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Online consumption and affective experience moderate live streaming users' loneliness: A nationwide survey in China

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Abstract

Loneliness is one of the most common mental conditions in modern society, especially when social interactions and human affection are deeply fragmented in the era of internet and social media. Based on a large-scale survey (n = 9,311) in China, the present research examined whether online consumption tendency and affective experience moderated the association between live-streaming immersion and loneliness. As expected, live streaming immersion was associated with greater loneliness, and this relationship was moderated by online consumption and affective experience among live streaming users. In particular, live-streaming immersion was positively related to loneliness among users with lower online consumption tendency or lower affective experience, but negatively related to loneliness among users with higher online consumption tendency or stronger affective experience. These findings suggest that the loneliness-related implication of live-streaming immersion depends on users' forms of involvement. Live-streaming immersion may be associated with greater loneliness when users remain less involved, whereas purchase-oriented and affective involvement may buffer and reverse this association.

1. Introduction

Loneliness refers to a subjective and unpleasant experience that occurs when people feel that their social relationships are not as close, supportive, or sufficient as they would like them to be (de Jong Gierveld, 1998; Perlman & Peplau, 1981). As online platforms have become part of everyday social life, many people now use social media not only for information and entertainment, but also for contact, companionship, and emotional support. However, the link between social media use and loneliness remains mixed. Some online activities may replace offline contact and relate to greater loneliness(Nowland et al., 2018; Primack et al., 2017), whereas others may help people find a sense of connection (Burke et al., 2010; Ellison et al., 2007). As a distinctive form of social media, live streaming adds several features to ordinary online interaction. Users can watch streamers in real time, interact with streamers and other viewers, make purchases, and become emotionally involved during the viewing process. These features make live-streaming immersion more than a matter of exposure. Its association with loneliness may depend not only on how much users are immersed in live streaming, but also on how they participate in it.

The present research examines the relationship between live-streaming immersion and loneliness among live-streaming users, and tests whether online consumption and affective experience shape this relationship. In particular, we examine whether these two forms of involvement buffer the loneliness-related risk of live-streaming immersion and whether this association differs at higher versus lower levels of involvement.

1.1 Live-streaming immersion and loneliness

Research on loneliness and social media use suggests that online social technologies can be related to loneliness in different ways. They may support reconnection when they help people maintain or build relationships, but they may also be associated with higher loneliness when they replace offline relationships or are used as a way to withdraw from direct social interaction (Nowland et al., 2018). Although live streaming provides more interactive possibilities than ordinary social media browsing, higher live-streaming immersion may still be associated with greater loneliness. A central explanation comes from the displacement logic in research on online communication. When online activities occupy time and attention that could otherwise be used for offline contact, they may weaken the quality of existing relationships or reduce opportunities for face-to-face interaction (Kraut et al., 1998). Consistent with this concern, prior evidence has shown that heavier social media use is positively associated with perceived social isolation (Primack et al., 2017).

In the context of live streaming, greater immersion may involve prolonged attention to streamers, comments, and ongoing interactions in the live-streaming room. Such immersion may provide a sense of mediated companionship, but it does not necessarily offer stable, reciprocal, or substantive social connection. For some users, therefore, stronger live-streaming immersion may reflect greater reliance on mediated social environments and a larger gap in meaningful social relationships. Based on this reasoning, we propose that *live-streaming immersion will be positively associated with loneliness (H1)*.

It is important to note that this expected positive association refers to the overall tendency between live-streaming immersion and loneliness. It means that, on average, users with higher live-streaming immersion may report higher loneliness, but the strength of this association may still vary across users. Because live streaming contains multiple forms of participation, the association between immersion and loneliness may depend on whether users mainly remain viewers or become more involved. Therefore, after examining the overall association, we further consider online consumption and affective experience as two factors that may shape both the strength and the direction of this association.

1.2 The buffering role of online consumption

Online consumption may be one important factor that shapes the association between live-streaming immersion and loneliness. In the present study, online consumption refers to users' tendency to use live-streaming channels for shopping, rather than their actual amount of spending. In live-streaming settings, such purchase-oriented involvement often occurs within a real-time social environment in which streamers introduce products, respond to viewers, create a shared atmosphere, and encourage audience participation. Prior research suggests that social commerce environments can enhance social presence, trust, and engagement between viewers and sellers or streamers (Lu et al., 2016; Wongkitrungrueng & Assarut, 2020). Thus, online consumption in live streaming may represent a more involved form of participation. Users with stronger live-streaming shopping tendencies are engaging with the commercial and interactional process of the live-streaming room, rather than only watching the stream.

