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THE ROLE OF BIG DATA ANALYSIS IN FASHION DESIGN

MODA TASARIMINDA BÜYÜK VERİ ANALİZİNİN ROLÜ

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Abstract

This article aims to reveal the purposes of using big data in the design field by investigating the technologies based on big data in the fashion industry in recent years. For this purpose, the current models, limitations and development direction of big data in fashion design are discussed. While big data research focuses on understanding consumer behavior, predicting trends and personalized products, the number of researches focused solely on design is limited. This study is original in terms of focusing on the design phenomenon and applications of big data in fashion. There is no academic study in the national literature in this context. It is expected that the study will contribute to the discussion on the effects of big data-based digital technologies in fashion design.

Öz

Bu makale son yıllarda moda endüstrisinde büyük veriyi temel alan teknolojileri araştırarak büyük verinin tasarım alanında kullanım amaçlarını ortaya koymayı hedeflemektedir. Bu amaçla büyük verinin moda tasarımında mevcut modelleri, sınırlılıkları, gelişim yönü tartışılmıştır. Büyük veri araştırmaları tüketici davranışlarını anlamak, trendleri tahmin etmek ve kişiselleştirilmiş ürünler üzerine yoğunlaşırken salt tasarım odaklı araştırmaların sayısı sınırlıdır. Bu çalışma büyük verinin modadaki tasarım olgusuna ve uygulamalarına eğilmesi yönüyle özgündür. Bu kapsamda ulusal literatürde akademik bir çalışma bulunmamaktadır. Çalışmanın moda tasarımındaki büyük veri temelli dijital teknolojilerin etkilerine ilişkin tartışmaya katkıda bulunması öngörülmektedir.

Key Words: *Fashion Design, Big data, Digital fashion, Fashion 4.0, 3D fashion design.*

Anahtar Kelimeler: *Moda Tasarımı, Büyük veri, Dijital moda, Moda 4.0, 3D moda tasarımı.*

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INTRODUCTION

Fashion design covers a wide and versatile design and production process that starts with yarns and continues with color, texture, pattern, technical knowledge and fashion presentations. The textile and fashion industry are the gateway to economic development for many countries. In fact, the luxury fashion sector has received the largest share of the economy among other sectors in its class in 2023 (McKinsey, 2024). Change is one of the indispensable dynamics for fashion (Kawamura, 2018). Fashion is affected by cultural and artistic changes as well as social and technological innovations (Särmäkari and Vänskä, 2022). Clothing design and production have managed to progress in line with the personalized demands of the age and people by utilizing different technologies developed throughout history (Ma et al., 2017, p.1-2). There are talented designers and brands who can discover customer demands and needs without even realizing it.

Fashion design principles are among the skills that every designer must acquire. Today's fashion designers add engineering approaches to their technical skills such as color knowledge, fabric knowledge, pattern knowledge, and production knowledge, and develop and advance their designer roles by specializing in new types of software (Sun and Zhao, 2018, p. 362). In addition to traditional methods in fashion design, the active use of digital tools and experimental studies with algorithms that form digital design software are seen as part of the fourth industrial revolution (Bertola and Teunissen, 2018). Another important issue in the fashion industry, besides technological knowledge and skills, is to find new solutions to create value in a way that the user can witness, feel or experience (Hirscher et al., 2018, p. 4545). Brands and designers who want to develop design products according to popular trends aim to offer high value-added products and experiences in the highly competitive free market. Because high value-added products have a high power to highlight the designer and the brand (De Chernatony et al., 2000, p. 42-43).

To create added value, fashion designers are expected to both master traditional methods and use innovative tools effectively. While the company that creates collections designed in accordance with innovative, new trends and creates them from scratch increases its earnings, other companies that produce similar products are dealing with products with decreased demand. In this case, firms that replicate the original design earn lower profits. In this context, fashion designers need to know traditional drawing methods as well as use programs with high technological infrastructure. While designing products according to new popular trends, it is expected that artistic,

innovative, questioning, investigative, researcher, problem solving and taking action competencies should be at a high level.

