rates. It is necessary to study how to retain users of mobile fitness platforms. Based on customer value theory and Socio-technical approach, this study proposed a theoretical model to study the factors that affect users' continuance intention to use mobile fitness platforms from a holistic perspective. A total of 320 valid questionnaires were collected to verify the model. The results indicate that utilitarian value and hedonic value are positively related to continuance intention. Social ties are negatively related to continuance intention. Meanwhile, it is found that technological characteristics have significant positive influences on utilitarian value, hedonic value and social ties. Network effects have significant positive influences on hedonic value and social ties. These findings extend our understanding of users' continued usage of mobile fitness platforms and provide practical implications for mobile fitness service providers.

Keywords: mobile fitness, continuance intention, customer value, technological characteristics, network effects

1. INTRODUCTION

With the development of mobile internet, mobile fitness platforms are playing important roles in encouraging regular exercise. In recent years, many mobile fitness platforms have emerged, such as Keep, Joyrun and so on. However, lots of mobile fitness platforms suffer from low retention rates [1]. For example, 26% of fitness apps are used only once by each user and that 74% of these apps are abandoned after their tenth use [1]. Therefore, it is necessary to study how to promote the continued use of mobile fitness users.

Although traditional information systems were mostly oriented by utilitarianism, it appears that today's systems not only provide instrumental services to users, but also create affective and social experiences for users [2]. More specifically, in the field of mobile fitness, quantified-self, gamification and social networking are the three popular system design classes [2]. Utilitarian, hedonic and social components should all be noted when evaluating the value of mobile fitness platforms. Therefore, this study integrated utilitarian value, hedonic value and social ties to explain the continued use of the mobile fitness platforms.

Since the customer value focus on constructs in terms of subjective feelings from user perspective [3], this study aims to further provide insights about which specific system characteristics lead to users' behavioral decisions. Previous studies in the context of online health communities emphasized the impact of technical and social factors [4]. Similarly, mobile fitness platforms not only provide users with a series of technological functions, but also exist network externalities due to its social network service [5], [6]. Hence, it is necessary to consider both technological and network effect factors. The socio - technical approach is a method to analyze technology use from technical and social factors [4]. Thus, this study adopted the socio - technical approach to identify the technological characteristics and network effects.

Specifically, this study explored the impacts of utilitarian value, hedonic value and social ties on users' continuance intention of mobile fitness platforms and the impacts of technological characteristics and network effects on utilitarian value, hedonic value and social ties.

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2.   THEORETICAL BACKGROUND

2.1 Mobile fitness use

Present studies on the use behavior of mobile fitness platforms have been mostly based on TAM, UTAUT and Motivation Theory [1] - [3]. Many factors that directly impact users' behavior have been found such as perceived ease of use, perceived usefulness and so on [1] - [3]. These factors can fully predict the continued use of mobile fitness platforms, but they cannot give specific recommendations to mobile fitness service providers. Although several studies have addressed the technological characteristics or network effects of mobile fitness platforms, these variables often appear as a single ambiguous variable. That is to say, there is still a lack of concern that the impact of system characteristics of the mobile fitness platforms on user's continuance.

2.2 Customer value theory

Customer value reflects the user's overall assessment of the utility of the product or service [7]. Users' behavioral intentions for products and services may be driven by multiple dimensional values [7]. Utilitarian, hedonic and social components should also be highlighted in the realm of mobile fitness [8]. Utilitarian value reflects the task-oriented, cognitive, and non-emotional outcome of using the mobile fitness platform [9]. Hedonic value refers to the fun or pleasure derived from using the mobile fitness platform [9]. Social ties refers to the strength of the relationships between users of mobile fitness platform [10].

2.3 Technological characteristics and network effects of mobile fitness platforms

The socio - technical approach is a method to analyze technology use from technological and social factors [4]. The technological factors refer to the attributes related to technologies and the social factors focus on the relationship between users. Some scholars described the mobile fitness platform as a social - technical system, where users interact not just with technology but also other users [11]. In this research, we considered the effects of technological dimension and network effect dimension on users' behavior, which were both considered to be able to cover the major characteristics of mobile fitness platforms [3], [6].

Studies have identified discrete technological characteristics of mobile fitness platforms such as personalization, recordability, networkability and information quality [12], [13]. Personalization, sociability and informativeness are important characteristics of mobile fitness platforms. Personalization refers to the extent to which the mobile fitness platform can understand and meet users' needs and preferences [12]. Sociability refers to the extent to which the mobile fitness platform facilitates social interaction by providing social context support [14]. Informativeness reflects the quality of information provided by the mobile fitness platform [13].

