



# Good night versus goodbye? Comparing the mourning remarks of virtual and human uploaders through a data- mining approach

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## Abstract

In response to the rapid growth in the popularity of virtual humans, this study investigates the attitudes and perceptions of young viewers, from Generation Z in particular, toward virtual uploaders (VTubers). We qualitatively and quantitatively compared the online mourning directed at the “demised” virtual uploaders and deceased human uploaders, and human celebrities through a data-mining approach. Two salient patterns emerge. The mourning remarks for virtual uploaders are considerably different from those concerning human celebrities. And the mourning remarks for the disembodied human uploaders are more consistent with those for virtual uploaders, but the remarks for embodied human uploaders are more in line with those for offline celebrities. Our findings suggest that young viewers are becoming accustomed to virtual beings in online environments and are beginning to treat humans like machines based on their similarities

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(the degree of embodiment in this case). Young generations immersed in virtual spaces may develop different concepts of life, demise, and even humanity.

### **Keywords**

Life and demise, online mourning, text similarity analysis, virtual human, VTuber

## **Introduction**

In 2022, Kizuna AI, a virtual idol from Japan with more than 4 million subscribers on YouTube and 1 million on the Chinese video-sharing platform Bilibili, has gone into an indefinite hiatus (or so-called “sleep”) after celebrating her fifth anniversary, even though “she” was successful enough to be selected as the ambassador for the “Come to Japan” campaign (Roll, 2018). Millions of fans gathered to express their deep “condolences” for this virtual celebrity in the comments section of Kizuna’s last video on streaming sites such as YouTube and Bilibili. Virtual idols or celebrities, who are typically regarded as immortal, in fact, also come to the end of their “lives.” As sad as it is, virtual idols have become, to some extent, one step closer to real humans, as they can “die” like humans, even though fans prefer the eulogy term “graduation” to demise, death, or sometimes “hibernation.”

Virtual uploader (VUP), also known as virtual YouTuber (VTuber) or virtual streamer, extends the virtual idol phenomena by similarly pairing a human uploader/streamer with a human idol/celebrity. VUP refers to a virtual avatar that conducts online live broadcasting, mainly using motion capture and computer graphic technologies, which can capture human physical and facial motion and produce animated images (Kim and Yoo, 2021). Despite the differences of VUPs compared to real-person streamers that may make viewers feel more distance between themselves and VUPs and show more tolerance to VUP’s offensive language and “stupid” behaviors, fans typically do not perceive VUPs as lifeless characters and instead develop attachments and affection for them (Tan, 2023).

VUP first emerged on YouTube and has become an international trans-media phenomenon. The popularity of VUP has attracted considerable scholarly attention including examinations of its current use and trend (Bredikhina et al., 2020), interactions with human viewers (Lu et al., 2021), and application as an online learning tool (Saputra and Setyawan, 2021). However, few studies consider the life spans of VUPs. They could “get killed” and no longer be active on-screen if their talent agencies revoke their support. VUPs’ sudden “death,” or demise to be precisely, can be painful for their fans as they perceive VUPs are living with their own life with identities and roles (Bredikhina, 2020). Obviously, VUPs’ demise is in no way organic or biological as human death; and their demise are at the will of their agencies, usually for commercial reasons. For the sake of consistency, this article uses the word “demise” to refer to the end of the operation of a VUP.

Online mourning has become commonplace since social media first emerged, which offer a mediated space and archives of the deceased lives for bereaved individuals to engage with the deceased virtually and spiritually (Brubaker et al., 2013; Kern et al., 2013). Mourning on these platforms reflects how people perceive and interact with the

deceased. Similarly, the mourning remarks left for demised VUPs provide an opportunity to investigate how they are perceived by fans or viewers. They also enable us to interpret how young generations in particular generally perceive virtual humans. We qualitatively and quantitatively examine this emerging trend of virtual humans using a data-mining approach, and compare the mourning remarks left for the demised VUPs with those for deceased human uploaders (HUPs).

## Literature review

### *Virtual Uploader (VUP)*

VUP has become an international sensation, particularly in East Asia (Tang et al., 2021). In 2021, business driven by VUP in China was valued at US\$17 billion (Stanford, 2022). Through developments in artificial intelligence (AI) and motion capture technologies, VUPs are becoming celebrities on mainstream video-sharing sites such as YouTube, NicoNico, and Bilibili, and have attracted dedicated fan bases and corporate sponsorship deals (Shirai, 2019). Most of the fans are young, typically from Generation Z (iResearch Inc., 2022). Entertainment companies in China and Japan have increasingly invested in developing virtual talent, including pop stars that appear on stage through holograms, animated personalities who live-stream themselves playing games and chatting with fans, and brand influencers powered by teams of computer scientists and voice actors (Li et al., 2022).

Both skeuomorphism and anthropomorphism design styles have been used in creating VUPs. To be comparable to human, only VUPs with anthropomorphic appearances are examined in this study. These VUPs resemble humans in their form and behavior, and are designed to interact with people. As HUPs can choose to develop fictional stories on their own or create ideal versions of them to attract fans, VUPs are similar to their human counterparts in maintaining relationships with fans by interacting frequently and intensely with viewers (Bredikhina et al., 2020). For sure, like any interactions between streamers (or uploaders) and viewers, the interaction between VUPs and fans could be two-way social interactions (e.g. a VUP chats with fans) or one-way parasocial interaction (e.g. a fan secretly sees the VUP as a friend; Yi, 2023). The latter may become dominant after the demise of a VUP when it loses the ability to respond to fans.

Research into VUPs is still limited, as it is a relatively recent phenomenon. Hsieh et al. (2019) evaluated the performance of e-learning videos featuring VUPs speaking through vocoder-transformed audio and compared them with traditional videos featuring lecturers, and found that VUPs outperformed their human counterparts in terms of teaching outcomes. VUPs can also be applied in commercial fields. Li et al. (2021) created a VUP named AliMe, and found that it generally reduced costs and improved the productivity of live-streaming sales for merchants.

