Materiales experimentales:
De los materiales y sistemas al diseño de procesos info-energético-materiales

Segunda parte / audiovisuales y comentarios
MCAS 2017/18 | ETS.Arquitectura Universidad de Sevilla

José Pérez de Lama 04.2018| actualizado 05.2020 | guión de clase

Sandro Botticelli, 1482, *Alegoría de la Primavera*. Fuente: wikimedia.org

Contenidos/

Nuevos y viejos materiales / procesos

** Recordatorio de la madera (Lara Bocanegra et al)*

** Gramazio & Kohler, ETH Zürich (Structural Oscillations...) 2007-08*

** Gramazio & Kohler, ETH Zürich (Flight Assembled Architecture...) 2010-11*

** Recordatorio Material Systems AA (Hensel, Menges, Weinstock...)*

** Achim Menges, Stuttgart ICD, 0 (ICD/ITKE research pavilion) 2013/14*

** Achim Menges, Stuttgart ICD, (ICD/ITKE research pavilion) 2016/17*

** Achim Menges at al, Stuttgart, 3 (Responsive Hygroskin) 2008-2013*

** Architectural Association, Tree-Barn, 2016 (memoria de los commons...)*

** Neri Oxman, MIT (Silk Pavilion) 2013*

Contenidos *I* (sigue)

** Marta Malé Alemany, IaaC / AA, FabBots (2008-2010)*

** Iaac, Aretí Markopolou & team, Minibuilders (2014)*

** Ecologic Studio (cyanobacterias...)*

** Programar micro-sistemas (Fab 3.0), la forma batesoniana / dry nanotechs*

**** El paradigma ADN & el paradigma Lego / wet nanotechs*

** Programar la materia (Fab 4.0) / diseñar con Avogadro, electricidad...*

** Cuidar & componerse con lo vivo (biohacking, ciclos largos, de vuelta a la madera)*

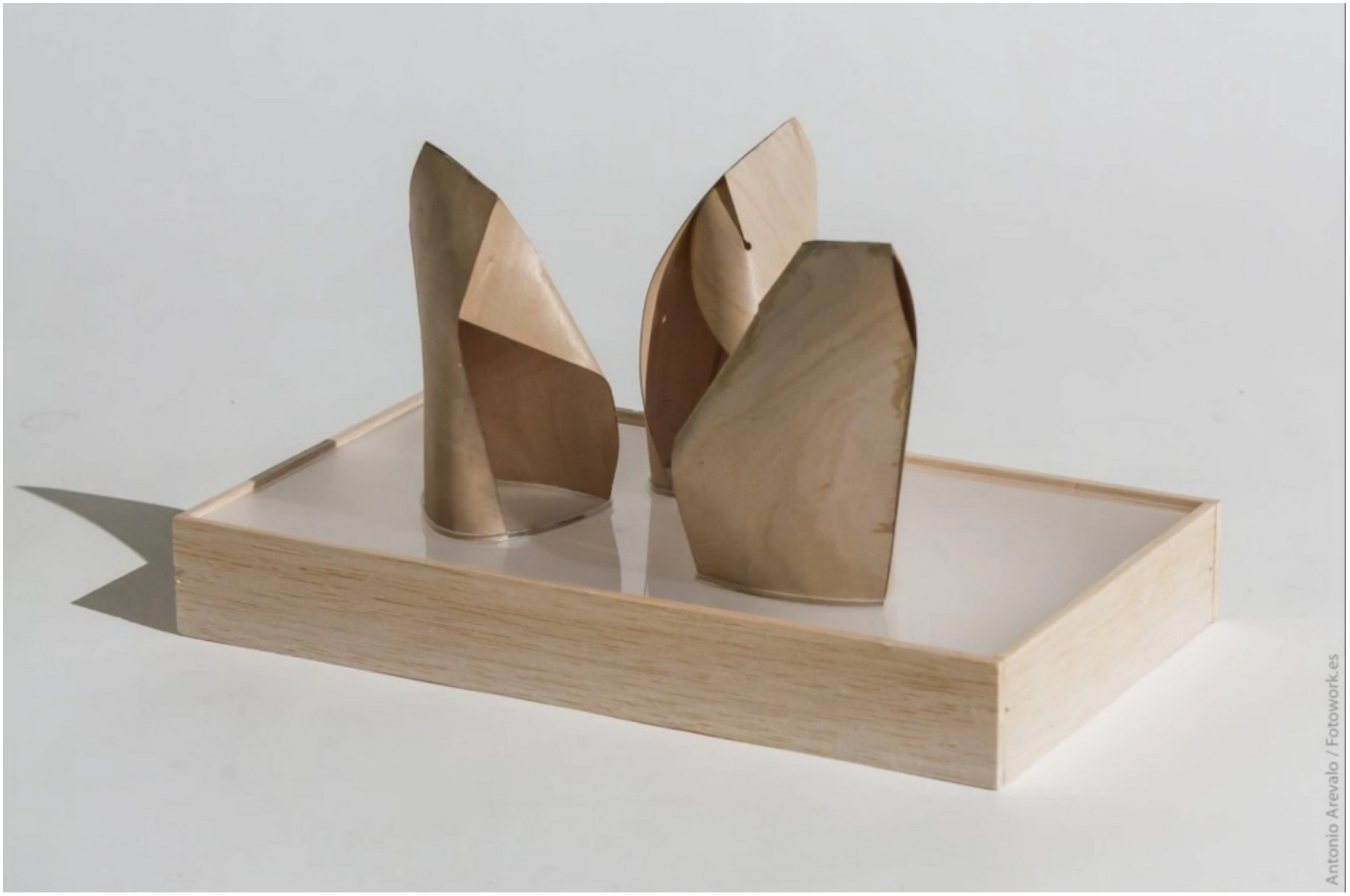
Coda:

Machines of Loving Grace

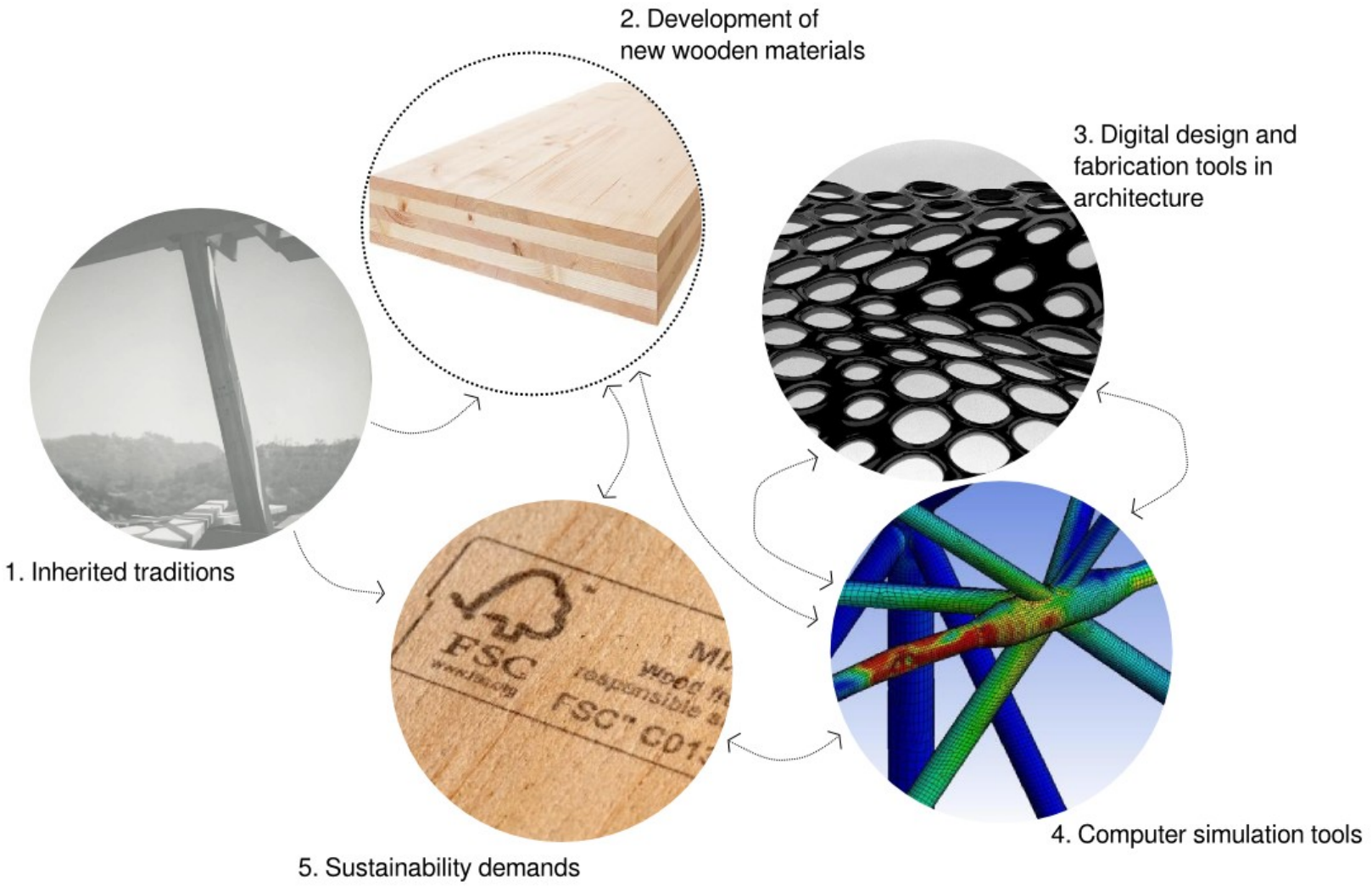
Langdon Winner, Whale / Reactor

Iván Illich, Convivencialidad

If You Can't Dance It's Not my Algorithm



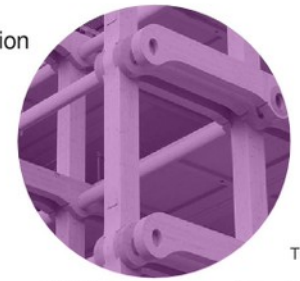
Vídeo exposición nueva construcción en madera
ETSA & Fab Lab 2016 / A. Lara Bocanegra y colaboradores


2. Development of
new wooden materials
3. Digital design and
fabrication tools in
architecture
1. Inherited traditions
FSC
4. Computer simulation tools
5. Sustainability demands

1. Structural canonical types form generation

1.1. Canonical structural types
Las Arenas Shopping Mall, Barcelona
Alonso-Balagué Rogers, 2011

Structural rationality ■■■
Form / structural innovation ■□□
Analogue <-> digital character ■□□
Digital tools integration ■□□
Tools & processes accessibility ■■■



Structural rationality ■■■
Form / structural innovation ■■□
Analogue/digital character ■□□
Digital tools integration ■□□
Tools & processes accessibility ■■■

1.2. Analogue transformations of canonical types
Tamedia Office Building, Zürich
Shigeru Ban, 2013

1.3. Digital transformations / parametrizations of canonical types
Timber Wave, London
Amanda Levete, AL_A, 2011

Structural rationality ■■□
Form / structural innovation ■■□
Analogue/digital character ■■□
Digital tools integration ■■□
Tools & processes accessibility ■■□

2. Plastic-visual form generation

Structural rationality ■■□
Form / structural innovation ■□□
Analogue/digital character ■□□
Digital tools integration ■□□
Tools & processes accessibility ■■□

2.1. Form generation from graphic patterns
Sumika pavilion, Tokyo
Toyo Ito, 2008

Structural rationality ■□□
Form / structural innovation ■□□
Analogue/digital character ■■□
Digital tools integration ■□□
Tools & processes accessibility ■■□

2.2. Digital processing of sculptural forms
Metrosol Parasol, Sevilla
Jürgen Mayer, 2011

3. Digital / computational form generation

Structural rationality ■□□
Form / structural innovation ■■■
Analogue/digital character ■■□
Digital tools integration ■□□
Tools & processes accessibility ■■□

3.1. Generative / algorithmic form finding
Fractal Pavilion, London
Architectural Association, 2006

3.1. Form finding through fabrication process conditions
Sequential pavilion, Zürich
ETH / Gramazio & Kohler, 2010

Structural rationality ■■■
Form / structural innovation ■■■
Analogue/digital character ■■■
Digital tools integration ■■■
Tools & processes accessibility ■□□

