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AIA Knowledge Communities



2014 PMKC Webinar

PM Series

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



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Practice Management

AIA Knowledge Communities



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Moderator:

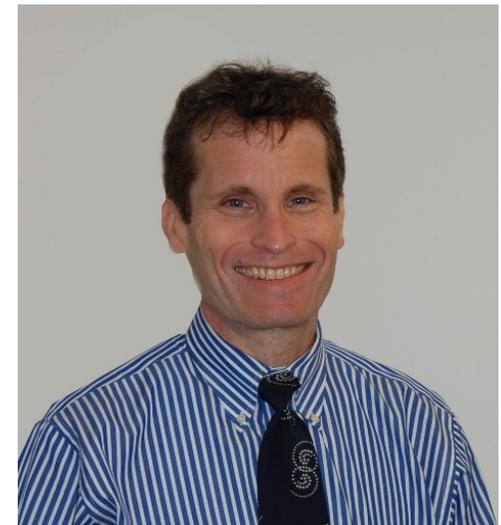
David Barkin, AIA

Chief Architect

State of Connecticut

DAS / Division of Construction Services

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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



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PMKC Webinar

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

Presenter:

JanJaap Ruijsenaars

Architect

Universe Architecture

Amsterdam, The Netherlands



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PMKC Webinar

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

Presenter:

Melissa Sterry

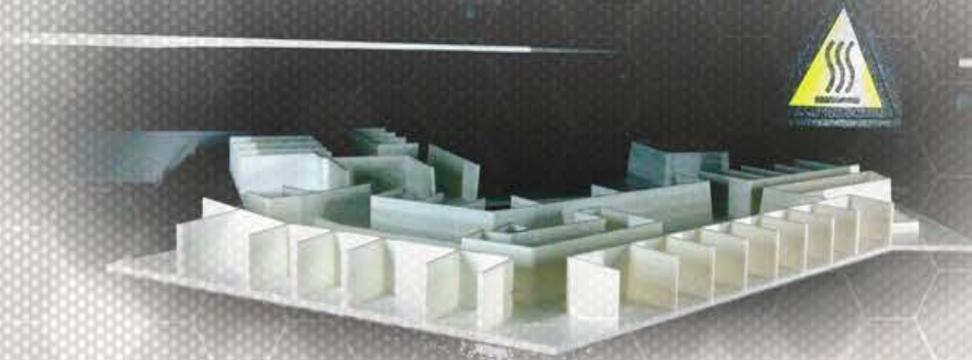
Design Scientist & Futurist

Bionic City[®], United Kingdom



3D PRINTING

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



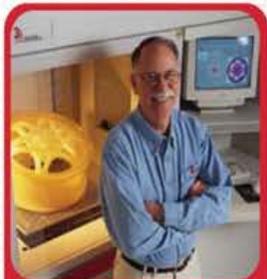
JEREMY LUEBKER

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



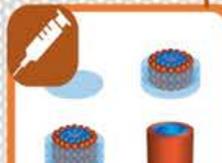
2008 DIY CO-CREATION SERVICE LAUNCHES
Shapeways launches.



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



2009 DIY KITS FOR 3D PRINTERS ENTER THE MARKETPLACE
MakerBot Industrie 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
i.materialise 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

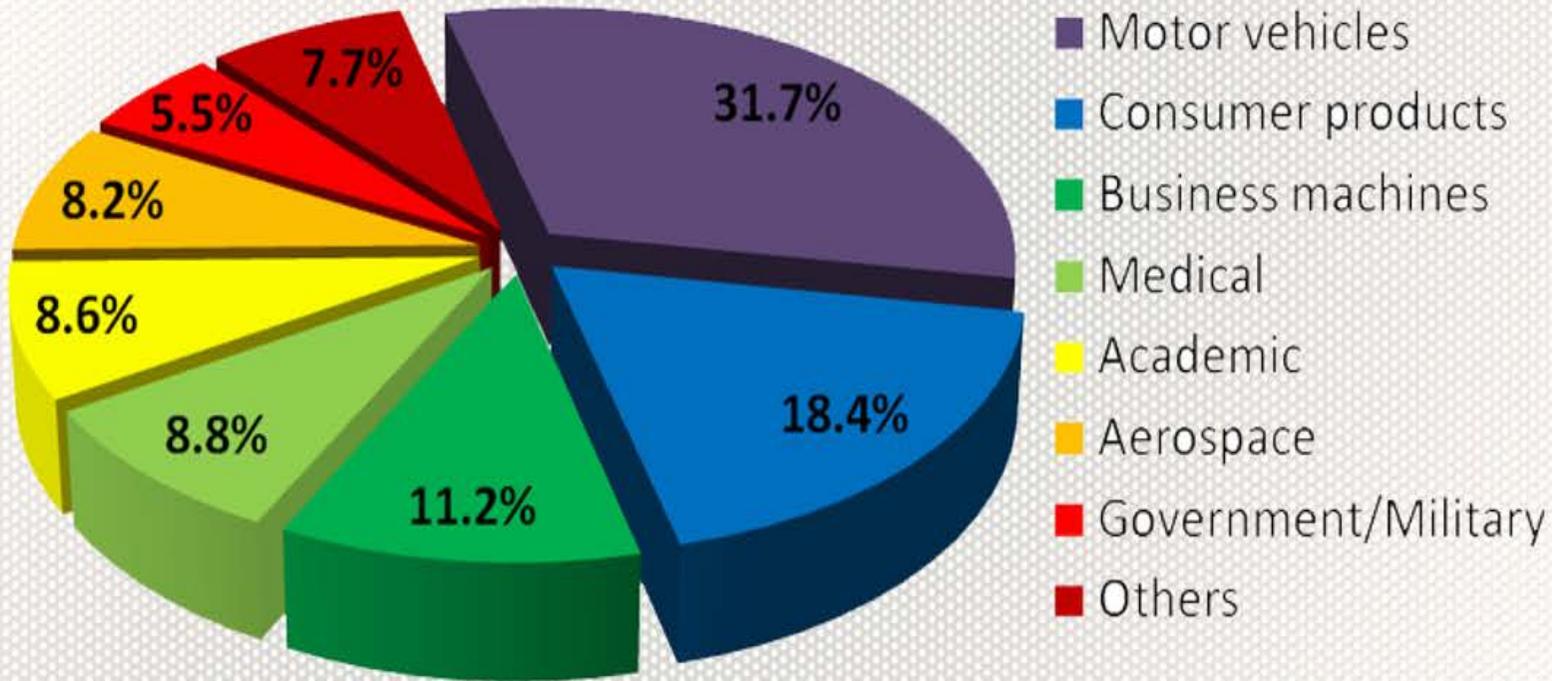


Medical

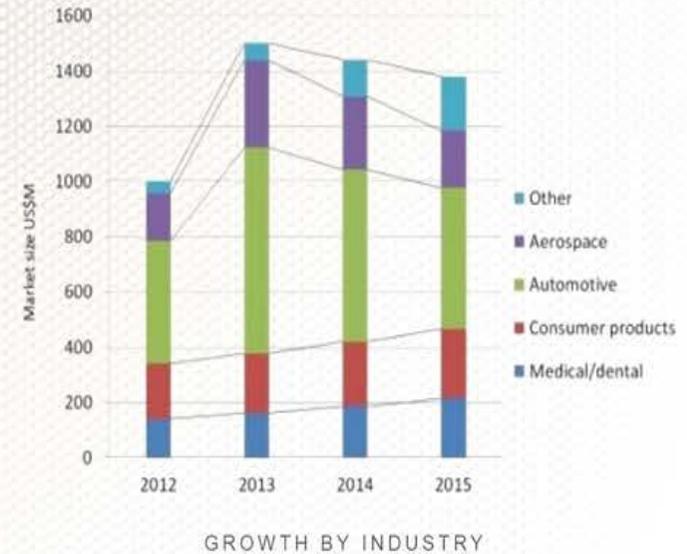
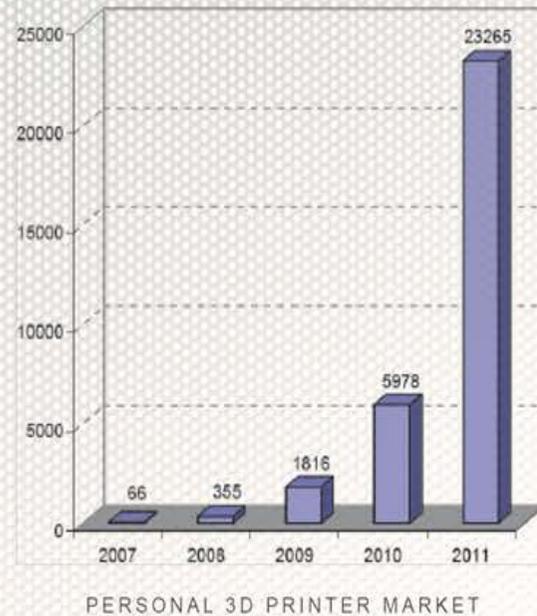
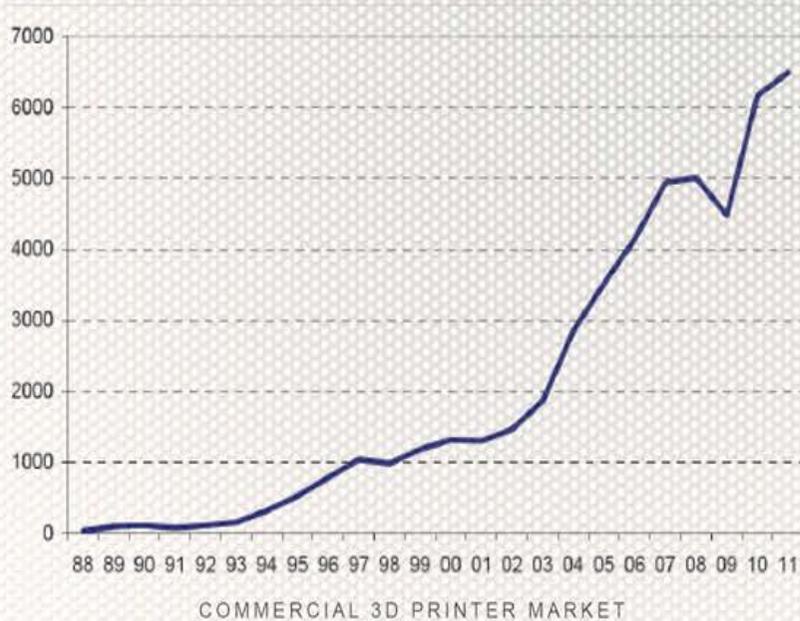


Jewelry

DRAMATIC GROWTH IN EVERY INDUSTRY...



- Motor vehicles
- Consumer products
- Business machines
- Medical
- Academic
- Aerospace
- Government/Military
- Others



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

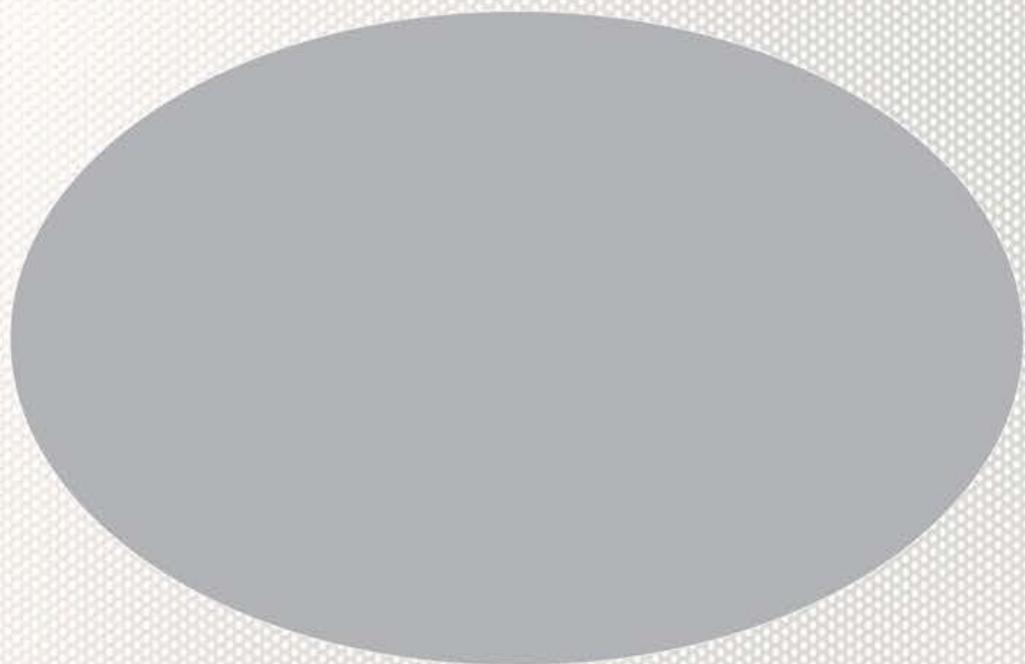


3D PRINTED
MODEL

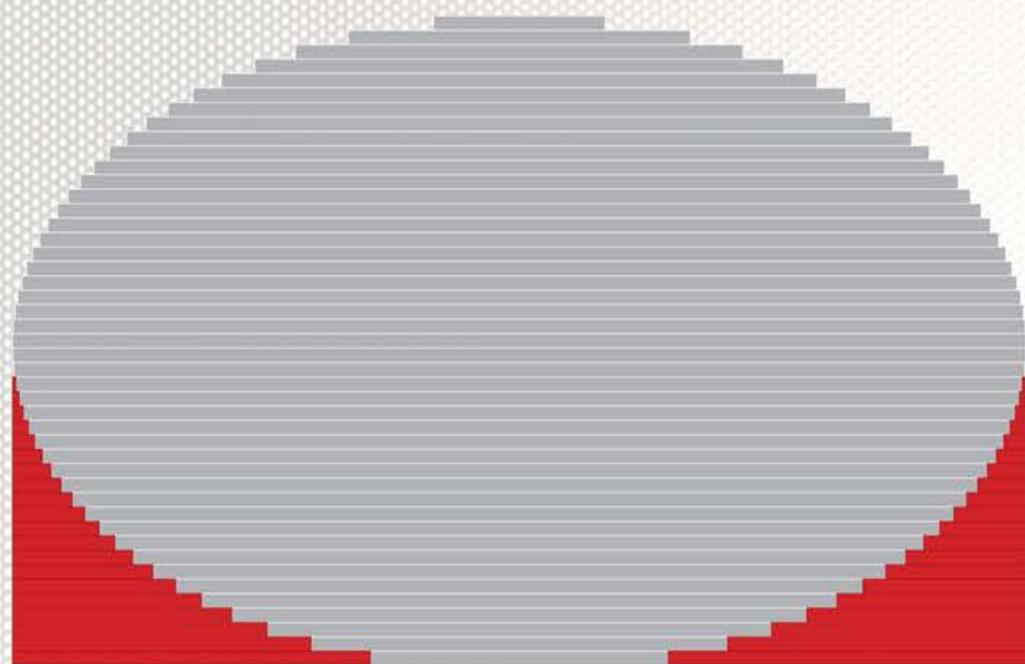
WHAT IS 3D PRINTING...