Notably, fans in East Asian Otaku culture where VUPs are popular can easily accept animated characters and adopt them as real members of society and the world (Cooper-Chen, 2012). Although human actors are usually behind most of the VUPs to provide motion and voice, VUPs have their unique identities distinct from human actors. In other words, even though the viewers are aware in theory that they are watching human actors'

performance when facing VUPs, they still intentionally regard VUP avatars distinct from the human actors and view the VUPs as independent virtual figures (Lu et al., 2021), especially given the highly immersive media experience such as VUP live-streaming (Nah et al., 2022). In fact, it is strictly forbidden in the Otaku culture that viewers expose the identities of human actors; and this taboo behavior is called “open-the-box” (*Kaihe*; Lu et al., 2021).

### *Online mourning in cyberspace*

Mourning for the deceased has been a ritual activity since ancient times, and mourning behavior is deeply influenced by cultural beliefs. Walter (2015a) summarized four types of mourning based on historical practices: family/community, private, public, and online mourning. In family/community mourning, grief is an experience shared within a small group, and thus a collective memorial ceremony is usually held. In private mourning, death is restricted to spaces such as homes or hospitals, which implies that private and public lives are relatively distinct. In public mourning, public and private spaces are generally conflated. The private feelings of the mourners, typically viewed as an expression of individualism, become the focus of attention. Finally, online mourning can be viewed as a return to the community, and people can participate in large-scale mourning in cyberspace through the technical affordances of social media (Walter, 2015b). Sumiala (2022) argues that the proliferation of mediating deaths has made death more visible to living individuals than ever before in human history. The advent of modern hybrid media and digital communication technologies has facilitated the “eventization” of personal losses in novel ways, allowing individuals to claim the status of mourners and place death events under the public interest. Today, public mourning blogs, memorial Facebook pages, Instagram selfies taken at funerals, hashtag tributes on Twitter, and YouTube tribute videos have all become essential elements of how death is mediated in the public sphere (Gibbs et al., 2015).

In comparison to traditional web memorials, social media platforms like Facebook enable users to create far more dynamic memorials for the deceased by seamlessly integrating mourners’ practices into their ongoing social relationships (Hutchings, 2016). Social media memorialization, therefore, celebrates a repositioning of the dead very much within the everyday flow of daily life as a broader cultural trend in mourning and memorialization practices, and allow the living sustain ongoing relationships with the dead (Arnold et al., 2017). For instance, commemorative social media profiles are continuously evolving through collaborative expressions, actions, and interactions, offering a range of possibilities for commemoration that differ from traditional memorials such as gravestones or online web memorials. While offline memorial sites like cemeteries and mausoleums involve collective maintenance such as visits to leave flowers and small gifts, the social media profiles of the deceased generate and extend social relations between the living and the dead, as well as fostering connections among the living (Gibbs et al., 2015).

Besides, the culture differences in the content of mourning should not be ignored. Globally, people would say “Rest in peace (R.I.P.)” at a funeral. In the Chinese context, there also exist unique and common mourning phrases such as “gone,”

“nirvana,” “have a good journey,” and “long slumber.” In Asian culture, it is taboo to address death directly, so people use a more respectful and obscure way to describe the departure of the deceased (Chow, 2017; Yick and Gupta, 2002). The scenario and form of online mourning have changed compared to traditional mourning, and this will certainly affect the content of mourning as well. When facing VUP’s demise, the Asian audience prefer the metaphorical term of “graduation,” revealing a positive perspective of death, and also fitting the cultural custom of metaphor (Cheung and Ho, 2004).

VUP’s demise in the current technological landscape is an intriguing topic. The idea of uploading consciousness into digital space to obtain immortality has been explored in many films. If digitalization means eternity, then it appears to be a way of escaping the shadow of demise (Savin-Baden et al., 2017). In the real world, demise means the end of communication, as no messages can be sent or received. Metaphorically, demise then appears to be a state of isolation. VUPs also face an endpoint similar to demise, that is, disconnection. When the activities of VUPs in cyberspace are suspended or terminated and no new messages can be produced, they are in a demise-like state. For example, if a VUP’s agency ceases operation or its hardware or software is deleted, malfunctioned, or damaged in any way, resulting in the emptying of all data, the VUP can be deemed demised.

Notably, the emotional connections between the audience and VUPs can be intense and real, and when VUPs enter a demise-like state, the audience will have mourning-like reactions in return, even though these emotional bindings are essentially parasocial relationships (Yi, 2023). The emotional tone of such reactions has been found to be mainly sad and regretful (Sabra, 2017). Besides, scholars found that memorial content on social media were primarily targeted at the living than the dead (Marwick and Ellison, 2012). Mourning online together can be seen as a ritual for the fan community (Yin, 2020), and this even could lead to some sort of grief hypejacking (Abidin, 2022). The archived and networked process, in which the private issue of celebrity death moves into the online public sphere, is significant for understanding the tectonic shifts taking place in today’s media ecology (Garde-Hansen, 2010). We therefore compared the comments provoked by a VUP’s demise with online comments mourning the death of a human uploader.

### *The current study*

In this study, as VUPs only exist or “live” in cyberspace, online mourning appears to be the only appropriate form to commemorate and express sadness for their hibernation. However, the prerequisite for mourning VUPs is that users consider them as real social actors rather than just programs or codes. Life and demise inform our thinking in many ways. Our understanding of demise can largely reflect the history and culture of our society and common beliefs (Kastenbaum and Moreman, 2018). Different generations may also have different mourning rituals (Walter, 2015b). Our focus in this study is on the mourning comments of younger people. Currently, we regard mourning for real people as the baseline to further explore the similarities and differences of online mourning between VUPs and HUPs. Therefore, we ask the following research questions:

*RQ1.* How do young viewers mourn hibernated VUPs online?

*RQ2.* How similar/different is the online mourning content posted by young viewers for VUPs, HUPs, and human celebrities?