In order to design innovative and high-end products, it is not enough to use programs such as CAD (computer-aided design), Illustrator, Photoshop, etc. Fashion designers need to have detailed information about many clothing elements such as fabric, color, texture, silhouette, which are highly demanded by users of that season within the ever-increasing data stack in product designs. Especially fast fashion brands change seasons approximately every 15 days (Jang et al., 2012, p. 63). Designers of brands that produce collections at such a fast pace have difficulty accessing seasonal information and creating new clothing designs. Therefore, the basic components of fast fashion include the ability to quickly find current fashion trends and carefully examine fashion markets and potentially produce new designs (Doeringer and Crean, 2006). This ability is driven by the analysis of big data that explains how many products customers buy and the design features of those products. Zara, H&M and Topshop use consumer and product information to forecast trends through big data analysis, which they can access for free on fashion blogs and social media (Silva et al., 2020, p. 22).

Big Data analytics in the fashion industry are used for a number of different purposes, including market identification, trend analysis, understanding the consumer, transforming high demand forecasts, informing designers, measuring the impact of variables affecting the market, sales forecasts, and e-commerce improvement (Silva et al., 2020, p. 21).

Trend forecasts, which are the lifeblood of the fashion industry, are the oldest and most popular of these analyses. Trend analyses, which proceed by analysing retrospective sales in previous years, are insufficient for today's personalized customer preferences. For this purpose, statistical analysis methods are being investigated for the new generation of fashion consumers and brand demands and needs. In their study, Silva et al. (2019) analyses variables such as trends, markets, products, and seasons of the Burberry brand using Google data from 2009-2014 with different forecast models and presents Google trends as a tool that can be used for strategic fashion management and marketing decisions (Silva et al., 2019, p. 9-10, 19).

Another area where Big Data analysis is used intensively is e-commerce. With the spread of e-commerce systems and the increasing ease of online shopping in electronic media, manufacturers are turning to this area. In their study, Chen and Luo examine clothing datasets on online shopping sites in the clothing sector, one of the most popular sectors in electronic commerce systems, with a machine learning-based approach (Chen and Luo, 2017, p. 16). Within these

clusters, it aims to find the best-selling images and filter the most preferred clothing styles with representative and distinctive features. This contributes to increasing the company's sales by automatically fetching clothes based on personal information or by bringing advertisements consisting of products that the person likes. Chen and Luo conduct a study on the automatic analysis of the best-selling products using machine learning with big data obtained from an electronic clothing sales site (Chen and Luo, 2017, p. 16-17). Studies in this direction contribute to the targeted and effective use of the ever-increasing e-commerce volume in the fashion industry for retailers and brands.

Artificial intelligence-based digital applications are used for a wide variety of purposes in the textile and fashion industry. Big data analysis is an important data processing method used in the fashion industry as an artificial intelligence-based application. As mentioned in the introduction and related works section of the article, there are many useful results in the literature on the application of big data to the fashion industry. This article aims to investigate the purposes and methods of using big data technologies in fashion design. For this purpose, the main research question of the article is how big data has been used in fashion design systems in recent years. In this context, this article first focuses on how big data and big data-based digital technologies are used in practice in fashion design after a general literature review on the applications of big data and big data-based digital technologies in the fashion industry. In the article, design processes are analysed with examples from CLO, one of the big data-based digital fashion design applications.

METHODOLOGY

This research investigates the use of big data, one of the machine learning systems, in the fashion industry. In this context, a detailed literature review was conducted. The ease of use of big data and big data supported 3D technologies in the field of fashion design has been examined within the scope of qualitative research with literature and sectoral applications.

In this article, the impact of big data technologies on fashion design is discussed in detail. The effects of big data on fashion and garment design, which have been previously discussed in the literature but have received little attention, are examined. The article is unique in that it deals with the topics of big data and fashion design together. Academic literature, industry articles, websites, software videos are used as research material.

Digital Technologies and Big Data in Fashion Industry

Big data artificial intelligence methodologies are a comprehensive structure that provides prediction, classification, identification, generation, optimization,

evaluation and partial design possibilities in general with neural networks. Big data is not about the size of a single dataset, but rather the capacity to search, combine and cross-reference different large datasets (Boyd and Crawford, 2012, p. 663).

