3D PrintingTechnology : The Surface of Future Fashion

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ABSTRACT
The most recent amazing issue in fashion and manufacturing is 3D printing. This technique influences different sectors as well as the fashion industry at a devastating rate all over the world. This study focuses on how 3D printing technology has been developed and how this technology is used in fashion industry to enhanche the designer's range of work. This also emphasises on country based renowned garments sector and fashion industry. Recently 3d printer manufacturers and the designers both are working to developed eco-friendly and nature friendly products. 3D printing and 3D modeling technology can be compared to the industrial revolution that forever changes the future of manufacturing. As Bangladesh is playing a cherished role in fashion design and garment manufacturing, this technique has boundless potential for exercising the designers' imagination and manufacturing any garment product as well as other fashion accessories more economically. This article also concentrates on future of 3D printing in Bangladesh and its overall impact on the industry.

Keywords
3D printing, fashion design, garment manufacturing and 3d modeling

1. INTRODUCTION
3D printing techniques has endless potential. This technique is capable of fabricating anything from toys to body parts as well as the accessories of entire houses. From instruments-toys to robots and mechanical parts, there's almost an infinite scope what a 3D printer can create. Technological advancement has provided a new era and applications in fashion design, through the adoption of the most widespread techniques such as, digital printing and laser cutting in textiles. Most recently, 3D printing in clothing development is another drift in fashion and textile industry.

2. RESEARCH BACKGROUNG
2.1 About 3D Printing
The first 3D printer (called a Stereo-lithograph) developed by Charles W. Hull in 1986. Carl R. Deckard invented the Selective Laser Sintering (SLS) 3D printer in 1987. 3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file [1]. The creation of a 3D printed object is achieved by using additive processes. D printing, which shoots coloured dyes on2 Unlike sheets of paper in an additive process, an object is created by laying down successive layers of material until the entire object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object.

2.2 How it works
The process of making 3D objects is a step by step way. It all starts with making a virtual design of the object one wants to create. This virtual design is made in a CAD (Computer Aided Design) file by using a 3D modeling program (for the creation of a totally new object) or with the use of a 3D scanner (to copy an existing object). A 3D scanner makes a 3D digital copy of an object. 3D scanners use different technologies to generate a 3D model such as time-of-flight, structured/modulated light, volumetric scanning and many more[2] . To prepare a digital file for printing, the 3D modeling software 'slices' the final model into hundreds or thousands of horizontal layers. When the sliced file is uploaded in a 3D printer, the object can be created layer by layer. The 3D printer reads every slice (or 2D image) and creates the object, blending each layer with hardly any visible sign of the layers. Finally the three dimensional object is created.

2.3 Application of 3D Printing
The possibilities of 3D Printing for product development and manufacturing are endless. 3D printing can be used in preproduction (i.e., rapid prototyping) to full-scale production (i.e., rapid manufacturing). It offers a quick and straightforward way of producing prototype that allows for multiple iterations of a product to arrive more quickly and efficiently at an optimum solution [3]. Thus the process saves time and money for developing a product.

There are some other constructive examples of 3D printing which may have a lot of impacts. 3D printing would include reconstructing fossils in paleontology, replicating ancient artifacts in archaeology, reconstructing bones and body parts in forensic pathology and reconstructing heavily damaged evidence acquired from crime scene investigations. Many automotive companies are now looking at the potential of 3D printing to fulfill after sales functions in terms of production of spare/replacement part, on demand, rather than holding huge inventories [4]. 3D printing technology is destined to transform almost every major industry and change the way we live, work, and play in the future. So fashion is not exception to this.

2.4 Designer's Contribution in 3D Printed Fashion
The idea of custom design has mass appeal and marketability. Who doesn't want to wear a perfectly tailored piece? Perhaps the teenager will get the facilities to wear a self-design dress using 3D printing technology.

Van Herpen was the first designer to send 3D-printed couture down the runway, beginning in 2010. Since then, 3D-printing has become one of the burning tools in the fashion industry. Major designers are creating geometric cutout gowns, stiff and shiny trims and garments that resemble skeletons. These innovations are mostly for runways, though a few have filtered into ready-to- wear.

Picture 1: Dress' detail, registered at Paris Haute Couture Week's Backstage 2012 [5]

Van Herpen's 3D-printed designs inspired other designers, including Francis Bitonti, who printed a gown for Dita Von Teese featuring more than 3,000 unique, articulated joints, and Karl Lagerfeld, who adorned iconic tweed Chanel suits with 3D-printed details earlier 2014 [3]. Fashion design students, too, are eager to experiment with 3D printing, though the cost often puts commercial 3D printing beyond their reach, and they need to learn the modeling software.

Danit Peleg, a student at Shenkar College of Engineering and Design in Israel, used a home 3D printer to create five garments for her graduate collection. Because the home printer was small, she had to print the material in pieces, and the project took more than 2,000 hours. The finished garments, made with a rubber-like material called FilaFlex, feature geometric cutouts—some delicate, some large-in bold colours[6].

