Received 25 November 2021
Revised 15 June 2022
7 February 2023
Accepted 7 February 2023

Can social interaction-oriented content trigger viewers' purchasing and gift-giving behaviors? Evidence from live-streaming commerce

Qiang Yang
School of Business, Nanjing Audit University, Nanjing, China and Department of Information and Knowledge Management, Tampere University, Tampere, Finland
Jiale Huo
Southwest Jiaotong University, Chengdu, China
Hongxiu Li
Department of Information and Knowledge Management, Tampere University, Tampere, Finland
Yue Xi
Southwest Jiaotong University, Chengdu, China and National University of Singapore, Singapore, Singapore, and
Yong Liu
Department of Information and Service Management, School of Business, Aalto University, Helsinki, Finland

Abstract

Purpose – This study investigates how social interaction-oriented content in broadcasters' live speech affects broadcast viewers' purchasing and gift-giving behaviors and how broadcaster popularity moderates social interaction-oriented content's effect on the two different behaviors in live-streaming commerce.
Design/methodology/approach – A research model was proposed and empirically tested using a panel data set collected from 537 live streams via Douyin (the Chinese version of TikTok), one of the most popular live broadcast platforms in China. A fixed-effects negative binomial regression model was used to examine the proposed research model.
Findings – This study's results show that social interaction-oriented content in broadcasters' live speech has an inverted U-shaped relationship with broadcast viewers' purchasing behavior and shares a positive linear relationship with viewers' gift-giving behavior. Furthermore, broadcaster popularity significantly moderates the effect of social interaction-oriented content on viewers' purchasing and gift-giving behaviors.
Originality/value – This research enriches the literature on live-streaming commerce by investigating how social interaction-oriented content in broadcasters' live speech affects broadcast viewers' product-purchasing and gift-giving behaviors from the perspective of broadcast viewers' attention.

Internet Research
Vol. 33 No. 7, 2023
pp. 46-71
Emerald Publishing Limited
1066-2243
DOI 10.1108/INTR-11-2021-0861

Moreover, this study provides some practical guidelines for developing live speech content in the live-streaming commerce context.

Keywords Live streaming, Social interaction-oriented content, Gift-giving behavior, Purchasing behavior, Broadcaster popularity

Paper type Research paper

1. Introduction

Due to information and communications technologies' increasing pervasiveness, live-streaming commerce is proliferating on a global scale (Lin *et al.*, 2021). Many mainstream social media platforms have embedded live-streaming commerce into their business practices, such as YouTube Live, Facebook Live and TikTok Live. In live-streaming commerce, broadcasters use live speech to promote consumer purchases and interaction (Fei *et al.*, 2021). Broadcast viewers may purchase promoted products and pay broadcasters for their professional performance, such as exchanging real currency for virtual gifts, which is defined as gift-giving behavior in live-streaming commerce (Fei *et al.*, 2021; Lin *et al.*, 2021; Yu *et al.*, 2018; Zhang *et al.*, 2019).

Online interaction with consumers has been a dominant research topic in the e-commerce literature due to its important role in promoting consumers' online purchases (Jiang *et al.*, 2010; Li and Ku, 2018). Promoting interaction has also been a dominant content marketing strategy in e-commerce, such as social commerce and live-streaming commerce (Fei *et al.*, 2021). In live-streaming commerce, broadcasters frequently use social interaction-oriented content in their live speech to attract broadcast viewers' attention and encourage viewer–broadcaster interaction. For example, to welcome a new viewer, a broadcaster might include social interaction-oriented content in live speech, such as, "Welcome to my live room! If you like me and my live speech, please join my fan group. Thank you for your support!" Similarly, they might include, "Please make your order as soon as possible if you like the product! Please also remember to give me a thumbs-up", to promote viewer interaction, such as a thumbs-up, sending gifts, posting messages and making purchases from viewers (Kang *et al.*, 2021). How such social interaction-oriented content in live speech affects viewers' purchasing and gift-giving behaviors is unclear.

Social interaction-oriented content can be defined as text or speech that includes many social words to promote consumer interaction (Yang *et al.*, 2022). In traditional e-commerce, social interaction-oriented content manifests in persistent online text, such as reviews and text-based chat channels (Wongkitrungrueng *et al.*, 2020). This traditional content enables consumers to browse social interaction information and make consumption decisions conveniently at any time when they need them. However, live-streaming commerce facilitates real-time social interaction with viewers as well as viewers' consumption. Broadcasters continually convey social interaction-oriented content through their speech and promote social interaction with viewers when introducing products, aiming to entice viewers to purchase products in real time.

As the main product promoters in live-streaming commerce, broadcasters themselves also attract viewers' attention. Broadcasters seek to increase their popularity among viewers when promoting products on live streams. Some viewers even express their approval of broadcasters by giving gifts as rewards (Ang *et al.*, 2018). Thus, broadcasters also promote themselves through social interaction-oriented content and receive gifts from broadcast viewers. When comparing live-streaming commerce with other e-commerce modes, broadcast viewers have been found to allocate fewer attention resources in their behavioral decision process in live-streaming commerce than other e-commerce modes—that is, their choice to purchase products or send broadcasters virtual gifts—since they must process broadcasters' live speech quickly and in real time (Wongkitrungrueng and Assarut, 2020).

However, previous studies have mainly examined the effect of consumer interactivity on live-streaming platforms or how the social interaction between broadcasters and viewers affects viewers' behavior from the view of social interaction. Little research has explored how broadcasters' live speech content, such as social interaction-oriented content in their live speech, could affect viewers' behaviors from a content point of view—including purchasing and gift-giving behaviors.

Unlike product information in broadcasters' live speech, which focuses viewers' attention on a product, social interaction-oriented content in broadcasters' live speech aims to trigger viewers' interaction with broadcasters (Guo *et al.*, 2021). Attention theory suggests that attention is the primary antecedent that determines individuals' behavior (Shen *et al.*, 2015). Consumers' attention to a specific product increases their awareness of that product and their corresponding consumption intentions (Deng *et al.*, 2016). And, given individuals' limited attention, when they focus on an information source, they ignore or even forget about other information sources (Lavie, 1995; Roda and Thomas, 2006). In live-streaming commerce, broadcasters and products are both important information sources and consumption objects (Fei *et al.*, 2021). It is unclear whether social interaction-oriented content in broadcasters' live speech attracts viewers' attention to broadcasters themselves and distracts viewers from products. Such a shift in attention would determine viewers' decisions to purchase products or give broadcasters gifts.

Most studies on live-streaming commerce have focused on how social interaction can affect viewers' gift-giving or product-purchasing behaviors from a consumer engagement point of view. No study has investigated how social interaction-oriented content in broadcasters' live speech affects viewers' product-purchasing and gift-giving behaviors from a content point of view. The desired outcomes of live-streaming commerce are, for broadcasters, receiving more gifts and, for companies, increasing product sales (Lin *et al.*, 2021; Zhang *et al.*, 2019). Therefore, exploring how social interaction-oriented content in broadcasters' live speech affects viewers' gift-giving and product-purchasing behaviors can fully explain how this content affects viewers' different behaviors in live-streaming commerce. Such an investigation could help broadcasters balance product sales with gift-giving goals by appropriately conveying social interaction-oriented content in their live speech, achieving both broadcasters' and companies' goals.

In addition, previous research has shown the importance of broadcaster popularity in live-streaming commerce (Kang *et al.*, 2021). In the live-streaming commerce context, broadcaster popularity can be measured using an online broadcast's number of live viewers (Kang *et al.*, 2021). Popularity has been identified as "a significant indicator of the quality of products or services" (Caminal and Vives, 1996). Therefore, highly popular broadcasters can be reasonably assumed to promote more gift-giving and purchasing behaviors than low popular broadcasters. However, highly popular influencers could also attract viewers' attention to themselves, distracting viewers from promoted products (Kuvita and Karlicek, 2014). Thus, highly popular broadcasters may negatively influence viewers' purchasing behavior. Therefore, broadcaster popularity may affect the relationships between broadcasters' social interaction-oriented content and viewers' gift-giving and purchasing behaviors. Accordingly, it is necessary to investigate its moderating effects to enrich the understanding of the impact of broadcasters' social interaction-oriented content on viewers' gift-giving and purchasing behaviors in live-streaming commerce.

To address these gaps in the literature, the current study explores the impact of social interaction-oriented content in broadcasters' live speech on viewers' purchasing and gift-giving behaviors as well as the moderating role of broadcaster popularity based on attention theory. The proposed research model was empirically tested with field data collected from Douyin (the Chinese version of TikTok), one of the most popular live broadcast platforms in China. The current study enriches the literature on live-streaming commerce by investigating

the impact of social interaction-oriented content in broadcasters' live speech on viewers' product-purchasing and gift-giving behaviors from a content point of view and by examining how broadcaster popularity moderates the impact. Furthermore, given the recently emerged research on live-streaming commerce, some scholars have called for studies that apply field data to explain viewers' consumption behavior in this context because such data can reflect viewers' real consumption behavior (Addo *et al.*, 2021; Kang *et al.*, 2021). Our study is among the first studies to use broadcast viewers' consumption behavioral data to understand their behaviors in live-streaming commerce.

The remainder of this paper is structured as follows. In Section 2, we discuss this study's theoretical background, including research on live-streaming commerce, social interaction and attention theory. Then, we present our proposed research model and hypotheses in Section 3 before presenting the research methods and the research findings in Section 4. Finally, we discuss the current study's findings and conclude by identifying its theoretical and practical implications, as well as its limitations and potential avenues for future research.

2. Theoretical background

2.1 Live-streaming commerce

Live-streaming commerce is a subset of e-commerce based on real-time social interaction via real-time streaming video and text-based chat channels. Live-streaming commerce attracts viewers through its utilitarian, hedonic and social values (Wongkitrungrueng *et al.*, 2020). In turn, these values promote viewers' positive attitudes and consumption behavior toward live-streaming commerce (Ang *et al.*, 2018). Inviting an opinion leader (Internet celebrity) as a broadcaster to promote products has become popular in this context.

