

Study on Yiyang Xiao Yu Bamboo Skill Crafts and Modeling Principles

¹Yuan Jindong, ²Guo Xiaoyu, ³Xia Lan

¹Chinese Tradition Furniture Research Innovation Center, ^{2,3}Faculty of Furniture and Art Design,
^{1,2,3}Central South University of Forestry and Technology, Changsha, China

Abstract—Yiyang Xiaoyu bamboo skill crafts are with long history of folk traditional handicraft techniques, its handmade products are not only with beautiful shape, but also with fine workmanship. Since 2006, “Xiaoyu Bamboo Skill Craft” was included in the non-material cultural heritage, since then, intensive studies were carried out by many scholars. Authors of this paper carry out the study mainly from the perspective of Xiaoyu bamboo technology and focusing on the Xiaoyu bamboo structure, aimed at better protection and transmission of traditional arts and crafts, and provide a theoretical basis for the improved design innovation of Xiaoyu bamboo craft.

Keywords—Xiaoyu bamboo skill craft; Structural feature; Modeling principle

I. INTRODUCTION

“YU” is a key word of Yiyang Xiaoyu bamboo skill crafts, it throughout the whole process, and has multiple meanings, it is not only refers to a specific technology name, sometimes it can refer to the whole process. When used to describe the Yu work skills, there are two kinds of meaning: one refers to bending the small cross-section wood bamboo members after heating, to make it meet the need of modeling; two refers to binding joints method between the vertical member and the horizontal member in the products. Xiaoyu bamboo utensil is focuses mainly on this skill, Small bamboo utensil was produced by traditional techniques of Mosaic, “scarf”, and tenon joint etc. , its beautiful shapes, and refined skills, so it is a fine folk traditional handicraft in Hunan.

II. ARTS AND CRAFTS SUMMARY

A. The Development of Xiaoyu Bamboo Arts

Xiaoyu is a kind of traditional folk arts and crafts originated in Yiyang. which use various bamboo materials to manufacture domestic tools or instruments. including dendrocalamus affinis whose diameters below 500 centimeters are used as framework, phyllostachys pubescens as auxiliaries. this crafts featured by it's firing work. “Yu” represents a local language in yiyang means buckling. Xiaoyu crafts are of exclusive to yiyang. Yu bamboo crafts can be divided into “large” which called dayu in Yiyang and “small” called xiaoyu. The two

kinds of crafts follow the same manufacturing principle but different in terms of materials and structure. Xiaoyu is made of dendrocalamus affinis with a smaller diameter. Dayu employs dendrocalamus affinis with larger diameter.

B. Basic Process

Yiyang “xiaoyu bamboo skill crafts” are divided into four major technologies: material selection, fire work, Yu work and decorate.

1. Material selection means prepare suitable materials to make products. The material selection craft is the first process in the production process of Xiao Yu bamboo skill crafts, the main process includes material selection, blanking, sanding, burning oil, straightening, coloring and preventing mold and moth processing etc..
2. Fire system is heating the bamboo through baking, and Softening bamboo fiber , change the physical properties of bamboo, so can implement the modeling design of bamboo. The fire system technology is a special and the core technology in “xiaoyu bamboo skill crafts”, enrich product modeling and improve the artistry of products through straightening and Yu bend bamboo, it can be said that the fire work throughout the whole process of making utensils. almost all of the production process of bamboo can not do without fire, however, “xiaoyu bamboo skill crafts” uses fire has reached the pinnacle point. In the long-term practice, Yiyang people summed up a set of fire work shaping process, representative process are burning oil, yu gap by fire , fire bend and the branch bent into the shape of flowers.
3. Yu work. The meaning of Yu system technology: first is the Yu work method of the skeleton structure, called the Yu work structure, this stage is mainly to build the basic structure of shape. The whole process is not complicated, but it is the most basic process and it also is the core process. Skeleton structure is directly related to the quality of the product , just like build high buildings, must have a solid foundation, but equally In the process of Yu work utensils must be solid skeleton and compact

structure. Second is the overall production process of the whole shape, called as Yu work utensils shape. Because there are many types of xiaoyu bamboo utensils, so the process of different utensils are not the same, but the basic process is consistent (Fig. 1).

