


Research on the Correlation between Sentiment of Danmaku and the Gift Value across Different Types of Live Streamers: Dictionary-based Sentiment Analysis and Regression Test

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Abstract: Live streaming becomes more and more important as an entertaining method these days, and viewers can interact with live streamers and others by sending gifts and sending danmaku. This paper had collected 1174040 pieces of danmaku data from 182 live streamers and the corresponding gift data from Huya TV from Dec. 7 to Dec. 23. The author investigated the relation between different types of sentiment of danmaku and the gift value for entertaining live streamers and game live streamers collectively. To analyse sentiment of danmaku, the sentiment dictionary made by Dalian University of Technology was adopted, and the regression model was established to test the correlation. The results show that compliment is positively associated with the gift value for entertaining live streamers while love and blame are positively correlated with the gift value for game live streamers, but hatred is negatively associated with the gift value for game live streamers.

1 INTRODUCTION

Live streaming is a data transmission method used to deliver a video file over the internet in real time (Cloudflare 2021), and it allows anyone to share his or her personal experience with the public at live events (Lu, Xia, Heo, Wigdor 2018). According to Xinhua net (Liu 2021), the number of live streaming users in China in 2020 reached 0.617 billion. The market size of worldwide video streaming industry was about 28 billion USD in 2020 (Live Streaming Market, 2021). What is more, for the sake of real time, viewers could interact with live streamers by sending danmaku, a type of texts scrolling over the screen that every viewer including live streamer could see, and by sending valued gifts (Zhou, Zhou, Ding, Wang 2019). With respect to the importance of gifts, several figures can illustrate that (Platform Data of all live streaming platforms in China, Toubang.tv 2021). Ranked by net gift value in China, during September 2021, the top one live streamer received gifts worth 51 million CNY, the 100th live streamer received 3.5 million CNY; during October 2021, the top one live

streamer received 10 million CNY, and the 100th live streamer received 2 million CNY.

This paper aims to dive deep into the relation between sentiment of danmaku and gifts-giving behaviours. Because sending danmaku and sending gifts are major ways to interact with live streamers and other viewers, and live streamers' characteristics will affect gift-giving intention (Li, Peng, 2021). This paper argues that the pattern of emotion is distinct among different types of live streamers and explores their relationship on gift-giving behaviours. Specifically, the research question is what types of emotion can contribute to the gift value in entertaining live streamer and game live streamers respectively. In doing so, firstly, this paper will introduce a different measurement of both sentiment of danmaku and gift-giving behaviors compared to the past literature. Secondly, this paper will propose a carefully-designed data selection process. This paper has several contributions to both past literature and live streamers. First, it argues that the number of gifts is not a good measurement of gift-giving behaviours and instead, it adopts the gift value as a proxy. Second, it analyses the correlation between

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different types of sentiment of danmaku and the gift value while the past literature (Zhou, Ding, Wang, 2019) only took excitement-related emotion into account. Third, it contributes to live streamers by revealing that different kinds of live streamers should be able to guide different sentiment pattern of danmaku.

2 LITERATURE REVIEW

Previous literature researched gift-sending behaviors through several lenses. Based on attachment theory that a strong emotional bond between individuals and a particular object can affect people's gift-giving intention (Ren, Harper, Drenner, Terveen, Kiesler, Riedl, Kraut, 2012, Wan, Lu, Wang, Zhao, 2017), Li and Peng (Li, Peng, 2021) researched the correlation between live streamer characteristics and gift-giving intention and the correlation between live scene characteristics and gift-giving intention; their results show that trustworthiness and attractiveness of live streamers are positively associated with gift-giving intention while the correlation between live scene characteristics and gift-giving intention is not significant. Li et al. (Li, Lu, Ma, Wang, 2021) studied the impact of viewers' identity on gift-giving behaviours. Specifically, they explored class identity and relational identity; viewers' class identity was measured by noble membership, a feature embedded in live streaming platforms to distinguish viewers by purchasing, and viewers' relational identity was measured by whether viewers wore fan badges; results reveal that viewers' class identity is positively associated with the number of paid gifts and negatively associated with the number of free gifts, but relational identity is positively related with both the number of paid gifts and free gifts. However, it is remarkable that in most of live streaming platforms in China, a fan badge is only worth 1 CNY, but viewers can decide whose badge they take. In light of social interaction theory that considers social interaction an indispensable desire for human beings (Baumeister, Leary, 1995), and that social interaction can affect people's behaviours (Castilla 2005, Rogers 2010), Zhou et al. (Zhou, Zhou, Ding, Wang, 2019) investigated the association between danmaku and the number of gifts, and found that the number of words, the number of excitement-related words, the similarity of danmaku, and debate level of danmaku are positively associated with the gift value. Nevertheless, it has several limitations. First, the number of gifts is not a good measure for gift-giving behaviours as differences among the gift value could

be extremely large. For example, the most expensive gift in Huya TV (<https://www.huya.com>) is worth 5000 CNY while the cheapest gift is worth only 0.1 CNY. Second, it only counted the number of excitement-related words, but words could have different types of emotions such as happiness, appraising, and peacefulness.

