

Journal of Fashion Business
Vol.25, No.6

ISSN 1229-3350(Print)
ISSN 2288-1867(Online)

J. fash. bus. Vol. 25,
No. 6:46-69, December. 2021
[https://doi.org/
10.12940/jfb.2021.25.6.46](https://doi.org/10.12940/jfb.2021.25.6.46)

Development of Sustainable Accessory Design Using Convertible Techniques

Wujun Tang* · Sumin Koot

*Dept. of Clothing, Konkuk University, Korea,

Corresponding author

Sumin Koo
Tel: +82-2-2049-6092
Email: smkoo@konkuk.ac.kr

Keywords

Convertible Techniques,
Sustainable Design,
Accessory, Evaluation,
Consumer Characteristics

Abstract

This research aimed to analyze the features of convertible accessories, develop sustainable accessory designs using convertible techniques, and evaluate the designs developed through a consumer satisfaction survey and in anticipation of commercialization. Through a review of literature and design cases, convertible accessories were classified; and six convertible accessory designs were developed into practical products. A survey on the convertible designs was conducted to evaluate their aesthetic, functional, and symbolic aspects, ease of use, usefulness, and the intention of consumers to purchase and use the products. In addition, a survey was performed to understand the differences in fashion leadership and eco commitment and behavior. The data were analyzed using descriptive analysis methods, a series of t-test, and ANOVA using the SPSS 25.0 software. There were 335 participants; mostly adult women aged between 20 and 60 years and living in China, one of the world's largest accessory markets. The participants showed high interest to use and purchase the developed designs. There were significant differences in aesthetics, functionality, symbolism, attitude, ease of use, usefulness, usage, and purchase intention for the developed convertible accessories among people with different levels of fashion leadership, environmental commitment, and behavior. The results of this study will help designers develop convertible accessories with a better understanding of consumer perceptions and attitudes towards convertible accessories.

—
This research is part of a doctoral dissertation.

I. Introduction

With the popularization of fast fashion, various problems have arisen in the environment, society, and economy, requiring changes in the fashion industry for sustainable development (Zakharkevich, Koshevko, Kuleshova, Ditkovska, Shvet, & Zhylenko, 2018). Sustainable development is considered as an important concept in protecting the environment and resources, establishing long-term human development and strategies for development around the world (Chen, 2014). Rather than educating or calling on consumers to act responsibly, it is recommended that designers develop products that minimize the waste of resources from the early stages of product development and help consumers create more sustainable lifestyles (Ma & Koo, 2016). Therefore, designers would need to consider ways to extend the clothing life and minimize waste from the product-planning stage (Zakhakevich et al., 2018). In other words, rather than treating produced products in a sustainable way, designers need to develop strategies to minimize resource use and waste even before production.

Many social and economic resources are being invested to deal with clothing and textile waste. Thus, the fashion sector, should also make efforts to reduce waste. However, the fashion industry can survive by changing first and introducing new products to the market to adapt to the rapidly changing trends. People also buy and discard many fashion products to meet their various needs (Hethorn & Ulasewicz, 2008). Total sales of clothing retail worldwide in 2018 amounted to \$1.438.2 trillion, with the compound annual growth rate (CAGR) reaching 4.2% (Ke, 2019). In addition, traditional design or production methods may not be sufficient to meet the needs of people who are develop with increasing diversity (Li, 2016). Thus, it is expected that convertible techniques among the various methods for sustainable fashion can vary the design and functionality of the product, satisfying consumers' changing needs and ultimately reducing unnecessary consumption and promoting sustainable fashion (Koo, Dunne, & Bye, 2014).

Fashion accessories at relatively low prices are consumed along with fast fashion, thus requiring attention to sustainable accessory design. The global accessory market grew at 6.18% (CAGR) between 2004 and 2018, with the market reaching \$356.4 billion (Qianzhanjingjixueren, 2020). China's accessory market grew 6.18% (CAGR) from 2009 to 2018, and it is expected to exceed 1.4 trillion yuan (Li, 2019). In relation to accessory, the amount of gold used in a single gold ring generates about 25–50 tons of mineral waste during mining, with China's gold production reaching 401,119 tons in 2018 alone, with large amounts of fast accessory materials becoming non-cyclic waste (Wu, 2019). Therefore, the fashion industry should not only consider clothing made of fiber, but also the development of sustainable fashion accessories.

Existing studies on convertible accessories are few and not deep enough, Zhu (2013) presented the concept of the convertible structure of accessories but discussed convertible accessory structure design mainly using stainless steel materials (Zhu, 2016). Luo, Guo, and Qin (2011) presented the concept of convertible accessories, but theoretically discussed the case analysis and development of convertible accessories. Yang (2018) mainly studied the combination of convertible accessories. However, there are many studies on convertible clothing, while there are few on convertible accessories. Thus, this study will focus on the development of sustainable accessory designs using convertible techniques.

II. Literature review

1. Sustainable fashion and convertible accessories

Sustainable fashion generally indicates an entire fashion system of eco-friendly or ethical product development, production, distribution, and it includes spirit, exercise, and behavior (Gordon & Hill, 2015). Considering that waste generation is related to the entire fashion system, not just to the production stage (Gwilt, 2014), it is necessary to try not to produce waste from the beginning to achieve sustainable fashion (Kim & Kim,

2018). In the fashion field, sustainable fashion has now become an essential consideration beyond trends.

There are various strategies for fashion industry to strive for sustainability, such as the zero-waste fashion design method. Approximately 10–20% of fiber waste is generated during clothing production (Rissanen, 2008). Zero-waste fashion design is a clothing design process to prevent waste from being generated when cutting and sewing clothing (Rissanen & McQuillan, 2016; Townsend & Mills, 2013). Hence, zero-waste has a very important meaning for sustainable fashion. There are four approaches for zero-waste clothing design, such as jigsaw, embedded jigsaw, tessellation, and multiple cloth methods (McQuillan, 2011; Rahman & Gong, 2016). Carrico and Kim (2014) suggested design method of minimal cut.

It is also important to minimize wastes or achieve zero-waste. The environmental impact is caused by the amount of waste generated from discarded clothing (Allwood, Laursen, Malvido de Rodriguez, & Bocken, 2006). Sustainable fashion design includes several aspects of circular economy, from initial material selection to lifespan and its potential recycling (Claxton & Kent, 2020). This concept of circularity is currently widely discussed within the fashion industry as the universal method to achieve sustainability (Claxton & Kent, 2020). As a way to minimize waste, a sustainable strategy is needed before the product cycle, but it would be most recommended to zero or minimize wastes generated from the initial production lifecycle.

The selection of sustainable materials is an important topic in the fashion industry (Claxton & Kent, 2020), but fabric is one of the materials with the lowest reuse rate among reusable materials (Cline, 2014). It is difficult to recycle fabrics mixed with various fibers. Only about 15% of used clothes were donated or recycled, and about 10.5 million tons were buried as garbage each year, increasing over the past decades (Cline, 2014). Innovative and continuous efforts are required to minimize wastes.

Thus, considering that the occurrence of waste is not only a problem in the production stage, but related to

the whole fashion system (Gwilt, 2014). To achieve sustainable fashion in today's fashion system, efforts should be made to avoid waste production from the beginning (Kim & Kim, 2018). In addition, the design with durability can prolong the lifespan of clothing and is also of great significance to sustainability. The design with excellent durability improves the possibility of product reuse (Gwilt, 2014). Fabric has a low recycling rate (Cline, 2014) and Vartan (2008) stated that redesign, renovation, and repair are ways to reduce total clothing consumption. However, in the study of Janigo and Wu (2015), only 15% of the respondents tended to spend time on garment renovation, and most of them thought they couldn't use the technique. Thus, it is necessary to find sustainable design methods in the design stage such as improving durability and facilitating transformation.

Among the various approaches to sustainable fashion, convertible clothing refers to apparel that can be worn by changed in design or function (Zakharkevich, Kuleshova, & Shvets, 2015). This type of convertible clothing can be worn in different situations, reducing unnecessary purchases by providing versatile design and functionality (Fletcher, 2008; Koo et al., 2014), and it is also a design that suits the rapid change of trends and lifestyles (Fletcher, 2008). As a consequence, convertible fashion is considered a way to realize sustainability while satisfying various needs and desires of people.

Convertible fashion has several positive effects as following. First, the possibility of consumers wearing the clothing may increase (Rahman & Gong, 2016). Second, the life of the clothing may be extended (Black, 2008). Third, psychological aging of the product may be prolonged (Fletcher, 2008). Fourth, the time for landfilling garment wastes may be delayed (Rahman & Gong, 2016). Fifth, variable clothing can be worn in several ways, reducing unnecessary purchases and enabling sustainable fashion (Dombek-Keith & Loker, 2011; Farrer, 2011; Fletcher, 2008; McQuillan, 2011). Thus, convertible fashion design would be a sustainable way to restrain garment consumption through changes, reconstructions or replacements of clothing parts

(Rahman & Gong, 2016).