Today's businesses are being invaded by a data-driven revolution in managing customer relationships and business models. The driver of this revolution is big data and the rapid development of big data technologies. Big data analytics includes streaming data and high dimensional data collected from distributed computing networks (Chen, 2018, p. 199). This data comes from search engines, social media platforms (Facebook, Twitter, Instagram), YouTube and mobile devices (Acharya et al., 2018, p. 91).

In this section of the article, the purposes for which big data technology is used in the field of fashion design are discussed through literature research. Big data technologies used in the literature and industry are classified under general headings and supported with examples.

Big Data to Create Personalized Fashion Experiences

The ever-improving living standards and people's demand for changes in aesthetic concepts are creating a shift in clothing consumption from popular clothing culture to a personalized demand (Olaru et al., 2020). People think of textile and fashion production as a means of self-expression. Textile consumption is also affected by technological innovations and changes in today's world. All textile products produced as a result of both individualized personalized demands and mass production have started to be produced as a result of analysing the fashion consumption perceptions of consumers (Ji and Jiang, 2020, p. 2). In order to meet the changing demands of consumers in fashion, significant technological changes are applied in many stages of a textile and fashion product such as production process, design, marketing and exhibition (Zhao et al., 2021). Fashion 4.0, the intertwining of the virtual-physical space with the fourth industrial revolution, has given birth to smart clothes and textiles, distributed intelligence, CAD systems. The innovations brought by Fashion 4.0 in general are listed below (Şen et al., 2020, p. 61-62; Yıldıran, 2022, p. 561-566).

- Mass customization and demand-driven tailor-made digital designs
- Smart textiles and clothing
- Artificial intelligence applications, Internet of Things (IoT)

Use of 3D technologies in design, production and distribution and marketing processes

In digital fashion, which emerged in the context of Fashion 4.0, often marginal garment designs are designed digitally, which are used to give a few images in social media and web-based programs. This minimizes environmental damage by eliminating garment production costs and waste (Yıldız and Ayranpınar, 2021, p. 6-7).

Big data provides segmentation and data-driven personalized fashion experiences for designers and brands, as well as information on when to deliver these experiences to the customer (Fashion, 2024). For this purpose, clouds of quality information such as demographic characteristics, age, gender, interests, shopping habits, etc. are created to get to know the customer better. Providing product recommendations, creating virtual wardrobes, predicting the customer's next clothing choice and establishing warmer relationships with customers are made easier with the use of big data (Bringe, 2023). The concept of mass personalization brought by Fashion 4.0 means that the more information about customers and customer groups can be examined under how many headings, the more personalization can be realized. This is possible with artificial intelligence applications that can generate data from data and make connections (Devillard et al., 2021).

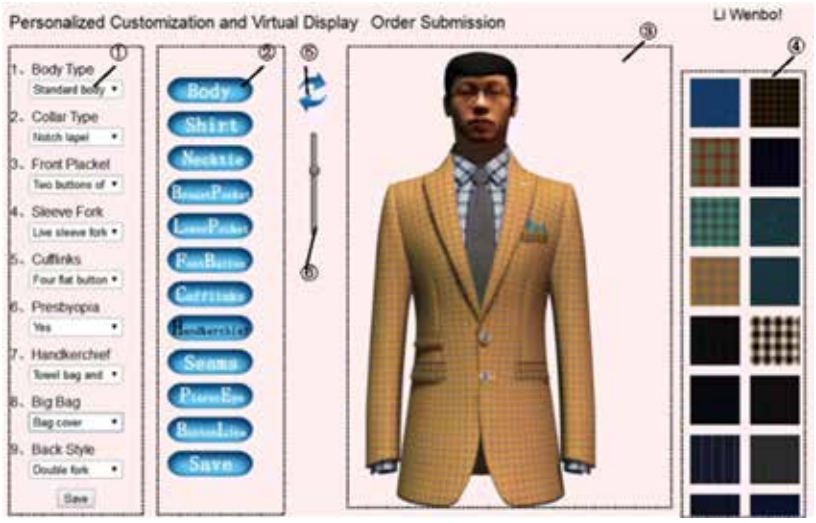

Figure 1. *Visual Interactive Personalized Cloth Design Interface (Zhu et al., 2018, p. 27173)*

In the system shown in Figure 1, Zhu et al. developed an interactive personalized fashion design application with thousands of color, pattern, model options obtained as a result of real customer preferences using customers' own faces. In this application, the desired body type, fabric, accessory, collar, pocket, cuff, armhole, placket closure types allow the user to develop their personal style on the 3D avatar (Zhu et al., 2018, p. 27167-27173).

