The Impact of Atmospheric Cues on Consumers' Impulse Buying in Live Streaming E-Commerce: The Mediating Role of Emotion

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ABSTRACT

Since live-streaming e-commerce (LSE) has surged at a remarkable growth pace, impulse purchase has attained increased prominence, while processes underlying the way atmosphere cues trigger such purchase are undertheorized. Following the Stimulus–Organism–Response (S-O-R) framework, this study investigates psychological processes under which atmosphere cues trigger consumers' impulse purchase via emotion. Extending previous scales, atmosphere cues were operationalized along four dimensions: information cues, navigation cues, design cues, and interactive cues. Data were collected from 215 Chinese live-streaming shop-experienced consumers and processed using partial least squares structural equation modeling (PLS-SEM) to test the research model. Results indicate navigation and interactive cues are direct stimulators of impulse purchase and information and design cues exert significant indirect effects mediated by emotions. Further, interactive cues exert both direct and indirect influenceon impulse purchase and therefore are foregrounded in triggering full-immersion experiences. Finally, emotions are found as a chief psychological mediator between atmosphere stimulus and behavior.The study extends existing literature by validating a comprehensive measurement framework of atmospheric cues in LSE and by clarifying the mediating role of emotions in impulse purchasing. Practically, the findings provide actionable implications for platforms and retailers to strategically design information delivery, navigation simplicity, aesthetic elements, and interactive engagement to foster positive emotions and stimulate purchase decisions.

Keywords:Live streaming e-commerce, Atmospheric cues, Impulse buying behavior, Emotion, SOR theory

1.0 INTRODUCTION

Live-streaming, as a novel form of information dissemination and interaction, has been widely integrated into e-commerce, giving rise to the innovative format of live-streaming e-commerce (LSE) (Tong et al., 2023). According to the CNNIC (2025) report, by June 2025, the number of online live-streaming users in China had reached 1.123 billion, of which 597 million were LSE users, accounting for 54.7% of the total online population.

Within this emerging format, impulse buying behavior is particularly salient. Impulse buying refers to unplanned purchases triggered by a combination of external stimuli and internal psychological states (Rook & Fisher, 1995), and it is more prevalent in the live-streaming context. Muvi (2022) report indicated that more than 80% of young consumers engage in impulse buying when shopping online, with the proportion being even higher in live-streaming settings.Compared with traditional e-commerce, live-streaming is more likely to trigger impulse purchase (Li et al., 2022; Lin et al., 2023). This is primarily because of the reason that LSE possesses higher interactivity and a more realistic shop-like environment, such that consumers can acquire real-time information from anchors and extra information regarding products. Therefore, the persistent growth of platform and seller of LSE is closely related to the impulse purchase tendencies of consumers (Zhang et al., 2022).

Within consumption-external stimulation underlying impulse buying, atmosphere cues are often viewed as central. Atmospheric cues are environmental parameters designed and controlled by retailers that can provoke the emotional responses of shoppers and elicit desired behaviors (Tang & Zhang, 2020; Wang et al., 2022). Traditional works suggest that layout of physical space, lighting, color, and background music can play a role in influencing the emotions and decision of shoppers (Helmefalk & Hultén, 2017; Kotler, 1973). For LSE, background music and background visual complexity (BVC) are particularly important. Current scholarship confirms that the pace of the music can help change consumption behaviors of shoppers based on their emotional responses and cognitive processing (Lehmann et al., 2019; Wu et al., 2008), and visual complexity can enhance purchase intention mediated by pleasure and arousal (Tong et al., 2023).

Here, emotion is the crucial mediator of the consumer's immediate reaction to environmental stimulation. Emotion is the consumers' feeling and subjective experience when they are under external stimulation (Li et al., 2009), and it has a significant impact on cognition and choice. It has been established that when under positive emotions, the consumers are optimistic and adventurous and increase the odds of buying (Shao et al., 2019). Conversely, negative emotions such as disgust can influence buying choices (Du, 2019).

Nonetheless, earlier research on atmospheric cues has its limitations. Firstly, most earlier research is grounded on offline retail or traditional e-commerce and has very little evidence of their validity when applied to the context of LSE. Secondly, earlier research tends to investigate either cognitive or emotional mechanisms and not simultaneously both (Helmefalk & Hultén, 2017), yet both mechanisms are essential and are related and interact. Thirdly, earlier research tends to rely on a unidimensional dimension of visual complexity or sound and fails to account for the cumulative effect of several dimensions such as informativeness, navigability, layout and interactivity. In the context of LSE, these multisensory atmospheric cues are always presented and are hence highly effective at influencing the end-consumer's emotions. Elements like presenters' voices, backdrop colors, and interactive full-screen comments provide information while simultaneously eliciting immediate feelings like as pleasure and arousal. Recent empirical studies also highlight the rapid evolution of livestream commerce, further strengthening the emotional mechanisms that drive consumers' impulse buying behaviour (Li et al., 2024; Zhou & Li, 2025).

However, these latest studies still lack a comprehensive examination of how multi-dimensional atmospheric cues activate emotions within the S-O-R framework. This gap underscores the continued relevance and necessity of the current study.

The current research uses the S-O-R paradigm developed in environmental psychology (Mehrabian & Russell, 1974), whereby ambiance cues are seen as S (stimulus), consumer emotion as O (organism), and impulse buying as R (response). In this way, it suggests research towards the 'atmospheric cues-emotion-impulse buying.' The research questions to be addressed in this study would be:
 (1) How do different atmospheric cues in LSE shape consumers' emotional and cognitive activities?
 (2) Do these emotional and cognitive states influence subsequent watching and purchasing behaviors?

