

Beauty Backfires: Beauty and Sales in Live Streaming

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Abstract. The iteration of live streaming commerce is accelerating and the rapid development of it has benefited from ever-increasing streamers joining the business. Thus, we shed light on the relationship between streamers' beauty and customers' purchase behavior using hard archival data of 2,597 live streaming clips from TikTok to investigate the mechanism of how streamers' beauty influence sales volume. We call the face recognition API interface of Face++ to score the streamers' appearance and then construct the estimation model. There is a negative relation between streamers' beauty and sales volume. Moreover, the danmaku's activity will have a partial mediation effect in the process of streamer's appearance impacts sales volume. Finally, we find that compared with utilitarian products, the beauty of streamers has a greater impact on customers' behavior when buying hedonic products. These results provide theoretical reference for the live streaming industry to admit the streamers marketing strategy from the visual level.

Keywords: streamer's beauty, sales volume, live streaming commerce, machine learning, unstructured data

1. Introduction

As a new pattern of e-commerce, the iteration of live streaming commerce is accelerating. By June 2022, the number of live streaming users of e-commerce in China had rapidly increased to 469 million^[26]. Based on the widespread proliferation of live streaming and tremendous user scale, e-commerce live streaming is reshaping the business environment. Live streaming commerce, as a fusion of live streaming and traditional e-commerce, not only allows streamers to give customers more detailed product information through real-time videos, but also allows customers ask questions through the bullet screens or shared chat rooms, and the sellers answer question in real time, which is a two-way interactive mode to improve customers participation and confidence in decision-making^{[10][28]}.

The rapid development of live streaming commerce has benefited from ever-increasing streamers joining the business^[4]. For one thing, the research on streamers is still in its infancy. For another, previous limited studies that explore the influence of streamers on customer behavior mainly focused on specific information embedded in streamers' discourse from the perspective of audio, ignoring visual content^[27]. In fact, live streaming commerce stresses the importance of appearance for the reason that beauty is associated with hedonism, casual presentation, and higher exchange value^[33]. From this perspective, the beauty of streamers satisfies customers' fantasy and preference, provides higher hedonic value, and may promote their subsequent online purchase behavior due to customers' continuous participation^{[6][16]}. However, psychological research and marketing research point out that visual attention will

affect customers' behavioral decisions^[31]. Compared with the visual focus on the product, when the beauty of streamers attracts customers' visual focus on the streamers, their purchase possibility may be lower^[2]. Meanwhile, customers may have heterogeneous visual focus and experience needs when buying different products. And research has shown that the value of streamers' beauty is linked to the customers' emotional needs in the shopping process, but is independent of the effectiveness of products^[23]. Accordingly, product type may be the key moderating variable to determine whether the streamers' beauty have vigorous or inactive impact on the sales effect. Moreover, Meng et al.^[18] shown that danmaku, as an extraordinary sort of interaction in live streaming, can influence customer purchase attention and behavior. Indeed, in the service relationship of e-commerce live streaming, the interaction of focus object is stimulated by the streamer who initiates and leads the live broadcast. Thus, the activity of danmaku is also a critical factor that should be paid attention in the study of streamers' beauty influence customers' purchase behavior, which has not been identified so far.

To bridge the aforementioned gaps, accordingly, the present study explores whether the beauty of streamers serve as an attracting factor to sales effect, then examines the potential mediating effect of danmaku's activity and moderating effect of product type. Contributions of this paper can be summarized as follows: First, based on the computer vision technology, our study adds to the streamers marketing literature in the new business context of live streaming. We rely on the large-scale industry data and call the face recognition API interface of Face++ to score the streamers' appearance level. It extends the validity of prior survey experiments using discrete variable to measure appearance level. Moreover, as a visual determinant, the facial attraction of streamers, was included in the study to make up for the limitation that most previous studies only focused on specific information embedded in streamers' discourse from the audio perspective. Third, the classification of utilitarian and hedonic product was incorporated into the model as a moderating variable. Indeed, product characteristics were less considered in the previous literature that investigating the influence of streamers' personal characteristics on sales effect. However, the product and streamer are both significant attractions of live streaming e-commerce^[13]. The verification of the moderating effect not only reveals the working conditions of the streamers' appearance on the sales performance, but also provides a theoretical basis for the formulation of streamer-product mix marketing strategies.

