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How the time-scarcity feature of live-streaming e-commerce affects impulsive buying

直播电商的时间性稀缺特征如何影响冲动购买

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ABSTRACT

Live-streaming e-commerce(LSE) features limited-time resources and usually only lasts for a few hours. Drawing on psychological reactance theory, this study investigates the effects of time scarcity on consumers' impulsive buying behavior by identifying perceived urgency as the underlying mechanism and examining the moderating role of product types. We conducted two scenario-based experiments to test the research framework. The results demonstrate that time scarcity increases impulsive buying and perceived urgency. Furthermore, the effect of time scarcity on perceived urgency depends on product types, but the effect of time scarcity on impulsive buying is independent of product types. In addition, perceived urgency mediates the effect of time scarcity on impulsive buying of utilitarian products. Our findings provide anchors with evidence on how to leverage the time scarcity feature of LSE to stimulate impulsive buying.

摘要

直播电商具有时间资源稀缺的特征，通常只持续几个小时时间。根据心理抗拒理论，本研究考虑感知急迫作为中介变量，并将产品类型作为调节变量来探究直播电商的时间性稀缺特征对冲动购买的影响。本研究通过两个情景实验对提出的假设进行检验。结果显示，时间性稀缺增加消费者的冲动购买和感知急迫，但产品类型却只调节时间性稀缺对感知急迫的影响。此外，感知急迫中介时间性稀缺对功利产品冲动购买的影响。本研究为主播利用直播电商的时间性稀缺特征来刺激消费者冲动购买提供了指导。

1. Introduction

The global popularity of live streaming has boosted the promotion of products in online markets and driven the transformation of e-commerce (Sun et al., 2019). Live-streaming e-commerce (LSE) has emerged as an innovative online shopping channel that evolved from e-commerce (Li, Li, et al., 2021). Compared with e-commerce, LSE is distinguished by the parasocial interaction between sellers (anchors) and consumers (viewers), leading to a fundamental shift in the way products are sold (Chen, Chen, et al., 2022;

Guo et al., 2022). Particularly, LSE can attract thousands of people to participate in real-time live streaming in a short period, where anchors present hundreds of products within a time limit of 2–3 h, shortening the time consumers need to make purchase decisions (Fei et al., 2021). An industry report indicated that the market size of LSE has expanded from ¥19.64 billion in 2017 to ¥236.51 billion in 2021, and the user base has grown from 2.20 billion to 4.64 billion (CNNIC, 2022), indicating that live-streaming shopping is becoming more widespread.

However, it is worth noting that the staggering figure includes a significant volume of impulse purchases. According to the industry report, 44.1% of respondents suggest that impulse purchases are serious in live-streaming shopping (China Consumers Association, 2021). In addition, impulsive buying behavior remains an important topic in the field of e-commerce, which helps online retailers increase sales and satisfy consumers' instantaneous desires (Abdelsalam et al., 2020; Chan et al., 2017). However, few studies to date have investigated the factors that trigger impulse purchases in LSE, including para-social interaction, social contagion, bullet information, and audience information (Lo et al., 2022; Wang et al., 2022; Zhang et al., 2022).

Although pioneering studies in LSE have helped advance academic research (Chen et al., 2021; Kang et al., 2021; Xue et al., 2020), research on impulsive buying behavior remains largely underexplored. It is noteworthy that consumers l browse hundreds of products within 2–3 h of live streaming shopping. Compared to traditional e-commerce, LSE provides consumers with limited time to make purchase decisions and implies that they will lose the opportunity to buy products as soon as the live streaming ends (Wang et al., 2022),. Thus, the limited-time scarcity of live-streaming shopping plays an important role in shaping consumer purchase behavior. However, to our best knowledge, few studies in the LSE context have explored the effect of time scarcity on consumers' impulsive buying behavior. Although irrelevant to live-streaming e-commerce, Li, Wang, et al. (2021) suggested that time scarcity increases tourists' impulse purchases during their temporary travel experience. Liu et al. (2022) demonstrated that the perception of time scarcity puts people under pressure, which in turn promotes impulsive buying. Similarly, Wu et al. (2021) found that online retailers often use limited-time promotion strategies to trigger consumers' purchase intention. These examples indicate that time scarcity plays a salient role in impulse purchases. However, the literature remains silent on the effects of time scarcity on consumers' impulsive buying behavior in the context of LES.

Against this backdrop, the current research aims to unveil the driving force of impulsive buying in the LSE context from the perspective of limited time resources to fill this research gap. Specifically, this study aims to answer the following questions: (1) *How can time scarcity lead to impulsive buying in the context of live-streaming shopping?* (2) *What mechanisms underlie the above relationships?* (3) *Can anchors leverage the promotional power of time scarcity to increase sales by sequencing product types?* The current study draws on psychological reactance theory and proposes a research model to answer these questions. We then adopt a scenario-based experiment method to simulate real-world live shopping scenarios and measure individuals' impulsive buying behavior as an outcome variable. Our findings suggest that time scarcity positively influences impulsive buying behavior and the relationship is mediated by consumers' perceived urgency. Furthermore, we confirmed that hedonic (vs. utilitarian) products elicit higher

perceived urgency when time scarcity is low, whereas the opposite is true when time scarcity is high.

This study provides the following contributions. First, we contribute to the literature on LSE by investigating the roles of time scarcity features in affecting impulsive buying. Second, this study extends psychological reactance theory to the LSE context by combining time resource scarcity and perceived urgency to explore the effects of an LSE strategy on consumers' impulsive purchase behavior. Third, our study indicates that the effect of time scarcity on perceived urgency depends on product types, whereas the effect of time scarcity on impulsive buying is independent of product types, providing the boundary condition for the effects of time scarcity by integrating product types. These findings provide theoretical and practical implications for e-retailers.

