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Emotional Expression of the Virtual Influencer “Luo Tianyi(洛天依)” in Digital'

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Abstract

In the context of contemporary digital media, virtual influencers have become an increasingly important form of socialization and entertainment, in which emotional expression is a key factor in attracting viewers. In this study, we take Luo Tianyi, a Chinese virtual influencer, as an example to explore how emotions are expressed and perceived through facial expressions in different types of videos. Using Paul Ekman's Facial Action Coding System (FACS) and six basic emotion classifications, the study systematically analyzes Luo Tianyi's emotional expressions in three types of videos, namely Music show, Festivals and Brand Cooperation. During the study, Luo Tianyi's facial expressions and emotional expressions were analyzed through rigorous coding and categorization, as well as matching the context of the video content. The results show that Enjoyment is the most frequently expressed emotion by Luo Tianyi, reflecting the centrality of positive emotions in content creation. Meanwhile, the presence of other emotion types reveals the virtual influencer's efforts to create emotionally rich and authentic experiences. The frequency and variety of emotions expressed in different video genres indicate Luo Tianyi's diverse strategies for communicating and connecting with viewers in different contexts.

The study provides an empirical basis for understanding and utilizing virtual influencers' emotional expressions, and offers valuable insights for digital media content creators to design emotional expression strategies. Overall, this study is valuable for understanding the complexity of virtual influencer emotional expression and its importance in digital media strategy.

Keywords: *Digital media, virtual influencers, Paul Ekman, facial action coding system, emotions*

1. INTRODUCTION

With the rapid development of Internet technology, digital media has become an important part of modern people's daily life [1]. Especially in entertainment and social interaction, virtual influencers, as a new digital media role, are gradually changing the way we consume content. Globally, virtual influencers are not only playing an increasingly important role in the digital entertainment industry, but also showing their unique value and potential in marketing, education, and other business sectors [2].

Luo Tianyi, China's first virtual singer and digital influencer, has gained immense popularity online since 2012. Through his participation in various forms of media performances, including music videos, advertisements, and online live broadcasts, Luo Tianyi has not only created an image of a popular virtual character among young people [3]. Emotional expression plays a crucial role in enhancing audience's

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emotional engagement and establishing emotional connections, especially in the context of virtual interactions.

The purpose of this study is to analyze Luo Tianyi's emotional expression in digital media, and to explore how she expresses her emotions through facial expressions in different types of videos. By systematically analyzing Luo Tianyi's videos on the Bilibili platform, this study adopts Paul Ekman's FACS and six basic emotion classifications [4] to identify and classify the emotions expressed by Luo Tianyi in his videos. In addition, the study will examine the differences and consistency of these emotions in three different video themes: Music show, Festivals and Brand Cooperation.

Through this study, we expect to reveal the characteristics of Luo Tianyi's emotional expressions. The results of this study will not only provide an empirical basis for understanding how virtual influencers enhance their influence through emotional interactions, but also provide valuable insights for digital media content creators. In addition, the findings will provide guidance for virtual character emotion modeling techniques and digital media strategy development.

2. SCOPE AND METHODOLOGY OF THE STUDY

This study focuses on analyzing the emotional expression of Chinese virtual influencer Luo Tianyi in videos posted on the digital media platform Bilibili. The scope of the study covers three types of videos in which Luo Tianyi participates: Music show, Festivals, and Brand Cooperation. A total of fifteen videos, five from each category, were selected for analysis. The research methodology used was Paul Ekman's FACS and the six basic emotion classifications. First, Paul Ekman's FACS was used to code the detailed facial movements of Luo Tianyi in the videos. This method allows for the systematic identification and categorization of facial expressions, which in turn allows for inferences to be made about the basic types of emotions expressed. Particular attention is paid to capturing subtle expression changes and how these changes match the context of the video content. In addition, six basic emotion categories (Enjoyment or Happy, Sadness, Fear, Surprise, Disgust, Anger) will be used to further analyze the specific expressions and changes of emotions. The study will compare the frequency and diversity of emotional expressions in different types of videos, and observe and analyze the patterns and effects of emotional expressions.

3. SCOPE AND METHODOLOGY OF THE STUDY

3.1 Virtual Influencers

Unlike physical influencers such as traditional celebrities and social media "Internet celebrities", virtual influencers were initially regarded as "Computer-generated influencers or (artificial intelligence influencers)" [5]. As more and more virtual influencers open their personal accounts in social media and interact more closely with their audiences, they are recognized as "characters that have no physical reality but can be created, produced, narrated, and managed to promote or sell a particular message or brand" [6].

