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Investigating the Key Drivers of Impulsive Buying Behavior in Live Streaming

Yi Cui, Communication University of China, China
https://orcid.org/0000-0001-6109-0968
Yanping Liu, Guangdong University of Finance and Economics, China*
Meng Gu, Communication University of China, China

ABSTRACT

Live streaming has become popular among various e-commerce models. As an efficient way of marketing, live streaming can stimulate consumers' impulse purchasing behavior by creating a compelling experience, flow experience. Even though research on flow experience has been applied to understand consumer behavior in e-commerce, few studies have been conducted in live streaming e-commerce, let alone the influencing factors. Drawing on the stimulus-organism-response (S-O-R) model, this paper examines the impact of cognitive stimuli and perceptive stimuli on the urge to buy impulsively via flow experience. The results indicate that information content, website design, time pressure, and personalized recommendation positively relate to flow experience and the urge to buy impulsively. They also find the direct effect of time pressure and personalized recommendation on the urge to buy impulsively. The theoretical contributions and the practical implications for e-commerce live streaming are presented.

KEYWORDS

Flow Experience, Impulse Buying, Live Streaming, S-O-R Model

INTRODUCTION

Live streaming continues to progress rapidly. Its content forms have penetrated aspects like entertainment, shopping, education, and social contact. The combination of live streaming and e-commerce became a mainstream trend during the pandemic. The networks' enthusiasm for live shopping comes directly from China, where live streaming is already a mature business for brands. According to Enberg (2021), live streaming sales in China reached US$131 billion in 2021, accounting for 37.4% of total social commerce sales. It is forecasted that, by 2023, 60.9% of social commerce dollars in China will come from live streaming, which will amount to US$281.21 billion. The number of daily active users on the TaoBao live streaming platform doubles each

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*Corresponding Author

year. The same situation also applies to social platforms like Facebook, Instagram, Pinterest, and TikTok. The data indicate that the traditional marketing methods of e-commerce can no longer meet consumers' current shopping needs. E-commerce live streaming has, therefore, become the focus of merchants' marketing strategies.

Impulse buying behavior is an essential topic in consumer behavior research, especially in e-commerce vs. traditional shopping. E-commerce is not limited by space and time; therefore, consumers can browse more product information, receive commodity stimulation, and are prone to impulsive buying behavior (Eroglu et al., 2001). This topic has been studied extensively in the field of traditional e-commerce, whereas less attention has focused on the field of live streaming e-commerce (Gong et al., 2020). Consumers on live streaming platforms tend to dawdle or "kill time," which makes impulse-buying behavior occur more often than in other forms of e-commerce.

Some studies use social relations to discuss the participation willingness of e-commerce live streaming providers (e.g., Hu & Chaudhry, 2020). However, this approach ignores consumers' perception of the attributes of e-commerce live streaming platforms. There is no doubt that social interaction, as the primary feature of live streaming, would encourage impulsive buying behavior (e.g., Hu & Chaudhry, 2020). Still, other factors are equally important. In this regard, most research on live streaming takes a technological or live streamer's aspect to optimize user experience (Hu et al., 2017). Extant literature lacks a comprehensive framework to explain consumers' impulsive buying behavior. To fill this gap, the present research focuses on the following questions:

1. What factors promote consumers' impulsive buying behavior in live streaming, especially in the dimension of user perception?
2. What are the mechanisms of such promotion?

Factors like website design and product discounts stimulate consumers to purchase impulsively (Chan et al., 2017; Overby & Lee, 2006). These factors analyze the reasons for impulsive buying behavior from the perspective of website quality and consumer value. However, consumers' immersive feelings in e-commerce live streaming is crucial to impulsive buying behavior. The immersive feeling, which is related to flow experience, was defined by Csikszentmihalyi (2008) as a particular state of mind. It means that an individual is fully engaged in an activity. Parboteeah et al. (2009) asserted that a consumer's state of mind (cognitive and affective reactions) is aroused by various environmental cues that could influence the urge to buy impulsively. This provides valuable insight into how a consumer's state of mind may mediate the effect between live streaming factors and impulsive buying behavior.

Studies have shown that flow experience can positively influence consumers' brand recognition and purchase intention (Catalan et al., 2019). Regarding website design, flow experience can act as an intermediary to influence consumers' purchase intention and willingness to revisit the website and online impulse buying (Hausman & Siekpe, 2009; Wu et al., 2016). In the context of social commerce, Chung et al. (2017) verified the positive influence of flow experience on impulse buying intention. Therefore, this study uses flow experience as a mediating variable to study the influencing factors of consumers' impulse buying behavior in e-commerce live streaming.

Based on the stimulus-organism-response (S-O-R) model, this study combines the characteristics of e-commerce live streaming platforms and explores the influence mechanism of consumers' impulse buying intention. This study has a solid practical significance for optimizing live streaming content, improving marketing strategy, and establishing the live streaming e-commerce process. At the same time, it can enrich the research field surrounding e-commerce live streaming consumers' purchasing behavior.

