

Predicting Online Shopping Intention: the Theory of Planned Behavior and Live E-Commerce

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Abstract. With the development of new media technology, some new changes have been brought to traditional shopping. In this environment, live streaming e-commerce has been loved by online consumers. We adopted the theory of planned behavior (TPB), perceived interactivity and perceived utilitarian value as the theoretical basis for research. In the part of data collection, we surveyed 600 Chinese online consumers, the results showed that attitude, subjective norms, perceived behavior control, perceived interactivity and perceived utilitarian value significantly affected consumer behavior intention. The article also discussed the practice and theoretical contributions for live streaming e-commerce.

1 Introduction

As live streaming increased in popularity, a new way of shopping gradually emerged called live streaming e-commerce. Amazon Live, Facebook Live, TikTok, and Taobao Live are prominent examples of live streaming e-commerce where customers can simultaneously shop and be entertained. At the time of this publication, there are two e-commerce streaming types: 1) shopping sites, such as Amazon, live style code, while Taobao.com and JD.com add a live streaming function to e-commerce; and 2) Live.me and Livby add e-commerce to live streaming [8].

In China, almost all e-commerce platforms possess live channels, such as Taobao.com, Douyin, JD.com, etc. On October 20, 2021, Taobao's anchor Jiaqi Li, saw a sales volume of single live streaming that reached 10.653 billion CNY, while Taobao's anchor Weiya, had a sales volume of single live streaming that reached 8.252 billion CNY. In 2021, "double eleven" will be broadcast live in the comprehensive e-commerce GMV of 952.3 billion CNY [11]. This data shows that live streaming e-commerce has occupied a large part of the market share in the retail industry and has become an important sales method.

Given the rapid development of science and technology, live streaming has become an increasingly popular form of media, accompanied by a large number of studies on this topic. Some of the research is about the technology of live streaming system [15, 27, 41]; there is also research on specific platforms, such as YouTube Live [20, 36], Twitch [7, 36], and Periscope [15, 39]. With the development of live broadcasting, the media form of live broadcasting has been added to online shopping, forming a new form of e-commerce, namely, live e-commerce. Live e-commerce is a new way of

shopping that combines live broadcasting with e-commerce, defined as a subset of e-commerce with real-time social interactivity and media [7].

Buying goods through live broadcasting has greatly changed the way people shop, which is reflected in the annual "Double Eleven Shopping Carnival" and the emergence of key opinion leaders, such as Li Jiaqi. The author wants to understand why live shopping can gradually occupy the market share, which is why consumers like to participate in live streaming e-commerce shopping. This paper will use TPB to study people's behavioral intentions to participate in live streaming e-commerce shopping, and also extends the traditional TPB model by considering two factors: Perceived interactivity; and Perceived utilitarian value. The created measurement scale was used to evaluate the influence of Perceived interactivity and Perceived utilitarian value on TPB variables, as well as the influence of attitude, perceived behavioral control, and subjective norms on behavioral intentions, so as to predict which factors affect people's behavior to participate in live streaming e-commerce shopping.

2 Literature review

2.1. The theory of planned behavior

Azjen [2] developed the theory of planned behavior (TPB) to predict people's willingness to act. Based on TPB, attitude, subjective norm, and Perceived behavioral control (PBC) are the key antecedents of three behavioral intentions. Ajzen and Fishbein [3] prove that behavioral intention can represent actual behavior well, and the behavioral intention is determined by the individual's attitude towards the behavior, subjective

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norms and PBC (Figure 1). Azjen's [1] research shows that an individual's attitude towards the behavior is based on the individual's overall evaluation of the behavior. Individuals with a more positive attitude toward a behavior are more likely to perform that behavior. Subjective norms are individuals' perceptions of their expectations of important reference groups around them, and their expectations of these reference groups. PBC refers to perceived behavioral control; actual behavioral control is very important. PBC is the perceived ease or difficulty of an individual in performing a behavior of interest.