## Method

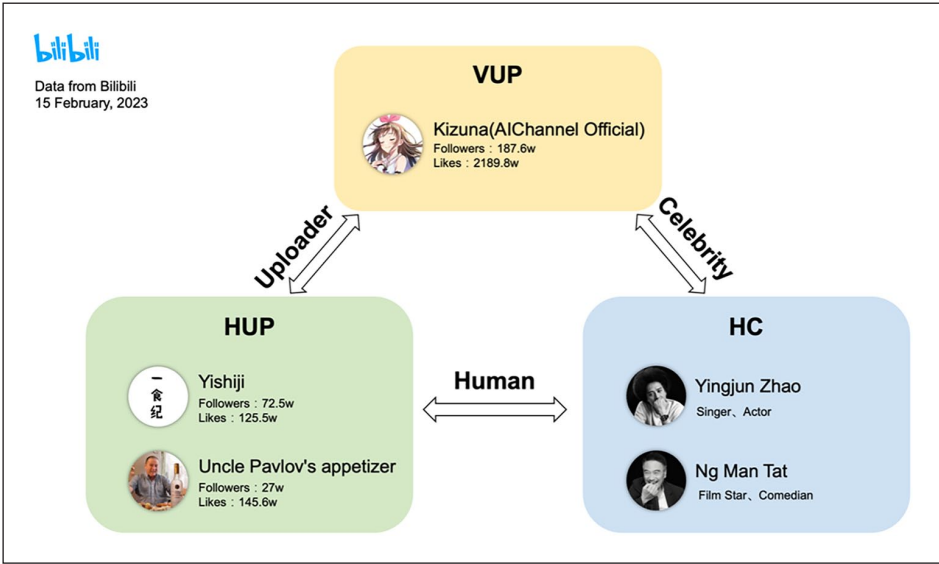
### Design

We addressed the RQs by taking a data-mining approach to examine the text, which can genuinely reflect people's perceptions (Wu et al., 2020). Qualitative and quantitative analyses were then conducted. We first addressed RQ1 through a thematic analysis. We then conducted a text similarity analysis to determine the relationships between text snippets, and measured the degree of similarity in the semantics expressed in different textual items (Pradhan et al., 2015). Text similarity has previously been applied to areas such as machine translation, information retrieval, text categorization, automatic summarization, opinion analysis, and clustering.

We addressed RQ2 through two types of quantitative analyses. We first assessed the term frequency-inverse document frequency (TF-IDF), a weighting technique used in information retrieval and data mining, to evaluate the importance of a word in terms of one of the documents in a document batch (Ramos, 2003). We collated the TF-IDF values of text words found in the comment sections of specific videos to observe the differences among comments regarding VUPs, HUPs, and humans. We then conducted a quadratic assignment procedure (QAP) correlation analysis. QAP can be used to calculate the degree of correlation between two matrices and compare the strength and specifications of the relationships in two networks (Krackardt, 1987). After compiling and comparing a co-occurrence matrix of video comments from different groups, we were able to establish the magnitude of similarity between the content of viewer comments concerning VUPs, HUPs, and humans, and then determine which two are more alike. The TF-IDF and QAP analyses can accurately measure text similarity by vectorizing the word frequency in the comments. The TF-IDF was used to establish the important words in each video, so that we could identify the main emotional themes and general impressions about VUP, HUP, and human celebrities (HC). The QAP analysis enabled us to further confirm the similarity of each group's text by comparing the co-occurrence matrix automatically generated by the word-splitting software.

### Sample

All mourning remarks were extracted from Bilibili, a video-sharing platform targeting young users in mainland China. Largely equivalent to YouTube, Bilibili shares similar affordances of sharing videos, live-streaming, advertising, and e-commerce, and has launched strategies for cutting-edge virtual idols. Currently, 94% of Bilibili's video content consists of professional user-generated videos, with an average of 272 million monthly active users in 2021 (Bilibili, 2022). Meanwhile, deeply influenced by Japanese Otaku culture that is characterized by a strong enthusiasm for manga, anime, and related subcultures (Mizuko et al., 2012), Bilibili has some unique characteristics dissimilar



**Figure 1.** Case selection.

from YouTube, one being strong community engagement. The social interactions among users and uploaders are considerably tight (Zhang and Cassany, 2020), as they can communicate through comments and danmu (bullet chat) that help provide immersive viewing experiences (Jia et al., 2017). Demographically, the platform’s user base is mainly comprised of male users aged 18–25. Over 70% of Bilibili users live in first- or second-tier cities, with relatively high family incomes (Bilibili, 2022).

We then considered the subjects in the VUP, HUP, and HC groups (Figure 1). The selection criteria included the following: (1) The subject has a positive image in entertainment and play a companionship role for their audience, so individuals can find it easier to establish an emotional connection with that subject; and (2) the subject died or demised around the same period of time (2021 to early 2022) to avoid any threat of history to internal validity of this study.

In the VUP group, we chose Kizuna, a Japanese VUP with the image of a 16-year-old girl. Kizuna has become the most popular virtual idol globally since her debut in 2016. On Chinese social media platforms, she usually uploads videos through the “AIChannel Official” account in Bilibili. This account currently has 1.8 million followers, with a total of 21.4 million likes and 230 million views. On 4 December 2021, she announced that she would go into indefinite hibernation after her farewell concert on 26 February 2022. We selected two videos: “Kizuna’s big announcement” (hereinafter “Kizuna Announcement”) and “Kizuna AI the Last Live ‘hello, world 2022’” (hereinafter “Kizuna Concert”). The former video was released on 4 December 2021, and has 5.3 million views and 31,523 comments, and the main subject is the announcement that Kizuna AI was going into indefinite hibernation. It can be considered as an obituary video, that is, an announcement of this VUP’s “demise.” The second video is Kizuna’s farewell



concert, and thus after this video, she went into indefinite hibernation, participating in no more activities and uploading no more content. This video had 2.4 million views and 12,987 comments.

