

Fashion Design Practices Using Korean Tradition in a Virtual Environment

- The Case of Cheollik -

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Abstract

The virtual world, a constituent of the metaverse, has penetrated into our daily lives through a constructed socioeconomic ecosystem that is similar to that of the real world. In the context of this increasing sociocultural and industrial importance of the virtual world, this study highlights Korean traditional garments and explores the possibility of the fashion design practice's contribution to the sustainability of cultural heritage in the virtual environment of the metaverse. This research approaches the topic from the perspective of fashion experience and sustainable cultural heritage through the practice of fashion design. As for the methodology, the practice as research by Neslon (2006) was adopted; conceptual framework, practical knowledge and evaluation. As the result, six digital fashion designs were developed and presented through virtual fashion films. The results were evaluated through the Wilcoxon signed-ranks sum test with the questionnaires on the original Cheollik and the developed design. The findings showed that the aesthetic and formative attributes of traditional Cheollik were reflected but there was a limitation to expressing the subtle texture or important quality like pleats due to the digital screen. It also showed the digital fashion design development in a virtual environment could provide small-scale companies with the opportunity to overcome physical limitations in terms of region and generation and promote such products to a wider audience. The findings allow for basic data to be used for cultural sustainability efforts through fashion practice using various cultural elements and the implications are drawn for the digital fashion design practice in the metaverse.

Key words : digital fashion design, Korean tradition, metaverse, fashion design practice, Cheollik

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I. Introduction

Can the metaverse help solve contemporary cultural issues? This study originated from questions regarding the continuity of a virtual space that evolved into an extended version of the real world and the role of fashion design. This research also focused on cultural diversity and its conservation and protection. UNESCO (2021) announced that protecting cultural heritage by conserving local indigenous culture can facilitate sustainable development, satisfying the environmental, social and economic needs of the current and future generations.

The recent worldwide interest in Korean popular culture has provided us with an opportunity to raise the values of our own culture, which has been disregarded in our nation, and work towards its conservation. Meanwhile, the demand for fashion to constantly reflect changes in contemporary is natural. Despite its historical value, traditional clothing as fashion has been considered as being behind the present times and contemporary utility, particularly alongside the novelty demanded in fashion (An et al., 2020). While the Korean government has made an effort to revive traditional clothing, it has had little success.

The virtual world, which is a constituent of the metaverse, penetrated into our daily lives by constructing a socioeconomic ecosystem that is similar to the real world. With the virtual world's increasing sociocultural and industrial importance, we are witnessing greater interest in the digital transformation of cultural heritage, which situates traditional culture in the virtual world, but is limited to the museological (Claisse et al., 2017; Mason & Vavoula, 2021) and architectural fields (Masciotta et al., 2021). Contemporary fashion design, which ought to satisfy ever-changing customer demands, is different from digital restoration, which focuses on

the conservation of cultural heritage data.

Many studies have been conducted on digital fashion, which uses 3D image technology to design and create clothes in a virtual space. Some scholars focused on the difference in fit between real and virtual design (Baytar & Ashdown, 2015), effects of reducing waste generated from sampling in terms of environmental sustainability (Creangă, 2019) and a digital fashion phenomenon from the perspective of occupational sociology (Särmäkari, 2023). Research on the production and utilisation of 3D virtual fashion goods has been conducted relatively recently. Additionally, a few studies have explored the role fashion practice can play in terms of sustainability of cultural heritage in such a new technology and media environment. Thus, this study aims to 1) develop digital fashion designs to sustain cultural heritage in virtual environments, such as the metaverse, and 2) consider the issues derived from the design process and results.

First, the study examines the possibility that fashion design practice can contribute to the sustainability of cultural heritage in the virtual environment of the metaverse. This research considers the quality of the metaverse from a fashion experience perspective and approaches cultural heritage sustainability through fashion design practice. Second, as basic data for fashion design practice, the characteristics of K-fashion design that reflect Korean traditional culture are identified through a case analysis. Third, it offers recommendations for the development and evaluation of contemporary fashion design using Korean tradition in the virtual environment. This study highlights the Korean traditional garment Cheollik. As a representative traditional clothing mostly used in contemporary fashion design, Cheollik can be accepted by people without any resistance (Cho, 2020), and many efforts have been made to adapt it into the digital fashion design. Despite being menswear, Cheollik

is assumed to have a formative possibility to cover different age groups and genders. Along with literature and case studies, the study performs digital fashion design development and fashion film production using software, such as 3D CLO 6.0 and Adobe Photoshop/Illustrator/PremierePro, respectively. The study also conducts a survey among professionals to evaluate the results of the developed fashion design. Based on the findings, the study intends to provide implications for digital fashion design development to achieve cultural sustainability.

II. Literature review

1. The metaverse as a fashion experience space

The term *metaverse* was coined by Neal Stephenson in his novel *Snow Crash* (1992), and in 2007, the concept of the metaverse began to be established with four suggested scenarios of the future Internet roadmap: augmented reality, lifelogging, virtual worlds and mirror worlds (Kim, 2021). Fifteen years later, along with digital platforms integrated into the industry, the metaverse is transforming into a new industrial paradigm where different actors interact with one another and form an industrial ecosystem, which has compelled many leading tech companies to rush into the metaverse industry.