Convertible fashion has long been under development. In ancient times, fabrics were precious and techniques for manufacturing clothing were lacking. Various techniques such as folding or tying, were used for wearing them (Cleland, Davies, & Llewellyn-Jones, 2007; Kim & Chun, 2012). For example, in ancient Egypt, knots on haik, robes, and cloaks were convertible, while ancient loincloth, sash, chlamys, and paludamentum were fixed convertible styles. Ancient Egyptian kalasiris, tunics, and chitons were styled for mixed variability (Kim and Chun, 2012). The ancient Greek heimation and peplos and ancient Roman toga were also convertible (Cleland et al., 2007). In addition, the Tibetan robe, with a history of more than 4000 years, is a kind of convertible clothing. The structure and way of wearing the Tibetan robe can be adjusted freely according to a change in temperature. When the Tibetan robe is opened and spread on the ground, it becomes a warm quilt (Wang, 2020). Tibetan robes are very practical for Tibetan nomads who live in areas with large temperature differences between day and night. More Convertible clothing can be found in designer clothing products such as Issey Miyake, as well as in daily life, such as clothes with detachable sleeves or pants legs. Fletcher (2008) stated that it's not enough to sustain a product for a long time to make a solid product. Therefore, for reducing environmental damage, it would be essential to prolong the product aesthetic life (Rahman & Gong, 2016). Convertible fashion designs naturally change appearance aesthetics when transform, and the wearer can actively change the desired shape and aesthetic according to place and psychological needs, resulting in greater satisfaction and achievement, which is expected to extend aesthetic life than general fashion.

Accessories are also affected by trends along with fast fashion, and many products are being made and discarded today. In the case of accessories, various materials such as metal, plastic, film, and fabric are mixed and used. It is not easy to recycle because various materials are mixed in a small volume, and most of the accessories are discarded rather than recycled. Therefore, it is necessary to design and develop accessories

sustainably. Convertible accessories refer to those that can be worn in a variety of designs and functions (Luo et al., 2011). Convertible accessories appeared in ancient Egypt and Greece. In the 1920s and 30s, convertible accessories appeared in large quantities, and convertible accessories became popular in the 1970s (Yang, 2018). Convertible accessories are generally smaller than clothes and have the advantage of being more convenient for the wearer, making them less burdensome. By providing a variety of functions and designs with one accessory, the wearer can match accessories to different styles of clothing.

The adoption of convertible fashion techniques needs to consider sustainability not only from the material aspect, but also from the design aspect, and develop products through multi-form and multi-purpose. It is expected that it will be able to achieve a sustainable purpose of saving resources by satisfying more needs of consumers and reducing consumption. As part of convertible fashion, convertible accessory is also considered a way to realize sustainability while satisfying various needs and desires of people. It also has the positive effects like convertible fashion as mentioned above. Thus, this study puts forward the possibility of the design and development of convertible accessories, provides inspiration, and establishes the data for other designers to develop convertible accessories, which is ultimately conducive to the fashion field of sustainable development.

2. Convertible accessory design methods and case studies

In a prior study, Zhu (2016) distinguished convertible stainless steel accessory structures according to arrangement type—combination, insertion, spiral, folding and flipping. Similarly, in this study, convertible accessory designs were classified by method of conversion: the open-close method, combination, folding, rotation, automatic and comprehensive, and we analyze convertible accessory cases and examines their characteristics.

The open-close method is a design technique whereby

an accessory can be opened and closed. The folding method is a method of achieving accessory transformation through folding. The combination method presents more than three visual effects through the free combination of two or more independent parts. Among convertible accessories, the combination method is most direct and frequently used. The rotation method refers to a convertible accessory rotating around a shaft core. The automatic method is not thoroughly manual, but through mechanical, intelligent and other clever technology, it makes accessories achieve automatic transformation. The comprehensive method refers to the use of two or more methods in the design. According to the classification of design methods, Convertible accessories can be divided into open-close, folding, combination, rotation, automatic and comprehensive (Table 1).

1) Open-close convertible accessory

Open-close convertible accessories typically include the renaissance sachel (Table 2. 1-a), the Victorian spy camera watch (Table 2. 1-b), the lotus watch (Table 2. 1-c), the tangerine ring (Table 2. 1-d), the heart locket (Table 2. 1-e), the secret locket mask pendant (Table 2. 1-f), the three-drawer ring (Table 2. 1-g).

2) Folding convertible accessory

Folding convertible accessories include the frog ring (Table 2. 2-a), the storybook necklace (Table 2. 2-b), the folding ring (Table 2. 2-c), the transformable platinum and gold ring (Table 2. 2-d), the transformative fashion accessories provide shelter and intimacy (Table 2. 2-e), the sun-moon bracelet ring (Table 2. 2-f), and the accorded paper ring (Table 2. 2-g).

3) Combination convertible accessory

Examples of combination convertible accessories include the wheel of arrows (Table 2. 3-a), the phoenix brooch (Table 2. 3-b), the bow pearl collection (Table 2. 3-c), the hamburger ring (Table 2. 3-d), the combination convertible diamond ring (Table 2. 3-e), the Antonio Bernardo secret compartment ring (Table 2. 3-f), and the “plique-à-jour” ring (Table 2. 3-g).

4) Rotation convertible accessory

Rotation convertible accessories include the Mécaniques Célestes rotation convertible ring (Table 2. 4-a), the Jörg Heinz rotation convertible pendant (Table 2. 4-b), Temple St. Clair rotation convertible pendant (Table 2.

Table 1. Classification of Convertible Accessories and Design Methods

Types	Methods	Concepts and characteristics
Open-close convertible accessory	Open-close method	A method of design through which an accessory can be opened and closed
Folding convertible accessory	Folding method	A method of accessory transformation through folding
Combination convertible accessory	Combination method	A method that can present more than three visual effects through the free combination of two or more independent parts
Rotation convertible accessory	Rotation method	A method of convertible accessory in which one part rotates around a shaft core
Automatic convertible accessory	Automatic method	A method through which mechanical, intelligent and other clever technology give accessories an automatic transformation
Comprehensive convertible accessory	Comprehensive method	A method using of two or more design methods

4-c), the pinning gyroscope pendant (Table 2. 4-d), the pinwheel ring (Table 2. 4-e), the silver leaf pocket knife necklace (Table 2. 4-f), and the “wind power” ring (Table 2. 4-g).

5) Automatic convertible accessories

Examples of automatic accessories include the Jardin des Papillons brooch (Table 2. 5-a), the automatic stainless-steel convertible ring (Table 2. 5-b), the Jacob

Table 2. Case Analysis of Convertible Accessory

Types	Name	Design method	Style & Feature	Reference
Open-close convertible accessory	Renaissance sachet	Open-close method	Consisting of small boxes that can be opened and closed and contain medicinal herbs.	Wartski, com, n.d.
	Victorian spy camera watch	Open-close method	It looks like a pocket watch, but when it is open, it is a small camera that can be retracted.	watchismo.blogspot.com, 2007
	Lotus watch	Open-close method	Lotus petals can be closed or opened as if in full bloom.	Garrahan, 2018
	Tangerine ring	Open-close method	When closed, it looks like a ball, but when opened, it looks like a cut tangerine.	Dong, 2019
	Heart locket	Open-close method	When closed, it is heart shaped, and when unfolded, it forms a four-leaf clover.	SilkPurseSowsEar, n.d.
	Secret locket mask pendant	Open-close method	Representing different face shapes when opened and closed.	Sylvaine Jewellery, n.d.
	Three-drawer ring	Open-close method	The drawers can be opened or closed	The Carrotbox 1, 2021
Folding convertible accessory	Frog ring	Folding method	When opened, it looks like a frog, which can also be folded.	The Carrotbox 2, 2013
	Story book necklace	Folding method	It has the shape of a book, which can be opened or folded.	Surian, 2015
	Transformable platinum and gold ring	Folding method	By folding, the wearer can change the position of the sphere on the ring and the form into different shapes.	Tom Rucker Fine Jewellery, n.d.
	Folding ring	Folding method	Four rings when unfolded and one ring when folded.	Stephanie Said, n.d.
	Transformative fashion accessories provide shelter and intimacy	Folding method	Through folding, the shape of the necklace changes. It can also be used as a hat.	Pakhchyan, 2010
	Sun moon bracelet ring	Folding method	Through folding, it can present the shape of a bracelet or ring.	Jewelers of America, 2021
	Accordioned paper ring	Folding method	It can stretch like an accordion.	The Carrotbox 3, 2021