3 METHODOLOGY

3.1 Data Selection

This paper takes two factors into account in the process of data selecting. Firstly, Zhu et al. (Zhu, Yang, Dai, 2017) argue that most gifts in live streaming platforms are channeled into a few live streamers. It implies that if people want to research gift-giving behaviors, they should focus on relatively large live streamers as they are the most important. Secondly, there is one thing that past literature ignored but is important. That is the difference regarding gift-giving behaviours among different types of live streamers can be extremely large; according to Toubang (Live streamers' list ranked by gifts value, <https://www.toubang.tv>), the average gift value per live streamer in Beauties and star-show section in China between Nov. 25 and Dec. 25 is 16 thousand CNY while the average gift value in League of legends, Honour of kings, and Game for peace is no more than 1 thousand CNY for each. In view of these points, this paper crawled data of Huya TV (<http://huya.com>) from Dec. 7 to December. 23. It is one of the biggest live streaming platforms in China and filters datafiles (every datafile is a collection of a single live streamer) less than 100 kb. The 100 kb criterion is determined arbitrarily, and the descriptive information of the dataset will be given later.

The dataset contains the following features: the live streamer's ID, the type of channel, the gift name, the gift number, and danmaku. As shown in Table 1, 182 examples were collected, and there are four types of live streamers, Beauties and star-show, League of legends, Honour of kings, and Game for peace. Specifically, 60 observations are for Beauties and star show, 44 observations are for League of legends, 42 examples are for Honour of kings, and 36 examples are for Game for peace. Concerning the gift value and danmaku number, examples from Beauties and star-show had obtained 819817 CNY and 226220 pieces of danmaku; examples from League of legends had obtained 152947 CNY and 273592 pieces of danmaku; examples from Honour of kings had

Table 1: Descriptive information of gift and danmaku.

Type of channels	live streamers' number	Gift value (CNY)	Pieces of danmaku
Beauties and star-show	60	819817	226220
League of legends	44	152947	273592
Honor of kings	42	235999	508051
Game for peace	36	121533	166177
Total	182	1330296	1174040

received 235999 CNY and 508051 pieces of danmaku, and cases from Game for peace had gained 121533 CNY and 166177 pieces of danmaku.

3.2 Research Design

In order to analyse different types of sentiment for Chinese danamku, this paper introduced a sentiment dictionary made by Dalian University of Technology(<http://ir.dlut.edu.cn/info/1013/1142.htm>). It includes 27466 sentiment words of 6 major sentiment types, happiness, praising, anger, sadness, fear, hatred, and amazement, and these major sentiment types can be extended into 21 sub-types. For example, praising can be extended into respect, compliment, trust, love, and wish. In the stage of data cleaning, this paper adopted Jieba

(<https://github.com/fxsjy/jieba>) to tokenize Chinese words. Moreover, this paper compared the proportion of emotional words between Beauties and star show and other types of live streamers, and ranked the most common 4 types of sentiment. The proportion of a specific type of sentiment is defined as the proportion of the number of this type of sentiment to the number of all emotional words. Table 2 shows that compliment and blame are the most common sentiment regardless of types of live streamers. In three types of game live streamers, happiness is the third most frequent sentiment, but in live streamers of Beauties and star-show, love is the third most frequent sentiment. What is more, this paper categorized League of legends, Honour of kings, and Game for peace into the game cluster and grouped Beauties and star show into the entertaining cluster.

Table 2: Comparison of different types of sentiment.