Big Data for Trend Forecasting

In fashion, forecasting is the process of determining which aspects of the culture and aesthetics of a period, selected from a myriad of information in order of importance, are more attractive and inspiring to be used as creative fuel for current or future collections. The themes selected from the vast field of possibilities are narrowed down with visual references. Thus, style and design formulas are created. According to Cassidy, fashion forecasting is the combination of statistical data with intuition and creativity (Cassidy, 2019, p. 24; Lopes, 2019). Forecasting processes consist of rigorous multi-layered modelling, developing meaningful predictions from theoretical calculations. It is important that forecasts are translated into visual scenarios and presentation boards that are understandable and applicable for brands and designers. Manufacturers or brands in the fashion industry interpret the information compiled by forecasters according to their own consumer audiences and embed the fashion image in all actions such as product development, supply chain and sales. At this point, artificial intelligence and big data models provide forecasters with important resources to assess the speed of adoption and diffusion of trends (Garcia, 2022, p. 445).

There are several examples that leverage big data sources and use machine learning to predict trends. One of these is Google trends. Google trends is an increasingly important online consumer trend forecasting application for fashion analysis. Current studies are being conducted on the accuracy of fashion analysis with Google trends (Silva et al., 2019). Google can analyse fashion trends according to geographical factors. Statistical results show which style, celebrity or topic stands out in the long and short term. The graph below shows the Google trends analysis with sales breakdowns for the US and UK for the example of the Bomber jacket (Boone, 2016).

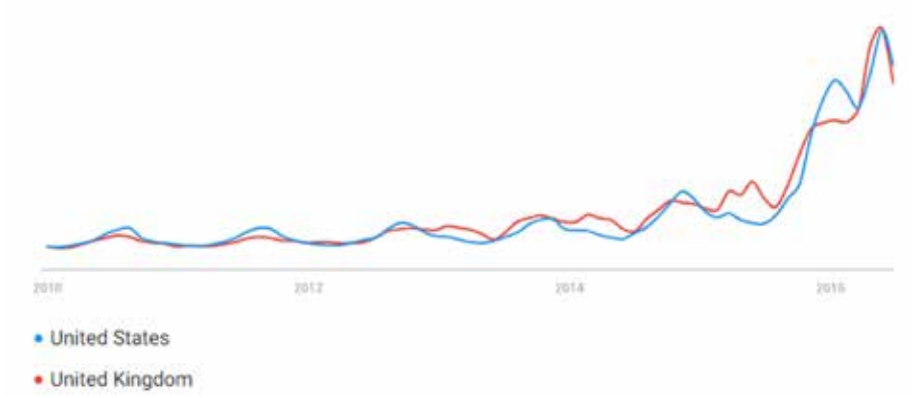

Figure 2. *Google search trends for bomber jackets in the UK and US (Boone, 2016)*

Based on the data in Figure 2, style and sales forecasts for the coming years can be made. In April, searches for bomber jackets increased by 297% year-on-year in the UK and 612% in the US.

Big Data for Smart Clothes

Smart clothing is a field that has emerged as a result of the holistic approach of many disciplines such as basic sciences, material science, engineering and design. Initially, this field focused on military and medical garments for safety and health purposes, but today it is used in the textile and fashion industry. Smart textile surfaces are structures that can sense mechanical, thermal, chemical and magnetic factors (Tao, 2001, p. 1-5). Smart clothing is designed with textile surfaces that can react to any effect and effect change (İşmal and Yüksel, 2016, p. 88). Smart clothing is preferred for functional and design purposes in almost every field, from the defence industry to the automotive sector, from home textiles to the healthcare sector, from the entertainment sector to the sports sector. In addition to these purposes, the data collection capabilities of smart clothing are used for purposes such as improving the quality of life in the healthcare field, improving performance in sports and athletics, and increasing comfort in fashion (Ahsan et al., 2020, p. 146377-146378). While smart clothing can produce enormous amounts of data in these areas, the processing of this data is complex and costly. Today, the integration of big data technologies into smart clothing helps solve many problems in the field of health. A few of these examples are presented below. On the other hand, other areas where smart clothing is used are open to developing innovative products and designs with big data collaborations.

