

Toward a Sustainable Social Media Ecology: How Contextual and Social Integration Harmonize User Experience with In-Feed Commercial Content

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ABSTRACT As digital citizens become increasingly discerning toward commercial infiltration in private social spaces, harmonizing commercial content and user experience on social platforms has become a critical challenge. This research investigates how the seamless contextual and social integration of in-feed commercial content reduces user psychological reactance. Through two empirical experiments (N = 416) taking WeChat (China's dominant social media platform) as the research object, the study examines two fundamental dimensions of platform content integration: contextual integration (CI) and social integration (SI). Experiment 1 demonstrates that both CI and SI significantly mitigate users' perceived intrusiveness. Further mediation analysis reveals distinct psychological pathways: flow experience partially mediates the effect of CI, whereas strong social presence fully mediates the impact of SI. To extend the boundary conditions of social integration, Experiment 2 reveals that users' active social use of in-feed content significantly enhances social presence, thereby alleviating cognitive disruption. This marks a conceptual shift in understanding social media users, moving from passive users of commercial content to active agents who utilize such content to fulfill personal social objectives. Ultimately, the study provides vital implications for digital media ecology, showing that enhancing contextual integration ensures a seamless information experience, while fostering social integration satisfies users' interpersonal needs within virtual communities.

INDEX TERMS Contextual integration, Social integration, Flow experience, Social presence

I. INTRODUCTION

SOCIAL networking platforms have evolved from mere communication tools into indispensable digital habitats for modern citizens [1]. In particular, spaces featuring strong tie social networks, such as WeChat, serve as a critical arena for identity performance and interpersonal connection [2]. However, the sustainable ecology of these digital spaces is increasingly challenged by the pervasive infiltration of in-feed commercial content [3]. As algorithms seamlessly push promotional information into users' daily social feeds, digital citizens have developed highly heightened defensive mechanisms [4]. They are no longer passive recipients easily swayed by intrusive commercial cues; instead, they display growing psychological reactance and cognitive disruption toward non-integrated commercial insertions. Consequently, how to achieve a harmonious co-existence between commercialization and platform user experience has emerged as a fundamental challenge in contemporary digital media ecology.

Historically, the inception of in-feed commercial content

relied heavily on visual camouflage, frequently blurring the boundaries between editorial and promotional material to elicit user engagement [5,6]. However, rooted in the persuasion knowledge model, users continuously refine their defensive cognitive schemas through ongoing media interactions, often resulting in active avoidance of misaligned commercial cues [7,8]. This evolution signals that the paradigm of relying on deceptive presentation has expired; instead, sustainable platform integration must prioritize the intrinsic value of content, ensuring its seamless alignment with the surrounding communication ecology [9,10].

To mitigate user reactance within interactive social environments, this study proposes that commercial content must achieve two critical dimensions of integration.

The first dimension is contextual integration. The ultimate objective of contextual integration is to embed commercial information smoothly into the native information flow [5,11], a characteristic that prior literature often operationalized through visual and textual "similarity" or "consistency" [12,13]. High contextual integration preserves the continuity

of browsing, reduces cognitive friction, and provides users with a seamless information acquisition experience, thereby establishing informational value equivalent to editorial content.

The second dimension, which represents the core theoretical extension of this article, is social integration. Social media spaces are fundamentally governed by users' intrinsic motivations to share experiences, maintain relationships, and seek interpersonal feedback [14,15]. Consequently, even if a commercial post aligns textually with the context, it remains a structural "intruder" that disrupts users' social experience, as corporate entities do not possess authentic relational ties within the user's private network. Therefore, achieving social integration requires that commercial content match and respect the surrounding social climate, transforming from an external disruption into a socially valuable interactive artifact.

This study identifies two primary mechanisms through which social integration is manifested and enhanced. First, structural social cues (e.g., likes and comments left by peers beneath the post) allow users to discover shared interests among their social circle, turning commercial content into a shared social nexus [16,17]. Second, and more importantly, users' active social use of in-feed commercial content functions as a vital antecedent that significantly mitigates its perceived intrusiveness. Media sociology establishes that individuals routinely appropriate media artifacts as symbolic resources to facilitate daily interactions and construct social meaning [18]. For instance, viral commercial campaigns on WeChat are frequently appropriated by users as socio-semantic resources, serving as interpersonal ties or conversational cultural currency, to maintain intimacy and connection in their everyday lives.

Crucially, the perspective of active social use enables a significant conceptual shift in our understanding of user-content dynamics: moving from passive media consumption ('viewing commercial content') to active, interaction-driven media utilization ('using commercial content').

Ultimately, this study conducts two empirical investigations within the WeChat environment to evaluate how contextual and social integration can harmoniously reconcile commercial content placement with users' ongoing social experiences.

II. LITERATURE REVIEW

A. CONTEXTUAL INTEGRATION: FORMAL AND THEMATIC ALIGNMENT OF COMMERCIAL CONTENT WITH PLATFORM CONTEXT

Contextual integration represents the formal and thematic alignment of commercial insertions with their surrounding informational environments. Previous literature has consistently verified the significant impact of this contextual alignment. For instance, in early web environments, Rodgers demonstrated that promotional information topically related to the surrounding news content elicited more favorable cognitive evaluations than contextually irrelevant material[19].

