

# Shigeru Ban's Architecture in the Context of Traditional Craft Techniques

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## 1. Introduction

Modern architecture is focused on renewable energy sources, recyclable materials, sustainable and flexible solutions serving to reduce material expenditure and working to satisfy people's spiritual needs. But we are also observing a process of exploration and rethinking of the capacities of well-known older materials, techniques and traditions in the traditional context and in our own time.

The subject matter of this study is the influence of the traditions and their application in current day conditions as well as the possibilities for their development. The attention is drawn to **Shigeru Ban's social and experimental architecture, which often represents the modern understanding of traditional techniques**. Here I discuss examples of Japan's lifestyle and culture, and the philosophy underlining the very construction of domestic home environments. Some of their main trends are explored and compared with Shigeru Ban's projects and realizations. A comparative analysis is also presented, conducted between Shigeru Ban's building concepts and Japanese craft techniques. Examples of traditional origami, folk techniques for wood, bamboo and paper processing and their larger-scale transfer in architecture are also being explored. In fact, investigated materials are apparently weak, but by knitting, folding or proper constructional scheme, they create a new, strong structure.

The aim of this study is to examine the traditional handicraft practices in using paper, wood and bamboo and through Shigeru Ban's interpretations of the matter, to reveal possible modern applications and approaches in the development of this material.

Here I will first introduce some basic features of the materials which are investigated in the study.

**Wood:** There are many symbolic trees for the people from the land of the rising Sun. One of the most famous symbols of spring in Japan are the magnificent pink cherry trees, also called "sakura". "Cherry blossoms are to be preferred not when they are at their fullest but afterward, when the air is thick with their falling petals and with the unavoidable reminder that they too have had their day and must rightly perish." [1] In Japan, cherry blossoms are one of the eternal metaphors of the short-lived nature of life; an association with the transitional character of color with exceptional beauty and upcoming death.

**Bamboo:** Bamboo is a peculiar building material - as a plant with its specific characteristics, but also as a symbol of Asian cultures. Although it rapidly grows in size, bamboo is considered to be a sort of grass, rather than a tree. "Bamboo should not be confused with tree species used for lumber; it is an extraordinary Pooideae (gramineous) whose hardness is a result of some of its constituents. It might be said to be the only tall and hard grass." [2] Another surprising fact about bamboo is that it is seemingly fragile but is, in fact, extremely tensile. Apart from decorative art, it is widely used in architecture and construction thanks to its well-appreciated qualities. On the symbolic side „In most Asian countries, bamboo is synonymous with wealth.“ [3]

**Paper:** In Japanese, the word for paper is "kami", but the same term can also mean "God":

"Shintō deities, known as kami, are believed to reside in natural features like rocks, mountains, and trees, and daily, seasonal, and special offerings are made to show respect for local deities." [4]. Paper is usually a fragile material for decorative art and small building elements (such as partition walls).

According to the author of "*Traditional Japanese Architecture: An Exploration of Elements and Forms*", the basic materials used in Japanese architecture are wood, grass and straw, stone, earthen matter and metal. [5] The Japanese prefer the beauty of the visible material - the tree, the bamboo, the paper, the stone. They prefer to reveal nature in the same way as they live in it: in harmony and with the constant strive to maintain a close relationship with nature: "THE ELEGANCE OF simplicity—beauty to be found in the texture and grain of wood and stone, in visible architectural structure, also in the precise stroke of the inked brush, the perfect judo throw, the rightness of the placing of a single flower. This beauty is both the expression and the result of an awareness that comes from a highly self-conscious regard of nature, as well as from an accompanying discipline that is one of the reasons the arts are rarely casual in Japan." [6]

## **1.2. Shaping in Shigeru Ban. The influence of traditions**

**Shigeru Ban** : The short biography of Shigeru Ban describes him as being born in Tokyo in 1957. From 1977 to 1980 he studies at the Southern California Institute of Architecture (SCI - Arc) but also attends the Cooper Union School of Architecture where he studies under the supervision of John Hejduk during the 1980-82 / 83-84 period. He has worked at Arata Isozaki's studio (1982-83) and in 1985 went on to establish a studio of his own in Tokyo. [7]

Let us trace those crucial points where Japanese philosophy intercepts with these three material sources: wood, bamboo and paper (to which we shall limit the range of this report because of the inability to discuss an entire culture in one single study).

