

Are You a Robot?: Consumer Perception of Highly Human-like Virtual Influencers

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ABSTRACT

Virtual influencers, which are computer generated influencers with highly humanlike appearance and behavior, are highlighted to overcome human influencers' limitation regarding the pandemic related restrictions. Though authenticity is an essence of successful influencer marketing, consumers often have doubts about virtual influencers' robotic nature, and the robotic doubts can decrease effectiveness of their marketing performance. This exploratory research aims to investigate what factors affect consumers' perception on virtual influencers' authenticity in social media. Lil Miquella, a virtual influencer with over three million followers on Instagram, was selected for preliminary analysis and its total 501 Instagram posts were collected as sample data. The preliminary results indicate a negative relationship between a post's popularity (e.g. number of comments and likes) and robotic doubts to the virtual influencer and the significant effects of a posts' text (e.g. readability, sentiment) and image characteristics (e.g. resolution, facial expression) for reducing the doubts. Theoretical contributions for virtual agent and influencer marketing literature are discussed, and practical implications are suggested.

Keywords: Virtual influencer, social media marketing, influencer marketing, Topic modeling, Text mining, Image mining

INTRODUCTION

An unheard-of tragic, Covid-19 pandemic has emerged. It changed our everyday lives as well as the marketing industry. CMO survey highlighted that after Covid-19, social media marketing and influencer marketing would be increased for years to come after the pandemic (CMO survey, 2022). Due to the pandemic related restrictions, for example lockdown, people have spent more time staying at home and using social media (Samet, 2020). Consumers started to utilize social media more actively as a tool for searching, evaluating, and buying products, and this highlights the increasing importance of social media marketing for post-Covid19 marketing strategy (Mason et al., 2021). For social media marketing, influencers are a critical element, and often, social media influencers are more effective than existing traditional macro influencers in terms of trustworthiness and brand attitude. This is because consumers perceive social media influencers are more authentic and relatable than traditional influencers like movie stars (Jin et al., 2019).

In spite of the increasing importance of these marketing strategies, pandemic-related restrictions like social distancing and lockdown were obstacles to producing marketing content. In this extraordinary situation, a virtual influencer received attention. A virtual influencer is an influencer that is solely created by software and interacts with consumers via digital mediums, and thus, it can continuously produce marketing contents regardless of the pandemic situation. It often obtains a high level of human likeness in perspective of appearance and behavior, but it is not a real person (Wibawa et al., 2022). A virtual influencer has an advantage for building an innovative brand image. In addition, it effectively represents consistent brand value because it is created to align to the brand image at the very first time.

Though virtual influencers have certain advantages, there are several challenges to consider. Digital media experts pointed out the biggest potential challenge of virtual influencers is the lack of authenticity (Moustakas et al., 2020). Even though virtual influencers obtain high human likeness for its visual representation and storytelling, the influencers are not real humans. Thus, consumers may have doubts about virtual influencers' nature, and these doubts for their authenticity can cause a negative effect on their marketing performance (Arsenyan & Mirowska, 2021; Conti et al., 2022). Since authenticity of influencers is a key element of influencer marketing, it is necessary to understand how consumers perceive virtual influencers' authenticity for their successful adoption. However, to the best of our knowledge, factors which can affect users' authenticity doubt toward virtual influencers have not been investigated yet. Therefore, we will investigate how and what factors can potentially affect

consumers' doubts toward virtual influencers' authenticity in social media. This research aims to improve understanding of consumer perception on a virtual influencer and suggest practical implications to enhance the effectiveness of their application.

This paper consists of the following structure. First, the existing works related to the nature of influencer marketing and characteristics of virtual influencers are reviewed. After that, data gathering and analysis methods are described, and preliminary analysis results are discussed. Then, practical implication and limitation of the preliminary results is suggested.

LITERATURE REVIEWS

Influencer marketing and influencers' authenticity

Social media marketing refers to a firm's activities generating social media resources to advance customer engagement and increase marketing performance (Li et al., 2021). Covid-19 accelerated changes in consumers' social media marketing behavior, and now consumers are more likely to use social media as a decision-making tool (Mason et al., 2021). Mason (2020) identified that consumers have a significant tendency of social media utilization behavior for identifying, comparing, evaluating, and purchasing products than before the pandemic.

For the past decades, social media Influencers became a crucial element for social media marketing (Kim & Kim, 2021). In general, influencers refer to social media users with considerable numbers of followers who can potentially affect an individual's purchase intention. Fundamentally, these individuals are not built solely for marketing purposes, and they pursue a broader scope of outcomes, for example gaining the attention from audiences and creating customer engagement with products (Brown & Hayes, 2008). Thus, they are distinguished from traditional celebrities in terms of their goal of using social media.