Problems such as the aging of the world's population and the burden of caring for the elderly require important measures today and in the future (Organization, 2015). Wearable fashion designs need to be created to overcome these problems. Improvements can be achieved by controlling wearable fashion designs with technology in situations such as daily care, rehabilitation, chronic disease management such as diabetes and blood pressure, which are among the personnel-dependent care services in the traditional medical support system (Olaru et al., 2020, p. 50–54). Sustainable health monitoring methods obtain big data by collecting various physiological indicators of the human body. Using the collected big data analytics, smart clothing is produced for purposes such as medical emergency response, emotional care, real-time haptic interaction and disease diagnosis. These garments are produced using different technological software and hardware and are also used as data collection tools. Chen et al. are making big data by collecting data from patients via wearable healthcare garments (Chen

et al., 2016, p. 826). The authors stated that they used mobile internet and cloud computing to achieve this and that they used big data analytics with the smart clothing system. It is claimed that electrocardiograph signals obtained from smart clothes can provide significant improvements in human mood monitoring and emotion detection (Chen et al., 2016, p. 831). Fashion design products designed as wearable garments have long been an important area of research in human health monitoring in the literature (Chen et al. 2011; Kim, 2015; Rodgers et al., 2014).

FINDINGS

The Use of Big Data in Fashion Design

Fashion designers are people with high creative powers who design textile products by taking into account the changing user demands and demands in the textile industry. Fashion designers should have the basic ability to express the trends and spirit of the time in the clothes they design (Vinken and Hewson, 2005). The designer's task does not end with interpreting the theme, sketching, product development, research on the product, but they should also transfer the implicit knowledge to their teammates to combine the hardware parts they will use in production (McKelvey and Munslow, 2011). Fashion designers offer embodied experiences by thinking and realizing what they think (Särmäkari and Vänskä, 2022). In addition, designers are expected to master three-dimensional CAD systems and digital software and improve their technical skills by keeping up with the evolving technological transformations (Sun and Zhao, 2018, p. 362). With the help of big data, fashion operators and software developers create precise marketing and design solutions by analysing consumers' behavior patterns, the most preferred options, to facilitate this challenging process for fashion designers (Tamborrini et al., 2018; Zhou et al., 2017, p. 1-2).

The digitalization of fashion design is in a sense a challenge to tradition for designers. The traditional fashion cycle is being restructured with digital interfaces and platforms. The designer's use of digital technologies in the early stages of the design process provides easy access to design elements and a lot of information. Besides all these, fashion designers underline that digital cannot replace traditional knowledge and craft methodologies (Black, 2019, p. 15). In this context, while digital design technologies cannot reach the qualities of craft-based design practices, they offer ideas about how the designer can reach the point he wants to reach. Designers using big data and digital technologies argue that digital technologies should be used while preserving the art of physical garment production (Särmäkari, 2023, p. 93). Brands and designers, especially those who pay attention to design details,

adopt traditional methods to ensure the integrity of their creative brand image (DuBreuil and Lu, 2020, p. 75).

Creating digital impressions of customer segments is a practice that fashion retailers have been using for many years. Brands used to categorize their customers by age, gender and geographical location to create their marketing strategies. However, big data offers detailed data interpretation services a few steps beyond this (Cgsinc, 2018). In the fashion industry, data sources such as shopping, social media, search engines, internet shopping, etc. are collected in a data pool. All collected data includes different indicators such as words, pictures, graphics. In the case of a fashion product, the product, the customer who uses the product, the time and place conditions when the product is presented to the market and many more information are the data that can be used by planning, design, production and logistics units in the fashion industry. Based on these data, product-based features such as color, pattern, fabric, size and style can be predicted based on customers' behavior based on brand, product, style, geographical factor or season. The data matrix used by big data in fashion design is shown in Figure 3.

