

Association for Information Systems

AIS Electronic Library (AISeL)

Rising like a Phoenix: Emerging from the
Pandemic and Reshaping Human Endeavors
with Digital Technologies ICIS 2023

Data Analytics for Business and Societal
Challenges

Dec 11th, 12:00 AM

Turning Chatters into Donators: An Investigation of Topic-Based Bullet Screen Mode on a Livestreaming Platform Short Paper

Xiaodie Pu

Univeristy of Nottingham Ningbo China, jenny.pu@nottingham.edu.cn

Tanguy Tresor Sindihebura

The University of Nottingham Ningbo China, tanguy.sindihebura@nottingham.edu.cn

yue guo

Southern University of Science and Technology, guoy@sustech.edu.cn

Alain Chong

University of Nottingham, alain.chong@nottingham.edu.cn

Follow this and additional works at: <https://aisel.aisnet.org/icis2023>

Recommended Citation

Pu, Xiaodie; Sindihebura, Tanguy Tresor; guo, yue; and Chong, Alain, "Turning Chatters into Donators: An Investigation of Topic-Based Bullet Screen Mode on a Livestreaming Platform Short Paper" (2023). *Rising like a Phoenix: Emerging from the Pandemic and Reshaping Human Endeavors with Digital Technologies ICIS 2023*. 12.

https://aisel.aisnet.org/icis2023/dab_sc/dab_sc/12

This material is brought to you by the International Conference on Information Systems (ICIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in Rising like a Phoenix: Emerging from the Pandemic and Reshaping Human Endeavors with Digital Technologies ICIS 2023 by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Turning Chatters into Donators: An Investigation of Topic-Based Bullet Screen Mode on a Livestreaming Platform

Short Paper

Xiaodie Pu

Nottingham University Business
School China, University of
Nottingham Ningbo China
199 Taikang Road, Ningbo, China
jenny.pu@nottingham.edu.cn

Tanguy Tresor Sindihebura

Nottingham University Business
School China, University of
Nottingham Ningbo China
199 Taikang Road, Ningbo, China
tanguy.sindihebura@nottingham.edu.cn

Yue Guo

College of Business, Southern
University of Science and Technology
1088 Xueyuan Avenue, Shenzhen,
China
guoy@sustech.edu.cn

Alain Yee Loong Chong

Nottingham University Business
School China, University of
Nottingham Ningbo China
199 Taikang Road, Ningbo, China
alain.chong@nottingham.edu.cn

Abstract

Despite the importance of social interaction in virtual communities, scant research has investigated the outcomes of social interaction features. Our study aims to investigate the business value of social interaction features in the context of livestreaming platforms. Specifically, we investigate the effect of the activation of topic-based bullet screen mode – an interactive feature which allows the streamers to set a theme or topic for the viewers to send bullet screen comments about. Our results from the regression discontinuity estimation suggest that the activation of the topic-based bullet screen mode yields an immediate decrease in viewers' chat interaction, which challenges the conventional wisdom social interaction features is a panacea for boosting increased user engagement. Nevertheless, we observe a compensatory effect whereby the decrease in chat interaction was accompanied by a surge in gift donations. This counterintuitive finding highlights the intricate interplay between social interaction features, user motivations, and platform affordances.

Keywords: Livestreaming, bullet screen, social interaction, gifting, danmu

Introduction

The widespread adoption of video technologies has fueled the rapid growth of livestreaming, which has emerged as a popular form of multimedia technology that enables real-time production and broadcasting of content (Forbes 2021). The global market for livestreaming is projected to experience substantial growth, with a compound annual growth rate of 12.1%, and reach USD 932 billion by 2028 (Information&Technology 2021). Livestreaming platforms provide a unique feature of real-time content delivery, which enables viewers to interact with content providers (i.e., streamers) and their peers spontaneously. This can not only improve viewer interaction, but also stimulate donation (i.e., sending virtual gifts) from the viewers, boosting the monetization of both streamers and the platform owners (Golom 2021; Liu et al. 2019).