Table 2. Continued

Types	Name	Design method	Style & Feature	Reference
Combination convertible accessory	Wheels of arrows	Combination method	It is a kimono belt buckle, composed of 12 hairpins, rings, brooches, etc.	Works of art, n.d.
	Combination convertible phoenix brooch	Combination method	It is composed of phoenix-wing earrings, a phoenix-tail brooch and a pendant in the mouth of the phoenix.	Sotheby's, n.d.
	Bow Pearl collection	Combination method	It consists of two short pearl necklaces, a brooch with diamond bows, and earrings with pearl tassels.	Zhubaoyibai, 2020
	Hamburger ring	Combination method	This ring consists of seven separate rings. Each ring is shaped into the image of vegetables, cream, tomato sauce and so on.	Ghosn, n.d.
	Combination convertible diamond ring	Combination method	This rose shaped combination diamond ring is actually composed of three rings.	Zhubaoyibai, 2020
	Antonio Bernardo secret compartment ring	Combination method	This is a secret compartment ring consisting of two metal rings.	King, 2012
	"Plique-à-jour" ring	Combination method	It is composed of three rings.	The Carrotbox 4, 2021
Rotation convertible accessory	Mécaniques Célestes rotation convertible ring	Rotation method	The smooth ball on the ring can be rotated to the inside of the gem inlaid on the other side through the shaft core.	Elie Top, 2015
	Jörg Heinz rotation convertible pendant	Rotation method	The external structure of the pendant can be rotated through the shaft core so that different internal forms can be exposed.	Flora, 2010
	Temple St. Clair rotation convertible pendant	Rotation method	It consists of many exquisite rings inlaid with gems, and the middle of the shaft core can be rotated to show different shapes.	Temple St. Clair, 2017
	Spinning gyroscope pendant	Rotation method	It is rotatable and transformable through the shaft.	The Beading Gem, 2013
	Pinwheel ring	Rotation method	When it is blown, it will rotate around the shaft core.	The Beading Gem, 2013
	Silver leaf pocket knife necklace	Rotation method	Through the rotation of the shaft core, the pendant can be changed from a leaf into the shape of a sharp knife.	Contrary, n.d.
	"Wind power" ring	Rotation method	It can rotate around the shaft core.	The Carrotbox 5, 2021

Table 2. Continued

Types	Name	Design method	Style & Feature	Reference
Automatic convertible accessories	Jardin des papillons brooch	Automatic method	With Tremblant technology, butterfly brooch can gently flap its wings.	Yilin jewelry design, 2018
	Automatic stainless steel convertible ring	Automatic method	Even with just a slight shake, the ring will keep dancing.	Orro, n.d.
	Jacob & Co astronomia solar watch	Automatic method	It is made up of 439 parts that rotate in both directions to present a moving solar system.	Naas, 2017
	Toy automatic convertible bracelet	Automatic method	With the wearer's movement, the freely moving spheres on the bracelet will collide, making a pleasant sound and different shapes.	Yael Sonia's jewelry, 2012
	Shadow automatic convertible accessory	Automatic method	It can cast wonderful shadows to decorate the human body. These shadows will automatically produce changes due to the changes of the light source.	Azevedo, n.d.
	'One Sand-one World' fluid convertible ring	Automatic method	The substances in the liquid in the ring can rise and fall, suspend and so on with the movement of the wearer.	Dong, n.d.
	"Incense" ring	Automatic method	Incense can be burned on the ring. With the burning of incense, smoke diffuses.	The Carrotbox 6, 2021
Comprehensive convertible accessories	Enamel compartment ring	Open-close method Rotation method	The ring is set with seven small rectangle boxes and seven covers. The seven covers have flower patterns on one side and letters on the other. These box covers can present the pattern of flowers, or they can turn through the axis to become the covers of adjacent boxes and present the pattern of letters.	Bejeweledmag, n.d.
	Observational jewelry	Automatic method Folding method	Its long rod can be folded to change its position and shape, while the magnifying glass itself can change the size and shape of the object to be viewed.	Dawson, 2010
	Gambling ring	Automatic method Rotation method	The unfixed dice can move with the movement of the wearer. In addition, the dice can be rotated by shaking the handle.	The Carrotbox 7, 2008

& Co. Astronomia solar watch (Table 2. 5-c), the toy automatic convertible bracelet (Table 2. 5-d), the Shadow automatic convertible accessory (Table 2. 5-e), the "One Sand/One World" fluid convertible ring (Table 2. 5-f), the "Magnification" ring (Table 2. 5-g).

6) Comprehensive convertible accessories

Comprehensive convertible accessories use two or more design methods. Examples include the Enamel compartment ring (Table 2. 6-a), observational jewelry (Table 2. 6-b), and the gambling ring (Table 2. 6-c).

3. Evaluation and consumer characteristic

1) Aesthetics, Functionality, Symbolism

Homburg, Schwemmler and Kuehnl (2015) proposed a new product design theory, a measure of product design from the perspective of symbolism, aesthetics, and functionality. The product design concept refers to the product elements that consumers recognize and constitute through the multi-dimensional structure of symbolism, aesthetics, and functionality (Homburg et al., 2015). Consumers perceive products as aesthetics, functionality and symbolism in three-dimensional structures, from which product design can be evaluated (Homburg et al., 2015). Homburg et al. (2015) proposed that design dimensions (aesthetics, functionality, symbolism) have a positive effect on the will of consumer to pay and positively influence the purchase intention, word of mouth. The convertible accessories developed in this study also belong to the category of fashion product design. In order to measure their consumer evaluation, in this study we analyze according to the aspects of symbolism, aesthetics, and functionality proposed by Homburg et al. (2015).

The aesthetic aspect means perceived beauty level (Desmet & Hekkert, 2007), and It is an important element affecting customer decision for selection (Wiecek, Wentzel, & Landwehr, 2019). The functionality aspect reflects consumers' understanding of the ability to achieve product objectives (Bloch, 2011; Boztepe, 2007). The symbolic aspect refers to the cognitive information about

the image from consumer to consumer and others based on visual factors (Aaker, 1999; Belk, 1988; Desmet & Hekkert, 2007). Without the physical beauty, method of operation and quality of the product, people may not completely grasp the general appearance of product design. Symbolism can be applied when evaluating products (Rindova & Petkova, 2007). Aesthetics, functionality and symbolism all affect the overall evaluation in terms of attitude toward the product (Homburg et al., 2015). Therefore, in this study, it was tried to understand consumers' evaluation of the aesthetics, functionality and symbolism parts of the developed convertible accessories.

2) Ease of use, Usefulness

The perceived usefulness, ease of use stems from the Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989). Behavioral intention to use is influenced by perceived usefulness and attitude. Attitude is decided by perceived usefulness, perceived ease of use (Davis et al., 1989). TAM is specially developed for the user's will to accept, use new technologies or media as information systems management (Ma, Gam, & Banning, 2017). The theoretical framework is also widely used in the research on the adoption of various information technologies (Chi & Kim, 2016). Recently, in terms of clothes shopping, TAM, which illustrates the application of consumer technology, has been widely used (MA et al. 2017). TAM is regarded as the most effective model to illustrate the consumer acceptance and use intention of information technology. This model also describes the user's technology adoption behavior founded on the perceived ease of use and usefulness that are considered as the main determinants (Hwang, Chung, & Sanders, 2016). Ease of use and usefulness are important determinants in accepting new products or systems (Davis, 1989). Perceived usefulness, ease of use are the main factors that shape user attitudes and behavioral intentions (Davis et al., 1989; Pavlou, 2003). Perceived ease of use refers to an individual being aware of how easily he or she can use a technology or product, and perceived usefulness means how useful people believe a

technology or product is (Davis et al., 1989). If the product or technology is not beneficial, people are likely not to use it (Devaraj, Easley, & Crant, 2008). Thus, in this study, perceived usefulness and ease of use were cited as important variables in the developed convertible accessories evaluation survey.

3) Fashion leadership

Characteristic theory developed for use in specific consumer behavior studies has applied to the studies of fashion leadership which belongs to personality variable (Schiffman & Kanuk, 2007). Fashion leadership refers to people buying or adopting new fashions faster than other people and playing a pioneer part in the acceptance of new styles (Kang & Park-Poaps, 2010). It is also an essential notion in the fashion industry since it plays a significant part for novel fashion trends spreading (Goldsmith, Freiden, & Kilsheimer, 1993). In addition, the one with high fashion leadership level is more possible to take sustainable action (Lang & Joyner Armstrong, 2018). Fashion leadership is widely used today in research on sustainable topics in clothing (e.g.: Kim & Kim, 2020; Lang & Joyner Armstrong, 2018). Unlike in the past, sustainable fashion is currently perceived as trendy. Whether the developed convertible accessories can receive a higher evaluation among fashion leaders or not, they can help select early-market consumer targets.