In this case, this study provides three major contributions. First, it derives its research context from the live streaming e-commerce industry. In this way, it not only broadens the generalizability of research about ambiance cues but also helps to generalize it to this new form of business. Second, it combines several aspects of ambiance cues such as informativeness, navigability, design, and interaction to investigate their impact on impulsive purchase behavior from an emotional mediation perspective. Finally, it provides theoretical and practical significances to this research by highlighting the critical role of emotional mediation in realizing impulse purchase behavior via atmosphere cues.

2.0 LITERATURE REVIEW

2.1 IMPULSE BUYING BEHAVIOR

Impulse buying refers to an instantaneous and spontaneous purchase triggered by a strong impulse, which is frequently not within a pre-existed buying plan of a consumer (Rook, 1987; Rook & Fisher, 1995). Impulse buying is more frequent on online platforms (Xue et al., 2020), and live-streaming e-commerce (LSE) is easier to induce impulse buying because of its higher immersion and higher interactability than other e-commerce platforms (Shi et al., 2023). Consumers' attitudes and preferences also influence their impulse purchase intentions in online environments (Abdullah Zawawi et al., 2023). When browsing live-streaming e-commerce sessions, new products are very numerous and viewing time is very short, and therefore it is difficult to deliberate rationally. Thus, they are prone to making purchase decisions based on intuition and feelings (Gong, 2022).

During the recent years, technological innovations have sparked impulse purchase further. For example, some brands incorporated technologies of AI, VR, and AR to provide personalized and interactive store interactions that increase the engagement and emotional involvement of their customers significantly and therefore boost impulse purchase. Empirical contributions have identified a series of central drivers of impulse purchases in LSE like broadcaster and product popularity (Ma et al., 2022), interface layout (Tang & Zhang, 2020), online interaction (Xue et al., 2020), and social presence (Wang et al., 2022). On the whole, these works suggest that impulse purchase being an unplanned consumption is triggered by external stimulus and endogenous psychological change. One such work is the S-O-R model that suggests a manner of uncovering environmental stimulus has on consumer emotion and therefore results in triggering of impulse purchase.

2.2 THE S-O-R FRAMEWORK

Human beings aren't reactors to what they are experiencing; they are rather actively reacting to environmental stimulation (Ittelson et al., 1974). Trying to characterize the individuals and their environment relation, Mehrabian & Russell (1974) proposed the S-O-R system. Here it is suggested that

stimuli are environmental features perceived by individuals, organism defines the inner psychological processes that regulate stimulation of the kind induced by stimuli, and response is the external behaviors resulting from such processes that are typically manifested as approach or avoidance tendencies.

The S-O-R framework has been applied widely in diverse fields like retailing, marketing, and information systems (Arora, 1982; Bitner, 1992; Eroglu et al., 2003; Kawaf & Tagg, 2012; Sherman et al., 1997). Subsequent work specified this by allocating stimulus at the task- and affect-related cue level (Parboteeah et al., 2009), or theorizing it based on technological attributes such as interactivity and vividness (Animesh et al., 2011; Ning Shen & Khalifa, 2012).

At the organism component level, previous work was concerned with feelings of emotion (Mehrabian & Russell, 1974). At the response component level, the S-O-R framework has been used widely to describe impulse buying. Other research has demonstrated it can apply equally well to retailing situations of consumer response (Donovan & Rossiter, 1981), online shopping scenarios (Eroglu et al., 2003), and more recently within LSE (Shi et al., 2023; Xue et al., 2020). From this foundation of evidence, the study employs the S-O-R approach to reveal how environmental cues within LSE function as external stimulation to direct their customers' emotions and these emotions direct their impulse buying.

2.3 ATMOSPHERIC CUES

Environmental stimulation within shop contexts are conveyed by atmosphere cues perceived by shoppers as being important information bearing on their thinking and behaviour (Demangeot & Broderick, 2010; Porat & Tractinsky, 2012). This is where atmosphere was first suggested by Kotler (1973), advancing the idea that shop atmospheres can be tailored with the express purpose of evoking particular emotions and stimulating purchase. Research within physical store contexts has shown atmosphere cues are made up of dimensions such as light and sound and smell and warmth and merchandise presentation and crowds and service personnel (Baker et al., 1994; Turley & Milliman, 2000).

In online shopping environments, atmospheric cues are more strongly associated with visual and informational elements. Eroglu et al. (2001) categorized them into high task-related cues (e.g., product information, navigation structures) and low task-related cues (e.g., colors, font size). Floh & Madlberger (2013) further divided them into three dimensions: content, navigation, and design. Building on this, researchers have proposed three distinct categories of atmospheric cues:(1)Task-related cues, directly linked to shopping efficiency, such as navigation bars, product descriptions, and cart functions (Parboteeah et al., 2009). (2)Emotional cues, related to shopping experience and aesthetics, encompass visual complexity, color, layout, and graphic style (Van Der Heijden et al., 2003; Zeithaml et al., 2002). (3)Social cues, reflecting the presence and interaction of others, such as customer reviews, product ratings, sharing options, and social media integration (Baker et al., 1994; Cyr et al., 2009, 2009; Gefen & Straub, 2004; Wakefield & Wildeman, 2011).

