THE FUTURE OF TEXTILE AND FASHION DESIGN IN VIRTUAL REALITY

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Abstract: *Virtual Reality is a technology that gives the user the experience of being surrounded by a computer-generated environment. With the recent upcoming of affordable VR technology a boom can be seen in a variety of areas. The fast paced progress made in this technology makes it important to also think of ways to connect it with fashion design. Possibilities to transfer the designing process into a virtual environment using drawing applications like Tilt Brush already exist. By placing a digital dummy puppet into the virtual environment the designer is able to intuitively paint clothes onto it. The created designs can then be exported and directly transferred to other 3D software packages for further processing or turned into plastic print-outs by a 3D printer. Transferring the whole prototyping process of clothes into a virtual environment will make it more intuitive, flexible and time saving.*

Key Words*: Virtual Reality, Immersion, Textile, Fabric, Fashion, Design*

1. INTRODUCTION

Computer technology, used in the field of fashion design, ensures fast and error-free production. This means designing and creating production reports in a digital environment without using paper, pencil, dyestuff, etc.. At the same time, for example in weaving fabrics, production reports can be transferred via computer directly to the weaving machines which then turn the designs into fabrics . Computer technology allows us to apply different patterns, models, colors etc. onto the designs very quickly. Limitless numbers of color variations or completely new patterns can be generated from one single existing pattern without effort. Quickly accomplished calculations can be sent online to the weaving or printing machines. After selecting the fabrics for the garment, molds can be prepared. Even the entire garment creation process can be produced in a digital environment, using computer aided design (CAD) and computer aided manufacturing (CAM). The invention of digital cameras has accelerated this process even further. By using a digital camera combined with a computer, in the scope of digital design and production, for example, a photograph can turned into a pattern which can then be directly printed, woven, knitted or embroidered. Animation, the way the design looks on the podium as well as body fit and mobility of the 3D virtual garment design, dressed onto the previously scanned and

imported body model, can be viewed in real time (For detailed information look at: Magnenat-Thalmann, Nadia, 2010).

The emergence of broadly available, affordable high-quality virtual reality (VR) technology, however, brings a whole new perspective to the designing process. But before getting closer into the subject it is important to clarify the terminology:

Virtual Reality is a term that is being used for quite a variety of things. For the sake of clarity a more specific definition of how the term will be used in the following is needed. Steve Bryson suggests following definition: “Virtual Reality is the use of computer technology to create the effect of an interactive three-dimensional world in which the objects have a sense of spatial Presence” (Bryson, 2013, p. 4).

In other words, the user finds him/herself surrounded by an artificial, computer generated, three-dimensional environment, which is achieved in most cases by replacing the sense of vision with a head-mounted display (HMD), and the sense of sound with headphones. In turn, the term HMD refers to a type of equipment, that strapped to the head of the user places small computer displays directly in front of his/her eyes.

Since the introduction of consumer VR headsets, like the Oculus Rift or the HTC Vive, a constant development of new applications can be observed in a great variety of different areas. Beside the gaming and entertainment industry we see uses in engineering, education or medicine. It is therefore reasonable to assume that VR will play a big part in the field of designing. Fabric and garment design will surely not stand back in this progress.

Creating designs and patterns in VR can offer interesting possibilities. By immersing themselves into a virtual environment designers are able to examine and interact with the design as if it had materialized in front of them. Not being bound to a two dimensional surface, like paper or a graphics tablet, a whole new experience arises by drawing directly onto 3D space (figure 1).



Figure 1. Interaction with Google’s Tilt Brush application [8]

Instead of having to look at a screen the user finds him/herself in a virtual surrounding and can design, assuming the whole space as if it was the fabric or garment itself. Unlike handling a conventional computer user interface the use of

tools is much more intuitive because the designer is basically holding them in his/her own hands. Feeling a part of the garment the designer can transfer all emotions and thoughts into the design. Designing in a virtual environment combines the hands-on-feeling of working in a traditional tailor workshop with all the advantages and flexibility a computer aided system brings to the process (figure 2). Therefore, through the use of virtual reality technology very different designs can be created in much shorter time and later directly be transferred to production machines. In the light of this information the aim of the paper is to show examples of works done in fabric and garment design with the use of virtual reality technology until now, to explain and demonstrate how textile and garment designs can be created in a virtual reality environment, and to predict how development and innovation in the field can be achieved.



