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**Parametric design in representation of culture****Topic:** Architecture**Authors:****Dai Juren**

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*This project was part  
020139 coursework led  
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**Abstract:**

This article aims to explore the prospect of parametric design in current architecture design, especially in the field of representation of culture. Recent years have witnessed that many architects successfully relate their projects with the local culture, but the methods used are viewed as monotonous by many critics. Therefore with the emergence of parametric design, we need to conceive that what influence this booming parametric design could contribute to the long-standing practice of regionalism works. Paradoxically, parametric design is considered as an objective design approach based on specific parameters, which lacks the interaction with the surrounding environment. However we think that parametric design might be a potential tool to achieve diverse cultural meaning in architecture. This article refers to our two design projects using parametric design. During the first design of a tea pavilion, we endeavored to convey the image or feeling of traditional tea culture in our architectural design, and this transition between our initial concept and the final project is realized by parametric design methods such as grasshopper plug-ins. When compared with traditional design methods such as model making, parametric design provides us with more options of design developments, and it enables us to try more approaches within limited time. However this new design method cannot convey the cultural meaning as gently and naturally as traditional design methods. Since parametric design is processed in computer, designers are deprived of the chance to feel the actual dimension or atmosphere of architectural model, which are the foundation of our understanding of culture in architecture.

But during the second project which is a highrise design in Jinxiang area, parametric design becomes a suitable tool to reflect culture since it is used to represent an object which is already existing. Due to its advanced capacity of shape handling, it could be an appropriate tool in actualizing the image of an object, but it still lacks the capacity to represent phenomenological feelings. Therefore we come to this conclusion that parametric design cannot replace the role of traditional design methods in the field of representation of culture in architecture at present. It is, nonetheless, a tool with great implications for cultural architecture, as we seek to demonstrate in this paper.



*concept of tea pavilion*



*source of the concept of second project*

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**Keywords:**

Parametric, Architecture, Regionalism, Glocalization, Post-modernism, Culture, Pavilion, China

# The prospect of generative arts on cultural representation

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## **Premise:**

This article aims to explore the prospect of parametric design in current architecture design, especially in the field of representation of culture.

Recent years have witnessed that many architects successfully relate their projects with the local culture, but the methods used are viewed as monotonous by many critics. Therefore with the emergence of parametric design, we need to conceive that what influence this booming parametric design could contribute to the long-standing practice of regionalism works. Paradoxically, parametric design is considered as an objective design approach based on specific parameters, which lacks the interaction with the surrounding environment. However we think that parametric design might be a potential tool to achieve diverse cultural meaning in architecture.

This article refers to our two design projects using parametric design. During the first design of a tea pavilion, we endeavored to convey the image or feeling of traditional tea culture in our architectural design, and this transition between our initial concept and the final is realized by parametric design methods such as grasshopper plug-ins. When compared with traditional design methods such as model making, parametric design provides us with more options of design developments, and it enables us to try more approaches within limited time. However this new design method cannot convey the cultural meaning as gently and naturally as traditional design methods. Since parametric design is processed in computer, designers are deprived of the chance to feel the actual dimension or atmosphere of architectural model, which are the foundation of our understanding of culture in architecture.

But during the second project which is a high-rise design in Jinxiang area, parametric design becomes a suitable tool to reflect culture since it is used to represent an object which already exists. Due to its advanced capacity of shape handling, it could be an appropriate tool in actualizing the image of an object, but it still lacks the capacity to represent phenomenological feelings. Therefore we come to this conclusion that parametric design cannot replace the role of traditional design methods in the field of representation of culture in architecture at present. It is, nonetheless, a tool with great implications for cultural architecture, as we seek to demonstrate in this paper.

## **Acknowledgement:**

This article is under guidance of Dr. Quinsan Ciao, and the project was part coursework led by Dr. Quinsan Ciao, Tongji University.

## **Culture background in Architectural design**

As students majoring in architecture, too often we create the stage upon which the drama of life unfolds, without really understanding the purpose of the play. Therefore when we were given the task to design a tea pavilion, we may be predisposed to take the time to explore the projects laterally, to contemplate a while on how we might embrace a new design paradigm wholeheartedly such as parametric design.

Recent years have witnessed that many architects successfully relate their projects with the local culture, but the methods used are often viewed as monotonous by many critics. There are many reasons that result in this phenomenon. Admittedly, it is true that we live in more fragmented times than ever before. Unlike Greek temples or Gothic cathedrals, contemporary buildings might look like anything, because they are not driven by beliefs, ritual, dogma or political certainties that nurture or drive them into particular forms, plans, sections and ways of commanding attention. The obsession on appearance becomes a great challenge for architects as well as a potentially growing risk for our society in the foreseeable future. In this article, we are not trying to refute the current situation, and what we are seeking for is a new solution to develop buildings that are seamless works of art, technology and science that, at the same time, are truly humane. This requires architects to look deeply into the culture where architectures locate, and endeavour to integrate the culture with function required by clients. Actually during the recent decades, a number of local Chinese architects have contributed a lot in the exploration on how to reflect regional culture in architectural design for the time being. And the following cases are among one of the best, as we think.

