

Practice Management

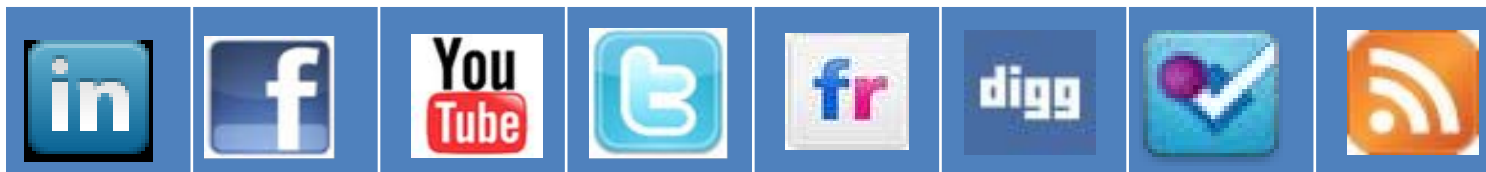
**AIA** Knowledge Communities



## 2014 PMKC Webinar

### PM Series

Emerging Practice: 3D Digital Printing and the "Maker Economy" - Transforming Practice



For audio, please listen through your computer or refer to your registration confirmation to listen by phone.

# Practice Management

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<http://network.aia.org/PracticeManagement/Home/WebinarResources/>

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## PMKC Webinar

# Emerging Practice: 3D Digital Printing and the "Maker Economy" - Transforming Practice

### **Moderator:**

**David Barkin, AIA**

Chief Architect

State of Connecticut

DAS / Division of Construction Services

PMKC Advisory Group



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## PMKC Webinar

# Emerging Practice: 3D Digital Printing and the "Maker Economy" - Transforming Practice

### Panel Moderator:

**Lira Luis, AIA, RIBA, NCARB, CeM,**  
Chief Collaboration Architect  
ALLL formerly atelier lira luis, LLC  
PMKC Advisory Group



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## PMKC Webinar

# Emerging Practice: 3D Digital Printing and the "Maker Economy" - Transforming Practice

**Presenter:**

**Jeremy Luebker**

Digital Fabrication Specialist, NRI





## PMKC Webinar

# Emerging Practice: 3D Digital Printing and the "Maker Economy" - Transforming Practice

**Presenter:**

**JanJaap Ruijsenaars**

Architect

Universe Architecture

Amsterdam, The Netherlands







## PMKC Webinar

# Emerging Practice: 3D Digital Printing and the "Maker Economy" - Transforming Practice

**Presenter:**

**Melissa Sterry**

Design Scientist & Futurist

Bionic City®, United Kingdom





# ***3D PRINTING***

*THE FUTURE OF YOUR INDUSTRY AND HOW IT  
WILL AFFECT YOU*



**JEREMY LUEBKER**  
*DIGITAL FABRICATION SPECIALIST, NRI*

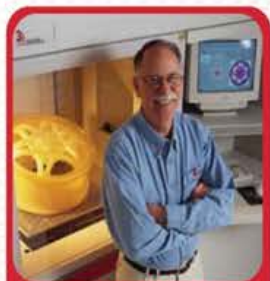


Who Am I...





# IN JUST 3D SHORT YEARS...



**1984 THE BIRTH OF 3D PRINTING**  
Charles Hull, later the co-founder of 3D Systems, invents stereolithography.

1990s



**1992 BUILDING PARTS, LAYER BY LAYER**  
The first SLA machine is produced.



**1999 ENGINEERED ORGANS**  
The first lab-grown organ is implanted in humans.

2000s



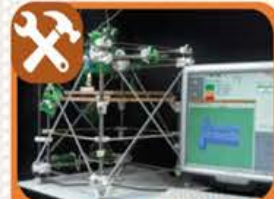
**2002 A WORKING 3D KIDNEY**  
Scientists engineer a miniature functional kidney.



**2005 OPEN-SOURCE COLLABORATION WITH 3D PRINTING**  
Dr. Adrian Bowyer at University of Bath founds RepRap.



**2006 SLS LEADS TO MASS CUSTOMIZATION IN MANUFACTURING**  
The first SLS machine becomes viable.



**2008 THE FIRST SELF-REPLICATING PRINTER**  
The first self-replicating printer, able to print the majority of its own components.

1980s

1990s

2000s

2010s



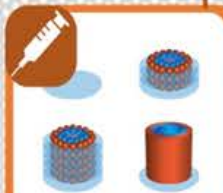
**2008 DIY CO-CREATION SERVICE LAUNCHES**  
Shapeways launches.



**2008 MAJOR BREAK-THROUGH FOR PROSTHETICS**  
The first person walks on a 3D-printed prosthetic leg.



**2009 DIY KITS FOR 3D PRINTERS ENTER THE MARKETPLACE**  
MakerBot Industries starts selling DIY kits



**2009 FROM CELLS TO BLOOD VESSELS**  
Bioprinting innovator Organovo uses a 3D bioprinter to print the first blood vessel.

2010s



**2011 WORLD'S FIRST 3D-PRINTED ROBOTIC AIRCRAFT**  
3D printing allows the plane to be built with elliptical wings, a normally expensive feature that helps improve aerodynamic efficiency and minimizes induced drag.



**2011 WORLD'S FIRST 3D-PRINTED CAR**  
Urbee, with a complete 3D-printed body, gets 200 mpg highway and 100 mpg.



**2011 3D PRINTING IN GOLD AND SILVER**  
Imaterialise becomes the first 3D printing service worldwide to offer 14k gold and sterling silver as materials.



**2012 3D-PRINTED PROSTHETIC JAW IS IMPLANTED**  
Doctors and engineers in the Netherlands use a 3D printer to print a customized three-dimensional prosthetic lower jaw.

INDUSTRIES



Automotive



Aviation



Do-it-yourself



Manufacturing



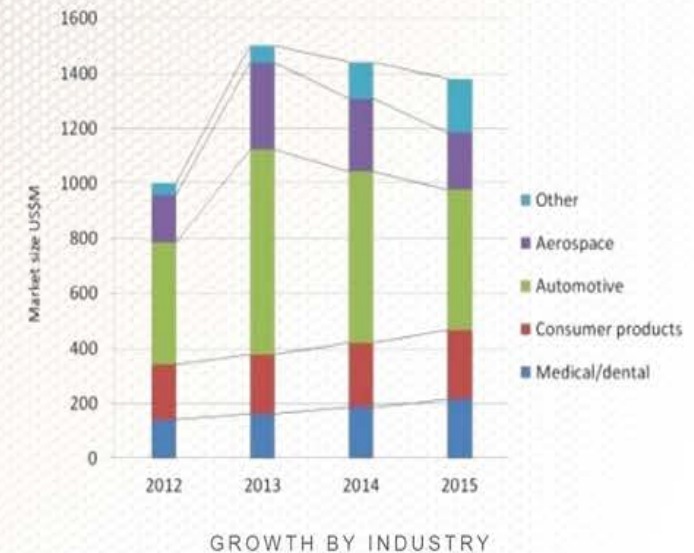
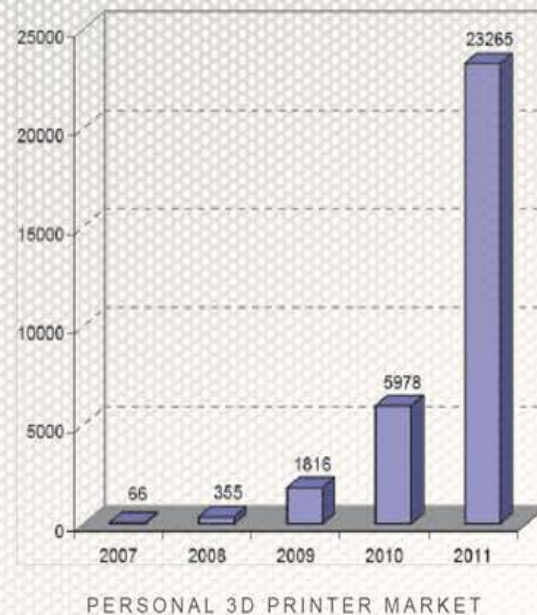
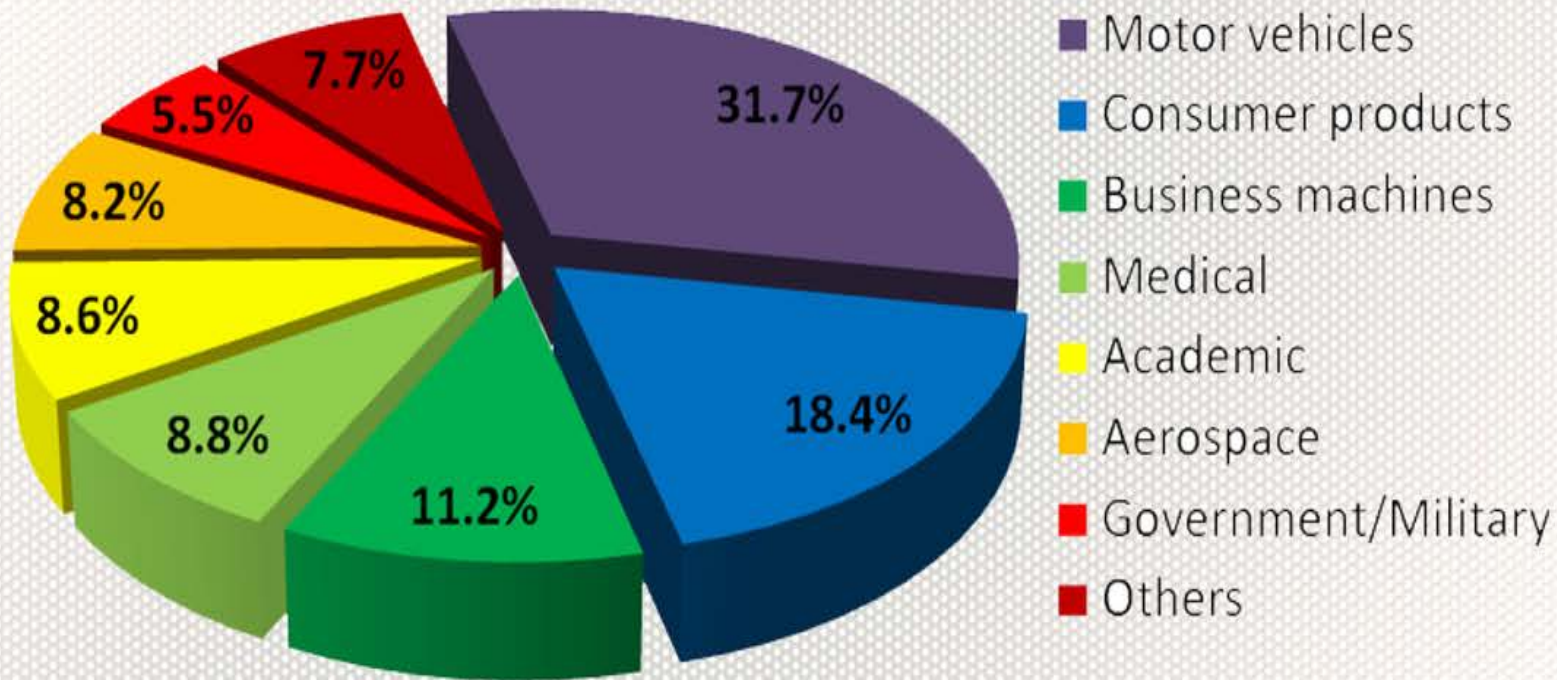
Medical



Jewelry



# DRAMATIC GROWTH IN EVERY INDUSTRY...





WHO IS NRI AND WHY ARE HERE TODAY...



ROLL TRACINGS ON THIS TUBE  
DO NOT PUT THEM INSIDE

**NATIONAL  
BLUE PRINT CO. INC.**

110-114 WEST 32nd STREET  
(OPPOSITE GIMBELS)  
**NEW YORK 1, N. Y.**

PHONE PENNSYLVANIA 6-5674



# HOW WE DO THINGS DIFFERENTLY...

TRADITIONAL 3D PRINTING BUREAU BUSINESS MODEL

STL → 3D PRINT

## THE NRI WAY

STL  
OBJ  
ZPR  
WRL  
REVIT  
SKETCHUP  
RHINO  
SOLIDWORKS  
3DSMAX  
MAYA



PROJECT  
COORDINATION

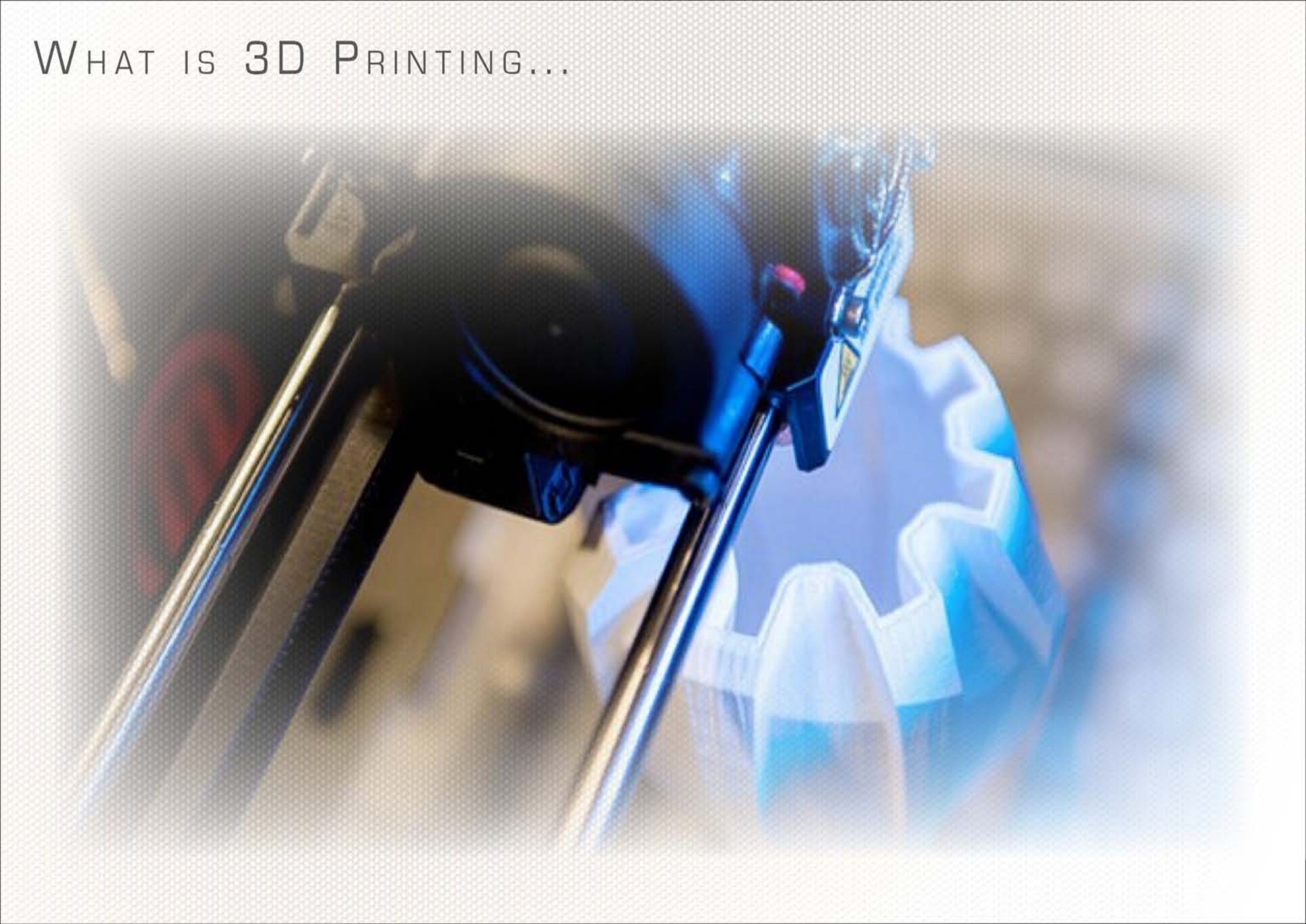
- CONSULTATION
- FILE-FIXING
- TRAINING
- MIXED MEDIA
- MODEL-MAKING
- BASES
- CUSTOM FINISHING