Similarly, within online content platforms, Wang and Li confirmed that the semantic consistency between embedded commercial messages and editorial content heavily modulates user responses[20].

Building upon these insights, theoretical developments underscore that synchronizing both the formal and thematic dimensions of commercial insertions is imperative for preserving the native user experience [21,22].

When embedded messages integrate naturally into their context, they effectively mitigate users' cognitive disruption. Perceived disruption reflects an individual's subjective awareness of how an external insertion interrupts ongoing cognitive processes [23,24]. When a message is processed as highly disruptive, it triggers defense mechanisms and heightened psychological reactance, which frequently manifest as emotional irritation or active avoidance behaviors [23].

This disruption is particularly pronounced within strong-tie social networks like WeChat Moments, where users primarily engage in social communication with acquaintances; in such contexts, the contextual alignment of commercial content serves as a critical buffer that preserves the natural information-gathering flow.

H1. Contextual integration has a negative impact on users' perceived intrusiveness. Specifically, commercial insertions with high contextual integration elicit significantly lower levels of perceived intrusiveness compared to those with low contextual integration.

B. THE MEDIATING ROLE OF FLOW EXPERIENCE BETWEEN CONTEXTUAL INTEGRATION AND PERCEIVED INTRUSIVENESS

Flow experience characterizes a state of optimal cognitive engagement and deep immersion within an ongoing activity, wherein individuals become intensely focused and frequently lose their temporal awareness [25,26,27]. Digital social networks operate as highly interactive and dynamic informational environments that necessitate continuous cognitive monitoring and active behavioral engagement with social cues [28,29]. As users navigate through these rich interpersonal streams, the high level of interactivity and psychological investment frequently induces a robust flow experience [30].

WeChat Moments allows users to keep up to date on their friends' latest news and interact with their friends through likes and comments. Because of WeChat Moments' fantastic content and user-friendly interface, users will likely become unconsciously immersed in it and experience a flow experience [31].

Attention focus constitutes an essential cognitive dimension of the flow experience, characterized by the concentration of mental resources on a limited field of environmental stimuli while filtering out extraneous thoughts and perceptions [32]. This concentrated allocation of attention facilitates the continuous evaluation and cognitive processing of incoming information, preserves the continuity of the users' browsing trajectory, and deepens psychological

immersion, ultimately eliciting a state of positive affect [33]. When users navigate WeChat Moments, their cognitive resources are heavily dedicated to social connection and interpersonal cues. External commercial insertions that lack contextual integration compel individuals to allocate supplementary mental effort to process the mismatched stimuli, thereby disrupting the continuity of selective attention. Conversely, commercial insertions characterized by high contextual integration alleviate this cognitive burden by presenting synchronized content and harmonious interface designs. Consequently, the alignment of these informational properties preserves the user's focal attention and sustains the immersion within the ongoing browsing flow, ultimately mitigating the generation of perceived intrusiveness.

Following these findings, we hypothesize:

H2. Contextual integration reduces users' perceived intrusiveness indirectly through the mediating mechanism of the flow experience.

C. SOCIAL INTEGRATION: ALIGNMENT OF COMMERCIAL CONTENT WITH SOCIAL CONTEXT

Social integration entails the seamless embedding of commercial content into users' social interactions, effectively transforming it into an organic component of interpersonal dialogue.

Extant literature primarily examines the presence of peer engagement (such as friends' likes and comments) from a traditional word-of-mouth or social endorsement perspective [34,35]. However, this conventional paradigm merely conceptualizes peer interaction as an external evaluative cue, failing to capture why such engagement fundamentally reshapes user perception from the lens of the intrinsic communicative nature of social integration.

Digital platforms establish a social context characterized by interpersonal interconnectedness among familiar peers [36]. Within this environment, peer-generated social cues are displayed beneath commercial content structure in interactive environments. Specifically, 'likes' operate as foundational, low-effort social signals that manifest passive engagement and psychological alignment [37].

In contrast, 'comments' constitute high-manifestation social cues with stronger informational value; they allow individuals to articulate nuanced attitudes via text or symbolic expressions, thereby facilitating direct, multi-way discursive interactions regarding the topics embedded within the content [38]. Consequently, rather than serving as mere promotional tools, commercial insertions integrated with these interactive properties co-create a dynamic social space. This collaborative environment enables users to decode peer perspectives, navigate shared meanings, and experience mutual affective resonance.

Consequently, rather than remaining as intrusive disruptions, commercial content accompanied by vibrant peer interactions serves as a relational conduit that connects users and their peers. By generating intrinsic social value, these commercial insertions are effectively absorbed into

the platform's social ecology, thereby achieving true social integration.

Following these findings, we propose the following hypothesis:

H3. Social integration has a significant negative impact on users' perceived intrusiveness. Specifically, higher social integration in commercial content leads to a lower level of perceived intrusiveness.

