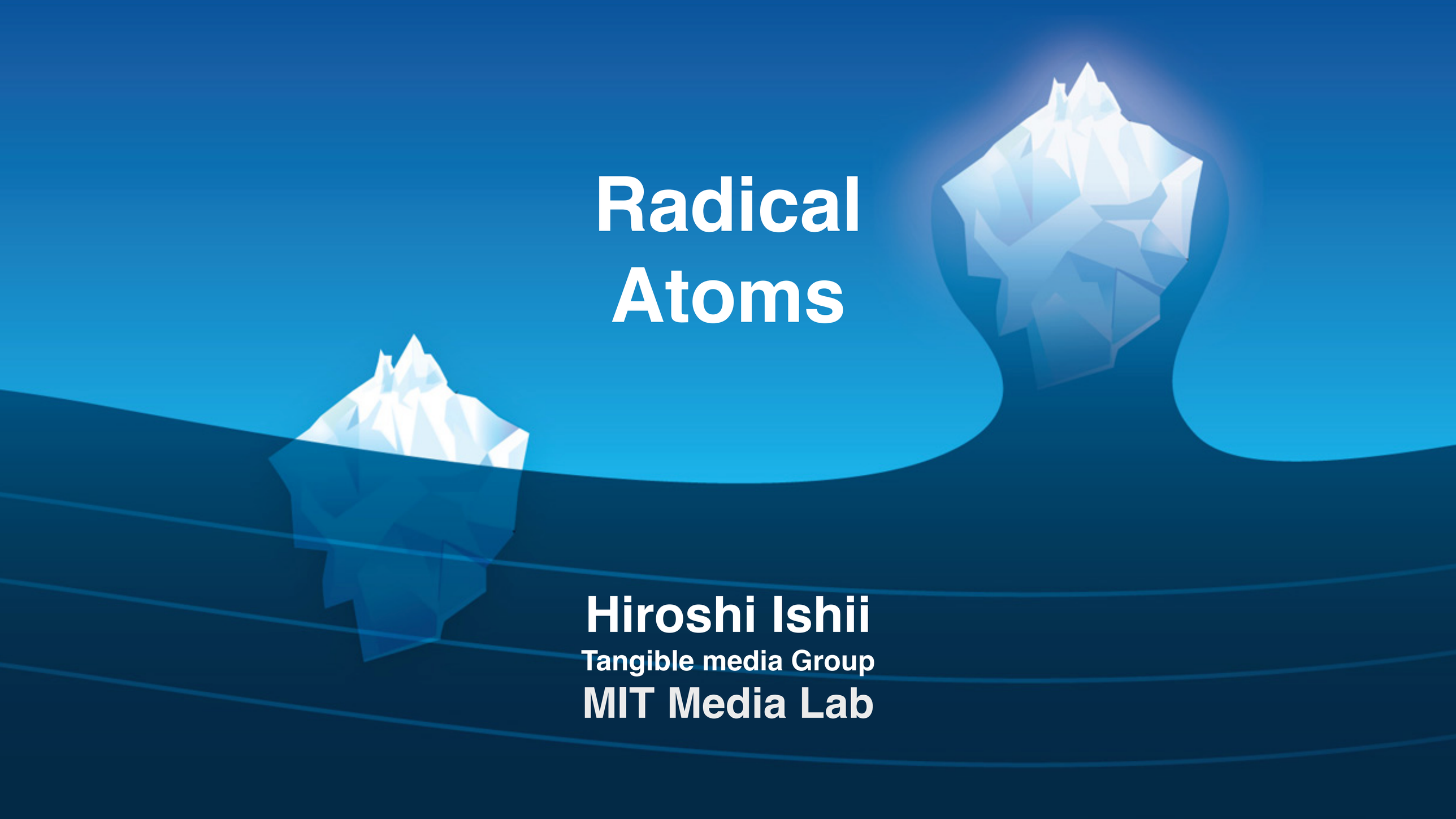
Radical Atoms



Hiroshi Ishii

Tangible media Group

MIT Media Lab

PopTech 2014 in Camden, Maine

Hiroshi Ishii shared his album: 2014-10-25 POPTECH 2014 Closing Talk.
October 26 at 11:34pm · Edited ·

Thanks to John Maeda and amazing PopTech crew for the opportunity of my closing talk on October 25th at Camden. Great honor! Thanks are also due to my colleagues of Tangible Media Group & MIT Media Lab.
▶ Video: http://fora.tv/2014/10/25/session_xi

Hiroshi Ishii added 182 new photos to the album 2014-10-25 POPTECH 2014 Closing Talk.

