Laser Cutter Enhances URUSHI Craft Practice and Expression

INTRODUCTION

"URUSHI(Japanese wood lacquer)" is a natural paint material which is gathered and refined from URUSHI trees, and can mainly be found in Asia. The use as the product of URUSHI is said to date back to 9,000 years ago. Since the dawn of history, in Japan we commonly used wooden and earthen vessels coated with " URUSHI " until we began to import porcelain from China.

Lacquered "URUSHI" has a uniquely pure beautiful shine, profoundly serene colors and gentle warmth of touch. Japanese have a particular affection for them and hold them in high esteem due to their unique ability to convey the richness of Japan's cultural heritage.

URUSHI stiffens thus it has been used as resin to create three-dimensional form like Buddha statue of Ashura zou in Kofuku-ji(**Fig.1**) that has existed more than 1,300 years through burnt down of the cathedral that happened one after another. It was made with technique of the dry lacquer called KANSHITSU that hardened a hemp cloth with URUSHI in TENPYO period (the 7th to 8th century) in Japan. Essentially it has very similar principle to FRP in the modern technique. Each technique has cloth for structure and resin as glue. The only difference is nature of the material, natural or synthetic.

Fig.1

Increasingly over the last 5 years, digital creative environment and computer controlled manufacturing equipment so called ”Digital Fabrication” have become more affordable and thus accessible to any individuals such as art and design practitioners. The craft, due to their historical association with manufacturing technology, are well placed to exploit the potential of these developments. However, this is still considered ’new’ practice with only a relatively small but growing group of craft practitioners who have been aware of the possibilities as tools that enhance their work.

The craft including URUSHI has been making its history being based on handwork practice. Industrial technology has been great impact on handwork practice and the regime of the practice has been inevitably changing its meaning through the 20th century. In the 21st century, almost all of industrial technologies are operated by digital

technology. Since the meaning of handwork practice vary over time of the history, the appropriate regime of craft for any given era may also vary.

This report reveals that KANSHITSU material is ideal and suitable for laser cutting and the possibility of URUSHI as a modern media in the craft design expression through reinterpreting URUSHI technique by digital fabrication especially by laser cutter.

MATERIALS AND METHODS

Making plane and flat KANSHITSU sheet and laser cutting

KANSHITSU is a name of the technique for making three dimensional object using hemp or cotton cloth and URUSHI as a resin and also the name of the generated object of itself. In this research KANSHITSU was made into two-dimensional sheet something like ready-made material while KANSHITSU has been mainly used for three-dimensional work. Traditionally, KANSHITSU is made and layered up on a surface of a mold made of clay or plaster, but in this report a vinyl chloride sheet, which is 1mm thickness and easy to purchase in the DIY market, has been used as a flat mold surface in order to make it easier to peel off the sheet after the KANSHITSU sheet cured. Because KANSHITSU can peel off the vinyl chloride sheet without any mold release material.

The KANSHITSU was made from glue, which was mixed 60g of URUSHI with 100g of rice paste, and 5 sheets of cotton cloth. As a result, the KANSHITSU sheet, which consists of 5 layers of cotton cloth and URUSHI, became 1mm thickness board state material. The more layers the sheet has, the stiffer it is.

25w laser cutter was used in this report and the machine was trotec rayjet 100. 1mm thickness KANSHITSU sheets were used as material and changing power and speed of laser cutter in order to evaluate the quality of the edge of the sheets(**Fig.2**).

Fig.2

Design concept and method

A pattern of linked ovals can be found on the surface of artificial and traditional products or places in anywhere in the world such as the floor decoration of St. Peter's Basilica in Vatican City (**Fig.3**). This popular pattern is purely geometric. When this pattern is applied onto a surface of three-dimensional surface of ceramic or porcelain, each pattern is geometrically linked each other and beautifully harmonized.

Traditionally craftsmen regularly draw rectangles by their hands and tools on the surface as grid for the pattern and then circles are placed into the rectangles. It may be said that this is algorithmic process thus it is easy to control mathematically on the computer.

The pattern is nothing more than simply surface decoration, but in terms of what the patt ern represents, the pattern of itself can be realized as a bunch of regularly crossing lines of its structure. It looks like wire frame drawing on 3D CAD design software. If this three-dimensional pattern can be extracted from the structure into two-dimensional unfold shapes, the structure could be reconstructed from the shapes that can be cut out from physical ready-made board material.

Fig.3

Being based on this idea, using Rhinoceros and Grasshopper, which is a popular combination of 3D CAD and GAE (Graphical Algorithm Editor) in contemporary design farm, I designed a work of KANSHITSU craft. According to the data of the shape that produced from the digital program, laser cutter cuts the pieces out of the KANSHITSU sheets and then all parts are fabricated each other with acrylic custom made rivets in one piece of three dimensional KANSHITSU work (**Fig.4**).