D. THE MEDIATING ROLE OF SOCIAL PRESENCE BETWEEN SOCIAL INTEGRATION AND PERCEIVED INTRUSIVENESS

Social presence was proposed by Short, who defined social presence as the salience of interpersonal interactions and the prominence of other people's presence when using technology for communication [39]. Scholars who agree with Short believe that social presence is the degree to which a person feels connected to and with others while communicating through media [40,41,42].

Social presence serves as a foundational determinant across a myriad of online modalities, with extant literature demonstrating its pivotal role in e-commerce frameworks [43], virtual communities [44], and digital learning environments [45].

As a form of instrumental communication, commercial content embedded within social platforms generally lacks the inherent warmth and relational appeal characteristic of genuine interpersonal dialogue. However, peer-generated interactions, such as likes and comments displayed beneath this commercial content, foster a profound sense of "being with others."

This heightened social presence engenders a state of psychological immersion and affective pleasure, effectively transforming how individuals process information within these relational matrices. Consequently, when commercial content is embedded within peer interactions, users perceive it as a natural extension of the social context, thereby lowering its perceived intrusiveness.

Following these findings, we propose the following hypothesis:

H4. Social integration reduces users' perceived intrusiveness indirectly through the mediating mechanism of social presence.

III. STUDY 1

Study 1 aims to validate the four primary hypotheses. First, to test the impact of contextual integration on perceived intrusiveness, in order to validate H1; second, to determine whether contextual integration influences perceived intrusiveness through the flow experience, in order to validate H2; third, to assess the effect of social integration on perceived intrusiveness, in order to validate H3; and finally, to determine whether social integration affects perceived intrusiveness through social presence, in order to validate H4.

A. STUDY DESIGN AND PROCEDURE

211 participants were recruited for the experiment through the Credamo online research platform. 125 women (59.2%) and 86 men (40.8%) were recruited. The study participants' age distribution was as follows: 7.1% (n=15) were 0–20 years old, 49.3% (n=104) were 21–30, 35.1% (n=74) were 31–40, 3.8% (n=8) were 41–50, and 4.7% (n=10) were 51 years or older (Total N=211). The participants' educational attainment was distributed as follows: bachelor's degree (75.8%, n=160), college diploma or below (11.4%, n=24), and master's degree or above (12.8%, n=27).

This study employed a 2 (contextual integration: high vs. low) $\times$ 2 (social integration: high vs. low) between-subjects design. First, subjects were invited to imagine that they were browsing their WeChat Moments and were shown a picture containing two friend posts and a commercial insertion. The study employed Axure RP 9 software to replicate the WeChat Moments interface, providing participants with an authentic experience of the WeChat Moments platform. Every participant was assigned at random to one of the four experimental groups. Upon reviewing the experimental images as instructed, the participants completed the questionnaire at the end of the experiment.

B. MANIPULATION

Contextual integration is manipulated by the degree to which the commercial content integrates into its surrounding context regarding its content and form. In a high contextual integration scenario, the informational content of the commercial insertion is relevant to the context and consistent with the context in terms of design; in a low contextual integration scenario, the informational content of the commercial insertion is irrelevant to the context and inconsistent with the context in terms of design.

Specifically, the peer-generated posts constituting the surrounding context in the experiment focused on topics related to 'fitness' and 'weight loss.' These themes were selected because they reflect benign everyday life routines shared on social platforms. Unlike heavy societal topics, they avoid triggering cognitive tension; similarly, unlike deeply personal dynamics such as travel logs or private photography, they remain free from boundary-invasive privacy concerns. Additionally, the background of the platform interface was set to white with black text.

Thus, in a high contextual integration scenario, the experiment selected a fat-reducing meal commercial insertion relevant to the peer-generated content. The commercial insertion was designed to have the same background color and text color as WeChat Moments; in a low contextual integration scenario, an irrelevant umbrella commercial insertion to the content of friends' posts in WeChat Moments was selected, along with a commercial insertion design that did not match the background color or the text color of WeChat Moments.

Prior to the formal experiment, authentic examples of in-feed commercial content were gathered as a baseline reference. To control for potential confounding effects of brand

familiarity and pre-existing brand attitudes, two fictitious brands were created as experimental stimuli: 'Sand Green Light' (representing the weight-management category) and 'Love on Rain' (representing the umbrella category).

As conceptualized earlier, social integration reflects the degree of social interaction embedded within commercial content. Consequently, the absence of any peer interaction (zero likes and zero comments) beneath the commercial post in WeChat Moments served as the low social integration condition. Conversely, the presence of three likes and three distinct comments served as the high social integration condition.

Notably, the user comments deliberately excluded any specific details regarding product attributes or brand characteristics to prevent confounding word-of-mouth (WOM) effects from biasing the experimental outcomes. Additionally, brand familiarity and advertising quality were assessed within the study and statistically controlled for as covariates in the subsequent analyses.

C. MEASUREMENT SCALES

The focal constructs in this study were assessed using well-established scales adapted from prior literature, all measured on five-point Likert scales.