In the HUP group, we first chose “Yishiji,” which means “a record of eating alone” in Chinese. This cooking-video uploader taught people how to make various Chinese dishes on his channel. He lived alone and so his cooking followed the theme of “eating alone,” and thus is very popular among the many young people who live alone in China. The account posted 263 videos, with a total of 724,000 followers, 1.2 million likes, and 32.2 million views. On 5 May 2022, Yishiji uploaded a video titled “Thanks, Bye,” announcing his death by suicide, which was the last video posted by the account. The police later confirmed his death. This last video had 4.9 million views and 62,394 comments. We also chose “Uncle Pavlov’s appetizer” (hereinafter “Pavlov”) which was also a food theme video uploader. The main subject of the account is a Russian man named “Pavlov.” Most of his videos are about Russian food and alcohol. This account has 264,000 followers, with 1.4 million likes and 20.4 million views. On 19 October 2021, the account posted an obituary video entitled “Good Bye, Uncle Pavlov” announcing Pavlov’s death with the COVID. This video received 6.5 million views and 20,189 comments.

For the HC group, Ng Man Tat and Yingjun Zhao were selected. Ng Man Tat was a comedian from Hong Kong, who appeared in many classic comedy movies and was well-loved by the public. He died of liver cancer on 27 February 2021, and news of his death generated much social media attention. Yingjun Zhao was a musician from mainland Chinese who wrote popular music for several famous singers, and passed away due to illness on 3 February 2021. Hundreds of people expressed their sadness on Bilibili and other social media platforms. As these two celebrities did not have personal accounts on Bilibili, we searched for the terms “Ng Man Tat died” and “Yingjun Zhao died” on Bilibili and selected the videos with the highest overall rankings as the subjects of study. As the video search engine ranking is significant (Epstein and Robertson, 2015), thousands of viewers search for “Ng Man Tat died” and “Yingjun Zhao died” on the platform when the news was released. When a virtual or human uploader demises, people typically leave comments in the obituary message or for the last video. For HCs, comments are most likely to be found under the top video, they find through the search results. For Ng Man Tat, we selected the video entitled “Grieved! Actor Ng Man Tat died of liver cancer” delivered by CMG Mobile. This account has 2.2 million followers. The video has been played 1.1 million times and received 7162 comments. For Yingjun Zhao, we chose the video entitled “Famous songwriter Yingjun Zhao died of cancer at the age of 43” released by *Boiling Point Video* on 3 February 2021. Although Boiling Point Video is a news media account with only 22,000 followers, it has accumulated a total of 99.2 million views. The selected video had 879,000 views and 4511 comments.

All raw data were crawled on 15 February 2023, and all metadata reported here were recorded on that day. According to the user analysis on Xinzhuan database (<http://xz.newrank.cn>), the user profiles concerning VUP (Kizuna), HUP (Yishiji, Pavlov), or HC (Zhao Yingjun, Ng Man Tat) are similar in terms of age (18–24 years), gender (dominantly male), and usage habits (high interaction rates).





“good night,” which appeared in comments such as “Good night, Kizuna,” and “Time to get sleep, good night!” The use of “good night” implied a temporary departure rather than a permanent farewell.

We conducted a further thematic analysis on the total 44,510 valid mourning comments left for Kizuna, and the three themes that emerged were wishing good night, showing gratitude, and expressing the expectation that Kizuna would come back.

### *Wishing good night*

The format of the online mourning remarks meant that they differed from traditional mourning, as they were more intermittent, dispersed, and resembled the characteristics of online sharing. However, despite the format change, the core topic remained the expression of grief. “Farewell” is generally expressed in the mourning of individuals online (Myles et al., 2019). In the VUP context, many viewers wished Kizuna a “good night” in their comments, as they would do to someone who was about to go to sleep. This farewell contained sadness but was also a blessing for the VUP, which indicates another subtle difference between VUP and real human mourning. One example of this type of comments read as follows:

Just think of her as having finished starring in an anime. She was tired and went to sleep after a glorious life of VUP. (25,952 likes)

### *Showing gratitude*

When faced with a farewell, people often politely offer their thanks. Many of Kizuna’s dedicated fans documented the important role she played in their daily lives, and expressed their gratitude for the time they spent with the VUP. This is similar to the comments left to deceased online human celebrities, and their social accounts offer an online space for giving thanks for the intentional entertainment or unintentional companionship provided by these celebrities (Zhou and Zhong, 2021):

I’ve gotten used to her presence, to her daily good morning, like an old married couple. She has influenced me a lot, and I also learned from her what is called perseverance. Thank you, Kizuna. (15,378 likes)

When I first started working, I was terrified of being alone and the unknown of the outside world. So when I first saw Kizuna jumping around and doing all sorts of silly things, I felt very happy. Now that five years have passed and my life is slowly getting better, I will always miss that time and thank Kizuna for being there for me through those difficult times. (10,228 likes)

### *Expressing an expectation of coming back*

“Expectation” also appears frequently, in terms of the hope that VUP will return in the near future after a temporary “sleep.” Although Kizuna is not physically dead, some users believed that as AI she has a soul and could be re-activated in a new form:

My major is animation and digital art, so I feel immune to the new age of puppetry like VUP. Only Kizuna, although I know her nature is 3D model plus motion capture, I don't know why I always feel she is alive, and she has a soul. (14,492 likes)

These five years for me are just like a dream. From the first video I saw to the present hibernation, everything seems to be yesterday, what a beautiful dream. Now I cry to wake. but I will always expect Kizuna to come back and bring me into this beautiful dream once again. I will wait for Kizuna forever. (5304 likes)

## *RQ2. How similar/different is the online mourning content posted by young viewers for VUPs, HUPs, and HCs?*

The TF-IDF values of all words were calculated and after sorting, the top 20 words in the TF-IDF ranking were selected from each video for comparison (Table 1).

TF-IDF can help us quickly identify keywords in the text. Table 1 gives the 20 most important words in each video from the three groups, and they effectively represent the audience's reactions to the videos and what they think about the uploaders/human celebrities. They enabled us to identify the most important words in the comment sections of videos. The more frequently the words appear in these sections, the more similar the texts of the video comment section are, and the greater the likelihood that the audiences will be consistent in their evaluations of each subject.

We color-coded the words according to their frequency of occurrence. Those in yellow appear in all three groups. These represent the majority, indicating that the audiences' overall impressions of the three groups were similar. Those in blue indicate the words' presence in both the VUP and HUP groups. They indicate the extent to which audiences give similar comments to both virtual and human uploaders. The top words or phrases identified are "good night," "come back," "expect," and "remember."