The current literature on live-streaming commerce is dominated by two research streams. One stream has mainly investigated the antecedents to viewers' engagement in live-streaming commerce. For example, Xue *et al.* (2020) found that live streams' personalization, responsiveness, entertainment, mutuality and perceived control could encourage consumers to participate in social interaction in live-streaming commerce. Hu and Chaudhry (2020) explored how relational bonds between broadcasters and consumers influence consumer engagement and found that social, structural and financial bonds positively affect consumer engagement via affective commitment. Guo *et al.* (2021) proposed that consumers' trust in broadcasters could translate into trust in brands, thereby increasing consumer engagement in live-streaming commerce. These studies found that factors related to products or broadcasters determine consumer engagement in live-streaming commerce (Wongkitrungrueng *et al.*, 2020).

The other research stream has mainly focused on factors that affect viewers' consumption behavior in live-streaming commerce, such as purchasing and gift-giving behaviors. Prior research found that social competition, viewers' engagement and broadcasters' popularity affect gift-giving behavior among viewers (Kang *et al.*, 2021; Yu *et al.*, 2018; Zhou *et al.*, 2019). Lin *et al.* (2021) found that broadcasters' positive emotions in live streams could promote gift-giving behavior. Zhang *et al.* (2019) compared online product sales via live streams versus the same sellers' other online channels and found that live-streaming sales greatly exceed sales via other online channels. They argued that live-streaming commerce could improve consumers' purchasing intentions by reducing psychological distance and perceived uncertainty through real-time interaction. Consumer engagement in live streams—such as likes, chat, visits and exposure time—has also been found to positively affect broadcasters' purchasing behavior (Addo *et al.*, 2021). A summary of the prior research on live-streaming commerce is presented in Table 1.

Previous studies on consumer behavior in live-streaming commerce have mainly focused on the characteristics of broadcasters or consumers but ignored the role of broadcasters' speech

Table 1.
Recent research on live-streaming commerce

Authors	Theoretical foundation	Data source	Independent variables	Dependent variables	Main findings
Main Research Stream 1: Consumer engagement					
Kang *et al.* (2021)	SOR	Field data	Interactivity	Consumer engagement	Interactivity has a nonlinear (inverted U-shaped) relationship with consumer engagement
Guo *et al.* (2021)	Trust transfer theory	Survey data	Trust	Consume engagement	Trust in broadcasters positively affects trust in products and community members, which positively influences trust in products
Hu and Chaudhry (2020)	SOR	Survey data	Relational bonds	Consumer engagement	Social and structural bonds positively affect consumer engagement, directly and indirectly, via affective commitment. Meanwhile, financial bonds only indirectly affect consumer engagement via affective commitment
Wongkitrungrueng *et al.* (2020)	Theories of relationship marketing	Qualitative research	Live-streaming strategy	Consumer engagement	These authors identified four sales approaches and 12 strategies adopted in acquiring and retaining consumers
Wongkitrungrueng and Assarut (2020)	Value theory	Survey data	Perceived value	Consumer engagement	Symbolic value, directly and indirectly, affects consumer engagement via trust in sellers. Utilitarian and hedonic values affect customer engagement indirectly and sequentially through customer trust in products and trust in sellers
Xue *et al.* (2020)	SOR	Survey data	Interactions	Consumer engagement	Live interactions (i.e. personalization, responsiveness, entertainment, mutuality, and perceived control) positively affect perceived usefulness and negatively affect perceived risks and psychological distance, promoting social commerce engagement
Chen and Lin (2018)	Flow theory	Survey data	Flow, entertainment, and social interaction	Usage intentions	Flow, entertainment, and social interaction are the main factors that affect consumers' usage intentions for live-streaming services

(*continued*)

Table 1.

Authors	Theoretical foundation	Data source	Independent variables	Dependent variables	Main findings
Main Research Stream 2: Consumption behavior					
Addo *et al.* (2021)	/	Field data	Customer engagement price	Purchase intentions	Consumer engagement (likes, chats, visits, and exposure time in social commerce) positively influences followership and purchase intentions in live-streaming commerce. While price is a significant moderator, its effect becomes insignificant once consumers become followers
Lin *et al.* (2021)	/	Field data	Broadcasters' emotion	Gift-giving	Happier broadcasters make audiences happier and trigger more gift-giving from audiences
Hou *et al.* (2020)	Uses and gratification theory	Survey data	Interactivity, social status display, humor appeal, and sex appeal	Consumption intentions	Sex and humor appeal, social status displays, and interactivity influence viewers' consumption intentions in live-streaming commerce, and their effects vary across different live streaming types
Zhou *et al.* (2019)	Social interaction theory	Field data	Viewers' social interaction	Gift-giving	Other broadcast viewers' presence and social competition positively affect viewers' gift-giving behavior in live-streaming commerce
Zhang *et al.* (2019)	Construal level theory	Survey and field data	Psychological distance	Purchase intentions	Live video streaming strategies improve consumers' online purchase intentions by reducing psychological distance and perceived uncertainty in live-streaming commerce
Yu *et al.* (2018)	/	Field data	Engagement socialization motives	Gift-giving	Viewer engagement is positively associated with their gift-giving decisions. Their socialization motive highly correlates with their gift-giving behavior. The relationship between viewers and broadcasters affects the number of gifts from viewers

Note(s): SOR represents the stimulus organism response theory;/means no specific theory applied in studies

content—though this content is the main information that persuades viewers to interact and purchase. Additionally, prior research has examined gift-giving and purchasing behaviors but not how broadcasters' speech content in live streams influences these two different behaviors. Furthermore, most previous studies have applied the survey method to investigate consumer behavior in this context (Lin *et al.*, 2021). Scholars have called for research to better explain consumer behavior in live-streaming commerce using field data (Addo *et al.*, 2021; Kang *et al.*, 2021). An exploration of how broadcasters' speech content affects viewers' gift-giving and purchasing behaviors, based on panel data from live-streaming commerce platforms, can meaningfully enrich the live-streaming commerce literature.

2.2 Social interaction

Social interaction reflects communication activities between two or more people (Lim *et al.*, 2019). Previous studies have shown that social interaction can encourage individuals to identify with a community and increase mutual trust, satisfaction and commitment (Liang *et al.*, 2014). One of the most common social interaction methods is communication-based speech content. People use some specific content in speech, such as speaking specific words, to stimulate others' interactive intentions. Additionally, research in psycholinguistics has argued that a speaker's use of more social words in speech can convey social interaction-oriented content to audiences, potentially triggering social interaction (Huang *et al.*, 2012). Some natural language processing tools (such as Linguistic Inquiry and Word Count (LIWC)) have also been developed to calculate the proportion of social words in a text in order to determine whether a text is social interaction-oriented, and such tools have been employed in recent research (Liu *et al.*, 2021).

Previous research has suggested that real-time social interaction is the main advantage of live-streaming commerce (Shen *et al.*, 2019; Xue *et al.*, 2020). Broadcasters interact socially with viewers through activities, such as greeting, chatting, or addressing social topics, to create a relaxing live-streaming atmosphere (Lin *et al.*, 2021). Previous studies have also shown that social interaction positively affects viewers' attitudes and perceived value of watching live broadcasts (Chen and Lin, 2018). Additionally, social interaction among viewers can promote gift-giving behavior through arousal (Zhou *et al.*, 2019). Social interaction between broadcasters and viewers positively affects viewers' perceived usefulness and negatively affects their perceived risks and psychological distance (Xue *et al.*, 2020), promoting viewers' consumption (Xu *et al.*, 2020).

Previous studies have mainly explored how social interaction between broadcasters and viewers or among viewers affects consumer behavior in live-streaming commerce and have ignored the role of live speech content in understanding consumer behavior. Fei *et al.* (2021) explored how viewers' herding messages and interactive text affect viewers' attention and purchase intentions from viewers' perspectives. However, little research has attempted to explore how broadcasters' speech content affects viewers' purchasing and gift-giving behaviors from the perspective of content.

2.3 Attention theory

Attention has been defined as "the set of processes enabling and guiding the selection of incoming perceptual information" (Roda and Thomas, 2006, p. 559). It is among the dominant antecedents to individuals' behavioral decisions (Shen *et al.*, 2015), and it is among the popular theories explaining individuals' cognition of information (Roda and Thomas, 2006). It has been widely applied to various research fields, such as information systems, psychology and marketing (Fei *et al.*, 2021; Giesbrecht *et al.*, 2014; Javadi *et al.*, 2013).

Attention theory suggests that attention is a limited cognitive resource (Lavie, 1995). Usually, individuals cannot cognitively process all visual stimuli within a certain period; they

can only allocate their attention to processing part of a stimulus, abandoning the other parts (Lavie, 1995; Roda and Thomas, 2006). Because people have limited attention, visual stimuli compete for attention resources (Shen *et al.*, 2015). Some scholars have stated that attention is the most valuable and scarce resource in Internet marketing (Falkinger, 2008; Thrall *et al.*, 2014). The Internet's increasingly rich media content provides users with novel experiences but also overloads users' information-processing, leading to a competition for attention (Shen *et al.*, 2015). A previous study showed that the association between different stimuli can cause an attention transfer (Radon *et al.*, 2021). A visual stimulus may activate a learned memory association that triggers individuals' attention goal for searching in the next stage (Pieters and Wedel, 2018). Therefore, the stimulus that an individual is currently focusing on could be more likely to attract attention than other stimuli that are not in focus (Radon *et al.*, 2021).

Individuals' attention could affect their behavioral responses (Florack *et al.*, 2020). For example, individuals' attention to a product could increase their awareness, attitude and evaluation of that product (Florack *et al.*, 2020). Their increasing awareness of products could further increase their purchases (Deng *et al.*, 2016). When consumers' attention is distracted from a product, they are less likely to purchase that product (Deng *et al.*, 2016).