Contextual Integration. Adapted from Kim et al., this construct was conceptualized as a unified variable integrating both content and form dimensions, measured via four items[11]. An exploratory factor analysis (EFA) demonstrated a robust single-factor structure for the overall scale (explained variances = 81.21%, Cronbach's alpha = .922), confirming its one-dimensionality. Example items are as follows: "The content of the insertion was highly relevant to the surrounding environment" (content dimension) and "The visual presentation of the insertion blended seamlessly with the overall interface layout" (form dimension).

Social integration. Adapted from a study on information cues in social environments [46], a single-item metric focusing on peer feedback was employed to capture participants' explicit detection of interpersonal signals within the interface. Participants evaluated their awareness via the following item: "During browsing, I was able to perceive and understand network peers' perspectives and views regarding the embedded material."

Perceived intrusiveness. Perceived intrusiveness was measured using three items adapted from a study on advertising intrusiveness [23]: "The presence of the insertion is abrupt," "The insertion is distracting to me," and "The insertion is annoying to me." Factor analysis revealed that the items load on one factor (explained variances = 84.03%, Cronbach's alpha = .904).

Flow experience. Flow experience [47,48] was measured using three items ("I felt immersed while browsing," "I felt happy while browsing," "I didn't think about anything else while browsing"). Factor analysis revealed that the items load on one factor (explained variances = 70.60%, Cronbach's alpha = .787).

Social presence. Social presence [49] was measured using four items capturing the users' perceived psychological closeness afforded by social cues (e.g., "The presence of peer interactions like likes and comments created a genuine sense of connection," "I could perceive the emotions of my network peers"). Factor analysis revealed that the items load on one factor (explained variances = 74.41%, Cronbach's $\alpha = .883$).

Control Variables. To isolate the unique effects of our focal variables, brand familiarity was measured using a three-item scale adapted from [50], and advertising quality was assessed via a single-item five-point diagnostic evaluating the novelty and creativity of the presentation layout.

D. RESULTS

The independent-sample t-test results showed that participants in the high contextual integration group scored significantly higher on the contextual integration manipulation questions than those in the low contextual integration group ($M = 4.20$, $SD = 0.67$ vs. $M = 2.90$, $SD = 1.18$; $t = -9.79$, $p < .001$). Therefore, contextual integration was manipulated successfully.

Similarly, the independent-samples t-test results revealed that participants in the high social integration group scored significantly higher on the social integration manipulation questions than those in the low social integration group ($M = 4.30$, $SD = 0.61$ vs. $M = 3.31$, $SD = 1.31$; $t = -7.07$, $p < .001$). Therefore, social integration was manipulated successfully.

An ANCOVA was conducted with contextual integration and social integration as independent variables, perceived intrusiveness as the dependent variable, and brand familiarity, advertising quality, and gender as covariates. The results are shown in Table I.

(1) The main effect of contextual integration was statistically significant ($F(1, 204) = 16.46$, $\eta^2 = .075$, $p < .001$), indicating that participants in the high contextual integration condition perceived lower intrusiveness than those in the low contextual integration condition.

(2) The main effect of social integration was also significant ($F(1, 204) = 4.70$, $\eta^2 = .023$, $p < .05$), revealing that high social integration led to less perceived intrusiveness compared to the low social integration condition.

(3) However, the two-way interaction effect between contextual integration and social integration on perceived intrusiveness failed to reach statistical significance ($F(1, 204) = 0.23$, $\eta^2 = .001$, $p = .636$). Therefore, H1 and H3 were supported.

The study employed Hayes' PROCESS macro (Model 4) to examine the mediating effect of flow experience, with contextual integration as the independent variable and perceived intrusiveness as the dependent variable. The significance of the mediating effect was assessed using the bootstrapping method with 5,000 resamples. The results are shown in Table II and Table III.

The results indicated that contextual integration exerted a significant negative effect on perceived intrusiveness ($B = -.87$, $t = -5.62$, $p < .01$). When the mediating variable was included, the direct effect of contextual integration on perceived intrusiveness remained significant ($B = -.63$, $t = -4.70$, $p < .01$). Moreover, contextual integration significantly and positively predicted flow experience ($B = .35$, $t = 2.92$, $p < .01$), which in turn had a significant negative influence on perceived intrusiveness ($B = -.67$, $t = -8.72$, $p < .01$).

Furthermore, neither the upper nor the lower limit of the bootstrap 95% confidence intervals for the direct effect of contextual integration on perceived intrusiveness and the mediating effect of flow experience contained 0, suggesting that contextual integration not only directly predicts perceived intrusiveness, but also predicts perceived intrusiveness through the mediating effect of flow experience. Thus, H2 was supported.

The study employed Hayes' PROCESS macro to examine the mediating effect of social presence, with social integration as the independent variable, perceived intrusiveness as the dependent variable, and brand familiarity, ad quality, and gender as covariates. The significance of the mediating effect was assessed using the bootstrap method. The results are shown in Table IV and Table V.