### **NingBo Museum**

#### **-Texture**

Ningbo museum is the representative work of Wang Shu, who is one of the most prestigious architects in China. He is famous for his research of representing Chinese culture through modern architecture language, which also gives us a lot of inspiration. The museum provides us the unique way of showing the culture of Zhejiang region, which is located in the eastern coast of China.

The exterior decorations of Ningbo Museum are made in two ways. Walls are decorated by millions of tiles recollected from local areas, where many old dwellings have been wiped out and left huge amount of tiles to be piled up.

This kind of decoration itself is a common way of building an economical house in ancient days in Ningbo when cements are not introduced. Other walls are decorated with cement-covered bamboos. It is reported that Ningbo Museum is the first museum built with large number of used materials. And in the following works of Wangshu, we could also see the similar method employed such as Ningbo Tengtou Pavilion in Shanghai World Expo.



## 2010 China Pavilion in the world expo

### - symbol

As the Chinese national museum of Expo 2010, China Pavilion embodies Chinese culture in various ways.

The 69.9-metre high pavilion, the tallest structure at the Expo, is dubbed "The Oriental Crown" because of its resemblance to an ancient Chinese crown. It was meticulously designed with profound meaning and symbolism. The architectonic feature of the building was inspired by the Chinese roof bracket known as the dougong as well as the Chinese ding vessel. The 'dougong' is a traditional wooden bracket used to support large overhanging eaves which dates back nearly 2,000 years. It symbolizes the unique charm of Chinese architecture and the unity and strength.



The main façade is similar to the Chinese character “Hua”, which means China in Chinese. Such imitation can be distinguished by common people easily. Besides, as we all know, red is a widely used color in China, which makes a happy atmosphere in the site. When visitors step into the site, they would get the idea easily that they are in China Pavilion.



## Suzhou Museum

### -spatial hierarchy

The current building of Suzhou Museum was designed by Pritzker Prize-winning Chinese-American architect Ieoh Ming Pei in association with Pei Partnership Architects. Construction of this building started in 2002. It was inaugurated on October 6, 2006.

Different from Ningbo museum, Suzhou museum reflect the culture in Jiangzhe region both in the volume and proportion of architecture. This museum is combined with the traditional architecture features, placing the museum in yards, which is an excellent way to coordinate with environment. When visitors stepping around the exhibition, they would going through spaces of different sizes, the huge public space and small private space. Such rhythm in space would represent the characteristics of tradition Jiangzhe dwelling.



## Our design

### -tea pavilion

Recently, we participate in a school project led by Professor Ciao which aims to design a tea pavilion within an area of twelve square meters. The core requirement of this project asks the participants to reflect the spirit of Chinese tea culture by design. This task calls for the understanding of Chinese traditional culture as well as the basic ability to deal with a logical architecture. For us, we have to reach the balance between the essence of culture and the logic of architecture, and this difficulty in building the harmonious relationship between the tea pavilion we design and the culture the pavilion reflects pushes us to think deeply on how our modern design of architecture could satisfy the needs of the project as well as convey the culture where the architecture locates. Once, Ludwig Mies Van de Rohe suggested that architecture was the will of the epoch translated into space. More prosaically, and no less wisely, he also said architecture existed when two bricks were put together well. His definitions are complementary rather than contradictory. This giant of early Modernism was right, yet only partially, as I'm sure he knew. Since architecture, although a cultural continuum stretching back to the first temple complexes of ancient Mesopotamia, is an art, a discipline, a way of seeing and ordering the human experience, that continues to change. Led by this principle, we strive to feel the culture reflected by the tea pavilion.

Paradoxically, we seem to be familiar with the Chinese tea culture at first, but when we try to realize the culture in our architectural design, we came across a dilemma. The tea culture involves complicated rituals and the variety between different areas. It's hard to choose one or two characteristics which could represent the Chinese tea culture explicitly. What we need is something which can be realized in our architectural design, and this must be identifiable to the majority.

Then, we try to extract the indispensable elements of Chinese tea culture. We

carry on a thorough analysis on tea culture, and we find out later that there is a close connection between Chinese Confucian culture and tea culture, those elements in common could remind us with the impression of Chinese traditional culture. What matters most is the site where the tea ceremony is held, and such representation of these traditional tea ritual sites impresses the viewers, and we believe that by representing these sites, we could arouse in the users of tea pavilion the impression of traditional tea culture.