3.3. Material computation
ICD/ITKE pavilion
Achim Menges et al., 2010

Structural rationality ■■■
Form / structural innovation ■■■
Analogue/digital character ■■■
Digital tools integration ■■■
Tools & processes accessibility ■□□

(*) "Equalizer" values refer mostly to the shown examples and are, by now, the authors' subjetive appreciations

Architectural Timber Structures and Form Generation: A Tentative Cartography

A.J. Lara & J. Pérez de Lama / Fab Lab Sevilla / University of Sevilla 2014

GRAMAZIO KOHLER RESEARCH

Current
Thin Folded Concrete Structures
Jammed Architectural Structures
On-site Robotic Construction
Mesh Mould Metal
Smart Dynamic Casting and Prefabrication
Spatial Timber Assemblies
Robotic Lightweight Structures

2017
Mesh Mould and In situ Fabricator
Complex Timber Structures

2016
Spatial Wire Cutting
Robotic Integral Attachment
Mobile Robotic Tiling

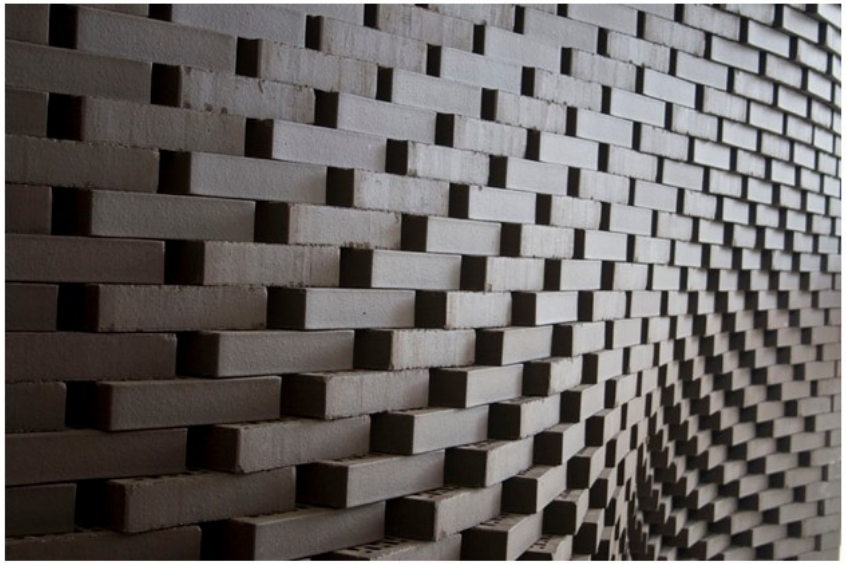
2015
YOUR Software Environment
Aerial Construction
Smart Dynamic Casting
Topology Optimization

2014
Mesh Mould
Acoustic Bricks

2013
TailorCrete

2012
BrickDesign
Echord

2010



De

Structural Oscillations, 2007-2008 | Installation at the 11th Venice Architectural Biennale
https://vimeo.com/69236155 | http://gramaziokohler.arch.ethz.ch/web/e/forschung/142.html

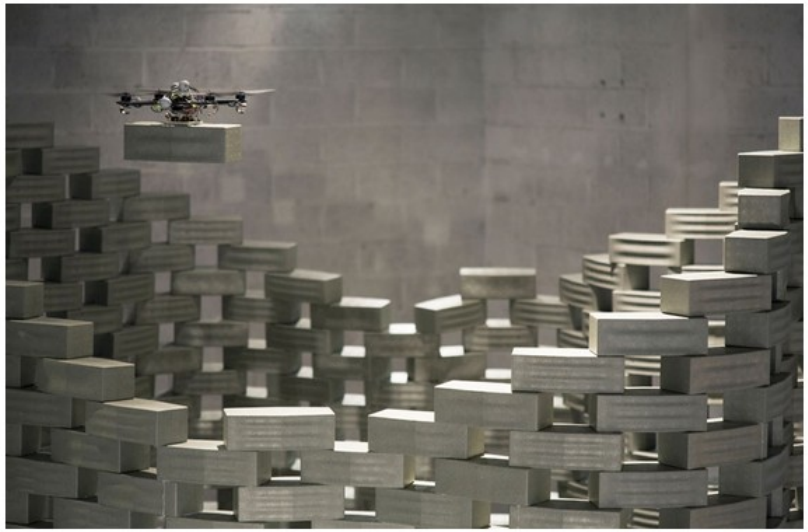
GRAMAZIO
KOHLER
ARCHITECTS

Buildings
Installations
- Spannungsreihe
- Flight Assembled Architecture
- Illumination Zellwegerpark
- Architonic Concept Space
- Lightline
- Park illumination
- XMAS Bahnhofstrasse
- Byte Cube
- Interference Cube
- mTable

Contact

Deutsch

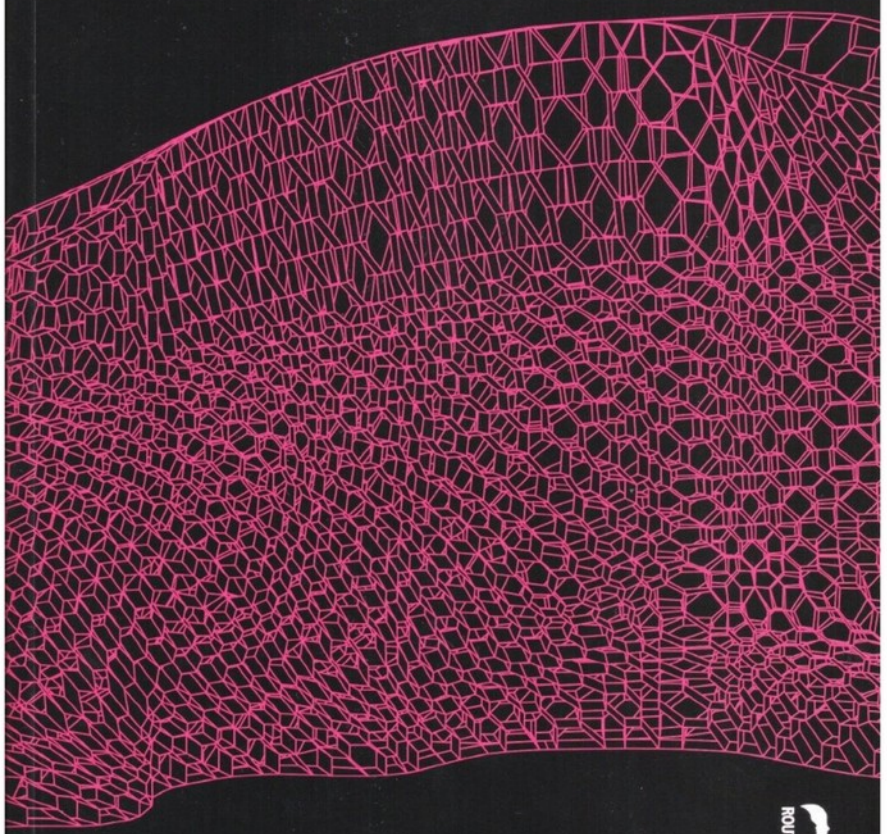
Flight Assembled Architecture, 2011-2012
FRAC Centre Orléans



Flight Assembled Architecture, 2010-11, Installation FRAC Orleans
http://www.gramaziokohler.com/web/e/installationen/209.html

EMERGENT TECHNOLOGIES AND DESIGN

Towards a biological paradigm for architecture



Michael Hensel, Achim Menges and Michael Weinstock

ROUTLEDGE

0.2

Natural systems analysis: bamboo. In order to investigate the relation of bamboo's overall morphology and its anatomy, digital models of different scales were constructed. The relative densities and strengths of the fibres and surrounding matrix were established, so that FEA simulations of the response to different stresses and loadings could be conducted. For example, the deflection behaviour of the stem (top) was investigated in relation to the local stem morphology around the diaphragm and the intermodal transition of the stem cross section (centre) as well as the interaction between stiff fibres and the much softer surrounding material matrix on the microscopic scale (bottom). EmTech Natural Systems Module, Atul Singla, Juan Subercaseaux, Li Zou and Taek Yong Yoon, 2005.

Hensel, Menges, Weinstock, 2010

Gottfried Semper, 1851, *Die vier Elemente der Baukunst*

hogar: fuego, cerámica
suelo: cantería / *la cueva, lo sublime..?*
techo: carpintería
cerramiento: tejido

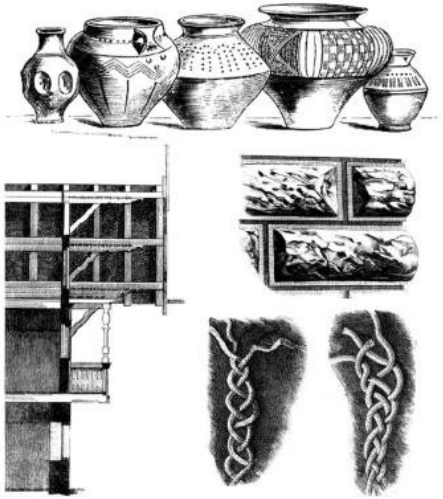


FIG 3.10 *Semper's illustration of the four primary artisan traditions and their relationship to the expression of the four elements of architecture.*

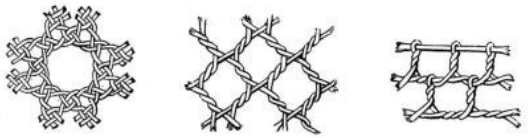


FIG 3.11 *Semper's illustration of typical knot forms found in traditional practice depicting the beginning of the joint and architecture.*

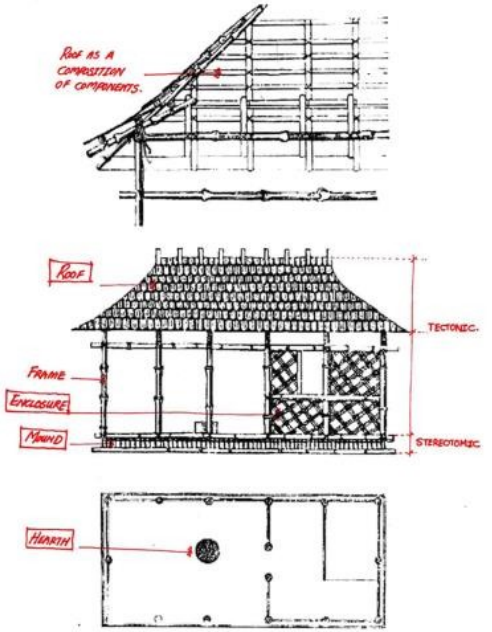


FIG 3.9 *Semper's illustration of the Caribbean hut depicting the four elements of architecture.Annotations by author.*