4) Environmental commitment and behavior

The most important value of sustainable development is environmental protection (Leiserowitz, Kates, & Parris, 2006). Convertible designs lead consumers to participate in Sustainability (Dombek-Keith & Loker, 2011; Farrer, 2011; Koo, Dunne, & Bye, 2014; Loker, 2008). Moreover, the higher the degree of attention to the environment, the more aware of environmental consumption behavior consumers become (Park & Oh, 2005). Rahman, Fung, & Chen (2020) observed differences in environmental commitment and behavior and consumer innovation between consumers with high behavior and low behavior. In a previous study, Rahman et al. (2020) observed the differences in consumer

innovation between consumers with high environmental commitment and behavior and consumers with low environmental commitment and behavior. Thus, in this study, the satisfaction of consumers with high and low environmental commitment and behavior for the development of convertible accessories were compared to select potential consumers.

III. Methods

1. Convertible accessory development method

On the basis of convertible design examples and literature reviews, six convertible accessories were designed and prototypes were produced: two folding convertible earrings, two comprehensive convertible brooches, one pair of rotation convertible sunglasses, and one rotation convertible headband. Compared with the simple open-close method, the combination method, and the automatic method, the folding, rotation and comprehensive methods with more changes in shape were adopted in this study. They were mainly made of white copper, brass and resin lens. Under the theoretical background, the results of design cases show that although there are many rings, necklaces, bracelets and so on, the diversification of other forms of accessories is insufficient. Therefore, in this study, the earrings, headband, glasses, and brooch were developed for expanding the possibility of variable jewelry design and development. Materials were mainly made of cupronickel, brass, and resin lenses. These materials are widely used for accessories and cupronickel and brass have similar characteristics with gold and silver, but they are more economical and sustainably anti-bacterial. Among the developed products, the sunglasses were drilled to combine pieces together, but the glass lenses were easily broken. Thus, the more durable material of resin lenses that the glass lenses were used for the longer product lifecycle. In the manufacturing process, strip types of materials were mainly used instead of using plate types that needed to be cut, and the strip types were bent and connected to minimize the wastes.

2. Evaluation and questionnaire survey

The survey developed for the evaluation of the design was uploaded to the online survey website (<https://www.wjx.cn/>) for the collection of data. In this study, the research subjects were aged 18 or older and living in China, one of the world's largest accessory markets. Because the customers of fashion are mainly women (O' Cass, 2004), the subjects of this questionnaire were female consumers aged 20–60.

The questionnaire included the following: three questions about demographic background; nine questions evaluating symbolism, functionality, and aesthetics (Bettels & Wiedmann, 2019; Homburg et al., 2015; Wiedmann, Haase, Bettels, & Reuschenbach, 2019); four questions on ease of use (Adams, Nelson, & Todd, 1992; Davis, 1989; Koo, 2018); three questions on usefulness (Davis, 1989; Koo, 2018; Ma et al., 2017; Tang & Koo, 2020); three questions on usage intention (Perry, 2017; Venkatesh, Morris, Davis & Davis, 2003); four questions on purchase intention (Kim et al., 2020; Popov & Koo;

2020 Yu & Yu, 2020); five questions on fashion leadership (Kim & Kim, 2020; Lang & Joyner Armstrong, 2018); and 8 questions on environmental commitment and behavior (D'Souza, Gilmore, Hartmann, Ibáñez & Sullivan, 2015; Rahman et al., 2020). The survey used 7-point Likert scales. The adopted measurement scales were Cronbach's alpha values, all higher than 0.70 (0.83 to 0.96), with high internal consistency (Table 3). The collected data were analyzed using descriptive analysis methods and a t-test, using SPSS 25.0.

IV. Results and Discussion

1. Development of convertible accessory design

1) Folding convertible earrings

The processes of making the two folding convertible earrings are the same: 1) select the material (4mm wide, 0.5mm thick white copper; 4 mm wide, 0.5 mm thick brass); 2) cut the white copper and brass bars into 10

Table 3. Questions and Cronbach's alpha

Category	Number of Questions	References	Cronbach's alpha
Aesthetics	3	Bettels & Wiedmann, 2019; Homburg et al., 2015; Wiedmann et al., 2019	0.921
Functionality	3	Bettels & Wiedmann, 2019; Homburg et al., 2015; Wiedmann et al., 2019	0.929
Symbolism	3	Bettels & Wiedmann, 2019; Homburg et al., 2015; Wiedmann et al., 2019	0.930
Usage intention	3	Perry, 2017; Venkatesh et al., 2003; Koo, 2018	0.939
Purchase intention	4	Kim et al., 2020; Popov & Koo, 2020; Yu & Yu, 2020	0.957
Ease of use	4	Adams et al., 1992; Davis, F.D., 1989; Koo, 2018	0.937
Usefulness	3	Davis, F.D., 1989; Koo, 2018; Ma et al., 2017; Tang & Koo, 2020	0.937
Fashion leadership	5	Kim & Kim, 2020; Lang & Armstrong, 2018	0.828
Environmental commitment and behavior	8	D'Souza et al., 2015; Rahman et al., 2020	0.841



Figure 1. Design A
(photo by author)



Figure 2. Design B
(photo by author)

mm long rectangle pieces; 3) grind the rectangle pieces; 4) punch holes at both ends of the rectangle pieces with manual drill; 5) connect the rectangle pieces with rivets to complete the folding transformation earrings. Two adjacent copper sheets can be folded around the joint of the copper sheets, so that by adjusting each copper sheet, various shapes can be selected, including a cross, dragon, strip, rectangle, circle, eye, and others (Figure 1). The second folding convertible earring is a closed structure, which can be changed into a four- or five-pointed star shape, triangle shape, circle shape, rectangle shape, gourd shape, irregular shape and so on (Figure 2).

2) Rotation convertible accessories

The process of making the convertible sunglasses is as follows: 1) select materials (glasses without power, resin lenses, etc.), 2) punch holes with manual drill for colorless glasses and resin lenses, 3) connect glasses and resin lenses with rivets to complete the convertible sunglasses. Each piece of resin lens can be rotated on the rivets. The wearer can choose the required color by rotating the lens, while other resin lenses can play the

role of decoration (Figure 3). The process of making the rotation convertible hairband is as follows: 1) select the material (10 mm wide, 1mm thick white copper), 2) punch holes at both ends of the copper bars with a manual drill, 3) connect the copper bars using rivets. it can be transformed into a headband, sunglasses, mask, necklace, ornament, and basket by rotating the copper bars (Figure 4).

3) Comprehensive convertible brooches

These two convertible brooches are similar to the above convertible earrings: 1) select the materials (0.9mm wide, 0.5mm thick white copper; 0.9 mm wide, 0.5 mm thick brass); 2) cut the white copper and brass bars into rectangle pieces; 3) grind the rectangle pieces; 4) drill holes at both ends of the rectangle pieces with a hand drill; 5) connect the rectangle pieces using rivets and connect the rectangle pieces and the round copper sheet using rivets. These two transformable brooches do not only change into various shapes of brooches, but they can also be wound behind the neck to act as necklaces (Figure 5) (Figure 6).

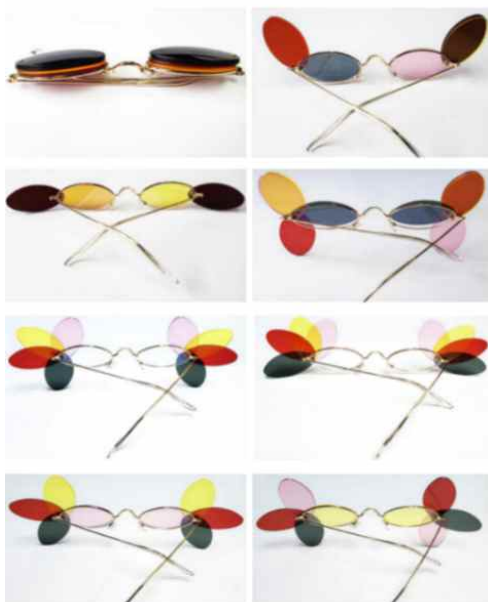


Figure 3, Design C
(photo by author)



Figure 4, Design D
(photo by author)



Figure 5, Design E
(photo by author)



Figure 6, Design F
(photo by author)

2. Satisfaction evaluation and questionnaire results

1) Demographic characteristics

335 responses were collected in total and analyzed as a result of demographic characteristics. The age was generally similar, with 100 in their 20s (29.9%), 94 in their 30s (28.1%), 79 in their 50s (23.6%) and 62 in their 40s (18.5%), but the ratio was slightly higher in their 20s and 30s. Among them, 224 (66.9) were married, and 111 (33.1%) were unmarried, indicating that more respondents were married. The number of housewives was 133 (39.7%), with 56 businessmen (16.7%), 55 employees (16.4%), 54 professionals (16.1%), 30 students (9%) and 7 classified as other (2.1%) (Table 4).

