**Project Title: The Influence of Virtual Influencers Compared to Human Influencers on Users' Emotional Responses in Social Media Platforms**

**Research Goals: An Examination and Comparison of the Emotional Impact of Posts and Publications by Virtual Characters Versus Human Individuals on Social Media Platforms: Investigating the Effect of Knowing Whether an Influencer is Virtual or Human on Users' Emotional Responses**

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# The Influence of Virtual Influencers Compared to Human Influencers on Users' Emotional Responses in Social Media Platforms

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## Abstract

*This research examined emotional responses to virtual versus human influencers on Twitch streams through sentiment analysis. Statistical analysis revealed three key findings: (1) Virtual influencers did not evoke more negative responses (T-statistic = -3.5827, p ¡ 0.001, Cohen's d = -0.0326) contrary to expectations; (2) Human influencers generated significantly higher positive sentiment (T-statistic = -14.7844, p ¡ 0.001, Cohen's d = -0.1361); and (3) Overall emotional responses showed significant differences between groups (T-statistic = -13.8505, p ¡ 0.001, Cohen's d = -0.1243). While all differences were statistically significant, the small effect sizes suggest modest practical differences in how users emotionally engage with virtual versus human influencers.*

## 1. Introduction

With the rapid development of social media and e-commerce, the concept of "influencer" is defined as "an individual who has significant effects on others" , is introduced, and famous in social media (e.g. Instagram, Facebook, Twitter,Twitch). With this concept, several companies and organizations have attempted to conduct marketing activities with influencers in social media, to attract new customers [1] .Moreover,several unique types of influencers have been proposed and employed. Among them, a virtual influencer (VI), which is defined as "the modern-day version of fictional brand characters or mannequins in shop windows that are suddenly more lifelike and real" [2].

Virtual influencers (VIs) resemble human characteristics, behavior, and actions but do not correspond to any human in the real world. Companies are not publicly disclosing the software or technology used to create virtual influencers (VIs)[3]. However, it is expected that these VIs are created using advanced computer-generated imagery (CGI) techniques, which rely on artificial models built with computer vision-based graphic technologies [4, 5]. Sometimes, VIs are digitally altered versions of real people or a digital combination of a CGI-made head and a real person's body.These models and technologies work together to generate the lifelike appearance and behaviors of the virtual influencers. We presume that even content related to VIs (e.g., posts), which nowadays is mainly created by humans, will always be more gener-ated by artificial intelligence (AI). [3].

One recent study stated that people like or comment on VIs' posts three times more than human influencers ones. This trend began in 2019 and was consistent in 2020 as well [6], yet how people emotionally respond to them remains unclear . Understanding this is important because VIs are prone to inflating people's perceptions. By redrawing expectations for appearance, style, and culture, adolescents could feel forced to imitate and follow those standards. This could negatively affect the audience's mental and physical health without considering that these digital creations do not physically exist in the real world [3]. At the same time, companies can leverage this insight to strategically enhance their brand image using VIs

Emotional response refers to the immediate and instinctive feelings that individuals experience in reaction to stimuli, such as social media content. It encompasses a range of emotions, including happiness, sadness, anger, and surprise, which can influence subsequent behaviors and attitudes [7]. Emotional responses are often measured through various psychological frameworks that assess both subjective feelings and physiological reactions, revealing how content resonates with an audience on a deeper level [8].Thus, examining how people emotionally respond to both VIs and human influencers is critical to understanding the broader impact on behavior, both for individual well-being and brand influence.

