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Addressing excessive social media use: effects of perceived intrusiveness and psychological reactance on compliance with Douyin healthy use reminders

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Abstract

Purpose: Excessive social media use has emerged as a pressing issue in recent years, prompting concerns about its adverse effects on users' physical and mental well-being. In response to these concerns, the Chinese short video platform Douyin has implemented healthy use reminders to mitigate excessive and problematic use. This study aims to investigate the effectiveness of Douyin healthy use reminders on users' perceptions and behaviors.

Design/methodology/approach: We conducted an online survey on Chinese college students who were Douyin users. We measured users' perceived intrusiveness toward the reminder messages, perceived freedom threat, psychological reactance, attitudes toward the reminder messages, and their compliance behavior in the survey.

Findings: Results from structural equation modeling showed that users' perception of the reminders' intrusiveness negatively impacted their attitude, subsequently affecting compliance behavior. Additionally, results showed that this effect could be explained by psychological reactance theory, as perceived intrusiveness heightened users' sense of freedom threat and psychological reactance, further influencing attitude and compliance behavior.

Implications: Our findings imply that social media platforms like Douyin should take into account user experience and acceptance of the healthy use reminders to

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enhance the persuasive effects. Possible strategies to enhance the communication effectiveness of the healthy use reminder messages are discussed.

Originality/value: Although recent literature has paid more attention to the problematic and excessive use of social networks, these studies primarily focused on exploring users' dispositional traits to explain the association between excessive social media use and users' well-being. The present study is the first to explore the psychological processes that explain the effectiveness of platform-initiated healthy use intervention. We also extend the theoretical understanding of the psychological reactance theory in social media use in a non-English context.

Keywords: Douyin; healthy use reminder; excessive social media use; psychological reactance; compliance behavior

1 Introduction

The short video platform is one of the fastest-growing industries in the global social network market. Launched in 2016 by the Chinese tech company ByteDance, the short video app Douyin is now the most-used social network in China, with a user share of 76 % (Statista 2024a). TikTok, which was launched in 2017 as the international version (accessible outside mainland China) of Douyin, has grown exponentially and currently sits at more than 1.5 billion monthly active users (Statista 2024b). In 2023, TikTok generated over 1 billion downloads and has become the most downloaded mobile app worldwide (Statista 2024b). However, the growth and increase in popularity of short video apps and social networks have also been accompanied by criticism of excessive use of these platforms, particularly among younger media users. Both industrial and academic research has highlighted the negative outcomes associated with problematic engagement with social media and short video apps such as Douyin and TikTok on media users' physical and mental well-being (e.g., Chen et al. 2022; Hou et al. 2019; Qin et al. 2022; Smith and Short 2022, Weinstein 2023; Yang et al. 2022; Ye et al. 2022).

In response to such concerns, the Chinese short video platform Douyin has proactively implemented initiatives over the past few years to cultivate a more health-conscious environment for its users, aiming to mitigate excessive and problematic use. As early as March 2018, Douyin introduced interventions to remind users of their screen time and mitigate excessive use. Douyin has also initiated collaborations with video creators to produce a series of screen time reminder videos. Today, these screen time reminder videos, under the topic "#DouyinHealthyUsePlan", typically feature influencers or celebrities encouraging users to disengage from their mobile devices and take breaks from the digital

realm. Such reminder videos are pushed onto users' video feeds when the algorithm detects excessive usage – usually after 60 minutes of non-stop activity. More recently, Douyin has been experimenting with various formats for healthy use interventions, including a time management prompt that presents calming scenic visuals within users' feeds reminding users to "take a break".

Douyin is not the only digital channel that offers similar healthy use interventions. Today, many digital applications, whether smartphone-inbuilt or third-party, offer screen time notifications or healthy use reminders aimed at mitigating excessive and problematic use of smartphones and social media. However, empirical evidence regarding the effectiveness of such interventions remains limited and ambiguous. Okeke et al. (2018), for example, explored how phone vibration notifications reduced the amount of time people spent using the Facebook app. They found that the notification reduced time spent on Facebook daily by over 20 % and enhanced people's awareness of their digital habits. While Loid et al. (2020) found that screen time notifications did not significantly lower participants' screen time or their self-reported problematic smartphone usage. Kent et al. (2021) investigated the effectiveness of a digital intervention, primarily comprising a reminder message with feedback on screen time and suggestions. Results from this study showed post-intervention improvements in problematic phone use among eight of the ten participants. However, there was no consistent pattern in screen time change.

Despite these recent attempts to evaluate healthy use interventions of digital media, how such interventions would actually influence media users' perceptions, reactions, and behavior remain largely unknown. To fill this gap, we adopted a user-centered approach and investigated how Chinese users psychologically process and respond to the healthy use reminder videos on Douyin. Specifically, we drew on the psychological reactance theory and examined how the reminder messages might interrupt the flow of Douyin usage, which potentially explains Douyin users' acceptance and compliance with the intervention.