2) Satisfaction with aesthetics, functionality, and symbolism

As a result of researching the satisfaction of convertible accessories in terms of aesthetic, functional, and symbolic

aspects, participants expressed satisfaction with the convertible accessories developed in this study. The results of the 7-point Likert scales showed that the Average responses were higher than 4.86. In aesthetic terms, over 80% of the participants were positive to all developed convertible accessories. The one with the highest satisfaction of aesthetic was design C (rotation convertible sunglasses) ($M=5.24$, $SD=1.27$), followed by design F (comprehensive convertible brooch 2) and E (comprehensive convertible brooch 1). In functionality terms, over 80% of the participants were positive to all developed accessories. Design C (rotation convertible Sunglasses) ($M=5.25$, $SD=1.24$) was the most popular, followed by Design E and D (rotation convertible headband). In symbolic terms, more than 90% of respondents were positive to Design C, and over 80% were positive to other developed accessories. Design C ($M=5.27$, $SD=1.27$) was the most satisfactory on average, followed by Design F and Design E (Table 5).

Table 4. Demographic characteristics

Category	Sub-Category	No.	%
Age	20s	100	29.9
	30s	94	28.1
	40s	62	18.5
	50s	79	23.6
Marital status	Single	111	33.1
	Married	224	66.9
Occupation	Student	30	9
	Homemaker	133	39.7
	Employee (by government, companies, etc.)	55	16.4
	Professional (lawyer, researcher, doctor, etc.)	54	16.1
	Business owners	56	16.7
	Others	7	2.1

Table 5. Aesthetics, Functionality, Symbolism Satisfaction

Category	Design No.	M	SD	Satisfied (%)
Aesthetics	Design A	4.92	1.49	80.6
	Design B	4.86	1.36	80.9
	Design C	5.24	1.27	87.8
	Design D	5.05	1.23	88.4
	Design E	5.14	1.29	88.7
	Design F	5.18	1.43	86.9
Functionality	Design A	5.05	1.42	83.9
	Design B	4.95	1.37	82.7
	Design C	5.25	1.24	89.9
	Design D	5.18	1.23	89.6
	Design E	5.23	1.27	89.9
	Design F	5.13	1.43	85.7
Symbolism	Design A	5.11	1.46	86.0
	Design B	4.93	1.39	82.7
	Design C	5.27	1.27	90.7
	Design D	5.11	1.30	88.1
	Design E	5.14	1.32	87.5
	Design F	5.16	1.47	86.3

3) Ease of use, usefulness satisfaction

Participants expressed satisfaction with the usefulness and ease of use of the developed convertible accessories. In ease of use terms, over 85% of respondents were positive to all developed accessories, and the average response was higher than 5.02. In particular, more than 90% of respondents were satisfied with Design D. Among them, Design C (M=5.21, SD=1.26) was the most satisfactory in terms of ease of use, followed by designs E and D. In usefulness terms, over 80% of the respondents were positive to all developed accessories, with the average

response higher than 4.94. Design C (M=5.15, SD=1.31) was the most popular, followed by designs E and A (Table 6).

4) Usage intention and purchase intention

Participants expressed satisfaction with the usage intention and purchase intention of developed convertible accessories. The average response was higher than 4.84, with more than 90% of respondents satisfied with Design C and more than 80% of respondents willing to use other developed designs. Design C (M=5.24, SD=1.32)

was the most satisfactory in terms of intention, followed by designs E and A. More than 80 percent of the respondents expressed they wanted to buy all accessories

but Design B, which scored 79.7%. Design C ($M=5.16$, $SD=1.37$) was the most satisfactory in terms of usage, followed by designs D and E (Table 7).

Table 6. Ease of use, Usefulness Satisfaction

Category	Design No.	M	SD	Satisfied (%)
Ease of use	Design A	5.12	1.38	88.1
	Design B	5.02	1.33	86.0
	Design C	5.21	1.26	89.6
	Design D	5.15	1.27	89.6
	Design E	5.20	1.29	91.6
	Design F	5.12	1.45	85.7
Usefulness	Design A	5.09	1.47	84.2
	Design B	4.94	1.36	83.6
	Design C	5.15	1.31	87.2
	Design D	5.07	1.30	87.8
	Design E	5.10	1.38	86.0
	Design F	5.06	1.45	86.0

Table 7. Usage and Purchase Intention

Category	Design No.	M	SD	Rank	Satisfied (%)
Usage intention	Design A	5.06	1.46	3	84.8
	Design B	4.88	1.42	6	80.9
	Design C	5.24	1.32	1	90.7
	Design D	5.06	1.29	4	87.5
	Design E	5.12	1.36	2	88.1
	Design F	4.98	1.52	5	84.2
Purchase intention	Design A	4.98	1.53	4	82.4
	Design B	4.84	1.47	6	79.7
	Design C	5.16	1.37	1	89.3
	Design D	5.05	1.32	2	85.4
	Design E	5.03	1.43	3	84.5
	Design F	4.93	1.52	5	83.0

From the above satisfaction results of the developed convertible accessories, people were most satisfied with Design C (rotation convertible sunglasses) with aesthetic ($M=5.24$, $SD=1.27$), functionality ($M=5.25$, $SD=1.24$), and symbolism ($M=5.27$, $SD=1.27$). In addition, the perceived ease of use ($M = 5.21$, $SD = 1.26$) and usefulness ($M = 5.15$, $SD = 1.31$) also received the top scores, and participants most used it ($M = 5.24$, $SD = 1.32$) and wanted to buy it ($M = 5.16$, $SD = 1.37$). People were found to be satisfied with all of the developed variable accessory designs, but Design B (foldable variable earring 2) received relatively low marks. Satisfaction with Design B's aesthetics ($M = 4.86$, $SD = 1.36$), functionality ($M = 4.95$, $SD = 1.37$), Symbolism ($M = 4.93$, $SD = 1.39$), ease of use ($M = 5.02$, $SD = 1.33$) and usefulness ($M = 4.94$, $SD = 1.39$), $SD = 1.36$) is relatively lower than other designs, it is recommended that other designs be developed to obtain higher scores.

The above findings are similar to previous studies. For example, the aesthetics, functionality, and symbolism aspects have a positive impact on purchasing intentions (Homburg et al., 2015). Positive attitudes are more likely for individuals to participate in actions (Lang & Joyner Armstrong, 2018), usefulness and ease of use influence will of use and purchase (Davis, 1989; Indarsin & Ali, 2017). Therefore, the six convertible accessories that we developed are likely to be further developed and commercialized in the future.

5) Differences in fashion leadership, environmental commitment and behavior

For fashion leadership, first of all, through Cluster K-Means, fashion leadership is divided into two groups: the low (4.07, $n=112$) and the high (5.79, $n=223$) ($p < 0.001$). Between different groups with fashion leadership, the developed convertible accessories have significant differences in aesthetics, functionality, symbolism, usefulness, ease of use, purchase intention, usage intention, and environmental commitment and behavior. The high fashion leadership group showed greater satisfaction with the developed convertible accessories in

symbolism, functionality, and aesthetics terms than with the low fashion leadership group ($p < 0.001$). The high fashion leadership group recognized that the developed convertible accessories were more useful and easier to use than the lower one ($p < 0.001$). In addition, high fashion leadership groups were more willing to use and purchase the developed convertible accessories than low fashion leadership groups ($p < 0.001$). High fashion leadership groups also had higher environmental commitment and behavior than low fashion leadership groups ($p < 0.001$). These results are consistent with Kang and Park-Poaps' (2010) findings fashion leaders are more possible to play a pioneering role in buying new fashions early and in accepting new fashions. In addition, the one with high level of fashion leadership is more possible to have a positive attitude toward sustainable behavior (Lang & Joyner Armstrong, 2018). Therefore, it is recommended that when marketers commercialize convertible accessories, they take the people with high fashion leadership as the initial target consumers.

For environmental commitment and behavior, first of all, through Cluster K-Means, environmental commitment and behavior is divided into two groups: the low (4.47, $n=124$) and the high (5.95, $n=211$) ($p < 0.001$). Between different groups with environmental commitment and behavior, the developed convertible accessories have significant differences in aesthetics, functionality, symbolism, usefulness, ease of use, purchase intention, and usage intention. The high environmental commitment and behavior group showed greater satisfaction with the developed convertible accessories in symbolism, functionality, and aesthetics terms than with the low environmental commitment and behavior group ($p < 0.001$). The high environmental commitment and behavior group recognized that the developed convertible accessories were more useful and easier to use than the lower one ($p < 0.001$). In addition, high environmental commitment and behavior groups were more willing to use and purchase the developed convertible accessories than low environmental commitment and behavior groups ($p < 0.001$).