IT'S A CONTOUR MODEL...



ORIGINAL PART
[CAD]



3D PRINTED
PART

THE TOYS...



DIGITIZED "HOT GLUE GUN"

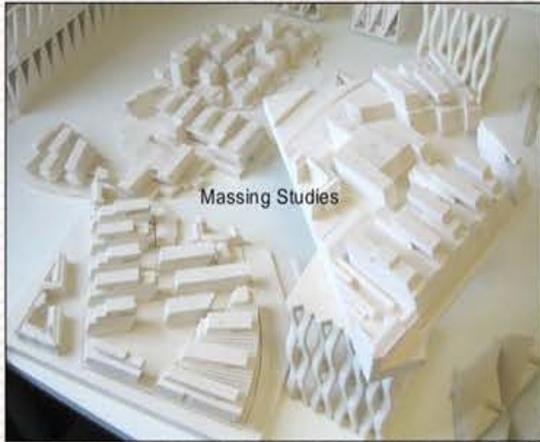


PLOTTER ON A SANDBOX

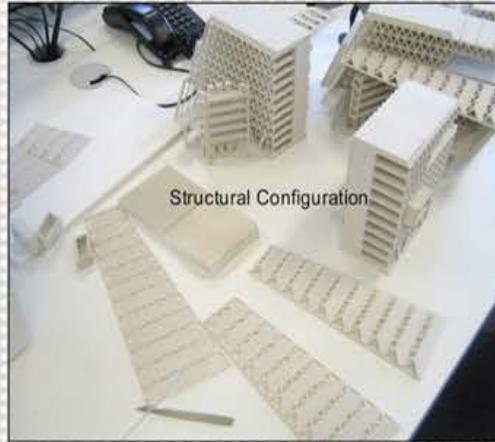


CURRED BY ENERGY SOURCE

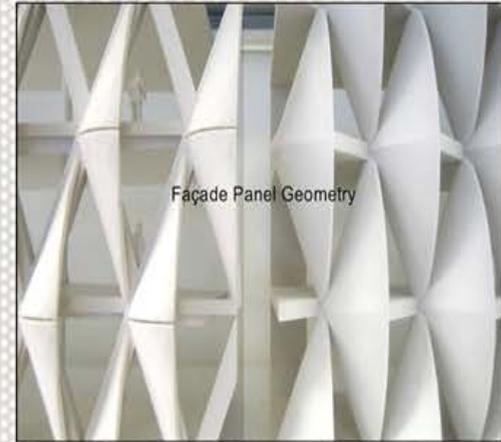
WHAT 3D PRINTING GOOD FOR...



Massing Studies



Structural Configuration



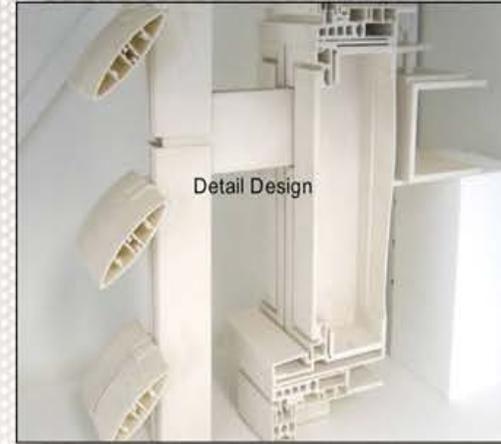
Façade Panel Geometry



Terrain Modelling



Full color topography



Detail Design



Building Option Studies



Form Options



Final Models

WHAT WE DO...



KPF

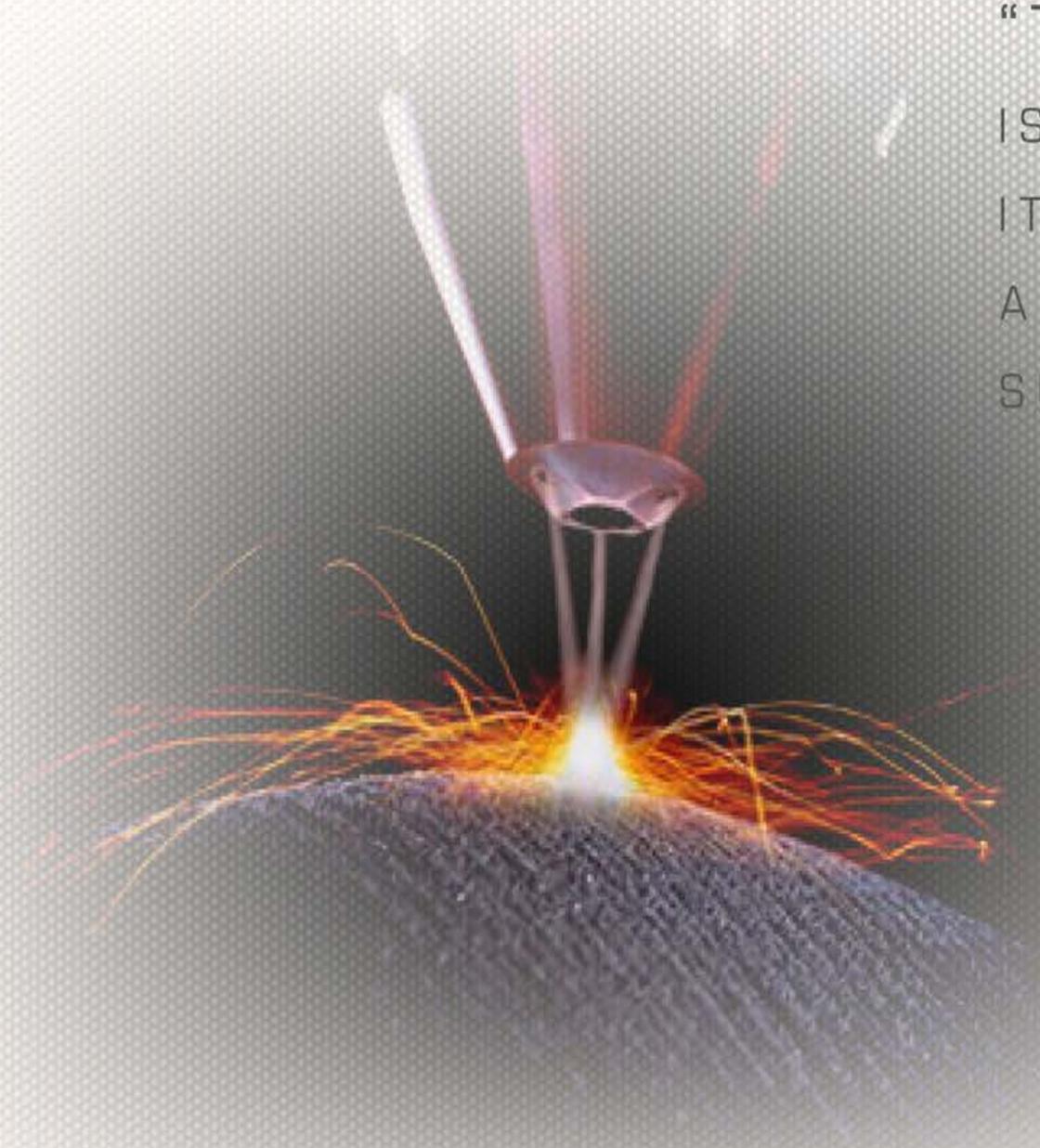


Toll Brothers

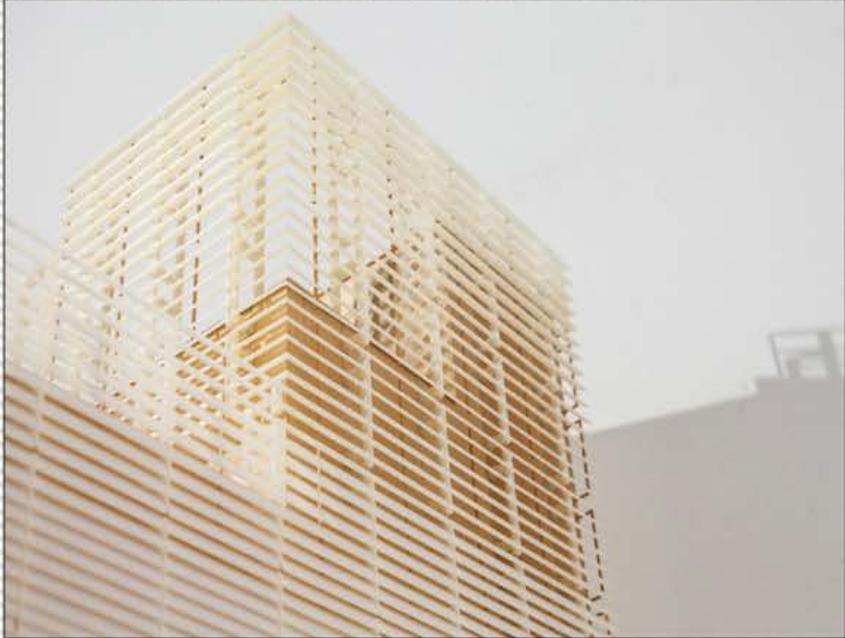
WHY 3D PRINTING...

“THE VALUE OF THE PROTOTYPE IS NOT THE PROTOTYPE ITSELF, IT’S THE INTERACTIONS AND COMMUNICATIONS THAT SURROUND THE PROTOTYPE.”

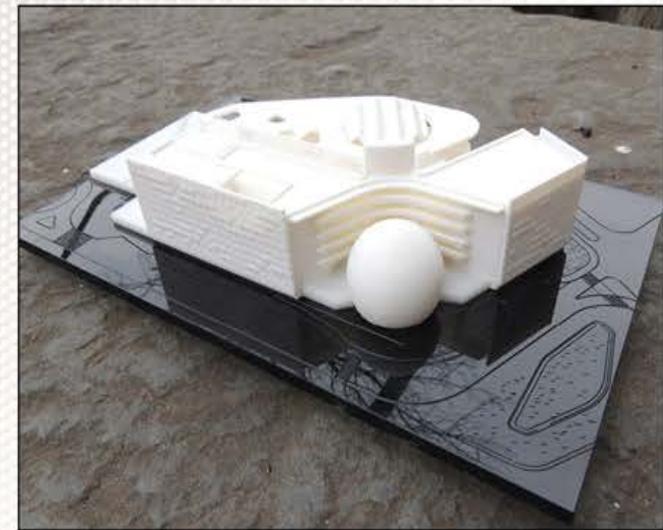
MICHAEL SCHRAGE



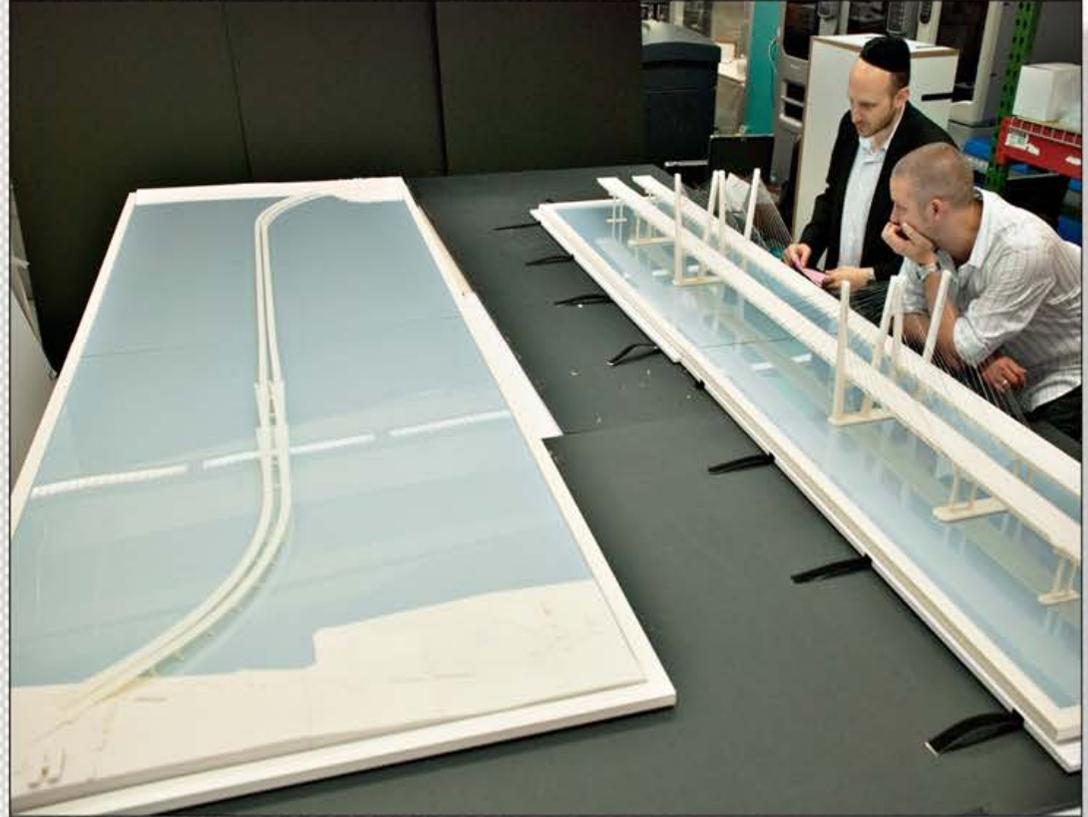
SOME OF THE PROJECTS WE MAKE...