Those in green are present in both HUP and HC groups, and indicate a more familiar reaction to actual human death. "Farewell," "heaven," and "afterlife" are all highly relevant to demise in the real world, which is also implied in the phrase "permanent farewell." Unlike those found for VUP, these reflect a greater concern for human nature and life, and the list also includes words with religious connotations such as "heaven," which reflect the complex social and interpersonal relationships of the real world. The gray blanks indicate the words present in both VUP and HC groups or only in one group. These generally refer to content that is specific to a particular group and are not consistent across groups.

We then selected the top 100 words in the text of each video comment section by sorting them based on the frequency and combining various synonyms. We first matched words using Gooseeker and obtained a co-word matrix for each video comment text. The QAP method requires the elements of both matrices to be identical for comparison, so we selected the top 10 words in the VUP-HUP, HUP-HC, and VUP-HC matrices, respectively, according to the number of co-occurrences. We finally obtained six  $10 \times 10$  matrices.

The QAP analysis was conducted using the software tool Ucinet6, and the Pearson correlation coefficient (PCC) values were calculated (Table 2). The similarity of the VUP

**Table 1.** Top 20 words TF-IDF of each video’s comments.

VUP		HUP		Human	
Kizuna Farewell	Kizuna Concert	Yishiji	Pavlov	Ng Man Tat	Yingjun Zhao
Times	good night	hope	farewell	farewell	death
Leave	good morning	happy	leave	thank	farewell
come back	come back	world	heaven	happy	like
Happy	leave	sad	friend	sad	pity
Hope	hope	like	come back	leave	world
Like	happy	leave	happy	forever	hope
Sad	expect	good night	hope	memory	leave
graduate	like	friend	pity	accompany	heaven
thank	thank	afterlife	sad	like	sad
hibernation	forever	come back	like	hope	talent
good morning	remember	nice	thank	heaven	R.I.P
forever	sad	expect	world	youth	happy
expect	virtual	pity	forever	pity	friend
accompany	world	remember	remember	opportunity	thank
fan	times	thank	health	times	live
world	rest	good morning	expect	classical	special
memory	meet	lonely	meet	legend	youth
pity	cheer	warm	bless	time	forever
meet	cute	brave	good night	death	afterlife
remember	fan	sorry	accompany	miss	life

TF-IDF: term frequency-inverse document frequency; HUP: human uploaders; RIP: rest in peace; VUP: virtual uploader.

■ All groups

■ VUP & HUP only

■ HUP & Human only

■ VUP & Human; One group only

**Table 2.** QAP analysis of comments for VUP and HC.

		VUP			
		Kizuna announcement		Kizuna concert	
		PCC	p	PCC	p
HC	Ng Man Tat	-.15	.26	.39	.06
	Yingjun Zhao	.07	.36	.29	.06

VUP: virtual uploader; PCC: Pearson correlation coefficient; HC: human celebrities.

Pearson correlation coefficient (PCC) is used to measure the degree of correlation between two variables, with a value between -1 and 1.

and HC group mourning texts was not significant ( $PCC_{\text{Kizuna Announcement versus Ng Man Tat}} = -.15$ ,  $p = .26$ ;  $PCC_{\text{Kizuna Announcement versus Yingjun Zhao}} = .07$ ,  $p = .36$ ;  $PCC_{\text{Kizuna Concert versus Ng Man Tat}} = .39$ ,  $p = .06$ ;  $PCC_{\text{Kizuna Concert versus Yingjun Zhao}} = .29$ ,  $p = .06$ ). The results indicated that audiences' remarks about the topic of demise in relation to virtual and real people were very different.

Table 3 indicates that the HUP Yishiji text was more similar to the Kizuna Concert ( $PCC = .482$ ,  $p = .009$ ) than to the Ng Man Tat text ( $PCC = .48$ ,  $p = .03$ ), but it was not significantly similar to either the Kizuna Announcement or Yingjun Zhao. This indicates that audiences treated the HUP Yishiji more like a VUP than a HC. The HUP Pavlov text was not significantly similar to the VUP text ( $PCC_{\text{Pavlov versus Kizuna Announcement}} = -.05$ ,  $p = .42$ ;  $PCC_{\text{Pavlov versus Kizuna Concert}} = .17$ ,  $p = .10$ ), but was significantly similar to those of the HCs ( $PCC_{\text{Pavlov versus Ng Man Tat}} = .67$ ,  $p = .003$ ;  $PCC_{\text{Pavlov versus Yingjun Zhao}} = .39$ ,  $p = .045$ ). From our comparison of the HUP and HC groups, we found that both Yishiji and Pavlov were significantly correlated with Ng Man Tat but not with Yingjun Zhao. The PCC between Pavlov's and Ng Man Tat's texts was relatively high, indicating that audiences perceived Pavlov as more like a HC than a VUP.

## Discussion

In response to the rapid growth in the popularity of virtual humans, we investigated the attitudes and perceptions of young viewers, from Generation Z in particular, toward VUPs. We compared the online mourning directed at VUPs, HUPs, and HCs. We identified two main patterns among the mourning remarks of the young viewers in these three groups.

First, the mourning remarks for Kizuna AI (VUP) were considerably different from those concerning the two HCs. We deliberately selected two videos for Kizuna: the announcement that she was going to hibernate and her last uploaded video. One might expect that these announcements would provide the function of an obituary, but for the VUPs that do not "demise" immediately, it is more like a countdown. Thus, these mourning remarks are distinct from those left for a sudden demise announcement. For the last video by Kizuna, which was her farewell concert, the comments imply that this functioned as both entertainment and as a farewell. This differs from the death announcement videos for the two human celebrities, and the differences reflect how young viewers perceive these two types of "demise." The words "death" and "forever" only appear in the mourning remarks for the HCs, so the viewers appeared to consciously understand the actual meaning of human death. In contrast, the words "come back" and "good night" appeared throughout the remarks posted for Kizuna. "Good night" seems a more subtle and delicate articulation compared to the solemn "rest in peace." Although the moment when Kizuna might "wake up" from its "sleep" seems unlikely, there remains a faint glimmer of hope for the VUP's potential resurgence.