A number of marketing literature explored effects and their mechanisms of influencer marketing on marketing outcomes, especially in the perspective of trust. Kim & Kim (2021) investigate how influencer characteristics affect marketing outcomes. The authors suggested that trust has a mediating effect of influencer characteristics on marketing outcomes. Based on the social exchange theory, authenticity, homophily, and expertise of influencers have a positive impact on marketing outcomes such as loyalty to influencers, product attitude, and purchase intention. Lou & Yuan (2019) proposed an integrated model to explain the marketing effect of influencers. This social media influencer value model represents that informative value of contents, trustworthiness, attractiveness, and similarity to followers have a positive impact on trust in branded posts which affects brand awareness and consumers' purchase intention. (Lou & Yuan, 2019)

Several literatures confirmed that trust and trustworthiness are important elements of influencer marketing for achieving desirable marketing outcomes. In particular, influencers' perceived authenticity is a critical premise on consumers' trust, because intuitively, if consumers feel an influencer is not real, they will not consider the influencer as a proper source of trust. Particularly, Jin et al. (2019) identified the power of influencer marketing and its mechanism by comparing social media influencers and traditional celebrities such as movie stars. The authors argued that consumers feel a stronger social presence to social media influencers than traditional celebrities, and the social presence mediates a causal effect relationship between influencer type and trustworthiness. Through the research, authenticity and relatability are indicated as salient factors for social presence regarding to type of influencer. When people feel an influencer is more real, they feel like the influencer is more feasible and attainable, and this perception leads to higher trustworthiness, more positive brand attitude, and higher envy.

Virtual influencer

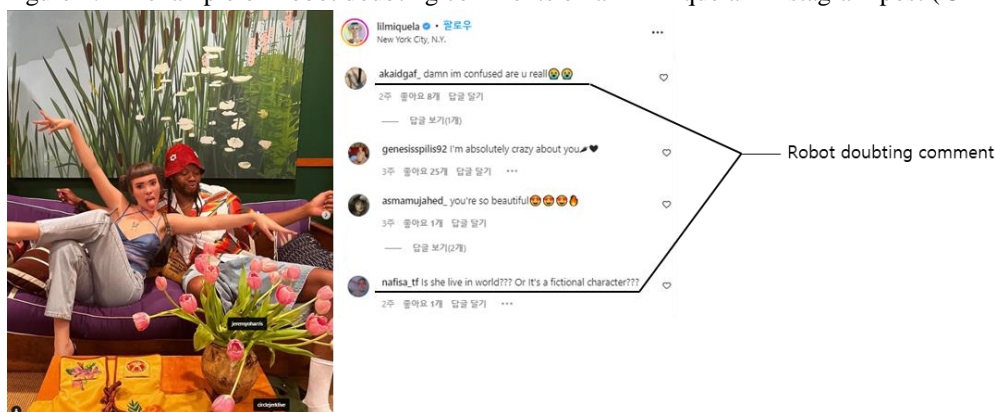
A virtual influencer is a computer-generated influencer which often presents human characteristics in terms of appearance and personality (Moustakas et al., 2020; Wibawa et al., 2022). It interacts with consumers via digital mediums, especially image-oriented social media platforms including Instagram. For example, Lil Miquela is one of most famous virtual influencers with over three million followers on Instagram. It identified itself as 19-years-old Brazilian-American female living in LA. It is Computer-Generated Imagery (CGI) and usually posts photos of daily lives and selfies.

Emergence of virtual influencers suggests several new opportunities for the influencer marketing area (Conti et al., 2022). One thing to note is that virtual influencers are highly flexible in content production regardless of physical limitations. Human influencers were constrained for producing their contents by Covid-19 restrictions, but virtual influencers are relatively less affected by the policy changes. In addition, virtual influencers can help to build innovative brand image, especially for young generations. For instance, a Korean public organization introduced a virtual influencer to appeal to the target market with an innovative and tech-sassy brand image. On 24th June 2022, the Korea Tourism Organization introduced "Yeo Lizzie" for

honorary ambassador of Korea tourism through its social media channels. Yeo Lizzie is a 22-years-old virtual influencer. The organization has appointed world-popular celebrities like Son Heung-Min and EXO to its ambassadors.