LITERATURE REVIEW AND THEORETICAL BACKGROUND

Impulse Buying Behavior

Impulse buying has been regarded as a consumer's sudden, strong desire to buy when consumers are exposed to a stimulus (Rook, 1987). Stern (1962) divided the urge to buy impulsively into four types: (1) pure urge to buy impulsively; (2) advisory urge to buy impulsively; (3) suggestive urge to buy impulsively; and (4) planned urge to buy impulsively.

The urge to buy impulsively can promote the retail profit. With the progress of science and technology, e-commerce has become an innovative way for modern merchants to retail and consumers to purchase. Empirical studies on the online urge to buy impulsively have attracted scholars' attention. The relevant studies focus on analyzing the influencing factors of the urge to buy impulsively. For example, Chan et al. (2017) divided the stimulus factors of online impulse buying into internal and external stimuli. The external stimulus include website, market, and situational stimulus. The internal stimulus refer to consumers' characteristics. Also, stimuli in the online environment can trigger consumers' impulse purchases, such as attractive pictures, shopping experiences of other consumers, imaginative product descriptions, e-mail reminders, and coupons (Larose & Eastin, 2002). Generally, the influence factors of online impulse buying could be categorized as the following: product factors like product price (Park et al., 2012), product type (Liao et al., 2016), and product reviews (Liu, 2006); website factors like visual appeal (Parboteeah et al., 2009), navigation (Chen et al., 2016), and product display (Liao et al., 2016); and individual characteristics like impulsiveness (Chung et al., 2017) and demographic traits (Chan et al., 2017).

Impulse buying behavior has been proven to be an essential research topic in e-commerce (e.g., Parboteeah et al., 2009), social commerce (e.g., Xiang et al., 2016), and mobile commerce (e.g., Zheng et al., 2019). The primary function of live streaming is to satisfy consumers' social and recreational needs. Thus, most transactions in live streaming are impulse buying behaviors. This article, therefore, focuses on the urge to buy impulsively rather than the intention to purchase.

S-O-R Model

The S-O-R model was proposed by Mehrabian and Russell (1974) to describe how the environment affects human behavior. There are three key elements within the model:

1. **Environmental Stimuli (S):** This refers to an individual's external stimuli, such as store atmosphere and website's quality (Zheng et al., 2019).
2. **Consumer Internal States (O):** This element includes emotional, cognitive, and internal states (Parboteeah et al., 2009).
3. **Reactions (R):** This is an individual's response to their perceptions, including approach response and avoidance response (Mehrabian & Russell, 1974).

The S-O-R model applies to both offline and online contexts. In a brick-and-mortar store, stimuli relate to cues related to the store's appearance, decor, music, scent, and staffing (Bake et al., 2002). More generally, Fiore and Kim (2007) regarded stimuli as the store's ambient, design, and social cues. With the superiority of the online environment, time and space distances are shortened by the virtual space of human-computer interaction. Stimuli then refers to cues and signals from the elements of online stores (Hu et al., 2016).

The S-O-R model has been widely used to study perceived website characteristics on consumer response (Sohaib et al., 2019). Moreover, studies on social commerce and mobile commerce apply this model with specific cues according to the unique business model's features. For example, Hu et al. (2016) and Liu et al. (2016) employed the interaction factors of social commerce websites as the stimuli for consumer behavior. Zheng et al. (2019) used portability as a primary advantage of mobile commerce in exploring consumers' urge to buy impulsively. The current research is a preliminary

exploration of impulse consumption in live streaming; therefore, it considered the four stimulating factors from two fundamental aspects of platform design (cognitive aspect) and functionality (perceptive aspect).

Flow Experience

Flow experience is a general sensation experienced by users when acting with deep involvement (Csikszentmihalyi, 2008). It is recognized as a dominant component in facilitating the creation of a compelling experience (Gao & Bai, 2014). This concept has been extensively used as an essential metric of online consumer experience in human-computer interaction (Chang & Wang, 2008; Gao & Bai, 2014). Besides, the computer-mediated environment facilitates interactivity between members, creates a sense of immersion, and induces a state of flow experience (Mollen & Wilson, 2010).

Flow experience, as a multi-dimensional concept, covers control, interest, attention, and curiosity (Shin, 2017b; Wang et al., 2007). Research has investigated the antecedents of this construct in the context of online services. For example, using the technology acceptance model, Hsu and Lu (2004) noticed that perceived ease of use can enhance flow experience and promote users' intention to play an online game. Zhou (2012) identified the following influence factors related to flow experience and the willingness to use mobile banking: (1) structural assurance; (2) perceived ease of use; (3) personal innovativeness; and (4) trust. More recently, flow experience has been used to study consumers' online impulse buying. According to Wu et al. (2016), the key drivers of flow experience in online shopping are web skills, challenges, and perceived usefulness. Cui et al. (2022) asserted that flow experience is crucial in generating impulsive buying intention when consumers browse short videos. Further, Cui et al. (2022) empirically identified the following variables that lead to a high-flow experience: (1) perceived expertise; (2) perceived similarity; (3) perceived familiarity; (4) personalization; (5) serendipity; and (6) visual appeal.

