

# Module: Digital Architecture

## Week 1

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This first week is an introductory session of this module. We will be informed on how this semester's schedule looks like, some grounding rules of the module (for facilitator and students), and a brief introduction of this area of study.








# DR. MIA A. TEDJOSAPUTRO



FOUNDER AND CREATIVE DIRECTOR  
AKSEN (CHINA - INDONESIA)  
Est. 2001

## Roles

Designer/ architect	
Design researcher	
Lecturer in NBU	
Lecturer in UNNC	
Enter(design)preneur	

I am an expat in our beloved city, Ningbo China. I am an Indonesian architect, did my M Arch in Digital Architecture in 2011 and also holds a PhD degree (2018); both are from University of Nottingham UK. I completed my PGCHE, a British teaching qualification in Higher Education, in 2020. I will also be updating my own skills and knowledge through this module journey.

**Welcome on board!**

# Research Interests

**01**

Study of design behaviour

**02**

AR/VR in Architecture

**03**

Bamboo architecture

**04**

Digital Design Cognition

**05**

Design Pedagogy

**06**

Embodied creativity



**02**



**Mixed Reality in  
Architecture**

+

**03**



**Bamboo architecture**

# Today session's aims and objectives

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- To provide a clear outline of the Digital Architecture module (schedule, assessments, etc)
- To communicate ground rules
- To expand what to expect from this module
- To jumpstart the discussion with a lecture of three introductory concepts

# Outline

## Of today's session

### 1 ABOUT THE MODULE

AIM AND OBJECTIVES

LEARNING OUTCOMES

(TENTATIVE) SCHEDULE

ASSESSMENTS AND FEEDBACKS

STUDENT ENGAGEMENT AND REGISTRATION

GROUND RULES OF THE MODULE

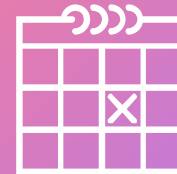
WHAT TO EXPECT

### 2 DIGITAL ARCHITECTURE

MY PAPER ON DIGITAL ARCHITECTURE PEDAGOGY

3 IMPORTANT CONCEPTS

READING LIST



## ABOUT THE MODULE

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This **17 weeks** module aims at introducing computational design thinking to NBU students. Requisite knowledge is unnecessary, although some of you might have self-learned related software such as Rhino. This module is designed to encourage your **active learning** so please make sure you spare enough time to engage in discussions, reading materials, etc.

Range of topics cover: theories, important concepts, design precedents, software skills, research skills; so you can top the knowledge with your personal interest. At nearly the end of module, assessments are used to demonstrate your cultivated skills. I will be closely monitoring your engagement, so make sure you **sign in**. However, this is not a software course.

# Aims and objectives of module



**#1**

To equip students with necessary knowledge through series of lectures, discussions and hands-on activities (if possible).



**#2**

To critically analysed and apply these theories to student's' own practice.



**#3**

To apply learned skills in creation of micro architectural project and write a reflective essay critically evaluating the process.

