Virtual Fashion Influencers:

towards a more sustainable consumer behaviour of Generation Z?

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Abstract

Since the end of 2019, online platforms have flourished as offline activities were significantly reduced due to the epidemic. To survive in such a context, some fashion brands took advantage of the growing CGI(Computer-generated images) technology, allowing VIs and virtual models to be used as vehicles for fashion presentations. Gen Zers, who grew up in the digital generation, are very receptive to such VIs and are full of novelty. At the same time, Gen Z is the biggest consumer group in fashion, the positive influence of Gen Z on fashion consumption can make the whole fashion consumer market develop in a more positive direction. It is necessary to explore the direction of VI design to guide GenZ to a more sustainable fashion consumption concept. Therefore, I set "what kind of design of virtual fashion influencers can lead the consumer behavior of Generation Z towards more sustainable attitudes and behaviors?" as the research question of this thesis, and found the five categories of VI influence research proposed by Batista da Silva Oliveira & Chimenti and applied them to my research. Based on this five-category theory, the thesis discusses the factors of VI design success concerning the current VIs and how the five categories impact Gen Z's intention of sustainable fashion. I provided guidelines and principles for designing VI based on different aspects through three research methods: case studies, surveys, and semi-conducted interviews, and I answered the research questions.

Through the case study analysis, I compared the current successful VI cases. I summarized the practices and principles and the operation methods of the team behind them to improve the impact of VIs. Also, I conducted a survey distributed among people interested in VIs and

fashion and collected data for analysis. I inspected and verified that a higher index of the five categories would lead to a higher intention of Gen Z to consume sustainable fashion. To get more insights from these professionals and to represent the group's perspective as Gen Z, I interviewed people from the sustainable fashion industry and virtual human and digital art industry.

This study summarized the key points that can be used to improve the impact of VIs and proofs that the attractiveness, authenticity, controllability, anthropomorphism, and scalability of VI will positively contribute to consumers' intention to support sustainable fashion. This thesis also concluded with design guides about physical appearance design, psychological character design, and the operation mode of Virtual influencers that promote sustainable fashion.

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Introduction

With the development of Artificial Intelligence and the Internet of Things, every industry is experiencing a dramatic digital transformation. This transformation process has gradually blurred the digital and the physical boundaries, and the field of fashion is also influenced by this digitalization trend, entering the "fashion 4.0" era (Särmäkari, 2021). For example, in the fashion industry, computer-generated images (CGI) technologies are increasingly used in the fashion design, production, visualization and marketing process (Särmäkari, 2021).

In the context of "Fashion 4.0", virtual 3D fashion, or so-called "digital fashion," has received considerable attention in the media, especially in the last few years. One reason for this is the restrictions and protections of COVID-19, which obliges companies to evolve their processes and user experience towards a digitalization direction (Särmäkari, 2021). During the pandemic, fashion brands and companies cannot shoot their products' photographs on location. The models, spokespeople, or celebrities who showcase fashion products also have to transform into a digital version to maintain business operation. An increasing number of fashion brands tend to create a digital version of products and collaborate with virtual celebrities. Under these circumstances, the frequency of collaboration between fashion brands and virtual influencers has increased significantly, thus allowing fashion products to be displayed continuously even during the pandemic (BoF & McKinsey, 2021).

Before the appearance of virtual influencers, influencer marketing had long been recognized as an efficient way to promote commercials. The exposure rate of social media influencers has rapidly increased in the last decade and has become an essential alternative to

traditional advertising (Kota & De, 2021). Such people have a huge psychological influence on potential buyers of brands. In influencer marketing, internet influencers can provide the audience a greater sense of intimacy than traditional celebrities. This is because users can participate in the events held by those internet influencers from the bottom up and interact with them on social media platforms directly (Arsenyan & Mirowska, 2021). This more interactive relationship provides users with a higher sense of attachment and trust (Djafarova & Rushworth, 2017). In addition, with the increasing CGI technology and catalyzing effects of the pandemic, non-physical and virtual internet influencers have been created.

In recent years, people have observed the emergence of "virtual influencers" (VIs) which are defined by Arsenyan & Mirowska (2021) as "agents augmented with digital avatars, designed to look human" (p. 2). According to Khan & Sutcliffe (2014), these virtual influencers offer an exciting context, "given that anthropomorphized representations of virtual agents, especially visually attractive ones, elicit social responses and behavioral change in humans" (as cited in Arsenyan & Mirowska, 2021, p. 2).

With the support of CGI technology, VIs that appear to be more anthropomorphic are more achievable and have gradually become increasingly active on various social media platforms (Moustakas et al., 2020). This thesis presents research on the role of virtual celebrities in the fashion field.

Virtual influencer collaboration in the fashion sector dates back to 2018. At the time, the fashion industry witnessed the emergence of the first virtual influencers who captivated audiences' attention, and they are Lil Miquela, Shudu, and Noonoouri. Lil Miquela, for example, attended the Prada FW 18/19 show in Milan and took over the fashion house's Instagram

account in this process. The collaboration was an unprecedented move for Prada. Moreover, it set a precedent for involving virtual influencers in live physical fashion events (Hiort, 2021). Thus, fashion brands and companies also started to collaborate with a growing number of virtual influencers for advertising and marketing, which led the field first to develop gradually and then expand due to the pandemic in 2020.

Compared with traditional influencers, VIs provide some advantages in marketing. Virtual influencers are created by operator teams. The virtualization of the influencer and the controllability of their background and personality settings enable the operations team behind the virtual influencer to design and augment virtual influencers' positive effects on audiences (Moustakas et al., 2020).

However, due to its high degree of controllability, the commercial use of VIs has aroused some ethical discussion. According to Robinson (2020), VI does not have a mind separating from that of its creator, which is why it has such a high level of controllability. Part of the VI's appeal for brands is the controllability of its PR risk. Considering that all the contents of VIs are created among a group of thoughtful people, the risk of the VI publishing about political incorrectness or inconsistency with the brand is close to zero, so it can always provide the best interest to those brands (Robinson, 2020). But on an ethical level, as the whole image of the character is fictionalized, it is difficult to say whether establishing VI's personality and creating content is solely a new type of brand promotion or an agency to spread the correct social values better. Meanwhile, VI cannot be responsible for all the words and behaviors because it is the team behind creating the content, not VI itself. Perhaps the situation will become more complicated when VIs start using machine learning technology and creating content

independently without human being input. The ethical issues discussed here need to be explored in greater depth in subsequent research (Robinson, 2020).

Virtual influencers' largest audience is Generation Z, who have grown up in a digital environment. CGI influencers have proven to have excellent appeal to Generation Z (Gen Z) audiences (MediaKix, 2019). Gen Z refers to "those individuals who were born in the decade following the widespread emergence of the World Wide Web, from the mid-1990s to the early 2000's" (Wood, 2013, p. 1). Their growth environment has determined their high acceptance level of digitalization. Their lives are tightly connected with social media and they are deeply impacted by influencers on Instagram, Twitter, etc. They are also the main force of the current fashion consumption market. In terms of fashion consumption, although Gen Z possesses a more vital sustainable consciousness than other generations, they still mainly consume fast fashion brands (BoF, 2021). It is not unfamiliar for most people that members of Gen Z are more focused on sustainability and responsibility principles than previous generations, while they conceptualize interaction and transparency as critical elements of communication (Krahn & Galambos, 2014). They also engage in more self-examination, are more involved in environmental issues, and are skeptical of corporations (Haynes, 2019). But the research of Casalegno et al. (2022) shows that, in real life, older people buy more environmentally friendly and sustainable products. Casalegno et al. (2022) speculated that it is possible that older people can afford more expensive and responsible products, but the valid reasons for this are unknown. Hence, there is an attitude-behavior gap between Gen Z's awareness of sustainability and actual consumer behavior.

The attitude-behavior gap has been frequently mentioned in ethical consumption and

sustainable consumption in recent years due to consumers' increasing concern for sustainable products and consumption. However, this attitude does not translate into actual behavior, especially when it comes to fashion products (McNeill & Moore, 2015). Despite accepting environmental consumerism values, consumers rarely demonstrate their beliefs during actual shopping sessions (Belk et al., 2005; Carrington et al., 2014). Because the difference between intentions and actual purchase behavior remains poorly perceived (Carrington et al., 2014) and deserves serious attention (Gupta & Ogden, 2009), researchers have called for the study of this weak relationship known as the "ethical purchasing gap" (Nicholls & Lee, 2006). Understanding green consumption and closing the gap could better contribute to economic and environmental sustainability. However, no studies have explicitly examined the approaches to narrow the gap in sustainable fashion products (Park & Lin, 2020). Therefore, it is meaningful to explore how to narrow the gap for the sustainable awareness and the Fashion consumption behavior of Gen Z.

Some public interest organizations such as Fashion Revolution and Fashion for Good are currently spreading the concept of sustainable fashion online and organizing events. Some methods they use to foster sustainable fashion consumption concepts and behaviors are effective. It is practical to know ways to narrow the gap between sustainable awareness and the fashion consumption behavior of Gen Z from the approaches of concept promotion of these organizations.

Firstly, they disclose the dark side of the fashion industry chain and the social problems and educate people about the global fashion industry's systemic challenges that raise to generate public awareness of sustainable fashion. Except for that， they share knowledge and

approaches to living a sustainable fashion lifestyle. For example, they provide alternatives to buying new clothes such as rent swaps, borrowing thrift, mending, remaking, house dying clothes. Also, they have provided platforms through the Internet to empower the public so everyone can participate sustainably and make an enormous impact. And They are committed to focusing on and delivering more creative solutions for sustainable fashion evolution have provided a platform for innovative fashion designers and new sustainable material applications.

By doing so, they can also positively influence many fashion consumers in a more sustainable direction. The promotional channels used by these accounts could be more beneficial to Gen Zers if they were designed to be more specific to the preferences of this target group.

But before further discussion, this is a definition that needs to be figured out: what is the meaning of sustainable specifically? Although sustainable fashion is not new at the applied level, there is still a lack of an unequivocal definition in academic theoretical research. According to Reilly & Weirup (2012), the principle of sustainability is the integration of ecological, social, and economic issues, this is consistent with one of the most frequently cited definitions of sustainability by the Brundtland Commission in its report "Our Common Future":

> Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (Brundtland, 1985, p.41)

Therefore, a sustainable (fashion) product is a product that uses environmentally and socially responsible resources and methods. For example, it allows raw materials to be regenerated or does not cause pollution and does not negatively impact future generations.

Mukendi et al. (2020) provide a working definition of sustainable fashion: “the variety of means by which a fashion item or behavior could be perceived to be more sustainable, including (but not limited to) environmental, social, slow fashion, reuse, recycling, cruelty-free and anti-consumption and production practices” (p. 2). And the report of Institute of Digital Fashion (2021) discusses sustainability and inclusiveness in fashion. They point out that digital fashion is a future trend with more possibilities with the support of digital technology, so it is very inclusive. They also suggested that digital fashion can be sustainable only when such inclusiveness in fashion is met.

The sustainable consumers discussed in this thesis are the cohorts who have the above concept and awareness of sustainable fashion. They also use sustainable fashion products as their fashion consumption choice during their consumption behavior.

According to the above discussion with respect to virtual influencers and sustainable fashion among Gen Z, the birth of virtual influencers might be a reasonable solution to narrow the attitude-behavior gap among Gen Z. First of all, Generation Z is the largest audience for virtual influencers. Moreover, research by Krämer (2013, 2018) has revealed that communication and interaction with virtual influencers can meet some of the audience's needs for human interaction in a manner similar to interaction with human counterparts. This suggests that virtual celebrities can also acquire a certain degree of influence on the behavioral awareness of the audience. In this case, I assume that designers could create sustainable and ethical personas of virtual celebrities to influence Gen Z and narrow the attitude-behavior gap. Virtual celebrities can also learn from the promotional methods used by the organizations mentioned above or work with them to significantly impact their audience.

The above discussion illustrates that there are reasons to expect that virtual celebrities can lead the consumer behavior of Gen Z. First, virtual influencers' persona can subconsciously impact audiences' consumer behavior. At the same time, due to the virtual and non-physical form, the whole image of virtual celebrity is more controllable. Therefore, it is meaningful to look into what kind of VIs can make Gen Z's fashion consumption more sustainable.

In the research process, I have conducted a qualitative case study, quantitative online surveys, and then applied semi-structured interviews to analyze the research question: **what kind of design of virtual fashion influencers can lead the consumer behavior of Generation Z towards more sustainable attitudes and behaviors?**

In order to interpret the particular design of VIs and how it can work on building behavioral changes in Gen Zers, I begin by introducing the concept of Virtual influencers in the following sections. Subsequently, I begin to review the existing literature on “virtual influencers” and “Generation Z”.

Literature review

1. Virtual Influncer

1.1 Introduction

In recent years there has been a rise in the analysis of virtual influencers in psychology, marketing, technology, and human-computer interaction. Still, there is a lack of research in the design field. Here I present a brief analysis of marketing, human-computer interaction, and virtual character design, sorting out the theories that currently guide or direct the creation of

Virtual Influencer.

1.2 Virtual influencer in marketing

With the development of computer-generated images (CGI) technology, the catalyzing effects of the epidemic, and the acceleration of digitalization, the internet influencer is also starting to develop towards a virtualization direction. Virtual influencers(VI), which are virtual robots that can emulate human appearance and behavior (Batista da Silva Oliveira & Chimenti, 2021), have become a trend in marketing. Moustakas et al. (2020) define that “virtual influencers are computer-generated influencers (CGI) or artificial intelligence influencers (AII) with a social media presence” (p. 1). Their study has explored the effectiveness of using VIs as a marketing strategy. It suggests creating an engaging backstory is not only the key to building an influential character but also makes the virtual influencer more human-like. At the same time, adding the character's psychological struggle, conflicts, pursuits, aspirations, etc., to VI's daily life will make the character seem more realistic and thus gain more favorable feelings from his followers. (Moustakas et al., 2020).

From ontological and ethical perspectives, Robinson (2020) discussed the marketing behaviors of influencer and virtual influencer and their impact on the audience, concluding that "there is no meaningful difference between VI and other 'real life' influencers.” They also suggested that VI is "simply as tools used by human agents," thus demonstrating VI's controllability. Based on previous research, Batista da Silva Oliveira & Chimenti (2021) concluded three categories that influence the effectiveness of nonhuman influencers' points: attractiveness, authenticity, and controllability. Besides, the study has also identified two other

categories, which are scalability and anthropomorphism/humanization (Batista da Silva Oliveira & Chimenti, 2021). The categories of VI influencing effectiveness suggested by (Batista da Silva Oliveira & Chimenti, 2021) – **attractiveness, authenticity, controllability, scalability and anthropomorphism/humanization** – guide the analysis of my thesis.

When it comes to the potentially profitable industries of VI marketing, previous research has all stated segments like fashion and luxury, are more open to VI marketing and can potentially benefit from utilizing VI (Batista da Silva Oliveira & Chimenti, 2021; Moustakas et al., 2020; Robinson, 2020). Yet, empirical evidence is lacking to show how VIs can impact the fashion industry in marketing. Therefore, I have conducted an empirical study on the GenZ attitudes towards VIs to investigate how VIs as a marketing strategy can have an impact on fashion customers from the basis of attractiveness, authenticity, controllability, scalability and anthropomorphism.

1.3 Virtual influencers in human interaction

As virtual agents increasingly prevail in many realms, VIs are becoming active on social media platforms, meanwhile integrating human networks and interacting with followers. Its interaction with humans and human-likeness has aroused researchers' attention (Arsenyan & Mirowska, 2021).

According to Kang & Watt (2013), “human-likeness in form or function of technology is often referred to as technology realism and is manifested in the way technology looks (visual realism) and the way it behaves (behavioral realism)” (as cited in Cornelius et al., 2021). Some research shows that more realistic avatars tend to provide higher acceptance of the technology.

For example, Nass, Steuer, & Tauber (1994) and Nass & Moon (2000) investigated that people tend to be more familiar with and receptive to technology interfaces that support realistic avatars or images (as cited in Cornelius et al., 2021). However, Mori (1970) hypothesized the uncanny valley theory opposite to the findings above. Mori (1970) argues that when humans see a robot that has a highly anthropomorphic appearance but is not exactly the same, it may cause eeriness and discomfort to humans. The results of previous studies related to technology realism varied due to particular experimental conditions of usage of different technologies. With the emergence and development of virtual influencers, researchers started to look into VIs. Also, they tried to figure out if increasing levels of visual realism could impact the effects of VIs.

Cornelius et al.(2021) examined "users' perceptions of VI credibility for increasing levels of visual realism to determine their persuasive power based on appearance." And Batista da Silva Oliveira & Chimenti (2021) have shown a relatively positive attitude towards the human-likeness of VIs. In their analysis, those VIs with higher anthropomorphism tend to arouse more affection from the followers, and those with human-like behaviors evoke broader emotions in their followers. Arsenyan & Mirowska (2021) found that "under the context of authenticity and social identity, the more human-like virtual influencer obtained substantially more negative reactions, proving the uncanny valley."

However, it is still not known whether audiences feel more attracted and reliable with VI who appear to be realistic (e.g., Lil Miquela) or those who are animated and less human-like virtual influencers (Moustakas et al., 2020).

1.4 Virtual Character Design.

Although virtual influencers (VI) are increasingly prevalent in various fields, the process of creating VI and its operation mode has never been disclosed. For example, Brud, the operator behind Lil Miquela, has never uncovered the creation process of the VI (Robinson, 2020). To construct a deeper understanding of VI design, I read and analyzed the related literature from fields of virtual character design. At the same time, I also collected and summarized the content of the previous study that involves the design part of VI.