3D PRINTED  
MODEL

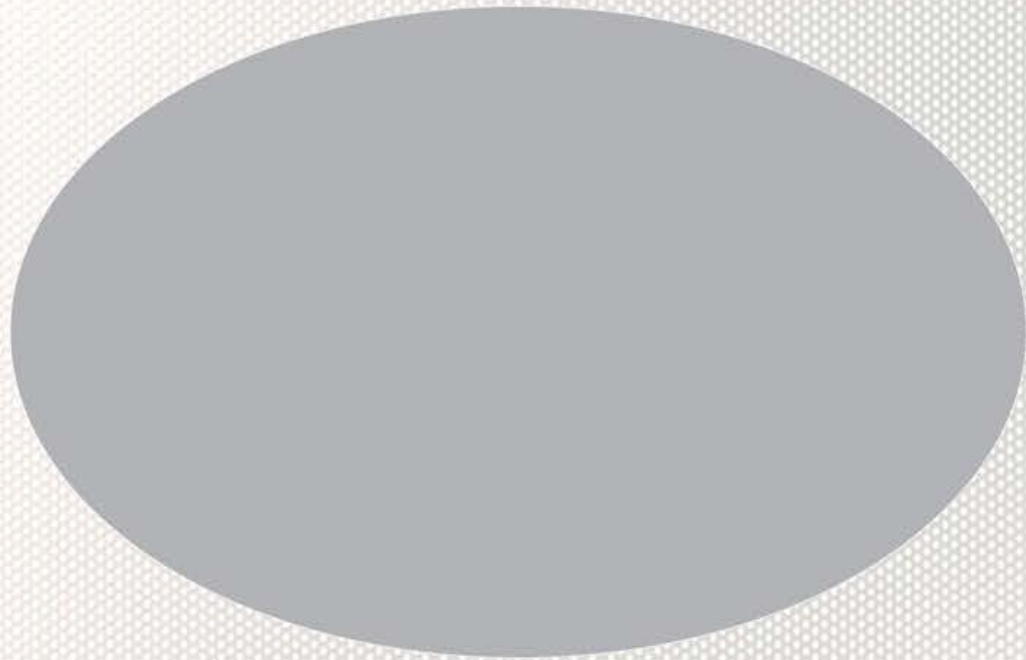


WHAT IS 3D PRINTING...

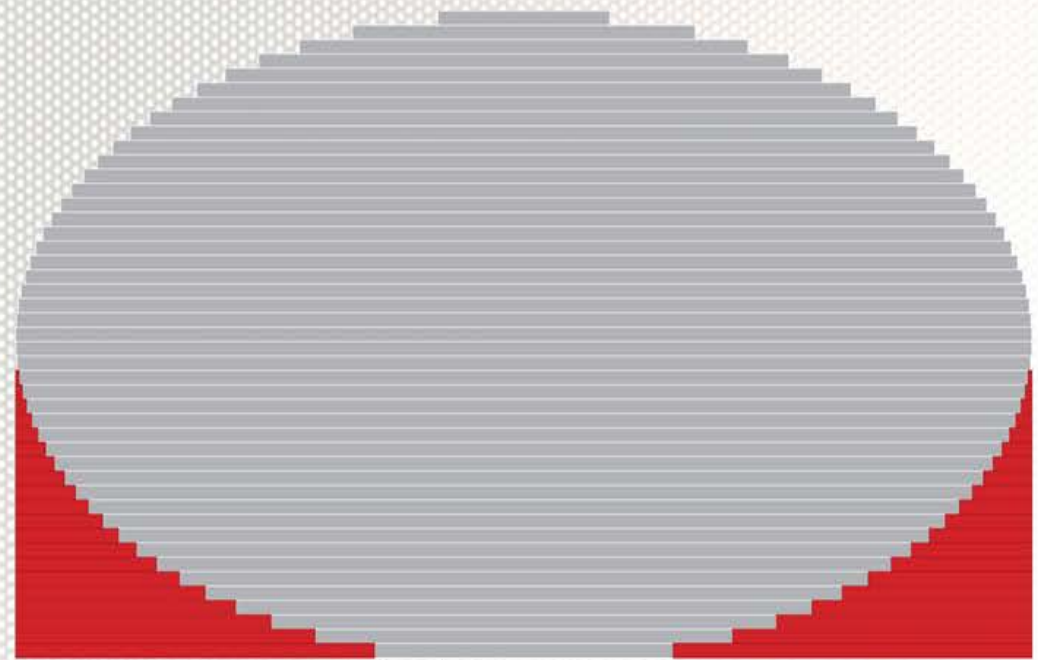




IT'S A CONTOUR MODEL...



ORIGINAL PART  
[CAD]



3D PRINTED  
PART

# THE TOYS...



DIGITIZED "HOT GLUE GUN"



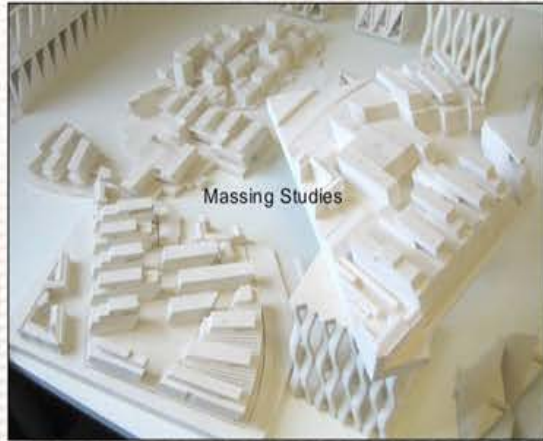
PLOTTER ON A SANDBOX



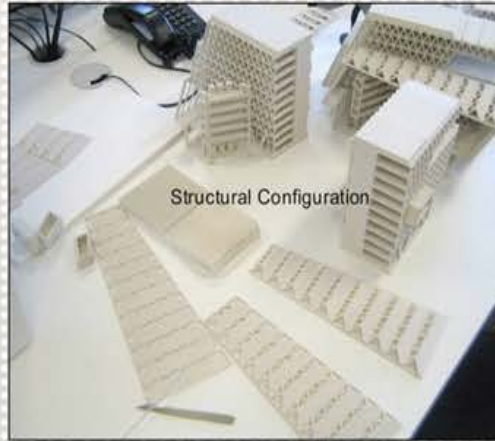
CURRED BY ENERGY SOURCE



# WHAT 3D PRINTING GOOD FOR...



Massing Studies



Structural Configuration



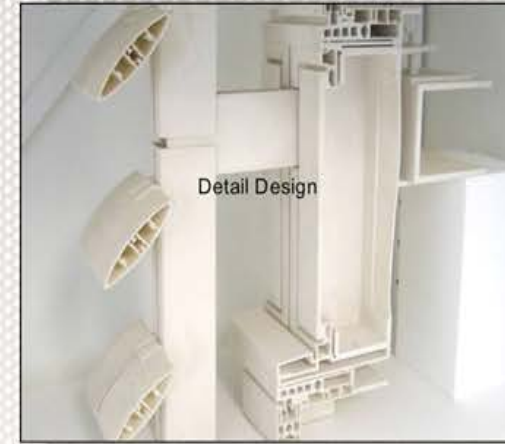
Façade Panel Geometry



Terrain Modelling



Full color topography



Detail Design



Building Option Studies



Form Options



Final Models



# WHAT WE DO...



KPF



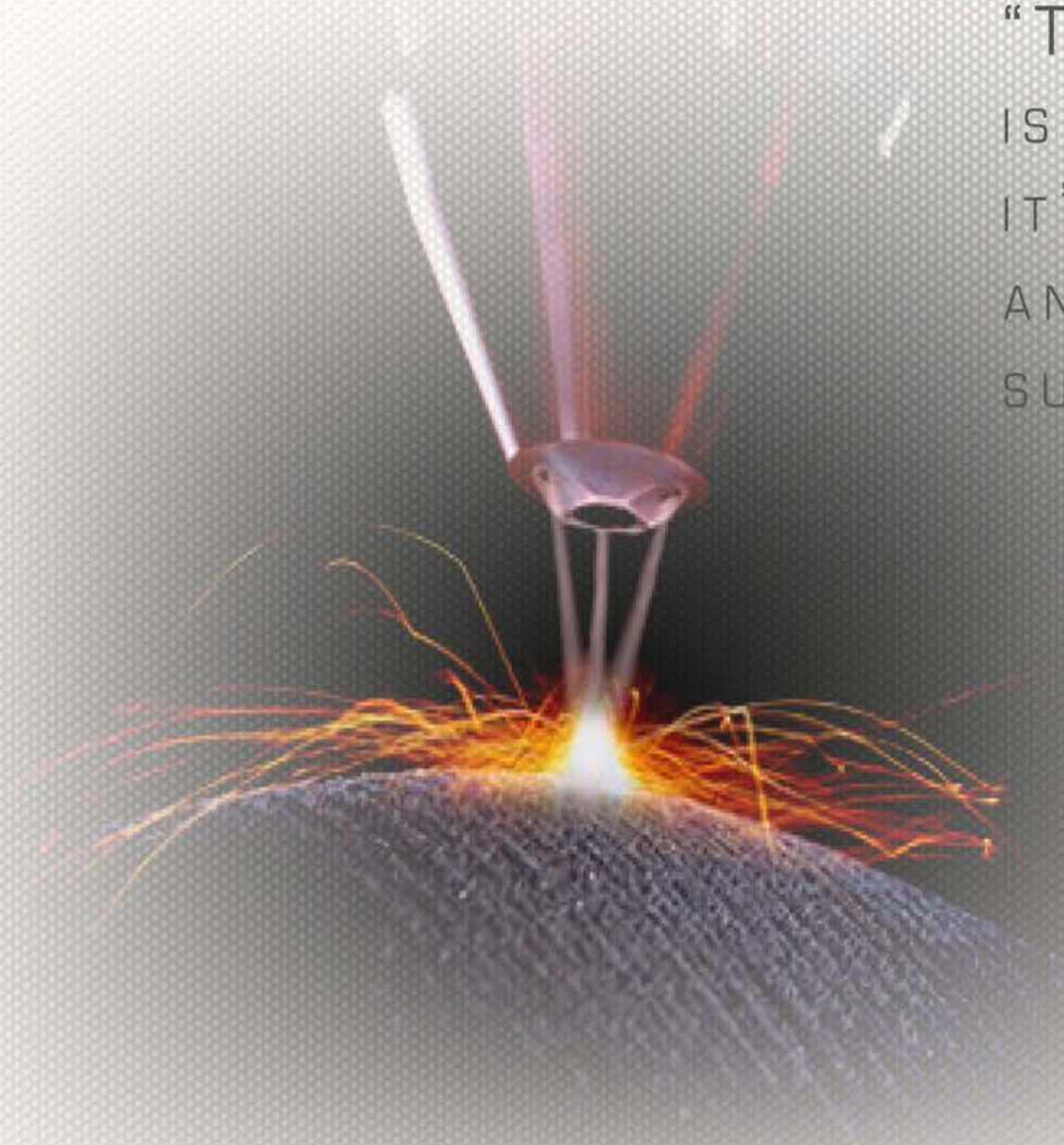
Toll Brothers



# WHY 3D PRINTING...

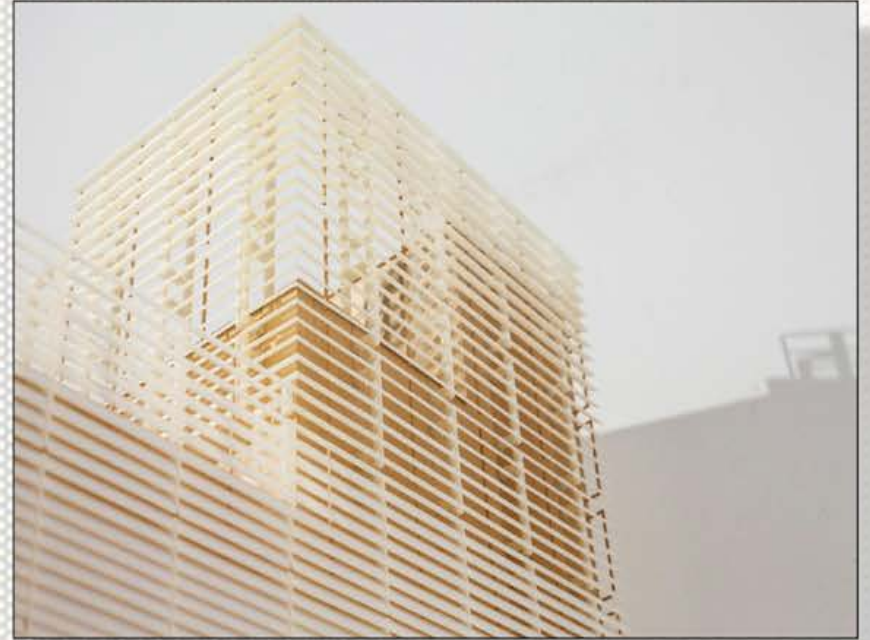
"THE VALUE OF THE PROTOTYPE IS NOT THE PROTOTYPE ITSELF, IT'S THE INTERACTIONS AND COMMUNICATIONS THAT SURROUND THE PROTOTYPE."