When live-streaming immersion is accompanied by little purchase-oriented involvement, users may remain closer to the role of viewers who watch, follow, and observe the ongoing interaction. In this case,

greater immersion may be more likely to reflect mediated companionship without sufficient substantive social connection. When users report stronger online consumption tendency, however, their immersion may include more active attention to product presentation, stronger involvement in the commercial interaction, and a clearer sense of participation in the live-streaming environment. From a compensatory consumption perspective, consumption-related preferences and intentions may sometimes reflect individuals' attempts to respond to unmet psychological or social needs (Mandel et al., 2017). In the live-streaming context, this perspective suggests that online consumption may indicate a more involved way of participating in live streaming. Therefore, the positive association between live-streaming immersion and loneliness may become weaker, and may even shift direction, as online consumption tendency increases. We propose that *online consumption will moderate the association between live-streaming immersion and loneliness, such that this positive association will be weaker at higher levels of online consumption (H2)*.

1.3 The buffering role of affective experience

Affective experience may also shape the association between live-streaming immersion and loneliness. In the present study, affective experience refers to users' emotional responses to product or brand presentations during live streaming. It captures whether the streamer's product introduction evokes feelings and whether the presented brand feels emotionally engaging to users. This definition is consistent with the brand experience literature, which treats affective experience as emotional responses elicited by brand-related stimuli (Brakus et al., 2009).

In live-streaming settings, affective experience may make immersion more emotionally involved. When live-streaming immersion is accompanied by little affective experience, users may remain closer to the role of viewers who watch, follow, and observe the ongoing interaction. In this case, greater immersion may be more likely to reflect mediated companionship without sufficient substantive social connection. When users report stronger affective experience, however, their immersion may involve more emotional response, personal resonance, and subjective engagement with the product presentation and the live-streaming atmosphere. Prior research on live-streaming commerce suggests that live-streaming environments can strengthen viewers' engagement by creating a sense of interaction, presence, and connection with sellers or streamers (Wongkitrungrueng & Assarut, 2020). In this sense, affective experience may indicate that users are more emotionally involved in the live-streaming environment. Therefore, the positive association between live-streaming immersion and loneliness may become weaker, and may even shift direction, as affective experience increases. Therefore, we propose that *affective experience will moderate the association between live-streaming immersion and loneliness, such that this positive association will be weaker at higher levels of affective experience (H3)*.

1.4 The present research

Based on a large-scale survey in China, the present research examined the association between live-streaming immersion and loneliness among live-streaming users in China. We first tested whether live-streaming immersion was positively associated with loneliness. We then examined whether this

association varied in strength and direction as a function of online consumption and affective experience. This approach allows us to clarify how purchase-oriented and affective forms of involvement shape the loneliness-related implications of live-streaming immersion.

2. Method

2.1 Participants

Totally 11,210 participants from 22 provinces in China were recruited from June 29 to July 2, 2020, and 1,899 of them failed the attention check (e.g., making a wrong choice on the items “please select the option 1”), resulting in 9,311 (83.06%) valid cases, including 4,169 females, aged from 18 to 60 years (*M* = 29.91, *SD* = 7.73). Data collection was conducted on a temporary web platform (wj.txtx.net) for this project, which was closed after the survey was completed, and participants’ residence located across 22 provinces of Mainland China. All procedures involving human participants were conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all human participants involved in this study. The research protocol was approved by the Institutional Review Board at Department of Psychological, Tsinghua University (No. THU-2020-08).

2.2 Measures

Loneliness

The three items of loneliness were referenced from Hughes et al. (2004) and Pieters (2013). Participants were asked to report their feelings of loneliness (e.g., often feel that you lack friends and partners, often feel left out, often feel isolated) on a 3-point Likert scale (1 = almost none, 3 = often). With good reliabilities in the current study, higher total scores indicated more symptoms of loneliness (Cronbach’s α = 0.87).

Live streaming immersion

The six items of live-streaming immersion were referenced from Ning Shen & Khalifa (2008), Lu et al. (2016) and Ma et al. (2022). Participants were asked to rate their level of immersion in live streaming, including perceived presence of the streamer, perceived awareness from the streamer, and attention to other viewers’ interactions during live-streaming sessions (e.g., feeling as if the anchor is physically present, believing the anchor notices their engagement, paying attention to other viewers' interactions) on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). With good reliabilities in the current study, higher total scores indicated stronger live-streaming immersion (Cronbach’s α = 0.89).

Online consumption

Three items measuring online consumption were adapted from Pavlou & Gefen (2004) and Wongkitrungrueng & Assarut (2020). Participants were asked to evaluate their reliance on live-streaming platforms for shopping, based on their current and future purchasing behaviors (e.g., prioritizing live-

streaming platforms for shopping needs, intending to frequently purchase via live-streaming) on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). With good reliabilities in the current study, higher total scores indicated greater purchasing behavior (Cronbach's α = 0.91).