The previous study related to virtual character design mainly focuses on the field of game design. Many researchers have classified and summarized factors and frameworks for virtual character design in the game design field. Sloan (2015) proposed and established critical frameworks that can guide the design and analysis of virtual characters; he mainly classified factors of character design into two areas. In the area of presentation of virtual characters, the authors focus on “Biological factors,” “basic visual and audio theory,” and “correlation between appearance and character identity.” In the area of “performance of virtual characters,” the authors focus on “psychological principles of emotion,” “personality,” “nonverbal communication,” “external factors that affect character performance.” Thus, a theoretical framework was built that can be used to guide the design and analysis of virtual characters. Nevertheless, Lankoski (2002) introduced the framework of dramatic character design in virtual character design and followed Robert Berman's principle of "six aspects of dramatic personae" in character design. He proposed "Deliberate dramatic change," "Mannerisms and habits," "point of view and attitude," "Disadvantages" can make the character more vivid and charming, and suggested considering physical, psychological, and sociological qualities

(Egri,1960) to categorize factors to be considered in character design. Thus, Lankoski (2002) introduced a new theoretical framework for virtual character design. These frameworks for guiding virtual characters design in games also guide virtual influencer design.

Makryniotis (2018) focuses on the fashion and costume design of avatars in computer and video games. He proposes that all symbols of virtual characters, from hair color to skin tone, reflect the characters' social status. At the same time, he noted that fashion in video games has a social meaning and that people consciously associate clothing with the character's social status and influence the appearance of the virtual character due to some social circumstances in the virtual world. He also suggested that because of the development of 3D technology, the costume design of avatars in virtual worlds has more possibilities. Virtual costumes have become a contemporary form of costume design, a creative statement.

Although there is no systematic exploration of design theories from research on VI, most scholars agree that a strong "creative vision" is needed to make VI generate a long-lasting appeal to followers. Besides, a unique personality and a compelling storyline make the VI more attractive.

According to Choudhry et al. (2022), visual appeal, the sense of mystery, and creative storytelling are what set VIs apart from human internet influencers and gained so many followers. The researcher also suggests that VIs are not constrained by human limits, which could evoke a sense of mystery among social media users (Choudhry et al., 2022). At the same time, Moustakas et al. (2020) also emphasize that creative vision and constant media content are the key elements that are indispensable for the long-term viability of VI.

In general, there are many studies related to virtual character design in terms of theory and

technical implementation. Some researchers have also looked at the intersection of character design and fashion design in games. But, the current identity creation system still has limitations and is not diversified enough. Also, there is a lack of research related to the character design of virtual influencers. In previous studies, it has been mentioned that in the design process of VI, a character with personality and a distinctive standpoint is the key to attracting the audience. Therefore, in this thesis, I will explore the creation system of virtual influencer design and consider incorporating more diverse and inclusive classifications into the whole system in the research process.

2. Generation Z

This section mainly explores the diverse consumption concepts of Generation Z and focuses on their attitudes towards fashion and sustainable consumption.

As the core user group of this research is Generation Z, this part is mainly related to the generation growing up in the digital environment, which is considered the most influential audience group for virtual celebrities. Generation Z usually refers to the generation born between 1995 and 2010. Due to the fact they were born in the years of the technology explosion, high-tech products such as the Internet, instant communication, smartphones, etc., have imposed prominent effects on them (Chen, 2019). They are a group of young people who are willing to display personalized expression in their behaviors and attitudes and embrace new economic forms.

Koulopoulos & Keldsen (2014) pointed out that youth in Generation Z are characterized by “high age inclusiveness, online presence, low technological threshold, cultural crossover,

and creative thinking" (as cited in Zhang & Yang, 2021). Moreover, as a huge consumer group, their consumption potential is unpredictable; they have distinctive consumption habits, choices, and styles with former generations and have formed their unique consumption patterns (Ao, 2021).

2.2 Characteristics of Gen Z's consumption concept

Generally speaking, there are three characteristics of Generation Z's consumption concept. Firstly, Gen Zers pay attention to the consumer experience and shared economy. According to Ao (2021), Gen Zers pay more attention to the memory, feeling, and new cognitions brought by the whole process provided by brands, from accessing the product to using the product, even after using the product. And the product could be tangible or intangible. Moreover, they are willing to experience the services brought by new technology and new consumption patterns; Francis & Hoefel (2018) mentioned that for Gen Zers, consumption is always about "having access to products or services, not necessarily owning them." This indicates that Gen Z's consumption concept has changed from transacting traditional products to experiencing service.

Secondly, generation Z is a pragmatic generation. Their pragmatic choices are due to the upbringing of Gen Zers, who grew up in an era of social, political, and economic uncertainties. Gen Zers are cautious and concerned about their emotional, physical, and financial security (Chicca & Shellenbarger, 2018). They have experienced the global recession and were impacted by technology-related events such as the public availability of the World Wide Web in the early 1990s, the explosion of handheld technology, including smartphones, cyberattacks, and cyberbullying. They have also been affected by the September 11 attacks, public violence,

rising unemployment rate, economic collapse, the world at war, and the pandemic (Seemiller & Grace, 2016; Shatto & Erwin, 2016; Shatto & Erwin, 2017; Twenge, 2017). These factors, together, have created prudence and pragmatics in their generational genes. Although Gen Zers have a great deal of choice and information at their disposal, they pursue a good value for money than members of previous generations (Francis & Hoefel, 2018). They promote purchasing items that suit their needs best, rather than things that could flaunt their status and luxury (Ao, 2021).

Thirdly, Generation Z admits consumer symbols, and in identifying with their inclusive consumer symbols, they build new fashion and lifestyles with their subcultural characteristics (Ao, 2021). Unlike previous generations, Generation Z only embraces consumer symbols for expressing their identity, not for expressing their social class or wealth.

In addition to these, Francis & Hoefel (2018) also mention that Gen Z is "anchored on ethics" regarding consumption. They expect brands to have their attitude towards specific issues, ethics, and values and implement these ethical values throughout the brand ecosystem.

2.3 Attitudes towards sustainable consumption

As mentioned, Gen Zers are becoming increasingly aware of ethical consumption. Lee's (2008) study showed that social influence, environmental concerns, self-image, and perceived moral responsibility were the top predictors of sustainable purchasing among young adolescents. Furthermore, the growing interest in sustainable causes has influenced the more youthful generation. It has been revealed that 87% of Millennials versus 94% of Gen Zers believe that organizations are required to tackle social and environmental issues (GlobeScan,

2018). This shows that Gen Z, who grew up against increased resource scarcity and environmental pollution, has a stronger sense of sustainability than other generations.

However, there is no research to prove that sustainability is a real driving factor in Gen Zers' purchasing behavior. According to Mohr et al. (2001), although consumers are aware of social responsibility and its apparent influence on purchase intentions, sustainability plays only a small role in their consumption decisions, this may contradict the trend that "Generation Z is the most ethical generation" (Eisingerich et al., 2011).

Sustainability is a concern for generation Z, but some factors prevent them from converting this into their purchasing decisions, which shows a gap in sustainable consumption in terms of awareness and behavior among generation Z.

2.4 Attitudes towards fashion consumption

Self-identity also influences Gen Zers' fashion purchasing decisions. According to researchers Johnson & Ein-Gar (2008), young consumers regard fashion choices as a form of self-expression, a statement of who they are or want to be. Hence, Generation Z is defined by the products they own. Because their fashion items are a cohesive expression of their individuality, they spend time making decisions and choosing specific products (Mittal, 2006).

At the same time, Gen Zers are growing up in an environment where the boundaries between the physical and virtual worlds are blurring, so in terms of personal identity and individuality, they don't stick to physical fashion items. Instead, they create their image on virtual platforms as part of their lives (Lyst x The Fabricant, 2020).

For example, Gen Zers are willing to spend on digital fashion items in the gamey industry,

known as skins, for their virtual avatars. Fortnite's Gen Z players try their best to work hard to save up for skins. According to Dara (2018), Gen Zers spend around $25 on game skins per month. Animal Crossing has created its fashion island in the game, where its users can wear designer clothes for the brand's new season (Samcox, 2021). In this scenario, "Screenwear becomes the new Streetwear," says Michaela Larosse, Head of Content & Strategy at The Fabricant (L.P.). Strategy at The Fabricant (Lyst x The Fabricant, 2020).

Because of Gen Zers' upbringing, they are accustomed to building and creating things with 3D software. With the support of 3D software technology, the barrier for gen Zers' creators to access and create digital fashion has been reduced so that even non-professionals or enthusiasts are willing to develop and share digital creative fashion content (Särmäkari, 2020). As a result, more and more digital fashion content has appeared on social media.

Not only that, growing up in a digital environment, Gen Zers are also adept at using the internet to access information that helps them make decisions about their fashion purchases. Social media is a significant channel of self-expression for Gen Zers (Ahn, 2011). The celebrities and influencers they follow on social media also represent their preference of lifestyle and fashion attitudes. The influence of traditional advertising in this generation has gradually shifted to social influencers (Hulyk, 2015).

At the same time, online shopping has become a vital consumption channel for Generation Z. A study conducted by J. Walter Thompson (JWT) Intelligence (2012) showed that “among 81% of Gen Zers who use social media, there is over 50% of them in 2015 do their purchasing behaviors online”. The logistics industry and the development of e-commerce have made it possible for people to purchase their favorite products without leaving home. But in the

meanwhile, traditional offline shopping has not been eliminated, and it is still regarded as an effective way to socialize with friends and family (Stone, 2017).

2.5 conclusion

The reviewed literature has investigated that Generation Z is currently the most aware generation of sustainable consumption. Still, they do not consider sustainability a key driver in their consumption decisions. At the same time, Gen Z's fashion purchasing decisions are influenced by social media and the aesthetics and lifestyles of social celebrities. They are focusing on physical items consumption and virtual items consumption. According to their digital background, they are accustomed to digital fashion and software, and online fashion information is a significant source that influences their purchasing decisions.

Therefore, the possibility of VIs affecting Gen Zers' fashion consumption behavior in terms of sustainability should be studied. This topic has not yet been discussed in the academic community. Therefore, this thesis aims to fill the gap in this area.

Methodology

This section focuses on the methodology and methods used in the study.

The research question is： What kind of design of virtual influencers can lead the consumer behavior of Gen Z towards more sustainable attitudes and behaviors?

Two sub-questions have been developed in order to analyze this research question better. (a) How do the five influence categories act on the influence of virtual influencers? (b) How to design a VI that can efficiently promote sustainable fashion?

Based on the above questions, the study employed both qualitative and quantitative

analysis process, which includes a case study, a survey and semi-structured interview.

3.1 Qualitative research

The purpose of the qualitative approach is to generate an in-depth and illustrative understanding of the various dimensions of the problem under analysis when it comes to a sense of universal meanings, motivations, aspirations, beliefs, values, and attitudes, the qualitative methodology can lead to more promising results. It generally corresponds to a deeper domain which includes relationships, processes, and phenomena (Maxwell, 2012). It is suitable for studies such as dynamic social relations that cannot be quantified (Queirós et al., 2017).

In the initial exploration process, I first explored the current most known VIs to comprehend why they are influential, thus building a foundational understanding for further exploration. Also, I used semi-structured during the research. I interviewed seven people working in fashion or virtual influencer creation, which allowed me to construct a more profound understanding of knowledge in relevant areas.

3.2 Quantitative research

The purpose of using quantitative research is to construct the foundation of understanding the picture of how VIs could be more effective in promoting sustainable fashion with VIs.

Quantitative studies generally require large samples so that they can be representative of the population (Queirós et al., 2017). In this way, these results can be considered a sufficiently comprehensive view of the population as a whole (Bridgmon & Martin, 2012). Therefore, the

quantitative research used in this thesis aims to find the relationship between the five influence categories and the VI influencers and how they can influence the concept of Gen Z fashion. I applied quantitative methodology and collected a large amount of data to support the results.

3.3 Case study

As mentioned earlier in this thesis, based on the five influential categories of VI, which are proposed by Batista da Silva Oliveira & Chimenti (2021), the influence phenomenon of VI can be studied in terms of anthropomorphism, humanization, attractiveness, authenticity, scalability, and controllability. In order to have a clearer perception of how the five categories function in the influence of VI, I collected the most known VIs on Instagram and used case studies to dig into the basics related to VI and its influence.

Case studies are a commonly used qualitative or mixed method that provides a means of investigating complicated scenarios with several variables. Case studies are particularly compelling for developing the knowledge base of a field, and the approach provides an excellent opportunity to innovate and challenge current theoretical assumptions (Queirós et al., 2017).

I collected the top virtual Instagram influencers in 2021 (*The Top Virtual Instagram Influencers in 2021 | HypeAuditor Blog,* 2021) for a case study. Since this paper focuses on the influence of VIs in the fashion industry, the top list of VIs I have studied is targeted at those positioned in the fashion field. The list of Top Fashion VIs is shown in Table 1.

Table 1. The list of Top Fashion VIs (based on Nick Baklanove, 2021).

Top Fashion Virtual Influencers 2021		
Virtual influencer	instagram page	Visual style
lilmiquela	https://www.instagram.com/lilmiquela	hyper-realistic
guggimon	https://www.instagram.com/guggimon	3D cartoon
janky	https://www.instagram.com/janky	3D cartoon
noonoouri	https://www.instagram.com/noonoouri	3D cartoon
imma.gram	https://www.instagram.com/imma.gram	hyper-realistic
bermudaisbae	https://www.instagram.com/bermudaisbae	hyper-realistic
shudu.gram	https://www.instagram.com/shudu.gram	hyper-realistic
blawko22	https://www.instagram.com/blawko22	hyper-realistic
rozy.gram	https://www.instagram.com/rozy.gram	hyper-realistic
amara_gram	https://www.instagram.com/amara_gram	hyper-realistic
ruby9100m	https://www.instagram.com/ruby9100m	hyper-realistic
nana.the.shrimp	https://www.instagram.com/nana.the.shrimp	2D cartoon
itsbinxie	https://www.instagram.com/itsbinxie	hyper-realistic
yameiionline	https://www.instagram.com/yameiionline	3D cartoon

In the case selection process, I selected the most representative cases from the top ten most influential virtual fashion influencers for analysis. The subjects chosen were Lil Miquela, Imma.gram, Shudu. According to their appearance, they are all human-like VIs (Arsenyan & Mirowska, 2021) in the field of fashion, with different fashion styles, but they come from different companies and are operated in different ways, all of them have a superb influence. The primary analysis is based on five influencing categories of VIs and explores their appearance design, persona, social status, and operating model.

3.4 Survey

After establishing a basic knowledge of the current VIs, the goal of the second phase was to understand how the five categories work to influence the effectiveness of VI and the correlations between them through a quantitative research approach. To recognize which type could impact the effectiveness of VIs the most and attitudes towards VIs, I surveyed the audience of VI through the internet.

A survey is a research technique that collects data directly from a questionnaire's participants, consisting of a set of questions organized in a specific order. It is a frequently used

quantitative method that reflects a group of people's opinions, perceptions, and behaviors through the results collected by a questionnaire and, as a result, the understanding of a particular phenomenon. Also, implementing a survey has the advantage of being highly representative of the entire population. However, at the same time, it is more accessible and low-cost compared to other research methods (Queirós et al., 2017).

In order to figure out how those five categories impose effects on VIs' followers' sustainable consumption behaviors. I designed a questionnaire based on the findings from the case study. The content of the questionnaire is shown in Appendix A. In the questionnaire design and generalization process, I focused on "how the five dimensions of virtual influencers affect the fashion consumption behavior of the audience." I hope to find correlations among the five independent variables and their relationship with VI influence.

Instagram is the leading social media channel I focus on because it is one of the fastest-growing social media sites (Sheldon & Bryant, 2016) and the most used platform by Internet celebrities (Casaló et al., 2020). It is a highly visually engaging platform (Casaló et al., 2021), where people publicly display the celebrities they follow and the content they view. In addition, followers are engaged in the online community.

The main approaches I used to carry out the survey were as follows: 1) Story posting and reposting on Instagram to engage Gen Zers interested in this aspect. 2) Questionnaire distribution on VI's Instagram followers list.

3.5 Semi-structured interviews

After collecting the survey's opinions, I understood how the five influence categories of

VIs could function on the impacts of VIs. However, which picture of VI could facilitate sustainable fashion more efficiently is unclear. The way to encourage and express sustainable fashion concepts, the appearance, personality, social status, and operation mode of VIs are still blurry. In-depth knowledge about this is needed at this stage, and some professional voice is required to establish a more accurate framework and gain a clearer perception of the design principles of VIs. So based on previous studies and research, I conducted a series of semi-structured interviews.

A semi-structured interview is a linguistic blend in which the interviewer attempts to elicit information from another individual by questioning them. While the interviewer prepares a series of pre-established questions, semi-structured interviews are often conducted conversationally and so provide participants with the space and opportunity to explore and discover what their issue is significant to them. Although semi-structured interviews have pre-determined questions, interviews ensure the overall interview's flexibility by giving the informant the freedom to discover and highlight issues and follow the informant's pace during conversation (Clifford et al., 2016) . It provides a focused structure for the discussion during the interviews but does not have to be very rigid in adhering to the structure (Kallio et al., 2016). It is easier and has more innovative opportunities than a fully structured interview.

I chose semi-structured interviews because I was able to narrow down some of the areas or topics I wanted to inquire about with Gen Zers while gaining more insight into their perspectives. Fully unstructured interviews run the risk of not eliciting topics or themes from Gen Zers that are more closely related to the research questions under consideration. Fully structured interviews, however, run the risk of failing to uncover deeper information. There

were specific topics that I wanted to include in the conversation, but at the same time, I wanted to hear insightful opinions from interviewees.

Findings

4.1 Cases

4.1.1 Lil Miquela

Lil Miquela (@lilmiquela) is a virtual influencer in the virtual world which Brud launched in 2016. She now has 1,233 posts (as of Oct. 12) and 3 million plus followers while maintaining a rate of about two weekly updates on the Instagram.