Previous studies on attachment theory have shown that, when consumers are more attached to a celebrity influencer in an advertisement, they will allocate more attention to that influencer (Kuvita and Karlicek, 2014; Saldanha *et al.*, 2018). Consumers' attachment and attention to an influencer can also migrate to the product that the influencer is recommending, encouraging consumers' attention and attitudes toward the product (Ilicic and Webster, 2011, 2014). However, some scholars have argued that, when influencers receive too much attention from consumers, they can overshadow promoted products or brands (Erfgen *et al.*, 2015). In other words, consumers' excessive attachment and attention to celebrity influencers could weaken consumers' attention to the promoted products since they might concentrate on the influencers and ignore the products, negatively affecting product promotion (Erfgen *et al.*, 2015).

Live-streaming commerce is live, audiovisual broadcasting over the Internet. In this context, viewers' attention can be regarded as a scarce resource for which both products and broadcasters compete (Fei *et al.*, 2021). In live broadcasts, speech is the main information delivered to viewers as a stimulus, attracting their attention and triggering their behavior—such as purchasing and gift-giving behaviors (Fei *et al.*, 2021). Therefore, attention theory could be an appropriate theory to explain how speech content delivered to viewers by broadcasters can affect viewers' behaviors in live-streaming commerce.

3. Research model and hypotheses

3.1 Research model

Drawing on attention theory, as well as the prior literature, we established a research model to investigate how social interaction-oriented content in broadcasters' live speech influences viewers' gift-giving and purchasing behaviors. Specifically, we assumed that social interaction-oriented content in such speech affects viewers' gift-giving and purchasing behaviors. Additionally, broadcasters' popularity has been found to affect the effectiveness of broadcasters' speeches (Kang *et al.*, 2021). For example, highly popular broadcasters are more likely to hold viewers' attention and overshadow product information (Erfgen *et al.*, 2015). Therefore, we assumed that broadcaster popularity also affects the impact of social interaction-oriented content in broadcasters' live speech on viewers' gift-giving and purchasing behaviors in live-streaming commerce. Figure 1 depicts the present study's theoretical model.

3.2 Hypotheses

Previous research has indicated that social interaction-oriented content is an important factor that affects consumers' online purchasing behavior (Zhao *et al.*, 2018). Prior research has

mainly examined social interaction-oriented content included in online texts, finding that this content affects consumers' information processing and purchase intentions in e-commerce (Hennig-Thurau *et al.*, 2014; Zhao *et al.*, 2018). In live-streaming commerce, social interaction-oriented content is delivered to viewers through live speech when broadcasters promote products or services. Viewers process such information to support their real-time decisions, such as decisions to purchase products or to give gifts to broadcasters (Lin *et al.*, 2021; Zhang *et al.*, 2019). Therefore, it is reasonable to assume that social interaction-oriented content in broadcasters' live speech affects viewers' behaviors in live-streaming commerce, such as purchasing and gift-giving behaviors.

According to Zhou *et al.* (2019), the content of broadcast viewers' review comments that scroll across a screen in real time can increase viewers' arousal in live-streaming commerce. Individuals' arousal could increase their attention resources allocated to the information source (Cheung *et al.*, 2017). Following the prior findings in the literature, in live-streaming commerce, we assumed that the social interaction-oriented content in broadcasters' live speech could increase viewers' arousal within an optimal range, making viewers pay attention to both broadcasters and promoted products. Related studies on attention theory found that, when consumers pay more attention to a product, they are more likely to purchase that product (Deng *et al.*, 2016), and when consumers are distracted from a product, their purchasing probability falls (Fei *et al.*, 2021). Therefore, we could reasonably assume that broadcast viewers' attention to a product on sale in live-streaming commerce increases their purchasing behavior.

However, when the social interaction-oriented content in broadcasters' live speech exceeds the optimal level, viewers could be distracted from promoted products and focus more on interactions with broadcasters since broadcasters and products must compete for consumers' scarce attention resources. Prior research on this eclipsing effect has shown that, when viewers focus on an endorser excessively—rather than a product—during product promotion, viewers could ignore product information (Ilicic and Webster, 2014). Therefore, when the social interaction-oriented content in broadcasters' live speech exceeds the optimal threshold, a reverse effect occurs as social interaction-oriented content disrupts viewers' purchasing behavior. Accordingly, we hypothesized:

H1. The social interaction-oriented content in broadcasters' live speech and viewers' purchasing behavior share an inverted U-shaped relationship in live-streaming commerce.

In live-stream commerce, when broadcasters promote products, they also hope to increase their own influence among viewers (Hu *et al.*, 2017). Therefore, broadcasters must also attract viewers' attention and promote themselves in this context (Hu and Chaudhry, 2020). Viewers' gift-giving behavior is a popular way to assess broadcasters' influence or performance. Given broadcasters' celebrity, when they include more social interaction-oriented content in their

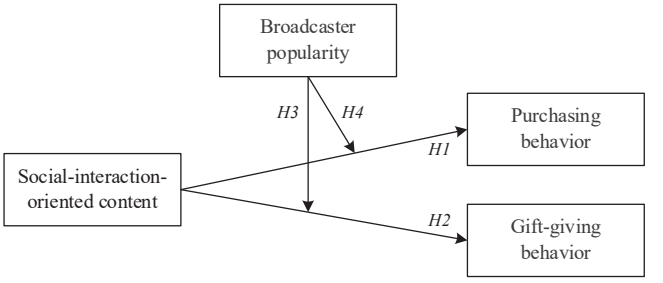

Figure 1.
Research model

live speech, viewers might allocate more attention to broadcasters (Ilicic and Webster, 2014). Previous studies have shown that live-streaming broadcasters' social interaction can increase viewers' attention to the broadcasters, inducing viewers to perceive the broadcasters' personal charm (Xue *et al.*, 2020) and potentially encouraging viewers to send broadcasters virtual gifts (Yu *et al.*, 2018). Therefore, we could reasonably assume that, as social interaction-oriented content increases in broadcasters' live speech, viewers might also increase their attention to broadcasters, likely triggering more gift-giving behavior. Accordingly, we proposed:

H2. The social interaction-oriented content is positively related to viewers' gift-giving behavior in live-streaming commerce.

Previous research has indicated that broadcasters' popularity can affect viewers' consumption behavior (Kang *et al.*, 2021). Highly popular broadcasters could attract more viewers to view and participate in their live streams (Ladhari *et al.*, 2020; Li and Peng, 2021; Wang *et al.*, 2019). For example, viewers have been found to feel attached to popular broadcasters, such as through curiosity and celebrity worship (Hu *et al.*, 2017). Previous research has shown that people are more interested in popular broadcasters, who can attract more viewer attention (Kang *et al.*, 2021). Broadcaster popularity could trigger viewers to send broadcasters virtual gifts during live streams, awarding their professional performance or expressing respect for or worship of broadcasters (Addo *et al.*, 2021). Social interaction-oriented content in the live speech delivered by highly popular broadcasters could more likely arouse broadcast viewers' positive emotions and attract their attention to the broadcasters than the content delivered by broadcasters with low popularity. Therefore, we could reasonably assume that social interaction-oriented content in highly popular broadcasters' live speech has a stronger positive impact on gift-giving than the corresponding content by less-popular broadcasters. We proposed:

H3. Broadcaster popularity moderates the relationship between broadcasters' social interaction-oriented content and viewers' gift-giving behavior. Specifically, such content from highly popular broadcasters has a stronger positive impact on viewers' gift-giving than corresponding content from less-popular broadcasters.

Meanwhile, broadcaster popularity might make viewers trust promoted products more due to viewers' attachment to live-streaming broadcasters, leading viewers to purchase products (Chen *et al.*, 2022). The information delivered by highly popular broadcasters has a greater impact on viewers compared to information delivered by the low-popularity broadcaster (Kang *et al.*, 2021). Therefore, social interaction-oriented content from highly popular broadcasters could be more likely to arouse viewers' attention to both the promoted products and the broadcasters. When broadcasters provide appropriate social interaction-oriented content in their live speech to increase viewers' attention to both themselves and promoted products, viewers are more willing to purchase products recommended by broadcasters with higher popularity because viewers generally believe broadcaster popularity to be an important indicator of live-stream quality.

However, when broadcasters' social interaction-oriented content exceeds the optimal range, such content delivered by highly popular broadcasters will more likely attract viewers' attention excessively to the broadcasters themselves. Due to viewers' limited attention resources to process real-time information in live-streaming commerce, when viewers pay more attention to broadcasters, they pay less attention to promoted products (Erfgen *et al.*, 2015). Therefore, we could reasonably assume that highly popular broadcasters could simultaneously strengthen the positive and negative impacts of social interaction-oriented content on purchasing behavior in a U-shaped relationship.

Additionally, since more popular broadcasters are more likely to encourage broadcast views, highly popular broadcasters can deliver less social interaction-oriented content to optimize audience arousal and cause earlier peaks in purchase behavior. This impact shifts the turning point in the inverted-U-shaped relationship between such content and purchasing behavior to the left. Accordingly, we hypothesized:

H4. Broadcaster popularity moderates the inverted-U-shaped relationship between social interaction-oriented content in broadcasters' live speech and viewers' purchasing behavior. Specifically, higher broadcaster popularity steepens the peak of this relationship and shifts it to the left.

4. Method

4.1 Data collection

The proposed model was empirically tested with data from the live-streaming commerce platform Douyin, the Chinese version of TikTok. The platform has about 680 million monthly active users. It is one of the top three live-streaming platforms with which Chinese companies and broadcasters can conduct live-streaming commerce in China (Kaye *et al.*, 2021). The data were collected from a live-streaming service provider in China (https://www.douchacha.com), including 537 live-streaming sessions on Douyin from April 13 to June 9, 2021. The sample is specifically described in Table 2. Additionally, to avoid data deviations caused by different live-streaming session times on different days, we selected live-streaming sessions that took place from 8:00 p.m. to 10:00 p.m.—the most active time for viewers to participate in live-streaming sessions on Douyin.