Figure 3. *Big data in fashion design (Jain et al., 2017, p. 4)*

Designers can use big data to determine the design elements classified below. In addition, for example, when designing women's t-shirts, it can analyse the best-selling women's t-shirt models, colors, brands, patterns, patterns, fabrics, and special production processes, if any, by conducting a product-based

search. It can do all of this by determining the focus of its design and using big data platforms (Zhao et al., 2021, p. 254). On the other hand, it is stated that although big data analysis in fashion design has successful predictions in garment design elements such as general, style, color, pattern, texture, it has difficulty in statistical predictions for garment design details (DuBreuil and Lu, 2020, p. 68).

CLO is a design software that enables designers to generate new outputs through machine learning using large datasets as input (Clo, 2024). It enables all stages of a garment before it is produced to be analysed in the shortest time and in the most economical way. Below is a broad categorization of the big data of the fashion industry and fashion design and the sample possibilities offered to designers by CLO as an application interface using big data.

Theme Information

The theme is the basic idea that makes up the collection. There are different themes within a season. The theme is reflected in the garment designs by blending with the brand image according to the strategic plan of the brand or the designer. Fast fashion brands produce about 8 seasonal collections in a year, using a lot of sustainable themes (Bhardwaj and Fairhurst, 2010, p. 167). Slow fashion brands and designers create collections for fewer seasons based on core themes. Big data supports designers about the frequency of adoption and acceptance of past themes and the prediction of future themes. Big data analysis tools for the textile, fashion and apparel industry such as EDITED, WSGN, Style.com, Trendalytics, Nextail Labs, which contain visual and written information on colors, patterns, styles and many other design-supported visual and written information prepared periodically, are offered to the market. These platforms have theme and inspiration boards with classifications such as women's, men's, children's, outerwear, underwear, etc. for each year, season or sub-season. For 12 years, EDITED has been collecting information from more than 5,000 fashion and style sites, providing its users with more than 200 million insights (Edited, 2024). Trend analysis platforms support brands and designers by opening up their datasets and giving them direct access. Another service is to analyse their clients' collections and make them richer with up-to-date data. WSGN shares the latest fashion consumer preferences and consumer insight surveys generated through data analysis of fashion companies (Wgsn, 2024).

Material Information

The main material in the textile and fashion industry is fabric. Auxiliary materials are diversified such as yarn, interlining, lining. In addition to all these

materials, many accessories such as zippers, buttons, embroidery, printing, decoration materials are used in a product. At this point, all components of a fashion product such as the texture, touch, strength and feel of the fabric, auxiliary material and accessory are seen as data. In design, information such as the appearance of the fabric surface, its touch and its harmony with the body come to the fore. Millions of current and future-oriented material samples (fabric, zipper, button, clasp, ribbon, tape, embroidery, print, etc.) filtered from platforms where different brands, designers and retailers send data are used in garment designs with the closest simulated images to reality. Figure 4 shows the presentation of a blouse made of a jersey fabric with pleated sleeves on CLO, and Figure 5 shows zipper and fabric samples.

Figure 4. a) *Fabric image with CLO,* **b)** *Real fabric image (Clo 3D, 2024)*

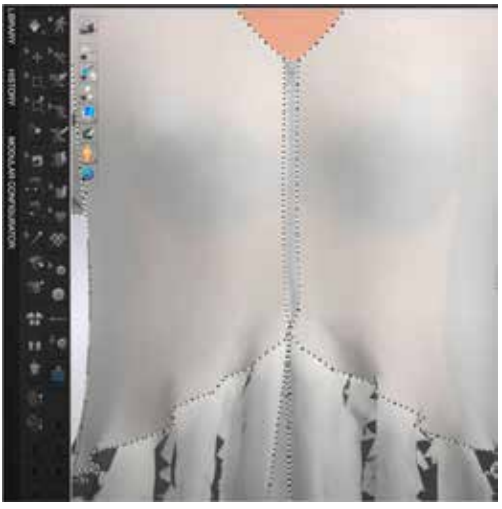

Figure 5. *CLO zipper and fabric selection interface (Clo, 2024)*

Technical Information

Technical information covers how the fashion product will be produced and the sharing of these transparent production methods with the customer. The production methods and forms of the product, which we call know how, are examined here. Details such as the pattern, form, stitching, printing type of the garment constitute technical knowledge. Some sustainable and traditional production methods are examined under this heading. CLO brings together more than 39 thousand different designers and manufacturers from all over the world and establishes active and real-time relationships (Clo Virtual Fashion, 2024). These relationships also enable day-to-day information sharing.