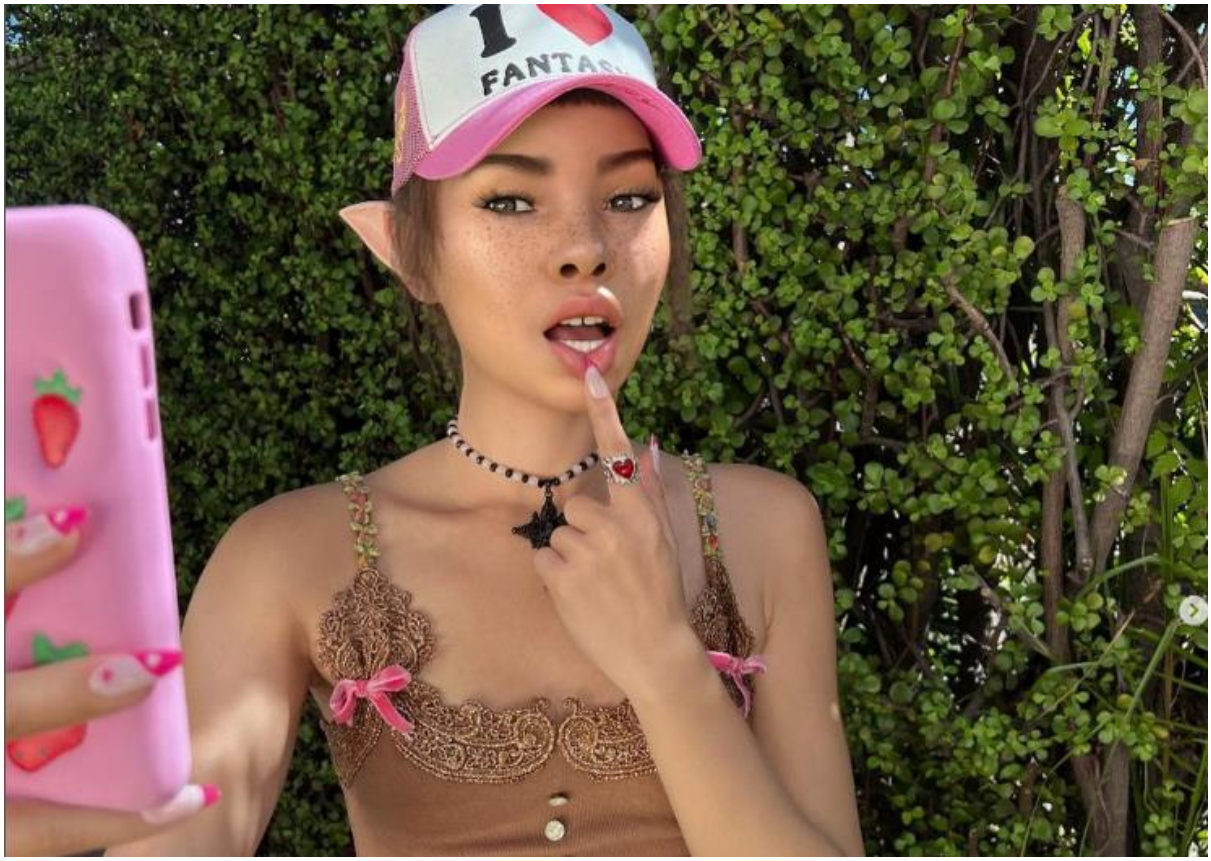
The operations team gave her a very detailed character set: a Spanish-Brazilian mixed-race, 19-year-old American girl. Also, she has complex character relationships with virtual influencers launched by Brud.

She also shares her personal life on social media and posts pictures of her excursions with friends.

Due to her hyper-realistic appearance, many followers wondered whether her real identity was a human or a robot. In 2018, she gave everybody an answer and admitted to her identity as a "robot," a human-generated CGI technology. Still, she has continued to express her complex emotions as an actual human on the Internet and has sometimes even felt sad and struggled with her robot identity. For example, in Posts, she stated, "Normalize ugly crying in public.""Getting ready for something big, and I'm screaming crying, and THROWING UP." "Obsessed with my Secret Santa gift." etc.

Figure 1.

Lil Miquela is taking a selfie



Note. Brud, 2022, (www.instagram.com/p/Cl6psOdPkS5/?utm_source=ig_web_copy_link)

Anthropomorphism

In terms of the degree of anthropomorphism, Lil Miquela is hyper-humanlike. From her overall presentation to backtrack her character setting, the positioning of Miquela is to achieve a high degree of human-like, which can be seen from the initial movement of her team. Initially, the operation team did not announce her real identity, whether she was a robot or an actual human. It seemed to want to create a buzz about her real identity and attract attention. Indeed in the early days, many fans questioned her identity, which aroused increasing heat for her.

Miquela looks very similar to human girls in appearance, not unapproachably perfect, but still pretty. She doesn't have a super-golden ratio face, has many tiny freckles, and a small gap in her incisors. Yet Miquela is still very playful and cute, has a perfect model figure in conventional aesthetics, and has her sense of fashion, wearing bright contrasting colors and showcasing her unique street fashion style. But sometimes, her flawless, smooth skin triggers the audience to question whether she is real.

Figure 2.

Lil Miquela is using meme to express herself

Note. Brud, 2022, (www.instagram.com/p/CUQJGB-loFK/?utm_source=ig_web_copy_link)

At the same time, she not only resembles a human in appearance but also reveals complex emotions similar to human beings. On the one hand, she shows expressions and movements through pictures and sends memes and stories to express her current mood and feelings as every

social media user does, and on the other hand, she also reflects her mood state through text narratives.

Figure 3.

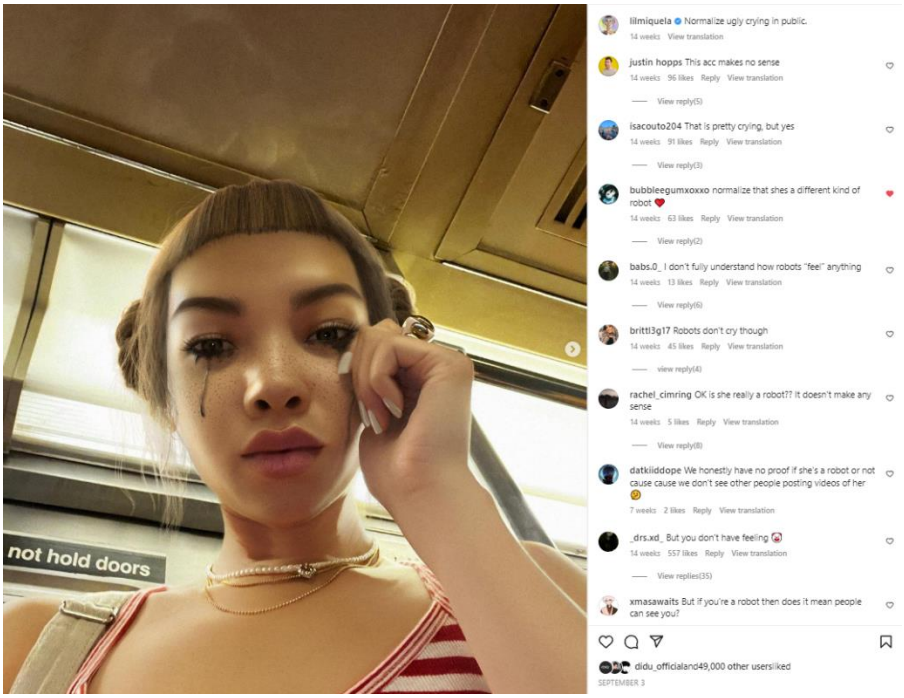
Lil Miquela is making fun of her robot identity

Note. Brud, 2022,

(https://www.instagram.com/p/ChxVG3kpkqD/?utm_source=ig_web_copy_link)

Figure 4.

Lil Miquela wanna normalize ugly crying in public



Note. Brud, 2022, (www.instagram.com/p/CiDU6EEPiYj/?utm_source=ig_web_copy_link)

She once broke down and cried in the subway or public places and called for "Normalize ugly crying in public." Also, she jokes about her identity "a stranger stopped me to take a selfie with the 'human dressed like a robot'...Who gonna tell him."

Some people showed positive attitudes towards her display of emotions. Still, others showed negative attitudes, especially when Miquela displayed negative emotions, and there were more negative responses in the comments than when she stated positive emotions.

At the same time, her complicated interpersonal relationships further strengthen her resemblance to human beings; this is not only limited to her interactions with other VIs and between her and real humans. She and her virtual human friends Blawko and Bermuda frequently comment on each other on Instagram and appear in each other's Posts. Also, Miquela interacts with her human fans; more often than that, she attends different events, collaborates with human celebrities, and seems to have a close relationship with them. And even her

boyfriends are existing people in the physical world, which builds up her human-like character. This interpersonal relationship partially compensates for her lack of existence in the physical world.

Figure 5.

Lil Miquela with her boyfriend

Note. Brud, 2022, (www.instagram.com/p/CejUxelJ-D2/?utm_source=ig_web_copy_link)

Meanwhile, unlike some VIs that use CGI technology to create imaginative scenes in their posts, the environments in each of Miquela's posts are very surreal and similar to places in real life. It also conveys that the team intended to develop the character towards a hyper-realistic VI when setting her up.

Attractiveness

Attraction is related to the influencer's (physical and behavioral) appeal to followers and

the business dimension, endorsement, and consistency with the brand (Torres et al., 2019). In terms of physical appearance, Lil Miquela has a top knot, tiny freckles on her face, a small crack in the middle of her incisors, bronze skin, and very street-style, colorful fashion aesthetics. She is not a traditional beauty in the sense of perfect looks. Still, Miquela is cute and has a unique understanding of fashion, always able to mix and match fashion items from various brands to create her unique style. In addition, she has also collaborated with very many luxury brands, constantly working with them. Besides, collaborating with celebrities and attending events also keeps her exposed to the public eye. People familiar with the fashion-related field may get to know her in various ways and thus become curious about her.

It is also that attraction occurs due to attributes such as value creation, novelty, and exclusivity. As for value creation, Lil Miquela's act of speaking out for various social issues manifests in conveying positive values. The #blacklivesmatter topic in her profile shows her stance on social causes. She also focuses on reproductive rights and LGBTQ+ causes, brings these topics to a broader audience, and supports the righteous side with a positive attitude; this has positively shaped Lil Miquela and made her more appealing on the other hand.

Of course, Lil Miquela's identity as an avatar is also a big part of what makes people interested in her. Because people are curious about this new form, they will pay attention to exploring her and try to learn more about the way Lil Miquela lives and exists.

Authenticity

Lil Miquela has made a lot of efforts to enhance her authenticity, and she strives to showcase her life and work and make her transparent in front of the audience. As a fashion

blogger, she actively participates in various fashion shows and collaborates with fashion brands. As a musician, Miquela writes her music, collaborates with musicians, and shares photos of herself working in the studio. She also shares social news and comments on it like every internet user, shares funny memes to express her mood, counters comments from Internet trolls with humor, etc.

Figure 6.

Lil Miquela is rehearing

Note. Brud, 2020, (www.instagram.com/p/CIwdf8sHRxh/?utm_source=ig_web_copy_link)

At the same time, Miquela has maintained consistency in her narrative on social media to maintain her authenticity (Batista da Silva Oliveira & Chimenti, 2021). In her recent post (19.10.2022), she claims to have "found a new folder on my USB necklace," which "contains so many huge moments" since she got Instagram, and has recently started looking back at previous memory. From those flashbacks, her character has remained consistent, and those old

experience has also shaped her current presence. For example, several years ago, her account was hacked by the other VI Bermuda. After getting her account back, Miquela announced her robot identity, after which she occasionally showed her confusion and frustration about her bot identity. Still, gradually she learned to face it head-on and tell her story with humor.

Figure 7.

Lil Miquela found a usb and wanna share old memories with follower

Note. Brud, 2020, (www.instagram.com/p/CjlNBFYpxF0/?utm_source=ig_web_copy_link)

In addition to being transparent in her life and maintaining cohesion in her characterization, Miquela's consistency in her fashion style and nexus with advertisers reflects her authenticity as a VI.

Miquela is known for her street style. Her stylish aesthetic has enabled her to collaborate

with branded hoodies, cropped pants, and comfy sneakers, including top luxury brands such as Burberry, Chanel, Coach, and Prada.

In addition to this branding promotion approach, which is similar to traditional human celebrities, Miquela, as a CGI celebrity herself, is of innovative and technical features, which allows her to collaborate with many brands uniquely and innovatively. For example, during Fashion Week 2018, Lil Miquela worked with Prada on a luxury marketing campaign. She promoted the brand's Fall 2018 collection and took over their Instagram account during the FW 2018/2019 shows. Miquela uploaded videos and images to Prada's Instagram Stories and invited all her followers to Prada's Instagram. Also, Miquela gave them behind-the-scenes clips and previews of the collection before the show started, which attracted a lot of heat for the show.

All in all, Miquela's transparency in front of the audience, consistent trendy style, and genuine demonstration of collaboration with brands constitute her authenticity. They have accumulated a lot of popularity and loyal followers for her.

Controllability

Lil Miquela's controllability can be described in several dimensions. The first dimension is that Miquela is under the control of the whole operating team. Since the Brud team controls her appearance, personality, social status, and output content, she is always on the right track.

She has a precise characterization, she is much more controllable than a real-life influencer. Since she only exists in a virtual world, her character setting never falls apart. At the same time, real-life influencers tend to have fake characters in front of the audience, ultimately leading to

losing fans and damaging the brand's image if their real image was exposed. As a reason, virtual influencers are gradually becoming more trustworthy to collaborate with.

On the other hand, controllability has to do with certain predictability of influencers, which can be partially tracked through contracts, etc. Also, it involves social media metrics (audience, engagement, conversion rates, etc.). Because the data from the collaboration with Lil Miquela is trackable, in this respect, her content can have the control to make adjustments based on feedback data from audience. If the data flow is good for the content, it can be directed to produce more similar content afterward.

Scalability

In terms of influence, Lil Miquela has surpassed many human internet celebrities. She has certain advantages regarding her virtual presence, such as her technicality and innovation, allowing her to collaborate with brands that position themselves as technological innovators. While in the virtual world itself, many companies that want to expand in the direction of the metaverse naturally choose to work with Miquela rather than actual humans.

Samsung, a technology brand whose main keywords are innovation and endless possibilities, also invited Miquela to feature the #TeamGalaxy campaign with the Gen Z audience as the leading target group. In this campaign, Miquela takes on the identity of a Virtual influencer for Samsung's innovation energy. In a video for the campaign, Miquela said, "I am the product of technology myself, so I can relate to Samsung in a way that's a LOT more literal than most people." Samsung succeeded in associating unlimited potential with Miquela and reaped good brand benefits.

Figure 8.

Lil Miquela in #TeamGalaxy campaign

Note. Brud, 2022, (https://www.youtube.com/watch?v=AogkLmimfRU)

And with the emergence of fashion 4.0, the meta-universe concept, etc., Lil Miquela's digital existence is becoming an advantage, especially for brands that plan to expand the business to the web 3.0 direction. For example, Pacsun, an online e-commerce brand that designs lifestyle clothing for teens and young adults, has partnered with her as a spokesperson, teaming up to produce social content and drive the brand's back-to-school and holiday campaigns throughout 2022. Miquela has the advantage over human celebrities in this field because she already lives in a virtual world. Her humanized presence but virtual identity is becoming an essential way for brands to interact with Web3 technology and establish a dialogue with digital natives, as known as Generation Z.

Again, Miquela is highly controllable, and her characterization and presentation are created in a careful team arrangement. So she would not lose fans by suddenly having her real-life setting misaligned with her online set like a human internet celebrity. Miquela only exists in the virtual world, so her characteristics will never fall apart as long as the team is still

working.

But there are still many things she can't achieve as a bot. For example, she can't have an authentic experience with certain products, such as food and skin care products. As a result, when she recommends this part of the goods or content, the audience will also be skeptical. When fans ask her about her skincare process, she has no way to go about actually sharing it because she exists in the digital world, and her skin doesn't age due to sun exposure

4.1.2 Imma.gram

Imma (@imma.gram) is a 3D Human-like virtual girl based in Tokyo. In 2018, she first appeared online, lauched by the team Aww Tokyo. She now has 689 posts (as of Oct. 12) and 0.4 million plus followers while maintaining a rate of weekly updates on the social platform. Meanwhile, she is very active on Tiktok, following the most trendy topics on Tiktok and posting related new videos.

She has a character set that she is very interested in Japanese culture, film and art. Because of her attractive character, Imma has worked with many organizations today, from fashion brands to media companies to museums to web 3.0 companies, and has received relatively good feedback.

ModelingCafe and Aww share resources and work as a close team to create Imma. The artists have finely polished Imma to the smallest detail, from facial expressions to hair and makeup to unique styles. At the same time, the team doesn't want to maintain the current presentation of Imma. Its ultimate goal is to combine CGI humans with AI programs capable of real-time animation to promote synchronization of the virtual and real worlds.

Figure 9.

Imma is playing game with her pet

Note. ModelingCafe & Aww, 2022,

(www.instagram.com/p/Cj684ETrxoM/?utm_source=ig_web_copy_link)

Attractiveness

Imma is approaching perfect beauty in terms of her physical appearance. Her perfect proportion, immaculate-looking skin, pastel pink hair, and distinctive cute style are the reasons why she attracts and gains so many fans, and it also gets her a lot of brand deals. She often shares photos of herself taking selfies, hanging out on the streets of Tokyo, or eating at restaurants.

As the first CGI model in Japan, Imma is doing better than most real-world models. She has become a spokesperson for well-known brands, including IKEA, Amazon, Valentino, Dior, Puma, Nike, and Calvin Klein. she was also selected as one of the "New 100 Talents to Watch" by Nihon Keizai Entertainment.

Besides her obsession with culture and art, Imma is very much concerned about social

causes. Such as race, environment, and gender, and she gives voice to these social issues in both the virtual and real world, caring about them even more than some real-life internet celebrities.