We obtained minute-level, structured data for each live-streaming session, such as the number of sales, gifts and online viewers at each minute. Our data set also included broadcasters' information in each live-streaming session, such as their gender, the number of fans, promotion capability and the number of live broadcasts per month. Additionally, we collected recorded videos of all live-streaming sessions during the observed period.

We applied speech recognition technology and natural-language-processing technology to convert broadcasters' audio speech into text data for each minute. The final data set included 35,736 min structured speech text data.

4.2 Variables

Words are the most basic unit through which ideas are expressed and specific words' frequency in information can reflect a communicator's communication strategy (Pezzuti *et al.*, 2021). People can use social features in their language to express ideas about social

Variable	Measurement	Sample size	Variable	Measurement	Sample size
Gender	Male	124	Broadcaster type	Direct-sale broadcaster	309
	Female	413		Agent-sale broadcaster	228
Number of fans	<100,000	11	Promotion capability	General	11
	100,000–1 million	230		Good	344
	1 million–10 million	213		Great	182
	>10 million	83			

Note(s): The platform sets broadcasters' promotion capability at three different levels: General, good, and great

Table 2. Demographic details of the live broadcaster sample in this study (n = 537)

interaction (Yang *et al.*, 2022). Previous studies have shown that social interaction-oriented content can be measured by calculating social words' frequency in communication content (Tausczik and Pennebaker, 2010; Yang *et al.*, 2022). We applied the Chinese dictionary used in the LIWC software to encode the social words included in the live-streaming speech for each minute. LIWC uses natural language-processing technology to classify different categories of words in text content and calculate words' frequency (Tausczik and Pennebaker, 2010). This software has been widely applied to content analysis in the live-streaming context (Diwanji *et al.*, 2020; Lin *et al.*, 2021). One of the 80 sub-dictionaries that define the category names of words and word lists in LIWC is devoted to social words (Huang *et al.*, 2012; Packard and Berger, 2021). Specifically, LIWC provides a Chinese dictionary containing 587 Chinese words that describe social processes and the desire for social interactions in text content (e.g. welcome, thanks, hello, entertain, friends, greeting and introduction). Following prior research, we adopted social words' frequency per minute in a broadcaster's live speech to measure the social interaction-oriented content in live speech.

We used increased sales and gift volumes during each minute to measure viewers' purchasing and gift-giving behaviors, respectively. Previous studies have stated that the number of concurrent viewers of a live broadcast can serve as a proxy measure of a broadcaster's popularity in live-streaming commerce (Kang *et al.*, 2021). Therefore, following prior research, we used the number of online viewers per minute to measure a broadcaster's popularity.

Additionally, we included some broadcaster-related control variables in this study since the prior literature has shown that some factors related to broadcasters' live streams affect viewers' behavior in live-streaming commerce. For example, broadcasters' gender, promotion capability, broadcaster type, the number of fans, the number of live broadcasts per month, and live-stream word counts per minute can affect viewers' social interaction (Todd and Melancon, 2018), attitudes and trust toward broadcasters (Kim and Park, 2013) and information-processing (Fieder *et al.*, 2018). Therefore, we adopted broadcasters' gender, promotion capability, type, the number of fans, the number of live broadcasts per month and live-stream speech word counts per minute as the current study's control variables (see Table 3 for more details).

4.3 Data analysis

Table 4 summarizes our data set. In order to ensure that the proposed research model was tested properly, we evaluated our data set's statistical distribution to select an appropriate method for our analysis. Purchasing and gift-giving numbers for each minute constituted the study's count data and were distributed with a positive skew. For example, the number of purchasing for each minute ranged from 0 to 34,092 (M = 121.84, skewness = 27.39, kurtosis = 554.04, SD = 675.85), and the number of gift-giving per minute ranged from 0 to 43,168 (M = 66.86, skewness = 42.74, kurtosis = 1647.44, SD = 591.91). These data's skewness and kurtosis exceeded the acceptable limits for normal distribution (skewness >3; kurtosis >7; Kline, 2015), indicating the data set's over-dispersion. Therefore, we employed negative binomial regression in this study since it suits count data with over-dispersion characteristics and has been widely used to analyze such data (Fan *et al.*, 2022; Jin *et al.*, 2015). Additionally, since the characteristics of each live broadcast room vary, which could affect broadcasters' performance, we used the fixed-effects model to control for these discrepancies.

We performed a Spearman's correlation test to examine the relationships between the variables included in the analysis since this approach fits to count variables and non-normally distributed variables. As Table 5 shows, the correlations among the key variables were all significant, indicating that these variables may have influenced each other.

Variable	Measurement	Proxy	References
Dependent variable			
Purchasing behavior	Viewers purchase products introduced by broadcasters in live-streaming commerce	The number of increased sales per minute recorded in live streams	Hu and Chaudhry (2020)
Gift-giving behavior	Viewers send broadcasters virtual tokens or gifts they have purchased from the platform with money	The number of increased gifts from viewers per minute recorded in live streams	Lin *et al.* (2021)
Independent variable			
Social interaction-oriented content in broadcasters' live streams	Social signals to express or identify the interaction intentions in broadcasters' live speech	The proportion of social words contained in broadcasters' speech content in each minute recorded	Durlauf and Ioannides (2010)
Moderator			
Broadcaster popularity	A broadcaster's popularity	The number of online viewers in a live-streaming room recorded at the end of a minute	Kang *et al.* (2021)
Control variable			
Gender	A broadcaster's gender	1 = male; 0 = female	
Promotion capability	A broadcaster's promotion ability	A broadcaster's promotion capability	
Broadcaster type	A broadcaster's type	Broadcasters that only promote one brand as direct-sale broadcasters = 1; broadcasters that promote multiple brands and multiple types of products as agent-sale broadcasters = −1	
Number of fans	The viewers' attachment to a broadcaster	A broadcaster's number of fans	Derbaix and Korchia (2019)
Number of live broadcasts per month	A broadcaster's live broadcast activity per month	A broadcaster's average number of live broadcasts per month	
Live-stream word counts per minute	The number of words a broadcaster expressed through live speech per minute	The number of words in a broadcaster's live speech per minute recorded	Fieder *et al.* (2018)

Table 3.
Variables and measurements

Variables	Mean	SD	Min	Max
Purchasing behavior	121.836	675.850	0	34,092
Gift-giving behavior	66.857	591.910	0	43,168
Social interaction-oriented content	18.230	14.934	0	95.238
Broadcaster popularity	1826.183	19844.89	3	635066.5
Promotion capability	1.659	0.519	1	3
Broadcaster type	0.146	0.989	−1	1
Number of fans	2.217	0.743	0.048	19.613
Number of live broadcasts per month	6.452	9.421	1	31
Live-stream word counts per minute	196.621	107.30	0	1,381

Note(s): We calculated the number of fans by 1,000,000 for scaling purposes

Table 4.
Descriptive statistics

Variables	PB	GB	SC	BP	Gender	PC	Pt	NOF	NOM	WC
Purchasing behavior (PB)	1									
Gift-giving behavior (GB)	−0.038**	1								
Social interaction-oriented content (SC)	0.053**	0.153**	1							
Broadcaster popularity (BP)	0.019**	0.263**	0.132**	1						
Gender	−0.006	0.305**	0.094**	0.438**	1					
Promotion capability (PC)	0.017**	0.008**	0.020**	0.026**	0.217**	1				
Broadcaster type (PT)	0.011*	−0.403**	0.099**	0.525**	−0.356**	−0.235**	1			
Number of fans (NOF)	0.017**	0.448**	0.076**	0.508**	−0.455**	0.345**	−0.551**	1		
Number of live broadcasts per month (NOM)	−0.006	0.227**	−0.047**	0.298**	0.103**	0.374**	0.197**	0.062**	1	
Live-stream word counts per minute (WC)	0.011*	−0.239**	0.102**	−0.444**	−0.155**	0.088**	0.183**	0.258**	0.196**	1

Note(s): *$p < 0.05$, **$p < 0.01$

Table 5.
Correlation test results

All correlation coefficient values were less than 0.7, indicating no serious collinearity (Dormann *et al.*, 2013). Specifically, we observed significant positive correlations between both social interaction-oriented content and purchase behavior (correlation = 0.053) and social interaction-oriented content and gift-giving behavior (correlation = 0.153), and we observed a negative correlation between purchase behavior and gift-giving behavior (correlation = −0.038). Additionally, broadcaster popularity was significantly correlated with social interaction-oriented content, purchase behavior and gift-giving behavior.

We estimated a series of regressions to test how social interaction-oriented content in broadcasters' live speech affects viewers' purchasing behavior (see Table 6). For each model, we checked each variable's VIF value. The highest VIF value in the overall models was 2.74, which was below the vigilance threshold of 5.0 (O'Brien, 2007), indicating that multicollinearity was not a serious issue for these regression models.

First, we tested the independent variables' main effect on viewers' purchasing behavior (see Model 2). The results show that the likelihood ratio test for the negative binomial regression model was significant (log likelihood = −175934.05, $\chi^2[9] = 56.76$, $p < 0.001$), indicating a decent fit. The beta parameter for social interaction-oriented content was positive and significant ($\beta = 0.129$, $p < 0.001$), and the parameter of the square term of social interaction-oriented content was negative and significant ($\beta = -0.008$, $p < 0.001$, turning point = 8.86; See Model 2), implying that the relationship between social interaction-oriented content and purchasing behavior was shaped like an inverted U. These results support H1. Figure 2 depicts this relationship.