2. Research Background

2.1 Impact of the streamers' appearance on customers

The face of an individual, as the most overt and accessible personal characteristics to others in social interactions, is known to bias decisions^[32]. It has a continuous impact on subsequent interpersonal communication^[5]. Many findings support the popular belief that beauty have a premium. For instance, in the field of psychology, researchers have proved that individuals will be attracted by others whom they consider good-looking^[12], perhaps because good-looking person have a "halo effect" which means people tend to view them as smarter, competent, sociable, and interesting. Research in the field of marketing reinforce this beauty stereotype. Studies have found that a good-looking salesperson enhances customer evaluation of a product simply by touching it. The aforementioned results confirmed that beauty is strongly related to positive social traits (like perceived intelligence and social skills) and successful outcomes. Live

streaming commerce emphasizes the significance of appearance and aggravates people's concern with beauty and greatly affected social and consumption behaviors^[22]. An attractive streamer may impersonate a charming actor, appealing to customers through beauty^[33]. Previous studies indicated that beauty is attractive to customers, it may further influence their subsequent purchase decisions^[35]. Although most studies have shown the premium of beauty, Gheorghiu et al.^[7] indicated a potential ugliness premium: students rate unattractive professors as better scientists than attractive professors. Moreover, a U-shaped relationship between appearance and product sales has been proved exist in Peng's^[22] study, which suggests that the effect of beauty is not always positive.

Meanwhile, Psychological research points out that the visual attributes of stimuli not only affect the audience's visual focus, but also have an effect on their related behavioral decisions^[24]. Visual attention to a product increases the likelihood that it will be selected^[8]. It follows that the role of streamers' beauty remains an unexplored gap that shape customers' purchase intentions. Hence, we propose the following hypothesis:

Hypothesis 1: The appearance of streamers affects the sales effect. Specifically, the more beautiful streamers are, the higher the sales volume.

2.2 The Mediation Effect of danmaku's activity

In addition to streamers, customers are also an indispensable portion of the communication relationship^[27]. Modern viewers can no longer be satisfied by receiving messages passively. And posting danmaku is a real-time user engagement behavior, it reflects how customers interact with live content and is a considerable indicator to measure consumer engagement^[34]. As one of the ways for the focus objects to interactive with each other in the e-commerce live streaming service relationship, danmaku is stimulated by the streamer who initiate and lead the live streaming^[27]. Therefore, the characteristics of streamer such as appearance might be the critical factors affecting the danmaku's activity. Simultaneously, the interaction between the streamer and the audience will bring realism, presence, and immersion to customers^[28], which facilitates customers focusing their attention on live shopping activities and increasing their willingness to purchase. On the other hand, Zhou et al.^[36] show that danmaku, as a sensory stimulus, the more active it is, the more likely it is to impair a calm, careful decision-process, which usually results in hedonic purchase behavior. Thus, the danmaku's activity is a crucial variable that affects the sales effect. The process that the appearance of streamers influences the sales effect may first affect the participation behavior of customers, and then affect the subsequent consumption behavior. On the basis, we propose the following hypothesis:

Hypothesis 2: The quantity of danmaku will mediate the process that the appearance of streamers influences the sales effect.

2.3 The Moderating Effect of Product type

Both the product and the streamer are crucial attractions of e-commerce live streaming^[33]. Hedonic and utilitarian products, as the common classification criteria of product type, exert a strong influence on the purchasing behavior of customers^[1]. Although online retailing is applying e-commerce live streaming to promote both hedonic and utilitarian products, there is a different effectiveness of utilizing this tool across the two types of products^[30]. Therefore, it is essential to introduce the product type to uncover the influence of streamers' appearance on

sales effect in a live streaming scenario. For hedonic products, the subjective of pleasure may force customers to pursue subjective impressions and reduce reliance on “tangible” product features or information, while for utilitarian products, the objective link between function and utility simplifies product communication and information^[29]. Customers have diverse expectations when facing these two types of products. Hedonic products include aesthetic and sensory fantasies of the customer^[25]. Therefore the attractiveness of streamers’ beauty is a kind of hedonic motivation, and beauty can enhance the perceived hedonic value of customers^[14]. That is to say the value of streamers’ beauty is related to customers’ emotional needs in the process of shopping, when customers select hedonic products, their behaviors or decisions are more likely to be affected by the streamer’s appearance. On the basis we propose the following hypothesis:

Hypothesis 3: Product type moderates the process that the appearance of streamers influences the sales effect. Compared with buying utilitarian products, the appearance of streamers has a greater impact on customers’ behavior when buying hedonic products.

