

PARAMETRIZING TRADITIONAL ARCHITECTURE

A multi-disciplinary approach to strength cultural sensibility

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Traditional Chinese architecture has certain millenary definitions in terms of orientation, positioning, scale, and elements usually inspired by natural forms or animals, furthermore, it is also generated by ruled-base geometric configurations, for instance, proportion of rooms or geometric ornamented screens. A collection of architectural drawings compiled by Liang (1954) is a historical document preserving architectural attributes, proportions, and elements of Chinese architecture. The detailed information presented in his book and ruled-base architecture can be studied using contemporary methods such as parametric design. Analysing and repurposing such traditional elements contributes to creation of cultural preservation and identity in Chinese architecture students. There are several studies applying computational thinking such as shape grammars to describe traditional Chinese designs, for instance, Li (2000) integrates symbols and spatial information, Stouffs (2006) computes Stiny's (1980) findings, and shape grammars generated for architecture from Song and Ching dynasty (Li, Knight & Brown 2013). These studies successfully recreate patterns, and the application in new architectural designs is briefly suggested.

The module Integrated Design to Architecture 2 (IDA2) offered by the architecture course at the University of Nottingham Ningbo China aims at expanding the range of topics as well as skills developed from previous years to gradually advanced architectural design; and it is divided in two semesters. First students understand how CAAD tools support the design process, learning CAAD software and environmental analysis. In the second part of the module they focus on parametric design and digital fabrication integrating traditional patterns to strength cultural sensibility by applying potential Chinese architectural elements in contemporary design scenarios. Similar experience of integration of traditional architecture concepts in digital design studios is reported by Agirbas (2017), but in this case using Islamic designs. IDA2's students research traditional Chinese architecture identifying principles that can be automated and replicated through parametric design, or used as inspiration. Thus, allowing the interpretation of traditional architecture to a contemporary context, examining elements that produce relevant designs. The module proposed combining several disciplines: architecture history, digital design and fabrication, and research by design to promote a critical reflection of traditional architecture in terms of sustainability and design potential in a real case scenario. It is expected that the module leads to sustainable practices in terms of representativeness of traditional architecture, new design methods and fabrication, and learning of architectural practices.

The module proposes as part of the learning methods: documentation of traditional architecture, insight lectures on traditional ornament and digital fabrication, and parametric design tutorials. The participants applied traditional Chinese architecture

elements as inspiration for designs using Grasshopper as generative tool and developed knowledge on architecture history, computational design and digital fabrication. Students designed structures to be installed under the skylights in the studio space. The module emphasized the interpretation of rules and geometric compositions to new designs. The module had to adapt to new teaching conditions due to Covid-19, which limited the possibilities of fabrication and testing of models. The students prepared files for printing and laser cutting that were produced separately when the health safety conditions to use the fabrication lab were clear. We conclude that there are still many aspects of Chinese architecture to be discovered and explored, which can support the design of innovative architectural compositions. In the future, we plan to focus on specific rule-based elements to promote a reflection on applicability of such designs.



Figure 1: Cassion Skylight is a lounge furniture inspired by Cassion, a type of ceiling decoration technique in Chinese Architecture. Authors: Qihao Ren, Yiran Sun, Yuan Sun, Wei Zhang, 2020.

