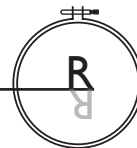


REVERSE THE ROLE.
REVERSE YOUR MIND.



POLITECNICO
MILANO 1863

Final Thesis
by Bokyung Jeong



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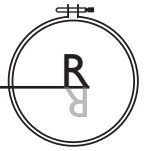
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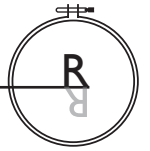
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I. INTRODUCTION

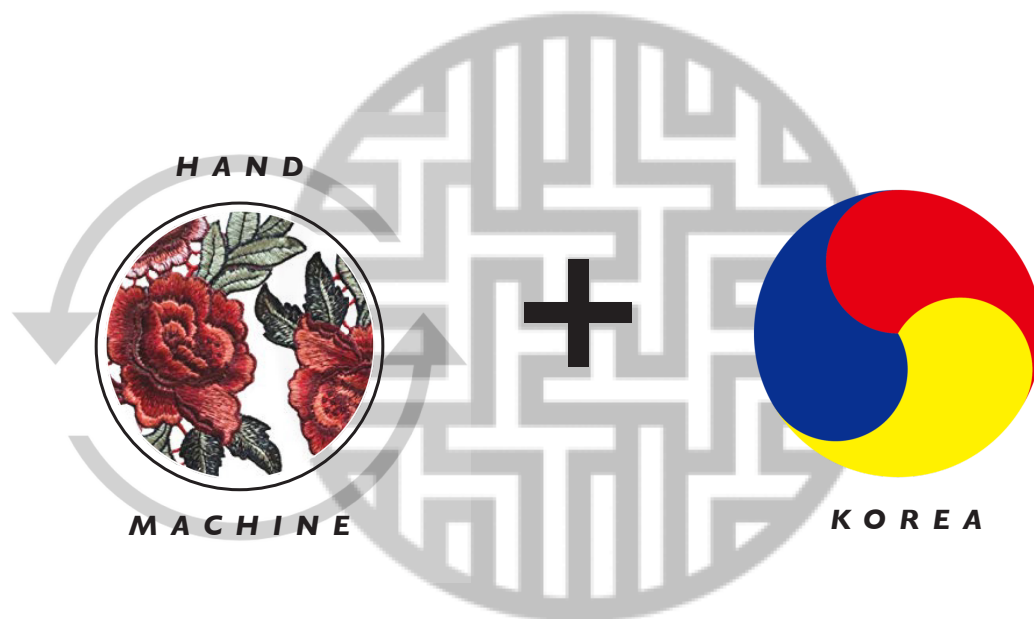
:Breif explanation about the concept of the final thesis "REVERSE".

I. "REVERSE" project fused with Korean aesthetics

Project "REVERSE" started from reversing the role of 'hand embroidery' and 'machine-made fabric' to crack out from the conventional role of embroidery. Combining one of the most newest technique of accessory production -3D printing, and the most conventional technique of decoration -hand embroidery, REVERSE can open up a new looking, a new aesthetic that was never seen before.

The hand embroidery is being replaced with 3D printing with texture in monotone, giving a realistic look with 3D modeling, while the base of the embroidery_ fabric can be hand weaved or hand crafted with multiple colors.

As hand embroidery is part of Korean culture starting from the ancient times, there are lot of patterns, motifs, hand embroidery techniques that has been developed and preserved from the past.



Especially, 'Jogakbo' is one of the most well-known hand crafted patchwork which is still being preserved in Korea. And 'Sagunja', so called 'The Four Gentlemen' is the motif that was often used as a pattern for hand embroidery.

These Korean elements are softly melted into the project "REVERSE" and developed as brand "REVERSE" to be loved world wide and to introduce the aesthetics of Korean art and traditions.



2. RESEARCH

[2] RESEARCH



:Research about the historical background of Korean hand embroidery and how 3D printing has developed in fashion.

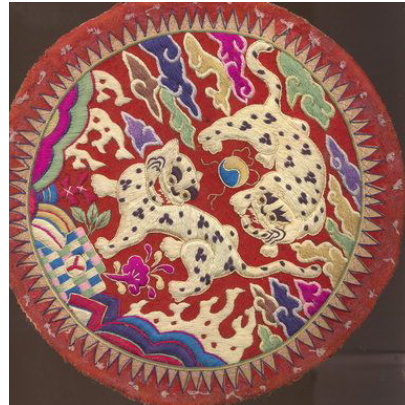
[2-1] History of Korean hand embroidery

Embroidery started from the human desire to decorate clothes and to give beauty to every day life; the aim was not on practical reasons but rather for aesthetics. It developed as a way not only to express beauty but also to symbolize social status or rank and further to express human desire and wishes.

Traditional embroidery of Korea has a long history and each kingdom had developed different characteristics of how they expressed

the aesthetics of Korea. Traditional Korean embroidery mainly used silk cloth and thread for loyal families and later developed to become daily when it spread to common people in Chosun dynasty.

What differs Korean embroidery from other countries is that it has sense of humor and coziness inside the embroidery. And that not only as a way to decorate garments, but widened the scope of embroidery to daily supplies; such as adding small embroidery to sewing box to cultivate beauty in every corner of life.



[a] Samgukside (Three Kingdoms Period)

Samgukside (3 kingdoms are Goguryeo, Baekjae, Shilla) is the period when the Korean traditional embroidery formed. Because there are no embroidery artifacts left in current times, we can assume by the wall paintings and old books that the embroideries of this age was based on nature and geometrical patterns.

In the Samguk-sagi and Samguk-yusa (both old books), the Shilla dynasty sent "Taipyong-Song" which is an embroidery produced as a diplomatic gift, to Chinese Tang dynasty. "Taipyong-Song" is a masterpiece with 100 Chinese characters embroidered, which are the letters used for rituals that praised Korean king-Gojong's dignity.

Starting from Samgukside, social class was divided according to power and wealth. The royals and aristocrats were willing to show off their status through clothing, and thus, embroidery was developed in clothing in a luxurious way. The method and motifs of the embroidery were developed to strengthen the sophisticated style of the loyalties.

[b] Unified Shilla Period

Three Kingdoms were unified and their cultural characteristics were fused and gathered and became the glorious golden age of culture. Embroidery was also developed both quantitatively and qualitatively. But there are no existing artifacts left up till today, but at the "Samguksagi" which is an old book, it mentions that the embroidery was used to decorate from cloths to saddle, and daily necessities, and Buddhist embroidery has also prospered.

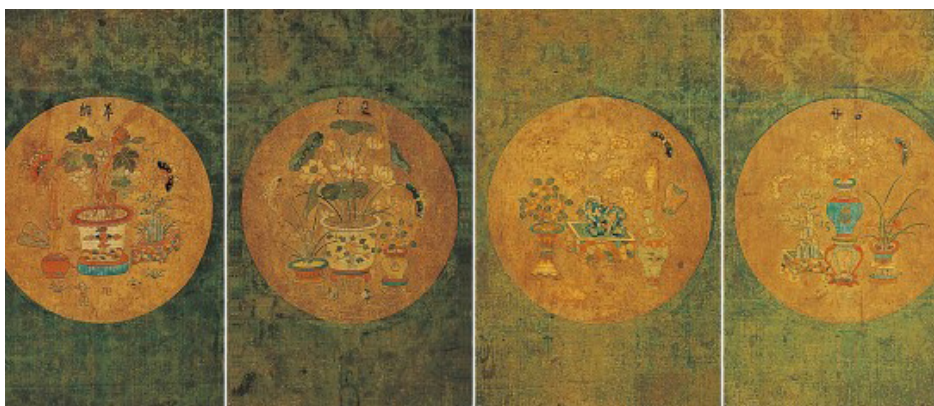
In this era, costume ban was issued and stipulated the kind of use of fabric according to the status. This ban was enforced, and it can be seen that the demand for fine fabrics and embroidery was considerable due to the luxury that was prevalent in the noble society.

On the other hand, many workshops dedicated to weaving, dyeing, and sewing had existed in this period, contributing to the development of textile arts.

[c] Goryeo Period

Embroidery has evolved more in Goryeo as the country established a bureaucratic office and manual book to produce various cloths and hand-crafts. As Buddhism was the national religion, Buddhism embroidery was developed in this period. And just like the Unified Shilla Period, luxurious culture was spread within noble and royal which left extravagant embroideries using gold and silk, decorated with jades as per records and old books which exist nowadays.

But due to the frequent war, there are only few artifacts left from this era, and one of them is "Sagaebungyeongdo" (which is a folding screen) which shows that Goryeo embroidery had been developed as a art piece itself, only to be displayed; which was unlike the previous periods where embroidery was mainly used to decorate clothes not as a separate art piece to be appreciated.



"Sagaebungyeongdo" of Goryeo Period

[d] Joseon Dynasty

In Joseon Dynasty, national religion was changed to Confucianism which pursued honest poverty; it controlled the extravagant culture of the previous eras, and developed comparably simple and refined culture.

The most noticeable feature of embroidery of Joseon dynasty is that the handicrafts usage was spread to general level. Thus, there were 2 kinds of embroidery; one is royal palace embroidery and the other is common people's embroidery. In royal palaces, ladies were trained inside the court, and skilled ladies belonging to the court made the embroidery expressions more precise and sophisticated with strict forms. Especially due to the "Hyungbae" rule (motif sewed in the stomach of the palace costume symbolizes the rank inside the palace), the ladies in the court had to sew with skills.



Example of Palace costume with embroidery on the stomach ("Hyungbae" rule)

Common people's skills were not as good as those inside the palace, but the type and the content of the embroidery were more interesting as they can sew with their taste.

[e] Modern times

After Joseon Dynasty, Korea was conquered by Japan and due to the Japanese education made at schools, Korean embroidery became more like Japanese thread colors becoming less close to primary colors, and the stitch techniques changed to Japanese styles. But luckily, traditional Korean embroidery was being taught from grandmothers to the young generation at home.

Korea got independence after 30 years of conquer, but second crisis came as the western culture was flowing in, and the Korean embroidery got rapidly influenced by the French embroidery. After the 70's Korean people started to be aware of the importance of traditional embroidery and started to preserve and develop the Korean traditional embroidery in modern ways.

[2-2] Types of Korean hand embroidery

There are mainly 4 types of Korean hand embroidery; Bokshik Jasu, Saenghwal Jasu, Gamsang Jasu, Buddhist Jasu.

[a] Bokshik Jasu - embroidery on clothes

Based on the Jasu of Joseon dynasty, Bokshik Jasu was divided into 2 kinds; Embroidery for Royal costumes, formal dresses for nobles and the other is Embroidery for common people's clothes.



Example of "Hwal-ot" in Chosun dynasty

Hwal-ot is one example of embroidery of noble classes, which was worn on wedding days. Mainly mix of flower motifs were sewed on silk and cranes and pheonix were also one of the most used motifs. As it was worn by the noble class, the embroidery was very sophisticated and refined with high techniques. Other than Hwal-ot, patch embroidery pieces with tigers, cranes, wild goose, peacock

and mythical unicorn lion of Korea - Haetae was worn on the stomach as a costume for those working inside the palace.

[b] Saenghwal Jasu - embroidery on accessories and daily supplies

Not only on clothes, but also on the small accessories to go with the clothes were decorated with embroidery such as hats, korean socks -Beoseon, shoes, hair band -Daenggi, decorated string -Norigae and etc.

For daily supplies as pillows, cushions, wrapping clothes -Bojagi, spoon case and etc were decorated with embroideries. The motifs used for embroidery varied according to the class of the user and the meaning they wanted to add to the daily items. For example, for men's pillow, pine trees, tigers and bamboo were sewed, while for women's pillow, mainly flowers and butterflies were sewed.



Example of "Norigae"

[c] Gamsang Jasu - Embroidery to be displayed

Starting from Goryeo period, embroidery was displayed such as a picture and was appreciated by itself. The motifs used for embroidery was almost the same as those used for paintings. The most famous form of Gamsang Jasu can be found on the folding screens such as "Chochungdo". The techniques and colors used for embroidery was as delicate as the paintings.



"Chochungdo"

[e] Buddhist Jasu - Embroidery related to Buddhism

Embroidery related to Buddhism was done based on the longing to god. More than other embroideries, it was done with care and sincerity with sophistication. Mainly the Buddhist Jasu can be found as embroidery on book covers, cloth to cover Buddhist scriptures, Bun - type of flag to symbolize Buddah's virtue and sedan chair.



Example of "Bun" of Sorim temple

[2-3] Korean embroidery patterns

Korean art crafts and daily supplies mainly used patterns around our daily life or motifs related to human desire; to live long, to become rich, to give birth and etc.

The patterns used in Korean embroidery can be divided into 8 types; nature, plants, animals, mythical creatures, fish, Chinese characters with good meanings, geometrical patterns and human.

1) Nature: Common surroundings such as the sun, clouds, waves which was an important factor in agriculture life in the past.

2) Plants: Lotus and peony was frequently used, and "Sagunja" motif such as the bamaboo, chrysanthemum, Japanese apricot flower, orchid.

3) Animals: Crane, deer, turtle were the 3 best animals as they symbolize long life in Taoism. It shows the human desire to live long with out sickness.



Pillow case with Pheonix

4) Mythical creatures: Pheonix and dragons. Dragons symbolize the king and was used as the motif on king's costumes and belongings. Pheonix was considered to be the head of the birds and has wiseness to foresee the future.

5) Fish: The most wanted fish pattern was carp. In Goryeo period, people believed that sewing 2 fish together will make the couple harmony together.

6) Chinese charaters with good meanings: Sewed Chinese charaters meaning happiness, long life, luck, wealth, peace, honor and etc.

7) Geometrical patterns: Patterns inspired from the window frames, and door frames were used.

8) Human: Taoist hermit, beautiful woman, cultural landscape with human was used as embroidery patterns. For example , in "Ho-ryeop-do", people who are hunting are described.



"Ho-ryeop-do"

[a] "The Four Gentlemen"

Out of the patterns listed, "Sagunja" - also known as "The Four Gentlemen" is one of the most famous motifs; The Four Gentlemen is a term referring to four plants: the plum blossom, the orchid, the bamboo, and the chrysanthemum. They are most typically depicted in traditional ink and wash painting categorized in the bird-and-flower painting in East Asian countries.

The Four Gentlemen represent the four different seasons (the plum blossom for winter, the orchid for spring, the bamboo for summer, and the chrysanthemum for autumn), the four are used to depict the unfolding of the seasons through the year. The term compares the four plants to Confucian gentlemen. In Korea, they especially refer to the noble mindedness and purity of scholars who does not change their convictions easily; those with noble character, high virtue and learning were often compared to the four gentlemen. Each plant has different metaphor according to the characteristics of the plant.



"Sagunja"

Plum blossom blooms in the most early spring in the cold weather. It blooms among the snow and notes that the spring is coming; metaphor for integrity and fidelity of the scholars who have strong beliefs that does not change in hardship.

Orchid spreads the delicate and soft scent gently and far. It was considered that the soft scent which lasts long has power to edify people gently. The flower of orchids does not bloom a lot, but even one flower has power to fill up the scent. Thus, it was known for its noble characteristics.

Chrysanthemum blooms in late autumn overcoming the cold winter weather. It was often compared to the scholars who left to the woods to keep their integrity. Bamboo stays evergreen even in the winter after all the other trees lost their leaves. It was a metaphor for those who have strong integrity and fidelity that never changes.

[2-4] 3D printing and fashion industry

3D printing, also referred as digital fabrication technology, creates the object by adding up layers of material; thus, also referred as Additive Manufacturing (AM).

3D printing is a fast-emerging technology which is spreading in wide range of industry such as artificial heart pump, steel bridge, rocket engine as well as jewelry collections and fashion clothes. The new technology of visualizing computer-aided designs (CAD) into real objects, has opened up a new stage in manufacturing industries in the aspect related to efficiency & design.