One of the key real-time social interaction feature provided by livestreaming platforms is *Bullet Screen* (also refereed as *Danmu* or *Danmaku*), a time-synchronized commentary feature that “flies” across the screen (and, hence, are highly visible to all viewers) that allow viewers to publicly express their opinion and interact with peers during livestreaming sessions (Zhang and Cassany 2020). This interactive nature of Bullet Screen creates an immersive communication environment for both streamers and viewers, enabling viewers to participate in the livestreaming in a manner that was previously unavailable through traditional media channels. As a result, bullet screens have gained immense popularity and have become a critical element of live streaming platforms. It was reported that in 2021 there were over 11.7 billion bullet screens created on Douyu (one of the leading livestreaming platforms in China) (ChinaNewsWeb 2021). Despite the growing body of research in the Information Systems discipline that has documented the positive impact social interaction feature incorporation has had on improving digital platform operations (Cui et al. 2018; Feldman et al. 2022; Zeng et al. 2020), there is also criticism that extensive use of social interaction features may lead to negative consequences, such as cognitive overload and distraction, which will impair user experience (Jiang and Cameron 2020; Jones et al. 2004). There remains a scarcity of study empirically investigating the effects of social interaction features on digital platforms, which hinders our understanding of optimal design strategies that could enhance viewer interaction and livestreaming performance.

Therefore, this study endeavors to fill the current gap in understanding the effects of social interaction features on viewer’s chat interaction and gift donation. Our study focuses on the empirical context of a leading living streaming platform in Asia, with a special focus on an interactive feature called the topic-based bullet screen mode. This interactive mode is typically initiated by the streamers, who will set a theme or topic for the bullet screen comments, and encourage viewers to participate by sending bullet screens related to the theme during a designated period of time (usually one minute). One example of such topics would be letting the viewers comment on why they follow or like the streamer. To foster viewer engagement and incentivize participation, the streamer may also provide incentives, such as virtual gifts or prizes, to viewers who send particularly interesting or creative comments. The topic-based bullet screen mode creates a fast-paced and interactive environment, which may improve viewer chat interaction and encourage them to send virtual gifts as an appreciation of their enjoyment of the streamers’ streaming shows.

To examine the effects of topic-based bullet screen mode, we obtained internal operations data from a livestreaming platform with a full data sample of livestreaming sessions within the gaming category, covering the timeframe from September 1st, 2019, to December 31st, 2019. To gain a granular understanding of the effects of social interaction feature, we aggregated the data at minute-level and employed a 30-minutes time window before and after the activation of an event. Our final sample for analysis consisted of 41,964 livestreaming sessions, with 2,559,804 session-minute level observations. Contrary to our hypothesis, our results from regression discontinuity estimation suggest that the activation of the topic-based bullet screen mode yields an immediate negative impact on viewers' chat interaction, as shown by a decrease in the number of bullet screens, the number of colored bullet screens, and the average length of bullet screens. Gift donation, on the contrary, is positively affected by topic-based bullet screen mode, which is demonstrated by greater total and average monetary value of the gifts sent by the viewers. Our findings challenge the conventional wisdom that incorporating social interaction features is a silver bullets for elevating user engagement, and the reduction in viewers’ chat interaction could be compensated by greater financial outcomes for the streamer. These innovative insights hold significant implications for digital platforms that incorporate social interaction features, providing valuable guidance for the design and implementation of more effective and engaging digital environments.

Theoretical Background and Hypothesis Development

Social Interaction Features of Digital Platforms

The business value of social features (e.g., social post, direct messaging, and user generated content) in platform operations has been widely discussed in the IS literature. Generally speaking, social features help platforms to improve operational efficiency by allowing them to easily acquire comprehensive insights about customer behaviors (Cui et al. 2018; Qiu and Whinston 2017). For instance, Cui et al. (2018) concluded that the incorporation of social media data could improve sales forecast accuracy. In addition, social feature design might also spur the adoption of new products and amplify promotion effectiveness

(Gao et al. 2020). In particular, Schmidt et al. (2020) identified the value creation mechanisms of social information systems, namely, social production, co-creation, weak ties, and egalitarian decisions.

Furthermore, social features can increase user activities by empowering knowledge sharing (Cui et al. 2020), mediating buyer-supplier communications (Hong and Shao 2021), and encouraging more job applicants (Hong et al. 2021). Yan et al. (2021) found that users were motivated to post more new articles and comments on social media after the introduction of a retweeting mechanism. Kao et al. (2016) developed a five-stage model (Interact-Engage-Propose-Act-Realize, IEPAR) of utilizing social media to co-create value with consumers. Burtch et al. (2021) explored how a dispute resolution system might reduce buyers' reliance on sellers' reputation. Qiu and Kumar (2017) found that a larger social network led to better quality of user content contribution. Zeng et al. (2020) examined that providing customer-related information could positively affect providers' service capacity and enjoyment.