The characteristics of live streaming can be summarized as the combination of shopping with social and mobile aspects in real-time. Therefore, studies must highlight immersion, control, and enjoyment as dimensions of the flow experience based on the advantages of shopping via live streaming. This study further defines flow experience as a temporarily unaware experience in which an individual engages in live streaming with total immersion, control, and enjoyment.

E-Commerce Live Streaming

E-commerce live streaming is a user-generated content e-commerce model that promotes online transactions by using interactive social media to enrich consumers' online shopping experience (Shen & Eder, 2011). During real-time live streaming, consumers can interact with live streamers via text message to obtain product knowledge (Hilvert-Bruce et al., 2018). Xu et al. (2022) revealed that live streaming on cross-border e-commerce platforms promotes transactions through perceived product transparency, seller transparency, and transaction transparency. These three elements facilitate the acquisition and presentation of information. Therefore, e-commerce live streaming can help consumers obtain information and meet their social needs.

There are two modes of e-commerce live streaming. The first, live streaming embedded in e-commerce, includes platforms like Amazon Live, Taobao Live, and JD Live. The second is e-commerce integrated into live streaming like Facebook Live, TikTok, and Kuaishou. China leads the world in the field of e-commerce live streaming. Compared to other countries, China has an explosive user growth rate, inclusive government support policies, a high degree of specialization, and a mature business model.

Research on e-commerce live streaming has explored the antecedents of consumers' behavior in various forms, including purchase intention, engagement, attitudes, and social sharing (Lu & Chen, 2021). These antecedents cover the perspectives from information technology-enabled functions or mechanisms like visibility, interactivity, and guidance shopping (Sun et al., 2019), live streaming-

related factors like live streaming-product match (Park & Lin, 2020), and product-related factors like product values, product uncertainty, and product presentation (Wongkitrungrueng & Assarut, 2018).

Given the development of e-commerce live streaming, this empirical research follows the major research trend of consumer engagement. Specifically, this research focuses on the urge to buy impulsively rather than purchase intention or engagement. As mentioned, impulse buying behavior is common on live streaming platforms. Therefore, this study pays attention to neglected areas while also considering factors related to platform design and function, which may induce consumers' urge to buy impulsively. However, the working of these two perspectives remains unclear. Based on flow theory, this study postulates that these design and function factors promote the urge to buy impulsively through flow experience with live streaming.

HYPOTHESES DEVELOPMENT

According to Kotler (1973), the term "atmosphere" refers to the conscious design of space, especially the shopping environment, to create specific buyer effects that can produce an emotional impact and improve consumers' purchase rate. Eroglu et al. (2001) first classified online atmosphere cues into high and low task-related categories. High task-related cues refer to the interface's cues that enable consumers to complete the purchase task successfully. Low task-related cues refer to the interface information unrelated to completing the purchase task.

This study focuses on studying atmosphere cues of the e-commerce live streaming platform from the aspects of information content and website design. In the field of information systems and technology, website design is usually defined from a usability perspective, especially a user-friendly interface with visual appeal. Nevertheless, website design acts as an important factor in helping customers locate information for online impulse buying (Wu et al., 2016). Information quality and content quality are often used interchangeably to describe the relevance, reliability, and timeliness of knowledge provided by information systems (Shin, 2017a). However, this study applies information content adapted from Floh and Madlberger (2013) to highlight the visual product information provided by the system. Live streaming platforms show the appearance of products from multiple angles; therefore, information content is more suitable for this study scenario. The information content is used as high task-related cues, whereas website design represents low task-related cues.

Studies have shown that flow experience refers to the ability of individuals to fully engage in activities to balance challenges and skills to feel pleasure and happiness (Hoffman & Novak, 2009). Oh et al. (2008) showed that store design and information display could affect the image of online stores. Such an internal state, in turn, affects consumers' expectations. In the context of e-commerce live streaming, high-quality product information content and appealing website design (external environmental factors) are likely to make consumers feel excited and happy. Therefore, this study makes the following hypotheses:

H1. In the context of e-commerce live streaming, information content positively influences flow experience.
H2. In the context of e-commerce live streaming, website design positively influences flow experience.

Marketers often use time pressure for hunger marketing. Svenson and Edland (1987) compared significant differences between two groups of students in the choice of dormitories with the same attractiveness in the context of time pressure and absence of time pressure. Their study indicated that time pressure, as a restriction, can stimulate the emotional response of consumers. Inbar et al. (2010) suggested that decision makers are more inclined to use heuristic thinking to make quick decisions under time pressure. Due to a time limit, consumers will have a herd mentality in the e-commerce live streaming setting, stimulating a positive and exciting buying mood. Under such conditions,

consumers are more likely to immerse themselves in live streaming and interact with live streamers. Therefore, this study makes the following hypothesis:

H3. In the context of e-commerce live streaming, time pressure positively influences flow experience.