We believe the current research makes several theoretical contributions to research on healthy social media use. The existing literature primarily focuses on establishing the association between problematic use of digital media and psychopathology including mental health and daily-life dysfunctions (Loid et al. 2020). In particular, this body of literature highlights the role of individuals' dispositional factors, such as personality traits, genetics, and self-management/regulation skills, in explaining such associations (e.g., Blachnio et al. 2017; Khan et al. 2021; Nikolinakou et al. 2024; Smith and Short 2022; Yang et al. 2022). However, relatively fewer studies have examined the effectiveness of platform-initiated interventions promoting healthy use behaviors. Within this limited stream of research (e.g., Kent et al. 2021; Loid et al. 2020; Murata and Tanaka 2023), even less attention has been given to investigating media users' psychological processing of such intervention designs or

messages, which potentially explain the effectiveness or ineffectiveness of the interventions. The current research, on the other hand, focuses on media users' situational and more dynamic responses to such interventions. Specifically, we investigated possible psychological predictors of users' compliance behavior with the healthy use reminders. Drawing on the psychological reactance theory, we seek to provide a theoretical explanation of how users interact with and respond to the healthy use interventions of short video and social media platforms like Douyin. Furthermore, by exploring the interaction between Chinese users and the Chinese-based platform Douyin, the current research also aims to provide novel insights to extend our understanding of not only the psychological reactance theory but also social media use in general to a non-English and non-western context.

2 Theoretical framework and hypotheses

2.1 Psychological reactance theory

The current research drew on the psychological reactance theory as the main theoretical framework that explained the effectiveness of Douyin healthy use reminders on users' responses and behavior. Psychological reactance refers to "the motivational state that is hypothesized to occur when a freedom is eliminated or threatened with elimination" (Brehm and Brehm 1981: 37). Psychological reactance theory consists of four components: freedom, threat to freedom, reactance, and restoration of freedom (Quick et al. 2013). The theory assumes that individuals cherish their freedom of choice and therefore place a high value on personal control and autonomy (Brehm 1966; Brehm and Brehm 1981; Quick et al. 2013). It is argued that individuals perceive a series of ways in which they are free to behave. Once a behavior is perceived as a specific freedom, anything that makes it more difficult to exercise that freedom constitutes a threat. When one's freedom to choose has been threatened or eliminated, reactance will be aroused (Dillard and Shen 2005). Then individuals will be motivated to restore their freedom by enacting the behavior that is threatened, generating negative attitudes toward the message, or derogating the message source, etc. (e.g., Dillard and Shen 2005; Feng and Xie 2019; Goodrich et al. 2015).

The psychological reactance theory has been widely applied to study persuasive communication effectiveness in a variety of contexts, including online advertising (e.g., Hu and Wise 2021; Shoenberger et al. 2021; Youn and Kim 2019), health communication (e.g., Clayton 2022; Clayton et al. 2023; Li and Sundar 2022; Quick and Stephenson 2007; Reynolds-Tylus 2019; Sun and Lu 2023), environmental communication (Bessarabova et al. 2013, 2017; Chang 2021; Yan et al. 2024), etc. In the meantime,

previous studies have also offered accumulated evidence that the psychological reactance theory is not applicable to all issues (e.g., Quick et al. 2015). In response to the call for more studies to test the theory across different issues (Quick et al. 2015; Zhang 2020), the current research focuses on a relatively unexplored area in persuasive communication: platform-initiated persuasive messages that promote healthy use of social media. In this study, we explored how Douyin healthy use reminders might threat users' freedom and affect reactance.

2.2 Perceived intrusiveness and psychological reactance

Based on the understanding of the psychological reactance theory, we argued that Douyin users are likely to develop reactance to the healthy use reminders, primarily due to the inherent interruption and interference nature of those reminder videos, a concept typically termed as perceived intrusiveness in the persuasive communication literature. Perceived intrusiveness refers to a psychological response to media messages that interfere with individuals' goals (Edwards et al. 2002). Douyin healthy use reminders, which are pushed onto users' video feeds, can interfere with users' primary goal of enjoying the regular video content on Douyin, thereby eliciting a sense of intrusiveness.

Using Douyin can be seen as a freedom because users can freely determine their viewing flow. According to the psychological reactance theory, the healthy use reminders can pose a threat to such freedom because the pushed messages interrupt the flow of using Douyin freely. The more a user perceives the reminder video as intrusive and interfering, the more the reminder will be seen as threatening their goal of freely engaging with the curated Douyin videos on their feed. While prior research has demonstrated the relationship between message intrusiveness and negative responses such as attitude toward the persuasive message (e.g., De Keyzer et al. 2022; Lee et al. 2016; Zhao and Wang 2020), relatively little research has directly examined the role of perceived intrusiveness in the psychological reactance theory framework. To more systematically understand this effect in the context of healthy use of social media, we explored perceived intrusiveness as an antecedence contributing to users' perceived freedom threat:

H1: Perceived intrusiveness of Douyin healthy use reminders will positively affect users' perception of freedom threat.

