THE 3D PRINTING’S PANORAMA IN FASHION DESIGN

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Abstract: This article provides a panorama of the main productions in the Fashion Design, specifically the 3D printed clothes. Starting with an introduction to this technology and materials, following by a historical overview ending with a research about creations shown on the runways in the last years, and the perspective about this technology in some proposals with focus on technological innovation.

Keywords: Fashion Design, 3D Printing, Technological innovation.

Introduction

Technological advancement has provided new perspectives and applications in Fashion Design, through the adoption of the most widespread techniques such as, digital printing and laser cutting in textiles and more recently, 3D printing in clothes development. According to, Pires et al: “Technological innovations can represent a large differential factor nowadays; at every moment new products arise, from new technologies or adaptations of existing machines” (PIRES et al, 2012, p 172.).

Therefore, as well as digital printing technology enabled new perspectives in the creation of prints and textile applications, broke new ground to clothing design, Bowles and Isaac (2009) state that the interdisciplinary use of graphic design programs, digital photography, videos and special effects which were part of the generation of new designers, influenced the hybrid materials formation and create a new fashion in Pattern Design (BOWLES; ISAAC, 2009).

In 2009, digital printing was relatively new, and due to its high costs was only accessible to medium and high-level industry, even then this technology led to an increase in creativity of designers because of the speed and spontaneity of digital tools (BOWLES; ISSAC, 2009).

Over the years, digital printing reduced its cost, becoming the main printing method on fabrics. With the inclusion of this technology there has been a disruption of old paradigms of serigraph prints, as Bowles and Isaac (2009) indicate in their book Diseño y Estampación Textil Digital, digital printed textiles would have some advantages over such processes, for example, the possibility of greater use of tones, shades, colours, shapes, high fidelity prints to digital photographs and images.
However, returning to 3D printing, according to this research, it is possible to obtain information about this new technology in the market, mainly by the proportion that it is being used in Fashion Design, very low comparing with digital textile printing.

Since 2013 there was an increase in the 3D printed clothes production. Currently, it is possible to make clothes, shoes, accessories such as, sunglasses and watches. In this article a bibliographic research on 3D printing technology, materials, and especially the productions presented in fashion runways, as well as opportunities and innovations from the use of this process for the manufacture of clothes.

Introduction to 3D Printing

According to 3D Printed Company (2014), 3D printing had its idealization in the 80s, when Dr. Hideo Kodama filed the first patent application for rapid prototyping technology (Rapid Prototyping / RP).

This process was initially designed for rapid creation of prototype industrially developed products. However, due to problems occurred, the patent was not registered. In 1986 the first patent was issued for Stereolithography Apparatus technology (SLA). This patent belongs to Charles Hull, who invented the SLA machine in 1983. Hull co-founded the 3D Systems Corporation, which is currently one of the largest in 3D printing technology industry.

In the 90s this prototypical process goes through technological changes and other systems are developed, especially the Selective Laser Sintering (SLS), and the Fused Deposition Modelling (FDM). The FDM technology was registered by a company called Stratasys, currently is one of Stratasys main printing method.

In the 2000s, this technology goes through modifications and changes and, in 2010, the costs decline, marking a device introduction costing less than a thousand dollars on the market. Since 2012, alternative methods for 3D printing have been opened to the market.

Clothes and Accessories Printed in 3D

With the introduction of more effective 3D printing technology in the market, and also with the cost reductions, it became more affordable and since then, uncountable productions had been designed
with it, for example, structures such as prostheses for medical use, artistic pieces and different product designs, and also clothes, which were studied in this research.

Currently, 3D printing has opened new borders for creations in Fashion Design, since this technology enables a new transgression of previously unavailable technical limits.

Clothes, accessories, glasses, watches, and much more can be created from CAD (Computer Aided Design), which enables 3D modelling (UDALE, 2009). Therefore, the design is printed on the most suitable material.