Figure 6. *Interface showing clothing parts and measurements in CLO program (Clo-set, 2018)*

Design Information

Design Information is the knowledge that supports the creation of a product in line with design elements and principles. A garment design is influenced by many variables such as the spirit of the era in which it exists, the emotions of the user, habits and short-term trends. When you look at the history of fashion, you can see that different design principles stand out in the clothes and costumes of each period. Traditionally, design departments were located within the companies themselves. Today, with big data technologies, it is becoming a social discipline that can be managed with feedback and renewal processes with designers from all over the world (Cgsinc, 2018).

One of the most important advantages of big data-based design applications is the capacity to make design analyses by using multiple design attributes (color, fabric, accessories, etc.) and presenting different correlations, rather than relying on a single design attribute (e.g. style) (Dong et al., 2020, p.

471). In CLO's virtual environment, more than 66 thousand 3D style and trend information (color, pattern, texture) are uploaded to the platforms by retailers, brands and fashion businesses. Thus, designers using CLO and similar technologies can prepare big data-supported collections.

Figure 7. *It works on a computer screen (changing the pattern in CLO) and on a human-sized screen (visualization of the garment) (Särmäkari, 2023, p. 94)*

In Figure 7, Rickard Lindqvist, founder of the Swedish digital fashion company Atacac, shows the final version of a garment design from pattern, design and avatar with CLO3D design application.

Body Information

In fashion, body data varies according to age, gender, geographical region, etc. Body data is stored in mathematical form or in the form of 2D or 3D data. This is done using traditional body measurement methods or body scanners. Based on the aesthetics and anatomy of the human body, images of body structure, bones, muscles and typical aspects are collected using big data methods (Cui et al., 2021, p. 2). Thousands of collected body measurements used to automatically match and mass customise garment designs for target customers. CLO offers more than 34,000 personalised body avatars, classified according to age, gender and geographical differences (Clo Virtual Fashion, 2024). The mold and body fit of the products designed with CLO are checked. The body avatar and garment fit maps are shown in Figure 8.

Figure 8. *Body avatars and clothing fit maps (Clo, 2024)*

Color Information

While color choice affects human psychology and behavior, it is also affected by these factors. Colors have warm and cold tones, soft and hard chrome, light or greyish values. The most basic and easy way of directing innovation in fashion is the use of colors. Colors help evoke different emotions such as excitement, joy and calmness in people. Certain color combinations are considered to be more attractive and harmonious (Westland et al., 2007, p. 13). This combination of sensations evoked by colors is called color emotions. There is a relationship between color emotion and color preferences. Scientific studies are being conducted on single color and multiple color senses (Ou et al., 2004, p. 232).

Figure 9. *Different color options with CLO (Clo, 2022)*

In the light of this information, which colors customers prefer more based on season, theme and geographical region can be analysed within the scope of big data. Changes in color preferences and repetitive patterns in color popularity constitute color cycles (Figure 9). The reasons for these cycles are consumers' lack of interest in current trends, loss of excitement and search for innovation (Wong et al., 2016, p. 2). Table 1 lists the advantages of design applications based on 3D and big data in fashion design.

Advantages
Preparation of samples saves time and cost. Material, color and mold changes take place in a very short time.
Thousands of design elements allow for an infinite number of possibilities in fashion design.
Improved collaboration between the design and tooling departments. Enables the design department to produce an unlimited number of graphics, patterns, prints and colors.
The limitless possibilities of three-dimensional design are a driving force in the marketing of the samples.
Visualization of the entire collection at the early planning stage makes the product development process efficient.

