

A Study of the Technique Combining Traditional Bamboo Furniture and Carpentry

Shih-Hsing Wu and Ming-Chyuan Ho

Abstract—Bamboo craft and bamboo furniture in Taiwan are mainly designed, created, produced, and sold in Chushan city, a place that prospered during the period of economic growth in the 1970s and 80s in Taiwan. In those days, there were about 2000 bamboo factories but over time, the number declined. Since there are few studies on traditional bamboo furniture and craft, this study aims to explore: 1. traditional techniques of bamboo furniture; 2. carpentry of bamboo furniture; 3. comparison between the making of bamboo furniture with traditional techniques and carpentry. Based on grounded theory, this study collects firsthand information in field research and action research. The researchers personally participated in the production process to understand the differences between the making of bamboo furniture with traditional techniques and carpentry. The results shows that in order to open a path for the future with the past as a foundation, bamboo furniture can be made by combining traditional craft techniques of different fields and carpentry so as to produce new products with traditional and innovative techniques.

Index Terms—Bamboo furniture, carpentry, bamboo craft, traditional technique.

I. INTRODUCTION

Bamboo furniture used to be one of Taiwan's specialty products. However, the rise of cheap labor in China and Southeast Asia, imported furniture, and service and electronics industries all had a major impact on the bamboo furniture industry in Taiwan in the 1970s. To change the stereotypical image of bamboo furniture in Taiwan and revive the industry, it is necessary to create "innovative value" in its style and production for greater appeal and popularity. Therefore, the designers have to integrate technology, science, art, and humanism [1] to create more possibilities for the future and reduce making "bland" and "coarse" products [2].

Based on the abovementioned research background, this research explores the connection between traditional techniques of bamboo furniture making and carpentry and compares their unique advantages and disadvantages. These research materials are collected, organized, and analyzed so as to facilitate the passing down of traditional techniques and culture. As traditional bamboo furniture artists grow older and older and few young people are interested in the training of the traditional techniques, this industry that is uniquely Taiwanese in culture is on the verge of extinction.

This study aims to explore: 1) Traditional techniques of

bamboo furniture; 2) Carpentry of bamboo furniture; 3) Comparison between the making of bamboo furniture with traditional techniques and carpentry.

With these three purposes in mind, this study hopes to provide preliminary research on this issue so as to understand the relationship between bamboo furniture making with traditional techniques and carpentry, and new methods of making bamboo furniture.

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II. REVIEW OF RELATED RESEARCH

This chapter focuses on the differences between bamboo furniture making with traditional techniques and carpentry.

A. Bamboo Furniture Making with Traditional Techniques

Bamboo was an indispensable material for people in early Taiwan. In History of Taiwan, Lien Heng noted that "Bamboo in Taiwan is used in many different ways everywhere. It is used to make beds, tables, baskets, and daily utensils." Women in rural villages wove bamboo sticks during their leisure time, while men "carved" large pieces of furniture from bamboo. As time went by, bamboo products transformed from a traditional Fujian and Guangzhou style into daily bamboo craft with unique Taiwanese characteristics [3].

In 1943, Japanese folk artist Liu Zong-yue visited Taiwan and was charmed by the natural aesthetics of rural life. Liu thought highly of traditional Taiwanese bamboo furniture and craft. He was deeply intrigued by the simplicity of bamboo furniture in Taiwan because of the beauty of bamboo and the uniqueness in structural design [3].

The comparison between the application of traditional craft and modern design is shown in Table I.

Besides, according to other research, bamboo furniture used in early Taiwan can be divided into three types [6]: 1) Fujian and Guangzhou Ming Style, such as armchairs, basin stands, bamboo stands, lounge chairs, bamboo stools, etc.; 2) Applications in life, such as bamboo tables, bamboo chairs, bamboo beds, bamboo stools, mother and baby chairs, strollers, bamboo cabinets, bamboo stands, etc.; 3) Artistic style, such as crown chairs, pillows, strollers, etc. The first

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two types are modeled according to traditional wooden furniture, while the third type is modified according to modern design. In terms of decoration, all three types apply heat to bend the slender pieces of bamboo, and the carving of the bamboo partially incorporated certain other materials, such as glass, rattan, metal, and plastic.

Traditional bamboo furniture making is not a simple process. The production methods of bamboo furniture are [3]-[5]: 1) Picking bamboo, removing the knots, removing the oil, drying, and preserving; 2) Cutting, sawing, carving, gouging, heating, inserting, gluing, assembling, nailing, and painting; 3) decorating, such as polishing, painting, inserting flower ornaments and other materials.

Although the shape of bamboo furniture tends to imitate wooden furniture and is limited by its material properties and inherited traditional techniques, bamboo furniture made with traditional techniques and modern design is different from traditional wooden furniture carpentry in its style and unique production methods.