The structures in our focus of attention are the locations around the house and the backyard where we find realized the techniques usually applied to wood, bamboo and paper.

## **2. Modular repetitions**

### **2.1. Modular figures**

Let us start with the application and impact of the knitting and weaving techniques. If we look at traditional Japanese knitting we can see constant repetitions of one and the same folded or assembled element. In other words - a module joint, or a "module".

The city of Beppu is often called as the center for the preservation and appraisal of the Japanese bamboo traditions. There are many ways in interweaving the bamboo in the basket knitting for example. Often they are based on triangle or square motive and form a net from modules. We can meet and some floral motives. Variations of weaving techniques are shown on figure 1. Due to its physical characteristics bamboo is a material suitable for building columns, beams, trusses, stairs, porches, floors and even bridges. "The construction of hanging bridges of bamboo, with a clearance of some 100 m [over 300 feet] are an example of the physical properties of this material. Bamboo is used in this case instead of cables. The Himalaya's Bridge is a good example of this." [8] Bamboo is stronger, as used in Japanese small-scale details, but now it has also proven to be a mighty supporting structure, which in Japan usually are made by different types of wood.

Repetitions of knits, knots or module elements are also now observed in structures, such as fences, floorings, partition walls (internal and external), roofs. And again, the basic materials used are wood, bamboo and paper.

Mixed constructions, with modular repeated assemblies executed by wood and paper and wood and bamboo, are particularly impressive.

So there is no way to miss the common movable barriers, typical of Japanese architecture, in the sphere of interior design and exterior/outer walls. Various materials are used for this purpose and they depend on the location of the final construction. According to Japanese philosophy, internal spaces transfuse between each other and a natural connection should exist between the interior and the exterior of every home. Thus, a complex task is being achieved via a very simple solution. The barriers are easily replaceable, easy to move and to store; they are made of local materials, are the result from many years of tradition and are subject to various techniques of execution serving to achieve a variety of different tasks. Some are translucent, others quite dense.

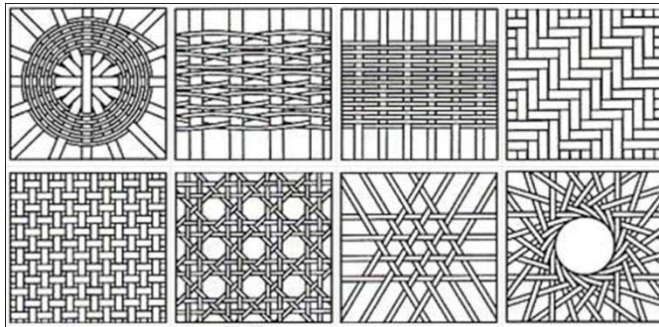
Those partition walls, separating various spaces are named "shoji screens". In his book "The Complete Guide to Shoji and Kumiko Patterns, Volume 1", Desmond King writes: "In the past, before the introduction of modern paper manufacturing technology, kumiko arrangement was determined by the width of the washi (Japanese hand-made paper). The standart shoji with total dimensions of just under 1.800x900 mm ..." [9] There is a module based on washi's dimensions. The meaning of "Shoji / shōji: Generic term for doors, windows and room dividers with translucent paper-backed lattice panel within a frame." [10]

Shoji screens are used for interior and exterior partition walls, but can also be applied as furniture doors. There are also "fusuma screens" that are used only in the interior, and "...while in the case of shōji this structural skeleton is pasted only on one side with translucent paper, the fusuma wood grid is covered on both sides by heavy opaque paper and additionally framed all the way around by a delicate wooden ledge..." [11]