In the field of Chinese anime-like virtual influencers, one of the most talked about is Luo Tianyi (Figure 1), a virtual idol introduced in 2012, who is one of the virtual female singer characters developed and marketed by Yamaha's VOCALOID 3 on the Vsinger platform [2]. Currently, Luo Tianyi has more than 10,000 original tracks, and is still climbing at a rate of nearly 100 tracks per month.In 2019, Brud USA created Lil Miquela (Figure 2) with the help of Computer-generated Imagery. She is algorithmically portrayed as a fashionista, singer and democracy fighter. Virtual influencers are often a combination of advertising and audience engagement, with virtual influencers often engaging at about three times the rate of humans and gaining followers at a much higher rate. Virtual influencers interact amongst themselves and with real-life humans, and can provide narrative opportunities and orchestrated events to generate publicity and engage audiences through "emotional storytelling and empathy" [7].

Figure 1. Luo Tianyi

Figure 2. Lil Miquela

3.2 The Facial Action Coding System (FACS)

Human face reveals human thoughts and feelings. Especially, facial expression can show a person's inner state and social behavior, which plays a very important role in human communication. Analyzing the facial units of the human face can more accurately and objectively explain the facial expressions of the human face, which is gradually becoming a major research direction. 1970s, American scholars Paul Ekman and others proposed the FACS is the most widely used coding system in behavioral sciences [3]. Based on FACS (Table 1), facial expression can be expressed as a series of facial muscle movements, and FACS defines these facial muscle combinations as "facial action units", abbreviated as AU (Action Unit). Facial action unit (AU) detection plays a fundamental role in describing comprehensive facial expressions [8].

According to this coding system, a happy expression can be characterized by the activation of muscle activation units 6 and 12. For example, when recognizing a joyful emotion in another person's facial expression, we can perceive the muscles around the eyes moving by seeing the activation of the orbicularis culi and pars orbitalis, and the activation of the zygomaticus major by seeing the activation of the 6AU, and the upturning of the lip tail by seeing the activation of the 12AU [9].

Table 1. The Facial Action Coding System (FACS)

AU	Clarification	AU	Clarification	AU	Clarification	AU	Clarification
1	Inner Brow Raiser	10	Upper Lip Raiser	20	Lip stretcher	28	Lip Suck
2	Outer Brow Raiser	11	Nasolabial Deepener	22	Lip Funneler	41	Lid Droop
4	Brow Lowerer	12	Lip Corner Puller	23	Lip Tightener	42	Slit
5	Upper Lid Raiser	13	Cheek Puffer	24	Lip Pressor	43	Eyes Closed
6	Cheek Raiser	14	Dimpler	25	Lips parted	44	Squint
7	Lid Tightener	16	Lower Lip Depressor	26	Jaw Drop	45	Blink
9	Nose Wrinkler	18	Lip Puckerer	27	Mouth Stretch	46	Wink

3.3 Ekman's Six Basic Emotions

The information that contributes to the recognition of emotion can vary widely, such as a trembling voice, gestures, or facial expressions [9]. Facial expressions can be a very important tool for understanding the emotions of others, as emotional information is often conveyed in facial expressions without any conscious effort on the part of the person to reveal it [10]. Although people often make facial expressions that indicate different emotions to avoid revealing their true emotional state, it is easier to tell whether a facial expression is genuine or not by observing its features more frequently and for longer periods of time [11].

The emotional information revealed by facial expressions varies, and the emotion can be recognized by the characteristics of the muscle movements that produce the facial expression. Darwin and Prodger (1872) describe in detail the features of facial expressions that correspond to each emotion, for example, they argue that to recognize the emotion of joy, we look for wrinkles under the eyes and curved lips at the corners.

Expression is an important carrier for human beings to express their emotions, desires, and intentions, and

Paul Ekman defines six universal basic expressions, which are Enjoyment, Sadness, Fear, Surprise, Disgust, and Anger (Figure 3). According to the definition of FACS, the six universal basic expressions can be fully represented by the combination of AUs [12].

Figure 3 Ekman's six basic emotions

4. EXTRACTION OF FACIAL MOVEMENTS OF VIRTUAL INFLUENCERS

4.1 Extraction Principles

In this study, facial movements were extracted based on a facial coding system and a table of emotion correspondences established in previous academic literature [13][14]. The combination of facial coding and emotions from this literature was summarized to form the analysis tool for this study (Table 2). The adoption of this system ensured objectivity and reproducibility in the analysis of facial expressions, providing a standardized set of tools for studying the emotional expressions of virtual influencers such as Luo Tianyi.

