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## A challenge for higher education: Wearable technology for fashion design departments

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### Abstract

As the technology is integrated into different disciplines, we witness how powerful it can be. Rather than standing in isolation, technology changes the nature of the field it arrives in. Wearable technologies in fashion design education is a good example for this. Wearable technology defined as lightweight, easy portable and wearable smart devices that have sensors and computing capabilities. The structure of wearable technologies has brought a new trend to fashion design area. Fashion design, as known to be a very dynamic application area, has already accepted the issue and started using the most powerful examples of wearable technologies already. However, although the stages are using wearable technologies, the schools that graduate fashion designers of the future are far beyond the capacity of the stages. It is therefore; this paper brings suggestions for the integration of technology into fashion design departments in Turkey and while doing this it tries to be country specific.

Keywords: wearable technology, wearables, fashion design, fashionable technology

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## 1. Introduction

Wearable technology has great potential to transform our lives. We witness the new experiences between human and wearable devices as never happened before. The wearable technology is defined as lightweight, easy portable, flexible and wearable smart devices that have sensors and computing capabilities to receive, store, analyze, display and transmit data (Kuzu, & Demir, 2015). The "Wearable" word gains new meaning with technological advancements (Park, Chung, & Jayaraman, 2014). Wearables change the way of human-computer interaction radically. The widespread and early-adopted wearables are smartwatches, fitness bands, head mounted displays, wristbands and ear buds. On the other hand, many wearables such as skin sensors, smart lenses and smart textiles are recently about to go mainstream.

Sensor is known as one of the key components of wearables. Wearables must have sensor to sense environment and perform specific tasks given by user. Sensors make great contribution to wearables in adjusting their functions to be more suitable for the activities and conditions of the users (Farrington, Moore, Tilbury, Church, & Biemond, 1999). A great deal of data such as location, speed, pulse, temperature, pressure, gas, vibration and pH level can be collected through varied sensors (Weinman, 2015). Sensors are classified in four heading fields as physical, temperature, chemical and electromagnetic (McGeough, Crean, & O'Kennedy, 2012). In general, sensor is an integrated part of the wearables. However, sensors can be embedded into new objects. Owing to this, emerging smart devices with sensors are developed to be used in daily life. Sensors transform objects clothing and accessories to multi-functional wearables.

Wearables are instantly reachable and easy accessible by users (Liu, 2014). Different kind of data can be recorded and transmitted via connectivity specifications such as WiFi (Wireless Fidelity), NFC (Near Field Communication) and Bluetooth. Wearables transform data to valuable information about body and environment of user, which is called quantified self-data. This data can be securely shared with third party Web 2.0 sites and applications (Conheady, 2014; Seppälä & Broens, 2013).

Wearables are considered as extensions of our bodies, therefore paradigm shift happens from mobile computing to wearable computing as human-computer interaction differs (Sawaya, 2015). Wearables provide the same functionality with the mobile devices without limitation of holding device (Jackson, & Polisky, 1998). This freedom increases the use of wearables in daily life naturally. Daily use of wearable technologies among the people of all ages has led to a need related to the aesthetics of these devices. People desired the devices as fashionable accessories that could reveal their style. Due to the aesthetic concerns, appearance and fashionableness of wearables are now considered before their technological capabilities. Therefore, wearables should be designed fashionably to attract users in contrast other technologies (Kalinauckas, 2015). Designers and producers should regard the key attributes of wearables as they are lightweight, aesthetically pleasing, invisible and shape conformable. In addition, wearables should not inconvenience any additional social, psychological, or ergonomic burden on the individual (Park, Chung, & Jayaraman, 2014). Wearables are expected to carry out traditional function of object and also new functions as a technological device.

## 2. Wearable Technologies and Different Disciplines

Nowadays, societies have been involved in a social change process from information age to interaction age (Butcher, 2010; Kaya, 2011). Therefore, the community-residing persons' point-of-views towards constructing information were influenced by this transformation process. These individuals are no longer the persons who display and access the information passively and unilaterally. Moreover, they are the persons who actively participated in building knowledge for themselves and also for other people's sake (Selwyn, 2012; Solomon & Schrum, 2007). At the present time, among the emerging technologies, wearables are playing key roles in enabling this case mentioned above.