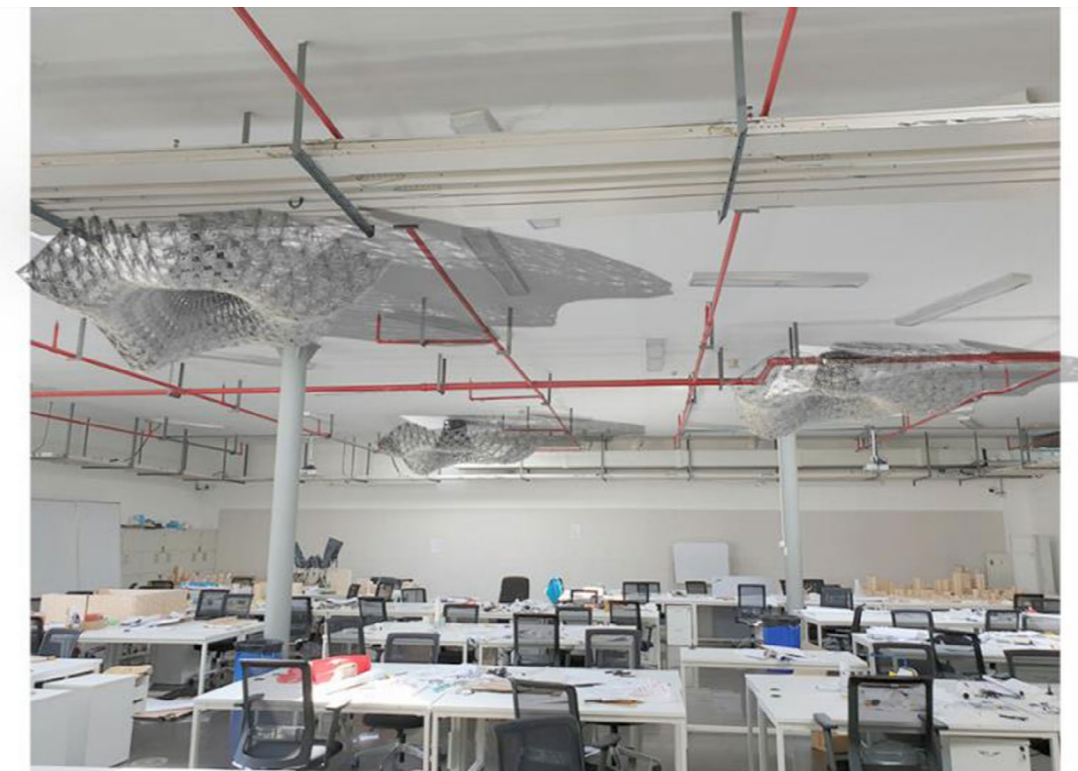


Figure 2: Hanging Orchid, inspired by Chinese lanterns and roofs, the group inverted the traditional roof upside down. Authors: Patricia Carrilero, Kawthar Namakula, Pal Pandit, Iuliia Volkova, 2020.

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Figure 3: Auspicious Cloud, clouds are common element in Chinese architecture, the group combined the surface shape with a screen traditional pattern. Authors: Yanhan Wang, Yang Lai, Yinzhe Lou, Yumeng Zhang, Xiaoyi Wu, 2020.

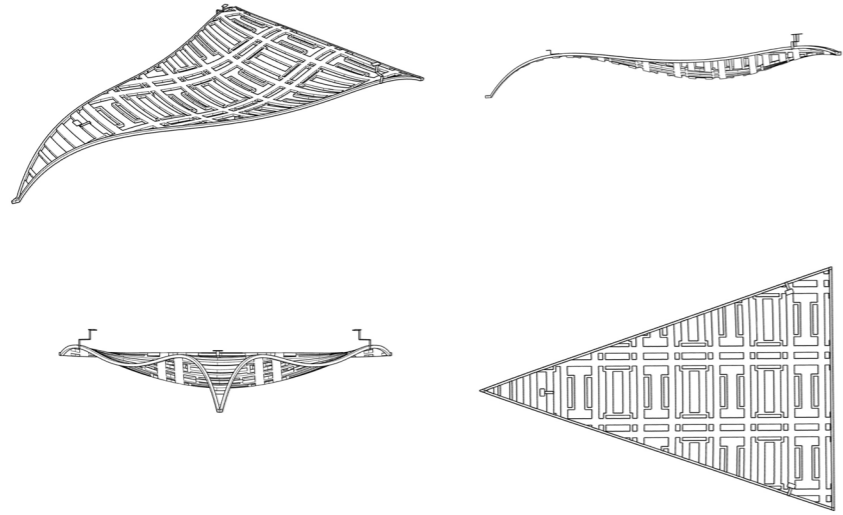


Figure 4: Lotus is a design inspired by the lotus flower and its diamond shaped leaves. Authors: Libeier Huo, Zheyi He, Yimin Feng, Shenglin Zhu, 2020.