In the context of LSE, atmospheric cues gain significantly heightened importance due to the medium's real-time interactivity and immersive nature. Their extend beyond standard models, and cover informativeness, navigability, design quality, and interactivity. Research shows retail atmospherics significantly influence consumer engagement and preferences (Hashim et al., 2022). Realtime interactions between viewers and broadcasters, remarks presented with bullet screens, and para-social interaction are unique features of LSE atmospheres (Wang et al., 2022; Xue et al., 2020). Moreover, auditory and visual elements like background soundtracks, presentation of broadcasters, and arrangement of scenes further elicit consumer emotions and induce impulse purchases (Xin et al., 2025; Zhang et al., 2023). Social cues of live-streaming were further

evidenced by Yao & Zhang (2021) to reinforce consumers' emotions of attachment toward the retail space and therefore compensate for the lack of social attributes of standard e-commerce websites.

Empirical research has consistently shown strong positivity between stimulation from atmospheres and consumers' impulse buying tendencies. However, cultural subtlety is likely to moderate. For example, under the influence of Confucianism values, consumers are likely to show constrained or negative reactions when presented with added stimulation (Yao & Zhang, 2021). As information technologies advance at breakneck velocities toward maturity development, their influence is growing increasingly emphatic (Floh & Madlberger, 2013). Accordingly, noting stimulation from atmospheres as main stimulants within the LSE context is central when moving forward with understanding impulse buying conduct. Overall, while prior studies provide descriptive insights, few integrate all four dimensions or examine their interactions, leaving a gap that the present study aims to address.

2.4 CONSUMER EMOTION

Prior studies confirm that emotions mediate between environmental cues and consumer behavior(Ismail & Ahmad, 2023). Emotion was described by Belk, (1975) as the individual's interpretation and reflection of ambiguous environments under specific situations and can critically contribute to cognition and behavior. Emotion was described by Bagozzi et al. (1999) as a self-aware state that is developed from awareness of events or ideas and is usually accompanied by the development of physiological reactions and through psychological processes can produce specific behaviors. For online retailing, Liu et al. (2018) described that emotions are short-lived strong affective and behavior interpretations developed by a vast array of stimulants. Similarly, Liu & Li (2019) described that emotions are short-lived physical and psychological reactions that are triggered by external stimulants in marketplaces. Hamelin et al. (2024) further highlighted the transient, intense, and targeted nature of emotions, while Guo (2021) noted that emotions reflect consumers' psychological experiences and behavioral responses when exposed to stimuli during online shopping.

Previous research has shown that atmospheric elements serve as important external stimuli which significantly influence consumer behavior. In particular, LSE whose development increases the closer-to-real-world integrated characteristics such as interactivity, musical accompaniment, bullet comments, and communicators' styles, have been classified as atmospheric elements to highlight their role in enchating consumer immersions and impulses. However, there would seem to be several research gaps in past literature pertaining to LSE: (1) Measurement gap/gap in literature context are traditional research methods inadequate to deal with new developments such as LSE? Many live streaming research methods have derived from traditional and static online research models; nevertheless these models cannot possibly measure LSE's interactive and broad requirements. (2) Mechanistic ambiguity an atmosphere element like LSE significantly affects consumer cognition and behavior; nevertheless, what exactly makes these elements operate in live streaming commerce platforms such as LSE have been less extensively explored. (3) Emotion gap Ideally, LSE research would like to encompass cognitive processes; nevertheless, these approaches disregard emotional processes in rendering results. The current research gap in literature would seem to be absent in systematically analyzing LSE models involving emotional processes to act as mediators.

In terms of findings, it has been shown in past research that positive emotions play a significantly prominent role in increasing consumer engagement and purchase intentions; conversely, high-arousing emotional states may result in decreased perceived decision time and increased probability of impulse purchase. However, it can be observed that past research encompasses mainly offline research setups and static online

platforms rather than analyzing in-depth emotional processes occurring in live streaming setups (LSE). In other words, for understanding atmospheric cue-emotions and impulse purchase connections in LSE from a comprehensive perspective and to fulfill the research gap established above, this research study reconnoiters atmospheric cues (Stimulus), consumer emotion (Organism), and impulse purchase behavior (Response) together in a single research framework utilizing the S-O-R Model.

To provide a clearer overview of the key studies relevant to atmospheric cues, emotion, and impulse buying in LSE and related environments, a summary of the most relevant literature is presented in Table 1.

Table 1. Summary of Prior Studies on Atmospheric Cues, Emotion, and Impulse Buying

Author(s), Year	Context / Setting	Key Variables	Methodology	Key Findings	Relevance to Current Study
Helmefalk & Hultén (2017)	Offline retail	Multisensory cues, emotions	Experiment	Sensory cues trigger arousal and shape purchase decisions	Shows atmosphere cues affect emotions but limited to offline context
Lin et al. (2016)	Online shopping	Visual & audio cues	Survey	Visual design influences emotions and purchase intention	Indicates digital cues matter but not specific to LSE
Tong et al.(2023)	Livestream e-commerce	Visual complexity, pleasure, arousal	PLS-SEM	Visual complexity, emotions ,buying intention	Supports visual cues as emotional triggers
Wu et al. (2008)	Digital shopping	Music tempo	Experiment	Fast tempo increases arousal	Demonstrates music as emotional stimulus
Zhang et al. (2022)	Live commerce	Interactivity, impulse buying	Survey	Interactivity increases impulse buying	Supports social/interactive cues
Shao et al. (2019)	Consumer psychology	Positive emotion	Lab study	Positive emotions increase purchase	Emotion, behavior link
Du (2019)	E-commerce	Negative emotions	Survey	Negative emotions change product choice	Emotions influence evaluation
Abdullah Zawawi et al. (2023)	Malaysian consumers	Organic food preference	Survey	Health, price & trust shape preferences	Supports consumer psychology aspect
Hashim et al. (2022)	Retail / mall environment	Lifestyle, atmospherics	Survey	Mall atmosphere influences preference	Shows atmospheric cues influence behavior
Ismail & Ahmad, (2023)	Government employees	Cognitive, emotional, behavioral debt factors	Survey	Emotions significantly affect financial decisions	Supports emotion–decision mechanism