PopTech 2014 - Rebellion - Camden, Maine http://poptech.org/rebellion
Hiroshi Ishii's Closing Talk on October 25th, 2014
Photo Credit: Akira Himei & Ryo Kikuchi from Morisawa Inc.
Video: http://fora.tv/2014/10/25/session_xi

Hiroshi Ishii added 13 new photos to the album PopTech 2014 - Rebellion - Closing Talk in Camden, Maine, October.
October 25 at 7:48pm ·

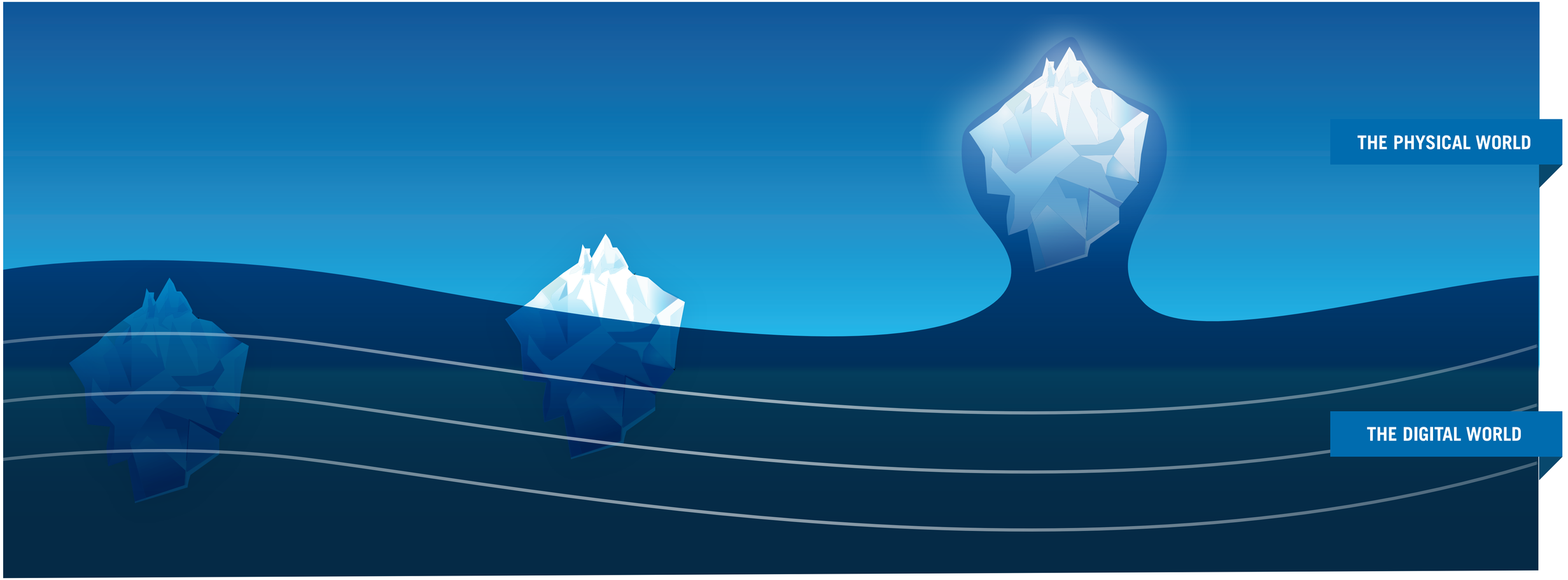
PopTech 2014 - Rebellion - Camden, Maine http://poptech.org/rebellion
Photo Credit: Asa Mathat https://www.flickr.com/photos/poptech/ — at Camden Harbor.