Network effects occur when the benefits of using services depend on the number of other users [15]. It has been found that network effects significantly affect users' attitude and behavior in the context of mobile fitness [6]. Network effects in mobile fitness platform include number of users and number of peers [15]. The number of users refers to users' perception of the overall user size within the mobile fitness platform and the number of peers refers to users' perception of the size of the relevant network within the platform [6], [15].

3.   RESEARCH MODEL AND HYPOTHESE

The present study explored the drivers of users' continuance intention to use mobile fitness platforms by integrating customer value theory and socio-technical approach. The research model established in this paper is shown in Figure 1. The hypotheses are demonstrated as follows.
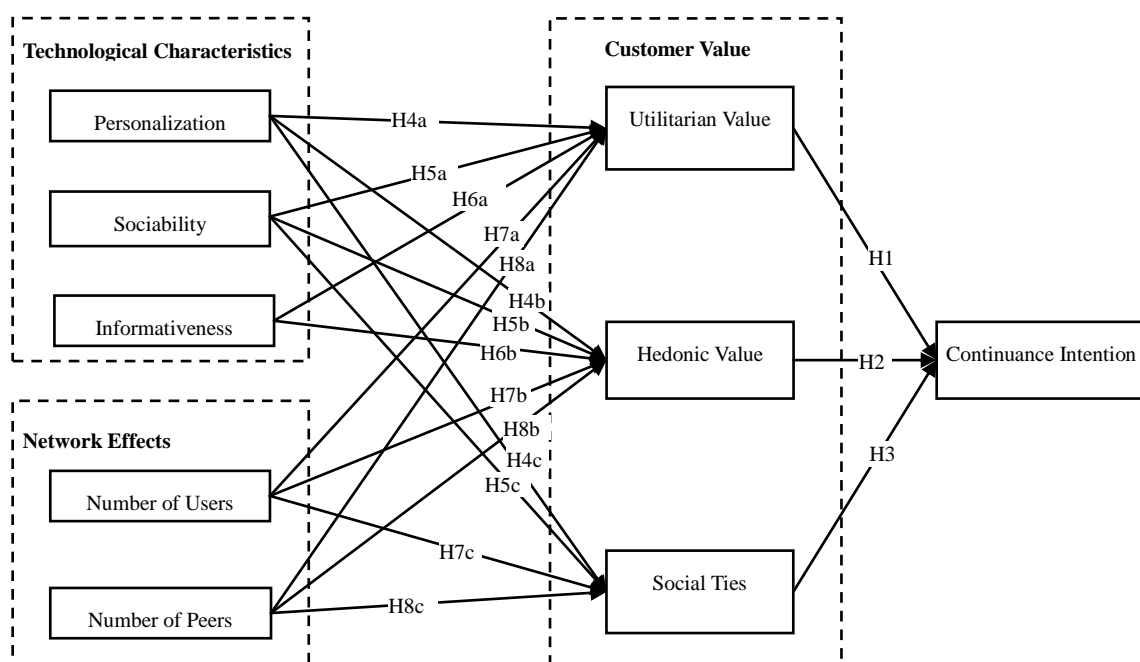
Figure 1.   Research model

3.1 Customer value and continuance intention

The research model of traditional information system is mainly based on the viewpoint of utilitarianism. In the following research on the user behavior of continuous use, the utilitarian variable is also considered to play an important role [3]. In addition to utilitarian functions such as recording data and self-monitoring, the gamification also makes mobile fitness platforms become more attractive. The important predictive role of hedonic value in use behavior has also been studied before [3]. In addition, strong social relationships provide users with opportunities to recommend services to others. In this case, these relationships largely determine the users' willingness to continue using the mobile fitness platform [7]. Thus, the following hypotheses are proposed:

H1: Utilitarian value positively affects continuance intention.

H2: Hedonic value positively affects continuance intention.

H3: Social ties positively affects continuance intention.

3.2 Technological characteristics and customer value

Personalization can provide users with customized content in line with their preferences, which reduces users' search costs and enhances the perceived utilitarian value [12]. Personalization can also promote user participation, making them actively invest time and energy. This focused engagement enhances their sense of control and naturally enhances their perception of hedonic value [17]. In addition, personalization can increase the matching degree between media content and users' preferences. Therefore, a high level of personalization will enhance the user's perception of being valued by the service provider and affect the social ties in the online environment [17]. Thus, the following hypotheses are proposed:

H4a: Personalization positively affects utilitarian value.

H4b: Personalization positively affects hedonic value.

H4c: Personalization positively affects social ties.