3.0 THE RESEARCH FRAMEWORK AND HYPOTHESES

3.1 RESEARCH MODEL

In this research work based on Stimulus-Organism-Response (S-O-R), it explores the role of external signals in last-second economy (LSE) and its influence on consumer impulsive purchase behavior. The external signals (stimuli), classified into four dimensions, comprised information signals, navigation signals, design signals, and interactive signals. The external signals have consequences associated with consumer organism (Organism), which results in impulsive purchase behavior (Response).

The use of live demonstrations, explanations, and interactive elements helps to ensure ease in the dissemination of product information to consumers even as it creates a favorable environment for shopping to take place. The processes of decision-making by consumers are therefore influenced not only by rational elements such as product information and usability but also aesthetic elements such as layout designs, color combinations, background sound, and interactive features such as immediate responses and exchanges offered by bullet screen elements.

Positive affect, which involves experiences associated with pleasure and excitement, can shorten deliberation time and serve as antecedents to impulse buying episodes. Environmental cues act as stimulists to emotional experiences, where emotion mediates these processes from stimuli to response. The framework of research presented below in Figure 3.1:
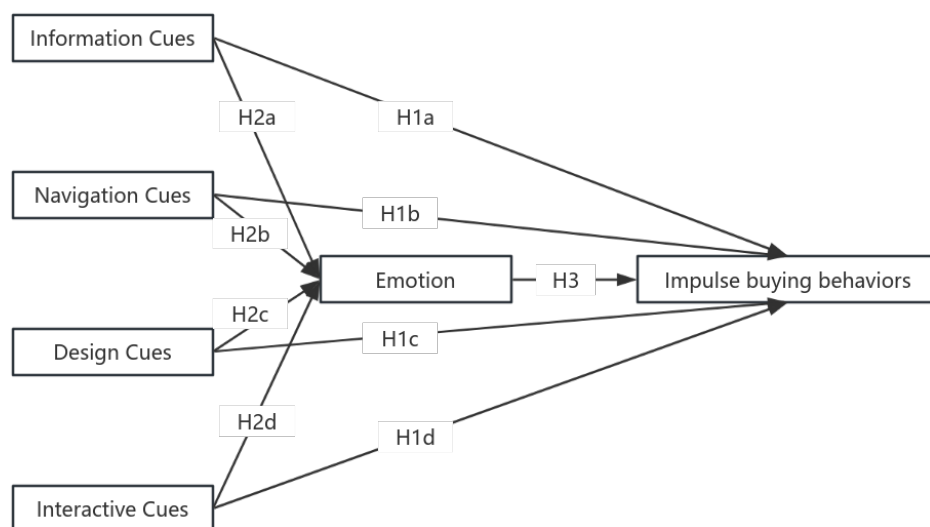

Figure 1. Theoretical Framework

3.2 HYPOTHESES DEVELOPMENT

3.2.1 The Influence of Atmospheric Cues on Impulse Buying Behavior

Present research efforts have shown that atmospheric elements present in shopping situations play a critical role in creating consumer cognition, emotional responses, and behaviors. In traditional shopping situations, store atmosphere was proven to be a critical external factor in consumer behavior. For instance, Turley & Milliman (2000) confirmed that store atmosphere not only affects services and product perceptions but also leads to behavioral responses. Due to advancements in e-commerce, researchers have shifted their attention to investigating online shopping situations and have confirmed that color schemes, information content,

consumer reviews, and systems have critical effects on consumer perceptions and evaluations (Gao et al., 2015; Mazaheri et al., 2011).

The atmospheric cues of LSE have been shown to be more diverse. Eroglu et al. (2001) break down atmospheric cues into high-task-related cues (product information, payment information), and low-task-related cues (color, background pattern). Other researchers (Floh & Madlberger, 2013; Gao et al., 2015) have classified these cues as including elements of navigation, information, and design. In continuation to these findings, this study proposes to use four dimensions of atmospheric cues; these dimensions include information, navigation, design, and interactivity to embed characteristics of LSE.

The literature shows that rich information presented in live streaming situations increases consumer understanding and impulses to buy (Gong et al., 2020). Easy-to-navigate systems improve consumer experiences, and their role in impulse purchasing is to decrease cognitive efforts (Eroglu et al., 2003). Attractive elements such as color combinations, arrangement, and background melodies result in increased consumer immersions to induce purchase impulses (Helmefalk & Hultén, 2017). More importantly, interactivity that stands out in live streaming entertainment (LSE) is associated with reduced uncertainties to trigger impulse purchasing (Shi et al., 2023). For these reasons, there are expectations to test the following hypotheses:

H1a: Information cues positively influence impulse buying behavior.
H1b: Navigation cues positively influence impulse buying behavior.
H1c: Design cues positively influence impulse buying behavior.
H1d: Interactive cues positively influence impulse buying behavior.