Like · Comment · Share

GUI PAINTED BITS

TUI TANGIBLE BITS

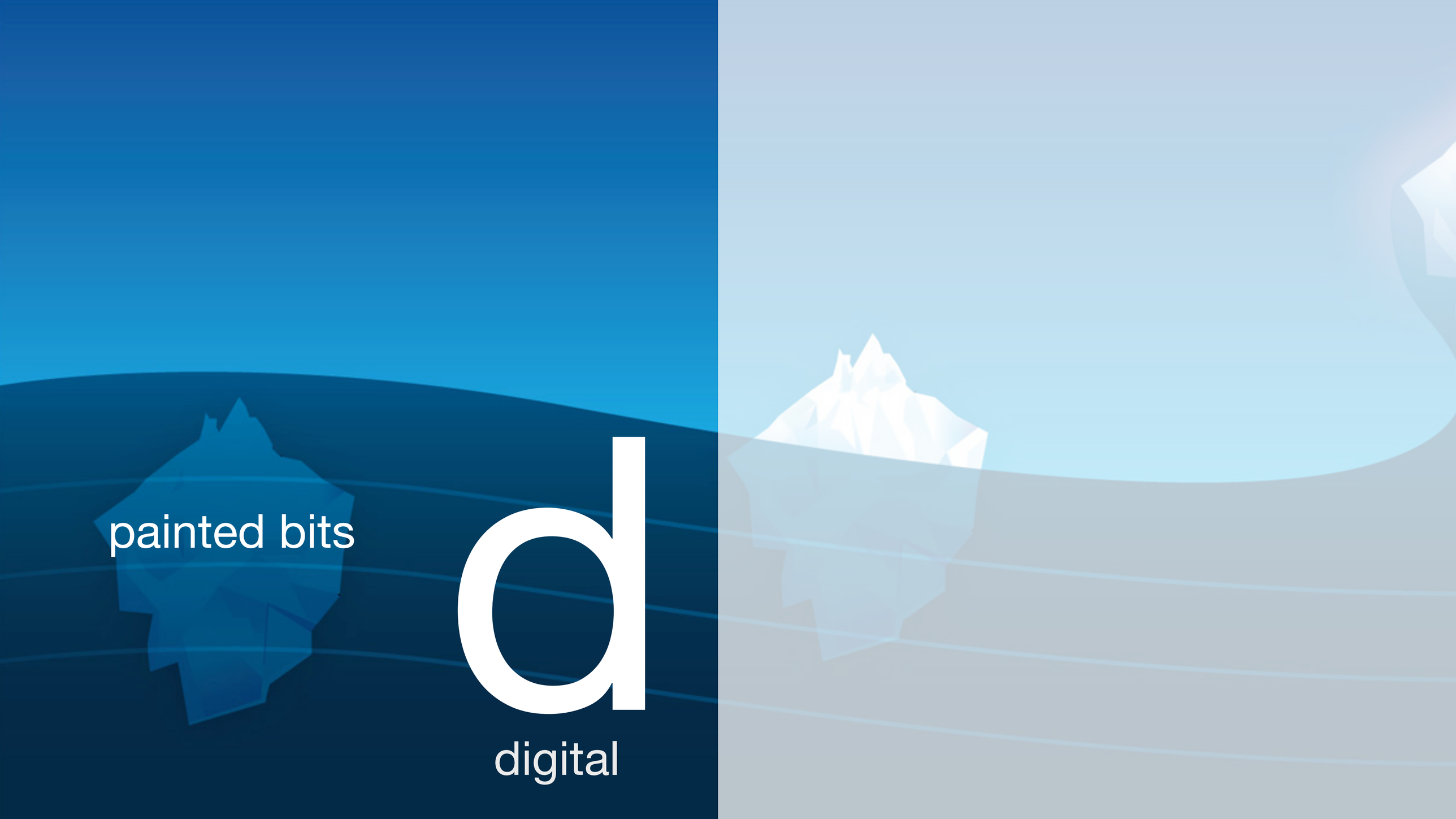
RADICAL ATOMS



A Graphical User Interfaces only let users see digital information through a screen, as if looking through a surface of the water. We interact with the forms below through remote controls such as a mouse, a keyboard or a touch screen.

