

[1] diverse types of subdivision

## Aims and Methods

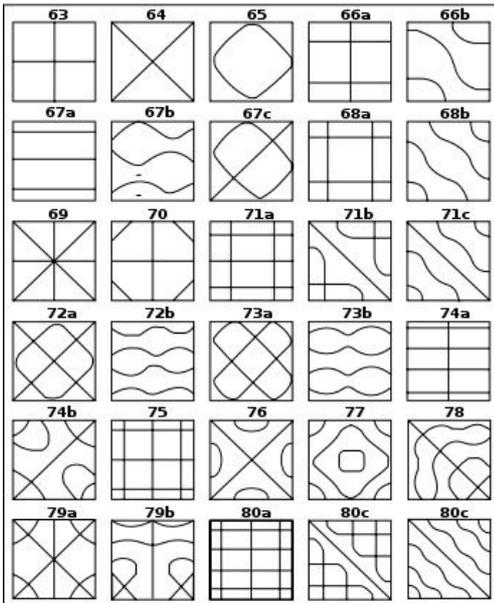
keywords: architectural acoustic, soundscape, tiling, subdivision, mathematical programming, folding

In our times computational design plays a significant role in the way architecture is being conceived and constructed. The implementation of such processes in architecture changes the way we perceive design and influences tremendously the prediction of building realisation and the performance of the building.

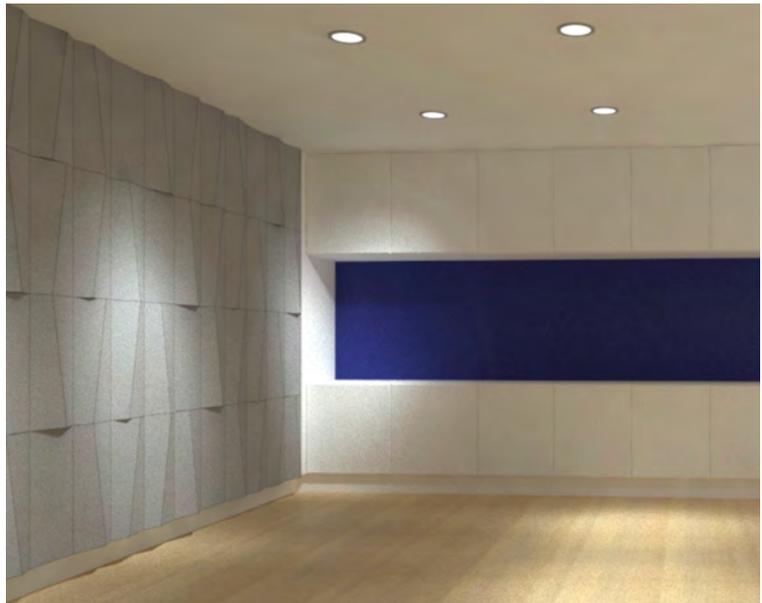
Sound, as an invisible vibration which is transmitted from the building exterior envelope to interior and vice versa, is mostly considered to be controlled to improve building acoustics and solve building sound problems. If sound, as environmental parameters (from nature, human, society, mechanism, indicators), could be analysed and converted into visible mathematical databases, what can we apply on architecture in computational way? Chladni's best-known achievements was inventing a technique to show the various modes of vibration of a rigid surface [2], which had answered our question.

Based on the practical experiences of designing the acoustic panels for rehearsal rooms in Wei-Wu-Ying centre for the arts (WWY) in Taiwan [3], we would like to ask if sounds that forms or arises from an immersive environment could be stored as an architectural object? If we can read the sound as a visible solid object from architecture? When architectural acoustic not just focused on good quality of sound performance, but also the sound-transformed object consisted by time, space and human history.

Our point of interest lies in considering the sound as a visible body which we try to inform and implement computationally. Our tool is programming, particularly customised commands in computer software which is based on mathematical subdivision of geometry [1], and 3D modelling for further tiling and connects to fabrication and laser cutting. Through coding we use the databases derived from sound, subdivide recursively and in different patterns platonic solids. We update this process based on folding techniques and our intuitive experience with such techniques. Our aim is to explore the possibilities and limitations of sound visualisation with computational tool and thinking.



[2] Chladni's figures



[3] acoustic panels of rehearsal rooms in WWY

### Resulting work of the workshop to be exhibited

size of acoustic panel: 40(W) x40 (H) x varies depths(depends on individual design)

site: a proper size of passage in Xi' An Jiaotong- Liverpool University will be an ideal site for the resulting work to be exhibited. The final result depends on the number of participants.

### Requirements for the participants

target audience

anyone who is enthusiastic about architectural acoustics, geometric programming, subdivision and folding.

learning experience for the participants: basic knowledge of processing and rhinoceros 5

maximum number of participants: 11

software: processing, rhinoceros 5

hardware: personal laptop

### Technical requirements for the host

materials: a2 sheets of 12.7 mm corrugated cardboards , glue, double sided tape

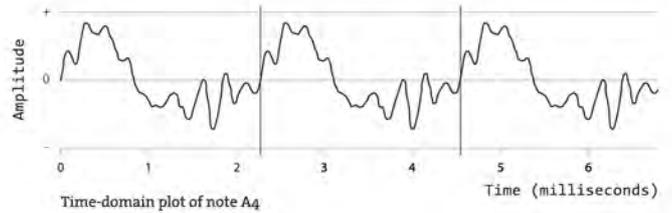
facilities: laser cutting machines for cutting & engraving, 3D printer