By means of the ubiquity features arising from the sensors, microprocessors and wireless communication capabilities, wearable technologies are on the cusp of worldwide adoption (Howard, 2015; Lorente & Morant, 2014). People from every walk of life started to adopt and use wearables in order to ease their lives and gain more quantified self-data day-by-day. This daily use also affected on the professional fields. The use of wearable technologies in diversified disciplines varies from health care, military, education, business to entertainment, mass media, fashion, travel and so forth. When examining the practices in professional fields, it can be obvious that a vast quantity of practices have been carried out in health care. The wearable technology practices in health care are related to the wellness of the patients by their data gathered through sensors such as gyroscopes, accelerators, etc.; as well as the affordances for operators such as accessing the information needed ubiquitously, educating the practitioners simultaneously or consulting to other operators during the process, etc. Last but not the least, these technologies can help the patient's relatives to monitor the patient's conditions instantly by the help of other devices connected to the wearables. A massive use of wearables is on market for fitness purposes. The sensors mentioned before totally matches with the fitness purposes of the people. So that, brands which are most known in fitness fields have been developing diversified shaped wearable devices, that is fitness trackers, for answering these fitness-related needs.

There are also some attempts to use these technologies in education fields. Teachers from all around the world have been trying existing smart glasses, watches and wristbands in order to use them for educational and instructional purposes and share the implications in regard to their practices via their blogs (Fuller, 2014; Goodman, 2015; Vanden Huevel, 2013). Wearables are frequently used to capture just-in-time videos, photos or voice records to store them for analyzing later or to show them to the other stakeholders later. In a simple example case of Huevel (2013), an online physics teacher from Michigan used an existing smart glass and connected to his physics class via Internet. The students were able to watch the scene as the teacher could see in his eyes concurrently. In this context, by the help of the glass, the teacher had the chance to take his students to a visual trip to the Large Hadron Collider (LHC) at CERN in Geneva, Switzerland.

Practices such as the ones mentioned above are now rising all around the world, and in every field of life. And along with the views of researchers, field experts and practitioners; it can be said that these wearable technologies will keep taking parts in people's lives for a longer time. For this very reason, people should find a way to be accustomed to these technologies and accept them as their everyday life outfits. Herein, another issue related to the aesthetics of the wearables is burst forth. Since then, the researchers and designers of wearable technologies have been putting so much effort on developing devices with fashionable attractiveness.

### **3. Implications of Fashionable Technology**

Fashion and Technology is both have connections together with the wearables; design, fashion, science, and innovation are the components of it and there is a new area emerging. Dr. Sabine Seymour, who is an entrepreneur and researcher works on the next generation of wearables and the engagements of aesthetics and function in our garments, terms this area as "Fashionable Technology" (Somerer et al., 2008). In our modern world we consider fashion related with the body, dress, clothing, style and adornment. However, we should know that fashionable technologies are cross-borders; bringing wearable technologies to a fashion concept enlarge the meanings of it. The term fashion'able' technology refers to technology with an aesthetic appeal. The focus of the term is on 'able' with the intention of making technology fashionable and aesthetically pleasant (Seymour, 2010).

According to Seymour (2008), technology integration in wearables divides into three topics,

- Clothing as the container for technology,
- The technology is physically embedded into clothing or textile substrates,

- Technical and scientific advances are integrated into the fabric.

Following up this argument, implications on fashionable technologies will be discussed on Seymour's perspective in this paper.

#### Electronic textiles

"Technical and scientific advances are integrated into the fabric" (Seymour, 2008).

Many experts agree on the only new thing that fashion can offer is the material, the technology-not the design not the cut (Bauxbaum, 2009). The integration of the electronics, new technologies and fashion, signals the start of a new era in the clothing and textile industry, in which visions are giving way to products now ready for the market (Loschek, 2009).

Fashionable technology refers to all technologies interlinked with the body like biotechnology, nanotechnology, digital technology, textile technology, etc. Additionally, it refers to tools and software applications associated with textile technologies and fashion design (Seymour, 2010). Since textile is a fundamental medium for fashion, it is observed there are many innovations and applications on textile and fabrics. As an example there are several high-tech textiles, which is also known as smart textiles are capable of conducting electricity. An electronic textile consists of biometric or external sensing, wireless communication, power supply and interconnection technology. Sensors or computing devices can be integrated into a fabric, so that by using this fabric, the features mentioned above can be set to work together in the same network (Berzowska, 2005).