Previous studies have explored various aspects of how virtual influencers impact people emotionally. For example, Arsenyan and Mirowska [9] studied how people react to virtual influencers who look almost

human and found that these influencers often make people feel uneasy. Molin and Nordgren [10] examined how the authenticity of virtual influencers affects how much people trust and connect with them, finding that human influencers are generally trusted more. Stein et al [11] looked at how the appearance and abilities of virtual influencers influence user acceptance, showing that while advanced virtual influencers can be engaging, they are still less emotionally connected than human ones. Block and Lovegrove [12] researched how virtual influencers like Miquela can still build strong emotional connections with their audience, despite being virtual. However, in the study by Stein, Breves, and Anders [13], no additional insights were found regarding the emotional difference between virtual influencers and human influencers , but participants responded more strongly to virtual characters, despite perceiving them as less "human" and less similar to themselves. In contrast to all other studies, the paper by Ham, Li, Looi, and Eastin [14] analyzed only the virtual influencer and not the human influencer.The results showed that most of the virtual influencer's posts conveyed positive emotions, with emotions like happiness and love leading to perceptions of higher emotional intelligence, anthropomorphism, and authenticity, resulting in more positive attitudes, while sadness and lust led to less favorable responses.

This research examines the emotional impact of virtual influencers compared to human influencers on users in social media platforms. It focuses on how content created by virtual influencers affects users emotionally and whether these reactions differ from those caused by human influencers. By looking at these differences, the study aims to highlight how virtual influencers influence user engagement, trust, and brand perception, and what this means for the future of influencer marketing. Additionally, the findings will serve as a resource for decision-makers in educational institutions, equipping them with the tools needed to address the emotional implications of the emerging phenomenon of virtual influencers on social networks.

## 2. Literature review

In recent years, virtual influencers (VIs) have entered the market, creating competition for human influencers .Virtual influencers are fictional, computer-generated individuals who possess human traits, characteristics, and personalities [15]. These artificially created characters amass followings of up to a few million on social media platforms.

Mori's uncanny valley theory [16] predicts that consumers may respond negatively when artificial faces become too realistic, resulting in feelings of uncanniness and creepiness. Consequently, consumers' perceptions of VIs can reach a point where animosity and mistrust outweigh curiosity and fascination. A recent report shows that followers engage more with VI-generated content than with content from human influencers within the same follower number range [17]. Other studies have shown that VIs' lack of authenticity and transparency could diminish consumers' positive reactions to and credibility and trust in VIs' sponsored posts [9, 10, 18]

Although they are computer-fabricated identities, virtual influencers – like human influencers – are content generators and personalities on social media. They exhibit human characteristics in their posts and interactions with followers, amassing a sizable following [19, 20, 21]. When judged by their level of human likeness, virtual influencers can be broadly split into two categories: anime-like VIs (e.g., Noonoouri) and human-like VIs (e.g., Lil Miquela)[9].

The study by Arsenyan and Mirowska [9] explores the interaction dynamics between users and different types of influencers on social media, focusing on comparisons between human influencers (HIs), human-like virtual influencers (HVIs), and anime-like virtual influencers (AVIs). The research aimed to understand how these various influencers impact user engagement and emotional responses, particularly concerning the Uncanny Valley phenomenon, where entities that appear almost human but not quite can evoke feelings of unease. The researchers conducted an 11-month longitudinal study, analyzing posting behaviors and user comments related to three distinct influencers: a human influencer, a human-like virtual influencer, and an anime-like virtual influencer. They gathered data from social media platforms, focusing on 46,827 user comments. The study analyzed key variables such as the number of comments, emotional tone (positive and negative emotions), word count, and the use of informal language. The findings revealed significant differences in user engagement depending on the type of influencer. The human-like virtual influencer attracted a higher volume of comments; however, these comments were generally less positive, reinforcing the Uncanny Valley hypothesis. Users expressed skepticism and doubt about the authenticity of the human-like virtual influencer more frequently than with the other influencers. In contrast, the human influencer elicited a broader range of emotional responses, including both positive and negative sentiments. Research methodology in this article is suitable for our study.

In a related study, Molin and Nordgren [10] explored the emotional responses of consumers to

virtual influencers and the factors of source credibility that enhance parasocial interactions on social media. The researchers employed a qualitative research design, conducting semi-structured interviews with Swedish consumers who engaged in a pretest by following and interacting with two virtual fashion influencers on Instagram. The study focused on users' perceptions of the virtual influencers, their emotional responses, and the credibility of these digital personas. The findings indicated that consumers generally responded more positively to virtual influencers that exhibited human-like traits, such as relatable appearances and lifelike activities. However, concerns about authenticity were prominent, with users often perceiving virtual influencers as less genuine compared to human influencers. This perception of authenticity significantly impacted users' emotional responses, with many preferring content that felt human and relatable. The study highlighted the importance of source credibility in fostering effective parasocial interactions on social media platforms, suggesting that both virtual and human influencers face challenges in maintaining credibility and emotional connection with their audiences.