With digital marketing and big data technology development, personalized recommendations optimize consumers' shopping choices (Cui et al., 2022). Algorithm-based recommendation systems are popular tools used by online services to help users access the growing amount of data available on the internet (Shin, 2020). An accurate and transparent recommendation system would provide users with convenience and usefulness. Subsequently, user satisfaction and continuance intention toward services would be enhanced.

Aljukhadar and Senecal (2011) used qualitative methods to study the success factors of product recommendation agents. They found that personalized recommendations based on consumer needs can make consumers' shopping process convenient and interesting. Regarding e-commerce, Song and Zinkhan (2008) studied the factors affecting consumers' perception of interactivity when sending instant messages to electronic stores. They verified that the degree of personalization of online information is the most vital factor that affects consumers' perception of interactivity. The personalized recommendation can bring consumers a more interesting and interactive shopping experience, making it easier to immerse themselves and find satisfaction and pleasure from the shopping process. Therefore, this study makes the following hypothesis:

H4. In the context of e-commerce live streaming, personalized recommendation positively influences flow experience.

Time pressure can trigger herd behavior in consumers. This process requires limited information and perception processing. In other words, the stimulation of time pressure may directly lead to consumers' responses. Swain et al. (2006) emphasized the importance of time limits in promotional activities. The sense of urgency caused by the time limit would profoundly affect consumers' purchasing behavior. Kauffman et al. (2010) believed that time pressure would bring a sense of urgency to consumers, paying more attention to positive information like product promotions while ignoring the risks in the purchase process. This, in turn, would speed up the decision-making process of consumers' purchases. In the context of e-commerce live streaming, the sense of urgency brought about by time pressure is likely to make consumers have irrational consumption behaviors. Therefore, this study makes the following hypothesis:

H5. In the context of e-commerce live streaming, time pressure positively influences the urge to buy impulsively.

Personalized recommendation is essential in influencing consumers' decisions (Tarn & Ho, 2005). For example, personalized recommendations can promote total sales growth in mobile commerce by increasing consumers' brand loyalty (Lee et al., 2015). Personalized recommendations can also improve the efficiency of online shopping and product marketing (Yan et al., 2016). Xiao et al. (2019) showed that personalized recommendations positively influence consumers' purchase intention in the context of cross-border e-commerce. This study believes that the conclusion of the above studies remain valid in e-commerce live streaming. Therefore, it makes the following hypothesis:

H6. In the context of e-commerce live streaming, personalized recommendation positively influences the urge to buy impulsively.

Four factors already discussed can immerse consumers in terms of arousing consumers' flow experience. For the subsequent ripple effect, Gao and Bai (2014) argued that flow experience is an immersive experience. Thus, concentration will be intense when a consumer is immersed. Consumers will get excitement and satisfaction from such a flow experience. Moreover, Richard and Chandra (2005) showed that flow experience positively influences purchasing intention. Therefore, impulsive buying intention is likely to be dominated by flow experience when the consumers are immersed in excitement and satisfaction. This study makes the following hypothesis:

H7. In the context of e-commerce live streaming, flow experience positively influences the urge to buy impulsively.

Figure 1 presents a research model built according to this discussion.

METHODOLOGY

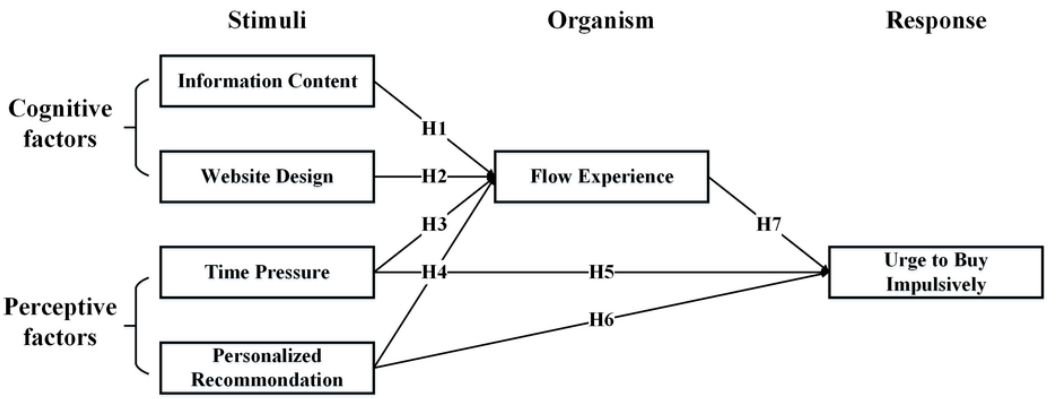
Measurement Development

The questionnaire was divided into two parts. The first captured demographic information; the second was made up of the main survey. It included six variables. To ensure the validity of the questionnaire, the study used multi-item measurements from mature research scales in the relevant field (see Appendix A). It used a five-point Likert scale to develop the questionnaire, ranging from one (strongly disagree) to five (strongly agree). The questionnaire was originally in Chinese; therefore, the study conducted a back-translation procedure to ensure translation validity to English. A pilot test was used to determine whether the survey instruments were understandable for participants and if there were ambiguous or confusing measurement items. The study recruited 76 undergraduate students for the pilot test. All items with their intended constructs loaded as expected. All items' reliability and validity should fall within an acceptable range.