Cook + Fox, NY



Grimshaw



HDR

EXPECTATIONS AND MISCONCEPTIONS...

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

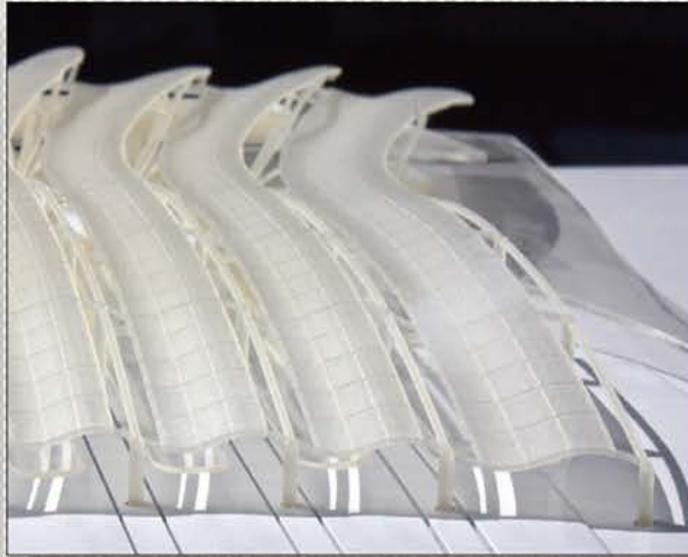
GEORGE LEE



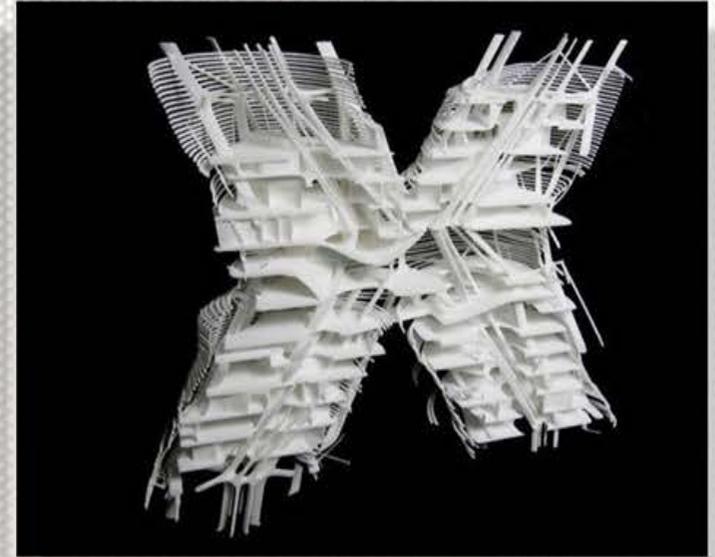
ONE PRINT CAN'T DO IT ALL...



Brookfield Residential

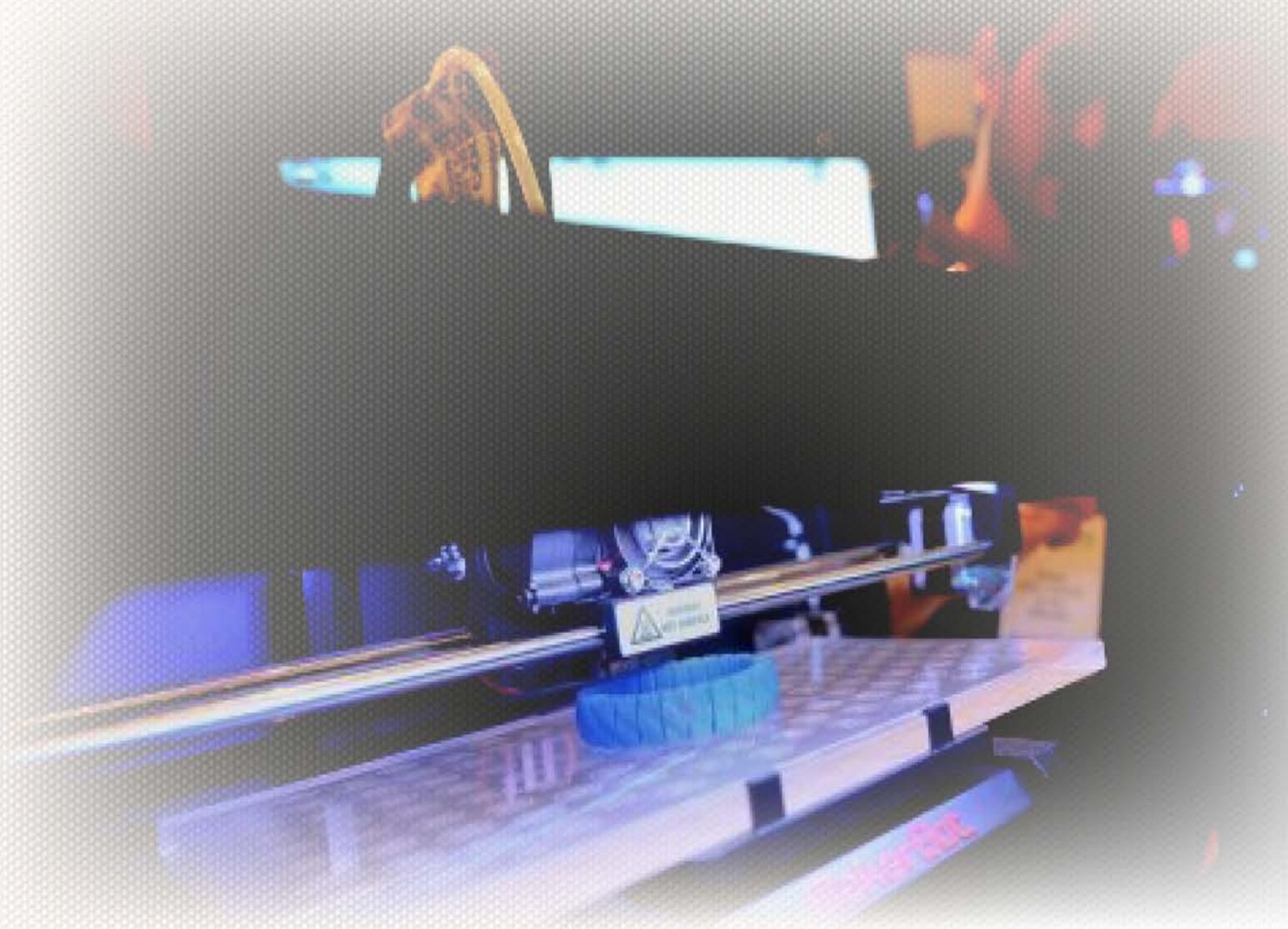


KPF



Dorma

OUR RECOMMENDATION...



THANK YOU

QUESTIONS AND COMMENTS ARE WELCOME

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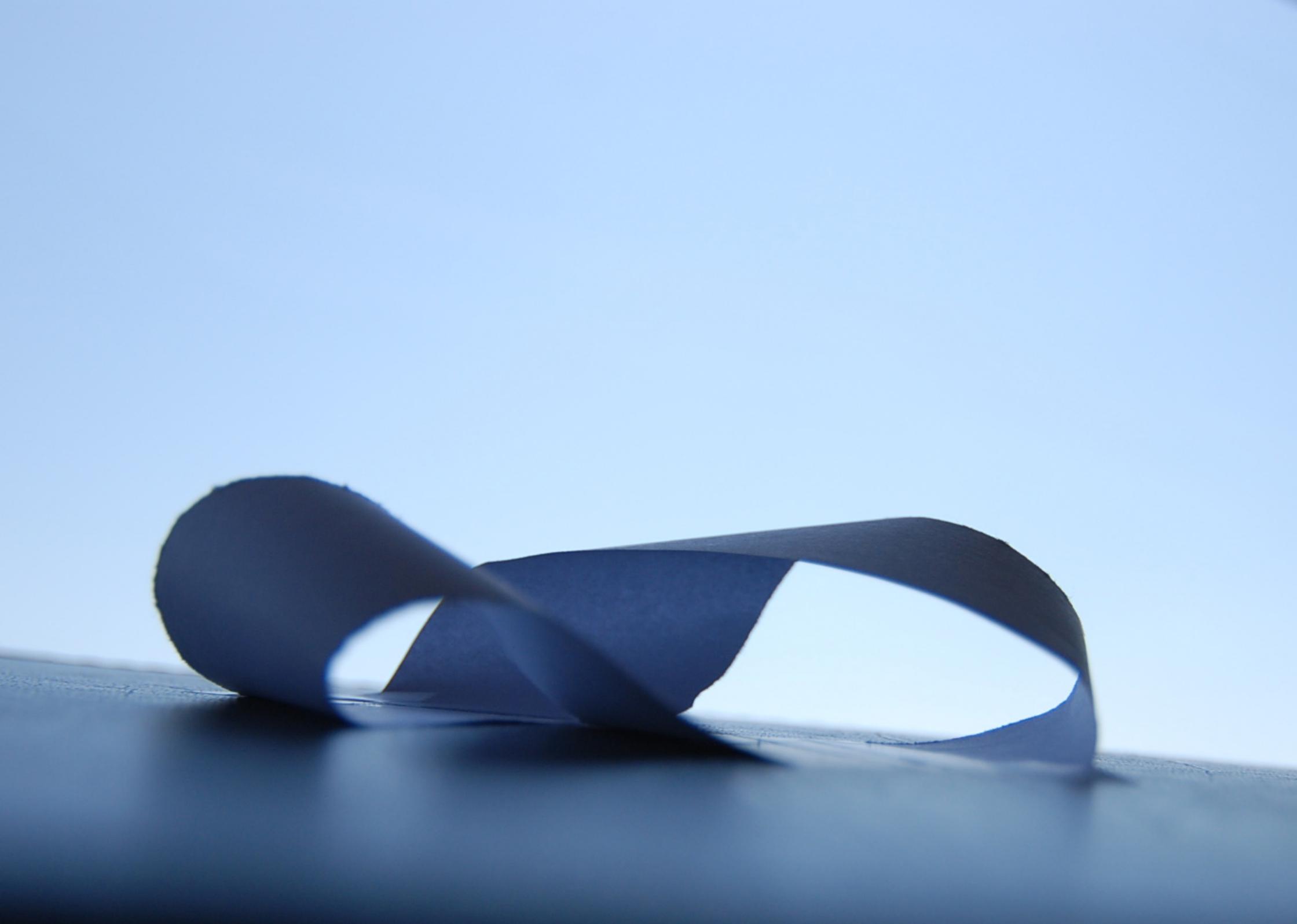
© NRI 2014