MICHAEL SCHRAGE

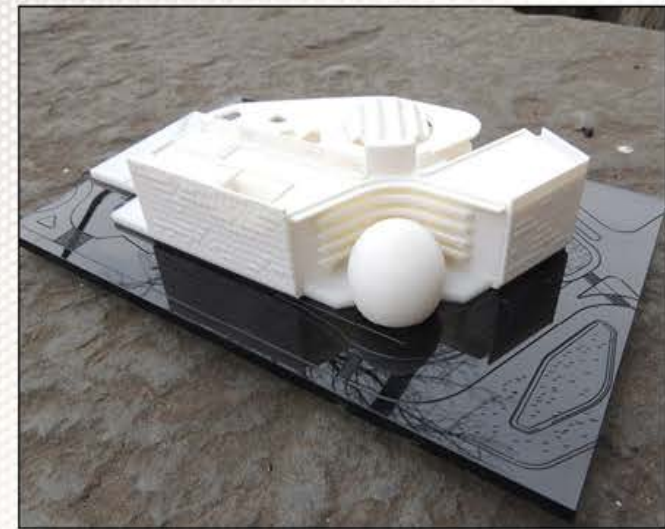
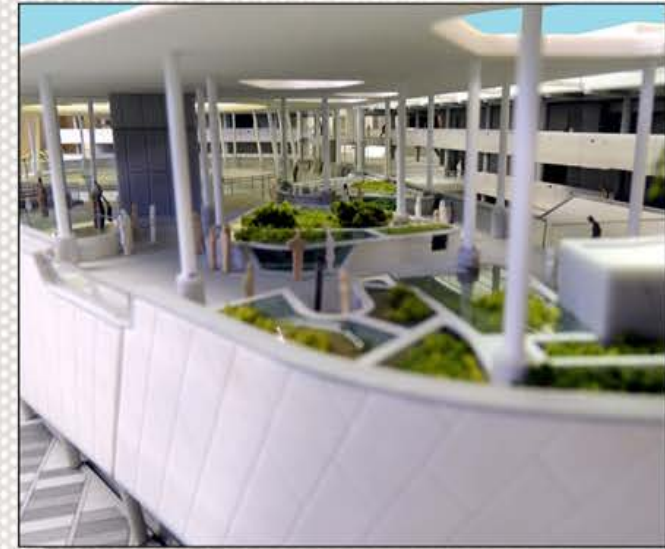




# SOME OF THE PROJECTS WE MAKE...

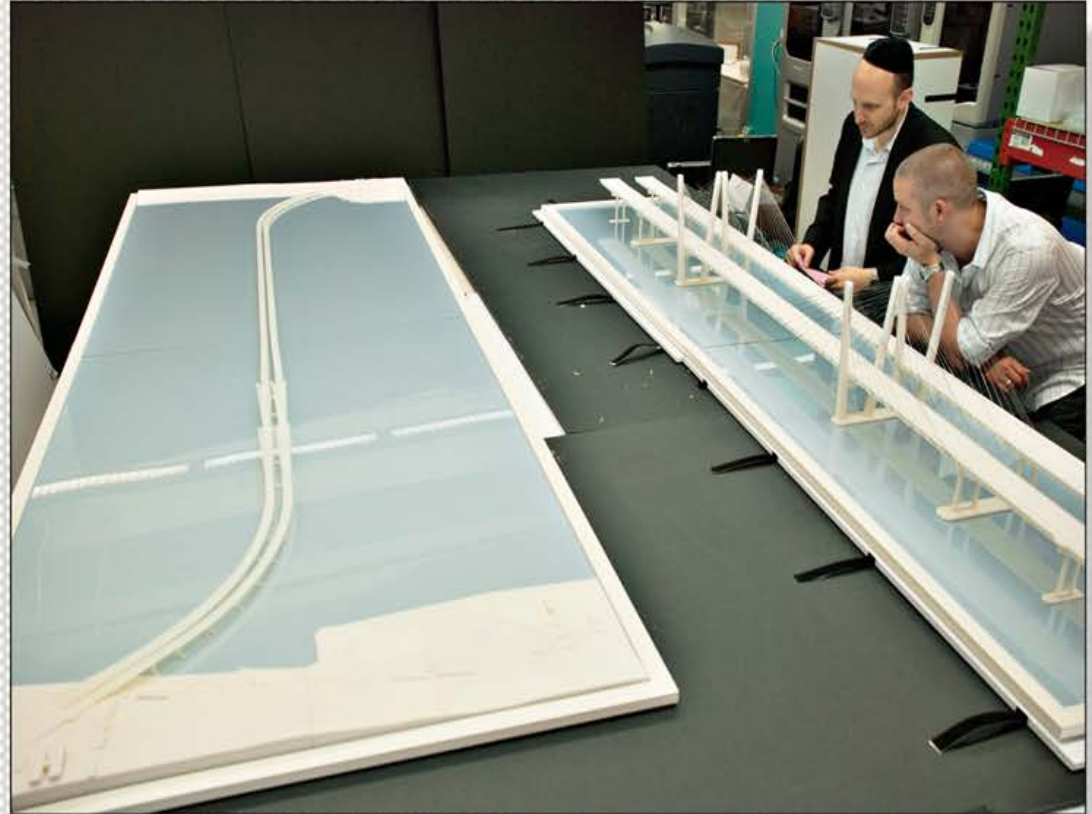






Grimshaw







# EXPECTATIONS AND MISCONCEPTIONS...

"A 3D PRINTER AIN'T NO  
VENDING MACHINE, IT NEEDS A  
GOOD OPERATOR TO GET GOOD  
RESULTS."

GEORGE LEE

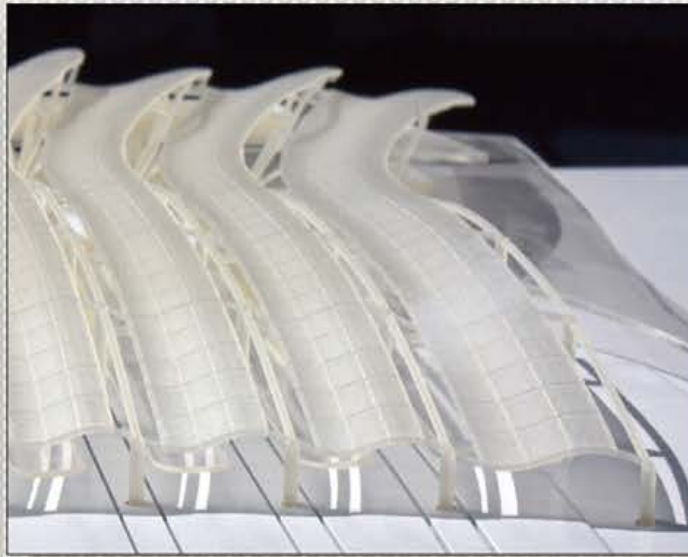




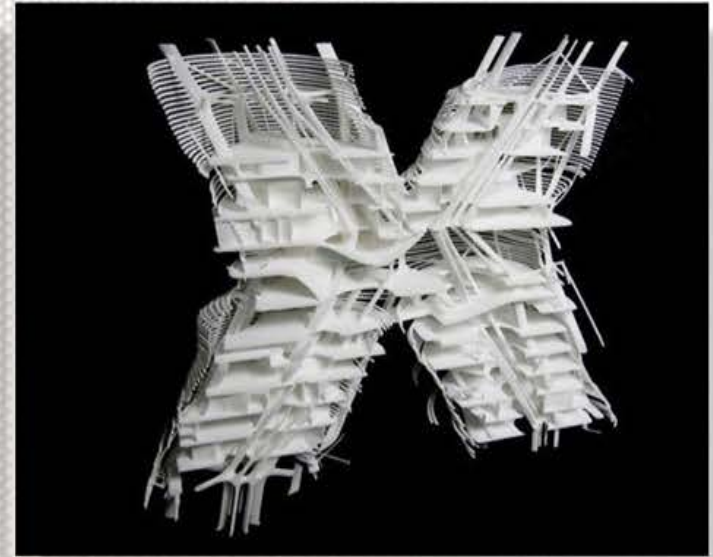
ONE PRINT CAN'T DO IT ALL...