The sociability enhances the possibility that users can jointly dig out the required information and related services, which enables users to better realize their utilitarian expectation [13]. Second, human are naturally happy in the process of social interaction. As the platform more encourages social interaction between users,

their interactions are more likely to create hedonic value [18]. In addition, previous studies have shown that high sociability in the virtual world can prompt users to construct online identities, which further promotes the development of social relationships among participants [14]. Thus, the following hypotheses are proposed:

H5a: Sociability positively affects utilitarian value.

H5b: Sociability positively affects hedonic value.

H5c: Sociability positively affects social ties.

Informativeness is considered as an important predictor of perceived value [13]. On the one hand, accurate, relevant and timely information can enhance utilitarian value by reducing the useless search and letting users focus on the main activities [13]. On the other hand, informativeness improve users' pleasant experience by enhancing the applicability of the obtained information to users and making them deeply attracted and addicted [11]. Thus, the following hypotheses are proposed:

H6a: Informativeness positively affects utilitarian value.

H6b: Informativeness positively affects hedonic value.

3.3 Network effects and customer value

Previous studies have suggested that mobile fitness platforms integrated with social networks are more likely to increase users' continued participation in exercise [20]. As the user size increases, people are more likely to participate in fitness and thus enhance their perception of utilitarian value [15]. Meanwhile, more users means that they can find more like-minded partners and enables them to obtain more entertainment resources [15]. Moreover, previous studies have suggested that online communities with more members can inspire positive interaction and social ties [21]. Thus, the following hypotheses are proposed:

H7a: Number of users positively affects utilitarian value.

H7b: Number of users positively affects hedonic value.

H7c: Number of users positively affects social ties.

Compared with strangers, the communication between companions will reduce the barrier of information transmission. With more peers, users are able to find more required services and realize utilitarian value of mobile fitness platforms [15]. Secondly, tacit understanding between peers will make people feel happy. More peers means more hedonic value can be aroused [15]. In addition, people tend to share with more familiar people [20]. More peers participate in the mobile fitness platform can make users be more active in maintaining social relationships and form stronger social ties [6]. Thus, the following hypotheses are proposed:

H8a: Number of peers positively affects utilitarian value.

H8b: Number of peers positively affects hedonic value.

H8c: Number of peers positively affects social ties.

4.   RESEARCH METHODOLOGIES

4.1 Questionnaire design and construct measurement

The questionnaire includes nine latent variables. All measures of the variables were based on related studies. There were no less than 3 items for each variable, and all items were measured on a five-point Likert scale ranging from "1 = strongly disagree" to "5 = strongly agree". Three Chinese researchers were asked to translate the English scales into Chinese. Then another researcher compared the similarity of the two scales. In order to further ensure the quality of the questionnaire, the pre-questionnaire was sent to 20 actual mobile fitness users. After repeated modification and testing, the formal questionnaire was finally generated.

4.2 Data collection and descriptive analysis

The survey was conducted from August 2019 to September 2019 through online and offline channels synchronously. The online survey were conducted through the company SoJump, which is a famous online survey platform in China. And the printing questionnaires were distributed in different universities in Wuhan and Nanchang. Participants were asked if they had used a mobile fitness app before filling out the questionnaire. Only those who answered yes were asked to complete the questionnaire. A total of 373 responses were obtained. After eliminating the invalid questionnaires, we received 320 valid questionnaires finally.

We then used SPSS Statistics 22 to conduct descriptive Statistics. The demographic profiles of the respondents indicated that the ratio of female and male was 41.3% and 58.8%. In terms of age, young people over the age of 18 account for a large proportion of the subject. When it comes to education, the majority of respondents have a bachelor's degree. Through analyzing the usage frequency, it is found that the usage frequency of respondents are distributed at various levels. On the whole, the distribution of gender, age, education and frequency of use of the samples are consistent with the actual mobile fitness users.

5. DATA ANALYSIS AND RESULTS

We used Smart PLS 3.2.7 to test the measurement model and the structural model.

5.1 Measurement model test

To test the measurement model, we analysed the reliability, convergent validity and discriminant validity.

Cronbach's α and the composite reliability index (CR) were used to assess the reliability of constructs. As shown in Table 1, the Cronbach's α values of most variables are greater than 0.8 except that the utilitarian value is 0.772. The CRs are equal to, or greater than 0.868. The Cronbach's α values and CRs are both higher than the suggested cut-off value of 0.7, indicating a relatively consistent of the content of the model.

Average extraction variance (AVE) was adopted to test the convergent validity of constructs and the AVEs of all latent variables are required to be greater than 0.5. It can be seen from Table 1 that AVEs range from 0.666 to 0.882, which indicates that the constructed latent variables can explain most of the variance of measurement items and had good convergent validity.