The results showed that the negative influence of social integration on perceived intrusiveness was significant ($B = -.27$, $t = -2.04$, $p < .05$), but when the mediating variable was included, the direct predictive effect of social integration on perceived intrusiveness was not significant ($B = -.09$, $t = -0.68$, $p = .500$). The positive effect of social integration on social presence was significant ($B = .56$, $t = 5.51$, $p < .01$) and the negative effect of social presence on perceived intrusiveness was significant ($B = -.31$, $t = -3.59$, $p < .01$).

Furthermore, the direct effect of social integration on perceived intrusiveness was not significant, and the mediating effect of social presence was significant, indicating that social presence fully mediated the effect of social integration on perceived intrusiveness. Thus, H4 was supported.

TABLE I. THE EFFECTS OF CONTEXTUAL INTEGRATION AND SOCIAL INTEGRATION ON PERCEIVED INTRUSIVENESS

Source	Type III Sum of Squares	df	Mean Square	F	p	η^2
Corrected Model	133.53	6	22.25	26.88	< .001	.442
Intercept	183.26	1	183.26	221.37	< .001	.520
Advertising quality	46.25	1	46.25	55.87	< .001	.215
Brand familiarity	8.81	1	8.81	10.64	.001	.050
Gender	1.85	1	1.85	2.23	.137	.011
Contextual integration	13.63	1	13.63	16.46	< .001	.075
Social integration	3.89	1	3.89	4.70	.031	.023
Contextual integration * Social integration	0.19	1	0.19	0.23	.636	.001
Error	168.87	204	0.83			
Total	1703.22	211				
Corrected Total	302.4	210				

Note. $R^2 = .442$ (Adjusted $R^2 = .425$).

TABLE II. THE MEDIATING EFFECT OF FLOW EXPERIENCE ON THE RELATIONSHIP BETWEEN CONTEXTUAL INTEGRATION AND PERCEIVED INTRUSIVENESS

Dependent Variable	Independent Variable	R	R^2	F	B	t	LLCI	ULCI
Flow experience	Contextual integration	.20	.04	8.53	.35	2.92	.11	.58
Perceived intrusiveness	Contextual integration	.60	.36	59.51	-.63	-4.70	-.90	-.37
	Flow experience				-.67	-8.72	-.82	-.52

TABLE III. TOTAL, DIRECT, AND MEDIATING EFFECTS OF CONTEXTUAL INTEGRATION ON PERCEIVED INTRUSIVENESS THROUGH FLOW EXPERIENCE

Effect Type	Path	Effect	BootSE	BootLLCI	BootULCI
Total effect	Contextual integration → Perceived intrusiveness	-0.87	0.15	-1.17	-0.56
Direct effect	Contextual integration → Perceived intrusiveness	-0.63	0.14	-0.90	-0.37
Mediating effect	Contextual integration → Flow experience → Perceived intrusiveness	-0.23	0.08	-0.40	-0.08

TABLE IV. THE MEDIATING EFFECT OF SOCIAL PRESENCE ON THE RELATIONSHIP BETWEEN SOCIAL INTEGRATION AND PERCEIVED INTRUSIVENESS

Dependent Variable	Independent Variable	R	R^2	F	B	t	LLCI	ULCI
Social presence	Social integration	.60	.35	28.31	.56	5.51	.36	.76
Perceived intrusiveness	Social integration	.66	.43	31.10	-.09	-.68	-.36	.18
	Social presence				-.31	-3.59	-.49	-.14

TABLE V. TOTAL, DIRECT, AND MEDIATING EFFECTS OF SOCIAL INTEGRATION ON PERCEIVED INTRUSIVENESS THROUGH SOCIAL PRESENCE

Effect	B	se	LLCI	ULCI
Total effect	-.27	.13	-.53	-.01
Direct effect	-.09	.14	-.36	.18
Mediating effect of social presence	-.18	.07	-.32	-.06

E. DISCUSSION: SOCIAL USE AS ANOTHER FORM OF SOCIAL INTEGRATION

In summary, the initial findings from Study 1 demonstrate that contextual and social integration collectively mitigate users' perceived intrusiveness. Specifically, regarding social integration, when commercial content is embedded alongside relational cues (e.g., peer interactions), individuals exhibit lower cognitive resistance because the social context allows the commercial stimulus to more naturally integrate into the user's ongoing social experience. However, this mechanism represents a relatively passive form of social integration, wherein users function merely as observers of social interactions rather than active participants.

To bridge this gap, this research extends the theoretical boundaries of social integration by incorporating the notion of active social use. Distinct from mere observation, active social use implies that individuals proactively leverage com-

mercial content.

Seminal work by Ritson and Elliott conceptually discussed the early social use of commercial messages, arguing that traditional research often neglects socio-cultural contexts and mischaracterizes the product users as isolated individuals disconnected from interpersonal realities[18]. They emphasize that because all consumption activity occurs within a collective socio-cultural framework, understanding the social context of commercial messages is paramount.

Furthering this paradigm, Mitchell et al. investigated how young adults engage with commercial messages in social settings, revealing that individuals frequently deploy communication elements (e.g., slogans and taglines) for interpersonal purposes entirely unrelated to immediate product purchase[51]. This evidence strongly supports the argument that commercial content can be consumed and utilized independently of the products they sponsor [51].