A Tangible User Interface is like an iceberg: there is a portion of the digital that emerges beyond the surface of the water - into the physical realm - that acts as physical manifestations of computation, allowing us to directly interact with the 'tip of the iceberg.'

Radical Atoms is our vision for the future of interaction with hypothetical dynamic materials, in which all digital information has physical manifestation so that we can interact directly with it - as if the iceberg had risen from the depths to reveal its sunken mass.

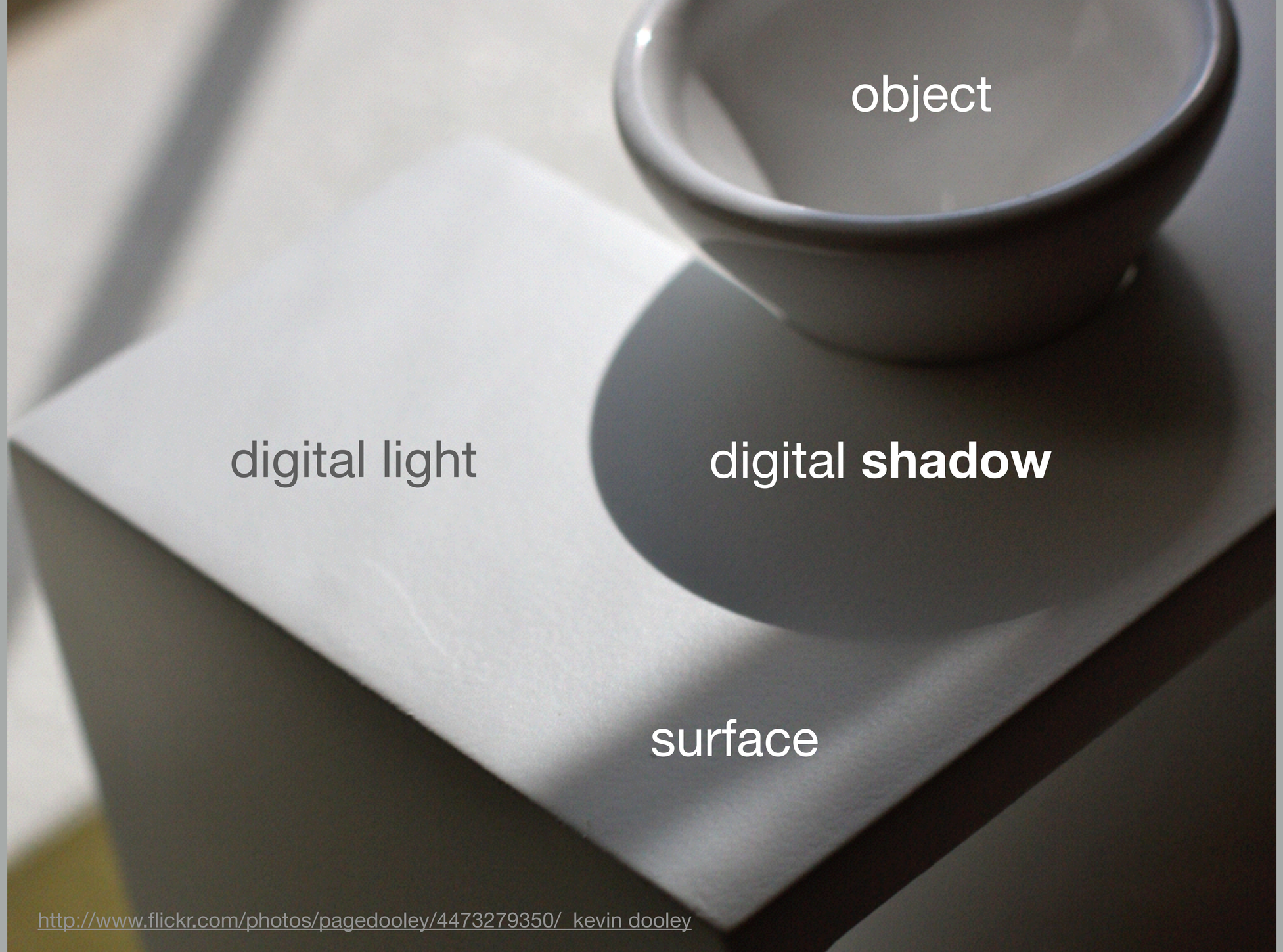

painted bits
d
digital

digital augmentation viewer & glasses

http://petitinvention.wordpress.com/2008/02/10/future-of-internet-search-mobile-version/

(c) Mac Funamizu “Looking Glass”

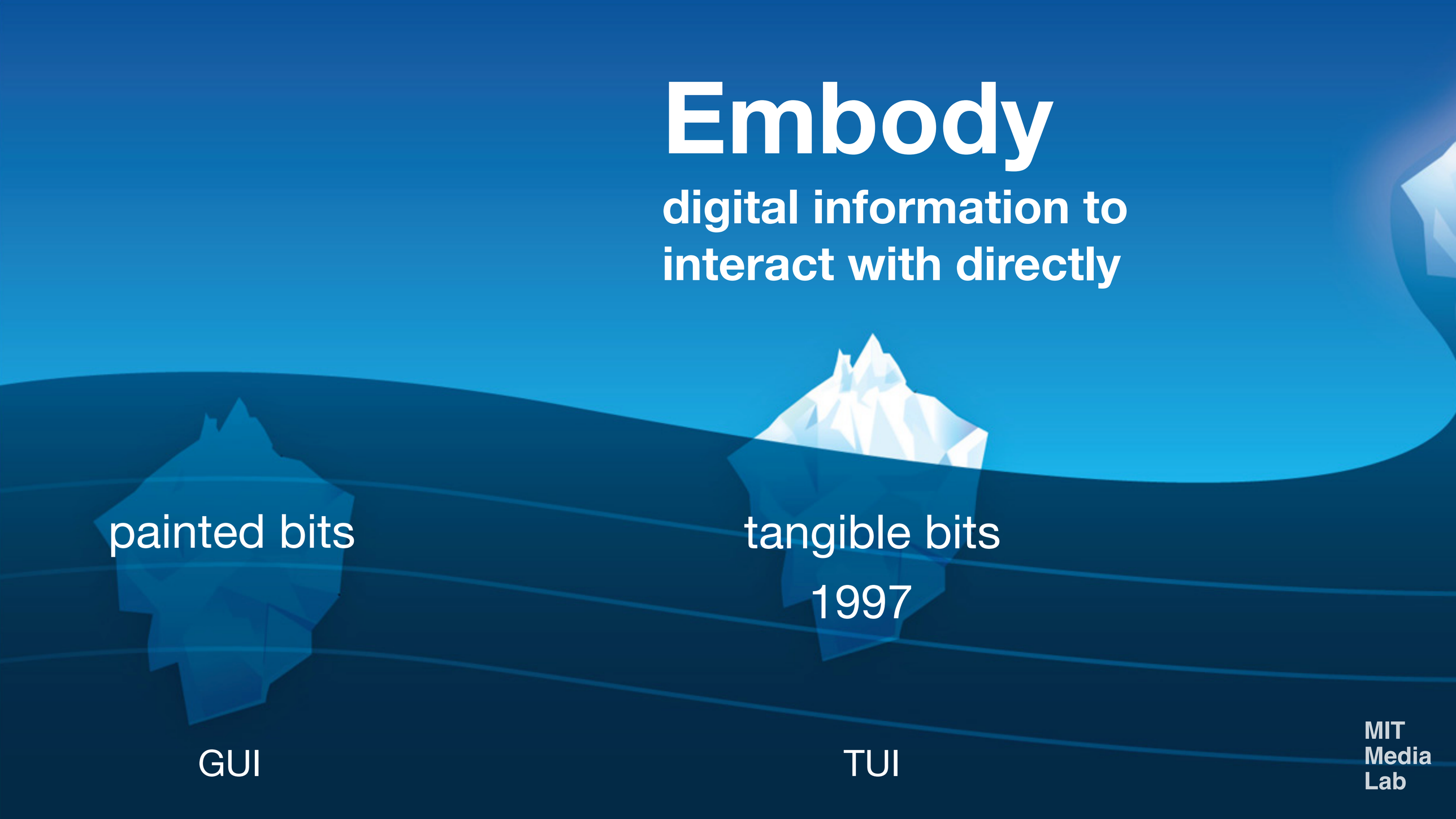
http://www.flickr.com/photos/37644572@N00/50576379/



