

The Impact of Big Data and AI-Enabled Personalized Recommendation on Impulse Buying Behavior of Live-Stream E-commerce Consumers — Based on the Mediating Role of Emotional Arousal

Yisheng Wang

International College, China Agricultural University, Beijing, China
YISHENG.WANG@UCDENVER.EDU

Abstract. With the rapid development of the digital economy, live-stream e-commerce has become the mainstream form of online consumption. Big data and artificial intelligence (AI) serve as the core driving force for marketing transformation, shifting marketing from an extensive mode to more accurate user profiling and personalized recommendations. Existing studies mostly focus on the direct relationship between traditional marketing factors and consumer behavior, while few explore how AI-enabled personalized recommendation influences impulse buying through internal psychological mechanisms. Based on the S-O-R (Stimulus-Organism-Response) theoretical framework, this study takes big data and AI-enabled personalized recommendation as the independent variable, impulse buying behavior as the dependent variable, and emotional arousal as the mediating variable. Adopting the quantitative research method, a questionnaire survey was conducted among 200 valid respondents with live-stream shopping experience. SPSS 26.0 was used to conduct reliability and validity tests, correlation analysis, regression analysis and mediating effect tests. The results show that AI-enabled personalized recommendation has a significant positive impact on impulse buying, and emotional arousal plays a partial mediating role in their relationship. This study clarifies the psychological mechanism of AI-driven consumer impulse buying and provides practical implications for platforms and merchants to optimize data-driven precision marketing strategies.

Keywords: Artificial intelligence, Personalized recommendation, Live-stream e-commerce, Impulse buying behavior, Emotional arousal

1. Introduction

Driven by continuous breakthroughs in digital technology, live-stream e-commerce has witnessed explosive growth and remodeled global consumer ecosystems. Relevant national e-commerce industry reports indicate that China's live-stream commerce market size keeps expanding rapidly year after year, which serves as a vital driving force for online consumption growth and the digital transition of the real economy [1]. In this process, big data and AI technologies enable platforms to

construct accurate user profiles and deliver real-time personalized recommendations to different consumers via intelligent algorithms, transforming traditional extensive marketing into precision-oriented marketing.

While existing research on live-stream e-commerce is fairly extensive, certain gaps still need to be addressed. Most existing studies focus on the direct impacts of traditional marketing factors—such as streamer characteristics, price promotions, and interactive atmosphere—on consumers' impulse buying behavior, while paying relatively insufficient attention to the role of technology-driven marketing tools like AI-enabled personalized recommendations [2]. Meanwhile, few studies have revealed the internal psychological transmission path from AI stimulation to impulse buying, especially lacking empirical tests on the core mediating role of emotional arousal. Therefore, this study centers on AI-enabled personalized recommendations to explore their effects on consumers' impulse buying behavior and the mediating effect of emotional arousal. This study adopts the methods of literature review, questionnaire survey, and statistical analysis. Theoretically, it enriches the research on AI marketing and consumer behavior in live-stream scenarios. Practically, it helps platforms optimize recommendation algorithms and assists merchants in designing emotional arousal-oriented marketing strategies to improve conversion efficiency.

2. Theoretical foundation and research hypotheses

2.1. Theoretical foundation: the S-O-R framework

The S-O-R (Stimulus-Organism-Response) theory was proposed by Mehrabian & Russell in 1974 as a classic theoretical framework in environmental psychology and consumer behavior research [3]. The theory posits that individual behavior is not directly triggered by external stimuli. Instead, external environmental stimuli (S) act on an individual's internal psychological states (O), which in turn drive the final behavioral responses (R), forming a complete transmission mechanism of "stimulus – psychology – behavior". Given its ability to clearly explain how external environmental factors influence consumption decisions through internal psychological pathways, the S-O-R theory has been widely applied in behavioral mechanism studies in fields such as online consumption, live-stream e-commerce, and precision marketing [4].