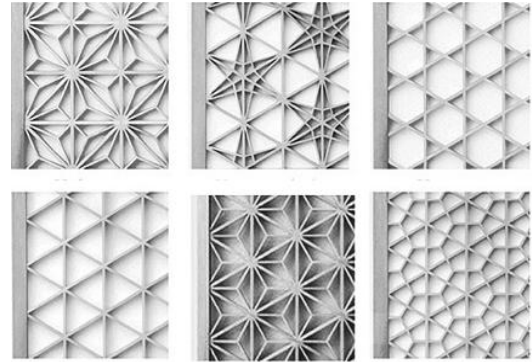
"Shoji are broadly classified by both kumiko arrangement and by structure, and all shoji are a combination of both. Although there was a functional consideration for kumiko arrangement in the past in terms of dimensions of the shoji paper..." [12] "Kumiko" are horizontal and vertical wood elements, which form a net into the wood frame of the shoji. There are many variations of kumiko patterns i.e. modules. The change of number of horizontal and vertical kumiko - this is one module type. Another type is when kumiko patterns are filled with wood elements.

One of the most attractive kumiko patterns is the asa-no-ha: "The asa-no-ha (hemp leaf) is perhaps the quintessential floral pattern in the square jigumi (pattern base) structure and also in the much more complex diamond jigumi. Its simple and ancient design has remained popular down through the centuries. The hemp plant grows quickly and straight, so in the past the pattern has often been used in children's clothing to encourage their healthy growth. In Japan it has been used in weaving, dyeing, traditional paper manufacture, and, of course, in woodworking, particularly in kumiko art and craft." [13]

Modules in shoji are achieved by assembling wood elements. Floral triangle motives and the different combinations of squares are very popular schemes. These types of modules (pattern) reminds me the weaving techniques with bamboo (*figure 2*).



**Figure 1**



**Figure2**

Other key aspect related to shoji screens is light: "The paper backing in shoji fills the room with a gentle soft light, and introduces an element of ambiguity so valued by the Japanese. The play of light and shadows on the paper allows the outline to be discerned, but not clearly enough to be identified. The object can be seen, but not seen." [14] Some shoji screens are used as a connection between the interior and the exterior by lifting the bottom to allow the seated person to see nature outdoors. Another type of partitions have glasses provided. And in the third type there is a part that opens.

Other interesting module example are Japanese wall or "komai-kobe, literally meaning "wall with small (bamboo) laces" [15] "As the columns of the vertical framework are the only bearing members, the wall's sole constructional function is to sustain itself. This is achieved by a wood-bamboo skeleton... Into each opening is tied a bamboo lathwork, consisting of a major frame, mawatashi-dake (literally, spanning bamboo), and a grid of bamboo strips, komai-dake (literally, bamboo in small laces). They are individually fastened either with rice-straw fiber or rope.." [16] The wall seems like it is a module in the module.

The mats over the wooden floor, on which all the activities are done, including sleeping, are called "tatami". The dimensions of the tatami are 90/180 cm. The size of the room is determined by the tatami. Again we find modular construction.

In most of the individual elements of the classic Japanese house are implemented unique specialized techniques.

Now, let's take a look at some projects of Shigeru Ban, in which there is a close association with the modular techniques of traditional craft products.

There are cases where Ban changes only the scale of the knit, moving from the detail in the decorative art to the details of a roofing structure by using - for example - wood, paper pipes and metal extenders. Often the details of such structures create a knitting effect in spite of not been transferred in the literal sense of the word. The use of a similar module, transferred from kumiko patterns of triangles can be seen in the ceiling of the Veneer Grid Roof House, Chiba, Japan, 2001. The triangle is a leading modul also in the Paper Dome, Amsterdam/Utrecht, Holland, 2003; in Paper Tower, London, 2009; in Centre d'Interpretation du Canal de Bourgogne, Pouilly-en-Auxois, France, 2005. It's obvious the traditional knit in the ceiling in Haesley Nine Bridges Golf Club House, Korea, 2010. Literally inspired by the weaving techniques are the Wickerwork House, Nagano, Japan, 2002; Aspen Art Museum, Colorado, USA, 2014. The Japanese pavilion for the World Exhibition in Hannover is another example of a possible, purely visual comparison with the complex traditional knits and the design of the

pavilion. At the Hermes Pavilion, there is also an association with knitting, albeit at an abstract and simple level. The pavilion is reminiscent of a basket, with interlacing effects and variations in the scale of modular elements.