The articles by Stein et al. [11] and Block and Lovegrove [12] further explore the impact of virtual influencers on user engagement and emotional responses, particularly in comparison to human influencers. Stein et al. [11] aimed to understand how the appearance and mental capabilities of digital entities, including virtual influencers, influence user acceptance and emotional responses. To achieve this, the researchers conducted an online experiment where participants were exposed to different types of influencers. They manipulated two independent variables: the Type of Influencer (virtual or human) and Mental Capabilities (simple algorithms or advanced AI). Participants were shown visual and textual stimuli, and their emotional responses were measured. The findings revealed that virtual influencers with human-like features and advanced emotional capabilities elicited mixed reactions. While they were perceived as innovative and engaging, they also triggered feelings of eeriness, similar to the uncanny valley effect observed in humanoid robots. In contrast, human influencers were generally seen as warmer and more emotionally connected, leading to a higher level of acceptance. This suggests that despite the advanced features of virtual influencers, users prefer the authenticity of human influencers, and concerns about authenticity and trustworthiness negatively impact engagement with virtual influencers.

Block and Lovegrove [12] focused on how virtual influencers, such as Miquela, engage audiences and affect emotional responses within the realms of public relations and influencer marketing. The researchers employed a mixed-method approach that included digital ethnography, manual textual analysis, and computational sentiment analysis. The data analyzed included over 800 texts, with a specific focus on 80 Instagram posts and 64 news articles about Miquela, collected through typical case sampling. The study covered a four-year period from April 2016 to July 2020, analyzing Miquela's social media presence, news media coverage, and fan comments. The findings revealed that Miquela successfully cultivates parasocial relationships with her followers, characterized by a sense of friendship and emotional interaction. This connection enhances her credibility and influences followers' purchasing intentions. The study highlights that Miquela's storytelling, which includes personal experiences and social justice advocacy, resonates deeply with her audience, creating a sense of authenticity despite her virtual nature. The research suggests that the unique nature of CGI characters like Miquela allows them to navigate the complexities of identity and engagement in digital spaces, challenging traditional notions of authenticity in influencer marketing.

However, in the study by Stein, Breves, and Anders [13], no additional insights were found regarding the emotional difference between virtual influencers and human influencers. The aim of the study was to examine how individuals respond to virtual influencers compared to human influencers, with a focus on interactions through video content featuring both virtual and real-life characters. The goal was to assess the perceived similarity and humanness between the characters in the virtual and real-life videos. The experiment involved 179 participants, who were divided into two groups. Each group watched a video featuring either a human or virtual influencer from a popular streaming program. Participants then completed questionnaires that assessed their perceived similarity to the character, the character's perceived humanness, and their level of interaction with the character. The results of the study revealed no significant difference in interaction ratings between the human and virtual influencer groups. However, participants demonstrated a stronger response to virtual influencers, despite perceiving them as less "human" and less similar to themselves. Their study aims to further explore the types of emotions elicited in response to videos of virtual characters compared to real-life characters, as well as examining reactions to live-stream videos that were not assessed through questionnaires.

In contrast to all other studies, the paper by Ham, Li, Looi, and Eastin [14] analyzed only the