LANDSCAPE HOUSE[©]
2014

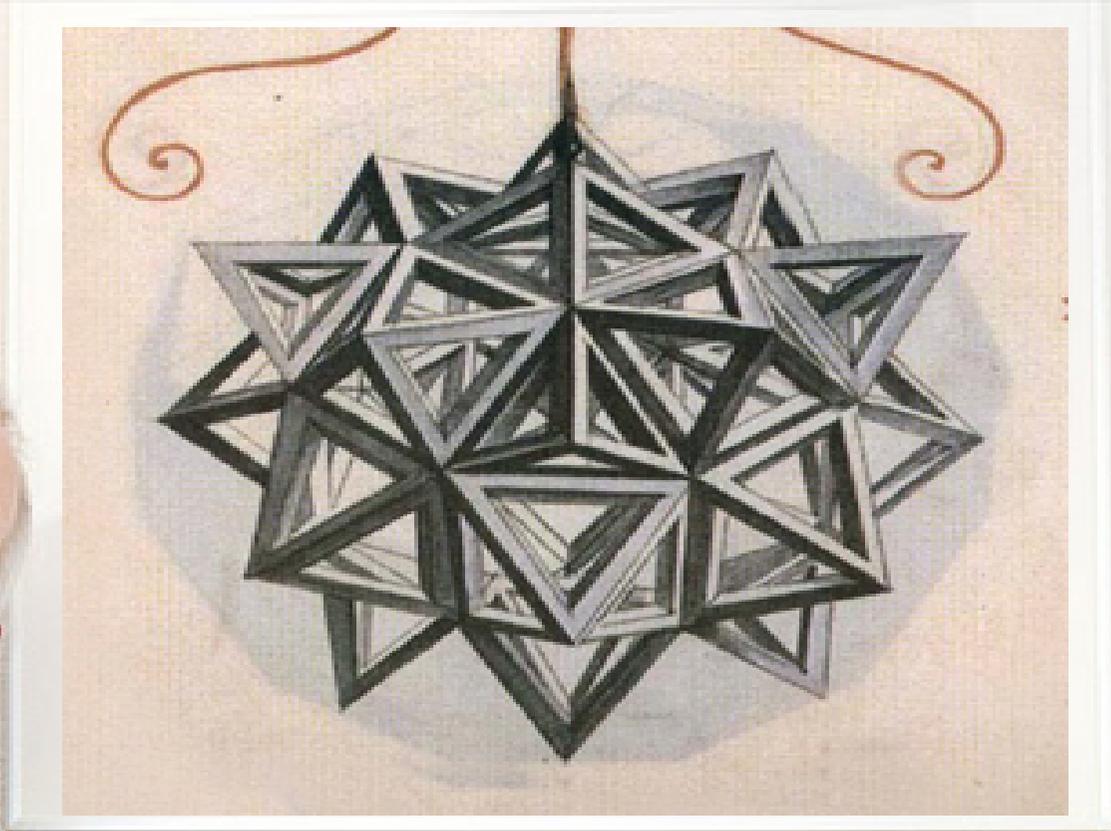
Universe **A**rchitecture

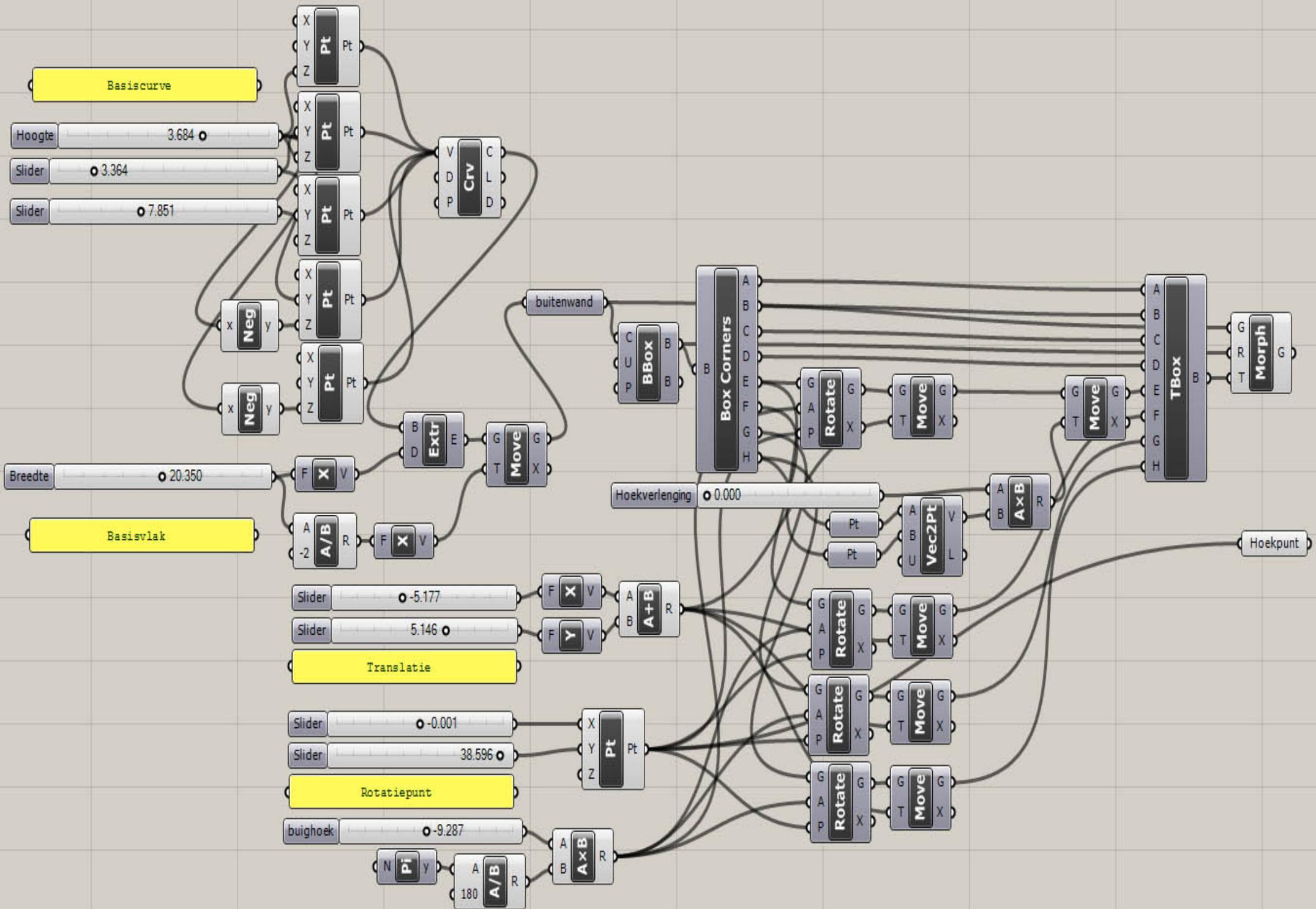




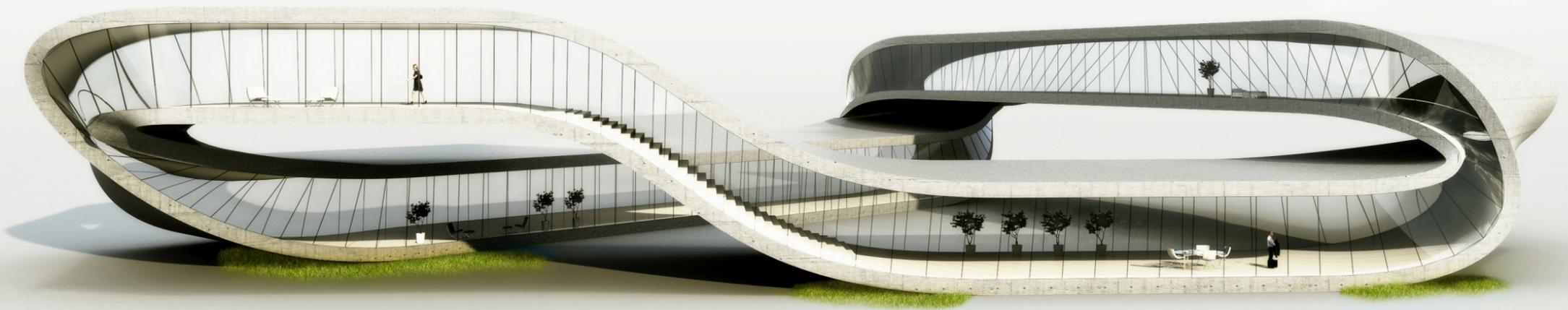


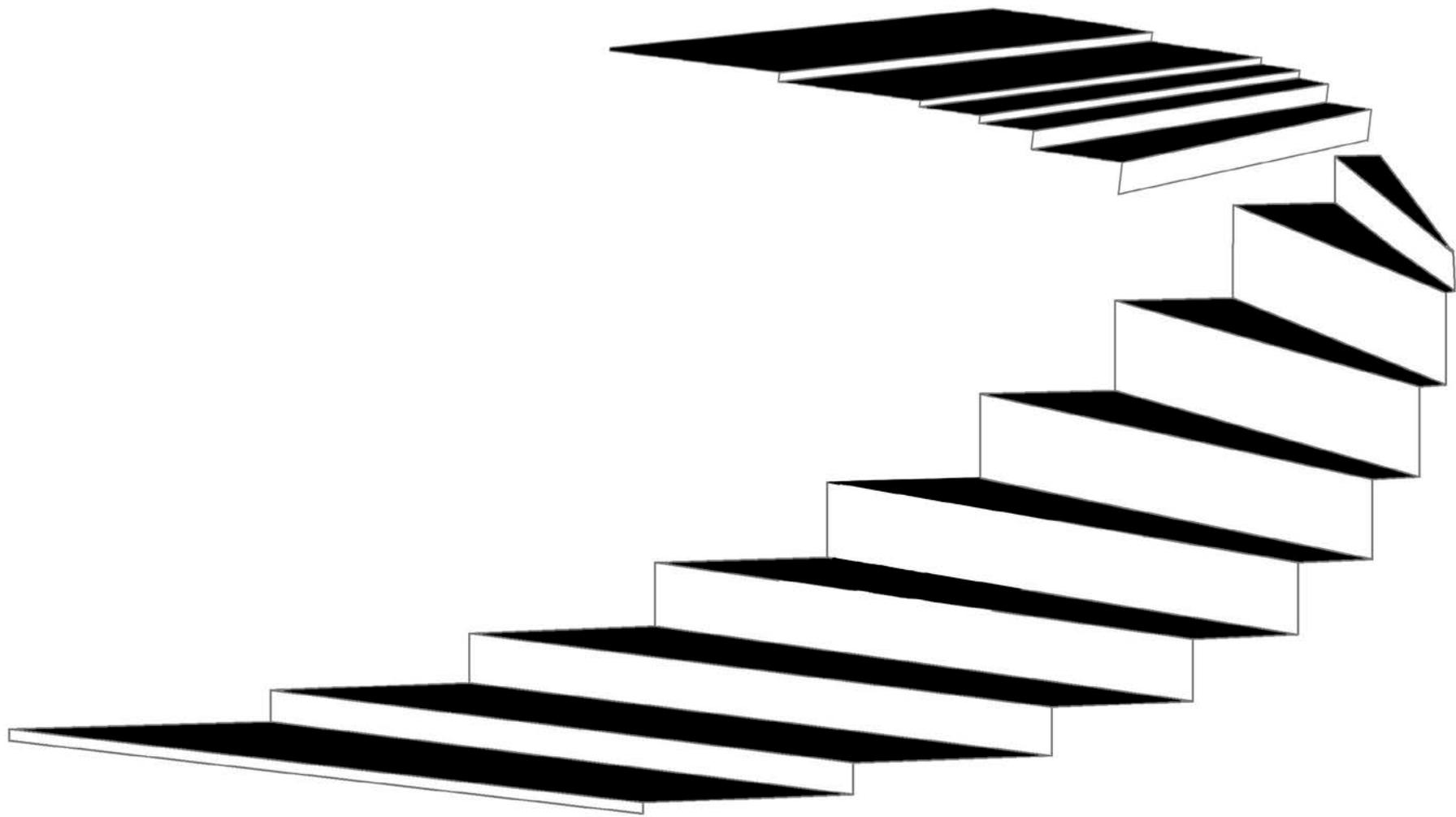


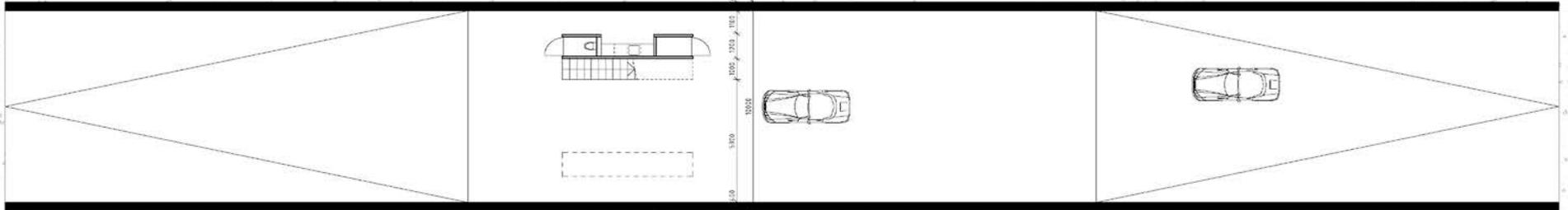
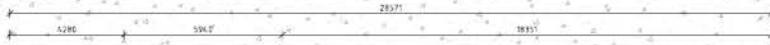
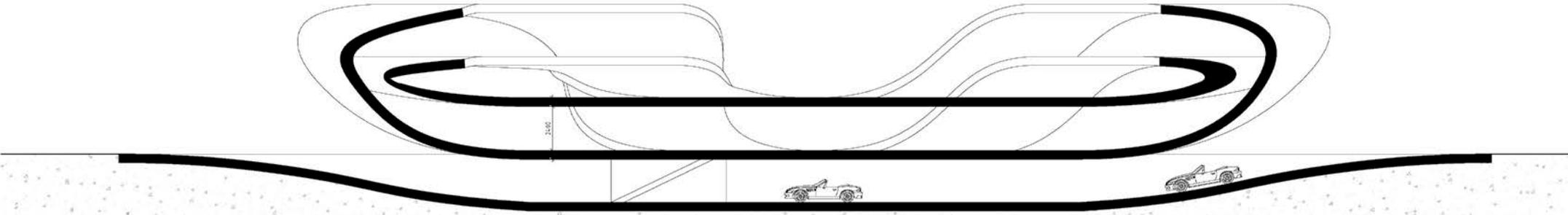