Each set of facial gestures was coded to be associated with one or more emotions, such as happiness, sadness, and surprise. During the analysis process, the methodology described in the literature was strictly followed to identify and record each facial movement of Luo Tianyi in the video. This included analyzing successive frames of Luo Tianyi's expressions frame by frame to capture brief but expressive movements.

Table 2. FACS and Emotions

Emotion	Facial Action Units (AU)
Enjoyment	AU6, AU12, AU25
Sadness	AU1, AU14, AU15, AU17, AU43
Fear	AU1, AU2, AU4, AU5, AU7, AU20, AU25, AU27
Surprise	AU1, AU2, AU5, AU26, AU27
Disgust	AU9, AU15, AU16,AU26
Anger	AU4, AU5, AU7, AU22, AU23

4.2 Emotion and Facial Movement Extraction

At this stage of the study, we performed a detailed facial action analysis of Luo Tianyi's expressions in order to accurately extract information about emotional expressions from the visual data. This process first involves coding the facial movements in the captured images, and then labeling the corresponding facial movement codes directly on the images. This labeling method facilitates the identification and recording of specific facial movements displayed by Luo Tianyi in different contexts, which are classified and described according to Paul Ekman's Facial Action Coding System (FACS) (Table 3).

During the extraction of facial movements, we noticed that the same type of expression recurs in multiple videos. In order to improve the efficiency of the study and the accuracy of the analysis, it was decided to take the following steps to deal with this phenomenon: first, all the collected images were systematically reviewed to identify those with repeated expressions. Subsequently, representative images were filtered from these repeated emotional expressions. This selection was based on the clarity of the expression, the completeness of the expression, and its importance in the video narrative. Only the most representative expressions were retained for subsequent detailed analysis.

Table 3. FACS analysis

Emotions	AU
Enjoyment	
Sadness	
Fear	
Surprise	
Disgust	
Anger	

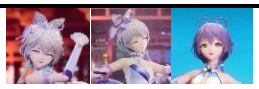
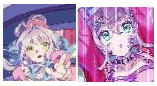
5 SENTIMENT ANALYSIS OF VIRTUAL INFLUENCERS

5.1 Analysis by Theme Type

The aim of this part of the study is to analyze in depth the emotions expressed by Luo Tianyi in different types of communication videos, in order to reveal the diversity of her emotional expressions and the corresponding strategies. In order to systematically conduct this analysis, the videos were categorized into three thematic types: Music show, Festivals and Brand Cooperation. In order to simplify the analysis process and to standardize the data format, the naming scheme of the videos was standardized. Specifically, the original video titles were not easy to analyze and cite directly due to their varying length and complexity. Therefore, each video was renamed to correspond to a video type followed by a serial number, e.g., Music show videos were labeled as "Music show 1", "Music show 2", etc. After analysis, the main mood types were labeled as "Music show 1", "Music show 2", and so on.

After analysis, the main emotion type is "Enjoyment", which indicates that Luo Tianyi expresses happiness or enjoyment more frequently in Music show videos, reflecting the purpose of Music show to create a pleasant experience. The number of times the emotion of happiness appeared in different videos varied (from 4 to 9 times). This suggests that although happiness is the dominant emotion in Music show videos, the intensity and frequency of its expression varies according to the content of the video. The small amount of 'Sadness' and 'Surprise' emotions were associated with changes in musical content (Table 4).

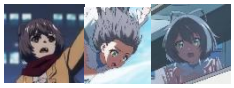
Table 4. Music show category

Name	Emotion	Imagery	Number of occurrences
Music show 1	Enjoyment		9
Music show 2	Enjoyment		7
Music show 3	Enjoyment		9
Music show 4	Enjoyment		6
Music show 5	Enjoyment		4
	Sadness		1
	Surprise		2

The Festivals video (Table 5) shows a wider range of mood types, such as "Fear", "Disgust", and "Anger", reflecting the diversity and complexity of holiday themes. This reflects the diversity and complexity of holiday themes. For example, some holidays may include an element of surprise ("Surprise"), while some holiday traditions may be designed to bring about an emotional response of excitement or playfulness ("Fear," "Disgust"). The presence of these emotions suggests that holiday videos are designed to create a multidimensional emotional experience, eliciting a broader range of emotional responses from viewers.