Affective experience

Two items adapted from Brakus et al. (2009) measured affective experience to brand presentations during live-streaming sessions. Participants rated their emotional engagement with the brand (e.g., the anchor's product descriptions evoked emotional resonance, perceiving the brand as emotionally expressive) on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). With good reliabilities in the current study, higher total scores indicated stronger affective experience (Cronbach's α = 0.85).

Covariates

This paper considers several potential influencing factors, including gender, age, ethnicity, socioeconomic status, education, marriage status, quarantine experience, virus infection, pandemic exposure and confirmed cases.

3. Results

3.1 Participant characteristics

As shown in Fig. 1, The final 9,311 cases were from 22 provinces of Mainland China, providing broad geographical coverage. The province-level sample frequencies were reported in Appendix A.

[Figure 1 Geographic distribution of the final analytic sample across Mainland China.]

The results of descriptive analyses were presented in Table 1. Correlation analyses showed that live streaming immersion was positively related to loneliness. In addition, live streaming immersion was positively related to gender, age, income, and marriage status, but negatively to education and quarantine. Loneliness is positively related to ethnicity, but negatively to age, income, education, and marriage status (see Appendix B).

Table 1
Descriptive of the variables in the current study.

Characteristic	***N* (%)**	***M* (*SD*)**
Age		29.91 (7.73)
Gender		
-Male	5,142 (55.23)	
-Female	4,169 (44.77)	
Ethnicity		
-Han majority	8,769 (94.18)	
-Minority	542 (5.82)	
Social class (income per year)		
-1k or lower	1,398 (15.01)	
-above 1k and below 2k	755 (8.11)	
-above 2k and below 5k	3,053 (32.79)	
-above 5k and below 10k	2,804 (30.11)	
-above 10k and below 20k	898 (9.64)	
-above 20k and below 30k	197 (2.12)	
-above 30k and below 40k	62 (0.67)	
-above 40k and below 50k	24 (0.26)	
-50k or above	120 (1.29)	
Education		
-Elementary	145 (1.56)	
-Primary	1,741 (18.70)	
-Secondary	2,302 (24.72)	
-Undergraduate	2,973 (31.93)	
-Master	2,003 (21.51)	
-Postgraduate	147 (1.58)	
Marriage status		
-Single	3,827 (41.10)	
-In relationship	5,484 (58.90)	

Characteristic	*N* (%)	*M* (*SD*)
Quarantine experience		
-Quarantined	5,810 (62.40)	
-Not quarantined	3,501 (37.60)	

3.2 Moderation Analyses

To quantify the relationship between live streaming immersion and loneliness, we constructed regression models with loneliness as the dependent variable, live streaming immersion as the independent variable, online consumption or affective experience as the potential moderator, and socioeconomic variables such as gender, age, ethnicity, income, education level, marriage status, and quarantine experience. Results demonstrated a significant positive association (β = 0.043, t = -4.17, p < .001, *CI* 95% [0.023, 0.062]).

Next, we examined the moderating role of the online consumption and affective experience in the enhancement effect of live streaming immersion on loneliness (see Fig. 2). After controlling for socioeconomic variables, live streaming immersion was positively related to loneliness, and this relationship was significantly moderated by online consumption (β = -0.051, t = -5.23, p < .001, *CI* 95% [-0.070, -0.032]) and affective experience (β = -0.043, t = -4.55, p < .001, *CI* 95% [-0.061, -0.024])) (see Appendix C).

[Figure 2 Moderating effects of online consumption and affective experience on the association between live streaming immersion and loneliness]

Specifically, live streaming immersion was positively related to loneliness among those less involved in online consumption (β = 0.069, t = 4.06, p < .001, *CI* 95% [0.036, 0.102]), whereas this relationship became significantly negative among those more involved in online consumption (β = -0.032, t = -2.03, p = 0.043, *CI* 95% [-0.063, -0.001]). A similar pattern was observed for affective experience, that is, live streaming immersion was positively related to loneliness among those with lower affective experience (β = 0.053, t = 3.02, p = 0.003, *CI* 95% [0.019, 0.088]), but this relationship was significantly negative among those with greater affective experience (β = -0.033, t = -1.97, p = 0.049, *CI* 95% [-0.065, -0.000]).

3.3 Network analysis

To further examine whether the moderation pattern observed in the regression models could hold in the structural network of item-level associations, we conducted a supplementary network analysis. Participants were divided into low- and high-involvement groups using the 25th and 75th percentiles of online consumption and affective experience, respectively; the middle 50% of cases were excluded to enhance group differentiation. This yielded 2,377 participants in the low-consumption group and 2,604 in the high-consumption one; 2,754 participants in the low-affective group and 2,775 in the high-affective group, respectively.