3. Data and methodology

This paper adopts real live streaming video and real secondary data (sales) to conduct behavioral research. The data is obtained from TikTok, the world’s third-largest social network behind Facebook and Instagram (Yahoo, 2021). 2,597 live streaming videos of 260 streamers whose number of followers has reached millions were randomly selected, and the total volume of our data is about 197.67G. For each video clip, we collected sales volume, the number of audiences and any other provided directly by the live streaming platform. Studies suggested that people everywhere are all using the same, or at least similar criteria in their judgments^[11]. Due to there is a considerable agreement across individuals and cultures (and sometimes species) on what is found attractive, facial attractiveness is a quantifiable trait that can be assessed by computer algorithms^[21]. Consequently, this study is based on computational vision and call the face recognition API interface of Face++ to score the streamers’ facial attractiveness. All descriptive statistics are shown in the Table 1.

Table 1. Variables Overview for Live Streaming Data

Variables	Description	Mean	SD	Min	Max
<i>Dependent variable</i>					
Sales Volume	Real-time sales amount of the living streaming room	23.400	63.365	0	1226
<i>Independent variable</i>					
Beauty	The score of streamer’s appearance	73.946	6.124	47.818	90.940
<i>Control variables</i>					
Reputation	The credibility of the influencer	4.770	0.210	4.05	5

Age	Influencers' age	25.131	4.006	18	52.5
Gender	Female influencers are marked as 0, male influencers are marked as 1.	/	/	/	/
Ave_price	Average price of products sold in this live streaming	313.170	286.060	22.880	3586.240
Hue	A particular shade of color	19.374	94.709	0	130.251
Saturation	The richness of color	25.863	69.329	0	147.165
Clarity	The brightness and darkness of color	540.279	554.814	0	3992.070
Mediator					
DanmakuCount	The total number of danmaku per ten seconds	186.527	253.311	3	186.527
Moderator					
Product type	Utilitarian product is marked as 0 and the hedonic product is marked as 1.	/	/	/	/

To evaluate the relative impact of the predictor variable on the particular outcome, simple regression analysis is preferred. Peng et al.^[22] also used regression model to analysis how the facial attractiveness of seller profile pictures in e-commerce affects consumer behavioral outcomes and product sales. In view of the chief purpose of this study-to assess the effects of streamers' appearance on sales volume, we controlled for the three kinds of variables. The model is as follows :

$$Y_i = \beta_0 + \beta_1 X_i^2 + \beta_2 X_i + \beta_3 Z'_i + \varepsilon_i, \quad (1)$$

Where Y is the sales volume; X is the streamers' appearance; Z represents a set of control variables (age, gender, reputation, avg_price, hue, saturation, clarity) discussed in the previous section; β_0 allows for different video clip intercept; ε_i is the random error term; and i is streamers; The parameter β_1 is of interest because it measures the nonlinear effect of streamers' appearance on sales volume, holding Z fixed.

4. Empirical results

4.1 Main effect of streamers' appearance on audiences' purchase

First, we looked for model-free evidence in support of our prediction that the sales volume will be higher when the streamer is more beautiful. The regression results are shown in table 2. The estimate effect is negative and significant, meaning that there is a negative relation between streamers' appearance and sales volume. The regression results are not consistent with our prediction. Second, to further control for the characteristics in live streaming, we conducted a