Especially in the design industry perspective, 3D printing has gave cosumers to have greater input to the final product and to manufacture to fit their specific needs or desires. Thus, the big advantage of 3D printing design product is that it can increase the creative designs with more experimental approach (as it is possible to make modified shapes without molds), and can improve the design by offering unique and peronalized products to customers. This means that new era of mass-customization is being opened with 3D printing manufacturing.

3D printing has been growing its portion in fashion industry, and still the research and development is being continued.

[2-4.1] 3D printing & fashion garments



Pangolin 3D printed dress collaborated by "ThreeASFOUR"

Since 2010, 3D printing technology has become more accessible. Due to its characteristics, it is more easily applied to rigid creations and geometrical shapes rather than flexible objects. Thus, in fashion garments, it started to be applied in

integral pieces such as the photo above, which was created by Dutch designer Iris van Herpen during the fashion show “Crystallisation” (2011) using SLS (Selective Laser Sintering) 3D printers. Giving a new look and texture to the fashion garments, it gave inspirations to new designs but due to the limitation of the existing 3D printing materials, it can not be applied to ready-to-wear section; needed more flexibility to the material. And due to the time applied to print out the integral pieces and time took to compose the garments, it seems not adoptable to everyday garments; the 3D printing technique was left for more artistic fashion garments to be shown on the runway and museums.



The birth of Venus collection by "Danit Peleg"

Stepping over the limitation of the fabrication is to utilize the mesh texture of the fabric. The representative designer is Danit Peleg, who uses FilaFlex filaments which are rubber-like filaments with more flexibility to create mesh garments since 2015, which are more wearable to everyday life; this is marked as a major step in pushing the digitalization of fashion into the next phase.



Virus by "Anastasia Ruiz" in collaboration with SCULPTEO

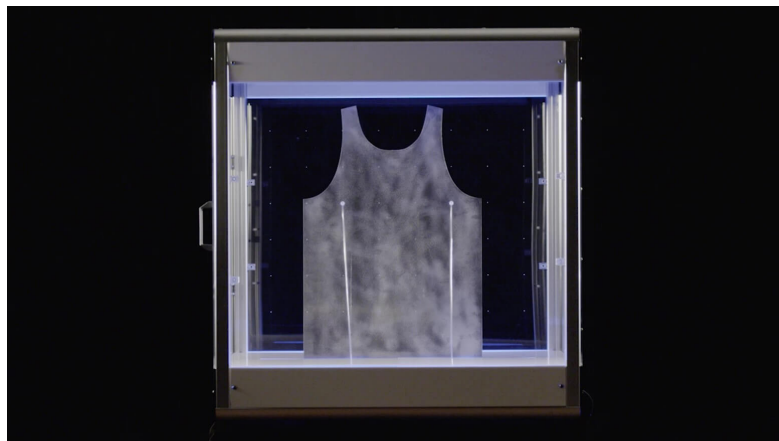
Other than mesh, 3D printing in fashion garments are used as ornaments in the garments, used as jewels. It can be added to traditional textile and also to leather goods using TPU (Thermoplastic polyurethane) or other polymers such as polyamides elements.

More than using 3D printing as garment parts, researchers in this field have developed a parametric model to translate 2D patterns into 3D data. This enabled designer Iris van Herpen to create a next level 3D printed garment using Polyjet technique; creating pieces with high quality resin with a smooth surface. It can print sheet-shaped patterns up to 0.8mm thin, giving softness. This disruptive process made the creation of Iris Van Herpen's 3D printed dress possible as per below photo.



3D printed dress by "Iris Van Herpen"

Most recently, Tamicare company has been invented cosyflex fabric, which produces textiles by composing materials in a speedy additive manufacturing process; using 3D printing to create textiles. With the baseplate shaped in T-shirt, the materials are precisely deposited layer by layer in fast speed, eliminating the traditional process of garment production; no cutting, no dyeing needed. By fast layering of water-based polymers and real textile fibers, the fabric needs a few more curing and finishing steps to become a finished product. This 3D printing fabrication may give an alternative solution to eco-friendly garment as it may use recycled fibers and polymers, and cuts down the polluting process in garment production; dyeing, washing and etc.



Textile 3D printed by "Electroloom"

[2-4.2] 3D printing & fashion accessories



3D printed bracelet, collaboration of VOJD STUDIOS and LOEWE

3D printing has been used in accessory production as a whole or in parts of the product. Especially it is used variously in costume jewelry as the artificial looking of the 3D printing materials fits the design of costume jewelries. There has been an eye-catching progress in the luxury field; luxury brands collaborating with a 3D printing company VOJD, who is collaborating with luxury fashion brands such as Kenzo, Acne Studios, Louis Vuitton, Loewe and other brands. They are integrating 3D printing techniques into the runway collection by adding 3D printed accessories, jewelry in experimental shape, structure and texture; building a synergy between luxury and progression, it combines the latest technological innovations with traditional quality craftsmanship to redefine the way we think about design and introduce a new aesthetic to the luxury fashion industry.



Acne studio bag in 3D printing

Not only costume jewelry, 3D printing is used in mainly 2 ways in jewelry. One is prototyping and the other is direct production.

In prototyping, it is used to create molds for complex and technical parts of the jewelry pieces as it can save time and cost. Brands such as Cartier and Goossens are using 3D printing for prototyping.

In Direct production, through computer-generated images of 3D modeling, customers can fix the design together with the brand and upon customer's choice it can lead to the

production. It can create a customized jewelry in low cost in a simple and quick way. Upon customer's choice or designer's intend, various 3D printing material can be applied to manufacture a 3D printed jewelry; from polymers to metals, and polymers to be plated with metal finishings and etc. The pros of direct production is that complex designs can be achieved easily without traditional craftsmanship; reducing cost for highly complicated designs and has gave more opportunity for customers to be involved in the design process. Also for the designers, it opened up a range of new designs that can be 3D modeled in the computer and which can be realized by the 3D printing in a fast speed.

In leather goods such as bags and wallets, 3D printing can be used to make metal parts of the goods by using metal binder jetting to print stainless steel at a reduced cost. Especially for those with complex designs and textures, 3D printing can help to reduce cost and increase efficiency as it only uses necessary materials without waste, and can be visioned in the computer modeling before production.



3D printed bag by "XYZ BAG"

Not only as a part of the bag, but as a whole piece, XYZ Bag has commercialized 3D printed handbags, which seems to be using SLS (Selective Laser Sintering) technique. The bags can be personalized by choosing different texts and colors for the bag and comes with a leather strap attached to the 3D printed bag.

As part of fashion accessories, watches are also utilizing the 3D printing technology in both ways; used for prototyping and also used for direct manufacturing as the jewelry industry applies the 3D printing. An example is Panerai's Lo Scienziato Luminor 1950 Tourbillon GMT Titanio which case is 3D printed, through the Direct Metal Laser Sintering technique (DMLS). Also the machinery parts of the watch are developed in 3D printing with precise numerical control which watch makers need.



3D printed watch case by "Panerai"

[2-4.3] 3D printing & footwear



Futurecraft 4D shoes by "Adidas"

One of the most widely used 3D printing technology in fashion industry is in footwear, where sneaker brands like Nike, Adidas, New Balance and Reebok applied 3D printing to make the prototypes faster but also to mass customize the shoes.

Mostly 3D printing footwear refers

to applying the technique to the midsoles inside the shoes. Adidas Futurecraft 4D sneakers used midsoles 3D printed with increased lattice density which provides support and cushioning and comfort. Using carbon DLS (Digital Light Synthesis) printing technique collaborated with the Carbon company, Adidas developed unique elastomer lattice structure for the midsole. With UV curable resin and polyurethane (liquid resin), DLS uses digital light projection to form the final product.

The innovative point is that it has overcome the limits of previous manufacturing process; traditional methods cannot achieve complex, high-performance monolithic designs as fast and precisely as the 3D printing. And it reduces the time and cost for molding, and



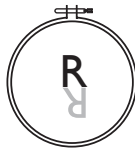
Adidas Futurecraft 4D sole's printing process in DLS

allows the designers to freely design multiple parts to create varying performance zones within a single midsole.

Not only in the performance footwear is 3D printing being developed, but also in fashion shoes as the example of Ganit Goldstein.



3D printed fashion shoes by "Ganit Goldsteini"



3.MATERIALS & TECHNIQUES

[3] MATERIALS & TECHNIQUES

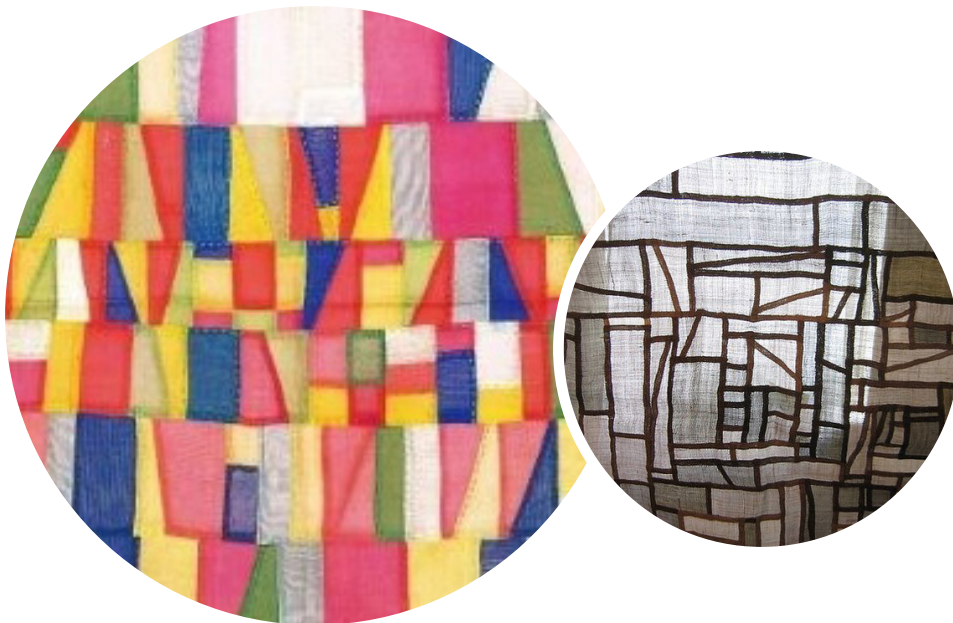


:Research about Korean traditional hand craft materials and 3D printing techniques which will be used for the project "REVERSE".

[3-1] Materials

[3-1.1] Handcrafted fabric & "Jogakbo"

Handcrafted (woven) fabric such as silk, hemp, ramie cloth, cotton are the most common fabric used for handcrafted items in Korea. Hemp and ramie were used mainly for summer cloths and was colored with natural dyeing to achieve mild and natural colors. As these hand weaved fabrics were mainly used for Korean traditional clothes, it naturally became the common base fabric for Korean embroidery.



'Jogakbo' is one of the most well-known hand craft works still being utilized nowadays as Korean traditional craft. It started from using the left over fabrics from making clothes to make 'Bojagi' which is a wrapping cloth/ bag to cover various objects.

The beauty of Jogakbo is the irregular patterns made by borders of seams after stitching the cloth pieces together; every piece of Jogakbo has different patterns and color combination according to the taste of the sewer. And by combining different pieces of colors, or different shades of colors which are dyed in different lots, the Jogakbo can be very colorful or in monotone with gradation. Also when materials such as hemp or ramie is used, the transparency of the seam gives random geometrical lines.

Nowadays, Jogakbo is more considered as an artpiece as itself rather than embroidery for practical daily items.

[3-1.2] 3D printing materials

[a] PLA - Poly-Lactic Acid



PLA is one of the most-used 3D printing materials as it is very versatile and does not have warping. Also it is low price as it is made from renewable sources like sugar cane. But the melting point is low which is not adequate for high heat prototypes. And as it is quite fragile, it is not appropriate for those that need high resilience.

[b] ABS - Acrylonitrile Butadiene Styrene

ABS is affordable, lightweight and strong and comes in wide range of colors. Together with PLA, ABS is the second main plastic material used for 3D printing. It has higher melting point than PLA, and more durable compared to PLA. More adequate for adding other techniques such as painting, polishing and sanding as it cracks less. Good example are the LEGO bricks.



[c] Nylon (Polyamide)

Known as "white plastic", nylon is flexible and strong that can be used from engineering to arts. Nylon 3D prints have rough surface that can be smoothed after polishing. As it has strong bonding between the layers, it is ideal for items that require good tensile and mechanical strength. But nylon prints are weak to moisture as it has tendency to absorb moisture.

[d] PET & PETG (Polyethylene Terephthalate/ Glycol)



PET is strong and flexible as ABS and it does not emit odorous fumes when melted. It is what water bottles are made of, which tells that this material is food safe. It has a glossy finish after being printed which makes this material popular.

PETG is a variant of PET which has high transparency; it is PET combined with glycol. It is also food safe material and is preferred as it can be printed in lower temperature which makes the printing speed higher.

[e] ASA - Acrylonitrile Styrene Acrylate

ASA is a thermoplastic which is highly resistant to high temperature and UV rays with good mechanical strength. So it is used commonly in outdoor applications and automotive industry. But it is pricey and gives out fumes that are harmful to health.

[f] PVA - Polyvinyl Alcohol

It is commonly used as support material as it's soft and biodegradable. The most strong characteristics of PVA is that it dissolves completely in warm water without chemicals.

[g] HIPS - High Impact Polystyrene



Together with PVA, it is commonly used as support structures. Unlike PVA, it is water resistant but dissolves in chemical Limonene. But HIPS itself is also very durable which can resist high impacts.

[3-1.3] 3D printing materials in jewelry

3D printing has opened up a new sector in jewelry design; various designs such as geometrical or structural, can be obtained with delicate 3D modeling. The sophisticated jewelry production work done with craftsmanship can be replaced with the 3D printing with lower cost -of course depending on the 3D printing material.

Rather than placing more time on production for complicated jewelry designs, jewelry designers can concentrate more on the concept and 3D modeling for better designs. And as 3D printing techniques can cover various designs with complex structures, it gives more ideas to jewelry designers with no limits. Due to the positive sides of 3D printing, new range of jewelry are nowadays seen in the jewelry industry with affordable price as complex designs can be mass produced without skilled craftmanships.

[a] Plastic type material

Most used material for jewelry making is plastic based materials such as PLA & nylon (polyamide). For nylon, as it is light weight and has strong mechanical strength, it is ideal for jewelry. And as it is also flexible, it may give comfort to the wearer.

As 3D printed nylon objects have rough surface, it can be left as natural texture depending on the jewelry design, or can be finished more smoothly with polishing or adding glaze depending on the design intentions.



Bracelet made in black nylon



Bracelet made in white nylon



Ring made in black nylon

Also PLA is often used for jewelry as it is versatile and affordable. The strong point about plastic based material is that the color is versatile and can achieve the desired color easily as plastic base filaments can realize the colors very well.



Ring made in PLA

[b] Metal type material

Various metallic materials are used for 3D printing; in both ways as Direct printing and indirect printing.

For Direct printing, most metallic materials are 3D printed in powder form, being melted according to the 3D modeling data by laser.

Titanium can be 3D printed by using titanium alloy powder being sintered together by a laser; it can achieve matte surface finishing and is strong to corrosion comparably and is light weight. Also stainless steel are also used in 3D printed jewelry using



Ring made in 14K gold



Ring made in titanium



Ring made in stainless steel

stainless steel powder.

Other than direct 3D printing of metal jewelry, 3D printing can be indirectly used for making jewelry with precious metals; 3D printing Lost wax casting. This technique prints the desired design in wax to make the mold and pour the metal into the mold to get the final product. Well-known metals such as gold, sterling silver, brass, bronze and etc can be managed with this technique and could reduce the risk and time of prototyping and mass production.