Figure 2. By use of a virtual draping dummy the design can be drawn directly onto it [9]

2. MATERIAL AND METHOD

The setup for this attempt requires a head-mounted display (HMD) and two VR hand controllers. For this setup the Oculus Rift HMD is used in combination with Oculus Touch controllers (Figure 3). Two sensors placed diagonally in front of the user track the position of the headset and the controllers and send this data to the software, making sure that the movement the user does in the physical space is transferred to the virtual environment. The controller feature more or less the same buttons a regular gamepad does. But in combination with the position and rotation tracking they become representations of the user's hands in the virtual world.



Figure 3. : Oculus HMD, Position Tracking Sensor and Hand Controllers [10]

In order for the Oculus Rift HMD to display high quality images with great detail smoothly, it has to be connected to a powerful gaming computer via cables. The PC used in the setup features an 8GB graphics card, an Intel i7 Processor with a speed of 3.60GHz and 16GB of RAM memory. This computer is used both to run the VR equipment and to process all the data, that is peripheral to the designing process.

For the actual designing in virtual reality Google's Tilt Brush software is being used. The tools featured in the application are quite similar to those of any simple computer-based drawing program, with a few additions. The main difference, however is, that the users find themselves in a virtual environment, by using the hand controllers is able to draw lines directly into the air and can then walk around the drawings to look at them from any desired angle. The simple user interface makes it possible to intuitively change parameters like bush style, brush size, line color or line opacity. The user can scale up or down the drawn as he/she desires. One of the available environments features the 3D model of a regular draping dummy (Figure 4). But any kind of 3D model can be imported into the program (figure 4).



Figure 4. View through VR headset. Custom 3D models can be imported [7]

For the designing process the user moves freely around the draping dummy, intuitively drawing the clothing onto it (figure 5). This can be done in a very rough a sketchy manner but by scaling up the the drawings also very detailed designs can be created. At any point the design can be exported as a 3D model and further modified in any kind of 3D application or even sent to a 3D printer to create a 3D plastic print-out of it.

Along with commonly used body scanners and the development of standards in fashion, every passing day new advances in digital garment modeling and simulation applications are being introduced to the fashion industry. Both 2D and 3D CAD / CAM systems are broadly used. 2D CAD systems allow the creation of two-dimensional molds of the designed garment. Using a 3D CAD system, the molded parts can then be placed according to earlier taken body measurements or onto a digital human avatar created through body scanning (Vitali & Rizzi, 2018, pp. 131-135). This digital workflow makes it possible to rehearse virtual

clothing on an individual. Thanks to the 3D imagery, the fit on the body and the way the fabric falls can be observed. These methods are common practice in the clothing sector today. The concept communicated here, with the use of virtual reality, however, combines the designing of the garment, the creation of 2D molds, the rehearsal and control of the clothing's fit on the individual and by doing so makes improvement of the garment development process, a decrease of time and cost and the attaining of results in shorter time foreseeable.

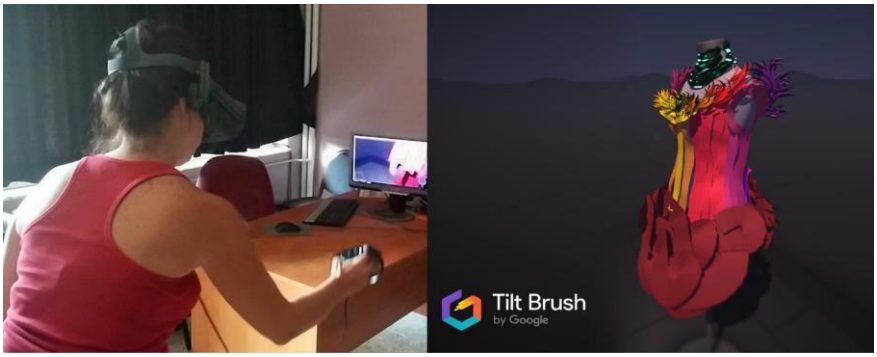


Figure 5. Use of VR headset and hand controllers (left). Finished design (right) [performer S. Kozbekçi Ayranpınar]