Nevertheless, it is important to recognize that social interactions can engender negative cognitive consequences, including information overload and interruptions. The theoretical framework of Jones et al. (2004) identifies that detrimental effects ensue when the cognitive demands imposed by processing social communication information exceed the individual's capacity, as defined by their average maximum communication load threshold. In response to this cognitive strain, individuals are compelled to adapt their social interaction behaviors, including simplifying their communication, which can inadvertently lead to communication errors, diminishing active participation, or, in more extreme cases, complete withdrawal from social interactions. The cognitive costs to process information may incur negative externality (Butler 2001), leading to an inherent tradeoff between the quantity and quality of information in online communities (Gu et al. 2007). In light of the ongoing debates surrounding the impact of social interactions on user engagement, our study seeks to bridge the existing knowledge gap by investigating the business value of social feature designs in emerging livestreaming platforms.

Chat Interaction

Livestreaming is a unique medium that combines real-time video and text chat (e.g., rolling comments and bullet screens). The technological features of real-time text chat, namely pseudo synchronicity, perceived proximity, and comment-content congruence, create a co-viewing experience for viewers (Fan et al. 2017; Fang et al. 2018), therefore is a key indicator of the performance of a livestreaming session. Past studies have investigated different factors that may affect the chat interaction of the viewers. For example, Wang and Li (2020) concluded that because livestreaming promoted interactive ritual chains between the streamer and the audience, the number of viewers, the gender of streamers, and gifting behaviors all had a significant effect on viewers' chat and commenting behaviors. In addition, viewers' chat interaction is heavily affected by the behaviors and characteristics of the streamers. According to Lin et al. (2021), the interactions between streamers and viewers during livestreaming are characterized by instant and contagious emotion. Therefore, a happy streamer can increase audience sentiment, stimulating more comments and chats from the viewers. Viewers will also be more engaging when the streamer is more interactive with their comments. It is found that when viewers' comments receive responses from the streamer, the viewers will be more likely to continue watching and engaging in chat interaction (Nelson and Yasunobu 2017). These findings suggest that viewers' motivation to engage in chat interaction during livestreaming is largely driven by their expectation of receiving recognition or attention from the streamer, which is consistent with the tenet of the social exchange theory that individuals engage in social interactions with the anticipation of obtaining some form of rewards (Homans 1974). By adopting topic-based bullet screen mode, a streamer could highlight and reward selective bullet screen comments, which provides an opportunity for viewers to receive recognition and attention from the streamer and other viewers. In exchange for the streamer's attention, the viewers' will be more engaging in chat interaction and send more bullet screens during the activation of topic-based bullet screen mode.

In addition to interaction with streamers, social interaction with other viewers is an important factor motivating viewer engagement. According to social identity theory, individuals categorize themselves and others into social groups based on shared characteristics, such as race, nationality, or membership in a particular organization (Tajfel and Turner 2004). On livestreaming platforms, viewers identify themselves as part of a community of fans or followers of a particular streamer (Hu et al. 2017). Interaction with other viewers can promote social identification by allowing viewers to feel a sense of belonging and connection within the community of fans and followers of the streamer (Ashforth and Mael 1989). This sense of

community can encourage continued engagement and participation, as viewers feel invested in the success of the streamer and the community as a whole. During the activation of topic-based bullet screen mode, viewers are encouraged to generate real-time chat comments related to the topic set by the streamer. By reading these comments, viewers may perceive that the values and beliefs of other viewers are in line with their own (Hu et al. 2017), which will reinforce their sense of identity and belonging within the community. This can motivate them to send more comments or create comments to convey more information, as they want to demonstrate their loyalty and support for the streamer. Based on the discussion above, we propose the following hypothesis:

H1. *The activation of topic-based bullet screen mode in a livestreaming session will positively affect viewers' chat interaction.*

Reward Donation

While chat interaction is an essential aspect of livestreaming, receiving donations from viewers is the primary way for streamers and the platforms to monetize their content. Platforms such as Tik Tok and Twitch have developed systems that allow viewers to easily donate to streamers through features such as "Tik Tok Coins" and " Gifting Through Chat". These features not only allow viewers to show their support for streamers, but also create a sense of competition to stimulate more contribution from the viewers. According to social comparison theory, individuals have an innate drive to compare themselves to others in order to assess their personal and social worth (Festinger 1954). This suggests that, during livestreaming sessions, viewers may compare their own gifting behavior to that of other viewers, which will motivate them to donate more in order to keep up with or outdo their peers. The activation of the topic-based bullet screen mode will further intensify this sense of competition because, to stand out and win the recognition of the streamer, viewers will not only strive to create bullet screen comments that are more creative, interesting, or funny, but may even be more inclined to send gifts to be more visible among the viewers.