Brookfield Residential



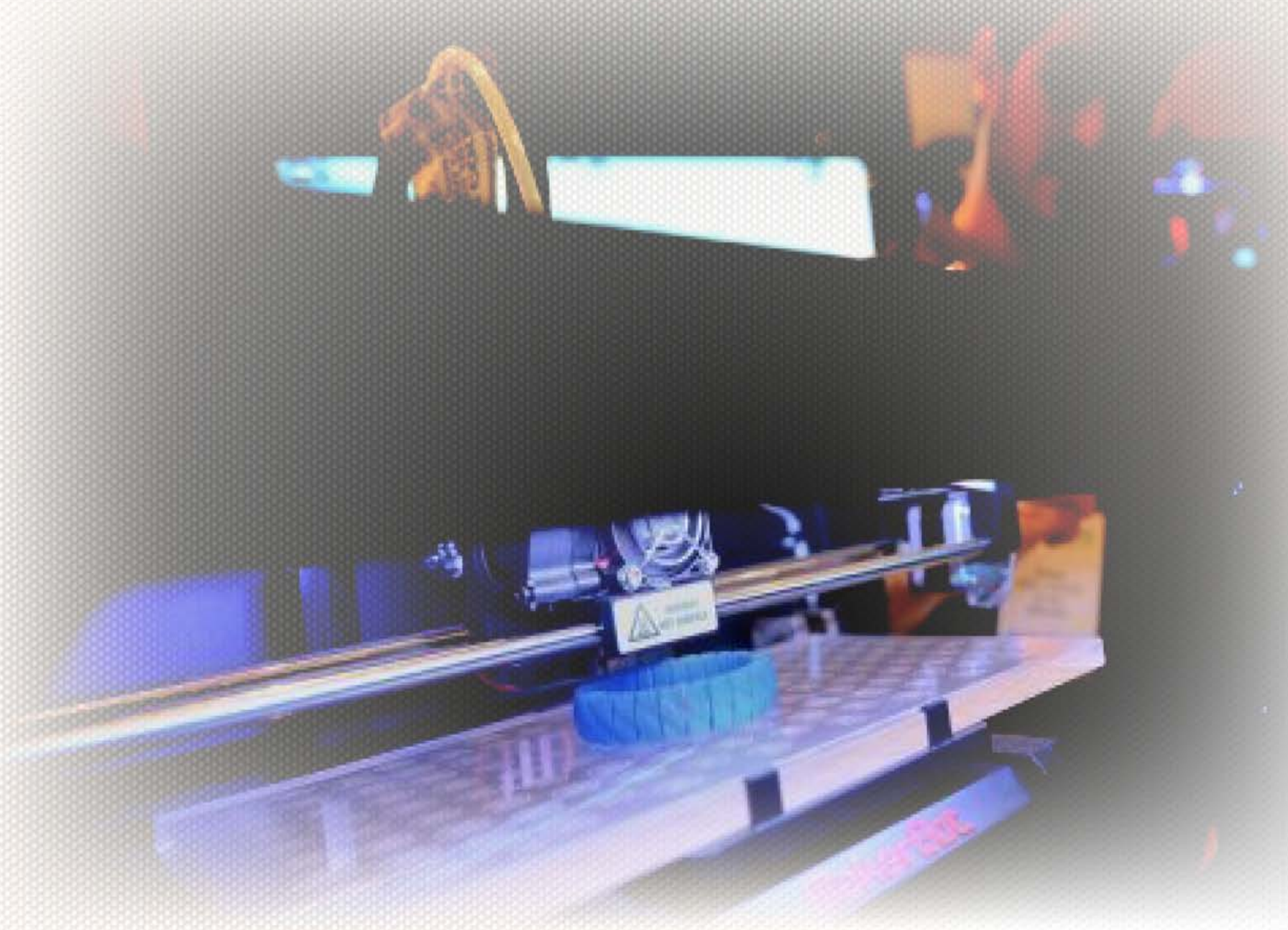
KPF



Dorma



# OUR RECOMMENDATION...





# *THANK YOU*

QUESTIONS AND COMMENTS ARE WELCOME

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# LANDSCAPE HOUSE®

## 2014

Universe **A**rchitecture

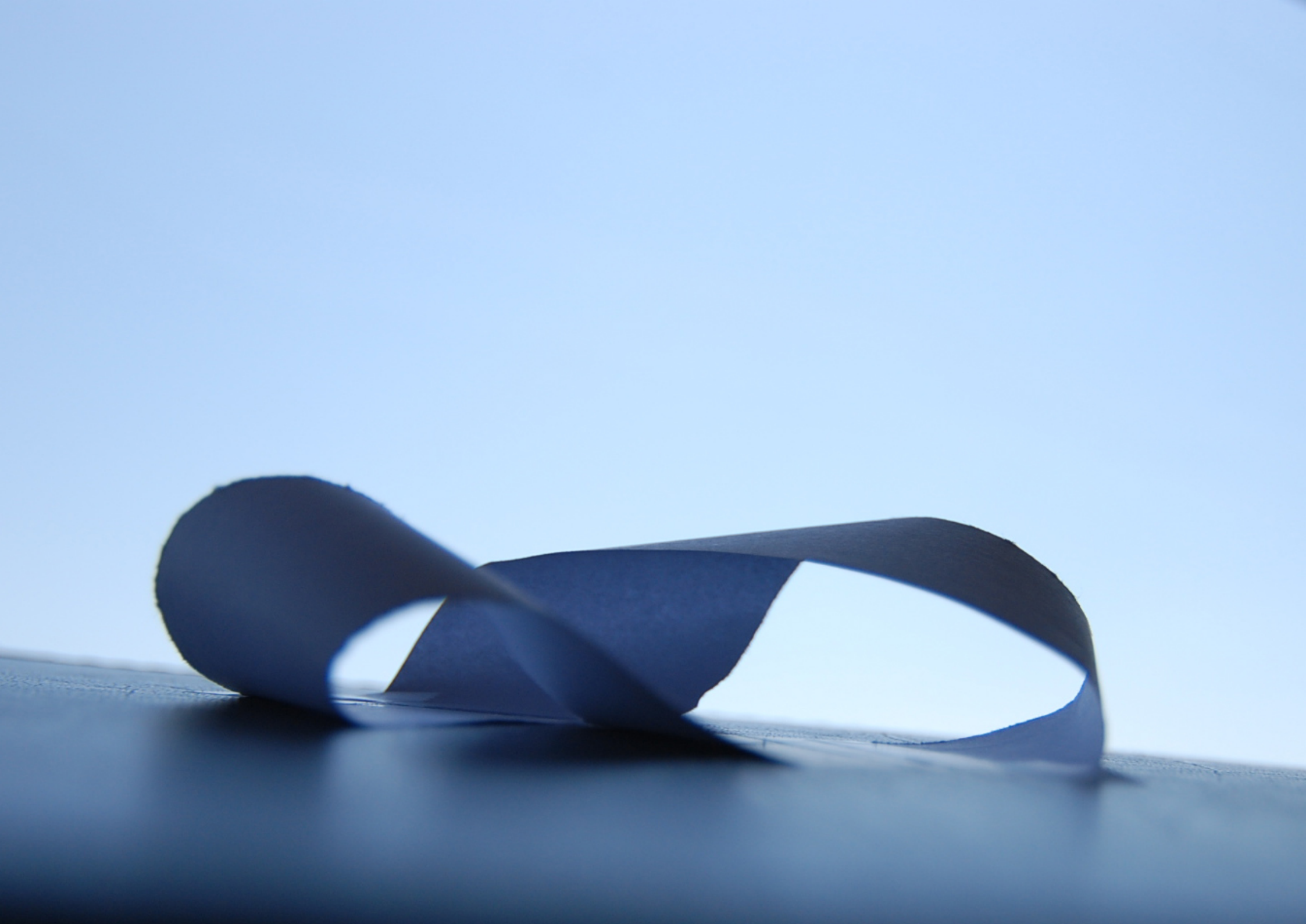










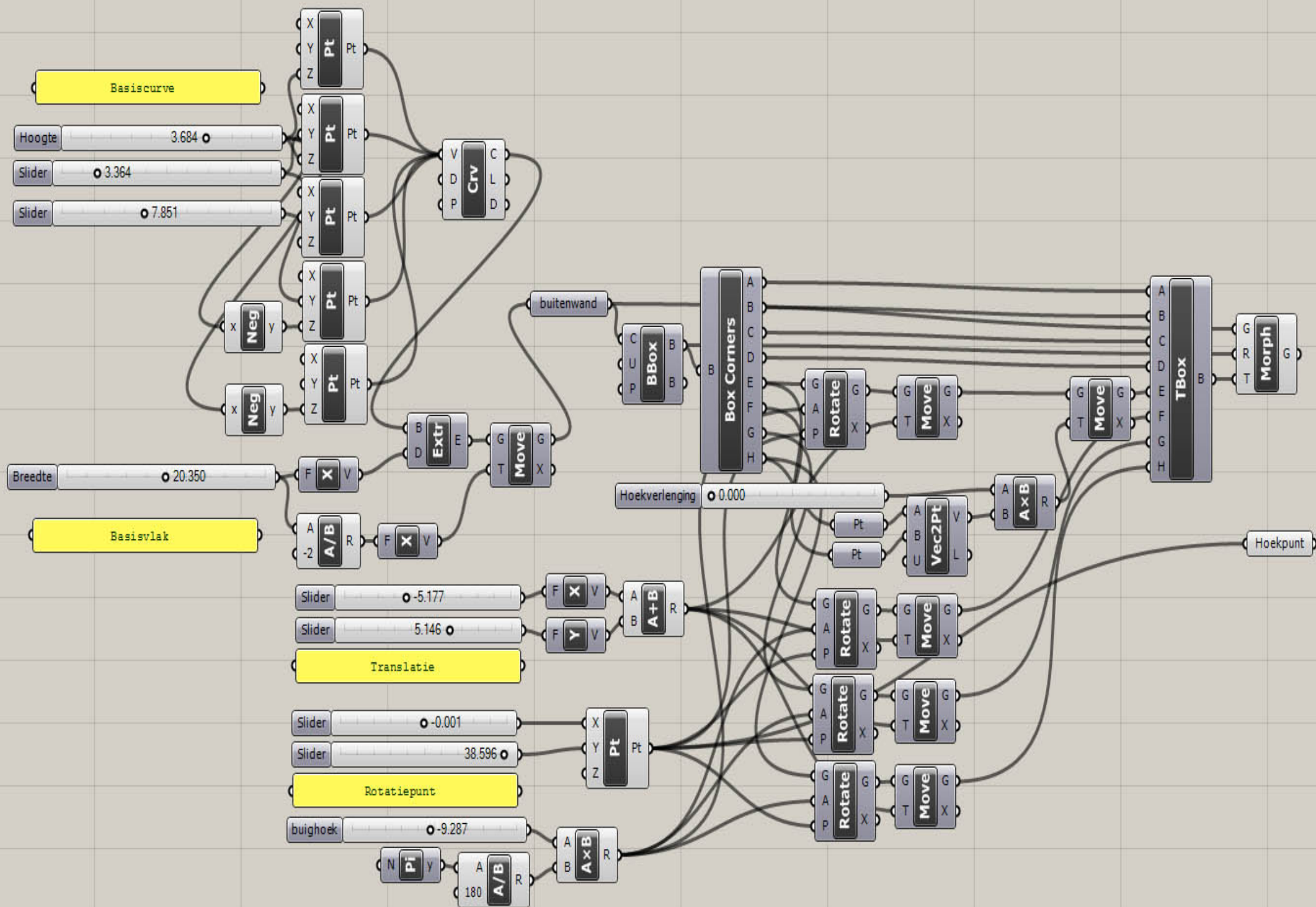






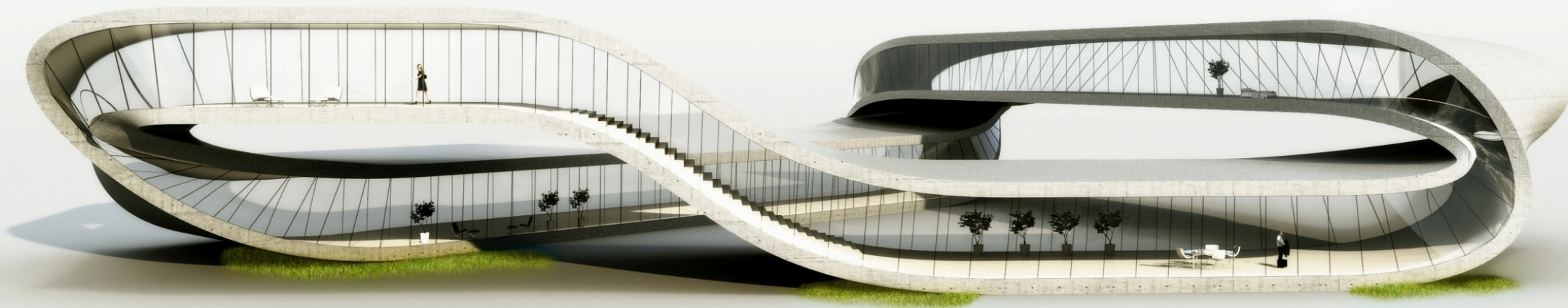


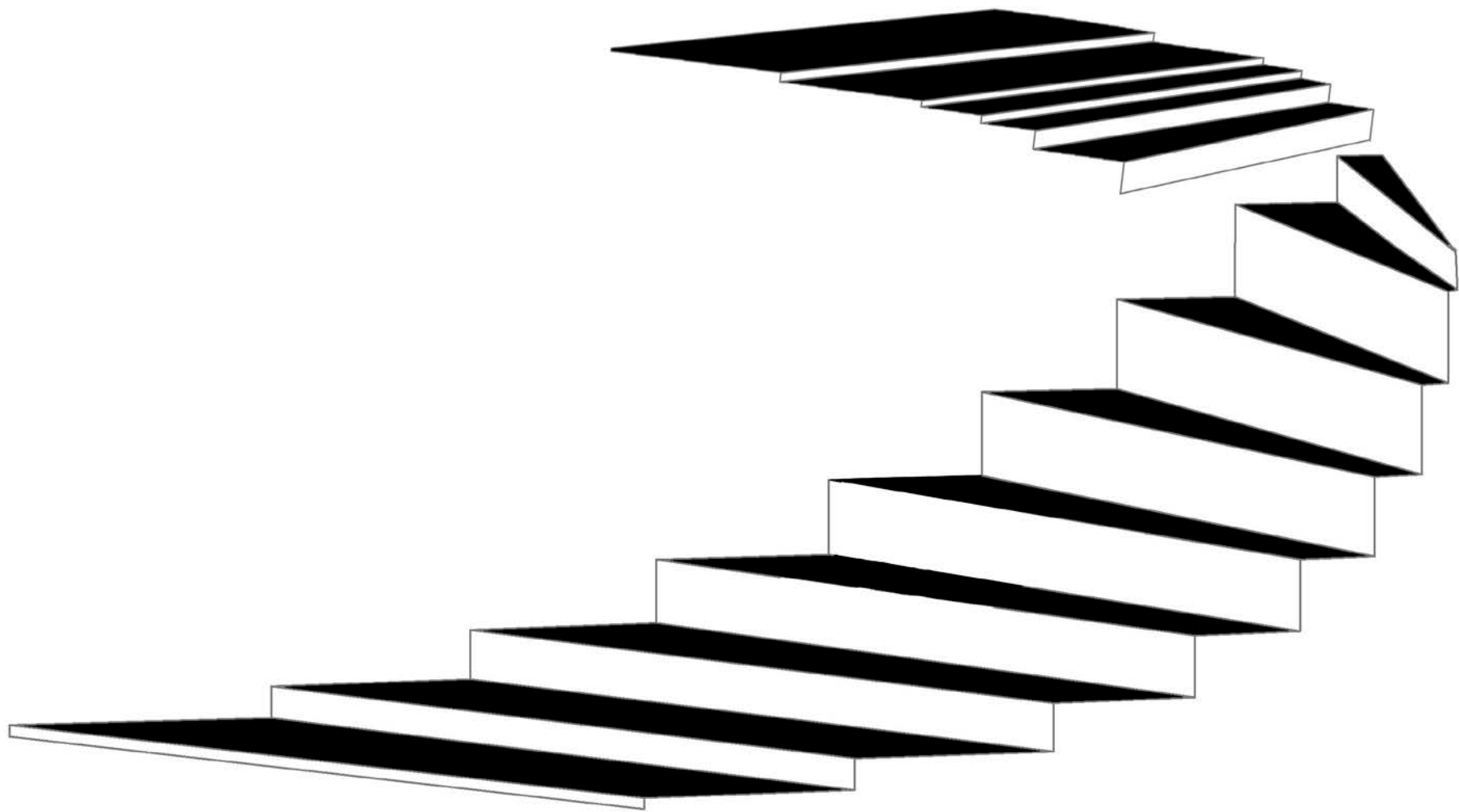




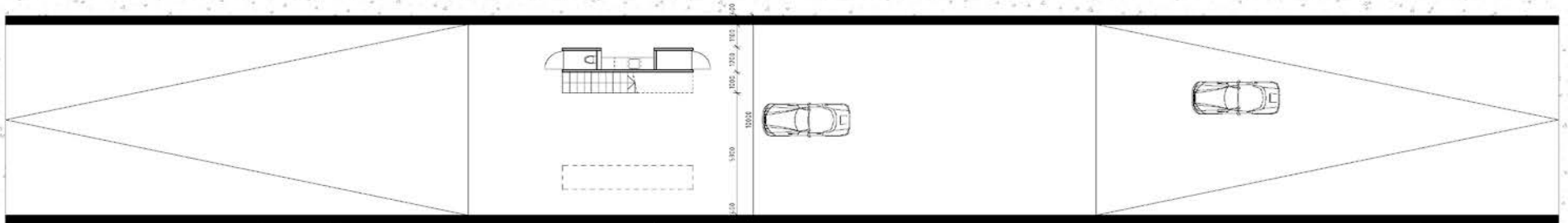
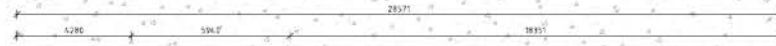
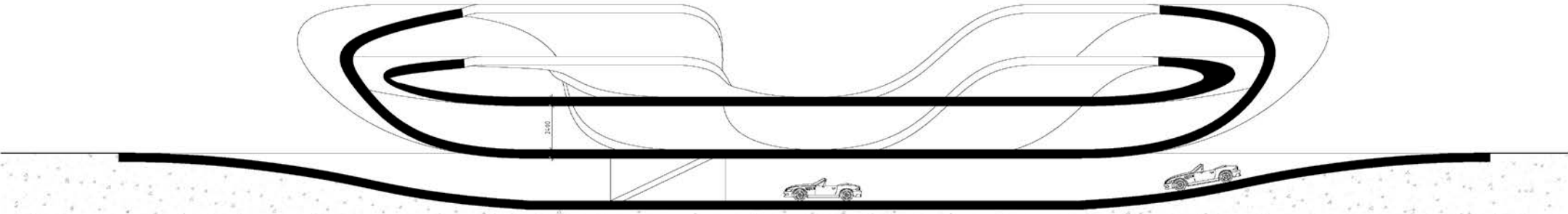