Overall, Imma's presentation is recognizable and combined with the novelty, and people instantly remember this virtual girl. Her cute appearance always allows people to ignore the truth that she only exists in the virtual world and embrace and support her. For example, when she said she couldn't touch and kiss people in reality because of her virtual identity, her followers just comforted her that it didn't matter if there was physical contact as long as her emotions were connected with them. This further verifies that virtual people can also have a parasocial theory with their fans.

Some even say, "Whether you are a virtual person or not, I am willing to be your fan, and please take my money." It also shows that the greater the attractiveness, the more influence it can help VI get . However, being too perfect can also generate counterreaction and criticism. Fashion imagery has already caused appearance pressure and narrow body norms. It is the responsibility of VI developers not to fuel them further.

Figure 10.

Imma supports LGBTQI+

Note. ModelingCafe & Aww, 2022,

(www.instagram.com/p/CLbp5RTjo1N/?utm_source=ig_web_copy_link)

Scalability

As a virtual celebrity, Imma uses more CGI techniques in the visual presentation than real ones, making the overall visible presence more imaginative and futuristic. Unlike Brud's VIs, the Imma team does not seek to resemble natural scenes or humanoids when presenting scenes. Although most of Imma's post content is still displayed in real-life images, the team also adds some fantasy elements into some of Imma's visual presentations, such as Imma appearing as a giant in a city or a 3D synthetic virtual illusion space. The team behind Imma has been famous for producing high-tech fantasy effects before, so Imma also cooperates with many virtual costumes. Through CGI synthesis technology, Imma also presents some digital fashion items

as models, bringing solid visual shock and showing the digital world's beauty.

Figure 11.

Imma appearing as a giant in a city or a 3D synthetic virtual illusion space

Note. ModelingCafe & Aww, 2022,

(www.instagram.com/p/CjaJFu1rMR4/?utm_source=ig_web_copy_link)

Figure 12.

Imma's image has become a solid intellectual property

Note. ModelingCafe & Aww, 2022,

(www.instagram.com/p/CRl0XVbDLuF/?utm_source=ig_web_copy_link)

Moreover, since Imma's image has become a solid intellectual property and she is a created being, many artists and exhibitions would love to cooperate with her; this is something that a human celebrity cannot achieve because a real person is only a human being, after all, not a creation, and cannot present and recreate themselves as the exhibition's theme.

In addition, Imma also has the characteristics that every VI has, which is that she does not grow old and is of the character of innovation. At the same time, the identity of the virtual human makes it easier for her to connect with the WEB 3.0 and metaverse-related industrial content.

Authencity

Imma’s operating team wanted her to have a natural, everyday life that human beings could follow. Because generally, people wanted to hear opinions and see updates about other real people, not CGI creations. As a result, a lot of work has gone into creating Imma's daily life. When she's not modeling for big brands, she's probably hanging out with her siblings or her dog Einstein. And the audience can see her interacting with other people and hanging outs. Overall, her life seems more interesting than general social media users, which is why she has accumulated many followers.

Based on her Instagram feed, she is passionate about Japanese culture, film, and art. Her curious personality leads her even to question her identity with the hashtag #ithinkimcgi, which takes her to art museums and explores fashion to discover herself through human culture.

She often doubts her identity on Instagram and makes jokes about her virtual existence.

She also follows current trends on TikTok and makes videos with the corresponding content, which attracts a vast audience of younger generations.

Anthropomorphism

On the one hand, Imma's anthropomorphic trait is expressed through her ultra-realistic appearance, lively personality, and narrative, and on the other hand, it is through her interaction with people.

From what is shown on Imma's Instagram, the photos she "shot " are the product of a combination of reality and CG. The Creator's approach is to have the model take a photo of a natural scene and then have Imma's head made separately, render and photoshop her head into the picture. Most of the images viewers see, whether of the scenes or the model's body, exist in the physical world, and the creative team replaces the exact model's head with Imma's. They claim to have more energy to perfect the delicacy of the virtual human face in this way.

From the photos, this CG and a natural blend of images are confirmed to bring a high level of realism to Imma's appearance. At the same time, the creative team handled the lighting and shadow effects with considerable care and attention to detail. Generally, in this kind of CG and reality combined work, the light and shadow are the part that could look false most easily. To present the effect with an ultra-realistic impact, we need to work on the morning and shadow effects in post. To create a super realistic virtual character, the team repeatedly tested and improved it so that her movements and expressions were infinitely close to those of a natural person. With female engineers on the team, Imma's hyper-realistic face results from female-defined aesthetics by a group of female makeup and visual artists.

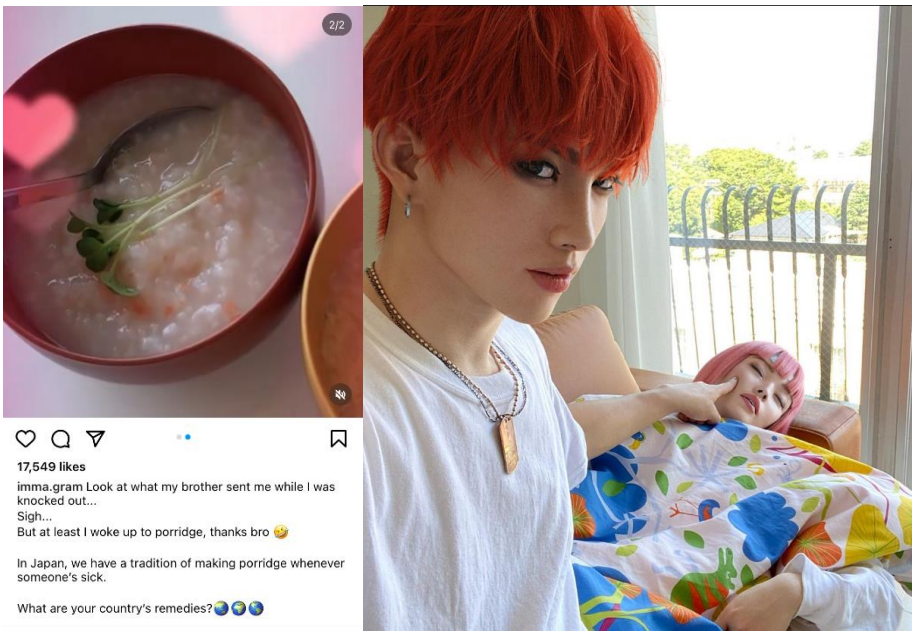
In addition, the high frequency of interaction with actual celebrities, virtual friends, and

fans also contributes to Imma's human-like traits. One thing that sets her apart from other VIs is that in addition to replying to fan messages and liking them, she also visits fan pages to like their posts, which strengthens the stickiness of her followers. She has different interpersonal relationships but they are not as complicated and dramatic as Miquela's.

Also, Imma shows her emotions quite truthfully and often; she shared that she suffered from a seasonal cold during the change of seasons and felt unwell, and shared that her brother cooked hot porridge for him, saying it was a Japanese custom.

Figure 12.

Lil Miquela is taking a selfie



Note. ModelingCafe & Aww, 2022,
（www.instagram.com/p/CQs48F5DZiC/?utm_source=ig_web_copy_link）

4.1.3 Shudu.gram

Shudu (@Shudu.gram) is a 3D Human-like virtual supermodel from South Africa. Her

team claims she is the World's First Digital Supermodel. She first appeared online in 2017 as the work of photographer Cameron James Wilson, founder of the Diigitals, the first virtual modeling agency in the world. The agency has blurred the boundaries between the physical and the virtual. Cameron used to work as a fashion photographer, shooting stories that would only exist until magazines were published for one week and were thrown in the trash a week later. Slowly feeling empty, Cameron said he wanted to do something artistic but more sustainable, and Shudu is an example of an early step in his creative project. Now, Shudu has 112 posts (as of Oct. 12) and 0.2 million plus followers while maintaining a rate of weekly updates on Instagram.

Figure 13.

Shudu X Samsung

Note. ModelingCafe & Aww, 2022,
（https://www.instagram.com/p/CER3abjB8lY/?utm_source=ig_web_copy_link）

Scalability

In addition to her extraordinary beauty and perfect figure, Shudu has the same advantages as all the other VIs. That is, she has innovative traits and more creative possibilities. But apart from that, Shudu is also different from the first two hits VIs mentioned in previous chapters. Shudu uses 3D technology to present the clothes and all the scenes instead of using human models to shoot and change to 3D heads. This approach requires a high level of technology. It reduces the carbon footprint of garment transportation, which satisfies part of the creator's original intention when he started making Shudu, which was to create something artistic and more sustainable in fashion scenes.

When Shudu works with other brands or magazines, etc., the brand team casts and styles her, just as they do other non-digital models. Still, they digitize the outfits and send them to Shudu's creators, who create the composites of Shudu and her fantastic fashion photography. A brand also offered a commission that they wanted the presentation of the model to be in the desert. With the creator's attempts, he used 3D technology to create visual effects composites that looked so realistic that the team would have had to fly to the desert if they had done it in real life. As the fashion industry increasingly tries to become more sustainable, significant brands are selecting to showcase their collections virtually instead of packing up boxes of samples and sending them all over the world. From a sustainability standpoint, it's powerful.

Figure 14.

Shudu X @wwd X @itsclo3d

Note. the Diigitals, 2018,（www.instagram.com/p/BkA-Px9FaEh/?utm_source=ig_web_copy_link）

Controllability

From the point of view of controllability, Shudu's entire production process is under the creator's control. Cameron uses the 3D modeling program, Daz 3D, to create work. As a fashion photographer before, he “shot” Shudu as a model to express some creative fashion photography. He also uses familiar lighting techniques to control the skin's texture to enhance Shudu's visual imitation of human beings. He considers Shudu to be his artistic creation project.

Cameron also noted that the process of finding the right 3D assets was challenging, especially finding assets of black characters. In Cameron’s opinion, the 3D world severely lacks racial diversity, like many industries, and there are few black character assets. So he also expects this project to bring attention to this issue and hopes that as technology and the 3D industry advance, there will be more diversity in 3D characters and resources.

Cameron's role as the man behind Shudu, a white male biologically, has received a lot of criticism. Some people believe that he is taking advantage of consuming black people's identities and carrying out cultural appropriation. Others suggested that Shudu's image was too perfect and controlled and that she might replace many black models' job opportunities.

However, Cameron is happy to see this discussion and believes it could bring more attention to the status and opportunities of black models in the modeling industry. In his eyes, Shudu is not taking away jobs from talented black models but instead providing a window to showcase more diversity and beauty, allowing more people to see the power of black models and gaining more attention for them.

Authenticity

It is clear from Shudu's Instagram that her company does not intentionally try to create a personality for Shudu, as her social media feeds to show more professional photos of her work and not any scenes from her life. Her post narrative is also more rigorous, announcing new collaborations and projects in the manner of a professional model. Unlike Imma and Miquela, who use text and Internet abbreviations to emphasize their "human" and "netizen" features, the team does not use very complex relationships to reflect Shudu's human-like and authentic nature. While Shudu does have virtual model friends, she does not frequently show her life with them on her page. She clearly states that she is a digital supermodel, showing enough transparency in her identity to eliminate any suspicion of her identity.

The team's approach to Shudu's personality setting is that they are not under any illusion that Shudu has a personality of her own, as they allow her followers to relate to her in many different ways and project their identities onto her.

Still, there are questions like "are u a human or robot" in Shudu's comments, even though the real identity is stated on the profile. This situation could be that her hyper-realistic presentation is unbelievable for the audience, even after knowing her real identity. Because the creator is a former fashion photographer, he understands the importance of proper lighting, the fidelity of character details, and no over-retouching or beautifying of characters in post-production, which often makes Shudu look incredibly realistic. When creating Shudu, the creator added natural imperfections such as pores, hyperpigmentation, and thin lines to make her look more realistic. The reflection of light in Shudu's eyes is also under modification. As technology develops, the creators continue to test new techniques to add further details to Shudu.

Except for dealing with creating details, Shudu has always been consistent in the tone of her collaborations with brands. She has always worked with and for high-end fashion brands. Shot in natural environments with a technological and surreal aesthetic, Shudu, with a stunning fashion presentation, represents a new reality in terms of high fashion.

Attractiveness

Shudu is a prime example of VI, who has gained massive appeal due to her beautiful appearance. Her ultra-perfect look has made many brands and photographers want to collaborate with her without knowing she is a virtual human being.

At first glance, South African model Shudu Gram is striking, with her high figure, angular features, and pouty lips. Her flawless chocolate skin seems to glow from the inside out, and her hair is neatly cut. Her striking features and ideal style make her the perfect supermodel. According to Shudu's creators, her look is inspired by the South African princess of Barbie,

with her sculpted facial contours, neck ring, and traditional cultural dress.

When Shudu first appeared on Instagram, she received a lot of attention in a short period. Thanks to her appearance, hashtags such as #melanin, #blackisbeautiful, and #blackgirlsrock became popular. What's more, Fenty Beauty's Instagram account reposted her pictures after finding a photo of her using Saw-C lipstick. Her beauty was so stunning and incredibly perfect that people claimed not to believe it was real. She quickly gained a massive following on the platform and became known for her symmetrical features and shiny dark skin.

Figure 15.

Shudu using Fenty beauty Saw-C lipstick

Note. the Diigitals, 2018, (www.instagram.com/p/Be0ldl7F-Pu/?utm_source=ig_web_copy_link)

Since then, Shudu has received offers from many brands in the fashion and tech worlds, and all of the brands wanted to work with CGI models. In February 2018, Harper's Bazaar USA magazine wrote a report about Shudu, and after four months, Women's Wear Daily wanted to incorporate her into one of its fashion pages.

Shudu's looks are gaining more and more collaborations in the fashion industry. She is an example of a VI who is not intentionally operated to have a personality. Still, the appeal of her appearance keeps her highly popular and gains her a solid fan base.

4.1.4 Cross-case analysis through five categories

Anthropomorphism

All three of them are human-like settings from an external appearance perspective. Miquela and Emma not only resemble people in appearance but also reveal complex emotions similar to those of people. Shudu is different from them in that the Shudu team did not deliberately create a specific personality for her.

On the one hand, they express her current mood and feelings through pictures showing expressions and actions, sending memes and stories, just like every social media user; on the other hand, they also reflect her emotional state through textual narratives.

At the same time, their complex interpersonal relationships further reinforce her resemblance to humans; they interact with other VIs, with human celebrities, and with fans. This interpersonal relationship partially compensates for their lack in the physical world.

However, the way each VI is operated varies from company to company. Lil Miquela's design team deliberately made her appearance more anthropomorphic by making her flawed in the traditional aesthetic sense. She does not have a super-golden ratio face, has many tiny freckles, and has a small gap in her incisors, but this imperfection makes people feel closer to her.

At the same time, the settings in each of Miquela's posts exist in real life, which makes people feel that Miquela is real because they can go to the places where she has shown up. Most of the scenes in Emma's posts are also natural scenes. Still, her team did not pursue 100% realism but used CGI technology to create many more imaginative scenes to highlight the characteristics of her virtual identity. Shudu is entirely different. All of her visual representations, from characters to costumes to the whole process of scenes, are synthesized with CGI technology, and the entire process can reduce production costs.

Attractiveness

Some natural or apparent factors, such as talent, beauty, style, comedy, and sensuality, are essential elements in the composition of attractiveness.

All three have beautiful appearances and excellent fashion taste, and overall, their visual presentation is recognizable and combined with novelty. They are also attractive due to their identity as avatars that are also very novel.

Collaboration with famous brands gives them a boost to their reputation and attractiveness as well. All three cases have worked with many well-known luxury brands and maintain partnerships with each brand.

The positive values they convey also make them more appealing, Imma and Miquela give a voice to various social issues and communicate positive values. They seem to care more about these issues than some real people.

However, the way each VI is operated varies from company to company. Visually, Imma and Shudu are near-perfect beauties. Although the creators did wish Shudu's skin texture was less refined and tried to add more hair and pores to Shudu's face, Shudu is still close to perfection based on appearance and body shape. She quickly gained a large following on Instagram and became known for her symmetrical features and glowing dark skin.

Compared to other VIs, Shudu is an example of a VI who does not deliberately manage her personality. Nevertheless, her professional ability as a model and attractive appearance have enabled her to maintain high popularity and gain a solid fan base.

Miquela's team is different from the other two VIs' teams in that Brud did not make Miquela a beauty in the traditional sense, without a perfect appearance. However, Miquela is still playful and cute, has a unique understanding of fashion, and can always mix and match fashion items from various brands, so she still has extraordinary appeal.

Authenticity

Lille Miquela and Imma have done a lot to increase its authenticity. They have tried to show her life and work to make her transparent in front of the audience. Therefore, much work has been done to create their everyday life. In addition to fashion shoots for big brands, they also try to show their daily life with other VI or human friends. Also, they maintain consistency in their social media narratives, such as story continuity between before and after posts, etc., to

keep their authenticity.

Not only do they maintain continuity in character and content, but their fashion style and relationships with advertisers are also consistent, reflecting their authenticity as a VI. Shudu has been working with and for high-end fashion brands. Shot in natural settings with a technological and surreal aesthetic, Imma and Miquela have also been working with high-end fashion brands, embodying their unique sweet or playful styles.

However, the way each VI is operated varies from company to company. Also, in addition to some of the same ways of enhancing realism, the teams of the individual VIs design them in different ways to enhance realism.

In the character set, Imma was set up with some more specific interests to appear more realistic, such as liking Japanese culture, movies, and art.

Another example is that when creating Shudu, the creators added natural flaws such as pores, pigmentation, and fine lines to make her look more realistic.

But unlike the other two VIs, Shudu's team's approach to Shudu's personality setup is that they are under no illusion that Shudu has her own personality because they allow her followers to relate to her in many different ways and project their identities onto her.