## **2.2. Origami**

Another popular small scale “vernacular” art is origami. The classical origami is folded from a square piece of paper or it can be made up of one or more sheets of paper of different size, shape, color and thickness depending on the desired effect. "Origami is the art of folding uncut sheets of paper into decorative objects such as birds or animals. The word for this ancient Japanese art comes from ori-, meaning “folded,” and -kami, meaning “paper.”” [17] A modern interpretation of art of folding paper *origami* is a *modular origami* made of component parts, or modules. Normally the individual pieces are simple but the final assembly may be way too complex.

Origami concepts are used both in simple roofing and in complex shell-type surfaces. Curved surfaces resulting from the repetition of one and the same fold, whereby stable shapes are obtained, are a known building practice. One may associate these with folded constructions and the literally repetition of the principles of folding in the art of origami. Many authors around the world have been inspired by similar volume-space solutions. For example in Shigeru Ban projects we could mention Hanegi Forest Annex and its roof decision - Tokyo, Japan, 2004. Another simple example is the Studio for Vocalists and its ceiling design - Tokyo, Japan, 1991.

Exploring modular principles, one may also consider temporary shelters, erected after natural disasters to be, in effect, repetitive units forming a complete housing system, serving the most urgent needs. Initially, even common Japanese homes were built with the same consideration in mind: to meet the most basic of needs, such as shelters. Thus modulation, also seen as a net or a knit, is today repeated quite literally in the individual spaces which are created by Ban in gymnasiums with the project Paper partition system. By using a simple "knitting" scheme a considerable degree of complexity and unlimited repeatability have been achieved; at times, neighboring modules can be combined thus giving leeway for a certain zonal flexibility depending on the size of the family. A repetition of the same modules is also observed in the container designs made at Shigeru Ban's studio. I explain this type of module and its interpretation as a knit here almost because of use of paper and the sense of repetitive paper element as a module.

As sheer material, paper can also be subjected to recycling and reuse; to the transformation and realization of the ever so important tube – Ban`s construction element.

## **2.3. Cylindrical columns. "Walls" and "curtains" made of columns**

In most fences we also find similar principles with modularity. Some fences are light and allow tracery friability, while others are tall and dense and act like walls. Here we see another type of complex repetition - vertical columns or elements fastened each other by other connecting parts and forming a complete net - a wall or a curtain.

For example, the round bamboo stems are stacked and tied together to form a fence. We can easily make a comparison between the cylindrical shape of the bamboo and Ban`s paper tubing; between their seeming fragility and elegance and their true strength; between their mode of application in both the small and the larger scale. It is Shigeru Ban's preference for

the circular section of the cylinder, which allows for the curved outlines of a given barrier - Miyake Design Studio Gallery - Shibuya, Tokyo, Japan, 1994; Paper House, Lake Yamanaka, Yamanashi, Japan, 1995; Camper Traveling Pavillion, transported with the Volvo Ocean race, 2011; and others. These curved shapes are in fact typical of the Japanese landscapes and their decorative art reflections. The individual elements of the objects, constructed in this way, permit the typical tracery friability, both on the small scale - the fence, the partial transparent partition walls - and on a larger scale. Those structures are manifested by Shigeru Ban in the Paper church, Kobe, 1995 and the exhibition of Alvar Aalto, Tokyo, Japan, 1986. But he also applies cylindrical shapes, in designing furniture - chairs, tables.

By literally using the length of bamboo and paper tubes it is possible to grasp the spaces by raising podiums on a number of shorter "columns", as in Alvar Aalto's exhibition. In fact, this gradation of the spaces via different levels is also observed in traditional Japanese houses.

Some of Ban's buildings combine the both trends - assemblies and cylinders - in a modular repeatability. In the experimental houses, the pipes are arranged vertically next to each other and in the example of the Hanover pavilion they are interwoven with an appropriate element. At Hanover – again - we can observe the tying of the bamboo fence. The seemingly simple material has been used to obtain extremely complex details and the merger of simplicity and complexity dresses it in extraordinary beauty.