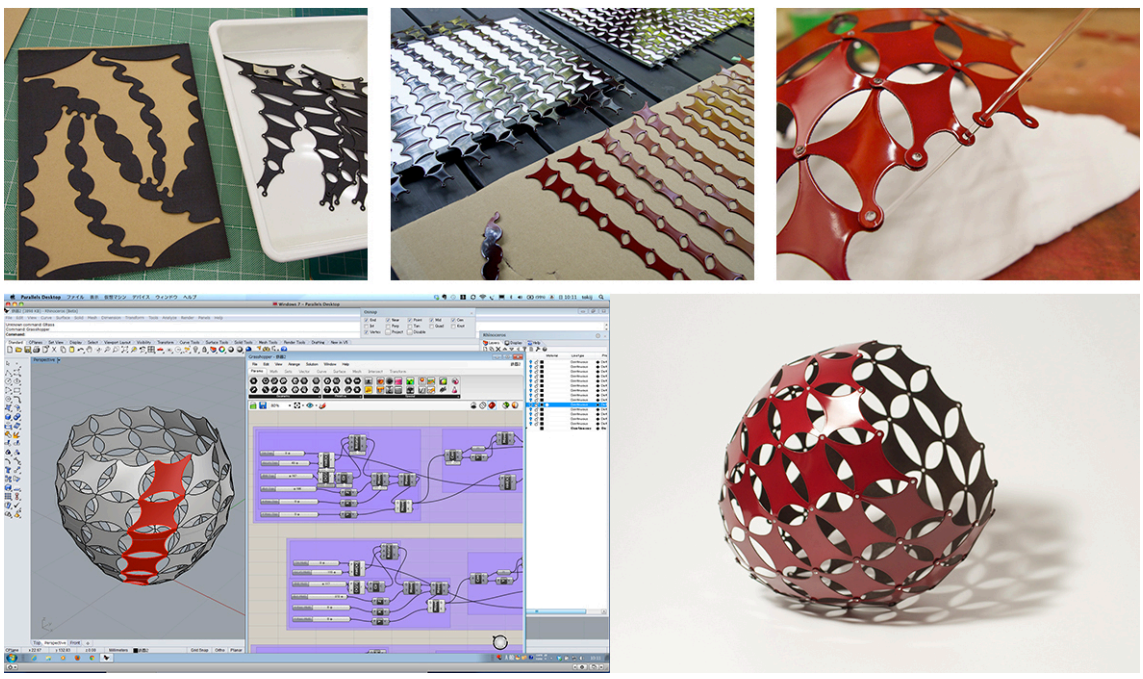

Fig.4

RESULTS AND DISCUSSION

In terms of the thickness of KANSHITSU sheet, only 1 layer is too thin to be rigid and 6 or more layers would be too hard for 25w laser cutter to have a good result. The best combination of power and speed by using the laser cutter was 30% of power and 1% of speed. The quality of the edge of the sheets is very fine although some soot can be found a bit on and around the edge, they can be wiped away by a cloth easily. Also as subsidiary result, it is found that laser cutter can beautifully engrave KANSHITSU surface. The result shows that KANSHITSU sheet is ideal material for laser cutting and similar to other material like acrylic or MDF board and moreover the quality of its surface is much more beautiful and one can enjoy gentle warmth of touch.

Conventionally, KANSHITSU needs highly trained craft skill to make three dimensional form with layering up hemp or cotton cloth on clay or plaster mold and it takes long time to complete one. In this case if this form were made with conventional KANSHITSU process, it would have taken three month. On the other hand KANSHITSU sheet took only 4days to complete and also it is plane and flat material thus as long as they can use laser cutter it is easy for anyone to work in the way of DIY style rather than the way of craft artisan strict attitude. This means that working on KANSHITSU sheet by using laser cutter brings new realm of URUSHI craft and opens the door of URUSHI craft that has been understood as a world of highly trained artisan.

Although Rhinoceros and Grasshopper is a popular digital design environment in various design and architectural activity, it is still away from craft people. As this report shows possibility of combination of digital design process and digital fabrication for KANSHITSU craft, digital tools would be becoming more useful in the near future as the meaning of handwork practice vary under the rise of digital fabrication.

CONCLUSIONS

1) It was found that the nature of the KANSHITSU is ideal for laser cutting. In order for the process, the material should need to be plane and flat. And also found that a vinyl chloride sheet was ideal for making the sheets because the layered up KANSHITSU can peel off the vinyl chloride sheet without any mold release material.
2) The new design method for URUSHI craft, which consists of KANSHITSU sheet, 3D CAD design and laser cutter, was achieved. This series of work named “Linked Oval Vessels” was getting popular among the contemporary craft and invited to show in four exhibitions in museums and galleries in the last three years.
3) Follower increased. FabLab SENDAI FLAT, a digital fabrication farm in Japan started a workshop program of KANSHITSU sheet. FabLab KAMAKURA has done a workshop with KANSHITSU sheet and the same kind of workshop was held in Fab10 in Barcelona in 2014. In any of the venue, target was not craftspeople but ordinary people. It provides general people, especially students or children and their parents with an opportunity to meet with genuine URUSHI through KANSHITSU sheet while their school never show what URUSHI is all about in today.

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