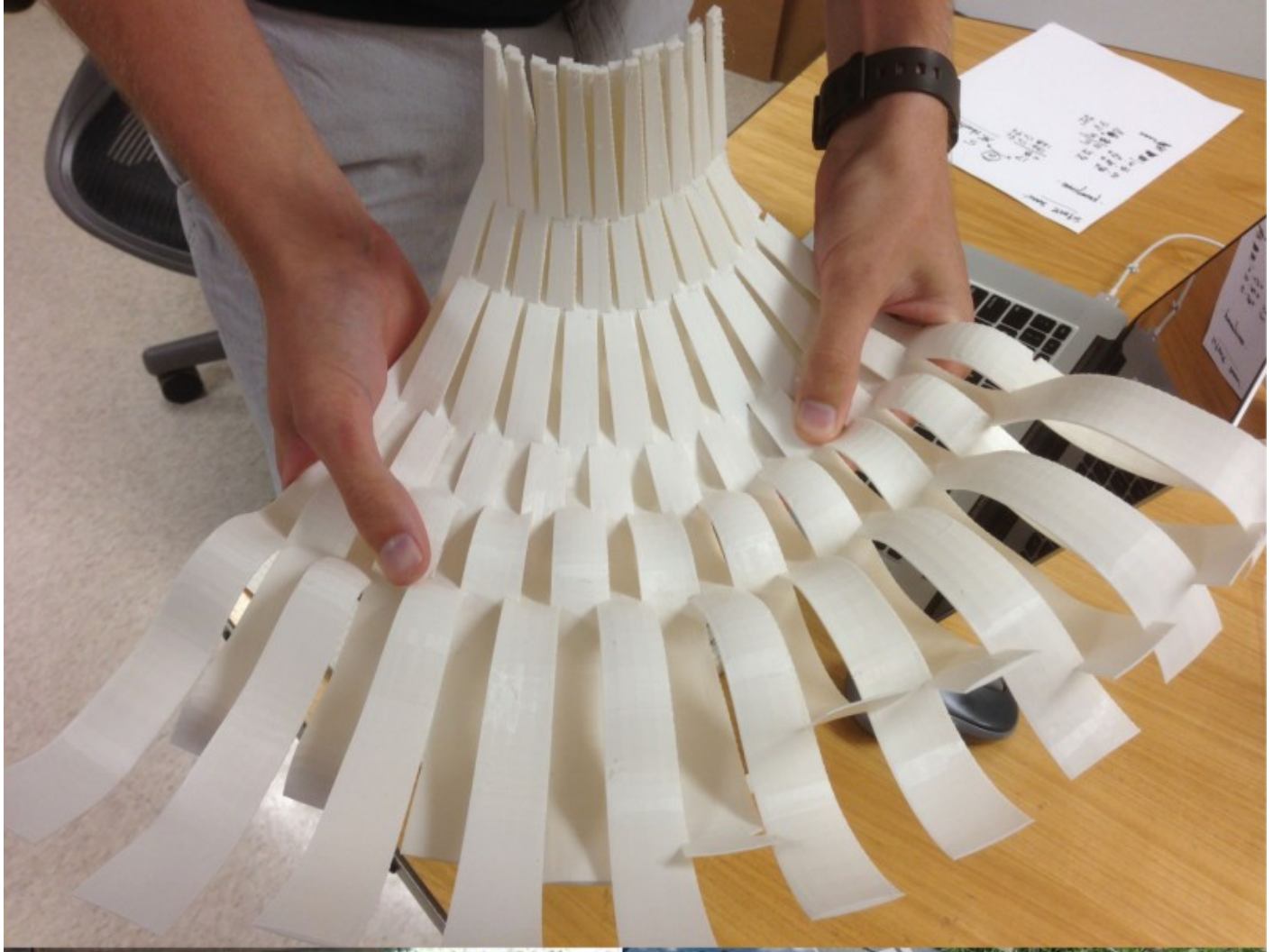
PRIMITIVE | PARAMETRIC

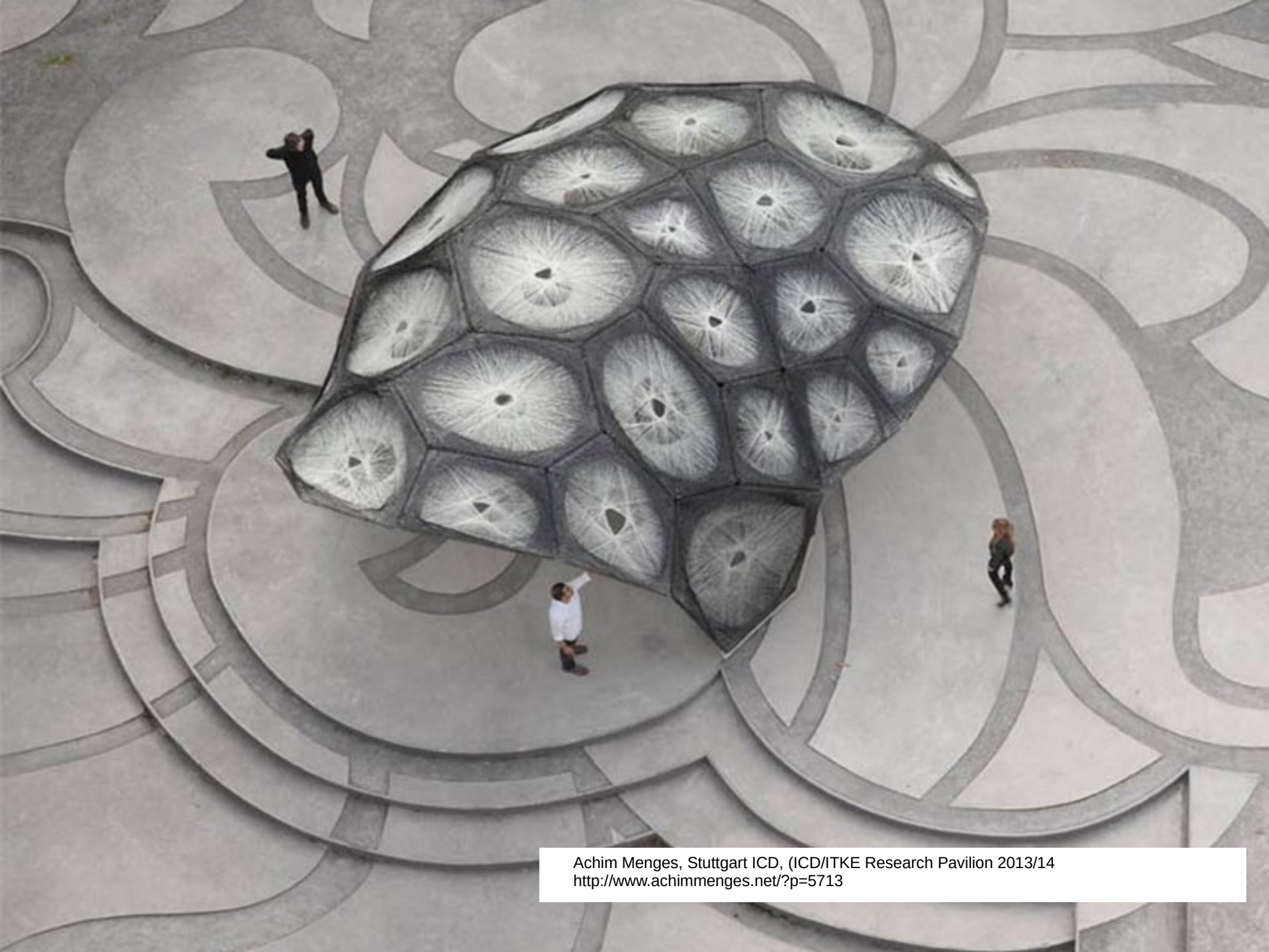
S Ca Ce T

carpentry
ceramics
stereotomy
textiles

https://raceandarchitecture.com/2014/03/26/architectural-biology-in-the-genomic-age/

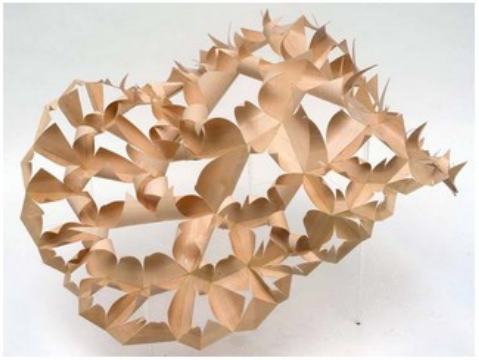
SEMPER | MENGES





Achim Menges, Stuttgart ICD, (ICD/ITKE Research Pavilion 2013/14
http://www.achimmenges.net/?p=5713

Achim Menges, Stuttgart ICD, (ICD/ITKE Research Pavilion 2016/17
http://www.achimmenges.net/?p=19995

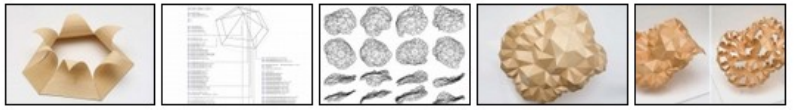


2008 HfG Offenbach

Form Generation and Materialisation (Prof. A. Menges)

Responsive Surface Structure II

Steffen Reichert



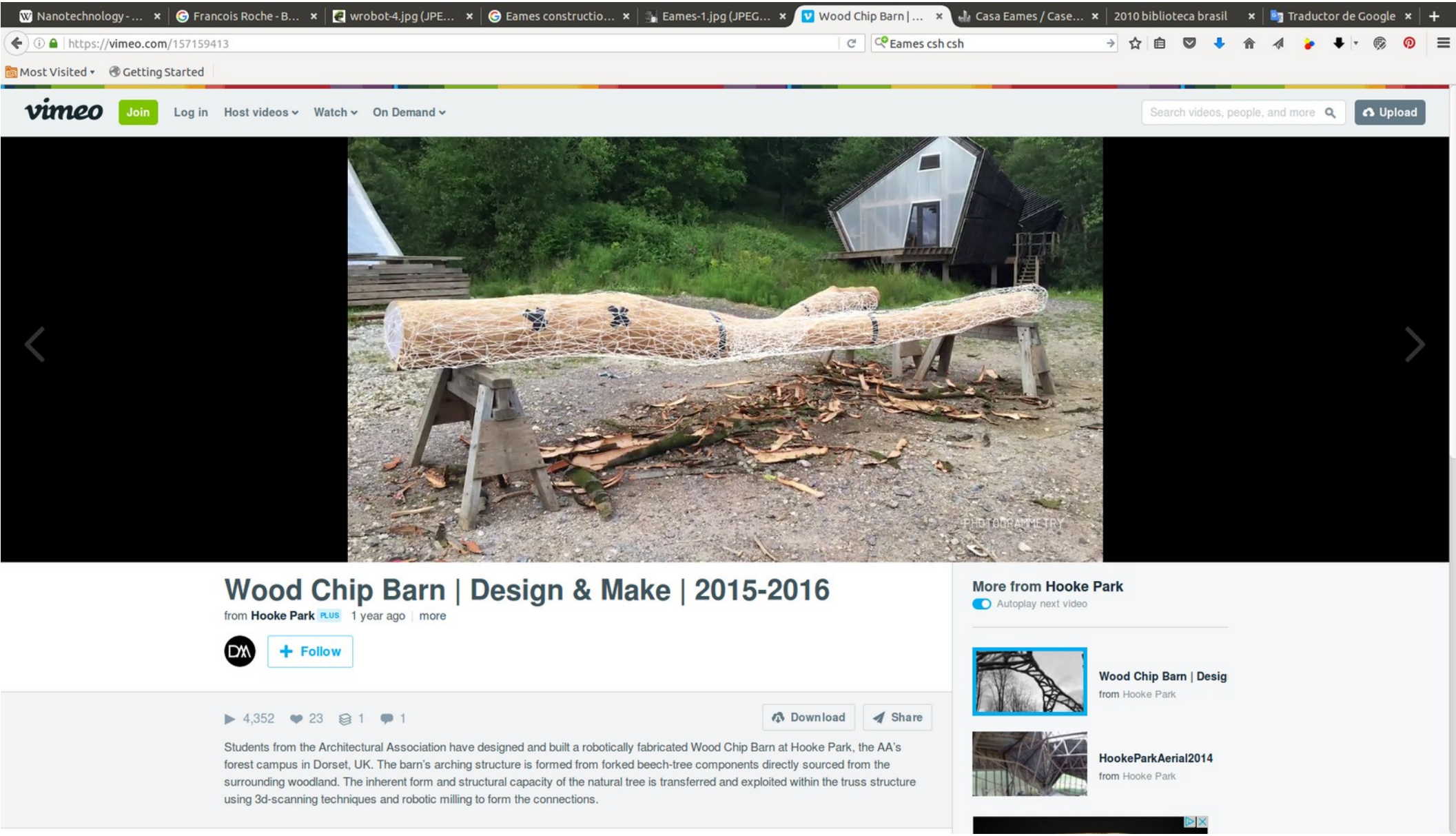
Responsive Surface Structure II

The second research phase of the Responsive Surface Structure project focused on the development of a more integral system that constitutes both the reactive skin and the load bearing structure within one material system. Through variations in local thickness and fibre direction it is possible to construct the system from wood laminates only. The ordering system of the four to seven sided polygonal elements is algorithmically derived. The computationally evolved surface structure allows for articulating globally doubly curved surfaces with varying densityof elements in response to different structural requirements.

A functional, full scale prototype was constructed and tested. Once exposed to changes in relative humidity the opening and closure of each local component results in different degrees of porosity over time and across the surface, which is both structure and responsive skin. This high level of integration of form, structure and material performance enables a direct response to environmental influences with no need for additional electronic or mechanical control.

