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# CONCERNS IN DIGITAL TURNS IN ARCHITECTURE

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# Peer-reviewed conference paper

## Concerning digital design in architectural pedagogy

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**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

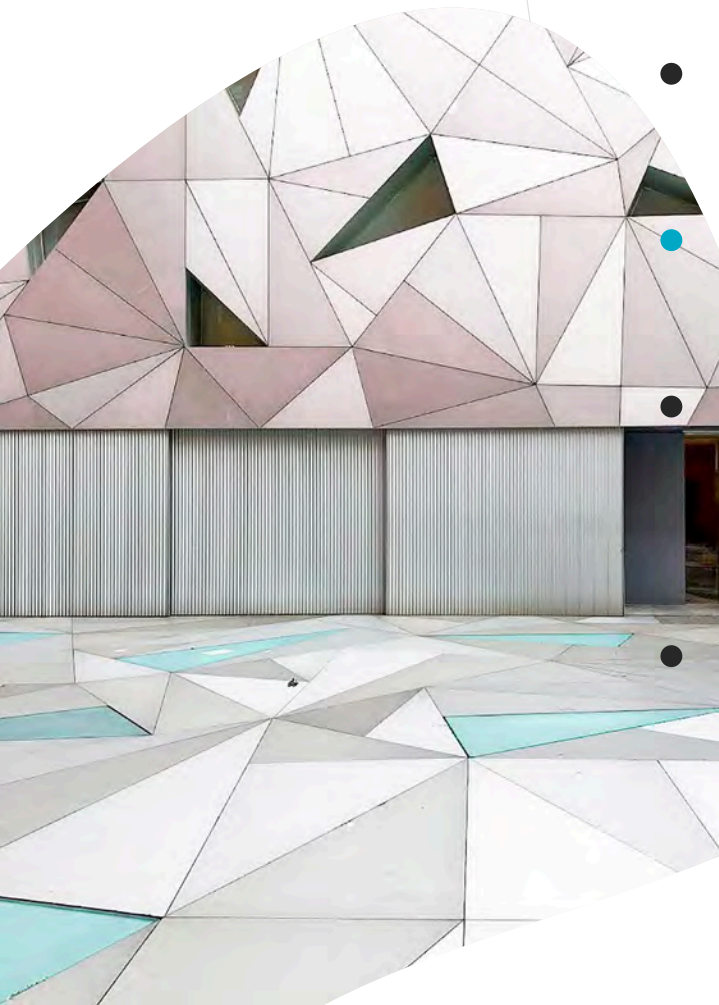
MARIO CARPO

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.

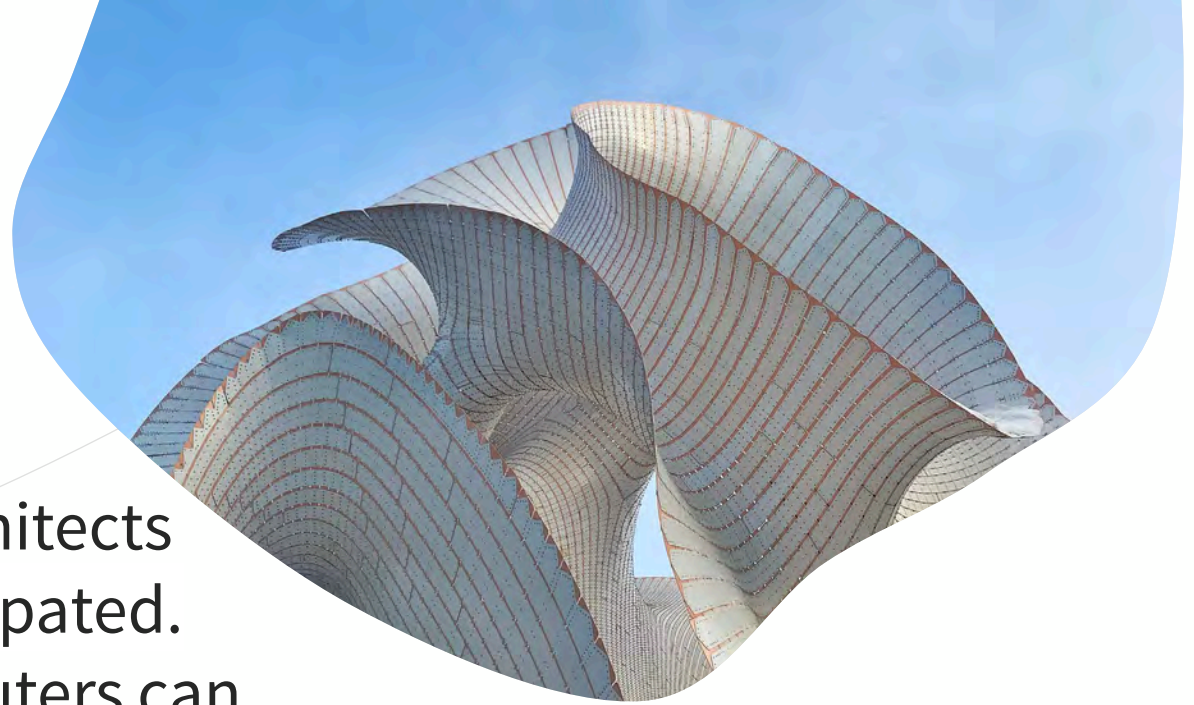






# Second digital turn

- 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.



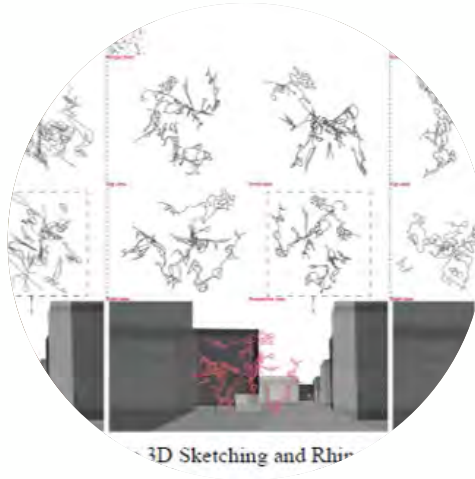
Oxman, Rivka (2008). Digital architecture as a challenge for design pedagogy: theory, knowledge, models and medium. *Design Studies*, 29, 99-120.

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

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# Research methodology: Six design education practices







## Six design education practices

Download the paper from supporting materials section in <https://miatedjosaputro.com/2020/02/25/week-1-about-module/>

**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, Rhinoceros3D, 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.

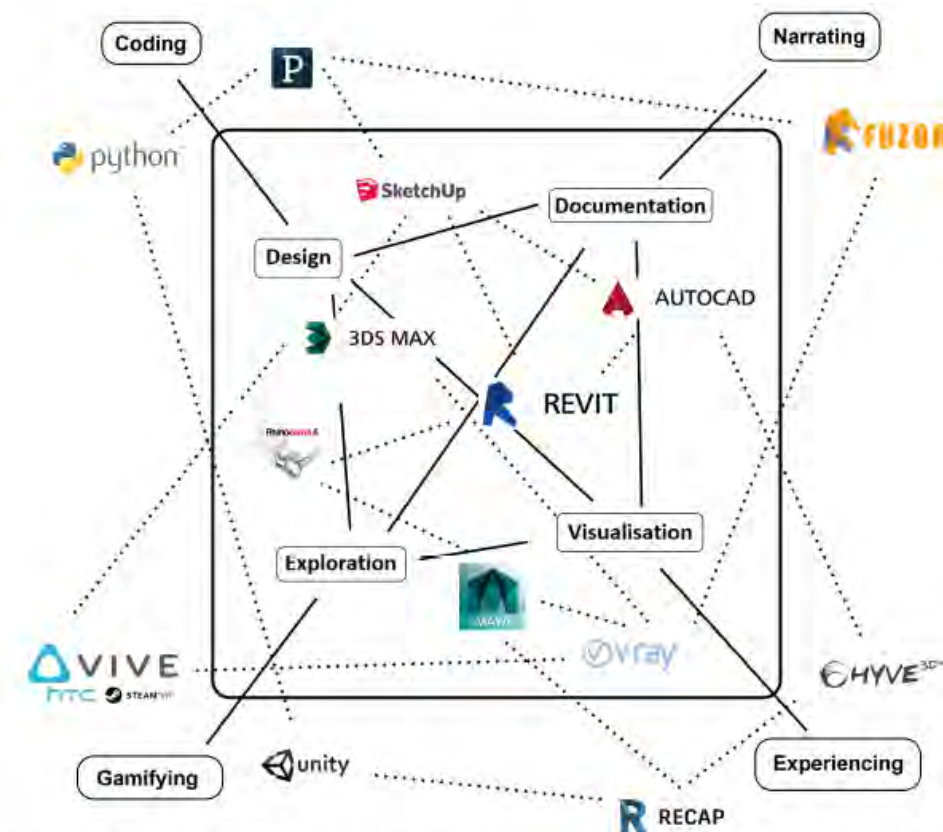


Figure 4. Dynamic Eco-system of the design process expanded from the conventional design process.





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

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.





# Discussion

<https://miatedjosaputro.com/2020/02/25/week-1-about-module/>

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

*How did the relational value between design tools and designers shift?*

*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**



# 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.

Further  
reading




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