TABLE I: COMPARISON OF BAMBOO FURNITURE IN TRADITIONAL CRAFT AND MODERN DESIGN

	Traditional Craft	Modern Design
Style	<ul style="list-style-type: none"> 1. Products feature cultural and regional characteristics. For example, Fujian and Guangzhou Ming style armchair; 2. Bamboo furniture or other crafts that can be easily used in daily life For example, bamboo table, bamboo cabinet; 3. Adjustable form to different specifications and simpler style; 4. Less ergonomic. 	<ul style="list-style-type: none"> 1. No historic or cultural background; 2. Due to high cost, the specification is not easily changed; 3. Elegant style but not easily matched with other bamboo furniture and craft; 4. Emphasizes more on human factors; 5. Design is more delicate and intricate.
Production Process	<ul style="list-style-type: none"> 1. Material is hollow and therefore difficult to bend and glue it; 2. Manually intensive production; 3. Difficult to pass down the techniques (time and labor intensive, but the techniques are not complicated); 4. Inexpensive and the tools are simple; 5. The special techniques are appreciated by foreign artists. 	<ul style="list-style-type: none"> 1. Mostly bamboo laminates; 2. Most parts are machine, and less are handmade; 3. Expensive as it relies on imported materials. Machines are expensive, most of which is carpentry equipment.
Application	<ul style="list-style-type: none"> 1. Easily replaced by furniture of other materials (plastic, leather, rattan, steel); 2. Column and straight patterns look warm and high quality. Modern furniture is blended with tranquil and peaceful atmosphere; 3. Materials are readily available. Inexpensive but good quality. Affordable to the average consumer. 	<ul style="list-style-type: none"> 1. The material is hard and smooth. Blends effortlessly into one's living environment; 2. Expensive, so may not be affordable to the average consumer; 3. Sophisticated living goods can be made, such as lampstands, ornaments, tea ware, bowls, and so on.

Sources: Wu Shi-xing, Cheng Ying-bin, and Chen Qi-xiong (2004): A comparative study on bamboo furniture made in traditional techniques and modern design. *Industrial design* 32.2, 202-207.

B. Carpentry in Bamboo Furniture

Over the past 20 years, private Taiwanese companies and the National Taiwan Craft Research and Development Institute have achieved significant progress in the design and development of bamboo furniture styles. The design and making is divided into two types, natural bamboo and laminated bamboo furniture [3], [4], [6]: 1) Natural bamboo

furniture is usually made using traditional techniques, which is a simple style of connected bamboo stems; 2) Laminated bamboo furniture is made from bamboo that has been processed in order to become laminated bamboo, which results in a style of furniture that looks more like wooden furniture. Besides, composite materials can be used to create a style with greater flexibility and appeal. Laminated bamboo furniture lends itself to more innovative design yet still maintains the classic look and feel of bamboo. Thus, it is being used more and more widely in modern bamboo furniture.

Currently, bamboo furniture made with carpentry techniques utilizes laminated bamboo. Laminated bamboo can be cut using carpentry equipment and is often fixed with mortise and tenon joints. It in turn influences traditional bamboo furniture making. In other words, designers gradually adopt carpentry techniques for some parts of the bamboo furniture structure to enhance its robustness and durability. However, traditional techniques of bamboo furniture making are often better than carpentry techniques. What are the differences, and what are the advantages and disadvantages? Field research shall be undertaken to clarify these points.

III. METHODOLOGY

This study is conducted through field research and action research. By collecting firsthand information and participating in related activities, the differences between the collected materials and actual situation can be understood. A theory is built through experience and action, and the research result can be directly utilized in dealing with societal problems [7]. Reflection and opinions of the issue can be raised in order to enhance the development of this study and serve as a reference for related industries.

During 1996 and 2003, we attended numerous programs including: the Advanced Program for Bamboo Furniture Design; the Commodity Development Program; the Teaching Training Institute held by the Dept. of Bamboo Craft, National Taiwan Craft Research and Development Institute; and enrolled six times in the Bamboo Producers Training Program, held by the Nantou County Industrial Development and Investment Promotion Committee, Small and Medium Enterprise Administration, Ministry of Economic Affairs. We participated in person in a variety of training, including hands-on practice, development, design, marketing, and visiting the few remaining Bamboo production companies in Taiwan. By interviewing related personnel, we attempted to apply theories of bamboo furniture design and production techniques to practice so as to be more familiar with the design and techniques of traditional and modern bamboo furniture.

IV. RESULTS OF ANALYSIS AND DISCUSSION












A. Traditional Bamboo Furniture Production Techniques

Bamboo is different from other materials. It is hollow and has no xylem, while its fiber and stem are very hard and grow in parallel form. Therefore, the tools and techniques

employed in bamboo furniture production are unique.