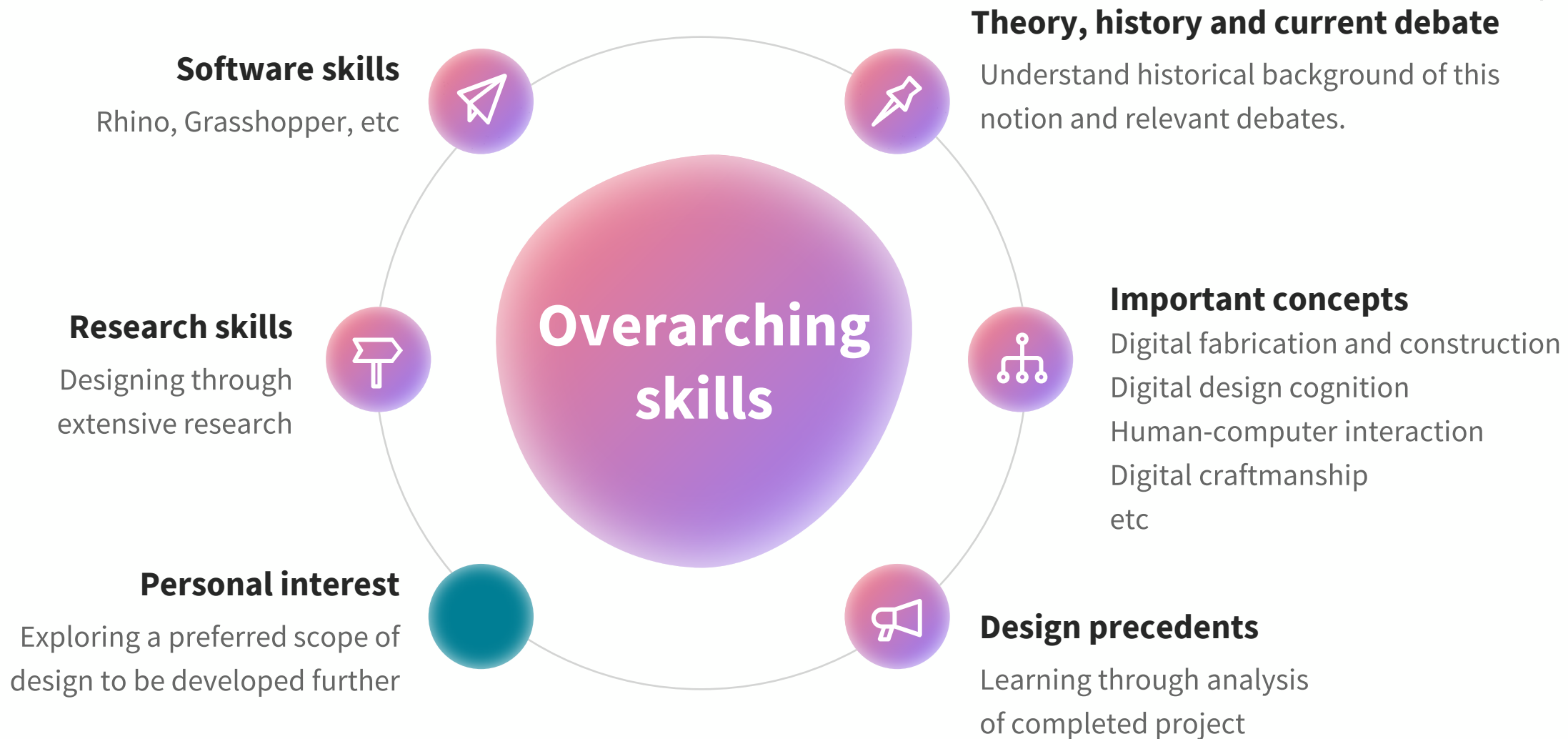


# Learning Outcomes



*At the end of Semester 2, students should be able to do the following:*

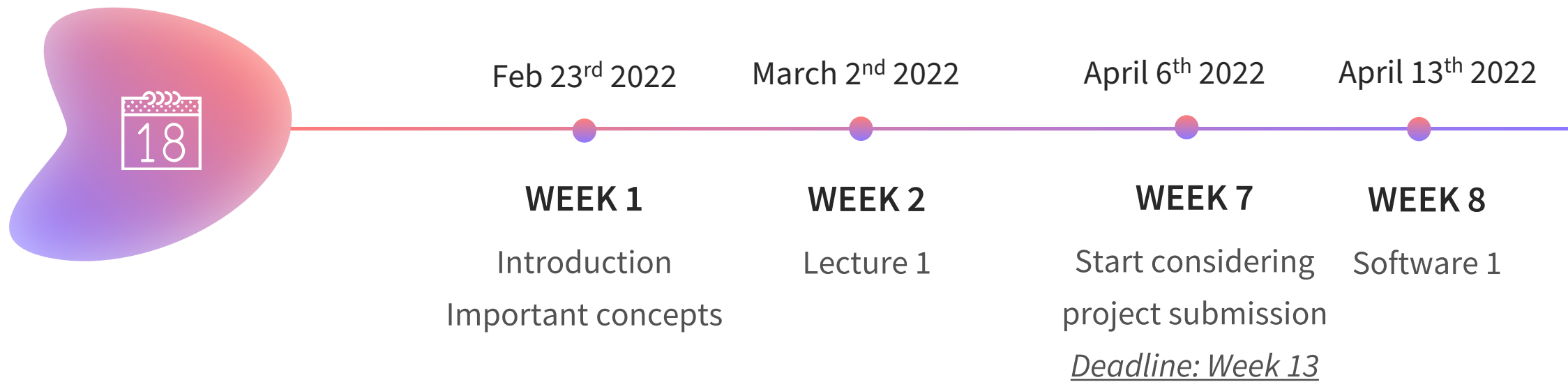
1. Have improved knowledge of historical perspective and current development in the fields.
2. Understand related important concepts and terminology.
3. Be able to critically analyse case studies.
4. Have developed relevant software skills.
5. Know strategies for effective research related to micro architecture project.
6. Effectively reflect, appraise, and evaluate peers' forum posts.
7. Have practised generating a novel three dimensional model for micro architecture.
8. Have gained awareness of digital design cognition.



# Before you start..

1. Please check that you have access my **website** (<https://miatedjosaputro.com/category/nbu/digital-architecture/>). Materials will be uploaded in this site only.
2. Password to access weekly page: **nbu**
3. Make a **Disqus** account to leave comments on dedicated weekly page. Link how to upload images, click [here](#). *Note that for submissions, you cannot upload Word/PDF file through Disqus.*
4. Make sure you have joined the **WeChat** and **DingTalk** group chat.

# Module timeline





# List of topics

## Week 1-5

### Derived from overarching skills

Note: tentative schedule. Please pay attention to announcements via Wechat group chat. To be confirmed in weekly basis due to the current pandemic situation.



Week 1

Introduction of module and three important concepts



Week 2

Historical background and current debate



Week 3

Digital design practice and research groups



Week 4

Theory, philosophy and methodology



Week 5

Parametric Design

# List of topics

Week 6-10

## Derived from overarching skills

Note: tentative schedule. Please pay attention to announcements via Wechat group chat. To be confirmed in weekly basis due to the current pandemic situation.



Week 6

Digital fabrication



Week 7

Digital design cognition and practice

*Note: start considering your project submission*



Week 8

Software 1: Rhino



Week 9

Software 2.1: Grasshopper



Week 10

Reading week

# List of topics

Week 11-17

## Derived from overarching skills

Note: tentative schedule. Please pay attention to announcements via Wechat group chat. To be confirmed in weekly basis due to the current pandemic situation.



Week 11

Software 2.2: Grasshopper Plug-ins



Week 12

Seminar



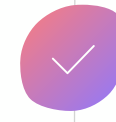
Week 13

Artificial intelligence in architecture  
Submission 1



Week 14

Peer assessment for Assignment 1



Week 15

Tutorial



Week 16

Assignment 2 submission

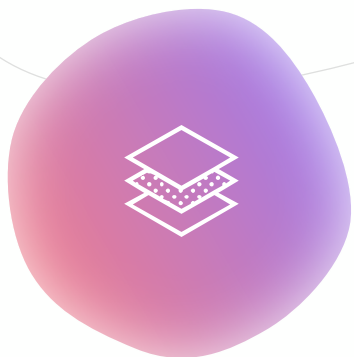


Week 17

Teacher and students feedback, reflections.

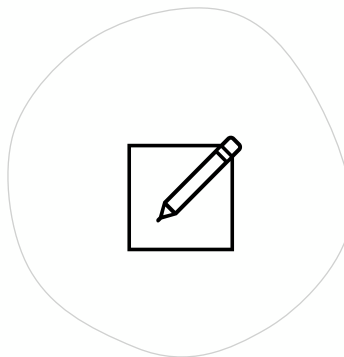


# Assessment and feedback



## Submission 1: Project submission

Week 13  
40%



## Submission 2: Essay

Week 16  
40%



## Online forum post counts

Week 1-17  
20%

# Student engagement and registration

20% of your total grade

**1- DingTalk presence.** Webcam needs to be on.

**2- Forum post counts.**

You have to be involved in every single discussion post.  
Active learning by producing.

Deadline: every **Friday** 11:45pm (China time)

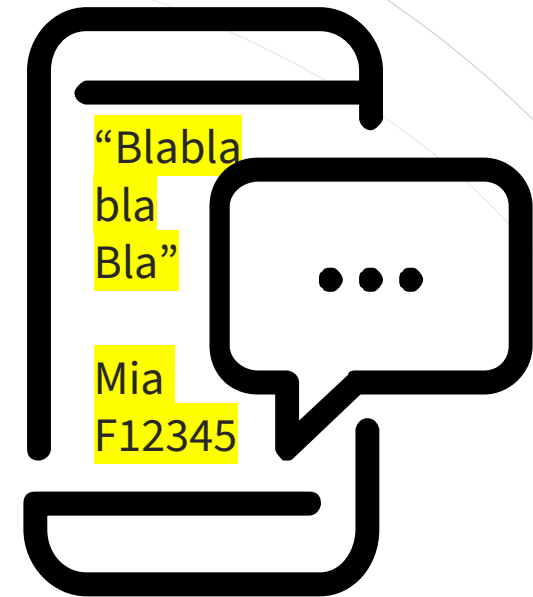
*Alternative: send me an email with the format 'week no + name + student ID '.*

What do you think?  
0 Responses

0 Comments Mia Tedjosaputro Login

Sort by Newest

LOG IN WITH OR SIGN UP WITH DISQUS



Make sure to sign off with in this format:

**Week no +  
Name+Student ID**

Forum links will be attached in respective slides. Or head to here:  
<https://miatedjosaputro.com/category/nbu/digital-architecture/>

# Ground rules

**Any disabilities** have to be declared before the beginning of Week 2 class.

**Plagiarism** is a big issue, in weekly posts or in submissions. It will not be tolerated.

If you have to **miss a class** (*or unable to engage in forum in online environment*) due to extenuating circumstances let me know before the class. Evidence is needed.

**Respect your peers** whilst engaging in (online or offline) discussions, or any online or offline correspondence. Keep it concise.

I am here to facilitate your learning, you are in charge of your own learning. if you have any learning problems however, kindly notify me.

**Mia Tedjosaputro**, Facilitator

# Plagiarism

feedback studio

Contessa Ruiz

The Goliath of the Sea

75 /100

< 18 of 28 >

## The Goliath of the Sea

The majestic blue whale, the goliath of the sea, certainly stands alone within the animal kingdom for its adaptations beyond its massive size.

<sup>1</sup> At 30 metres (98 ft) in length and 190 tonnes (210 short tons) or more in weight, it is the largest existing animal and the <sup>2</sup> heaviest that has ever existed. Despite their incomparable mass, aggressive hunting in the 1900s by whalers seeking whale oil drove them to the brink of extinction. But there are other reasons for why they are now so endangered.