Department of Form Generation and Materialisation (Prof. Achim Menges)
Steffen Reichert, HFG Offenbach University of Art and Design, Germany, 2008

A. Menges & Steffen Reichert, 2008-2011, Responsive Surface Structure II
http://www.achimmenges.net/?p=4638 | vídeo: https://vimeo.com/73727749



Architectural Association | Design & Make, 2016, Wood Chip Barn, https://vimeo.com/157159413

Interferencia: material computation & producción manual “convivencial” | Luces de Barrio, 2016-17, Polígono Sur Sevilla
Luca Stasi ctrl-z, foto dcha: Fernando Alda

Mediated Matter

About
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Environments
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Courses
News
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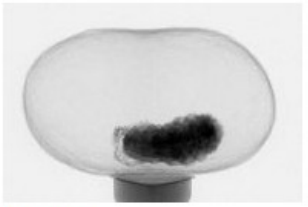
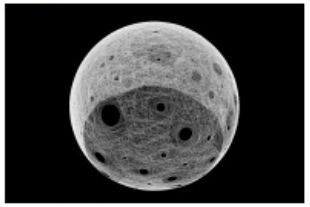
Project Video

Images

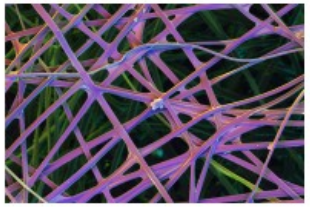


Experiments

Fabrications



Computations



Micrographs

Silk Pavillion

2013 CNC Deposited Silk Fiber & Silkworm Construction
MIT Media Lab

Markus Kayser, Jared Laucks, Jorge Duro-Royo, Carlos David Gonzalez Uribe, Prof. Neri Oxman

http://matter.media.mit.edu/environments/details/silk-pavillion

Marta Malé-Alemany, fabricación aditiva, (FAB)bots, Iaac & Architectural Association
Exposición Disseny Hub Barcelona, 2010 |

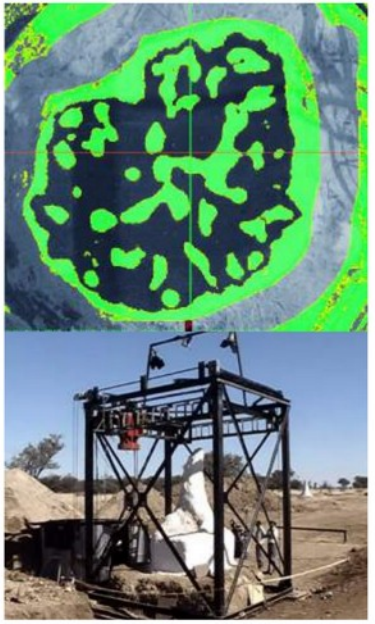


Figura 6.19
Desbaste y escaneado de un monte de termitas en Namibia

Figura 6.20
Impresora 3D XL para el depósito de materiales pastosos en la Universidad de Loughborough

Rupert Soar, Additive Manufacturing Research Group (AMRG), Universidad de Longhborough, hacia 2009; investigación hábitat termitas (http://www.archdaily.com/34235/the-termite-pavilion)
Izq. Fisac parametric variations, I+GC arquitetcura

Dcha. Rupert Soar; fuente, Marta Malé, 2015

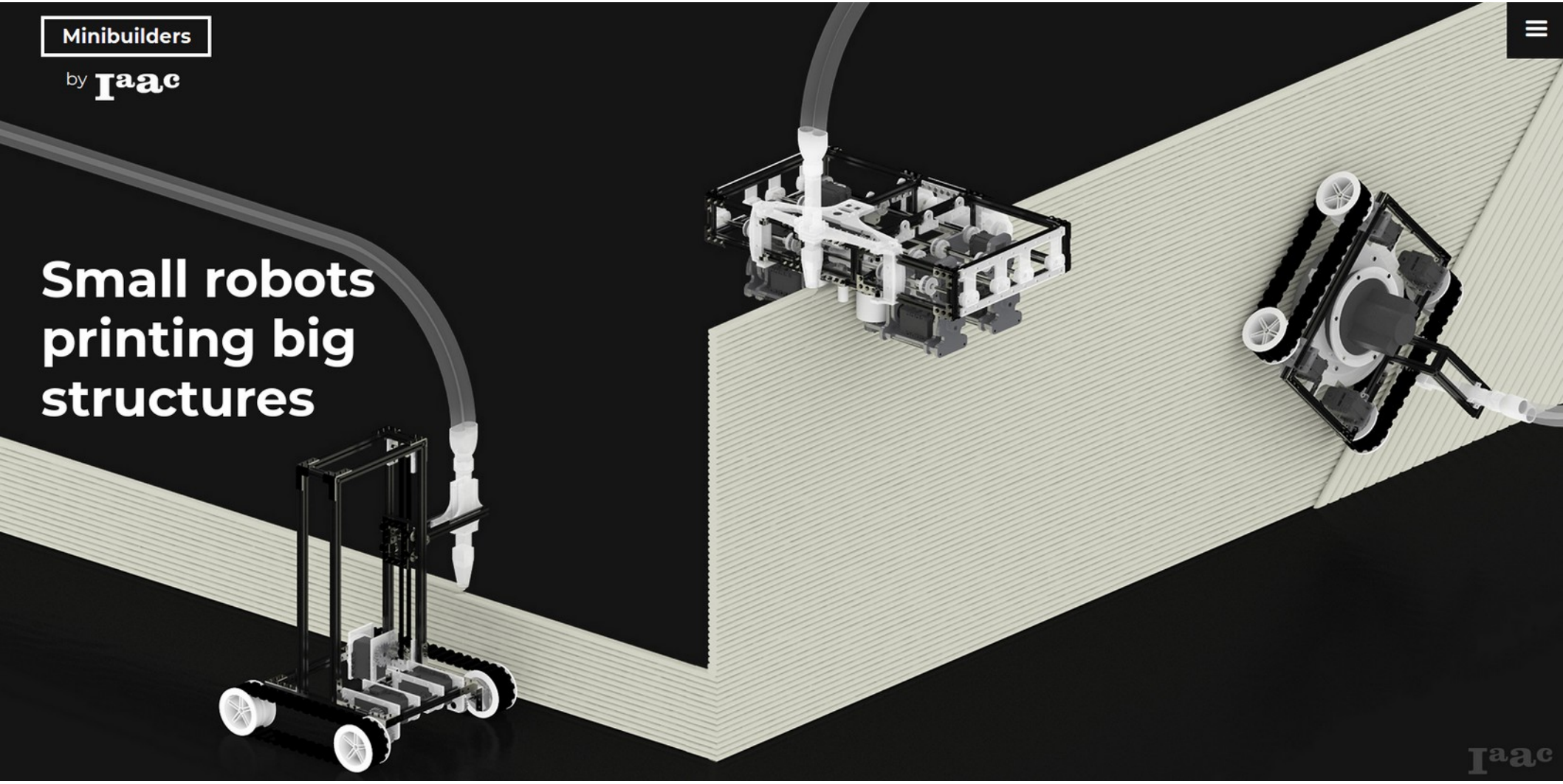
Marta Malé-Alemany en estancia de prácticas en D-Shape, con los hermanos Enrico y Riccardo Dini, y el arquitecto James Gardiner. La Toscana, Italia (Julio 2009)

Enrico Dini, D-Shape
Fuente: Marta Malé, 2015

(FAB)bots, *Fluid Cast*, Marta Malé-Alemany (profesora); equipo: Ma. Eugenia Villafañe, Ena Llorte, Catalina Pollak, Jaime de Miguel,

(FAB)bots

https://vimeo.com/search?q=%28FAB%29Bots
Presentation Marta Malé: https://vimeo.com/16954625
Presentaciónn exposición: https://vimeo.com/19349552
Digital Vernacular: https://vimeo.com/32596409
Fluid Cast: https://vimeo.com/32606570



Iaac, Aretí Markopolou & team, Minibuilders (2014) | https://vimeo.com/97976677 | http://robots.iaac.net/
Máster nuevo en robótica y arquitectura... 2018/19

H.O.R.T.U.S ZKM: ***Fibrous Structures*** / *algae* / *architecture* / *cyber-Gardens* / *water*

October 30, 2015

< > 1/ 2/ 3/ 4/ 5/ 6/ 7/ 8/ 9/ 10/ 11/ 12/ 13/ 14/ 15

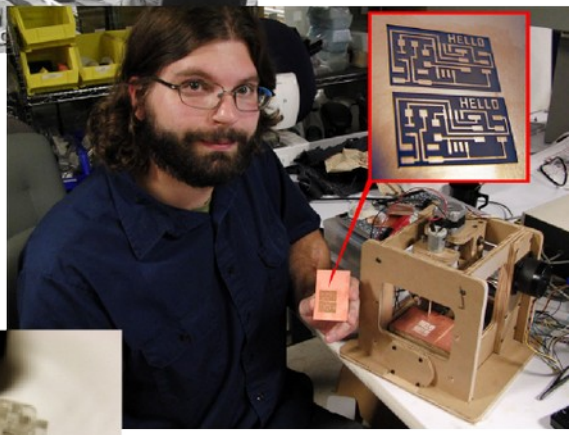
.H.O.R.T.U.S. Karlsruhe engages the notion of Urbansphere2 as an augmented biosphere; the synthesis of renewable energy and nutrients for human consumption is reconsidered as an urban practice enabled by a novel bio-digital gardening prototype; the architectural apparatus transforms the archetype of the column into an high-density photo-bioreactor able to connect in space and time human metabolism to the proliferation of life within micro-algal ecologies such as cianobacteria cultures.

Flows of Energy [light radiation], Matter[proteins, CO2] and Information [data-feeds] are processed and fed back in real-time, stimulating the emergence of multiple mechanisms of self-regulation and evolving novel forms of hybrid self-organisation.Visitors turned cyber-gardeners are invited to engage directly with H.O.R.T.U.S enriching their material experience of bio-digital micro-ecologies and embodying future urban cyber-gardening practices.

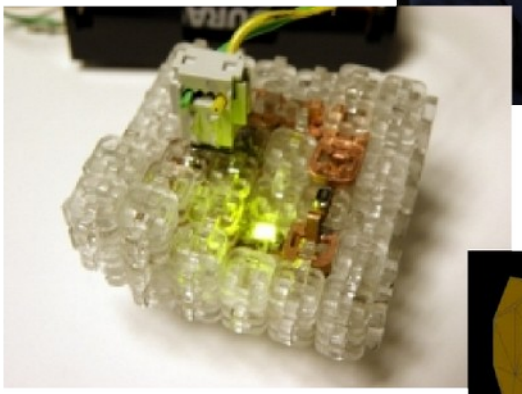
ecoLogicStudio, Claudia Pasquero & Marco Poletto, http://www.ecologicstudio.com/v2/index.php