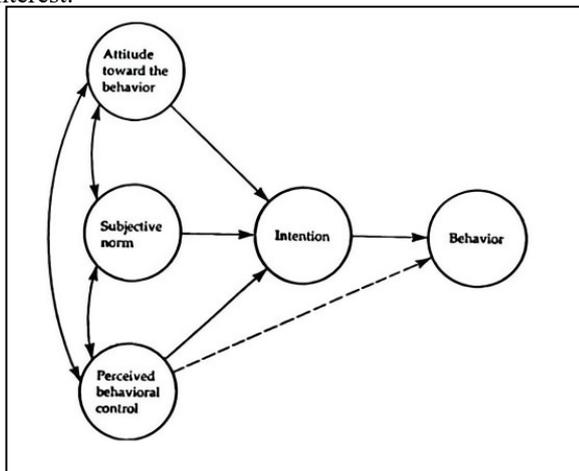


Fig. 1. Theory of planned behavior [1, 2]

The use of TPB is well supported in a wide range of areas. For example, it is widely used to predict behavior, such as health [12], the environment [18] and environmental behavioral intentions [23] TPB has been widely used to predict consumer behavior and is well supported in predicting behavior. Several studies of Internet buying behavior are also based on TPB [5, 16, 25, 27, 32]. George [17] used the TPB to study how much consumers trust Internet credibility and found that consumers were more likely to shop online than those who did not have this belief. Battacherjee [5] found TPB to be useful in explaining that acceptance of e-commerce services, with live e-commerce also having had the characteristics of e-commerce; hence, the author believes that TPB is also effective in the field of live e-commerce. However, in the environment of live e-commerce, compared with traditional e-commerce, live e-commerce has more media and real-time interaction, and in this case, consumers' shopping motivation may change. Therefore, it is necessary to use TPB to study consumer behavioral intentions in the live streaming e-commerce.

Therefore, we propose the following hypothesis:

H1: Consumers' attitudes towards live e-commerce are positively correlated with their behavioral intentions to participate in live e-commerce shopping.

H2: Subjective norms are positively correlated with the behavioral intention of participating in live e-commerce shopping.

H3: Perceived behavioral control is positively correlated with the behavioral intention of participating in live e-commerce shopping.

2.2 Extended TPB model: including antecedent variables

In addition to the three core constructs of attitude, subjective norm, and perceived behavioral control, the TPB also considers antecedents that affect the core factors [18]. These factors, as antecedent variables of the TPB model, affect the core factors, thus affecting the behavioral intention. Some previous studies have combined external variables with TPB to expand the TPB model and found that it can effectively predict consumer behavior. For example, Chen and Tung [9] established an extended TPB research model that combines ethics and the consequences of recycling to explain consumers' recycling intentions and found that this extended TPB research model can explain consumers' recycling intentions well. Hoeksma et al. [24] used the TPB model extended by personal norms to predict consumers' willingness to buy MSU meat, proving that the extended model can predict consumers' purchasing behavior more comprehensively than the TPB model alone. In Yadav and Pathak's study [43], environmental concern and environmental knowledge were added to the traditional TPB model as antecedents of green purchase intention to study consumers' green purchase intention, and the results showed that the explanation of purchase intention was better than that of the TPB model when environmental concern and environmental knowledge were added to TPB. This also shows that the extended the TPB model is effective in predicting consumer behavior intention. Extending the TPB model has a relatively high ability to explain the intention of purchasing behavior, the author boldly introduces two antecedent variables to expand the TPB theoretical model.

In the selection of antecedent variables, the author refers to some previous literature studies and finds that perceived utilitarian value is often used to predict behavioral intentions in some past studies related to live e-commerce [7, 35], therefore, the author adds the perceived utilitarian value antecedent variables to the TPB model to predict consumers' behavioral intentions.

Compared with traditional e-commerce, live e-commerce has more real-time social interaction [7], which is an important feature of live e-commerce. Cai and Wohn [8] found that enjoying interaction and leading the trend are important motivations for consumers to participate in live streaming e-commerce. Therefore, the author adds perceived interactivity to the TPB model as another antecedent variable.

2.3 Perceived interactivity

Leo's [30] research shows that the perceived interactivity directly and indirectly affects the user's attitude towards the website, and the live streaming e-commerce also has the characteristics of network interaction. We therefore believe that perceived interactivity affects consumers' attitudes towards live e-commerce. Lin's [31] research shows that the more interactivity consumers perceive, the higher their purchase intention, and the higher their positive attitude towards the website. From the previous

literature, it was found that perceived interactivity was closely related to consumers' attitudes and behavioral intentions. Furthermore, live e-commerce has more real-time social interactivity. Therefore, in this paper, perceived interactivity is put into the TPB model as an antecedent variable to explore whether perceived interactivity in the TPB model also has a positive impact on attitudes and behavioral intentions.