We then tested broadcaster popularity's moderating effect on the relationship between social interaction-oriented content and purchasing behavior (see Model 3). The interaction effect between broadcaster popularity and social interaction-oriented content ($\beta = 0.051$, $p < 0.01$), as well as social interaction-oriented content square term ($\beta = -0.016$, $p < 0.01$), were significant. Our test results indicate that broadcaster popularity moderates the inverted U-shaped relationship between social interaction-oriented content and purchasing behavior through a nonlinear, moderated relationship (see Figure 3). These parameters' symbols show

Table 6.
Fixed–effects negative binomial regression results for social interaction-oriented content's effect on purchasing behavior

	Model 1		Model 2		Model 3	
	β (se)	*p*	*β (se)*	*p*	*β (se)*	*p*
Intercept	5.345 (0.162)	0.000	5.324 (0.165)	0.000	5.374 (0.161)	0.000
Gender	−0.132 (0.069)	0.056	−0.161 (0.071)	0.023	−0.132 (0.074)	0.077
Promotion capability	0.031 (0.061)	0.613	0.051 (0.062)	0.623	0.027 (0.060)	0.648
Broadcaster type	0.095 (0.035)	0.006	0.103 (0.034)	0.003	0.099 (0.034)	0.004
Number of fans	0.172 (0.049)	0.000	0.030 (0.049)	0.001	0.201 (0.051)	0.000
Number of live broadcasts per month	−0.098 (0.071)	0.163	−0.095 (0.070)	0.175	−0.105 (0.070)	0.129
Live-stream word counts per minute	0.070 (0.030)	0.020	0.058 (0.029)	0.051	0.050 (0.030)	0.097
Broadcaster popularity (BP)	0.095 (0.044)	0.000	0.076 (0.043)	0.000	0.071 (0.043)	0.000
Social interaction-oriented content (SC)			0.129 (0.029)	0.000	0.142 (0.028)	0.000
SC^2			−0.008 (0.001)	0.000	−0.014 (0.007)	0.025
SC * BP					0.051 (0.026)	0.003
SC^2 * BP					−0.016 (0.011)	0.002
VIF	1.50		1.51		2.74	
Log likelihood	−175988.34		−175934.05		−175918.12	
Wald χ^2	21.90	0.002	56.76	0.000	72.98	0.000
AIC	351,994		351,890		351,864	
BIC	352,071		351,983		351,983	
N	35,736		35,736		35,736	

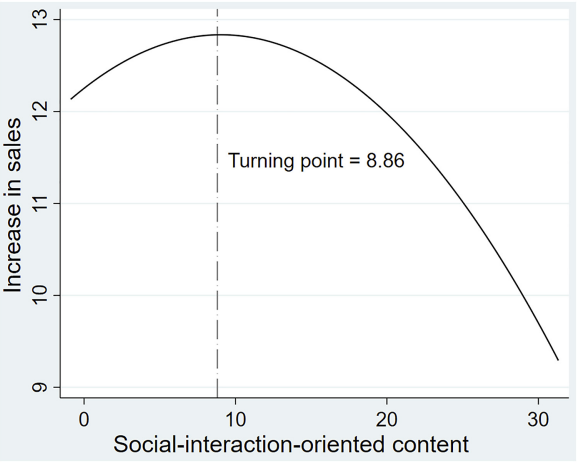

Figure 2.
The inverted U-shaped relationship between social interaction-oriented content and purchasing behavior

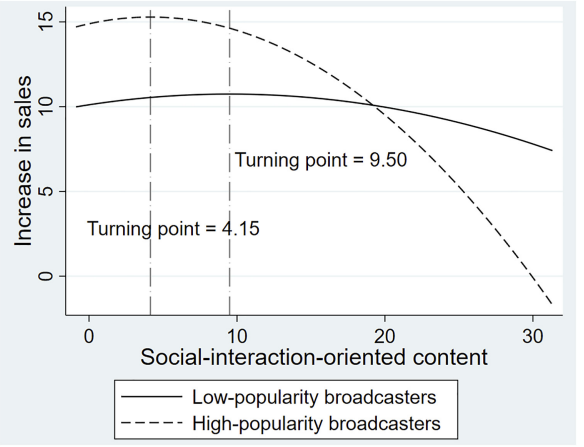

Figure 3.
The moderating effect of broadcaster popularity (purchasing behavior)

that broadcaster popularity strengthens the inverted U-shaped relationship between social interaction-oriented content and purchasing behavior.

To better understand these nonlinear, moderating effects, we further categorized the observed broadcasters by high or low popularity, based on this study's mean value of broadcaster popularity. Then, we tested social interaction-oriented content's impact on purchasing behavior among these two broadcaster groups using fixed-effects negative binomial regression (see Table 7). The test results show an inverted U-shaped relationship between social interaction-oriented content and purchasing behavior in both the low-popularity and high-popularity broadcaster groups. As Figure 3 shows, high-popularity broadcasters strengthened social interaction-oriented content's positive and negative impacts on purchasing behavior. Additionally, the additive combination of high-popularity broadcasters in the inverted U-shaped relationship between social interaction-oriented content and purchasing behavior led to a leftward shift in the turning point of this relationship (turning point = 4.15), causing an earlier peak in purchasing behavior.

Table 7.
Fixed–effects negative binomial regression results for social interaction-oriented content's effect on purchasing behavior among the two different broadcaster groups

	Model 4 (High-popularity broadcasters)		Model 5 (Low-popularity broadcasters)	
	β (se)	*p*	*β (se)*	*p*
Intercept	5.855 (0.263)	0.000	5.279 (0.191)	0.000
Gender	−0.357 (0.094)	0.000	−0.072 (0.096)	0.453
Promotion capability	0.036 (0.092)	0.692	0.022 (0.073)	0.759
Broadcaster type	0.240 (0.047)	0.000	0.093 (0.041)	0.024
Number of fans	0.524 (0.101)	0.000	0.135 (0.056)	0.017
Number of live broadcasts per month	−0.084 (0.130)	0.518	−0.156 (0.070)	0.067
Live-stream word counts per minute	−0.025 (0.061)	0.674	0.058 (0.033)	0.081
Social interaction-oriented content (SC)	0.191 (0.060)	0.001	0.133 (0.033)	0.000
SC^2	−0.032 (0.018)	0.025	−0.007 (0.001)	0.000
Log likelihood	−45358.676		−130501.31	
Wald χ^2	63.84	0.000	46.97	0.000
AIC	90,739		261,024	
BIC	90,817		261,114	
N	9,195		26,541	

In contrast, the low-popularity broadcasters weakened social interaction-oriented content's positive and negative impacts on purchasing behavior. They also increased the range of social interaction-oriented content's positive influence on purchasing behavior. Thus, the additive combination of low-popularity broadcasters in the inverted U-shaped relationship between social interaction-oriented content and purchasing behavior shifted the relationship's turning point rightward (turning point = 9.50), supporting H4.

Additionally, we estimated a series of regressions to test how social interaction-oriented content influences viewers' gift-giving behavior (see Table 8). For each model, we checked

Table 8.
Fixed–effects negative binomial regression results for social interaction-oriented content's effect on gift-giving behavior

	Model 6		Model 7		Model 8	
	β (se)	*p*	*β (se)*	*p*	*β (se)*	*p*
Intercept	7.407 (0.357)	0.000	7.359 (0.345)	0.000	5.207 (0.230)	0.000
Gender	0.517 (0.120)	0.000	0.530 (0.111)	0.000	0.457 (0.117)	0.000
Promotion capability	−0.471 (0.090)	0.000	−0.527 (0.097)	0.000	−0.421 (0.071)	0.000
Broadcaster type	−0.328 (0.069)	0.000	−0.305 (0.064)	0.000	−0.120 (0.047)	0.011
Number of fans	0.741 (0.102)	0.000	0.778 (0.086)	0.000	0.727 (0.068)	0.000
Number of live broadcasts per month	−0.720 (0.097)	0.000	−0.581 (0.090)	0.000	−0.622 (0.076)	0.000
Live-stream word counts per minute	−0.099 (0.032)	0.002	−0.116 (0.035)	0.001	−0.001 (0.027)	0.963
Broadcaster popularity (BP)	0.384 (0.069)	0.000	0.358 (0.066)	0.000	0.324 (0.067)	0.000
Social interaction-oriented content (SC)			0.271 (0.073)	0.000	0.217 (0.046)	0.000
SC^2			−0.034 (0.037)	0.354		
SC * BP					0.142 (0.037)	0.000
VIF	1.73		1.74		1.75	
Pseudo R^2	0.057		0.058		0.087	
Log likelihood	−140114.37		−139849.71		−134575.22	
Wald χ^2	2629.77	0.000	2511.54	0.000	1775.73	0.000
AIC	280,246		279,721		271,193	
BIC	280,323		279,814		271,295	
N	35,736		35,736		35,736	

each variable's VIF value. The highest VIF value in the overall models was 1.75, which was below the vigilance threshold of 5.0 (O'Brien, 2007), indicating that multicollinearity was not a serious issue.

Then, we tested social interaction-oriented content's main effect on viewers' gift-giving behavior (see Model 7). The results show that the likelihood ratio test for the negative binomial regression model was significant (log likelihood = −139849.71, $\chi^2[9] = 2511.54$, $p < 0.001$), indicating a good fit. Notably, the beta parameter of social interaction-oriented content was positive and significant ($\beta = 0.271$, $p < 0.001$), and the parameter of the square term of social interaction-oriented content was not significant ($\beta = -0.034$, $p = 0.354$), implying that social interaction-oriented content has a positive linear relationship with viewers' gift-giving behavior and supporting H2.

Next, we tested broadcaster popularity's moderating effects on the relationship between social interaction-oriented content and gift-giving behavior (see Model 8). The results show that social interaction-oriented content and broadcaster popularity have a significant interaction effect on gift-giving behavior ($\beta = 0.142$, $p < 0.001$). Also, we tested broadcasters' high and low popularity using fixed-effect negative binomial regression (see Table 9). We found that social interaction-oriented content in live speech delivered by highly popular broadcasters ($\beta_2 = 0.291$, $p < 0.001$) has a strong impact on viewers' gift-giving behavior than such content delivered by low-popularity broadcasters ($\beta_1 = 0.166$, $p < 0.001$; see Figure 4), supporting H3.