3. DISCUSSION

As can be understood from the information above, with VR technology it is possible to design fabrics and clothes as well as make quick changes to them in a virtual 3D environment, send them to other programs or print them out using a 3D printer. VR drawing applications like Google's Tilt Brush are great tools, especially for sketching out ideas, however, they are limited and designed to be intuitive and easy to use. The next step has to be to design tools created with the fashion and fabric designer in mind. With the right applications a full integration of virtual reality into the design and production process is thinkable and will quite possibly open doors for completely new workflows and areas of application. If VR can be used for designing clothes or patterns then it will also be possible to design the characteristics of different fabric structures like texture, the volumetric structure depending on production technology and material characteristics, like woven, knitted or non-woven surfaces. Production reports of the fabric designs can be prepared and then transferred directly to the production machine online.

There are two approaches towards clothing design. Designing clothes according to the fabric or designing the fabric according to the apparel model. Ensuring that the desired effect of the fabric texture or pattern is achieved when applied to the designed clothes is what makes a successful design.

The designing of clothes is a long process including work steps like the production of the fabric, draping, cutting, sewing or fitting the clothes on the costumer. It requires the right use of time and immediate action. Transferring that process to a virtual environment will make it much more flexible and lead to results in much shorter time.

Additionally, more than one textile and fashion designer could work together on the same virtual design at the same time without having to be present at the same physical location.Developing new software will make it possible to transform three-dimensional fashion designs prepared in a virtual environment into two dimensional garment molds. The design created on the virtual draping dummy can be divided into mold sections on the same draping dummy making it possible to directly obtain the necessary parts. This way, extracting a mold for each section of the clothing and rehearsing each module separately is not necessary anymore. Thus, it is possible to obtain the clothing molds fitting the body in much shorter time. At this point, the production can directly be started without needing a sample garment.
Another possible scenario for the employment of VR technology into the production process is in creating highly customized clothing. Customers could send 3D scans of their own body online to the tailor, which could be done from their home. The 3D scanned body model is than placed into a virtual working environment, where the tailor, wearing a VR headset and VR hand controls, takes the measurements (Vitali, A., & Rizzi, C. (2017)). The designing process can start at the same time by drawing and fitting the garment directly onto the customers body. For feedback the customer can be invited into the virtual environment online to discuss the design without having to be in the same physical space with the designer.

After the design process is finished the virtual environment can be turned into a professional photo studio. By placing spotlights and adjusting the background as well as camera settings, professional pictures of the design can be taken, even before the production process has started. Within the same application a finished three dimensional design could then be transformed into two dimensional garment molds. The design created on the scanned 3D model of the customer's body can be divided into the mold sections needed for the production for the garment. The garment molds are then directly transferred to the production machines which output the finished product. So almost like regularly ordering clothes online Virtual Reality could open up the possibility to shop for custom created clothes without having to leave their home.

Additionally, it is important to note that VR technology is still pretty much at the beginning of its possibilities. The technology has been available to the broad public only for a little more than two years and it has continued being in a state of constant development since. For example powerful, untethered headsets are starting to be released enabling the user to move around in the virtual environment more freely, without having to worry about cables. In the close future VR gloves and suits will make the feeling of being part of the virtual world much more vivid and will make it possible to feel virtual objects. It will be possible to

touch surfaces and feel its textures and thereby feel different fabrics. Around the globe engineers, designers and artists are keen to discover the possibilities of the medium, where many of the rules are still to be written. Also in the field of fashion and fabric design it is of important to stay curious, keep the eyes open for new developments and an open mind.