We conclude the two most distinctive elements in both cultures: rocks and trees. In traditional Chinese paintings, rocks are always displayed as the site where scholars taste tea and share ideas with each other. These natural rocks in the painting are believed to be a symbol of freedom and the purse to become a part of the nature. Trees are not only the natural object but also the embodiment of a person. Also, trees play an important role in tea culture, and those scenes which people taste tea, sitting under trees are quite common in traditional Chinese paintings which depict tea culture. Therefore, we try to apply these two crucial elements of tea culture to our design of tea pavilion. Later we focus on the conceptual model and try to work out a solution to represent our ideas.

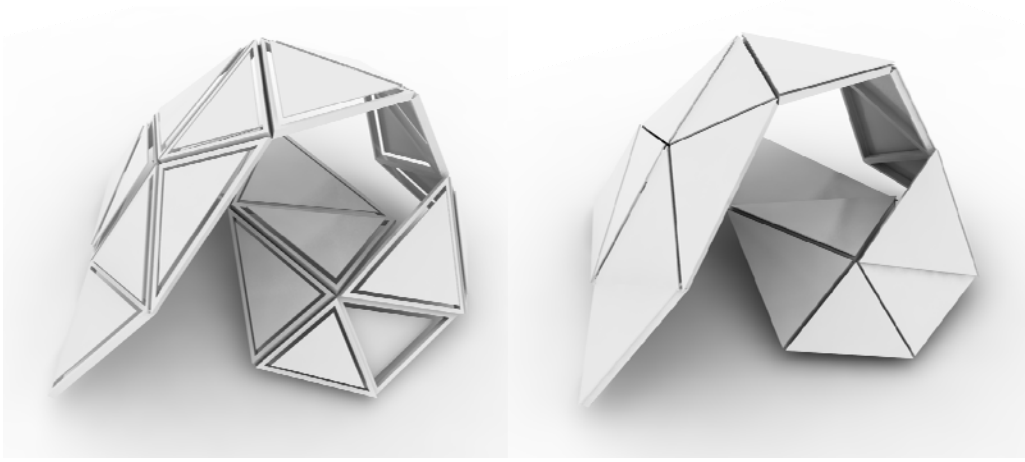
Undoubtedly, making concept model is an important process which helps us to capture the essence of Chinese tea culture when we advance our design. During the process of making concept model, we try to be emotional in dealing with the shape of architecture. We try different materials and structures to explore the best way to represent the culture in architecture, and during this process, we do not simply imitate the shape of trees or rocks. On the contrary, what we focus on is to explore the appropriate way to represent culture accurately.



We make several models, and we continuously improve it according to our prospect. Such exploration gradually develops into the clue for our further design. Also more importantly, we came to realize that some solutions such as parametric design other than hand-made models are more appropriate for this design since it provides more possibilities to try varied approaches, and parametric design could become an ideal testing ground in our exploration of culture representation.

We realize it's important to convert the concept to a real architecture. And we try the parametric ways to develop our design based on the concept before. We try various approaches to explore the tea culture in each design, and then evaluate whether the tea pavilions convey the tea culture elements appropriately. After several approaches, we decide on the repetition of folding plates, and such means try to arouse in the visitors the impression of rocks. In additional, two comparatively large tree-like structures are installed so as to sustain the weight of these folding plates. With the application of parametric design, we were able to work out the final project, and it also shows the complexity and accuracy which is an obvious advantage resulted from parametric design. However, we may not achieve the prior expectation to reflect the traditional tea culture simply but straightforward.





## Our design

### **-urban design *in jingxiang area***

Later on, we also work on another project which is an urban design in Jingxiang area. And the design base is located in the central part of China and by the side of Han River, which is an important branch of Yangtze River. From the spring and autumn Period, about 2,500 years before, Jingxiang region has been cultivated and the prosperity of local culture had lasted for a long time. This region has been the trading hub benefit from the transport capacity of Han River and Yangtze River.