### Schedule of workshop

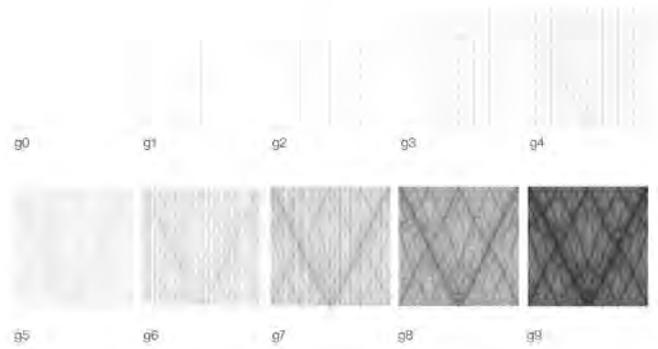
/1/ 1st day morning:  
background information of architectural acoustic, soundscape and databases of sound-analyse applied in industrial, architectural and computational design.



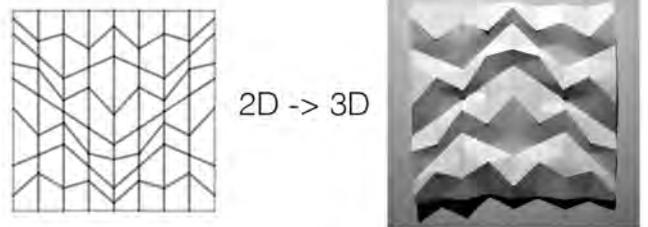
/2/ 1st day morning:  
programming techniques introduction(learn the basic code framework of recursive and iterative techniques) and analyse the sound by processing to generate mathematical databases(organisers will prepare code for sound-analysis).



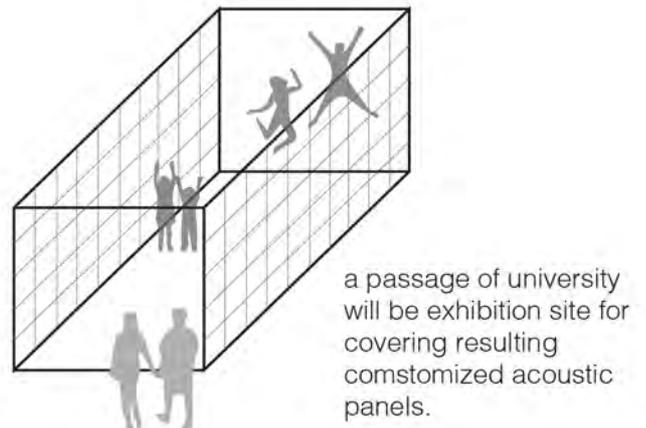
/3/ 1st day afternoon:  
exploring the mathematics strategies behind geometry mathematics and subdivision programming, and then use databases generated from sound to compose the code and start to program soundscape on your own.



/4/ 2nd day morning:  
export the 3D data from processing, unfold the 3d models and create the acoustic panel as basic element in rhino 5, repare file for production by laser cutter or 3D printer.



/5/ 2nd day afternoon:  
build your own acoustic panel and construct panels into space as the final result of workshop and exhibited in CAADRIA 2017 conference.



## **Workshop organisers**

### *Yunying Chiu*

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MAS Architect ETH Zürich  
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### **workshop organiser experiences**

“Sustainable parametric design”, National Taiwan University of Science and Technology, Taipei, Taiwan, 16&23 Dec. 2014.

“Folding Facade of Architecture”, eCAADe 2013:Computation and Performance , TU Delft, the Netherlands, 16th September, 2013. [[https://foldingfacade.wordpress.com/2014/02/06/ecaade\\_one\\_day\\_workshop/](https://foldingfacade.wordpress.com/2014/02/06/ecaade_one_day_workshop/)]

[un]fold workshop of the course, “TONI Outside-In: Responsive Materials in Interior Architecture”, Zürich University of Arts(ZHDK), Switzerland, 6th December, 2012. [[https://foldingfacade.wordpress.com/2013/08/06/zhdk\\_workshop/](https://foldingfacade.wordpress.com/2013/08/06/zhdk_workshop/)]

### **publications**

Chiu, YY., 2010, “How to make a soft skin? A preliminary framework for the parametric design of the bionic soft skin”, eCAADe 2010: Future Cities, pp. 237 - 242, ETH Zürich, Switzerland

Chiu, YY., 2010, “How to make the soft skin? A soft skin free form without the bones”, CAADRIA 2010: New Frontiers, Hong Kong

### **lecturer experiences**

“Dutch sustainable living & architectural typologies”, Taiwan sugar staff training courses, Tainan, Taiwan, 21 Dec. 2016

“Mixed-use complex”, design instructor, National Cheng Kung University, Tainan, Taiwan, 17 May, 2016

### *Yuya Hosomi*

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Bachelor of Architectural Design, Okayama Prefectural University  
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### **workshop experiences**

“Folding paper bridge”, OPU with ETH Zürich, Okayama Prefectural University, Japan, 8~11, May, 2012

“Knitting architecture”, OPU with Keio University, Okayama Prefectural University, Japan, 21 Jan., 2012

“Programming and form”, OPU with Columbia University, Japan, 17 Nov., 2011