Aligning with this theoretical lineage, we conceptualize active social use in the digital context as the process wherein individuals proactively leverage commercial content to facilitate interpersonal interactions and achieve social goals through explicit engagement (e.g., sharing or collaborative discussion). During this active appropriation, the commercial content ceases to be an external disruption; instead, it is organically imbued with idiosyncratic social value, achieving a higher order of psychological embeddedness. Therefore, to comprehensively delineate the boundary conditions of social integration, Study 2 shifts the focal inquiry from passive observation to active social use.

Within modern Social Network Services (SNS) environments, users can instantly engage with commercial content by leaving feedback in the accompanying comments section of these messages or directly interacting via chat interfaces. Consequently, commercial messages embedded within social feeds are uniquely positioned to expedite this social use. During this process, the commercial stimulus naturally assimilates into the overarching social context and reduces the perceived disruption to the user. Accordingly, this research posits that the active social use of embedded commercial stimuli facilitates a higher degree of social integration, which subsequently mitigates users' perceived intrusiveness through the psychological mechanism of social presence.

IV. STUDY 2

Experiment 2 is designed to examine whether the proposed research hypotheses remain robust when social integration manifests operationally as the active social use of commercial content. Specifically, this study aims to achieve two interconnected empirical objectives: first, to test Hypothesis 3 (H3) by evaluating whether social use negatively affects users' perceived intrusiveness; and second, to investigate the mediating mechanism postulated in Hypothesis 4 (H4) by assessing whether social use mitigates perceived intrusiveness through the psychological pathway of social presence.

A. STUDY DESIGN AND PROCEDURE

205 participants were recruited for the experiment through the Credamo online research platform. Of these, 68 men (33%) and 137 women (67%) were recruited. The sample comprised 205 participants with the following age distribution: 4.9% (n=10) were 0–20 years old, 46.8% (n=96) were 21–30, 36.1% (n=74) were 31–40, 5.9% (n=12) were 41–50, 5.4% (n=11) were 51–60, and 1.0% (n=2) were over 60 years old.

The study used a one-factor (social integration: high social integration vs. low social integration) between-group design. At first, participants were asked to imagine a scenario where they casually opened WeChat Moments, intending to browse their friends' posts. Subsequently, they were presented with a picture of WeChat Moments containing commercial content for a footwear brand. The study used a created brand of footwear called Light Step to avoid any

additional influences resulting from brand familiarity. To avoid the association between the subjects and the products in the experiment from interfering with the results, the study also measured the relevance of information and excluded its effect by covariance.

B. MANIPULATION

The level of social use was manipulated by the extent of user engagement with the firm-initiated topic. In the highly active social use context, the experiment stipulated that a topic was initiated within the comment section of the WeChat Moments commercial content, and subjects shared this topic with their friends for discussion, thereby engaging in active social use of the content. In the low active social use context, no topic was initiated within the comment section of the WeChat Moments commercial content, and subjects did not engage in social use.

Specifically, in the highly active social use scenario, the brand-initiated comment beneath the commercial content featured the topic: "A question for professionals: Do you wear slippers in the office? @ a friend to share their office quirks." The subjects were then instructed to imagine themselves in the given scenario: "You plan to discuss it with a WeChat friend who you believe has relevant experience, and please write down their nickname or your relationship in the blank space provided."

C. MEASURES

All focal constructs were measured using established scales adapted from prior literature and evaluated via a 5-point Likert approach (1 = strongly disagree, 5 = strongly agree). *Perceived Intrusiveness*. Adapted from Experiment 1, this construct was assessed using a three-item scale. Sample items include: "The commercial content is intrusive to me" and "The presence of the commercial content is abrupt." Factor analysis revealed that the items load on a single factor (explained variance = 83.07%, Cronbach's alpha = .897).

Social Presence. Modified from Experiment 1, the scale comprised four items capturing users' psychological closeness. Sample items include: "I have a real sense of communicating with good friends" and "I can understand the viewpoints and opinions of my WeChat friends." Factor analysis confirmed its one-dimensionality (explained variance = 78.11%, Cronbach's alpha = .906).

Active Social Use. To check the manipulation, a five-item scale adapted from Fan et al. was employed[52]. Sample items include: "The commercial content allowed me to interact with other people in real-time and in a fun way," and "Overall, I think the commercial content promotes communication and interaction." Factor analysis indicated a single-factor structure (explained variance = 77.39%, Cronbach's alpha = .926).

Information Relevance. This construct was assessed via a four-item scale adapted from Hayes et al.[53]. Sample items include: "The product featured in the commercial content meets my needs" and "The commercial content is relevant

TABLE VI. THE EFFECTS OF SOCIAL USE ON PERCEIVED INTRUSIVENESS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	η^2
Corrected Model	139.70 ^a	2	69.85	108.53	< .001	.52
Intercept	489.53	1	489.53	760.64	< .001	.79
Information Relevance	120.39	1	120.39	187.06	< .001	.48
Social use	9.54	1	9.54	14.83	< .001	.07
Error	130.00	202	0.64			
Total	1823.22	205				
Corrected Total	269.70	204				

Note. ^a $R^2 = .518$ (Adjusted $R^2 = .513$).