These findings support previous research that fashion does not need to contradict sustainability (Walker, 2006),

Table 8. T-tests results for Fashion Leadership, Environmental Commitment, and Behavior

Category	Fashion leadership		<i>t</i>
	Low group (N=112)	High group (N=223)	
Aesthetics	4.409	5.392	-11.133***
Functionality	4.465	5.464	-11.322***
Symbolism	4.477	5.443	-10.336***
Ease of use	4.514	5.450	-11.118***
Usefulness	4.351	5.430	-11.429***
Usage intention	4.307	5.434	-11.83***
Purchase intention	4.209	5.394	-11.952***
Environmental commitment and behavior	4.665	5.770	-13.287***
Category	Environmental commitment and behavior		<i>t</i>
	Low group (N=124)	High group (N=211)	
Aesthetics	4.503	5.393	-10.926***
Functionality	4.577	5.456	-9.835***
Symbolism	4.544	5.459	-9.916***
Ease of use	4.579	5.465	-11.479***
Usefulness	4.480	5.417	-10.374***
Usage intention	4.410	5.437	-11.382***
Purchase intention	4.367	5.368	-10.555***
Fashion leadership	4.436	5.676	-13.555***

*** $p < .001$

confirming a good relationship between environmental attitudes and fashion leadership, indicating that the one with higher fashion leadership level is more possible to engage in sustainable behavior (Cho & Warkman, 2014; Lang & Armstrong, 2018) (Table 8).

V. Conclusion

Through an examination of the literature and research into design cases, in this study, prototypes of convertible accessories were developed and satisfaction with the developed products, perceived characteristics, use, and purchase intention were evaluated. It was also analyzed

the differences between people with different levels of consumer fashion leadership and environmental commitment and behavior, in order to improve the understanding of commercialization and future development and design for the target consumer.

The major results were: first, in this study more than 80% of the participants were satisfied with all the developed convertible accessories in symbolism, functionality, and aesthetics terms. More than 85% of the respondents regarded all the developed accessories as easy to use designs, moreover, more than 80% of the respondents thought they were useful. More than 80% of the participants expressed their intention to use and

purchase the developed convertible accessories. Thus, the convertible accessories developed in this study have the possibility of commercialization. Among the designs developed, Design C (rotation convertible sunglasses) showed the highest aesthetics, functionality, satisfaction with symbolism, usefulness, ease of use, intention to use, and purchase intention. Thus, in the early stages of development and commercialization, it is recommended that Design C form the center.

Second, the high fashion leadership group and high environmental commitment and behavior group were shown to have high satisfaction with aesthetics, functionality, symbolism, usefulness, ease of use, and intention to buy and use the developed convertible accessories. Therefore, we recommend that, when commercializing convertible accessories, marketers take people with high fashion leadership and environmental commitment and behavior as the initial target consumers. Consumers with high fashion leadership are usually opinion leaders and they are more active in adventuring and buying novel products. If designers can satisfy consumers with high fashion leadership and motivate them to purchase novel products, they are expected to affect consumers with low fashion leadership. It is expected that consumers will naturally participate in sustainable fashion lifestyles through the purchase and use of variable accessories.

As a limitation to the research, first, we recommend the diversification of materials including those that are more environmentally friendly. In addition, rivets are not strong, thus, frequent use may cause loose connections, making it difficult to maintain their shape. Therefore, in future research, developers may find more environmentally protective materials such as recycled plastics or biodegradable materials and special screws for glasses.

Second, it is recommended that researchers conduct consumer surveys at an even rate based on demographic background, consumer fashion leadership, and environmental commitment and behavior. In addition to Chinese consumers, researchers should analyze consumers living in other countries and find ways to diversify

developed products. It would be also interesting if people

Third, subjects only looked at the image of the convertible products and answered the questionnaire, and this may have an impact on the results. In particular, with the transformation of the actual design, it was expected to obtain a more real opinion of the usefulness and ease of use. Hence, it is recommended that researchers explore product improvement plans through interviews after the actual use of the convertible products.

Convertible accessories can change in various forms. It is expected to enhance sustainability by satisfying consumers' changing needs, reducing unnecessary consumption, and saving resources. However, there is only a little research into convertible accessories developed in this aspect. These results are expected to provide relevant information for the development of convertible accessories and for sustainable designs.

References

- Aaker, J. L. (1999). The malleable self: the role of self-expression in persuasion. *Journal of Marketing Research*, 36(1), 45–57. doi: 10.2307/3151914
- Adams, D. A., Nelson, R. R., & Todd, N. P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: a replication. *MIS Quarterly*, 16(2), 227–247. doi: 10.2307/249577
- Allwood, J., Laursen, S., Malvido de Rodriguez, C., & Bocken, N. (2006). *Well dressed? the present and future sustainability of clothing and textiles in the United Kingdom*. Cambridge, UK: Cambridge University Institute for Manufacturing.
- Azevedo, S. P. (n.d.). Maiko Takeda's shadow jewelry. Workflow. Retrieved January 7, 2021, from <https://spereiraazevedo1.workflow.arts.ac.uk/maiko-takeda-s-shadow-jewelry>
- Bejeweledmag. (n.d.). *Banding together over history: the enamel compartment ring*. Retrieved January 7, 2021, from [https://www.bejeweledmag.com/banding-together-history-enamel-compartment-ring/#prettyPhoto\[gallery-\]/5/](https://www.bejeweledmag.com/banding-together-history-enamel-compartment-ring/#prettyPhoto[gallery-]/5/)

- Belk, R. W. (1988). Possessions and the extended self. *Journal of Consumer Research*, 15(2), 139–168. doi: 10.1086/209154
- Bettels, J., & Wiedmann, K. P. (2019). Brand logo symmetry and product design: the spillover effects on consumer inferences. *Journal of Business Research*, 97, 1–9. doi: 10.1016/j.jbusres.2018.12.039
- Black, S. (2008). *Eco-Chic the fashion paradox*. London, UK: Black Dog Pub.
- Bloch, P. H. (2011). Product design and marketing: reflections after fifteen years. *Journal of Product Innovation Management*, 28(3), 378–380. doi: 10.1111/j.1540-5885.2011.00805.x
- Boztepe, S. (2007). User value: Competing theories and models. *International Journal of Design*, 1(2), 55–63.
- Carrico, M., & Kim, V. (2014). Expanding zero-waste design practices: a discussion paper. *International Journal of Fashion Design, Technology and Education*, 7(1), 58–64. doi: 10.1080/17543266.2013.837967
- Chen, Y. Y. (2014). Innovation design on express packaging in the concept of sustainable development. *Packaging Engineering*, 35(24), 10–12. doi:10.19554/j.cnki.1001-3563.2014.24.003
- Cho, S., & Workman, J. E. (2014). Relationships among gender, fashion leadership, need for affect, and consumers' apparel shopping preference. *Family and Consumer Sciences Research Journal*, 42(4), 369–385. doi: 10.1111/fcsr.12070
- Claxton, S., & Kent, A. (2020). The management of sustainable fashion design strategies: an analysis of the designer's role. *Journal of Cleaner Production*, 268, 1–40. doi: 10.1016/j.jclepro.2020.122112
- Cleland, L., Davies, G., & Llewellyn-Jones, L. (2007). *Roman dress from A to Z*. New York, NY: Routledge.
- Cline, E. (2014, July 18). Where does discarded clothing go? *The Atlantic*. Retrieved January 2, 2021, from www.theatlantic.com/business/archive/2014/07/where-does-discarded-clothing-go/374613/
- Contrary. (n.d.). *Silver leaf pocket knife necklace*. Retrieved January 7, 2021, from <https://www.etsy.com/listing/61999188/silver-leaf-pocket-knife-necklace>
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. doi: 10.2307/249008
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982–1003. doi: 10.1287/mnsc.35.8.982
- Dawson, W. L. (2010, February 8). *Axis*. Retrieved January 7, 2021, from <https://www.axisweb.org/p/wendyleahdawson/>
- Desmet, P., & Hekkert, P. (2007). Framework of product experience. *International Journal of Design*, 1(1), 57–66.
- Devaraj, S., Easley, R. F., & Crant, J. M. (2008). How does personality matter? relating the five-factor model to technology acceptance and use. *Information Systems Research*, 19(1), 93–105. doi: 10.1287/isre.1070.0153
- D'Souza, C., Gilmore, A. J., Hartmann, P., Ibáñez, V. A., & Sullivan-Mort, G. (2015). Male eco-fashion: a market reality. *International Journal of Consumer Studies*, 39(1), 35–42. doi: 10.1111/ijcs.12148
- Dombek-Keith, K., & Loker, S. (2011). Sustainable clothing care by design. In A. Gwilt, & T. Rissanen (Eds.), *Shaping sustainable fashion: changing the way we make and use clothes*. London, UK: Earthscan.
- Dong, H. Y. (2019, May 16). *Markin Fine Jewellery*. Retrieved January 7, 2021, From http://k.sina.com.cn/article_2267654861_p8729aacd02700gdqo.html?from=fashion
- Dong, J. L. (n.d.). *One sand - one world*. Retrieved January 7, 2021, From <https://www.jiangliuart.com/one-sand-one-world>
- Farrer, J. (2011). Remediation: discussing fashion Textiles sustainability. In A. Gwilt, & T. Rissanen (Eds.), *Shaping sustainable fashion: changing the way we make and use clothes*. London, UK: Earthscan.
- Fletcher, K. (2008). *Sustainable fashion and textiles: design journeys*. London; Sterling, VA: Earthscan.
- Flora, T. R. (2010). *Jörg Heinz-tying up the loose ends*. Retrieved January 7, 2021, From <https://www.europastarjewellery.com/Highlights-1776-Jorg%20>