### Match Overview

43%

3 matches

1	en.wikipedia.org Internet Source	17%
2	animals.nationalgeogr... Internet Source	14%
3	www.squidoo.com Internet Source	12%

### FUNDAMENTALS OF ACADEMIC WRITING:

### PARAPHRASING, CITING, AND BALANCE BETWEEN AUTHORS' WRITER'S VOICE

25 May 2020

By: Matt Wallwork

### LINK TO THE DOCUMENT:

<https://miatedjosaputro.com/202>

[1/02/27/week-1/](https://miatedjosaputro.com/202)

**password: nbu**

# Preferred academic writing style:

## Harvard referencing style

Download the guide from this link or use *Google Scholar* to generate reference list  
<https://miatedjosaputro.com/2021/02/27/week-1/>

### IN-TEXT CITATION

Author (Year) or (Author, Year)

Example:

"After that I lived like a young rajah in all the capitals of Europe..." (Fitzgerald, 2004).

or

Fitzgerald (2004) posits that he lived like a young rajah in the capitals of Europe..

### REFERENCE LIST

Author (Year).

Example:

Fitzgerald, F. (2004). *The great Gatsby*. New York: Scribner.

# (Virtual) office hour

During this online learning environment, I will be happy to received your concern anytime in the day. Preferred method of communication:

## Email



**MIA@MIATEDJOSAPUTRO.COM**

FOR PERSONAL CONCERN  
PLEASE SIGN OFF WITH  
YOUR NAME+MODULE+STUDENT ID

## Group chat



ON WECHAT, IF YOUR CONCERN  
MIGHT BENEFIT YOUR PEERS



# Weekly teaching materials

**Download from this link :**

<https://miatedjosaputro.com/category/nbu/digital-architecture/>



# Assessments Schedule

<https://miatedjosaputro.com/2022/02/18/dg-2022-live-assessment-docs/>

**Deadlines are set and will not move, so please plan your studies.**



## What to expect from this module

Apart from the listed aims and objective,

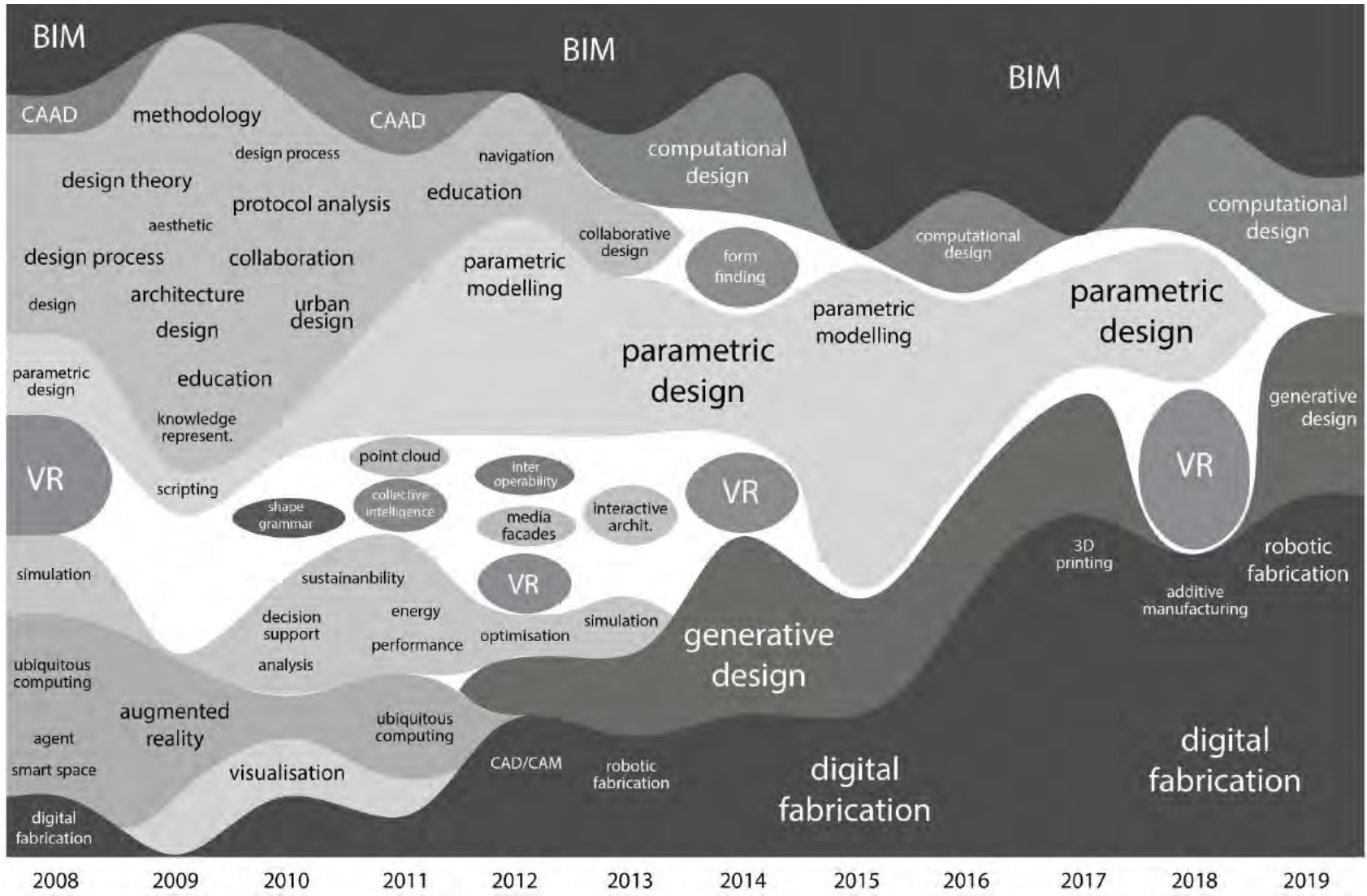
1. You will exercise your **independent learning** skills.
2. You will be **more critical** on analysing case studies, theories, methods, etc.
3. You will be able to exercise the notion of “**design by research**”.
4. You will be able to do your own **further learning** and research based on the provided materials.



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# Break

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[CuminCAD](#) : CUMINCAD Papers : Paper caadria2020\_253:CAADRIA at Age 25: Mapping our Past, Present, and Future

ICEA 2019, SURABAYA-INDONESIA  
25-27 APRIL

# CONCERNS IN DIGITAL TURNS IN ARCHITECTURE

*Mia A. Tedjosaputro*



# Peer-reviewed conference paper

## Concerning digital design in architectural pedagogy

[mia@miatedjosaputro.com](mailto:mia@miatedjosaputro.com)

**Abstract.** The emerging field of digital design in architecture has changed the way designers think and the way it should be taught. This paper looks at six design educational exercises which have adopted digital tools using various systems. Discussions are rooted in digital design cognition, digital design eco-system and pedagogy. This paper attempts to observe the change of ways of making within these themes using design cognition lens. It is proposed that digital design tool affordances is a pertinent concept to support this emerging field, both pedagogically and with regard to software development. It is also suggested that the digital eco-system framework need to include the dialogue between analogue and digital design tools.