Controllability

From a controllability perspective, all VIs are highly controlled until AI technology is used to create them VIs. The content creation of the VIs is entirely designed and produced by the team staff. All three VIs are under the control of the entire operations team, which controls the appearance, personality, social status, and output of the VIs. They are always on the right track,

with persona and behavior consistency.

In addition, the size of the influence that VIs have when they work with brands is also controllable. As VIs can influence the behavior of their followers, brands will conduct activities with them to achieve the purpose of promotion. When VIs work with brands, whether they cause the click rate and purchase rate of a product or an activity to rise or fall, they can be tracked and counted in the influence report. From this perspective, VIs also have strong controllability.

Scalability

First of all, since VIs are a more technological innovation application, they have advantages over real internet celebrities due to this reason. For example, due to the virtual presence of VIs, their existence is technical and innovative, so some brands that are positioned with innovative technologies want to collaborate with them. At the same time, the virtual human identity makes it easier for her to be associated with WEB3.0 and metaspace-related industries, and many companies that want to expand into the metaspace direction naturally choose to work with VIs rather than actual humans.

Then again, in terms of visual presentation, VIs will more naturally and easily use more CGI technology, making the overall VI presentation more diverse and imaginative and giving more possibilities. At the same time, they become digital fashion models, bringing more opportunities for fashion innovation from virtual space.

Again, the VIs are highly controllable, and their personalities and expressions are created under the careful arrangement of the team. Therefore, they retain fans like human internet

celebrities who suddenly appear to have their real-life settings misaligned with their online ones. In addition, they don't get old and can be more consistently influential.

But there are aspects of them that can't transcend real humans. First, they can't have authentic experiences with certain products, such as food and skin care products. Also, some of the population will resist the emergence of such new technological applications and thus resent them.

However, the way each VI is operated varies from company to company. while not all VI fashion looks are now produced with 3D modeling, Shudu's content is presented in 3D technology-from the body to the clothes and all the scenes. Rather than being photographed with accurate models and then replacing the face with the 3D head by photoshop. This method reduces the carbon footprint of clothing transportation and is a more environmentally friendly form of fashion promotion.

4.1.6 Conclusions

From the above findings, I have summarized the following content, which can provide some sustainable fashion VI design guidelines.

Table.2 Design guides to make VI more influential

Attractiveness	• pretty appearance* • collaborated with very many luxury brands, constantly working with them* • unique and creative fashion style* • showing positive trait for example caring about social causes

Authenticity	• showcase the life and work and make it transparent in front of the audience. • maintain consistency in narrative on social media* • consistency in the fashion style and continuity with advertisers. *
Controllability	• the team needs to ensure the appearance, personality, social status, and output content are on the right track. *
Anthropomophism	• hyper-realistic appearance* • realistic scenes* • also reveals complex emotions similar to human beings • use pictures, posts, text narratives to show their personality. • complicated interpersonal relationships • interact with followers
scalability	• use their innovative and technological traits, have a potential to collaborate with brands that position themselves as technological innovators. * • take advantage of the identity of the virtual human makes it easier to connect with the WEB 3.0 and metaverse-related industrial content.* • use the long-lasting trait to accumulate more followers and influence. * • present more creative possibilities.

*means features all three cases have

4.2 Survey results

During this part of the research, 158 people filled out the questionnaire. After screening out respondents who did not complete the questionnaire and deleting respondents who took less than one minute to fill out the questionnaire, this survey finally obtained 150 valid questionnaires. The questionnaire recovery rate was 94.94%. In order to understand whether the content and structure of the questionnaire are reliable, I conducted reliability analysis and validity analysis. I also conducted frequency analysis in order to have the basic information of the respondents, such as gender, age and other percentages. I also conducted correlation analysis to understand the correlation between the five influential VI categories and people's attitude toward sustainable fashion, and conducted regression analysis and mediating effect analysis to verify the hypothesis that the five VI categories have a positive contribution to consumers' willingness to consume sustainable fashion.

4.2.1 Reliability and validity analysis

Before other analyses, this study started with reliability and validity analyses to examine the reliability of the overall questionnaire survey and whether the structure of the questionnaire was logical and valid. If the values of reliability and validity analyses were higher than 0.6, the content and design of the questionnaire were feasible, and the next step of the study could be conducted.

The result is shown in Appendix B, which turned out that the reliability of the questionnaire passed the test for the five categories and the overall, because their Cronbach's Alpha value all passed 0.6.

In this step, I utilized the Kaiser-Meyer-Olkin (KMO) test to verify if the questionnaire is valid. The Kaiser-Meyer-Olkin (KMO) test is a statistical measure used to identify whether data are appropriate for factor analysis. This test measures the adequacy of sampling for each variable in the model and the full model. The statistic is as a measure of the proportion of variance between potentially co-variant variables. The larger the proportion, the larger the kmo value, the more suitable the data are for factor analysis (IBM Documentation, 2021). The test result shown in Appendix C presents that no matter from the perspective of different categories or general content, the questionnaire is feasible and logical, because the KMO values are all bigger than 0.6.

4.2.2 Frequency Analysis

General Information of Respondents

A study that quantitatively portrays the features of a set of data is called descriptive statistics. Frequency analysis is a part of descriptive statistics. In the context of statistics, frequency is the number of times an activity happens.

In this study, frequency analysis shows the prominent groups of people who are interested in VI, the main gender share, the occupation share, and the overall level of awareness of VI. These essential statistics will provide helpful insights for VI orientation, promotion strategy and other decisions (*What Is Frequency Analysis? | Research Optmius*, n.d.).

A frequency analysis was conducted to understand the basic profiles of the respondents. As it is shown in Appendix D, respondents who were born between 1997-2012 are the most numerous, accounting for 76% of the total. The number of male respondents is 49, and the number of female respondents is 83, which is the most numerous, accounting for more than

half of the total, accounting for 55.3%. The respondents who have Bachelor's and Master's degrees are the most numerous, accounting for 36% and 36.7%, respectively. The number of respondents with Occupation in Arts, culture and entertainment industry is the largest, accounting for 54.7%. The respondents who follow fashion content daily or 2-3 times a week are 59 and 41, respectively, accounting for 39.3% and 27.3%, reaching more than 76% of the total. The respondents who have heard of VIs or are very aware of VIs are the most prominent groups, accounting for 53 and 58, respectively, for 35.3% and 38.3%. The numbers of respondents who heard of VIs but haven't looked into it or support VIs are the highest.

Also, we can read respondents' willingness to support and consume sustainable fashion by the Appendix E. Among them, the number of respondents, who are very supportive of sustainable fashion, is 83, accounting for 55.3%. And the number of respondents who think fashion is unsustainable anyways relatively high, which is 24. The participants who think sustainable fashion is their passion also occupy a big part, accounting for 24.7%.

To understand what the mean values of each category look like, I also conducted descriptive statistics, as shown in the Appendix F. The table shows that people's perception of VIs and fashion is still generally low. Most people still feel that VI is more controllable and attractive; this may also be because of the team manipulation of VI and VI's novelty feature.

4.2.3 Differential Analysis

The goal of differential analysis is to understand whether the identity of respondents, such as age group, gender, and cognitive level fashion could affect consumers' willingness to support sustainable fashion.

It can be shown in the Appendix G, at the 0.05 Significance Level, there is a significant

difference in the purchase intention of respondents of different ages, and the mean value of purchase intention for people born before 1997 is the highest. At the 0.1 significance level, there is a significant difference in the attitude toward sustainable fashion of Attention, Expectation. The mean values of the respondents who follow fashion content daily or 2-3 times a week are mostly tend to consume sustainable fashion. At the same time, people who work in the VI industry tend to support sustainable fashion the most when it comes to expectations.

4.2.4 Correlation Analysis

Next, to clarify whether the five influential categories of VI and sustainable fashion consumption intentions correlate to each other, I conducted a correlation analysis to gain a preliminary understanding of the relationship between the five influential categories of VI and sustainable fashion consumption intentions respectively.

As we can see in the Appendix H, the correlation coefficients between all categories pass the significance test at the 1% level. The correlation coefficients between measurements are positive and significant, so the hypothesis of this study is initially judged to be valid. Among these five influencing categories, attractiveness and attitudes toward sustainable fashion consumption are the most relevant, because the value is also strongest, at 0.853, which passed the significance test at the 1% level. At the same time, the correlation between Authenticity and Consumption is the second strongest at 0.817, which still passed the significance test. The correlation between Authenticity and Consumption is the second strongest, with a correlation coefficient of 0.817, which still passes the significance test. That is, the higher the Authenticity, the higher the Consumption. Among the five dimensions, the correlation coefficient of

controllability is 0.668, but there is still a significant positive correlation.

4.2.5 Analysis of regression

After Knowing that the pro-sustainable fashion intent and the five influence categories are mutually influential, I looked into how they influence each other, whether they promote or inhibit each other or something else, and how strongly they influence each other, so I conducted the regression analysis.

From the data in the Appendix I, all the data are greater than zero, meaning that the five influential categories positively affect the attitude towards sustainable fashion consumption. In terms of the data, the standard regression coefficients indicate the degree of influence of the independent variable on the dependent variable, with Attractiveness being the largest, so it has the most significant positive effect on attitudes toward fashion consumption. Also, it is shown in the table that the ranking is Attractiveness, Authenticity, Controllability, Anthropomorphism, and Scalability in the order of influence.

The next step is to verify how the five influential categories of VI affect the perception of knowledge respectively. From Appendix J, the five independent variables influence perceptions positively if the standardized coefficients are positive. From the fact that the standard coefficients in the above table are all positive, it can be concluded that these five coefficients positively influence knowledge perception. At this point, the coefficients of the effects of Attractiveness, Authenticity, Controllability, Anthropomorphism, and scalability on Perception are 0.253, 0.236, 0.148, 0.127, and 0.097, respectively, all pass the significance test at the 1% or 5% significance level. This result means Attractiveness, Authenticity, Controllability,

Anthropomorphism, and scalability significantly affect the mediating variable Perception, which means it passed the second step of the mediating effect. Next, the five dimensions and knowledge perception are put into a model, and the third step of the mediating effect is analyzed, data is shown in Appendix K.

When this knowledge perception was added to the model, it was clear that the data changed, so it was clear that the knowledge perception had a mediating effect on the five influence categories. Therefore, people's support for sustainable fashion is partly determined by their awareness of VI and fashion. It can be seen that there is a significant effect of knowledge perception with the inclusion of knowledge perception. Among the five dimensions, there is a significant effect of all the dimensions except Scalability, indicating a specific mediating impact on knowledge perception.

4.2.6 Results of the quantitative survey

The analysis of the survey data confirms this article's hypothesis: that the five categories of VI would positively contribute to consumers' willingness to consume sustainable fashion. It also proves the extent of the five categories of Attractiveness, Authenticity, Controllability, Anthropomorphism, and Scalability, as previously proposed by (Batista da Silva Oliveira & Chimenti, 2021), have an impact on the VIs' audiences.

The questionnaires were distributed through the follower lists and stories of each VIs on Instagram, so the participants participated voluntarily. Their primary motivation for completing the questionnaires was their interest and willingness.

From the frequency analysis, most of the participants in this survey are interested in

fashion, virtual fashion, and VI, and there are more women. The age group is concentrated in Generation Z, which proves that Generation Z is currently the largest audience of VI. Also, most participants supported buying sustainable fashion brands and products. Those who follow fashion regularly are more willing to buy sustainable fashion products.

Among the correlations between the five categories and the willingness to purchase sustainable fashion, the correlation between attractiveness and desire to consume is the strongest, with a significant positive contribution and the most substantial effect. Then there are authenticity, controllability, and anthropomorphism in a row, but scalability is the lowest.

It can also be obtained that the level of human perception of VIs and fashion impacts the intention to support sustainable fashion. The higher the awareness level, the more the approval of sustainable fashion. Therefore, it is essential not only to improve the five categories but also to help improve the level of cognition of virtual people and fashion in the content design of VI.

This analysis resulted in a leading way for the designer VI design process in the future. They can adjust the work focus according to the design goal in the design process. **To make VI have a better orientation to promote sustainable fashion, the designer can focus on enhancing attractiveness first, then enhancing authenticity, controllability, anthropomorphism, and scalability.** Finally, there is a significant contribution of the five categories to knowledge perception, and there is a particular mediating effect of knowledge perception.

4.3 Semi-structured interviews

During the survey process of this research question, I collected the contact information of

participants who were interested in the study and conducted follow-up semi-structured interviews with them to build more profound knowledge. The main reason for using semi-structured interviews was that I had already established partial knowledge in the previous survey and wanted to be more in-depth and flexible in understanding more details under the established framework.

I composed the script for the interviews based on the results of a previous literature review and questionnaire. The questionnaire outcomes are confidential and protected, and no personal information will be disclosed, and this research follows the ethical research policy of Aalto University. The questionnaire was mainly concerned with the content of sustainable fashion and the design of VI features. The interviewees were selected from the respondents of the questionnaire and the related fields, which allowed for more technical information and inspiration from people in the corresponding areas. On the other hand, semi-structured interviews allow respondents the freedom to generate insights and perspectives that are not covered in the literature and questionnaires.

Seven Gen Z people in relevant areas participated in semi-structured interviews, four of whom were students studying fashion-related fields, three were designers working on VI creations or virtual fashion, and one of them is also running a virtual human design company. Table 3 presents a summary of the interviewees' profiles.

Table 3 Interviewee's profiles

Interviewee/ Expert	Age	Generation	Gender	School Training	Occupation
Interviewee 1	20-25 years old	Z	Female	Masters	A textile designer researched sustainable fashion in her MA study, focusing on natural dye.

Interviewee 2	20-25 years old	Z	Female	Masters	A founder of a womenswear brand, majoring in textile design in MA. After researching natural dye, she wants to rebuild her brand's core values sustainably.
Interviewee 3	25-30 years old	Z	Female	Masters	Master's degree in Fashion, Clothing, and Textile Design, with research on the aesthetics of sustainable fashion.
Interviewee 4	20-25 years old	Z	Female	Bachelor	A digital artist and designer, co-owner of a digital art studio. The main business of the studio includes collaborating with fashion brands, magazines, and celebrities to produce visual concept campaigns through digital art visual presentation, including avatar design and production.
Interviewee 5	25-30 years old	Z	Female	Masters	A digital artist based in London, she has her virtual clothing studio and has done a lot of research on AR and the virtual fashion world.
Interviewee 6	25-30 years old	Z	Female	Masters	A fashion designer, known for her wearable soft toys collection.
Interviewee 7	25-30 years old	Z	Female	Bachelor	A digital artist, co-owner of a digital art studio. She has many followers on social media because of her virtual human digital art.

The average length of the recordings for the seven interviews was 75 minutes (525 minutes in total).

The interview design includes thirty questions, which are shown in the appendix L. The former three questions were aimed at gaining an overview of attendees' professional knowledge and affiliations and making sure they met the Sampling Standards, while the remaining questions directly addressed the need for exploration what would be more suitable for character design of VI for sustainable fashion and how to promote sustainable fashion idea by VIs.

Questions were primarily related to the four areas are physical appearance design, psychological character design, social role design, operation method, and sustainable fashion promotion. The list of questions can be viewed in Appendix L.

A few days before the interview, interviewees received information about the virtual influencers and interview questions via email. This way, it can offer them a chance to re-familiarize themselves with the virtual influencer account through the link sent to them and give them sufficient time to organize their ideas and establish their point of view.

4.3.1 Analysis approach

During the analysis, interview transcripts were analyzed for thematic grouping to discover clusters and recurring patterns of interviewees' perspectives. The thematic analysis consisted of the following steps, (a) acquainting with the data, (b) making initial codes, (c) exploring coding groups to identify themes, (d) examining themes, (e) giving names to themes, and (f) writing a report (Braun & Clarke, 2006).

4.3.2 Findings

This part of the study is divided into categories according to the questions. Since the questions are about sustainable fashion and the design of appearance, characterization, social status context, and operation, the content of the interviews will be related to these four aspects of design. In the interviews with fashion or textile designers, the focus was on interviewing them about knowledge of sustainable fashion. In the interviews with the virtual human designers, we asked them about the process of designing virtual humans, the factors they

consider, and how they would design and operate the VIs if they incorporated the values of sustainable fashion.

Physical appearance design

Appearance presentation is highly significant for VI because in a social media like Instagram, visuals of images are mainly the dominant factor. People's attention will be quickly attracted by eye-catching photographs in a short time so that appearance presentation will form the first impression of VI to humans.

From the point of view of appearance design, Sustainable fashion VIs are more impactful when the appearance is more human-like. First of all, the form of the VI itself is novel to people, and it is known from the Appendix M that such novelty increases the attractiveness of the VI. And also, people tend to have a higher sense of trust in what is already known; they are more likely to trust a VI if its appearance belongs to someone they are more likely to encounter in real life. Also, in the fashion industry, human-like VIs are easier to promote. If VIs are involved in brand partnerships or endorsements, they need to be physically similar to people to use these fashion items.

In addition to being human-like, having a realistic, relatable look for VIs makes them persuasive. Through such appearance, people can associate themselves with VI, integrate VI's life into real life, and combine it with scenes to produce more resonance.

In addition to the Physiological features of the character, the overall aesthetic style also occupies a large part of VI's appearance. Professor Kirsi Niinimäki (Niinimäki, 2013) mentioned the form of green aesthetics, discussing whether sustainable fashion should have a

particular aesthetic. She also claims that change is at the heart of fashion and that by embracing change, novelty, and aesthetics, it is still possible to focus on reducing the speed of change and growing the longevity of design in fashion design. Based on these points, we also had some discussions in the interview.

Most people have the stereotype that sustainable fashion has a similar kind of aesthetic, including its patterns, color palette, etc. People think of sustainable fashion as minimalist, with a natural and pale color palette. The images are always in a natural setting, as well as the presentation of the clothes. And also, zero-waste pattern fashion is a typical type of aesthetic style. This has changes over the years but is still worth considering when designing the appearance of the VIs.