Separate Gaussian graphical models were estimated for the low- and high-involvement groups. Each network included nine nodes: three loneliness items and six live-streaming immersion items. Networks were estimated using the EBICglasso procedure to obtain sparse and interpretable partial-correlation networks. Edges represent regularized partial correlations controlling for all other nodes in the network. Network differences between groups were tested using the Network Comparison Test with 2,000 permutations, including tests of overall network structure and global strength. To evaluate robustness, nonparametric bootstrapping and case-dropping bootstrapping were conducted with 2,000 resamples each.

Network structure and cross-community connectivity

As shown in *Figs. 3–4*, the loneliness items formed a closely connected item community in both low- and high-involvement groups, and the items of live streaming immersion also showed strong within-community connections, suggesting that both indicators of both loneliness and liver stream immersion were structurally coherent across groups. However, the connection between the live-streaming immersion community and the loneliness community differed across levels of online consumption and affective experience.

[Figure 3 Estimated networks of live-streaming immersion and loneliness in the low (left) versus high (right) online-consumption groups.]

For online consumption, the pattern suggests that live-streaming immersion was more positively embedded in the loneliness community among users with lower online consumption tendency, whereas this linkage was weakened and slightly reversed among users with higher online consumption tendency. In particular, the low-consumption network showed a positive cross-community connection between live-streaming immersion and loneliness (mean weight = 0.002, summed weight = 0.040), while in the high-consumption network, the cross-community connection became slightly negative (mean weight = -0.0004, summed weight = -0.007).

[Figure 4. Estimated networks of live-streaming immersion and loneliness in the low (left) versus high (right) affective experience groups.]

For affective experience, a similar was observed. The low affective experience network showed a positive cross-community connection between live-streaming immersion and loneliness (mean weight = 0.002, summed weight = 0.040), while in the high-affective-experience network, this connection was substantially attenuated (mean weight = 0.0002, summed weight = 0.003).

In addition, as shown in Table 2, the network comparison test indicated that the high versus low online consumption networks differed significantly in overall structure of live-streaming immersion and loneliness ($M = 0.097$, $p = .032$), and that the high versus low affective experience also showed a significant difference in overall network structure ($M = 0.178$, $p < .001$). The bootstrap analyses supported the interpretability of the estimated networks. Case-dropping bootstraps indicated strong

stability of expected influence across all four networks, with CS-coefficients approximately equal to 0.75. Strength centrality also showed acceptable to strong stability, with CS-coefficients ranging from 0.67 to 0.75. These results suggest that the centrality estimates were sufficiently stable for interpretation.

Table 2
Group-based network comparison and cross-community connectivity between live-streaming immersion and loneliness.

Comparison	Group	n	Mean cross-community weight	Sum cross-community weight	Network structure test	Global strength test
Online consumption	Low	2,377	0.002	0.040	$M = 0.097$, $p = .032$	$S = 0.070$, $p = .121$
Online consumption	High	2,604	-0.0004	-0.007	—	—
Affective experience	Low	2,754	0.002	0.040	$M = 0.178$, $p < .001$	$S = 0.089$, $p = .078$
Affective experience	High	2,775	0.0002	0.003	—	—

Note. Cross-community weights summarize the edges connecting the live-streaming immersion items and loneliness items. Positive values indicate stronger positive connectivity between immersion and loneliness, whereas values closer to zero or negative values indicate weaker or reversed connectivity.

Taken together, the network analyses show a consistent pattern with the primary moderation results. Among users with higher online consumption or stronger affective experience, the live streaming immersion–loneliness linkage was negative or less positive. By contrast, low online consumption and low affective experience groups show a positive connectivity between live streaming immersion and loneliness. These findings provide supplementary item-level network evidence that the loneliness-related implication of live-streaming immersion varies structurally across users' forms of involvement.

4. Discussions

The present research examined how online consumption and affective experience shape the association between live-streaming immersion and loneliness among live-streaming users. Consistent with our expectation and with prior concerns about intensive social media use, live-streaming immersion was associated with greater loneliness. More importantly, both online consumption and affective experience buffered this positive association. Specifically, live-streaming immersion was positively associated with loneliness among users with lower online consumption tendency or lower affective experience, whereas this association became significantly negative among users with higher online consumption tendency or higher affective experience. These findings support the view that the loneliness-related implications of live-streaming immersion depend not only on the degree of immersion, but also on how users participate in the live-streaming environment.

The buffering effects of online consumption and affective experience point to the role of involvement in live-streaming participation. These buffering effects could be understood through the distinction between passive and more personally involved forms of social media use. Prior research suggests that passive social media use, such as browsing or observing others' activities, is more likely to be associated with poorer affective well-being, whereas more directed or personally meaningful forms of communication may be more beneficial for users' well-being (Burke & Kraut, 2016; Verduyn et al., 2015). Although this distinction should not be treated as a simple division between harmful and beneficial use, it is useful for interpreting the present findings. Live-streaming immersion with little shopping tendency or affective experience may resemble a more passive mode of watching, following, and monitoring the live-streaming room. In this mode, users remain exposed to a mediated social environment, but their participation may lack a clear sense of agency, response, or personal involvement. When live-streaming immersion is accompanied by stronger online consumption or affective experience, users may become more actively involved in what happens in the live-streaming room. Purchase-oriented involvement gives users a more concrete role in the commercial interaction, and affective experience indicates emotional investment in the presented content. These forms of involvement may make live-streaming immersion less similar to passive viewing and more closely tied to personally engaged participation, which may explain why the positive association between immersion and loneliness was buffered and reversed at higher levels of involvement.