4. CONCLUSIONS

When designing in a virtual environment the designer has the possibility to easily try out different textures, patterns, colors and shapes and is able to examine the results in real time. This new dimension to the designing process will reflect in the products and will leave an innovative visual impact. Being immersed into this three-dimensional environment creates a whole new experience for designers and is sure to inspire new approaches to the creative process.

Virtual Reality (VR) is an important development for the conceptual design process, which allows designers to visualize their imagined designs as real-life appearances, rather than present them as two-dimensional sketches. 3D garment design will make it possible to adjust clothing so it fits regular sized customers as well as those who have the potential to not fit the norm. It will enable to make designs directly on uploaded human avatars given the desired measurements. Designing in a virtual environment, by simulating the effect of the garment on the human body replace repeatedly manual changes on the life model as is common practice in a traditional designing process. But the most important advantages that this system brings to product development are the need for less samples, faster prototyping and easier decision-making.

Making fabric and garment designs in a virtual environment can be an effective way of bringing clear results in tailoring molds according to the individual's ergonomics and body type. It is fair to consider that better results in creating molds especially for drop size and anatomical defects like scoliosis (Hong, Y., Bruniaux, P., Zeng, X., Liu, K., Curteza, A., & Chen, Y., 2018, p. 35-45), hip protrusion, rounded shoulders can be achieved.

Through virtual reality taking measurements and rehearsal process by a professional can lead to healthy result even over long distances. Designer and Customer don't have to find themselves at the same place. In this case, the designer will be able to evaluate body type, body size and anatomical structure in the virtual environment and make accurate determinations and measurements. Instead of verbalizing the results, he/she may present the results to the customer visually.

The three-dimensional garment design created in the virtual environment can, again, be transformed into two-dimensional garment molds. The appropriately partitioned garment mold pieces can be obtained from the same draping dummy on which it was designed. This way the process of extracting every module of the garment individually to rehearse it can be abolished and it will be possible to obtain plainly fitting garment molds.

REFERENCES

Makryniotis, Thomas, (2015). 3D Fashion Design: Technique, design and visualization. Pavilion Books. ISBN 1849942935, 9781849942935

Editor; Magnenat-Thalmann, Nadia (2010). Modeling and Simulating Bodies and Garment. London: Springer. ISBN 978-1-84996-262-9. e-ISBN 978-1-84996-263-6. DOI 10.1007/978-1-84996-263-6

Vitali, A., & Rizzi, C. (2017). A virtual environment to emulate tailor's work. Computer-Aided Design And Applications, 14(5), 671-679. doi:10.1080/16864360.2016.1273584

Bryson, S. (2013). Virtual Reality: A Definition History - A Personal Essay.

Hong, Y., Bruniaux, P., Zeng, X., Liu, K., Curteza, A., & Chen, Y. (2018). Visual-Simulation-Based Personalized Garment Block Design Method for Physically Disabled People with Scoliosis (PDPS). Autex Research Journal, Vol 18, Iss 1, Pp 35-45 (2018), (1), 35. doi:10.1515/aut-2017-0001

Vitali, A., & Rizzi, C. (2018). Acquisition of customer's tailor measurements for 3D clothing design using virtual reality devices. Virtual And Physical Prototyping, 13(3), 131-145. doi:10.1080/17452759.2018.1474082.

prototypeD TEAM Inc. [Screen name]. (2017, April 08). Virtual Fashion - Tiltbrush VR to Blender [Video file]. Retrieved from https://www.youtube.com/watch?v=pyZmIX1KP5E&t=397s

VRScout [Screen name]. (2016, August 22). Tilt Brush Fashion - Dress Form HTC Vive Mixed Reality [Video file]. Retrieved from https://www.youtube.com/watch?v=pyZmIX1KP5E&t=397s

[Digital image]. (n.d.). Retrieved from https://www.boomer.fr/wp-content/uploads/tilt-brush.png

Wikipedia (2018, January 29). The tale of two Flaccos. Retrieved from Wikipedia (2018, August 29). Oculus Rift,. Retrieved from https://en.wikipedia.org/wiki/Oculus_Rift