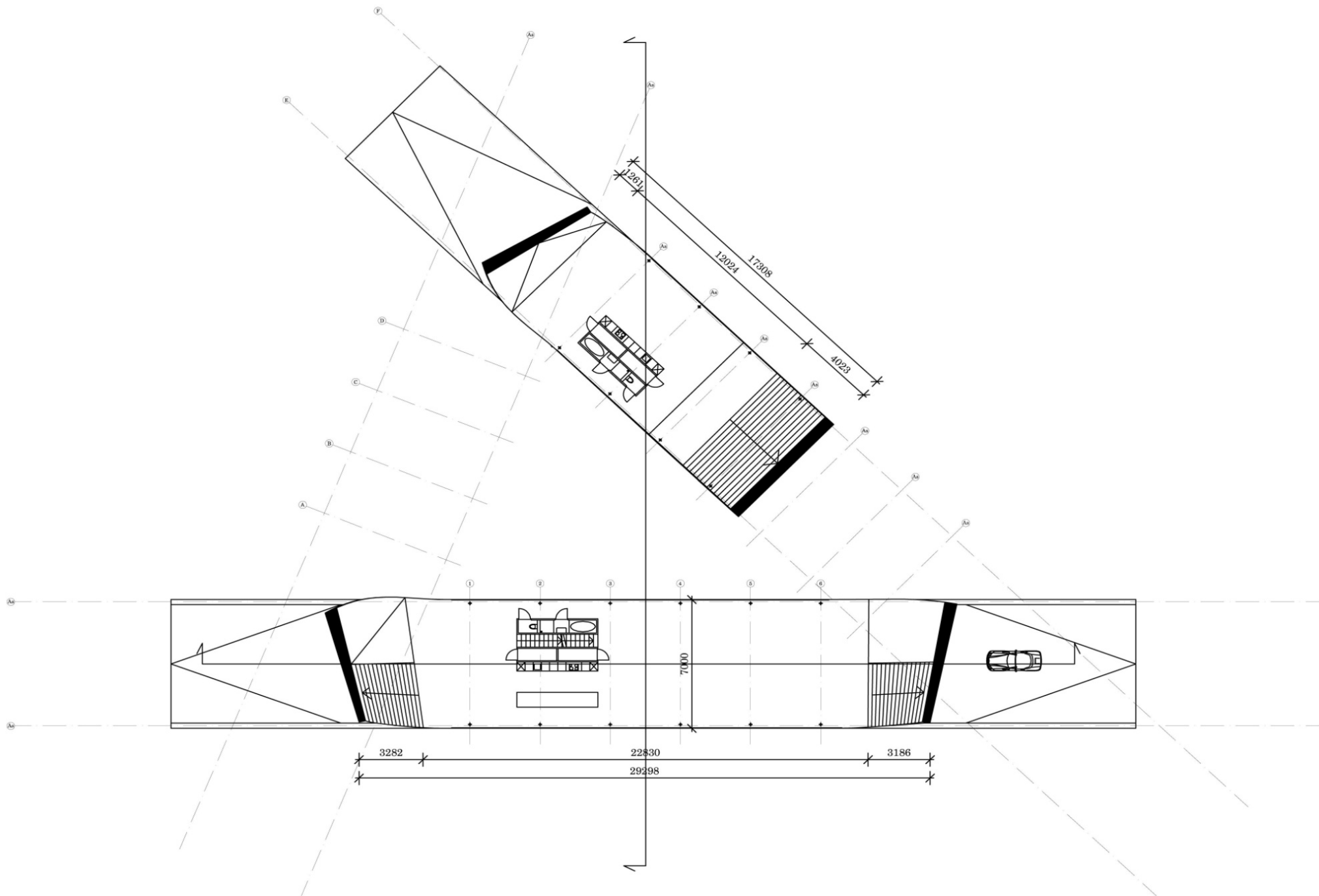




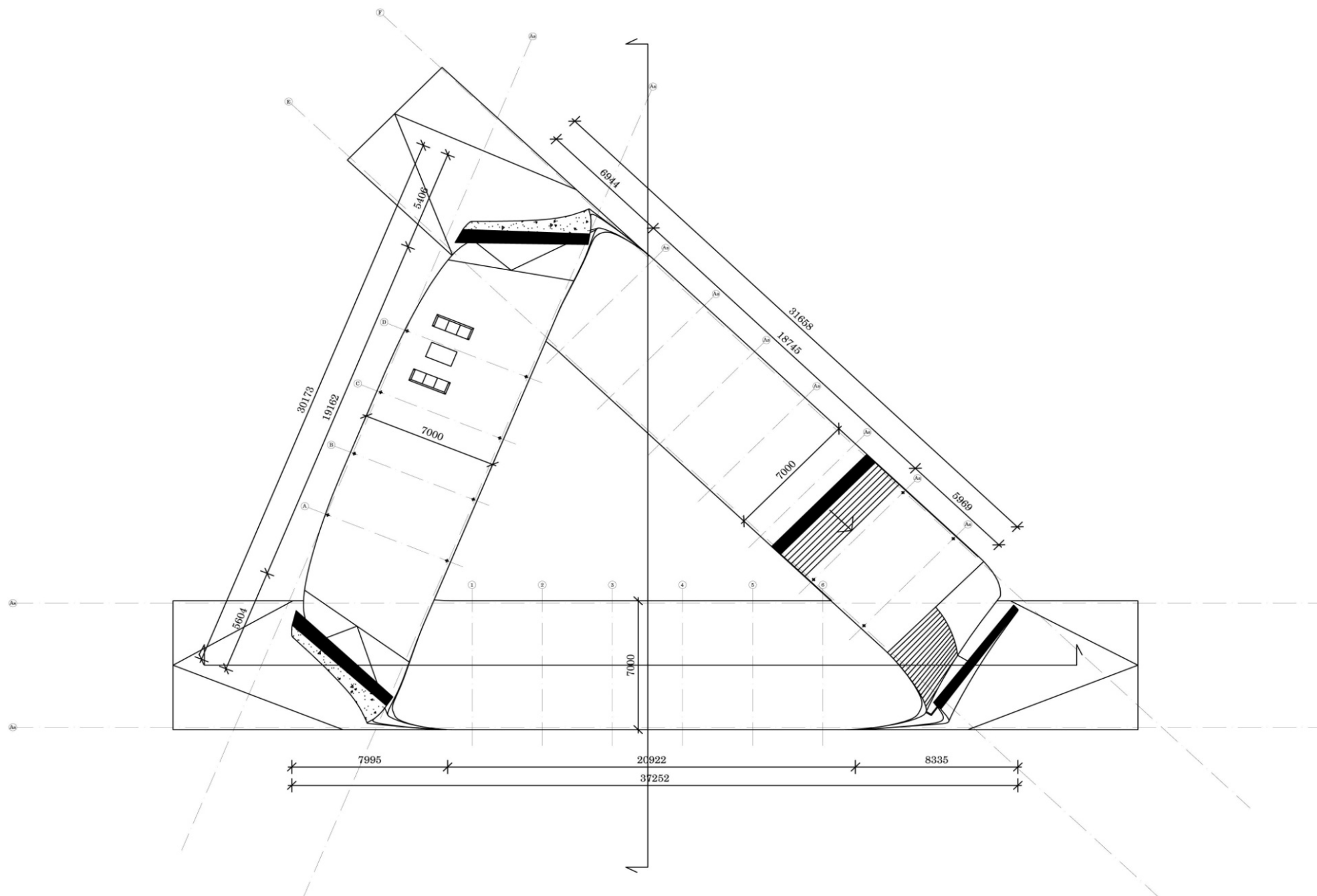


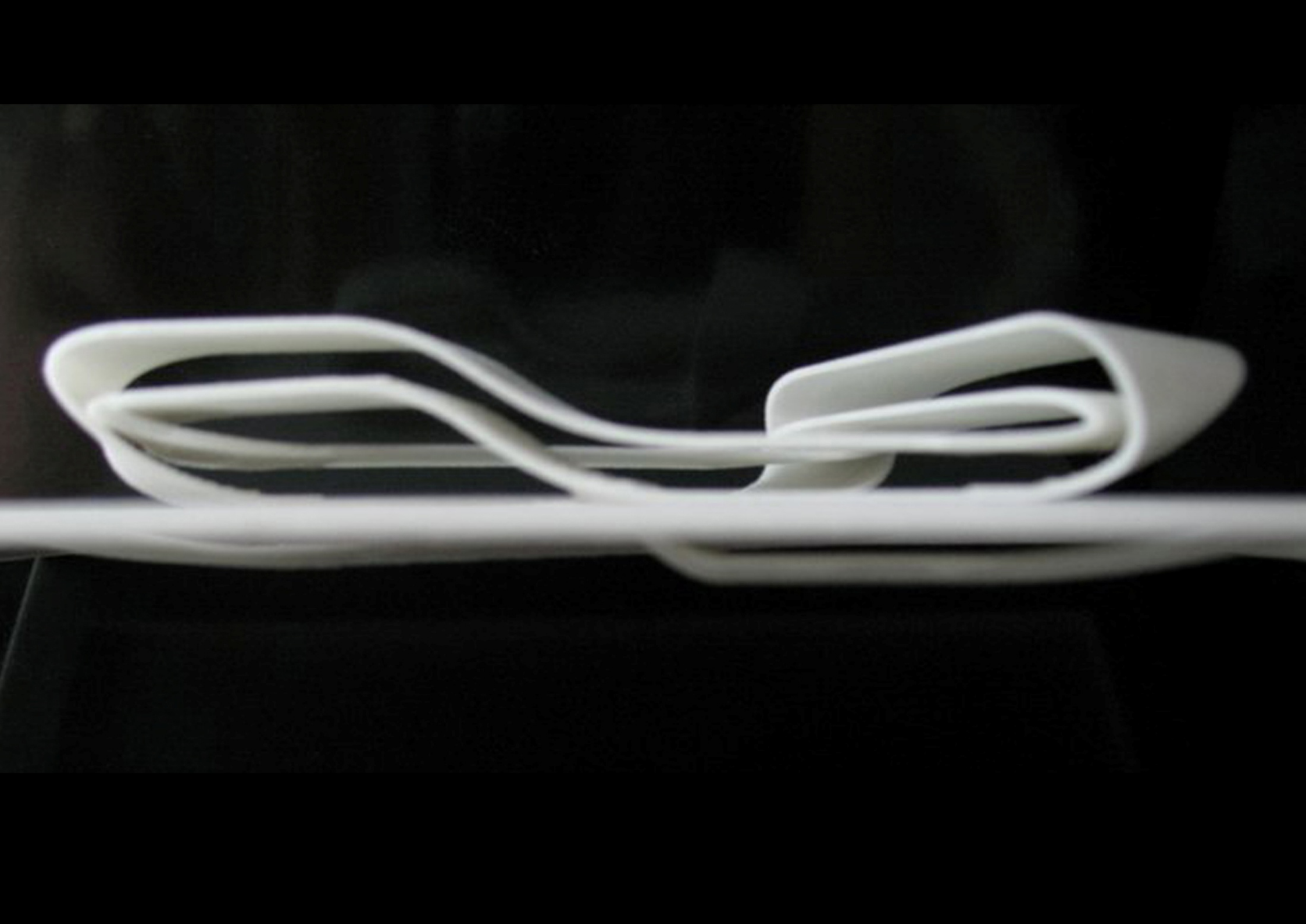






















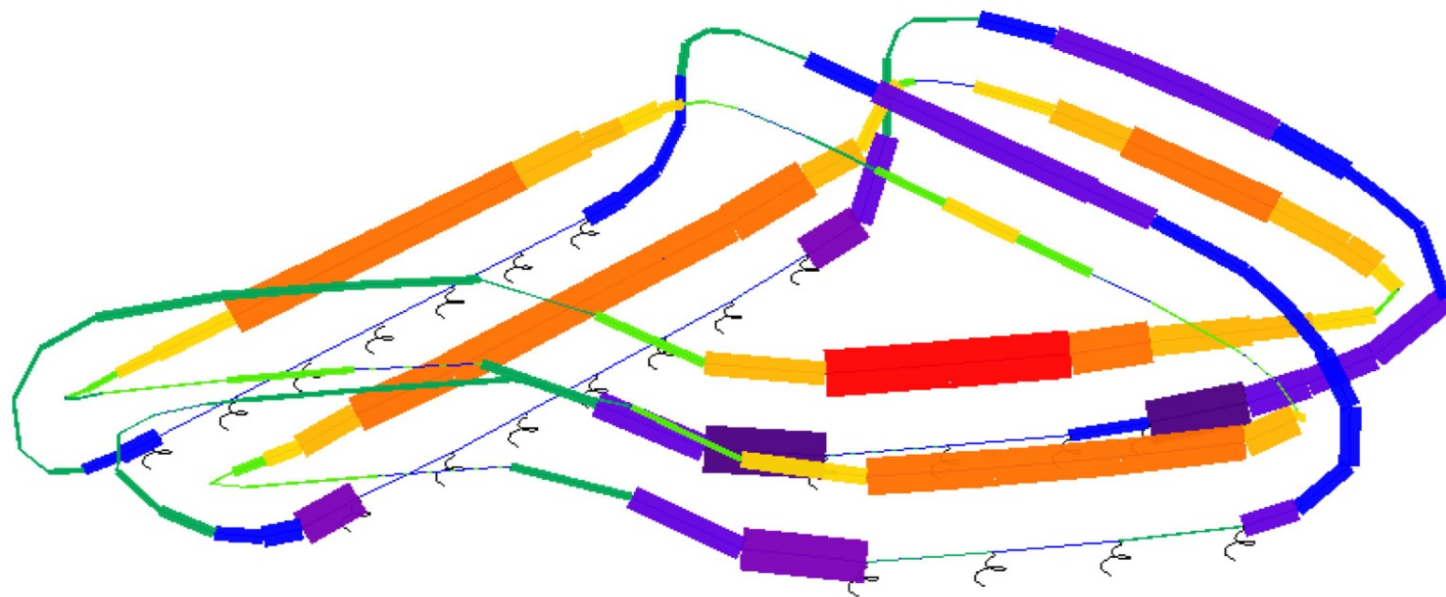
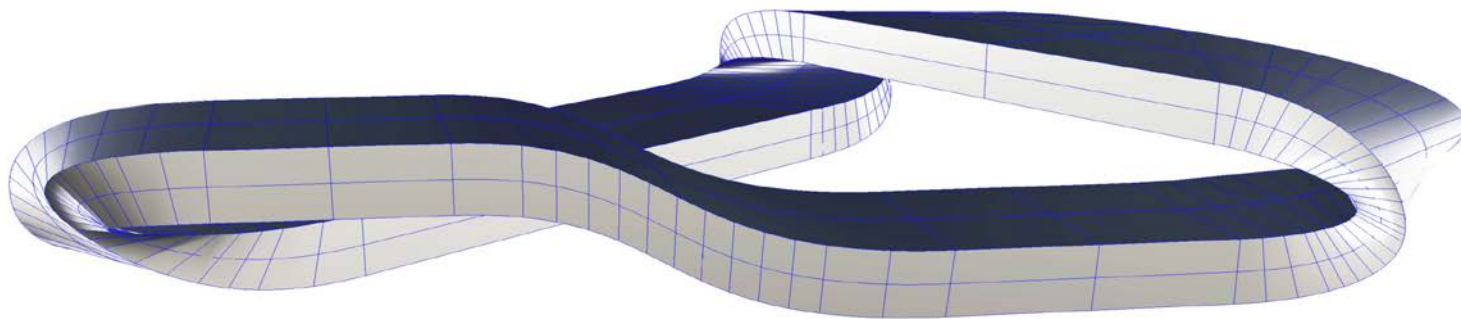












Element list "Horizontal"