3.3.2 The Influence of Atmospheric Cues on Consumer Emotion

Emotions arise from the combination of external environmental stimuli and in-built psychological antecedents of customers. Some scholars have utilized the concept of appraisal theory to argue that external stimuli cause changes in emotional experiences, which in turn stimulate modifications in consumer behavior (Ladhari et al., 2017). In traditional shopping settings, environmental elements such as store displays, background sound, smell elements, and color combinations have previously been confirmed to be eliciting positive and negative emotional experiences influencing consumer decision-making (Imschloss & Kuehnl, 2017). In digital settings, the information value, perceived efficacy, and entertainment quality of websites have previously been confirmed to have major impacts on emotional experiences of customers (Zhang, 2007).

In LSE, environmental cues serve as strong affective stimulants. The presence of rich and informative content helps to minimize uncertainties and maximizes ease and control to result in positive affect. Intuitive usability helps to minimize effortful cognition to result in a relaxed yet engaging interface. The role of design cues fits into the concept of visual and auditory stimuli (for example, color choices and background scores), allowing for immersive experiences to stimulate enjoyment and excitement. More vitally, interactive processes involving real-time engagement with other viewers and broadcasters help to improve social presence and belonging to result in intense experiences. In this way, we submit:H2a: Information cues positively influence consumer emotion.

H2b: Navigation cues positively influence consumer emotion.
H2c: Design cues positively influence consumer emotion.
H2d: Interactive cues positively influence consumer emotion.

3.2.3 The Influence of Consumer Emotion on Impulse Buying Behavior

The consumer generally makes use of their intrinsic psychological states while making purchasing decisions (Bagozzi et al., 1999). Positive affect states such as pleasure and excitement ease the threshold level for rational evaluation, hence increasing spontaneous and unplanned consumer purchasing (Kang & Jin, 2015; Sundar & Noseworthy, 2014). The empirical study shows a positive relation between consumer emotional states and impulse purchase intentions in LSE (Shi et al., 2023). Conversely, negative emotional states lower purchase intentions and even cause consumers to leave the live streaming session (Sima et al., 2025). Hence, the following hypothesis can be formed:

H3: Consumer emotion positively influences impulse buying behavior.

3.2.4 The Mediating Role of Consumer Emotion

A study based on the S-O-R theory recognizes emotion as a critical mediator between environmental stimuli and consumer behavior (Sharma, 2004; Westbrook, 1987). In the context of consumption, atmospheric cues have been shown to have an indirect effect on consumer purchasing behavior through their ability to alter consumer emotion (Gamaya & Suardana, 2024). In LSE environment conditions, consumer emotion elicited by atmospheric cues will not be directly associated with the product but would have the ability to determine impulsive buying intentions. Hence, it would be assumed to have emotion as the mediator to impulsive buying behavior.

H4a: Emotion mediates the relationship between information cues and impulse buying behavior.

H4b: Emotion mediates the relationship between navigation cues and impulse buying behavior.

H4c: Emotion mediates the relationship between design cues and impulse buying behavior.

H4d: Emotion mediates the relationship between interactive cues and impulse buying behavior.

4.0 RESEARCH METHODOLOGY

4.1 RESEARCH DESIGN AND PRETESTS

The research uses the theoretical framework of Stimulus-Organism-Response (S-O-R), besides employing a quantitative research methodology to investigate atmospheric variables affecting impulsive purchasing behavior in live streaming e-commerce (LSE), with emotion as the mediator. To improve research methodology in its survey research framework, this research study embraces several methods from other researches (Mitchell, 1986; Podsakoff et al., 2003), involving pre-test research to test several major research variables. The research also tests multicollinearity present in all variables by variance inflation factor (VIF), all of which were below the threshold level of 5. The single-factor test employing Harman's technique assesses common method bias among all variables and confirmed that there were no single factors contributing to common method bias in exceeding the majority level of variance. The result of pre-test research implied major differences among other product dimensions in the experiment conducted to test consumer preference towards products.

4.2 MEASUREMENT DEVELOPMENT

Established scale measures from antecedent research were used in this study to ensure construct reliability and validity. A five-point Likert scale (1=Strongly Disagree to 5=Strongly Agree) measure was used to measure all construct dimensions. The perceptions of atmospheric elements, emotional experiences, and impulse purchase intentions were related to LSE.Specifically, atmospheric factors were composed of four dimensions: information cues, navigation cues, design cues, and interactive cues), according to Floh & Madlberger, (2013), Gong (2022), Ma et al. (2022), and Xue et al.(2020). Emotion, as "organism" in the S-O-R framework, captures customers' subjective feeling experiences derived from live streaming purchase behavior. The use of self-rated pleasure, arousal, and excitement captures emotion operationalized

according to Floh & Madlberger (2013) and Hsieh et al. (2014). The likelihood of impulse purchasing behavior as the dependent variable captures spontaneous and unplanned behavior triggered by environmental stimuli in live streaming. Shi et al. (2023) was used as the foundation of the measurement scale.The final item set is presented in Appendix A.

