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The Effects of Live Platform Exterior Design on Sustainable Impulse Buying: Exploring the Mechanisms of Self-Efficacy and Psychological Ownership

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Abstract: The sensory upgrading facilitated by live platforms, such as YouTube Live, Twitch, and Periscope, can facilitate much better interactions and understanding between a product, its brand, and the user. The question of how to enhance sustainable marketing effects using exterior design is currently a major topic in the live streaming marketing sector. The effect of the exterior design of a live platform on the impulse purchases of its consumers has rarely been discussed by academic research. Accordingly, based on the theory of self-determination, this study explored the direct effects of exterior design, self-efficacy, psychological ownership, and impulse buying by using multiple linear regression, and examined the indirect effects of these variables using the structural equation model. In this study, 534 samples were collected from live consumers, and our hypotheses were verified by employing hierarchical regression. As revealed from the results obtained, the self-efficacy and psychological ownership exhibited by consumers exerted synchronous and chain mediating effects on the relationships between the exterior design of the platform and consumer impulse buying. To enhance this marketing effect, live platforms should focus on designing pleasant exterior clues, creating a better psychological atmosphere, and the enhancement of consumers' self-efficacy.

Keywords: exterior design; impulse buying; self-efficacy; psychological ownership; live platform

1. Introduction

Sustainable e-commerce marketing not only requires companies to sell green products—that is, products that meet the requirements of an ecological environment and resource-saving development—but also concerns social and business sustainability when conducting e-commerce activities. Such services should meet the individual needs of consumers, help companies improve the conversion rate of their marketing activities, avoid unplanned production and resource wastage, improve the consumption experience of users, and build a sustainable e-commerce eco-environment [1,2].

As a new social interaction platform, live streaming has developed rapidly since 2015, and provides a method to promote online sustainable product consumption [3]. Specifically, as live streaming carriers, live platforms such as YouTube Live, Twitch, and Periscope consist of a streamer, a scene and substance, and public audio and video content, which draw an audience's attention through

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real-time games, special events, and behind-the-scenes tours [4,5]. The live streamer, acting as the content creator of the streaming platform, is capable of uploading real-time video and audio (e.g., video games, talent shows, and daily life records) to satisfy the diversified needs of users [6]. In other words, flattened, equal, and real-time communication can be achieved between users and the live streamer through the live platform, as well as among users, thereby narrowing the distance between companies and individuals.

The growing popularity of live platforms has also had certain effects on the existing marketing methods and user buying behavior of companies [7]. Data show that in 2017, 48 percent of internet users in the USA watched live streaming at least once a week [8]. As suggested by a report from the China Internet Information Center, the number of live streaming users in mainland China reached a total of 433 million in June 2019, making up 50.7% of China's entire internet population. With such a considerable number of users, live platforms have started reshaping marketing channels and enhancing marketing effects. The global live streaming market was predicted to expand from US\$30.29 billion in 2016 to US\$70.05 billion by 2021 [9]. During the "618" period in 2019, Taobao's live streaming led to commodity sales worth CNY13 billion. Compared with the conventional marketing channels, live platforms have a more thorough impact on consumers' purchasing behavior. Thus, since live streaming is such a novel and powerful marketing tool, the questions of whether consumers engage in impulse buying after being exposed to live streaming, and how an exterior design presented in a live streaming scenario impacts impulse buying should be answered.

Currently, due to the progressively fierce competition in the retail market, companies have been attempting to make their products unique in terms of user friendliness, convenience, and pricing, while creating a pleasant and exciting shopping atmosphere for consumers [10–12]. Exterior design is considered as the development of designs that are intended to be aesthetically pleasing to customers, which has become a vital part of atmosphere design [13]. Impulse buying refers to a sudden, irresistible, and hedonic complex buying process in which all relevant information and choices are not rigorously considered, while buying decisions are made quickly [14,15]. As a shared phenomenon in marketing, impulse buying behavior has been studied extensively in the conventional e-commerce environment, whereas less sufficient attention has been focused on the field of social commerce, particularly in the community marketing environment [16].

Self-efficacy refers to the belief that a person can organize and execute specific action processes, which is critical for users who have not yet nurtured the skills required to adopt social media [17]. Moreover, following the increased prevalence of psychological ownership research in organizational behavior in recent years, researchers have progressively begun to pay attention to customer psychological ownership. Some studies have demonstrated the role of customer psychological ownership in customer citizenship behavior, perceived value, and word-of-mouth communication [18–20]. Accordingly, this study focuses on the deep-seated mechanism of exterior design in impulse buying and delves into the relationships between exterior design, self-efficacy, psychological ownership, and impulse buying from live platforms.