Therefore, we propose the following hypothesis:

H4: Perceived interactivity is positively correlated with consumer attitudes.

H5: Perceived interactivity is positively related to consumer behavioral intention.

In TPB, perceived behavioral control and behavioral intention jointly control the generation of behavior [2]. Perceived behavioral control refers to people's perception of ease or difficulty in performing the behavior of interest. Compared with information systems-related work, the effectiveness and efficiency are similar to the perceived usefulness and perceived ease of use in the technology acceptance model (TAM) [13], and other studies have noted the strong similarities between the two groups of structures [6]. In Teo's [40] research, interactivity is related to effectiveness and efficiency. In other words, if the website can be considered more interactive, it can be regarded as more effective and more efficient. Combined with Benbasat and Barki's previous research, we believe that interactivity has similarities with perceived usefulness and perceived ease of use, and the stronger the perceived usefulness and perceived ease of use of the website. The Hansen et al. [21] study shows that, in the context of social media transactions, "Perceived ease of use" moderates the effect of "perceived behavioral control." The empirical results support the hypothesis that perceived ease of use (from TAM) significantly amplifies the effect of perceived behavioral control (from TPB) about the intention to use social networks for transactions. Therefore, we believe that in the network trading environment, perceived behavior control will be affected by consumers' perceived other factors. Combined with previous studies in the literature, we know that perceived interaction has a positive correlation with perceived ease of use, which has also been shown to positively influence PBC in past studies. In this paper, we add perceptual interaction to the TPB, and combined with these studies above, we propose the idea of whether perceived interaction has a relationship to the PBC in the TPB model, and whether this relationship is positive.

Therefore, we propose the following hypothesis:

H6: Perceived interaction affects the perceived behavioral control, and it is positively correlated.

2.4 Perceived utilitarian value

Studies have shown that consumer attitudes can significantly predict purchase intentions [37]. In the past, most of the research on consumer behavior intention focused on the influence of hedonic value and utilitarian value on consumer behavior intention [7, 8, 22]. Utilitarianism means work capability, instrumentality

and practicability. Utilitarian outcomes are the result of the "conscious pursuit of desired outcomes" [4], and utilitarian motivations include convenience and cost reduction (i.e., money, time, and effort) [29]. The convenience and cost reduction that individuals perceive in the process of participating in live shopping is perceived utilitarianism.

Perceived value during shopping positively influences consumers' attitudes and behavioral intentions [34]. Khare's [29] research also showed that perceived value is positively related to consumers' attitudes, including the utilitarian value perceived by consumers, as demonstrated by many studies [20, 36]. Utilitarian values play a strong predictive role in predicting consumers' attitudes and future intentions toward online retailers, and it can be seen that online consumers' shopping preferences are mainly due to utilitarian reasons [37], such as price savings and greater convenience. Cai et al. [7] found that consumers prefer to participate in live e-commerce rather than traditional online shopping, and there are many motivations related to convenience, discounts, and products, such as more time-saving, more favorable prices, and access to the latest product-related information and demonstrations. These are the utilitarian motives of live shopping. It can be said that the utilitarian value perceived by consumers from live shopping greatly affects their purchase intention (behavioral intention). However, in these past studies, there is no literature adding perceived utilitarian value into the TPB to study its influence on attitude and behavioral intention. The authors want to understand whether perceived utilitarian value also positively affects attitude and behavioral intention in the TPB model.

Therefore, we propose the following hypothesis:

H7: Perceived utilitarian value positively affects consumer attitudes.

H8: Perceived utilitarian value positively affects consumer behavior intention.

In previous content, we have mentioned that perceived ease of use positively affects perceived behavior control [22], while in the definition of perceived utilitarian value, utilitarian interests can be explained as the result of ease of use and satisfaction [7], so we believe that perceived utilitarian value has the characteristics of perceived ease and can also affect perceived behavior control. This paper aims to study how perceived utilitarian value affecting perceived behavior control is positive, as shown in past literature.

Therefore, we propose the following hypothesis:

H9: Perceived utilitarian value was positively correlated with perceived behavioral control.