**Keywords:** Digital design cognition, pedagogical approach, design tools affordances



**THE ALPHABET  
AND THE ALGORITHM**

MARIO CARPO

VARIETY

*Writing Architecture* series



**THE SECOND DIGITAL TURN**  
DESIGN BEYOND INTELLIGENCE

MARIO CARPO

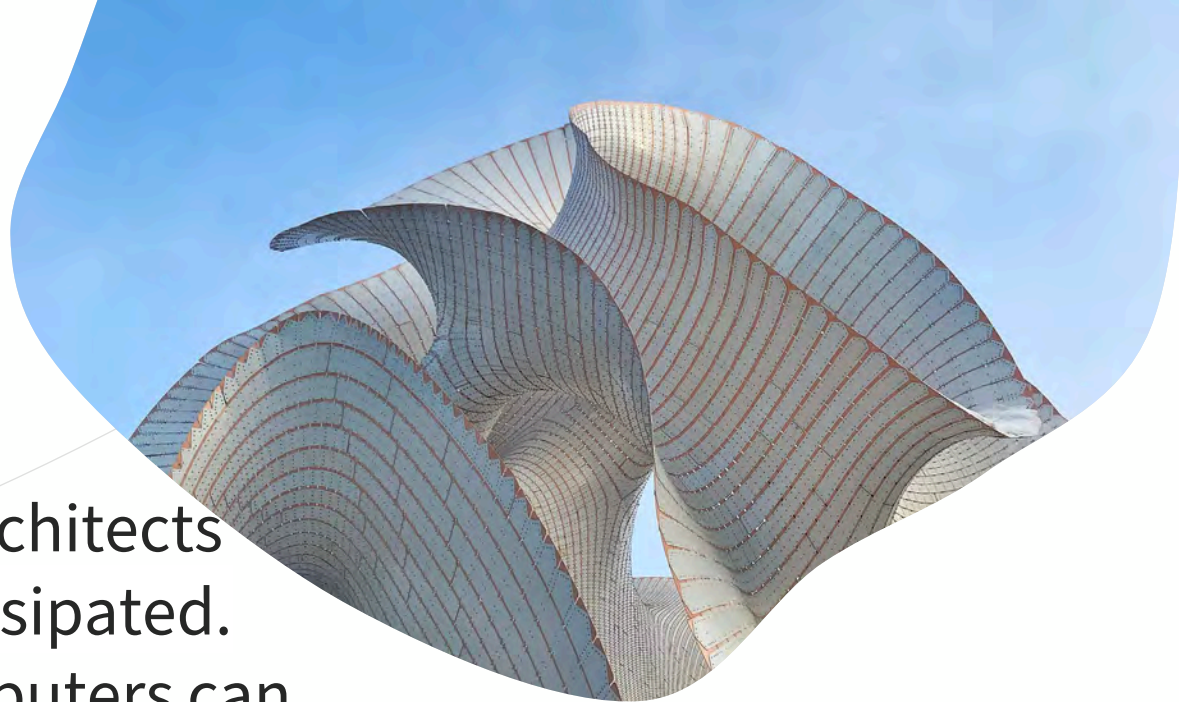
Carpo, M. 2011. The alphabet and the algorithm, MIT Press.  
Carpo, M. 2017. The Second Digital Turn: Design Beyond Intelligence, MIT Press.

# First digital turn

- Circa 1990, renowned architects **embraced digital change.**
- Identical copies to customised or non-standardised products.
- **First generation** of digital design and fabrication.
- Digital fabrication does not use mechanical matrices, casts, stamps or moulds.
- Making digital copies will not reduce the cost.

# Second digital turn

- Circa 2010s
- Separations of the ways architects **think, draw and make** dissipated.
- Non-humanistic way: computers can work and faster.
- New taxonomy of digital architecture.
- Oxman (2008): digital architecture as a **challenge in design pedagogy**.
- Oxman and Oxman (2014), an edited book: **theoretical foundations** of this new architecture.



Oxman, Rivka (2008). Digital architecture as a challenge for design pedagogy: theory, knowledge, models and medium. *Design Studies*, 29, 99-120.

Oxman, Rivka and Oxman, Robert (2014). *Theories of the digital in architecture* / [edited by] Rivka Oxman and Robert Oxman, Routledge, Taylor & Francis Group.

Photo by Evgeniy Sholokh on Unsplash



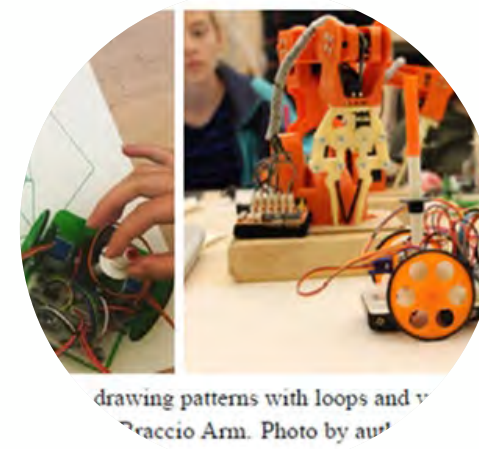
# Research methodology: Six design education practices



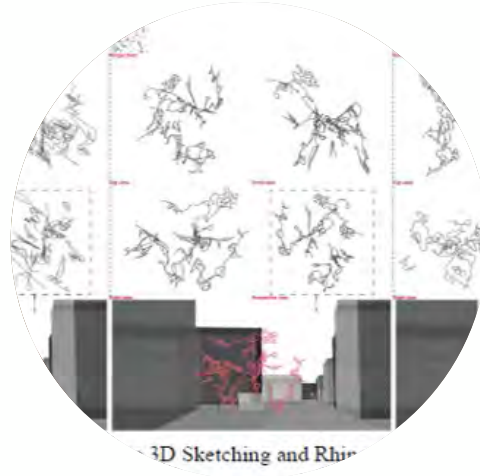
Figure 2 HIS. Shown partially opened for student presentations in this project



set in a plywood apparatus to...  
ing arm. Photo by au



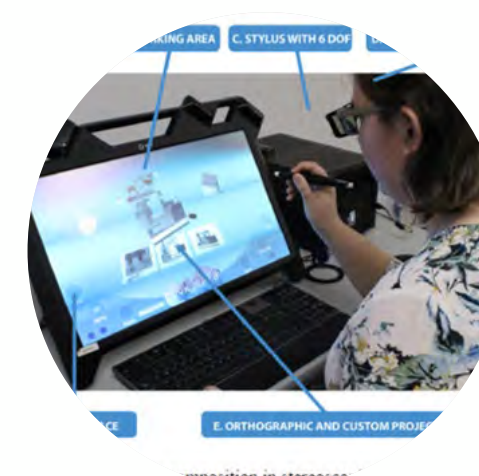
drawing patterns with loops and v...  
Raccio Arm. Photo by au



3D Sketching and Rhin



Figure 1. (left) The Virtual Envi...  
(right) The V



position in stereos



Figure 2 HIS. Shown partially opened for student presentations in this project



1. WebVR website w

## Six design education practices

Download the paper from supporting materials section from the site.

**Table 1.** List of observed design educational practices

Case studies:	Digital Design Environment	Location
1- Dorta et al.[9]	Real time and immersive co-design environment, called Hybrid Ideation Space (HIS): 2D sketching, pseudo-3D sketching, 360° immersive sketches, 3D models, physical models and 4D 360° Immersive Animations.	University of Montreal, Canada
2- Fereos et al.[10]	“Spaceship Architecture” bachelor design studio. Workshops and tutorials on: Rhinoceros 3D, Grasshopper 3D, Phyton and CSharp within Grasshopper, digital fabrication and model making workshops.	University of Innsbruck, Austria
3- Hopfenblatt and Balakrishnan [11]	A multi-platform immersive environment: Unity game engine, zSpace Virtual/Augmented Reality desktop monitor (using a stylus) and HTC Vive head-mounted display and handheld controllers.	University of Missouri, USA
4- Oprean et al.[12]	Site data was collected from 360° images and videos. Immersive environment with three types of headset (Web VR, HTC Vice and cardboard with Android phone).	The Pennsylvania State University, USA
5- Rogers et al.[13]	Quela within Grasshopper, Autodesk ReCap Photo, Hyve 3d, Google Tilt Brush, Rhinoneros3D, Fuzor and Unity.	Victoria University of Wellington, New Zealand
6- Lo and Schnabel[14]	Virtual and Augmented Studio Environment (VASE): HTC Vive headsets, Microsoft Hololens and Hyve3D.	Victoria University of Wellington, New Zealand

# Concerns are classified into three categories

01

**Digital  
design  
cognition**

02

**Digital  
design  
eco-  
system**

03

**Digital  
design  
pedagogy**

01

# Digital design cognition

- The shift is the **relational value** between designers and design tools.
- Proposing the use of *embodied cognition*\* lens in design studies.
- Mind-body-design environment.
- “What is the dialogue between designers and (digital) design tools in the design ideation process?”
- Design tool affordances.

\* Tedjosaputro, M. A. & Shih, Y.-T. (2019). Perceiving Design Processes as Embodied Experience. Research into Design for a Connected World. Springer.

02

## Digital design eco-system

- Digital tools do not work in isolation.
- **The eco-system** hosts a variety of design software in application.
- **Dynamic ecosystem** is proposed by case study #7.
- Selection of tools entails strength and weaknesses of **designers** and **tools** (#6)
- **Interoperability** challenges (#5).
- **Design fixation** challenges.

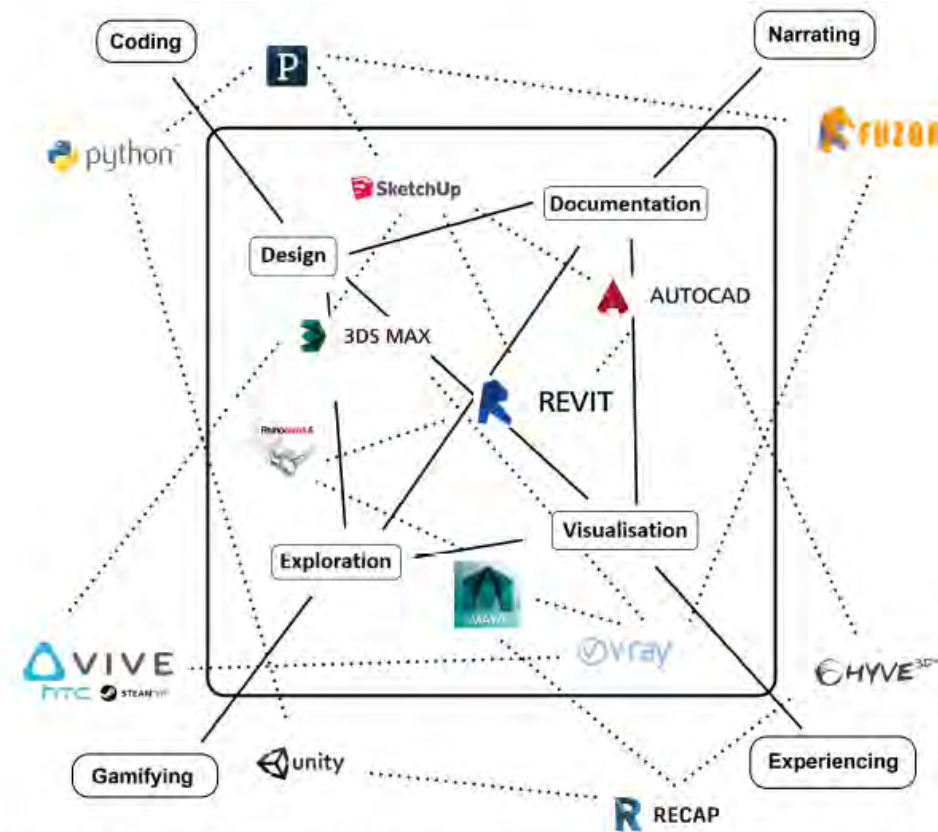


Figure 4. Dynamic Eco-system of the design process expanded from the conventional design process.

03

## Digital design pedagogy

- Specialist software requires specialist knowledge.
- **Potential problems:** design fixation and lack of understanding of design tool affordances.
- New design skills are shaped.
- **Scripting** in architecture pedagogy?
- Suggestions: subtle **transitions** between analogue and digital design pedagogy.

# Re-thinking architectural pedagogy

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Knowing when and why **digital mass customisation** is needed.  
Celebrating **craftmanship**.  
Re-learning from the “**local wisdom**”.

**Architects in the middle** during of  
the act of: notating, representing  
and fabricating.  
Utilising **technological advances**  
to full potentials.



# Digital design

## Example on a design process:

### Bamboo Pod 1

#### STEPS:

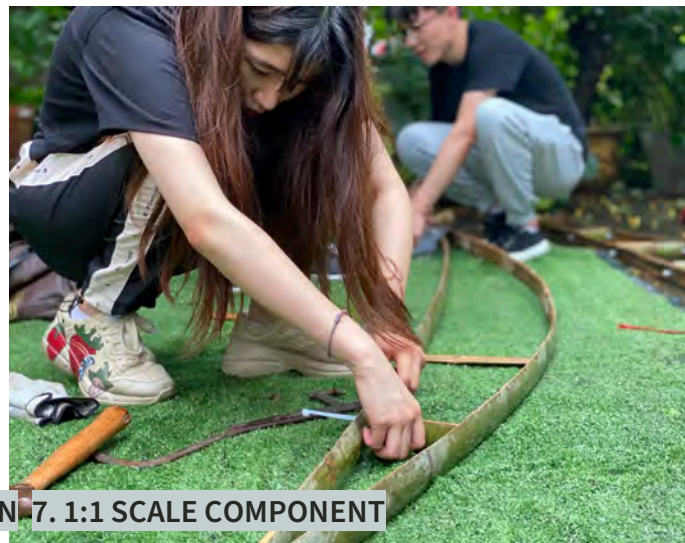
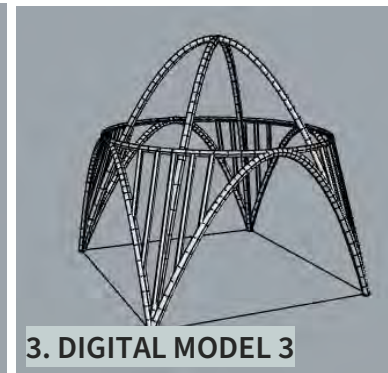
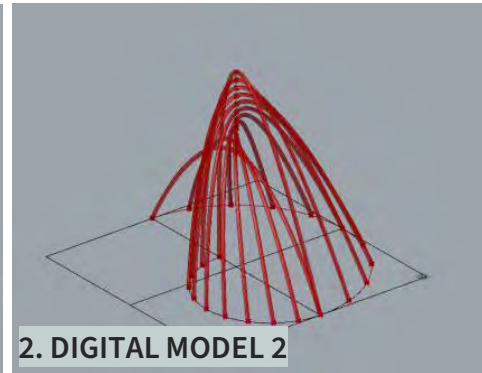
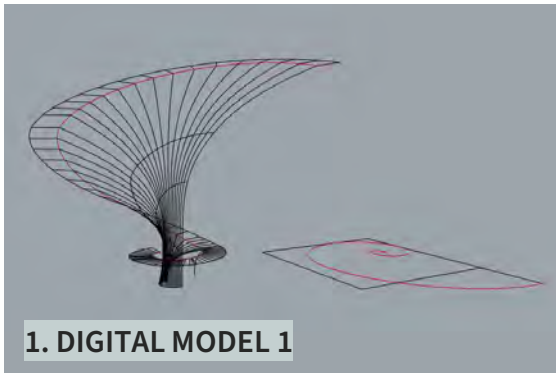
1. Initial concept 1: Model making
2. Initial concept 2: Visual scripting
3. Initial concept: Visual scripting 2
4. Prototype 1: Off site
5. Final concept: Visual scripting including generated dimensions
6. Prototype 2: On-site
7. Construction
8. Post-construction potential scenario for relocation





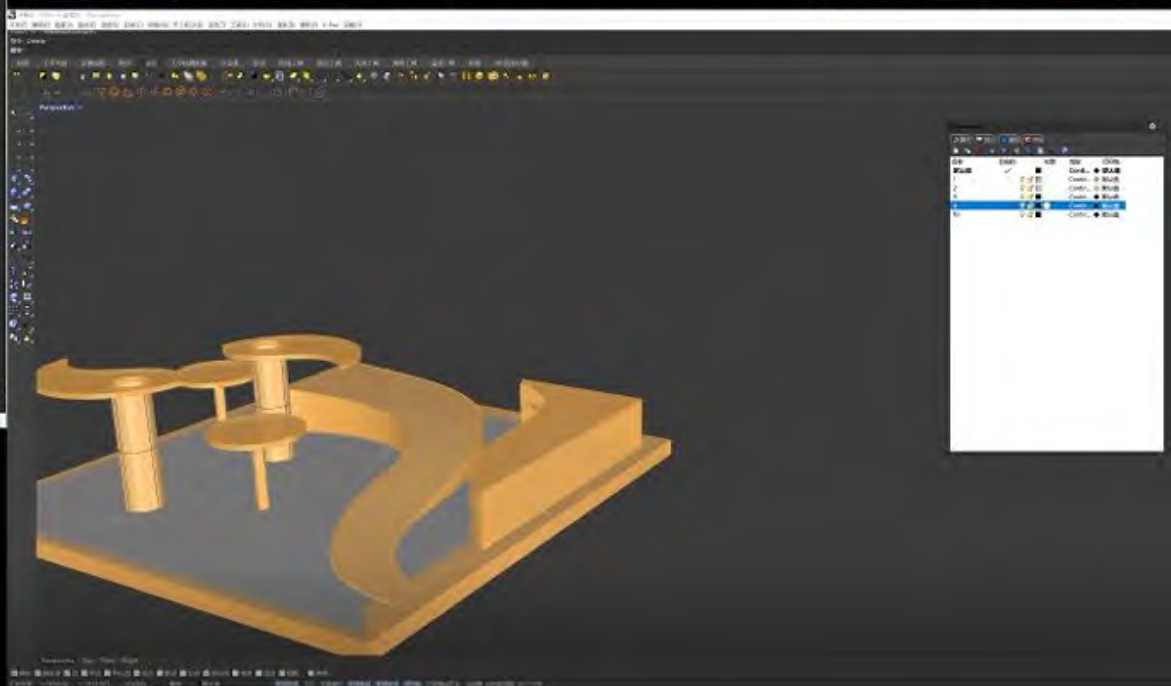
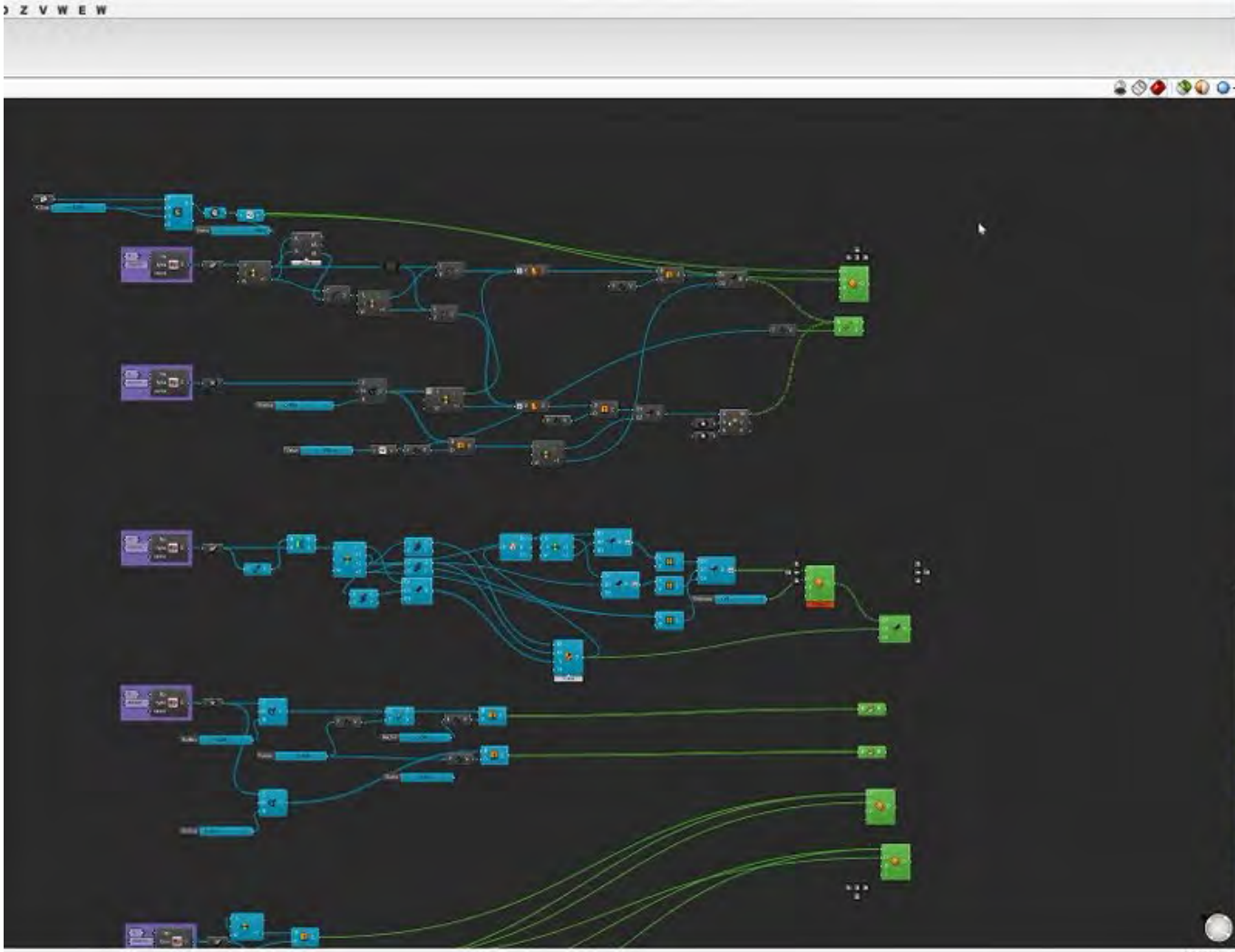
# Digital design

## Example on a design process: Bamboo Pod 2



### 8. CONSTRUCTION PREPARATION

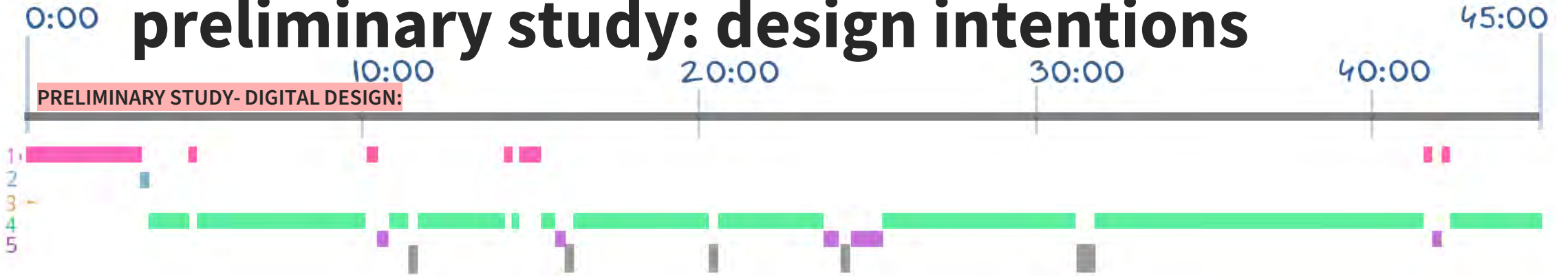
- MATERIAL LIST
- JOINTS
- CONSTRUCTION PROCEDURE
- FINDING EXACT SITE LOCATION USING AUGMENTED REALITY



**Digital design**  
**Preliminary study using**  
**the same design brief**

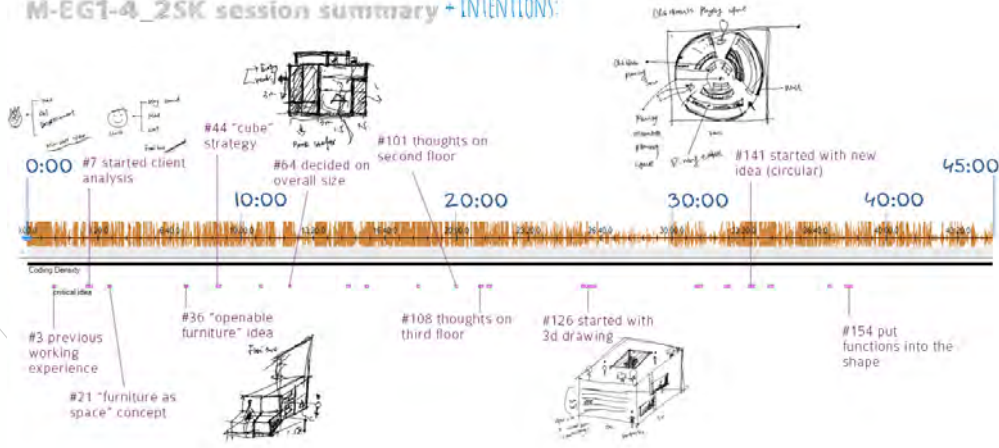
# Digital design

## preliminary study: design intentions



1: SITUATION 2: PROBLEM 3: PATTERN 4: SOLUTION 5: DOMAIN- RELATED INTENTIONS

### M-EG1-4\_2SK session summary + INTENTIONS:



### PHD STUDY- SKETCHING SESSION (SAME BRIEF)



**Analogue**

**VS**

**digital design**

**In the scope of early design phase**

Algorithmic vs non-algorithmic thinking

Direct modelling vs parametric modelling

Medium and ecosystem

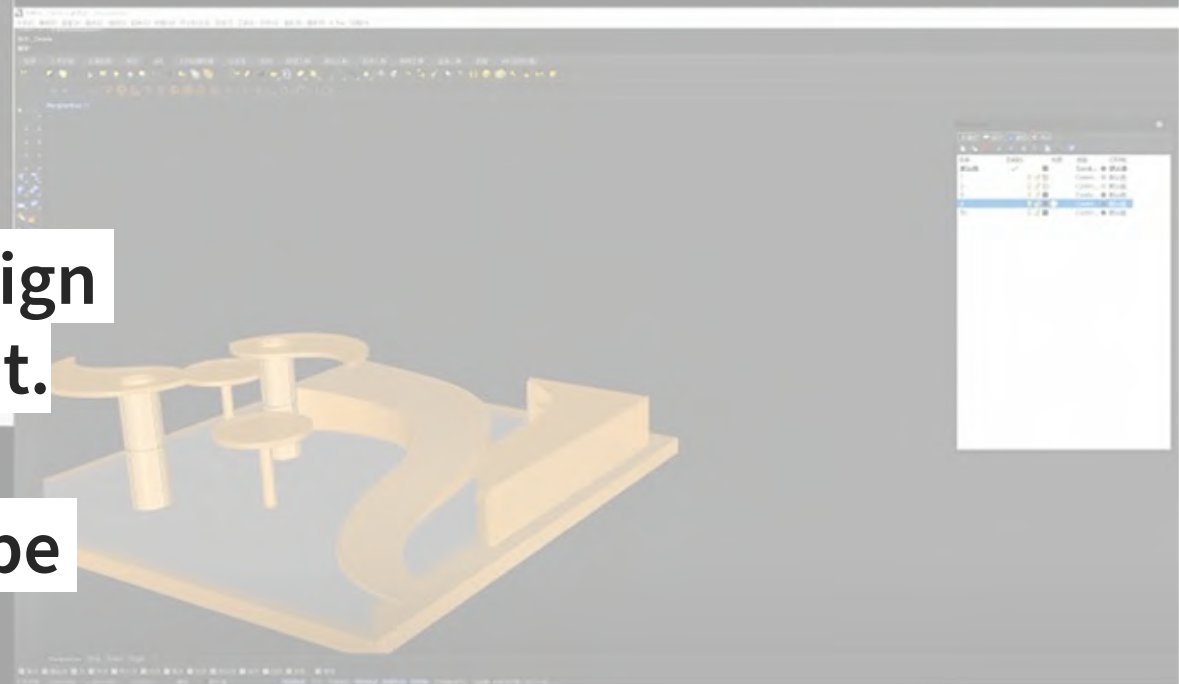
Designer's position in design process

Feedback iteration

**DG: observed potentials in a controlled experiment**

Designers mapped out their design strategies in form of visual script.

Transcription does not need to be verbatim.





# Discussion

<https://miatedjosaputro.com/2022/02/>

[18/dg-week-1/](#)

**password: nbu**

*What are major changes in terms of the way architects think, make and design?*

*What did you know about digital architecture which previously you didn't know?*

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**Leave your thoughts at the bottom of the post**

# Recommended reading list

Carpó, M. (2017). *The second digital turn: design beyond intelligence*, MIT press.

Dunn, N. (2012). *Digital fabrication in architecture / by Nick Dunn*, Laurence King.

Licklider, J. C. (1960). Man-computer symbiosis. *IRE transactions on human factors in electronics*, 4-11.

Lynn, G. (1993). *Folding in architecture*, Academy Editions Limited.

Migayrou, F. & Mennan, Z. (2003). *Non standard architectures*. Editions du.

Oxman, R. (2006). Theory and design in the first digital age. *Design Studies*, 27, 229-265.

Oxman, R. & Oxman, R. (2014). *Theories of the digital in architecture / [edited by] Rivka Oxman and Robert Oxman*, Routledge, Taylor & Francis Group.

Schumacher, P. (2016). Parametricism 2.0: Gearing Up to Impact the Global Built Environment. *Architectural Design*, 86, 8-17.

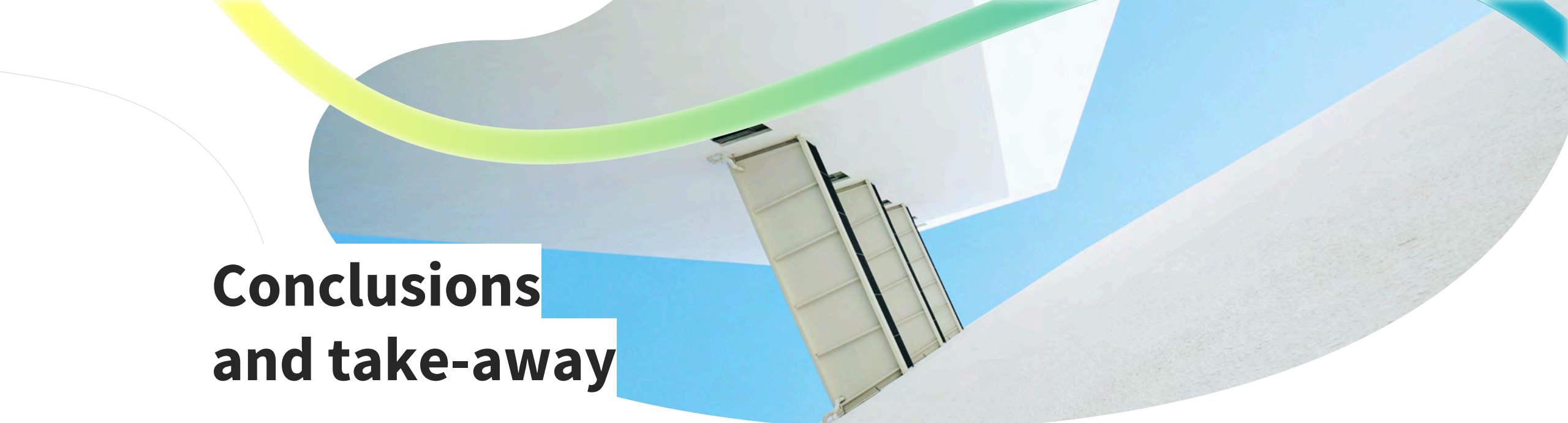
Sheil, R., Menges, A., Glynn, R. & Skavara, M. (2017). *Fabricate 2017*. UCL Press.

Tedeschi, A. (2014). *AAD, Algorithms-aided design: parametric strategies using Grasshopper*, Le penseur publisher.

Woodbury, R. (2010). *Elements of parametric design*.

Yuan, P. F., Leach, N. & Menges, A. (2018). *Digital fabrication*, Tongji University Press Co., Ltd.





# Conclusions and take-away

## 01

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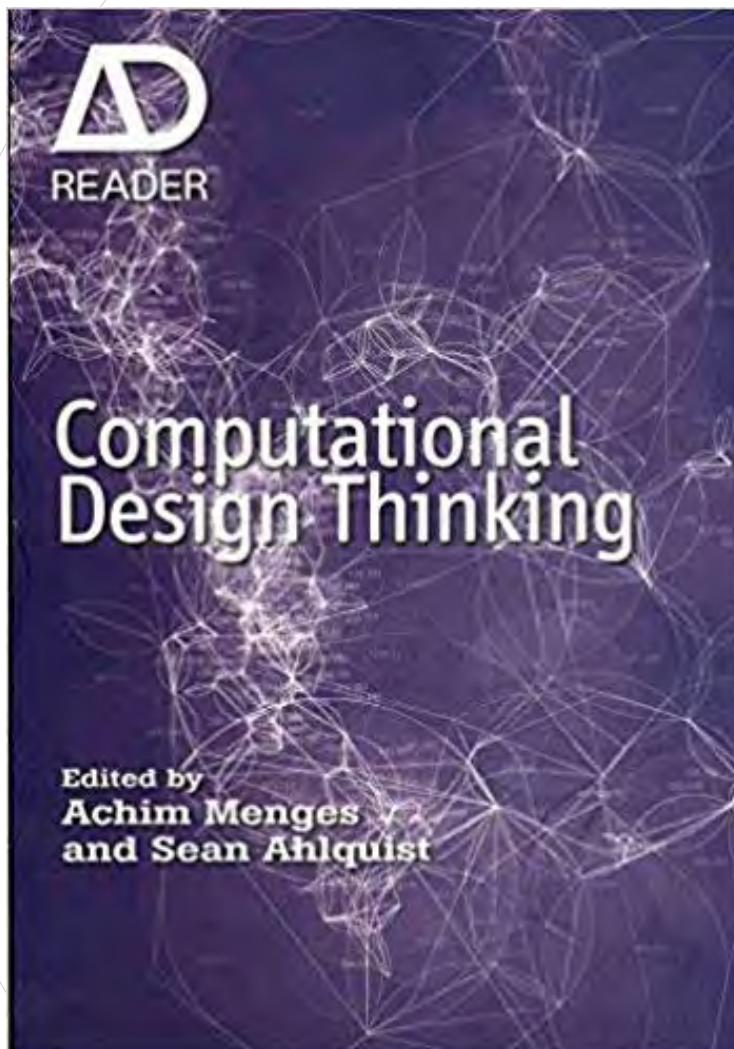
Design behaviour has shifted due to the change of relational value between designers and digital design tools.

## 02

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From CAD (Computer Aided Design) to computational design, as a new discourse.

# Digital design Resources




papers.cumincad.org/

Menu

# CumInCAD

CumInCAD is a Cumulative Index about publications in Computer Aided Architectural Design supported by the sibling associations ACADIA, CAADRIA, eCAADe, SIGraDi, ASCAAD and CAAD futures



 Open Access

**Organisation with regular conferences**

ACADIA: <http://acadia.org/>

CAADRIA

# Digital design Resources

← → ↻ 🏠 🔒 https://www.digitalfutures.world/ 🌐 📄 ☆ 🗨️ 🏠 ⋮

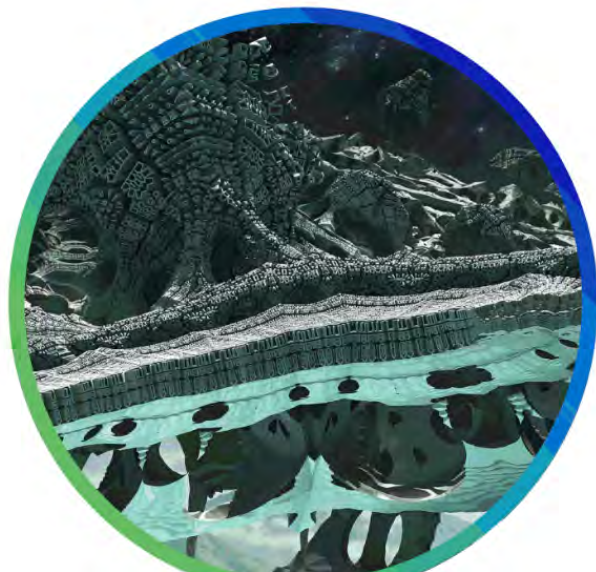


Manifesto · 2020 Workshops · Talks · Young · Awards · Past Workshops · People · News · 中文区网站

## DigitalFUTURES WORLD

Facilitating symposia / workshops / talks / awards / publications for 10 years

Weekly presentations by young researchers, instructors and established architects.



### DigitalFUTURES Young : Space Architecture

**12 December @ 9:00am EST / 3:00pm CET / 10:00pm China**

Following our *Space Architecture* panel in November, we ask what role can emerging architects play in the space industry? This panel brings together young architects, who have been exploring the potential of constructing habitats on the Moon and Mars.

Presentations by:

"Project Marshaus" by Arise Wan / TU Delft & DIA

"Infinite Typing" by Dan Liang, Chen Zhang, Lulin He / LAC studio

"Colonisation of Trojan Asteroids" by Levent Ozruh / The Bartlett UCL

"Home Away from Home" by Selin Sevim / Lund University Graduate

"Printing the City of Ember" by Jack Hatcher / University of Virginia

"Anaximander: The Mellontic Archaeon" by Luis Orozco / ICDC, University of Stuttgart

"Kemikism" by Albert Elias / Aberrate llc, Real-estate Innovation Lab

Streaming on:

[www.youtube.com/c/digitalfuturesworld/live](https://www.youtube.com/c/digitalfuturesworld/live)

<https://live.bilibili.com/22290623>