Although they are all part of sustainable fashion, the aesthetic of sustainable fashion should be diverse, and people's perceptions of sustainable fashion should be more comprehensive than a specific aesthetic form.

Especially for Gen Z, a group of people willing to express their identities by outfit, tend to show the culture they love and the group they belong to through what they wear. They have a very diverse fashion aesthetic. Therefore, when VI conveys sustainable fashion values, especially when the target user is GenZ, it should be more inclusive and encourage the emergence of diverse, sustainable fashion aesthetics.

For example, through remaking and the use of new materials, sustainable fashion can be maximum. It can be of a lot layered, it can be colorful, or it can be futuristic with recycled materials 3D printing. Here it is essential to mention that thrift and remake frequently appeared in the interviews. The concept of thrifting is becoming increasingly popular among young

people, for example, due to the Y2K （year two thousand) aesthetics that has emerged in recent years, and they are looking at secondhand with a retro aesthetic.

In a word, it is essential to have enough education and understanding of sustainable fashion's basic knowledge and core value to convey the meaning of this green aesthetic. If everyone can develop an understanding of green aesthetics and then put green aesthetics into practice from the perspective of their actions, sustainable fashion looks will be more prosperous and more diverse. The important thing is not to present a particular "green" image but to realize what matters is the sustainable manner behind fashion products and present sustainable fashion in a way where your passion is.

Based on this view, some interviewees suggested that they do not want to set a specific style for sustainable fashion VI to avoid leading people to it. If the VI has a neutral style, it can adapt to different sustainable fashion aesthetics and convey other possibilities of sustainable fashion.

Some interviewees also suggested that the appearance of VIs should be more open and creative based on the virtual nature of VIs. Since VIs are virtual, they can be created through CGI technology to achieve different features. Such as entirely unisex characters or a VI that do not fit the traditional aesthetic sense; a VI with healthy body figures that do not promote figure anxiety; a VI of a sexual minority group, or a character with more fantasy of its appearance. However, it is also suggested that Sustainable Fashion VI has universal educational significance. Its primary value is sustainable fashion, so these are additional settings that do not significantly affect its appeal. It would be more appropriate to give it human-like features. Because this is also following the aforementioned human-like image that will be integrated into

ordinary people's lives, it will be more pursuable for people to accept its behaviors.

Psychological character design

Appearance presentation can give the first visual impression, while it is also essential to establish the personal attitude and viewpoint of VIs. In this part, we mainly discuss what is better to reflect the sustainable fashion values from VI's personality.

In the interview, there was some discussion about the character's background. The first direction is to set the character's experience closer to the people who might exist in their lives. In contrast, the second direction is more imaginative, as the surface could be a perfectionist sustainable fashion practitioner.

Most of them mentioned that the character could be a promoter who is a promotion ambassador of sustainable fashion or that everyone can advocate sustainable fashion without a specific background. However, some say that if the campaign is educational, the character could be a sustainable brand director or fashion designer, which would be more convincing because of the professional endorsement. Some even suggested that there could be a backstory, such as a designer who, after working for a well-known brand and becoming disillusioned with the dark status quo in the fashion industry, quits and starts calling for sustainable fashion. These are some of the possibilities that are more relevant to life. Some people also suggested that the VI could be a scholar or related practitioner in a sustainable fashion.

Regarding the social status of the virtual person, we all agree that the social status of this VI is not the most important because the value of sustainable fashion is the actual content carried by the VI, and practicing sustainable fashion is something that everyone can do. It does

not require a certain social status, so there should be no limit here.

In addition to the background setting of the character, most interviewees repeatedly emphasize the design of the personality and the subsequent behavior to maintain consistency and continuity. Even if there is a perfect character setting, if it is not supported in the later stages of doing sustainable behavior or things, the personality would also collapse, causing people to resent it. So how to maintain VI's consistency is also in the design process that needs to be focused. In the third part of the interview, there is a focus and discussion on this aspect of the idea.

Although it was commonly mentioned that the person needs to practice sustainable fashion and spread the values continuously, they also noted that the VI should not be too perfect but should be able to fit in with everyone's life. So people feel that such a person could exist in the world, rather than too good to be true. If the VI is perfect at everything in a sustainable fashion, it can pressure people to follow it. Hence, the ideal characters would be the ones that are constantly promoting sustainable style. Still, they are only a little more progressive than the majority of society can be, but not as well as achieving a position of infallibility. This way, VI could grow and progress step by step with followers together, and followers will not feel overwhelmed.

Operation mode

Both the Appendix N, it is shown that promoting the values of sustainable fashion is of utmost importance. Because it's better to promote sustainable values than to promote specific brands, just as that knowledge is the best charity. If more people have sustainable values, they

will probably generate more ideas to achieve sustainable fashion rather than have more clothes from sustainable brands.

It is also crucial to establish the target group because only after the core group is selected the communication design can be targeted to their characteristics. In this thesis, the audience group has been set as Gen Z, so the interviews were conducted with Gen Z as the target group.

I had a lot of discussions with the interviewees about how to promote sustainable values and maintain consistency in this part. Interviewees said that people often cannot accept a didactic approach to education and that many young people will not accept it if sustainable fashion value is conveyed in a way that is too serious and harsh. That is why many interviewees mentioned that Gen Zers want to receive the information in the most acceptable way.

Nowadays, people like vivid and exciting things, especially in the era of information and rapid overall changes. Gen Z hopes to get the most accurate information in the quickest time. The emergence of short videos and artificial intelligence algorithm content recommendation allows them to get the content they want accurately and quickly. VI is a very new media. If we can use VI in combination with Gen Z's generally preferred form of promotion, we can achieve twice the effect with half the effort.

So many people mentioned that the operation team of VI could use TikTok and reels short videos to make content. Also, people have said online courses, live streaming, Vtuber, Instagram story sharing, VR, AR, and other new forms. Of course, we still need to keep the presentation of Instagram posts, plus the narration of posts' descriptions. It needs to be supported by these approaches to maintain its existence since VI lives only in the artificial world.

In addition to the form, the content of the message is also essential. According to interviews, a sustainable fashion lifestyle and a disclosure to the fashion industry can form a significant part of the content delivered by the VI.

Many people mentioned that it is important to convey a sustainable fashion lifestyle. While many people know or have heard of the concept of sustainable Fashion, they don't know how to live in a sustainable when it comes to Fashion.

Several organizations are doing an excellent job in this area and actively using internet platforms such as Instagram to communicate sustainable fashion lifestyles, they share practices that can be done in every stage of sustainable fashion, from the process of consumption, to after consumption. For example, they provide alternatives to buying new clothes such as rent swaps, borrowing thrift, mending, remaking, house dying clothes. These methods are accessible and approachable to implement, making it easier for people to start the process. They also bring more attention to sustainable brands and creatives and share and impart the possibilities of sustainable methods in the fashion world. Also, Fashion for good is constantly updated with knowledge about clothing materials, from what materials are available to the impact of materials and alternatives. The material's content is divided into different chapters to introduce trivia knowledge about each material so that people can read small but precise paragraphs but form an overall understanding of clothing materials. In this way, people can read small but concise passages and develop a general knowledge of clothing materials to choose materials that are better for the planet and people in designing clothing.

By browsing those content, people can realize that these small changes in behavior can cause less harm to the environment and waste fewer resources. Inspired consume less, value

quality, and take better care of their clothes, which allows fashion market demand to be shifted in a more sustainable direction.

Also in the interviews, remake and thrift shopping took up a lot of the conversation. Multiple people mentioned that rediscovering the beauty of unwanted clothes through remaking would allow everyone to claim and acquire their sustainable aesthetic. And people also get interested in remakes with their creativity and unique aesthetic, thinking that remakes can give a second life to old clothes. During the interview, some people mentioned that VI could participate in various offline remake workshops and share through live streaming or Instagram story. It was also suggested that VI could shoot videos of their remake techniques, both for people to learn and to spread the concept of sustainable fashion. At the same time, some people proposed to let VI provide a platform for selling remakes, etc.

In addition to personal lifestyles, it is also essential to have a disclosure of the fashion industry. Many people are unaware of the dark side of the fashion industry, including the environmental pollution and human resource exploitation caused by it. Even clothing factories sometimes find it challenging to trace the source of their production, so it is even more difficult for fashion consumers to understand where their clothes are from and how much bad influence it would take to make them. So it is important to make consumers aware and show how toxic the industry is to people. In this process, VI can show the whole production process of the apparel industry and let people know what happens in the production process and under what circumstances may cause harm to human rights and the environment. In this way, it could help consumers form an awareness so that the consumer can monitor. The whole production process becomes more transparent and sustainable under supervision.

Many brands currently market themselves under sustainable fashion, even if they are not truly sustainable, which is called green Wash. The knowledge from production across the board will also help strengthen people's understanding of sustainable fashion and thus screen out deceptive marketing.

In addition to discussing how to do advocacy, we also discussed how the emergence of new technologies could help with sustainable fashion.

The advent of CGI technology has brought new forms like the VI and the ability to make fashion design present virtual. For example, clod 3d can design the style and choose the material on the virtual model, thus automatically generating the pattern in the software and cutting the fabric by machine. And the attempt to design in the virtual world dramatically reduces physical consumption like fabric waste. Then the designer could apply the digital version of clothes directly to the virtual model or influencer, who can be used as the promoter, thus reducing the cost of recruiting models, shipping products, shooting, etc.

Just like the production pattern of the pioneering fashion company Atacac, they present and sell the garments in advance in a digital way and start small-scale production when they know the number of preordered garments (Särmäkari, 2021).

Similarly, the concept of digital fashion has also entered people's views with the support of technology. Digital fashion refers to designers who rely on 3D technology not only for physical fashion design but also to launch digital-only fashion collections (Särmäkari, 2021). It can be dressed by digital models and celebrities, as well as AR on a natural person's body. Virtual fashion enables to achieve the functionality of self-expression in fashion.

An interviewer proposed the concept of a digital wardrobe based on digital fashion. When

working with sustainable brands, the VI could wear the garments in digital versions and ultimately promote the brand through virtual methods. At the same time, it is also possible to let real influencers try on the AR sustainable brand fashion.

There are advantages of digital fashion. Not only does its application bring novelty to people, but CGI technology is also highly-efficient. CGI technology allows for stable multiple clone replication and low technical maintenance. "CGI humans instead of real people enables to save a variety of additional costs such as the construction of the scene and the actual decoration, labor change costs, is also the low-cost choice in the capital results-oriented." Said interviewee 7.

Furthermore, VI is long-lasting, they will not age, and their character will not suddenly break down under the team's control. For example, VIs have no age limit, illness, emotional distress, gossip, character weaknesses, etc. Also, VI can build up popularity, keep building up fans, and increase influence based on years and years of accumulation. So from this point of view, it has durability.

However, some have questioned that although the process sounds like it reduces material consumption, digital 3D artists might not necessarily use less electricity and human resources in the creation process than traditional fashion promotion processes. The discussion above raises questions about whether digital fashion could contribute to an ethical and sustainable fashion industry.

For example, each person's carbon footprint by attending a digital fashion week may be lower. Still, because the digitization of fashion week enhances its accessibility, more people can participate than at any offline fashion show; this leads to the result that the carbon footprint

of online digital fashion shows is not necessarily lower than that of physical events.

On the other hand, the most significant negative voice regarding the sustainability of digital fashion is about the impact of NFT (non-fungible tokens authenticated on blockchain) on the environment (Wang et al., 2021). Digital fashion is primarily bought and sold using cryptocurrency as NFT. However, from the many studies that have been done so far, it is proven that NFT has a significant negative impact on ecology.

Most NFTs are part of the Ethereum blockchain. Like other major cryptocurrencies such as Bitcoin, Ether uses proof of work to protect transactions and to mark time for each new block. Such a process of generating an NFT consumes a lot of energy, and one transaction uses as much electricity as an American household uses for 2.5 days (Sedlmeir et al., 2020). So the NFT digital fashion could save the consumption of fabric, transportation, and so on, but in fact, it increases energy consumption in another way.

It has also been suggested that there are currently ways to reduce the environmental impact of NFTs simply by switching the method used to protect transactions from proof-of-work to proof-of-stake. Cryptocurrencies such as the Flow blockchain and Ether 2.0 are already using them (Sedlmeir et al., 2020). But whether digital fashion can contribute to a more sustainable fashion industry is a topic that still needs further discussion and research. These years sustainability has unconsciously become the keyword in the fashion industry, and designers are emphasizing design style while eco-friendly fabrics are becoming trendy and hot. For example, fashion designer Vivienne Westwood, known as the "mother of punk," released her Fall/Winter 2021 collection at London Fashion Week. One of the highlights was that 90 percent of the fabrics were made from "materials that reduce environmental impact."

Dutch fashion designer Iris van Herpen, known as the "Queen of 3D printing," collaborated with the Oceanic Environment Group to create a stunning 3D-printed collection at this year's Paris Haute Couture Week, using recycled plastic and other eco-friendly materials.

Sneaker brand SCRY also uses 3D printing technology to achieve small-batch custom production. SCRY is trying to challenge the long-standing tradition of traditional footwear with long R&D cycles, high innovation costs, complex functional requirements, and sustainability challenges by introducing the first truly wearable "one-piece additive manufacturing" footwear. It is different from the 3D printed midsoles or other printing processes already on the market and is no longer a model of unwearable design.

The emergence of new technology brings new materials, and the application of new materials will bring new aesthetic styles, allowing sustainable fashion to become more diversified and inclusive. VI, which has its innovative attributes, can showcase these innovative products in content combined with CGI technology and educate more people about these brands and the sustainable concepts behind them.

Conclusions

Since the end of 2019, online platforms have flourished as offline activities were significantly reduced due to the epidemic. To survive in such a context, some fashion brands took advantage of the growing CGI technology, allowing VIs and virtual models to be used as vehicles for fashion presentations. And the use of virtual humans in the fashion industry was able to appear and become mainstream increasingly. Gen Zers, who grew up in the digital generation, are very receptive to such VIs and are full of novelty to them. They build their trust

by following them and get influenced by VIs under their constant attention to VIs.

At the same time, Gen Z is the biggest consumer group in fashion. They are studied and targeted by many brands. Therefore, the positive influence of Gen Z on fashion consumption can make the whole fashion consumer market develop in a more positive direction. Meanwhile, In this era, people are aware that the impact of fashion on the environment can no longer be ignored. Since Gen Z, the largest group of fashion consumers, can be influenced by VI; it is necessary to explore the direction of VI design to guide GenZ to a more sustainable fashion consumption concept. Therefore, I set "what kind of design of virtual fashion influencers can lead the consumer behavior of Generation Z towards more sustainable attitudes and behaviors?" as the research question of this thesis.

In the literature review phase, I found the five categories of VI influence research proposed by Batista da Silva Oliveira & Chimenti and applied them to my research. Based on this five-category theory, the thesis discusses the factors of VI design success concerning the current VIs and how the five categories impact Gen Z's intention of sustainable fashion.

Two sub-questions have been developed to analyze this research question better. (a) How do the five influence categories act on the influence of virtual influencers? (b) How to design a VI that can efficiently promote sustainable fashion? I provided guidelines and principles for designing VI based on different aspects through three research methods and answered the research questions.

For the first sub-question, I used qualitative and quantitative methods to study, using case study analysis and a survey. Through the case study analysis, I compared the current successful VI cases and summarized the practices and principles and the operation methods of the team

behind them to improve the impact. In this part, I chose 3 VIs that have a significant influence in the fashion industry, their ranking of influence is within the top 10, and their appearance is highly human-like, from different operation teams. The analysis of VI cases here is mainly based on Batista da Silva Oliveira & Chimenti's five categories, including attractiveness, controllability, anthropomorphism, scalability, authenticity, etc. By comparing the operation methods of different operation teams, I summarized their success factors.

Also, to answer the first subquestion, I conducted a survey distributed among people interested in VIs and fashion and collected data for analysis. Since the previous study by Batista da Silva Oliveira & Chimenti did not mention how these five categories could work on the influence of VIs, I wanted to determine how the five categories affect sustainable consumption intentions using quantitative analysis. To build a deeper understanding of the five categories, I proposed a hypothesis that a higher index of the five categories would lead to a higher intention of Gen Z to consume sustainable fashion.

I designed a questionnaire containing questions on three main aspects. After collecting the questionnaires and excluding invalid ones, I got 150 questionnaires as samples and analyzed the data using SPSS. The regression analysis was used to determine the relationships between consumer consumption intention of sustainable fashion and the five categories' influence.

To get more insights from these professionals and to represent the group's perspective as Gen Z, I interviewed people from the sustainable fashion industry and virtual human and digital art industry. The interviews were semi-structured, allowing the interviewees enough freedom to discuss and express their views within the framework of the discussion. The interviews were framed in four main sections: appearance, personality, social context, and operating model of

VIs, and were conducted to understand the views of professionals on how to promote sustainable fashion through VI and how to design them.

5.1 Summary of Findings and Conclusions

Based on Batista da Silva Oliveira & Chimenti's VI five categories and the Case Study of the three VIs, I summarized the key points that can be used to improve the impact of VIs. However, some of these points apply to sustainable fashion VIs, while others are not and are contradictory to some points of view from the later interviews.

In terms of attractiveness, it is often necessary to design a pretty appearance for the VI, collaborate with many reputable brands and constantly work with them, construct a unique and creative fashion style for the VI, and show positive traits, for example, caring about social causes.

Some of these points sound superficial, for example, designing a pretty appearance. When it comes to appearance, beauty standards are highly contextual and relative. Also, beauty standards are often criticized by the people for whom sustainability values are essential. So it is significant to target which is the core group of the VI and then, based on them, do research and design. An attractive look can catch people's first attention, so this one is necessary. Still, I think the other three points can be left out from the sustainable fashion VI design aspect because sustainable fashion VI's primary purpose is to promote values. They can work with brands, not necessarily with reputable brands but with sustainable fashion brands. And whether a unique stationary style is needed or not is also controversial in the later discussions of interviews. Some interviewees mentioned that a neutral style is more adaptable to the different

aesthetics generated by various sustainable fashion paths, thus being able to promote all kinds of sustainable fashion paths. Regarding character building, caring about sustainability is a vast topic and already a way of showing positive traits.