[c] Mixture of materials

3D printed jewelry can have various looking by plating other material on the 3D printed jewelry. Commonly, gold or silver coating can be done; brass combined with gold plating, stainless steel plated with gold, bronze plated with gold or resin coated with silver and etc.

The robust metal contains up to 40% bronze. 23,5k gold plated after printing.



Bracelet in bronze plated with 24k gold



Bracelet in recycled wood and polymer

Other than coating, mixture of 3D printing base materials can be done experimentally. An example can be found such as mixture of more than 50% recycled wood with a binding polymer.

With the development of 3D printing skills, more combinations can be expected to widen the range of 3D printing jewelry.

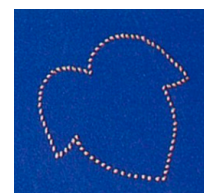
[3-2] Techniques

[3-2.1] Korean embroidery techniques

From the past, the main thread used is made from silk which used to be winded with the spinning wheel. Traditional Korean embroidery uses threads which are twisted. So the embroiderers may look rough and rigid to those which use untwisted threads, but has a sense of dignity.

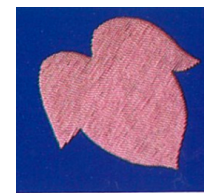
[a] Types of embroidery techniques

1) Jeom-su: Technique to express small dots. It can be used to fill the whole face or just the outline. The effect differs from the thickness of the thread used and the tension when stitch is done.



"Jeom-su"

2) Eueum-su: Basic technique to express a line which is similar to the "outline stitch" of western embroidery. By the way stitch is overlapped, it can have different looking.

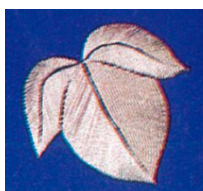


"Pyeong-su"

3) Pyeong-su: Technique to stitch without spaces. The face and the back of the embroidery looks the same. By the direction the stitch is done, it can be categorized as horizontal, vertical or diagonal.

4) Garyeum-su: Most commonly used for stitching small leaves or leaves which has separated parts like maple tree leaves. When expressing garyeum-su, the stitch should be done in 25-30 degree slanted to make the surface look smooth.

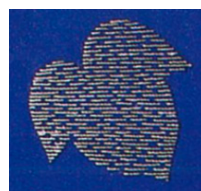
5) Jaryeon-su: Used for expressing the embroidery motifs more realistic; such as giving gradation in one motif or expressing the change of colors by using various colored threads. The length of the stitch can be regular and irregular.



"Garyeum-su"



"Jaryeon-su"



"Gwan-su"

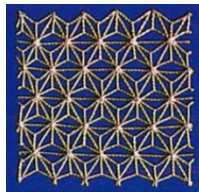


"Muneumok-su"

6) Gwan-su: Embroidery technique to stitch in horizontal with regular space. As it gives soft mood to the motif, it is used for motifs such as the cloud, waves or for outlining.

7) Muneumok-su: Technique to stitch regularly following the texture of the grain to create a pattern. It is a unique technique of Korean embroidery. It gives different impression from each sides and different brightness.

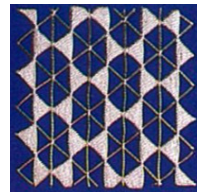
8) Samnip-su: Shaped continuously as the Japanese cedar tree leaves, it is a technique unique in Korean embroidery.



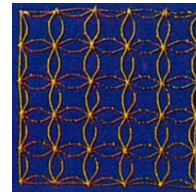
"Samnip-su"



"Solnip-su"



"Byeolmuneu-su"



"Chilbo-su"

9) Solnip-su: Technique used for expressing Pine tree leaves which is shaped as a cone in 45 degrees.

10) Byeolmuneu-su: Embroidery which is shaped as stars; each stitch is short and textured, so it is adequate for embroidery on clothes. It is was often used for clothes in Joseon dynasty.

11) Chilbo-su: Mixture of Pyeong-su and coaching stitch to express geometrical patterns. It is a unique technique of Korean embroidery, normally using gold, silver threads.



Korean embroidery piece mainly using "Jaryeon-su"

[3-2.2] 3D printing techniques

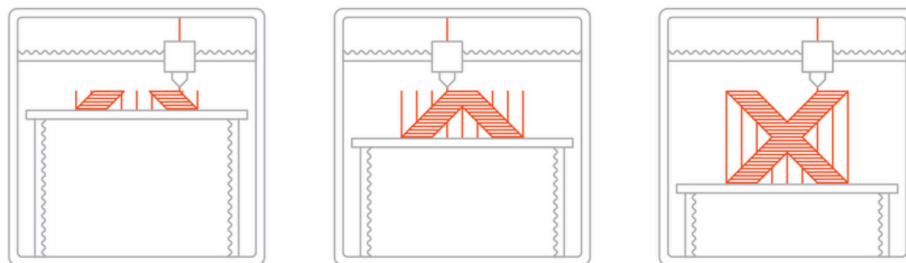
3D printing creates the object by adding up layers of material; thus, also referred as Additive manufacturing (AM). ISO/ASTM 52900 standard, which was created in 2015, aims to standardize all terminology and classify each of the different types of 3D printer.

[a] FDM - Fused Deposition Modeling

Method using material extrusion where a filament of solid thermoplastic is pushed through a heated nozzle and melted. Also referred as FFF (Fused Filament Fabrication), the printer moves the extrusion head according to the specified coordinates



building up the molten material onto the build plate where the material is cooled and solidified. When one layer is complete, it proceeds to lay down another layer and continuously building layer upon layer. Depending on the object, may need support material that can later be removed. After printing with supports, the supports need



to be removed together with the excess plastic with fingers or cutting tools.

The precision and smoothness of the 3D printed object depends on the nozzle size and precision of the extruder movements. Also it is influenced by other factors such as warping, misalignment of layers, shrinking of lower parts.

FDM printers use mostly PLA, PETG, ABS filaments and can also use nylon, PVA, TPU and PLA blends mixed with wood, ceramics, metals and etc. One of the merit of using FDM is that the filaments are available in various colors and even some manufacturers can produce the colors by demand. And also, FDM printers can use standard filament rolls that comes in 2 sizes (diameter 1.75mm or 2.85mm) from variety of sources.

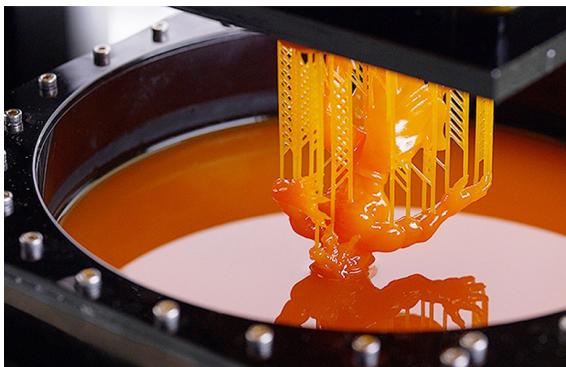
FDM 3D printing's strength is in rapid prototyping and low cost that are easy to approach as a first experience in 3D printing. FDM is more adequate for objects requiring less precision and smooth surface.



FDM printed pendant by "Cambiamente D&S"

[b] SLA - Stereolithography Apparatus

Categorized in VAT Polymerization, where a photo-polymer resin in a vat is selectively cured by a light source. SLA printer uses galvanometers (mirrors) which rapidly shoots a laser beam across a vat of resin, selectively curing and solidifying an object layer by layer. SLA printers mostly build the objects from top to bottom as the build platform lifts the object upwards out of the liquid resin.



Unlike FDM, materials used for SLA are more limited as the pallet of resin materials are limited. And also when it comes to SLA printers, some material proprietary cannot be exchanged between printers as sometimes they have highly specialized materials for industrial uses such

as dental, flexible resins and heat-resistant and etc. Not only is the resin limited for printing, but also the choice of colors; mostly comes in black, white, grey and clear resins.

SLA can produce precise and smooth objects with higher resolutions as the production is determined by spot size laser which is really small. And as the object is built from top to bottom, less force is applied to the object while being printed. And this is why SLA is more adequate for objects with fine details. One difficulty using SLA printing method is that it is hard to remove the printed object from the print platform as a large amount of resin is left on the platform. In most cases, the

sticky resin that are covering the object are removed with isopropyl alcohol.

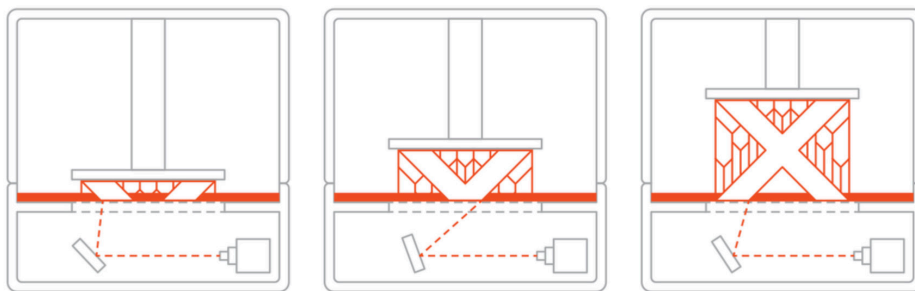
The cost of the SLA printing is comparably more expensive than FDM, as the resin tank has to be replaced, and time to time the build platform has to be replaced as it gets damaged when the printed object is removed from the platform. But due to the merit of preciseness, SLA has the most applications in industry fields such as dentistry and jewelry industry.



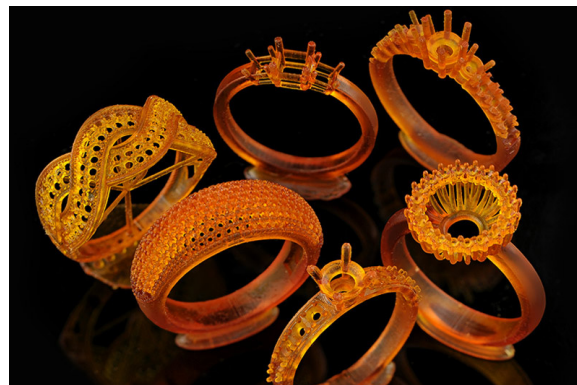
3D printed ring using SLA printed molds by "Anna Reikher"

[c] DLP - Digital Light Processing

Almost same type as SLA, but the difference is that DLP uses a digital light projector composed of pixels to flash a single image of each layer at once or multiple flashes for large parts. Thus, each layer is composed of small rectangular blocks called voxels.



Light is projected onto the resin using LED screens or UV lamps, and the light is controlled by micro mirrors called Digital Micromirror Device (DMD) which directs where the light is beamed and creates light patterns on the build surface. The pros compared to SLA is that it prints faster as the it projects the entire layer at once.



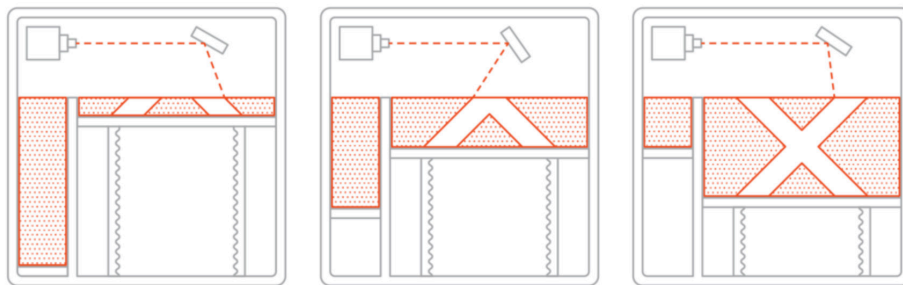
DLP 3D printed ring by "Cadjewelry"

[d] SLS - Selective Laser Sintering



SLS is a technique to create an object based on Power Bed Fusion where a thermal energy source is selectively fused between powder particles to create a solid object. A bin of polymer powder gets heated just below the melting point, and then a recoating wiper deposits a very thin layer of

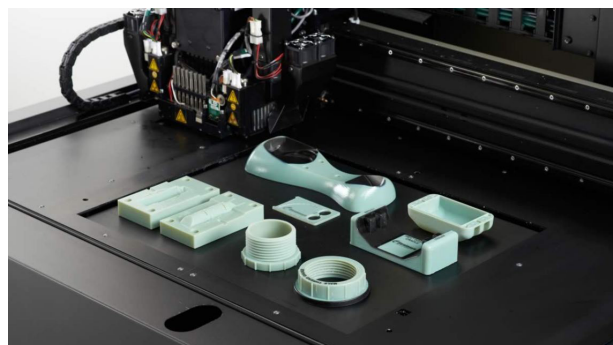
of the powdered material onto a build platform. A laser beam selectively sinters the powder and solidifies a cross section of the object. When one layer is done, the build platform will move down according to one layer thickness and then the recoating wiper deposits a fresh layer of powder on top and the process goes on till completed.



[e] MJ - Material Jetting & DoD (Drop on Demand)

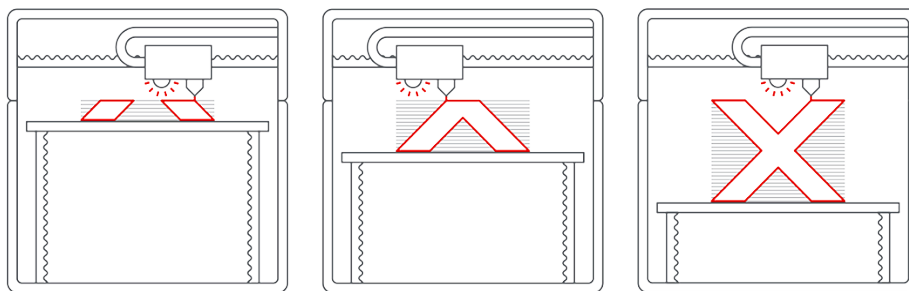
Material Jetting's mechanism is similar to the standard inkjet printer. The printer's head jets hundreds of tiny droplets of photopolymer and then solidifies with UV light. After one layer is done, the build platform is lowered down as one layer thickness and the process is repeated. Material Jetting technique deposits the layer in line-wise unlike other 3D printing techniques. This means that it is possible to build multiple objects in a single line.

Another 3D printing technique that is similar to material jetting is DoD (Drop on Demand), one of the most commonly used wax 3D printing technology. MJ and DoD are almost identical, but there is a



difference when it comes to how the layers are printed; material jetting prints the material in lines, while DoD prints the material in a single point.

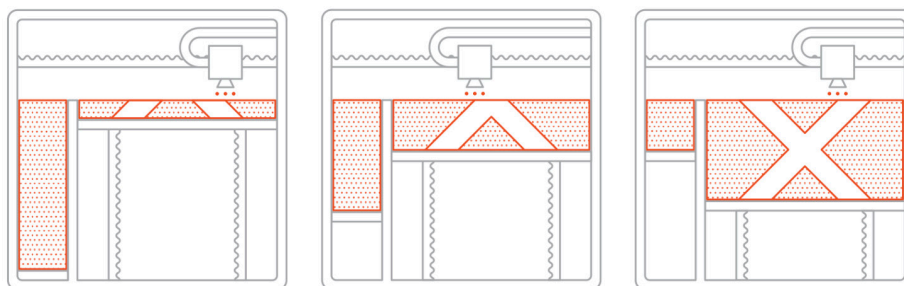
DoD is commonly used for mold making process that is used frequently in the jewelry industry for making complex patterns; they are not typically used to produce end-use parts. As DoD printers have two print heads that deposits two different materials simultaneously, one depositing the main material for the one part and the other depositing soluble support material that dissolves in a liquid, it can widely apply to the mold making for jewelry.