The core of the metaverse lies in providing users with new experiences. The metaverse resulted from the convergence of two ideas—virtual reality and a digital second life—which has been ongoing in the last several years (Chen, 2022). Emma-Jane MacKinnon-Lee, founder of the metaverse platform service Digitalax,

describes the metaverse as ‘[a] nebulous, digitally mixed reality with both non-fungible and infinite items and personas not bound by conventional physics and limitations’ (Hackl, 2021). As such, the metaverse connects the virtual realisation of the physical reality and imaginary ideals, thus providing us with an opportunity to have experiences beyond physical limitations.

Fashion experience is a process in which people perceive fashion in different ways and that is shaped as an overall behaviour associated with clothing through interactions with the environment (Kim, 2018). The metaverse used in the fashion industry offers three kinds of experiences. The first is the intellectual experience of fashion information. Since favourable attitudes formed via profound cognition do not easily change, providing cognitive experiences and conducting relevant activities are important to promote the link between brand and user (Petty & Cacioppo, 1986). Fashion brands use a metaverse platform as a vehicle for releasing information about their new product designs and stores. For instance, in 2021, Gucci introduced their collection through Gucci Villa, which they opened at the metaverse platform Zepeto, which has the same form as the physical store and where users can experience an environment similar to that of a tangible store and purchase and wear digital fashion goods.

The second is the sensory experience, which provides aesthetic pleasure through five senses (Schmitt, 1999). Since the platform is based on an audio-visual medium in which avatars are used during the metaverse experience, sensory experience points are extremely high (Choi & Pyun, 2021). This virtual space provides an audio-visual and visual-tactile space. In fashion design, where the use of the senses is emphasised, the utilisation of the virtual space is effective. For example, the Fabricant is a leading enterprise that is pioneering a new

field of digital fashion (Särmäkari, 2023). Fashion houses design and produce digital fashion goods and sell assets using presentation and blockchain technology in a virtual space. Here sophisticated digital fashion designs are characterised by intangible textures of a material based on digital visualisation but nevertheless provide a tactile experience that one can feel first-hand, as it is difficult to distinguish from reality. Various digital video technologies and sound effects are added to the presentation of a collection, and a virtual space transforms fashion design from a visual-based formativeness to an object where multisensory content is experienced.

The third is the imaginary experience of a fashion space. Balenciaga, for instance, used a game format to present its 2021 FW collection titled 'Afterworld: The Age of Tomorrow'. This video game format collection show created virtual models and environments in the metaverse platform (Hitti, 2020), which is different from a traditional fashion show on a physical catwalk. It was distinctive in that it focused on users as its audience. If a user moves along arrows for 20 minutes, they can find characters' clothes placed on the street. The user explores a virtual future set in 2031 by Balenciaga and identifies the costumes in the collection through a simple mouse operation. Such digital fashion contents provide the user with an opportunity to experience a fashion space created from imagination. Users directly select clothes, during which relations among the collection, clothes and users are closely connected. Ultimately, it shows that the metaverse, when used in the fashion industry, is an effective space where producers can extend their expressive spectrum, allowing the fashion experience to enhance the relation between service provider and user. Accordingly, providing a fashion experience in the metaverse is significant in that it serves as a tool for presenting the novelty pursued by fashion,

which means it plays an effective role in establishing relations between user and object.

2. Digital fashion design as a medium for sustainability of cultural heritage

Cultural heritage pertains to *culture*, which is the product of human intellectual and creative activities, and *heritage*, which refers to lifelong values to be handed down to future generations (UNESCO, n.d.). It includes not only tangible relics but also intangible products with historical and artistic value and cultural functions. Therefore, customs associated with food, clothing and shelter, which help us understand the lifestyle of a group of people, must be classified and preserved as folk cultural assets (Cultural Heritage Administration, n.d.a). At a global level, digital archiving is being conducted to conserve cultural heritage, which involves the historical and cultural values we must pass down to the next generations. This is because the digitalisation of cultural heritage is characterised by a lower risk of ageing or loss, excellent storage and a multitude of approaches. Hence, the digitalisation of cultural heritage is actively underway.

The metaverse functions as a place in which the cultural identity of the physical world can be reflected, maintained and extended. An avatar is a medium that connects the real and virtual spheres. In the metaverse, a virtual body, that is, an avatar, cannot be created without a physical body and is part of the embodied entity (Ajana, 2005). The avatar, as the extension of oneself, represents a channel through which one can communicate in the virtual world; the body of the avatar is connected to the physical body, and both are places in which individual identity is established (Liao, 2011). Deleuze and Guattari's (1987) idea of a body without

organs provides a clue to the relation between the avatar experience and identity formation. According to this concept, the body cannot be regarded solely as a sociocultural object and is rather full of diversity. Simply put, such diversity contains endless variations and creations beyond the fixed order, and because of this diversity, the fact that it is a single body does not change even if it is divided. Accordingly, in the metaverse, the experience formed by the avatar consists of part of the body.

Entwistle (2000) regarded human bodies as those in clothes and viewed garments as means of socialising bodies and giving them meaning and identity. By offering physical human experiences, an avatar's costume becomes a medium for reflecting a user's identity and influencing the way they form their identity. Therefore, a user who wears clothes and expresses themselves through an avatar is given an opportunity to establish their self and acquire social and aesthetic experiences. Here an avatar's costume that reflects cultural heritage and a metaverse space can contribute to cultural heritage conservation and sustainability through mutual relations with a body. Digital fashion reflects traditional cultural heritage, which can be applied to avatars that are part of both physical reality and the metaverse. The metaverse is becoming a new sociocultural space and is important to promote and transmit cultural heritage values on digital platforms of this type.