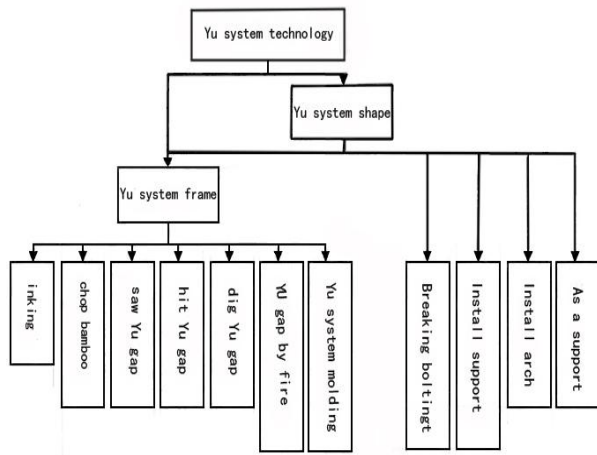


Figure 1: Yu system process flow

4. Decoration. Yiyang “Xiaoyu bamboo skill crafts” is of high artistic value, not only because of the structure are simple, but because of its complicated decoration techniques. At the beginning of the 70s ,people invented four process include coloring bamboo bark, bamboo veneer, bamboo top edge, bamboo branch embossing ,and it has pushed “Xiaoyu bamboo skill crafts” to a new climax, attracted world attention to the Xiao Yu bamboo skill crafts.

III. STRUCTURE FEATURES

“Revolve Yu” is the main structure of Yiyang “Xiaoyu bamboo”. In the traditional techniques, measuring length of yu gap depends on the artist’s experience skills. When making products of tetragonal structure, often using older bamboo master proposed the concept data that all of the yu gap length is 9/16 of the bamboo pillars, but the data is not suitable for making products of other shapes , so the author regarded bamboo as an ideal equal diameter material in the research process ,which uses mathematical formula to calculate the length of all yu gaps, in order to obtain a reasonable length value of yu gap.

When making products of special type, it may be due to the performance of bamboo can not reach the requirements and thus use the other methods of make breach for bending. As shown in Figure 2 is the two most common bending methods of make breach: circle bending and angle bending ,collectively known as the pan triangle notch bending method, namely the need to bend the place to dig out the triangle tooth uniformly on the bamboo surface, and then heating it, towards the

triangle tooth direction bending, make the bamboo bending to the preset level in the case of no damage , such as the table panel, the arm of the sofa and decoration parts are often used this structure. In order to stabilize the overall shape of the product, in the production process will be applied to the tenon structure.

A. The Calculation Method of “Revolve Yu” Structure

As shown in Figure 2, assume that “a” is the angle after revolving, such as three around fold is 60 degrees, four around fold is 90 degrees etc. Then,

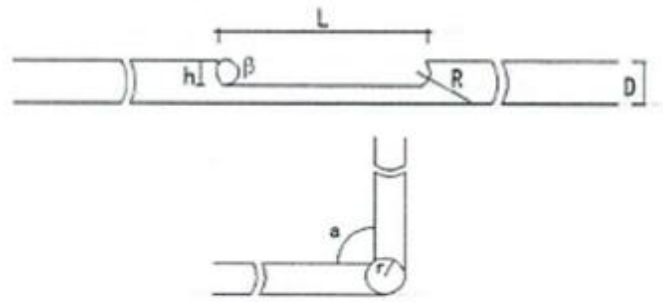


Figure 2: Calculating of revolve Yu

The length of yu gap (unit :cm): $L = 2\pi r - a\pi r / (180^\circ)$

The curvature radius of yu gap(unit:cm): $R = r$

The depth of yu gap(unit:cm): $h \leq r + r \sin(a/2)$

The angle of yu gap(unit:°): $\beta = 90^\circ + a/2$

Table 1: Common length of starting Yu opening

name	angle a/ (°)	length	angle beta/ (°)	depth h (≤)
3around fold	60	5/3r	120	1.5r
4around fold	90	3/2r	130	1.707r
5around fold	108	7/5r	144	1.809r
6around fold	120	4/3r	150	1.866r
8around fold	135	5/4r	157.5	1.924r
12around fold	150	7/6r	165	1.966r
18around fold	160	10/9r	170	1.985r

B. The Calculation Method of “Circle Bending” Structure

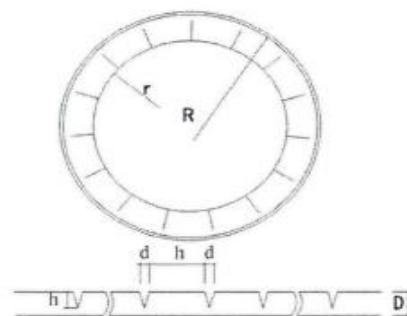


Figure 3: Calculating of circle bending

As shown in Figure 3, assume that “n” is the sum of saw

kerf ,then:

The depth of kerf (unit:cm) : $D/2 \leq h \leq 3D/4$

The width of kerf (unit:cm) : $d = 2\pi h/n$

The space of kerf (unit:cm) : $I = 2\pi r/n$

The outer edge of the circle bending structure are often using side-wrapped form,the length of side-wrapped is calculated as follows:

The net material length of side-wrapped (unit:cm) : $L_{net} = 2\pi R$

The material length of side-wrapped (unit:cm): $L = 2\pi R + L_{joint}$

C. The Calculation Method of “Fillet Bending” Structure

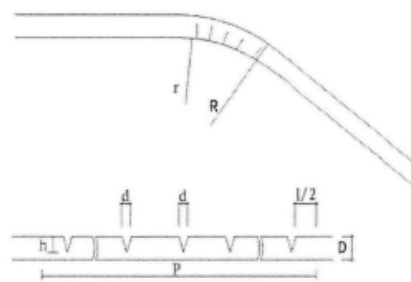


Figure 4: Calculating of angle bending

As shown in Figure 4,assume that “a” is an angle formed and “n” is the sum of tin gaps.Then,

The depth of tin gap (unit:cm): $D/2 \leq h \leq 3D/4$

The width of tin gap (unit:cm): $d = a\pi h/(n180^\circ)$

The space of tin gap (unit:cm) : $I = a\pi r/(n180^\circ)$

Accurate data on the length and depth of yu gaps and serrated jaws can be obtained through mathematical calculations, but in practical applications, due to the anisotropy of bamboo, these data can only be used as a reference, it should be adjusted according to actual situation.

D. Tenon Structure

Tenon joint means make bamboo processed into tenon tooth and pore to cooperate,tenon tooth convex,tenon pore concave. Tenon joint structure generally used in making bamboo furniture, bamboo furniture structure is very solid and appearance is more beautiful after with tenon joint, commonly used bamboo timbers are phyllostachys pubescens and Dendrocalamus latiflorus . We need to Drying bamboo timbers before tenon joint. The middle tenon, the side tenon and the through tenon are three common forms of bamboo timbers tenon joint. The middle tenons are generally used for structure of support type, in order to fill the vacancy of products. The side tenons are often used for bamboo sofa arm and other locations, plays the role of reinforcement. The

through tenons are generally used for stabilize support,plays the role of stable, such as movable table rack (as shown in Figure 5 for several basic tenon structure).

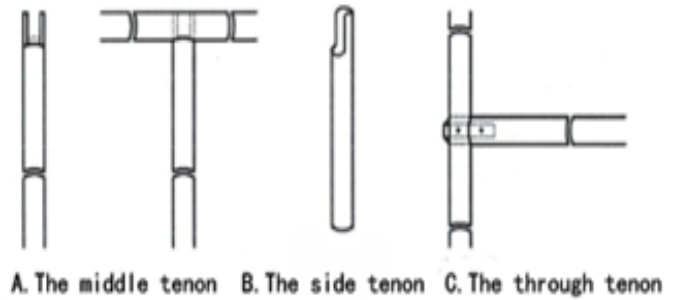


Figure 5: Many kinds of tenon structure

IV. MODELING PRINCIPLES

“ Xiaoyu bamboo skill crafts”is a traditional folk handicraft, so modeling is no fixed pattern, they are determined according to the functional needs, which is the root reason of the xiaoyu bamboo skill crafts minimalist functionalism. With the progress of the times, the xiaoyu bamboo skill craft shapes are also changes, such as increasing decorative lattice, the bamboo branch bent into the shape of flowers ect., Not only increase the aesthetic and artistic of the xiaoyu product, but also play a role in strengthening the structure of the product, reflects the whole bamboo utilization principle. Xiaoyu artists in the design of xiaoyu products, also take into account the product should be to give people the visual enjoyment of beauty, so in the design use of quite a few design principle , shows xiaoyu artists exquisite craft and Xiaoyu bamboo rich modeling.

A. The Composition Principle of Unity Combines with Change

Unity and change is the unity of the overall composition, and the shape, quality, color have changes mainly follow the principles like this: contrast and harmony. In the xiaoyu bamboo product modeling, xiaoyu artists are good at contrast use of Square-circle,virtual-real, length, curve -straight, density, height, width. Such as lamps and fish tank in Figure 6, they are comparison and combination of square and circle, Square frame structure provides a contrast for Cylindrical lamp shade in the lamps, different treatment methods of materials are contrasted materials.Fish tank on the whole seem to use a square to set off a circle, highlighting the desktop and desk legs, and table legs support in the whole play a harmony effect, so that the overall look is very harmonious.



Figure 6: Contrast and harmony

Repetition and rhythm. The Xiaoyu bamboo modeling is mainly by using linear, and linear has full of changes, line is in regular pattern has a combination changes and with strong rhythm and modeling artistic appeal. Repetition and rhythm are most frequently used modeling principles in xiaoyu bamboo, almost everywhere in the xiaoyu bamboo products. In Figure 7 the bamboo cabinet and bamboo crafts, they are used in the form of the branch bent into the shape of flowers to generate duplicate in modeling, and forming a rhythm.