[f] BJ - Binder Jetting

Binder Jetting is similar to SLS, as it requires an initial layer of powder on the build platform. But instead of using laser to sinter the powder, Binder Jetting uses printer heads to move over the powder surface to deposit binder droplets which are small as 80 microns in diameter that binds the powder together to form a layer.

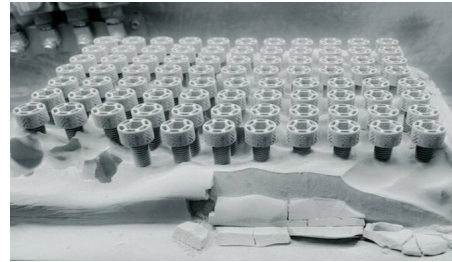
Depending on the material, the method is used for Sand Binder Jetting and Metal Binder Jetting and most widely, it is used for ceramic 3D printing. In the case of



metals, BJ can produce various types of metal alloys such as steels, titanium, copper and etc. Also thermoplastic polymers and polyamides can be done and in BJ printing, materials such as metals, ceramics, polymers can be mixed in granular form.

While printing in BJ printer, it is possible to add colors by adding color at the

same time as the binder to form a full color object. After the printing process, post-processing is needed to remove the unsolidified powder by using brush or pressurised air. And to increase properties like resistance and to revive the colors of the printed objects, it needs to be cured depending on the material used. For example of colored ceramics printed, it needs to be covered with acrylic to improve the colors and the resistance mechanically.



- [g] DMLS - Direct Metal Laser Sintering
- SLM - Selective Laser Melting
- EBM - Electron Beam Melting

DMLS, SLM and EBM uses Powder Bed Fusion techniques which produces solid objects by using thermal source to induce fusion between metal powder particles layer by layer; 3D printing technologies used for producing metal objects directly.

While DMLS heats the metal powder to melting point so that it can fuse together on a molecular level, SLM uses laser to melt the metal powder (20-40 micrometer metal particles) to form a homogeneous part. The noticeable difference between DMLS & SLM is the temperature ; SLM gets higher temperature on the metal powder surface than DMLS.

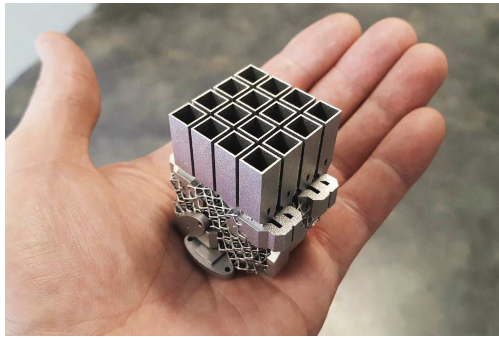


SLM printing process

And EBM uses high energy beam or electrons to make fusion between the metal powder. DMLS can produce parts from metal alloys to pure metals while SLM can

use only single element materials. And DMLS printing does not affect the properties of the material and can even mix powders like aluminum and nylon. Depending on the metal particle size and shape, the resolution of the final object differs; smaller metal particle size has less variation and has better detail solution.

DMLS & SLM are used with great benefits for medical, dental, and aerospace industries by printing high-performance or rare materials.



Satellite antenna by DMLS printing

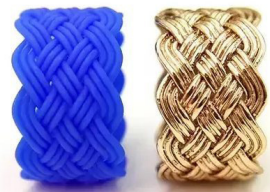
EBM seems to be similar to SLS technique, but the difference is in the energy source where electron beam is used for melting conductive metal powder instead of a CO₂ laser that melts thermoplastic polymer. EBM printing must be produced in vacuum

to protect the electron beam. The final object is covered with semi-sintered powder, which must be removed after printing. As it involves high temperature, it has risk of distortion. To reduce the risk, supports are required to function as a pathway for the excess heat to move out. EBM provides metal printed objects with high density with strength, but the material that can be used are limited to titanium or chromium-cobalt alloys and other expensive metals.

In general, the DMLS, SLM and EBM are meaningful in the sense that in the future it can replace the traditional manufacturing; reducing the wasteful process such as reducing the surplus material used. And 3D printing metal uses less energy and reduces waste to its minimum.

[3-2.3] 3D printing & Lost wax printing and casting

3D printing especially in the jewelry industry is approached in 2 ways; one is direct 3D printing which the design is made directly by printing and the other is indirect 3D printing technique which uses 3D printing in the process of realizing the design.



Ring in resin for molding and ring in gold as a final product

One of the most popular indirect 3D printing used in jewelry industry is lost wax printing and casting; printing highly detailed wax models which are later used to make molds. This has revolutionized how jewelry is produced, keeping the precision and details realized in a faster and accurate

way. In most cases, SLA 3D printing technique is used with wax-like resins which has similar consistency to the waxy texture required.

[a] The process of lost wax casting

The first step is to 3D design the lost wax casting part; the desired jewelry in CAD and to export the 3D modeled file compatible to the 3D printer (SLA 3D printer) which is the basic step for 3D printing.



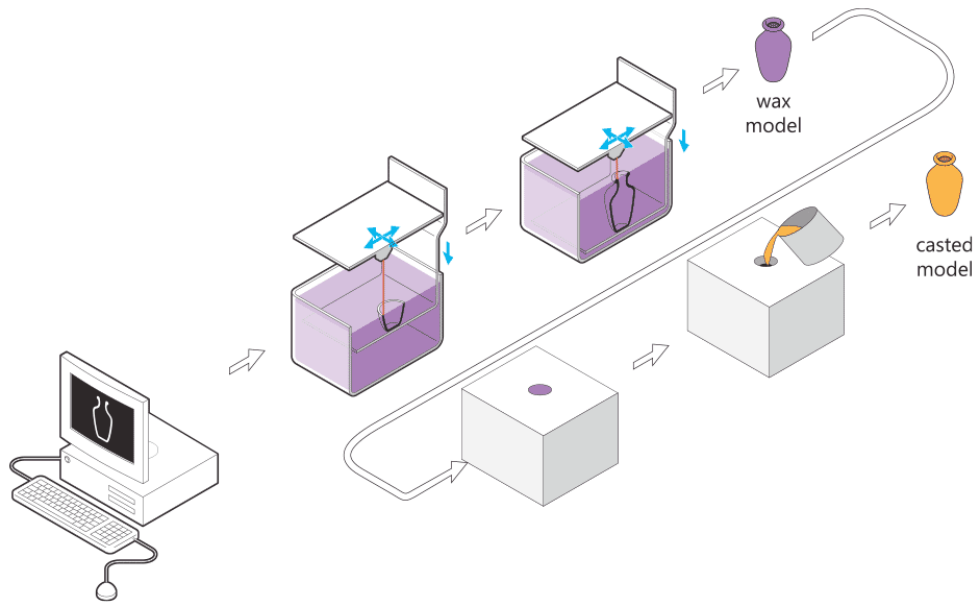
3D printed jewelry in wax tree

Next step is to 3D print the jewelry with support structures to make sure that the printed objects doesn't fall apart. Using castable wax resin in SLA printer may precisely print the complex designs with smooth surfaces. Especially when it comes to mass production, the jewelry should be printed out as much and should be put together on a plastic or wax tree.

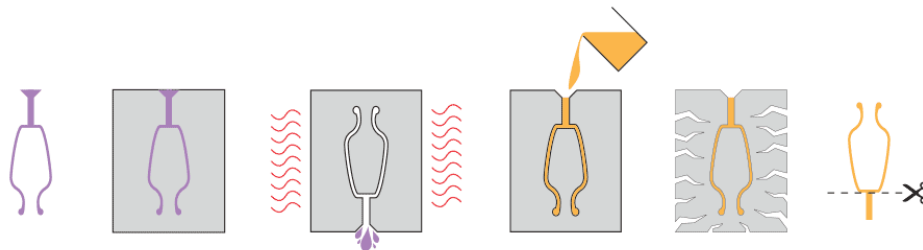
This stand are then placed in a flask where the material (fine plaster) for making the 1st molds are poured.

When the mold are solidified it is put in an oven to melt the 3D printed wax jewelry and the wax stands. It creates exactly a negative mold of the final product; mold for casting the metal.

When the mold is ready, the molten metal is poured to fill the empty space where the wax used to fill up. After the metal inside has solidified and cooled, the plaster mold gets broken and the final metal jewelry are removed by hand. Finally, the jewelry should be sanded, polished to remove the sprues.



Side view of the printing process



Section view of the printing process

[b] Materials for lost wax casting

The combination of 3D printing and lost wax casting is mainly used in jewelry, therefore, variety of metals which are precious and expensive are used.

- Gold in 14K or 18K are mainly used for precious jewelry and are often mixed with an alloy to gain intensity.
- Silver in solid sterling silver made of 92.5% pure silver and 7.5% of other metal are used for making jewelry and other ornaments.
- Bronze is used in alloy and are comparibly affordable. As it oxidates or tanishes easily, varnishing or PU coating is required.

- Brass which is alloy of copper and zinc are used often as replacement for precious metals to pre-test the print. As it oxidates it needs to be plated or varnished.
- Copper is used in 100% pure copper and also needs coating or varnish to avoid corroding.



Ring in silver by "Jweel"



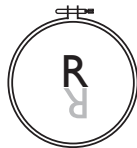
Ring in bronze by "Bert De Niel"



Ring in copper by "Nils Faber"

Also the important material is the wax in lost wax casting 3D printing. Mainly when using SLA printers, variety of wax-like resins are used such as castable wax resin by Formlabs. It is 20% wax-filled material that are reliable for casting with zero ash content and clean burnout to achieve smooth surface. Castable resin made from pure polymer can be used as well.

FDM printers can also be used for lost wax casting. When using FDM printers, there are filaments with wax properties such as Print2Cast wax filaments or MOLDLAY filaments developed by Kai Parthy which extrudes in lower temperature.



4.PROJECT "REVERSE"

[4] PROJECT "REVERSE"



:Explanation about "REVERSE" as a project- from design concept to realization of the full collection.

[4-1] Project concept

1. Reversing the role of hand and machine

Embroidery being hand stitched on the machine-made fabric has been the norm since the past for making embroidery related items. In REVERSE, the conventional role of hand and machine is reversed; making the machine - 3D printing to take over the role of hand crafted embroidery; "3D printed embroidery". And the machine weaved fabric to go back to the hand weaved or hand crafted fabric. This will give another aesthetic to the conventional embroidery items; more simple and modern look made with 3D printing materials which are more rigid and stiff looking than the normal embroidery threads used.

3D Printed Embroidery + Hand Weaved Fabric



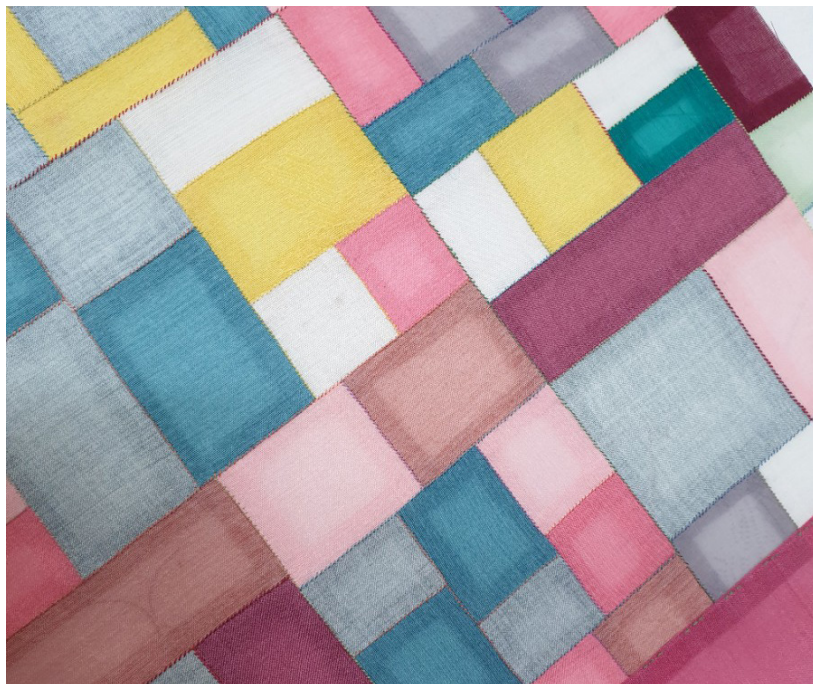
By reversing the role of hand and machine, this connects the past embroidery industry to another alternative direction in the future; combining the new technologies ready to be used. Using machine 3D printing embroidery it will not only take over the conventional hand embroideries but may expand the variety of embroidery motifs with unlimited designs mixed with new materials and different texture. And by hand weaving the base fabric, still the hand crafting will keep its role on the most basic and essential part of the embroidery items; keeping the balance between hand and machine.

2. Combining with Korean traditions

Together with the concept of reversing the role of hand and machine, project "REVERSE" used the main concept from the Korean traditional embroidery. Using one of the most common Korean embroidery motif - 'The Four Gentlemen' to be 3D printed on each piece of collection; bracelet with plum blossom, ring with orchid, brooch with chrysanthemum, necklace with bamboo and additional to the four gentlemen motif, necklace with Korean geometrical pattern is included in the collection to accomplish the collaboration between Korean tradition and modern 3D printing.

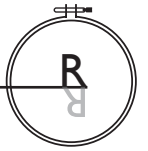
The base layer is in ramie cloth where the 3D printed motifs are attached; it is hand weaved to replace the machine made fabric. The Korean traditional patchwork which is heavily handcrafted in ramie cloth, called 'Jogakbo' can be found in 2 pcs of the collection. The colors used in Jogakbo are dyed naturally to achieve soft and mild colors that are used for Korean traditional items, such as the Korean traditional clothes (Hanbok) and small goods.

Combining the natural texture of the ramie cloth with the modern and clean texture of PLA 3D prints shows how nature and artificial, tradition and technology can be harmonized into the jewelry pieces.



'Jogakbo'

[4] PROJECT "REVERSE"



[4-2] Design

[4-2.1] Design concept : Mood board + Color palette



H A N D C R A F T
&
M A C H I N E



W H I T E
&
T E X T U R I Z E D



Main colors:



R: 255 G: 255 B: 255



R: 218 G: 222 B: 227



TANGLING



PATCHWORK



NATURE

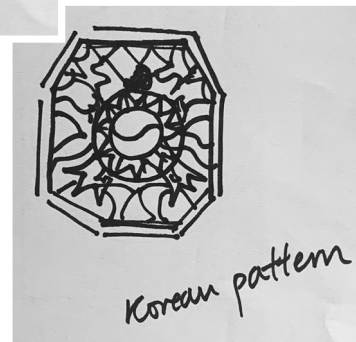
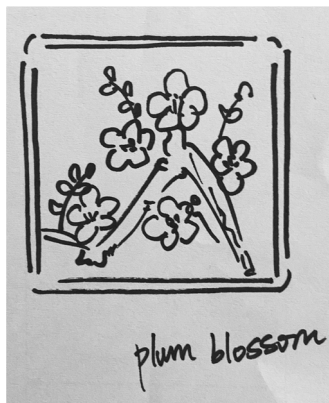


[4-2.2] Design development - 5pcs collection

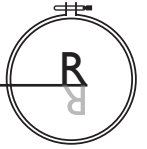
: 5 pcs collections are composed of 2 necklaces, 1 brooch, 1 bracelet and 1 ring. Each pieces have different motifs inside using 'The Four Gentlemen' & a traditional korean pattern 3D printed.