Nevertheless, the lack of authenticity and relatability is pointed out as its potential challenge (Conti et al., 2022; Moustakas et al., 2020). Though the key component of influencer marketing is authenticity of the influencers (Jin et al., 2019; Kim & Kim, 2021; Lou & Yuan, 2019), consumers may perceive the virtual agents as unrelatable and less authentic because they are not real humans. Arsenyan and Mirowsak (2021) identify users' significant negative reaction and high robotic doubts for human-like virtual influencers. The authors investigate users' reaction toward virtual influencers on Instagram by comparing three different types of Instagram influencers in perspective of user engagement and reaction. They selected an anime virtual influencer, a human-like virtual influencer, and a human influencer for their analysis. Among these three types, the users showed significant negative reactions toward the human-like influencer than the others. In Particular, doubt of its nature and authenticity is the highest for the human-like virtual influencer. Their work suggests that highly human-like virtual influencers are obtaining high ambiguity for its nature, and this may cause uncanny valley phenomenon which affects their negative reaction and doubt for the influencer's nature. This may harm the influencers' trustworthiness and decline brand loyalty (Conti et al., 2022).

Figure 1: An example of Robot doubting comments on a Lil Miquela's Instagram post (@LilMiquela)



For effective adoption and utilization of virtual influencers, it is important to understand consumers' doubts for virtual influencers' authentic nature in social media. Throughout the study, we aim to identify factors that can affect consumers' perception on authenticity of virtual influencers in social media.

DATA & METHODOLOGY

Data and Variables

We collected a total 501 Instagram posts of Lil Miquela for our sample data. As described before, Lil Miquela is a virtual influencer, and she introduced herself as a 19-year old woman who lives in Los Angeles, a Brazilian-American model, musical artist in her Instagram bio. In 2018, she was on the list of the 25 most influential people on the internet from Time Magazine. Arsenyan and Mirowsak (2021) validated that Lil Miquela is perceived as the most human-like virtual influencer than other famous virtual agents by Instagram users. Though Lil Miquela is active on Instagram as well as Twitter and YouTube, virtual influencers are usually more active on Instagram than other social media such as TikTok and Facebook (Conti et al., 2022). Therefore, we selected Lil Miquela for our focal virtual influencer and gathered data from Instagram.

We gathered data from Miquela's latest 501 Instagram posts, including timestamps, locations, number of likes, number of comments, post-images, picture-tagging texts, post content, post-tagging texts, and comments. We calculated readability (Hu et al., 2012) and sentiment from textual information in each post. In terms of comments, we obtained 500 recent comments for each post for the analysis. Total 25,500 comments were preprocessed such as removing non-English words, emoticons, numbers, and stop words. In the case of images, we extract abundant image characteristics like resolution, hue, brightness and so on. Furthermore, we used Facial emotion recognition (FER) to calculate the percentage of emotions (angry, disgust, fear, happy, sad, surprise, neutral) in each image. Afterwards, we get the proportion of "robot doubting" comments of each post as a dependent variable by using topic modeling.

Method

Topic modeling

Topic modeling is a data mining method used to understand and categorize documents by extracting word patterns in text contents (Saxton, 2018). It allows us to understand what kinds of topics the documents have. In this study, we set the percentage of "robot" topics in each post's comments as the dependent variable. For the analysis, we preprocessed text data: all the words were changed to lower letter, uninformative words (stop-words) like 'a', 'the', 'in', 'because', and 'and' were eliminated. Additionally, we dropped unrecognizable words by comparing each word with word corpus in NLTK. Afterwards, we also identified infrequent words which might cause noise on our data. Lastly, we lemmatized each word to reduce them to their lexical form.

For Topic modeling, we used the widely used Latent Dirichlet Allocation(LDA) from gensim, which is an open-source library for unsupervised topic modeling. Additionally, to find the proper number of topics, we build many LDA models with different numbers of topics(k) and pick the one that gives the highest coherence value. In this analysis, we got high values of coherence with 4, 8, and 12 topics. We chose 4 topics because we got the same keywords('robot') being repeated in multiple topics, which means 'k' is too large.

As a result of the topic modeling, four topics were identified: 69.3% of tokens from each post's comment sentences were about "robot doubting" (Topic1: robot, like, confused, human, really, etc.), 16.7% were about "beauty" (Topic 2: beauty, perfect, stunning, baby, precious, etc.), 13.6% were "non-English" (Topic 3), and 1.3% were about "military" (Topic 4: military, democracy, leader, government, citizen, etc.). We were unable to exclude certain non-English words that are in the NLTK word corpus, which caused the Topic 3(non-English). Moreover, topic 4 is not about virtual influencers, which stems from government and war-related issues.