It is important to interpret the buffering and reversal effects carefully. The simple-slope results indicate that, at higher levels of online consumption and affective experience, greater live-streaming immersion was associated with lower loneliness. However, this pattern should not be interpreted as evidence that online consumption or affective experience causally reduces loneliness. The interaction plots suggest a more complex pattern: highly involved users may show relatively higher loneliness when their live-streaming immersion is low, but their loneliness decreases as immersion increases. This pattern is compatible with a compensatory interpretation. Prior research suggests that loneliness and social media use may be linked in a bidirectional and dynamic way, with lonely individuals sometimes turning to online environments as possible routes to reconnection (Nowland et al., 2018). Related work on social surrogacy also suggests that media experiences can provide a temporary sense of belonging when social connection is threatened (Derrick et al., 2009). From a consumer perspective, the compensatory consumer behavior model proposes that consumption-related preferences can emerge as responses to unmet psychological needs (Mandel et al., 2017), and research on lonely consumers further suggests that commercial interactions may carry relational meaning for some consumers (Rippé et al., 2018). Based on these lines of work, one possible interpretation is that users with greater loneliness may be more inclined to rely on live-streaming shopping or to become emotionally involved in product and brand presentations. For these users, live-streaming immersion may provide a form of involved participation that buffers further increases in loneliness, even though their overall loneliness remains relatively high. Nonetheless, given the cross-sectional design, this interpretation should be treated as a possible explanation rather than evidence of a directional process.

As a supplementary analysis, the network analysis provided an item-level structural perspective on the conditional pattern identified in the regression models. The loneliness and live-streaming immersion items formed internally coherent communities in each group, but the connections between the two communities varied across levels of involvement. Cross-community connectivity was positive in the low-consumption and low-affective-experience groups, became slightly negative in the high-consumption group, and was close to zero in the high-affective-experience group. The significant network-structure tests, together with the nonsignificant differences in global strength, suggest that involvement was associated with the configuration of particular relations between immersion and loneliness, while the overall level of network connectivity remained broadly comparable across groups. Thus, the network results complement the regression findings by showing that the conditional association was also visible in the pattern of item-level relations.

Theoretically, this study contributes to the literature in three ways. First, it extends research on social media use and loneliness to the live-streaming context, where real-time interaction, commercial participation, and emotional involvement are integrated within the same platform environment. Second, it shifts attention from whether live-streaming immersion is related to loneliness to how this association is shaped by users' forms of involvement. Third, the similar buffering patterns of online consumption and affective experience suggest that different forms of involvement may weaken the loneliness-related risk of live-streaming immersion, even when they do not imply lower loneliness among highly involved users.

Several limitations should be noted. First, the cross-sectional design prevents causal conclusions. Live-streaming immersion may contribute to loneliness, but lonely users may also be more likely to become immersed in live streaming and to develop stronger shopping tendencies or affective involvement. The negative association observed among highly involved users should therefore be interpreted as a conditional association rather than evidence that greater immersion in live streaming reduces loneliness. Second, online consumption was measured as users' tendency to use live-streaming channels for shopping, rather than actual purchase behavior. Future studies could use longitudinal designs, experimental methods, and platform-based behavioral data to examine the temporal ordering among loneliness, live-streaming immersion, online consumption, and affective experience. Finally, the data were collected from Chinese users in 2020, when pandemic-related restrictions and quarantine experiences may have increased both loneliness and reliance on online platforms. Future research should examine whether the buffering pattern found here can be replicated in post-pandemic settings and in other cultural or platform contexts.

In conclusion, live-streaming immersion was associated with greater loneliness mainly among users with lower online consumption tendency or lower affective experience. Among users with higher online consumption tendency or stronger affective experience, this association became negative. These findings suggest that the loneliness-related implication of live-streaming immersion depends on users' forms of involvement, rather than immersion alone.

Declarations

Competing interests

The authors declare no competing interest.

Note

Cross-community weights summarize the edges connecting the live-streaming immersion items and loneliness items. Positive values indicate stronger positive connectivity between immersion and loneliness, whereas values closer to zero or negative values indicate weaker or reversed connectivity.

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Author Contribution

MSW, ZL, and KP: Conception, research design and management; MSW, YW, TYW, YR, HM, and ZL: data analysis, paper writing & revisions; MSW, TYW, and KP: review and final revisions.