Companies such as Stratasys (2014) have several different materials to use in their machines as:
(a) Thermoplastics: high performance and durability matter; (b) Photopolymer: finest finishes and realistic prints, with chameleon-like ability, flexible biocompatible materials; (c) Truecast: wax-like material, which can be used for dental prosthesis.

Offering 3D printing services on a variety of materials with delivery service to anywhere in the world, Shapeways company (2015) uses a printing technology from the use of lasers and powder solidification, and other processes developed with the use of templates, which as a final result, enables printing in aluminium, bronze, gold and other materials.

Sustainability is also a concern of today designers. Therefore, researches are welcome, an engineer at Rzeszow University of Technology has developed a material capable of synthesizing a resembling wood-like surface.
In fact, 3D technology has evolved considerably in the last years, enabling a wide range of options to the final product. Therefore, its use creating fashion pieces followed the evolution of systems and technological material processes.

The first wearable piece ever made from this technique was the Black Drape Dress in 2000, which was developed by an industrial engineer, Jiri Evenhuis, in collaboration with the industrial designer, Janne Kyttänen. On the website itself, it is possible to get information about the creation of what would be the first fully functional 3D printed dress, and they used SLS technology (selective laser sintering), process that uses lasers to melt a fine powder into 3D shapes (KYTTÄNEN, 2015).

Currently, the Black Drape Dress is part of MoMA's collection (Museum of Modern Art), but copies have been already purchased at some websites for two thousand dollars. Considering that the technology allows you to create unique pieces, but can also reprint (KYTTÄNEN, 2015).
In 2005, Janne Kyttänen founded Freedom of Creation; a group specialized in research and design using 3D printing technologies, where he developed the White Drape Dress, now part of the Museum of Fashion institute of Technology collection in New York. Today Kyttänen is the Creative Director for 3D Systems, the largest specialized 3D printing company in the world (KYTTÄNEN, 2015).

3d fashion on the Runaways and Iris Van Herpen

Iris Van Herpen is a Dutch fashion designer. She studied Fashion Design at the Artez Institute of the Arts in Arnhem and interned at Alexander McQueen, in 2007, she started her own label (HERPEN, 2015).

Herpen was the first fashion designer to present a 3D printed piece on the runways. This happened in 2010 at the Amsterdam Fashion Week, with her Crystallization collection, which included a printed piece in 3D (Image 4). In January 2011, Iris Van Herpen introduces 3D printing on the runways of Paris Haute Couture Week in Paris, where from the twelve looks presented, four were printed in 3D.
These printed pieces are characterized by variation of matter in comparison to the one shown in the previous year. In this collection the surfaces are composed of thin wires, as fibers, composing the pieces and giving lightness to provide greater flexibility (HERPEN, 2015).

In July 2011, Iris Van Herpen presents the Capriole collection in Paris Haute Couture Week, and also a new printed piece, the Skeleton dress. In this 3D piece there is not much variation in the material used, but highlighting the details and structural forms of a skeleton.

In January, in the Paris Haute Couture Week 2012, the designer presents the MICRO collection, especially the part in 3D, "Cathedral", printed from SLS technology in polyamide and sculptural details.

That same year, 2012, she presented in July in Paris Haute Couture Week her Hybrid holism collection, with pieces where there is the introduction of the 'Mammoth Stereo lithography' technique, which consisted of a 3D printing method, where a container with polymers that hardens when struck by a laser beam. This machine developed by Materialise has the ability to print very large parts, up to 2.1 x 0.7 x 0.8 m (HERPEN, 2015). The combination of Mammoth technology with the material used allowed the creation of the 3D piece displayed in the Haute Couture Week in Paris, which had a liquid appearance, transparent, with some similarity to honey (Image 7).
In her 2013 collection, Voltage, Iris Van Herpen presents the first flexible printed dress, in collaboration with the MIT Media Lab, where a different texture was developed, incorporating a hard material and soft one, able to assign softness and elasticity. (HERPEN, 2015).