Freedom threat is theorized as an important antecedent of reactance (Brehm and Brehm 1981; Dillard and Shen 2005). While Brehm and Brehm (1981) argued that reactance could not be measured directly, Dillard and Shen (2005) validated the measurement of reactance by comparing four distinct models of reactance in the

contexts of flossing and alcohol usage. Building from the work of previous researchers, Dillard and Shen (2005) identified four possible ways to operationalize reactance: (1) as a purely cognitive process comprised of counterarguing, (2) as a purely affective process comprised of anger, (3) as a parallel process comprised of cognitive and affective components, which have separate and unique effects on persuasive outcomes, or (4) as an intertwined cognitive and affective process. Results from this study showed that the intertwined model best fitted the data. Dillard and Shen (2005) concluded that reactance could be operationalized as a composite of self-report indices of anger and negative cognitions.

When perceived freedoms are threatened, individuals respond in a negative manner, both emotionally and cognitively (Dillard and Shen 2005). While some studies only focused on one dimension of reactance (e.g., anger) or examining the effect of perceived freedom threat on anger and negative cognitions separately (e.g., Chang 2021; Hu and Wise 2021; Shoenberger et al. 2021; Youn and Kim 2019), considerable empirical evidence demonstrated that perceived freedom threat positively predicted the intertwined model of reactance (i.e. a combined variable of anger and negative cognitions) (e.g., Clayton 2022; Clayton et al. 2023; Li and Sundar 2022; Quick and Stephenson 2007; Richards et al. 2022; Shen 2010, 2011; Zhang 2020). The present study followed the intertwined model and operationalized reactance as a composite of anger and negative cognition. Based on the psychological reactance theory and relevant literature, we hypothesized that:

H2: Douyin users' perceptions of threat to freedom will be positively related to psychological reactance.

2.3 Psychological reactance and persuasion effects

The psychological reactance theory has been applied to predict the effectiveness of persuasive messages. Prior studies consistently showed that reactance impaired evaluations toward persuasive messages. For instance, Shoenberger et al. (2021) found that psychological reactance triggered by freedom-threatening advertising messages negatively predicted attitudes toward the ads. Li and Sundar (2022) investigated users' responses to online health messages on anti-drinking. They found that psychological reactance, measured by both the affective (anger) and cognitive (negative cognitions) components, led to negative evaluations of message persuasiveness. Another study also showed that both anger and negative cognitions were negatively associated with attitudes toward anti-smoking campaigns (Kim 2017). Therefore, we explored the effect of psychological reactance on users' attitude:

H3: Douyin users' psychological reactance will be negatively related to their attitude toward the reminder messages.

The above arguments imply that perceived intrusiveness of the message might influence users' attitude through perceived freedom threat and reactance. Indeed, studies on psychological reactance theory constantly confirmed the mediation role of psychological reactance in explaining the effect on individuals' reactions. For example, Shen (2010) found that message-induced empathy had an indirect effect on individuals' attitude toward the message advocacy via psychological reactance. Li and Sundar (2022) examined the persuasive effect of binge drinking-related PSA. They found that bandwagon perceptions of the PSA video had a significant indirect effect on attitude through perceived threat and reactance. Accordingly, we tested the indirect effect of perceived intrusiveness on attitude toward the reminder messages:

H4: The effect of perceived intrusiveness on users' attitudes toward the reminder messages will be mediated by perceived freedom threat and reactance.

While the perceived intrusiveness can enhance perceived freedom threat and psychological reactance, an indirect path to persuasive outcomes, it can also influence persuasion directly. Prior research showed that perceived intrusiveness was a significant predictor of persuasion outcomes, especially users' attitudes toward the messages. For instance, one study showed that the perceived intrusiveness of native ads on social media negatively influenced users' ad attitudes (Lee et al. 2016). Another study on personalized advertising on social networking sites also found that perceived intrusiveness had a negative effect on brand attitude (De Keyzer et al. 2022).

Existing research on perceived intrusiveness primarily focused on the effects of digital advertising, including pop-up ads (e.g., Edwards et al. 2002), mid-roll ads (e.g., Choi and Kim 2021; Freeman et al. 2022), social media ads (e.g., Youn and Kim 2019; Zhao and Wang 2020), and ad personalization (Feng and Xie 2019; Smink et al. 2020). This is primarily because advertising messages are usually perceived as distractors that interfere with media users' primary tasks such as news reading and video viewing (Edwards et al. 2002; Li and Meeds 2007). Moreover, advertising messages, being commercially motivated, are often regarded as intrinsically manipulative (Ham et al. 2022). As a result, perceived intrusiveness becomes a prominent factor that explains consumers' responses to advertising. While Douyin healthy use reminders aim to reduce excessive social media use and thus promote the digital well-being of the users, the interruptive nature may still induce perceived intrusiveness, which negatively influences users' evaluations of the messages. Given these findings, we believed that it was also reasonable to hypothesize the direct effect of perceived intrusiveness on attitude:

H5: Perceived intrusiveness of Douyin healthy use reminders will negatively affect users' attitudes toward the reminder messages.