### **3. Design philosophy. The influence of traditions.**

#### **3.1. Minimalism**

A concept aspect of the principles of modular design is the application of a minimum quantity of materials and economizing on expenses: something which is characteristic of both the traditional Japanese architecture and of Ban`s individual work. Speaking of "minimum", I mean not only the optimal use of the available material but also of the types of materials which have found their application in the realization of a given project. One characteristic example of Ban`s visionary approach is Furniture House 1 (Yamanashi, Japan, 1995), the construction of which also serves as a storage space. As we can see in the book of Mira Locher "*Traditional Japanese Architecture: An Exploration of Elements and Forms*" this tradition is readily observed in all Japanese homes: storage spaces are usually hidden in a niche below the staircase or behind the removable partition walls, which appear as such but which actually conceal storage cabinets. The traditional Japanese house hosts a minimum volume of furniture. [18] The furniture in Ban's projects like the Paper House (Lake Yamanaka, Yamanashi, Japan, 1995) has also been brought to a minimum and this applies to the Wall-less House (Nagano, Japan, 1997) too as well as to the shelters. The objective there has been to create an open space allowing for a functional diversity. And this is yet another aspect of the minimal use of materials and their proper exposure.

Shigeru Ban was brought up in an environment teaching him to treat the available materials with respect, to try not to waste them and to possibly reuse them - as he himself describes his own upbringing by his parents and the Japanese educational system. [19]

#### **3.2. Local materials and builders;**

Influenced by the Japanese tradition, Ban is always mindful of using easily accessible and local materials and of respecting the local climate and traditions. The use of local materials implies their prompt delivery and cheaper construction work on a given building. The principle is

fundamental in the building of traditional Japanese houses and sheltering facilities in the event of a natural disaster. The Japanese culture is also characteristic with a profound respect for nature. For each craftsman it is of importance to be familiar with the material, with its unique properties and to find its best possible sphere of application: "Traditional Japanese carpenters understand trees well: how they grow and how the manner and place, in which they grow affects their structural strength and dictates how they should be used" [20]

In 1995 Shigeru Ban does not hesitate to help the injured in his native country after the earthquake on the island of Awaji, 20 km from Kobe. Shigeru Ban's reaction is the "Paper Tube Structure 07" project. The area of this temporary home is 16 square meters and it is raised on beer crates filled with sand, with walls made of cardboard tubes and a roof of cardboard tubes with a membrane cover. The design phase took place in the months of May and June and by the end of the summer 27 homes were made for both the Vietnamese and the Japanese displaced families. [21] As we can see, local and accessible materials were used.

A further example of shelter constructions, after a disaster, is the earthquake in Kirinda, Sri Lanka, of December 26, 2004, causing the appearance of destructive tsunami waves. We discuss the Shigeru Ban project not because of the cardboard tubes, which are his favorite element, but of what is of greater importance in this particular case - the reduction of the cost of building the project. The project proposes homes of appropriate sizes by using cheap, local materials selected in such a way as to keep the house's interior cool regardless of the local climate and, actually, in harmony with it. The building blocks are made of earthen mass designed as LEGO bits and used by non-professionals. [22] Folding doors are used to separate the rooms and the covered yard beneath the roof is reminiscent of the shade of a tree. In all, 67 homes built.

We will not discuss all of Shigeru Ban's projects for the so-called "Log houses", because they are the subject matter of a separate investigation. I will only remark that, for example, after the earthquake in Turkey, Ban uses the same system as in Kobe but uses local materials such as plywood which has different sizes bringing to a change in the size of the constructed dwellings. In the Philippines, walls are closed with interlaced bamboo panels and the roofs are made of vinyl panels covered with dried palm leaves. In other words, the "Log houses" project is flexible in view of the available local materials, traditions, culture and climatic conditions.

### **3.3. Everything is only temporary**

Looking at the materials - paper, bamboo and wood - we see that it is all about temporary solutions. These are materials which age, weaken, rot or could be damaged by insects. But we also see the reflection of time and how everything changes - an underlying principle in Japanese philosophy. Once things change everything falls in place: when their time is over things change into something new - whether it will be a part of the bamboo fence or a partition paper wall. And all of this can be found in Ban's architecture. The materials he uses is either temporary or reused: such as the paper tubes and the containers. The beauty of the efficacy and the fragility of the material in time is a fundamental part of Japanese philosophy. In addition to the natural materials, used in architecture, the Japanese show the same approach to decorative art and the beauty of nature, which they bring to their homes through the art of ikebana and it is maybe the short lived flowers which impress us most as an indicator of the passage of time. The architect Kurokawa Kisho explains: "It is an ancient Japanese belief that a house is only a temporary abode. If it burns down it can be easily rebuilt" [23].