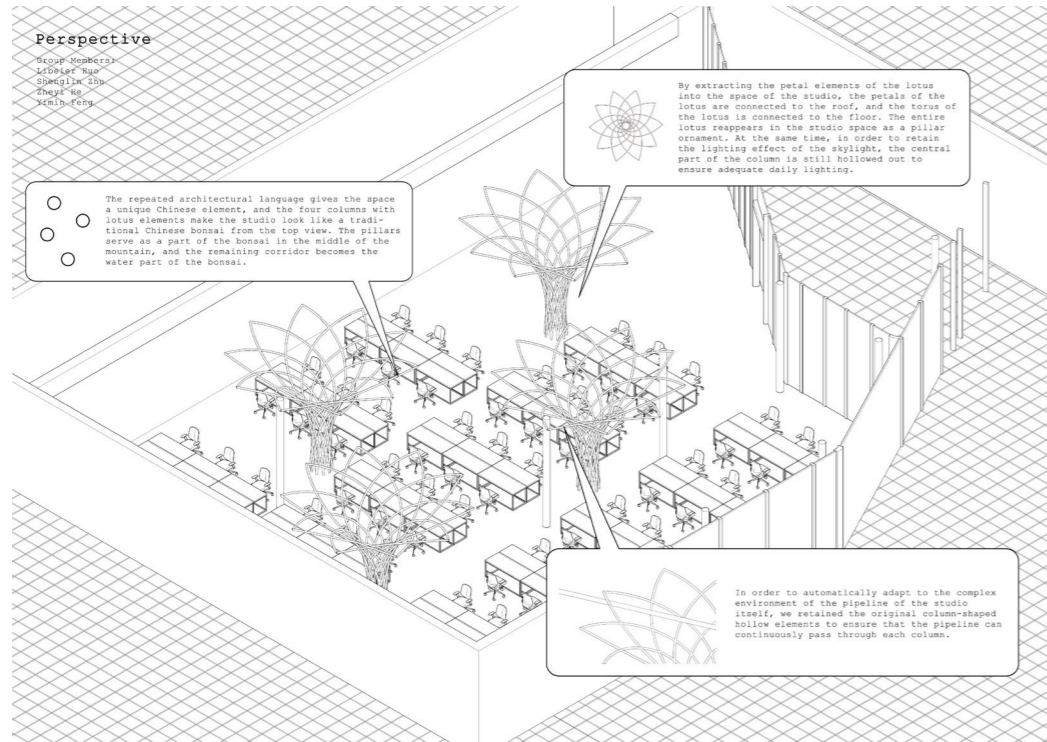
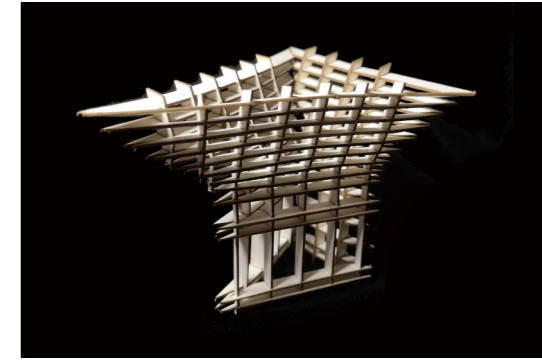
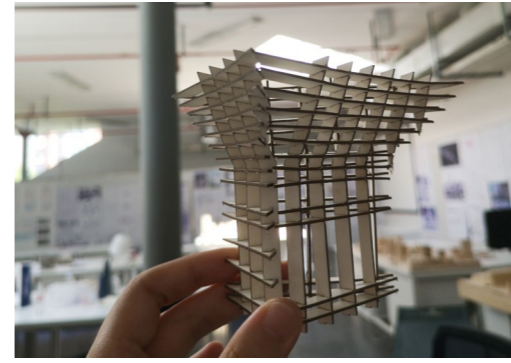
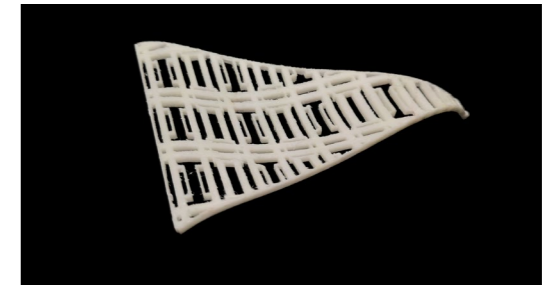


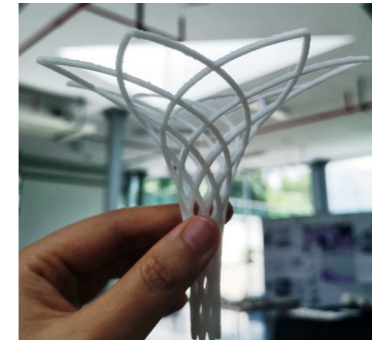
Figure 5: Ice Ray Lattice inspired by Ice Ray Lattice, a typical detail for windows' screens. Authors: Shunning Lin, Pei Wen Lim, Ruibo Liang, Huizhao Liu, 2020.



Figuras 6 e 7: Cassion Skylight fabrication in scale using laser cutter. Authors: Qihao Ren, Yiran Sun, Yuan Sun, Wei Zhang, 2020.



Figuras 8 and 9: Auspicious Cloud, fabricated by 3D printing. Authors: Yanhan Wang, Yang Lai, Yinzhe Lou, Yumeng Zhang, Xiaoyi Wu, 2020.



Figuras 10 and 11: Lotus, fabricated by 3D printing. Authors: Libeier Huo, Zheyi He, Yimin Feng, Shenglin Zhu, 2020.

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