Data Availability

The data supporting the findings of this study are publicly available on the Open Science Framework (OSF) at https://osf.io/p7xk6/overview

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Figures

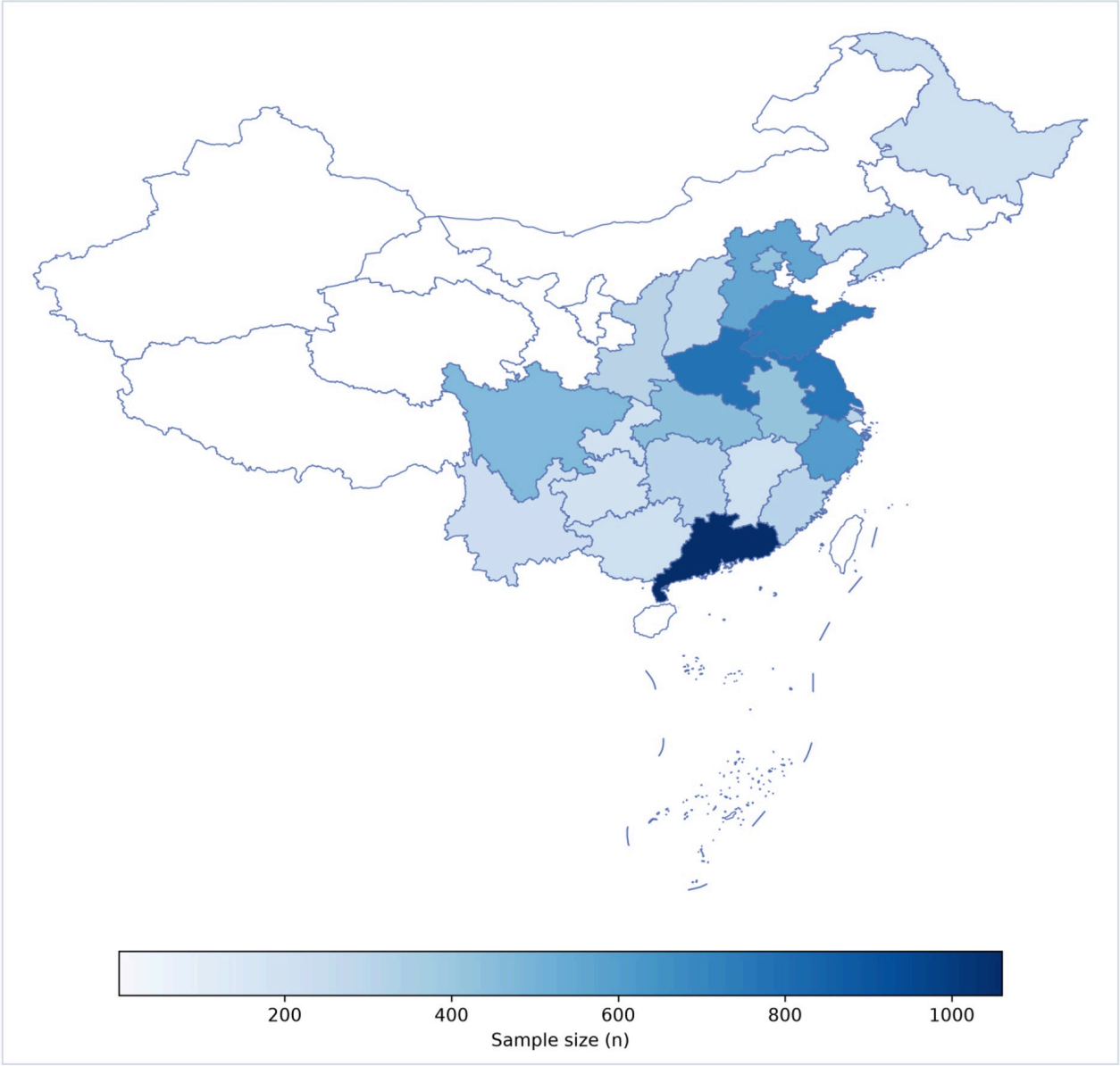


Figure 1 Geographic distribution of the final analytic sample across Mainland China.

Figure 1

See image above for figure legend.