2. Theoretical background and research model

2.1. Impulsive buying in live streaming commerce

Impulsive buying is typically preceded by an unanticipated thought and a sudden and intense desire to purchase (Stern, 1962). It has been investigated extensively across multi-disciplines in recent years because it enables retailers to achieve better economic benefits (Iyer et al., 2020). Previous studies have largely investigated the causes that lead to impulse purchases, such as the number of likes that a post gets (Chen et al., 2016), online reviews (Zhang et al., 2018), marketing strategies (Yang et al., 2020), and shopping companions (Chen et al., 2021), as well as the mechanism behind impulse buying behavior, such as pleasant emotion (Liu et al., 2022), overconfidence (Li, Li, et al., 2021), and perceived value (Teubner & Graul, 2020).

Although impulsive buying is one of the most important customer shopping behaviors that frequently occurs in e-commerce (Li, Wang, et al., 2021; Wu et al., 2021), it has not been well studied in the context of LSE. LSE has become a new shopping channel and is gaining increasing attention in e-commerce (Kang et al., 2021; Luo et al., 2021). Compared to social e-commerce, LSE is typically distinguished by prosocial interaction between sellers (anchors) and consumers, in which anchors present hundreds of products within a limited predetermined time and persuade consumers to purchase (Wang et al., 2022). Previous research on LSE has focused on an extensive exploration of consumer engagement (Fei et al., 2021; Kang et al., 2021; Xue et al., 2020) and purchase intention (Chen et al., 2021; Sun et al., 2019). Few studies have focused on the factors that lead to impulsive buying in the context of LSE (Lo et al., 2022; Wang et al., 2022), including guidance information, bullet information, parasocial, and scarcity persuasion.

However, one of the most important characteristics of LSE is time scarcity which distinguishes it from other types of e-commerce. Since consumers are limited to buying products within the time of live streaming, the limited time may facilitate the purchase decisions (Liu et al., 2022; Teubner & Graul, 2020). However, few studies have focused on the effects of time scarcity on consumers' impulsive buying behavior. Therefore, this study aims to shed light on the factors that influence impulsive purchases in the LSE context by considering the limited time resource available for purchase. Particularly, we aim to investigate the effects of promotional effectiveness of time scarcity on consumers' impulsive buying and the mechanism underlying this relationship.

2.2. Psychological reactance theory

According to psychological reactance theory, individuals' perceived threat to freedom might induce the motivating emotion of internal reactance, making them feel constrained in their behavior (Brehm, 1966). More specifically, individuals are motivated to rebuild their decreased freedom when they feel that their freedom is being challenged (Brehm & Brehm, 2013). Particularly, individuals have a sense of 'now more than ever' and show a stronger eagerness to act quickly, indicating that restriction makes the action more appealing (Gong et al., 2021). Hence, people get more motivated to take action when they feel a certain type of loss aversion, such as a threat or removal of behavioral freedom. For example, Song et al. (2019) suggested that the perception of sellout risk can motivate people to make a buying decision.

The unavailability of resources, such as product, time, and money, constrain a person's power to make a decision, consequently posing a threat to freedom (Clee & Wicklund, 1980). By contrast, individuals with sufficient resources have more flexibility and feel less pressure to make desired decisions (Kraus et al., 2009). In addition, individuals with scarce resources are likely to show agitation because their freedom to make decisions is extremely restricted (Cannon et al., 2019). For instance, individuals with less travel experience may perceive risk in purchasing products they actually want to buy (Huang et al., 2020). Similarly, consumers who experience insufficient time may have to compromise with reality and adjust their plans (Li, Wang, et al., 2021; Liu et al., 2022). Thus, it can be inferred that perceptions of resource scarcity may pose a psychological threat to individual decisions, leading to unexpected behavior (Gong et al., 2021).

In the context of LSE, consumers are confronted with the limited time of live streaming, which implies that they have to make purchase decisions before the live streaming ends. In particular, anchors often remind consumers of the time remaining and encourage them to seize the opportunity to buy, giving consumers a sense of urgency. Therefore, the psychological reactance theory provides an appropriate theoretical lens for exploring the effect of time resource scarcity on consumers' impulsive buying in LSE.

2.3. Time scarcity and impulsive buying

Scarcity is derived from the constraints of possessing or experiencing a resource, and it can be induced by a lack of many types of resources, such as time, quantity, and money (Tang et al., 2022). Based on this definition, time scarcity means the time available to conduct an activity is less than the required time (Liu et al., 2022). In practice, time scarcity is broadly adopted by marketers to promote consumption, such as online booking (Song et al., 2019), holiday promotion (Peng et al., 2019), and travel purchases (Li, Wang, et al., 2021).

Although previous studies in service and e-commerce have widely explored the impact of time scarcity appeals on impulsive purchases, these findings have been inconsistent. Barakat (2019) suggested that consumers in shopping malls are more inclined to make impulsive purchases when more time is available. Similarly, Li, Wang, et al. (2021) showed that adequate time to browse in a store encourages consumers to return later and then make an impulse purchase. In contrast, some studies have demonstrated that the scarcity of remaining time for online shopping increases the perceived value of

products and subsequently leads to impulsive buying (Wu et al., 2021). Thus, it can be found that time scarcity has different effects on impulsive buying behavior across scenarios,

Importantly, live-streaming shopping is distinct from social e-commerce and offline-store contexts. A key feature is that live streaming lasts for a limited time and thus shopping activities usually last only several hours, making LSE pose a time constraint on consumers' potential consumption. However, the literature remains silent on the effects of time scarcity in the LSE context. Particularly, given the opposing findings between online and offline shopping situations (Barakat, 2019), there is an urgent theoretical and practical need to investigate the effects of the time scarcity feature of LSE.