In TPB, subjective norms interact with attitude and PBC, and subjective norms refer to perceived social pressure to perform or not to perform behavior [2], derived from the reference group that individuals consider important. Consumers perceive the utilitarian value in the process of participating in live-streaming e-commerce, such as more favorable prices and time saving. Whether these characteristics will also affect the subjective norms, that is, the important reference group that consumers think that they will do this, for example,

to participate in live-streaming e-commerce shopping because of a lower price.

The author did not find the relevant literature shows the influence of perceived utilitarian value and subjective norms, but in the perceived utilitarian value as an antecedent variable in TPB, studies how important the perceived utilitarian value is on affecting the TPB variable. Hence, this paper aims to understand whether perceived utilitarian value has an impact on subjective norms, and we put forward the following research questions:

RQ1: Does perceived utilitarian value affect subjective norms? Is it a positive correlation or a negative correlation?

The hypotheses included in the model are listed below (Figure 2):

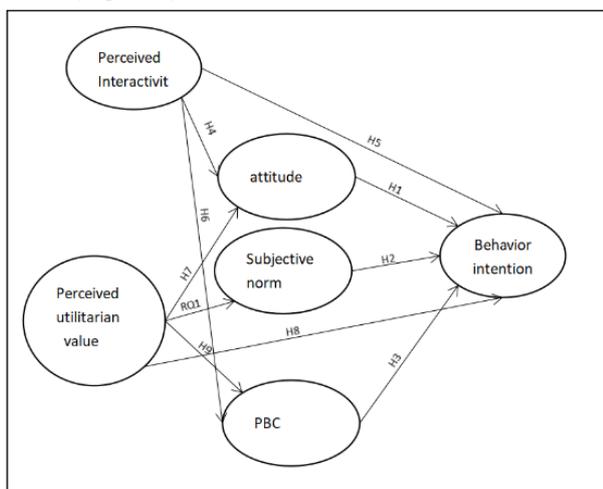


Fig. 2. hypotheses included in the model

3 Methods

3.1 Data collection

From July 15 to July 31, 2022, we conducted a national online survey. Six hundred questionnaires were collected from China. Before conducting the survey, we obtained the informed consent at the beginning of the questionnaire. Only the participants who read and agreed to the informed consent form could continue to answer the questions.

Participants came from 27 provinces in China, with Fujian (14.5%), Jiangsu (14.33%), Liaoning (14%), Anhui (10.67%), and Zhejiang (10.5%) accounting for 64 percent. In total, 245 males (40.83) and 355 females participated in the questionnaire. More than half of them had a bachelor's degree or higher (53%), and 73.66% of people had a monthly income of more than 5000 CNY. Of the participants, 75.33% had the experience of participating in live streaming e-c shopping.

3.2 Measures

The author developed the questionnaire by adjusting the existing reliable and valid questionnaire scales.

3.2.1 Attitude.

Attitudes are measured according to the three dimensions employed by Sadiq et al. [38], and George [17]. Participants measured their attitudes towards participating in live streaming e-c shopping through the following dimensions: (a) I like to participate in live streaming e-c; (b) Participating in live streaming e-c will make me feel happy; and (c) I think live streaming e-c is very useful, not only to save money, but also to let me better understand the products. The Likert 5-point scale was used, from strongly disagree to strongly agree, and these items were averaged to form a composite index for positive coding, in which the higher the score, the better the attitude towards live streaming e-c shopping behavior. ($M=3.630$, $SD=1.000$, Cronbach's $\alpha=0.900$).

3.2.2 Subjective norm.

Subjective norms are measured on a four-point scale that combines the scales of George [17] and Sadiq et al. [38], in which participants rated the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree): (a) My friends or family support me to participate in live shopping e-c shopping; (b) My friends or family members think it is valuable to participate in live shopping e-c shopping; (c) My friends or family are very willing to do live shopping e-c shopping; (d) I can often hear information about live shopping e-c shopping from my family or friends, such as 618 discount activities, double 11 discount activities, etc. The items are averaged to create a composite index, the higher the score, the higher the group referred to by individual recognition of live streaming e-c shopping. ($M=3.590$, $SD=1.010$, Cronbach's $\alpha=0.901$)