Attitude has been widely acknowledged as a critical predictor of behaviors (e.g., Dillard and Shen 2005; Kim and Hunter 1993; Rains and Turner 2007; Zarouali et al. 2019). Particularly, literature in persuasive communication demonstrated that positive attitudes toward persuasive messages enhanced individuals' intention or actual behavior to comply with the advocacy in the persuasive messages. For example, Lee et al. (2013) examined factors that determined college students' adoption of mobile-based text alerts short message services. Results from this study showed that users' attitude toward the short message service was positively related to their actual adoption behavior. Zhang (2020) also found that people's attitude toward persuasive message advocacy on health issues positively predicted people's intention to act in line with the promoted actions. Based on the above theoretical evidence, we explored the following hypotheses:

H6: Douyin users' decreased attitude toward reminder messages will lead to decreased compliance behavior.

Additionally, we would also like to examine the effects of perceived intrusiveness on the compliance behavior as the persuasive outcome. Extending what we hypothesized in H4 and H5 by adding compliance behavior as the outcome variable, we further tested the following hypotheses regarding the mediation effects on compliance behavior:

H7: The effect of perceived intrusiveness on users' compliance behavior will be mediated by perceived freedom threat, reactance, and attitude.

H8: The effect of perceived intrusiveness on users' compliance behavior will be mediated by users' attitude.

3 Methods

3.1 Sample

We used convenience sampling and recruited respondents from a southeastern university in China. We asked two screening questions: (1) whether the respondent used Douyin, and (2) whether the respondent had seen reminder messages when

using Douyin. Only people who used Douyin and had seen Douyin healthy use reminder messages were qualified to participate. Besides, we also used snowball sampling and asked our respondents to forward the survey link to qualified people. All respondents are 18 years or older and agreed to the informed consent before participation. A total of 253 respondents passed the screening. Subsequent checks identified 11 responses that were incomplete or bot-generated (extremely speedy survey completion and non-substantial open-ended answers), which were excluded from analyses. This left a valid sample of 242. We conducted a-priori sample size calculation using the Sample Size Calculator for Structural Equation Models (Soper 2024) developed based on the work of Westland (2010), which suggests a sample size of 229. The sample demographics are summarized in Table 1. In general, our sample aligns with the demographic profile of Douyin user population in China, as industry reports show that the majority (72 %) of Douyin users are Gen Z or Millennials and a relatively high share (79 %) of Douyin users have a college education (Statista 2024a). Additionally, prior studies have shown that younger media consumers, such as Chinese college students and adolescents, are especially susceptible to excessive social media use (Mu et al. 2022; Qin et al. 2022; Ye et al. 2022). We contend that exploring the perceptions and responses of this sample to healthy use reminders on Douyin will offer valuable insights and serve as a foundational step for future research on this critical issue.

3.2 Materials

Before answering the survey questionnaire, each respondent was given examples of healthy use reminders from Douyin. These examples included descriptions and

Table 1: Sample demographics.

	<i>n</i>	%
Age*		
18–24	207	86.61
25–34	6	0.03
35–44	19	0.08
45–54	5	0.02
55+	3	0.01
Gender		
Female	172	71.07
Male	70	28.93

*Three respondents chose not to disclose their age. $M = 23.73$, $SD = 7.54$.

screenshots of real reminder videos. Each respondent was randomly assigned to view one of the two types of reminder videos currently used by Douyin: the *screen time reminder video* and the *time management reminder*. The screen time reminder video closely resembles the general videos in a user's feed and features celebrities urging users to put down their phones. This type of reminder video are typically posted by Douyin's official account and include the hashtag "#DouyinHealthyUsePlan." Users can easily skip this reminder by scrolling. In contrast, the time management reminder has a different format. It initially displays scenic visuals for a few seconds, followed by text reminders to take a break and a "ignore" button. Clicking the button allows users to ignore the time management reminder and continue viewing videos on their feeds (see Appendix A for examples). By using both types of Douyin healthy use reminders, rather than limiting to just one, we aimed to enhance the generalizability of our findings.

Following prior research that pooled multiple datasets for analyses (Jin and Youn 2022; Youn and Kim 2019), we conducted ANOVA to inspect possible differences in the measures across the two reminder messages prior to combining the data. Results showed that the two types of healthy use reminders did not differ significantly on the dependent measures (see Table 2 for results), thus making it possible to combine the two datasets for analyses.

3.3 Measures

Measurements used in this study were adopted from prior research and adapted to fit the context of Douyin usage. All constructs were measured on seven-point scales. All items were written in Chinese and translated by two bilingual language professionals. Back-translation was also performed to ensure that the translation did not

Table 2: ANOVA results on differences across two types of Douyin healthy use reminders.