In addition, anchors dominate product sales and directly provide consumers with various information, such as guidance information, personalization information, and promotion information, to facilitate customers' purchases (Park & Lin, 2020; Zhang et al., 2022). Considering the limited time of live-streaming, anchors often inform consumers about the remaining time during live streaming to urge them to place orders. Some messages, such as 'Ends soon!' or 'Next product coming soon', give consumers a sense of time constraint and remind them to seize the opportunity (Park & Jang, 2018). Previous studies have shown that scarcity-related promotional materials have a significant effect on how customers screen items and how they make purchase decisions (Brannon & Brock, 2001). The time information conveyed by anchors could interfere with consumers' information processing (Gong et al., 2021). The availability of time resources in the LSE context for shopping threatens consumers' buying freedom and pushes them to make purchase decisions as soon as possible. Therefore, we conjecture that the later (vs. initial) stage gives consumers a sense of time scarcity to promote consumers' impulsive buying in the live-streaming shopping context. Hence, the following hypothesis is developed:

> H1. Time scarcity positively influences impulsive buying. That is, high (vs. low) time scarcity will trigger higher levels of impulsive buying

Time scarcity appeals are frequently applied to attract and remind consumers to purchase products across offline and online shopping (Aggarwal et al., 2011). People psychologically value opportunities more when they expect to miss them soon, which may encourage them to take immediate action toward threatening situations (Wu et al., 2021). Specifically, urgency-related emotions may occur when people perceive the availability of a product as limited (Teubner & Graul, 2020). Live-streaming shopping is characterized by a fast pace, and consumers tend to be more sensitive to changes in time (Zhang et al., 2022). Therefore, as time progress, consumers become more immersed in live-streaming shopping, and the decrease in the time remaining further intensifies the consumers' perceived urgency. Therefore, we propose the following hypothesis:

> H2. Time scarcity positively influences perceived urgency. Specifically, High (vs. Low) time scarcity will trigger higher levels of perceived urgency

2.4. Moderating role of product type

Previous studies classified the products into utilitarian and hedonic types (Kim et al., 2019). By definition, utilitarian products help individuals fulfill particular functions,

whereas hedonic items bring pleasure (Chang et al., 2020). The consumption of hedonic products is associated with entertainment, while the consumption of utilitarian products is related to functional performance (Liu et al., 2022). Consumers are primarily motivated by their daily needs when purchasing utilitarian products and therefore pay more attention to the product's function. By contrast, hedonic products are purchased by consumers in a more sensory manner because people place more emphasis on the pleasurable nature of such products (Kivetz & Zheng, 2017).

In general, utilitarian consumption involves more effort than hedonic consumption, indicating that consumers need to consider utilitarian products more carefully than hedonistic ones (Liu et al., 2022). Specifically, utilitarian products are more sensitive to resource scarcity than hedonic products, and the formation of normal decisions about utilitarian products requires a more unrestricted environment to process information. Thus, customers usually tend to purchase a product featured with hedonic instead of utilitarian attributes because limited resources restrict them from putting in more effort (Shiv & Fedorikhin, 1999). However, due to the different types of constrained resources and purchasing scenarios, it is questionable whether the previous research results are transferable to the LSE context. Products sold via live streaming include hedonic and utilitarian, such as jewelry, cosmetics, and sports equipment (Zhang et al., 2020).

Live-streaming shopping usually lasts only a few hours and features limited-time resources, which poses a time restriction on consumers' purchases. Notably, consumers have less time as live streaming proceeds to the second half; by contrast, the remaining shopping time for consumers in the live streaming start stage is relatively sufficient. The subtle change in the timeline may show different effects on product consumption. In particular, the utilitarian product requires more effort from consumers to make a purchase, indicating that utilitarian consumption is sensitive to time resources (Klein & Melnyk, 2016). In contrast, hedonic consumption is mainly based on affective experiences (Liu et al., 2022), which are less sensitive to the reduction of time resources than utilitarian products.

Accordingly, hedonic products elicit a greater perceived urgency than utilitarian products in the early stages of live streaming, when time scarcity is low. However, in the second half of live streaming, when time scarcity is high, the paradoxical situation that utilitarian consumption takes more time but the remaining time of live streaming seems scarcer intensifies the perceived urgency. Thus, we propose the following hypothesis:

H3. The interaction between time scarcity and product type affects perceived urgency

H3a. Perceived urgency for hedonic (vs. utilitarian) products will be higher under low-time scarcity

H3b. Perceived urgency for utilitarian (vs. hedonic) products will be higher under high-time scarcity

2.5. Mediating role of perceived urgency

Individuals attach more importance to buying behavior when they expect to miss such an opportunity (Song et al., 2019). The time restriction of live-streaming shopping alerts

customers that they will not buy products once live streaming ends. The time unavailability of purchasing products urges customers to make a decision as soon as possible, which triggers urgency-related effects (Liu et al., 2022). Previous studies suggested that the perception of urgency prompts people to initiate tasks (Bayuk & Patrick, 2021; Teubner & Graul, 2020).

Based on these arguments, we conjecture that perceived urgency mediates the effect of time scarcity on impulsive buying. In general, individuals are inclined to consume more when time scarcity is high than when it is low in that the former situation releases a signal of urgency, which prompts consumers to act quickly and results in impulsive buying. Therefore, we propose the following hypothesis. Figure 1 shows the research framework.

> H4. Perceived urgency plays a mediating role in the effect of time scarcity on impulsive buying. That is, time scarcity is (a) positively associated with perceived urgency which (b), in turn, is positively related to impulsive buying

3. Research methods

We conducted two studies to test the proposed hypotheses. Study 1 tested the main effects of time scarcity and the moderating role of product types on perceived urgency, with Study 2 adjusting the manipulation of the independent variable based on Study 1 and examining the mediating role of perceived urgency.

