

Application of 3D Printing Technology for Fashion Products with Kawung Pattern

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Abstract: Current technological developments are growing very rapidly, especially in the development of 3D printing. 3D printing applications in the world of fashion have been carried out by several world-renowned designers. Indonesia has many ornaments that can be developed using this technology. In a previous author's research, the author tried to develop the kawung pattern, one of the decorative patterns in Indonesia, using 3d printing technology. The results are good but need to be further developed. This article reports next experiment that working to develop the 3D shapes of Kawung's pattern and how to apply on fashion products.

1 INTRODUCTION

The fashion world is increasingly experiencing rapid development. Both in terms of fashion, material, application, to production technology. This rapid application demands that the fashion market activists continue to innovate. 3D printing is a technology that is being developed as an alternative material in fashion design. 3D printing mode is created with a 3D printing machine in several steps; create 3d models in software, slice models to 2d, and imaging layer-by-layer objects to become 3-dimensional objects (Perry, 2017). The development of 3d printing in the world starts with the Irish van Herpen in its collection called Crystallization. In Indonesia, designers who have developed 3d mode designs are Tex Saverio. He made an Exoskeleton Collection containing 5 designs of haute couture dresses that use a mixture of media between fabric and 3d printed material.

Currently, designers all over the world are still developing 3d materials for Clothing Products. Danit Peleg is the first fashion designer to make commercial 3d print jackets that can be customized and purchased on his website. 3D printing is expected to be an environmentally friendly alternative material for the development of new fashion designs and has a process that is easy to work with fashion.

2 PROBLEM STATEMENT

Indonesia has various cultures and arts, one of which is decoration. Variety of decorative is a decorative form in the form of repetitive pattern (Safiera, 2014). Ornamental use in Indonesia is generally used in ornaments for interiors, architecture, and textiles. For textiles, the variety of decorative forms is still limited to 2D patterns. In early 2018, we conducted an experiment to develop one of the decoration motifs, namely the Kawung motif, because the form was easily modified by 3D printer treatment in terms of simple, geometric, and repetitive motifs (Faruq, 2017). However, the results obtained still need to be further developed so that they can be applied into fashion products. In this study the authors carried out the application of the results of the kawung motif experiment with 3D printer techniques on fashion products, namely in the form of bags and accessories. The software used in making the product form is Autodesk Fusion 360.

3 LITERATURE and THEORY

3.1 Rapid Prototyping

Rapid Prototyping (RP) can be defined as the methods used to construct a prototype model from starting part of a product or assembly quickly using three-dimensional Computer Aided Design (CAD)

data. Rapid Prototyping allows the visualization of a three-dimensional image into a native three-dimensional object that has volume. Some of the current Rapid Prototyping methods are: (Djoko Kuswanto, 2017)

1. Stereolithography (SLA)
2. Direct Light Processing (DLP)
3. Continuous DLP (CDLP)
4. Selective Laser Sintering (SLS)
5. Both Selective Laser Melting (SLM) and Direct Metal Laser Sintering (DMLS)
6. Electron Beam Melting (EBM)
7. Multi Jet Fusion (MJF)
8. Fused Deposition Modeling (FDM)

An inexpensive and often used technique is the so-called fused deposition modelling (FDM) firstly established by Stratasys (Redwood, 2018), in which a thermoplastic polymer is molten in an extruder nozzle, and the fluid material is deposited on the printing bed line by line, building the first layer of the planned object. After finishing the first layer, the printing bed is lowered, and the next layer is printed on top of it until the highest layer of the object is finished (C. K. Chua, 2010). The materials used for printing with the FDM technology are, e.g., ABS (Acrylonitrile butadiene styrene), PLA (polylactic acid) and several others with diverse physical and chemical properties.

3.2 Indonesian Decorative Pattern

(Kawung Pattern)

Decorative variety is one form of art that is very attached to the identity of the Indonesian nation. Various kinds of decorations can be found in Indonesia, whether in batik cloth, woven fabric, songket, temple, and praying place. Types of decoration are generally classified into 4 parts, namely geometric, flora, fauna, and figurative. Kawung motif is included in Indonesian geometric Pattern. The following are the types of kawung motives and their pattern elements: (Sarwono, 2005)

1. Kawung Sari

The main ornaments are oval-shaped spheres, and on each part of the kawung pattern are given a line that divides into two parts as if they resemble the shape of a broken coffee fruit. This kawung pattern is often also referred to as Kawung Kopi.

2. Kawung Sekar Ageng

The main ornament is in the form of four oval spheres that have changed into a square or square shape. In each main ornament there are three lines (sawut) and three points (cecek).

3. Kawung Sen

The main ornament in the form of four oval spheres composed by the main is arranged in the direction of a diagonal oblique angle as if the kawung pattern is limited by curved lines.