3. Fashioning traditional clothing: The Hanbok

- 1) The origin and formative characteristics of Cheollik as cultural heritage and changes

The representative garment of the Joseon dynasty in Korea (1392 - 1910), Cheollik, is a kind of overcoat with a connected top and bottom. Its origin may be identified from Yeobgido, a hunting painting that is known to have been drawn by the 31st Goryeo king Gongmin (Kim, 2015) (Figure 1). Based on the waist, Cheollik is an outerwear that connects the opened top of a straight silhouette and a skirt with pleats, which was made separately (Cho et al., 2013). Cheollik has a unique structure in that its top and bottom, although attached, are made separately and then sewn together (Figure 2). Its lower part is open and wide with pleats so that one can move their legs with no restrictions. Such formative characteristics enhance men's agility when riding a horse (Kim, 2015). Hence, it was worn mainly by male civil and military officers during the Goryeo dynasty (918 - 1392), but in the Joseon dynasty, it was worn by men of various classes such as kings, officials, military men, villains and ordinary people.

The Cheollik has changed with the times in a high or low waist, shape of collar and sleeves, width and length of strings and pleat techniques. For instance, the bottom was lengthened, based on a waistline ratio of 1:1 in the early Joseon Dynasty (1392 - 1506) to 3:7 in



Figure 1. Hunting painting, 1330 - 1374.
From National Museum of Korea. (n.d.).
<https://www.museum.go.kr>



Figure 2. Cheollik, 1392 - 1910.
From Emuseum. (n.d.).
<https://www.emuseum.go.kr>



Figure 3. Cheollik dress by Tchae Kim.
From Tchae Kim. (n.d.).
<https://tchaikim.co.kr>

1637 - 1897. The collar also changed from a double collar in the Goryeo dynasty to a knife-shaped and round collar. Details also vary according to the era, such as elaborate, evenly spaced inverted, one-way and accordion pleats.

In summary, despite certain changes over time, such as collar type, waist height and sleeve length and width, the Cheollik is characteristically composed of a single piece of fabric in which a straight-collar top and pleated bottom are formally connected. This study used this formative characteristic to develop a virtual fashion design.

2) K-fashion, current traditional clothes and Cheollik

K-fashion is a term coined by the government and media during the spread of the Korean wave in the 2000s (Kim et al., 2017). K-fashion refers to fashionable Hanbok as a concept encompassing both contemporary clothes reflecting Korean traditional culture and Korean traditional clothes reflecting Western contemporary clothing. Government efforts and public attention towards the modernisation and sustainability of Hanbok are not new, but the recent situations are different from those of the past.

Around the 19th century, Western culture began to spread to Korea, and in those days, people wore both Hanbok and suits. Western clothes, which are convenient for activities, began to replace Hanbok in the 1950s during the advent of the Korean War and industrialisation (Keum et al., 2012). With the rising standard of living and active international cultural exchange in the 1980s, the nationwide ‘Wear Our Clothes Movement’ was launched to encourage Koreans to discover what is theirs (Hong, 1985). In the 1990s, the Ministry of Culture and Sports enacted ‘Hanbok Day’, among other efforts (Hwang, n.d.). Brands influenced by such initiatives

began to emerge, which pursued the improvement of Hanbok for activity, away from fashionability (Lee, 2002). However, this new Hanbok style attracted only a few people and had difficulty penetrating the public in Westernised mainstream fashion markets. Such a tendency began to change after the 2010s during the spread of social media (Jeong & Lee, 2018). People’s pride in traditional Korean culture and interest in their identity increased under the influence of popular culture and digital media, with a unique difference in that it originated from public acceptance, which reflected the desire to promote Korean culture to the world, rather than from government efforts (Kim, 2022). In addition, interest in K-fashion and the activities of current K-fashion designers, which had previously been non-existent, suggest a direction towards the sustainability of traditional culture, especially Hanbok.

Various fashion brands are being launched using the formative elements of Hanbok or traditional culture, and K-fashion designers are actively working with Hanbok to reflect the tastes and trends of the younger generations (Jeong & Lee, 2018). Originally for men, Cheollik is now frequently used by people today because of the lack of a clear distinction between men and women and also because it is easy to apply to womenswear design with pleats on a waist similar to those of a skirt.

III. Methodology

Practice as research refers to the use of creation as a research methodology in art and design. It is a way to create the structure of a virtuous circle by encouraging individuals to generate knowledge from practical experience and by allowing it to inspire artistic and creative practice (Park & Han, 2016). From a practice as research

perspective, Nelson (2006) said that as an embodied knowledge, a creation produces not factual knowledge or ‘know what’ but rather ‘know how’, suggesting a dynamic triangular model for practice as research under creative/theoretical bases in artistic works and research, derived from the triangular structure for data groups in social science. This model consists of three elements: a conceptual framework as a process for deriving traditional and theoretical knowledge; procedural knowledge induced from creation and practical knowledge as creation of the work and critical reflection as a basis for research validity, allowing individuals to conduct practice through different approaches involving these elements (Figure 4) (Nelson, 2006). This practice as research is the appropriate methodology for pondering whether creative activities for developing digital fashion design that reflects cultural heritage can strengthen cultural sustainability in the metaverse, which is not yet in full swing, or can be classified in a much narrower category in a virtual environment. Practice as research for developing digital fashion design, using Cheollik in a virtual space, is composed of (1) deriving the types and defining the aesthetic and formative attributes of traditional Cheollik based on literature research as the conceptual framework,

(2) selecting a theme and developing a design for a digital fashion collection as practical knowledge and (3) conducting expert evaluations/surveys as critical reflection.