3.1. Study 1: moderating role of product type

3.1.1. Experimental design and pretest
A 2 (time scarcity: high vs. low) × 2 (product type: utilitarian vs. hedonic) between factorial experiment was conducted. Time scarcity was manipulated by restricting the remaining time of live streaming. Referring to previous studies on time scarcity and considering the actual situation of LSE (Liu et al., 2022; Wu et al., 2021), we set 10 min after the start as the low level of time scarcity and 10 min before the end as the high level of time scarcity. The hedonic and utilitarian items were selected according to the definition of product type, and relevance to the live-streaming retail scenario. The perfume was identified as a hedonic product and the power bank was identified as a utilitarian product.
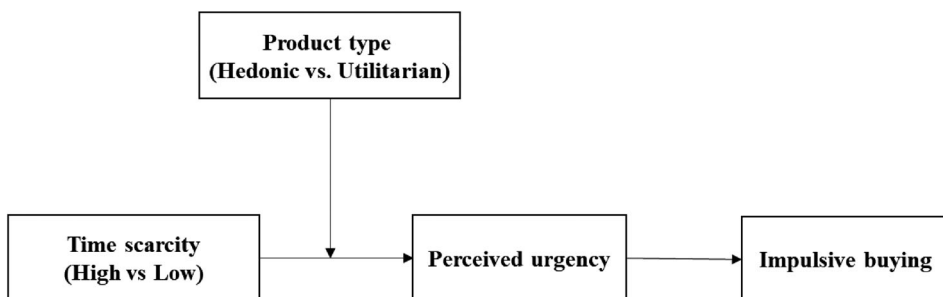

Figure 1. Conceptual framework.

Before the main experiment, a pretest was conducted with 100 participants to validate the suitability of the experimental setting. To verify the manipulation of perceptions of low and high time scarcity, all participants were required to assess the availability of time they perceived in their respective situations. The scale ranged from extremely insufficient (1) to extremely sufficient (7). The participants also responded to the three-item questions adapted from Li, Li, et al. (2021) to assess the hedonic and utilitarian levels of the two selected products.

Independent samples t-tests were conducted and showed that participants in the high-level group reported a higher perception of time scarcity than the low-level group ($M_{high} = 2.368$, $M_{low} = 4.723$, $p < 0.001$), indicating that the textual message of experimental design stimulated subjects' perceptions of time scarcity. Moreover, participants in the hedonic product group believed that the product is more hedonic than the utilitarian group ($M_{hedonic} = 2.356$, $M_{utilitarian} = 1.052$, $p < 0.001$). Thus, it is acceptable to use perfume for the hedonic product and a power bank for the utilitarian product in our main experiment.

3.1.2. Procedure and stimulus

According to the calculation with G*Power, about 180 individuals were appropriate to test the two-way between-subjects ANOVA effect. Therefore, a total of 200 subjects were recruited through the online platform Credamo.com (www.credamo.com), a professional research platform known worldwide for its data quality. Credamo adopted random sampling to help the client to recruit subjects (Chen, Zhang, et al., 2022). Then, each participant was randomly assigned to one of four experimental scenarios and received a small reward (about ¥ 5 each) after the experiment. In all four experimental scenarios, subjects were required to imagine that they were watching a live-streaming sale on an e-commerce platform.

To manipulate time scarcity, participants were required to imagine the following situation:

> You are watching a live-streaming shopping, and the entire live streaming is expected to last about 3 hours. Right now, it has been 10 minutes since the start of the broadcast (low-level time scarcity)/there are 10 minutes left until the end of the broadcast (high-level time scarcity).

To manipulate product type, subjects were instructed to imagine an anchor selling products on the live broadcast and then read either.

> The anchor is presenting a user-friendly power bank. You noticed that this power bank performed well. So you like it and want to own it right away. But remember that you have spent a great amount of money on live-streaming shopping, and it already exceeds a planned budget. You are pondering whether to buy it. (utilitarian product)
>
> or
>
> The anchor is presenting a very good-looking perfume. You are attracted by the perfume. So you like it and want to own it right away. But remember that you have spent a great amount of money on live-streaming shopping, and it already exceeds a planned budget. You are pondering whether to buy it. (hedonic product)

Since impulsive buying implies spending more than the originally planned budget (Liu et al., 2022), we set all groups to be given to the following text scenario: 'So you like it

and want to own it right away. But remember that you have spent a great amount of money on live-streaming shopping, and it already exceeds a planned budget. You are pondering whether to buy it'. After that, participants were asked to complete manipulation checks and measurements for the variables of interest, including questions about perceived urgency and impulsive buying.

Next, participants were asked to recall the specific time that anchors reported in the depicted scenario as an attention check, such as 'How long has the live streaming been going on' or 'How much time is left for the live streaming?' The scenario realism of the experimental design was assessed by subjects, followed by demographic questions and personal impulsiveness. Because all the questions were in Chinese, we followed the translation and back-translation process and asked two multilingual academics to translate the original English scales separately.

3.1.3. Measures

The manipulation of time scarcity was tested using the question, 'How available do you think the given live-streaming shopping time is?' The response ranged from 'extremely sufficient' to ' extremely insufficient' on a seven-point scale (Wu et al., 2021). Product type manipulation was checked with three-item questions corresponding to the pretest (Liu et al., 2022). Then, participants evaluated how likely they wanted to buy the product right now and how interested they would buy the product right now to measure impulsive buying (Liu et al., 2022). A three-item, seven-point bipolar scale ranging from 'strongly disagree' to 'strongly agree' was used to measure the perceptions of urgency (Aggarwal et al., 2011). Participants were asked to rate their personal impulsiveness on a three-item, seven-point scale adapted from Beatty and Ferell (Beatty & Ferrell, 1998). We also included demographic characteristics as several potential control variables. Finally, scenario realism was assessed by a single-item, seven-point scale on which participants were asked to indicate how realistic the scenario was (1 = unrealistic, 7 = realistic). All scale items of the variables are summarized in Table 1.

Table 1. Scale items.

Construct	Items	Source
Time scarcity manipulation	How available do you think the given live-streaming shopping time is? ('extremely sufficient' to 'extremely insufficient.')	(Wu et al., 2021)
Product type manipulation	Pt1: Useful-Fun Pt2: Functional-Enjoyable Pt3: Utilitarian-Hedonic	(Liu et al., 2022)
Perceived urgency	Pu1: If I don't buy it now, I may lose the opportunity to buy this product Pu2: There is a lot of competition from other people for buying this product Pu3: In order to possess this product, I feel that I should buy it soon	(Aggarwal et al., 2011)
Impulsive buying	Ib1: How likely you were to buy this skincare right now? (1 = very unlikely, 7 = very likely) Ib2: How interested you were to buy this skincare right now? (1 = not at all interested, 7 = very interested)	(Liu et al., 2022)
Personal impulsiveness	Pi1: When I go shopping during live streaming, I buy things that I had not intended to purchase. Pi2: I am a person who makes unplanned purchases Pi3: It is fun to buy spontaneously during live streaming.	(Beatty & Ferrell, 1998; Lo et al., 2022)

Several control variables were included to account for additional concerns. It is generally accepted in the literature that personal impulsiveness plays an important role in determining impulsive buying (Lo et al., 2022; Wang et al., 2022). Consumer experiences have also been found to influence impulse buying behavior, such as the frequency of shopping and length of the shopping experience (Li, Wang, et al., 2021; Wang et al., 2022). Thus, we considered consumers' prior experience with live-streaming shopping and also included demographic characteristics variables, such as age, gender, educational background, and monthly income.