	Mean		<i>F</i>	<i>p</i>
	Screen time reminder	Time management reminder		
Perceived intrusiveness	3.80		3.56	1.85 0.18
Perceived freedom threat	3.27		3.15	0.42 0.52
Anger	2.40		2.22	0.90 0.34
Negative cognition	3.06		2.88	0.87 0.35
Attitude	4.22		4.51	3.63 0.06
Compliance behavior	3.09		3.22	0.44 0.51

alter the original meanings. Additionally, we also referred to Chinese journal articles on similar topics for measurement scales and item wording.

Perceived intrusiveness was measured using three items adapted from prior research (Li et al. 2002; Wang and Cheng 2013). Perceived freedom threat was measured by three items adapted from prior research (Dai and Cao 2022; Dillard and Shen 2005; Youn and Kim 2019).

Psychological reactance was measured by both anger and negative cognition (Dillard and Shen 2005). Anger was measured using three items: irritated, angry, and annoyed (Clayton et al. 2019; Kim 2017; Rains and Turner 2007; Youn and Kim 2019).¹ Negative cognition was measured by one item: “I criticized the message while watching it” (Hanus and Fox 2017).² Consistent with the intertwined model of reactance and prior research (Rains 2013; Richards et al. 2017), reactance was then modeled as a second-order latent construct made up of anger and negative cognition. To measure attitude toward the message, we used three bipolar items (“bad/good,” “negative/positive,” and “unfavorable/favorable”) (Dillard and Shen 2005; Gong and Xu 2018). Compliance behavior was assessed as a single-item construct. Respondents were asked to indicate their agreement on whether they would usually follow the advocated suggestions and pause Douyin usage after seeing the healthy use reminders.

¹ Previous studies have used the four-item scale proposed by Dillard and Shen (2005) to measure anger: irritated, angry, annoyed, and aggravated (e.g., Clayton 2022; Shen 2010; Zhang 2020). During the translation and back-translation processes of this scale, we found that there was no specific term for “aggravated” that did not overlap with the meanings of the other three items in Chinese. After consulting Chinese journal articles on psychological reactance, we decided to use a three-item scale for anger, which showed good reliability (Cronbach’s $\alpha = 0.93$). Additionally, some previous studies have also employed a three-item scale to measure anger (e.g., Clayton et al. 2019, 2020; Kim 2017; Youn and Kim 2019).

² Previous studies have not formed a consistent measure of negative cognitions (Ratcliff 2021). After consulting relevant literature, particularly in the context of digital media communication (e.g., Hanus and Fox 2017; Hu and Wise 2021; Youn and Kim 2019), we adapted the negative cognitions scale for the current study context using three items. One item focused on counter-arguing: “I criticized the message while watching it.” Two items focused on cognitive appraisal (reverse-coded): “The message was reasonable,” “The message was fair.” However, the reliability was not ideal (Cronbach’s $\alpha = 0.63$). We decided to focus on the counterarguing item in our analysis for two reasons: (1) the counterarguing item showed greater correlation with anger ($r = 0.32$) than the cognitive appraisal items ($r = 0.27$); (2) more recent studies on psychological reactance primarily focused on counterarguing as the cognitive dimension of reactance (e.g., Clayton 2022; Clayton et al. 2020, 2023; Rains 2013). Using the two cognitive appraisal items for negative cognition resulted in a less satisfactory model fit, but the path analysis results for hypotheses testing were identical.

3.4 Analysis

The current study adopted the covariance-based structural equation modeling (CB-SEM) to estimate the relationships hypothesized in the current model. CB-SEM uses a maximum likelihood estimation procedure to estimate model coefficients so that the discrepancy between the estimated and sample covariance matrices is minimized (Hair et al. 2017). Researchers suggested that CB-SEM is more suitable for confirming or rejecting a developed theory (Hair et al. 2017). Since the current study primarily drew on the psychological reactance theory to examine the relationship between perceived message intrusiveness, psychological reactance, and users' compliance behavior, we believe CB-SEM is suitable for testing the hypothesized relationship.

4 Results

We employed the two-step approach (Anderson and Gerbing 1988) for structural equation modeling. This approach starts with assessing the measurement model using the confirmatory factor analysis (CFA). Once a satisfactory measurement model is obtained, the structural model is then tested.

4.1 Measurement model

A CFA was conducted using SPSS AMOS 29. The Maximum Likelihood (ML) estimation method was employed. Overall, the confirmatory factor model showed an acceptable fit ($\chi^2 = 134.15$, $df = 58$, $p < 0.001$, $CFI = 0.96$, $SRMR = 0.048$, $RMSEA = 0.074$) based on recommended cutoff values: $CFI \geq 0.95$, $SRMR \leq 0.09$, and $RMSEA \leq 0.08$ (e.g., Browne and Cudeck 1992; Hu and Bentler 1999).