Viewers would also donate as a token of appreciation of the performance of the streamer, and such reciprocity will be reinforced if they feel that their participation is acknowledged and appreciated. Several studies have found that when receiving gifts from viewers, most streamers would express their gratitude in different ways (Wulf et al. 2020), such as thanking the donators verbally, playing or singing a song, or performing a special action or gesture in front of the camera. By acknowledging and appreciating the support of their viewers, streamers can reinforce reciprocity and encourage more gifting behaviors. As the streamer will provide financial rewards to selective participants of the topic-based bullet screen mode, viewers will perceive that their participation is appreciated and valued by the streamer. This can motivate viewers to donate more as a means of demonstrating their reciprocity. Therefore, we posit the following hypothesis:

H2. *The activation of topic-based bullet screen mode in a livestreaming session will positively affect viewers' reward donation.*

Methods

Sample Data and Variables

Our empirical setting is a leading livestreaming platform in Asia with over 1.6 million individual streamers and more than 130 million monthly active users as of 2021. The platform streams content ranging from e-sports, music and dance, talent shows and traveling. Individual streamers can host livestreaming shows in their streaming room, and viewers can enter and exit any livestreaming room at any time during a livestreaming session, and can leave comments directed at the streamer or communicate with other viewers. In addition, they can also send virtual gifts to show appreciation to the streamers.

The platform provided us with the full data sample of livestreaming sessions within the gaming category and their related data, covering the timeframe from September 1st, 2019, to December 31st, 2019. The dataset comprised detailed records of the exact time stamps of each activation of topic-based bullet screen mode, along with viewer behavior data, such as their bullet screen comments, gifting behaviors, and the start and end times of livestreaming sessions. We selected livestreaming sessions that had activated topic-based bullet screen mode, which resulted in a sample of 137,394 unique sessions. To build our panel data, we combined all variables at the minute level. We scrutinize viewer behaviors by employing a 30 minutes time window before and after the activation of a topic-based bullet screen mode event. To eliminate the

confounding effects of multiple event activations within a short span, we removed any livestreaming session that had more than one event activation within the 61-minute span or whose observation period could not cover 61 minutes. Ultimately, our final sample consisted of 41,964 livestreaming sessions, with 2,559,804 session-minute level observations.

To estimate the changes in viewer chat interaction, the following proxies were calculated: 1) the number of bullet screen comments sent by viewers (*CountComment*); 2) the number of colored bullet screen comments sent by viewers (*CountCommentColor*); and 3) the average length of bullet screen comments sent by viewers (*CommentLength*). Colored bullet screen is a privilege of users who paid for VIP services, which is a useful proxy of the chat interaction by valuable viewers. The length of bullet screen comments could be an effective indicator of viewer participation and engagement. The longer the comments, the more efforts the viewers devote to interact with the steamer.

Gift donation is proxied by three variables including: 1) the number gifts sent by viewers (*CountGift*); 1) the sum of the monetary value of the virtual gifts sent by viewers (*GiftSum*); and 1) the average monetary value of the virtual gifts sent by viewers (*GiftValue*). We also control for the number of viewers of a streaming session (*ViewerCount*). All variables are aggregated at minute level. A detailed list of our variables and their definitions can be found in Table 1. The descriptive statistics of variables are presented in Table 2.

Variables	Definitions
<i>Mode_{st}</i>	The dummy indicator of whether a topic-based bullet screen mode was activated or not for livestreaming session <i>s</i> at minute <i>t</i> (1: after activation; 0: before activation)
<i>CountComment_{st}</i>	The number of bullet screen comments sent by viewers (paid VIP fans) in livestreaming session <i>s</i> during minute <i>t</i>
<i>CountCommentColor_{st}</i>	The number of colored bullet screen comments sent by viewers in livestreaming session <i>s</i> during minute <i>t</i>
<i>CommentLength_{st}</i>	The average length of bullet screen comments sent viewers in livestreaming session <i>s</i> during minute <i>t</i>
<i>CountGift_{st}</i>	The number of virtual gifts received in livestreaming session <i>s</i> during minute <i>t</i>
<i>GiftSum_{st}</i>	The summation of the monetary value of the virtual gifts received in livestreaming session <i>s</i> during minute <i>t</i>
<i>GiftValue_{st}</i>	The average monetary value of the virtual gifts received in livestreaming session <i>s</i> during minute <i>t</i>
<i>ViewerCount_{st}</i>	The number of viewers for livestreaming session <i>s</i> at minute <i>t</i>