4.4 Post hoc analyses

We conducted post hoc analyses to ensure our findings' robustness. First, previous studies have shown that the significant coefficients of an independent variable and its square term are necessary but not sufficient to establish a quadratic relationship (Haans *et al.*, 2016). Checking whether the U-shaped relationship between the independent and dependent variables exists within the data set's scope is also necessary; for example, the slope must be sufficiently steep at both ends of the data range and have opposite signs, and the turning point must be located well within the data range (Haans *et al.*, 2016). Our further U-shaped relationship test results show that less social interaction-oriented content in live speech positively and significantly influenced purchasing behavior (slope = 0.141, $p < 0.001$).

	Model 9 (High-popularity broadcasters)		Model 10 (Low-popularity broadcasters)	
	β (se)	*p*	*β (se)*	*p*
Intercept	6.610 (0.557)	0.000	4.681 (0.286)	0.000
Gender	0.630 (0.157)	0.000	0.120 (0.103)	0.248
Promotion capability	−0.309 (0.199)	0.121	−0.536 (0.079)	0.000
Broadcaster type	−0.079 (0.144)	0.488	−0.059 (0.033)	0.072
Number of fans	0.617 (0.153)	0.000	0.498 (0.084)	0.000
Number of live broadcasts per month	0.403 (0.134)	0.000	−0.534 (0.075)	0.000
Live-stream word counts per minute	−0.149 (0.064)	0.020	−0.044 (0.032)	0.170
Social interaction-oriented content (SC)	0.291 (0.064)	0.000	0.166 (0.041)	0.000
SC^2	−0.033 (0.047)	0.263	−0.013 (0.062)	0.331
Log likelihood	−54386.43		−80900.56	
Wald χ^2	277.39	0.000	380.90	0.000
AIC	108,794		161,823	
BIC	108,873		161,913	
N	9,195		26,541	

Table 9. Fixed–effects negative binomial regression results for social interaction-oriented content's effect on gift-giving behavior among the two different broadcaster groups

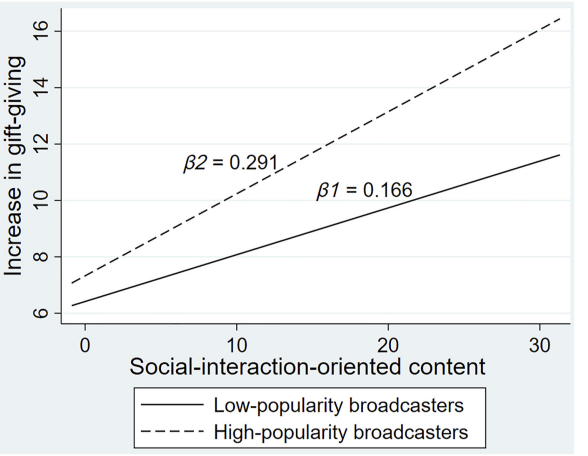

Figure 4.
The moderating effect of broadcaster popularity (gift-giving behavior)

Meanwhile, more social interaction-oriented content in live speech negatively and significantly influences purchasing behavior (slope = −0.328, $p < 0.001$). Additionally, we estimated the turning point for social interaction-oriented content and calculated confidence intervals based on the delta method (Lind and Mehlum, 2010). The results show that the turning point for social interaction-oriented content is within the data's limits (turning point = 8.86, LLCI = −0.879, ULCI = 31.321). These results demonstrate an inverted U-shaped relationship between social interaction-oriented content and purchasing behavior in the current study.

Second, previous studies have shown that both negative binomial regression and zero-inflated negative binomial regression are suitable for discrete count data (Alderighi and Gaggero, 2019; Grewal and Stephen, 2019). Compared to negative binomial regression, zero-inflated negative binomial regression is more suitable for data that contains too many zero counts. In our data sample, some live-stream broadcasts recorded zero sales and zero gifts. In order to explain our data's "zero inflation", we used fixed-effects, zero-inflated negative binomial regression to retest our hypothesis model, and we achieved consistent results.

Third, to reduce the influence of the independent variable's uncertainty on our results, we performed a set of sensitivity analyses using two other time windows (three and five minutes), testing the previous results' robustness. Specifically, we counted the values of each variable in three-minute and five-minute periods, and we analyzed the new data sets using fixed-effects negative binomial regression. The results showed that social interaction-oriented content's effects on purchasing and gift-giving behavior and the moderating effect of broadcaster popularity in the three-minute and five-minute observation windows were consistent with the results of the previously performed tests based on a one-minute observation window. The results of these robustness tests additionally support this study's main findings. Table 10 summarizes the results of all hypotheses tests for this study in the post hoc analysis.

5. Discussion

This study investigated how social interaction-oriented content in broadcasters' live-streaming speech influences viewers' gift-giving and purchasing behaviors from an attentional perspective.

We found that social interaction-oriented content in broadcasters' live-stream speech has an inverted U-shaped relationship with viewers' purchasing behavior. Specifically, social interaction-oriented content in broadcasters' speech is positively related to viewers' purchasing at the optimal range of this content, and it could increase viewers' arousal levels and, thus, increase their attention to both products and broadcasters at this optimal point (Zhou *et al.*, 2019; Cheung *et al.*, 2017), which promotes their purchasing behavior. When social interaction-oriented content in broadcasters' live speech exceeds this threshold, it could negatively affect viewers' purchasing behavior. This finding can be explained by the attention resources allocated to the broadcasters and products featured in live streams, given viewers' limited resources to process all the information from such broadcasts in real time. Excessive social interaction-oriented content in live streams attracts more viewers' attention to broadcasters and less attention to processing product information. When fewer attention resources are allocated to promoted products, viewers retain only vague information to support their product assessments, lowering their purchase behavior. Therefore, the social interaction-oriented content in broadcasters' live speech negatively influences viewers' purchasing behavior when this content exceeds that threshold. This finding echoes Fei *et al.*'s (2021) study, which found that social cues in live broadcasts may have both a negative distraction effect and a positive spillover effect on viewers' attention to promoted products since, in our study, social interaction-oriented content delivered in live speech can be regarded as a source of social cues. However, our findings extend the study by Fei *et al.* (2021) from viewers' attention on promoted products to their purchasing behavior in live-streaming commerce, revealing that social interaction-oriented content has a negative distraction effect and a positive spillover effect on viewers' purchasing behavior.

In line with earlier research by Xue *et al.* (2020), we also found that social interaction-oriented content in broadcasters' speech has a positive linear relationship with viewers' gift-giving behavior. Since social interaction-oriented content promotes viewers' attention to and interaction with broadcasters, as broadcasters use more of this content in their speech, viewers' attention to broadcasters continues to increase and can even overshadow their attention to promoted products. This effect positively affects viewers' gift-giving behavior. This finding is also consistent with the past studies' finding that social interaction can help broadcasters improve their relationship with viewers, increasing viewers' attachment to broadcasters and their gift-giving behavior in live-streaming commerce (Li and Peng, 2021).

Moreover, we found that broadcaster popularity moderates the inverted U-shaped relationship between social interaction-oriented content and purchasing behavior, as well as the linear relationship between social interaction-oriented content and gift-giving behavior. Broadcaster popularity provides viewers with information about the potential quality of a live broadcast. Compared to low-popularity live-streaming broadcasters, highly popular broadcasters attract more viewer attention, leading viewers to also pay more attention to highly popular broadcasters' speech content. The more attention viewers pay to the live-

Hypothesis	Fixed–effects negative binomial regression	Post hoc analysis		Sensitivity analysis
		U test	Fixed-effects zero-inflated negative binomial regression	
H1	Supported	Supported	Supported	Supported
H2	Supported	–	Supported	Supported
H3	Supported	–	Supported	Supported
H4	Supported	–	Supported	Supported

Table 10. Summary of all test results in post hoc analysis

streaming broadcasters, the better their awareness and assessment of these broadcasters, which can trigger broadcast viewers' decisions to endorse broadcasters via gift-giving during live streams. Therefore, the social interaction-oriented content in highly popular broadcasters' live streams promotes more gift-giving behavior than the corresponding content delivered by low-popularity broadcasters.

Additionally, broadcaster popularity could increase viewers' trust in promoted products (Chen *et al.*, 2022). Therefore, highly popular broadcasters could trigger more positive purchasing behavior by delivering appropriate social interaction-oriented content than low-popularity broadcasters. However, highly popular broadcasters are more likely to attract viewers' attention excessively to themselves. According to Erfgen *et al.* (2015), when viewers focus on highly popular endorsers, these endorsers are more likely to undermine consumers' cognitive attention to endorsed products (Erfgen *et al.*, 2015). Since viewers lack sufficient attention resources to process product information and support their purchasing decisions, highly popular broadcasters could strengthen excessive social interaction-oriented content's negative impact on purchasing behavior, while low-popularity broadcasters could have the opposite effect.

6. Conclusion

6.1 Theoretical implications

This study offers several theoretical contributions to the literature. First, it enriches the literature on social interaction in live-streaming commerce by extending the social interaction research to strategies for triggering social interactions in this setting—specifically social interaction-oriented content in broadcasters' live speech. Previous research has focused on how social interaction between broadcasters and viewers or among viewers influences viewers' behavior (Xue *et al.*, 2020; Zhang *et al.*, 2020). In contrast, the current study has deeply explained how broadcasters' speech content affects viewers' behaviors, and it has provided a new research perspective on social interactions in live-streaming commerce.