3.1.4. Results

3.1.4.1. Sample characteristics.
The final sample contains 191 participants who passed the attention check and had live-streaming shopping experiences in the last month. Altogether, 113 participants were female, and 78 were male. Participants aged 25–34 years made up 69.1% of the total ($n = 132$). Most participants had a college degree or higher education (83.2%; $n = 159$), and 82.2% ($n = 157$) earned a monthly income of more than ¥3000. Among them, 78.5% ($n = 150$) had made live-streaming purchases more than twice in the month before participating in the study. Table 2 shows the demographic data of the participants.

3.1.4.2. Manipulation checks.
We adopted an independent sample t-test to verify the manipulation of time scarcity and product type. Participants in the high-level time scarcity

Table 2. Sample characteristics.

Variable	N	%
Gender		
Male	78	40.8
Female	113	59.2
Age		
18–24	43	22.5
25–34	109	57.1
35–44	23	12.0
45–54	13	6.8
55 or order	3	1.6
Education		
High school or less	8	4.2
Junior college	24	12.6
College	129	67.5
Graduate school	30	15.7
Monthly income		
Less than ¥ 1000	4	2.1
¥ 1000 to ¥ 2000	21	11.0
¥ 2001 to ¥ 3000	9	4.7
¥ 3001 to ¥ 5000	38	19.9
¥ 5001 or more	119	62.3
Length of time using live shopping		
Less than 1 year	11	5.8
1–2	53	27.7
2–3	55	28.8
More than 3 years	72	37.7
Frequency of live shopping in the last month		
1–2 times	61	31.9
3–4 times	62	32.4
More than 5 times	68	35.6

group responded to a higher level of time scarcity (M_{high} = 2.47, SD = 1.45) than subjects in the low-level condition (M_{low} = 4.62, SD = 1.97). And the difference was significant (t = 8.607，$p < 0.001$). Therefore, the manipulation for time scarcity worked as expected. The same t-test for product type revealed a significant difference between the utilitarian product group (M = 1.16, SD = 0.36) and the hedonic product group (M = 2.65, SD = 0.45, t = −25.50, $p < 0.001$). Thus, the manipulations were successful. The mean score for the realism of stimuli was 6.04 (t = 37.57, $p < 0.001$, compared to the scale midpoint), indicating that participants perceived the experimental scenario in live-streaming shopping as realistic.

3.1.4.3. Measurement model. We assessed the reliability and validity of the proposed research model. Table 3 shows the descriptive statistics, construct reliability, and correlations matrix. Composite reliability and Cronbach's alphas were above the threshold of 0.7, indicating that all items exhibited internal consistency (Fornell & Larcker, 1981). Indicator loadings (all values > 0.70) in Table 4 further show that all items loaded well on their intended constructs, suggesting the validity of all constructs (Chin, 1998). Convergent validity was suggested by average variance extracted (AVE) > 0.50 (Fornell & Larcker, 1981). For discriminant validity, the square roots of AVE values of all constructs are greater than the correlation coefficients between each pair of constructs (Fornell & Larcker, 1981). We also confirmed that all heterotrait-monotrait (HTMT) values were below the maximum conservative threshold value of 0.90, suggesting acceptable discriminant validity (Henseler et al., 2015).

3.1.4.4. Impulsive buying. One-way analysis of variance (ANOVA) showed that participants in a high-level time scarcity condition reported a significantly stronger intention to buy impulsively (F (1,180) = 10.996, $p < 0.001$). Specifically, participants in the high time-scarcity group were more likely to buy impulsively than those in the low time-scarcity group (M_{high} = 5.23, SD = 1.21 vs. M_{low} = 4.61, SD = 1.50), indicating support for H1. Furthermore, a two-way analysis of variance was conducted with impulsive buying as the dependent variable, time scarcity (−1 = low, 1 = high), and product type (−1 = utilitarian, 1 = hedonic) as the independent variables. The results suggested an insignificant interaction effect on impulsive buying ($F(1,190)$ = 4.408, $p > 0.05$), indicating that high-level time scarcity triggers consumers' impulsive buying regardless of the product type.

3.1.4.5. Perceived urgency. A 2 × 2 ANOVA on perceived urgency was performed to examine the joint effects of time scarcity and product type. The results showed a significant main effect of time scarcity ($F(1,180)$ = 23.96, $p < 0.001$). Specifically, the mean of perceived urgency under the high-level time scarcity condition (M = 4.81, SD = 0. 1.57) was

Table 3. Constructs descriptives, reliability measures, and correlations matrix.

|	Descriptives					Correlations Matrix		
	Mean	SD	Composite Reliability	Cronbach's Alpha	AVE	PU	IB	PI
PU	4.293	1.670	0.898	0.829	0.746	0.864		
IB	4.924	1.399	0.943	0.879	0.892	0.800	0.944	
PI	4.841	1.510	0.926	0.883	0.807	0.487	0.456	0.898

Notes: PU refers to Perceived urgency, IB refers to Impulsive Buying, PI refers to Personal impulsiveness.

Table 4. Result of factor analysis.