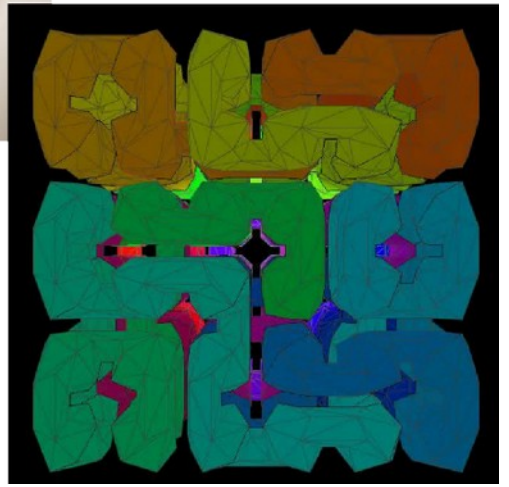
1.0: computers → machines

2.0: machines → machines



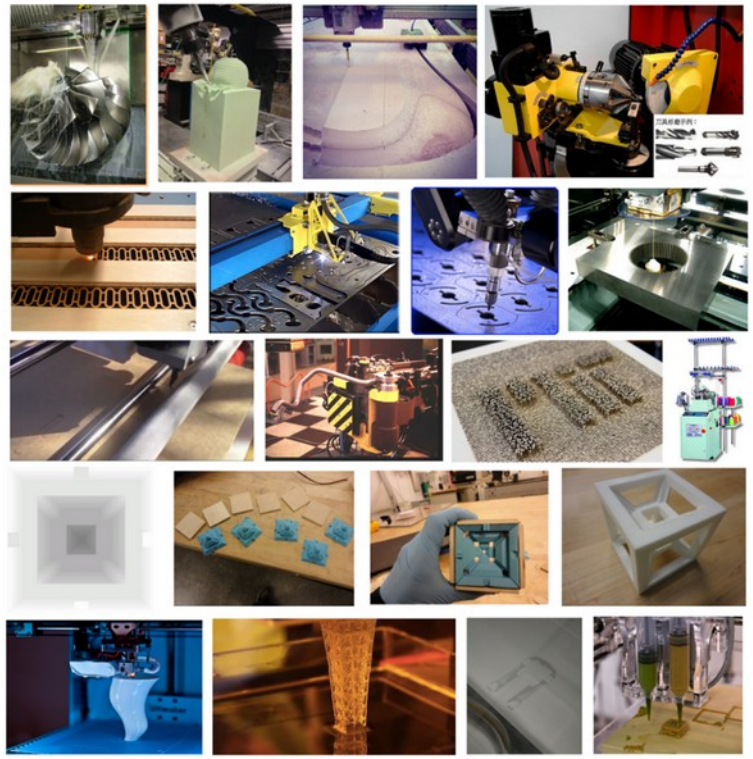
3.0: codes → materials





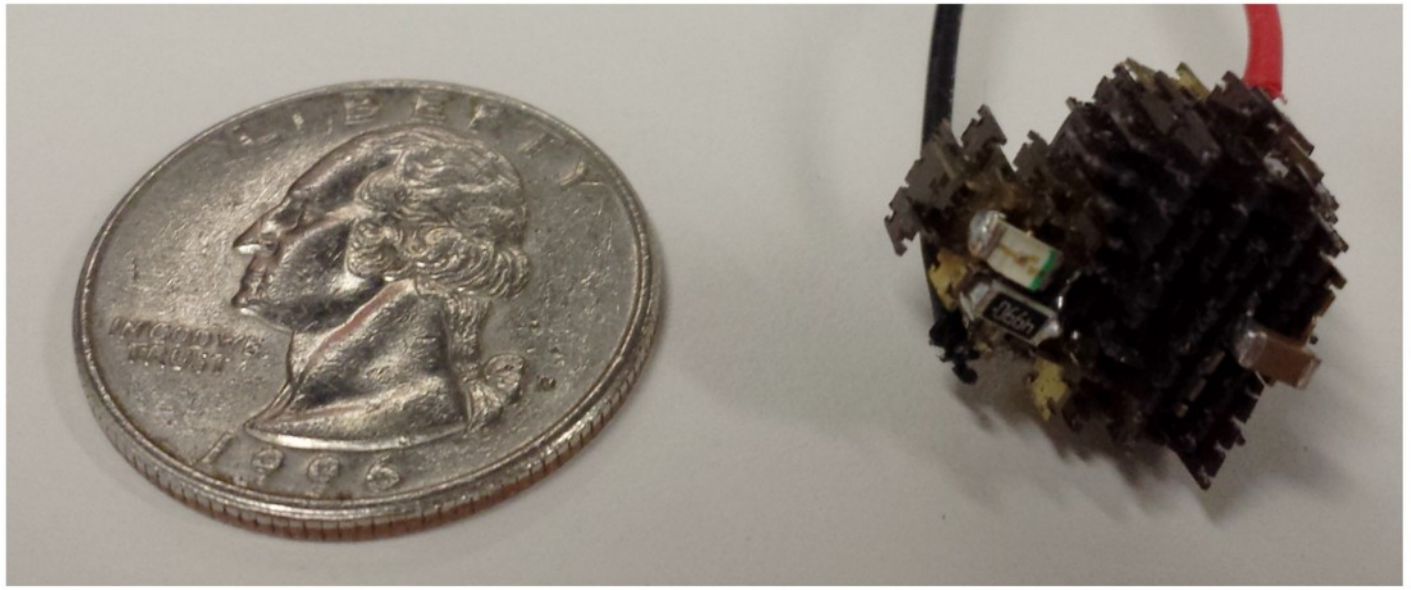
4.0: programs → materials

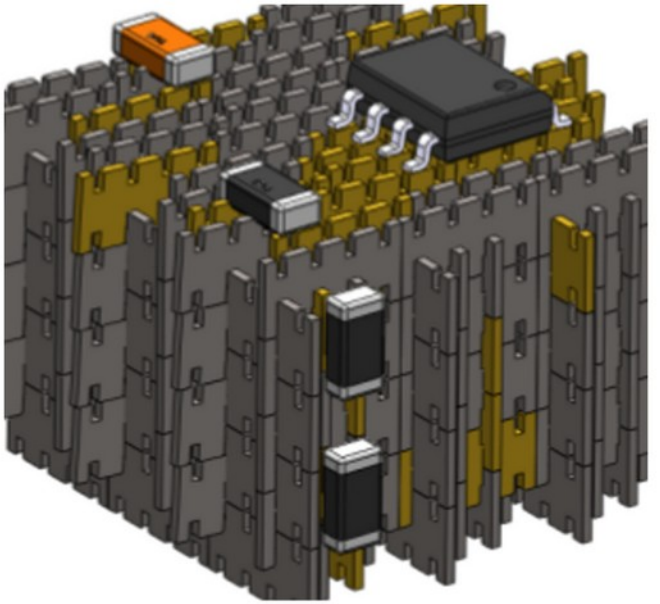
Neil Gershenfeld, 2015, 2018, http://ng.cba.mit.edu/show/script/17.09.fab.show.html

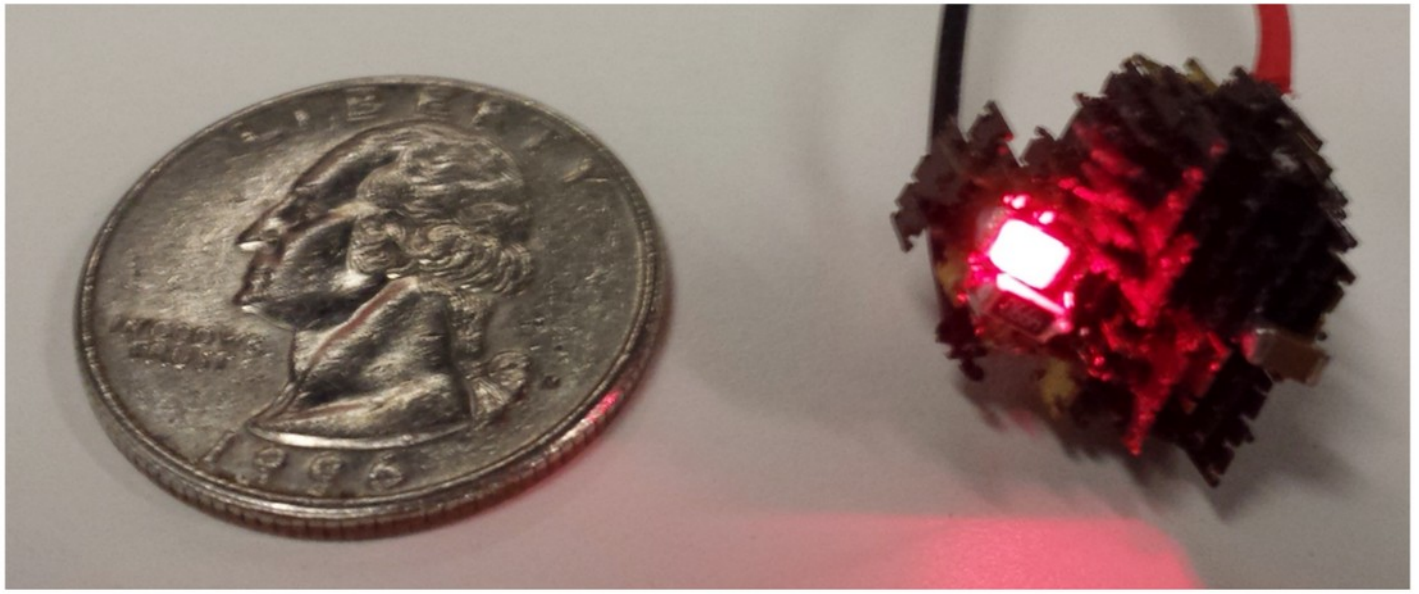


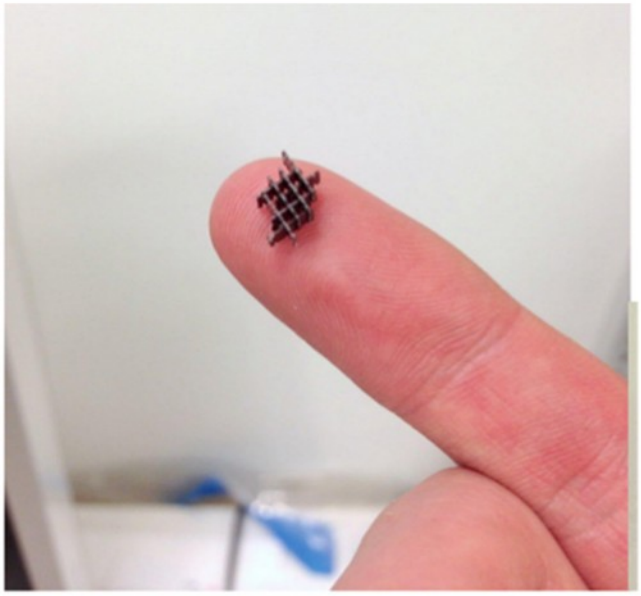
continuous	*state*	discrete
global	*metrology*	local
accumulate	*errors*	correct
similar	*materials*	dissimilar
irreversible	*reuse*	reversible