3.2.3 Perceived behavioral control.

Perceived behavioral control was adapted from George's [17] scale, measured in four dimensions, in which participants rated the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree): (a) I have time to participate in live shopping e-c shopping; (b) I have the financial ability to participate in live shopping e-c shopping; (c) I can participate in live shopping whenever I want; and (d) Whether I participate in live shopping e-c shopping is entirely up to me. The items are averaged to create a composite index; the score indicates the degree of ease and difficulty that consumers perceive when participating in live shopping. The higher the score, the easier consumers feel when participating in live streaming e-c shopping. ($M=3.61$, $SD=1.01$, Cronbach's $\alpha=0.901$)

3.2.4 Perceived Interactivity.

Perceived interactivity was adapted from Xiang and Chae [42], in which participants rated the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree): "Do you agree that the following

behaviors will make you like to shop by participating in live streaming e-c shopping in live streaming e-c shopping?": (a) Send a bullet screen to interact with others; (b) Other users respond positively to my bullet screen; (c) My bullet screen (or question) can get a quick reply from the host.; (d) the host will be very patient to reply to my bullet screen or give me purchase suggestions. The items are averaged to create a composite index, scores indicate the effect of perceived interaction on attitudes, subjective norms, PBC, and consumer behavioral intentions, with the higher the score, the greater the effect ($M=3.650$, $SD=1.010$, Cronbach's $\alpha=0.896$).

3.2.5 Perceived utilitarian value.

Perceived utilitarian value is measured in three dimensions by combining the scales of Chiu et al. [11], and Cai and Wohn [8], in which participants rated the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree): "Do you agree that the following characteristics will make you like to shop by participating in live streaming e-c shopping in live streaming e-c shopping?": (a) There are often preferential activities in the live broadcast room, which are cheaper than usual (such as 618 activities, or exclusive preferential activities for Internet celebrity anchors, etc.); (b) Live broadcast enables me to see the details of the product more intuitively; (c) In the live broadcast room, I can see what other buyers have bought, so that I can keep up with the trend. The items are averaged to create a composite index, scores indicate the effect of perceived utilitarian value on attitudes, subjective norms, PBC, and consumer behavioral intentions, with the higher the score, the greater the effect ($M=3.680$, $SD=1.020$, Cronbach's $\alpha=0.894$).

3.2.6 Behavioral intention to participate in live streaming e-c shopping.

Behavioral intention is adapted from the scale of George [17], which has three dimensions to measure, in which participants rated the following statements on a scale of 1 (strongly disagree) to 5 (strongly agree): (a)I am willing to spend money and time to participate in live shopping e-c shopping; (b) I want to participate in live shopping e-c shopping later; (c) I have plans to participate in live shopping e-c shopping in the future. The items are averaged to create a composite index. The higher the score, the stronger the consumer's behavioral intention, and the higher the possibility of participating in live shopping in the future ($M=3.570$, $SD=1.060$, Cronbach's $\alpha=0.897$).

4 Results

First of all, we import the survey data into SPSS, and analyze the reliability and scale statistics of each dimension of the variables. After the reliability of the dimensions is determined to be up to the standard, the

data of each dimension is integrated into one variable by calculating the variables in SPSS.

Next, we used AMOS to construct a model graph and import data to run a structural equation model to test the relationship between model fit and study variables on the basis of sufficient sample size, no outliers, and normal distribution of all measurement items, a goodness-of-fit statistic measuring the model indicated a good fit to the data ($CFI=0.99$; $TLI=0.99$; $PCMIN/DF=1.298$ and $RMSEA=0.02$).

Table 1. Reliability and correlations

	CR	ATT	SN	PBC	PI	PUI
ATT	0.900	1				
SN	0.901	0.395	1			
PBC	0.901	0.43	0.440	1		
PI	0.896	0.424	0.408	0.393	1	
PUV	0.894	0.432	0.425	0.431	0.402	1

Note(s): ATT: Attitude; SN: subjective norms; PBC: perceived behavioral control; PI: Perceived Interactivity; PUV: Perceived utilitarian value; CR: composite reliability