4.3 SAMPLE AND DATA COLLECTION

The online survey form was created and administered via Wenjuanxing (see https://www.wjx.cn/), one of China's most popular online survey sites. The data collection method used convenience sampling via online platforms like social media websites and live streaming sites. Consistent with the recommended minimum number of samples needed for sample adequacy in PLS-SEM (at least ten times as many samples as the number of latent variables (Hair et al., 2022), a minimum of 210 usable responses were required (21 questions × 10). The data collection process ran for one month; responses were discarded if they took less time than usual to complete and had visible errors and incompleteness. The α values for all constructs were all greater than 0.70.

5.0 DATA ANALYSIS AND RESULTS

5.1 DESCRIPTIVE STATISTICS AND CORRELATION ANALYSIS

The last questionnaire was conducted using Wenjuanxing, an online survey site in China. A total of 220 responses were gathered. After careful screening for incompletely answered questionnaires, inconsistencies in answers, completion time, and attention questions, 215 questionnaires were considered acceptable. The response rate here is 97.73 percent. The study by CIRN (2024) guarantees sample representation.

5.2 MEASUREMENT MODEL ANALYSIS

5.2.1 Reliability and Convergent Validity

The research utilized Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) to test the reliability and validity of data collected via the scale. The values for all constructs were greater than 0.85, far exceeding the minimum requirement of 0.70 (Nunnally & Bernstein, 1994), ensuring high reliability. The results for CR were close to 0.90, far above the minimum threshold of 0.70, ensuring data reliability. The data confirmed convergent validity as all factor loads were greater than 0.75 and were significantly different from zero. AVE values for all constructs were greater than 0.70 and satisfied the minimum requirements of 0.50 (Fornell & Larcker, 1981).

5.2.2 Discriminant Validity

To further confirm the discriminant validity in the measurement model, the Fornell-Larcker criteria were used. The square roots of average variance extracted (AVE) values shown in the table were greater than the correlations between constructs in both row and column comparisons. This suggests that all constructs were considerably different from one another; and as such, it provides strong confirmation of their discriminant validity. To reinforce additional validation of discriminant validity, Heterotrait-Monotrait (HTMT) ratios of correlations were calculated. All values were below the conservative threshold of 0.85.

5.2.3 Common Method Bias Test

In order to determine the potential occurrence of common method bias (CMB), the full
To determine if common method bias (CMB) can be present in this study, the full collinearity variance inflation factor (VIF) test developed by (Kock, 2017) was used. The application of this test helps determine if common method bias is present in a study. It makes calculations to determine the values of all VIFs. If

all values are less than 3.3, it means common method bias isn't affecting data significantly; thus, data can be used to conduct structural equation modeling. The test showed all values to be in the range of 1.75 to 2.827, which is far below 3.3. Hence, common technique bias isn't significant in this study.

5.3 STRUCTURAL MODEL ANALYSIS

A research paper applied partial least squares structural equation modeling (PLS-SEM) to determine the predictive role of climatic signals and emotional experiences as mediators to measure their role in impulsive purchasing behavior as presented by Bollen (1989). The result based on SmartPLS presented acceptable fit indices; this is indicated by; the value of SRMR (0.049) stands below .08 and shows negligible residuals; values of both d_ULS (0.556) and d_G (0.322) were acceptable; the value of NFI (0.854) exceeded 0.80; and there were no issues shown in the value of singular value (426.057).

The outcomes of the route analysis are as table 2. Information cues (β = 0.014, p = 0.773) exhibited no significant correlation with impulse purchase behavior, so rendering hypothesis H1a unsupported. Navigation cues (β = 0.241, p < 0.001) had a strong beneficial influence on impulse purchase behavior, hence corroborating H1b. Design cues (β = –0.001, p = 0.983) exhibited no significant correlation with impulse purchase behavior, so demonstrating that H1c was not substantiated. Conversely, interaction cues (β = 0.368, p < 0.001) exerted a strong beneficial influence on impulse purchase behavior, hence corroborating H1d. Regarding the impact of ambient cues on emotions, information cues (β = 0.151, p = 0.016), navigation cues (β = 0.240, p = 0.004), design cues (β = 0.162, p = 0.006), and interaction cues (β = 0.274, p = 0.001) exhibited substantial positive impacts, therefore substantiating hypotheses H2a–H2d. Moreover, emotions were determined to have a substantial and favorable effect on impulsive purchase behavior (β = 0.354, p < 0.001), thus corroborating hypothesis H3.

Table 2. Structural Equation Model Validation Results

H	Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Hypothesis
H1a	INC -> IBB	0.014	0.016	0.05	0.289	0.773	unsupported
H1b	NC -> IBB	0.241	0.241	0.061	3.947	***	supported
H1c	DC -> IBB	-0.001	0.002	0.051	0.021	0.983	unsupported
H1d	IC -> IBB	0.368	0.366	0.065	5.626	***	supported
H2a	INC -> EM	0.151	0.152	0.063	2.419	0.016	supported
H2b	NC -> EM	0.24	0.242	0.084	2.85	0.004	supported
H2c	IC -> EM	0.274	0.272	0.083	3.305	0.001	supported
H2d	DC -> EM	0.162	0.165	0.059	2.73	0.006	supported
H3	EM -> IBB	0.354	0.354	0.067	5.278	***	supported