As shown in Table 3, all multi-item first-order constructs had Cronbach's alpha scores greater than 0.7 and composite reliabilities greater than 0.6, displaying evidence of construct reliability (Hair et al. 2018). We further checked convergent validity and discriminant validity. Results showed that all standardized factor loadings were above 0.7, and the average variance extracted (AVE) value was greater than 0.5 for each construct, confirming convergent validity (Hair et al. 2018). Results also showed that the AVE value for each construct was greater than the maximum shared variance (MSV), thus confirming the discriminant validity (Fornell and Larcker 1981; Hair et al. 2018) (see Table 3 for detailed statistics). For the second-order latent construct reactance, we followed the persuasive communication literature and assessed the factor loading as well as the correlation between anger and negative cognition (e.g., Clayton 2022; Rains 2013; Rains and Turner 2007; Shen 2010). The factor loading coefficients for

anger and negative cognition were 0.67 and 0.47 respectively, with both coefficients significant at the 0.001 level. Anger and negative cognition were also significantly correlated ($r = 0.32, p < 0.001$). These coefficients are consistent with prior research testing the intertwined model of psychological reactance theory, which reported correlation coefficients ranging from 0.23 to 0.52 (e.g., Rains 2013; Rains and Turner 2007; Shen 2010, 2011; Yan et al. 2024).

The above evidence showed that a satisfactory measurement model was achieved.

Therefore we proceeded to structural modeling.

4.2 Structural model

We conducted structural equation modeling (SEM) with ML estimation in SPSS AMOS

29. The goodness-of-fit statistics provided an acceptable fit ($\chi^2 = 175.63, df = 72, p < 0.001, CFI = 0.952, SRMR = 0.062, RMSEA = 0.077$).

Table 3: Summary of measurement model statistics.

Construct and items	Standardized loadings	Cronbach's alpha	Composite reliability	AVE	MSV
Perceived intrusiveness		0.80	0.62	0.57	0.41
1. I think the message was interfering	0.72				
2. I think the message was distracting	0.73				
3. I think the message was obtrusive	0.82				
Perceived freedom threat		0.87	0.72	0.68	0.41
1. The message threatened my freedom to continue to use Douyin	0.77				
2. The message tried to interfere with my use of Douyin	0.95				
3. The message tried to pressure me	0.75				
Anger		0.93	0.87	0.83	0.31
1. Irritated	0.82				
2. Angry	0.96				
3. Annoyed	0.95				
Negative cognition		-	-	-	-
I criticized the message while watching it	-				
Attitude		0.90	0.86	0.76	0.34
1. Bad/good	0.90				
2. Negative/positive	0.95				
3. Unfavorable/favorable	0.76				
Compliance behavior		-	-	-	-
I would usually follow the advocated suggestions and pause Douyin usage after seeing the message	-				

Note. The actual measurement scales and items were presented in Chinese.

Figure 1 summarizes the SEM path analysis results. H1 predicted that users' perceived intrusiveness of Douyin healthy use reminders positively influenced their perception of freedom threat. The path between perceived intrusiveness and perceived freedom threat was positive and significant ($\beta = 0.66, p < 0.001$), thus supporting H1. H2 predicted the positive relationship between perceived freedom threat and psychological reactance. Results showed that perceived freedom threat had positive and significant effects on reactance ($\beta = 0.85, p < 0.001$), which compromised anger ($\beta = 0.67, p < 0.001$) and negative cognition ($\beta = 0.49, p < 0.001$). Therefore H2 was supported. H3 addressed the effect of reactance on users' attitude toward the reminder messages. Results showed that reactance was negatively related to attitude ($\beta = -0.32, p < 0.001$), thus supporting H3. H5 predicted the direct effect of perceived intrusiveness on users' attitude. The path between perceived intrusiveness and attitude was negative and significant ($\beta = -0.40, p < 0.001$), providing support to H5. Finally, H6 predicted the positive relationship between attitude and users' compliance behavior. The path analysis indicated a positive relationship between attitude and compliance behavior ($\beta = 0.33, p < 0.001$), supporting H6.

Next, we conducted a series of indirect effects tests to analyze the mediation effects hypothesized in H4, H7, and H8. We performed the bootstrapping with 5,000 samples and the bias-corrected (BC) 95 % confidence intervals. Table 4 summarizes the indirect effects results. H4 predicted that the effect of perceived intrusiveness on attitude was mediated by perceived freedom threat and reactance. This indirect effect was negative and significant ($b = -0.20, SE = 0.07, p < 0.01, 95\% CI = [-0.38, -0.09]$), thus supporting H4. Perceived intrusiveness also had a significant negative indirect effect on compliance behavior through perceived freedom threat, reactance, and attitude ($b = -0.08, SE = 0.03, p < 0.01, 95\% CI = [-0.18, -0.03]$). This supported H7 that the effect of perceived intrusiveness