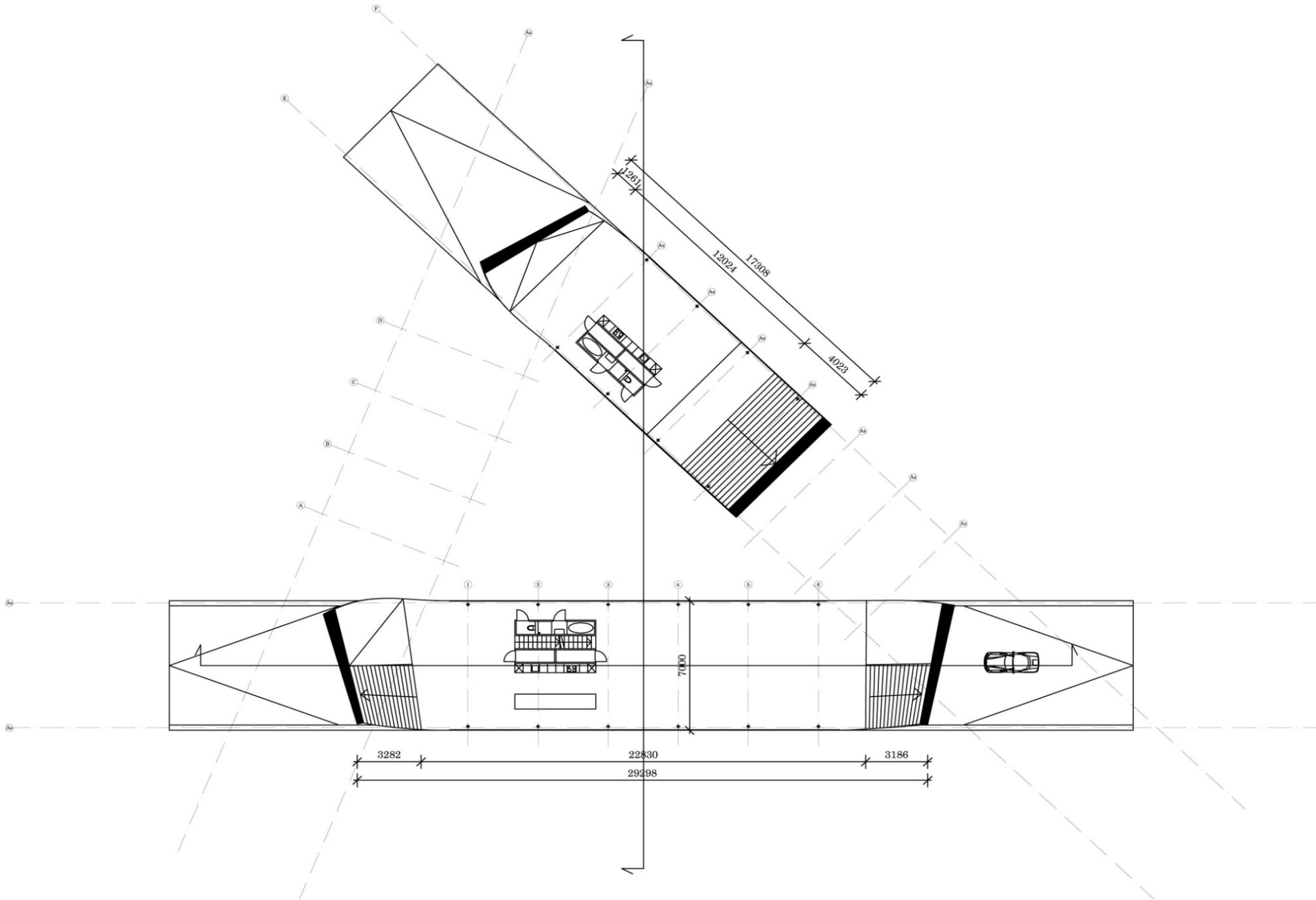


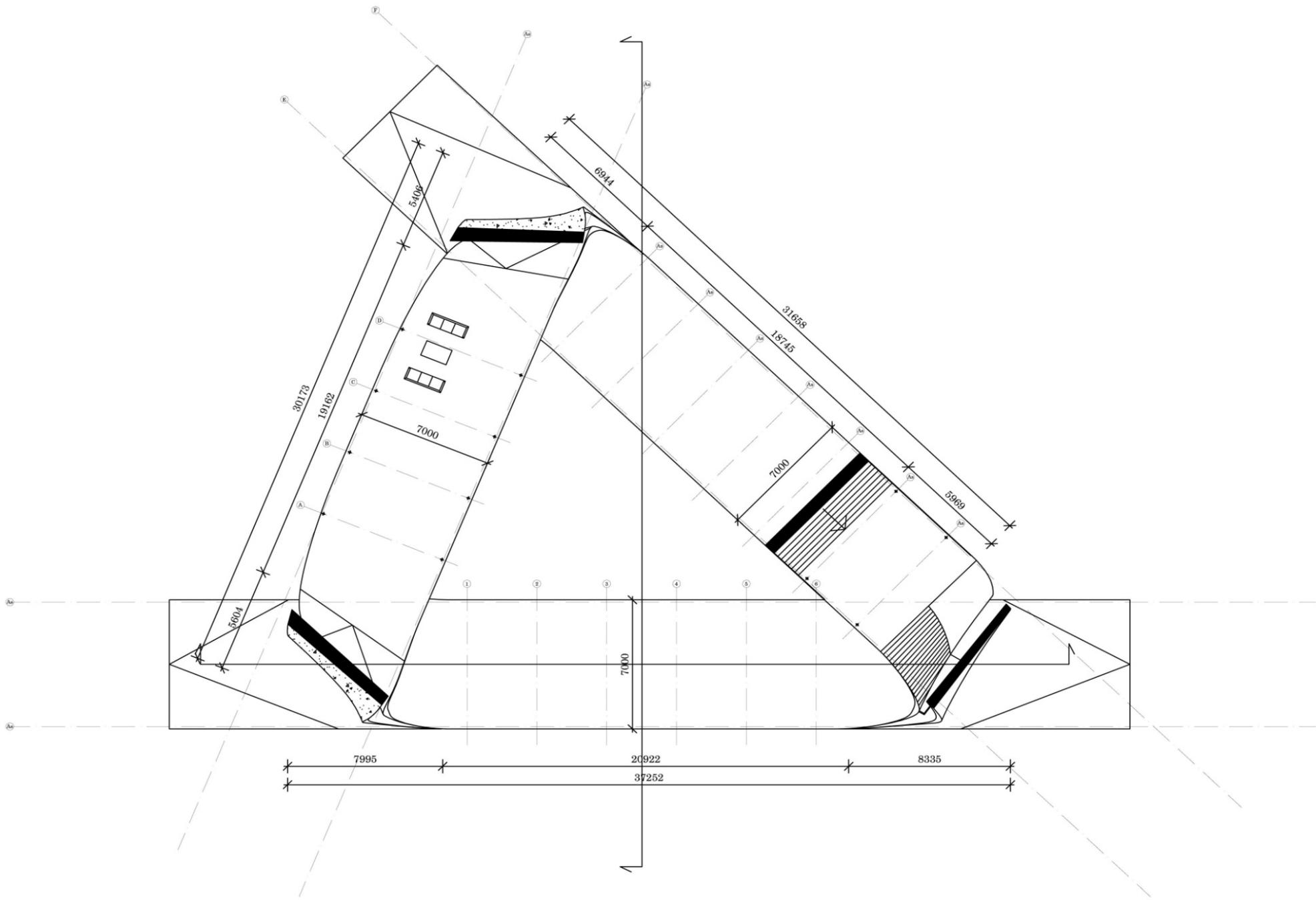


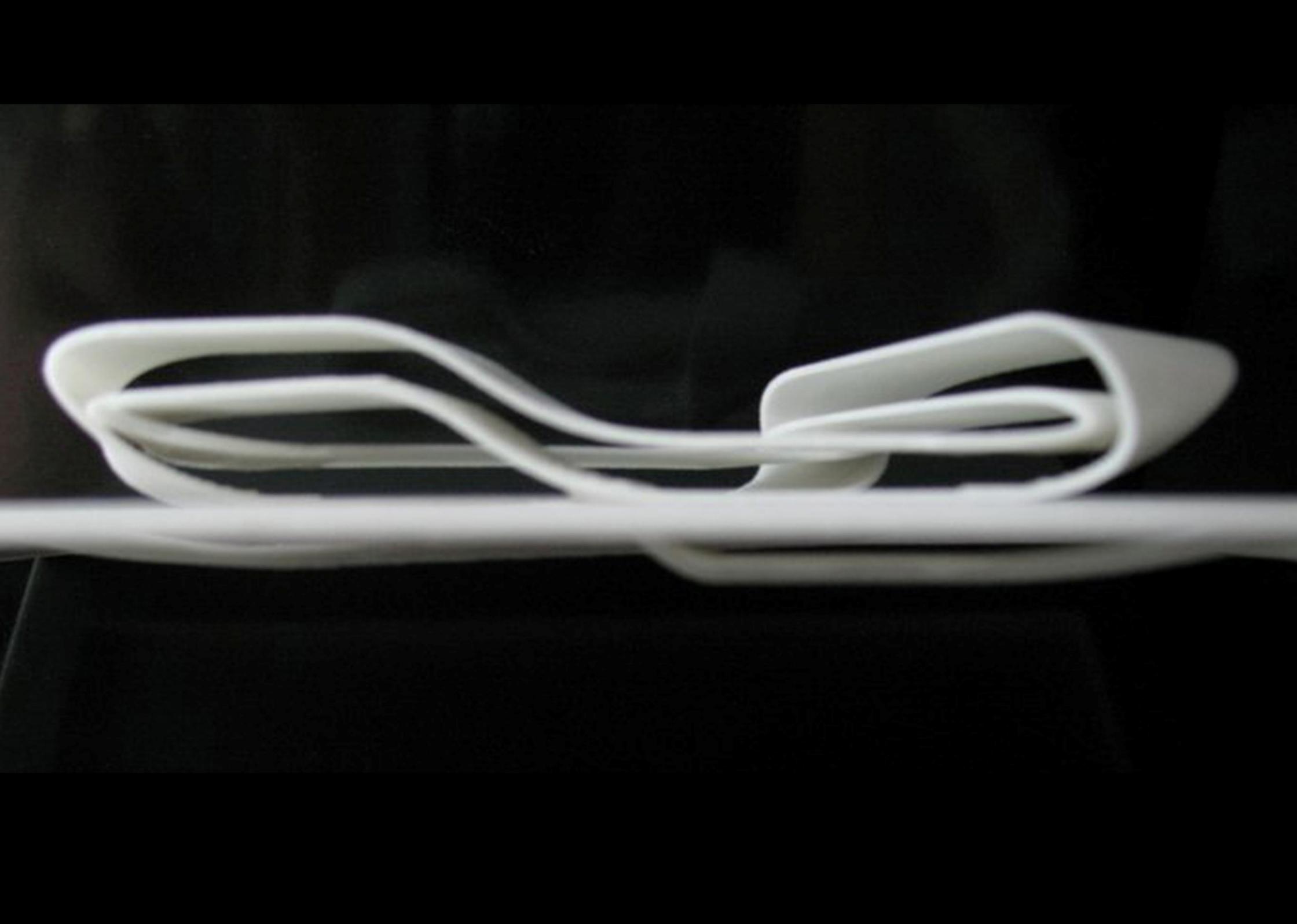








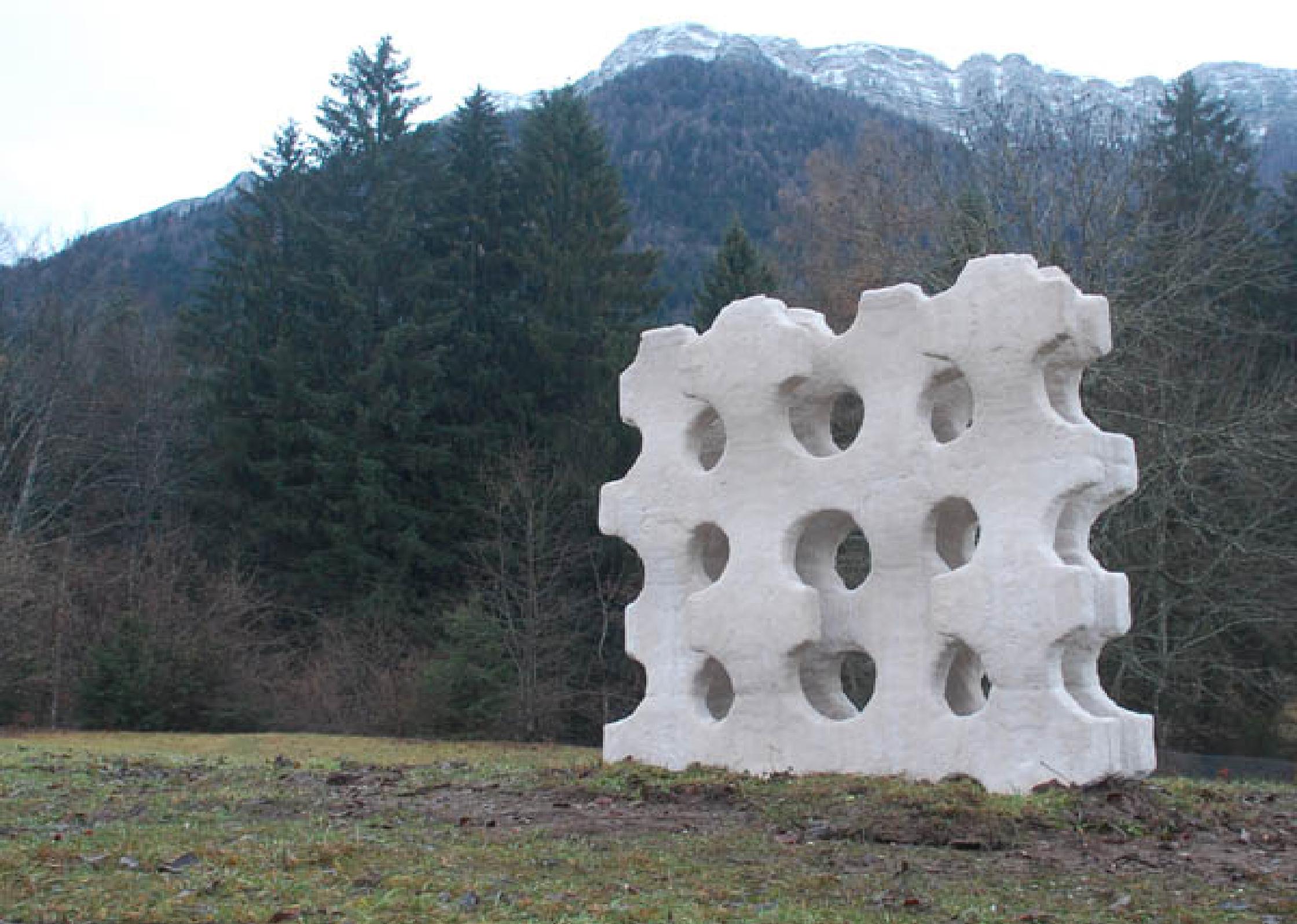




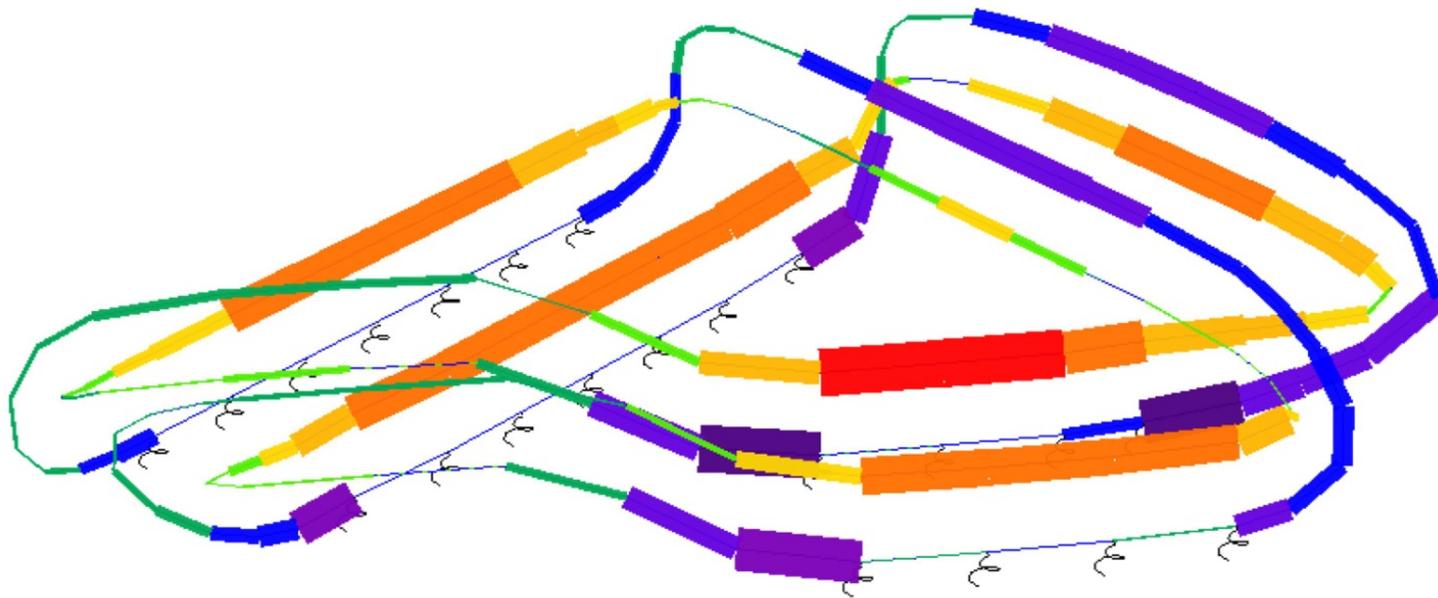
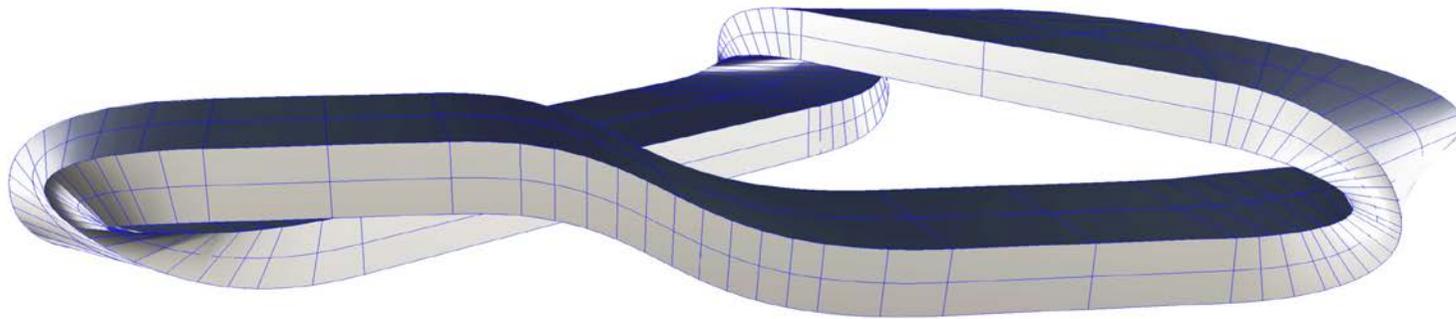












Element list "Horizontal"