Table 2. Results of hypotheses testing

Hypothesis	Path	β	P Label
H1	ATT→BI	0.177	***
H2	SN→BI	0.181	***
H3	PBC→BI	0.195	***
H4	PI→ATT	0.298	***
H5	PI→BI	0.183	***
H6	PI→PBC	0.255	***
H7	PUV→ATT	0.311	***
H8	PUV→BI	0.202	***
H9	PUV→PBC	0.327	***
RQ1	PUV→SN	0.900	***

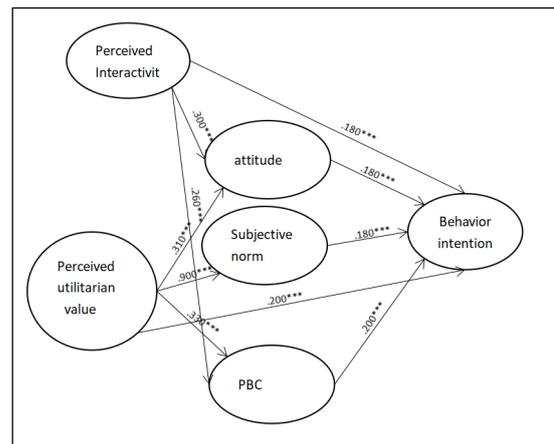


Fig. 3. Evaluated model

The reliability of all items is higher than 0.6, indicating that the measurement validity is acceptable. In the present study, at least in this sample, attitude and behavioral intention showed a significant positive correlation ($\beta=0.177$, $p < 0.05$), which is consistent with our hypothesis, and thus judging that H1 is supported. Subjective norms showed a significant positive correlation with the behavioral intention ($\beta=0.181$, $p < 0.05$), as supported by H2. The PBC showed a

significant positive correlation with the behavioral intention ($\beta=0.195$, $p < 0.05$), and the H3 was supported. As the three original variables in the TPB model, the relationship with the behavioral intention was once again supported in this study. It can be concluded that the TPB model is also very effective in the research of live streaming e-commerce.

According to Table II: new added antecedent variables were also supported in the study, perception interaction was positively correlated with attitude presentation ($\beta=0.298$, $p < 0.05$); the H4's are supported; perceived interaction positively influences the behavioral intention ($\beta=0.183$, $p < 0.05$) that supported the H5, as in past studies; a positive correlation was presented between perceived interactivity and attitude and behavioral willingness. Meanwhile, the difference was that, verifying perceived interactivity equally positively influences attitudes and behavioral intentions in the TPB model; and in the environment of live streaming e-commerce, in other words, the interactivity perceived by consumers in live streaming e-commerce can positively affect consumers' attitude and behavior intentions.

Perceived interactivity positively affects PBC ($\beta=0.255$, $p < 0.05$), supporting H6. In previous studies, we know that perceived ease of use can positively affect PBC, so we believe that PBC will be affected by antecedents in TPB. In this paper, we boldly assume that perceived interactivity can also affect PBC as antecedent variables, and this effect is positive. The results of the data prove that, at least in this sample, this hypothesis is true, and perceived interactivity positively affects PBC.

Perceived utilitarian value positively affects attitude ($\beta=0.311$, $p < 0.05$), which supports H7. Perceived utilitarian value positively affects behavioral intention ($\beta=0.202$, $p < 0.05$), which supports H8. Different from previous studies, it is verified that the perceived utilitarian value in TPB also has a positive impact on attitudes and behavioral intentions, and it can be said that the utilitarian value of live e-commerce is an important motivation of consumer behavioral intentions. Perceived utilitarian value has a positive effect on PBC ($\beta=0.327$, $p < 0.05$), which supports H9.

In the above, a research question is raised, whether perceived utilitarian value affects SN, and whether the effect is positive or negative. In the research data, it is shown that perceived utilitarian value significantly affects SN, and the effect is positive. ($\beta=0.900$, $p < 0.05$). This paper aims to study how the perceived utilitarian value affects each factor in the TPB model.