regression analysis with control variables. The column 3, 4, and 5 of table 2 shows the results. The relationship between streamers' appearance and audiences' purchase is consistent with the model free evidence. The result of ordinary least square regression (OLS) still shows there is a negative relation of the main effect. Firstly, for the details of streamer. There is a pattern of positive correlation among streamer characteristics and audiences' purchase. Mitic's^[19] study established the principle that 'reputation means money'. Therefore, the better the streamer's reputation, the higher the sales volume will be ($\beta_{reputation} = 53.62695$, $p < 0.01$). In contrast, there are several variables influencing audiences' buying negatively. For instance, younger streamers are more competitive in live streaming ($\beta_{age} = -12.29255$, $p > 0.1$). Secondly, for the commodity information. There is a negative correlation between product price and sales volume ($\beta_{Ave_price} = -0.006$, $p > 0.1$). As proved by Malik, Ghafoor & Iqbal^[17], customers want to buy products of good quality and low price. Thirdly, for the details of live streaming room setting. The higher the saturation, the higher the sales volume ($\beta_{Saturation} = 0.02332$, $p > 0.1$). In order to check the robustness of the results, we use the sales volume per minute as another dependent variable. The results of model verification are shown in column 6, 7, 8, and 9 of table 2, we get the same conclusion. Hypothesis 1 has not been verified.

Table 2. Results of Model Specification

	Model free	Model1	Model2	Model3	Model free (Robustness check)	Model4	Model5	Model6
Beauty	0.9698** (-4.766)	- (-5.034)	0.9505** (-4.565)	0.9877** (-4.327)	-0.009318* (-2.123)	0.0106147* (-2.440)	0.01701*** (-3.843)	-0.01408** (-2.896)
Reputation		46.3398* (7.895)	47.90*** (8.032)	48.30*** (7.804)		0.0237084* (9.434)	0.02087*** (8.231)	0.01977*** (7.520)
Gender (male)		-11.7376 (-1.418)	-11.36 (-1.372)	-11.82 (-1.377)		-0.0021165 (-0.597)	-0.002806 (-0.798)	-0.004695 (-1.288)
Age		-0.6906* (-2.216)	-0.6819* (-2.188)	-0.5323 (-1.572)		0.0003976* (-2.980)	0.000414* (-3.122)	0.000373* (-2.591)
Ave_price			-0.006 (-1.468)	0.005845 (-1.410)			0.000011* (6.297)	0.000011* (6.007)
Hue				0.03303 (-0.472)				-0.000055 (-1.847)
Saturation				0.02332 (0.441)				-0.000024 (-1.090)
Clarity				0.003158 (-1.248)				-0.000000 (-0.877)
F	22.72	23.52	19.25	12.3	4.507	25.68	28.78	18.56
R ²	0.008399	0.03393	0.03437	0.03405	0.001366	0.03708	0.0514	0.05193

Note: * $p < .1$, ** $p < .05$, *** $p < .01$.

4.2 Mediation effect

We combine the bootstrap method in the structural equation model to test the mediation effect of danmaku's activity between streamers and customers in this section. The quantity of danmaku is playing an indirect mediation effect. For one thing, streamers' facial attractiveness will influence the quantity of danmaku ($\beta = -4.5232$, $p < 0.01$) in a negative direction. It means that the more beautiful the streamer, the fewer the danmaku sent by audiences. On the one hand, part of the reason for audience to view or send the danmaku is for hedonic value^[3]. However, Li & Zhang^[14] elucidates that a good-looking appearance provides higher hedonic value. Consequently, when the hedonic value that pursued by the audience in live streaming is mostly satisfied by the beautiful streamer, the danmaku they send will reduce. On the other hand, streamers' good-looking appearance will affect the visual attention of customers, making them ignore product information. Then, show a decrease on the quantity of danmaku.

For another, the mediation effect results manifest that the quantity of danmaku ($\beta = 0.0908$, $p < 0.01$) will have a positive impact on sales volume. Li et al.^[15] show that the interactive features of the danmaku will positively promote consumer purchase. When we add three categories of control variables in turn to model 7, 8, and 9, we get the same conclusion and show the results in the Table 3. The danmaku's activity is playing the partial mediation effect during the process for the reason that the main effect remains statistically significant after been mediated.

Table 3. The mediation effect analysis

	Model free	Model7	Model8	Model9
Beauty → Danmaku	-2.4397**	-2.7848***	-3.6395***	-4.5232***
CountTrendData	(-2.991)	(-3.405)	(-4.348)	(-4.951)
DanmakuCountTrendData →	0.0920***	0.0893***	0.0906***	0.0908***
Sales Volume	(20.088)	(19.529)	(19.782)	(19.717)
	-0.2245***	-0.2486***	-0.3298***	-0.4108***
Mediation effect	(-27.552)	(-30.177)	(-37.007)	(-35.755)

Note: * $p < .1$, ** $p < .05$, *** $p < .01$.