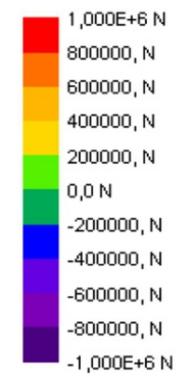
Scale 1 202,5

Highlighted

Coincident Nodes

Coincident Elements

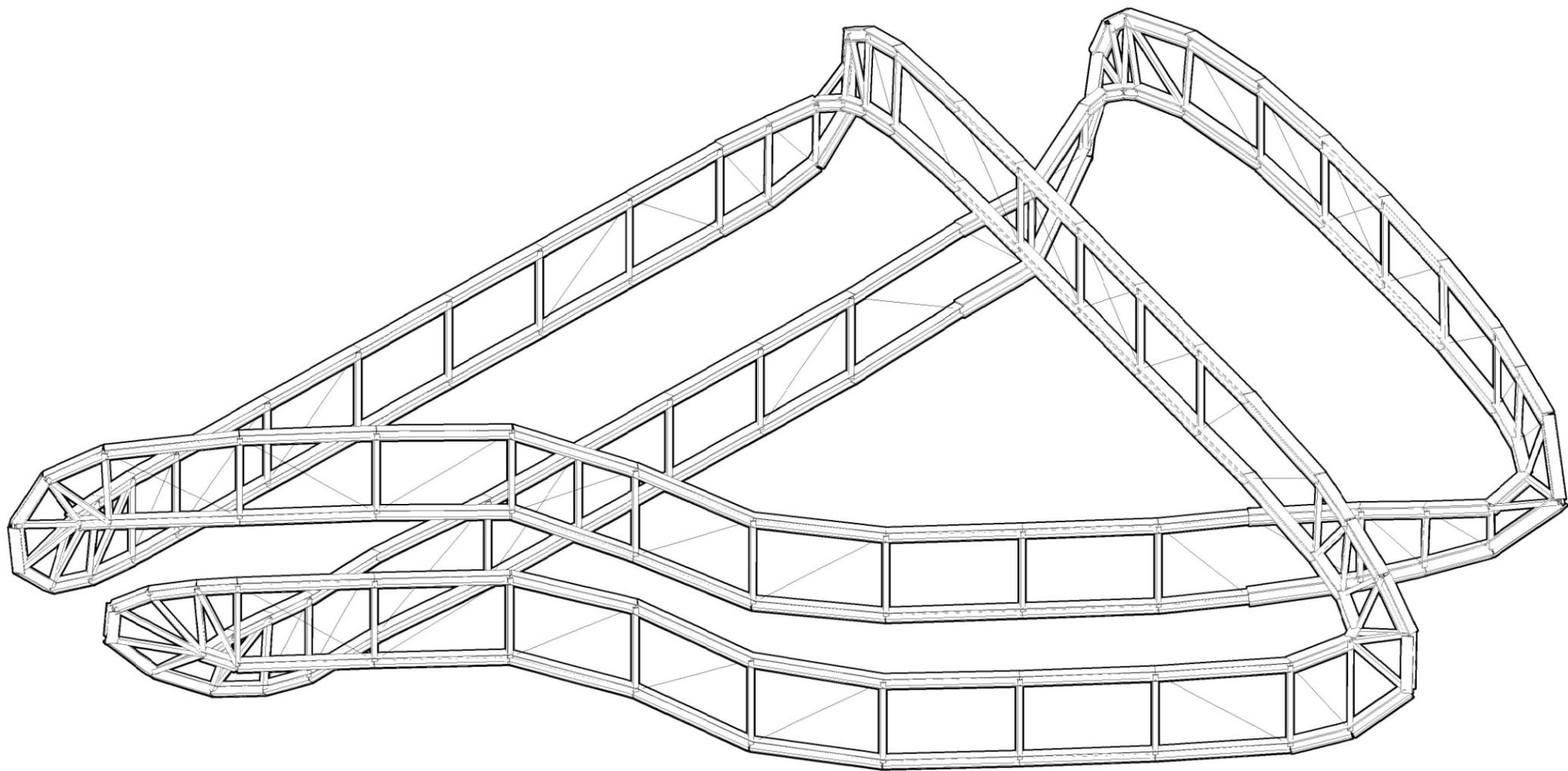
Axial Force, Fx 1,250E+6 N/pic.cm



Case L3 VL

Case A3 VL

Contour case

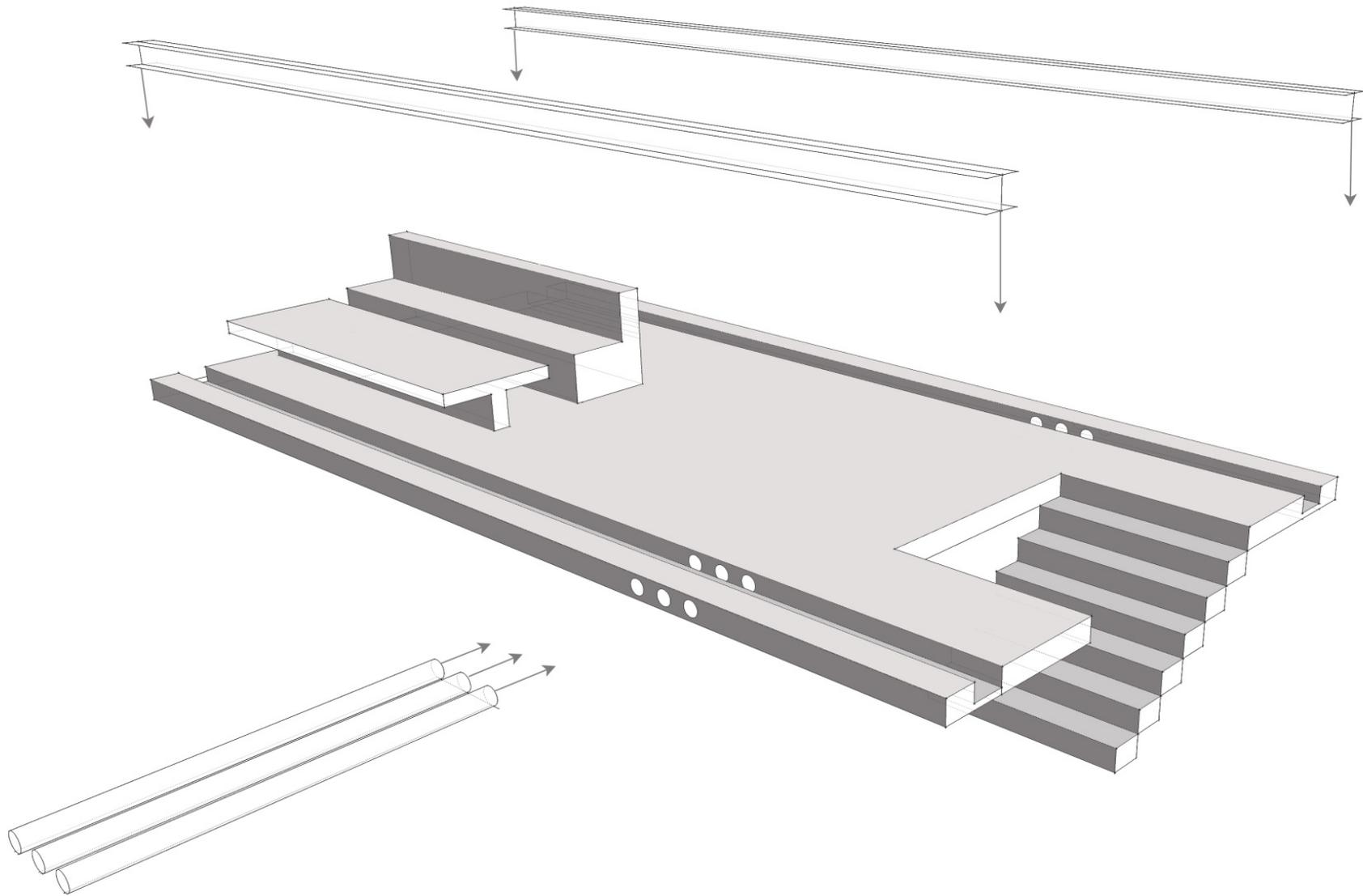


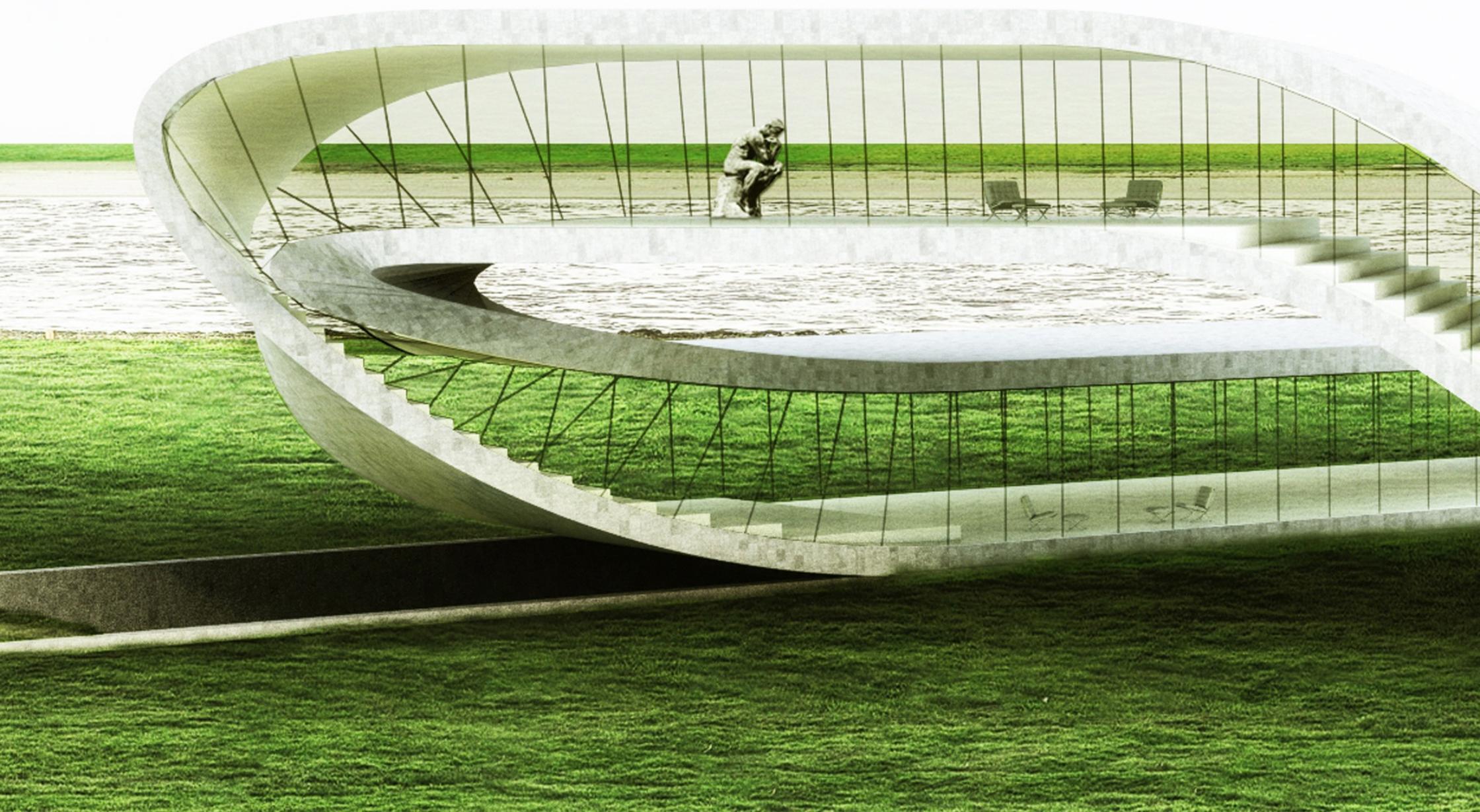


Joris Laarman



Arup





ARTS

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

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

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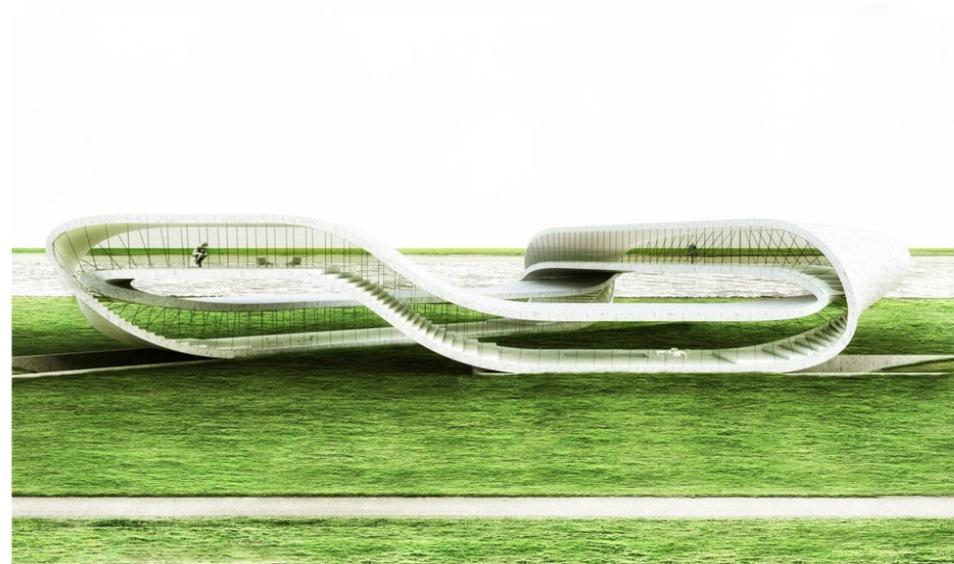
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Architects and designers have utilized 3D printing technology as part of their work for many years, but it is only now that an architect has come forward with a design for an actual, habitable residence using that same technology.