TABLE VII. THE MEDIATING EFFECT OF SOCIAL PRESENCE ON THE RELATIONSHIP BETWEEN SOCIAL USE AND PERCEIVED INTRUSIVENESS

Dependent variable	Independent variable	R	R^2	F	B	t	LLCI	ULCI
Social presence	Social use	.33	.11	24.09	0.67	4.91	.40	.94
Perceived intrusiveness	Social use	.69	.47	92.10	-0.11	-0.90	-.35	.13
	Social presence				-0.75	-12.51	-.87	-.63

TABLE VIII. TOTAL, DIRECT, AND INDIRECT EFFECTS OF SOCIAL USE ON PERCEIVED INTRUSIVENESS THROUGH SOCIAL PRESENCE

Effect	Effect Size	se	Boot LLCI	Boot ULCI
Total effect	-.61	.16	-.92	-.31
Direct effect	-.11	.12	-.35	.13
Indirect effect (via Social presence)	-.50	.11	-.73	-.30

to me.” Factor analysis showed that the items load on one factor (explained variance = 69.97%, Cronbach’s alpha = .854).

D. RESULTS

The independent-samples t-test results indicated that participants in the high social use group scored significantly higher on the social use manipulation check items than those in the low social use group ($M_{\text{high}} = 3.64$, $SD_{\text{high}} = 0.92$ vs. $M_{\text{low}} = 3.01$, $SD_{\text{low}} = 1.09$; $t = -4.45$, $p < .01$). Therefore, the experimental manipulation of social use was successful.

An analysis of covariance (ANCOVA) was conducted with social use as the independent variable, perceived intrusiveness as the dependent variable, and information relevance as the covariate (see Table VI). The results revealed that the perceived intrusiveness scores of participants in the high social use group were significantly lower than those in the low social use group ($M_{\text{high}} = 2.44$, $SD = 1.05$ vs. $M_{\text{low}} = 3.06$, $SD = 1.17$; $F(1, 202) = 14.83$, $p < .01$). Thus, these findings demonstrate that when social integration operationally manifests as the social use of commercial content, it exerts a significant negative effect on users’ perceived intrusiveness. Consequently, Hypothesis 3 (H3) is fully supported.

To test Hypothesis 4 (H4), the mediating effect of social presence was examined using the PROCESS macro (Model 4)[54], with social use entered as the independent variable, social presence as the mediating variable, perceived intrusiveness as the dependent variable, and information relevance as the covariate. The statistical significance of the mediating pathway was evaluated using the bootstrapping method with 5,000 resamples. The comprehensive results of this mediation analysis are summarized in Table VII and Table VIII.

The results indicated that the total effect of social use on perceived intrusiveness was significantly negative ($B = -0.61$, $t = -3.96$, $p < .01$). However, when the mediating variable (social presence) was introduced into the model, the direct effect of social use on perceived intrusiveness became non-significant ($B = -0.11$, $t = -0.90$, $p = .37$). Concurrently, social use exerted a significant positive impact on social presence ($B = 0.67$, $t = 4.91$, $p < .01$), and social presence had a significant negative impact on perceived intrusiveness ($B = -0.75$, $t = -12.51$, $p < .01$).

Furthermore, the direct effect of social use on perceived intrusiveness was statistically non-significant. In contrast, the indirect effect through social presence was statistically significant, indicating that social presence fully mediated the relationship between social use and perceived intrusiveness. These findings demonstrate that when social integration operationally manifests as the social use of commercial content, it mitigates users’ perceived intrusiveness entirely through the mechanism of social presence. Consequently, Hypothesis 4 (H4) is fully supported.

V. DISCUSSION

This research provides clear empirical evidence for how the contextual and social integration of in-feed commercial content harmonizes user experience with commercial presence, advancing a sustainable ecology for social media platforms. Experiment 1 reveals two parallel pathways through which content alignment mitigates user resistance: first, contextual integration (CI), achieved through the formal and thematic alignment of commercial insertions with their surrounding informational environments, induces a seamless flow experience, which in turn effectively reduces perceived intrusiveness; second, social integration (SI), operationalized through interpersonal cues such as peer interactions, significantly

buffers perceived intrusiveness by evoking a robust sense of social presence. Extending the boundary conditions of social integration, Experiment 2 redefines social integration from a static platform property into an active process of social use. The empirical outcomes show that this dynamic form of utilization effectively mitigates cognitive disruption, relying on the consistent mediating mechanism of social presence.

These findings offer substantive theoretical contributions to the literature on social media by demonstrating how contextual and social integration can reconcile commercial content with user experience—a key condition for fostering a sustainable platform environment.