	Perceived urgency	Impulsive Buying	Personal impulsiveness
PU1	**0.870**	0.651	0.374
PU2	**0.925**	0.812	0.509
PU3	**0.792**	0.582	0.358
IB1	0.747	**0.943**	0.448
IB2	0.763	**0.945**	0.413
PI1	0.445	0.370	**0.891**
PI2	0.317	0.286	**0.859**
PI3	0.507	0.514	**0.943**

larger than under the low-level time scarcity condition ($M = 3.78$, SD = 1.16), indicating that H2 is supported.

Given that the interaction effect between time scarcity and product type on perceived urgency was significant ($F(1,180) = 5.837$, $p < 0.05$; see Figure 2), this provides supportive evidence for H3. We further examined the mean score between the interaction effect of time scarcity and product type on perceived urgency (H3a and H3b). In the low time scarcity condition, participants had higher perceived urgency for the hedonic product than for the utilitarian product ($M_{hedonic} = 4.114$, SD = 0.199 vs. $M_{utilitarian} = 3.486$, SD = 0.200; $F(1, 180) = 4.9422$, $p < 0.05$). Therefore, H3a was supported. In the high time scarcity condition, the mean of perceived urgency reported by the utilitarian group is higher than that of the hedonic group ($M_{utilitarian} = 4.948$, SD = 0.196 vs. $M_{hedonic} = 4.621$, SD = 0.198), but
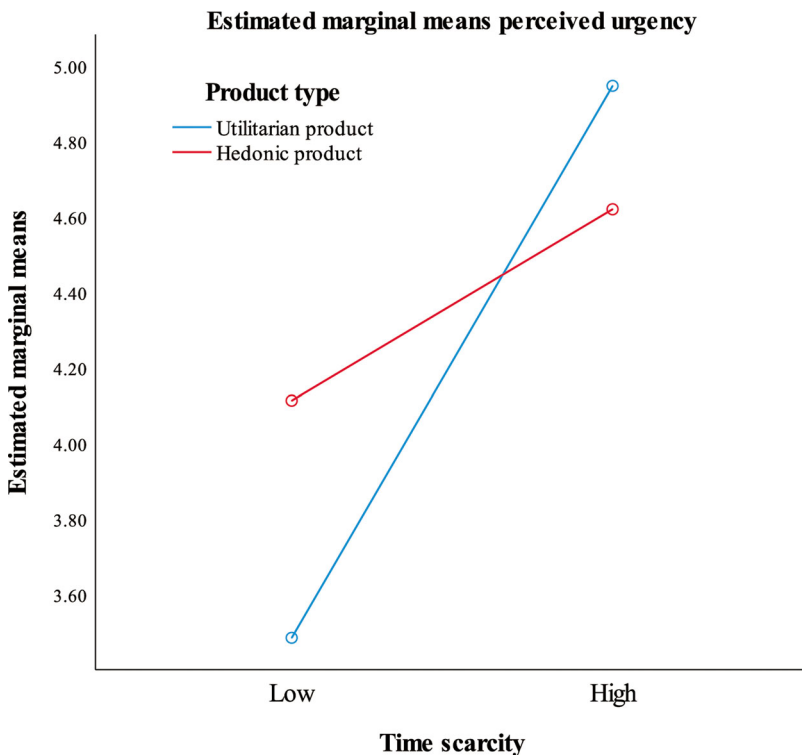
Figure 2. Mean Plot of perceived urgency.

no statistically significant difference between the means of these two groups ($F(1, 180) =$ 1.381, $p > 0.05$). Thus, H3b was not supported.

3.1.5. Discussion of Study 1

The results of Study 1 confirmed H1, H2, and H3. The time scarcity feature of LSE positively affects impulsive buying and perceived urgency. Thus, it provides a marketing strategy for anchors to facilitate impulsive buying by consumers. The results also indicate the interaction between time scarcity and product types on perceived urgency. Specifically, the results suggested that hedonic products were more effective in eliciting consumers' perceived urgency than utilitarian products when time scarcity was low. However, at high time scarcity, utilitarian products were more effective in stimulating the perception of urgency, although the difference is not significant. In addition, to increase the robustness and validity of this research, we test the mediation effect of perceived urgency between time scarcity and impulsive buying.

3.2. Study 2: mediating role of perceived urgency

3.2.1. Experimental design and pretest

In this study, we adopted a 2 (time scarcity: high vs. low) × 2 (product type: utilitarian vs. hedonic) between factorial experiment design to examine the mediation effect of perceived urgency. To avoid using the same time setting as stimuli, which may bias our findings with unexpected noises, we use 20 min after the start of live streaming as low-level time scarcity and 20 min before the end of live streaming as high-level time scarcity. In addition, we reselect skincare as the hedonic product and desk lamps as the utilitarian product to improve the validity of the results. Then, we conduct a pretest with 100 participants to check the suitability of the experimental design. Next, participants are required to complete the same time scarcity and product type manipulation questions as in Study 1.

We run independent samples t-tests to examine the manipulation of independent variables. Results showed that participants in the high-level group reported higher perceptions of time scarcity than the low-level group ($M_{high} = 2.301$, $M_{low} = 4.810$, $p < 0.001$), and the group with hedonic products suggested the product was more hedonic than the group with utilitarian products ($M_{hedonic} = 2.452$, $M_{utilitarian} = 1.286$, $p < 0.001$). Therefore, the experimental design of time setting and product selection is acceptable.

3.2.2. Procedure and stimulus

Through the same G*Power test as in Study 1, we recruited 200 subjects from the online sample collection platform Credamo (www.credamo.com) to participate in this study. All participants were randomly assigned to scenarios and received a small reward (about ¥ 5 each) after the experiment.

The manipulation of time scarcity was the same as in Study 1. Participants were instructed to imagine an anchor selling products on the live broadcast to manipulate the product type and read either,

> The anchor is presenting a user-friendly desk lamp. You noticed that this desk lamp performed well. You like it and want to own it right away. But remember that you have spent

a great amount of money on live-streaming shopping, and it already exceeds a planned budget. You are pondering whether to buy it. (utilitarian product)

or

The anchor is presenting a very good-looking skin care product. You are attracted by the skin care product. So you like it and want to own it right away. But remember that you spent a great amount of money on live-streaming shopping, and it already exceeds a planned budget. You are pondering whether to buy it. (hedonic product)

Afterward, participants were asked to complete manipulation checks and measures for the variables of interest, including questions on perceived urgency and impulsive buying. Next, they were required to answer the attention check question, followed by a scenario realism question, demographic questions, and personal impulsiveness (see Table 2 for all scale items).