Traditionally, life and demise are inevitable and irreversible, making the matter of life and demise an important issue of long-term concern and seriousness for human beings. Life and demise follow natural and physical laws, and therefore, human beings have developed a set of concepts and ideas associated with them (Sumiala, 2022). Demise, in particular, highlights the finite nature of life, emphasizing the insignificance of humans

**Table 3.** QAP analysis of comments for HUP versus VUP, and HUP versus HC comparisons.

		HUP			
		Yishiji		Pavlov	
		PCC	<i>p</i>	PCC	<i>p</i>
VUP	Kizuna Announcement	−.28	.12	−.05	.42
	Kizuna Concert	.48	.009**	.17	.10
HC	Ng Man Tat	.48	.03*	.67	.003**
	Yingjun Zhao	.24	.16	.39	.045*

HUP: human uploaders; PCC: Pearson correlation coefficient; VUP: virtual uploader; HC: human celebrities.  
\**p* < .05; \*\**p* < .01.

and revealing the immutable law of nature. However, the birth of virtual avatars gives humans the “God-like power” to decide whether a virtual human lives or demises, and at the same time, bring the virtual human back from the dead. Thus, for the young users, they are not facing a world that is completely “doomed to lose,” as the virtual world gives the possibility of “rebirth.” So, they may no longer have the fear of demise and the awe of limited life as much as their ancestors did.

Second, interestingly, the mourning remarks for the two HUPs exhibited distinct patterns: those for Yishiji (HUP) were more consistent with those for Kizuna, but the remarks for Pavlov (HUP) were more in line with those for two offline celebrities. Embodiment, which refers to the state of the body such as postures, arm movements, and facial expressions, may have an effect here, as it is important during social interaction and is central to the processing of social information (Barsalou et al., 2003). The concept of embodiment can help us interpret the communication effects of body cues (Mollahosseini et al., 2018). Research has shown that the combination of facial expressions and postures can help to determine emotions and assessments (Adelmann and Zajonc, 1989). Human celebrities, as famous real-world individuals, appear as more rounded characters to the public as they are viewed in many different contexts. For example, Ng Man Tat can be seen in a comedy movie, telling jokes on a TV show, or dining at a restaurant in a paparazzi photo. Thus, viewers perceive HCs as living, breathing people. The image of a HUP is, in contrast, relatively flatter. The “self” is only shown in the video content, and viewers cannot get more detailed information about the character in other scenarios. In addition, the social media accounts of demised VUPs and deceased HUPs can be considered tombstones that users can go to and pay their condolences, leaving messages from time to time. For HCs, although they may also have their own social media accounts, the meanings of their online tombstones are not as rich. Users can experience celebrities in various dimensions, but can only follow VUPs and HUPs through a single channel of social accounts. As HUPs generally provide the fewest physical cues and have relatively homogeneous images, it is unsurprising that Internet users treat them as producers of content rather than living human beings.

As for the differences between those two HUPs, no face and few body parts appear in Yishiji's video, and the account "Yishiji" is not even the uploader's real name. Viewers then pay more attention to how the dishes are made and are less interested in knowing Yishiji as a person. Yishiji is thus somewhat "virtual" to viewers, as this uploader only appears in the virtual world and has no trace in the physical world. In contrast, Pavlov does not hide his face and body in his videos so viewers can see him and know him as a person. Pavlov is therefore more embodied and thus more "human" than Yishiji. The degree of embodiment can therefore help determine how "human" a character is in the eyes of viewers. Previous study found that a high level of embodiment can strengthen people's capability of perception and learning (Meier et al., 2012). Furthermore, the degree of embodiment is usually presented in the form of bodily cues, like face, height, or posture (Dijkstra and Post, 2015; Reh et al., 2017). Hence, the missing bodily cues could explain why faceless HUP, Yishiji, received the machine-like eulogy while Pavlov with more bodily cues was memorized as other human celebrities.

Taken together, those two trends have emerged simultaneously, one being "human being less human," and the other being "virtual human being more human." Much more VUPs have appeared since the debut of Kizuna in 2016. In 2021, virtual beauty expert Liuyexi released her first short video on TikTok, earning over 3 million likes, and in 2022, the virtual singer Teresa Teng performed a classic song live in a New Year's Eve concert and the audience was warmly appreciative. Technological advancements have meant that the public is increasingly aware of avatars. Whether the digital body of a real human or a completely fictional virtual character, virtual humans are gaining recognition and becoming increasingly realistic. "Human-like" is the goal that avatar developers constantly pursue. From appearance to demeanor and from the tone of voice to personality, the virtual human learns and imitates human body cues piece by piece through motion capture and deep learning, eventually becoming closer to humans. Thus, the development path of virtual humans involves the process of enhancing their embodiment. How will these two apparently conflicting trends affect young viewers and society? This question demands further attention.

Although they are viewed as virtual, VUPs and the HUP Yishiji are not short of humanness. That is why VUPs could enter fans' daily life (including marriage; Jeffery, 2018) and Kizuna was chosen as the ambassador of the "Come to Japan" campaign. As Kember and Zylinska (2012) posit, digital media have provided all-encompassing and in-divisible mediatization of life. This largely re-shapes "the experiences, implications and politics of lives lived in media saturated environments in cohabitation with networked devices, apps and screens . . ." (Coleman and Paasonen, 2020: 2). As predicted by Michel Serres, the framework of life has been replaced by technologies of mediation (Phillips, 2021). Humanness has been reconstructed in the virtual world and demands further exploration.

Thirty years ago, media psychologists noted that humans treat machines equally socially once machines signal out enough social cues (Nass et al., 1994). However, the technology landscape has greatly changed over the decades. No one would have imagined that intelligent voice assistants could automatically answer phone calls for humans and that algorithms can both provide us with in-depth knowledge and also keep us firmly trapped in an information cocoon (Kreitner, 2016). We have become used to treating



machines as objects of communication, and algorithm-driven AIs and humans often appear on the same web page at the same time. How then can we ensure that we are treating machines as humans, and not the other way around? Young people, particularly those from Generation Z, may as they get used to virtual beings in online environments, begin to treat humans like machines based on their similarity (the degree of embodiment in this case). Although such a conclusion is currently premature, this question surely requires further consideration.