Table 1. Description of Key Variables

	Mean	Std	1	2	3	4	5	6	7	8
1. CountComment	1.995	16.94								
2. CountCommentColor	1.603	14.11	0.986							
3. CommentLength	2.588	4.85	0.129	0.122						
4. CountGift	0.048	1.73	0.033	0.033	0.001					
5. GiftSum	1.020	422.34	0.000	0.000	-0.000	0.011				
6. GiftValue	0.358	95.47	0.000	0.000	-0.001	0.006	0.908			
7. Mode	0.491	0.49	-0.006	-0.006	0.004	0.000	0.000	0.000		
8. Duration	7.622	9.84	-0.010	-0.009	-0.010	-0.000	-0.000	-0.000	0.787	
9. ViewerCount	3.680	41.16	0.299	0.271	0.089	-0.002	-0.000	-0.000	0.000	0.007
For correlations, absolute values greater than 0.005 are significant at $p < .05$ (two-tailed tests)										

Table 2. Variable Statistics

Estimation Strategy

To evaluate the impact of the topic-based bullet screen mode, we employ the regression discontinuity approach (Imbens and Lemieux 2008). In contrast to its traditional application, which involves observing treatment and control groups above and below a predetermined threshold, we adhere to recent studies that have employed this method to compare the same subject before and after the occurrence of an event of interest (Goes et al. 2016; Lee et al. 2018). As such, we specify the following polynomial with fixed effects:

$$y_{st} = \beta_0 + \beta_1 Mode_{st} + \sum_{p=1}^2 \beta_{2,p} \times duration_{st}^p + \sum_{p=1}^2 \beta_{3,p} \times Mode_{st} \times duration_{st}^p + \beta_4 control_{st} + \varepsilon_{st}$$

where y_{st} represents the dependent variable of streaming session s at minute t , $Mode_{st}$ is a dummy variable which takes the value of 1 if minute t is on or after the initiation of topic-based bullet screen mode, and 0 otherwise; $duration_{st}$ denotes the number of minutes that before and after the activation of the event for livestreaming session s , where a positive value represents the number of minutes that has lapsed after the event and vice versa. To allow the model to vary across both side of the discontinuity point, i.e. the trend before and after bullet screen mode activation, we follow prior research and include an interaction term $Mode_{st} \times duration_{st}$ (Goes et al. 2016; Lee et al. 2018). We examine the sensitivity of our results by including models with polynomial orders, with p value up to 2. Fixed effects are included to control for time-invariant heterogeneities of streamers and livestreaming sessions. Since our dependent variables are non-negative positive values, Poisson model is employed (Kuppuswamy and Bayus 2017).

Preliminary Results

Our preliminary results are presented in Table 3. For brevity, we only present the results showing our models with the second polynomial order. Regarding our chat interaction variables, the results show that the topic-based bullet screen mode has a negative effect on the number of bullet screens ($\beta_1 = -0.540$, $p < 0.001$, model 1) and the number of colored bullet screens sent by paid viewers ($\beta_1 = -0.551$, $p < 0.001$, model 2) while it does not have a significant effect on the average length of the bullet screens ($\beta_1 = 0.003$, ns, model 3). Overall, these results indicate that the activation of topic-based bullet screen mode will negatively impact viewers’ chat interaction. Thus, our hypothesis 1 is not supported. For gift donation variables, topic-based bullet screen mode is found to be negatively related the number of gifts sent by viewers ($\beta_1 = -0.332$, $p < 0.05$, model 4) but is positively related with the sum ($\beta_1 = 0.541$, $p < 0.001$, model 5) and average ($\beta_1 = 0.313$, $p < 0.001$, model 6) monetary value of the gifts sent by viewers. In general, our hypothesis 2 is supported by the results which indicate that topic-based bullet screen mode will trigger more donation in terms of monetary value, although the total number of gifts sent by viewers will experience a drop.

	Chat Interaction			Gift Donation		
	CountComment	CountCommentColor	Comment Length	CountGift	GiftSum	GiftValue
	(1)	(2)	(3)	(4)	(5)	(6)
Mode	-0.540*** (0.002)	-0.551*** (0.003)	0.003 (0.002)	-0.332** (0.016)	0.541*** (0.003)	0.313*** (0.006)
Duration	0.100*** (0.000)	0.098*** (0.000)	0.012*** (0.000)	0.060*** (0.002)	0.008*** (0.000)	-0.001 (0.000)
Duration ²	0.003*** (0.000)	0.003*** (0.000)	0.000*** (0.000)	0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Mode× Duration	-0.125*** (0.000)	-0.121*** (0.000)	-0.023*** (0.000)	-0.075*** (0.003)	-0.008*** (0.001)	-0.007*** (0.001)
Mode× Duration ²	-0.002*** (0.000)	-0.002*** (0.000)	0.000** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
ViewerCount	0.000*** (0.000)	0.001*** (0.000)	0.000** (0.000)	-1.190*** (0.202)	-2.341*** (0.147)	-1.114*** (0.166)
Observations	1,653,405	1,634,922	1,653,405	409,798	409,798	409,798
AIC	8,533,239.57	7,495,817.97	11,124,252.06	622,915.08	12,866,941.23	5,197,565.22
BIC	8,553,313.48	7,495,891.81	11,124,325.97	622,980.62	12,867,006.77	5,197,630.76
Note. Robust standard errors in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.						
Table 3. Impact of Topic-Based Bullet Screen Mode						