Data Collection

The study collected data through a professional online survey website (www.wjx.cn). It targeted respondents as consumers who have watched and purchased on live streaming e-commerce platforms. Thus, the study added the following sample-selecting question in the questionnaire's first part to ensure that all samples had been live-shopped: "Have you ever shopped via live streaming e-commerce?" The survey ended if the answer was "No." To motivate respondents, the study promised to give a

Figure 1. Research Model



red envelope worth 1-5 RMB randomly after the survey. During three weeks of data collection, a total of 210 questionnaires were collected. Questionnaires with more than five missing values were removed, as well as those with the same answer to all questions. The study checked the IP address to avoid multiple answers from one respondent. Finally, 188 valid questionnaires were obtained.

Data Analysis

This study used IBM SPSS 20.0 for initial statistical analysis and IBM AMOS 24.0 for structural equational modeling (SEM) analysis. IBM AMOS is a powerful tool that combines principal components analysis (CFA) and regression to estimate the measurement and structural model simultaneously. In line with the study on the urge to buy impulsively from Parboteeah et al. (2009), IBM AMOS 24.0 was used. The demographic information is displayed in Table 1.

RESULTS

Common Method Bias

The study conducted Harman's single-factor test by running an exploratory factor analysis of all the scale items. The result shows that all items were categorized into six factors. All factors explain 73.83% of the variance in this study's constructs, with the first factor explaining 36.79%, less than 40%, and the last explaining 4.39%. In addition, the study compared correlations among constructs, finding no constructs with correlations over 0.9. These results indicate that the common method bias is not a threat in the present study.

Measurement Model

The information on confirmatory factor and construct validity analyses is displayed in Table 2. All constructs are reliable, with Cronbach's Alpha value over 0.7 (ranging from 0.771 to 0.851). The constructs' AVE values are above 0.50 (ranging from 0.546 to 0.673), confirming the constructs' convergent validity (Fornell & Larcker, 1981). The constructs' CR values are above the recommended value of 0.70 (ranging from 0.795 to 0.869). Furthermore, no cross-loadings are observed. Therefore, according to Table 2, the study collected a set of reliable and valid data for this research.

Discriminant validity and construct correlations are tested through measurement model analysis. Table 3 shows the construct correlations and square roots of AVE values on the diagonal. All square roots of AVE values are greater than construct correlation coefficients, indicating that this study's discriminant validity is good.

Table 1. Descriptive Statistics of Respondents' Characteristics

Demographic	Category	Samples (%)	Demographic	Category	Samples (%)
Gender	Male	62 (33%)	**Education**	Under high school	1 (0.5%)
				High school	4 (2.1%)
				College	7 (3.7%)
	Female	126 (67%)		Bachelor's	137 (72.9%)
				Master's and above	39 (20.7%)
Age	Less than18	4 (2.1%)	**Cost**	Less than 500	52 (27.7%)
	18-25	154 (81.9%)		500-999	63 (33.5%)
	26-35	16 (8.5%)		1000-1999	51 (27.1%)
	36-45	5 (2.7%)		2000-4999	19 (10.1%)
	Over 45	9 (4.8%)		Over 5000	3 (1.6%)

Table 2. Confirmatory Factor and Construct Validity Analyses

Variable	Alpha value	CR	AVE	Items	Mean(S.D.)	Loadings
Information Content (IC)	0.772	0.843	0.643	IC1	3.160(0.683)	0.759
				IC2	3.176(0.750)	0.879
				IC3	3.362(0.751)	0.762
Website Design (WD)	0.771	0.829	0.620	WD1	3.021(0.827)	0.701
				WD2	3.186(0.762)	0.842
				WD3	3.207(0.727)	0.812
Time Pressure (TP)	0.851	0.869	0.627	TP1	3.484(0.945)	0.791
				TP2	3.415(0.912)	0.878
				TP3	3.452(0.949)	0.821
				TP4	3.431(0.890)	0.661
Personalized Recommendation (PR)	0.795	0.860	0.673	PR1	3.415(0.793)	0.760
				PR2	3.590(0.826)	0.887
				PR3	3.606(0.756)	0.809
Flow Experience (FE)	0.820	0.795	0.566	FE1	3.016(0.791)	0.739
				FE2	3.000(0.847)	0.828
				FE3	2.979(0.877)	0.683
Urge to Buy Impulsively (UBI)	0.837	0.826	0.546	UBI1	3.202(0.908)	0.651
				UBI2	3.037(0.939)	0.803
				UBI3	3.069(1.050)	0.812
				UBI4	3.133(1.002)	0.675

Table 3. Construct Correlations and Discriminant Validity

Constructs	IC	WD	TP	PR	FE	UBI
IC	**0.802**					
WD	0.372	**0.787**				
TP	0.222	0.238	**0.792**			
PR	0.191	0.182	0.205	**0.820**		
FE	0.382	0.547	0.457	0.316	**0.752**	
UBI	0.319	0.431	0.621	0.400	0.654	**0.739**

Note: Diagonal numbers in bold are the square root of the average variance extracted. Pearson correlations are shown below the diagonal.