Table 1: Variable description

VARIABLES	Descriptions	Source
Number of Likes	Number of Likes in each post	
Number of Comments	Number of Comments in each post	
Video	1: if the post has video	
Number of Pictures	Number of pictures in each post	
Number of tags	Number of tags in post's picture	
Location	1: if post has location tag	
Time	Day passed from posting date	
Number of Emojis	Number of emojis used in post's content	
Readability	Readability score	Hu, N. et al. 2012
Text - Positive	Positive sentiment score (0,1)	NLTK
Text - Negative	Negative sentiment score (0,1)	NLTK
Text - Neutral	Neutral sentiment score (0,1)	NLTK
Image – High resolution	1: if resolution higher than mean value	
Image – Positive	Positive emotion score from picture (0,1)	fer library
Image – Negative	Negative emotion score from picture (0,1)	fer library
Image - Neutral	Neutral emotion score from picture (0,1)	fer library

PRELIMINARY RESULTS

First, we investigate whether our interest topic from consumer reviews really matters to virtual influencers. Table 2 showed that Topic which is related with robot doubting is negatively associated with popularity measured by likes and comments. These results partly indicate evidence about the importance of studying which factors increase or decrease consumer's robot doubting topic score. The core dimension of social media marketing is customer engagement which includes following, viewing, likes, shares, and comments (Li et al., 2021).

Table 2: Negative effect of robot doubting on post popularity

VARIABLES	(1) Popularity (likes)	(2) Popularity (comments)
Topic – Robot doubting	-0.6752*** (0.1016)	-1.6529*** (0.1249)
Constant	11.5950*** (0.0675)	7.5286*** (0.0877)
Observations	501	501
R-squared	0.0802	0.2733

To see which component affects consumers' robot doubting topic scores, we divide numerous features into two categories. One is text-related features and the other is image-related features. Interestingly, when the post's readability is high, more consumers leave comments with regards to virtual influencer's robotic nature. In contrast, when the sentiment in each post is close to positive or neutral, people tend to talk less about authenticity. Among the image features, pictures with high resolution decrease a topic related with robot doubting. For face expression, pictures with positive and neutral facial emotions effectively decrease topic score. Both in text and image, only positive and neutral valence statistically significantly affects consumer's topic ratio.

Considering stereotypical images of a robot, it is not surprising that users express less robot doubting toward a post expressing neutral emotion. The neutral text sentiment and facial expression might accord with preformed image of robot and decrease ambiguity of the virtual influencer. An unexpected result of this explanatory study was that significant effect of positive emotion to decreasing robotic doubts. One possible explanation is that the uncanny valley phenomenon is primarily related to fear, and expressing positive emotion is less likely to induce feeling of fear and eeriness. In addition, Tinwell and her colleagues declared that a fully animated character expressing happiness is rated lowest in terms of human-likeness. According to their result, the users may feel lower human-likeness to a virtual agent expressing positive emotion and clearly recognize its robotic nature (Tinwell et al., 2011). This possibly implies that happiness can eliminate ambiguity of a virtual influencer's authenticity, and thus decrease robotic doubts.

Table 3: Main regression results

INDEPENDENT VARIABLES	(1) Topic Ratio	(2) Topic Ratio	(3) Topic Ratio
Number of Likes	0.1528*** (0.0251)	0.1561*** (0.0249)	0.1653*** (0.0257)
Number of Comments	-0.2140*** (0.0211)	-0.2147*** (0.0208)	-0.2161*** (0.0216)
Video	0.0237 (0.0208)	0.0208 (0.0204)	-0.0025 (0.0224)
Number of Pictures	-0.0014 (0.0051)	-0.0030 (0.0050)	-0.0010 (0.0053)
Number of tags	-0.0009 (0.0027)	-0.0014 (0.0028)	-0.0014 (0.0028)
Location	-0.0136 (0.0146)	-0.0141 (0.0151)	-0.0119 (0.0152)
Time	-0.0004*** (0.0000)	-0.0004*** (0.0000)	-0.0004*** (0.0000)
Number of Emojis		0.0015 (0.0067)	0.0046 (0.0067)
Readability		0.0024* (0.0012)	0.0021* (0.0012)
Text - Positive		-0.1258** (0.0553)	-0.0944* (0.0551)
Text - Negative		-0.0380 (0.0589)	-0.0136 (0.0577)
Text - Neutral		-0.1031** (0.0510)	-0.0836* (0.0494)
Image – High resolution			-0.0379*

			(0.0226)
Image – Positive			-0.0987***
			(0.0372)
Image – Negative			-0.0541
			(0.0410)
Image - Neutral			-0.1147***
			(0.0358)
Constant	0.5881***	0.6436***	0.6531***
	(0.1871)	(0.1899)	(0.1861)
Observations	501	501	501
R-squared	0.5108	0.5213	0.5319

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

DISCUSSION

This study explored which factors on social media affect users' robot doubting reactions. To identify these, we collected data from a famous virtual influencer's Instagram account(Lil Miquela) and conducted LDA topic modeling. Our research is novel as it provides interesting insights into virtual influencers as below.