Figure 7: Repetition and rhythm

Focus and general. In the bamboo products, often in order to highlight a site, decorated with lattice and the branch bent into the shape of flowers, in order to enhance the performance of the product (as shown in Figure 8).



Figure 8: Focus and general

B. The Composition Principle of Balance Combines with Stability

The composition principle of balance combines with stability is no matter what kind of shape to take, the overall structure needs to be stable, in order to achieve a balanced visual effects, highlighting the affinity between product with man and natural.

Balance and lively. "Xiao Yu bamboo skill crafts" often use left and right symmetry and front and back symmetry, in order to obtain the equilibrium effect. As shown in Figure 9 shows the table and lamps are through a symmetrical balance to achieve stable visual perception of products.



Figure 9: Balanced and lively

Stability and Lightweight. The main method of "Xiao Yu bamboo skill crafts" modeling is Revolve Yu by around bamboo and column bamboo. The arc support of round stool in figure 10, not only as a load-bearing structure, but enrich modeling, stool structures are stable and does not lose the light. And another product makes the simplicity of xiaoyu bamboo product structure are reflected to the extreme, while ensuring the stability of the product, very simple and with a sense of fashion.



Figure 10: Stability and Lightweight

V. STRUCTURE CONNECTION

Combine processed components into a complete bamboo appliance according to designing request, this process is called structural assembly, and this is the final stage of bamboo furniture production. There are component assembly and general assembly differences in bamboo furniture assembly, but its structural characteristics are roughly the same, we often use the traditional structure of punched holes and tenon joint, or use rattan and Plastic strips as an auxiliary bundling, the assembly structure has the advantage of simple and effective, no glue, non-toxic, natural environmental protection.

Punched holes, tenon joint. Because the bamboo bark has higher density and the longitudinal tolerance is insufficient, the bamboo bark surface would be easily broken if the nail are nailed directly into it, it must be positioned on bamboo in accordance with the design requirements, namely after drilling

or digging and then to nail into the pins . The practice of bamboo pin is split bamboo bark of old bamboo into tetragonal bar, then sliced into long corn shape that the fore-end is tapering and the rear part is thicker , this became the bamboo pins , make the bamboo pins into the hole,then cut the excess to ensure the surface smooth , and avoid to affect the appearance, as shown in figure 11.



Figure 11: Breaking bolting

Wrapping and assembling method. Wrapping denotes an assembly method that the part of connection in the frame of bamboo utensils with the rattan and Plastic strips wrap around the joint for reinforce . The use of auxiliary materials are bamboo pins, wood core, resin etc.. There are many kinds of ways of wrapped connection, such as the bundle wrapped connection, the bending wrapped connection, the tip wrapped connection, the combination wrapped connection, and the angle wrapped connection (as shown in Figure 12).

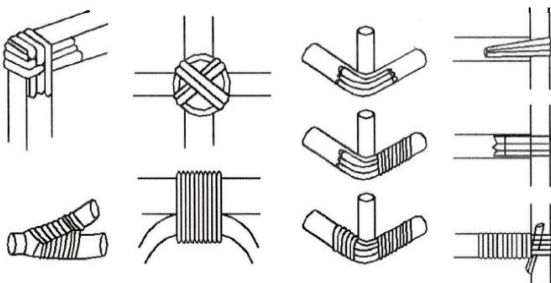


Figure 12: Wrapped connection

Glue assembly method. When assembling bamboo furniture , some key parts need to be reinforced with adhesive. Gluing assembly operation is usually choose the relatively dry bamboo, paint adhesive evenly on the parts of need to glue and make no gaps between various parts. For the low bonding strength and large elastic bamboo, it is recommended to use a fast curing agent, and must be fixed and pressed until fully cured during assembly, to prevent joint gap. In particular, bamboo utensils should use a non-toxic or antibacterial effect adhesive if it is use for holding food .

CONCLUSION

System research on traditional technology is to better protect and inherit the traditional crafts, make more and more people can understand the good traditional handicraft culture, expand

the application areas of traditional crafts, to enhance the cultural connotation of traditional crafts, rich artistic value. Yu technology is the basic crafts of small Yu bamboo, is the basic for product success or not. The author draws the following conclusion through the practice. 1 Yu framework mainly to control the degree of coordination between the around bamboo and the column bamboo, and build the most basic framework of the product. This requires that the length of the Yu gap is exactly, the width of the Yu gap is basically the same as the diameter of the around bamboo, the depth of all the Yu gap is consistent. Both ends of the Yu gap should be left with the applicable angle of the strut, and the all mouth of the same around bamboo must be on the same level. 2 The type of Yu requires according to different product design needs, use of various techniques, structural methods, modeling principles flexibly, etc. So as to produce products that accord with the use function and aesthetic taste.

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