3.2.3. Results

3.2.3.1. Sample characteristics. The final sample included 194 participants. Among them, 121 participants were female, and 73 were male. Participants aged 25–34 years made up 56.2% of the total ($n = 109$). Most participants had a college degree or higher education (85.6%; $n = 166$), and 81.4% ($n = 158$) earned a monthly income of more than ¥3000. In addition, 67.0% ($n = 130$) of participants had more than twice live shopping experiences in the month before participating in the study.

3.2.3.2. Manipulation checks. We performed an independent sample t-test to examine the manipulation of time scarcity and product type. Subjects under the high time scarcity condition reported significantly lower mean time scarcity than subjects with low time scarcity ($M_{high} = 3.23$, SD = 1.97 vs. $M_{low} = 5.01$, SD = 1.79; $p < 0.001$). Thus, the manipulation of time scarcity was successful. The same t-test on product type revealed a significant difference between the utilitarian and hedonic products groups ($M_{hedonic} = 2.633$, SD = 0.523 vs. $M_{utilitarian} = 1.300$, SD = 0.610; $p < 0.001$). Hence, product type manipulation was a success. The result of the scenario realism test is also as expected ($M = 6.05$, $t = 35.72$, $p < 0.001$).

3.2.3.3. Impulsive buying. We conducted an independent sample t-test to explore the effects of time scarcity on impulsive buying. The results showed that participants in the high-level time scarcity group reported a significantly stronger intention to buy impulsively than participants in the low-level time scarcity group ($M_{high} = 5.23$, SD = 1.21 vs. $M_{low} = 4.61$, SD = 1.50; $p < 0.01$), supporting H1. In addition, the results of a two-way ANOVA indicated that the interaction effect of time scarcity and product type on impulsive buying was insignificant ($F(1,183) = 3.090$, $p > 0.05$), suggesting that the effect of time scarcity on impulsive buying is not interfered by product type.

3.2.3.4. Perceived urgency. The same two-way ANOVA test was conducted to investigate the effects of time scarcity on perceived urgency. The results suggested a significant main effect of time scarcity ($F(1,183) = 14.324$, $p < 0.001$). Specifically, the mean of impulsive buying under the high time scarcity condition ($M = 5.23$, SD = 1.34) was larger than under the low time scarcity condition ($M = 4.15$, SD = 1.68), indicating support for H2.

3.2.3.5. Moderated mediation. To test Hypothesis 4, we rand a moderated mediation model using bootstrapping approach (Hayes, 2018) based on 5000 samples. Specifically, we coded −1 for low-level time scarcity and utilitarian products and 1 for high-level time scarcity and hedonic products. Time scarcity was entered as the independent variable, perceived urgency as the mediator, product type as the moderator, impulsive buying as the dependent variable, and demographic characteristics, live-streaming shopping experience, and personal impulsiveness as covariates variables.

The moderated mediation index for the conditional indirect effect of time scarcity on impulsive buying through perceived urgency was significant (Index = −0.267, SE = 0.128, 95%CI[−0.545, −0.045]), supporting the existence of moderated mediation. Specifically, for the utilitarian product, the mediating effect of perceived urgency was significant (Indirect: Effect = 0.439, SE = 0.101, 95%CI = [0.258, 0.650]), and perceived urgency played a positive mediating role between time scarcity and impulsive buying. The direct effect was not significant (Direct: Effect = −0.027, SE = 0.095, 95% CI = [−0.214, 0.160]), indicating the full mediating role of perceived urgency. For the hedonic product, the mediation effect of perceived urgency was insignificant (Indirect: Effect = 0.154, SE = 0.089, 95%CI = [−0.017, 0.332]), and the direct effect was also not significant. Thus, as shown in Tables 5 and 6, these results offer partial support for H4.

3.2.4. Discussion of Study 2

We modified the manipulation of the independent variable and repeat the process of Study 1 to test the mediation role of perceived urgency. The result suggested that the effects of time scarcity on impulsive buying and perceived urgency remained robust, although the setting of live-streaming time conditions and test products changed. Furthermore, perceived urgency acted as the underlying mechanism behind the effect of time scarcity on impulsive buying, but product types moderated the mediation effects. Specifically, the perceived urgency mediated the effects of time scarcity on impulsive buying only for utilitarian (vs. hedonic) products.

5. Discussion and conclusion

E-retailers are increasingly turning to live streaming to sell products on e-commerce platforms. Live-streaming shopping has become an important channel among consumers to purchase online. Based on the reactance theory, this study focused on the limited-time feature of LSE and investigated how LSE triggers consumers' impulsive buying. Two experiments were conducted to examine the hypotheses and the following conclusions were drawn.

Table 5. Conditional direct effect of perceived urgency.

	Product Type (−SD/+SD)	Effect	SE	t	p	LLCI	ULCI
Time scarcity→Impulsive buying	−0.995 (utilitarian product)	−0.027	0.095	−0.283	0.777	−0.214	0.160
	1.005 (hedonic product)	0.014	0.089	0.154	0.878	−0.162	0.189

Table 6. Conditional indirect effect of perceived urgency.

	Product Type (−SD/+SD)	Effect	BootSE	BootLLCI	BootULCI
Time scarcity→perceived urgency→impulsive buying	−0.995 (utilitarian product)	0.439	0.101	0.258	0.650
	1.005 (hedonic product)	0.152	0.089	−0.017	0.332

First, our findings suggest that time scarcity is positively associated with impulsive buying in the LSE context, regardless of product type. Although previous studies have found that scarcity persuasion influences impulse purchases (Lo et al., 2022), our findings further suggest that anchors could utilize the time scarcity feature of LSE to urge consumers to buy. Moreover, we found that the direct effect of time scarcity on impulse purchases is independent of product type. In addition, we demonstrated that time scarcity influenced customers' perceived urgency. This result is consistent with Teubner and Graul (2020) who found that scarcity in e-commerce is positively associated with perceived urgency.