- Bracelet in squared shape + plum blossom
- Ring in oval shape + orchid
- Brooch in round shape + chrysanthemum
- Necklace in rectangular shape + bamboo
- Necklace in octagon shape + Korean geometrical pattern

[a] Hand sketches



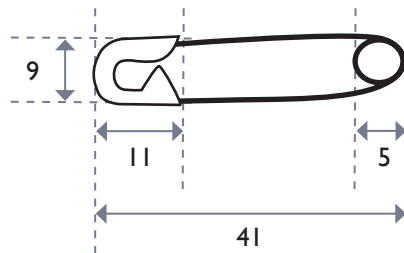
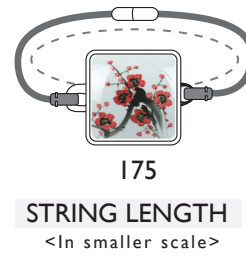
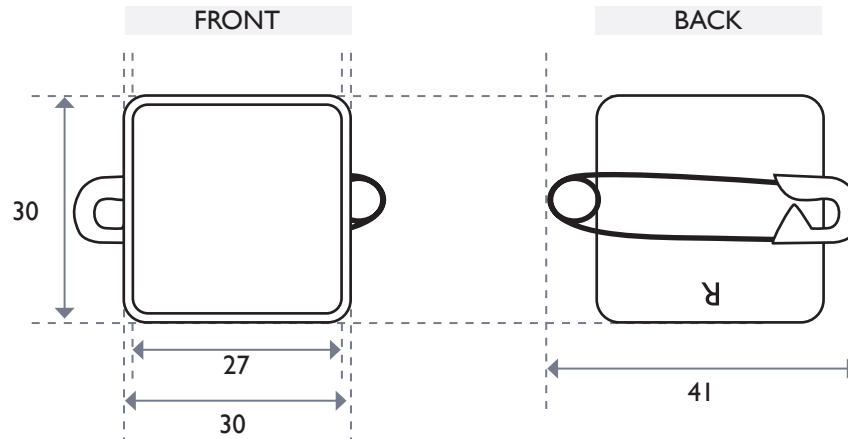
[4] PROJECT "REVERSE"

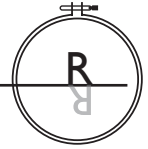


[b] Technical drawings (in mm / 100% scale)

[1] Bracelet in square shape + Plum blossom

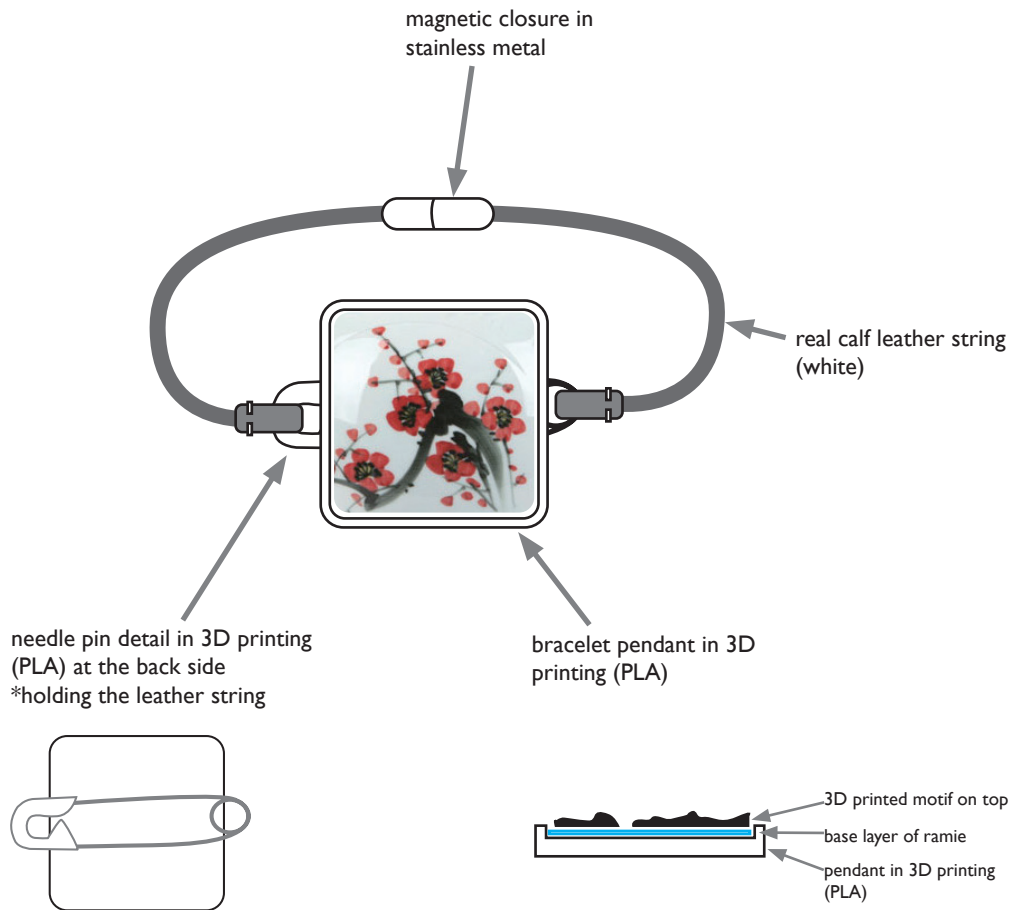
DETAILED





[1] Bracelet in square shape + Plum blossom

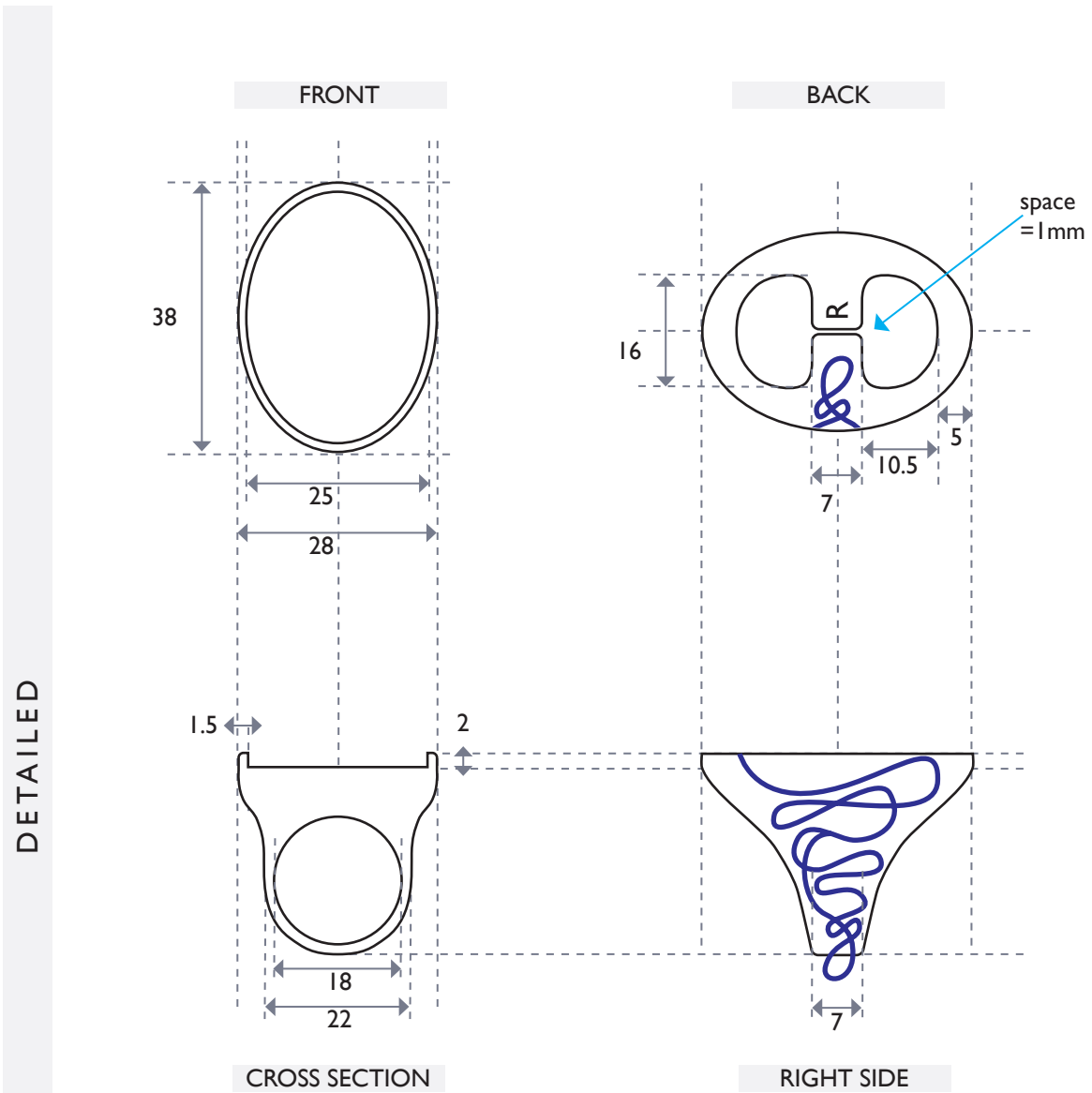
STRUCTURE



[4] PROJECT "REVERSE"



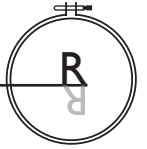
[2] Ring in oval shape + Orchid



ORCHID

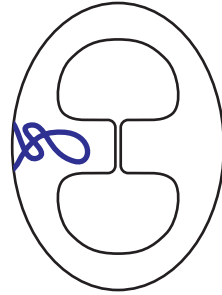


[4] PROJECT "REVERSE"



[2] Ring in oval shape + Orchid

STRUCTURE

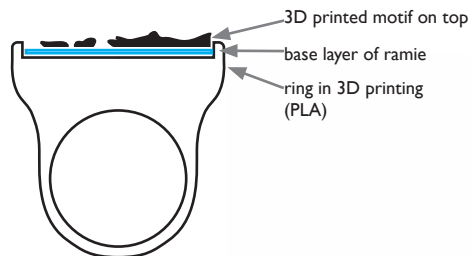
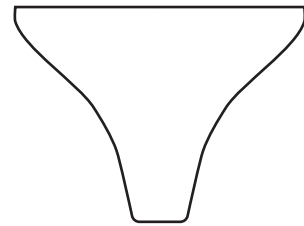
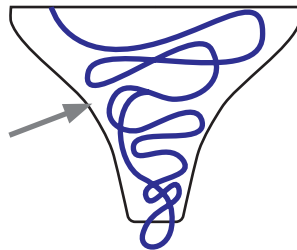


front & back view

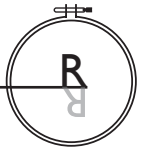
whole ring in 3D printing (PLA)

side view

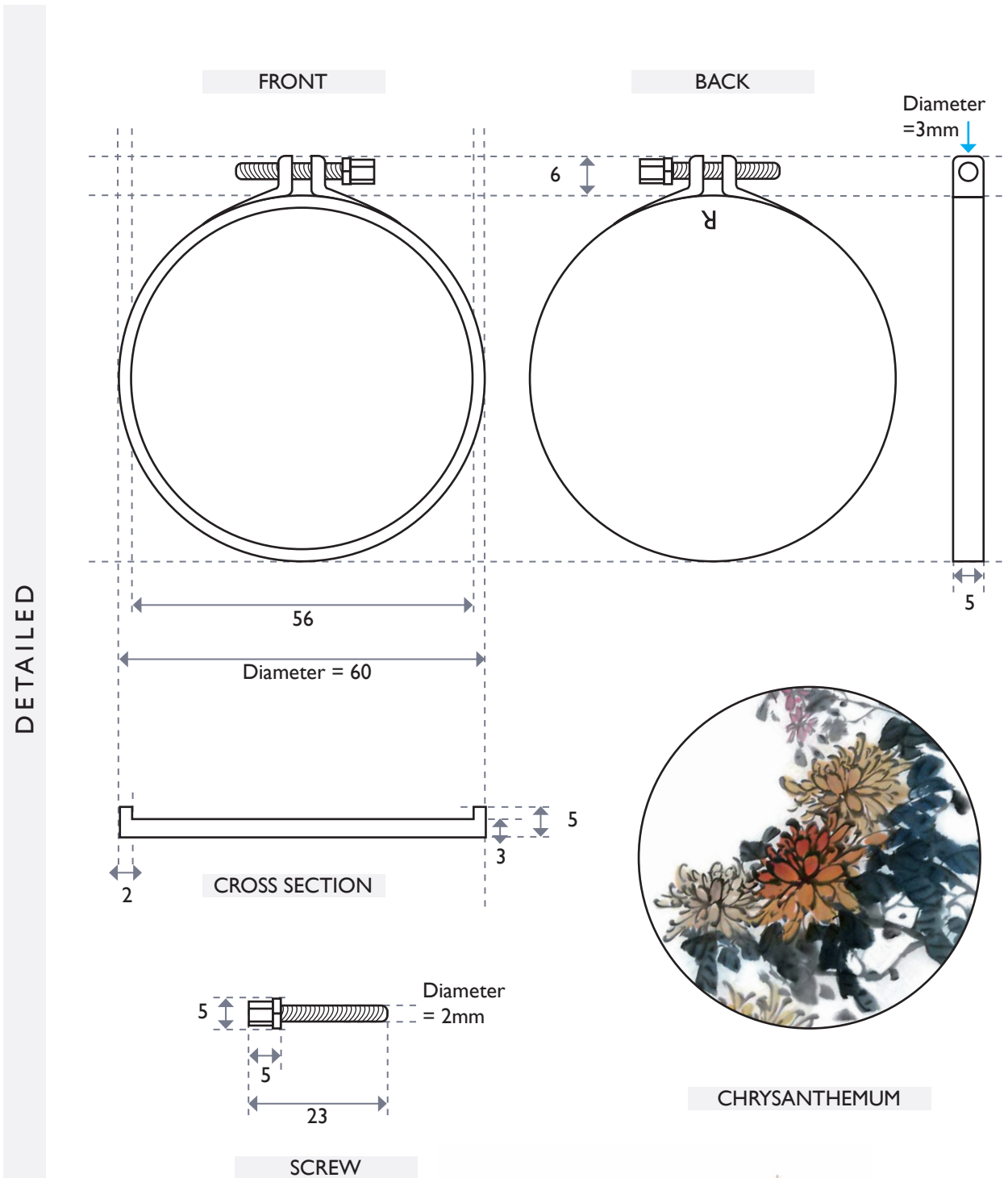
embossed 3D printing thread on left side of the ring



[4] PROJECT "REVERSE"