2.2. Definition of research variables

Based on the S-O-R theory and combined with the scenarios of live-stream e-commerce and AI marketing, this study defines the stimulus, organism and response variables, and clarifies their specific roles in the research. Corresponding respectively to Stimulus (S), Organism (O) and Response (R) in the S-O-R theory, the three variables jointly form a complete psychological transmission mechanism.

2.2.1. Stimulus variable: AI-enabled personalized recommendation (independent variable X)

As the independent variable of this study, AI-enabled personalized recommendation refers to a technology-driven marketing method. Relying on multi-dimensional user behavioral data including historical browsing, interaction, cart-adding and purchase records, live-stream e-commerce platforms construct accurate user portraits through AI algorithms such as collaborative filtering and deep learning so as to push commodities and content in real time that match users' interest

preferences and potential demands. Its core dimensions cover recommendation accuracy, timeliness and personalization.

In this study, this variable was operationalized through consumers' perceptions of recommendation accuracy, personalization, and timeliness.

2.2.2. Organism variable: emotional arousal (mediating variable M)

Emotional arousal serves as the mediating variable of this study. It refers to consumers' aroused emotional states and psychological involvement, such as anticipation and pleasure, thrills triggered by external stimuli including AI-enabled personalized recommendations. As a crucial internal psychological link connecting external stimuli and subsequent behavioral responses, emotional arousal can significantly promote consumers' immediate consumption decisions.

Emotional arousal was operationalized through consumers' emotional excitement and psychological engagement during live-stream shopping.

2.2.3. Response variable: impulse buying behavior (dependent variable Y)

Impulse buying behavior is the dependent variable of this study. It refers to consumers' unplanned, immediate and less deliberative purchase decisions induced by external marketing stimuli in the live-stream e-commerce context. It is the core behavioral outcome focused on in this research, as well as a key conversion indicator concerned by live-stream e-commerce platforms and merchants.

Impulse buying behavior is operationalized as consumers' unplanned and immediate purchase tendencies in live-stream shopping scenarios.

2.3. Theoretical model construction

Based on a clear understanding of the connotation of the S-O-R theory and the definitions of relevant variables, this study constructs a theoretical model with mediation effects as follows: AI-enabled personalized recommendation (X) → emotional arousal (M) → impulse buying behavior (Y).

This model indicates that AI-enabled personalized recommendation may not only directly affect consumers' impulse buying behavior but also exert an indirect effect via emotional arousal as a psychological mediating pathway.

2.4. Research hypotheses development

Combining the aforementioned theoretical framework with the classic S-O-R theoretical paradigm, this paper puts forward a core proposition: AI-driven personalized recommendation algorithms generate positive effects on customers' impulsive purchasing within live streaming commerce scenarios. Meanwhile, such intelligent recommendation services can trigger consumers' emotional excitement, and this emotional state will further encourage impulsive consumption. It is thus inferred that emotional excitement acts as a mediator variable linking AI personalized recommendations and impulsive buying. On this basis, four research hypotheses are raised as follows:

H1: AI-based personalized recommendations exert a notably positive effect on consumers' impulsive purchase intentions.

H2: AI-based personalized recommendations can significantly enhance consumers' emotional arousal.

H3: Higher emotional arousal level positively predicts consumers' impulsive buying behaviors.

H4: Emotional arousal partially mediates the correlation between AI personalized recommendation services and users' impulsive purchase behaviors.

2.5. Questionnaire design and data collection

Based on the research variables and live-stream e-commerce context, this study developed a questionnaire by adopting and revising mature scales from domestic and international literature. All measurement items used a 5-point Likert scale [5], ranging from 1 = "strongly disagree" to 5 = "strongly agree". The questionnaire mainly included demographic information and measurement items for three core variables: AI-enabled personalized recommendations, emotional arousal, and impulse purchase behavior.