Second, the current work enriches the literature on viewers' purchasing behavior in live-streaming commerce by examining how social interaction-oriented content in broadcasters' live speech influences viewers' varied behaviors, including giving broadcasters gifts and purchasing products, from a perspective of attention. The previous literature has mainly investigated either purchasing behavior or gift-giving behavior. By investigating two different behaviors, the current study enables a deep understanding of how viewers' attention allocation affects their varied behavior differently in live-streaming commerce. Discussing social interaction-oriented content's effect on only one behavior—such as purchasing or gift-giving behavior—may not sufficiently explain broadcast viewers' varied behavior in live-streaming commerce.

Finally, this study contributes to the research on live-streaming commerce by investigating broadcaster popularity's moderating effect on the relationships between social interaction-oriented content in broadcasters' live speech and viewers' purchasing and gift-giving behaviors. Our findings on the significant interaction effects of broadcaster popularity and such social interaction-oriented content have established boundary conditions for interactive marketing's efficacy in influencing consumer purchasing and gift-giving behaviors in this context.

6.2 Practical implications

Our findings can be translated into practical guidelines that help live-streaming platforms, companies and broadcasters determine their content marketing strategies in live-streaming commerce. Live-streaming platforms, such as Instagram Live and YouTube Live,

should encourage broadcasters to include social interaction-oriented content in their speech to promote both sales and the broadcaster themselves. However, excessive social interaction-oriented speech has a negative distraction effect and a positive spillover effect on product sales in this context. These platforms must also remind broadcasters to effectively control the frequency of this content in their live speech in order to balance viewers' focus on promoted products and broadcasters themselves. This control would achieve companies' product-promotion goals.

Broadcasters should be proficient in adopting social interaction-oriented content when speaking to viewers in live-streaming commerce since such content can positively influence viewers' purchasing behavior. However, broadcasters should understand that excessive social interaction-oriented content in their live speech can influence viewers' gift-giving and purchasing behaviors asymmetrically. Although excessive social interaction-oriented content can increase viewers' gift-giving behavior, it can simultaneously decrease product sales. Hence, live-streaming broadcasters should undertake measures to balance product content and social interaction-oriented content in their live speech, achieving an optimal balance between product sales and gift-giving.

Broadcasters can also adjust social interaction-oriented content in their speech according to their characteristics, such as their popularity. For example, low-popularity broadcasters can include more social interaction-oriented content in their live speech, triggering more gift-giving and product-purchasing from viewers. Highly popular broadcasters, however, should limit their social interaction-oriented speech to prevent viewers from ignoring product information and reducing product purchases.

This study also provides some practical guidelines for companies on how to choose suitable broadcasters to promote product sales in live-streaming commerce, as well as what content broadcasters should deliver in live streams. Since we found that excessive social interaction-oriented content in broadcasters' speech could shift viewers' attention from promoted products to broadcasters themselves, negatively influencing product sales, companies should establish clear agreements with broadcasters about the content of their live speech. These agreements should strike a good balance between product content and social interaction-oriented content to promote product sales. Moreover, companies should apply different strategies to deliver content in live speech when cooperating with broadcasters of varied popularity. Importantly, broadcasters themselves should not attract too much viewers' attention because this focus can overshadow viewers' attention to products, reducing their purchasing behavior.

6.3 Limitations and future research avenues

Several limitations of the current study should be acknowledged. First, the study's panel data were collected from one live-streaming commerce platform in China. Caution should be taken when generalizing our findings to other live-streaming platforms across different cultural backgrounds. Accordingly, future research could replicate the current study using data from various platforms with different cultural orientations.

Second, we used LIWC software to quantify social interaction-oriented content in broadcasters' live-streaming speech via content analysis. Though this approach has been widely applied to text analysis in the literature, future research could consider using machine learning algorithms to calculate social interaction-oriented content, based on texts, in order to derive more comprehensive sets of metrics that measure social interaction-oriented content.

Third, in this study, viewers' gift-giving and product-purchasing behaviors in live-streaming commerce were estimated at the collective level but not at the individual viewer level, based on the data available in the data set. Future research could consider

investigating these two different behaviors or viewers' other behaviors at the individual viewer level if individual-level data are available. Future research could also consider exploring the effect of consumer characteristics, such as gender and age, on the relationships between social interaction-oriented content and viewers' gift-giving and purchasing behaviors.

Fourth, the current study only examines the effects of broadcaster-related factors on viewers' gift-giving and product-purchasing behaviors in live-stream commerce. Future research could consider viewer-related factors—such as viewers' psychological differences— and explore their impacts on these behaviors.

References

Addo, P.C., Fang, J., Asare, A.O. and Kulbo, N.B. (2021), "Customer engagement and purchase intention in live-streaming digital marketing platforms", *The Service Industries Journal*, Vol. 41 Nos 11-12, pp. 767-786.

Alderighi, M. and Gaggero, A.A. (2019), "Flight availability and international tourism flows", *Annals of Tourism Research*, Vol. 79, 102642.

Ang, T., Wei, S. and Anaza, N.A. (2018), "Livestreaming vs pre-recorded: how social viewing strategies impact consumers' viewing experiences and behavioral intentions", *European Journal of Marketing*, Vol. 52 Nos 9-10, pp. 2075-2104.

Caminal, R. and Vives, X. (1996), "Why market shares matter: an information-based theory", *Rand Journal of Economics*, Vol. 27 No. 2, p. 239.

Chen, C.C. and Lin, Y.C. (2018), "What drives live-stream usage intention? The perspectives of flow, entertainment, social interaction, and endorsement", *Telematics and Informatics*, Vol. 35 No. 1, pp. 293-303.

Chen, H., Zhang, S., Shao, B., Gao, W. and Xu, Y. (2022), "How do interpersonal interaction factors affect buyers' purchase intention in live stream shopping? The mediating effects of swift Guanxi", *Internet Research*, Vol. 32 No. 1, pp. 335-361.

Cheung, M.Y.M., Hong, W. and Thong, J.Y.L. (2017), "Effects of animation on attentional resources of online consumers", *Journal of the Association for Information Systems*, Vol. 18 No. 8, pp. 605-632.

Deng, X., Kahn, B.E., Unnava, H.R. and Lee, H. (2016), "A 'wide' variety: effects of horizontal versus vertical display on assortment processing, perceived variety, and choice", *Journal of Marketing Research*, Vol. 53 No. 5, pp. 682-698.

Derbaix, M. and Korchia, M. (2019), "Individual celebration of pop music icons: a study of music fans relationships with their object of fandom and associated practices", *Journal of Consumer Behavior*, Vol. 18 No. 2, pp. 109-119.

Diwanji, V., Reed, A., Ferchaud, A., Seibert, J., Weinbrecht, V. and Sellers, N. (2020), "Don't just watch, join in: exploring information behavior and copresence on Twitch", *Computers in Human Behavior*, Vol. 105, 106221.

Dormann, C.F., Elith, J. and Bacher, S. (2013), "Collinearity: a review of methods to deal with it and a simulation study evaluating their performance", *Ecography*, Vol. 36 No. 1, pp. 27-46.

Durlauf, S.N. and Ioannides, Y.M. (2010), "Social interactions", *Annual Review of Economics*, Vol. 2, pp. 451-478.

Erfgen, C., Zenker, S. and Sattler, H. (2015), "The vampire effect: when do celebrity endorsers harm brand recall?", *International Journal of Research in Marketing*, Vol. 32 No. 2, pp. 155-163.

Falkinger, J. (2008), "Limited attention as a scarce resource in information-rich economies", *The Economic Journal*, Vol. 118 No. 532, pp. 1596-1620.

Fan, W., Liu, Y., Li, H., Tuunainen, V.K. and Lin, Y. (2022), "Quantifying the effects of online review content structures on hotel review helpfulness", *Internet Research*, Vol. 32 No. 7, pp. 202-227.

Fei, M., Tan, H., Peng, X., Wang, Q. and Wang, L. (2021), "Promoting or attenuating? An eye-tracking study on the role of social cues in e-commerce live streaming", *Decision Support Systems*, Vol. 142 No. 1, 113466.

Fieder, N., Nickels, L., Krajenbrink, T. and Biedermann, B. (2018), "Garlic and ginger are not like apples and oranges: effects of mass/count information on the production of noun phrases in English", *Quarterly Journal of Experimental Psychology*, Vol. 71 No. 3, pp. 717-748.

Florack, A., Egger, M. and Hübner, R. (2020), "When products compete for consumers attention: how selective attention affects preferences", *Journal of Business Research*, Vol. 111, pp. 117-127.

Giesbrecht, B., Sy, J., Bundesen, C. and Kyllingsbæk, S. (2014), "A new perspective on the perceptual selectivity of attention under load", *Annals of the New York Academy of Sciences*, Vol. 1316, pp. 71-86.

Grewal, L. and Stephen, A.T. (2019), "In Mobile We Trust: the effects of mobile versus nonmobile reviews on consumer purchase intentions", *Journal of Marketing Research*, Vol. 56 No. 5, pp. 791-808.

Guo, L., Hu, X., Lu, J. and Ma, L. (2021), "Effects of customer trust on engagement in live streaming commerce: mediating role of swift guanxi", *Internet Research*, Vol. 31 No. 5, pp. 1718-1744.

Haans, R.F.J., Pieters, C. and He, Z.L. (2016), "Thinking about U: theorizing and testing U and inverted U-shaped relationships in strategy research", *Strategic Management Journal*, Vol. 37 No. 7, pp. 1177-1195.

Hennig-Thurau, T., Walsh, G. and Walsh, G. (2014), "Electronic word-of-mouth: motives for and consequences of reading customer articulations on the internet", *International Journal of Electronic Commerce*, Vol. 8 No. 2, pp. 51-74.

Hou, F., Guan, Z., Li, B. and Chong, A.Y.L. (2020), "Factors influencing people's continuous watching intention and consumption intention in live streaming: evidence from China", *Internet Research*, Vol. 30 No. 1, pp. 141-163.