The tools include: thin blade saw, chopper, inclined knife, chisel, arch sharpener, bamboo straightening stand, wooden hammer, working stool, working station, bamboo ruler, electric driller, flame gun, rope, whetstone, and so on, as shown in Table II.
















TABLE II: TOOLS FOR MAKING BAMBOO FURNITURE WITH TRADITIONAL TECHNIQUES

Name	Thin Blade Saw	Chopper	Inclined Knife
Image			
Remark	• Used to saw bamboo.	• Used to cut down, sharpen, and knock bamboo.	• Used to polish holes in bamboo.
Name	Chisel	Chisel	Arch Sharpener
Image			
Remark	• Used for gouging. There are five chisels, with widths 1, 0.8, 0.7, 0.5, and 0.3 inch respectively.	• Used to hollow out bamboo for easy bending.	• Used to sharpen a circular angle.
Name	Bamboo Straightening Stand	Working Stool	
Image			
Remark	• Used to straighten arch bamboo stems.	• Used with the jig.	
Name	Jig	Wooden Hammer	Bamboo Ruler
Image			
Remark	• Made of wood. Used as a jig for sawing, cutting, knocking, pounding, and chiseling bamboo.	• Used to pounding chisels or wooden tools.	• Used for measuring.

Compiled by the study.

Bamboo is mainly processed by gouging, chiseling, paper gauge, bamboo stem wrapping, bending bamboo with heat, wrapping bamboo joints, fixing with bamboo nails, cutting bamboo, seat-top surface making, cabinet corner gussets, connecting mortise and tenon joints, making circular frames, making decorative bamboo floral patterns, weaving mortise and tenon joints, making circular frames, bamboo, and so on, as shown in Table III.

TABLE III: TRADITIONAL TECHNIQUES OF BAMBOO FURNITURE MAKING

Name	Paring	Chiseling	Polishing the holes
Image			
Remark	• Paring the extra parts before the bamboo is chiseled.	• Chiseling the main stem.	• Polishing the hole with a knife.
Name	Knocking	Sawing	Inserting
Image			
Remark	• Knocking a bamboo slide into the hole.	• Cutting the bamboo with a saw.	• Inserting a bamboo nail with a chopper.
Name	Trimming	Polishing	Straightening or Bending
Image			
Remark	• Trimming the inside of the bamboo.	• Polishing the surface of the bamboo.	• Straightening or bending the bamboo.
Name	Drilling	Heating	Fixing
Image			
Remark	• Drilling the bamboo with an electric driller.	• Heating the bamboo with a flame gun.	• Fixing the bamboo with cotton ropes.
Name	Inserting Bamboo Nails	Weaving the Seat-top Surface	Wrapping
Image			
Remark	• Fixing the bamboo with bamboo nails.	• Making the surface of the seat by lining bamboo slides.	• Chiseling the curved part of the bamboo to connect another piece.

Compiled by the study.

B. Bamboo Furniture Carpentry

Carpentry techniques are mainly adopted in bamboo furniture making with laminated bamboo and wooden joint structures. The techniques include: 1) dovetail--wood connected by right angles.

It is the strongest way to make joints due to the inherent mechanical strength. There are three forms: exposed dovetail, joint dovetail, and hidden dovetail; 2) equal size mortise and tenon joint--connect two pieces of wood by mortise and tenon; 3) mortise and tenon of different sizes--there are two forms: column and slide. The two tenons are of different length and are usually placed on the diagonal of the section; 4) tongue and groove joint--usually used in the connection of the patterns of plank; 5) V shape dowel joint--combining legs and rungs; 6) crossing tenons and connecting one side tilting to a certain angle--used in intricate parts such as frames and embedded planks; 7) Edge tenon joint--used in the joint of edges. The processes are shown in Table IV.

TABLE IV: TECHNIQUES APPLIED TO LAMINATED BAMBOO

Name	Exposed Dovetail	Equal Sized Mortise and Tenon Joint
Image		
Remark	•Wood connected by right angles produces joints with the most powerful mechanic strength.	•Tips of wood joint are connected by being shaped as tenons in the same size as the mortises.
Name	Mortises and Tenons of Different Sizes	Tongue and Groove Joint
Image		
Remark	•There are two kinds: columns and slides, whose lengths are different. The tenon is placed on the diagonal of the section.	•Usually used for the joining of patterned planks.
Name	V Shape Dowel Joint	Crossing tenons and connecting one side tilting to a certain angle
Image		
Remark	•Combining legs and rungs	•Used in intricate parts such as frames and embedded planks
Name	Edge tenon joint	Crossing tenons and connecting one side tilting to a certain angle
Image		
Remark	•Used in the joining of edges.	

Compiled by the study.