Compared with the booming field of live streaming in practice, we have several concerns about academia's approach to live streaming. The first concern is regarding the low level of attention currently paid to live streaming by academia. Under the banners of digital journalism [21], technical infrastructure and partnership schemes [22], and other fields, more academic studies should be conducted on live marketing. The second concern is that the few studies that have been conducted have taken a relatively decentralized and independent approach. In other words, most of the studies have examined exterior design, self-efficacy, psychological ownership, and impulse buying separately, whereas few have cross-integrated these mutually relevant concepts [13,23]. Whether the exterior design of live scenes can directly or indirectly act on impulse buying via self-efficacy and psychological ownership, respectively, requires further in depth studies. Hence, in accordance with self-determination theory, this study delves into the intrinsic mechanism of exterior design in impulse buying in live streaming scenarios, namely, whether the exterior design of live platform can positively affect consumers' impulse purchase,

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whether psychological ownership and purchase impulses can play a synchronous and chain mediating role in the direct effect of the live platform exterior design and on further consumers' impulse purchase, and whether the chain mediating effect of psychological ownership and purchase impulse is different from the individual mediating effect. The research conclusion has potential implications to improve the content quality and competitiveness of live platforms and to enhance the effect of live streaming marketing. This research will help open the "black box" of consumer impulse buying and further increase consumer buying behavior studies.

The rest of this study is organized as follows. In Section 2, the self-determination theory and relevant variables are briefly reviewed. In Section 3, we introduce the research hypothesis development in detail. Section 4 provides the details of our research methodology. An analysis of the empirical results is presented in Section 5. In Section 6, our conclusions, the limitations of this study, and directions for future studies are drawn.

2. Theoretical Background and Hypotheses

2.1. Self-determination Theory

Self-determination theory (SDT), as one of the most extensively applied motivation theories [24], discusses the degree of self-motivation or self-satisfaction of individual behaviors, builds a motivation framework to understand how to motivate and regulate people's behaviors, and discusses the significance of internal resources of human evolution for individual development and behavioral self-discipline. In accordance with the self-determination theory, if people's basic needs are satisfied, they are more inclined to pursue a higher level of performance, health, and happiness. The basic needs primarily consist of autonomy, competence, and relationships. The need for autonomy refers to a willingness or choice for certain behaviors or experiences. Competency requires a link to self-efficacy or confidence in a certain behavior or goal. The relationship need refers to a meaningful way to connect with others, care for others, be cared for by others, and be accepted by others.

The major concern of this theory is the difference between the internal motivation and external motivation. In the scenario of internal motivation, one is motivated to do something when it is intrinsically interesting or enjoyable [25], namely, to do something to satisfy the need of the activity itself. External motivation can vary considerably in terms of autonomy; for instance, it may bring results different from the activity itself (e.g., obtaining rewards or avoiding punishment), depending on the degree to which a particular behavior is internalized and integrated [26].

Thus, when the live platform interacts with consumers in any form, how to stimulate the internal motivation of consumers and promote the internalization of external motivation by regulating the external environment is a question that requires in-depth thinking. The exterior design of living platforms can satisfy the basic psychological needs of consumers at various levels and stimulate the formation of internal motivation and internalization of external motivation of consumers, as an attempt to stimulate their interest in participating in activities and maintain the relationships with companies.

2.2. Impulse Buying

Impulse buying refers to a decision-making style characterized by a spontaneous, irresistible, powerful, sustained, and immediate desire to buy products [27,28]. In the 1940s, impulse buying was formally considered as an object of academic research. By surveying over 50 types of products, advertising agencies studied DuPont's consumer buying habits, and impulse buying research began to sprout. Stern [29] upheld impulse buying for the first time. He split it into four categories (reminder, inducement, planning, and purely impulse buying). Since then, academic studies on impulse consumption behavior have increased. Consumers are more concerned about the immediate satisfaction of buying products; they are willing to accept impulse purchases without considering alternatives or future inferences. Subsequent research reported that, apart from consumer characteristics and product characteristics, adding consideration of the emotional state enhanced the interpretation for

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impulse buying. When environmental stimulus affects impulse buying, the cognitive and emotional responses consumers may experience act as the potential inducers [30] and as the essence of impulse buying [31,32]. Fueled by the advancement of communication and information technology, consumers are more encouraged to have impulse access to services and products [33] and to simplify their payment and purchase processes. When consumers suddenly feel the impulse to buy a product when they are shopping, unexpected purchases will occur; when the purchase is not involved in the assessment, such impulse purchases cannot be reflected [27].

2.3. Exterior Design

In today's era, shopping is not just a synonym for product purchase [34]. Consumers are more willing to share their feelings with stores that feel more attractive, rather than other stores that make the consumer feel irritated or even angry [35]. Accordingly, businesses usually invest considerable resources in creating a satisfactory atmosphere [34]. In 1973, the distinguished marketing scholar Kotler proposed creating a specific buyer effect by consciously designing spaces, especially shopping environments, capable of exerting emotional effects and improving the consumer buying rate. The offline environment primarily focused on social clues, design clues, and environmental clues [11].