A case analysis was conducted to identify the characteristics of K-fashion design that reflect the traditional Korean culture. Image data were collected from Instagram by searching combinations of keywords such as ‘new/hip/modern/daily/fusion/street/casual/fashion’ and ‘Hanbok’ in Korean and English; these terms have recently been discussed as terms for new styles of Hanbok. Hip Hanbok, a neologism that describes trendy Hanbok, was also added.

A total of 12 K-fashion brands were selected by retrieving the major keywords, collecting those with the 10 highest followers count on Instagram and adding two brands that reflect Korean tradition. The brands were Leesle (n = 285), Happy (n = 70), Danha (n = 100), Tchaikim (n = 122), Leehwa (n = 129), Heosarang (n = 154), Hantram (n = 75), Comaque (n = 184), Minjuhwa (n = 39), Coreano (n = 96), Cheonuimbong (n = 49) and Darcygom (n = 135). In total, 1,438 photos posted in the last three years were collected for the case analysis. The formative characteristics were analysed on the basis of fashion style components, such as items, styling, colour, material,

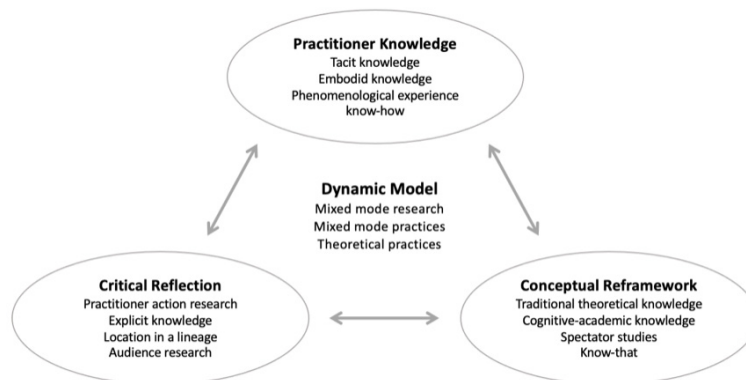


Figure 4. Model of practice as research.
Adopted from Nelson. (2006). p. 114.

silhouette and graphic pattern. The results are as follows.

1. The characteristics of Cheollik as a concept framework

1) Characteristics of traditional Cheollik

Previous studies have not clearly distinguished the formal types of Cheollik, but this is possible through classification of materials. Cheollik has different thicknesses and padding depending on the season, and it may be classified according to how it is made (Chang, 1997; Kim & Choi, 2008) and what season it is (Kim & Lee, 2018). According to the literature, traditional Cheollik could be divided into three types, depending on the season and thickness of clothing: single-layered, double-layered and padded (Kim & Lee, 2018). According to the Encyclopedia of Korean Culture (n.d.), single-layered Cheollik is worn around Dano, which is 5 May in the lunar calendar and also a Korean holiday, and is mainly assembled by attaching a cloth to the part that is easily worn out, considering practicality. Double-layered Cheollik generally has a lining and is worn around Chuseok, which is 15 August in the lunar calendar, in autumn (Encyclopedia of Korean Culture, n.d.). Padded Cheollik is worn in the winter season and is made with cotton (Chang, 2002). Based on these, a collection of six Cheollik suits, with two for each type, were designed.






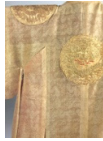

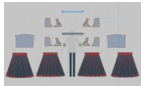

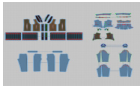




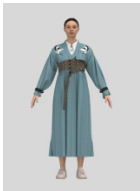
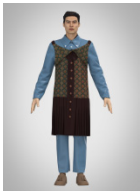
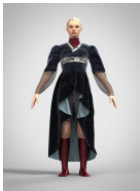

The characteristics of the traditional Cheollik are divided into two parts. From the literature on the traditional Cheollik (Choi, 2021; Kim, 2020; Kim & Kim, 2019; Yu, 2019), the sense of space, looseness and overlap were derived as aesthetic attributes, while top - bottom connectivity, emphasis on pleats, loose sleeves and traditional collar expression were identified as formative attributes. The combination of the formative attributes of a Cheollik creates its aesthetic attributes. For example, the top - bottom connectivity and pleats

provide Cheollik with a sense of space as the aesthetic attribute (Kim & Kim, 2019), and its simple panel composition and planes and pleats create a contrasting sense of space. Looseness, in this study, means a state having a margin due to physical, spatial and temporal sufficiency. The Cheollik's sense of space leads to the sensibility of relaxation that is quiet, large and spacious (Kim, 2010) but it does not lead to psychological anxiety. Moreover, the overlap of the front hem of the Cheollik, which is wider than any other garment, and the characteristic of the item designed to be worn multiple layers create the aesthetic attributes of overlap.