Discussion

Our study offers insights into how the social interaction feature of livestreaming platforms, specifically, the topic-based bullet screen mode, affects viewers’ chat interaction and gift donation. Contrary to our initial

hypothesis, our study reveals that the activation of the topic-based bullet screen mode yields an immediate negative impact on viewers' chat interaction. This is evidenced by a decrease in the number of bullet screens, the number of colored bullet screens, and the average length of bullet screens. The decrease in chat interaction may be attributed to the distraction caused by this event, as viewers are more focused on creating interesting and unique bullet screens to gain recognition from the streamer, rather than spontaneously participating in bullet screen generation.

While past study indicates that viewer gifting behavior is closely related to the popularity of the livestreaming session and viewer engagement (Lu et al. 2021), we show that a decrease in chat interaction is not necessarily associated with a negative financial outcome for the streamer. Our results suggest that the topic-based bullet screen mode can be a powerful tool for streamers to generate revenue, as shown by an immediate increase in the total monetary value of donations and the average value of the gifts. This could be due to that viewers may perceive the topic-based bullet screen mode as a form of competition, with the aim of creating bullet screen comments that are more creative and interesting in order to stand out and receive recognition from the streamer. The time-limited nature of topic-based bullet screen mode creates a sense of urgency among the viewers, which may prompt them to send more expensive gifts in order to compete for the streamer's attention in a short period of time. Additionally, the heightened sense of excitement and anticipation created by the activity may prompt viewers to send more expensive gifts as a form of appreciation for the streamer's efforts.

Interestingly, we observed a decrease in the number of gifts received by streamers, but an increase in the average value of the gifts. This suggests that the increase in streamer revenue is attributed to fewer viewers giving more expensive gifts, rather than a higher number of viewers giving gifts. This finding is consistent with prior studies which indicate a high concentration of viewer gifting behaviors, i.e., a small number of viewers contribute to a major portion of the revenue on livestreaming platforms (Zhu et al. 2017). This finding underscores the importance of fostering strong relationships with key viewers, and cultivating a loyal fan base in order to maximize revenue.

Conclusion, Limitations and Future Study

This study contributes to the growing body of literature on the effects of social interaction features of digital platforms. Specifically, our study provides insights into the relationship between social interaction feature and viewers' chat interaction and donation behaviors. By exploring the impact of the topic-based bullet screen mode on user engagement, this research sheds light on the mechanisms through which social interaction features affect user behaviors on livestreaming platforms. Our findings challenge the conventional wisdom that suggests including social interaction features as a panacea for boosting increased user engagement. We found that due to the competitive nature of the topic-based bullet screen mode, there will be a temporary decrease in chat interaction. Nevertheless, we observe a compensatory effect whereby the decrease in chat interaction was accompanied by a surge in gift donations, as viewers sought alternative ways to compete for the attention from the streamers. This counterintuitive finding highlights the intricate interplay between social interaction features, user motivations, and platform affordances, which collectively shape the overall user experience and platform outcomes.

The implications of our research could extend beyond the realm of livestreaming platforms and offer valuable insights for other digital platforms that incorporate social interaction features. By demonstrating the trade-offs that may arise when implementing certain social interaction features, our study underscores the need for platform owners to carefully consider the costs and benefits of these features in their specific context, as well as the potential unintended consequences that may arise from their implementation.

We acknowledge several limitations of our study which should be addressed by future endeavors. First, different types of topics set by streamers may trigger different levels of user engagement. For example, topics that are more controversial may attract more conversations among viewers while demotivating them from rewarding the streamers. Second, users' engagement may also vary across different categories of games featured in livestreaming sessions. It is worth exploring in the future to show how the main findings may vary across different topics and different genres of games, which will provide more granular insights on the mechanisms of our findings. In addition, we recommend that future research endeavors differentiate between various viewer categories to ascertain the primary contributors to the observed increase in overall donation value.