4. Kawung Pecis

The main ornaments are oval spheres, and are smaller in size compared to the main ornaments in Kawung Sen and the batik pattern in Kawung Pecis are rather oval square. The pattern of Kawung Pecis consists of two dots (cecek) contained in the main ornament.

5. Kawung Beton

The shape of the ornament on this motif is very large, and somewhat rounded, but still in an oval shape. Isen motif found in the main ornament in the form of cecek (dots) with a large size and in the middle there is a small circle shape. The shape of this circle

divides into four parts as if the main ornament is crossed.

6. Kawung Semar

The main ornament is in the form of four oval spheres with a large size as in concrete Kawung, but inside the main ornament is a smaller oval shape. Isen pattern on Kawung Semar consists of the form of cecek (dots) found in the circle inside the Kawungan sphere. In the middle of the main ornament is a rhombus-shaped motif that is filled with cecek (dots) and several circular shaped dots.

7. Kawung Buntal

The main ornaments in the form of a mixture from Kawung Pecis are combined with floral pattern. The flower pattern found in the Kawung Puffer are in the form of kenikir flowers, so the shape of the mixture of motifs is characteristic of the pattern of Kawung Buntal. Isen batik motif in Kawung Buntal consists of a small oval round shape which is divided into two parts placed in its main ornament, and a small, medium and rather large rhombus shape placed in the middle of the main ornament.

8. Kawung Kembang

The main ornament in the form of four oval spheres is made to resemble the shape of a flower (flower), so this motif is called Kawung Kembang.

9. Kawung Seling

The main ornament in the shape is almost the same as the Flower Kawung, which is an oval shape interspersed with flower shapes. But the size and variation of the flowers are not the same and made with striking color differences.

3.3 Fashion Product

Fashion is a vast and diverse industry that offers products consumed by everyone. Products used as a purpose to beautify themselves. Fashion products themselves are included in tertiary needs where objects do not have to be bought in a short time. Some common types of fashion products are bags and accessories.

4 METHOD

4.1 Observation

Observation methods are used to find out, obtain, and collect data by visiting sources directly. The results obtained are in the form of photos, video recordings, notes, etc. To find out the types of existing filament material characters, observations were made by visiting and observing intensely the research in the laboratory, ITS design, Kota Surabaya, East Java.

4.2 Study of the Similar Product's

Collecting data about similar products that are already on the market (already available), is an analysis process in designing. From this analysis arises a variety of needs and problems, and then developed again so that it can find solutions and needs of existing problems. We find solutions and needs of existing problems.

4.3 Analysis of Artifact

Identify users in assessing a fashion product based on 3 elements, namely behavioral, visceral and reflective to identify user decisions in buying an item, habits of users in using goods, knowing the impression of users of a product, knowing the tastes of users in terms of appearance of a product

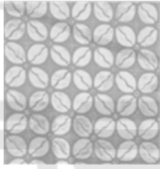
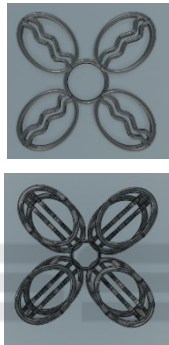

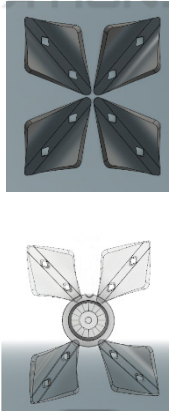
4.4 Design Development


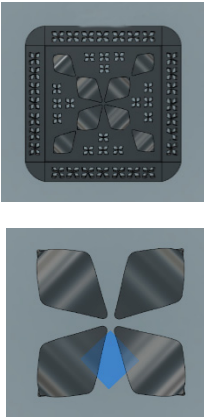
Used to find ideas, solutions in the form of images of bag and accessories products in two or three dimensions along with their shape, operation and size.

5 EXPERIMENTS

We conducted our experiments into three categories: motive stylation experiments, motive composition experiments, and experiments with rigid 3D printer techniques. In making 3D objects, Autodesk Fusion 360 author use software. Then the 3D object file that has been exported into the STL file format and imported software to make the printing process settings. 3d printer machine used manifold FDM with brand Anycubic I3 Mega 3D Printing. In this experiment use PLA filaments due to engine limitations. This printer's settings of 3D machine is a temperature of 195 ° C and the printing bed temperature to 50 ° C. The layer height was 0.2 mm.

Table 1: Stylation of Kawung Pattern.

Kawung Pattern	Stylation
1. Kawung Sari or Kawung Kopi 	
2. Kawung Pecis 	

Kawung Pattern	Stylation
<p>3. Kawung Kembang</p> 	

For the second experimental process, which is the experiment of composition of patterns, it is done by combining the modules that have been distilled beforehand.