Second, we demonstrated that the perceived urgency for customers in the LSE context resulted from the time constraint of live-streaming shopping, but was also moderated by product types. Specifically, we found that the perceived urgency was stronger for hedonic products than for utilitarian products when time scarcity was low. However, utilitarian products elicited higher perceived urgency than hedonic products when time scarcity was high, although this difference was not statistically significant. This result extends the findings of Zhang et al. (2020) who found product types (search products vs. experience products) moderate the effect of the LSE strategy.

Third, we uncovered the underlying mechanisms behind the relationship between the time scarcity feature of LSE and impulsive buying from the perspective of consumers' perceived urgency. Our findings suggested that perceived urgency fully mediates the effects of time scarcity on impulsive buying of utilitarian products, whereas the mediation effects disappear for hedonic products. We speculate that the gap in mediating effect lies in the difference in information processing for hedonic and utilitarian product consumption. Customers generally adopt cognitive information processing to make decisions for utilitarian consumption but affective processing for hedonic consumption (Klein & Melnyk, 2016; Liu et al., 2022). Time scarcity induces a sense of urgency and constrains consumers to give up cognitive information processing to buy impulsively.

5.1. Theoretical implications

Our findings provide theoretical implications on several fronts. First, this study contributes to the LSE literature by investigating the role of the time scarcity feature on consumers' impulsive buying. Although previous studies have identified the key factors of price perception (Lo et al., 2022), parasocial interaction (Wang et al., 2022), and information quality (Xu et al., 2020), few studies have paid sufficient attention to the time scarcity feature of LSE. Live-streaming shopping is typically characterized by limited time. Our study extends the theoretical understanding of customers' impulsive buying behavior on LSE by examining the effects of time scarcity. Our results provide an explanation for why LSE is increasingly becoming an effective marketing strategy from the perspective of time scarcity.

Second, our study contributes to the scarcity literature by suggesting that the effect of time scarcity on impulsive buying is independent of product types. However, the effect of time scarcity on perceived urgency depends on the type of product. Anchors in live streaming have to present hundreds of products within a limited time and therefore they need to arrange the sales sequence across the product (Sun et al., 2019; Wang et al., 2022). This study takes product type as a novel moderator to examine the effect on impulsive buying and customer perception. Our findings suggested that the product types only moderate the effect on perceived urgency but did not influence the relationship between time scarcity and impulsive buying in the LSE context. This study extends the understanding of product types into live-streaming e-commerce.

Third, we combined the psychological reactance theory and perceived urgency to illustrate the relationship between time scarcity and customers' online impulse purchases. Previous studies have suggested that limited time increases individuals' perceived arousal (Wu et al., 2021), decreases decision-making credibility, and affects customers' overconfidence (Li, Wang, et al., 2021). Moreover, urgency is a key element influencing customers' online purchases (Teubner & Graul, 2020). Our findings extend psychological reactance theory to the LSE environment and provide a theoretical understanding of psychological reactance by confirming that the effect of time resource scarcity on customers' behavior was mediated by perceived urgency. In addition, this study provides the boundary condition for psychological reactance by integrating the product types, indicating that the mediating role of perceived urgency is effective only for utilitarian products.

5.2. Practical implications

The current study also provides valuable implications for practitioners. First, anchors could take advantage of LSE's time scarcity to increase their sales. Our findings suggested that time scarcity positively influences consumers' impulsive buying behavior. Thus, anchors in live streaming could adopt time scarcity as a marketing method to increase product sales. For instance, during the live streaming, the anchor could constantly broadcast the remaining time to create a sense of time scarcity among consumers and urge them to make purchase decisions. Anchors could also guide customers to pay attention to the limited time resources of live-streaming shopping by counting down the time to increase product sales (Chou, 2019). In addition, anchors could leverage the effects of time scarcity to schedule products. For example, anchors could have high-value products sold in the second half of the live streaming when the time scarcity is high.

Second, this study demonstrated that product types moderate the effect of time scarcity on customers' perceived urgency. The results show hedonic products are perceived as more urgent by customers than utilitarian products when time scarcity is low. Therefore, anchors could sell products with hedonic (as opposed to utilitarian) properties at the beginning of LSE to stimulate perceptions of urgency. Moreover, by combining the findings on the mediation role of perceived urgency, anchors can promote products with utilitarian attributes at the end of live streaming when consumers' perceived urgency is high level. Considering that product attributes could also be manipulated by the product description (Liu et al., 2022), anchors could focus on certain aspects of the product to manipulate the attributes based on different conditions of time scarcity to trigger consumers' impulsive buying.

Third, consumers should focus on the time scarcity feature of live-streaming shopping and avoid impulsive buying. In particular, customers should alert themselves not to be tempted by the time scarcity cues to make impulsive purchases. In addition, based on the mediation roles of perceived urgency, customers should take action to build up individual control over this emotion when browsing for utilitarian products in a live-streaming shopping context.

5.3. Limitations and future studies

Our study has certain limitations but opens new windows for future extensions. First, the experiment participants were all from a single country, which restricts the generalizability of the results to other countries due to social-cultural differences (Leidner & Kayworth, 2006). Therefore, further-related research could emphasize generalizing the result globally where live streaming technology and culture differ from this scenario. Second, we mainly adopted a scenario-based experiment, which may preclude the external validity of the results. Hence, further studies should be conducted in the field or secondary data could be exploited to test the proposed model. Third, considering that the downside of scarcity appeals has received more attention (Biraglia et al., 2021), further investigation should be conducted to determine the impact of scarcity appeals on LSE purchase behavior when consumers do not get the product associated with scarcity appeals. Finally, previous studies have shown that live-streaming platforms are associated with impulsive buying. Thus, a future research direction is to explore how different live-streaming platforms influence impulsive buying in LSE.

Disclosure statement

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