The measurement items of the three core variables were adapted from well-established scales in prior studies and modified to fit the live-stream e-commerce context. Specifically, AI-enabled personalized recommendations were measured with 5 items, mainly reflecting recommendation accuracy, personalization, and timeliness. Emotional arousal was measured with 4 items, covering consumers' emotional excitement, pleasure, and psychological engagement during live-stream shopping. Impulse buying behavior was measured with 5 items, assessing unplanned and immediate purchase tendencies in live-stream scenarios. To ensure applicability, some expressions were moderately revised according to the features of AI-enabled recommendations and live-stream platforms.

The questionnaire was distributed online via the Wenjuanxing mini-program, targeting consumers with live-stream shopping experience. A total of 220 questionnaires were distributed. After screening, invalid questionnaires with incomplete information, excessively short response times, or logical contradictions were excluded. Finally, 200 valid questionnaires were obtained, with an effective recovery rate of 90.91%.

Among the 200 valid respondents, females accounted for 73.0% and males for 27.0%. In terms of age, respondents aged 18–25 accounted for the largest proportion (68.0%), followed by those aged 26–35 (20.0%). Regarding educational background, most respondents held a bachelor's degree (74.0%), while 16.0% had a master's degree or above. Regarding monthly income, the largest group earned 3,000–6,000 RMB (42.0%). Overall, the sample was dominated by young female consumers with live-stream shopping experience, which is in line with the mainstream user profile of live-stream e-commerce in China.

2.6. Reliability and validity test

This study first conducted reliability and validity analysis on the adopted scales. The data analysis results showed that the Cronbach's α coefficient of each variable was higher than 0.7, indicating that the overall reliability of the scale used in this study was satisfactory. Meanwhile, the KMO value was 0.876 and Bartlett's sphericity test yielded significant results. The cumulative variance explanation rate of the scale reached 71.82%, which was well suited for factor analysis. The overall structural validity met the standard, laying a valid foundation for subsequent empirical research.

2.7. Correlation and mediation effect analysis

Before the mediation effect test, this study employed Pearson correlation analysis to preliminarily explore the relationships among the core variables, aiming to verify the rationality of the

correlations among variables and lay a foundation for subsequent hypothesis testing. The results of the correlation analysis are shown in Table 1.

Table 1. Correlation analysis results of variables

Variables	Personalized Recommendation	Emotional Arousal	Impulse Purchase Behavior
Personalized Recommendation	1	0.671***	0.615***
Emotional Arousal	0.671***	1	0.704***
Impulse Purchase Behavior	0.615***	0.704***	1

Note: $p < 0.05$, $p < 0.01$, $p < 0.001$; $N = 200$

As shown in Table 1, all variables present significant positive correlations ($p < 0.001$), which align with the research hypotheses and support further mediation effect testing. This study followed Wen Zhonglin's mediation effect testing procedure [6] and adopted the Bootstrap method with 5000 repeated sampling tests to verify the mediating role of emotional arousal. The specific results are presented in Table 2.

Table 2. Mediation analysis results

Paths & Hypotheses	Standardized Coefficient β	p-value	95% Bootstrap Confidence Interval	Conclusion
H1: AI Recommendation $\rightarrow$ Impulse Purchase (Total Effect)	0.615	< 0.001	-	Significant, H1 supported
H2: AI Recommendation $\rightarrow$ Emotional Arousal	0.671	< 0.001	-	Significant, H2 supported
H3: Emotional Arousal $\rightarrow$ Impulse Purchase	0.529	< 0.001	-	Significant, H3 supported
Direct Effect: AI Recommendation $\rightarrow$ Impulse Purchase (Controlling for Mediator)	0.251	< 0.01	-	Significant
H4: Indirect Effect	-	-	[0.206, 0.419]	Does not contain 0, partial mediation, H4 supported

3. Results and implications

3.1. Main results

The results indicate that AI-enabled personalized recommendations in the live-stream e-commerce scenarios can positively promote consumers' impulse buying behavior. The more the recommended content matches user preferences and the more timely the delivery is, the more likely consumers are

to generate impulse consumption tendencies. Meanwhile, emotional arousal plays an important bridging role in this relationship. In addition to directly influencing consumers' purchase decisions, AI recommendations can further indirectly stimulate impulse buying by activating individuals' emotional states. Overall, the internal transmission logic of AI recommendations affecting consumer behavior is verified, forming a complete path where AI recommendations trigger emotional arousal and further influence impulse buying.