Picture 2: 3D printed dress and shoe [6], [7]

Picture 3: 3D Printed Accessories and Earring [8]

All these research look like tinkering with the future and these are doing the change in the fashion industry. Fashion houses will eventually have downloadable patterns on their websites, so people can print their clothes at home [5], [6].

Experts warn, however, that it may take decades to arrive at such a future. Lynne Murray, director of the Digital Anthropology Lab at the London College of Fashion, says 3D printing for fashion is still a new concept. "It's a nice idea, to be able to 3D print clothes at home, or at your local corner shop, but it won't be a reality in the next 10 years," she adds. Perhaps in 20 years and may be then the dress you get will also be able to change color or change shape. So we should look forward to the dramatic 3D fashion world. That world would be like scan it print it and wear it.

Table 1 Different Types of 3D Printing

Technology Type		**Materials**	**Process**
Light Polymerized	•Stereo-lithography (SLA), •Digital Light Processing (DLP) 3D Photo grafting •UV Inkjet printing	Photo polymer/ liquid resins and gels	SLA uses lasers to produce a solid part from a liquid. DLP uses a DLP projector to expose light selectively to a container of liquid polymer. 3D photo grafting/multi-photon photo polymerization uses a laser to trace designs at a micro-level in a block of gel. It has medical and pharmaceutical applications and can be used to grow artificial tissue. The inkjet approach uses an inkjet printer to apply photopolymer in ultra-thin layers, with each layer cured by UV light.
Extrusion Based	•Fused deposition modeling (FDM) •Fused Filament Fabrication (FFF	Thermoplastics in filament form including ABS and PLA. Also possible with metal wire and wood based composite filaments.	Filament is melted and extruded via a heated nozzle in thin strips. Simultaneous printing of objects in different colors and materials is possible through the use of multiple extruder heads.
Granular Material Binding	•Selective laser sintering (SLS) •Direct metal laser sintering (DMLS) •Electron beam melting (EBM) •Powder bed printing.	Polymers including PA, PEEK, and PS, elastomers, metal alloys, and ceramic powders.	Granular systems typically use lasers to fuse (sinter) powder in layers to build up a part. The un-fused media serves as a support to the item being produced; reducing the need for temporary supports to be integrated into the design and removed during the finishing process. Electron beam melting (EBM) involves melting metal powder layer by layer with an electron beam in a high vacuum. The powder bed approach uses an inkjet printer to apply a layer of powder (plaster or resin) and inkjet print a binder in the cross-section of the part. This technology allows for the printing of full color prototypes, as well as elastomer parts.

3. TECHNICAL IMPACT

The Readymade Garments (RMG) sector has a great impact for Bangladesh economy especially in exporting. About 81.69% of total export covers from this sector for the FY-2014-15 [9]. Through the RMG sector impact a lot, technological revolution of this side can bounce a big transaction. 3D printing has a direct effect on shaping the future of the fashion industry. The process of 3D printing will redefine how different sectors within the industry operate. This includes the job market, how designs are created, how fabric is made, and how articles of clothing are constructed. This technique just not only breaks down the barrier of drawing and creative design but forms envisioning scope of fabric construction.

The products needed for 3D printing are different from the typical textiles used. They vary in material such as air, light, and plastic. This change in use of products will affect the supply chain. The supply chain will be forced to provide other materials that are not textiles. The use of 3D printing requires more machines and less hand sewing work. These machines and changes in supply chain will lead to a direct decline in the job market. These machines also affect the way that garments

are constructed. Sometimes there may have no more separate parts that are sewn together at the seams. Instead, these garments are one continuous piece. Then the 3D printing process will additionally have an impact on the *Ready To Wear* market. This process will lead to body scans allowing shoppers to customize their clothes. As a result fashion companies will need to adjust how they sell their products. Besides, the separate joined fabric will need very few workers at all. Thus 3D printing is part of the future of the fashion industry and is on the rise.

4. SUSTAINABLE 3D PRINTING

New low-cost three dimensional printing has given many opportunities for research, education, humanitarian projects and development work. 3D printer creates or replicates solid models using plastic. So, a special focus may be given to the applicability of 3D printing in sustainable research, scientific development and education. The filaments used for 3D printing are kind of renewable materials. Traditionally, sustainable fashion meant organic or recyclable materials. Designers have begun to start experimenting 3D printed pieces of clothing and are exploring new era of sustainable fashion [10], [11].

5. CONCLUSION

Things are moving quickly. 3D printing will definitely become sustainable and the beauty is that limitations are based on materials. The most surprising thing about 3D printing is that this area is developing incredibily fast. It is radically innovative and is a point where human designers and computer can co-work creatively but in sustainable way. 3D printing design still has problems to be solved [1]. It is predicted by some additive manufacturing advocates that this technological development will change the nature of commerce, because end users will be able to do much of their own manufacturing rather than engaging in trade to buy products from other people and corporations.

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