Neil Gershenfeld, 2015, 2018

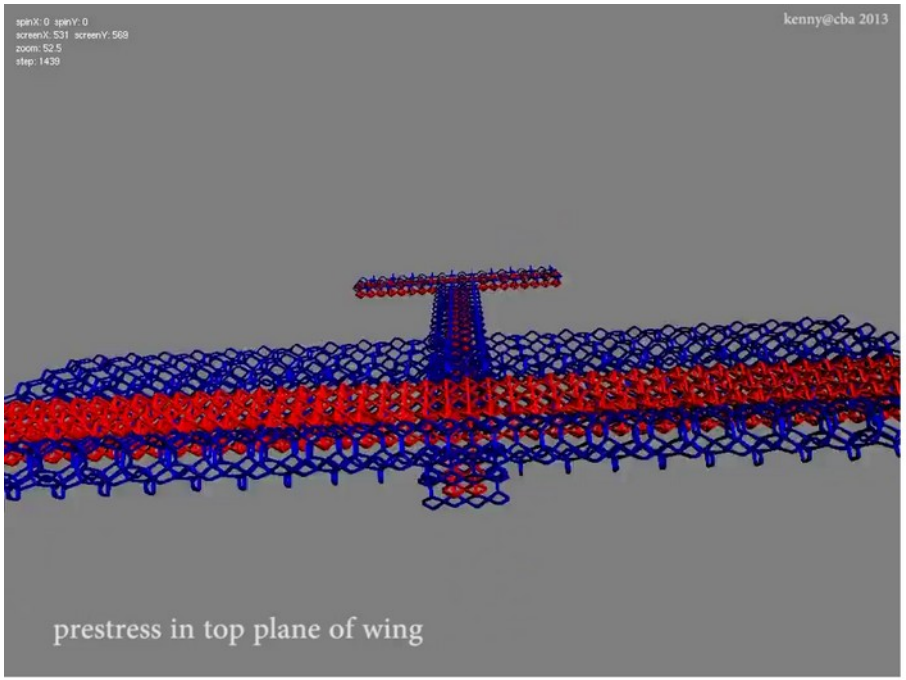


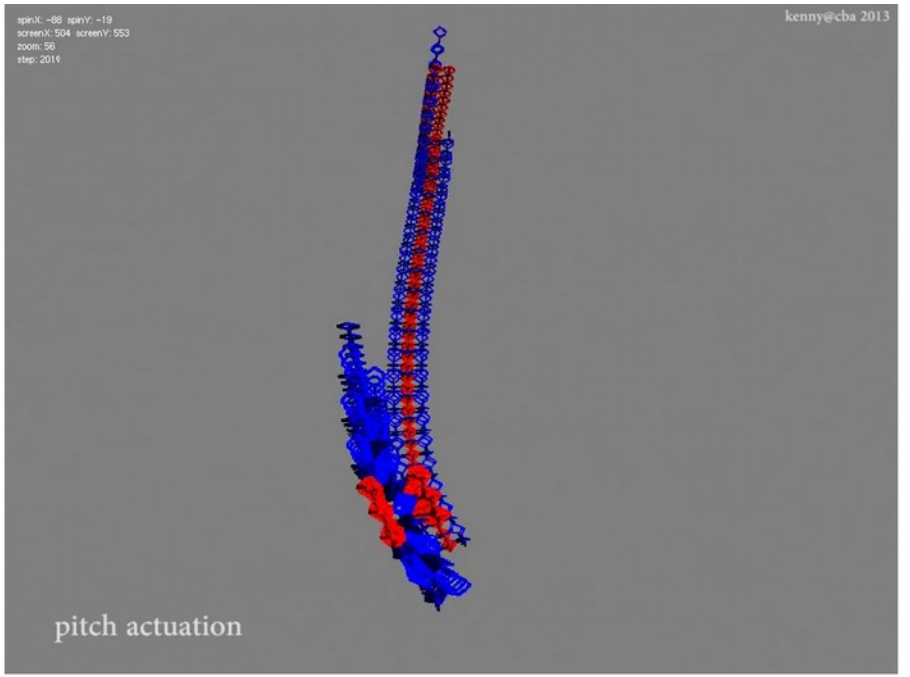


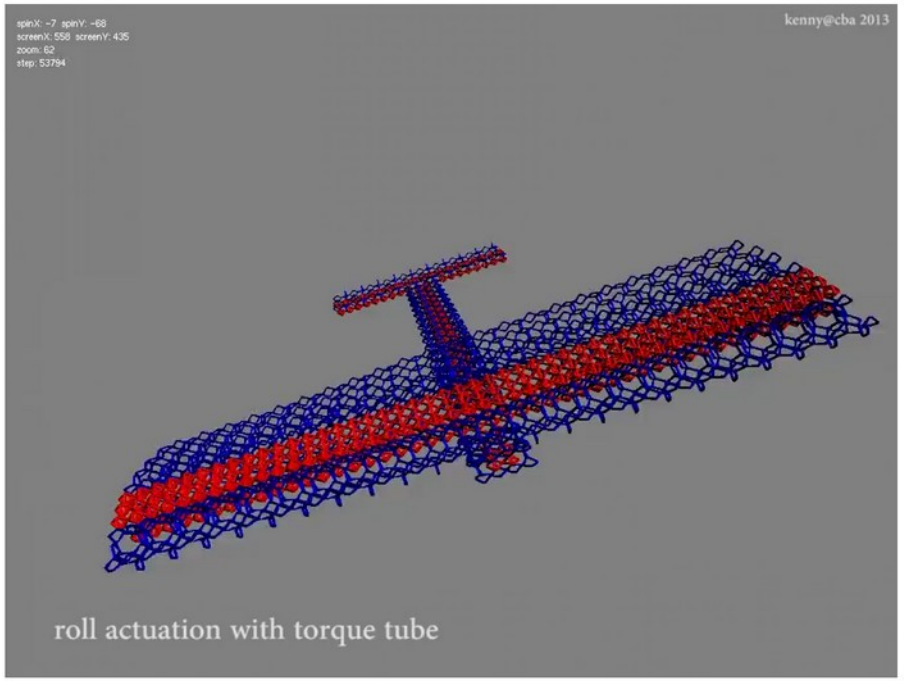


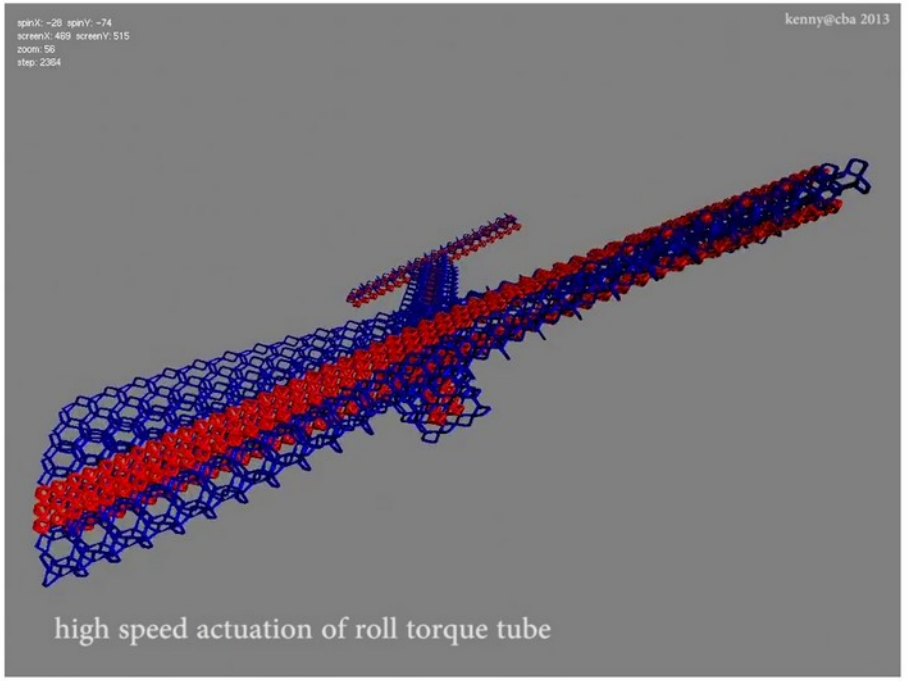


Neil Gershenfeld, 2015, 2018

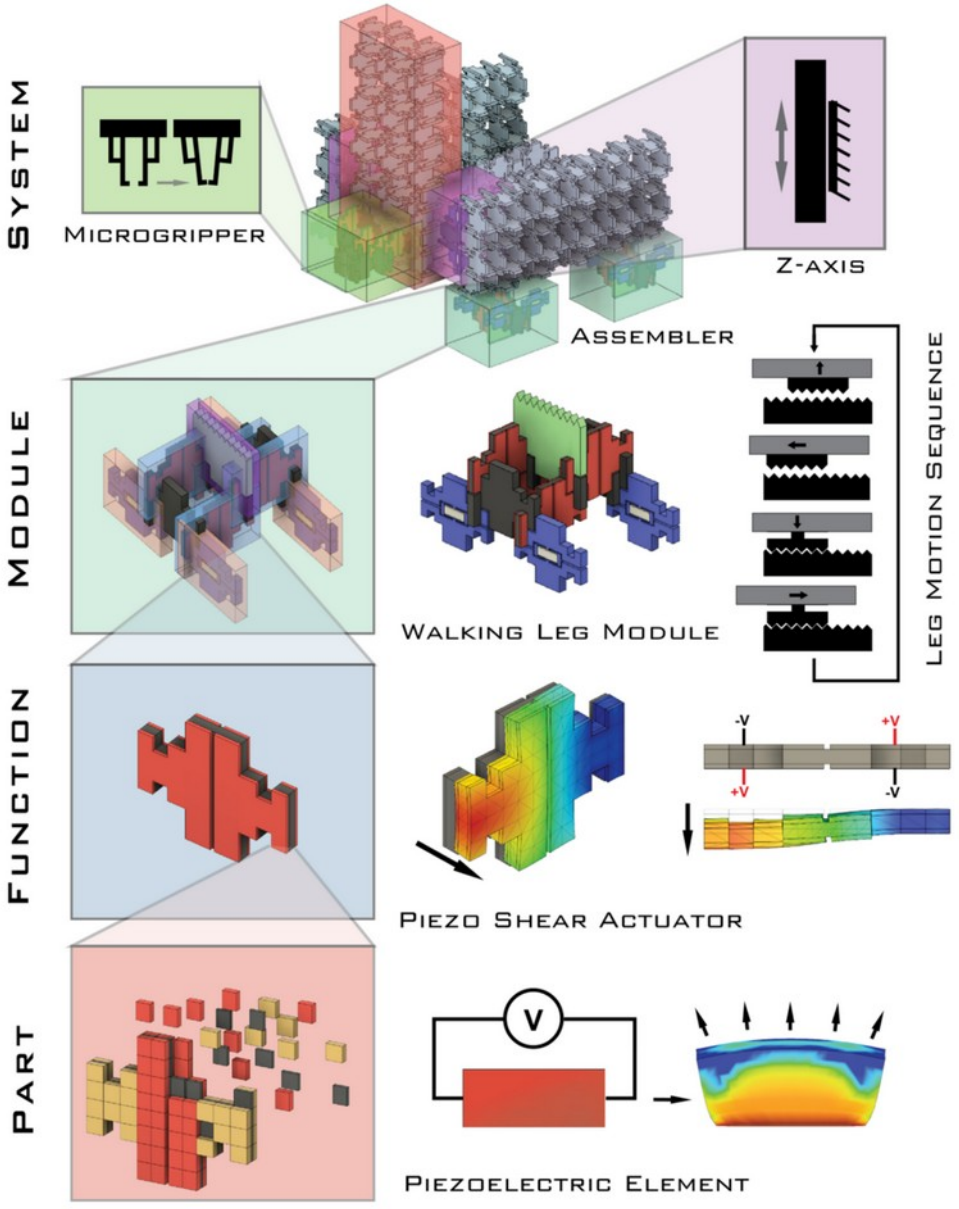


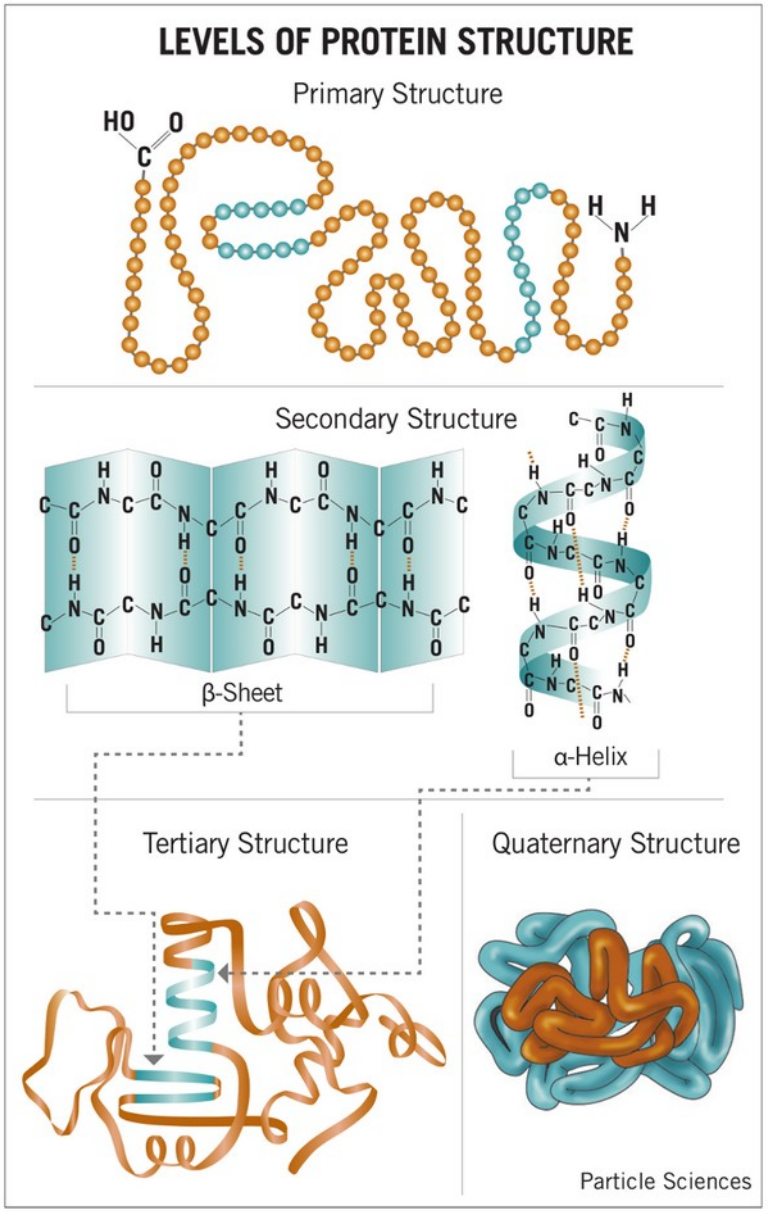






Neil Gershenfeld, 2015, 2018





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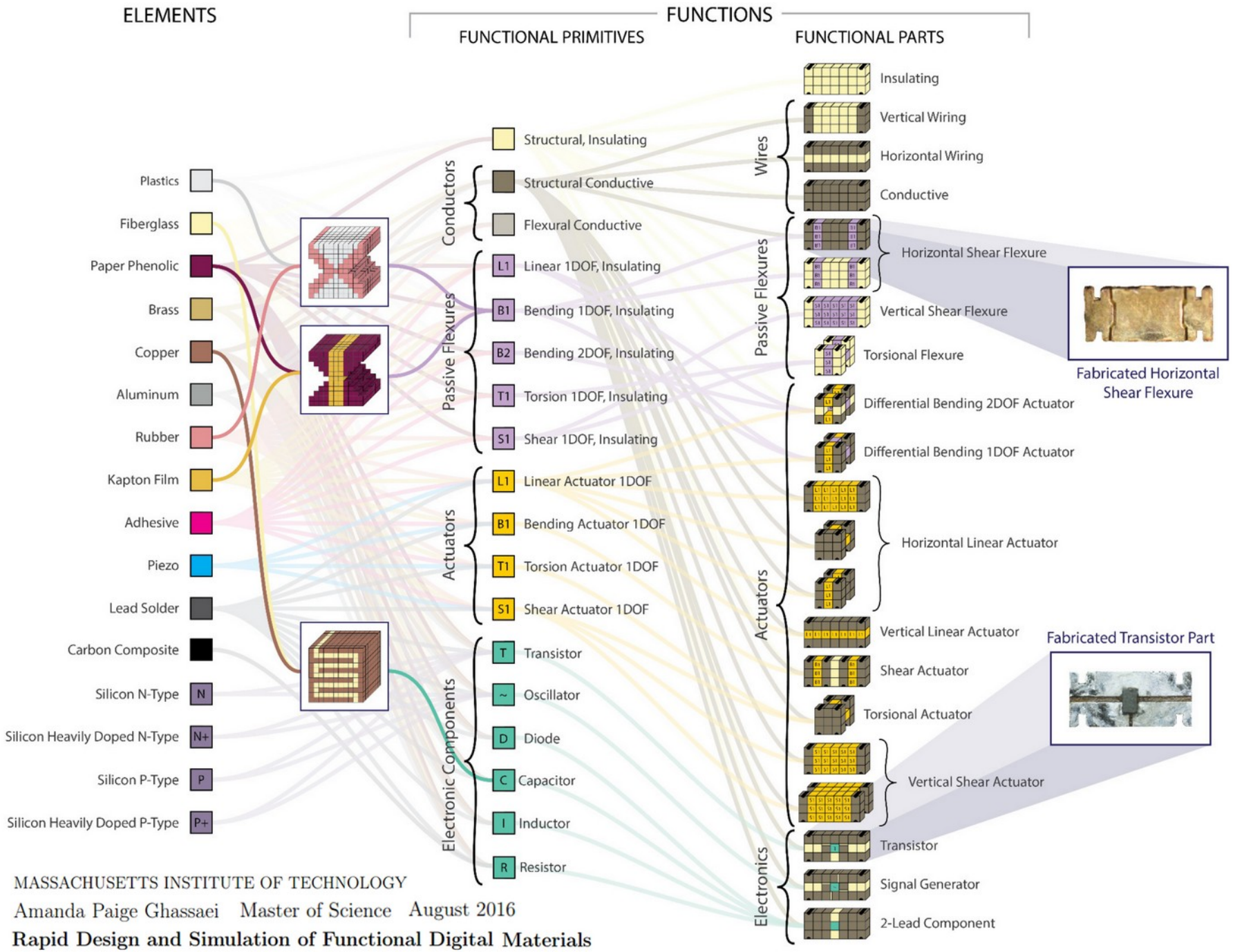

Neil Gershenfeld, 2015, 2018

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Programming a new reality

"Computer science is one of the worst things to happen to computers or to science," said Neil Gershenfeld at TED 2006. In this TEDxCERN talk, Gershenfeld elaborates on how computer science, unlike physics, has arbitrarily segregated the notion that computing happens in an alien world. He talks about breaking down barriers between the digital and physical worlds, and gives us a glimpse of a revolution that could change the way our economy works.

Aligning the representation and reality of computation with asynchronous logic automata

Neil Gershenfeld

Received: 15 October 2011 / Accepted: 24 October 2011 / Published online: 16 November 2011