Although the clues of online and offline marketing are significantly different, the concept of offline atmosphere clues is generally extended to both online and offline marketing [13,36]. Eroglu et al. [37] first split this into high and low task-related clues. High task-related clues refer to the words and patterns on the website that can help consumers complete their buying tasks smoothly (e.g., descriptions of commodities, prices, logistics, and refund policies). Low task-related clues refer to website information not relevant to the completion of buying tasks (e.g., color, font, animation, games, and music). However, with the rise in available bandwidth, designers must consider whether non-visual cues (e.g., video or music) are also a crucial factor in e-store design [13]. The attraction of a design primarily originates from its visual elements; the color used and the overall layout are the most apparent [38]. For instance, Liu et al. [39] took the product availability, usability, and visual appeal as vital measurement indicators.

2.4. Self-Efficacy

Self-efficacy refers to one of the vital concepts of individual cognition in the theory of social cognition. Bandura [40] highlighted that self-efficacy is an individual's confidence in whether they can use their skills to complete their work. Bandura et al. [41] reported that people with more confidence in their ability to act had higher expectations of results, and that positive expectations enhanced individual behaviors. Studies suggested that self-efficacy is associated with different contexts and concepts. Self-efficacy also generates various other types of self-efficacy, which should be determined by specific field correlation measurements rather than general measurements [42]. Accordingly, a specific sense of self-efficacy is demonstrated by understanding individual behaviors and adopting novel technologies [42,43]. Self-efficacy suggests that as social media users gain more self-efficacy, they are inclined to have higher expectations for specific results. Hsu et al. [44] reported that users' self-efficacy of knowledge sharing positively affected users' expectation recognition, indicating that internet users will progressively master complex tasks. Self-efficacy is not only associated with the skills one masters but also with one's confidence in using them [45,46]. Overall, users with low levels of self-efficacy are less likely to use and engage in social media-related behaviors and activities than people with higher levels of self-efficacy.

2.5. Psychological Ownership

Psychological ownership refers to a state of mind in which an individual feels that the goal of ownership or part of such a goal is theirs: "mine" [47]. Individuals may develop a psychological sense of belonging to various objects, which can be physical or immaterial [48]. Psychological ownership affects the individual's consciousness, thoughts, and belief in cognition and emotion (e.g., their property

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and its relevant personal significance) [49]. Psychological ownership is comparable to a sense of possession, allowing people to see the goal as an extension of themselves; it affects people's motivation and attitude and ultimately leads to a behavior. In information systems literature, scholars reported that the state of psychological ownership stimulated a person's acceptance of the system [50], commitment to playing online games [51], and intention to increase their participation in the virtual world. In virtual collaborative circumstances (e.g., virtual communities), participants' psychological ownership is of critical significance as it noticeably enhances their relationships with communities [52–54].

3. Research Model and Hypothesis Development

3.1. Live Platform Exterior Design and Impulse Buying

The presentation of live platform information is complicated, and users mainly rely on their eyes to obtain visual information to complete the platform interface search process. The better the entertainment of the platform interface, the better the user experience will be [55]. Therefore, a considerable number of marketers influence consumers' perception, judgment, and behavior through sensory marketing [56]. In other words, sensory experience clues are used to enhance the visual attraction to consumers, stimulate individuals to perceive the results of specific situations or behaviors in advance, attract consumers to browse, help consumers search for effective information, and stimulate consumers' impulse buying behavior [57,58].

Existing studies highlighted that store climate is a paramount factor affecting customer behavior, and has aroused growing attention from academia and industry over the past few years [59]. The user-friendly exterior design of live platforms (e.g., interface tone matching and pattern selection) provides consumers with a good use experience. In retail design, the use of color and light acts as a crucial design technology to attract customers and create more market opportunities [60]. High-quality photos and videos increase the attractiveness of websites, while helping consumers browse, evaluate, compare, and choose products [61]. Chen et al. [33] highlighted that social network environmental stimulus (the information quality of text advertisements, number of "likes" of users labeled on posts), and individual differences (impulse traits) remarkably impacted the impulse purchases of consumers. Based on the aforementioned analysis, we proposed hypothesis H1.

Hypothesis H1. *The exterior design of a live platform has a positive impact on impulse buying.*

3.2. The Mediating Effect of Self-Efficacy

Self-efficacy refers to people's confidence or belief in their ability to fulfill specific behavioral goals. In accordance with SDT, based on the differences in the degree of internalization of external rules, the types of motivation are divided into de-motivation, external motivation, and internal motivation. Internal motivation refers to a certain behavioral state generated for the pleasure of things themselves. Self-efficacy, as an internal motivation, can influence individual behavior to produce a high degree of autonomy. Under the influence of the exterior design of a live streaming platform, users will be interested in the content or products of live broadcasting based on their own preferences, thus influencing their behaviors autonomously. According to Bright et al. [17], the higher the exposure rate of social media sites, the stronger the users' self-efficacy.