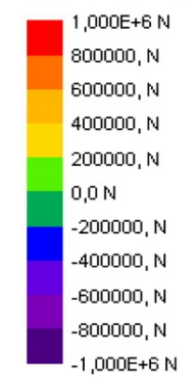
Scale 1 202,5

Highlighted

Coincident Nodes

Coincident Elements

Axial Force, Fx 1,250E+6 N/pic.cm

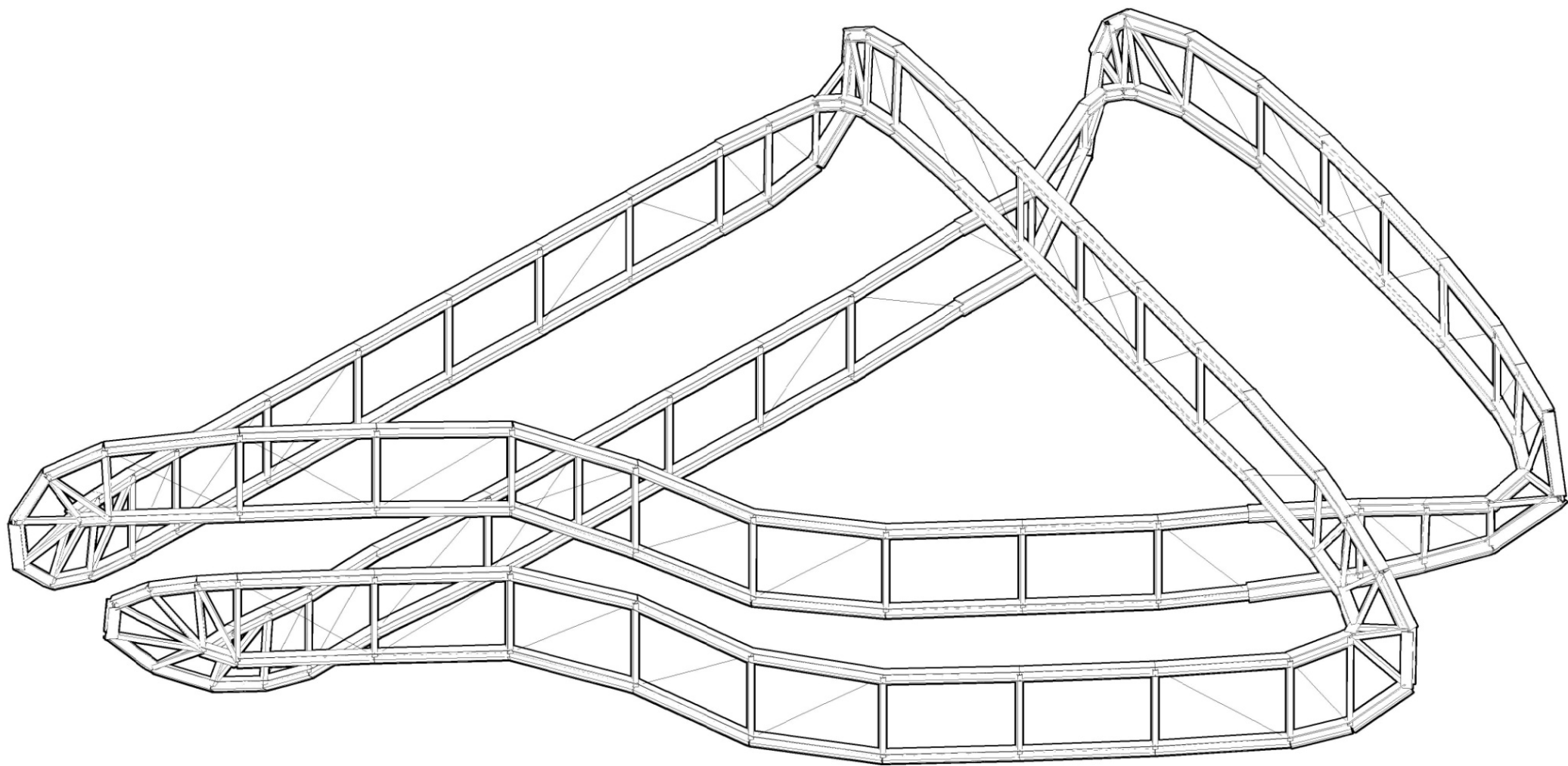


Case L3 VL

Case A3 VL

Contour case





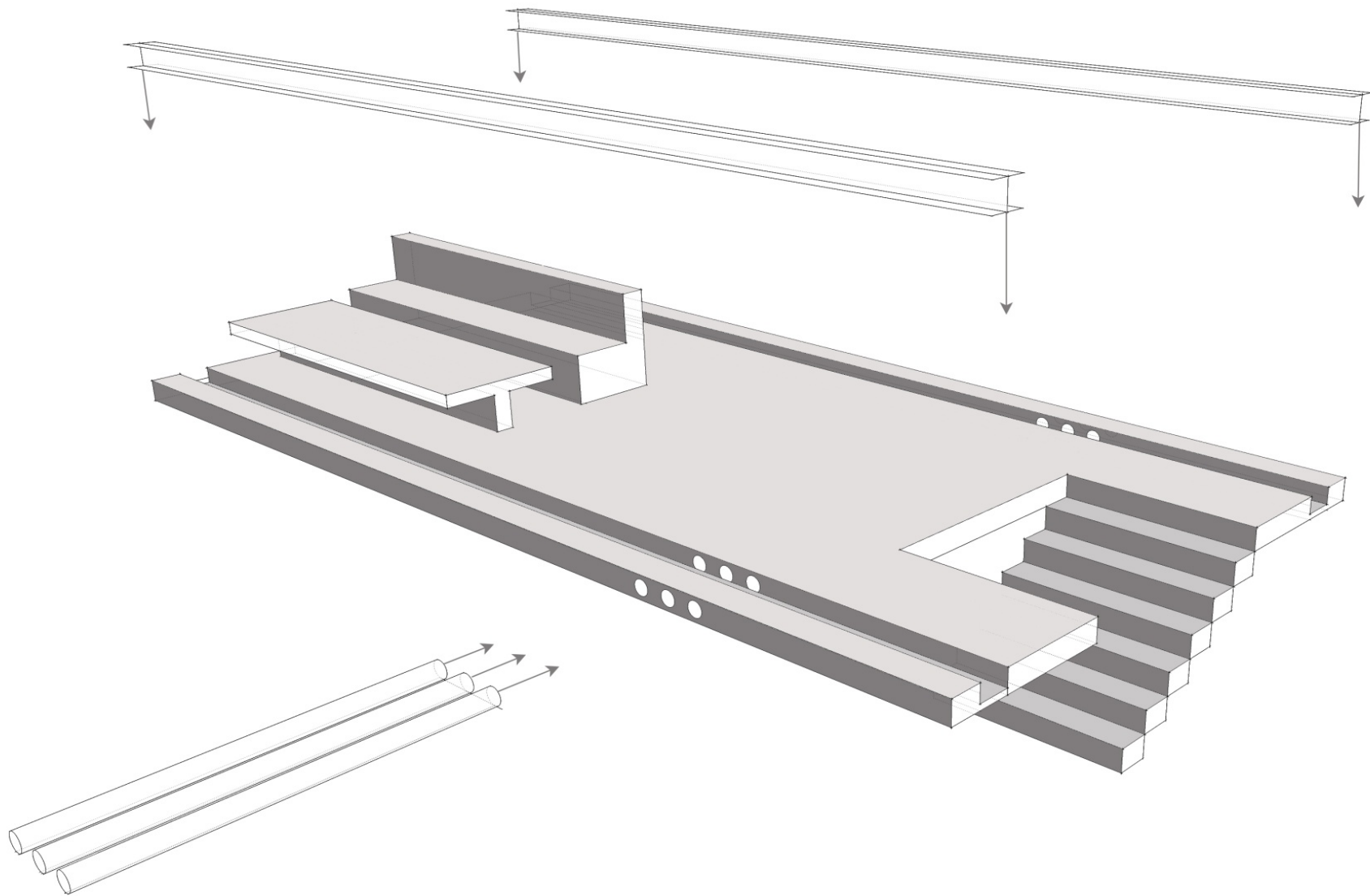


Joris Laarman

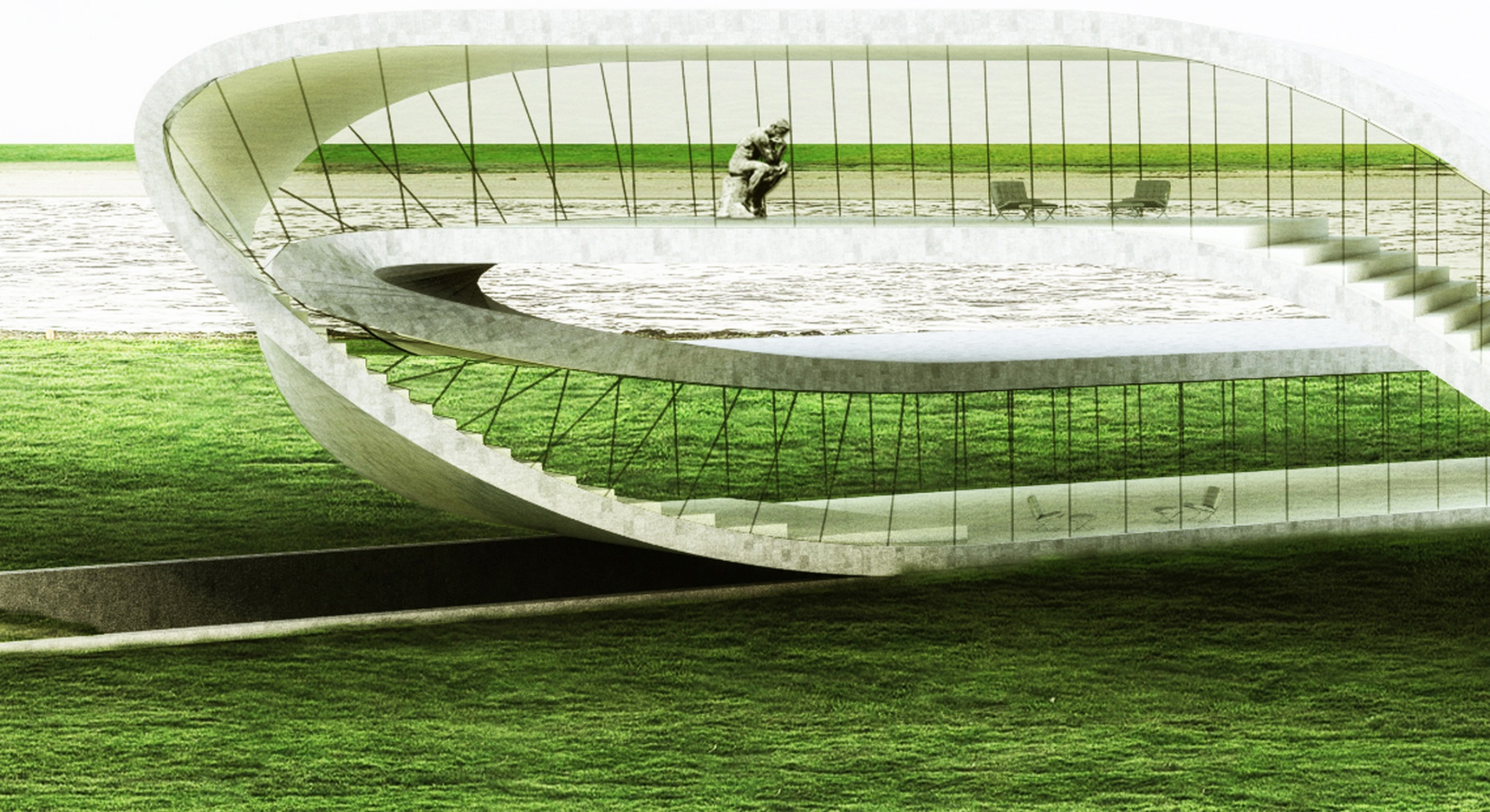


Arup







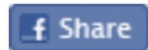




## ARTS

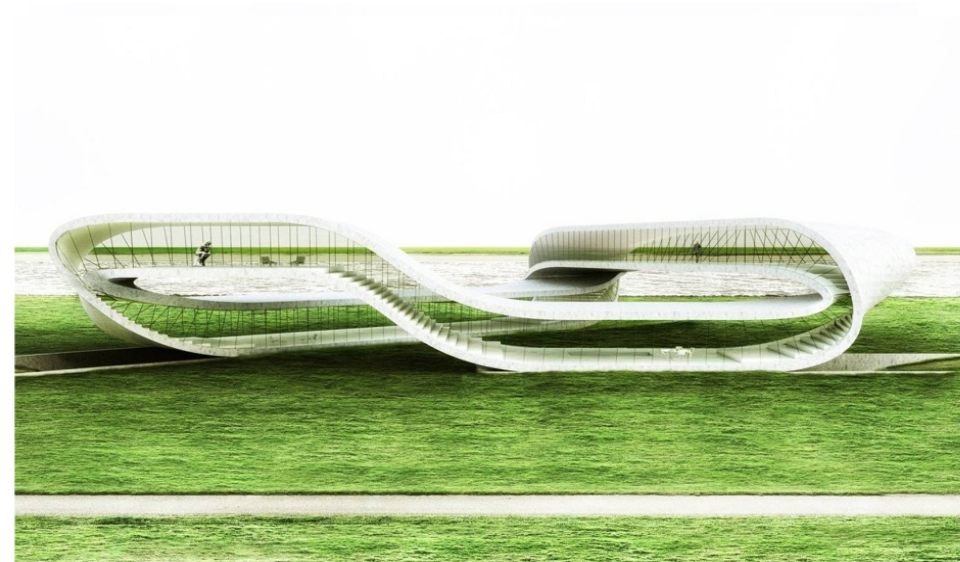
# The 3D-Printed House?! A Dutch Architect and Mathematician Break the Mold

By [Kharunya Paramaguru @Kharunya](#) | Jan. 27, 2013 | [Add a Comment](#)



Architects and designers have utilized 3D printing technology as part of their work for many years, but it is only now that an architect has come forward with a design for an actual, habitable residence using that same technology.

Dutch architect Janjaap Ruijsenaars of [Universe Architects](#) has designed a residence in collaboration with mathematician and artist [Rinus Roelofs](#) that they hope to begin construction on using a 3D printer by 2014.



Universe Architecture

The design for the building, the Landscape House, has been getting as much curiosity as the mode by which the designers plan to produce it. Based on the concept of a [Moebius Strip](#) – a single length of any material that forms a continuous loop with just one side – the Landscape House takes the form of a twisted but continuous loop in which the floor becomes the ceiling and the ceiling the floor.