Abstract There are many models of computation, but they all share the same underlying laws of physics. Software can represent physical quantities, but is not itself written with physical units. This division in representations, dating back to the origins of computer science, imposes increasingly heroic measures to maintain the fiction that software is executed in a virtual world. I consider instead an alternative approach, representing computation so that hardware and software are aligned at all levels of description. By abstracting physics with asynchronous logic automata I show that this alignment can not only improve scalability, portability, and performance, but also simplify programming and expand applications.

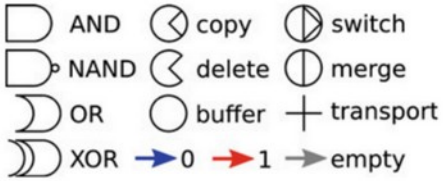


Fig. 3 ALA cells

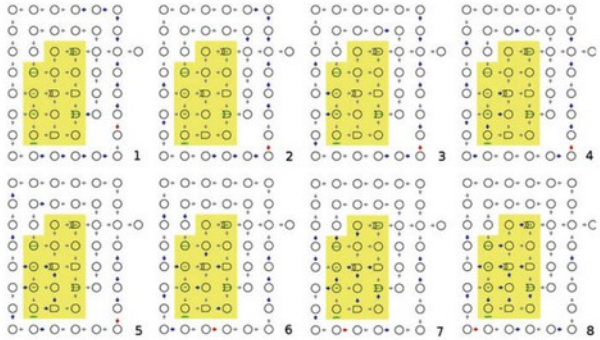
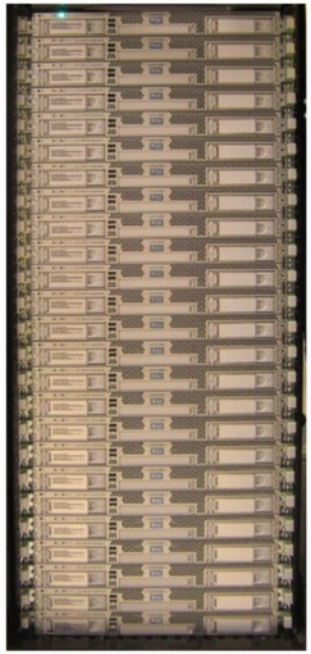
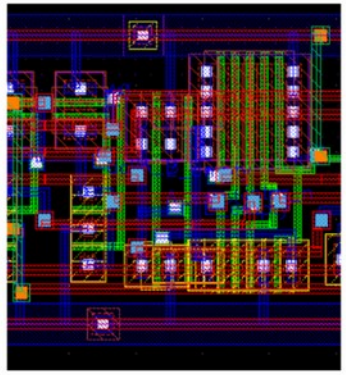
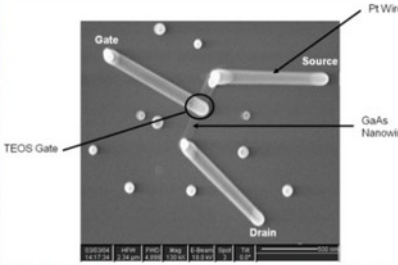
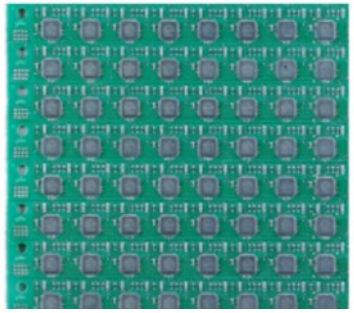


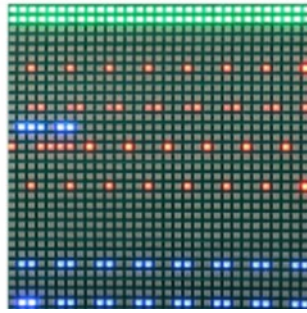
Fig. 4 Steps in the calculation of Fibonacci numbers with an ALA one-bit full adder