Table 1. *Advantages of 3D Design Based on Big Data (Clo 3D, 2024)*

Before 3D and big data technologies were used in fashion design, there were many challenging stages in the collection preparation process. The most important of these is the critical meetings before the final prototype sample is ready for production. In these meetings, modelist, stylist, fabric suppliers, model machinist, many units responsible for the final product participate and give their opinions. In addition, the fabric, auxiliary materials and accessories required for the production of the sample, the mold and sewing process require a long time and high cost. Today, organizations using CLO and big data-based design software are most satisfied with the elimination of problems such as information traffic, time and cost loss thanks to the virtual critical opportunity without creating the prototype sample (Clo 3D, 2024).

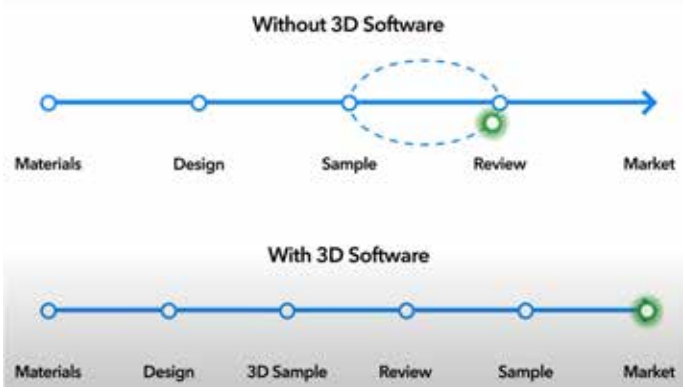

Figure 10. *Collection with 3D software and traditional methods (Clo 3D, 2023)*

Figure 10 shows that the sample and critical (review) processes in the design process prepared with traditional methods and 3D software applications are switched. The benefits shown in Table 1 and the process shown in Figure 10 complement each other. With the combination of both approaches and benefits, production is made more technical and technological.

RESULTS

Every day, the speed and volume of fashion and textile products being sold electronically is increasing. Collecting product information, time of sale information and customer information requires a lot of time using non-automated methods. Thanks to the developments in the software sector and the latest technologies, many important applications such as collecting the information needed by the fashion designer in the textile sector as big data, statistics, analysis and interpretation of the data will provide great contribution and support to fashion designers. Big data and big data analytics will not only provide insight into the realization of popular product design, but also accelerate the identification of product buyers' expectations and satisfaction. Consumers' tastes and preferences are becoming increasingly diverse and individual expression is transcending fashion requirements. The fashion industry is struggling to find a balance between brands seeking profit and society. Big data analysis helps fashion manufacturers by transforming the speed and multivariate structure of today's fashion industry into meaningful statistical information. In this article, the applications of big data in the fashion industry are examined from a broad perspective and the topics where it is used in fashion design are classified and analysed. Although big data serves many purposes in the fashion industry, it offers surprising support systems for designers in these days when design has evolved from the mass dimension to the personal dimension. The designer can prioritize the consumer demand obtained from big data analysis and make the design process shorter and more successful. As a result, big data-based fashion design offers endless options and convenience to designers, especially in product research and development phases.

Big data also has its limitations in the fashion industry and design. How to analyze big data against an unpredictable backdrop where cultural, social and economic structures change form every day is a matter of curiosity. Despite powerful advanced machine learning technologies, big data struggles to analyse variable cultural factors that influence fashion trends such as social, economic and political movements, ethics, emotions and human psychology. At this point, the existence of predictors that will take into account the contradictions, tensions and uncertainties inherent in human and social

behavior of statistical data comes to the fore. Collecting big data in the field of fashion design, as in other industries, and turning it into a usable system means long research and development processes. This process requires a specialized technological team, long time, complex communication network and high costs. The research and development methods of big data applied in fashion design differ significantly. This makes it difficult to compare important and big data and to measure whether it is of usable value for fashion design.

The ability to synthesize original creative inspiration and the perspective devoid of aesthetic pleasure for artificial intelligence-based applications is another research topic. The scenarios that big data can create in the fashion industry, which are ethical, sustainable policies and circular economy, can be considered among new research topics. The big data technologies and design dimension in the textile and fashion industry, which are specifically addressed in this article, can be built on the relational dimension of other departments with big data and design departments in subsequent studies.

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