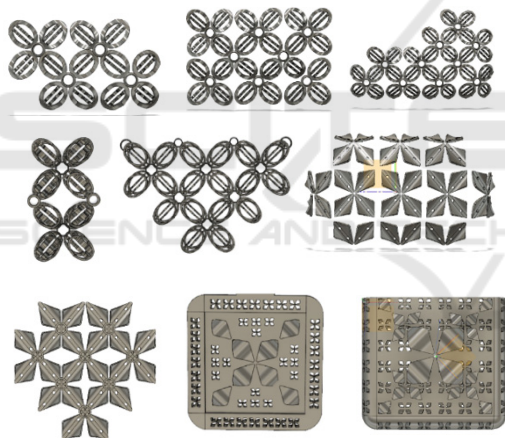


Figure 1: Experiments pattern composition.

The third experimental process is a rigid 3D printing technique. This experiment aims to determine the extent to which the kawung pattern can be explored in a rigid form so that it can be applied as a structure to accessories and bags products

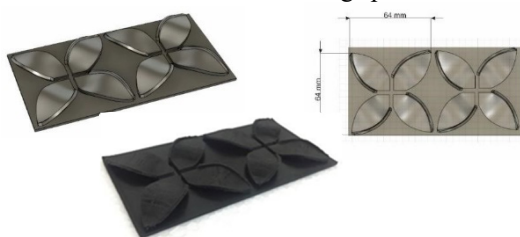


Figure 2: First trial of rigid 3D printing experiment.

In this first experiment of rigid form there were several forms which almost broke because the thickness of the motif was still very thin, but in terms of the overall results of the Kawung motif it was quite good and neat. So that to apply this motif to the product, the motif must have sufficient thickness.

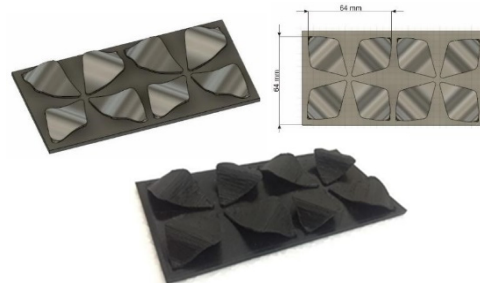


Figure 3: Second trial of rigid 3D printing experiment.

In the second experiment of rigid form, the overall results of the 3D kawung motif are quite good and neat and can be used as recommendations to be applied to the product.



Figure 4: Third trial of rigid 3D printing experiment.









In the third experiment of rigid form, the overall results of the 3D kawung motif are quite good and neat and can be used as recommendations to be applied to the product.



Figure 5: Fourth trial of rigid 3D printing experiment.

In the last experiment the overall results of the 3D kawung motif are quite good and neat.

Table 1: Experiments of 3D Printer Techniques with Rigid Forms Comparative.

	Trial 1	Trial 2	Trial 3	Trial 4
Pattern				
Photo of experimental results				
Result	There are several broken shapes	The overall results from the 3D kawung motif are quite good and neat	The overall results from the 3D kawung motif are quite good and neat	The overall results from the 3D kawung motif are quite good and neat

After doing a few experiments, then I made a comparison of the experiment like the table above. Of the four rigid 3D printer techniques, the most competent to be applied to bags and accessories are the second, third, and fourth experiments.

The next stage after the experiment process, applying the motif to the bag product with the type of bag in the form of clutch and sling bag, then applying the motif to the accessories product with the type of accessories in the form of earrings and necklaces.

In the process of slicing a 3D printer on a bag product using a 0.12 mm layer height, using tree support because it can produce a neat design, using Infill 75% because it produces a design that is not easily broken, uses a melt filament temperature of 195 degrees Celsius, and uses a 100 mm speed setting / s serves to adjust the speed of the 3D printer while operating

In the process of slicing a 3D printer on accessories products using a 0.1 mm layer height, not using support because it can produce a neat design, using infill 75% because it produces a design that is not heavy, uses a 195 degree celsius melt temperature and uses a speed setting of 30 mm/s function to adjust the speed of the 3D printer when operating.



Figure 6: Final Product series 1.



Figure 7: Final Product series 2.



Figure 8: Final Product series 3.

Here are the final results of bags and accessories making based on 3D Printing Technology.

6 CONCLUSION

The use of PLA filament material with 3D printer techniques can be applied to accessories and bag products with the aim of introducing techniques and providing alternative materials to the community. In previous experiments it was found that Indonesian decorative pattern that can be applied to 3D printer techniques are Kawung's patterns because the form is easily modified by 3D printing treatment in terms of simple, geometric, and repetitive patterns. Kawung's pattern experiment is quite interesting. But it requires a detailed process because of the unusual use of techniques and materials in the production process of making bags and accessories. Then some treatment is needed for the process of 3D printer slicing, and some standardization so that the product has a selling value that is equivalent to the materials and techniques that are often used in the production of bags and accessories.

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