From an authenticity perspective, VIs should be transparent about their lives in front of their audiences and maintain a consistent narrative on social media. They can show the flaws in their lives, in addition to good emotions and working positively. They can also show negative emotions appropriately, presenting a more three-dimensional personality.

From a controllability perspective, the VI's team should control their visual presentation personality, social status, and output to keep the VI operating on the right track.

From the anthropomorphic perspective, VIs should be highly anthropomorphic in appearance. And the scene setting should be realistic. Revealing the complex human-like emotions of VIs is also a way that can be used to strengthen the anthropomorphic human characteristics of VIs. At the same time, because the existence of VI is built on pictures, videos, and texts in the virtual world, it is necessary to use images, posts, and text narratives to show their personality. Some VIs also were set complex interpersonal relationships to enhance the degree of humanoid. But this is unnecessary and can be adjusted according to the goal of using VIs.

Regarding scalability, because VIs have innovative and technological characteristics, they can work with brands and companies that develop and use new sustainable material technologies. And due to the ageless features of VIs, if they can be appropriately operated and have their personas dynamically follow the development of time while maintaining the continuity of their personality, they can make them last and accumulate influence continuously.

In the Case study, the identity of the VI makes it easier to be associated with WEB3.0 and metaverse-related industrial content. But as mentioned in the previous section, combining digital fashion with NFT may bring more harm to the environment. So based on this point, it is vital to avoid the cooperation between the VI and NFT digital fashion and to publicize the reasons behind the non-cooperation to help the audience form Awareness.

The survey data analysis confirms this paper's hypothesis: The attractiveness, authenticity, controllability, anthropomorphism, and scalability of VI will positively contribute to consumers' intention to support sustainable fashion. Yet, attractiveness as a quality is controversial and highly relative.

The frequency analysis shows that the majority of participants in this survey are interested in fashion, virtual fashion, and VIs, and they are more among women. The age group is concentrated in Generation Z, which proves that Generation Z is by far the largest audience for VIs. Also, it is mentioned that people who follow fashion regularly are more likely to buy sustainable fashion products.

Of the five categories correlating to supporting sustainable fashion, attractiveness had the strongest correlation with consumption intention, with a significant positive contribution and the most significant effect. Authenticity, controllability, and anthropomorphism were next in descending order, but scalability was the lowest.

The level of human knowledge perception of VIs and fashion influences the intention to support sustainable fashion; the higher the group of people's perception, the higher the endorsement of sustainable fashion. Therefore, in the content design of VIs, it is essential not only to improve these five categories of VIs but also to help raise the perception of fashion and

VIs of Gen Zers.

This analysis provides an approach to the VI design process for future designers. They can adjust the priority of five categories based on the design goals during the design process.

Furthermore, from this interview, some ideas came out on top of sustainable fashion consumption. The most effective way to make fashion more sustainable is not just to promote sustainable fashion brands. The right thinking is to share knowledge from the origins of sustainable fashion. Communicating what kind of behavior is genuinely sustainable, empowering people to recognize more sustainable ways, and creating a sustainable aesthetic based on these methods that belong to their understanding rather than simply consuming it are all progressive ideas.

From the appearance point of view, the purpose and scenario of using VIs are apparent in this study, and the interviewees were all aware of the background of this study before the interview. As a result, from the perspective of physiological characteristics, they all suggested that VIs should be human-like in appearance when it comes to sustainable fashion VIs.

People trust more in what is known and human-like VIs. In addition, human-like VIs are more widely used in the fashion industry. They need to be physically similar to people to apply these fashion items.

From the aspect of aesthetic style. The aesthetics of the sustainable fashion are under discussion, and it is concluded that sustainable fashion aesthetics should be diversified and not be restricted to a specific type of stereotype.

The significance of this green aesthetic can be conveyed when people are sufficiently educated and understand the basics and core values of sustainable fashion. If everyone

understands the true meaning of sustainability and puts into practice the sustainable path they adhere to, a sustainable style aesthetic will flourish and diversify. The important thing is not to present a specific "green" image but to be aware of the sustainable approach behind fashion products and to present sustainable fashion based on the way every individual wants to follow.

Especially for the Gen Z community, which is aesthetically diverse and actively expressing themselves, it is valuable to develop a different sustainable fashion aesthetic for everyone.

As for personality of the VI, The characters' backgrounds are set in a way that leans towards daily characters, such as sustainable fashion brand owners, researchers, designers, etc. On the other hand, there are more unrealistic settings, such as the sustainable fashion advocate who is an extreme adherent of sustainable fashion, so the VI would do all the behaviors of sustainable fashion and then show them to the public.

But at the same time, many people mentioned that the VI design should not make the character too perfect and that a flawed one is more realistic and approachable. So the latter option is not valid.

Meanwhile, more people mentioned that keeping the character's personality consistent and stable is essential, which also aligns with the finding reached in the previous case study. Even with a perfect character setting, if the character does not consistently behave sustainably at a later stage, the personality will break down and cause a sense of deception and resentment from the audience.

Also, interviewees provided many valuable opinions about promoting sustainable fashion through VIs. It is clear from both the survey results and the interviews in Appendix N that

promoting the values of sustainable fashion is a core imperative; this is because promoting sustainable values is better than promoting a specific brand, just as knowledge is the best charity. If more people had sustainable values, they might generate more ideas for sustainable fashion than consuming more clothes from sustainable brands.

Regarding VI design orientation, choosing a target group of VIs should be done initially. Because only after the core group is selected the communication design can be specifically targeted to their characteristics.

As for promotion forms, people like vivid and exciting things, especially in the information age. Generation Z is used to getting the most accurate information quickly because the emergence of short videos and algorithm content recommendation allows them to get the content they want swiftly and accurately. As a result, using Generation Z's preferred forms of promotion would create a more effective conveyance of information. For example, To combine VIs with online courses, live streaming, Vtuber, Instagram story sharing, VR, AR, Tiktok short videos, Instagram posts, and other new forms could attract more Gen Zers' attraction and also convey the essential content quickly and vividly.

Not only are promotion forms necessary, but also the content is the core. Many people mentioned that it is vital to convey a sustainable fashion lifestyle. Even though there is some awareness of sustainable fashion, many people still need a clearer image of what kind of lifestyle can be more sustainable. That's why providing a sustainable fashion lifestyle in the content makes sense. As mentioned earlier, the medium of VI could offer alternatives to buying new clothes, such as renting, swapping, thrifting, mending, and remaking. These methods are easy to access and implement, making it easier for people to start the process. VI could also

bring more attention to sustainable brands and creations and share and teaches the possibilities of sustainable methods in fashion. In this way, people can accumulate and change in small steps, transforming their fashion attitudes and behaviors more and more in sustainability.

5.2 Limitations and Recommendations

Three case studies were conducted, and they were all human-like fashion VIs. The teams run them are from three companies, so the production methods and the aesthetic styles differ, but many operational approaches have similarities. However, many other successful VIs in the fashion n industry can be analyzed, and if they are all analyzed, the result would be more rigorous, and more insights may emerge. So if anyone is interested, they can expand this research.

In the survey, although it is clearly mentioned in the introduction of the questionnaire that the target group of the study is Gen Z, only 114 of the 150 valid questionnaires received belong to the Gen Z group; this is because it was not explicitly stated that only Gen Zers' answers were needed for the study. All people interested in VI were invited to do the questionnaire. Therefore, the conclusion can not represent the viewpoint of Gen Z but the viewpoint of people interested in VI and fashion in general. The study would be more focused on the core group if only Gen Zer participants were included.

Furthermore, it is worthwhile to consider the ethical aspects of the impact of VI on human beings. First, is it reasonable for VI to "manipulate" people as a virtual existence? I believe that if it promotes positive values in line with the direction of social development, it is possible to use the influence of VI to educate and popularize knowledge and values. But if the intentions

of people who use VIs are wrong, it would cause terrible consequences. I hope that in the future, there will be some legal regulations on using VI for promotion to avoid the influence of VI being misused.

Moreover, whether the emergence of VI will gradually replace the real influencers, reducing human employment is also a heated topic. This topic was discussed in many articles after the emergence of Shudu, and some people slammed the creator of Shudu and thought that the emergence of Shudu has brought black models more competitive pressure in the modeling world because now there is a virtual alternative. I am an optimist regarding this question. New technologies are constantly emerging in the development process of society, and humans are always able to adapt to new opportunities; new jobs are also following emerging technologies. And VIs will never replace real influencers but will be a creative form that could develop and exist together with real influencers.

In this thesis, it was agreed in this study that a more human-like VI would be more relatable and easier to trust as a sustainable fashion VI. However, the result of what degree of human-like VI would make people feel a sense of closeness without creating the uncanny Valley effect has not been examined, and this is worth exploring in subsequent studies.

5.3 Future research suggestion

In the current study, I proposed design principles for fashion VI that promote sustainable values, but the significance of the proposed design principles is to support the design practice. Therefore, I hope that researchers and designers can design VIs based on this principle and collect data to examine whether this principle helps increase the impact of VIs and whether it

positively affects Gen Z's sustainable fashion philosophy and consumer behavior.

From the application point of view, future researchers can study the application of VI in other fields. The research for this thesis started with my interest in digital fashion and VIs and the desire to understand how the positive effects of VI influence can be maximized. But the potential of VI is not limited to the fashion industry. VI influence can be beneficial in promoting good values. In the field of education, it is helpful for fun teaching, and in the field of entertainment, it can lead followers in a more positive direction as role models. And not only does it have the potential to develop in each area, but it also exists in the digital world, so there will be more forms of technology applied in the future. In the future, if more immersive human-computer interfaces are incorporated into daily life, VI can be presented in new ways by combining new technologies, such as holographic projection or immersive XR.

Then again, even though VI has been very much used in fashion, the positioning and identity of VI in the current successful VI are not diversified and inclusive enough because VI itself is virtual. Hence, its presentation form can break away from the traditional image and have more space for expression. For example, genderless VIs have no sexual characteristics, VIs belonging to a specific subcultural group can have a more edgy style, etc.

In addition to the above discussion, the emergence of VIs has generated much discussion about applying AI technology to VIs. Currently, the creation and content output of VIs is still primarily limited to team-controlled content output. However, as AI technology develops, some teams have already been researching and using AI in combination with VIs to produce content. For example, a Chinese company GLA Art Group has generated virtual idols through AI algorithms.

Ethical issues must be considered and limited as AI technology is increasingly used in the VI field. When AI creates the content of VIs with significant influence, it is absurd to think that machine-generated content can impact human minds. It is creepy to think that algorithms could unknowingly control human minds. So there is an urgent need for the team to gate-keep the content creation more strictly, as well as for authorities concerned to discuss the legislative aspects of the application of AI. AI application on VIs is developing rapidly, and I hope the discussion about the legislation will not be behind it.

The significance of this study is to explore the application of the medium VI in sustainable fashion as a new way of conveying information. VI has a significant influence on Gen Zers, and its existence is precious if it can be actively used to lead Gen Zers to a more sustainable direction of fashion expression. At the same time, the research approach of this thesis can provide some reference value for subsequent research on the application of VI in other fields.

Technology is developing very rapidly, and if we can find the advantages of technology to use it rationally and contribute to the future development of humanity, then our society will develop steadily and robustly.

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Appendix A

Questionnaire

Part-I. General Information Survey

1. Date of birth

1) Before 1997

2) 1997-2012

3) After 2012

4) Other

2. Gender

1) Male

2) Female

3) Non-binary

4) Intersex

5) Gender-fluid

6) Secret

3. The highest level of education you have received

1) Elementary School

2) Junior High School

3) High School

4) Vocational Schools

5) Bachelor's degree or equivalent

6) PhD

4. What is your current area of work?

1) Schoolchild

2) Architecture and engineering

3) Arts, culture and entertainment

4) Business, management and administration

5) Communications

6) Audio Engineering/Producing

7) Community and social services

8) Education

9) Science and technology

10) Installation, repair and maintenance

11) Farming, fishing and forestry

12) Government

13) Health and medicine

14) Law and public policy

15) Sales

16) Unemployed

17) Other

5. How often do you usually follow fashion content?

1) Daily

2) 2-3 times a week

3) Once a week

4) Once a month

5) A few times a month

6) rarely

6. Do you know about virtual fashion? I never heard of it

1) I've heard of it, but I haven't paid much attention to it

2) I know it, but l don't think it's promising

3) Very much aware and supportive

4) Very much aware,working in this industry

7. The willingness that you want to consume sustainable fashion.

("5" represents "very much" and "1" means "not at all".)

sustainable fashion:Sustainable fashion (also known as eco-fashion)is an all-inclusive term describing products, processes, activities, and actors (policymakers,brands, consumers) aiming to achieve a carbon-neutral fashion industry,built on equality, social justice, animal welfare,

and ecological integrity.

(1 2 3 4 5)

8. Do you know anything about virtual influencers on Instagram?

1) I never heard of them

2) I've heard of them,but I haven't looked into them

3) I know about them, but l don't think it's very promising

4) Very much aware,interested and supportive

5) I know it very well, and I am in this industry

Part-2 -Virtual web celebrity design characteristics analysis

For the following items, please choose the corresponding options according to your specific situation, where "10" represents "very agree" and "1" means "very disagree".

A, appeal

9. You follow VIs for some reasons (if you are following them)?

(1 2 3 4 5 6 7 8 9 10)

10. Did you find these vi through rich channels?

(1 2 3 4 5 6 7 8 9 10)

11. How much do you follow Vls because of their good looks?

(1 2 3 4 5 6 7 8 9 10)

12. To what extent do you follow the VI because of their unique characteristics, such as style or personality?

(1 2 3 4 5 6 7 8 9 10)

13. You follow Vls for your curiosity?

(1 2 3 4 5 6 7 8 9 10)

14.VI highly attractive to you? Do you have specific concerns?

(1 2 3 4 5 6 7 8 9 10)

15.Does the beauty of the 15.Vls make sense? Do you pay the most attention to this:

(1 2 3 4 5 6 7 8 9 10)

16. How important do you think appearance is to be a virtual fashion influencer?

(1 2 3 4 5 6 7 8 9 10)

17. Do you think the content of blog posts affects VI's appeal to you?

(1 2 3 4 5 6 7 8 9 10)

18. Do you think you like the stories or characteristics of similar people shown in the post? Do you find them even more attractive?

(1 2 3 4 5 6 7 8 9 10)

19. Some of the values that fashion Vls promotes make them more attractive to you?

(1 2 3 4 5 6 7 8 9 10)

B, facticity

20. Do you think the advice that Vls provides is true and reliable?

(1 2 3 4 5 6 7 8 9 10)

21. Have you selected the recommended product or content of your vi compliance?

(1 2 3 4 5 6 7 8 9 10)

22. In the fashion world, do you think you trust Vls more than really influential people?

(1 2 3 4 5 6 7 8 9 10)

23. In the fashion world, do you trust a part of Vls more?

(1 2 3 4 5 6 7 8 9 10)

24. If Vls recommends fashion products, do you want to buy them?

What products do?

(1 2 3 4 5 6 7 8 9 10)

25.Vls recommend, and do you want to try or buy?

(1 2 3 4 5 6 7 8 9 10)

26. Are you interested in creating content with a certain form of fashion items?

(1 2 3 4 5 6 7 8 9 10)

27. If you try what virtual celebrities recommend, will you make some action?

Does the empathy that

(1 2 3 4 5 6 7 8 9 10)

28.Vls shows in the post make you feel closer to them? For, for example, do you feel encouraged together when they advocate fighting against covid

(1 2 3 4 5 6 7 8 9 10)

29Can Vls's vivid storytelling make you ignore its shortcomings? For example, when they advocate fighting the disease, do you feel encouraged, even if Vls cannot be infected by the virus?

(1 2 3 4 5 6 7 8 9 10)

30. For you, some of the characteristics of VI authenticity can affect its appeal to you?

(1 2 3 4 5 6 7 8 9 10)

C, controllability

31. Do you think VIs will be more influential than humans in fashion?

(1 2 3 4 5 6 7 8 9 10)

32. Do you oppose using VI to encourage buying and selling?

(1 2 3 4 5 6 7 8 9 10)

33. Do you support using VI to promote the concept of sustainable fashion?

(1 2 3 4 5 6 7 8 9 10)

D, to human nature

34. When it comes to aesthetics, do you prefer a fashion VI that looks like people, or something more fictional (for example, an anime character)?

(1 2 3 4 5 6 7 8 9 10)

35. When you first see a VI, can you know if it is really a human or a robot?

(1 2 3 4 5 6 7 8 9 10)

36. Is it important that your favorite influencer is a real person or a virtual image?

(1 2 3 4 5 6 7 8 9 10)

37. When a VI is so human, and you can't tell the difference, and you can have emotional swings, especially in knowing that it's a virtual influencer?

(1 2 3 4 5 6 7 8 9 10)

38. Do you think human Vls can make it easier to feel that? Like your friend, your partner, or a close friend?

(1 2 3 4 5 6 7 8 9 10)

39. Would VI feel uncomfortable if I used an algorithm to predict the audience's preferences and create content accordingly?

(1 2 3 4 5 6 7 8 9 10)

E, extensibility

40. In fashion, do you think VI is more sustainable than human influencers?

(1 2 3 4 5 6 7 8 9 10)

41. Do you think Vls has more possibilities and expressions in terms of fashion presentation?

(1 2 3 4 5 6 7 8 9 10)

42. Can you name many of the qualities that the VI needs to promote sustainable fashion?

(1 2 3 4 5 6 7 8 9 10)

43.VI a better place for promoting sustainable fashion?