virtual influencer and not the human influencer.The article focuses on how users perceive the emotional expressions of virtual influencers (VIs) on social media and how these perceptions influence their attitudes toward the virtual influencers. The goal of the research was to investigate how the emotional expressions of virtual influencers on social media affect users' perceptions of the influencers' emotional intelligence, anthropomorphism, and authenticity, and how these factors influence users' overall attitudes toward the virtual influencers. The article includes two separate studies: in the first study, sentiment analysis was conducted on 1,196 Instagram posts from a prominent virtual influencer (Miquela Sousa) to examine the frequency, proportion, and intensity of emotions (positive vs. negative) conveyed in the captions accompanying her posts. In the second study, an online experiment was conducted with 142 participants from Generation Z and Millennials, who were exposed to posts from the same virtual influencer expressing emotions (happiness, sadness, love, lust) or no emotion, and their responses were measured in terms of perceived emotional intelligence, anthropomorphism, authenticity, and attitudes toward the virtual influencer. The results showed that: Study 1: Sentiment analysis revealed that most of Miquela's posts conveyed positive emotions, with higher frequency and intensity of positive emotions compared to negative ones. Study 2: Virtual influencers expressing emotions (especially happiness and love) were perceived as more emotionally intelligent, anthropomorphic, and authentic, which led to more positive attitudes toward them. Happiness, in particular, elicited the most positive responses, while lust and sadness led to less favorable reactions. However, unlike our study, this research does not compare the strength and types of emotions between human and virtual influencers within similar domains. Additionally, the analysis focuses on only one virtual influencer. It is important to conduct our experiment to provide a more comprehensive comparison and to examine whether the conclusions hold across additional profiles.

The first hypothesis—that emotional responses to posts by virtual influencers are more negative compared to those generated by human influencers—is supported by the Uncanny Valley theory. According to Mori [16] and subsequent studies [9], highly realistic virtual entities can evoke discomfort and negative reactions due to their almost-human appearance. This aligns with findings from Block and Lovegrove [12] , which suggest that despite advanced features, virtual influencers can trigger feelings of eeriness and skepticism.

The second hypothesis—that users will exhibit higher levels of affection and emotional identification with content presented by human influencers compared to virtual influencers—draws on research emphasizing the value of authenticity in forming emotional connections. Studies by Molin and Nordgren [10] and Stein et al [11]. highlight that human influencers are perceived as more genuine, leading to stronger emotional bonds and greater trust. These emotional connections are fundamental to effective parasocial interactions, which are less readily achieved with virtual influencers due to concerns about their authenticity.

The third hypothesis—that users will display greater curiosity and admiration towards content from virtual influencers compared to human influencers—acknowledges the novelty and innovative appeal of virtual influencers. As noted by Baklanov [17] and Miyake [19], virtual influencers often attract attention due to their unique and futuristic nature, which can lead to heightened curiosity and interest. This increased fascination with virtual characters, despite their potential for negative emotional responses, reflects their role as novel entities in the digital landscape.

The motivation behind these research questions and hypotheses stems from the need to understand the nuanced emotional dynamics between virtual and human influencers. By investigating these aspects, this study aims to contribute to the broader field of social media marketing and influencer research. It seeks to provide insights into how different types of influencers affect user engagement and emotional responses, offering valuable implications for content creators, marketers, and platform designers in crafting more effective and resonant social media strategies.

## 2.1. Research questions

How do virtual influencers compared to human influencers affect users' emotional responses on social media platforms?

## 2.2. Hypotheses

1. Emotional responses to posts by virtual influencers are more negative compared to those generated by human influencers.

2. Users exhibit higher levels of affection and emotional identification (approximated by the positive sentiment score) with human influencers' content compared to virtual influencers'.

3. There is a significant difference between the emotional responses to posts made by virtual characters versus human characters.

## 3. Methods

In this study, data was collected on user comments during live video broadcasts on the Twitch platform, comparing responses to virtual gaming users and real users. All comments from the selected videos were collected and tagged by the name of the video, with each video being linked to its respective user (virtual or human).

Before conducting sentiment analysis, a crucial preprocessing stage was cleaning the comments to ensure data quality and relevance. The cleaning process was implemented using the following steps:

1. **Emoji and Emoticon Replacement:** Emojis and emoticons were replaced with descriptive text using predefined mappings. For example, ":)" was replaced with "happy" and ":(" with "sad."
2. **Commas Formatting:** Ensured that commas were followed by a space for better tokenization.
3. **Lowercase Conversion:** All text was converted to lowercase to standardize the data.
4. **Stopword Removal:** Common words with little analytical value (e.g., "the," "is") were removed unless they contributed to sentiment (e.g., "not").
5. **Sentiment Words Filtering:** Words in the positive and negative sentiment lexicon were preserved to retain analytical context.
6. **Text Simplification:** URLs, special characters, punctuation, and numbers were removed.
7. **Stemming:** Words were reduced to their root forms to handle variations (e.g., "running" became "run").
8. **Final Cleanup:** Extra spaces were removed, and the words were cleaned and rejoined into coherent text.