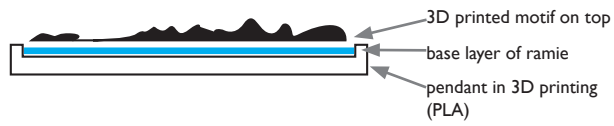
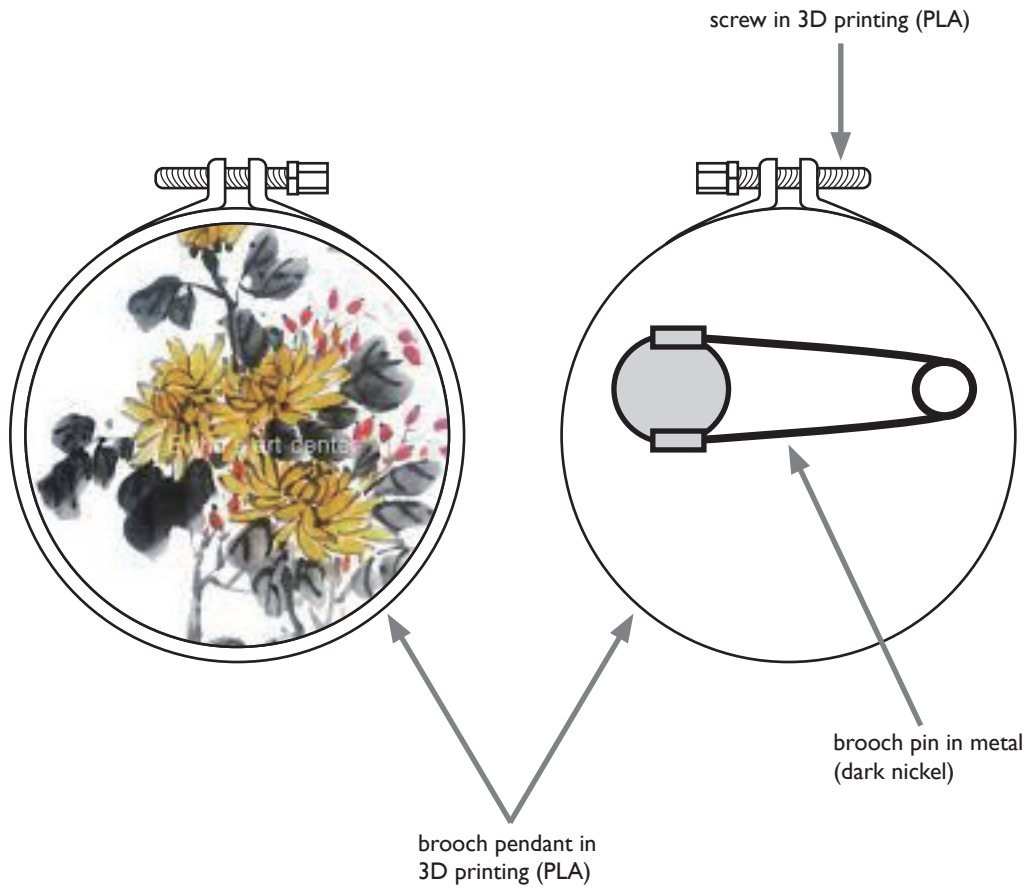


[3] Brooch in round shape + Chrysanthemum

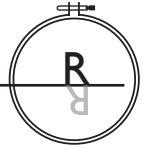


[3] Brooch in round shape + Chrysanthemum

STRUCTURE

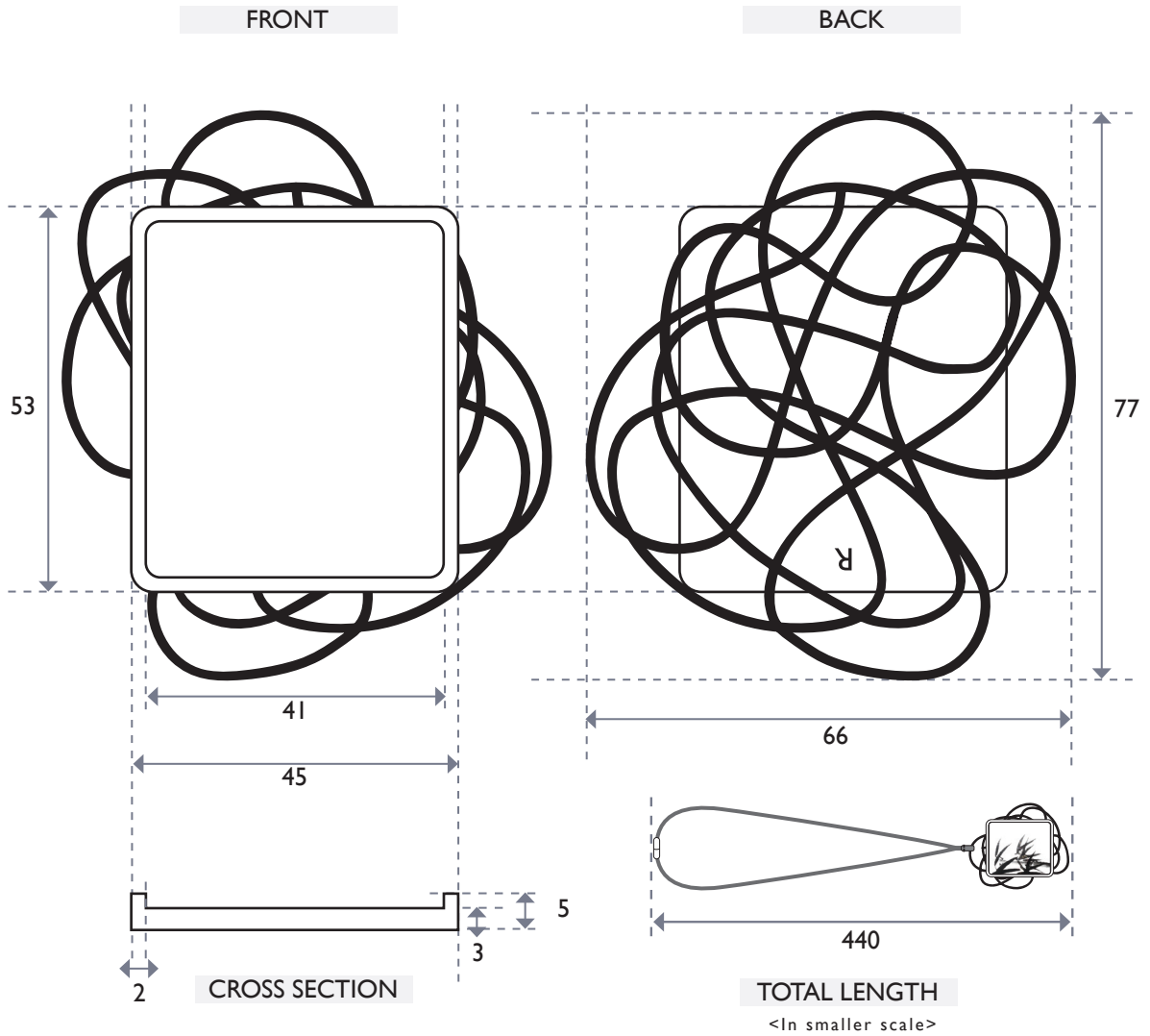


[4] PROJECT "REVERSE"



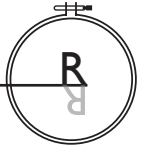
[4] Necklace in rectangular shape + Bamboo

DETAILED



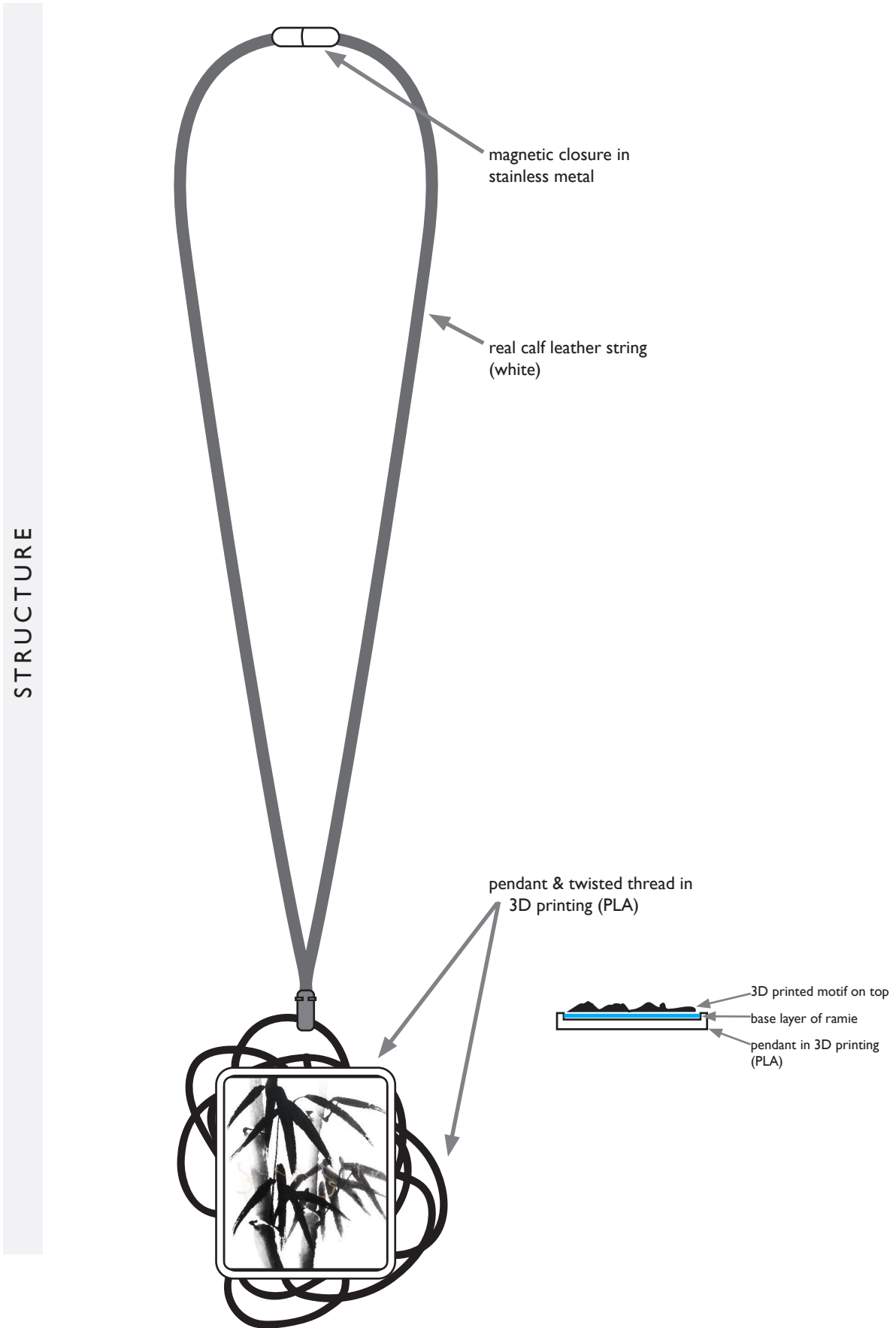
BAMBOO

[4] PROJECT "REVERSE"

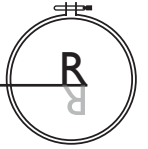


[4] Necklace in rectangular shape + Bamboo

<In 70% scale>

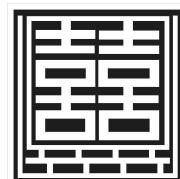
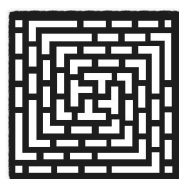
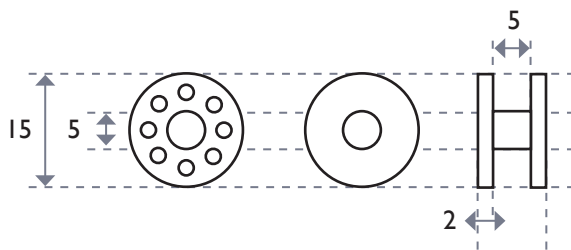
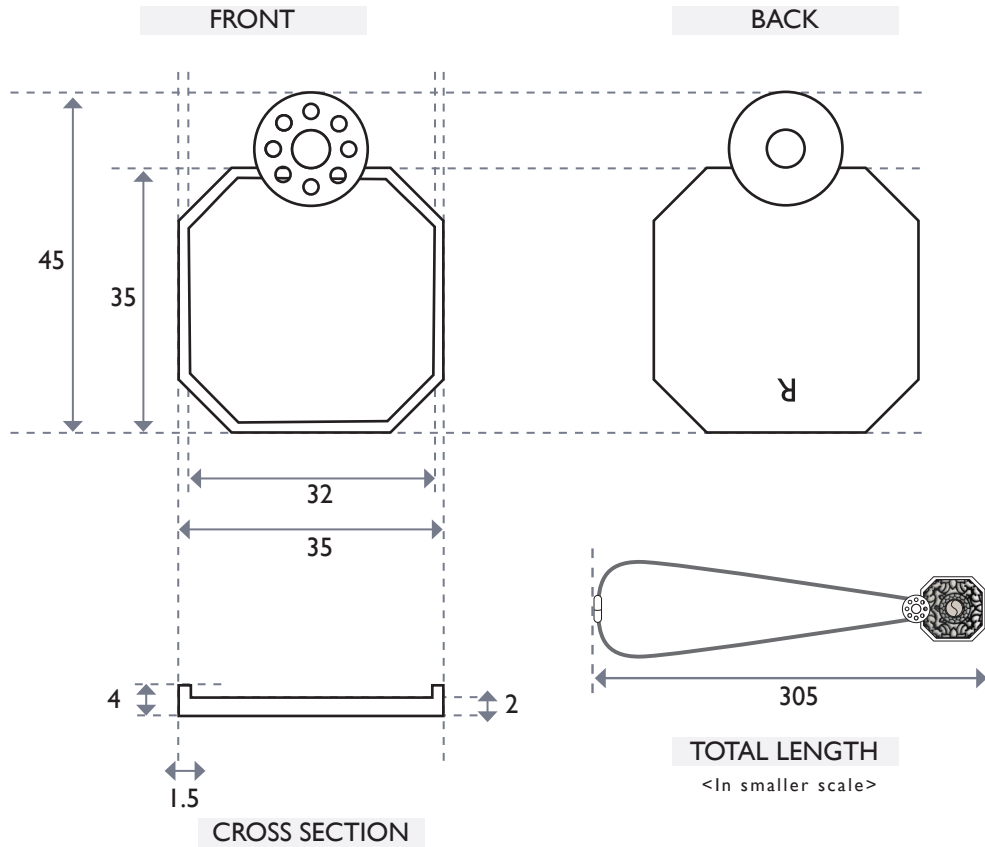


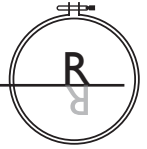
[4] PROJECT "REVERSE"



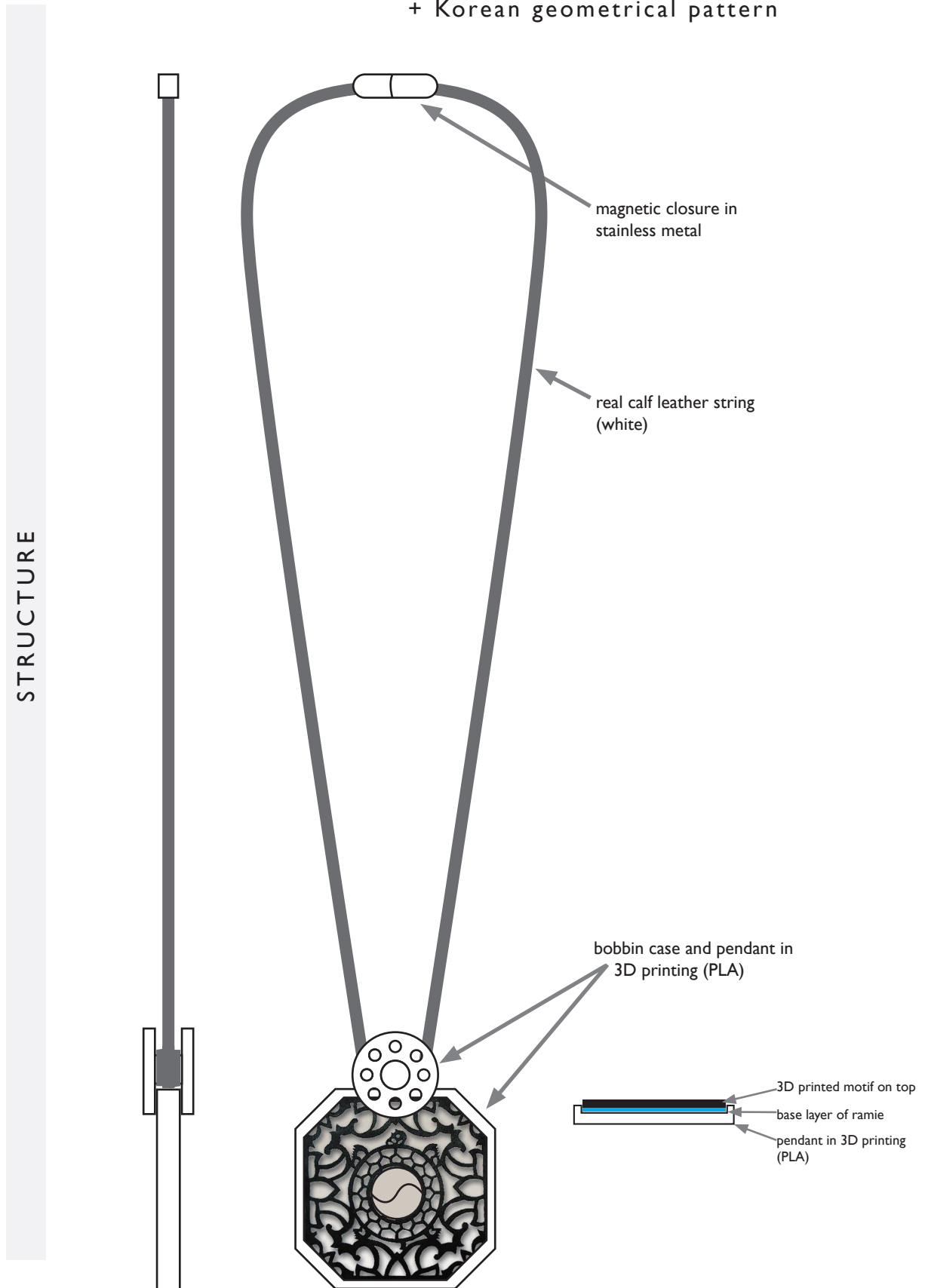
[5] Necklace in octagon shape
+ Korean geometrical pattern

DETAILED





[5] Necklace in octagon shape
+ Korean geometrical pattern



[4-2.3] Main Material & Technique

MAIN MATERIAL

[a] 3D Printing Material :



PLA (Poly-Lactic Acid)

PLA was used as it is adequate for delicate printing with affordable cost. And the material is made from corn starch which is eco-friendly and reusable.