C. Comparison of Bamboo Furniture Made with Traditional Techniques and Carpentry Techniques

According to the abovementioned description, bamboo furniture produced using traditional techniques is made of

bamboo, and features the main characteristics of bamboo: hollow, without xylems, fibers paralleling to stems, and hard texture. Therefore, if the bamboo needs bending, the artist would either hollow out one side or heat it. The bamboo is connected by either chiseling or fixing it with nails. Bamboo is utilized for its physical features.

TABLE V: COMPARISON OF THE TOOLS, TECHNIQUES, PRODUCTION PROCESSES, DECORATION, APPLICATION, AND TENDENCY OF TRADITIONAL AND MODERN BAMBOO FURNITURE

Type	Traditional Bamboo Furniture	Modern Bamboo Furniture
Tool	Thin blade saw, chopper, inclined knife, chisel, arch sharpener, bamboo straightening stand, wooden hammer, working stool, working station, bamboo ruler, electric driller, flame gun, rope, whetstone, etc.	Machines and tools used in modern wooden furniture making, bending heat equipment, gluing machine, etc.
Technique	Gouging, chiseling, bending by heating, wrapping bamboo joints, fixing with bamboo nails, cutting bamboo, making seat-top surfaces, making cabinet corner gussets, mortise and tenon, making circular frames, making decorative bamboo floral patterns, weaving bamboo, and so on.	Right angle joint by dovetail, equal size mortise and tenon joints, mortises and tenons of different sizes, tongue and groove joints, V shape dowel joints, crossing tenons and connecting one side tilting to a certain angle, edge tenon joints
Production Process	(1) Picking bamboo, removing the knots, removing the oil, drying, and preserving; (2) Cutting, sawing, carving, heating, and nailing; (3) decorating, such as polishing, painting, inserting floral patterns and other materials.	Made using carpentry equipment and mortise and tenon joints with other materials. The joints are formed in a more creative way.
Decoration	Traditional symbols of luck or ancient flowers are made by bending thin bamboo and inserting in an appropriate place in the furniture.	Carved with a pattern of luck in Chinese Ming Style furniture or inserted into an appropriate place in the furniture.
Application	With simplicity and ingenuity, a product necessary for daily life is made. Affordable for the average family.	(1) Emotionally, the design of modern bamboo furniture corresponds more to the taste and aesthetics of modern Taiwanese society. (2) In terms of lifestyle, bamboo furniture provides greater home decoration choices, especially for those who care about leisure and fashion. (3) In terms of practicality, bamboo furniture might be less durable. Therefore, it is more of an ornament rather than as a practical item.
Tendency	Traditional bamboo furniture demonstrates more cultural features. Besides the tendency of using green materials such as bamboo, the product also demonstrates "innovative value."	Modern bamboo furniture emphasizes more on design creativity. It tends to retain the traditional art of bamboo furniture and the essence of modern design in bamboo furniture.

The construction technique used in bamboo furniture making utilizes mortise and tenon joints with laminated bamboo. It focuses on the design using planks. The styles created from bamboo and laminated bamboos are different. In other words, the styles are not just created based on function, but also on the characteristics of the materials. Besides, traditional bamboo furniture often imitates wooden furniture. The designers often think about how to build a piece of bamboo furniture with the shape, function, and even quality of wooden furniture. According to research, the style of traditional bamboo furniture emphasizes more on culture, whereas modern bamboo furniture focuses more on design. Traditional bamboo furniture making emphasizes more on the techniques of chiseling and joints while modern bamboo furniture making is more about the use of carpentry tools and the use of other materials.

V. CONCLUSION AND SUGGESTIONS

This study concludes that: 1) Bamboo furniture companies today make traditional bamboo and laminated bamboo furniture differently. The former is plain, simple, and cheap, while the latter is luxurious, graceful, and expensive. 2) Traditional bamboo furniture is made using traditional techniques, while laminated bamboo furniture is made using carpentry techniques. 3) Therefore, it is difficult for traditional bamboo furniture to be produced in innovative styles because of inherent limitations due to the physical characteristics of bamboo. On the other hand, because laminated bamboo furniture is made using carpentry techniques, in fact, there is little difference between bamboo furniture and wooden furniture. According to the comparison between these two types of bamboo furniture (Table V), we suggest: 1) Besides keeping traditional features, traditional bamboo furniture can be strengthened by utilizing carpentry techniques. 2) Besides carpentry techniques, laminated bamboo furniture can be made using traditional techniques so as to retain the traditional culture and characteristics of natural bamboo. 3) Designers should explore new possibilities by studying the materials itself. 4) By balancing

traditional art and modern design of bamboo furniture, and with the global green materials trend, the almost extinct art of bamboo furniture in Taiwan will again be respected and focused on, and regain the possibility of future developments of the craft.

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