This cleaning pipeline was implemented using Python, ensuring high-quality data for subsequent sentiment analysis. This structured approach allowed for a robust comparison of emotional responses to content generated by virtual versus real users on Twitch.

Once the cleaning process , the next step involved conducting sentiment analysis. This analysis aimed to identify and classify the emotional tone of each comment based on several key sentiment categories, including positive, negative, or neutral. The positive category measures the proportion of positive words in the text, neutral measures the proportion of neutral words, and negative measures the proportion of negative words. Additionally, a compound score provides a weighted aggregate sentiment, ranging from -1 to 1: values closer to 1 indicate a highly positive sentiment, values closer to -1 indicate a highly negative sentiment, and values near 0 suggest a neutral or mixed sentiment. By applying sentiment analysis techniques, we can identify emotional patterns and trends in the user comments associated with virtual versus human gaming users.

To analyze the emotions in this study, we utilized the Python programming language. Essential libraries, including `pandas` for data management, `nltk` for sentiment analysis, and `scipy` for statistical testing, were installed and imported. Sentiment analysis was conducted using the VADER (Valence Aware Dictionary and Sentiment Reasoner) tool, which provided key sentiment scores: positive (amount of positive sentiment), neutral (amount of neutral sentiment), Negative (amount of negative sentiment), and Compound (overall sentiment score ranging from -1 to 1).

The final phase of the methodology involves comparing the sentiment data between the two categories of users. This comparison will provide insights into the semantic and emotional differences in user engagement between the two categories of gaming influencers in twitch. So,the posts and their sentiment scores were organized into a data frame, with sentiment scores categorized by the source of the posts (virtual vs. human). An independent samples t-test was performed using `scipy.stats.ttest_ind` to compare the sentiment scores, particularly the compound scores, between posts made by virtual characters and those made by human characters. The t-statistic measures the difference between group means relative to the variability within groups, while the p-value indicates the probability of observing the differences due to random chance. An alpha level of 0.05 was set to determine statistical significance.

For further details on the methodology, see the implementation on GitHub: sentiment analysis.

### 3.1. Methodology for Testing Research Hypotheses

H1 - Emotional responses to posts by virtual influencers vs. human influencers: To determine whether posts by virtual influencers elicit more negative emotional responses compared to those by human influencers, we compared the average negative sentiment scores between posts from the two groups. A t-test was conducted to evaluate these differences. A significant result (p-value ¡ 0.05) would indicate that

posts by virtual influencers are associated with more negative emotional responses.

H2 - Levels of affection and emotional identification: To examine whether users exhibit higher levels of affection and emotional identification with content from human influencers compared to virtual influencers, we analyzed the positive sentiment scores. A t-test was used to compare the average positive and compound scores between posts from human and virtual influencers. Higher scores for human influencers would support the hypothesis that users show greater affection and emotional identification with content from human influencers.

H3 - Overall difference in emotional responses: To assess whether there is a significant difference in overall emotional responses between posts made by virtual characters and human characters, a t-test was performed on the compound sentiment scores. This test compared the overall sentiment score between the two groups to determine if there is a statistically significant difference. A significant result (p-value ¡ 0.05) would confirm that emotional responses to posts by virtual characters differ significantly from those by human characters.

In all cases, the t-statistic measures the difference between group means relative to the variability within groups, and the p-value indicates the likelihood that the observed differences are due to random chance. An alpha level of 0.05 was used to determine statistical significance. If the p-value is less than alpha, the null hypothesis is rejected, indicating a significant difference; otherwise, the null hypothesis is not rejected, suggesting no significant difference.