2) Characteristics of K-fashion design

The results of analysing the characteristics of K-fashion design are as follows. The first pertains to the mixture of items from different eras and between men and women. While K-fashion design uses traditional Korean clothing, the manner in which it is worn is different and is mixed without considering the era. Leesle presented the '2021 OUR GOGURYE' collection inspired by the clothing culture of the Goguryeo era. Patterns from the Goguryeo era and Hanbok items from the late Joseon era were mixed and represented a combination of traditional men's and women's items. The second refers to the coexistence of disparate textiles and formal collapse of traditional clothing. The pleats of the Cheollik were also applied adequately to stage costumes considering movement. Tchai Kim, a popular K-fashion designer, performs handiwork for tailored Hanbok but shows designs reflecting the latest fashion trends or mixed with Western clothing or culture (Lee, 2016). In Tchai Kim's design, the use of Cheollik stands out; her 20SS one-piece dress transformed the uses and styles of Cheollik from menswear to women's dress (Figure 3). Unlike a traditional Hanbok silhouette, which

Table 1. Development of digital fashion design using Korean tradition.

Types	Single layered		Double layered		Padded	
Original Cheollik	 <p>Figure 5-1. Single-layered Cheollik of Jik Lee. From SeokJuseon Memorial Museum. (n.d.). https://www.museum.dankook.ac.kr</p>		 <p>Figure 6-1. Double-layered Cheollik of Eung-hae Lee. From Encyclopedia of Korean Culture. (n.d.a). https://encykorea.aks.ac.kr</p>		 <p>Figure 7-1. Single-layered Cheollik Suncheon Kim. From Cultural Heritage Administration. (n.d.b). https://heritage.go.kr</p>	
Designs	Design 1	Design 2	Design 3	Design 4	Design 5	Design 6
Graphic	 <p>Figure 5-2. Graphic pattern. Captured by author. (28 February, 2022)</p>		 <p>Figure 6-2. Graphic pattern. Captured by author. (28 February, 2022)</p>		 <p>Figure 7-2. Dragon pattern. From King's Robe with Dragon Insignia. (n.d.). https://www.heritage.go.kr</p>	
2D Patterns & Flats	 <p>Figure 5-3. 2D Flats of Design 1.</p>	 <p>Figure 5-4. 2D Flats of Design 2.</p>	 <p>Figure 6-3. 2D Flats of Design 3.</p>	 <p>Figure 6-4. 2D Flats of Design 4.</p>	 <p>Figure 7-3. 2D Flats of Design 5.</p>	 <p>Figure 7-4. 2D Flats of Design 6.</p>
All images are captured by author. (28 February, 2022)						
Presentation	 <p>Figure 5. Fashion design development of Chilseog.</p>	 <p>Figure 6. Fashion design development of Sibjangaeng.</p>	 <p>Figure 7. Fashion design development of Jagae and Yongmunui.</p>			

All images are captured by author. (28 February, 2022)

is cut in a straight line and conceals one's body shape, this style is characterised by various skirt lengths, sleeve lengths and widths and a tight top silhouette, showing an outline of the female upper body. A female silhouette is revealed by the narrowed waist and flared-out skirt.

It also used in all-over print cotton fabric by the well-known British brand Liberty (Tchai Kim, n.d.), with a history of over 130 years. This is completely different from traditional clothing, which mainly uses non-pattern silk, but its form has the core elements of the Cheollik.

The third pertains to the utilisation of graphic patterns with traditional motifs. Motifs of traditional culture, such as Korean traditional architecture; Hangeul; artworks, such as Korean paintings and pottery and folk items, such as saekdong and mother-of-pearl, were used along with digital printing and embroidery techniques. Danha digitally printed the Dancheong pattern and put it on a skirt. Thus, the method of utilising traditional cultural motifs through traditional or new techniques is confirmed in many K-fashion brands. This was used as a means to supplement the Korean identity, which could be weakened by the transformation of traditional items and forms.

2. Digital fashion design development as practical knowledge

The theme of digital fashion design development reflecting traditional Korean culture was set as folklore, which has been handed down across generations for a long time, titled *Bisang*. For design development that reflects the motifs and colours of Korean folklore, cut-out details, volume sleeves and leather were applied, which were suggested as fashion design trends in 2022 by digital fashion media.

The proposed theme reflects on the symbol of Korean cultural heritage. As cultural archetypes consist of symbolic narrative texts, the use of symbols promotes an understanding of the world and its history (Oh & Shi, 2021). Considering the characteristic of the digital space with no spatial, temporal and cultural boundaries (Suh, 2020), a seasonless fashion design, that is, with no distinctions among spring, summer, autumn and winter, was planned, and a virtual fashion film was produced. Adobe Photoshop and Illustrator were used for the development of graphic pattern, and 3D CLO

6.0 was used for the digital fashion design; meanwhile, a fashion design simulation video was recorded from various angles for the fashion film, which was edited with a background and music using Adobe Premiere Pro.

1) Chilseog [칠석, July 7th in the lunar calendar]