In addition, the more self-efficacy a user feels, the more likely he or she will be to engage in social media. The exterior design of the live platform will also affect a consumer's self-efficacy to some extent. Furthermore, self-efficacy affects people's behavioral choices. People are inclined to perform what they know they can and avoid tasks beyond their ability. Purchase intention refers to the willingness of live streaming users to purchase virtual goods and services (products) while watching live streaming. If live-streaming users attempt to win the favor of anchors and other users on the live-streaming platform, they may be then buy additional supplements and items. Accordingly, self-efficacy is one of the ways

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to fulfill this goal [46]. Studies demonstrated that network and computer self-efficacy were important indicators in the prediction of online shopping [62]. In other words, when consumers browse online, self-efficacy can be easily generated in the face of the goods they want, and the stronger and harder this feeling, the more likely consumers will be to make impulse purchases. Given the presented analysis, we proposed the following hypotheses.

Hypothesis H2. The exterior design of a live platform is positively associated with self-efficacy.

Hypothesis H3. Self-efficacy has a positive impact on impulse buying.

Hypothesis H4. *Self-efficacy plays a mediating role in the relationships between the exterior design of a live platform and impulse buying.*

3.3. The Mediating Role of Psychological Ownership

Psychological ownership was initially proposed by scholars in relation to employee stock ownership plans (ESOP). Subsequently, it was gradually applied to the field of consumer behavior. This concept extends to the strong sense of belonging and possession of customers for companies or their products. It substantially reflects these emotional relationships. Considerable studies reported that perceived efficacy, self-identity, and belonging are critical antecedent variables to forming psychological ownership [54,63,64]. SDT also stresses that human beings have three types of innate basic psychological needs, namely, autonomous needs, competency needs, and belonging needs [26].

The satisfaction of these three basic needs is determined by the "nutrients" provided by the external environment. Researchers verified that the properties of goods led to various degrees of psychological ownership; for instance, psychological framework and representation induced consumers to form psychological distance from objects [65] and a gradual sense of detachment [66]. Thus, the exterior design of a live platform can satisfy users' independent needs, competence needs, and ownership needs through pleasant color collocation and pattern selection, thereby impacting users' psychological ownership. However, consumers who have gained more psychological ownership can further experience the intimate relationships with the potential product, which can generate purchasing behaviors [67]. Given the presented analysis, the following hypotheses are proposed.

Hypothesis H5. The exterior design of a live platform is positively associated with psychological ownership.

Hypothesis H6. *Psychological ownership has a positive impact on impulse buying.*

Hypothesis H7. Psychological ownership plays a mediating role in the relationships between the exterior design of a live platform and impulse buying.

3.4. The Chain Mediating Role of Self-Efficacy and Psychological Ownership

Studies have shown that individuals with a strong sense of self-efficacy tend to attribute success to their own abilities and efforts. In turn, this way of thinking encourages people to become more motivated, improves their behavioral skill development, and contributes to the success of the activity [68]. Psychological ownership is closely related to a person's self-concept [69], which reflects the relationship between an individual and their possessions. In this relationship, the individual's self-concept relates to their belongings, and these belongings will become part of the expanded self of the individual [70]. Therefore, in order to maintain a good identity, people tend to invest in their possessions. People with higher psychological ownership are more likely to experience a sense of responsibility to care for their belongings, and they feel the need to care about them [71]. We can infer that in order to gain a sense of efficacy, individuals will take the initiative to control the surrounding

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things, and then have a sense of ownership. As an individual's desire to control things increases, so does their sense of ownership. In other words, a customer's sense of efficacy will make them want to own and control the enterprise brand, and this will become stronger with the enhancement of the customer's sense of self-efficacy.

This study further proposed that self-efficacy and psychological ownership exert a chain mediating effect between the exterior design of a live streaming platform and impulse buying. SDT suggests that the need to establish a relationship of mutual respect and connection with others can fulfill the goal of keeping the individual abreast with the social environment. According to several studies, the impulsiveness of live platform consumers reveals that they are primarily determined by consumers' feelings. Live platform design, as the external environment factor, can then bring consumers different feelings and experiences and self-efficacy. Thus, the relationship between consumers and the platform is established to further increase the psychological ownership of consumers. As a result, a complex set of psychosocial changes take place, such as word-of-mouth recommendations, product experiences, and their willingness to "take care" of the product, which in turn affects consumers' impulse buying behavior. Given the presented analysis, we proposed these hypotheses.

Hypothesis H8. *Self-efficacy has a positive impact on psychological ownership.*

Hypothesis H9. *Self-efficacy and psychological ownership exert a chain mediating effect between the exterior design of a live platform and impulse buying.*

Given the previous hypothesis, this study built a theoretical model of the chain mediation between self-efficacy and psychological ownership between the exterior design of a live platform and impulse buying (Figure 1).

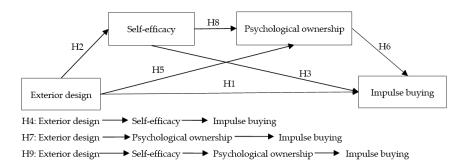


Figure 1. Conceptual model of the concepts used in our hypotheses.