4.3 Moderation effect

We use the processed data to carry out the regression analysis of the moderating effect. According to model-free results in table 4, after the interaction item was added, the effect of streamers' appearance on sales effect is still positive and significant ($\beta = -1.2950$, $p < 0.01$), proving again that the streamers' facial attractiveness is not a negligible factor in sales volume. Specifically, a negative interaction effect of beauty and product type ($\beta = -4.9229$, $p < 0.01$) implies that the appearance of streamers has a greater impact on customers' behavior when buying hedonic products. Customers pay close attention to product information when buying utilitarian products^[20], yet the value of streamers' beauty is independent of product utility^[23]. The negative effect of beauty is rather obvious for hedonic product, possibly because "ugly"

also has a premium. For instance, in recent years, short videos demonstrate the functions of beauty products through complete contrast before and after makeup. When we add three categories of control variables in turn to model 10, 11, and 12, we get the same conclusion. Hypothesis 3 has been verified.

Table 4. The moderation effect analysis

	Model free	Model10	Model11	Model12
Beauty	-1.2950*** (-6.285)	-1.3349*** (-6.493)	-1.2695*** (-6.010)	-1.2158*** (-5.316)
Product type	29.3732*** (6.825)	22.0030*** (5.044)	21.0421*** (4.761)	20.1354*** (3.996)
Beauty* Product type	-4.9229*** (-5.630)	-5.4846*** (-6.321)	-5.5736*** (-6.406)	-5.8422*** (-6.468)

Note: * $p < .1$, ** $p < .05$, *** $p < .01$.

5. Conclusion

Live streaming commerce has become the fastest-growing business in China in recent years. Although it has created an imposing sales record, not every streamer can attract viewers and sell their products successfully^[9]. This phenomenon in the entire livestreaming industry is of much concern among online sellers, nevertheless, research pertaining to the streamers in the live streaming is still at a nascent stage. The power of facial beauty is compelling^[22], thus a small difference based on appearance can have a nonnegligible effect on audience's purchase behavior. In view of this background, we use hard archival data of 2,597 live streaming clips from TikTok to investigate the mechanism.

Our field studies examined the influence of streamers' appearance on sales effect in a data-rich context of e-commerce live streaming, using linear regression estimation techniques and reliable and robust machine learning approach to assess facial attractiveness. Initially, we find that there is a negative relationship between the streamers' appearance and sales volume. This effect was shown to be robust after using several control variables. Consumers are less likely to purchase when the beauty of the streamers attract consumers' visual focus, revealing the mechanism of the phenomenon that customers just say "yes" instead of purchasing. To date, this negative correlativity has so far been absent in exploration and causal verification in the previous literatures. Although numerous experiments have demonstrated a "halo effect" of beauty, it is not hard to find that much of the beauty premium is related to the person himself. The ugliness premium, by contrast, works in this context. For one thing, the customers' visual focus on the products continuously, and for another, ugly person is perceived as more intelligent, trustworthy or make more effort to compensate for a lack of facial attractiveness. Accordingly, the findings enrich the previous literature on the impact of streamers' appearance on customers' purchase behavior. Second, we report the mediation effect of the danmaku's activity. We verify that the streamers' appearance will influence the quantity of danmaku in a negative direction. It can be explained by the satisfaction and visual attention. The saturation of hedonic value will reduce

the demand of customers to send danmaku. And the streamers' good-looking appearance will also affect the visual attention of customers, making them ignore product information, resulting in a decrease in the quantity of danmaku. Nevertheless, the positive impact of danmaku activity on sales volume are statistically significant. It expounds that interactive features of the danmaku will positively promote consumer purchase. Third, the moderation effect of product type was demonstrated in the process by which streamers' appearance influences sales volume. We find that compared with buying utilitarian products, the appearance of streamers has a greater impact on customers' behavior when buying hedonic products. For utilitarian products, the customers' visual is always concentrated on the product itself no matter how the streamers look like.

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