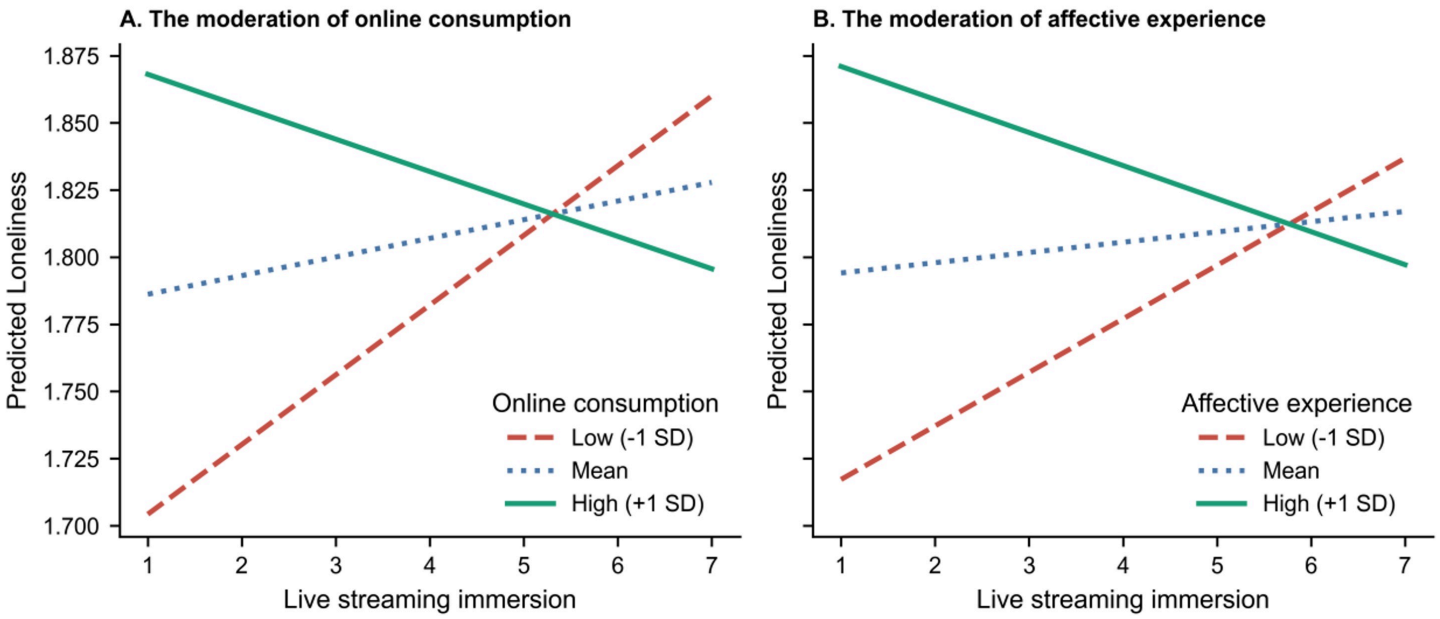


Figure 2 Moderating effects of online consumption and affective experience on the association between live streaming immersion and loneliness

Figure 2

See image above for figure legend.