Electronic textiles enable a computation system to eventuate on the body. They usually contain conductive yarns and also incorporation certain amount of conductive material (such as strands of silver or stainless steel) to allow electrical conductivity (Berzowska, 2005). We can observe that electronic textiles, also described as smart fabrics have been used for many areas in fashion design. The terms defined as wearables, wearable computing, wearable technologies, smart clothes, smart fashion, interactive wear and electronic dresses refer to functional electronic objects integrated into clothing portables become wearables and clothing becomes a user surface which also means an electronic interface (Loschek, 2009). As an example, in 2007, Philips Design's SKIN probe Project was launched small collection of garments that displays how electronics can be involved into fabrics and clothes. In SKIN Project Philips worked with Studio XO, which is a fashion and technology company based in London. There were 2 garments which express the emotions of the weaver via e-textiles have been used. "Bubelle"- the blushing dress surrounded by a bubble illuminated by patterns that change dependent on skin contact and behaves differently and "Frisson" a body suit reacts to being blown by igniting hundreds of tiny LEDs, attached to the fabric (Figure 1). Bubelle was used by a fashion icon Lady Gaga as a client of Studio XO, on the "Born This Way" album (Figure 2). Both projects reflect that fashionable technologies are also a bridge between human emotions and reflections to its environment. Thus, applied technologies are important to communicate not only with the dress but also with the surrounding.



Figure 1: Frisson



Figure 2: Bubelle

Figure 1 - Retrieved January 29, 2016 from: <http://www.dezeen.com/2007/10/12/design-probes-2007-by-philips-design-at-dutch-design-week/>

Figure 2 - Retrieved January 29, 2016 from: <http://ideasevolved.com/studio-xo/>

One of the latest innovation in e-textiles happened in 2015. The research team from University of Tokyo, leading Takao Someya, developed electricity-conducted ink to be used to print circuits on textile (see figure 3 and 4). According to the researchers, in the future, the ink could be used to cover the entire outfit and calculate how many calories a person has burnt or the circuits might be also used in a system to help golf players to correct their swings by measuring which parts of the body they should relax more (Matsuhisa et. al., 2015).



Figure 3: Electricity conducting ink

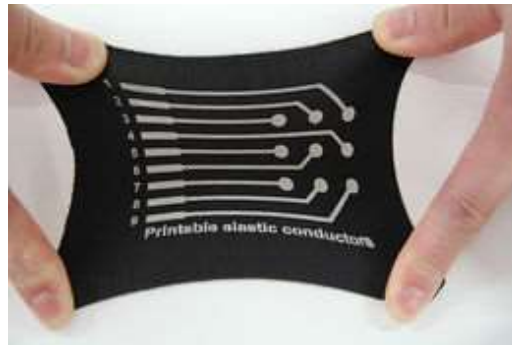


Figure 4: Ink printed on fabric

Figure 3 & 4 - Retrieved January 29, 2016 from: <http://blogs.wsj.com/japanrealtime/2015/06/26/univ-of-tokyo-researchers-develop-electricity-conducting-ink/>

#### 4. Fashion and Technology

*“Clothing as the container for technology” (Seymour, 2008).*

We can observe that wearable technologies have a connection with the fashion industry, not because of its origins as a cloth or as an accessory, but also for its industry. “Google Glass” was launched in 2012 at New York Fashion Week, in the collection catwalk with one of the worldwide known American fashion designer Diane von Furstenberg’s that was the President of Council of Fashion Designers of America at that time (Figure 1). Diane von Furstenberg is seen one of the greatest fashion designer in U.S.A. and she took a capsule collection in Google Glass with her designs. It can be said that this kind of partnership brought togetherness between a technological area and fashion industry. It is observed that, in Google Glass case, conventional designs are combined with new technologies and materials. There isn’t an unusual form makes an attraction to consumers but it is more about their innovations and technologies. In this sense, the privilege of carrying technology as a cloth recreates the meaning of technology itself.