4. Methods

4.1. Measures

- (1) Exterior design. The design subscale developed by Floh and Madlberger [13] covered three items (e.g., "The live platform is visually pleasing"). The Cronbach's alpha coefficient reached 0.802.
- (2) Self-efficacy. The single-dimensional scale developed by Bhattacherjee et al. [72] covered four items (e.g., "I can use the live platform independently for leisure/study/work"). The Cronbach's alpha coefficient reached 0.860.
- (3) Psychological ownership. Using the single-dimensional scale established by Van Dyne and Pierce [47], there were four items (e.g., "I feel a strong intimacy using this live platform"). The Cronbach's alpha coefficient was 0.883.
- (4) Impulse buying. The single dimension scale formulated by Jones et al. [32] consisted of four items (e.g., "I bought products (props) or rewards that I was not inclined to buy before"). The Cronbach's alpha coefficient was 0.823.

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(5) Control variables. This study used the individual characteristic variables that may affect the exterior design, self-efficacy, psychological ownership, and impulse buying of the live platform, and the differences of gender, age, marital status, education level, and monthly salary. All of these variables noticeably impacted the individual's impulse buying intention. Accordingly, the sex, age, marital status, education level, and monthly income level of the respondents were taken here as control variables.

4.2. Participants

As most of the subjects were young, college students were the first source for sampling. A pilot study was conducted. Questionnaires were distributed to 100 undergraduates and postgraduates to analyze the reliability and validity of the data, as well as to eliminate and adjust the items of the questionnaires. Considerable sample data were harvested by pushing the revised questionnaire via the "questionnaire star" platform. After invalid questionnaires were excluded, a total of 534 valid questionnaires were collected. Among them, 34.6% were males, 65.4% were females, 80.7% were 20–30 years old, 70.4% were students, and 83.7% had bachelor's degree or above.

4.3. Data Analysis Methods

The data analysis here consisted of three aspects: verifying the dimensions of the exterior design, self-efficacy, psychological ownership, and impulse buying; the direct effects of the exterior design, self-efficacy, psychological ownership, and impulse buying were tested by multiple linear regression; and the structural equation model was adopted to ascertain the indirect effects of the exterior design, self-efficacy, psychological ownership, and impulse buying. As the indirect effects hypothesis model here covers two modes, namely, synchronization and chain mediation, these modes evidently violate the normal distribution hypothesis. The Sobel method based on the normal hypothesis could not effectively ascertain the mediation effect [73,74]. This study adopted the method of a bootstrapping test as recommended by Preacher et al. [75] to test the multiple mediating effect. The bootstrapping method does not require the assumption of a normal distribution. If the confidence interval of the mediating effect does not cover 0, the effect is significant.

5. Results

5.1. Control and Test of Common Method Bias

With Mplus 8.3, the factor structures of live platform exterior design (ED), self-efficacy (SE), psychological ownership (PO) and impulse buying (IB) are delved into by confirmatory factor analysis. As revealed from the study on the fitted index values in Table 1, the model here outperforms the other three alternative models, effectively illustrating the subordination of ED, SE, PO, and IB. For distinctive constructs, the research scale exhibits a high construct validity.

Model	χ^2	df	CFI	TLI	SRMR	AIC	BIC	RMSEA (90% CI)
Four factor model	292.163	84	0.950	0.938	0.038	17,954.89	18,173.19	0.068 (0.060, 0.077)
Non measurable latent factor model	192.075	74	0.963	0.948	0.037	17,943.09	18,204.20	0.055 (0.045, 0.047)
Three factor model	514.410	87	0.898	0.877	0.054	18,171.14	18,376.598	0.096 (0.088, 0.104)
Two factor model	966.633	89	0.791	0.753	0.074	18,619.36	18,816.26	0.136 (0.128, 0.144)
Single factor model	1284.890	90	0.716	0.668	0.091	18,935.62	19,128.24	0.158 (0.150, 0.165)

Table 1. The test results of discriminant validity among the variables.

As ED, SE, PO, and IB data were all reported by respondents, a risk of common method variance (CMV) existed. The Harman single factor method was employed to analyze the results. Table 1 indicates that the fitting index of the one factor model is not ideal ($\chi^2/df = 14.28$, RMSEA = 0.158, CFI = 0.716, TLI = 0.668, SRMR = 0.091). To some extent, the variation of the common methods in this

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study is not serious. On the other hand, as Harman's single factor method was not extremely sensitive in testing the mutation risk of the common methods, this study also employed a method to regulate the effects of an unmeasured latent method factor to compare whether the fitting index of this model was better than that of the four-factor model [76]. Table 1 indicates that when a common method variance factor was added into the four-factor model, it manifested a slightly higher fitting degree, whereas the improvement range was overly narrow (in the range of 0.01–0.02). In brief, there is no serious common method bias for the measurements.