**vitra.**

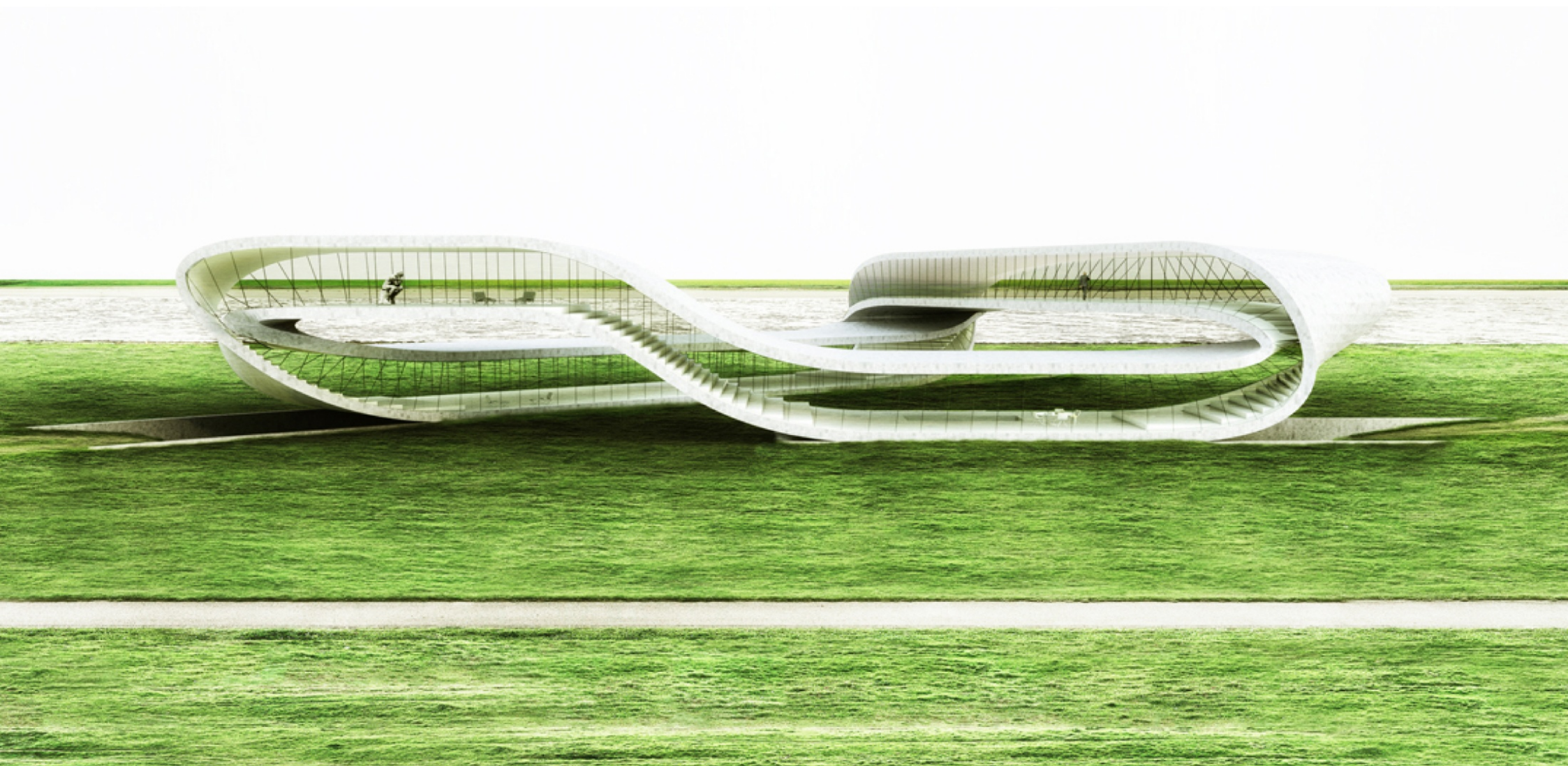
ARUP

Façade

Energy

Art

Light



 **bam**

 **AM**  
REAL  
ESTATE  
DEVELOPMENT

 **ABN-AMRO**

Universe  Architecture

**I amsterdam.**

**Deerns**



# Multi Dimensional Architecture

## The New Architecture Materiality and Systems

by Melissa Sterry, Design Scientist & Futurist, Bionic City® and University of Greenwich

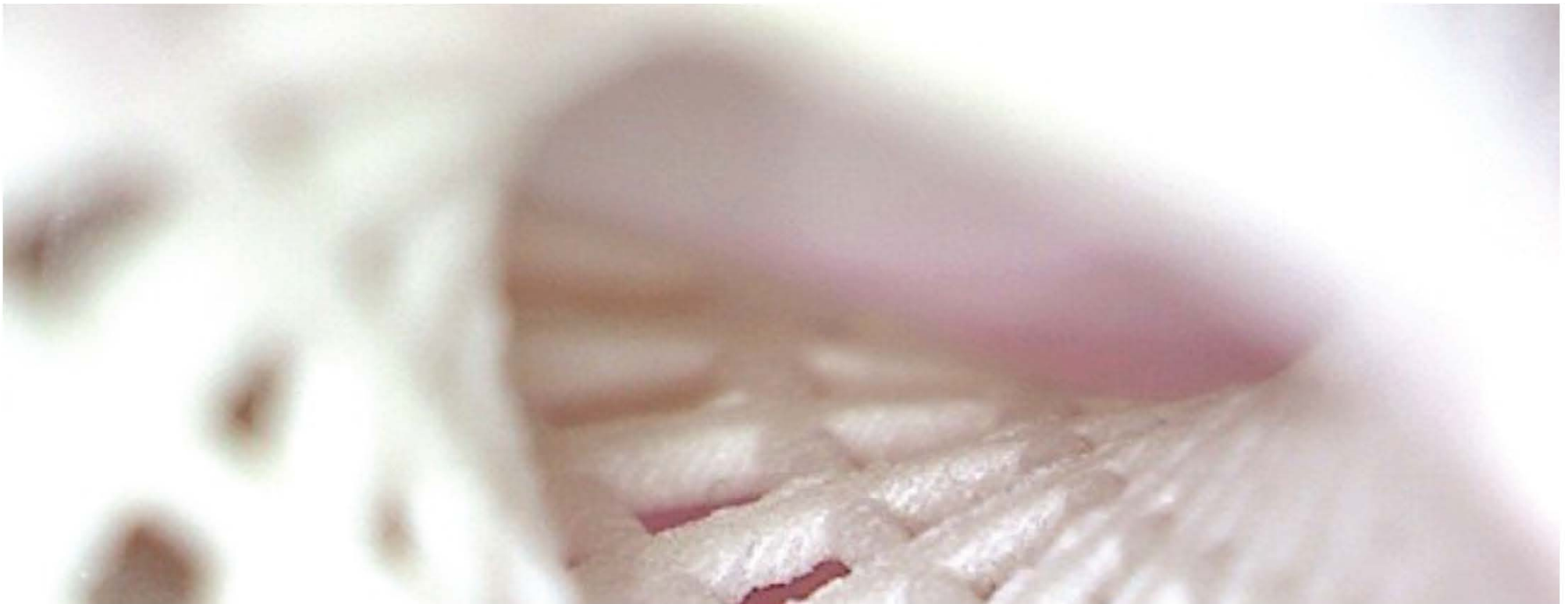


Image: M. Sterry

@melissasterry

# Biomimetics

*“study embracing the **practical use of mechanisms and functions of biological science** in engineering, design, chemistry, electronics, and so on.”*

Julian F. V. Vincent et al, Biomimetics: its practice and theory, Journal of the Royal Society, Interface (2006)

Image: M. Sterry

@melissasterry



# Biomorphic

*Forms or images that while **abstract** nevertheless refer to, or **evoke, living forms** such as plants and the human body.*

*Biomorphic comes from combining the Greek words '**bios**', meaning life, and '**morphe**', meaning form.*

*The term seems to have come into use around the 1930s to describe the imagery in the more abstract types of surrealist painting and sculpture particularly in the work of **Joan Miró** and **Jean Arp**. **Henry Moore** and **Barbara Hepworth** also produced some superb **biomorphs** at that time, and later so did Louise Bourgeois.*

Tate, Online Resource Library (2014)

Image: M. Sterry

@melissasterry

# Biological Prototypes

The physiology & behaviour of flora and fauna species and the relationships between them.

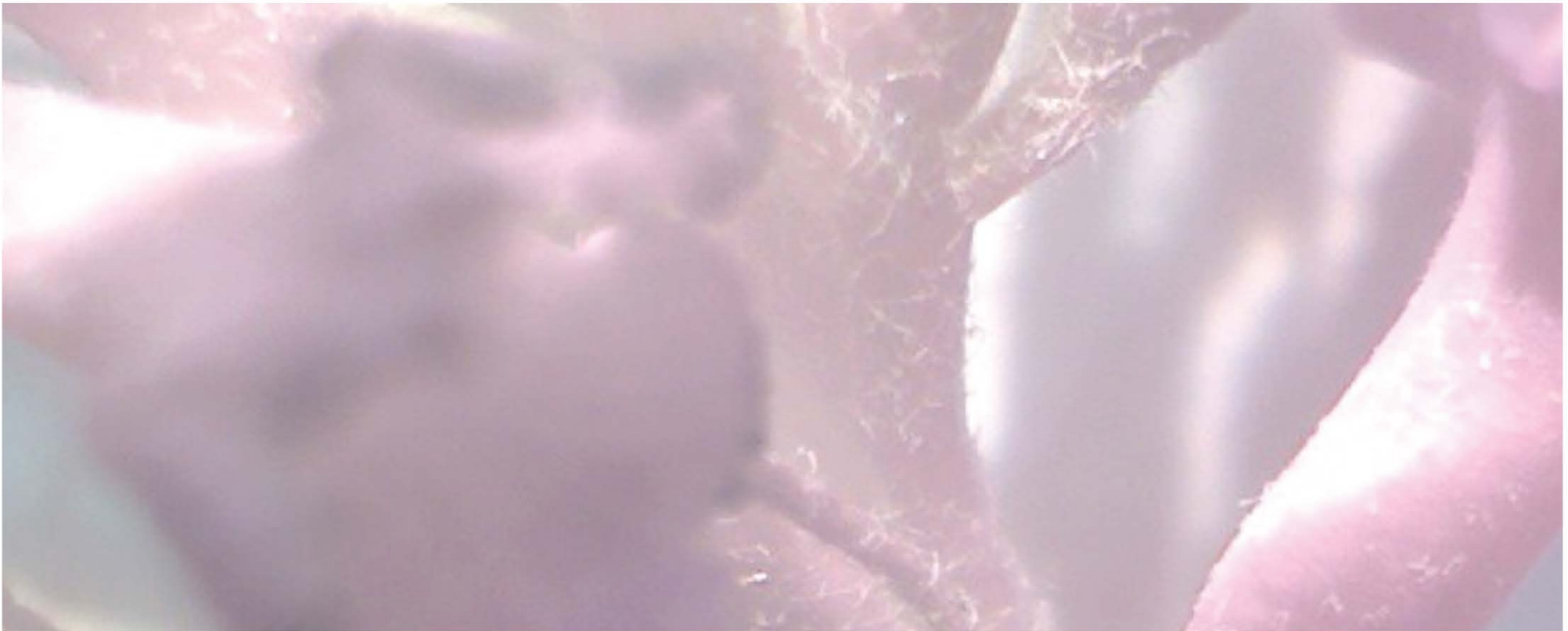
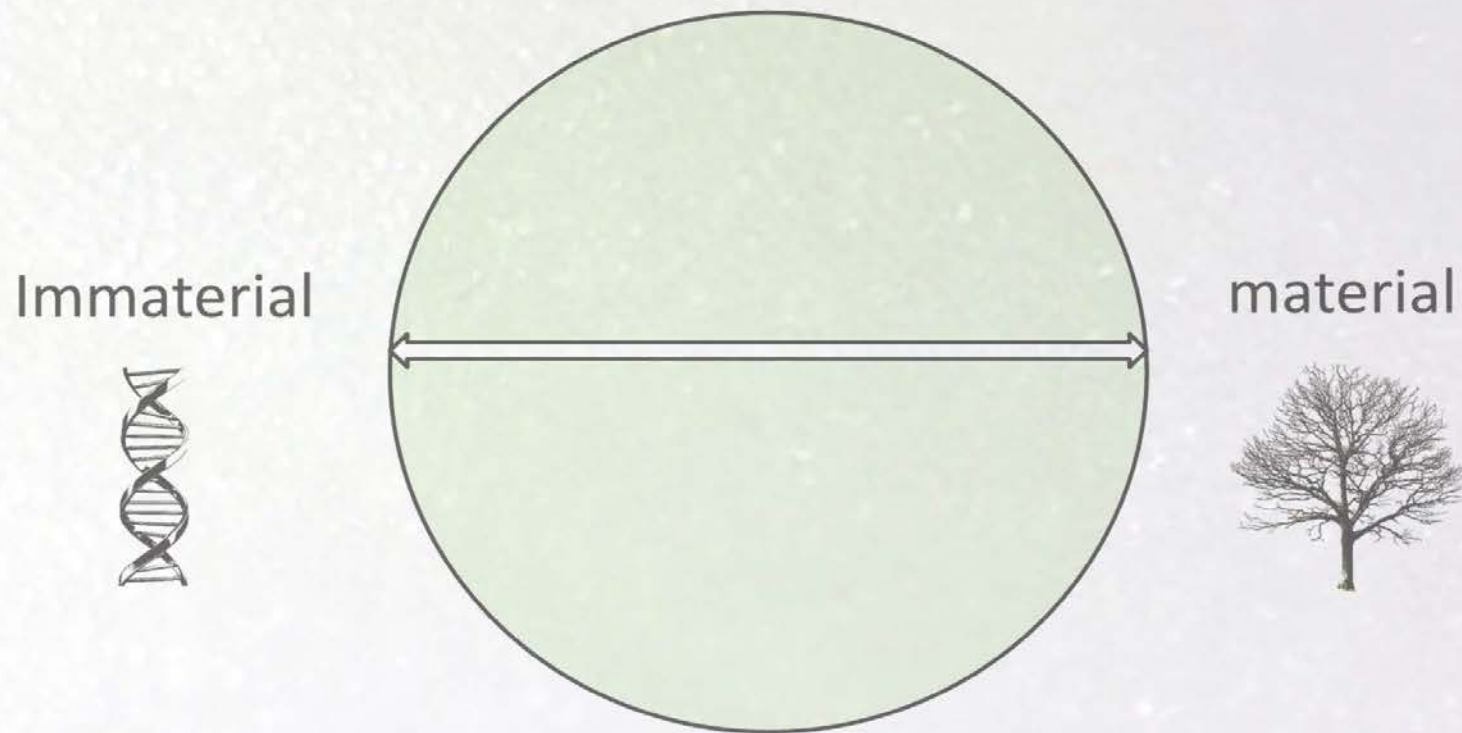


Image: M. Sterry

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*"The Circle of Variability" (2013)*