For the ‘Chilseog’ theme, based on the traditional Korean tale ‘Altair and Vega’, two designs of single-layered men’s and women’s Cheollik were manufactured. In this story, Altair and Vega, who lived in different stars, fall in love with each other but cannot meet. On 7 July in the lunar calendar, between the two stars, crows and magpies spread their wings and build a bridge, so the two can meet each other. This story has something to do with a natural phenomenon in which two stars from the east and the west meet across the Milky Way on the evening of 7 July. This story is illustrated in the murals of the Goguryeo dynasty, affecting national sentiment. Therefore, for the design development, motifs such as the milky way and crows and magpies were used as a graphic pattern (Figure 5-2), and cut-out details and leather, which are fashion design trends in 2022, were applied. design 1 and 2 reflect the structure of a one-piece dress that connects the top and bottom, that is, a pleated skirt and a collar that transforms the shape of a traditional collar. As the first design for the theme, Cheollik in the mid-Joseon dynasty was reinterpreted as a one-piece dress. The waistline was raised, deviating from the original Cheollik. The pleat spacing was also changed, and cut-out details suggested as fashion design trends were added (Design 1, Figure 5-3). design 1 changes the silhouette of traditional clothing with a body-conscious silhouette and indicates the fusion of disparate textiles by combining glitter and matte materials. For the second design, the Cheollik of Jik Lee (1677 - 1746) (Figure 5-1) was transformed into

a unisex coat, leaving the traditional Cheollik shape almost intact and replacing a string with a button for practicality. Meanwhile, the collar was designed as a double-knife collar of the traditional Cheollik. In the original Cheollik, evenly spaced one-way pleats can be identified, and these were added since they hold their shape with the pleats pressed to the hem of the skirt (Design 2, Figure 5-4). For the pattern, milky way and magpie motifs were expressed with embroidery.

2) Sibjangaeng [십장생, Ten longevity symbols]

Design was developed with a theme inspired by the 10 longevity symbols, which refer to objects of folk beliefs, using traditional double-layered Cheollik. Based on the desire of gods to know the secret to being forever young, these 10 symbols represent 10 longevity-related objects from the animal, plant and natural world: sun, moon or cloud, mountain, water, bamboo, pine, turtle, crane, deer and herb of eternal youth. They began to appear in the mural paintings of the Goguryeo dynasty. Blue, generally used for the painting of the 10 longevity symbols, was used as a main colour of these designs. In addition, these symbols were developed as genderless concepts to destroy stereotypes, which is a recent movement in fashion design. The first design for the 10 longevity symbols was developed by adding details of the Western trench coat to the traditional double-layered Cheollik (Design 3, Figure 6-3). Eung-hae Lee in the mid-Joseon Dynasty, which showed wide pleats (Figure 6-1). Cheollik characterised by straight pleats from the waist to the hem of the skirt. These pleats were applied to the developed design with an increased skirt length, different from the original Cheollik. By widening the closure of the top, the design was intended to be wrapped so that the two layers naturally overlap. Decorations for closing were replaced by buttons and zippers. The knife

collar was kept intact, but its width was narrowed with a low neck for harmony when styled with a shirt. In the collection of the 10 longevity symbols, the second was designed to set up the look of a cropped jacket, top and pants (Design 4, Figure 6-4). By lengthening the top and shortening the skirt, a variation was made so that pleats, the key details of Cheollik, are placed below the waistline. New graphics using the pattern of the 10 longevity symbols (Figure 6-2) were developed and applied to the lining of the top and jacket. In designs 3 and 4, the top and bottom appear to be separated; however, they are one-piece dresses, and the formative characteristics of K-fashion design are shown by applying the Korean traditional motif and modifying the method with which they are worn.

3) Jagae and Yongmunui

[자개와 용무늬, Nacre & Dragon pattern]

Nacre designs applied traditional padded Cheollik. Lacquerware inlaid with mother-of-pearl demonstrates a traditional craft technique. Nacre craft refers to cutting finely ground seashells in various shapes and putting them on an object's surface for decoration, and it has been used for furniture and other purposes (Doopedia, n.d.). Designs 5 and 6 were inspired from the padded type designs of Cheollik of Suncheon Kim (late 16C) (Figure 7-1). In this design, auroral colour unique to lacquerware was applied. For the artwork, a dragon



Figure 8. Virtual fashion film on YouTube.

pattern of a royal robe (Figure 7-2) was expressed using a lustered texture of traditional nacre and a colour contrast of black and aurora. For the first nacre design, traditional Cheollik was transformed into an unbalanced coat (Design 5, Figure 7-3). In this design, elaborate accordion pleats of the traditional Cheollik remain on the waist, and quilting details of traditional padded Cheollik are located on the top front from shoulder to chest with some transformation. The bottom was designed in an unbalanced manner by changing the front and back hemlines, making its short centre front longer as it passes towards the centre back. As for the second nacre design, traditional one-piece Cheollik was developed into two pieces by dividing the top and bottom (Design 6, Figure 7-4). This design consists of a cropped/padded jumper and a shirt. The cropped jumper has extremely shortened bottoms but includes a Cheollik shirt as inner wear. It has the traditional double round collar and pleat details on the waist. All these developed designs were presented in a virtual fashion film produced using Adobe PremierePro and YouTube(Figure 8). The background images of the film were derived from Pixabay, a copyright-free source (Anwaroptin, 2020). Furthermore, design 6 divided the upper and lower garments according to the characteristics of the formal collapse of traditional clothing, mix-matched velvet and cotton materials and included the characteristics of K-fashion design by applying traditional motifs.