Our study has several limitations. First, the number of subjects is small, even though the six videos have more than 138,000 comments in total. And although the subjects we chose had a large number of followers, they may not be sufficiently representative. For example, the two selected HCs were male and were middle-aged when they died, and thus may not have been particularly popular celebrities among young viewers. Second, we aimed to examine the young generations' perceptions of VUPs. But since we did not extract comments only from young users, there might exist some ecological validity issue in generalizing the findings. Future study can consider collecting a larger and broader sample to explore a wider range of dimensions such as including emoji symbols in addition to textual content.

In summary, we found that “good night” and “goodbye” represent two connected but distinct views of life and demise in cyberspace, and reflect how young viewers perceive different social actors in the online environment. For the three types of objects, VUPs, HUPs, and HCs, viewers hold similar attitudes toward VUPs and disembodied HUPs, and appear to be more optimistic treating their demise as a form of hibernation. In future research, we will further address users' attitudes toward virtual humans and more broadly how individuals perceive social actors in cyberspace.

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## References

- Abidin C (2022) Grief hypejacking: influencers, #ThoughtsAndPrayers, and the commodification of grief on Instagram. *The Information Society* 38(3): 174–187.
- Adelmann PK and Zajonc RB (1989) Facial efferece and the experience of emotion. *Annual Review of Psychology* 40(1): 249–280.
- Arnold M, Gibbs M, Kohn T, et al. (2017) *Death and Digital Media*. New York: Routledge.
- Barsalou LW, Niedenthal PM, Barbey AK, et al. (2003) *Social Embodiment*. New York: Elsevier Science.
- Bilibili (2022) About us. Available at: <https://www.bilibili.com/blackboard/about-Us.html> (accessed 26 February 2023).

- Bredikhina L (2020) Designing identity in VTuber era. In: *Proceedings of Laval virtual VRIC convergence*, 182–184. Available at: [https://www.academia.edu/download/63010301/Designing\\_identity\\_in\\_VTuber\\_Era20200419-76357-12og8r3.pdf](https://www.academia.edu/download/63010301/Designing_identity_in_VTuber_Era20200419-76357-12og8r3.pdf)
- Bredikhina L, Kameoka T, Shimbo S, et al. (2020) Avatar driven VR society trends in Japan. In: *20 IEEE conference on virtual reality and 3D user interfaces abstracts and workshops (VRW)*, Atlanta, GA, 22–26 March, pp. 497–503. New York: IEEE.
- Brubaker JR, Hayes GR and Dourish P (2013) Beyond the grave: Facebook as a site for the expansion of death and mourning. *The Information Society* 29(3): 152–163.
- Cheung W-S and Ho S (2004) The use of death metaphors to understand personal meaning of death among Hong Kong Chinese undergraduates. *Death Studies* 28(1): 47–62.
- Chow AY (2017) Death in the family—bereavement and mourning in contemporary China. In: Zhao LX and Zang X (eds) *Handbook on the Family and Marriage in China*. Cheltenham: Edward Elgar Publishing, pp. 373–391.
- Coleman R and Paasonen S (2020) Mediating presents. *Media Theory* 4(2): 1–10.
- Cooper-Chen A (2012) Cartoon planet: the cross-cultural acceptance of Japanese animation. *Asian Journal of Communication* 22(1): 44–57.
- Dijkstra K and Post L (2015) Mechanisms of embodiment. *Frontiers in Psychology* 6: 1525.
- Epstein R and Robertson RE (2015) The search engine manipulation effect (SEME) and its possible impact on the outcomes of elections. *Proceedings of the National Academy of Sciences* 112(33): E4512–E4521.
- Garde-Hansen J (2010) Measuring mourning with online media: Michael Jackson and real-time memories. *Celebrity studies* 1(2):233–235.
- Gibbs M, Meese J, Arnold M, et al. (2015) # Funeral and Instagram: death, social media, and platform vernacular. *Information, Communication & Society* 18(3): 255–268.
- Hsieh R, Shirai A and Sato H (2019) Effectiveness of facial animated avatar and voice transformer in elearning programming course. In: *ACM SIGGRAPH 2019 posters*, Los Angeles, CA, 28 July, pp. 1–2. New York: ACM.
- Hutchings T (2016) Wiring death: dying, grieving and remembering on the Internet. In: Davies DJ (ed.) *Emotion, Identity and Death*. London: Routledge, pp. 55–70.
- iResearch Inc. (2022) Research report on the ecology of China's virtual anchor industry. Report, iResearch, China, October. Available at: [https://report.iresearch.cn/report\\_pdf.aspx?id=4078](https://report.iresearch.cn/report_pdf.aspx?id=4078)
- Jeffery C (2018) Japanese man marries anime hologram of Hatsune Miku. Available at: <https://www.techspot.com/news/77385-japanese-man-marries-anime-hologram-hatsune-miku.html> (accessed 6 August 2023).
- Jia AL, Shen S, Chen S, et al. (2017) An analysis on a YouTube-like UGC site with enhanced social features. In: *WWW'17 companion: Proceedings of the 26th international conference on world wide web companion*, Perth, WA, Australia, 3–7 April, pp. 1477–1483. New York: ACM.
- Kastenbaum R and Moreman CM (2018) *Death, Society, and Human Experience*. New York: Routledge.
- Kember S and Zylinska J (2012) *Life After New Media: Mediation as a Vital Process*. Cambridge, MA: MIT Press.
- Kern R, Forman AE and Gil-Egui G (2013) RIP: remain in perpetuity. Facebook memorial pages. *Telematics and Informatics* 30(1): 2–10.
- Kim D-Y and Yoo H-S (2021) A comparative study of user experience according to one-person media virtual YouTuber (VTuber) and general YouTuber. *Asia-Pacific Journal of Convergent Research Interchange* 7(5): 1–10.
- Krackardt D (1987) QAP partialling as a test of spuriousness. *Social Networks* 9(2): 171–186.