- Heinz.html.
- Garrahan, R. (2018, January 10). *Glenn Spiro unveils his first-ever timepiece—and it's spectacular*. Retrieved January 7, 2021, From <https://robbreport.com/style/watch-collector/glenn-spiro-introduces-reveal-g-watch-2772309/>
- Ghosn, N. (n.d.). *Veggie burger ring*. Retrieved January 7, 2021, from <https://nadineghosn.com/products/veggie-burger-ring?variant=20200771813487>
- Goldsmith, R. E., Freiden, J. B., & Kilsheimer, J. C. (1993). Social values and female fashion leadership – a cross-cultural study. *Psychology & Marketing, 10*(5), 399–412. doi: 10.1002/mar.4220100504
- Gordon, J. F., & Hill, C. (2015). *Sustainable Fashion: Past, Present, and Future*. London, UK: Bloomsbury Academic.
- Gwilt, A. (2014). *A practical guide to sustainable fashion*. London, UK: Bloomsbury Publishing.
- Hethorn, J., & Ulasewicz, C. (2008). *Sustainable fashion: Why now? A conversation exploring issues, practices, and possibilities*. New York, NY: Fairchild Books.
- Homburg, C., Schwemmler, M., & Kuehnl, C. (2015). New product design: concept, measurement, and consequences. *Journal of Marketing, 79*(3), 41–56. doi: 10.1509/jm.14.0199
- Hwang, C., Chung, T. L., & Sanders, E. A. (2016). Attitudes and purchase intentions for smart clothing: examining U.S. consumers' functional, expressive, and aesthetic needs for solar-powered clothing. *Clothing and Textiles Research Journal, 34*(3), 207–222. doi: 10.1177/0887302X16646447
- Indarsin, T., & Ali, H. (2017). Attitude toward using m-commerce: the analysis of perceived usefulness perceived ease of use, and perceived trust: case study in Ikens wholesale trade, Jakarta Indonesia. *Saudi Journal of Business and Management Studies, 2*(11), 995–1007. doi: 10.21276/sjbms.2017.2.11.7
- Janigo, K. A., & Wu, J. (2015). Collaborative redesign of used clothes as a sustainable fashion solution and potential business opportunity. *Fashion Practice, 7*(1), 75–97. doi: 10.2752/175693815X14182200335736
- Jewelers of America (n.d.). *Sun moon bracelet ring*. Retrieved January 7, 2021, from <https://www.jewelers.org/ja/showcase/fine-jewelry/product/MTkwMQ==>
- Kang, J. Y., & Park-Poaps, H. (2010). Hedonic and utilitarian shopping motivations of fashion leadership. *Journal of Fashion Marketing and Management, 14*(2), 312–328. doi: 10.1108/13612021011046138
- Ke, S. F. (2019, June 21). *Analysis of the current situation and development trend of the global clothing retail industry in 2018, with steady growth of retail sales*, Qianzhan, Retrieved January 7, 2021, from <https://www.qianzhan.com/analyst/detail/220/190620-75e4578a.html>
- Kim, H. R., & Chun, H. J. (2012). The type classification on modifiable styling methods in western costumes – from ancient to Middle Ages. *Journal of the Korean Society of Costume, 62*(2), 1–12. doi: 10.7233/jksc.2012.62.2.001
- Kim, H. S., & Kim, Y. J. (2020). Role of fashion leadership influencing the effect of the environmental benefits of second-hand clothing on continuance usage intention. *Fashion & Textile Research Journal, 22*(5), 584–594. doi: 10.5805/SFTI.2020.22.5.584
- Kim, J. H., & Kim, H. Y. (2018). A study on zero waste fashion design that applied puzzle cutting method. *Korean Society of Fashion Design, 18*(1), 37–55 doi: 10.18652/2018.18.1.3
- Kim, J., Kang, S., & Lee, K. (2020). How social capital impacts the purchase intention of sustainable fashion products. *Journal of Business Research, 117*, 596–603. doi: 10.1016/j.jbusres. 2018.10.010
- King, C. (2012, August 15). *Antonio Bernardo secret compartment ring*. Retrieved January 7, 2021, from <http://www.stashvault.com/antonio-bernardo-secret-compartment-ring/>
- Koo, H. S. (2018). Design factors and preferences in wearable soft robots for movement disability. *International Journal of Clothing Science and Technology, 30*(4), 477–495. doi: 10.1108/IJCST-10-2017-0167
- Koo, H. S., Dunne, L., & Bye, E. (2014). Design functions in transformable garments for sustainability.

- International Journal of Fashion Design, Technology and Education*, 7(1), 10–20. doi: 10.1080/17543266.2013.845250
- Lang, C., & Joyner Armstrong, C. M. (2018). Collaborative consumption: the influence of fashion leadership, need for uniqueness, and materialism on female consumers' adoption of clothing renting and swapping. *Sustainable Production and Consumption*, 13, 37–47. doi: 10.1016/j.spc.2017.11.005
- Leiserowitz, A., Kates, R., & Parris, T. (2006). Sustainability values, attitudes, and behaviors: a review of multinational and global trends. *Annual Review of Environment and Resources*, 31, 413–444. doi: 10.1146/annurev.energy.31.102505.133552
- Li, Y. S. (2019, November 12). Analysis on current situation and competition pattern of global and Chinese jewelry market in 2019. *Qianzhan*. Retrieved January 7, 2021, from <https://www.qianzhan.com/analyst/detail/220/191111-1d6d4197.html>
- Li, Y. Y. (2016). *Diversified characteristics of modern jewelry design art* (Unpublished master's thesis). Nanjing University Of the Arts, Nanjing, China
- Loker, S. (2008). *Sustainable fashion: Why now? A conversation about issues, practices, and possibilities*. New York, NY: Fairchild Books.
- Luo L., Guo, J., & Qin, J. (2011). On variable jewelry design. *Art and Design*, 01, 195–197. doi: 10.16824/j.cnki.issn10082832.2011.01.071
- Ma, Y. J., Gam, H. J., & Banning, J. (2017). Perceived ease of use and usefulness of sustainability labels on apparel products: application of the technology acceptance model. *Fashion & Textiles*, 4(1), 1–20. doi: 10.1186/s40691-017-0093-1
- Ma, Y. J., & Koo, H. (2016). Preferences on transformable dresses for sustainability. *Research Journal of Textile and Apparel*, 20(4), 166–181. doi: 10.1108/RJTA-09-2016-0020
- McQuillan, H. (2011). *Zero-waste design practice: Strategies and risk taking for garment design*. London, UK: Earthscan.
- Naas, R. (2017, March 1). Jacob & Co. Brings a new level of astronomy to the wrist with the astronomia solar. *Forbes*. Retrieved January 7, 2021, from <https://www.forbes.com/sites/robertanaas/2017/03/01/jacob-co-brings-a-new-level-of-astronomy-to-the-wrist-with-the-astronomia-solar/?sh=5c7d68f53041>
- O' Cass, A. (2004). Fashion clothing consumption: antecedent and consequences of fashion clothing involvement. *European Journal of Marketing*, 38(7), 869–882. doi: 10.1108/03090560410539294
- Orro. (n.d.). Michael Berger. Retrieved January 7, 2021, from <https://www.orro.co.uk/blogs/design/michael-berger>
- Pakhchyan, S. (2010). Transformative fashion accessories provide shelter and intimacy. *Fashioning tech*. Retrieved January 8, 2021, from Transformative Fashion Accessories Provide Shelter and Intimacy | Fashioning Tech
- Park, H.H., & Oh, S. D. (2005). The influence of materialism and environment consciousness on recycling attitude and behavior of clothing. *Family and Environment Research*, 43(10), 167–177.
- Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce*, 7(3), 101–134. doi: 10.1080/10864415.2003.11044275
- Perry, A. (2017). Factors comprehensively influencing acceptance of 3D-printed apparel. *Journal of Fashion Marketing & Management*, 21(2), 219–234. doi: 10.1108/JFMM-03-2016-0028
- Popov, D. & Koo, S. (2020). Use of 3D printing technology to create personal fashion: UTAUT and need for uniqueness. *Journal of Fashion Business*, 24(6), 1–17. doi: 10.12940/jfb.2020.24.6.1
- Qianzhanjingjixueren. (2020, December 3). Analysis of the market status and competition pattern of the global and Chinese jewelry industry in 2020, with Zhou Dafu as the top in China. Retrieved January 7, 2021, from <https://baijiahao.baidu.com/s?id=1684846659013214024&wfr=spider&for=pc>
- Rahman, O., Fung, B. C. M., & Chen, Z. (2020). Young Chinese consumers' choice between product-related and sustainable cues—the effects of