Because streamers self-select into treatment, there might be potential self-selection bias that threatens the validity of our findings. Future studies should address this issue with robust identification strategy such as utilizing a modified difference-in-difference method to identify the average treatment effect on the treated (ATT) of topic-based bullet screen mode (Proserpio and Zervas 2017). Additionally, we acknowledge the potential limitations in the generalizability of our findings, as our investigation concentrates on a highly specific form of social interaction feature within an Asian livestreaming platform context. Future studies could expand on our research by exploring the impact of diverse social interaction features in a wider range of digital platforms and contexts, providing a more comprehensive understanding of the intricate effects of social interaction features.

Acknowledgements

This study is funded by grants from the National Natural Science Foundation of China (72102116) and Zhejiang Natural Science Program (LQ22G020011).

References

- Ashforth, B. E., and Mael, F. 1989. "Social Identity Theory and the Organization," *Academy of Management Review* (14:1), pp. 20-39.
- Burch, G., Hong, Y., and Kumar, S. 2021. "When Does Dispute Resolution Substitute for a Reputation System? Empirical Evidence from a Service Procurement Platform," *Production and Operations Management* (30:6), pp. 1565-1582.
- Butler, B. S. 2001. "Membership Size, Communication Activity, and Sustainability: A Resource-Based Model of Online Social Structures," *Information Systems Research* (12:4), pp. 346-362.
- ChinaNewsWeb. 2021. "Douyu 2021 Top Ten Bullet Screen Report Released Belongs to the Empathy of Young People." from <https://www.chinanewsweb.com/index.php/2021/12/28/douyu-2021-top-ten-bullet-screen-report-released-belongs-to-the-empathy-of-young-people/>
- Cui, R., Gallino, S., Moreno, A., and Zhang, D. J. 2018. "The Operational Value of Social Media Information," *Production and Operations Management* (27:10), pp. 1749-1769.
- Cui, X., Huo, B., Lei, Y., and Zhou, Q. 2020. "The Influence of Team Social Media Usage on Individual Knowledge Sharing and Job Performance from a Cross-Level Perspective," *International Journal of Operations & Production Management* (40:5), pp. 553-573.
- Fan, S., Lu, Y., Zhao, L., and Pan, Z. 2017. "You Are Not Alone: The Impacts of Danmu Technological Features and Co-Experience on Consumer Video Watching Behavior," *2017 Pacific Asia Conference on Information Systems (PACIS)*.
- Fang, J., Chen, L., Wen, C., and Prybutok, V. R. 2018. "Co-Viewing Experience in Video Websites: The Effect of Social Presence on E-Loyalty," *International Journal of Electronic Commerce* (22:3), pp. 446-476.
- Feldman, J., Zhang, D. J., Liu, X., and Zhang, N. 2022. "Customer Choice Models Vs. Machine Learning: Finding Optimal Product Displays on Alibaba," *Operations Research* (70:1), pp. 309-328.
- Festinger, L. 1954. "A Theory of Social Comparison Processes," *Human relations* (7:2), pp. 117-140.
- Forbes. 2021. "Going Live Online: The State of Live Streaming and the Opportunities for Brands." from <https://www.forbes.com/sites/forbesagencycouncil/2021/02/04/going-live-online-the-state-of-live-streaming-and-the-opportunities-for-brands/?sh=1d3085b4b977>
- Gao, H., Zhao, H., Tan, Y., Lin, Y., and Wei, L. 2020. "Social Promotion: A Creative Promotional Framework on Consumers' Social Network Value," *Production and Operations Management* (29:12), pp. 2661-2678.
- Goes, P. B., Guo, C., and Lin, M. 2016. "Do Incentive Hierarchies Induce User Effort? Evidence from an Online Knowledge Exchange," *Information Systems Research* (27:3), pp. 497-516.
- Golum, C. 2021. "Live Video Stats: What Consumers Want from Live Video." from <https://livestream.com/blog/live-video-statistics-livestream>.
- Gu, B., Konana, P., Rajagopalan, B., and Chen, H.-W. M. 2007. "Competition among Virtual Communities and User Valuation: The Case of Investing-Related Communities," *Information Systems Research* (18:1), pp. 68-85.
- Homans, G. C. 1974. "Social Behavior: Its Elementary Forms,"
- Hong, Y., Peng, J., Burch, G., and Huang, N. 2021. "Just Dm Me (Politely): Direct Messaging, Politeness, and Hiring Outcomes in Online Labor Markets," *Information Systems Research* (32:3), pp. 786-800.