5.2. The Mean, Standard Deviation, and Correlation Coefficient of the Variables

We adopted the Pearson correlation method to analyze the correlations among the variables. Table 2 lists the correlation matrix of the variables. The results demonstrated that: (1) the exterior design of a live platform was positively correlated with impulse buying ($\gamma = 0.524$, P < 0.001); (2) the exterior design of a live platform was positively correlated with self-efficacy ($\gamma = 0.618$, P < 0.001); (3) the exterior design of a live platform was positively associated with impulse buying ($\gamma = 0.459$, P < 0.001); (4) self-efficacy displayed a positive correlation with psychological ownership ($\gamma = 0.379$, P < 0.001); (5) self-efficacy was positively correlated with impulse buying ($\gamma = 0.569$, P < 0.001); and (6) psychological ownership was positively correlated with impulse buying ($\gamma = 0.421$, p < 0.001).

Variables SD ED 3.201 0.680 1 SE 2.665 0.801 0.618 *** 1 0.459 *** 0.379 *** PO 2.574 0.827 1 ΙB 0.524 *** 0.596 *** 0.421 *** 2.842 0.853 1

Table 2. The mean, standard deviation, and correlation coefficient of the variables.

Note: n = 534; *** p < 0.001.

5.3. Regression Analysis of the Direct Effect Test

The hierarchical regression analysis was adopted in this study, as shown in Table 3. First, according to the research questions and features of the sample data, all control variable items were virtualized. Second, the variance inflation factor (VIF) of each regression equation was also tested. The results indicated that the VIF of each equation was smaller than 2, suggesting that the sample data had low multicollinearity.

Variables -	SE			PO		IB			
	M1	M2	М3	M4	M5	M6	M7	M8	M9
Control									
Variables									
Gender	-0.138	-0.082	-0.008	0.057	0.063	-0.037	0.017	0.048	-0.032
Age	0.004	-0.001	0.016	0.010	0.014	0.014	0.009	0.011	0.004
Marital status	-0.457 **	-0.368 **	-0.307 *	-0.204	-0.070	-0.309 *	-0.224	-0.027	-0.120
Education level	-0.024	-0.020	-0.073	-0.068	-0.061	-0.052	-0.048	-0.037	-0.007
Monthly salary	0.014	0.001	0.013	-0.002	0.006	0.023	0.011	0.015	0.015
Independent									
Variable									
ED		0.455 ***		0.528 ***			0.437 ***		
Mediating									
Variables									
SE					0.517 ***			0.616 ***	
PO									0.618 ***
Model									
Summary									
R^2	0.064	0.205	0.055	0.233	0.290	0.051	0.166	0.364	0.390
F	7.184 ***	22.612 ***	6.147 ***	26.721 ***	35.903 ***	5.707 ***	17.494 ***	50.346 ***	56.083 ***
ΔR^2	0.064	0.141	0.055	0.178	0.235	0.051	0.115	0.313	0.338
ΔF	7.184 ***	93.464 ***	6.147 ***	122.518 ***	174.582 ***	5.707 ***	72.561 ***	259.568 ***	292.225 ***
MAX (VIF)	1.869	1.876	1.869	1.876	1.869	1.869	1.876	1.869	1.878

Table 3. The direct effect test and regression analysis.

Note: n = 534; *** p < 0.001, ** p < 0.01, * p < 0.05.

It can be seen: (1) The impulse buying was positively influenced by the exterior design of the live platform, self-efficacy, and psychological ownership (M7, β = 0.437, P < 0.001; M8, β = 0.616, P < 0.001; M9, β = 0.618, P < 0.001). We accepted Hypotheses 1, 3, and 6 with the support of the analytical statistics. (2) The exterior design of the live platform (M4, β = 0.528, P < 0.001) and self-efficacy (M5, β = 0.517, P < 0.001) had a strong positive influence on psychological ownership. Therefore, Hypotheses 5 and 8 were verified. (3) There was a strong positive relationship between the exterior design of the live platform and self-efficacy (M2, β = 0.455, P < 0.001). Hence, we assumed that Hypothesis 2 was verified.

5.4. SEM Analysis of the Indirect Effect Test

Based on the recommendation of Schneider et al. [77], we used the structural equation model (SEM) to test the mediation hypothesis here and tested the mediation effect by comparing various alternative models. Subsequently, six path coefficients were tested by SEM, and the individual and chain mediation effects of self-efficacy and psychological ownership were also tested. This method was capable of independently distinguishing the role of self-efficacy (H4) and psychological ownership (H7) and verifying the indirect effect of the exterior design of live platform on impulse buying (H9) through these two mediating variables in turn. The exterior design of live platform exerts significant positive effects on both self-efficacy and psychological ownership (β = 0.641, P < 0.001; β = 0.400, P < 0.001).