### 3.2. Variables and Measurement

Our research is applied analysis, focusing on developing a prototype model and testing our hypothesis based on the results. In this study, we carefully analyzed user emotional responses to social media posts by examining comment data. Using Python's Natural Language Processing (NLP) libraries, we extracted and measured emotional tones and sentiment polarities (positive, neutral, and negative) in user comments. Our main goal was to compare emotional responses to posts by virtual influencers (AI-generated content) with those by human influencers (human-generated content).

To structure our analysis, we categorized each post based on its origin as either AI-generated (from virtual influencers) or human-generated (from human influencers)—a categorical variable that helped us compare user responses across these two influencer types.

User emotional engagement was measured using four main sentiment scores derived from comment data:

- **Positive Sentiment Score**: Measures how positive each comment is, ranging from 0 (no positive sentiment) to 1 (fully positive). Higher scores mean more positive engagement and affinity with the post.
- **Neutral Sentiment Score**: Shows the level of neutrality in each comment. Scores closer to 1 are more neutral, while lower scores suggest a stronger emotional reaction, either positive or negative.
- **Negative Sentiment Score**: Measures the intensity of negative feelings, also ranging from 0 to 1. Higher scores reflect stronger negative responses, indicating dissatisfaction or criticism.
- **Compound Sentiment Score**: Combines positive, neutral, and negative sentiments into a single overall score, from -1 (most negative) to 1 (most positive). This score helps us get an overall emotional impression of each comment, allowing comparisons across influencer types.

Using these sentiment scores, we aimed to uncover key differences in how users emotionally respond, engage, and connect with content posted by AI versus human influencers.

## 4. Datasets

This study focuses on Twitch, a rapidly expanding social media platform recognized for its significant role in influencer culture and its emphasis on live-streamed content [22]. Given that Twitch is highly interactive and centered around personal engagement, it is an ideal platform to analyze user reactions to virtual versus human influencers

In this study, data was collected on user comments during live video broadcasts on the Twitch platform, comparing responses to virtual gaming users and real users.

The target users we examined are divided into two categories: Virtual gaming users: These are profiles operated by AI or virtual entities and real gaming users: These are profiles operated by actual humans.

For each category, we selected six prominent Twitch profiles within the gaming community:

**Three profiles managed by human influencers:**

- Shroud
- Itshafu

- Pokimane
- CohhCarnage
- Hutch
- NickMercs

**Three profiles managed by virtual influencers:**

- Ironmouse
- Sykkuno
- Vedal987
- Snuffy
- Shylily
- Hajime

All profiles were chosen based on their popularity and engagement with viewers and commenters in the gaming field.

For each account, the ten most popular videos exceeding one hour in duration were chosen. From each video, three segments were extracted: the first 10 minutes, the middle 10 minutes, and the last 10 minutes. This segmentation allowed for the analysis of engagement levels and emotional expressions at different points of the stream, providing a comprehensive view of audience reactions over time.

The comments from each selected segment of the videos were collected separately, resulting in three groups of comments (beginning, middle, and end) per video across ten videos for each of the twelve players, for a total of 360 sets of comments (total 48,053 responses).

All comments from the selected videos were collected and tagged by the name of the video, with each video being linked to its respective user (virtual or human). This labeling structure enabled us to distinguish between different content creators and user types.

### 4.1. document

To better understand user engagement, we analyzed posts from both human and virtual users. The posts created by human users are available at the following link: Link to posts by human users.

Similarly, the posts generated by virtual users can be accessed through this link: Link to posts by virtual users.

These datasets were instrumental in analyzing the emotional impact and engagement patterns associated with human versus virtual influencers.

## 5. Results

This section presents the findings for the three research hypotheses. The results are analyzed using independent samples t-tests to evaluate statistical significance, and effect sizes are calculated using Cohen's $d$ to assess practical significance. Each hypothesis includes a conclusion about whether it is supported or not.