On the cognitive dimension, this research deepens our understanding of user resistance. While prior literature consistently notes that mismatched information triggers defensive avoidance, our findings clarify the precise cognitive mechanics: commercial intrusions provoke psychological reactance precisely because they rupture the continuity of the user's flow experience. By establishing flow experience as a vital cognitive bridge, this study demonstrates that high contextual integration does not merely present a visually harmonious layout, but actively serves the user's psychological need for information continuity, thereby offering a more profound cognitive explanation for the mitigation of perceived intrusiveness.

On the social-emotional dimension, this research deepens our understanding of user resistance by fully accounting for the inherent attributes of social media environments. While prior literature consistently notes that certain platform characteristics influence users' avoidance behavior, it fails to penetrate the underlying mechanics of how commercial messages can transition from a cognitive burden into an organic part of users' social experience. Our findings clarify this puzzle by establishing social presence as a critical psychological mediator; when users experience the psychological warmth of being interconnected with others, their perceived intrusiveness of sponsored content is significantly minimized. This research demonstrates that such social presence can be successfully evoked through two pathways: the passive observation of interpersonal cues (such as peer interactions beneath the content) and, more importantly, users' active social use of the content to fulfill personal interactive goals. Notably, by introducing the overlooked perspective of social use, this study fundamentally shifts the conceptualization of platform users from passive information consumers to active agents who strategically utilize content to achieve social objectives, thereby offering a more advanced and sophisticated framework for audience psychology in digital networks.

Beyond theoretical discourse, the empirical insights of this research yield practical implications for the sustainable governance of digital media ecologies and user experience optimization. In an era where social platforms must balance capital sustainability with user retention, our dual-track findings offer a blueprint for platform architecture and content orchestration. First, on the informational front,

system designers should prioritize preserving users' cognitive flows. Rather than relying on disruptive, high-salience formats that interrupt browsing, interfaces should encourage stricter formal and thematic alignment of sponsored content with organic streams. Safeguarding this continuity respects users' psychological boundaries, lowering systemic fatigue in digital environments.

Second, and more importantly, on the relational front, platform operators should move beyond top-down commercial message dissemination models and cultivate community-driven social spaces. By leveraging relational cues (such as peer interactions) and content co-creation tools, platforms can directly enable users' active social use. This tactical shift allows digital spaces to effectively recontextualize commercial insertions into communal assets, transitioning users from passive recipients to active agents who enrich the virtual ecosystem. Ultimately, these strategies point toward a more harmonious digital media ecology where platform viability and user psychological well-being are no longer mutually exclusive.

Although this research provides robust empirical evidence for the dual-pathway mechanism of platform integration, several limitations inherent to the experimental design point toward valuable avenues for future inquiry.

First, to isolate the pure psychological effect of social integration, this study used peer comments devoid of product or brand evaluations. However, in authentic social networking environments like WeChat Moments, interpersonal interactions naturally blend task-neutral banter with valenced brand sentiments. Consequently, social integration and electronic word-of-mouth (eWOM) likely operate concurrently or interactively. Future research should construct a multiplex model that investigates how normative social influence and informational persuasion jointly shape user outcomes.

Second, in Study 1, our experimental design manipulated the static peer feedback (i.e., likes and comments) as the manipulation of social integration. In authentic networking environments, however, the user, their immediate peers, and the marketer engage in iterative, real-time, reactive exchanges. This layered conversational approach possesses the potential to generate a significantly heightened, emergent sense of social presence. Consequently, future inquiries should examine how multi-turn digital dialogues facilitate the organic assimilation of embedded content into users' social spaces. Moreover, future models should integrate nuanced relational contingencies, such as tie strength, perceived social status, and psychological distance among the interacting nodes, to comprehensively map how complex interpersonal networks modulate user psychology in collaborative digital spaces.

Third, the contextual boundaries of this inquiry are constrained by the structural and cultural architecture of a single platform ecosystem. Situated within WeChat Moments, our findings inherently reflect a private, strong-tie social network. The generalizability of these dual-track pathways across divergent platform architectures, such as open-

network, weak-tie environments (e.g., TikTok, Instagram), remains an open question. Comparative cross-platform analyses would be highly instrumental in delineating the systemic boundary conditions of our theoretical model.

VI. CONCLUSION

This study examined how contextual and social integration reduce the perceived intrusiveness of in-feed commercial content in social media environments. Across two experiments on WeChat, contextual integration lowered intrusiveness partly by maintaining users' flow experience, whereas social integration reduced intrusiveness by strengthening social presence. This social mechanism was evident both when users observed peer interactions and when they actively used commercial content for interpersonal communication. The findings therefore distinguish two complementary routes through which commercial content can be incorporated into social media: informational alignment with the surrounding content and social embeddedness within users' interactions. They also extend prior research by viewing users not only as passive recipients of commercial messages but also as active agents who may appropriate such content for social purposes. For platforms and advertisers, the results suggest that reducing disruption requires more than making promotional content visually similar to organic posts. Commercial content should also support meaningful interaction and fit users' ongoing social experiences.

FUNDING

This research received no external funding.

DATA AVAILABILITY STATEMENT

The data presenting the findings of this study are available on reasonable request from the corresponding author. The data are not publicly available due to privacy and institutional restrictions.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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