Self-efficacy and psychological ownership exerted significant positive effects on impulse buying $(\beta=0.422, P<0.001; \beta=0.517, P<0.001)$. Self-efficacy significantly positively impacted psychological ownership $(\beta=0.444, p<0.001)$. However, the design of the live platform slightly impacted impulse buying $(\beta=-0.024)$. The results also supported Hypotheses 4, 7, and 9. The fitting index of the model satisfied the requirements, $\chi^2/df=3.48$, less than 5; CFI = 0.950, and TLI = 0.938, more than 0.9; RMSEA=0.068, SRMR=0.038, less than 0.08, indicating that the model fits well. In order to further explore whether the chain mediation model played a full mediating role, by removing the direct path from the exterior design of the live platform to impulse buying, the fitting indices of the model were obtained by running SEM ($\chi^2/df=3.44$, CFI = 0.951, TLI = 0.939, RMSEA = 0.068, SRMR = 0.038). Given the presented analysis, this study accepted a more complete mediation model.

At the same time, this study followed the suggestions of Taylor et al. [78] and Hayes et al. [79] and used the bootstrap method to analyze the chain mediating effect, as an attempt to cross-verify the conclusions of the structural equation model test. According to the analysis steps of the chain multiple mediation effect that was proposed, the bootstrap method was adopted to analyze the chain mediation effect, which can be split into three aspects. (1) The mediation effect of specific paths of self-efficacy

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and psychological ownership, i.e., Me1 = a1b1, Me2 = a1b2 and Me3 = a1a3b2. (2) The total mediation effect, i.e., Me1 + Me2 + Me3. (3) The contrast mediation effect, i.e., D1 = Me3 - Me1, D2 = Me3 - Me2 and D3 = Me1 - Me2. The repeated sampling of the bootstrap was set at 5000 times, and the results are listed in Table 4.

Table 4. The indirect effects and path coefficients of the mediation models.

Complete Mediation Model	Standar	dized Path Co	efficient	Point	Bias Corrected 95% CI	
	PO	SE	IB	Estimation	Lower	Upper
ED	0.501 ***	0.312 ***				
SE		0.446 ***	0.407 ***			
PO			0.496 ***			
Total mediation effect				0.614	0.489	0.747
$Me1 = ED \rightarrow SE \rightarrow IB$				0.267	0.183	0.375
$Me2 = ED \rightarrow PO \rightarrow IB$				0.202	0.123	0.298
$Me3 = ED \rightarrow SE \rightarrow PO \rightarrow IB$				0.145	0.095	0.221
D1 = Me3-Me1				-0.122	-0.233	-0.011
D2 = Me3-Me2				-0.057	-0.160	0.055
D3 = Me1-Me2				0.064	-0.081	0.216

Note: n = 534; *** p < 0.001.

The mediating effect of Me1 of the exterior design of the live platform via the specific path from self-efficacy to consumer impulse purchase was 0.267, and the 95% CI (Confidence interval) of the deviation correction was =[0.183, 0.375]. The specific mediating effect Me2 of the exterior design of live platform through psychological ownership to the consumers' impulse purchase reached 0.202, with 95% CI of the deviation correction =[0.123, 0.298]. The specific mediating effect Me3 of the live platform exterior design from self-efficacy and psychological ownership to an impulse purchase, in turn, reached 0.145, with the 95% CI of deviation correction =[0.095, 0.221]. The upper and lower limits of the confidence intervals of Me1, Me2, and Me3 did not cover 0, demonstrating that the three mediating effects were significant. We assumed that H4, H7, and H9 were further supported.

The total mediating effect of the exterior design of the live platform through self-efficacy and psychological ownership was 0.614, and the 95% CI (CI = [0.489, 0.747]) of deviation correction did not contain zero. Accordingly, the effect of the exterior design of the live platform on impulse buying was entirely manifested by the role of self-efficacy and psychological ownership. Compared with Me2, the difference of D3 = 0.064 between Me1 and Me2 was not significant (the bias corrected 95% CI contained zero, CI = [-0.081, 0.216]), indicating that the mediation effect of self-efficacy and psychological ownership was equivalent; the difference between Me3 and Me2 was not significant, D2 = -0.057 (the bias corrected 95% CI contained zero, CI = [-0.160, 0.055]), namely, there was no difference between the chain mediation effect of "self-efficacy \rightarrow psychological ownership" and the specific mediation effect of self-efficacy. However, the difference between Me3 and Me1 was significant, D1 = -0.122 (the bias corrected 95% CI did not contain zero, CI = [-0.233, -0.011]), indicating that the chain mediation effect of self-efficacy and psychological ownership was significantly weaker than the specific mediation effect of psychological ownership.

6. Discussion

This study is one of the first studies to examine the potential mechanisms through which exterior design impacts impulse buying under live scenarios. The close relationships between exterior design and impulse buying are essential prerequisites for further mediating effect analysis between them. The total effect model suggested that exterior design is a crucial predictor of impulse buying under live streaming scenarios, demonstrating that streaming with a high degree of exterior design is more likely to trigger impulse buying. To the best of our knowledge, this is one of the few studies to unpack the relationships between exterior design and impulse buying, and no study had conducted empirical research on live streaming scenarios previously. Considering the consistency of previous studies

documenting the direct link between exterior design and impulse buying [13,80,81], this study also reported that exterior design was tightly correlated with impulse buying.