### 5.1. Hypothesis 1: Emotional Responses to Posts by Virtual Influencers are More Negative Compared to Those Generated by Human Influencers

Hypothesis 1 suggested that virtual influencers evoke more negative emotional responses compared to human influencers. The results indicate the opposite, leading to the rejection of this hypothesis. Hypothesis 1 is not supported, as human influencers elicited slightly more negative sentiment compared to virtual influencers, although the practical difference is minimal.

The mean negative sentiment score for virtual influencers was $M = 0.054123, SD = 0.0353$, while for human influencers, it was $M = 0.060259, SD = 0.0351$. The independent samples t-test yielded a $T$-statistic = $-3.582$, with $p < 0.005$. Despite the statistical significance, Cohen's $d$ was $-0.032$, indicating a negligible effect size.

### 5.2. Hypothesis 2: Users Exhibit Higher Positive Sentiment Toward Human Influencers Compared to Virtual Influencers

Hypothesis 2 proposed that users exhibit higher positive sentiment toward human influencers than virtual influencers. The results confirm this hypothesis. Hypothesis 2 is supported, as users expressed significantly higher positive sentiment toward human influencers. However, the practical impact remains limited due to the small effect size.

The mean positive sentiment score for human influencers was $M = 0.143945, SD = 0.0825$, compared to $M = 0.106949, SD = 0.0694$ for virtual influencers. The independent samples t-test yielded a $T$-statistic = $-14.7064$, with $p < 0.001$. The effect size, calculated using Cohen's $d$, was $-0.13$, reflecting a small effect.

### 5.3. Hypothesis 3: There is a Significant Difference in Overall Emotional Responses Between Virtual and Human Influencers

Hypothesis 3 stated that there is a significant difference in overall emotional responses, measured by compound sentiment scores, between virtual influencers and human influencers. The results support this hypothesis. Hypothesis 3 is supported, as there is a statistically significant difference in overall emotional responses, favoring human influencers. Nonetheless, the practical significance of this difference is small.

The mean compound sentiment score for human influencers was $M = 0.064223, SD = 0.068$, compared to $M = 0.032724, SD = 0.056$ for virtual influencers. The independent samples t-test produced a $T$-statistic = $-13.8505$, with $p < 0.001$. Cohen's $d$ for effect size was $-0.126$, indicating a small effect.

## 6. Conclusions

### 6.1. Neutral Emotional Responses

The study revealed that emotional responses to virtual influencers differ significantly from those directed at human influencers. While posts by human influencers typically evoke clear positive or negative emotional reactions, the responses to virtual influencers are mostly neutral. This suggests that people may feel a sense of unease or a lack of identification with virtual influencers, leading them to avoid expressing strong emotions. As a result, emotional engagement with virtual influencers tends to be lower, and interactions with their content often feel less meaningful or engaging compared to content created by human influencers.

### 6.2. Small Effect Sizes

Although the differences observed in the study are statistically significant, their practical impact is relatively small. Small effects, however, should not be overlooked, as they can become highly meaningful when applied at scale, in critical environments, or when accumulated over time. For example, a slight difference in emotional engagement could have a significant impact in large marketing campaigns, influencing customer behavior and decision-making. These findings underscore the importance of focusing on small but meaningful details when developing strategies, designing models, and refining technologies. Every small improvement can contribute to a broader, more impactful outcome.

### 6.3. Key Drivers of Emotional Impact

Two critical factors play a role in determining the emotional impact of influencers: perceived authenticity and the ability to create emotional connections. Human influencers often excel in both areas, as they bring relatable and genuine qualities to their content, fostering trust and a sense of connection with their audience. On the other hand, while virtual influencers often capture attention due to their innovative and unique nature, they may struggle to evoke the same level of emotional attachment. Their artificial origins can create a barrier to forming deeper emotional bonds with their audience, which may lead to a sense of detachment.

### 6.4. Overall Implications

The findings highlight the unique challenges and opportunities in utilizing virtual influencers effectively. To close the gap between virtual and human influencers, efforts should focus on improving the authenticity and relatability of virtual characters. Enhancing their emotional appeal and creating content that resonates on a deeper level with audiences can help virtual influencers build stronger connections and increase their overall impact.

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