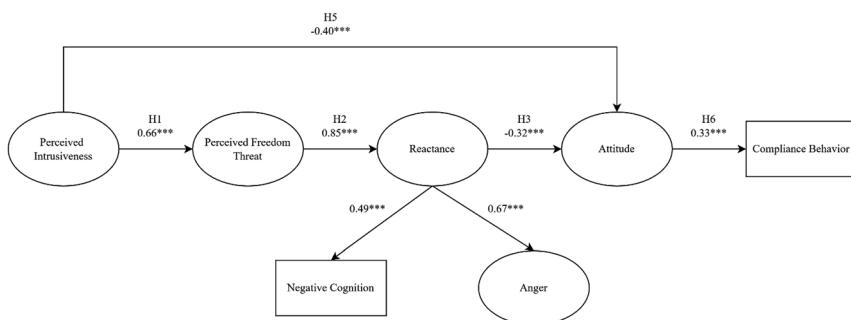


Figure 1: Results of path analysis. Note. *** $p < 0.001$.

Table 4: Mediation analysis: indirect effect results.

Hypothesis	Estimate	SE	BC 95 % CI
H4: perceived intrusive – perceived freedom threat – reactance - attitude	–0.20**	0.07	[–0.38, –0.09]
H7: perceived intrusive – perceived freedom threat – reactance - attitude – behavior	–0.08**	0.03	[–0.18, –0.03]
H8: perceived intrusive – attitude - behavior	–0.19***	0.06	[–0.34, –0.09]

Note. ** $p < 0.01$, *** $p < 0.001$.

on users' compliance to healthy use of Douyin was mediated by perceived freedom threat, reactance, and attitude. Finally, the indirect effect of perceived intrusiveness on compliance behavior through attitude was also significant ($b = -0.19$, $SE = 0.06$, $p < 0.001$, 95 % CI = [–0.34, –0.09]), thus supporting H8 that attitude mediated the effect of perceived intrusiveness on users' compliance behavior.

5 Discussion

This study tested Douyin users' psychological responses to healthy use reminders that mitigate excessive social media use, thereby providing insights into the effectiveness of persuasive strategies promoting healthy use behaviors. Findings revealed that users' perceived intrusiveness of the reminder messages negatively influenced their attitudes toward the messages, which further impaired users' compliance behavior. Building on the psychological reactance theory, we also found that such negative effects could be explained by users' reactance. Perceived intrusiveness enhanced psychological reactance toward the reminders through the influence on perceived freedom threat, which further affected attitude and compliance behavior. In sum, these results indicated that how users feel about the healthy use reminders significantly influences the persuasive effectiveness.

5.1 Theoretical implications

The current research contributes to the literature on excessive social media use, media user psychology, and health behavior. In recent years, the excessive use of short video platforms and social networks has become a growing concern, especially among young media audience (Mu et al. 2022; Qin et al. 2022; Ye et al. 2022). Although associations between problematic use of social media and psychopathology are well-established, relatively fewer studies have investigated the effect of

interventions aimed at mitigating problematic use and promoting healthy use behaviors (Kent et al. 2021; Loid et al. 2020). Unlike prior research that primarily examines individuals' dispositional traits to explain excessive and problematic use of social media (e.g., Błachnio et al. 2017; Shanahan et al. 2023; Smith and Short 2022), the current research focuses on the dynamics of users' interaction with platform-initiated interventions. Our study thus extends this literature by highlighting users' interactions with the healthy use reminder to understand the intervention effectiveness. Despite this study's focus on Douyin, considering that similar implementations of screen time or healthy use reminders are also present on a wide range of channels such as TikTok, Instagram, and smartphone usage, our approach should help broaden the scope of research on social media use and digital well-being in general.

The current research further explores the psychological process of how users interact with and respond to Douyin healthy use reminders. While some recent studies have provided preliminary evidence on the effectiveness of screen time reminders or similar interventions (e.g., Kent et al. 2021; Loid et al. 2020; Murata and Tanaka 2023), these studies primarily focus on general smartphone usage without considering engagement with specific social media platforms. Moreover, very little attention has been given to uncovering the psychological factors that explain the effectiveness or ineffectiveness of such interventions. Our study empirically examines the relationships between perceived intrusiveness, perceived freedom threat, reactance, and persuasive outcomes, including attitude and compliance behavior. The findings reveal that media users' perceived intrusiveness and reactance are predictors of low compliance with Douyin healthy use advocacy. This underscores the crucial role of media users' perceived behavioral autonomy and freedom in shaping their reactions to the healthy use intervention.