First, robotic doubts and popularity measured by number of likes and comments have negative relationships. The negative relationship between robotic doubts and a post's popularity states that consumers are less likely to engage a post which the virtual influencer's nature is ambiguous and raises robotic doubts. This finding emphasizes the importance of authenticity of virtual influencer in the perspective of influencer marketing which aligns with existing marketing literature. As consumer engagement is a core element in social marketing, it is important to minimize consumers' doubts about virtual influencers' robotic nature to increase customer engagement.

Thus, it is necessary to understand how consumers perceive virtual influencer generated content, and we identified Instagram post's characteristics which can decrease robotic doubts toward virtual influencers. The preliminary results indicate significant effects of Instagram posts' text and image features on decreasing robotic doubts. With high readability, neutral and positive post content decrease the users' robot doubting comments. In terms of images, the high resolution positive and neutral faces of virtual influencers have a significant effect on decreasing robot doubting.

There is no doubt that virtual influencers with high human likeness in terms of behavior and appearance can attract the public and have several advantages to accomplish certain desirable marketing outcomes. However, arguably, this work raises a question about effectiveness of their high anthropomorphism in terms of social media marketing. The results show the ambiguity of virtual influencers' nature might cause negative reactions of the consumers. There have been intense debates about the appropriate scope of anthropomorphism. Though generally human likeness of non-human agents increase users' emotional attachment and engagement, the scope of how much human likeness the agents should pursue is still controversial. Uncanny valley theory suggests that too much human likeness of non-human agents evokes unpleasant emotional responses of users (Mori et al., 2012), and it possibly reduces consumers willing to engage with the agents (Złotowski et al., 2015). Furthermore, Arsenyan and Mirowsak (2021) argue that ambiguous nature of human-like virtual influencers might induce users' negative reactions due to uncanny valley. As a result, we can reasonably conclude virtual influencers to be clearly distinguished from human influencers in terms of their image and text representation in order to increase user engagement.

Contribution

The work is expected to contribute to the influencer marketing and virtual agent literature by enhancing understanding of consumer perception on virtual influencers and their social media engagement. The findings confirmed an existing social media marketing insight that authenticity is an important component of influencer marketing as well as for virtual influencers. Also, we broaden the understanding of virtual influencers marketing and suggest. We discovered that user robot doubts have a negative impact on the popularity of virtual influencer posts. The results show that a high proportion of robot doubting comments on the posts lowers the posts' like and number of comments.

The findings imply practical implications for marketing usage of virtual influencers. The way to represent its human-likeness should be carefully managed depending on the purpose of use. This study suggests how to manage virtual influencers to get

high popularity. The users' robot doubting response should be managed to increase the users' attention. To lower the robot's doubting response, post-text and image should be positive or at least neutral in mood.

Future research

This preliminary work has several limitations in terms of data collection. First, the comment data is limited to English comments. Because Instagram is an international social media platform and accessible for global users, we cannot claim there is not any self-selection bias for our dataset. Furthermore, demographic information of users is not included in the data due to the systemic restriction of Instagram. We were not able to gather the users' demographic information like age, gender, and education level, while this information arguably affects technology acceptance and perception.

We selected Instagram for the influencer marketing channel, because it is an image-oriented medium platform which is more general and accessible social media for virtual influencers than video-oriented platform in terms of content production. However, some virtual influencers are being utilized on various social media platforms. For instance, Lil Miquela has its Twitter account and YouTube channel, and Yeo Lizzie interacts with users through Instagram, YouTube, and TikTok. For future research, we will examine the effect of other marketing channels. Moreover, the other virtual influencers will be included for generalized results.

CONCLUSION

This work examines consumer perception on virtual influencers in social media and factors affecting the perception. On the basis of topic modeling and regression analysis, the preliminary show that consumer doubts about virtual influencers' authenticity and popularity of posts are negatively associated. The analysis reveals that text features including readability and sentiment and image features including resolution and facial expression tend to decrease robotic doubts. In conclusion, human likeness of virtual influencers should be carefully controlled to decrease robotic doubts and increase consumer engagement in the perspective of influencer marketing.

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