- Kreitner R (2016) Post-truth and its consequences: what a 25-year-old essay tells us about the current moment. *The Nation* 30: 156–160.
- Li F-L, Zhao Z, Lu Q, et al. (2021) AliMe Avatar: multi-modal content production and presentation for live-streaming E-commerce. In: *Proceedings of the 44th International ACM SIGIR conference on research and development in information retrieval*, Virtual Event, 11–15 July, pp. 2635–2636. New York: ACM.
- Li J, Fang K, Sun X, et al. (2022) Gulliver's game: multiviewer and VTuber extreme asymmetric game. In: *2022 IEEE conference on games (Cog)*, Beijing, China, 21–24 August, pp. 598–599. New York: IEEE.
- Lu Z, Shen C, Li J, et al. (2021) More kawaii than a real-person live streamer: understanding how the otaku community engages with and perceives virtual YouTubers. In: *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, pp. 1–14.
- Marwick A and Ellison NB (2012) “There isn’t wifi in heaven!” Negotiating visibility on Facebook memorial pages. *Journal of Broadcasting & Electronic Media* 56(3): 378–400.
- Meier BP, Schnall S, Schwarz N, et al. (2012) Embodiment in social psychology. *Topics in Cognitive Science* 4(4): 705–716.
- Mizuko I, Okabe D and Tsuji I (2012) *Fandom Unbound: Otaku Culture in a Connected World*. New Haven, CT: Yale University Press.
- Mollahosseini A, Abdollahi H, Sweeny TD, et al. (2018) Role of embodiment and presence in human perception of robots’ facial cues. *International Journal of Human-Computer Studies* 116: 25–39.
- Myles D, Cherba M and Millerand F (2019) Situating ethics in online mourning research: a scoping review of empirical studies. *Qualitative Inquiry* 25(3): 289–299.
- Nah K, Oh S, Han B, et al. (2022) A study on the user experience to improve immersion as a digital human in lifestyle content. *Applied Sciences* 12(23): 12467.
- Nass C, Steuer J and Tauber ER (1994) Computers are social actors. In: *Proceedings of the SIGCHI conference on human factors in computing systems*, Boston, MA, 24–28 April, pp. 72–78. New York: IEEE.
- Phillips JW (2021) The accident in being: Michel Serres on the emergence of the object. *Media Theory* 5(1): 254–272.
- Pradhan N, Gyanchandani M and Wadhvani R (2015) A review on text similarity technique used in IR and its application. *International Journal of Computer Applications* 120(9): 29–34.
- Ramos J (2003) Using TF-IDF to determine word relevance in document queries. In: *Proceedings of the First Instructional Conference on Machine Learning* 242: 29–48.
- Reh S, Van Quaquebeke N and Giessner SR (2017) The aura of charisma: a review on the embodiment perspective as signaling. *The Leadership Quarterly* 28(4): 486–507.
- Roll D (2018) Popular virtual YouTuber Kizuna AI selected as ambassador for new “Come to Japan” campaign. *SoraNews24 -Japan News-*. Available at: <https://soranews24.com/2018/03/07/popular-virtual-youtuber-kizuna-ai-selected-as-ambassador-for-new-come-to-japan-campaign%E3%80%90%E3%80%91/> (accessed 23 July 2023).
- Sabra JB (2017) “I hate when they do that!” Netiquette in mourning and memorialization among Danish Facebook users. *Journal of Broadcasting & Electronic Media* 61(1): 24–40.
- Saputra DIS and Setyawan I (2021) Virtual YouTuber (VTuber) sebagai Konten media Pembelajaran online. *Prosiding SISFOTEK* 5(1): 14–20.
- Savin-Baden M, Burden D and Taylor H (2017) The ethics and impact of digital immortality. *Knowledge Cultures* 5(2): 178–196.
- Shirai A (2019) REALITY: broadcast your virtual beings from everywhere. In: *ACM SIGGRAPH 2019 Appy Hour*, Los Angeles, CA, 28 July, pp. 1–2. New York: ACM.

- Stanford (2022) *Artificial intelligence index report 2022*. Report, Human-Centered Artificial Intelligence. Stanford, CA: Stanford University.
- Sumiala J (2022) *Mediated Death*. Cambridge: John Wiley & Sons.
- Tan Y (2023) More attached, less stressed: viewers' parasocial attachment to virtual YouTubers and its influence on the stress of viewers during the COVID-19 pandemic. *SHS Web of Conferences* 155: 03012.
- Tang MT, Zhu VL and Popescu V (2021) Alterecho: loose avatar-streamer coupling for expressive vtubing. In: *2021 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*, pp. 128–137. IEEE.
- Walter T (2015a) Communication media and the dead: from the stone age to Facebook. *Mortality* 20(3): 215–232.
- Walter T (2015b) New mourners, old mourners: online memorial culture as a chapter in the history of mourning. *New Review of Hypermedia and Multimedia* 21(1–2): 10–24.
- Wu Y, Mou Y, Li Z, et al. (2020) Investigating American and Chinese subjects' explicit and implicit perceptions of AI-generated artistic work. *Computers in Human Behavior* 104: 106186.
- Yi J (2023) Female-oriented dating sims in China: players' parasocial relationships, gender attitudes, and romantic beliefs. *Psychology of Popular Media* 12: 58–68.
- Yick AG and Gupta R (2002) Chinese cultural dimensions of death, dying, and bereavement: focus group findings. *Journal of Cultural Diversity* 9(2): 32–42.
- Yin Y (2020) An emergent algorithmic culture: the data-ization of online fandom in China. *International Journal of Cultural Studies* 23(4): 475–492.
- Zhang LT and Cassany D (2020) Making sense of danmu: Coherence in massive anonymous chats on Bilibili.com. *Discourse Studies* 22(4): 483–502.
- Zhou B and Zhong Y (2021) Social media, collective mourning and extended affective space: a computational communication analysis of Li Wenliang's Weibo comments (2020–2021). *International Mass Media* 43(3): 79–106.

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