5 Discussion

The purpose of this paper is to understand what factors affect people's behavioral intention to participate in live streaming e-commerce, and the TPB theory is used as the theoretical basis of the research. The empirical results show that attitude, subjective norms, and perceived behavior control can predict consumers' intention to participate in live streaming e-commerce. Then, we explore the impact of perceived interaction and perceived utilitarian value on consumers' willingness to

participate in live-streaming e-commerce, and we add perceived interaction and perceived utilitarian value into the TPB model as preexisting variables to separately discuss their relationship with attitudes, subjective norms, perceived behavioral control, and behavioral intention. As expected, we found that perceived interactivity and perceived utilitarian value significantly and positively affected consumers' intention, attitude, and subjective norms to participate in live-streaming e-commerce. Perceived behavioral control significantly and positively affects consumers' intention to participate in live e-commerce. Moreover, the two pre-variables we added also affect the three original variables of TPB as assumed. The behavior intention of consumers to participate in live streaming e-commerce depends on the comprehensive role of the five variables: perceived interactivity, perceived utilitarian value, attitude, subjective norms and perceived behavior control.

This study has made several contributions to the current literature. First, this study discusses the influencing factors of consumers' participation in live e-commerce, and further enriches the participation behavior of live e-commerce. Second, this study expanded the TPB theory by adding two variables. Our findings confirm that there is a significant positive correlation between perceived interactivity and perceived utility value on the attitude, perceived behavior control and behavior intention of participating in live streaming e-commerce, and a positive association between perceived utility value and subjective norms. Finally, this study confirms the effectiveness of the expanded TPB model. The expanded TPB theory increases the R side interpretation power by 8% more than the original TPB model and has a good prediction ability (the original TPB model R side is 0.406, and the expanded TPB model R side is 0.486).

The findings suggest that TPB can predict consumer behavioral intentions, consistent with previous findings [5, 16, 25, 27, 32]. The same applies in the live streaming e-commerce environment. Attitudes, subjective norms, and PBC positively influence consumers' behavior intention to participate in live streaming e-commerce.

As we expected, perceived interactivity was positively associated with consumer behavior intention, which shared the findings of Lin [31], the stronger consumers' perceived interactivity, the higher their intention to buy and the higher their positive attitude towards the website. The essence of live streaming e-commerce is a way of sales. Consumers purchase intention is closely related to consumers' experience in the purchase process. The research results show that higher interactions can create a good experience for consumers. Moreover, perceived interaction also positively affects attitudes, similar to the findings of Leo [30]. This means that providing higher interaction to consumers is beneficial to facilitate consumer purchase, which is a sum effect on attitude and intention, affecting intention by influencing attitude, but also directly affecting intention.

In this paper, the impact of perceived interaction on PBC is a highly exploratory topic, and the results are the

same as our expectations, and the perceived interaction, which can positively affect PBC. As mentioned in Teo [40], the stronger and more interactive the website is, the more effective and efficient. In the context of the live streaming e-commerce environment, the stronger the interaction, the stronger the perceived ease of use (efficiency) and perceived usefulness (effectiveness) for consumers. In our results, perceived interaction is positively correlated with PBC, while Hansen et al. [21] showed that perceived ease of use regulates the effect of perceived behavioral control. It can be seen that this study also confirms the relationship between interaction and effectiveness and efficiency in the Teo [40] study. We guess that the interactivity of live streaming e-commerce improves the efficiency of consumers in the shopping process. Through the interactive ability of live streaming, consumers can buy goods faster and more accurately, thus improving consumers' intention of participation. Moreover, generally speaking, the more favorable attitudes and subjective the norms are, the stronger the perceived behavioral control, and the stronger the consumer behavior intentions [1]. However, in this study, it can be seen that perceived interaction significantly positively affects attitudes, and we believe that this is also an important reason for the positive correlation of perceived interaction with PBC. We also share the same view in explaining the relevance of perceived utilitarian value and PBC.

Perceived utilitarian value has been used as variables in past studies of consumer behavior [7, 8, 22], as perceived utilitarian value has a positive effect on the behavioral intention.

Perceptual utilitarian value has been widely used as a variable in past research on consumer behavior [7, 8, 22], and the results also demonstrate that perceived utilitarian value positively affects behavioral intention and perceived utilitarian value and attitude. According to the research results, the perceived utility value still plays a strong role in predicting consumer behavior. From the perspective of content analysis, perceived utilitarian value has a very positive impact on SN. We find that preferential prices and convenience of shopping are important factors affecting SN. The real-time interactivity of live e-commerce is also an important motivation for behavioral intention, such as the positive response to the information released in the live broadcasting room (57% agreed), and the host's reply and answer to consumer information.