The current research also extends the psychological reactance theory in the context of combating excessive use of short video apps and social media. In response to calls for further investigations into the reactance theory across diverse issues (Quick et al. 2015; Zhang 2020), our study delves into a largely underexplored domain of persuasive health communication: platform-implemented healthy use reminders aimed at mitigating excessive use of Douyin. Moreover, while the psychological reactance theory has been widely applied to study persuasion effects in Western and English-speaking contexts (e.g., Bessarabova et al. 2017; Chang 2021; Clayton 2022; Yan et al. 2024), there is less evidence to validate the theory in more diverse cultural contexts. In reviewing relevant Chinese literature (e.g., Dai and Cao 2022; Liao et al. 2022; Wang and Cheng 2013), we find that studies have investigated specific concepts or subsets of this theory but lack systematic validation of the entire theoretical framework. Our

study provides evidence supporting the theory in promoting healthy use of social media among Chinese audience, thus extending the psychological reactance theory to a non-English and non-Western context. This also underscores psychological reactance as a key factor in understanding social media use in a global communication context.

5.2 Practical implications

This study also provides practical implications. While we applaud Douyin for implementing the healthy use reminders that disrupts the platform's algorithmic rewarding loop that largely facilitates problematic social media use, our research suggests that there is room for improvement in making this design more user-centered. Our findings show that the persuasive effects of healthy use reminders might not be satisfactory, especially when users perceive the reminder videos to be intrusive. This implies that social media platforms like Douyin should take into account user experience and acceptance of the messages to enhance the persuasive effects. For example, it might be helpful to add an interactive survey question within the reminder video so users can rate their feelings and provide instant feedback, which should help the platform better gauge user experience and adjust the messages accordingly.

Additionally, we also included an open-ended question in our survey and asked respondents about their thoughts and suggestions for the healthy use reminders. Several respondents suggested that the platform should "create more diverse styles and formats of the reminder videos." Currently, the healthy use reminders primarily feature celebrities who directly persuade the users. As indicated by some respondents, such a format can be especially obtrusive if they do not like a particular celebrity. Therefore, it might be beneficial to tailor the style and content of the reminder message to individual users based on their preferences so the reminder video would appear less intrusive when pushed onto the users' video feeds. Big data analytics on users' behavior might be utilized to personalize the healthy use reminders.

Our findings that confirm the psychological reactance theory also highlight the important role of behavioral freedom in predicting media users' compliance with the healthy use reminders. According to the literature on psychological reactance theory, one common freedom-restoring strategy is to use a "restoration postscript." This typically consists of a few sentences informing participants that the choice to perform the advocated behavior is up to them, with the purpose of reaffirming a sense of autonomy in the mind of the message receivers (e.g., Bessarabova et al. 2013, 2017; Miller et al. 2007; Richards et al. 2022). This suggests that adding similar

restoring language in the video captions might help mitigate users' reactance and enhance the persuasive effects of the healthy use reminders. Future research can further explore possible approaches to help social media users restore their behavioral freedom.

5.3 Limitations and future outlook

There are limitations to the present study. First, we used convenience and snowball sampling, and our sample primarily consisted of college students. While this sample reflects a significant portion of Douyin and social media users in China (Statista 2024a), the findings reported here may not generalize to broader audience groups. Future research should employ larger and more diverse samples to generate richer insights into the effectiveness of social media healthy use interventions. Also, we only investigated Chinese users' psychological responses to Douyin healthy use reminders. This focus is due to Douyin being one of the leading social platforms implementing healthy use interventions, and it is only available to users in mainland China. With the rapid growth of short video platforms and other social networks globally, future research should investigate the effectiveness of social media use interventions in other contexts. Second, the variables in our study have relatively few indicators, which might potentially influence the reliability of the CFA model estimation. Future research should pay more attention to variable measurement and employ larger sample sizes. Third, we tested a limited number of variables in the current study. We primarily followed the psychological reactance theory and included measures within this theoretical framework. Also, we measured self-reported behavior instead of observing more objective and practical behavioral indicators. To have a more comprehensive understanding of the effectiveness of healthy use reminders, we hope the present study can inspire future research to explore the effects on a broader range of psychological and behavioral outcomes, such as objective measures of screen time. Experimental studies should also be conducted to further probe the effects of different message factors on users' responses. Additionally, although we included an open-ended question to gauge users' perceptions, future research could investigate users' experience with qualitative methods to further delve into users' understanding of social media use and digital well-being.

6 Conclusions

Digital well-being has emerged as a crucial topic on today's social networks, especially given the rising concerns about excessive and problematic use of these

platforms. Douyin, the leading social platform in China, has recently implemented an intervention by incorporating healthy use reminders into users' feeds to mitigate excessive social media use. This study adopts a user-centered approach to assess the effectiveness of this practice. Drawing on the psychological reactance theory, we conducted an online survey among Chinese Douyin users to investigate the psychological processes that influence their attitude toward Douyin healthy use reminders and compliance behavior. Our findings indicated that users' perception of the reminders' intrusiveness negatively impacted their attitude. This could be explained by the psychological reactance theory, as perceived intrusiveness heightened users' sense of freedom threat and psychological reactance, further influencing their attitude and compliance behavior. We believe this study lays the groundwork for future investigations into combating excessive social media use and promoting digital well-being in a global communication context.

Appendix A: Examples of Douyin healthy use reminders

Screen time reminder:



Time management reminder:



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