As shown in Table 2, the square root of AVE value of each latent variable is larger than the correlation coefficient of this variable with any other latent variable, indicating that this variable can better explain the variance of its measure term than other variables, thus having better discriminant validity.

The variance inflation factor (VIF) values range from 1.329 to 2.093 and all of them are less than the cutoff value of 10. Therefore, multicollinearity was not a point for concern.

Table 1.   Convergent validity and internal reliability

Constructs	No. of Items	Items loading	Cronbach's α	CR	AVE
Personalization (PER)	4	0.814-0.869	0.863	0.907	0.709
Sociability (SOC)	4	0.826-0.893	0.887	0.922	0.747
Informativeness (INF)	4	0.756-0.847	0.832	0.888	0.666
Number of Users (NU)	3	0.838-0.856	0.809	0.884	0.718
Number of Peers (NP)	3	0.909-0.921	0.902	0.938	0.835
Utilitarian Value (UV)	3	0.808-0.860	0.772	0.868	0.687
Hedonic Value (HV)	4	0.837-0.867	0.879	0.917	0.734
Social Ties (ST)	4	0.790-0.882	0.856	0.903	0.700
Continuance Intention（CI）	3	0.932-0.950	0.933	0.957	0.882

Table 2.　Discriminant validity

	PER	SOC	INF	NU	NP	UV	HV	ST	CI
PER	**0.842**								
SOC	0.468	**0.864**							
INF	0.522	0.285	**0.816**						
NU	0.275	0.224	0.277	**0.847**					
NP	0.267	0.287	0.255	0.640	**0.914**				
UV	0.585	0.375	0.522	0.266	0.300	**0.829**			
HV	0.592	0.579	0.460	0.404	0.375	0.646	**0.857**		
ST	0.430	0.682	0.256	0.228	0.370	0.337	0.522	**0.837**	
CI	0.400	0.238	0.381	0.371	0.291	0.599	0.536	0.201	**0.939**

5.2　Structural model test

As we can see from Figure 2, the variance of continuance intention is explained by 40.5%. Utilitarian value, hedonic value and social ties are explained by 42.6%, 53.0% and 51.2%, respectively.

In addition, utilitarian value (β = 0.433, t= 7.006) and hedonic value (β = 0.312, t = 4.094) are positively associated with continuance intention. Social ties is negatively associated with continuance intention (β = -0.108, t = 2.135). In terms of technological characteristics, personalization is positively associated with utilitarian value, hedonic value and social ties (β = 0.369, t = 7.027; β = 0.291, t = 4.669; β = 0.126, t = 2.329, respectively); Sociability positively predicts hedonic value and social ties (β = 0.348, t = 8.204; β = 0.580, t = 14.842); Informativeness positively predicts utilitarian value and hedonic value(β = 0.276, t = 5.452; β = 0.148, t = 2.760). In terms of network effects, Number of users positively predicts hedonic value (β = 0.174, t = 2.830), while number of peers positively predicts social ties (β = 0.220, t = 3.410).Therefore, H1, H2, H4a, H4b, H4c, H5b, H5c, H6a, H6b, H7b, H8c are supported, while H3, H5a, H7a, H7c, H8a, H8b are not supported.
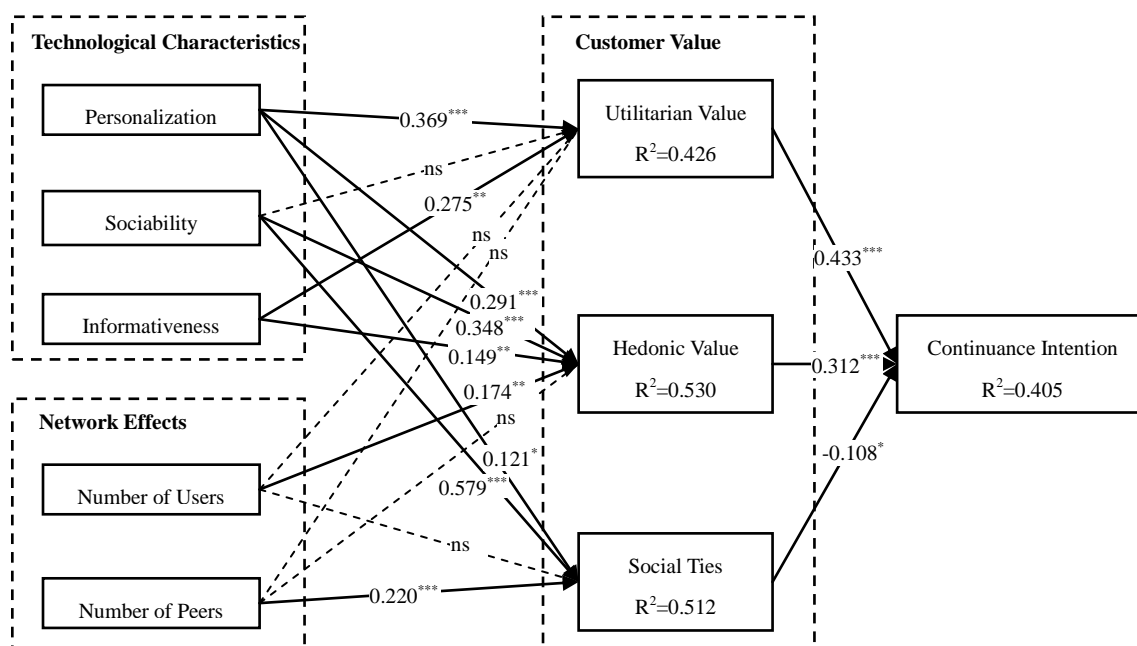
Note：*, p<0.05; **, p<0.01; ***, p<0.001; ns, not significant.