- Hong, Y., and Shao, B. B. M. 2021. "On Factors That Moderate the Effect of Buyer-Supplier Experience on E-Procurement Platforms," *Production and Operations Management* (30:4), pp. 1034-1051.
- 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* (75), pp. 594-606.
- Imbens, G. W., and Lemieux, T. 2008. "Regression Discontinuity Designs: A Guide to Practice," *Journal of Econometrics* (142:2), pp. 615-635.
- Information&Technology. 2021. "Video Streaming Market to Touch \$932.29 Billion by 2028." from www.fortunebusinessinsights.com/press-release/video-streaming-market-10038
- Jiang, J., and Cameron, A.-F. 2020. "It-Enabled Self-Monitoring for Chronic Disease Self-Management: An Interdisciplinary Review," *MIS Quarterly* (44:1).
- Jones, Q., Ravid, G., and Rafaeli, S. 2004. "Information Overload and the Message Dynamics of Online Interaction Spaces: A Theoretical Model and Empirical Exploration," *Information Systems Research* (15:2), pp. 194-210.
- Kuppuswamy, V., and Bayus, B. L. 2017. "Does My Contribution to Your Crowdfunding Project Matter?," *Journal of Business Venturing* (32:1), pp. 72-89.
- Lee, S. Y., Qiu, L., and Whinston, A. 2018. "Sentiment Manipulation in Online Platforms: An Analysis of Movie Tweets," *Production and Operations Management* (27:3), pp. 393-416.
- Lin, Y., Yao, D., and Chen, X. 2021. "Happiness Begets Money: Emotion and Engagement in Live Streaming," *Journal of Marketing Research* (58:3), pp. 417-438.
- Liu, G.-f., Li, L.-l., Xu, H.-m., and Luo, M.-q. 2019. "Research on the Influence of Online Video Bulletin-Board Advertising Marketing on Consumers' Purchasing Intention," Atlantis Press, pp. 427-432.
- Lu, S., Yao, D., Chen, X., and Grewal, R. 2021. "Do Larger Audiences Generate Greater Revenues under Pay What You Want? Evidence from a Live Streaming Platform," *Marketing Science* (40:5), pp. 964-984.
- Nelson, B. E., and Yasunobu, I. 2017. "Livestreaming for User Testing Context-Rich Observation of Game Player Behavior," *2017 International Conference on Management Science and Engineering (ICMSE)*, pp. 228-237.
- Proserpio, D., and Zervas, G. 2017. "Online Reputation Management: Estimating the Impact of Management Responses on Consumer Reviews," *Marketing Science* (36:5), pp. 645-665.
- Qiu, L., and Kumar, S. 2017. "Understanding Voluntary Knowledge Provision and Content Contribution through a Social-Media-Based Prediction Market: A Field Experiment," *Information Systems Research* (28:3), pp. 529-546.
- Qiu, L., and Whinston, A. B. 2017. "Pricing Strategies under Behavioral Observational Learning in Social Networks," *Production and Operations Management* (26:7), pp. 1249-1267.
- Schmidt, R., Kirchner, K., and Razmerita, L. 2020. "Understanding the Business Value of Social Information Systems—Towards a Research Agenda," *53rd Hawaii International Conference on System Sciences: HICSS Conference Office*, pp. 2639-2648.
- Tajfel, H., and Turner, J. C. 2004. "The Social Identity Theory of Intergroup Behavior," in *Political Psychology*. Psychology Press, pp. 276-293.
- Wang, M., and Li, D. 2020. "What Motivates Audience Comments on Live Streaming Platforms?," *PLOS ONE* (15:4), p. e0231255.
- Wulf, T., Schneider, F. M., and Beckert, S. 2020. "Watching Players: An Exploration of Media Enjoyment on Twitch," *Games and Culture* (15:3), pp. 328-346.
- Yan, Y., Toriumi, F., and Sugawara, T. 2021. "Influence of Retweeting on the Behaviors of Social Networking Service Users," Cham: Springer International Publishing, pp. 671-682.
- Zeng, Z., Clyde, N., Dai, H., Zhang, D., Xu, Z., and Shen, Z.-J. M. 2020. "The Value of Customer-Related Information on Service Platforms: Evidence from a Large Field Experiment," *Available at SSRN 3528619*.
- Zhang, L.-T., and Cassany, D. 2020. "Making Sense of Danmu: Coherence in Massive Anonymous Chats on Bilibili.Com," *Discourse Studies* (22:4), pp. 483-502.
- Zhu, Z., Yang, Z., and Dai, Y. 2017. "Understanding the Gift-Sending Interaction on Live-Streaming Video Websites," *Social Computing and Social Media. Human Behavior: 9th International Conference, SCSM 2017, Held as Part of HCI International 2017, Vancouver, BC, Canada, July 9-14, 2017, Proceedings, Part I 9*: Springer, pp. 274-285.