INC information cues, NC navigation cues, DC design cues,IC interactive cues,EM emotion, IBB impulse buying behaviors
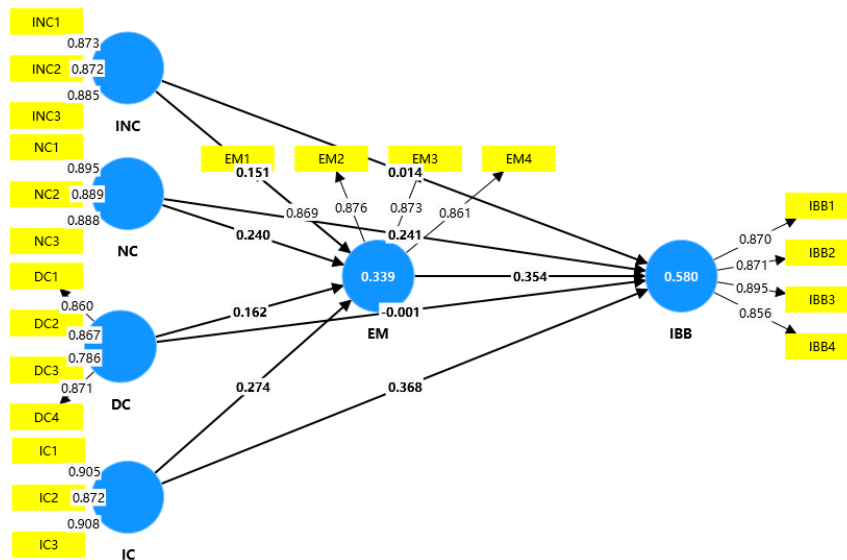N = 215, ***p < 0.001

Figure 2: Structural Model Analysis Result

5.4 MEDIATION ANALYSIS

This study utilized the bootstrapping approach (with 5,000 resamples) in SmartPLS4 to investigate the mediating effect of emotions on the link between ambient cues and impulsive purchase behavior. Table 3 encapsulates the findings of the indirect effects, total effects, and their corresponding 95% confidence ranges. The results indicate that the indirect effects of information cues (Coef = 0.054, p = 0.019, 95% CI [0.011, 0.101]), design cues (Coef = 0.057, p = 0.008, 95% CI [0.019, 0.104]), and interaction cues (Coef = 0.097, p = 0.013, 95% CI [0.031, 0.183]) on impulsive purchase behavior were statistically significant. It shows that emotions act as a partial mediator in these paths. The three types of ambient signals have a direct effect on customers' impulsive purchase behavior and, in addition to this, act as tools to make such behavior happen via desirable emotional responses.

Notably, navigation signals did not have a substantial direct influence on impulse purchase behavior. Nonetheless, their indirect impact through emotions was substantial (Coef = 0.085, p = 0.022, 95% CI [0.023, 0.167]).This indicates that when customers find navigation convenient, they may experience favorable emotions, thereby enhancing their propensity for impulse purchase.These results empirically validate hypotheses H4a, H4b, H4c, and H4d, affirming that customer emotions significantly mediate the relationship between ambient cues and impulsive buying behavior in live-streaming e-commerce.

Table 3: Indirect Effects And Total Effects

Indirect effects		Total effects			Test result
	Coef (O)	Bootstrap 95% CI		Coef (O)	Bootstrap 95% CI	
INC → EM → IBB	0.054	[0.011, 0.101]	INC->IBB	0.068	[−0.037, 0.179]	H4a:Supported
NC → EM → IBB	0.085	[0.023, 0.167]	NC -> IBB	0.327	[0.175, 0.469]	H4b:Supported
DC → EM → IBB	0.057	[0.019, 0.104]	DC -> IBB	0.056	[−0.047, 0.171]	H4c:Supported
IC → EM → IBB	0.097	[0.031, 0.183]	IC -> IBB	0.465	[0.320, 0.592]	H4d:Supported

6.0 DISCUSSION

6.1 SUMMARY OF FINDINGS

It can be seen from empirical results that interactive cues and navigation cues have great direct impact on impulse buying behavior, while information cues and design cues do not have direct predictive ability of impulse buying. Rather, these two aspects influence impulsive purchasing indirectly by eliciting favorable feelings in customers. This implies that impulse consumption of LSE is not only a reaction of external sense stimulation but is highly motivated by the immediate emotional experience of the consumers. It can be found that although design cues did not take direct activation of purchase decision-making, these significantly facilitated impulse buying by stimulating the pleasure and excitability of the consumers and highlighting the essential role of the "emotional pathway" of live-streaming shopping.

Specifically, interactive cues were the greatest influential factor and were significant on both direct and indirect routes. Findings from this study show that live interactive elements between streamers and viewers not only cause spontaneous store atmosphere experiences but also stimulate emotional arousal to influence impulse buys. Conversely, findings from this study show that the role of navigation cues mainly relates to ease of functionality to expedite fast decision-making processes but doesn't relate to emotional arousal. Generally speaking, the results confirm that emotions are a persistent mediator of most routes and illuminate their role as a fundamental psychological mediator connecting atmosphere cues and impulse purchase. When confronted with strong sensory and interactive stimuli in LSE, consumers' cognitive deliberation and rational evaluation are often weakened, prompting them to rely more heavily on emotional responses to make rapid purchase decisions. This emotional impetus underlies the psychological mechanics of impulse purchasing in live-streaming business.