[b] Hand Craft Material :



RAMIE CLOTH

Ramie cloth is commonly used for Jogakbo, as it has transparency that gives another beauty to Jogakbo; the seam creates irregular geometrical lines.

TECHNIQUE

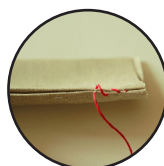
[a] 3D Printing Technique :



FDM (Fused Deposition Modeling)

Most common technique used for PLA material; the heated nozzle melts the PLA filament and builds the object layer by layer upwards.

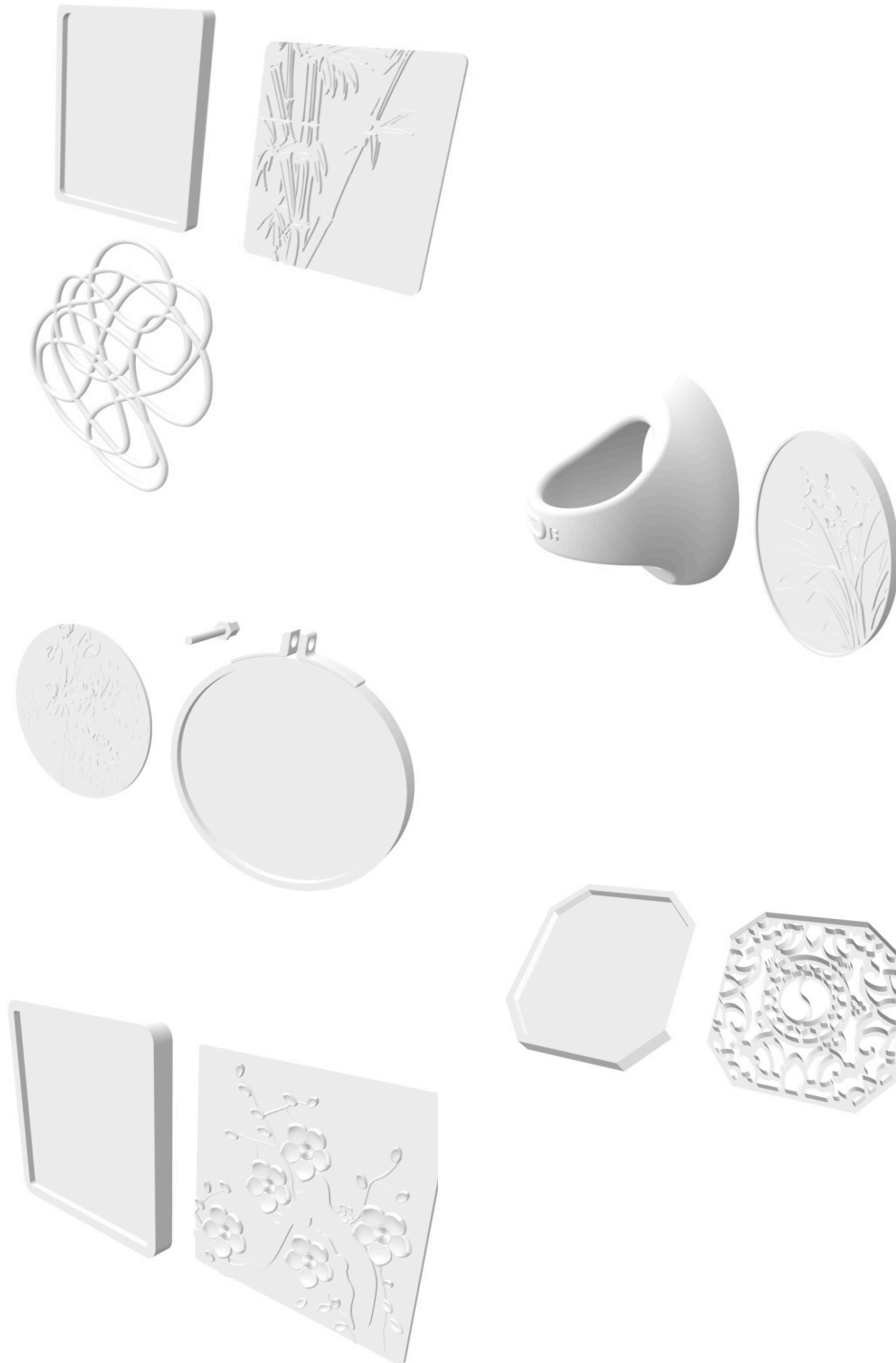
[b] Hand Craft Technique :



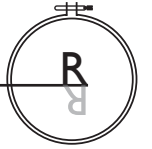
Gamchimjil (Hemming)

To stitch 2 pieces of cloth together, the stitch technique used is called Gamchimjil, which is commonly used for making Jogakbo. It stitches a diagonal line between the 2 clothes.

[4-2.4] 3D Rendering



[4] PROJECT "REVERSE"



[4-3] The Collection

[4-3.1] Photo shoots

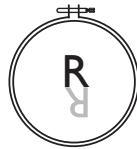


Photo shoots
"REVERSE"





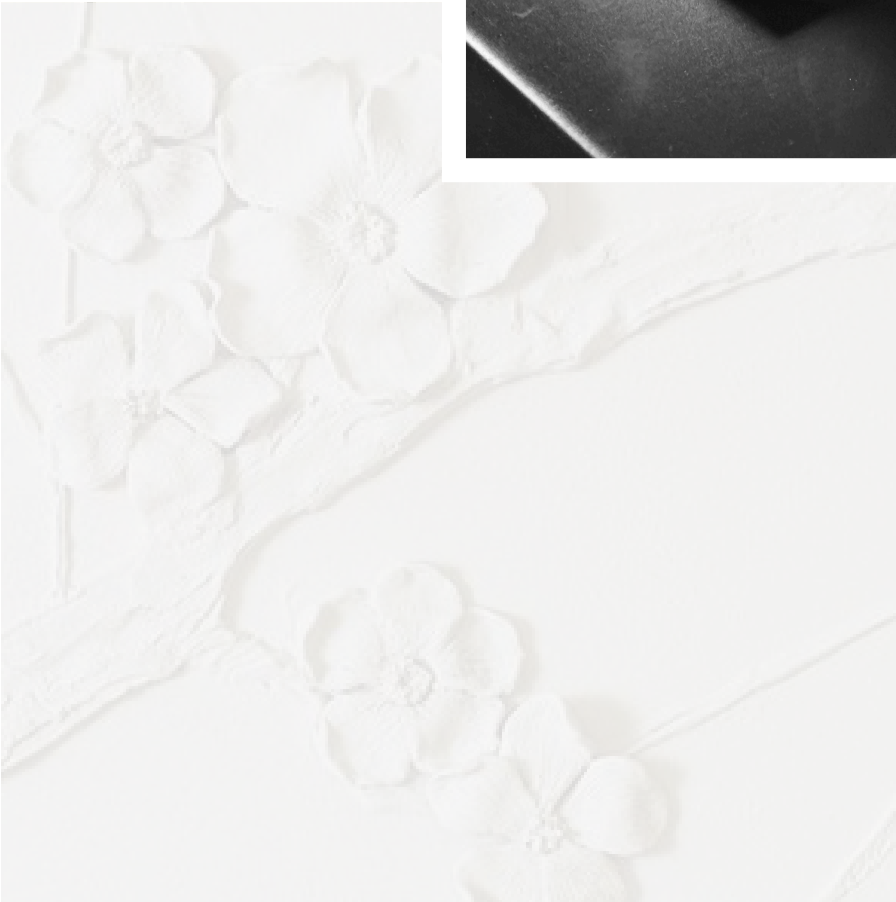
Brooch in round shape + Chrysanthemum





Necklace in octagon shape + Korean geometrical pattern

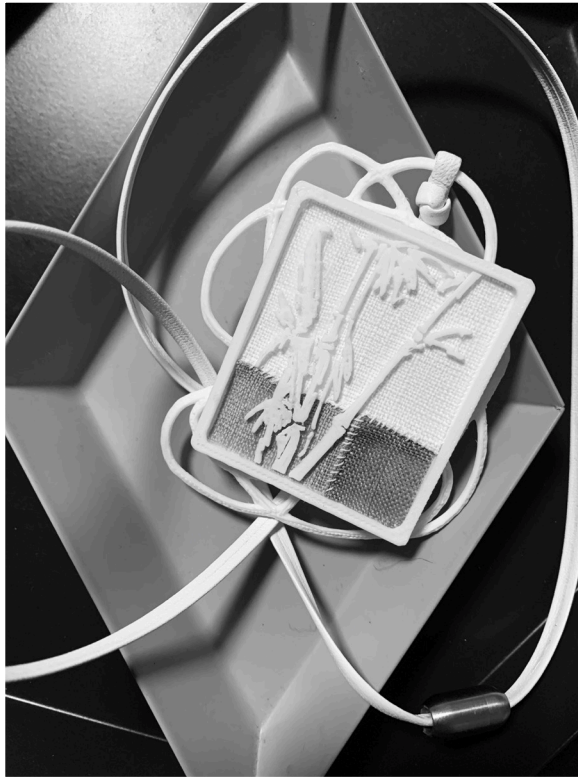
Bracelet in square shape + Plum blossom



Ring in oval shape + Orchid





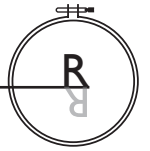


Necklace in rectangular shape + Bamboo



5. BRAND
"REVERSE"

[5] BRAND "REVERSE"



:Explanation about "REVERSE" as a brand - from brand positioning to marketing.

[5-1] Brand concept

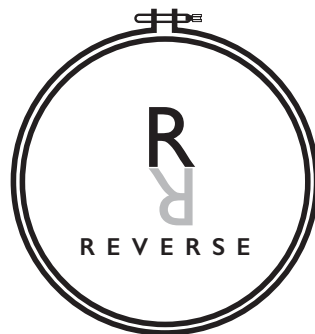
: Brand explanation with the brand concept board.

The brand "REVERSE" aims to crack the conventional looking of accessories that are combined with hand crafts; specifically those of hand embroidery. Reversing the role of hand and machine, the hand stitch embroideries are 3D printed, and the machine weaved base fabrics are replaced with the hand crafted fabrics and techniques.

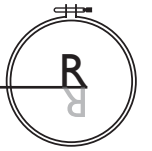
Reversing the role can widen up the range of embroidery patterns; what can be 3D modeled can be used as the motif for the accessory. And by using hand crafted base fabric to lay the 3D modeled motif, the balance between hand and machine are still kept in a single piece of jewelry.

Previous embroidery accessory may look old fashioned using the conventional materials that relate to the old generation. But "REVERSE" changes the norm; the embroidery patterns 3D printed in monotone and rigid texture gives a modern looking to the jewelry pieces.

Together with the change of roles, "REVERSE" combines the Korean culture to the design; the embroidery pattern are "The Four Gentlemen" which is a very common motif used for Korean traditional paintings and embroidery related to the virtue of scholars in the past. And the base fabric which uses the hand craft technique "Jogakbo", is also a traditional Korean embroidery technique still common in Korea. In this sense, "REVERSE" desires to spread the Korean traditional culture in the most modern way.



REVERSE THE ROLE.
REVERSE YOUR MIND.



Brand concept board



NATURE

MODERN

RIGID

WHITE



[5-2] Brand positioning

[5-2.1] Target customer

Brand Reverse aims to turn over the conventional looking of embroidery accessories and open a new category of accessory in the 3D printing field. Thus, it can be attractive to people who like to adopt early and show new fashion.

And together with the Korean motifs used, Reverse can appeal to customers around the world who are interested in Korea and who are looking for modern looking accessories with balance of tradition and modern.

Women

Mainly for women who loves accessories and are looking for alternatives other than gold, silver and etc plain materials which they already have.

Age 25~50

As the looking is clean and modern, it can be worn till the middle age. Though, it does not fit youngsters as it has a mature mood.

Interested in Fashion + Early adopter

For people who like to try new things and try on new lookings, as Reverse uses 3D printing technology.

Sub-customer: Foreigners visiting Korea

The Korean motifs and fabric makes Reverse unique at the same time, may appeal to foreigners as a kind of memory from Korea.



[5] BRAND "REVERSE"



[5-2.2] Brand & competitor analysis

Reverse has a strong brand identity to reverse the role of hand and machine and to give a modern looking to the jewelry that used to be combined with embroidery.

And as it is basically using PLA material for printing, the most basic and low-cost material for 3D printing, it can be affordable to customers who wanted to try 3D printing accessories that is not metal and high-priced.

Below SWAT chart was analyzed with "Dianas Garden" which is a 3D printing jewelry brand using nature-inspired and origami patterns to print in metal using low wax casting.



REVERSE

3D printed Acc.



DianasGarden

3D printed Acc.