- gender differences and consumer innovativeness. *Sustainability*, 12(9), 3818, doi: 10.3390/su12093818
- Rahman, O., & Gong, M. (2016). Sustainable practices and transformable fashion design – Chinese professional and consumer perspectives. *International Journal of Fashion Design, Technology and Education*, 9(3), 233–247. doi: 10.1080/17543266.2016.1167256
- Rindova, V. P., & Petkova, A. P. (2007). When is a new thing a good thing? Technological change, product form design, and perceptions of value for product innovations. *Organization Science*, 18(2), 217–232. doi: 10.1287/orsc.1060.0233
- Rissanen, T. (2008). Creating fashion without the creation of fabric waste. In Hethorn, J., & Ulasewicz, C. (Eds.), *Sustainable fashion: Why now? A conversation about Issues, practices, and possibilities* (pp. 184–206). New York, NY: Fairchild Books.
- Rissanen, T., & McQuillan, H. (2016). *Zero waste fashion design*. London, UK: Bloomsbury.
- Schiffman, L. G., & Kanuk, L. L. (2007). *Consumer Behavior* (9th ed.). Saddle River, NJ: Pearson Education.
- SilkPurseSowsEar. (n.d.). *Heart locket with photos*. Retrieved January 7, 2021, from <https://www.etsy.com/sg-en/listing/208817050/etched-heart-locket-picture-locket-photo?ref=related-4&frs=1>
- Stephanie Said. (n.d.). *Folding ring black/silver*. Retrieved January 7, 2021, from <http://www.stephanie-said.com/product/ss-conr-04-black-folding-ring>
- Sotheby's. (n.d.). *The "Walska Briolette diamond" Brooch, Van Cleef & Arpels, 1971*. Retrieved January 7, 2021, from <https://www.sothebys.com/en/auctions/ecatalogue/2013/magnificent-jewels-ge1305/lot.373.html>
- Surian, A. (2015, October 10). *Faux locket stamped story book necklace*. Retrieved January 7, 2021, from <https://happyhourprojects.com/faux-locket/#comments>
- Sylvaine Jewellery. (n.d.). *Secret locket mask pendant*. Retrieved December 26, 2021, from https://www.etsy.com/listing/204537182/secret-locket-mask-pendant-silver-unisex?ref=shop_home_active_2
- Tang, W. & Koo, S. (2020). Development and evaluation of wearable bags and consumer innovativeness. *Journal of Fashion Business*, 24(6), 89–108. doi: 10.12940/jfb.2020.24.6.89
- Temple St. Clair. (2017, July 19). *Temple St. Clair joins the Louvre*. Retrieved January 7, 2021, from <https://lescarats.com/2017/07/19/temple-st-clair-joins-louvre/>
- The Beading Gem. (2013, October 08). *More kinetic jewelry –spinning jewelry*. Retrieved January 7, 2021, from <https://www.beadinggem.com/2013/10/more-kinetic-jewelry-spinning-jewelry.html>
- The Carrotbox 1 (2021, January 26). Three-drawer ring. Retrieved November 3, 2021, from <https://www.thecarrotbox.com/blog/2101.asp>
- The Carrotbox 2 (2013, April 30). Frog ring. Retrieved January 7, 2021, from <https://thecarrotbox.com/blog/1304.asp>
- The Carrotbox 3 (2021, August 17). Exquisitely accorded paper ring by Japan's Nahoko Fujimoto. Retrieved November 3, 2021, from <https://www.thecarrotbox.com/blog/2108.asp>
- The Carrotbox 4 (2021, August 16). Pretty plique-à-jour from California's Andy Lif Jewelry. Retrieved November 3, 2021, from <https://www.thecarrotbox.com/blog/2108.asp>
- The Carrotbox 5 (2021, July 23). "Wind power" ring. Retrieved November 3, 2021, from <https://www.thecarrotbox.com/blog/2107.asp>
- The Carrotbox 6 (2021, April 30). "Incense" ring. Retrieved November 3, 2021, from <https://www.thecarrotbox.com/blog/2104.asp>
- The Carrotbox 7 (2008, September 30). Gambling ring. Retrieved from January 7, 2021, from <https://www.thecarrotbox.com/blog/0809.asp>
- Elie Top. (2015, May 13). *The New York times*. Retrieved January 7, 2021, from <https://www.nytimes.com/2015/05/14/fashion/elie-top-creating-his-own-jewelry-line.html>
- Tom Rucker Fine Jewellery (n.d.). *Transformable platinum and gold ring*. Retrieved January 7, 2021, from <https://tomrucker.co.uk/shop/geo-shush-kinetic-ring/>
- Townsend, K., & Mills, F. (2013). Mastering zero: how

- the pursuit of less waste leads to more creative pattern cutting. *International Journal of Fashion Design, Technology and Education*, 6(2), 104–111. doi: 10.1080/17543266.2013.793746
- Vartan, S. (2008). A case for eco-fashion: Eco-Couture Is changing fashion for the better. *E: The Environmental Magazine*, 19(6), 33–34.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: toward a unified view. *MIS Quarterly*, 27(3), 425–478. doi: 10.2307/30036540
- Walker, S. (2006). *Sustainable by design: explorations in theory and practice*. London, UK: Earthscan.
- Wang, S. (2020). *Ethnic costumes and fashion—research and application of Tibetan costume culture*. (Unpublished master's thesis). Hubei Institute of Fine Arts, Hubei, China.
- Wartski.com. (n.d.). *Pomander, German, 16th Century*. Retrieved January 7, 2021, from <https://wartski.com/collection/a-silver-gilt-pomander/>
- Watchismo.blogspot.com. (2007, May 10). *Victorian 1886 spy camera pocket watch*. Retrieved January 7, 2021, from https://watchismo.blogspot.com/2007/05/watchismo-times_10.html
- Wiecek, A., Wentzel, D. & Landwehr, J. (2019). The aesthetic fidelity effect. *International Journal of Research in Marketing*, 36(4), 542–557. doi: 10.1016/j.ijresmar.2019.03.002
- Wiedmann, K., Haase, J., Bettels, J., & Reuschenbach, C. (2019). It's not all about function: investigating the effects of visual appeal on the evaluation of industrial products using the example of product color. *Journal of Product & Brand Management*, 28(1), 15–27. doi: 10.1108/JPBM-07-2017-1524
- Works of art. (n.d.), *Sash clip Yaguruma (Wheels of Arrows)*. Retrieved January 7, 2021, from http://www.mikimoto-pearl-museum.co.jp/eng/collect/works/1_yaguruma.html
- Wu, S. Y. (2019). *Research on the practice of Chinese jewelry recycling project: Taking the Radical Jewelry Makeover project as an example* (Unpublished master's thesis). China University of Geosciences, Beijing, China
- Yael Sonia's jewelry. (2012, April, 3). *MyLifestyleNews*. Retrieved January 7, 2021, from <http://www.my-lifestyle-news.com/2012/04/introducing-yael-sonias-jewellery.html>
- Yang, G.Q. (2018). *Dismantling and deforming in jewelry design*. (Unpublished master's Thesis). China University of Geosciences, Beijing, China
- Yilin jewelry design. (2018, December 14). *Jewelry that can "dance", the wonderful ideas of those designers*. Retrieved January 8, 2021, from https://www.sohu.com/a/282019204_825482
- Yu, H. C., & Yu, L. B. (2020). Influence of Korean celebrity endorsement on Chinese consumers' purchase intention towards fashion goods. *Journal of Fashion Business*, 24(6), 148–158. doi: 10.12940/jfb.2020.24.6.148
- Zakharkevich, O., Koshevko, Y., Kuleshova, S., Ditkovska, O., Shvets, G., & Zhylenko, T. (2018). Expert system to select the fabrics for transformable garments. *Fibres and Textiles*, 25(2), 105–112.
- Zakharkevich, O. V., Kuleshova S. G., & Shvets G. S. (2015). Determination of fabrics properties for reversible garments. *Proceedings of International Conference TexTeh 7th "Creating the future of textiles" (pp. 78–88)*.
- Zhubaoyibai. (2020, March 20). *How to cultivate jewelry designer's good aesthetics?* Baijiahao, Retrieved January 7, 2021, from <http://baijiahao.baidu.com/s?id=1662124575652496175>
- Zhu, H. (2013). Pondering fashion jewelry design, based on the innovative thinking exploration of fashion jewelry design. *Art and Design*, 10, 113–115. doi: 10.16824/j.cnki.issn10082832.2013.10.031
- Zhu, H. (2016). Discussion on transformable structure design of stainless steel jewelry. *Journal of Gems and Gemmology*, 18(2), 62–66. doi: 10.15964/j.cnki.027jgg.2016.02.009

Received (September 29, 2021)

Revised (October 18, 2021; November 10, 2021)

Accepted (November 16, 2021)