3. Evaluation and critical reflection

A non-parametric test was used to objectively verify whether the results of the developed digital fashion designs reflect the characteristics of the traditional Cheollik. Non-parametric tests have the advantage of a small sample so that the assumption of normality is not

maintained and the data measured in qualitative scales can be analysed. Wilcoxon signed-ranks sum test, which is a non-parametric test, is used for testing the difference value of paired data. In this study, the Wilcoxon signed-ranks sum test was used as an objective evaluation method to compare the two groups, that is, whether the development design reflected the specificity of the original Cheollik. The results were evaluated as follows. If the P value is greater than 0.05, there is no difference between the two groups, and if the P value is less than 0.05 and the Z value has a positive difference, it was judged that cultural heritage was reflected in accordance with the intention. However, items with negative difference were evaluated as items requiring improvement. From the six developed designs, the researcher first selected three that well represent the design attributes and cultural themes of traditional Cheollik, which were evaluated by 23 fashion professionals based on the prepared items. These fashion experts were recruited through purposive sampling, including six with more than five years of experience in Hanbok education and practice, seven with more than three years of experience in fashion design education and practice and 10 individuals who are highly educated in fashion design. The evaluation aimed to determine, from an objective lens, if the designs that the researcher developed using 3D digital graphics properly reflected the attributes of traditional Cheollik and cultural heritage. The survey was conducted using Google Forms over a month in February 2022, due to the COVID-19 lockdown. The questionnaire presented the original Cheollik photos (Figure 8 - 10) that were referred to the design development and stated that the designs were inspired by traditional Korean culture. The raters were asked to answer a questionnaire while looking at images of the three kinds of traditional Cheollik referenced for design development and three

Table 2. Wilcoxon signed-rank sum test results of the developed digital fashion design.

Developed design - original design			Design A (Figure 4(c))	Design B (Figure 5(b))	Design C (Figure 6(b))
Aesthetic	Space	Z	-.910 ^b	-.483 ^b	-.795 ^b
		P	0.363	0.629	0.427
	Looseness	Z	-2.224 ^b	-1.658 ^b	-2.633 ^b
		P	0.026	0.097	0.008
	Overlap	Z	-1.534 ^b	-2.387 ^b	-1.795 ^b
		P	0.125	0.017	0.073
Formative	Connectivity (Top - bottom)	Z	-.879 ^c	-1.400 ^b	-.966 ^c
		P	0.380	0.161	0.334
	Pleat	Z	-2.695^c	-3.000 ^b	-2.781 ^b
		P	0.007	0.003	0.005
	Sleeve	Z	-2.684 ^b	-2.551 ^b	-2.151 ^b
		P	0.007	0.011	0.032
	Collar	Z	-3.008 ^b	-2.720 ^b	-1.694 ^b
		P	0.003	0.007	0.090

N = 23

Z: Test statistic, P: Two-tailed p-value, b: Based on positive ranks, c: Based on negative ranks

designs, which were design A (Figure 4(c)), B (Figure 5(b)) and C (Figure 6(b)), created by the researcher. They provided ratings based on a five-point Likert scale. The items consisted of seven characteristics, which are sense of space, looseness, overlap, top - bottom connectivity, emphasis on pleats, loose sleeves and traditional collar expression, derived from the conceptual framework. Respondents performed their evaluations by comparing the original Cheollik photos and the developed designs. For the responses, the significance between the two groups was evaluated using the Wilcoxon signed-ranks sum test (Table 2).

Analysis results showed that the developed designs generally reflected the formative characteristics than the aesthetic traditional Cheollik attributes. Specifically, while designs B and C are positively different in terms of the formative characteristics on the pleats, sleeve and collar, design A showed negative differences in the pleats. Although the pleat is a representative attribute

of the Cheollik, it is not well revealed in the original of design A. Thus, it is assumed that the pleat item of design A showed a negative difference. However, waist pleats of design C were changed into gathers that fit the design process to transform menswear into contemporary womenswear, although this was made in consideration of both of the traditional Cheollik attributes. The results showed that the dedicate distinction did not affect the raters' perception. Studies of sensory differences between digital images and real materials (Lee & Kim, 2016; Min, 2016) have shown that the difference between real materials and digital screen media recognises texture and produces different sensory experiences. According to Min (2016), the screen image, more than the actual object, strengthens or weakens the user's sensory experience depending on the degree of irregularity of the actual. Therefore, in this study, it is assumed that the design features could not be clearly identified on a digital screen. In the future, design development that uses digital

images, especially in the use of materials, should consider differences in media. The result implies that digital fashion design that considers output media is necessary. Accordingly, for elements critical to an object's design attributes, a strategic approach is crucial so that a colour is accentuated considering visual effects. Compared to traditional Cheollik, design B (Figure 5(b)) is positively different in terms of overlap as an aesthetic attribute.

IV. Discussion and conclusion

The fashion industry is advancing into the metaverse and is witnessing changes in the fashion ecosystem. The metaverse, which is open 7/24/365, has become an important space in terms of a fashion brand's marketing strategies and a sociocultural place where humans worldwide can simultaneously meet and foster a new culture. This study sought to examine the potential for the metaverse and fashion design to contribute to the sustainability of cultural heritage beyond a fashion industry perspective. In addition, through design development and evaluation using themes of traditional Korean clothing and cultural heritage, this research aimed to elicit suggestions for developing fashion design to preserve cultural heritage in the metaverse.

The research findings are as follows. The literature review shows that the metaverse is a space that provides users with intellectual, sensory and imaginary experiences for fashion information. In the metaverse, fashion design is performed by an avatar on behalf of a user, and in a virtual space, wearing and experiencing fashion goods helps in lowering the physical and psychological barriers to an object. This space makes it possible to develop a unique design of creative ideas, which cannot be experienced in a physical environment, and induce

sensory stimulation and interest through dynamic and synesthetic images. Furthermore, sustainability that lacks physical and temporal limitations can be maintained through generations.