Figure 2.　Model results

6. DISCUSSION

The results show that utilitarian value and hedonic value significantly affect continuance intention to use mobile fitness platform and utilitarian value is found to have more predictive power than hedonic value in terms of standardized beta coefficients. This finding indicates a leading utilitarian approach of users to decide whether to continue using mobile fitness platforms, which is similar to the results of Huang and Ren [3]. Unexpectedly, the study find that social ties negatively affects the continuance intention. The social ties between users in the mobile fitness platform can be generated by social sharing or social competition [11]. The observed negative association in this study may be due to the fact that the mobile fitness platforms we investigated mainly adopted social competition [2]. Social competition may generate negative interactions among users [2]. When a person is struggling in the competition, others' achievements of others may generate negative experience on their own performance, thus reducing the continued use [2].

Results show that technological characteristics positively predict utilitarian value, hedonic value and social ties. Network effects positively predict hedonic value and social ties. Specifically, most of our hypotheses about the influence of technological characteristics on perceived value are supported. Personalization positively predict utilitarian value, hedonic value and social ties. Informativeness positively predicts utilitarian value and hedonic value. Sociability positively predicts hedonic value and social ties. The results support that personalized services, social networking functions and reliable information services are powerful ways to enhance users' value perceptions [13]. However, the relationship between sociability and utilitarian value is found to be insignificant. One possible explanation is that most Chinese users hope to achieve the utilitarian goal through the mobile fitness platform [3]. Therefore, the social networking functions of the mobile fitness platform doesn't seem to make much sense for them. In terms of network effects, number of users significantly affects hedonic value. This means that more users lead to more entertainment resources, which in turn increases the users' perception of hedonic value. Meanwhile, number of peers significantly affects social ties. The more peers participating in the mobile fitness platform, the stronger the users' perception of the social attributes, which urges them to form stronger social ties [6]. Contrary to our expectations, network effects are found to have no significant influence on utilitarian value. That's probably because that the interaction between users in mobile fitness platforms only at a shallow level. This shallow level of interaction makes it difficult for users to extract useful information and obtain the utilitarian value.

7. CONCLUSIONS

The present study explored the factors that impacts on users' continuance intention to use mobile fitness platforms based on customer value theory and socio - technical approach. Given that previous studies mainly focused solely on the perception-based factors that directly influence sustained usage, this study provides an integrated model to understand the continuous use of mobile fitness platforms. Secondly, this study carried out a specific study on the technological characteristics and network effects of the mobile fitness platforms. In addition, this study systematically investigated how technological characteristics and network effects impact the continued use of mobile fitness users, thus filling in a gap in this field.

From a practical standpoint, the findings give useful advice for mobile fitness service providers. First, platform developers should upgrade the personalized technology constantly and provide services accurately. For example, they could provide personalized services such as exercise plans based on users' preferences and needs, which could further support users' functional and hedonic needs. Moreover, information quality should be strictly controlled. Third, they can affect perceived network size by adopting some strategies such as showing other users' comments in the platform or inviting celebrities to join the platform.

Due to the limitation of human and material resources, this study has still several limitations, and we hope

that it can be further improved in the following studies. First, the sample objects of this study did not cover all ages. Future research can expand the size and richness of the respondents and take different ages into consideration. Second, it was difficult to take all platform types into consideration. In the future study, we would further consider the influence of different types of mobile fitness platforms on users' continued usage.

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