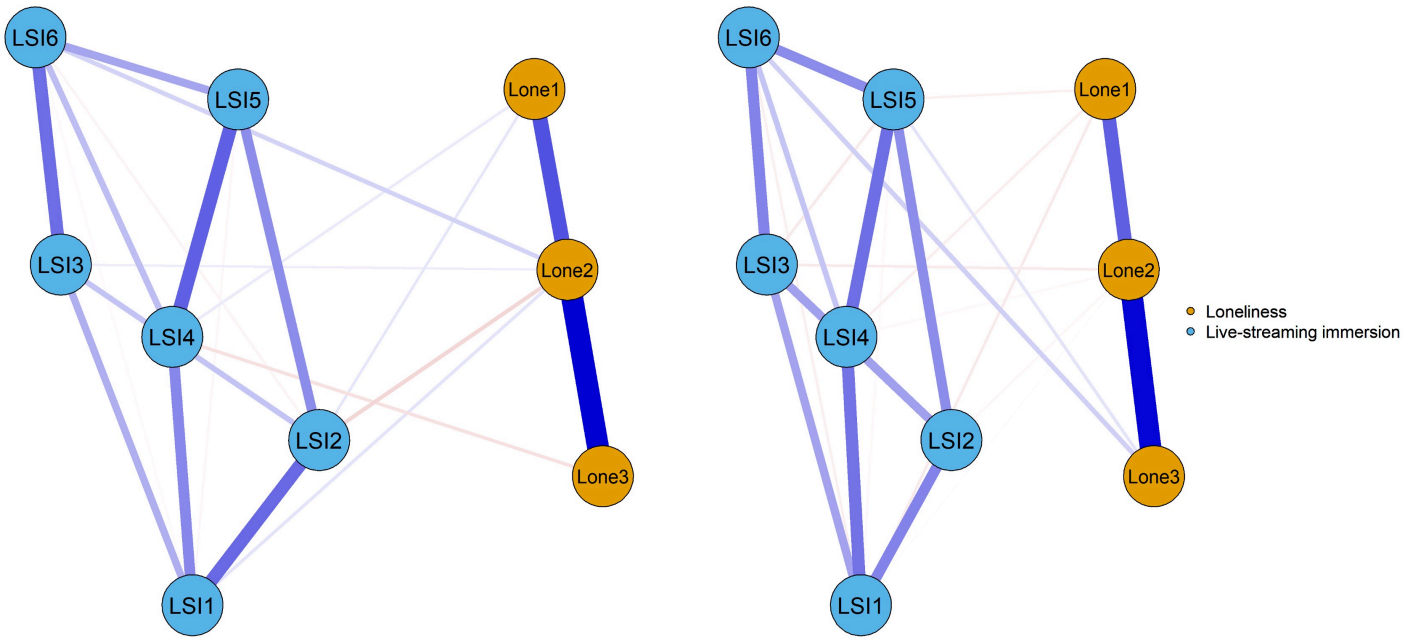


Figure 3 Estimated networks of live-streaming immersion and loneliness in the low (left) versus high (right) online-consumption groups. *Notes.* Yellow nodes indicate loneliness items, while blue nodes indicate live streaming immersion items. Purple edges indicate positive associations, while red edges indicate negative associations. Edge thickness reflects the magnitude of the regularized partial correlation. The same layout was used across groups to facilitate visual comparison. Cross-community edges between live streaming immersion and loneliness were visually amplified for readability; all statistical analyses were based on the original edge weights.

Figure 3

See image above for figure legend.

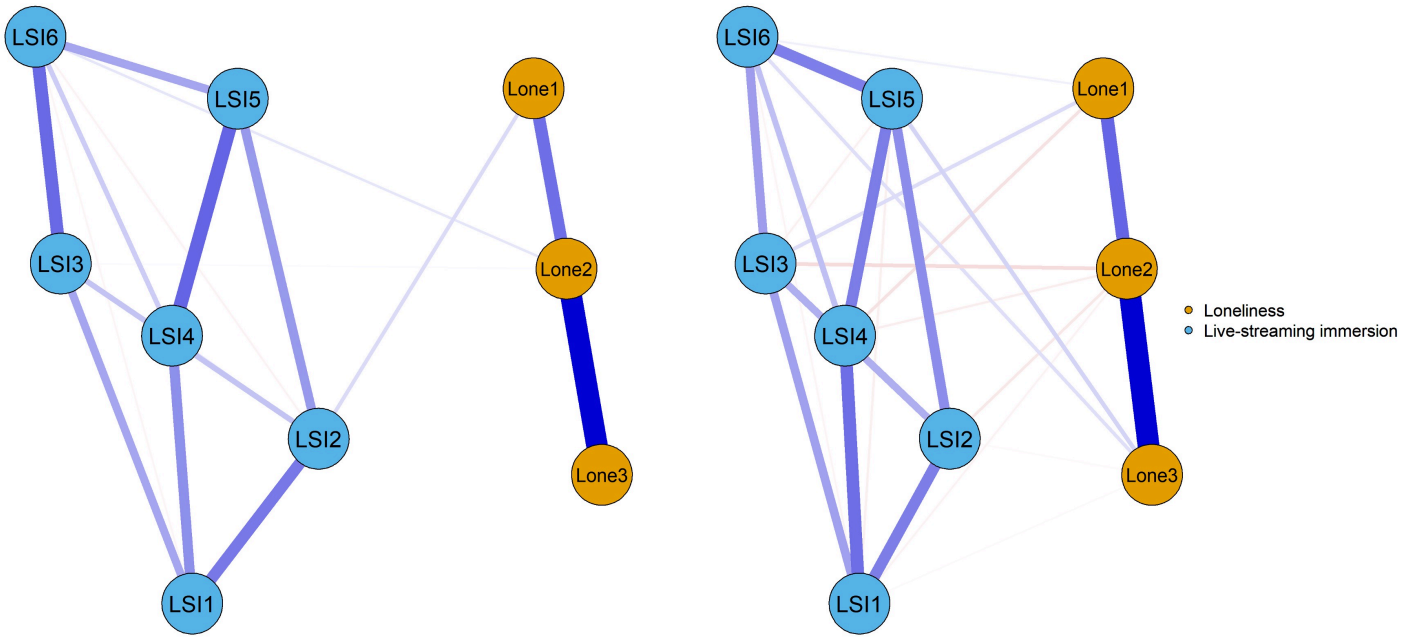


Figure 4. Estimated networks of live-streaming immersion and loneliness in the low (left) versus high (right) affective experience groups. Notes. Yellow nodes indicate loneliness items, and blue nodes indicate live-streaming immersion items. Purple edges indicate positive associations, while red edges indicate negative associations. Edge thickness reflects the magnitude of the regularized partial correlation. The same layout was used across groups to facilitate visual comparison. Cross-community edges between live streaming immersion and loneliness were visually amplified for readability; all statistical analyses were based on the original edge weights.

Figure 4

See image above for figure legend.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Table1.docx
- Table2.docx
- Supplementaryinformation.docx