3.2. Practical implications

In terms of core operational logic, live streaming platforms are able to integrate diversified data including user browsing tracks and consumption tendencies. By iteratively optimizing recommendation algorithms, platforms make the recommended content more consistent with users' real demands and lift the matching degree between audiences and recommended materials [7]. Supported by such technical foundations, sellers can prioritize customers' emotional perceptions. With the aid of flash promotions, live atmosphere building and scenario-oriented commodity presentation, merchants stimulate shoppers' shopping sentiments, which lowers users' rational judgment and ultimately increases transaction conversion rates [8].

When looking at the complete business framework, brand vendors and offline shops need to abandon duplicated marketing modes. They can implement refined operational plans according to segmented user groups, deliver customized products and content to target audiences, cut unnecessary resource consumption and optimize overall marketing returns [9]. To guarantee long-term steady growth, platforms need to moderately deploy personalized recommendation functions. Operators need to strike a balance between precise traffic positioning and user experience, strictly manage content push frequency and strengthen users' data privacy protection to lessen user weariness, so as to retain stable customer groups and realize sustainable business development [10].

4. Conclusion

Based on the S-O-R theory, this study explores the influence mechanism of AI-enabled personalized recommendations on consumers' impulse buying behavior in the live-stream e-commerce context. The results show that AI-enabled personalized recommendations can significantly promote consumers' impulse buying behavior, and emotional arousal plays a partial mediating role in this process, which clearly reveals the psychological path of algorithm-driven impulse consumption behavior. These findings provide practical references for platforms and merchants to optimize their operation strategies.

However, this study has certain limitations. The sample group is dominated by young females, resulting in limited representativeness; the cross-sectional data used in the analysis make it difficult to capture the dynamic changes between variables; in addition, only one mediating path (emotional arousal) is examined, while other potential influencing factors are not included. Future research can further expand the sample scope, introduce moderating variables such as platform trust and consumer personal traits, and conduct verification combined with longitudinal tracking or experimental design to improve the universality and accuracy of the research conclusions.

References

- [1] Ministry of Commerce of the People's Republic of China. (2023). *E-commerce in China 2022*. China Commerce and Trade Press.

- [2] Rolando, B. (2025). The impact of artificial intelligence-based recommendation systems on consumer purchase decisions in e-commerce. *Artificial Intelligence Research and Applied Learning*, 4(2).
- [3] Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. The MIT Press.
- [4] Hongsuchon, T., Chen, S.-C., & Khan, A. (2025). Applying the S-O-R model to explore impulsive buying behavior driven by influencers on social commerce websites. *PeerJ Computer Science*, 11, e3113.
- [5] Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 22(140), 1-55.
- [6] Wen, Z. L., Zhang, L., Hau, K. T., & Liu, H. Y. (2004). Testing mediation effects: Procedures and applications. *Acta Psychologica Sinica*, 36(5), 614–620.
- [7] Maharani, S., Damarani, Z. N., & Nurdianasari, R. (2025). Driving impulse buying: The role of personalization, responsiveness, and perceived usefulness in social commerce's live streaming shopping. *International Research Journal of Economics and Management Studies*, 4(3), 226–232.
- [8] Li, M., Wang, Q., & Cao, Y. (2022). Understanding consumer online impulse buying in live streaming e-commerce: A stimulus-organism-response framework. *International Journal of Environmental Research and Public Health*, 19(7), 4378.
- [9] Resindra, M. R., Haryanto, B., Wahyudi, L., & Setiawan, A. I. (2025). AI-powered personalization and its influence on impulse buying: A study of predictive algorithms in online retail. *Journal of Tianjin University Science and Technology*, 58(7), 871–871.
- [10] Misra, S., et al. (2024). AI-powered personalization and its influence on impulse buying. *Journal of Tianjin University*, 57(3), 289–296.