The 3D printing has been on the runways of 2013 Victoria Secret Fashion Show with the presentation of the play, Snow Queen, designed by the architect, Bradley Rothenberg, and printed in nylon by Shapeways, using Selective Laser Sintering technology, and with thousands of Swarovski crystals. (SHAPEWAYS, 2015).
In March 2014, in Iris Van Herpen, Biopiracy collection, 3D printing gains even more flexibility and movement with addition of new materials and the first printed dress in a flexible material is shown.

In September 2014, Iris Van Herpen presents her collection, Magnetic Motion, containing a printed 3D piece in a transparent material with crystalline formations.

In 2014, the Italian Vogue posted on its website an article entitled "The Life Fashion Scientific", commenting on Paris Fashion Week: "science now plays its part with forward-thinking designers – and is changing the face of fashion with experimental materials and extraordinary examples of clothes that go from the laboratory to the wardrobe" (VOGUE, 2014 s.p).
Once Again, the name that stands out in this article from Vogue is, Iris Van Herpen. According to the magazine's editorial staff, Van Herpen's ability is to transform scientific explorations into the reality of wearable clothes (VOGUE, 2014). Besides, the fashion designer stands out not only for being the first designer to take 3D printing on clothes to the runaways, but also for her constant research, creativity and innovation in presenting her creations.

**Wearable clothes with Smart Materials**

3D printing in technological innovation context, provides new aesthetic perspectives in clothing design, has been used with the purpose of creating ‘intelligent’ pieces. According to Udale “interactive clothes incorporate smart materials that respond to changes in the environment or human body” (UDALE, 2009, p. 39). An example is the piece developed by Anouk Wipprecht, Spider Dress 2.0. It consists of a mechatronic system printed in 3D, with sensors that respond to the presence and movements around those wearing it. The piece is inspired by the instincts of a Brazilian spider found in the Amazon rainforest (WIPPRECHT, 2015).

![Image 11: Spider Dress 2.0](http://www.anoukwipprecht.nl/)

Another example is the project that was first developed by the Dutch designer, Martje Dijkstra, in 2014, called "Hard Core Vein 2.0". 3D technology was used, exploring features and forms inspired on the human body.
According to Molitch-Hou (2014) this piece is a prototype that transmits a sense of living organism to who wears it because the 3D printed material also contains a substance that circulates through these vessels, as veins.

Another creation that stands out in this regard are the pieces from Neri Oxman and from a group of researchers from MIT Mediated Matter Group and others, who developed a technology that enables the creation of digital pieces using a multi-material, called "Wanderers: wearables for interplanetary pilgrims ". Such components have internal cavities and vascular structures that would enable to applicate a modified bacterium, intending to transform oxygen, or to generate biomass, biofuels and calcium, among others.
Final Considerations

Technological innovation is an important factor for innovative projects because coupled with creativity can provide differentiated aesthetic innovations as well as new materials for everyday use. Clothing design is a sector that is always attentive to innovations, which may enable a different design on a final product with, higher quality, sustainability and so many other factors that can add value to creation. In the last years, there has been implementation in use of technology in the clothing industry and accessories, such as digital printing and laser cutting technology for clothes and products derived from this segment.

Therefore, as digital printing has spread industrially, and is increasingly accessible and present in textile printing, establishing, new possibilities in the application of different prints from screen printing patterns, there is a possibility that 3D printing may open new borders for creation in fashion design, clothes and accessories such as handbags, shoes, among others.

Over the years, 3D printed clothes have gone through several changes since the Black Drape Dress in 2000, which would be the first printed dress in functional 3D. Until the most recent creations, especially Iris Van Herpen creations, combined with technology companies and researches in 3D printing (Materialise, among others), there is a greater variety of research in printed materials. Therefore, you can generate technological innovations that enable new applications and possibilities for clothing, attributing characteristics such as flexibility, movement, tactile and visual differential on the final piece.

Given all into consideration, it is possible to see that 3D printing technology application is still growing in fashion design, providing superior results compared to other processes that were being used. Remember that, as digital print has grown and increased its use application over the years, so 3D printing technology tends to spread, with the possibility of cost reduction and wider technology range, becoming one more tool for designers to create innovative pieces.

References

Books:


Sites:


