Week 8
Rhinoceros 3D

This week we will be exploring Rhino the software. Some of you who might not have access to the software, there will be an alternative learning method.

Photo by Mitchell Luo on Unsplash

Outline

01

Introduction of Rhino 3D

Exploring what Rhino is for and who uses the software apart fOR architects. Also contextualising the software with the parametric design thinking.

02

Links to tutorial

Due to the fact that face-to-face learning is not possible; suggested resources platforms and links to tutorial on YouTube will be presented.

03

Suggestions

Suggestion on how you can learn introductory part of the software. An alternative arrangements for those who do not have access to software will also be presented.

Photo by Muhd Asyraaf on Unsplash

Aims and objectives

- To relate Rhino 3D software to the digital design thinking we have built the last few weeks.
- To elicit background knowledge of Rhino 3D.
- To provide alternative tutorials by using available links from the video sharing platform.
- To suggest ways to learn the software.

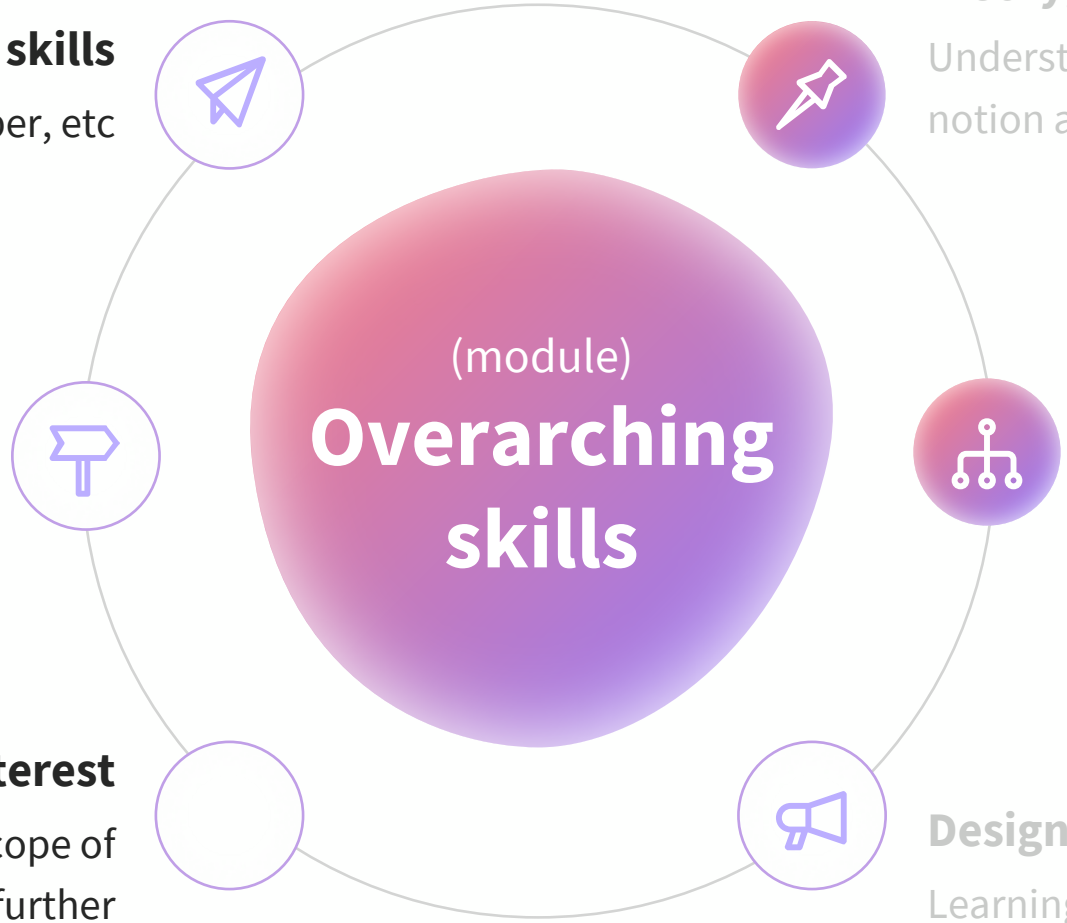
Learning outcomes

Students will be able to..

01 Summarise what Rhino offers compare to other 3D software.

02 Exercise basic Rhino commands.

03 Be informed on where to find resources for further study.



Software skills

Rhino, Grasshopper, etc

Theory, history and current debate

Understand historical background of this notion and relevant debates.

Research skills

Designing through extensive research

Important concepts

Digital fabrication and construction
Digital design cognition
Human-computer interaction
Digital craftmanship
etc

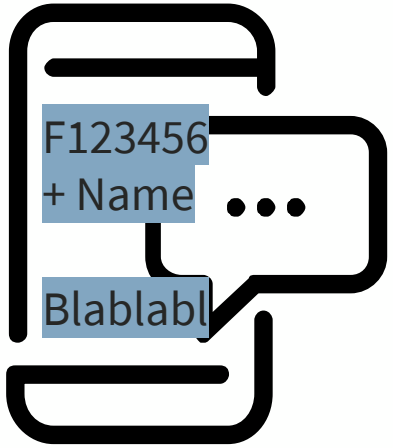
Personal interest

Exploring a preferred scope of design to be developed further

Design precedents

Learning through analysis of completed project

Upload



There is no forum discussion post this week, but it is expected that you upload one screenshot of your Rhino exploration.

Alternative 1: Try to utilise free trial.
https://www.rhino3d.com/download/rhino/6.0/evaluation

Alternative 2: If you can't access the software, leave a 150 words of comment on the software based on tutorials, or your friends' uploaded try-outs.

https://miatedjosaputro.com/2021/04/18/dg-week-8/

Who has previous experience of Rhino?

PollEv.com/miaatedjosap676

Rhinoceros 3D

Developed by: Robert McNeel & Associates

https://wiki.mcneel.com/rhino/rhinohistory

1998

RHINO 1.0 RELEASED

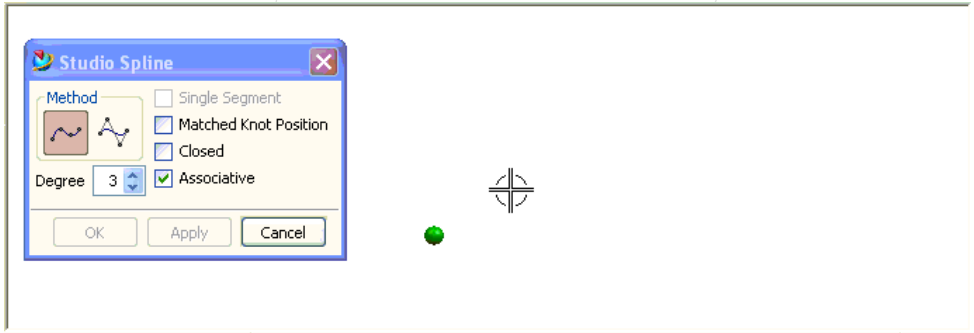
2018

RHINO 6.0 FOR WINDOWS

Rhinoceros 3D

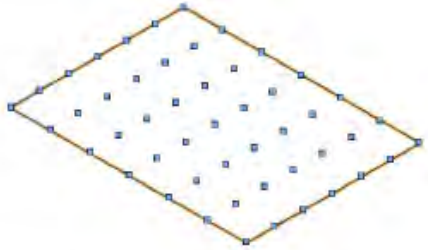
NURBS Modeling

NURBS (non-uniform rational basis spline) is a mathematical representations of 3D geometry, for generating curves and surfaces. Rhinoceros allows designers to produce **freeform surfaces**.



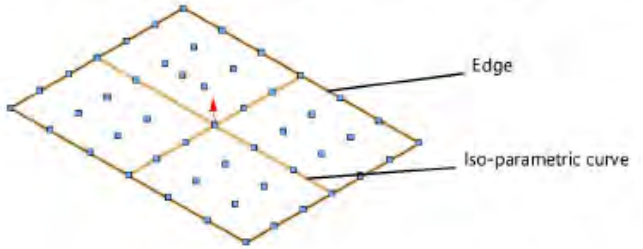
https://en.wikipedia.org/wiki/File:Spline01.gif

NURBS surface

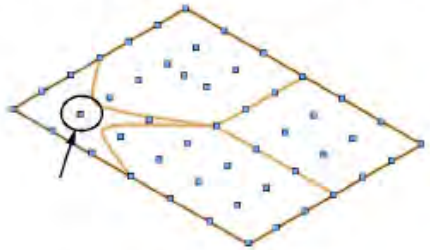


NURBS surface
U Degree = 6
V Degree = 6
Vertices = 49
Weight of all each vertex = 1

A NURBS surface also has a direction, or normal, which affects the outcome of certain operations, such as fillet surface creation. Iso-parametric curves indicate the U and V direction, and edge curves are drawn along the edges, helping to visualize the NURBS surface.



Each vertex on the surface can have a weight which "pulls" the surface towards the weighted vertices.

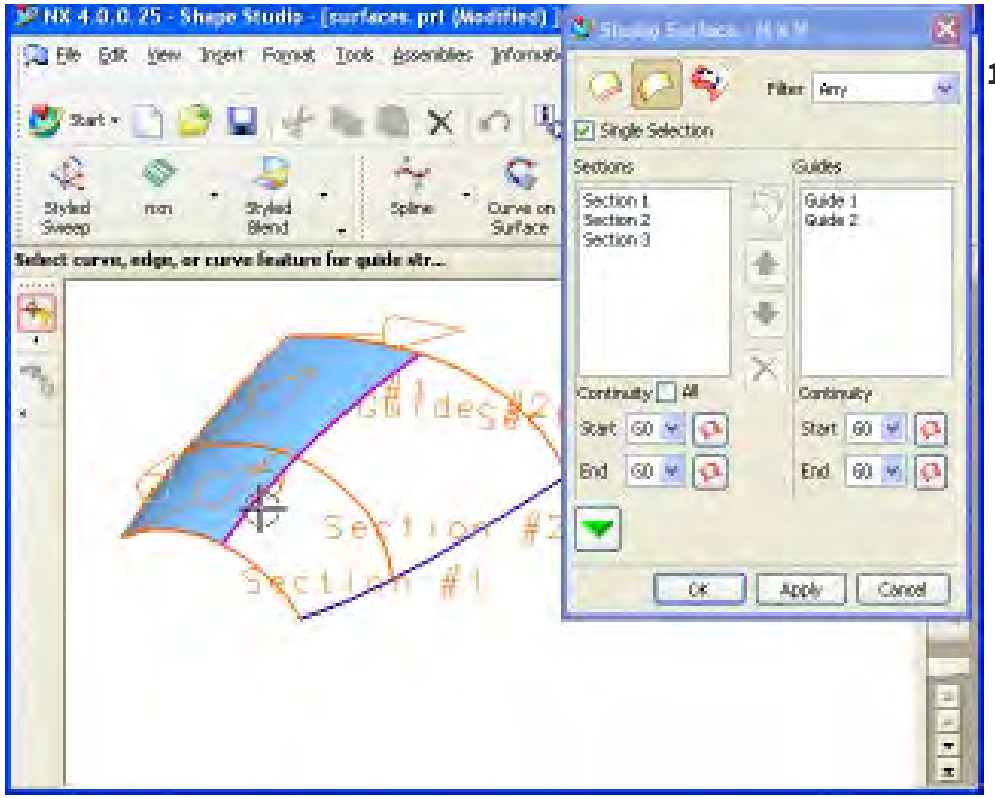


NURBS surface
U Degree = 6
V Degree = 6
Vertices = 49
Weight of selected vertex = 100
Weight of remaining vertices = 1

The **Reshape** tool can move a single vertex or a row of vertices, deforming the surface (see Reshaping NURBS surfaces).

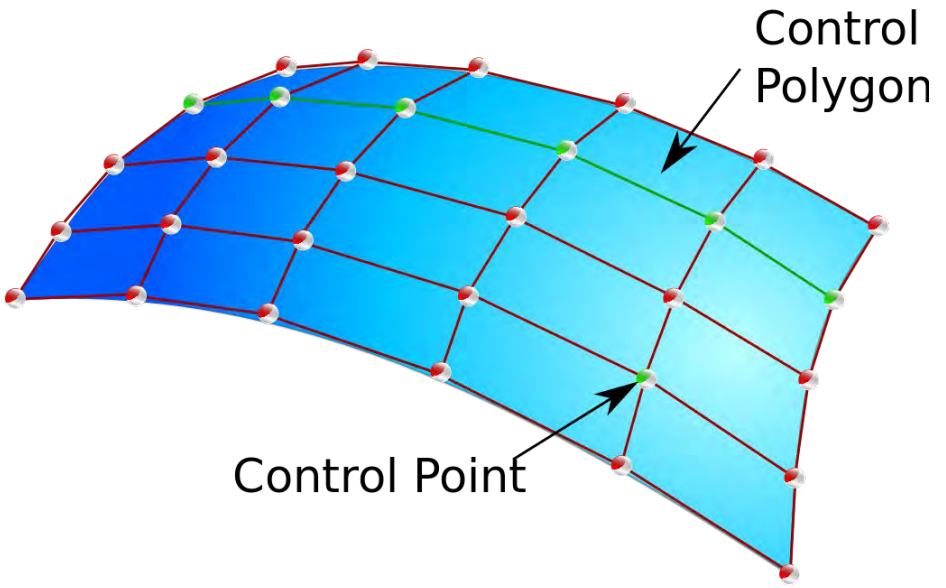
Rogers, D. F. (2000). *An introduction to NURBS: with historical perspective*, Elsevier.
https://app-help.vectorworks.net/2020/eng/VW2020_Guide/Shapes2/Concept_NURBS_curves_and_surfaces.htm
https://www.rhino3d.com/nurbs

Freeform surface modelling



Two ways of creating of surfaces:

1. **Constructing curves or splines**
2. **Manipulation of surface poles or control points**



https://en.wikipedia.org/wiki/Freeform_surface_modelling

Which disciplines use Rhino 3D?

Jewellery design

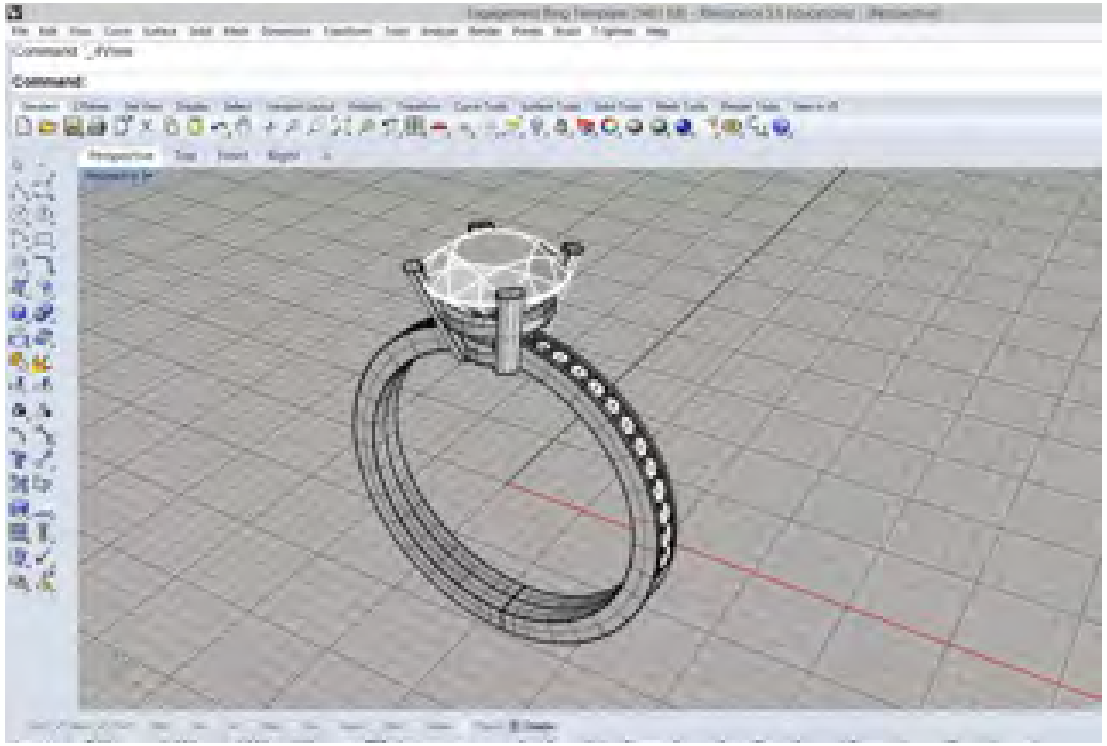
Industrial design

Marine design

Automobile

Architecture

and many more..



http://blog.rhino3d.com/2016/04/rhino-for-jewelers-online-class.html

Which disciplines use Rhino 3D?

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and many more..

https://www.rhino3d.com/gallery/1/54707

Which disciplines use Rhino 3D?

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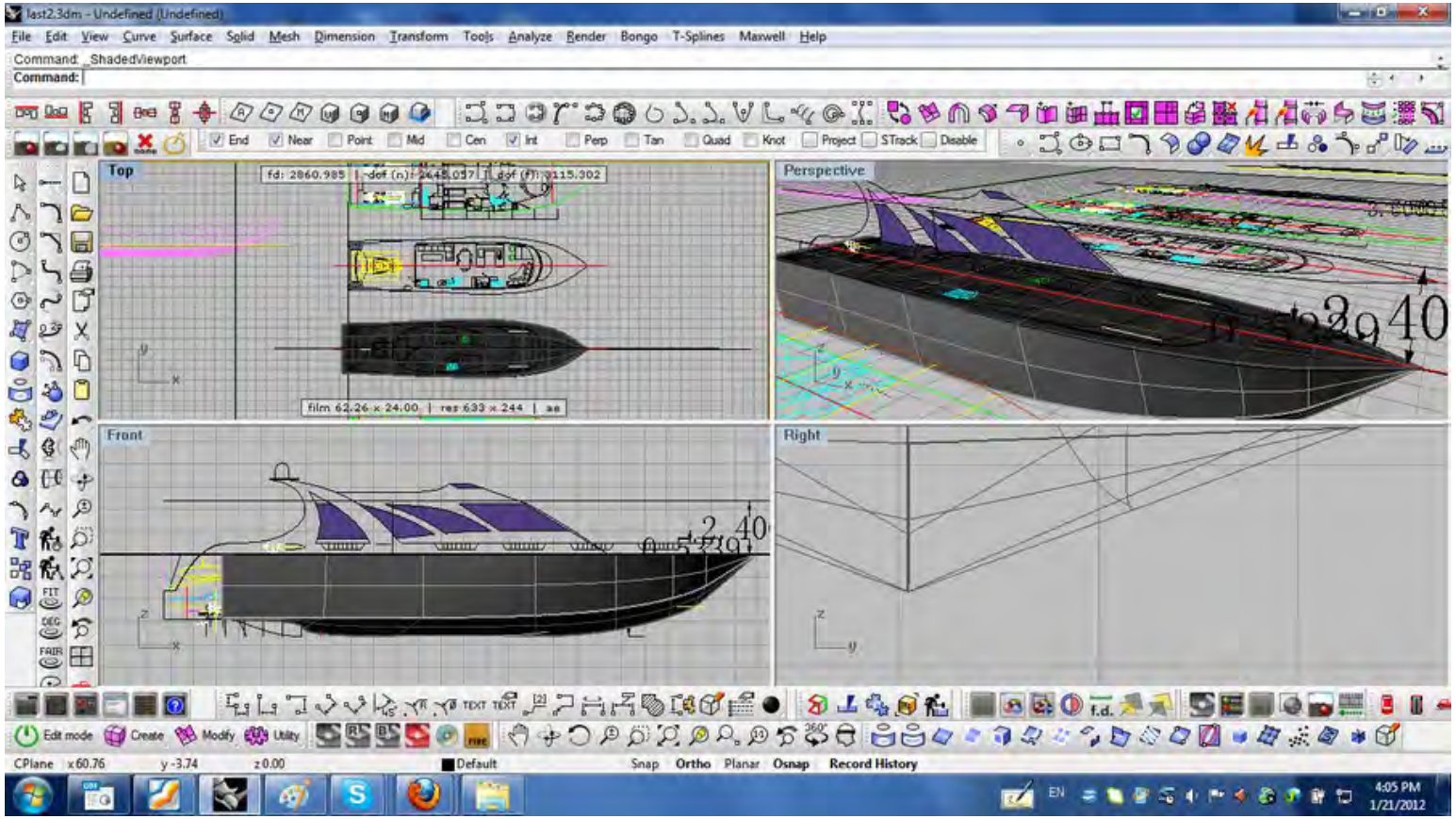

https://www.boatdesign.net/threads/automated-initial-ship-design-pipeline-excel-autocad-rhinoceros-maxsurf.44709/

Which disciplines use Rhino 3D?

Jewellery design
Industrial design
Marine design
Automobile
Architecture
and many more..

https://www.rhino3d.com/gallery/6/36726

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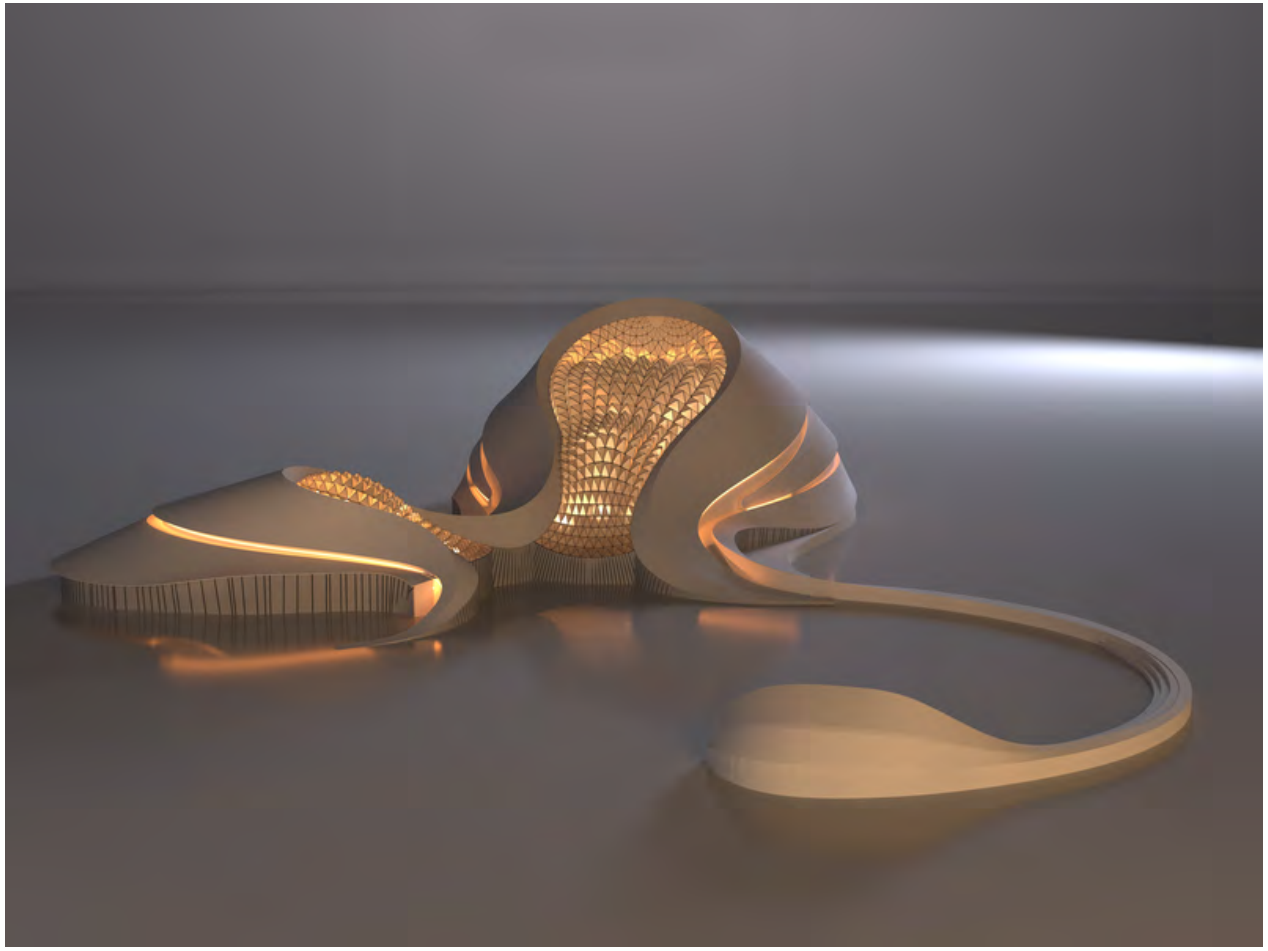


https://www.rhino3d.com/gallery/5/55268

Advantages and disadvantages

- Ability to model organic forms
- Accurately represents both standard geometric objects like lines, circles; and free-from geometry like car bodies.
- Provides design freedom with accuracy and quality
- Accuracy with adaptive mesh
- Compatible with 30 other CAD file formats, makes it a great translator
- Many plugins
- 90 days trial for educators and students

- MAC version does not work as good as Windows version.
- Lack of backwards file compatibility
- Line weights and layouts are difficult to use
- It is not natively 3D parametric software, without a plug-in

https://www.sculpteo.com/blog/2019/07/10/battle-of-software-rhino-vs-sketchup/
https://wiki.mcneel.com/rhino/nurbs
https://www.trustradius.com/products/rhinoceros-3d/reviews

18

Direct modelling: On-the-fly design modification

RHINOCEROS 3D

VS

Parametric modelling: Associative relationship

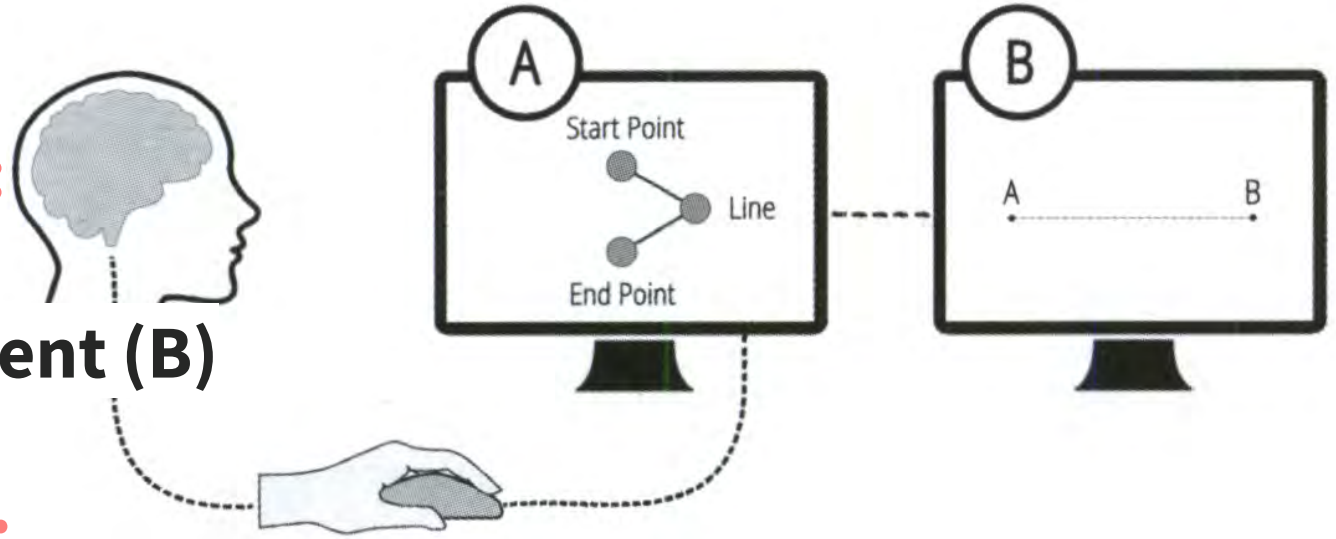
PLUG-IN FOR RHINOCEROS 3D SUCH AS GRASSHOPPER

Previously in Week 5..

Visual scripting

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

There are two working environments:
Visual Editor (A)
3D Modelling Environment (B)



Producing two outputs:
Node diagram, called *parametric diagram*
Output of *parametric diagram* constituted by parametric 3D or 2D geometry.

Previously in Week 5..

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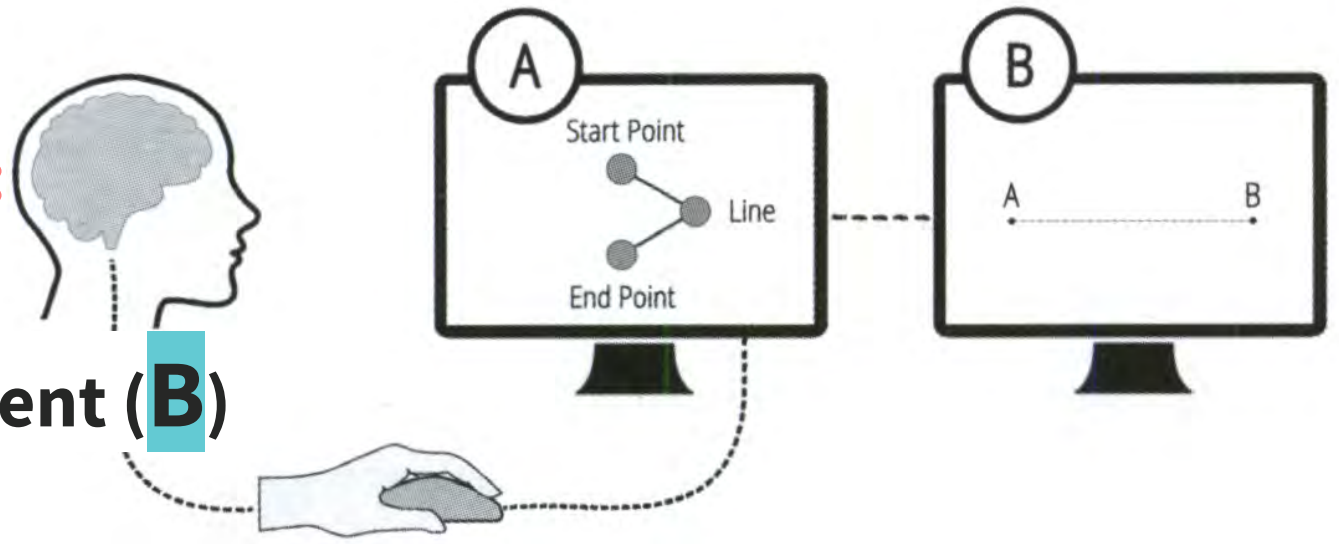
Tedeschi, A. (2014). *AAD, Algorithms-aided design: parametric strategies using Grasshopper*, Le penseur publisher.

A IS
GRASSHOPPER PLUG-IN

B IS
RHINOCEROS 3D



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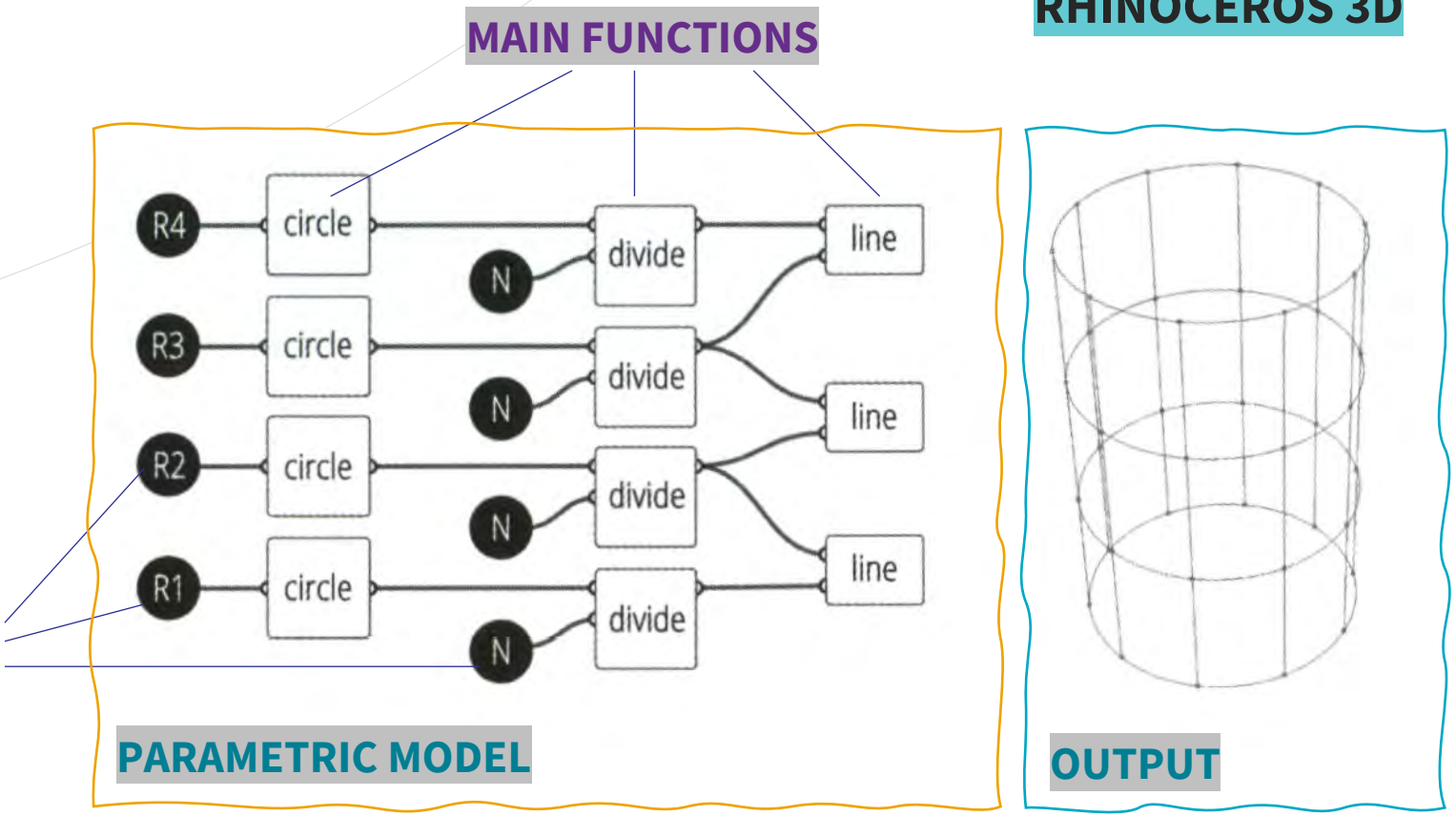
0. *Draw four circle*
1. *Subdivide the four circles into N parts, we get N points for each circle*
2. *Connect the corresponding points*

A IS **GRASSHOPPER PLUG-IN**

B IS **RHINOCEROS 3D**



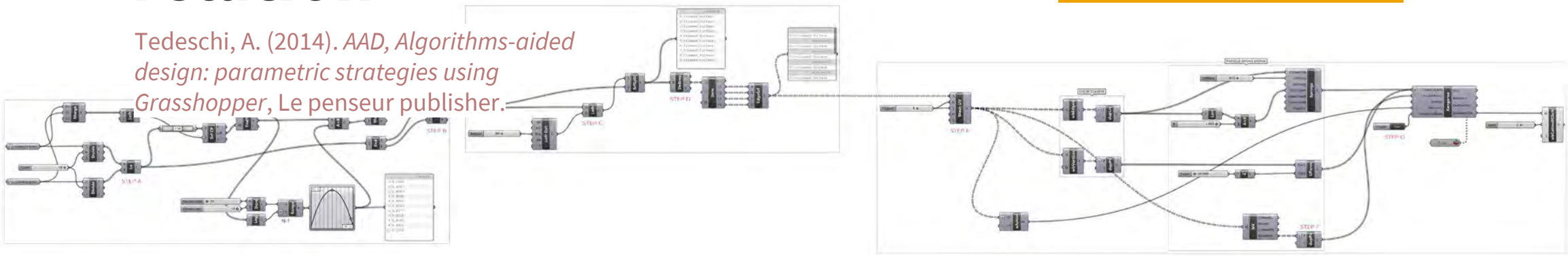
VISUAL TRANSPOSITION OF THE ALGORITHM

The advantage of the *parametric diagram* is in the intuitive logic, which allows designers to manipulate parameters.

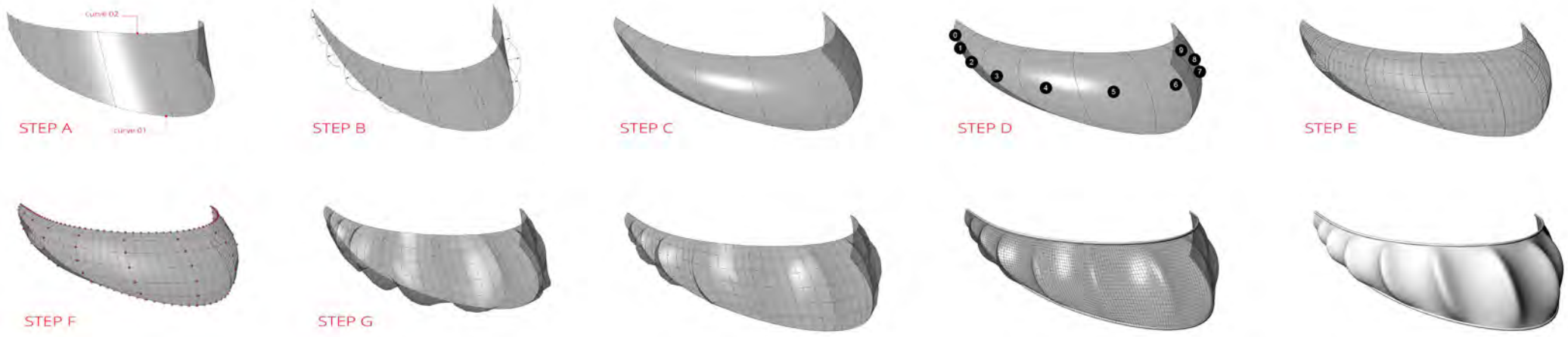
Example of Rhino and Grasshopper relation

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

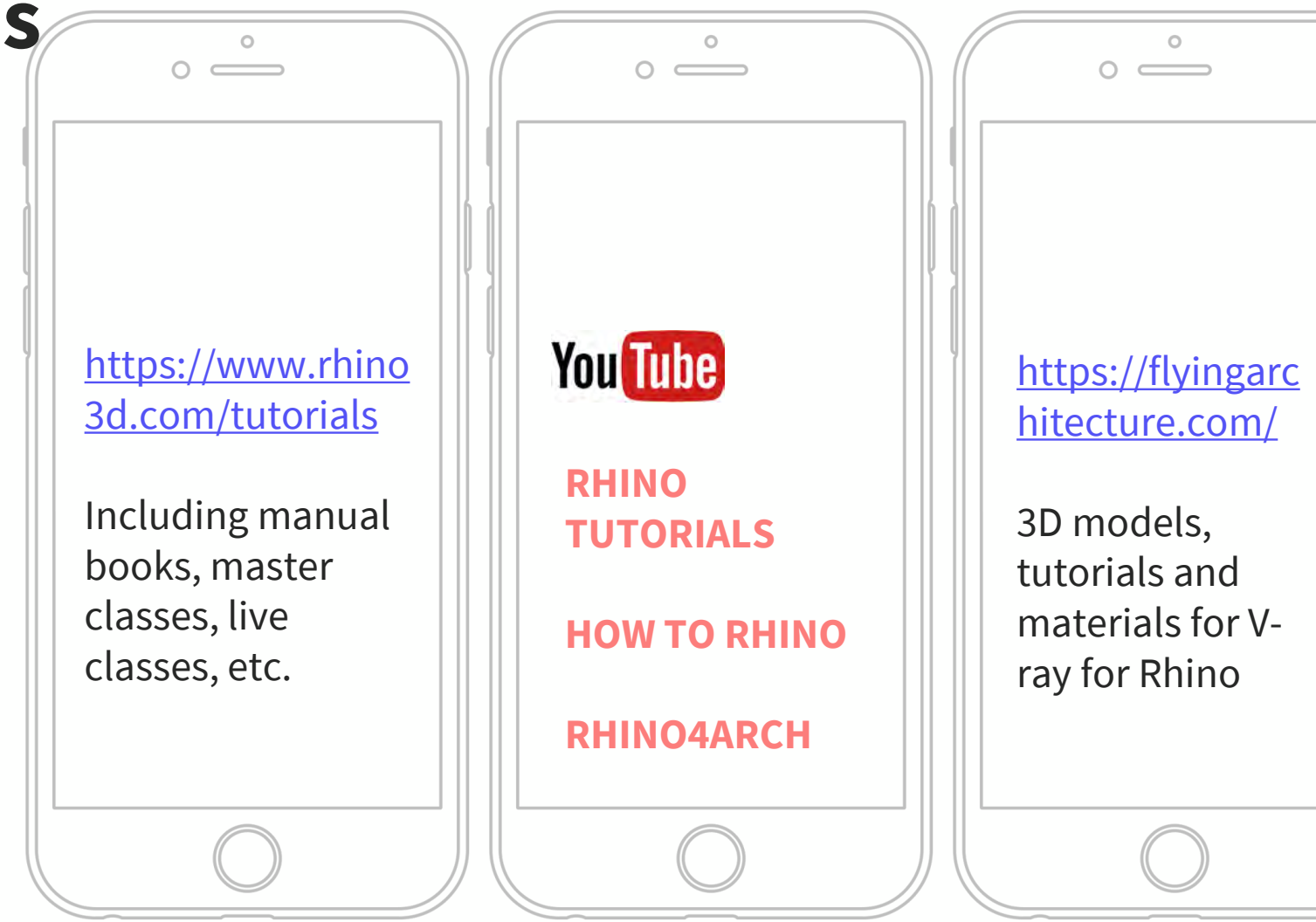
TOP: GRASSHOPPER PLUG-IN



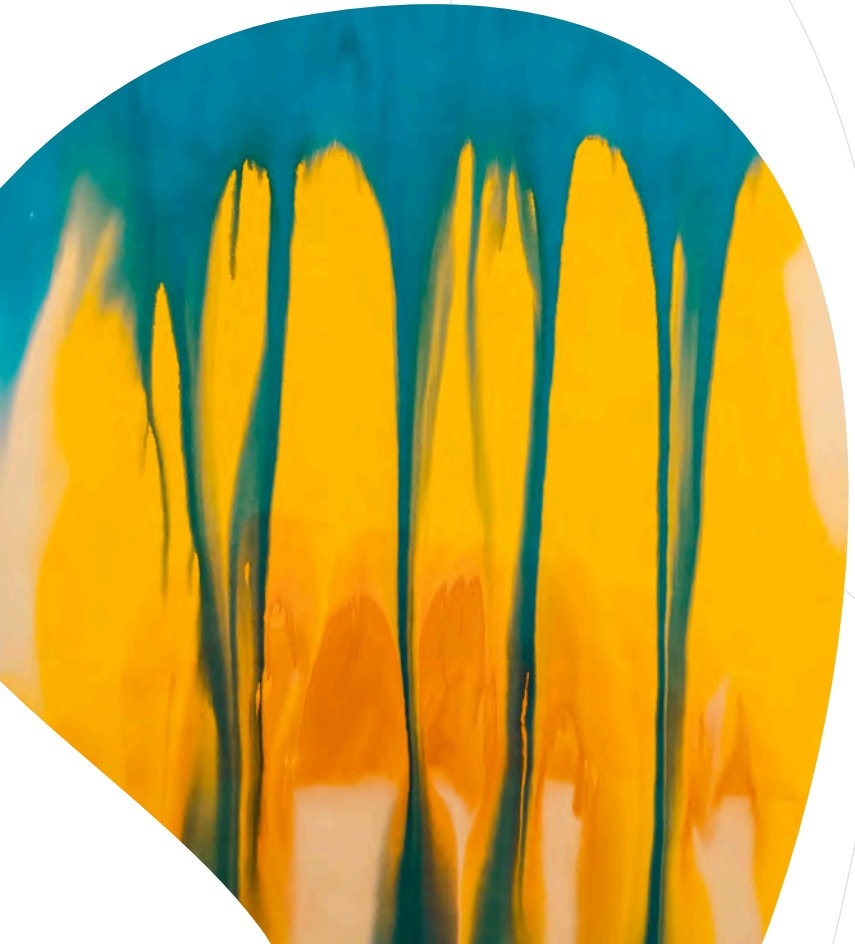
BOTTOM: RHINOCEROS 3D



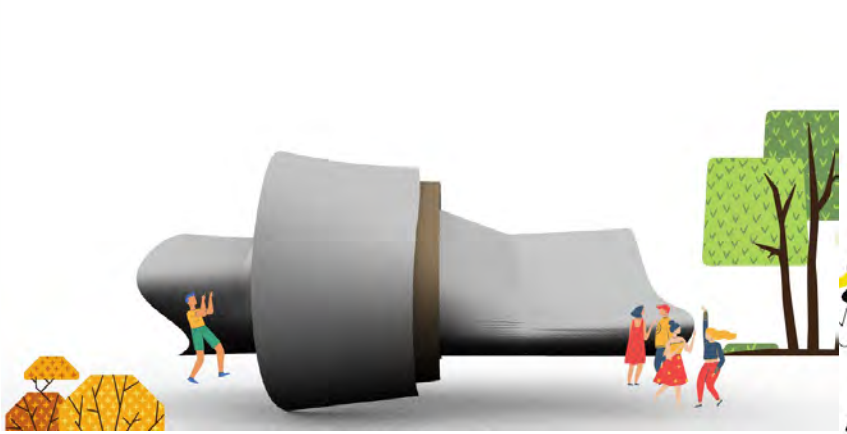
Rhinoceros 3D online resources



How do you get started?



- Try to download the **90 days trial.** Or if you already have the software, please go ahead.
- If you absolutely **cannot gain access** to software, take notes and submit the reflections.



Exploration 1:
Twist and pipe

(1) Shuhei Endo Architecture | Facebook

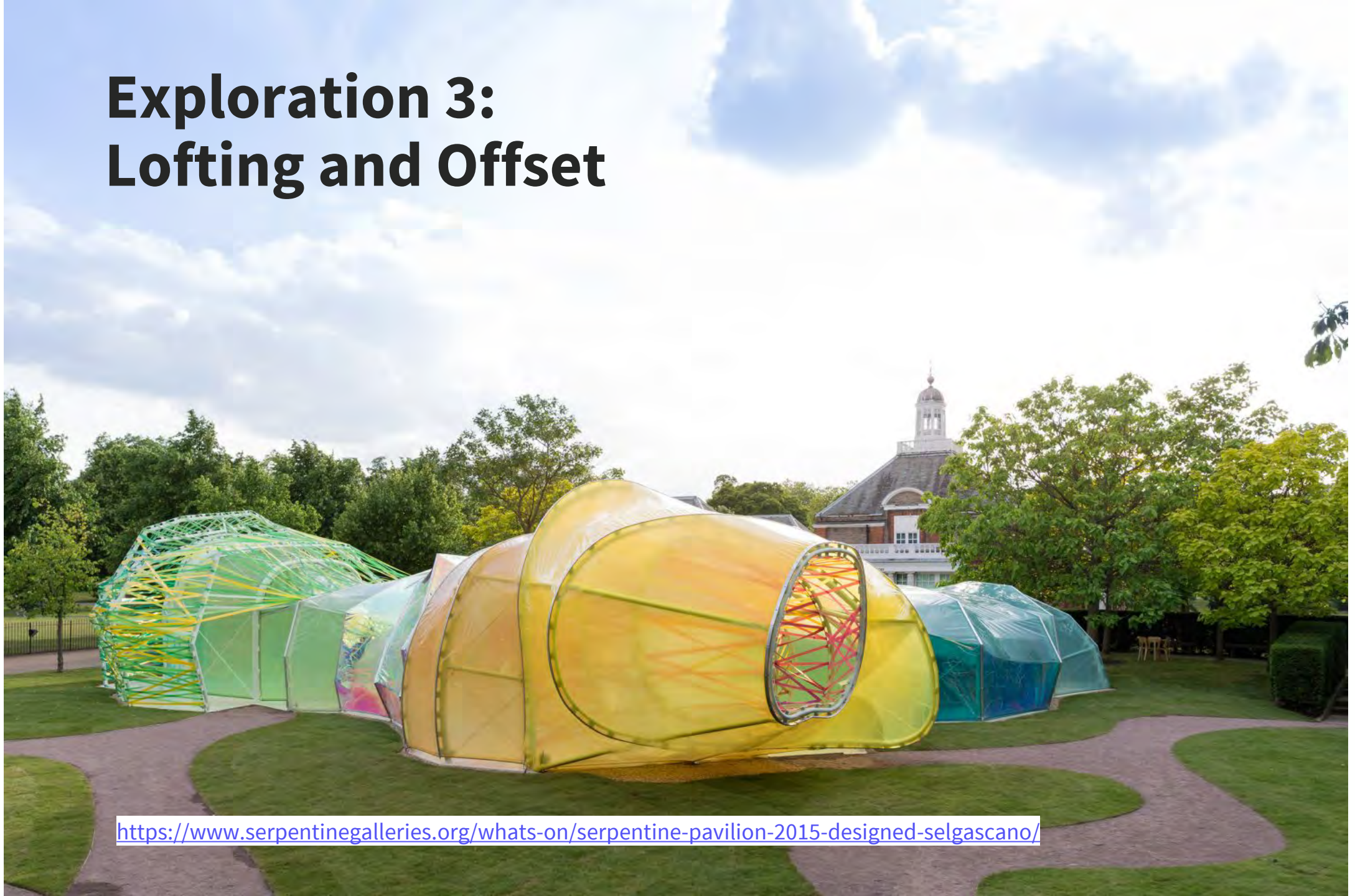
Exploration 1:
Twist and pipe

Exploration 2:
Spiral and Sweep 1

https://www.designboom.com/architecture/hiroshi-nakamura-nap-ribbon-chapel-spiral-hiroshima-japan-01-28-2015

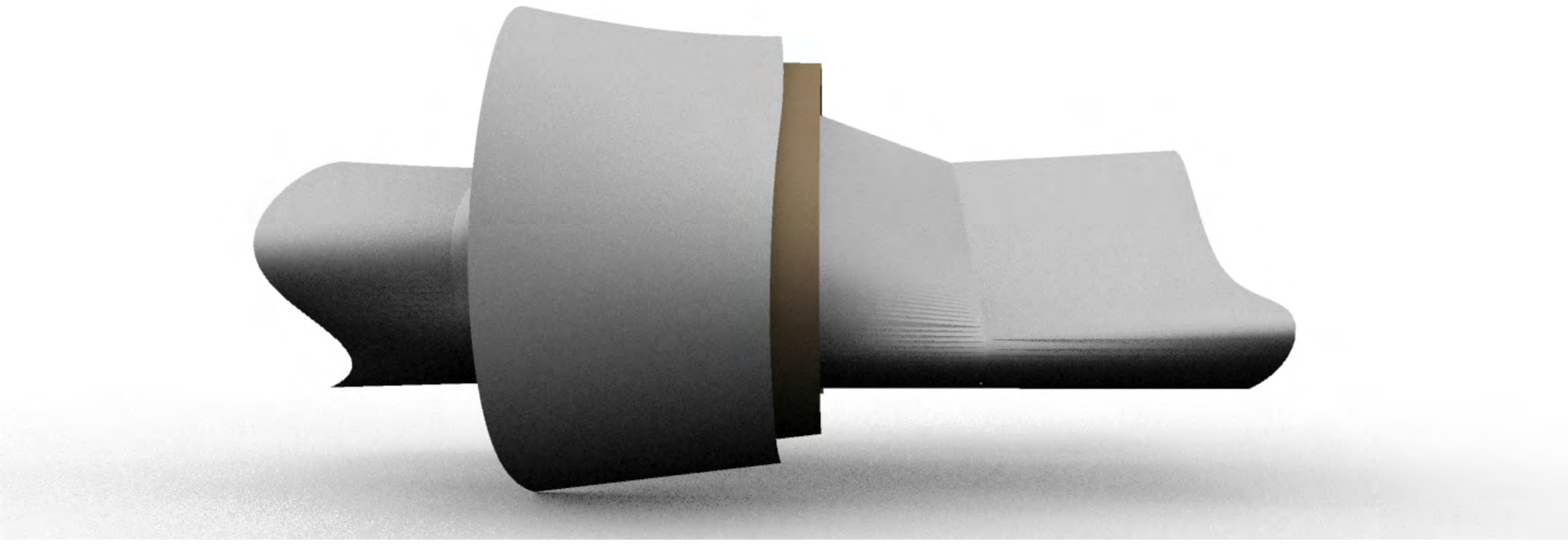
Exploration 2:
Spiral and Sweep 1

Exploration 3: Lofting and Offset

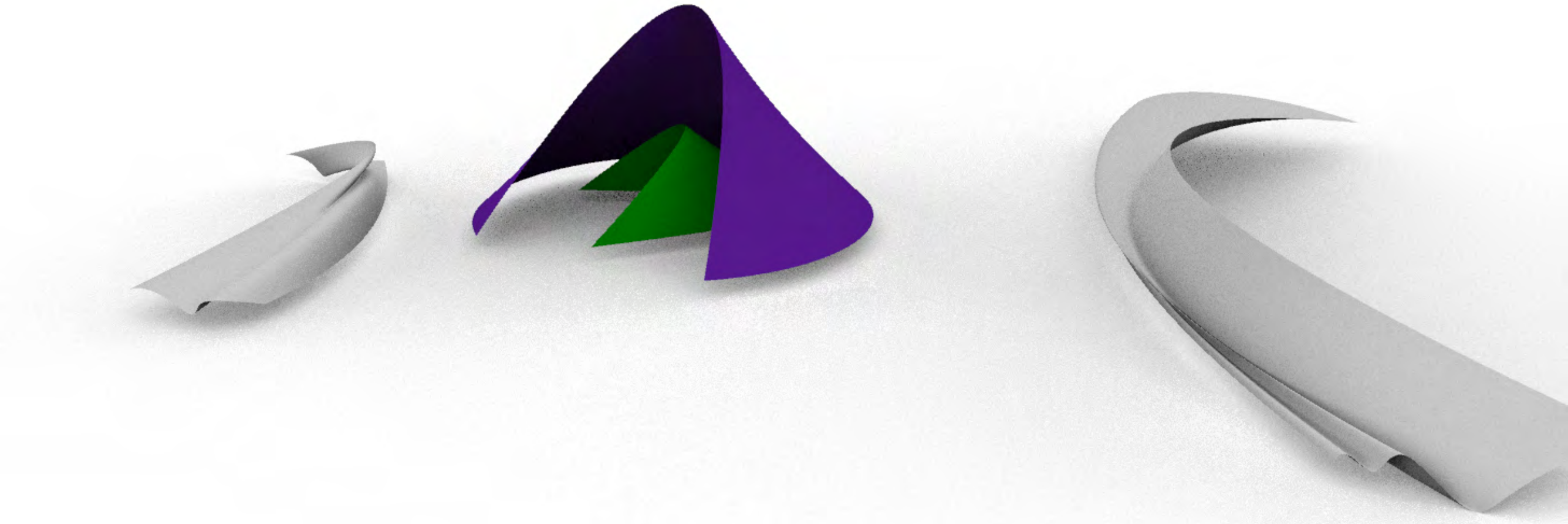


https://www.serpentinegalleries.org/whats-on/serpentine-pavilion-2015-designed-selgascano/

Exploration 3:
Lofting and Offset

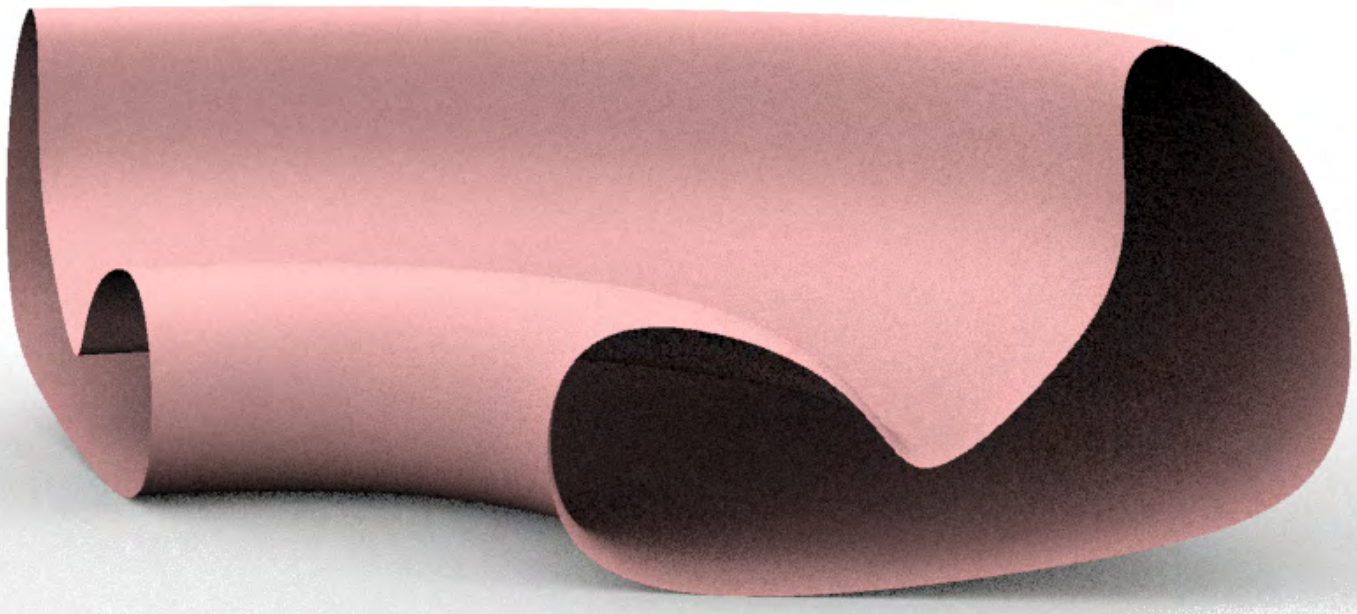


Exploration 4:
Sweep 2 rail



Exploration 4:
Sweep 2 rail

Exploration 5: Revolving



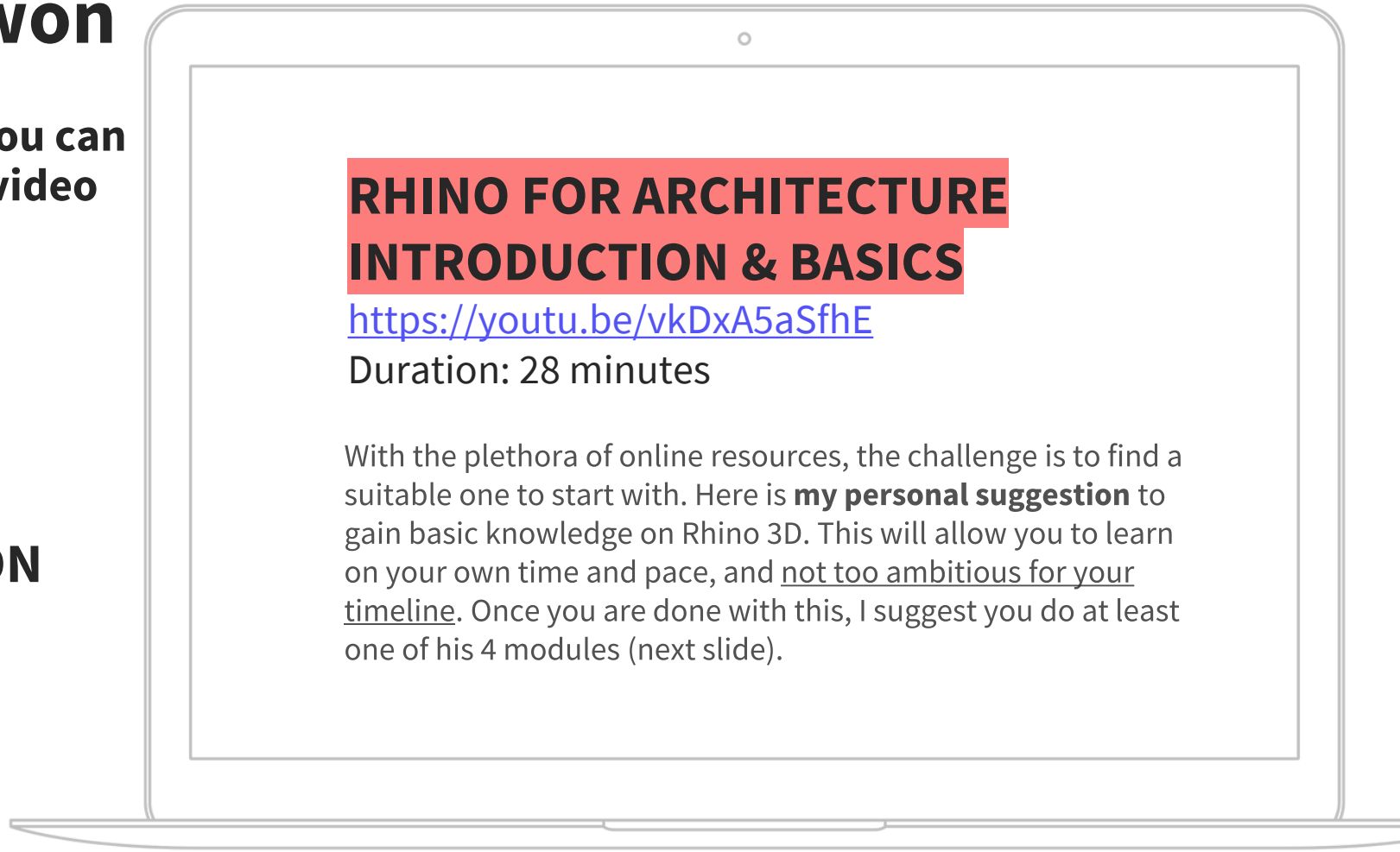
Rhino 3D tutorials by Nate McKewon

As additional learning, you can go through this tutorial video

NATE McKEWON

YOUTUBE

CLICK HERE



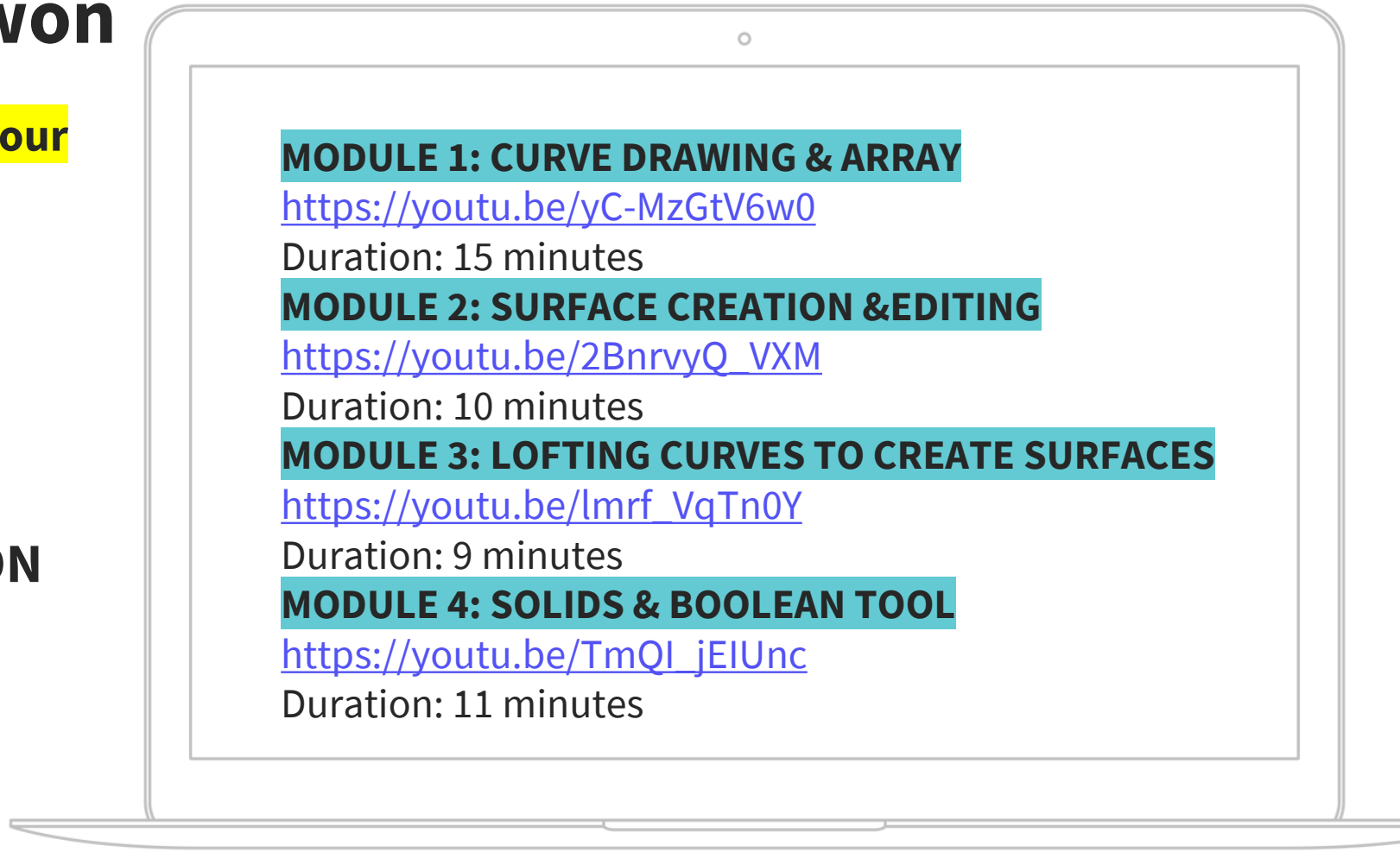
Rhino 3D tutorials by Nate McKewon

Do at least one of these four

NATE McKEWON

YOUTUBE

CLICK HERE



MODULE 1: CURVE DRAWING & ARRAY
https://youtu.be/yC-MzGtV6w0
Duration: 15 minutes

MODULE 2: SURFACE CREATION &EDITING
https://youtu.be/2BnrvyQ_VXM
Duration: 10 minutes

MODULE 3: LOFTING CURVES TO CREATE SURFACES
https://youtu.be/lmrf_VqTn0Y
Duration: 9 minutes

MODULE 4: SOLIDS & BOOLEAN TOOL
https://youtu.be/TmQI_jEIUnc
Duration: 11 minutes

Design fixation due to software skill

Please remember that you can have the whole summer to learn more about Rhino and Grasshopper. This module is just a point of departure of your learning. To equip your skills to **exercise computational design thinking**, software skill is essential but should not become a **creativity block**.

It takes years to master a software (I am no where near an expert!). Sometimes it gets frustrating, but what I would like to illustrate in your assignment is that: **understanding of the digital design thinking through research and reflections,** and how to work in **collaboration with your group members**. **NOT** your ability to master a software in a short period of time or producing the best design as this is not your studio module.

Re-iterating aims and objectives

- To relate Rhino 3D software to the **digital design thinking** we have built the last few weeks.
- To elicit **background knowledge** of Rhino 3D.
- To provide **alternative tutorials** by using available links from the video sharing platform.
- To suggest **ways to learn** the software.