The study used AMOS 24.0 to investigate both the measurement and structural models. Most indices of the model fit assessment fit the recommended values or are close to the threshold (see Table 4). Therefore, both the measurement and structural models are good.

Structural Model and Hypothesis Testing

The results of the hypothesis test are listed in Table 5. The study depicted the path analysis results and variances of the research model in Figure 2. It further tested the direct effect of information

Table 4. Summary of Model Fit

Model fit	Recommend	Measurement	Structural model
CMIN/DF	<3	1.527	1.447
RMR	<0.08	0.042	0.079
GFI	>0.9	0.895	0.894
AGFI	>0.8	0.856	0.857
NFI	>0.9	0.874	0.877
RFI	>0.9	0.842	0.850
IFI	>0.9	0.952	0.958
CFI	>0.9	0.951	0.958
RMSEA	<0.08	0.053	0.049

content and website design on the urge to buy impulsively to avoid the incomplete construction of hypotheses. However, there is not any significant effect. Therefore, all four stimulus factors can induce the urge to buy impulsively through flow experience. Besides, only time pressure and personalized recommendation can directly affect the urge to buy impulsively.

DISCUSSION

The results of this research are robust and consistent with previous studies in contexts like e-commerce and mobile commerce. The study found interesting points based on the path analysis results.

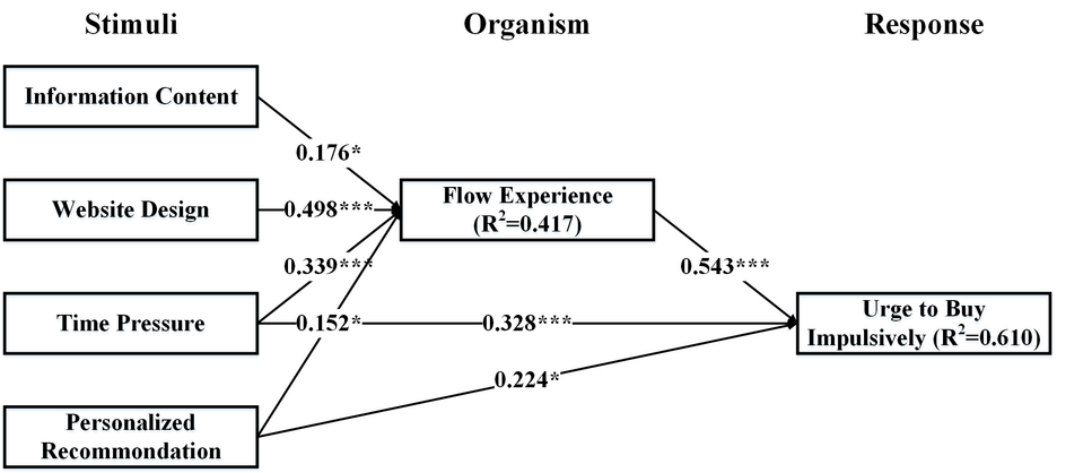
First, this study investigated how the urge to buy impulsively is formed through stimuli. Two stimulating factors (information content and website design) arouse the urge to buy impulsively through flow experience. In contrast, two other factors (time pressure and personalized recommendation) affect the urge to buy impulsively. The study regards the two indirect factors as cognitive stimuli that require information processing in consumers' brains. It will, thus, take time to make rational decisions. Suppose that only the information content and website design attract consumers; however, consumers are not immersed in the shopping situation to produce flow experience. In such a case, it will not stimulate consumers to have an impulse purchase intention. Flow experience can be hindered by low loading speed or impaired navigation function. Thus, e-commerce live streaming must maintain flow experience to make these two indirect factors lead to the urge to buy impulsively. On the other

Table 5. Results of SEM Analysis

Path	Loading	SE	CR	P-value	Result
H1:IC→FE	0.176	0.106	2.267	0.023*	Supported
H2:WD→FE	0.498	0.117	5.195	0.000***	Supported
H3:TP→FE	0.339	0.076	4.238	0.000***	Supported
H4:PR→FE	0.152	0.104	2.011	0.044*	Supported
H5:TP→UBI	0.328	0.071	4.100	0.000***	Supported
H6:PR→UBI	0.224	0.091	3.165	0.002*	Supported
H7:FE→UBI	0.543	0.087	5.816	0.000***	Supported

Note. *p<0.05, **p<0.01, ***p<0.001

Figure 2. Results of the Research Model



hand, the study regards the two direct factors as perceptive stimuli that touch the consumers' pain points through information matching or reduce the consumers' thinking time. Time pressure can bring consumers an intuitive sense of urgency; therefore, consumers have to make decisions in a shorter time. Personalization is often based on the preferences and demands of consumers. Therefore, when making a decision, consumers will pay more attention to the good attributes and values of the product and ignore potential risks. Consequently, perceptive factors influence consumers' impulse buying more efficiently.