From the perspective of content analysis, perceived utilitarian value has a very positive impact on SN. We find that preferential prices and convenience of shopping are important factors affecting SN. The real-time interactivity of live e-commerce is also an important motivation for behavioral intention, such as the positive response to the information released in the live broadcasting room (57% agreed), and the host's reply and answer to consumer information.

6 Impacts and limitations

This study has both theoretical and practical implications.

In terms of theoretical significance, the results of this study once again prove the effectiveness of the theory of planned behavior in explaining consumers' online shopping behavior, and many studies have successfully used TPB as a theoretical framework to explain the intention of online shopping or other e-commerce activities [5, 25, 17]. In this study, TPB is added to perceived interactivity and perceived utilitarian value, which enriches the antecedents of TPB in the field of online purchase behavior research. Increasing studies on the influencing factors of online purchase behavior use the TPB theoretical framework, and we can find out which factors are more important. This would be conducive to more research on online purchasing behavior in the future.

This article may highlight some tips for retailers and enterprises that plan to enter live e-commerce in the future. For example, consumers' perceived utilitarian value is an important motivation for them to participate in shopping, including the latest and most detailed product displays and preferential activities. Businesses can carry out some live, exclusive, preferential activities on specific dates or festivals, such as Singles' Day. At the same time, through the publicity of activities, potential consumers will forward and share with people around them. Research data shows that SN can positively influence consumers' behavioral intentions. More than half of the subjects (58.17%) can often hear preferential news about live shopping from friends or family. That is to say, when consumers are shared or invited by friends about activities, they will be very willing to participate in shopping. In terms of real-time interaction, live e-commerce has advantages over traditional e-commerce. The interaction between consumers is also very important, as most consumers (61.83%) who are willing to participate in live e-commerce send a messages to interact with other consumers, and consumers can get feedback from other users about the goods in the interaction. In addition, businesses can place staff in the audience to mobilize the overall atmosphere of the live broadcasting room. At the same time, the host and consumers cooperate and complete a better interaction.

From a practical point of view, with the rise of live e-commerce, this new consumption mode has gradually occupied the retail market. Our study has implications for these practices: first, our research can better provide suggestions for traditional retailers to change their operation mode, implying that traditional retailers can better understand the shortcomings of their own sales mode, so as to find ways to change or adapt to the market environment. At the same time, for live e-commerce businesses or platforms, our research can better advise them on how to improve their competitiveness, so as to share the market share.

In addition, we find that perceived utilitarian value has a significant positive impact on subjective norms. Simply put, the expectations of live e-commerce conveyed by consumers' important reference groups can effectively influence consumers' purchase intentions. The implication is that businesses can increase consumers' purchasing intentions by increasing the

publicity of some preferential activities, such as 618, Double Eleventh and other live broadcasting activities, and at the same time, they can achieve better results through mutual publicity among consumers.

As with any study, the study conducted in this paper has limitations that should be addressed in future research. First of all, we investigate the intention of live shopping behavior as a whole in our study, rather than the intention of live shopping behavior of individual platforms or certain categories of goods (such as cosmetics or clothing). Different platforms or different categories of goods may have different associations. Second, at present, there are two streaming e-commerce types: The first is that shopping sites such as Amazon live style code, while Taobao.com, and JD.com add the live streaming function to e-commerce; the others add e-commerce to live streaming like Live.me and Livby [7]. This paper studies the overall live e-commerce shopping behavior, yet for these two different types of live e-commerce, there is no distinction within the study; they may have different factors, which would also be an interesting direction for future research.

7 Conclusion

In conclusion, the results show that the extended TPB can effectively predict consumer behavior, and The validity of the extended TPB theory is confirmed. The data show that the extended TPB model has better prediction ability than the original TPB model. The two newly added variables: perceived interactivity and perceived utilitarian value will affect the three original variables of TPB, the behavioral intention of consumers to participate in real-time e-commerce depends on the comprehensive effect of five variables: perceived interaction, perceived utilitarian value, attitude, perceived behavioral control and subjective norms.

This study has theoretical and practical significance. From a theoretical point of view, it is helpful for other scholars to do more research on online purchasing behavior in the future. From a practical point of view, it can provide some effective suggestions for retailers and enterprises who plan to enter or have entered today's real-time e-commerce in the future.

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