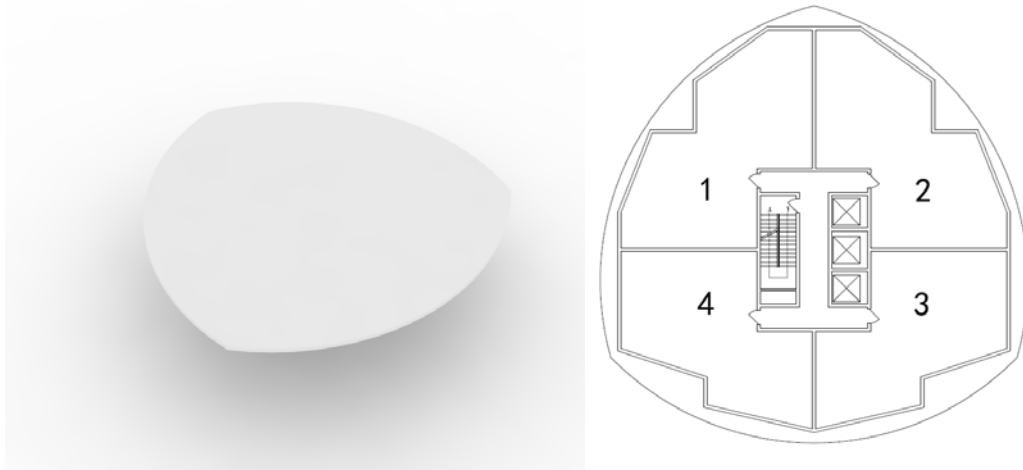


Developers of this project want to create these architectural landscapes of the whole base which would carry its function as well as a landmark which transforms this area. It is important for designers to reflect local culture, and the feeling of history is what they seek for.

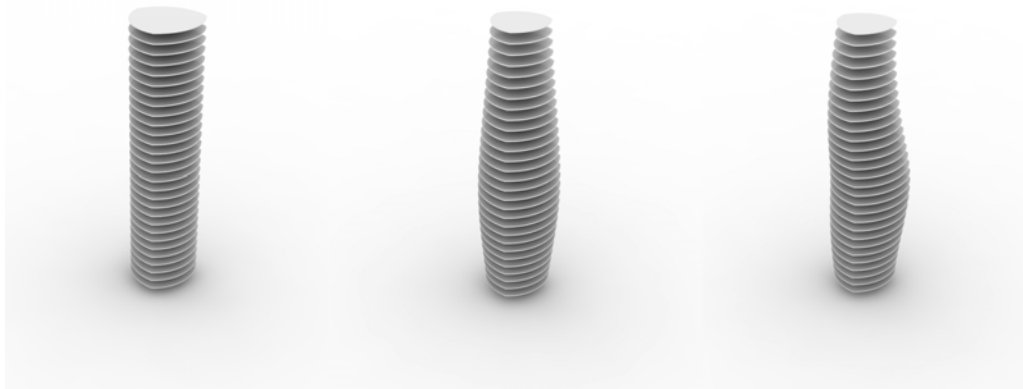
Our design initiates with the extraction of cultural elements. Since ancient times, china has been the core of Chinese and foreign trade, and it is also the symbol of highly developed handicraft industry in ancient China. As the trading hub of central China, JingXiang region is famous for its china and many newly discovered wares which were buried under ground have shown us the beauty of china again. As a consequence, we use the material china as the symbol of their local culture. Glittering and translucent carving china shows us the highly developed handicraft and their graceful curve has some connection with the rivers in JingXiang region.



In order to identify the symbol of culture, we try to realize this idea through parametric method, and the first step is to determine the form of parametric unit. By repeating such unit, we can make the whole architect design. In the progress of choosing unit, we cast off the form of circle outline which is common in the imitation of the material china. Similarly, we use a combination of the triangle and the round, not only with the edges and corners of triangle, but also with round boundary of circle. When compared with the pure round, such parametric unit has its own direction. In the progress of large combination, this unit can provide us a changing rhythm of the whole building, which is more beneficial to a changeable design and reflection of culture.



In the following step, we integrate the smooth curve of the material china with our design. When we repeat such parametric units, the unit is changing with the parameter chosen from selected curve. By using these parameters, the units are scaled to realize the curve outline of building and their centers are moved to make the building more graceful.



Also, by changing the curve from which we get the parameters, we get different kinds of single building, and all of these are combined together with the use of the former parametric unit. Based on this principle, we came closer to the final result.



In this design, we make effort to reflect the local culture by the method of parametric generating design. With the means of repeating parametric unit, we tried to represent the cultural symbol that we picked up from history and culture.

And the final result turns out to be a success, and the image of our projects is conceived to convey the impression of the material China gently and smoothly



## Conclusion

By comparing and evaluating these two projects, we may easily tell the advantages brought about by the parametric design. Apparently, it provides us with more opportunities to realize our initial conception, and its potential is still to be developed. Due to its advanced capacity of shape handling, it could be an appropriate tool in actualizing the image of an object, but it still lacks the capacity to represent phenomenological feelings. Therefore we come to this conclusion that parametric design cannot replace the role of traditional design methods in the field of representation of culture in architecture at present. It is, nonetheless, a tool with great implications for cultural architecture, as we seek to demonstrate in this paper.



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