Dutch architect Janjaap Ruijssenaars 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.

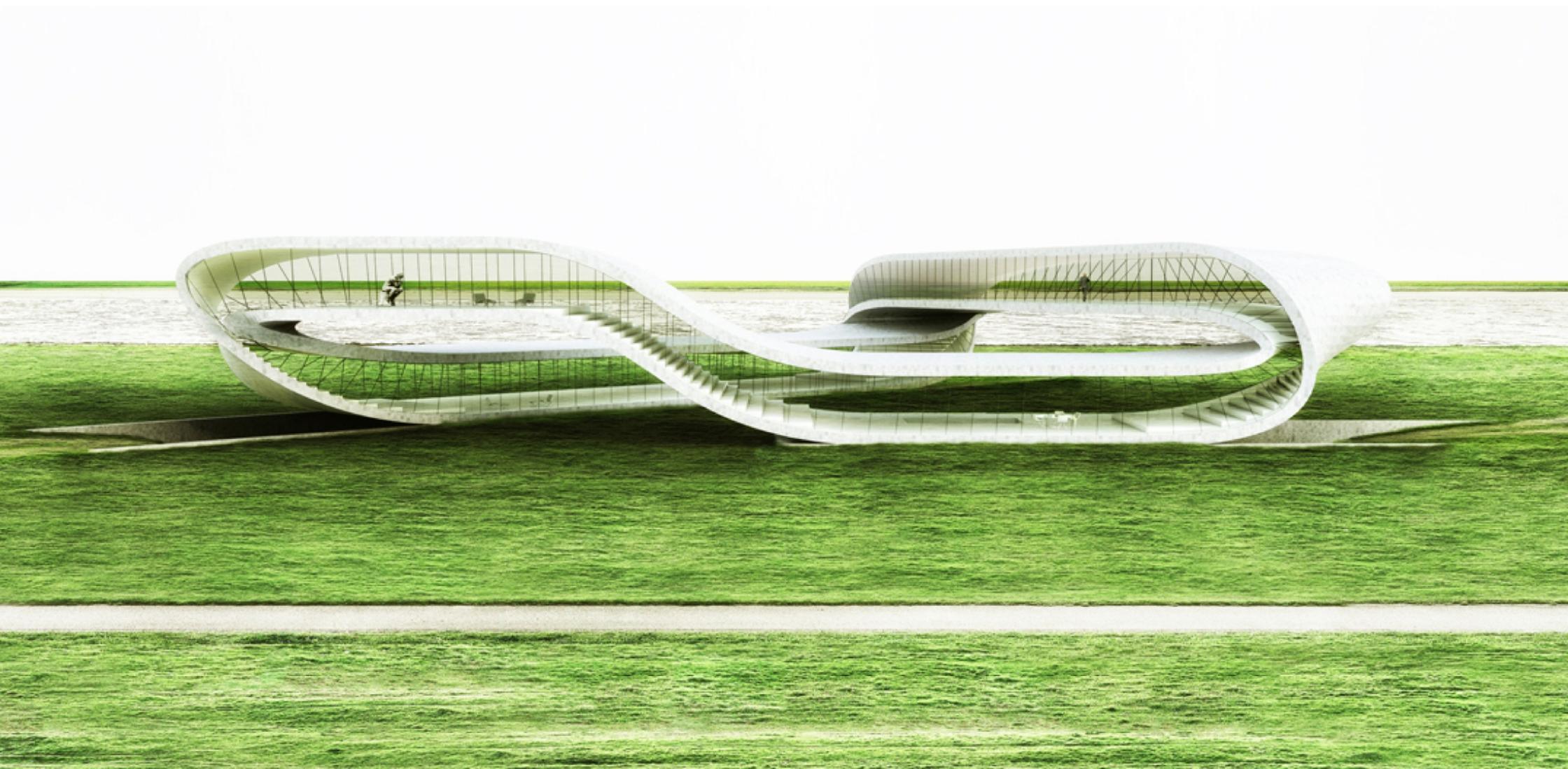
ARUP

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

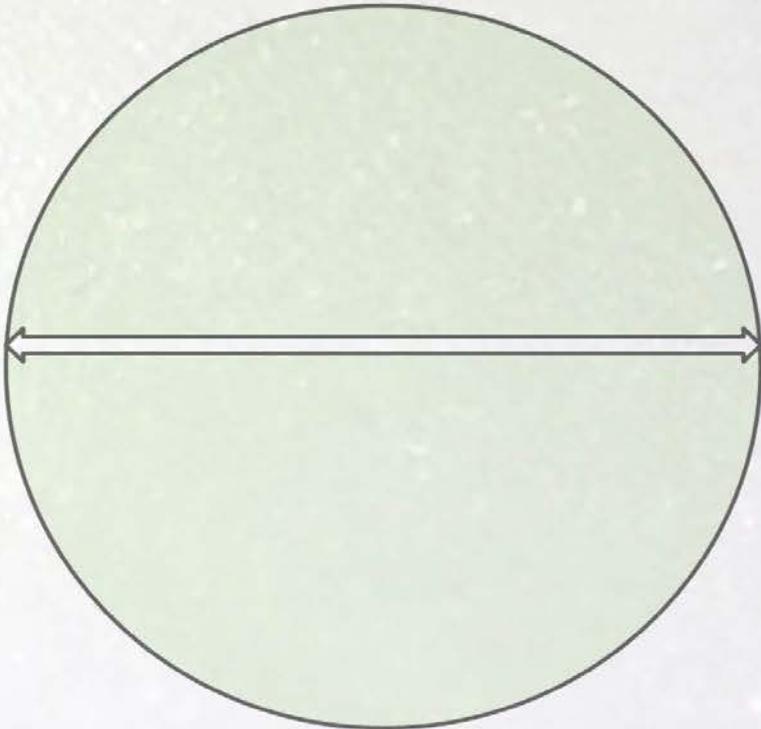
The physiology & behaviour of flora and fauna species and the relationships between them.



Image: M. Sterry

@melissasterry

Immaterial



material



"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

@melissasterry



Images: Strange Attractor by Johannes Hansen under Creative Commons License. Mount St. Helens in 1978 and the May 1980 eruption by US Geological Survey. Alpine Lupins by Johnston Ridge Observatory under Creative Commons License. Mount Saint Helens in summer 2003 by Eborutta, Wikimedia Commons.