Hu, M. and Chaudhry, S.S. (2020), "Enhancing consumer engagement in e-commerce live streaming via relational bonds", *Internet Research*, Vol. 30 No. 3, pp. 1019-1041.

Hu, M., Zhang, M. and Wang, Y. (2017), "Why do audiences choose to keep watching on live video streaming platforms? An explanation of dual identification framework", *Computers in Human Behavior*, Vol. 75, pp. 594-606.

Huang, C.L., Chung, C.K., Lin, Y.C. and Seih, Y.T. (2012), "The development of the Chinese linguistic inquiry and word count dictionary", *Chinese Journal of Psychology*, Vol. 52 No. 2, pp. 185-201.

Ilicic, J. and Webster, C.M. (2011), "Effects of multiple endorsements and consumer–celebrity attachment on attitude and purchase intention", *Australasian Marketing Journal*, Vol. 19 No. 4, pp. 230-237.

Ilicic, J. and Webster, C.M. (2014), "Eclipsing: when celebrities overshadow the brand", *Psychology and Marketing*, Vol. 31 No. 11, pp. 1040-1050.

Javadi, E., Gebauer, J. and Mahoney, J. (2013), "The impact of user interface design on idea integration in electronic brainstorming: an attention-based view", *Journal of the Association for Information Systems*, Vol. 14 No. 1, pp. 1-21.

Jiang, Z., Chan, J., Tan, B. and Chua, W.S. (2010), "Effects of interactivity on website involvement and purchase intention", *Journal of the Association for Information Systems*, Vol. 11 No. 1, pp. 34-59.

Jin, J., Li, Y., Zhong, X. and Zhai, L. (2015), "Why users contribute knowledge to online communities: an empirical study of an online social Q&A community", *Information and Management*, Vol. 52 No. 7, pp. 840-849.

Kang, K., Lu, J., Guo, L. and Li, W. (2021), "The dynamic effect of interactivity on customer engagement behavior through tie strength: evidence from live streaming commerce platforms", *International Journal of Information Management*, Vol. 56, 102251.

Kaye, D.B.V., Chen, X. and Zeng, J. (2021), "The co-evolution of two Chinese mobile short video apps: parallel platformization of Douyin and TikTok", *Mobile Media and Communication*, Vol. 9 No. 2, pp. 229-253.

Kim, S. and Park, H. (2013), "Effects of various characteristics of social commerce (s-commerce) on consumers' trust and trust performance", *International Journal of Information Management*, Vol. 33 No. 2, pp. 318-332.

Kline, R.B. (2015), *Principles and Practice of Structural Equation Modeling*, 4th ed., Guilford Press, New York.

Kuvita, T. and Karlicek, M. (2014), "The risk of vampire effect in advertisements using celebrity endorsement", *Central European Business Review*, Vol. 3 No. 3, pp. 16-17.

Ladhari, R., Massa, E. and Skandrani, H. (2020), "YouTube vloggers' popularity and influence: the roles of homophily, emotional attachment, and expertise", *Journal of Retailing and Consumer Services*, Vol. 54, 102027.

Lavie, N. (1995), "Perceptual load as a necessary condition for selective attention", *Journal of Experimental Psychology: Human Perception and Performance*, Vol. 21 No. 3, pp. 451-468.

Li, C.Y. and Ku, Y.C. (2018), "The power of a thumbs-up: will e-commerce switch to social commerce?", *Information and Management*, Vol. 55 No. 3, pp. 340-357.

Li, Y. and Peng, Y. (2021), "What drives gift-giving intention in live streaming? The perspectives of emotional attachment and flow experience", *International Journal of Human–Computer Interaction*, Vol. 37 No. 14, pp. 1317-1329.

Liang, T.-P., Ho, Y.-T., Li, Y.-W. and Turban, E. (2014), "What drives social commerce: the role of social support and relationship quality", *International Journal of Electronic Commerce*, Vol. 16 No. 2, pp. 69-90.

Lim, W.M., Jee, T.W., Loh, K.S. and Chai, E.G.F. (2019), "Ambience and social interaction effects on customer patronage of traditional coffeehouses: insights from kopitiams", *Journal of Hospitality Marketing and Management*, Vol. 29 No. 2, pp. 182-201.

Lin, Y., Yao, D. and Chen, X. (2021), "Happiness begets money: emotion and engagement in live streaming", *Journal of Marketing Research*, Vol. 58 No. 3, pp. 417-438.

Lind, J.T. and Mehlum, H. (2010), "With or without U? The appropriate test for a U-shaped relationship", *Oxford Bulletin of Economics and Statistics*, Vol. 72 No. 1, pp. 109-118.

Liu, Z., Zhang, N., Peng, X., Liu, S., Yang, Z., Peng, J., Su, Z. and Chen, J. (2021), "Exploring the relationship between social interaction, cognitive processing and learning achievements in a MOOC discussion forum", *Journal of Educational Computing Research*, Vol. 60 No. 1, pp. 132-169.

O'Brien, R.M. (2007), "A caution regarding rules of thumb for variance inflation factors", *Quality and Quantity*, Vol. 41 No. 5, pp. 673-690.

Packard, G. and Berger, J. (2021), "How concrete language shapes customer satisfaction", *Journal of Consumer Research*, Vol. 47 No. 5, pp. 787-806.

Pezzuti, T., Leonhardt, J.M. and Warren, C. (2021), "Certainty in language increases consumer engagement on social media", *Journal of Interactive Marketing*, Vol. 53 No. 1, pp. 32-46.

Pieters, R. and Wedel, M. (2018), "Attention capture and transfer in advertising: brand, pictorial, and text-size effects", *Journal of Marketing*, Vol. 68 No. 2, pp. 36-50.

Radon, A., Brannon, D.C. and Reardon, J. (2021), "Ketchup with your fries? Utilizing complementary product displays to transfer attention to a focal product", *Journal of Retailing and Consumer Services*, Vol. 58, 102339.

Roda, C. and Thomas, J. (2006), "Attention aware systems: theories, applications, and research agenda", *Computers in Human Behavior*, Vol. 22 No. 4, pp. 557-587.

Saldanha, N., Mulye, R. and Rahman, K. (2018), "A strategic view of celebrity endorsements through the attachment lens", *Journal of Strategic Marketing*, Vol. 28 No. 5, pp. 434-454.

Shen, W., Hu, Y.J. and Ulmer, J.R. (2015), "Competing for attention: an empirical study of online reviewers' strategic behavior", *MIS Quarterly*, Vol. 39 No. 3, pp. 683-696.

Shen, X.L., Li, Y.J., Sun, Y., Chen, Z. and Wang, F. (2019), "Understanding the role of technology attractiveness in promoting social commerce engagement: moderating effect of personal interest", *Information and Management*, Vol. 56 No. 2, pp. 294-305.

Tausczik, Y.R. and Pennebaker, J.W. (2010), "The psychological meaning of words: LIWC and computerized text analysis methods", *Journal of Language and Social Psychology*, Vol. 29 No. 1, pp. 24-54.

Thrall, A.T., Stecula, D. and Sweet, D. (2014), "May we have your attention please? Human-rights NGOs and the problem of global communication", *The International Journal of Press/Politics*, Vol. 19 No. 2, pp. 135-159.

Todd, P.R. and Melancon, J. (2018), "Gender and live-streaming: source credibility and motivation", *Journal of Research in Interactive Marketing*, Vol. 12 No. 1, pp. 79-93.

Wang, X., Tian, Y., Lan, R., Yang, W. and Zhang, X. (2019), "Beyond the watching: understanding viewer interactions in crowdsourced live video broadcasting services", *IEEE Transactions on Circuits and Systems for Video Technology*, Vol. 29 No. 11, pp. 3454-3468.

Wongkitrungrueng, A. and Assarut, N. (2020), "The role of live streaming in building consumer trust and engagement with social commerce sellers", *Journal of Business Research*, Vol. 117, pp. 543-556.

Wongkitrungrueng, A., Dehouche, N. and Assarut, N. (2020), "Live streaming commerce from the sellers' perspective: implications for online relationship marketing", *Journal of Marketing Management*, Vol. 36 Nos 5-6, pp. 488-518.

Xu, X., Wu, J.-H. and Li, Q. (2020), "What drives consumer shopping behavior in live streaming commerce?", *Journal of Electronic Commerce Research*, Vol. 21 No. 3, pp. 144-167.

Xue, J., Liang, X., Xie, T. and Wang, H. (2020), "See now, act now: how to interact with customers to enhance social commerce engagement?", *Information and Management*, Vol. 57 No. 6, 103324.

Yang, Q., Li, H., Lin, Y., Jiang, Y. and Huo, J. (2022), "Fostering consumer engagement with marketer-generated content: the role of content-generating devices and content features", *Internet Research*, Vol. 32 No. 7, pp. 307-329.

Yu, E., Jung, C., Kim, H. and Jung, J. (2018), "Impact of viewer engagement on gift-giving in live video streaming", *Telematics and Informatics*, Vol. 35 No. 5, pp. 1450-1460.

Zhang, M., Qin, F., Wang, G.A. and Luo, C. (2019), "The impact of live video streaming on online purchase intention", *The Service Industries Journal*, Vol. 40 Nos 9-10, pp. 656-681.

Zhang, M., Sun, L., Qin, F. and Wang, G.A. (2020), "E-service quality on live streaming platforms: swift guanxi perspective", *Journal of Services Marketing*, Vol. 35 No. 3, pp. 312-324.

Zhao, K., Stylianou, A.C. and Zheng, Y. (2018), "Sources and impacts of social influence from online anonymous user reviews", *Information and Management*, Vol. 55 No. 1, pp. 16-30.

Zhou, J., Zhou, J., Ding, Y. and Wang, H. (2019), "The magic of danmaku: a social interaction perspective of gift sending on live streaming platforms", *Electronic Commerce Research and Applications*, Vol. 34, 100815.

Corresponding author
Hongxiu Li can be contacted at: Hongxiu.li@tuni.fi