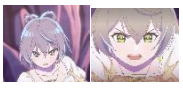
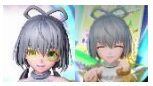
Table 5. Festivals category

Name	Emotion	Imagery	Number of occurrences
Festivals 1	Enjoyment		9
	Sadness		3
	Fear		2
	Surprise		5
	Disgust		5
	Anger		1

Festivals 2	Enjoyment		11
	Sadness		1
	Surprise		2
Festivals 3	Enjoyment		9
	Sadness		2
	Fear		4
	Surprise		6
Festivals 4	Enjoyment		7
Festivals 5	Enjoyment		6
	Surprise		2

In the Brand Cooperation category (Table 6), the emotion types are relatively homogenous, mainly "Enjoyment" and "Surprise", which reflects the common emotion strategy in brand promotion activities. By presenting positive emotions, Brand Cooperation videos aim to create a positive brand image and arouse viewers' curiosity and interest in the product or event.

Table 6. Brand Cooperation category

Name	Emotion	Imagery	Number of occurrences
Brand Cooperation 1	Enjoyment		3
	Sadness		1
	Anger		3
Brand Cooperation 2	Enjoyment		5
Brand Cooperation 3	Enjoyment		3

	Surprise		1
Brand Cooperation 4	Enjoyment		7
	Surprise		3
Brand Cooperation 5	Enjoyment		7

Taking the three categories together, it is clear that virtual influencer Luo Tianyi's emotional expressions are varied and designed to fit the specific needs of different video themes: Music show tends to convey a single strong positive emotion, Festivals expresses a wider range and complexity of emotions, while Brand Cooperation focuses on building a positive brand image and generating interest. Music show tends to convey a single strong positive emotion, Festivals express a broader and more complex emotion, and Brand Cooperation focuses on building a positive brand image and generating interest. Each type of video content has a different need for emotional expression, reflecting how virtual influencers use emotions to communicate and connect with viewers in different contexts.

5.2 Emotion-Based Analysis

This part is the emotion-based analysis (Table 7), and from the data in the table, hedonism (Enjoyment) is the most frequently occurring emotion with a total of 15 times. This emphasizes the importance of positive emotions in Luo Tianyi videos. Surprise appears 7 times, in Festivals and special occasions. Fear, Anger, and Disgust, which appear one to two times each, are used sparingly but add variety to the content of the videos. The radar chart further visualizes the distribution of the different emotions, with Hedonic having the furthest tip of the distribution, showing its dominance among all emotions.

Table 7. Sentiment-based analysis

Emotion	Thematic	Quantities
Enjoyment	Music show 1, Music show 2, Music show 3, Music show 4, Music show 5, Festivals 1, Festivals 2, Festivals 3, Festivals 4, Festivals 5, Brand Cooperation 1, Brand Cooperation 2, Brand Cooperation 3, Brand Cooperation 4, Brand Cooperation 5	15
Sadness	Music show 5, Festivals 1, Festivals 2, Festivals 3, Brand Cooperation 1	5
Fear	Festivals 1, Festivals 3	2
Surprise	Music show 5, Festivals 1, Festivals 2, Festivals 3, Festivals 5, Brand Cooperation 3, Brand Cooperation 4	7
Disgust	Festivals 1	1
Anger	Festivals 1, Brand Cooperation 1	2

5.3 Analysis of The Combination of Themes and Emotions

In the Music show category (Table 8), the emotion of pleasure (Enjoyment) was mainly expressed, appearing a total of 38 times across all five Music show videos. This reflects that the emotion of Happiness or Enjoyment is very significant in the Music show category videos.The Festivals category videos express complex and diverse emotions such as Happiness, Sadness, Surprise, etc., especially in the "Festivals 1"

video which shows the most types of emotions with a total of 6. In the Brand Cooperation category videos, these videos mainly expressed the emotions of happiness and surprise, such as happiness, sadness, and anger in the "Brand Cooperation 1" video, which appeared a total of 33 times.

Happiness was expressed most frequently in the different videos, reaching 75 times, especially in "Festivals 1", where the emotion was expressed 25 times. Sadness and surprise were the next most frequent, appearing 5 and 7 times respectively in different videos. Other emotions such as fear, disgust and anger were relatively rare.