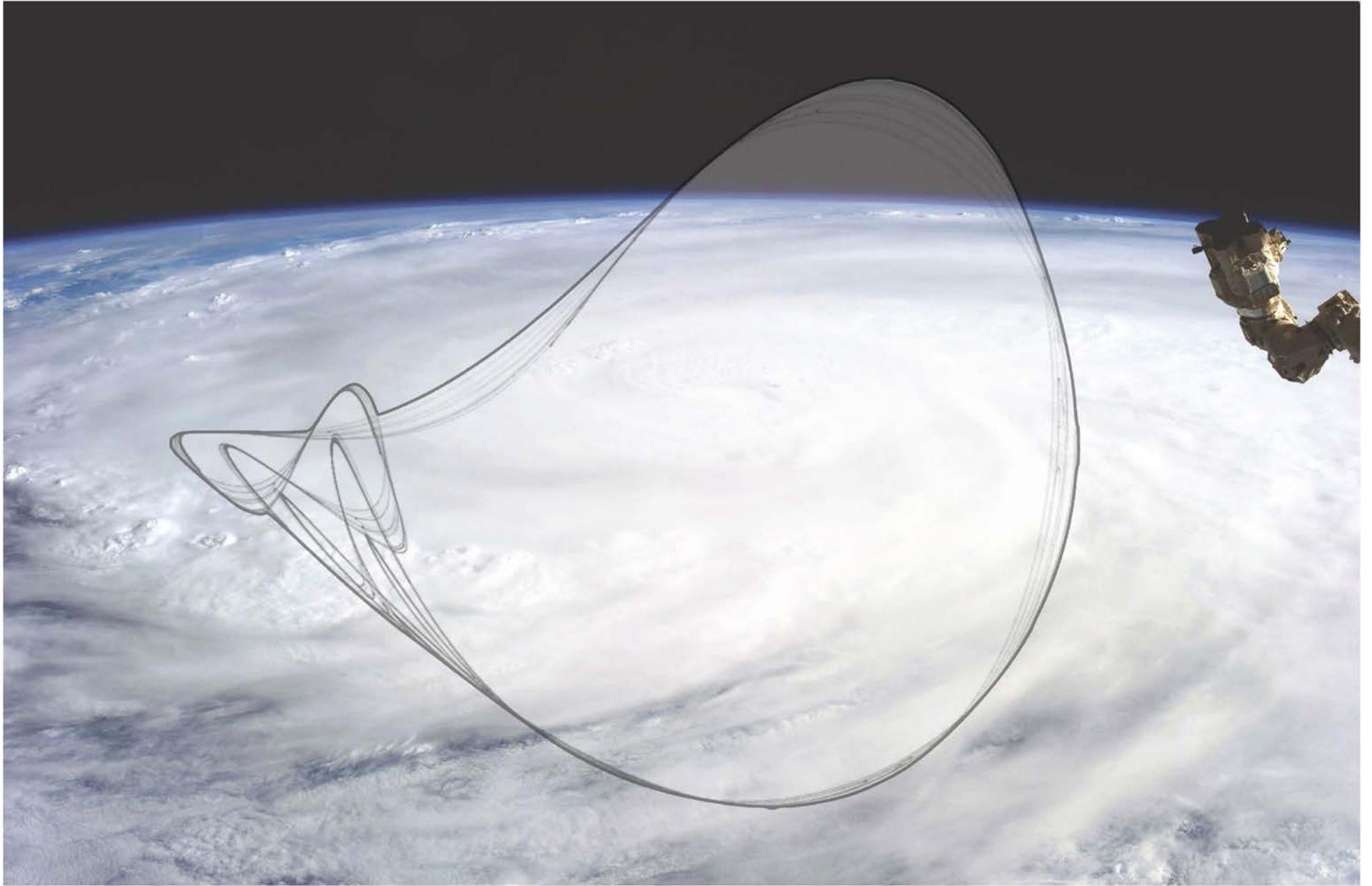
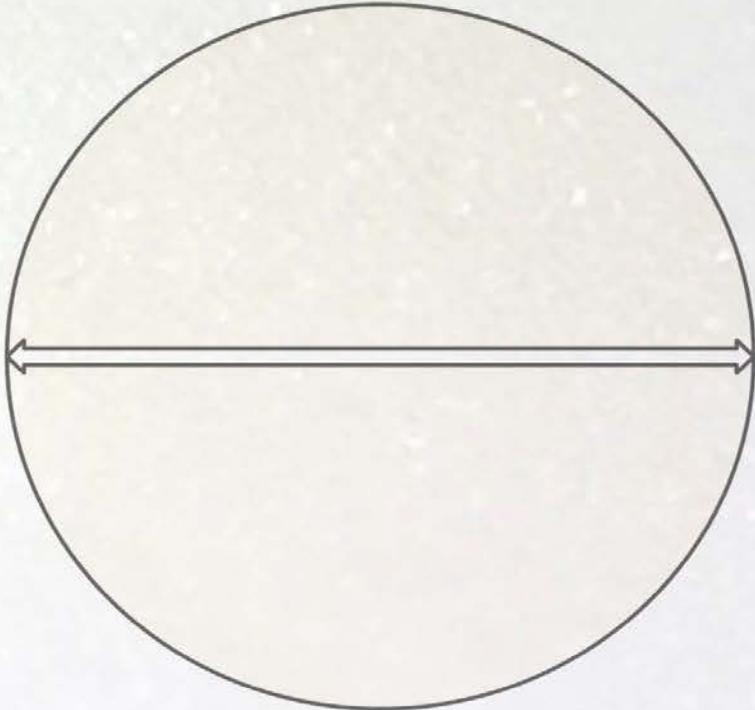


Image: Strange Attractor Johannes Hansen, Creative Commons License. Typhoon Haiyan by Karen Nyberg, NASA.

Information

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Objects



"The Circle of Variability" (2013)

Diagram: M. Sterry

#LeapfrogProject

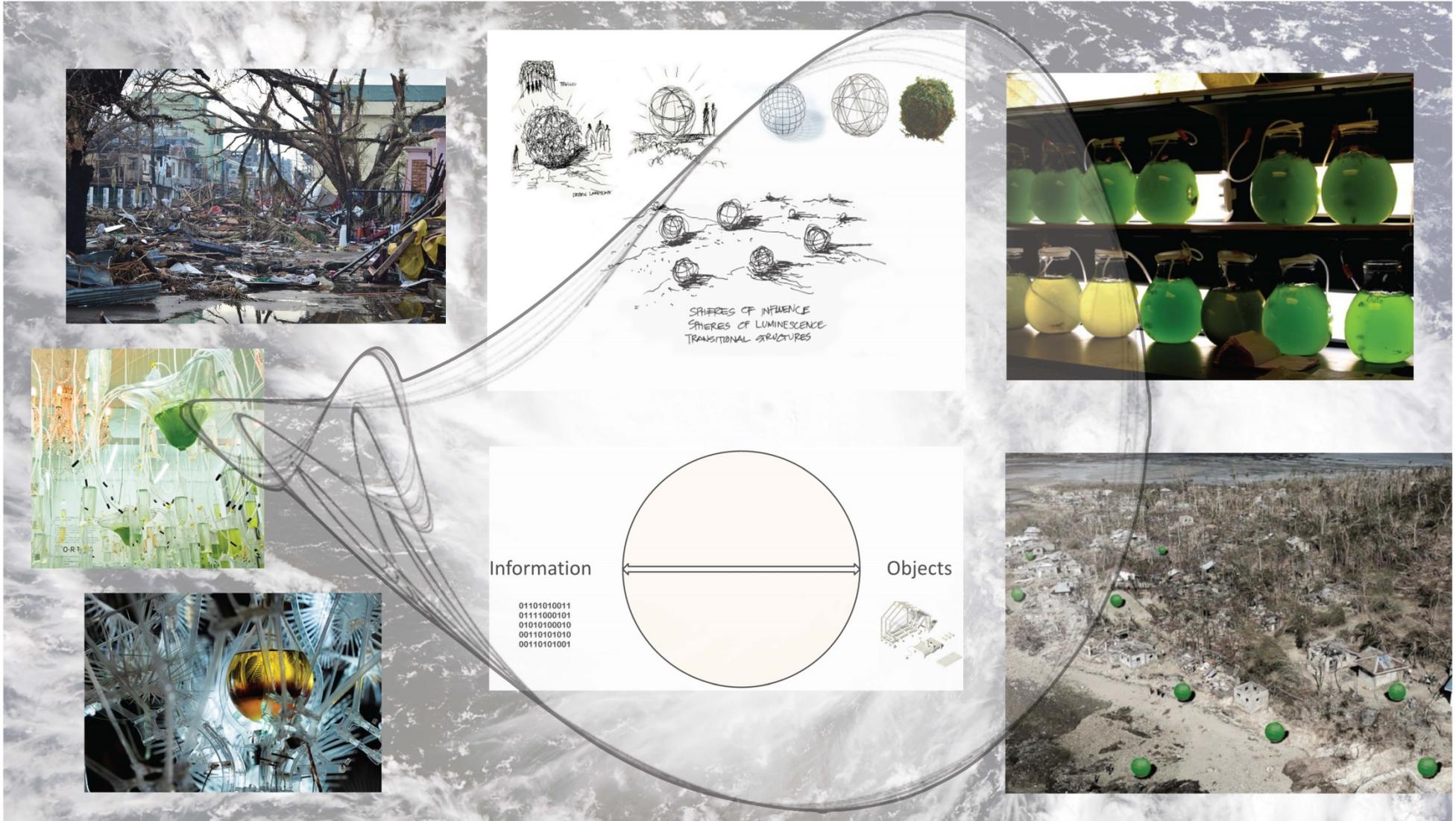
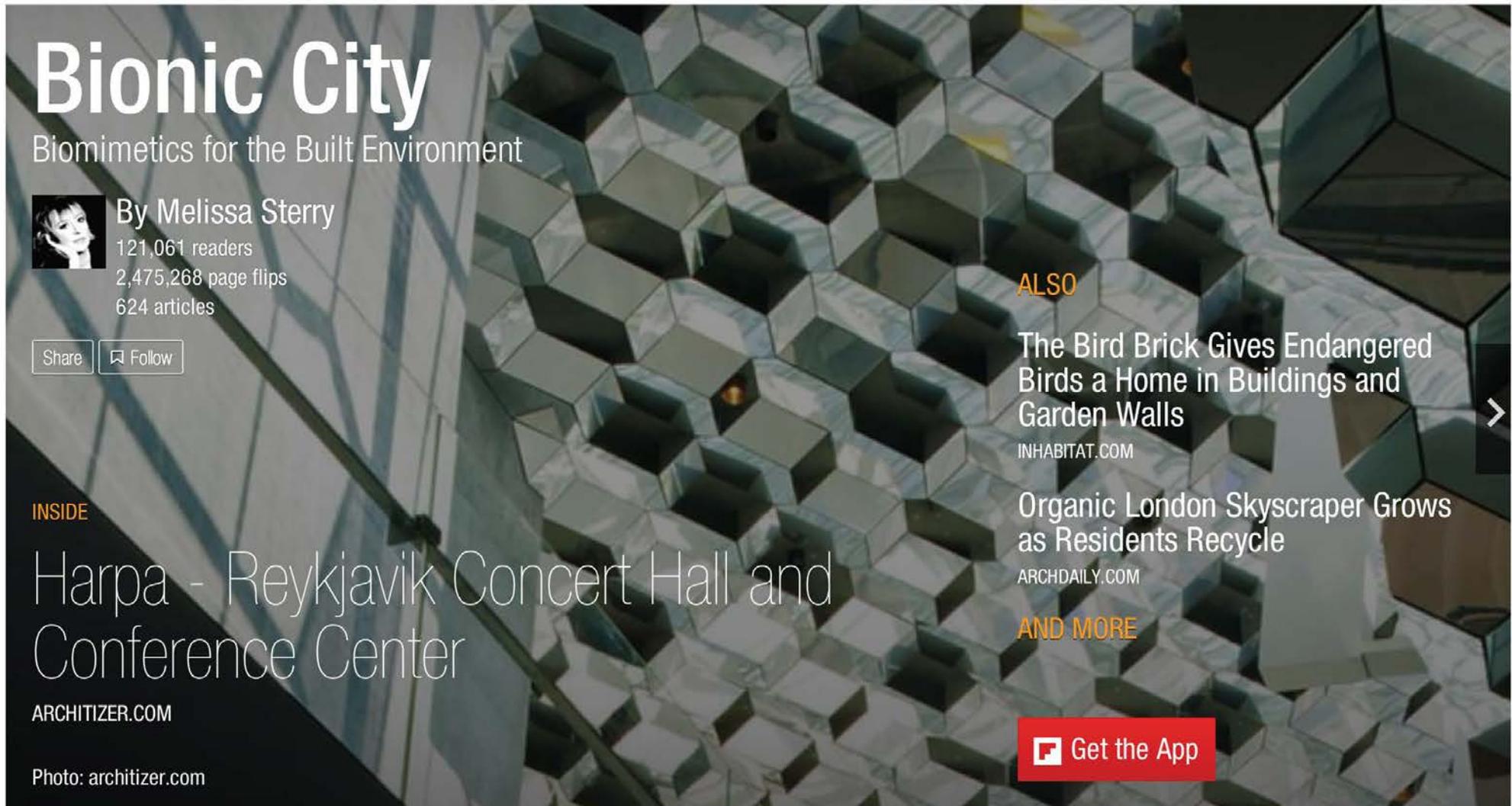


Image: Typhoon Haiyan, NASA, NOAA. Tacloban post Haiyan, Trocaire, Wikimedia Commons. Strange Attractor Johannes Hansen, Creative Commons License. Living Installation sketches and photography by Leapfrog Project. Circle of Variability by Melissa Sterry. Living Architecture by Rachel Armstrong & Philip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



Bionic City

Biomimetics for the Built Environment

 **By Melissa Sterry**
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Any Questions?

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