As a result of practice research, digital fashion design was developed, which can be used in the metaverse using a traditional Korean garment, Cheollik, and cultural heritage, and expert evaluation was conducted. Findings showed that designs generally reflected the aesthetic and formative attributes of traditional Cheollik but provided several implications for digital fashion design development. First, the development of fashion design requires the consideration of an end product as an output on a digital screen. It remains a challenge for a digital screen to convey the delicate texture of a real clothing material. Since design lines like seams are important elements that decide the visual characteristics of a design, a clear division of materials or colours by panel is necessary to stimulate active and sensory experiences. Second, the development of new fashion design considering cultural heritage involves work in which tradition and novelty must coexist. Such contradictory design development should be based on a full understanding of the identity of cultural heritage. A rater commented that the suggested design was similar to that of traditional clothing in neighbouring Asian regions including Japan and China. Presenting fashion design in a virtual and transcendental space where physical areas and cultures are mixed can cause confusion about its origin within the neighbouring cultural areas. Therefore, such controversy could be prevented through verification procedures. If the development of digital fashion design clearly expresses such nuances and adds new elements demanded by the present generation, it will help strengthen the intellectual resources of cultural heritage. Third, in Korea, inheriting traditional clothing or creating contemporary fashion

goods based on such clothing is mainly conducted by small-scale companies. A virtual space provides them with the opportunity to overcome physical limitations in terms of region and generation and promote such products to a wider audience. Another participant, who has been involved in creating traditional Korean clothing for more than nine years, stated that fashion design development based on traditional clothing using digital images is crucial to the preservation of tradition in the Westernised Korean fashion industry, but a technical challenge persists in its implementation. This industry creates clothes via labour-intensive handiwork, which involves meeting a few consumers in a physical space located at a digital blind spot. Accordingly, if they can obtain government support to establish strategies to produce digital fashion and use the metaverse in line with the changing digital media environment, they will be able to contribute to cultural sustainability.

The significance of this study lies in its analysis of K-fashion featuring the fashioning of Hanbok and its investigation of its design attributes from a cultural heritage sustainability perspective, which scholars have not examined thoroughly, providing specific implications for digital fashion design development that the fashion industry may apply hereafter. Highlighting the global issue of conservation and sustainability of cultural heritage, this study specifically aimed to suggest the role of fashion design practice, that is, digital fashion design development, in the metaverse, which has recently seen an increased utilisation. Since cultural sustainability is not specific to Korea only, fashion design development that reflects local culture and can be used in the metaverse, which is establishing a new fashion ecosystem with a wide ripple effect, can contribute to the diversification of global fashion culture and the revitalisation of the fashion industry. The purpose of this

study is not, in itself, to develop digital fashion design using 3D software. So, far, digital fashion design development has focused on how to overcome differences between the virtual and the real from a production perspective. Instead, this study sought to investigate the potential of the metaverse in the fashion industry and the role that digital fashion design can play in the space, providing implications for digital fashion design practice to achieve cultural sustainability as a global issue. This research developed digital fashion designs using traditional clothing and cultural heritage and provided objective opinions from experts. These findings will provide basic data to be used for cultural sustainability efforts through fashion practice in many cultural areas. This study did not focus on the commercialisation of works in the metaverse; hence, follow-up studies are expected to be conducted on the measures and strategies for applying and practicing them in an actual metaverse platform and on changes in user perceptions.

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가상환경에서 한국전통문화를 이용한 패션디자인 실천

- 철릭의 사례를 중심으로 -

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요 약

메타버스는 현실세계와 유사한 사회경제적 생태계를 구축하며 우리의 일상에도 영향력을 미치고 있다. 가상세계의 사회문화적, 산업적 중요성이 증가함에 따라 이 연구는 한국 전통복식인 철릭을 조명하고 메타버스와 같은 가상환경에서 패션디자인 실천이 문화유산의 지속가능성에 기여할 수 있는지 그 가능성과 시사점을 고찰하고자 하였다. 이에 이 연구는 패션디자인 실천을 통해 패션경험과 지속가능한 문화유산의 관점에서 접근하였다. 이를 위해 Nelson(2006)의 실천 방법인 개념적 틀, 실천적 지식, 평가 등의 절차를 적용하여 철릭과 한국 전통 문화유산을 이용한 디지털패션디자인 6벌을 개발하고 가상 패션필름을 통해 제시하였다. 결과는 오리지널 철릭과 개발된 디자인에 대한 패션분야 전문가로부터 받은 설문 결과를 Wilcoxon 비모수검정을 통해 평가하였다. 연구결과는 전통 철릭의 미적, 형태적 특수성을 반영하였으나 최종 출력 장치인 디지털 화면의 특성상 소재의 미묘함이나 플리츠와 같이 철릭에 있어 중요한 질감이 확실히 드러나지 않은 한계가 있음을 나타냈다. 또한 가상환경에서 디지털 패션디자인 개발은 영세한 소규모 기업에게 지역과 시대의 물리적 한계를 극복하고 더 많은 사람들에게 제품을 홍보할 수 있는 기회를 제공할 수 있음을 보였다. 이 연구는 문화적 지속가능성의 실천 방안으로 다양한 문화적 요소를 패션디자인 개발을 위한 기초자료를 제공하고 메타버스 공간에서 활용할 수 있는 실무적 시사점을 제공한다.

주제어 : 디지털 패션디자인, 한국전통, 메타버스, 패션디자인 실천, 철릭