S 
STRENGTHS

- Strong brand identity
- Affordable price

- Unique & detailed design
- Limited pieces

W 
WEAKNESS

- Low brand name value
- Unfamiliar motifs

- Low brand name value
- Weak marketing
- High price

O 
OPPORTUNITIES

- Growth of 3D printed manufacturing
- Can be developed with various themes & collections

- Can be developed to customized jewelry sector with details

T 
THREATS

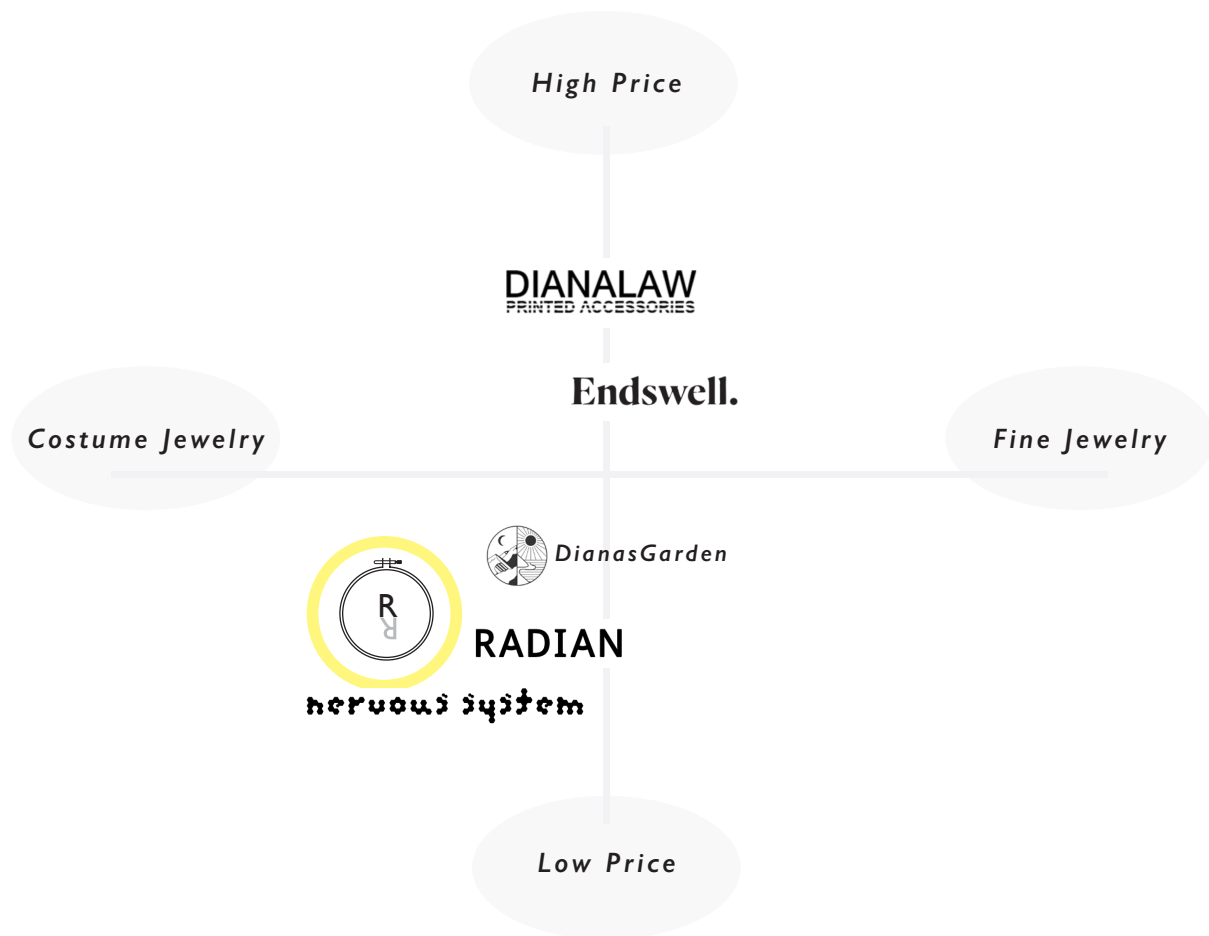
- Limited target customer
- Cannot be customized as other 3D printed jewelry

- Competition with large jewelry companies with mass production

[5] BRAND "REVERSE"



*Brand positioning map



[5-2.3] Pricing

Reverse aims to popularize 3D printed accessories with affordable price for people who loves accessories. Using PLA material & ramie cloth for production, the manufacture cost will go down.

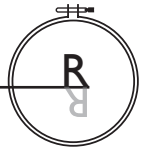
Thus, below is the price range per each accessory category.

[a] Neck lace pendant : \$50 ~ \$75

[b] Bracelet : \$35 ~ \$65

[c] Ring : \$50 ~ \$80

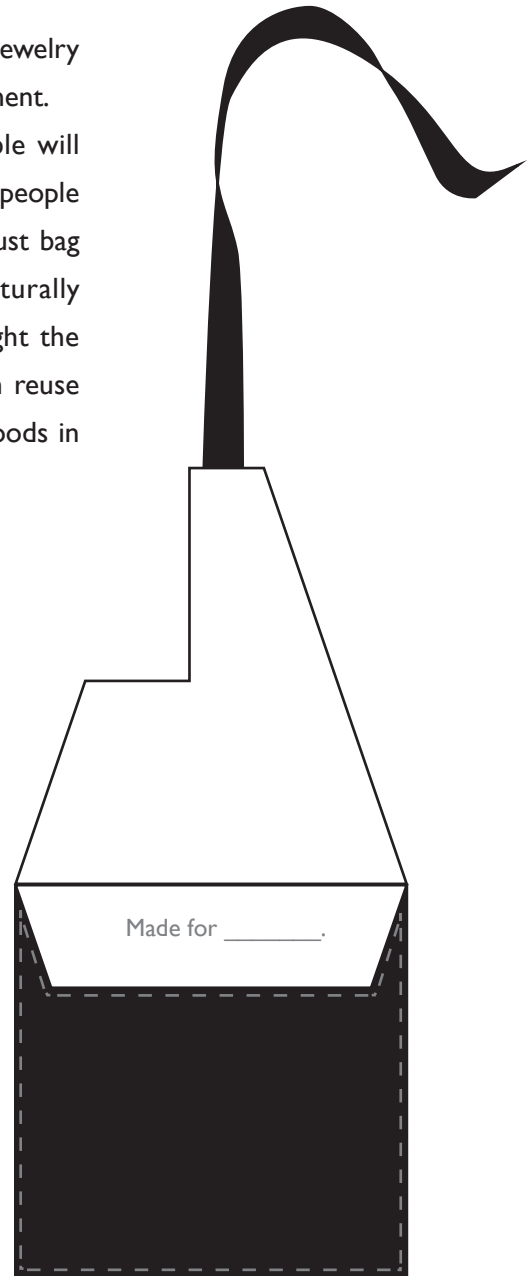
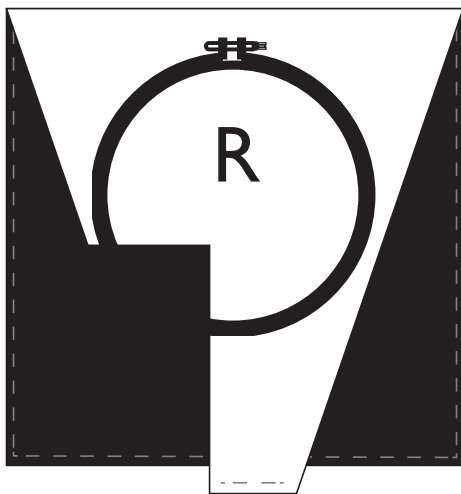
[d] Brooch : \$65 ~ \$100



[5-3] Brand marketing

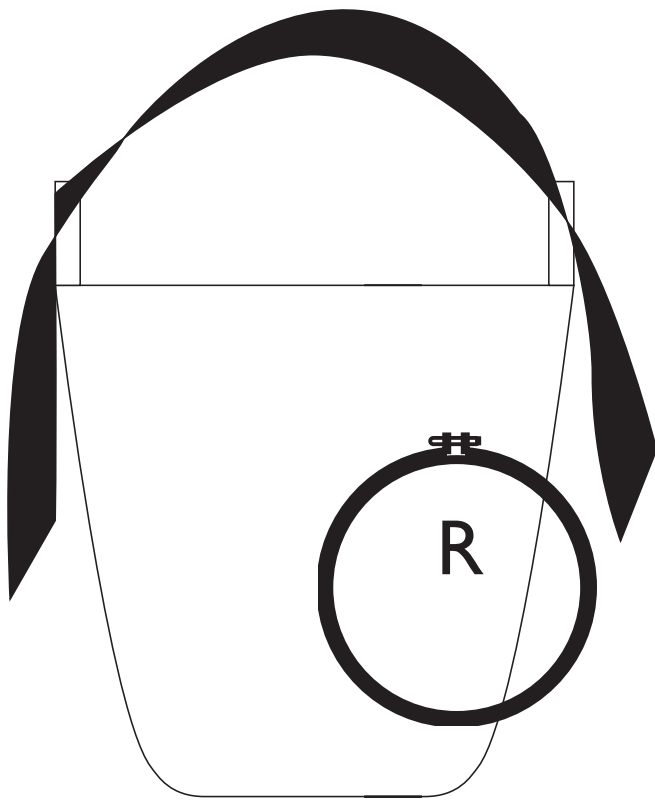
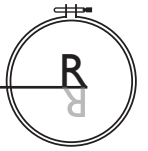
[5-3.1] Packaging

As a brand marketing, the shopping bag and the jewelry case (reusable) can be a media of brand advertisement. Shopping bag with strong logo which is reusable will attract the attention of people passing by making people curious about the logo and the brand. And the dust bag for the jewelry which is also reusable will naturally be exposed to various people who already bought the product and the people around them as they can reuse it for jewelry bag for traveling or to keep small goods in their handbags.



Jewelry case

*body size 10*10 cm*

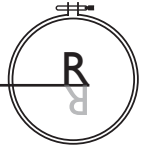


Shopping bag

*body size H20*W18 cm*

strap height 18cm

[5] BRAND "REVERSE"



[5-3.2] Online

Online marketing became crucial in means of easy access & exposure to the unspecified customers; homepage (including online shopping mall), instagram, online advertising, and etc. Connected with the off-line channel, online marketing is nowadays essential to lead the brand successfully.

[REVERSE Website]

In the website, REVERSE's introduction, catalogue, products and notice board is available to communicate through online with the customers.

<https://www.projectreverse.online>



REVERSE

MAIN INTRODUCTION CATALOGUE PRODUCTS NOTICE BOARD



REVERSE

REVERSE THE ROLE.
REVERSE YOUR MIND.



[5] BRAND "REVERSE"



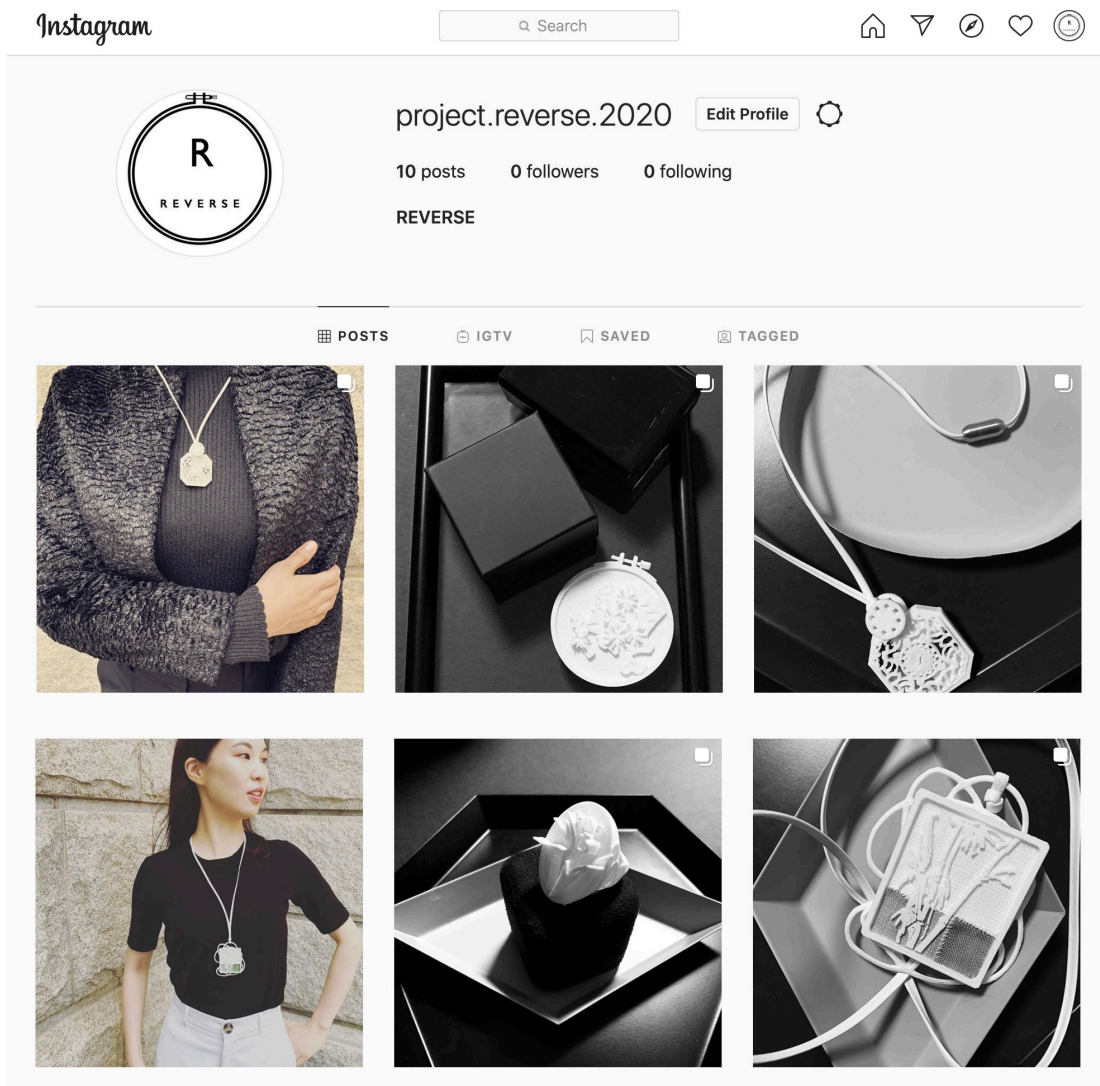
[REVERSE Instagram]

Instagram posting can be used to easily access the product and catalogue. Collecting followers and following can help the networking of 3D print jewelry brands and to find new customers.



[@project.reverse.2020](https://www.instagram.com/project.reverse.2020/)

<https://www.instagram.com/project.reverse.2020/>





6.CONCLUSION

[6] CONCLUSION

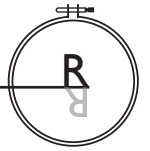


:Awakening of how hand & machine can be combined in an unconventional way in the future jewelry business, like "REVERSE".

Reversing the role of hand and machine in embroidery accessories was the start of this project. But while developing the idea, found out the potential of the 3D printed accessories and how it can develop the range of accessories in the future. Especially for the embroidery related accessories, as 3D modeling and printing can handle very sophisticated and detailed designs with less time and cost, it can widen the range of designs to be applied in accessories; no more limit on production as the 3D printing can print delicate designs faster and easier.

And together with the change of roles, "REVERSE" combines the Korean culture to the design. The base fabric in ramie which is dyed with natural pigments shows the smooth and natural colors of Korean traditional cloth. And the hand craft technique "Jogakbo", is also a traditional Korean embroidery technique still common in Korea. In this sense, "REVERSE" desires to spread the Korean traditional culture in the most modern way.

"REVERSE" shows how 3D printed accessory can be combined with hand craft, keeping the balance between the traditions & modern, hand & machine, natural & artificial elements. This is just one sector of 3D printing design and believe that various accessories can be developed starting from the change of roles, combining elements that are opposite to achieve a new sector in the jewelry industry.



"Jeontongjasu" written by Han Young Hwa (2010.07.26 printed)

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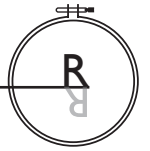
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in?ga_order=most_relevant&ga_search_type=all&ga_view_type=gallery&ga_
search_query=3d+printed+bracelet&ref=sr_gallery-1-4](https://www.etsy.com/listing/83317253/3d-printed-triangulated-cuff-bracelet-in?ga_order=most_relevant&ga_search_type=all&ga_view_type=gallery&ga_search_query=3d+printed+bracelet&ref=sr_gallery-1-4)

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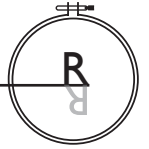
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MILANO 1863

Final Thesis
by Bokyung Jeong