Diagram: M. Sterry

## Panarchy

*“the structure in which **systems of nature** (e.g. forests, grasslands, lakes, rivers, and seas), of humans (e.g. systems of governance, tribes, and cultures), as well as combined human-nature systems (e.g. agencies that control natural resource use), are interlinked in never-ending adaptive cycles of **growth, accumulation, restructuring, and renewal.**”*

C.S. Holling, Theories for Sustainable Futures, Conservation Ecology (2000)

Image: M. Sterry

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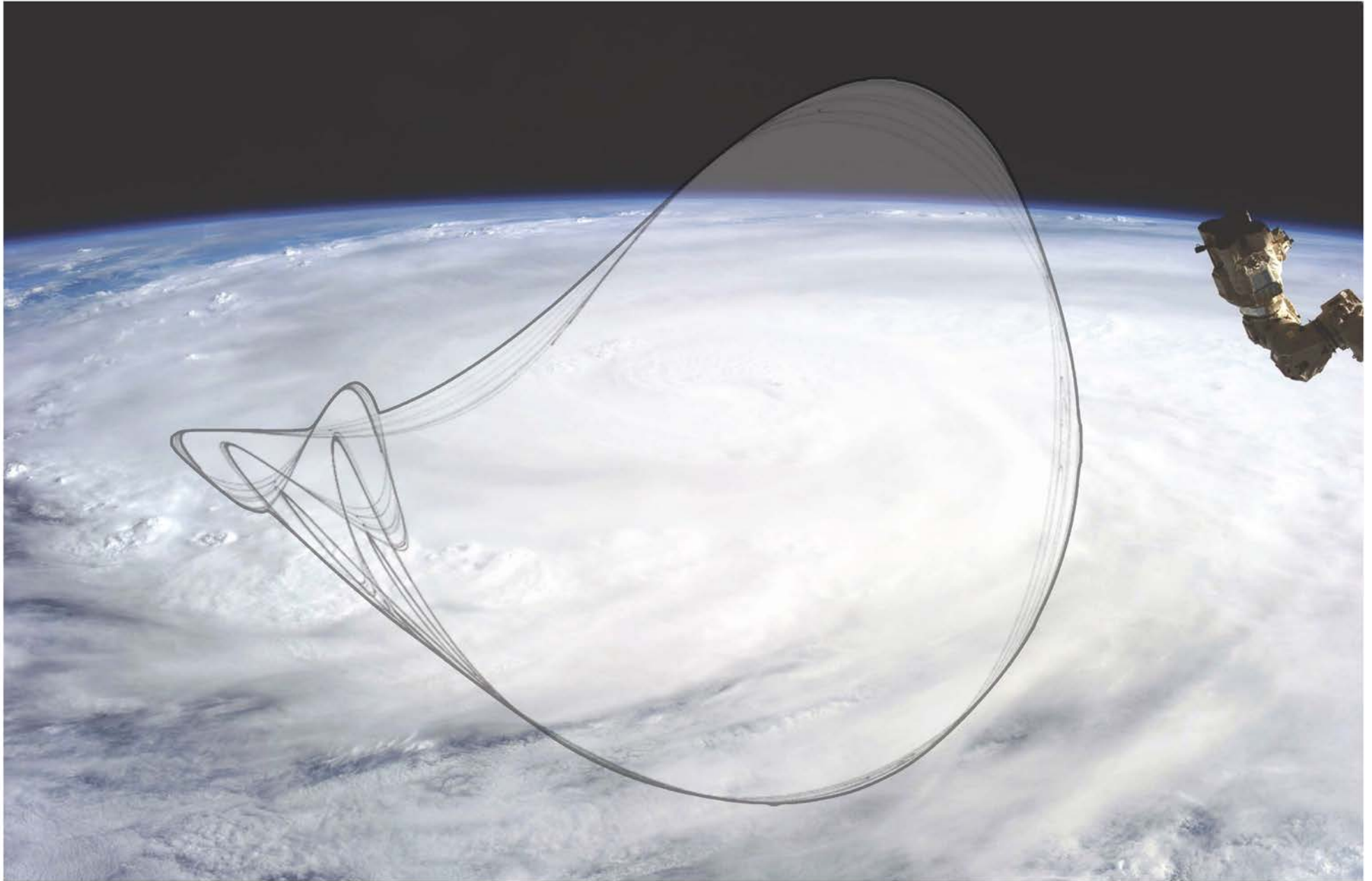
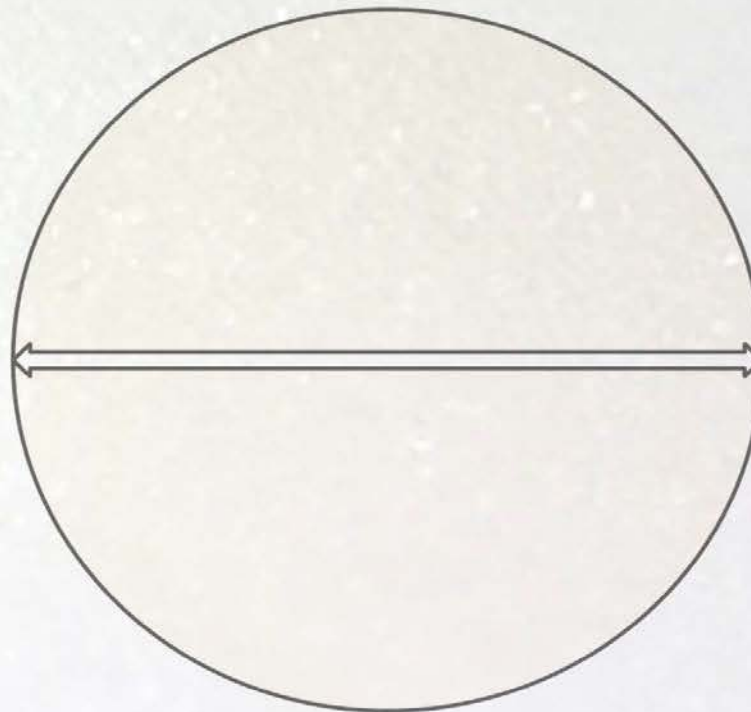


Image: Strange Attractor. Johannes Hansen, Creative Commons License. Typhoon Haiyan by Karen Nyberg, NASA.



Information

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00110101001



Objects



*"The Circle of Variability" (2013)*

Diagram: M. Sterry

# #LeapfrogProject

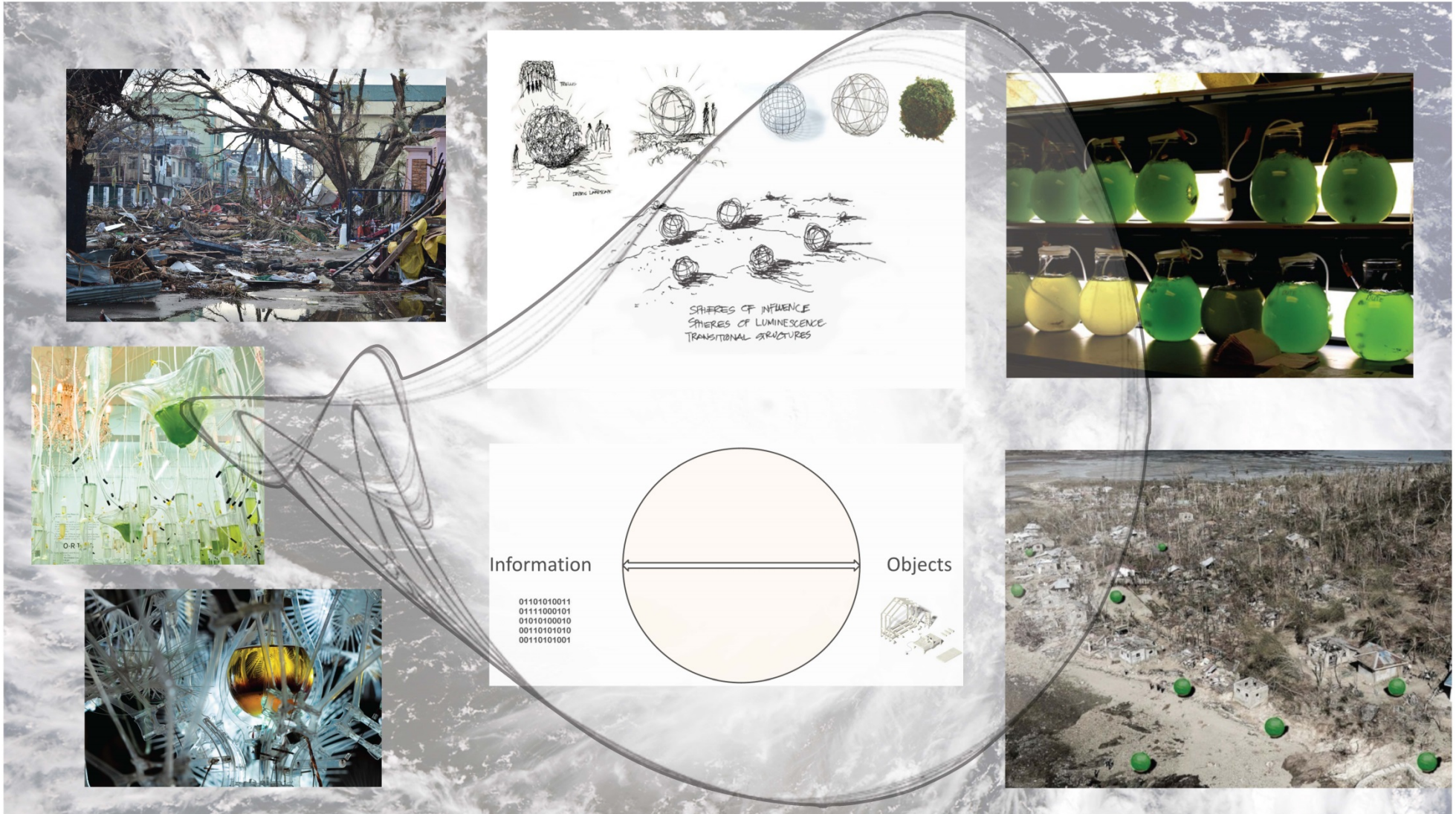
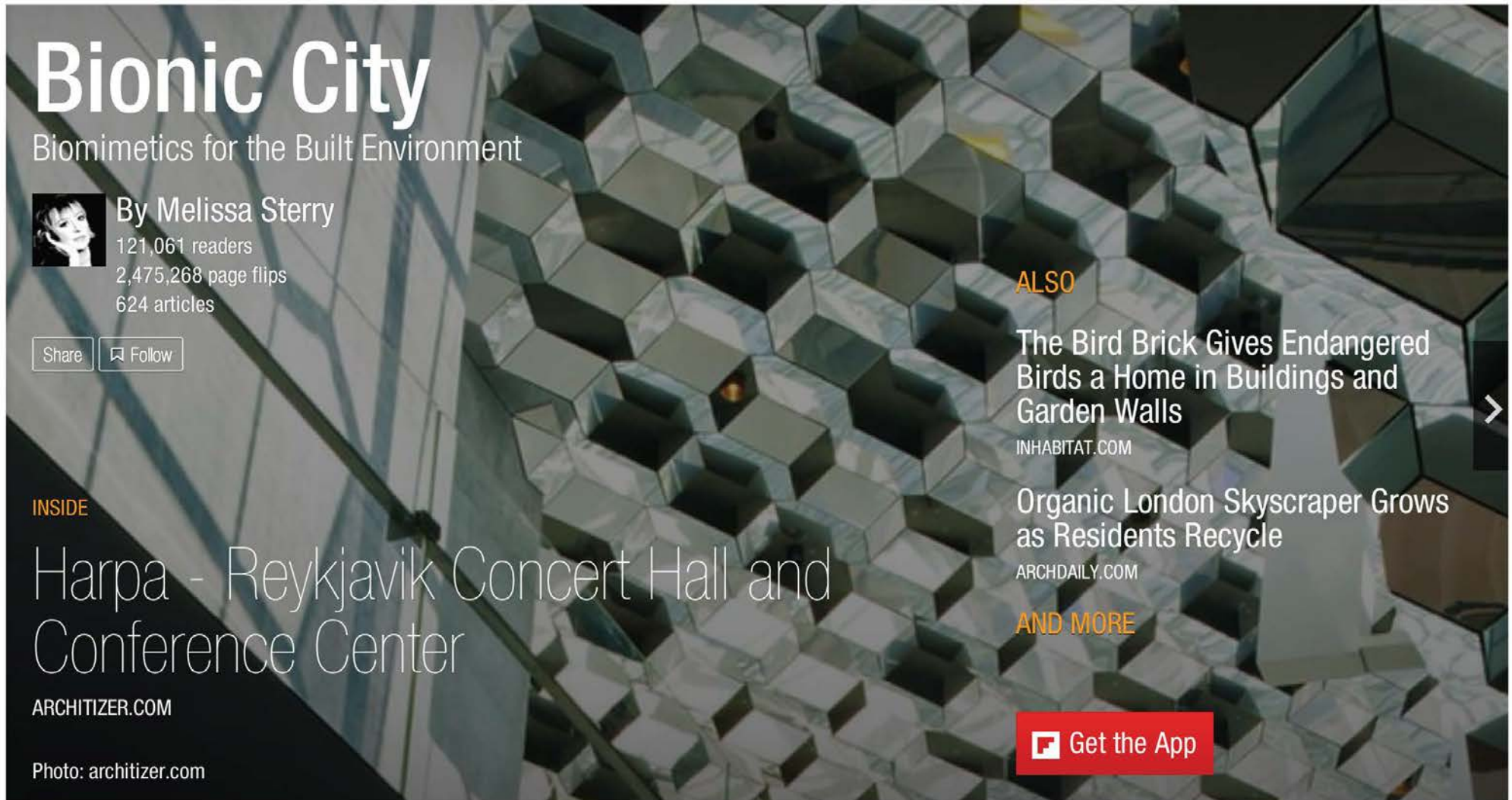



Image: Typhoon Haiyan, NASA, NOAA. Tacloban post Haiyan, Trocaire, Wikimedia Commons. Strange Attractor Johannes Hansen, Creative Commons License. Living Installation sketches and photography by Leapfrog Project. Circle of Variability by Melissa Serry. Living Architecture by Rachel Armstrong & Philip Beesley. Biocomputing by ecoLogic Studio.





**Bionic City**  
Biomimetics for the Built Environment

 **By Melissa Sterry**  
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# Thank you!



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## **Any Questions?**

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## Upcoming Webinars:

2014 Webinar Series

2030 Commitment – The Business Case

The Changing Nature of Health Care Practice – lessons for all firms (working title)

**View our webinar resources page for more information:**

<http://network.aia.org/PracticeManagement/Home/WebinarResource/>