6.2 THEORETICAL IMPLICATIONS

The findings further validate that ambient signals substantially affect impulsive purchase behavior, enhancing the literature on the precursors of impulse buying. Although impulsive purchasing is prevalent at LSE, there is a paucity of comprehensive study investigating the influence of ambient signals on this behavior. By adopting the S-O-R framework, this study reveals the pathways through which atmospheric cues influence consumer emotions and subsequent behaviors, thereby validating and extending prior findings .

Surprisingly, navigation cues did not significantly influence neither feelings of consumers nor intention of impulse purchase, a result that goes against some prior work. This is possibly due to the contextual features of LSE: whereas the platform navigation designs are now quite standardized and consistent, it reduces the cognitive burden of the interface-using consumers; at the other extreme end of the spectrum, streamers used to guide interface-using consumers using oral instructions, real-life demostrations, and visual cues, where navigation cues were therefore less significant.This data indicates that in the live-streaming scenario, the marginal value of functional signals is comparatively small, whereas emotive cues exert a stronger influence on impulsive consumption.

Finally, while prior literature has separately confirmed the positive effects of atmospheric cues on impulse buying and the critical role of emotions in consumer behavior, few studies have systematically examined the mediating role of emotions between atmospherics and impulse buying. This study establishes that emotions act as a partial mediator in these connections, offering a new theoretical framework for comprehending consumer behavior in LSE.

6.3 MANAGERIAL IMPLICATIONS

The current research provides significant implications for live streaming e-commerce business management. To be specific, it shows that even if the effect of informational cues did not directly result in impulsive purchasing behavior, it had a great impact on consumer choices as it influenced live streaming consumers' emotional responses. The results clarify that live streaming settings require comprehensive, correct, and up-to-date information to stimulate desirable emotional responses (trusting and reassuring), which would eventually promote impulsive purchasing behavior. As such, it would be essential for enterprises to not only ensure complete information about live streaming services presented in streamers' training courses but also to pay attention to how such information communicates to stimulate emotional responses. In particular, streamers can make use of emotional expressions in narrating products to heighten emotional experiences of consumers.

Secondly, it must be mentioned here that navigation elements had a very prominent place in this study. Contrary to what had been seen in other researches revealing that consumers value navigation less while engaging in online shopping, it was seen in this study that if the online shopping platform provides consumers with a very efficient and transparent way of navigation, it would be very effective in increasing their positive affect and would be able to aid them in impulse purchase directly.

The design cues had no direct effect on spontaneous purchase behavior; instead, they had an indirect effect mediated by emotional experiences. The result shows that attributes of the environment, like color combinations, layout, lighting, and background music, play a role in purchase behavior from the perspective of emotional triggers created rather than solely from aesthetic considerations. The implication here is that websites and business owners must use visual and sound attributes from design as tools to trigger these emotional experiences. For example, matching particular musical compositions and color combinations to particular types of merchandise may form areas of emotional congruency to motivate impulse purchase decisions.

The research shows that interactive elements have the greatest and longest-standing effect. They cause direct effects and simultaneously stimulate other effects related to emotional regulation. The direct effect of interactive elements emphasizes their great importance in creating social presence in regards to immersive elements. Therefore, online platforms should invest more in encouraging streamers to make use of interactive approaches and to implement organizational training to improve skills related to emotional regulation. In competitive market settings, such actions can be used to build a particular identity of this kind.

6.4 LIMITATIONS AND FUTURE RESEARCH

The study provides profound knowledge but suffers from challenges and suggests avenues to be explored in future research. First, data were gathered from Chinese consumers who have knowledge about live streaming purchase. The sample represents a close approximation to the general LSE consumer demographic but not necessarily provides assurance about generalizability across cross-cultural settings. The responses of consumers from other cultural settings may differ in their nuance to atmospheric elements and their role in impulse purchase behavior. For example, information and interaction indicators may play differing importance across high context versus low context cultures.

Second, the study narrowed its focus entirely to the behavior of impulse buying as the dependent variable. Even if it was perceived to be widely present in low-socioeconomic-exposure situations, there may be other facets of consumer behavior, such as compulsive purchase behavior or novelty seeking purchase behavior,

which require attention as well. The presence of such strong mediation from emotion as seen in this study would allow such research to broaden its perspective to other varieties of consumer behavior.

The results were obtained by validating the methodology in traditional live streaming e-commerce scenarios. The findings in this study prove that Navigation Cues have a direct effect on impulsive purchase behavior; this finding contradicts some other research results. The reason for this inconsistency may be justified by noticing the increased standardization of live streaming interfaces and users' greater familiarity with these interfaces. Further research should be conducted to verify if such results would be maintained in new technological developments such as Augmented Reality (AR), Virtual Reality (VR), and Metaverse live streaming.

Consumer behavior models inherently reflect dynamics wherein changes occur depending on life cycle and generational characteristics. While this study did not present direct data favoring generational differences, it provides indications about how customers may have differing responses to diverse atmospheric elements. In subsequent research, a cross-generational research methodology should be considered to analyze differing emotional responses and purchase behaviors of diverse ages to provide deeper insights about consumer behavior related to live-streaming e-commerce (LSE). Although this study promoted the role of emotional mediation in LSE transactions, further research is needed to pursue it. Further research may investigate how social influencers (KOLs) affect customer emotional responses and purchase behavior by analyzing commonalties between social influencers and their customer attributes related to products and platforms of live streaming-commerce.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES
No generative AI or AI-assisted technologies were used in the writing, data analysis, or preparation of this manuscript. All content was solely produced, reviewed, and approved by the authors, who take full responsibility for the publication.

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