(1 2 3 4 5 6 7 8 9 10)

F, other

44. What is the point of using VI to promote the concept of sustainable fashion?(This question is a short answer question)

Part-3-Consumers' perception of virtual web celebrity design

For the following items, please choose the corresponding options according to your specific situation, where "10" represents "very agree" and "1" means "very disagree".

A. General knowledge

45. If you set the cognitive cognitive score of virtual fashion, the higher the score, the higher the representative recognition, how much will you score on your own cognition of virtual fashion?

(1 2 3 4 5 6 7 8 9 10)

46.Do you support the sustainable development of the virtual web celebrity design?

(1 2 3 4 5 6 7 8 9 10)

47. If you set the cognitive score of the virtual influencer on Instagram, the higher the score, the higher the recognition is, do you know the virtual influencer on Instagram?

(1 2 3 4 5 6 7 8 9 10)

48. First impression, do you think you trust Vls more than really influential people in the fashion world?

(1 2 3 4 5 6 7 8 9 10)

49.With your first instinct, do you trust Vls with a fixed feature more in the fashion world?

(1 2 3 4 5 6 7 8 9 10)

50.With your first instinct, do you think VI is more suitable for promoting sustainable fashion?

(1 2 3 4 5 6 7 8 9 10)

B. Professional knowledge

51.Do you usually pay attention to the blog articles? And pay more attention to the professionalism of the article content, which affects your views on VI?

(1 2 3 4 5 6 7 8 9 10)

52.Do you usually pay attention to the creation of virtual web celebrity fashion items? And more focused on the content of item creation, which affects your view of VI?

(1 2 3 4 5 6 7 8 9 10)

Appendix B

Reliability analysis（Cronbach's alpha）

Categories	Cronbach's Alpha	Number of Items	Overall
Attractiveness	0.778	11	0.821
Authenticity	0.788	11	
Controllability	0.602	3	
Anthropomorphism	0.786	5	
Scalability	0.824	5	
Knowledge perception	0.783	8	

Appendix C

Validity analysis（KMO and bartlett test of sphericity）

Categories	KMO	df	综合
Attractiveness	0.720	55	0.873
Authenticity	0.784	55	
Controllability	0.717	3	
Anthropomorphism	0.828	10	
Scalability	0.795	10	
Knowledge perception	0.841	28	

Appendix D

Frequency Analysis

Item	Option	Frequency	Percent	Valid Percent	Cumulative Percent
Age	1	35	23.3	23.3	23.3
	2	114	76	76	99.3
	4	1	0.7	0.7	100
Gender	1	49	32.7	32.7	32.7
	2	83	55.3	55.3	88
	4	6	4	4	92
	6	7	4.7	4.7	96.7
	7	5	3.3	3.3	100
Edu	1	1	0.7	0.7	0.7
	2	2	1.3	1.3	2
	3	26	17.3	17.3	19.3
	4	9	6	6	25.3
	5	54	36	36	61.3
	6	55	36.7	36.7	98
	7	3	2	2	100
Occupation	1	5	3.3	3.3	3.3
	3	10	6.7	6.7	10
	4	82	54.7	54.7	64.7
	5	12	8	8	72.7
	6	1	0.7	0.7	73.3
	8	2	1.3	1.3	74.7
	9	17	11.3	11.3	86
	12	1	0.7	0.7	86.7
	13	1	0.7	0.7	87.3
	14	1	0.7	0.7	88
	15	4	2.7	2.7	90.7
	16	1	0.7	0.7	91.3
	17	13	8.7	8.7	100
Attention	1	59	39.3	39.3	39.3
	2	41	27.3	27.3	66.7
	3	23	15.3	15.3	82
	4	10	6.7	6.7	88.7
	5	3	2	2	90.7
	6	14	9.3	9.3	100
Understanding	1	14	9.3	9.3	9.3
	2	53	35.3	35.3	44.7
	3	18	12	12	56.7
	4	58	38.7	38.7	95.3

	5	7	4.7	4.7	100
Expect	1	10	6.7	6.7	6.7
	2	60	40	40	46.7
	3	23	15.3	15.3	62
	4	55	36.7	36.7	98.7
	5	2	1.3	1.3	100

The meaning of the numbers in Option can be derived from the questionnaire in Appendix A.

Appendix E

Frequency analysis of consumption willingness

Consumption	Frequency	Percent	Valid Percent	Cumulative Percent
1	3	2	2	2
2	83	55.3	55.3	57.3
3	3	2	2	59.3
4	24	16	16	75.3
5	37	24.7	24.7	100
Total	150	100	100	

The meaning of the numbers in Option can be derived from the questionnaire in Appendix A.

Appendix F

Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Attractiveness	150	2.730	8.270	6.116	1.075
Authenticity	150	2.090	9.270	5.161	1.565
Controllability	150	1.000	10.000	5.629	2.247
Anthropomorphism	150	1.200	9.000	5.515	1.746
Scalability	150	2.800	9.600	6.347	1.578
Perception	150	1.630	6.500	4.140	0.984

Standard deviation is the measurement of the average distance between each quantity and mean. That is, how data is spread out from the mean.

Appendix G

ANOVA (Analysis of variance)

Item	Option	N	Mean	F	P
Age	1	35	3.543	3.311	0.039
	2	114	2.921		
	4	1	2.000		
Gender	1	49	3.163	0.376	0.825
	2	83	3.072		
	4	6	2.833		
	6	7	2.714		
	7	5	2.600		
Education	1	1	2.000	0.651	0.689
	2	2	3.500		
	3	26	2.808		
	4	9	2.667		
	5	54	3.222		
	6	55	3.055		
	7	3	3.667		
Occupation	1	5	3.200	1.473	0.142
	3	10	2.800		
	4	82	3.220		
	5	12	2.750		
	6	1	5.000		
	8	2	2.000		
	9	17	2.529		
	12	1	2.000		
	13	1	2.000		
	14	1	5.000		
	15	4	2.000		
	16	1	2.000		
	17	13	3.615		
Attention	1	59	3.305	1.963	0.088
	2	41	3.220		
	3	23	2.870		
	4	10	2.700		
	5	3	2.000		
	6	14	2.357		
Understanding	1	14	2.500	3.233	0.014
	2	53	2.717		
	3	18	3.278		
	4	58	3.328		

	5	7	4.000		
Expectation	1	10	2.300	2.027	0.094
	2	60	2.900		
	3	23	3.217		
	4	55	3.255		
	5	2	4.500		

F-statistic: Mean Squares Treatment / Mean Squares Error

Appendix H

Correlation Analysis

		Consumption	Attractive	Authenticity	Control	Anthrop	Ductility	Perception
Consumption	Pearson Correlation	1	.853**	.817**	.711**	.791**	.668**	.743**
	Sig. (2-tailed)		0	0	0	0	0	0.003
	N	150	150	150	150	150	150	150
Attractiveness	Pearson Correlation	.853**	1	.728**	.754**	.711**	.793**	.664**
	Sig. (2-tailed)	0		0	0	0	0	0.001
	N	150	150	150	150	150	150	150
Authenticity	Pearson Correlation	.817**	.728**	1	.733**	.763**	.738**	.483**
	Sig. (2-tailed)	0	0		0	0	0	0
	N	150	150	150	150	150	150	150
Controllability	Pearson Correlation	.711**	.754**	.733**	1	.793**	.790**	.282**
	Sig. (2-tailed)	0	0	0		0	0	0
	N	150	150	150	150	150	150	150
Anthropomorphism	Pearson Correlation	.791**	.711**	.763**	.793**	1	.823**	.482**
	Sig. (2-tailed)	0	0	0	0		0	0
	N	150	150	150	150	150	150	150
Scalability	Pearson Correlation	.668**	.793**	.738**	.790**	.823**	1	.357**
	Sig. (2-tailed)	0	0	0	0	0		0
	N	150	150	150	150	150	150	150
Perception	Pearson Correlation	.743**	.664**	.483**	.282**	.482**	.357**	1
	Sig. (2-tailed)	0.003	0.001	0	0	0.32	0	
	N	150	150	150	150	150	150	150

** Significant effect at the .01 level (bilateral).

Appendix I

result of main effect of analysis of regression

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.209	0.148		1.414	0.159
Attractiveness	0.174***	0.057	0.180	3.034	0.003
Authenticity	0.164***	0.058	0.167	2.803	0.005
Controllability	0.139**	0.057	0.149	2.432	0.016
Anthropomorphism	0.100*	0.054	0.104	1.835	0.068
Scalability	0.095*	0.057	0.100	1.663	0.097
R Square	0.729				
Adjusted R Square	0.722				
F	97.676				
P	0.000				

Note:*** Significant effect at the .01 level (bilateral). **Significant effect at .05 level (bilateral). *Significant effect at .01 level (bilateral).

Appendix J

Five categories effects of knowledge perception analysis

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.462***	0.483		3.027	0.003
Attractive	0.253***	0.047	0.358	5.383	0.000
Authenticity	0.236***	0.046	0.325	5.130	0.001
Control	0.148***	0.046	0.237	3.208	0.002
Anthrop	0.127**	0.059	0.212	2.167	0.023
Ductility	0.097**	0.049	0.111	1.984	0.049
R Square	0.621				
Adjusted R Square	0.576				
F	112.386				
P	0.000				

Note:*** Significant effect at the .01 level (bilateral). **Significant effect at .05 level (bilateral). *Significant effect at .01 level (bilateral).

Appendix K

Effects of five categories and knowledge perception of consumption willingness analysis

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.111	0.098		0.113	0.789
Attractive	0.153***	0.059	0.159	2.588	0.009
Authenticity	0.143**	0.060	0.146	2.379	0.026
Control	0.120**	0.059	0.128	2.030	0.041
Anthrop	0.090*	0.048	0.091	1.875	0.063
Ductility	0.084	0.056	0.080	1.601	0.111
Perception	0.441***	0.13	0.324	3.402	0.001
R Square	0.821				
Adjusted R Square	0.736				
F	111.210				
P	0.000				

Note:*** Significant effect at the .01 level (bilateral). **Significant effect at .05 level (bilateral). *Significant effect at .01 level (bilateral).

Appendix L

Interview Questions

General

1.What are the factors to consider when designing a virtual influencer?
Appearance/Personality/Values

2.What are efficient ways to present a virtual influencer that promotes sustainable fashion?

3.What is the routine for virtual influencer design?

Physiology

4.Most people do not care if the influencer they follow is a natural person or an avatar. What do you think the reason is?

5.Many people would prefer a VI between the boundary of a realistic and a fictional appearance. What kind of features of VI could catch your attention in a good way?

6.Some say the look of the VI depends on the message they want to convey. What kind of image do you think a VI who promotes sustainable fashion should present?

7.In the survey, people think VIs that fit their fashion taste could make them feel most trustworthy, but everyone has different fashion aesthetics; In your opinion, when it comes to fitting most people's fashion standards, what is the most important thing to consider? And how to bring that standard relating to sustainable design?

8.Many people from the survey pay attention to non-normative beauty standards and surrealistic scene settings of VI; it seems like Gen Zers focus on the things that human influencers can't achieve. If you were the designer, what would be the highlight of the VIs designed by you? and how can it be connected with sustainable fashion?

9.What aesthetics may better ensure the longevity of fashion, and whether any such guidelines can be given?

In 2007, Saito suggested that favourable "green aesthetics" includes minimalism, durability and longevity, fittingness and site-specificity,perceivability of nature's function, health, care and a sensitive attitude. But professors Maarit Aakko and Niinimaki argued that these qualities might promote sustainability in fashion; however, aside from minimalism, they are mainly associated with functional details, not aesthetics.

10.What do you think “green aesthetics” is for Generation Z?

Psychology

11.People trust VIs with a good personality; what do you think is a good personality for a VI?

12.How to ensure that a VI is consistent in personality so that it can always be attractive and remain reliable?

13.In the research, more than half of the people think VIs communicating gender fluidity and inclusion are more attractive to them. What kind of VI do you believe can communicate the concept of gender fluidity and inclusion? How should it be designed? How to operate the social media of it?

14.More than a quarter of people find VIs communicating sustainable fashion appealing regarding value expression. What kind of VI do you believe would express the concept of sustainable fashion? How should it be designed? How to operate the social media of it?

15.When VI promotes sustainable fashion, people think it's better to communicate sustainable values than to support sustainable brands and behave sustainably. What, in your eyes, is the best way to share the importance of sustainable fashion?

Sociology

16.Which aspect of VI do you think you will care more about in the character set? Personality? Physical appearance? Or social status? the way of presentation on social media?

17.VIs can be very diverse in their presentation because of CGI technology (Computer-Generated Imagery), transcending gender, age, race, religion, etc. Do you have specific characteristics you want to see in a sustainable VI? For example, distinctive appearance, race, gender, groups they are involved with, jobs they do, etc.

Operation mode

18.Someone mentioned that in the fashion field, the emergence of VIs is just another way to do commercial promoting and marketing. What do you think about it? What do you think is a proper way to use VIs?

19.41% of people think recommendations given by VIs lack authenticity and reliability; why do you think people would think that way? Is there an approach to make up this?

20.33% of people think recommendations given by VIs are reliable and authentic, and 26% think it depends on different products and VIs.

21.What kind of products or content recommended by VIs are more reliable?

22.What kind of VI design makes you feel it is more trustworthy?

23.In the survey, 59% of Gen Zers are not willing to buy products recommended by VIs, but still, there are 28% people would love to buy them; the rest of the people said if the product is attractive enough or if they like it a lot, and also are affordable, they are willing to buy.

24.What kind of sustainable fashion products would you like to promote by VIs if you were the operator of VIs?

25.What content do you like VIs to share? Why? Most people mention they like daily wear, fashion show sharing, brand collaboration, and unboxing. Do you think more daily sharing could make VI more attractive?

26.What could be better ways to involve content related to arts, digital fashion, and fashion knowledge education in VI's presentation?

27.The vast majority of people think that VIs are more suitable for sustainable fashion promotion than real influencers. What is the reason behind it? What do you think are the advantages of VI?

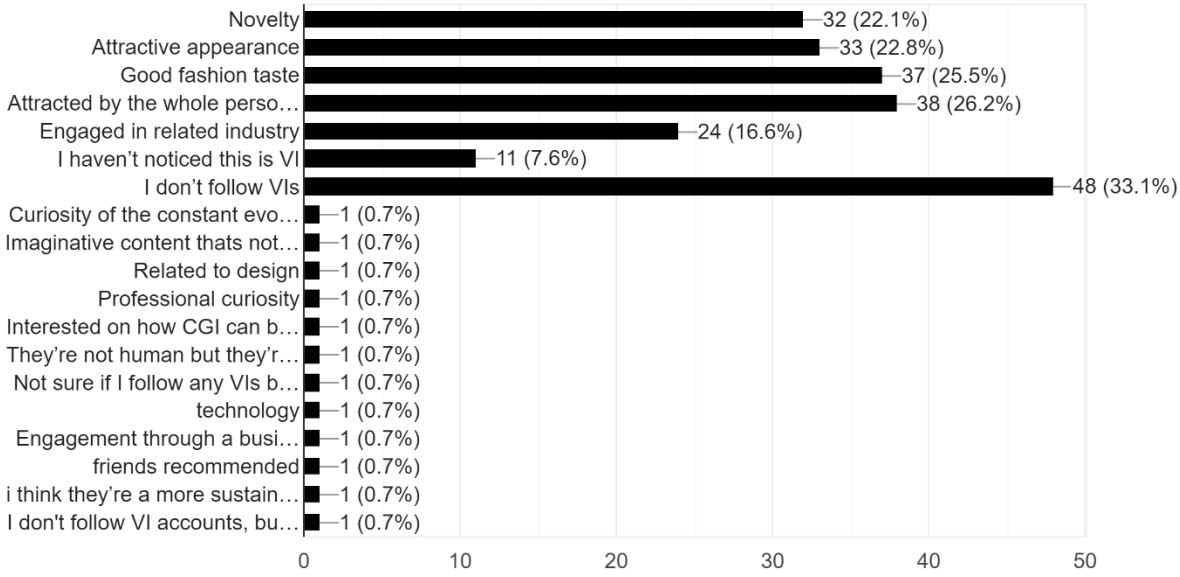
28.Are there some good ways to promote sustainable fashion by VIs in your mind?

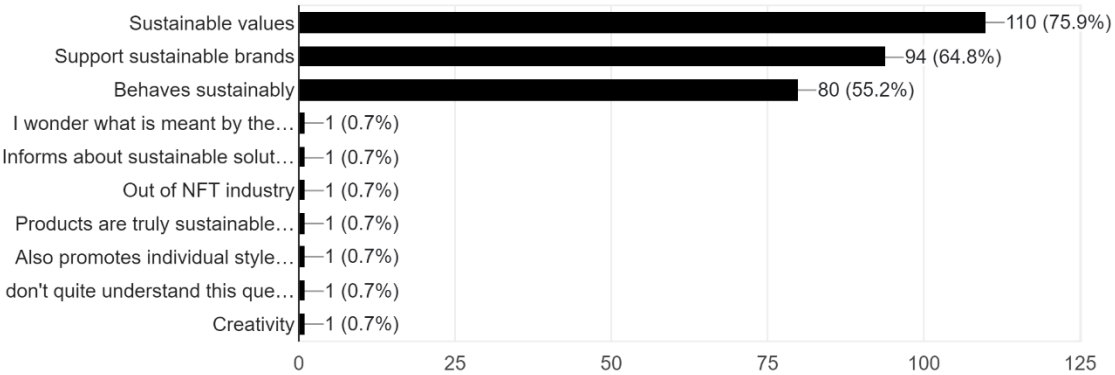
29.What could be the effective ways to use VI to spread the knowledge of sustainable fashion?

30.People are most willing to buy accessories recommended by VI than clothes, shoes, and bags. How could you utilise this when operating a virtual influencer of sustainable fashion?

Appendix M

The reasons why audience follow VIs



Appendix N

Qualities needed for a VI that promotes sustainable fashion