We must carefully consider the environment in which we live. Here the Japanese philosophy have developed to serve as the major drive behind the reaction of the architect and his response to disasters. The problems, which have deeply engaged the mind and soul of Shigeru Ban, are connected with disastrous situations and human inability to respond adequately. As Ban put it, architects just have to intervene because architecture is for the people. He explains his own his philosophy in the following way: "The most important thing for me, as an architect ... is to make such buildings which will make the people who use and live in them truly happy. I say this often but given these "temporary" paper buildings, if people really like them then they will become permanent. It is the big, concrete buildings which are designed for nothing else but money – they are temporary. A new conqueror comes, destroys them and builds something new". [24] One famous example of a temporary and truly appreciated architecture, in existence since 1995, is the Paper church. It just changed the place in 2005 - from Japan to Taiwan.

#### **4. Conclusion**

After exploring the examples here, we can summarize key points in Shigeru Ban's work, which are related to the traditions of his native country:

##### **As syntax - constructive and formative decision-making:**

1. Link to traditional designing the form - modularity, repeatable elements
2. Form transfer from small to large scale and from the simple to the complex
3. Application of similar principles to wood, bamboo and paper.

##### **In semantics - philosophical reasoning - the solution:**

5. Disclosure of the visible material and minimal waste of materials.
6. Everything is temporary

##### **Of pragmatics - useful for people - the solution:**

7. Anti-earthquake considerations, born of the modular principle and the bearing connections
8. Natural materials and sustainable development
9. Local materials and traditions. Economy and accessibility

Despite the impressive quests and solutions we have examined so far, I consider that Shigeru Ban is far from the limitations of his Japanese roots, in spite of his success in transferring the traditions of his native land to many of his projects and especially those targeted at solving social issues or pure architectural experimentation.

Of course, he is not the only architect working in this direction, but I am impressed by his constant and purposeful efforts. He aims to translate natural and traditional concepts into the language of modern architecture. Too often, architects choose their materials and approaches as a secondary tool, appropriate only for individual, specific cases. Shigeru Ban's choice of material far exceeds the contract logic and commercial attitude.

At the same time, despite the strong borrowing in constructive and philosophical terms, and the exquisite Eastern approach, for me, Shigeru Ban's architecture is over-national. Such principles could be extracted (and sometimes are extracted) in other geographic regions. And their contemporary interpretation is yet another way to reflect the change in time.

In Shigeru Ban's view next to me, the three building elements of today - wood, bamboo and



paper - are mutually interchangeable. Perhaps, and not accidentally, Ban has decided to try paper on a large scale, as wood and bamboo have already proven themselves as construction material not only in the Japanese tradition but also around the world.

Looking at Ban's projects and his interpretation of the traditions in the modern architecture, we can draw some basic principles that could be followed by other architects:

- Learning from the past, but not copying it literally;
- The correct interpretation of traditions can lead to up-to-date solutions - traditions are the foundation of the present;
- The use of modern, even innovative, materials could reveal new fields of expression and experimentations;
- Innovations can be rooted in something small, like changing a basic material;
- Accessible materials are a sustainable and cost-effective solution;
- (Contemporary) Repetitions of a (traditional) module can be interesting and even sufficient for the final concept of a project;

It is often the detail which solves the basic architectural tasks and this is why we have paid more attention to the smaller scale in the Japanese art and craft. The beauty of the crafts has been investigated so deeply, and has been tested so many times over the ages, that it is easily transferred to the much larger scale.

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#### **Pictures:**

Figure 1:

<https://www.city.beppu.oita.jp/06sisetu/takezaiku/english/03learning/03takumi/index.html>

Figure 2:

<http://www.ippinproject.com/product/kumiko-ramma-screen/>