This study aimed to delve into the psychological mechanisms of self-efficacy and psychological ownership in connecting exterior design with impulse buying. As expected, the study results supported our hypothesis that both self-efficacy and psychological ownership completely mediated the relationships between exterior design and impulse buying. These results are consistent with earlier studies regarding the relationships between them [52,82,83]. That is, individuals who tended to have higher level of self-efficacy and psychological ownership, were in turn motivated to perform more impulse buying behaviors.

Furthermore, the results of this study also support the path of exterior design →self-efficacy →psychological ownership →impulse buying. This path showed that self-efficacy was a mediator between the exterior design and psychological ownership while psychological ownership mediated the relationships between self-efficacy and impulse buying. That is, self-efficacy and psychological ownership played a chain-mediating role between the exterior design and impulse buying. The conclusion of this study demonstrated that there was a more complex mechanism between the exterior design of a live platform and impulse buying. Self-efficacy further promoted consumers' impulse buying behavior through psychological ownership and achieved an impact from the exterior design of the live platform. Thus, self-efficacy acted as both a proximal variable and a distant variable to influence impulse buying.

7. Conclusions

We drew on SDT to yield insights into the full course of motivation in the live streaming consumer's behavior process. Consistent with our hypotheses, our results reported that the exterior design of a live platform positively impacted the impulse buying. The self-efficacy and psychological ownership exerted a synchronous and chain mediating effect in the relationships between the exterior design of a live platform and impulse buying. The chain mediation effect of self-efficacy and psychological ownership was significantly weaker than the individual mediation effect of self-efficacy.

This study is of high theoretical significance in several aspects. First, the present study is one of few studies regarding impulse buying under a live context. Theoretically, this research can enlarge and enrich the study context of consumer impulse buying behavior in a new era of technology, and further broaden the role scenario of SDT. Second, the principles of the interaction between "exterior design \rightarrow self-efficacy \rightarrow impulse buying", "exterior design \rightarrow psychological ownership \rightarrow impulse buying" were discussed. The results of the concurrent and chain mediator roles clarified the underlying mechanisms between them, which helps to open the "black box" of impulse buying. Third, gaining insights into the complicated interplay among exterior design, self-efficacy, psychological ownership, and impulse buying contributed to novel live marketing strategies.

This study can effectively guide the practice of consumers' buying behavior in live streaming scenes. First, pleasant exterior clues should be created. A live platform should emphasize a consumer's personalized experience, use innovative and interesting content layout to achieve scenario guidance, and comprehensively exploit the functions of "reward", "red envelope", "voting", "message", and "bullet screen" to facilitate the flow of the live platform and host interface. Second, live platforms should proactively stimulate the psychological atmosphere of users. Additionally, live streamers should stress real-time interactive feedback from their consumers. Given the characteristics of younger consumer groups (e.g., consumption habits, their pursuit of personality, and concern for opinion leaders), fresh outdoor live streaming, interactive questioning, and star interviews should be developed and conducted. According to the psychological characteristics of consumers' quick access, companies can consciously exploit consumers to develop psychological ownership for products and companies while enhancing user stickiness. Third, platforms should stimulate consumer self-efficacy. With the combining of traditional marketing methods and network advantages, it is necessary to design

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easy-to-operate, personalized, and interesting marketing methods according to the consumption habits of the target groups, the pursuit of individuality, and the attention to opinion leaders. On this basis, the marketing forms a communication loop with other platforms to improve the sales conversion rate and achieve the effect of live broadcast marketing with both the brand and the effect.

Although this study attempted to delve into consumer impulse buying behaviors in live scenarios, which is of certain theoretical and practical significance, there are inevitably some limitations. First, this study discusses the consumer behavior of live streaming platforms but does not classify the live platforms. For instance, in terms of game live broadcasting, entertainment live broadcasting, e-commerce live broadcasting, and professional live broadcasting, consumer behaviors for different types of live broadcasting may be different. Therefore, the target marketing strategies of different live platforms can be explored based on classifications. Second, we discussed the chain mediating mechanism of the exterior design of live platforms on impulse purchases. Although the fully mediating effects of self-efficacy and psychological ownership were explored, the boundary conditions of the exterior design of a live platform on impulse purchases were not clarified here, as these require subsequent studies. Third, bound by time and energy, a cross-sectional design was adopted to analyze only the exterior design, self-efficacy, and psychological ownership with impulse buying relationships, and the sample focused on a distributed network questionnaire. Subsequent research can conduct experimental studies on causal inference, further expand the sample size, and perform multiple longitudinal studies to enhance the reliability of these research conclusions.

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