#### 5. Electronic Fashion

*“The technology is physically embedded into clothing or textile substrates” (Seymour, 2008).*

Experimental projects represent a test bed for fashionable wearables. Hussein Chalayan tapped into technology as a means of expression as a fashion designer. The inspiring pieces are conceptual and

have a performance character (Seymour, 2010). He adopted his futuristic style into technology but also there is an inspiration from technology itself. He uses the technology with a design philosophy. As an example, in his Echoform Collection in 1999, main theme of the collection was speed and its associated with airplane technologies. “The Airplane Dress” is a fiberglass construction with a flap that can be controlled electronically and moves like an airplane wing (see figure 5). In “Before Minus Now” collection, he was inspired by the relationships between human, nature and technology. It is observed that Hussein Chalayan is a fashion designer which is using technology and electronic applications on his designs while inspiring from the technological improvements.



Figure 5: The airplane dress



Figure 6: The Twitter dress

Figure 5 – Retrieved February 2, 2016 from:

[http://fashionartdaily.blogspot.com.tr/2009\\_11\\_01\\_archive.html#.VrCcCbKLSM8](http://fashionartdaily.blogspot.com.tr/2009_11_01_archive.html#.VrCcCbKLSM8)

Figure 6 – Retrieved February 1, 2016 from: <http://www.cutecircuit.com/the-twitter-dress/>

Though it seems fashionable technologies have been used for performance art for conceptual designs, internationally-known fashion house CuteCircuit, launched in 2004, known as the first fashion label creating fashion wearable technology collections. CuteCircuit shows the Ready to Wear collections at New York Fashion week and haute couture collections in many other places. The brand has become well known for their several designs; for example, “The Hug Shirt” as a fashionable technology, has attention-grabbing features which are sensors and actuators. These sensors can sense the strength, length and position of the touch, the temperature of body and pulsation rate of the person who wishes to send a hug to someone in distant. Also, there are actuators which can receive the information generated by the sensors mentioned above. By processing the information received, these actuators can produce representative senses such as sensation of touch, temperature and feeling of the hug for to the Hug Shirt of the distant one. In “The KDress” there is a small snap-in controller that recharges via USB in just two hours. Plugging it to charge into the USB port of makes the dress sparkle. “The Twitter Dress” has a fabric with MicroLEDs that generate extraordinary animations and receive Tweets in real time from Nicole Sherzinger’s fans using the #tweetthedress (see figure 6). With those designs mentioned, it can be said that when usability is integrated in fashionable technology, it becomes more spread and sustains as a well-known brand in industry.

## 6. A Challenge For Higher Education: Wearable Technology For Fashion Design Departments

Astounding novice experiences of humankind can be possible under favour of technology. Attractive and desirable garments help us to express our personality. If new generation of wearable technology products are expected to be successful, both the fashion and the technology industries should compromise to speak common tongue and to cooperate to make successful products (University College London, 2014).

As we all know, cultural shifts, cyclical attitudes and way of life changes give rise to the new trends. The industry keeps on developing and impacting consumer desires and purchasing habits, and now the worlds of technology and fashion design have started to consolidate. Electronic textiles and wearable technology are turning out to be generally utilized and recognized by the fashion industry. These developments are exploited by several clothing companies who generate increasingly innovative designs (Bearne, 2015).

There are significant investments to trigger a race to bring new kinds of product to market. Moreover, it is important to analyse early adopters' interaction with wearable technology to create new categories of wearable products. Despite all these developments, there is an increasing need for awareness by technology companies to comprehend and grasp the world of fashion. This kind of awareness should be the main focus of the educators in fashion design of the universities in Turkey. It is precisely because technology changes so rapidly that we must shift our focus from purely understanding specific tools to also being able to analyse the educational merit of new tools based on their capabilities (Mishra & Koehler, 2006). Another issue is that both fashion design and technology departments in Turkey do not graduate students for state based jobs which means their graduates must be entrepreneurs. In this regard, as well, the departments should follow the trends in technology. There is no field that will be isolated from technology in the coming years and it is sooner better for fashion departments to grasp this idea. As put forward by Bower and Sturman (2015), in order for educators to integrate wearable technologies into their learning designs and utilize them effectively in the classroom, educators need to first understand their use potentials, or 'affordances'. Thus the solution for Turkish HE institutions lies at elective course mechanisms. Fashion design departments may devote some percent of their field-based electives to technology. Another way to cover the technology may be with providing minor degrees, which is a rather difficult solution since it requires cooperation of Higher Education Council and technology faculties, a very heavy bureaucratic burden.

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