Type of channels	1st	2nd	3rd	4th
Beauties and star-show	PH, 52%	NN, 15%	PB, 11%	PA, 5%
League of legends	PH, 29%	NN, 19%	PA, 8%	ND, 7%
Honor of kings	PH, 31%	NN, 18%	PA, 9%	ND, 8%
Game for peace	PH, 48%	NN, 12%	PA, 10%	PB, 8%

Note: PH indicates compliment-related words, NN indicates the number of blame-related words, PB indicates love-related words, PA indicates happiness-related words, ND indicates hatred-related words

In light of these results, this paper constructed a research model whose dependent variable is the logarithm of the gift value to the base e and whose independent variables include the number of compliment-related words, the number of blame-related words, the number of love-related words, the number of happiness-related words, and the number of hatred-related words.

$$\ln_e Gifts = constant + \beta_1 * PH + \beta_2 * PA + \beta_3 * PB + \beta_4 * NN + \beta_5 * ND \tag{1}$$

4 RESULT ANALYSIS

Table 3 shows the regression results of the impact of different types of sentiment on the gift value. Panel 1

in Table 3 is regression results for entertaining live streamers. The number of compliment-related words is the only significant variable as its p-value is 4% smaller than 5%. It indicates that compliment is the only significant emotion out of five emotions for entertaining live streamers because its p-value is smaller than 5%. Its coefficient is 0.0008, which means compliment is positively associated with the gift value for entertaining live streamers, and every additional compliment-related word will increase 0.08% of the gift value. Panel 2 in Table 3 is regression results for game live streamers.

Significant variables include the number of love-related words, the number of blame-related words, and the number of hatred-related words as the p-value is less than 5% for each. The coefficients of the number of love-related words and the number of

blame-related words are 0.0045 and 0.0019, respectively, which indicates that love and blame are both positively correlated with the gift value received by game live streamers. The coefficient of the number

of hatred-related words is -0.0038, which indicates that hatred is negatively associated with the gift value for game live streamers, and an additional hatred-related word will decrease 0.38% of the gift value.

Table 3: Regression results for entertaining live streamers and game live streamers.

<i>Panel 1</i>	<i>Entertaining live streamers</i>		<i>Panel 2</i>	<i>Game live streamers</i>	
	<i>Coefficients</i>	<i>P-value</i>		<i>Coefficients</i>	<i>P-value</i>
Intercept	7,6579	0,00	6,8857	0,00	
PH	<u>0,0008</u>	0,04	-0,0003	0,45	
PA	0,0028	0,24	0,0009	0,47	
PB	-0,0003	0,73	<u>0,0045</u>	0,03	
NN	0,0004	0,39	<u>0,0019</u>	0,03	
ND	0,0019	0,29	-0,0038	0,00	

Note: PH indicates the number of compliment-related words, NN indicates the number of blame-related words, PB indicates the number of love-related words, PA indicates the number of happiness-related words, ND indicates the number of hatred-related words

According to the results, it is clear that the importance of different types of sentiment is distinct between entertaining live streamers and game live streamers. What is the reason behind that? Li and Peng (Li, Peng, 2021) argues that different characteristics of live streamers have an impact on gift-sending intention, but they did not state that different characteristics of live streamers could lead to different desired sentiment pattern regarding the gift value In general, entertaining live streamers are more attractive compared to game live streamers, but game live streamers are more trustful compared to entertaining live streamers because entertaining live streamers exhibit themselves to viewers while game live streamers exhibit the game content to viewers. Though do not know the actual mechanism behind that, this paper believes that different characteristics of live streamers is the cause of different sentiment patterns.

Regarding the positive coefficient of the number of blame-related words for game live streamers, the result is quite striking as intuitively the author expected that to be negative. In real life, many viewers send blame-related danmaku especially after live streamers made some mistakes. To some extent, viewers throw blame on game live streamers' shoulders to show they really engage with them, and hence it is positively associated with gifts value.

5 CONCLUSIONS

This paper examined the relationship between different types of sentiment of danmaku and the gift

value for entertaining live streamers and game live streamers. To conclude, different types of live streamers require different sentiment patterns to increase their gift value. Concerning entertaining live streamers, compliment is positively associated with the gift value. However, for game live streamers, love and blame are positively related with the gift value, but hatred is negatively related with the gift value.

This research has two important implications for live streamers. First, live streamers should realize their different characteristics compared to others. Entertaining live streamers should try to exhibit their attractiveness to viewers so as to make them express compliment. Game live streamers should try their best to earn viewers' trust and make viewers love them; meanwhile, game live streamers need to pay special attention to hatred-related danmaku as it can harm their gift value. Second, game live streamers should know how to get along with blame-related danmaku as the results show that blame is actually positively associated with the gift value.

This research also has one implication for further research. The dataset only includes two types of live streamers and 182 examples. Though this can give people a basic understanding of the research question, a larger dataset might be better.

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