Second, focusing on the cognitive stimuli shows a significant difference between the path coefficient of information content and website design. The study deduces that the visual factors are more likely to immerse consumers than the content factors. On this basis, the layout of the e-commerce platforms and live streaming room is more important than the content information from a cognitive point of view.

Third, time pressure will reduce consumers' psychological resistance to the active recommendation and enhance their willingness to accept it. It will also weaken consumers' information processing ability and reduce their decision-making efficiency, leading to impulse purchasing intention. This study further uncovers the underlying mechanism of how time pressure arouses the urge to buy impulsively through flow experience, especially in the context of live streaming. Time pressure can directly enhance the urge to buy impulsively; therefore, other possible mediators still need to be explored (for example, perceived convenience, hoarding behavior, etc.).

Fourth, personalized recommendation as an advanced means in e-commerce has been studied extensively. Cui et al. (2022) argued that personalized recommendations could promote consumers' urge to buy impulsively by enhancing utilitarian value and flow experience on mobile short video applications, an emerging model of e-commerce. Hence, personalized recommendation is essential for encouraging consumers' impulse buying. However, this construct has the least influence on flow experience and the urge to buy impulsively compared to other constructs. This situation may be due to the consumers' doubts about personalized recommendations. Recent studies have shown that a personalized algorithm system may be a deviation (Shin, 2020b; Shin & Park, 2019). In other words, more people are aware that personalized recommendations are not fair. It is raising concerns that artificial intelligence may have human prejudices. This matters to the design of personalized algorithms of online platforms because users' algorithm awareness will affect their information disclosure and the user experience (Shin, Kee et al., 2022). Fortunately, consumers' trust in the platform will

significantly increase their perceived usefulness, convenience, emotion, and subsequent satisfaction with a personalized algorithm system (for instance, personalized recommendation). Such trust from users will also increase the credibility and trust in algorithms (Shin, Rasul et al., 2022). Shin (2020b) also argued that the overall path from the user's perception of the system to satisfaction would be less robust without trust as a liaison factor. The main organism variable in this article is the flow experience rather than social-related or trust-related perception; therefore, the role of personalized recommendation may have been weakened. Yet, personalized recommendation is an important element in the urge to buy impulsively on live streaming.

Finally, the extant literature on the purchase intentions on live streaming pays attention to immersion, highlighting the absorption and neglecting the excitement of live streaming. This study utilizes flow experience instead of immersion to study the influencing factors of the urge to buy impulsively. Flow experience plays the most important role among the three direct factors. Therefore, fun, excitement, and immersion are the most important factors in increasing the sales of live streaming e-commerce.

CONCLUSION

Given its unique advantages on consumers' impulse buying behavior, e-commerce live streaming has become a primary e-commerce marketing tool. However, influencing factors and the mechanism of consumers' impulse buying behavior in e-commerce live streaming remain unclear. This study applied the S-O-R model to depict the cascade from e-commerce live streaming features to the urge to buy impulsively via the consumers' flow experience. Apart from social factors, the study found that information content, website design, time pressure, and personalized recommendation are the four fundamental factors for successful e-commerce live streaming. Further, time pressure and personalized recommendation are imperative for live streaming activities.

Theoretically, this study contributes to the literature by building a comprehensive model to indicate the factors of consumers' flow experience and impulse buying behavior in the context of live streaming. In line with research on e-commerce (Wu et al., 2016), m-commerce (Zhou, 2012), and s-commerce (Liu et al., 2016), this study examines the significance of flow experience in live streaming e-commerce. Moreover, this study contributes to the current knowledge that the fun and excitement within flow experience are as important as immersion in live streaming.

The study identifies the antecedents of consumers' flow experience in live streaming and tests those antecedents' stimulating role. This finding contributes to theoretical advance by explaining how flow experience is formed, the role it plays in live streaming e-commerce, and how it can be theorized, measured, and analyzed through a reference to the design of the live streaming platform. Further, the study finds that the stimuli can affect the response without intermediating organisms under certain conditions, which may be due to the attributes of stimuli. This will provide new thinking for the internal structure of the S-O-R mode.

This research sheds light on the study of flow experience in the live streaming research field. With the support of advanced technologies, consumers' online shopping forms are changing. The emotional factors reflected in online shopping are also improving. Traditional human-computer interaction shopping is transforming into online shopping through human-media communication like live streaming e-commerce. Nowadays, the proportion of impulse consumption is increasing. Flow experience in live streaming plays a crucial role as a bridge between purchase intention. Therefore, live streaming technology and content factors or other unexploited factors could be mediated by this novel construct on the purchase intention.