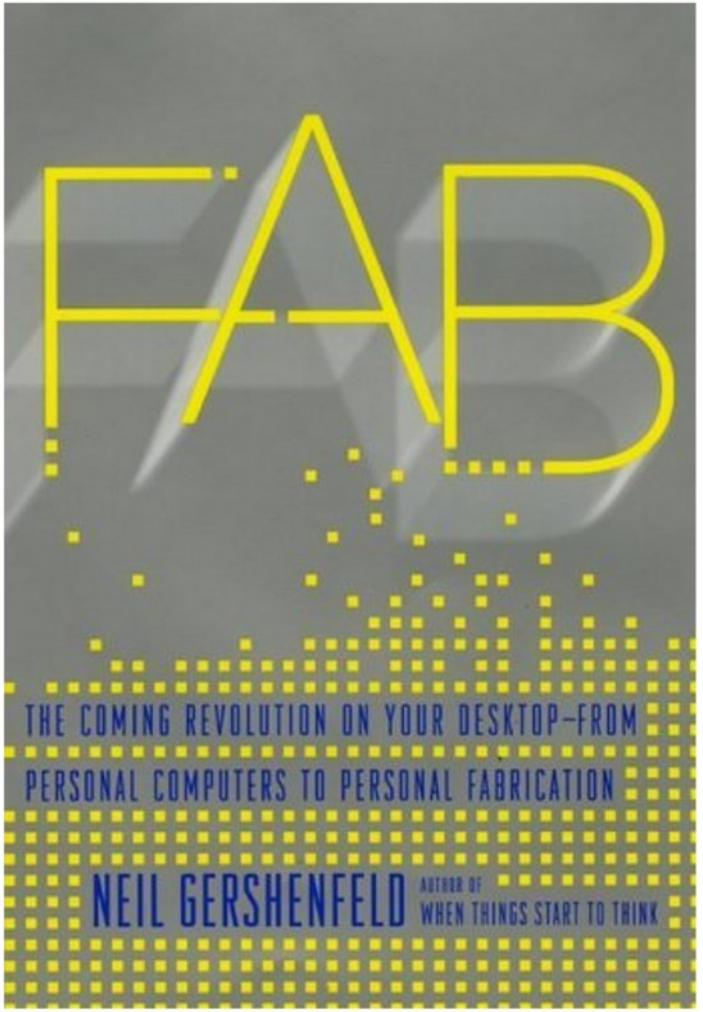








Neil Gershenfeld, 2015, 2018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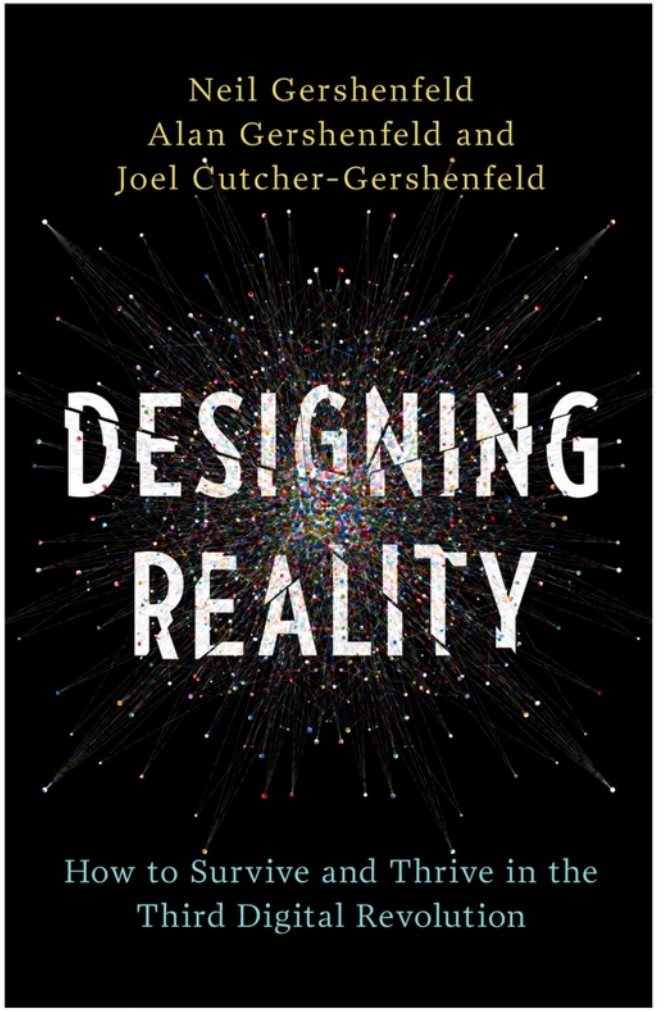
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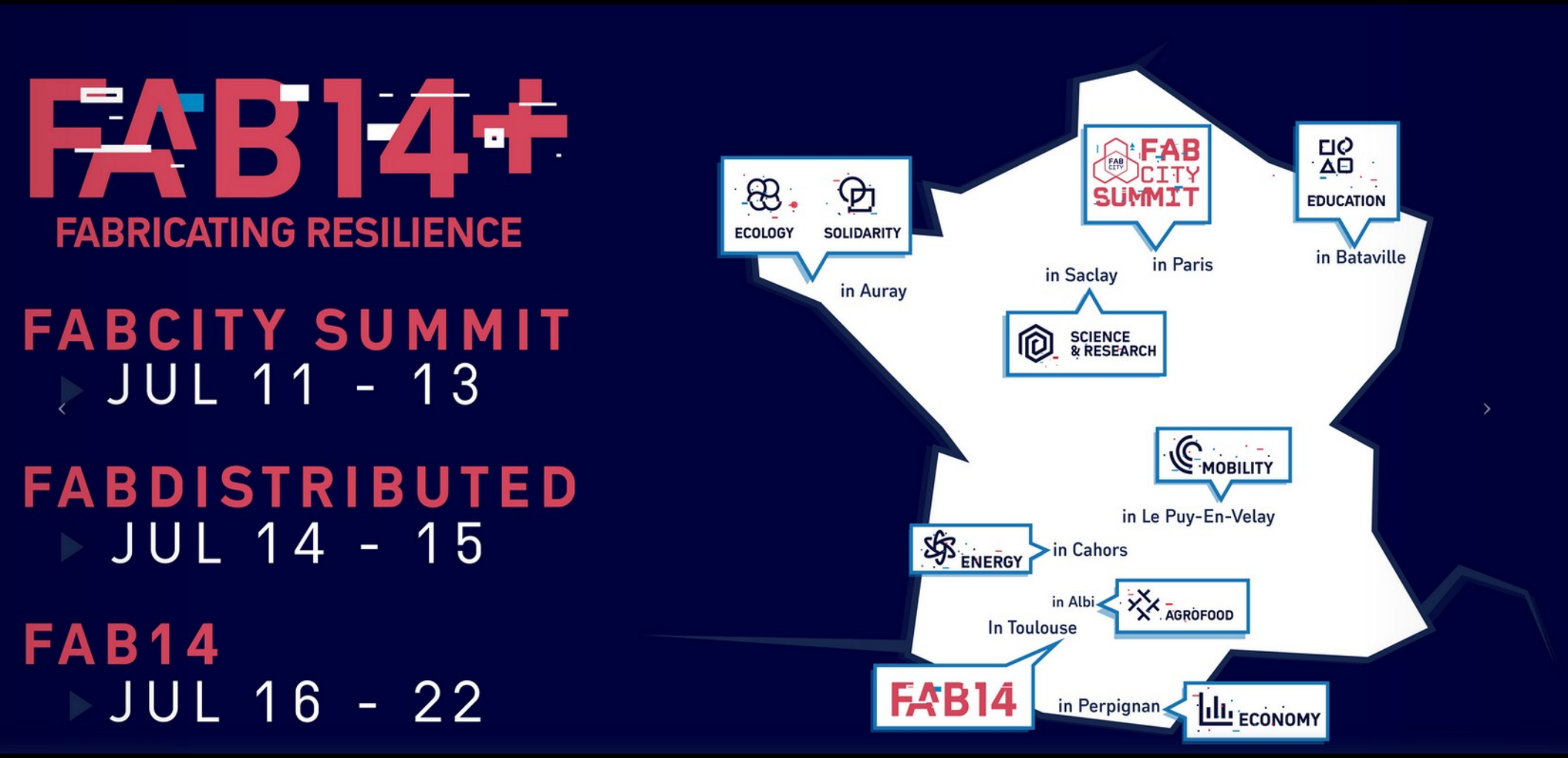

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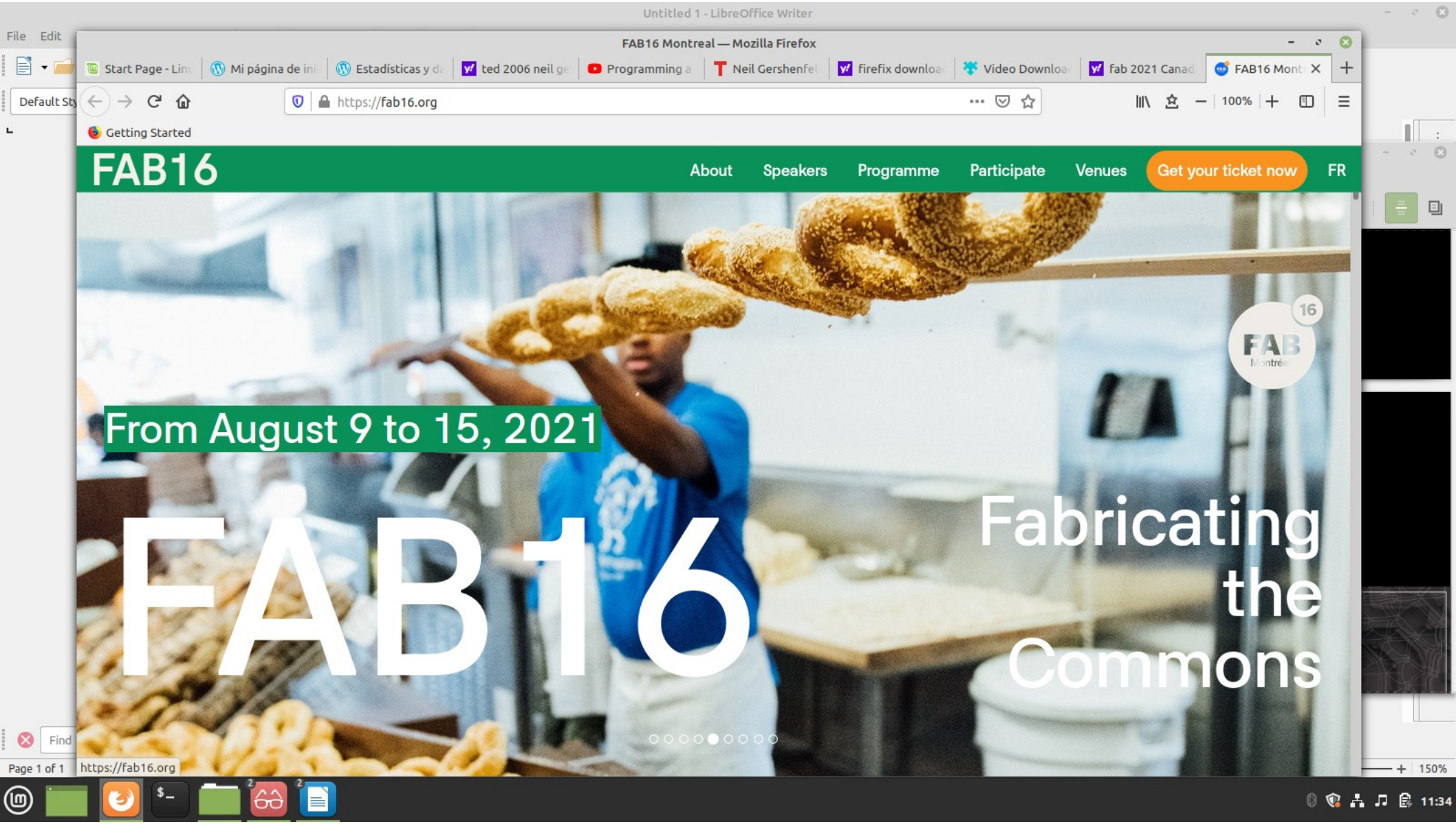
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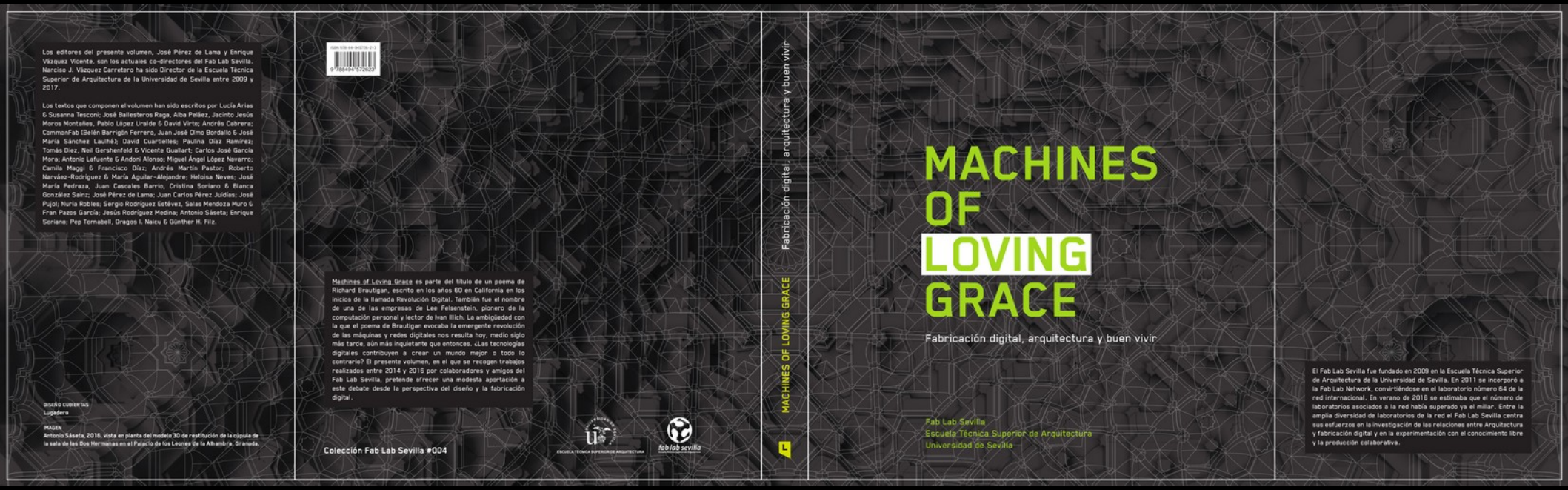

http://fablabsevilla.us.es/index.php/9-general/573-liberamos-machines-of-loving-grace

I like to think
(it has to be!)
of a cybernetic ecology
where we are free of our labors
and joined back to nature,
returned to our mammal
brothers and sisters,
and all watched over
by machines of loving grace.

Fragmento de *All Watched Over by Machines of Loving Grace,*
Richard Brautigan, 1963

Me gusta pensar
(¡tendrá que ser!)
sobre una ecología cibernética
en la que estaremos liberados de nuestros trabajos
y reunidos con la naturaleza,
de vuelta con nuestros hermanos
y hermanas mamíferas,
cuidados todos
por máquinas de gracia y amor.

“Si uno observa cuan profundamente nuestras vidas están modeladas por los sistemas interconectados de las tecnologías modernas, cuan intensamente sentimos sus influencias, respetamos su autoridad y participamos en su funcionamiento, uno empieza a entender que, nos guste o no, nos hemos convertido en miembros de un nuevo orden de la historia humana […] Observando las estructuras y los procesos de estos vastos sistemas, uno empieza a comprender una nueva forma de poder distintamente moderna, los cimientos de una cultura *tecnopolitana*. […] Lo que parecen ser sólo instrumentos útiles, constituyen, desde otro punto de vista, duraderos armazones (*enduring frameworks*) para la acción social y política.”

Langdon Winner [1989, The Whale and the Reactor. A Search for Limits in an Age of High Technology, p. ix-x]

Propina: la ciencia ficción como exploración del futuro: If You Can,t Dance, It's not my Algorithm
https://arquitecturacontable.wordpress.com/2018/04/20/if-you-cant-dance-its-not-my-algorithm-breve-relato-sci-fi/

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