Table 8. Combination of themes and moods

Tname (of a thing)ypology	Name	Emotion	Number of mood types	Aggregate	ordinal number	Total number of times
Music show	Music show 1	Enjoyment	1	7	9	38
	Music show 2	Enjoyment	1		7	
	Music show 3	Enjoyment	1		9	
	Music show 4	Enjoyment	1		6	
	Music show 5	Enjoyment, Sadness, Surprise	3		7	
Festivals	Festivals 1	Enjoyment, Sadnes, Fea, Surprise, Disgust, Anger	6	16	25	75
	Festivals 2	Enjoyment, Sadness, Surprise,	3		14	
	Festivals 3	Enjoyment, Sadness, Fear, Surprise	4		21	
	Festivals 4	Enjoyment	1		7	
	Festivals 5	Enjoyment, Surprise	2		8	
Brand Cooperation	Brand Cooperation 1	Enjoyment, Sadness, Anger	3	9	7	33
	Brand Cooperation 2	Enjoyment	1		5	
	Brand Cooperation 3	Enjoyment, Surprise	2		4	
	Brand Cooperation 4	Enjoyment, Surprise	2		10	
	Brand Cooperation 5	Enjoyment	1		7	

The radar chart for each video-based category (Figure 4) clearly shows the distribution of emotion types in different videos, with Music show videos featuring prominently in the expression of happiness, Festivals videos featuring prominently in surprise, and Brand Cooperation featuring a more balanced mix of happiness and surprise emotions. The radar chart (Figure 5), categorized by video theme, shows the comparison of the number of emotion types and the number of emotion occurrences among the three major categories of videos, from which it can be seen that the Music show category of videos has the most concentrated expression of emotions, whereas the Festivals category and the Brand Cooperation category of videos show a wide range and diversity of emotion expressions.

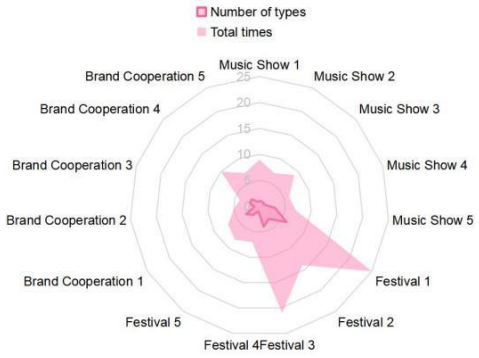


Figure 4. Emotions in each video

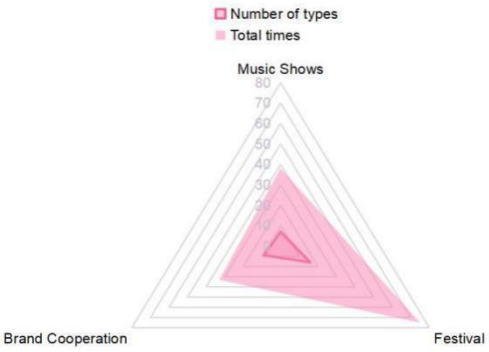


Figure 5. Theme Types and Moods

In summary, this study reveals the diversity and relevance of Luo Tianyi's emotional strategies by categorizing and analyzing her emotional expressions in different video genres in detail. This not only enhances our understanding of the emotional expressiveness of virtual influencers, but also provides valuable insights for future curation of virtual influencer content.

6. CONCLUSION

In this study, we systematically analyzed the emotional expression of the virtual influencer Luo Tianyi on digital media. Using Paul Ekman's Facial Action Coding System (FACS) and the six basic emotion categories, we conducted an in-depth emotion analysis of the three video types in which Luo Tianyi participated.

The initial phase of the study involved identifying the study population and video samples. By screening Luo Tianyi's Music show, Festivals and Brand Cooperation videos on Bilibili, 15 videos were selected for analysis. Subsequently, FACS was applied to encode Luo Tianyi's facial movements in detail, and six basic emotion classifications were used to analyze emotional expressions.

The analysis reveals that Enjoyment is the dominant emotion in Luo Tianyi's videos, which not only reflects the core goal of content creation to convey positive emotions, but also reflects the positive feedback from viewers on the expression of such emotions. Despite the dominance of Enjoyment, the presence of other emotions such as Sadness, Fear, Surprise, etc. suggests that Luo Tianyi aims to create an emotionally rich and realistic avatar. In addition, different types of video content present different combinations of emotions, demonstrating Luo Tianyi's diverse strategies for connecting with viewers in various contexts.

In summary, this study provides a systematic understanding of the emotional expression of virtual influencers. It not only expands the depth of virtual influencer research in the digital media field, but also provides guidance for content creators and marketers to utilize emotions more effectively when designing avatars and planning digital media campaigns.

There are also limitations to the research. First, the analysis of emotional expressions was limited to facial expressions, and did not take into account other factors such as language and tone that may affect the interpretation of emotions. Second, the sample size was relatively small, limited to 15 videos of Luo Tianyi. Future research could explore the differences in the emotional expressions of virtual influencers in different cultures, and examine the responses to emotional expressions in different markets around the world. In addition, with the advancement of technology, the modeling and expression of virtual influencers' emotions will become more complex and delicate, and continued research in this area will be essential.

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