In practice, this research has four managerial implications. First, live streaming e-commerce platforms and online retailers should focus on the appearance of their systems and products rather than descriptions. Most buying behavior in e-commerce live streaming is accidental and random; thus, consumers may not have a deep understanding of product details. The platform layout of the

live streaming room should be neat and clear. The color collocation should be comfortable to present a favorable shopping environment that attracts consumers and promotes impulsive buying behaviors. Second, compared to traditional e-commerce platforms, reducing inventory and limiting order times are considered effective marketing activities in live streaming e-commerce. In other words, hunger marketing is imperative for live streaming. Third, live streaming e-commerce platforms should pay attention to personalized service. For example, mobile location services or browsing histories can help platforms push personalized live streaming content to users in real time based on geographic locations and preferences. This would, thus, improve the user experience. An accurate, personalized recommendation can better cater to consumers' preferences and needs, bring consumers a good flow experience, make the consumer feel excited and satisfied, and promote the generation of impulsive buying behavior.

In addition, the dark side of personalized recommendations must be addressed. As Shin (2020b) mentioned, algorithm-based recommendation systems let users become more dependent on and vulnerable to the decisions of artificial intelligence. Therefore, concerns over fairness, transparency, and accountability are on the rise. For e-commerce platforms, the overuse of personalized recommendations may break the touch point between consumers and non-preferred commodities. This could result in reduced sales.

Finally, flow experience is more important for live streaming platforms. Any factors affecting consumers' flow experience should be improved. This includes navigation systems, network environment (especially on shopping festivals), advanced technology (e.g., AR/VR), and the anchor's verbal tricks.

There are three limitations associated with the current research. First, this study investigates the effect of flow experience on the urge to buy impulsively. Apart from flow experience, consumer trust and perceived risk may be influential; the role of these factors should be considered in future research. Second, the quality of anchors and fan interaction is essential to live streaming as compared to other contexts. Therefore, social factors need to be investigated. Third, the samples come from China. Whether the same situation is true for consumers in other countries needs further investigation.

Still, the development of live streaming e-commerce has a uniqueness in China, which holds the potential to become an influencing factor of impulse buying on live streaming. Research on these new influencing factors is encouraged to provide a deeper understanding of live streaming e-commerce under certain contexts. For example, celebrities and merchants engage in live streaming, as well as the government and mainstream media in China. The latter pays more attention to the public welfare of live streaming e-commerce. Even though the government and mainstream media possess a huge number of followers, they are amateurish compared to celebrities and merchants. Does the role of the live streamer impact the relationship between the influencing factors and purchasing behavior? Will live streamers' authority, credibility, and public welfare affect consumers' impulsive buying intentions? These country-specific factors should be considered in future research.

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APPENDIX

Appendix 1. Measurement items

Constructs	Items	Source
Information Content (IC)	1. The live streaming platform provides detailed information that is relevant to consumer needs.	Adapted from Floh and Madlberger (2013)
	2. The live streaming platform shows visual product information of good quality.	
	3. The information provided by the live streaming platform is up-to-date and timely.	
Website Design (WD)	1. The live streaming platform is visually pleasing.	Adapted from Floh and Madlberger (2013)
	2. The colors that are used on the site are attractive.	
	3. The structure and layout of the live streaming platform are attractive.	
Time Pressure (TP)	1. When I live streaming shopping, I thought of the deadline.	Adapted from Peng et al. (2019)
	When I live streaming shopping, I worry about limited time.	
	3. When I live streaming shopping, I am concerned about limited quantity.	
	4. When I live streaming shopping, I was anxious about the sold-out sign.	
Personalized Recommendation (PR)	1. Based on my browsing and purchasing history, the live streaming platform can understand my need.	Adapted from Lee et al. (2015)
	2. Based on my browsing and purchasing history, the live streaming platform can discover my preferences.	
	3. Based on my browsing and purchasing history, the live streaming platform recommends personalized information.	
Flow Experience (FE)	1. It is fun to communicate on the live streaming platform.	Adapted from Liu et al. (2016)
	2. When using the live streaming platform, I felt the excitement of exploration.	
	3. When using the live streaming platform, I was immersed.	
Urge to Buy Impulsively (UBI)	1. When watching the live streaming, I had a strong desire to buy goods.	Adapted from Parboteeah et al. (2009)
	2. When watching the live streaming, I wanted to buy the goods without careful consideration.	
	3. When watching the live streaming, I can not help buying the recommended goods, even if they are not on my shopping list.	
	4. I feel unsatisfied if I do not buy something I want on the live streaming platform.	

Yi Cui is a lecturer of School of Economics and Management, Communication University of China. His research focuses on electronic commerce, organizational culture and technology adoption.

Meng Gu is a Lecturer at the School of Economics and Management, Communication University of China. Her current research focus on innovation, strategic change and TMT process.