http://www.flickr.com/photos/pagedooley/4473279350/ kevin dooley

Embody

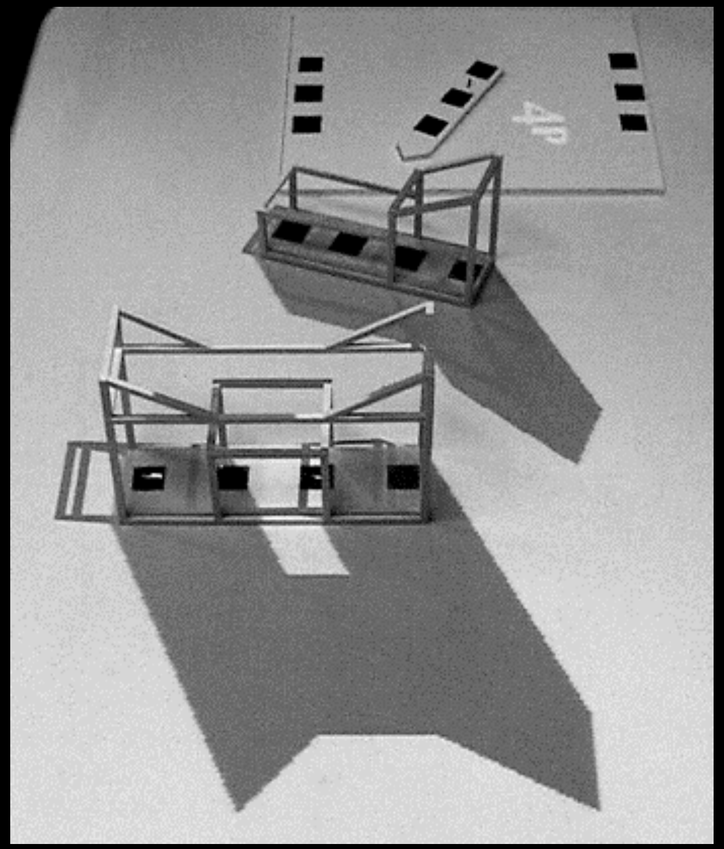
digital information to interact with directly



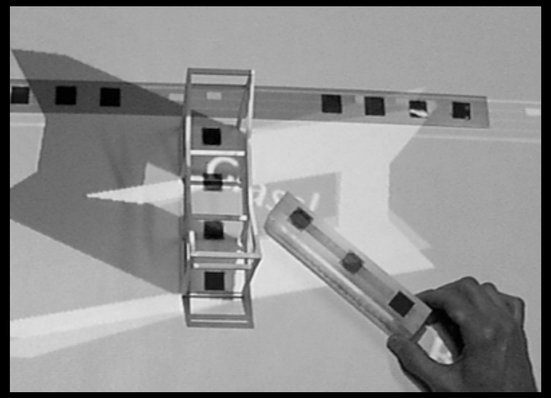
Urp:

Urban Planning Workbench

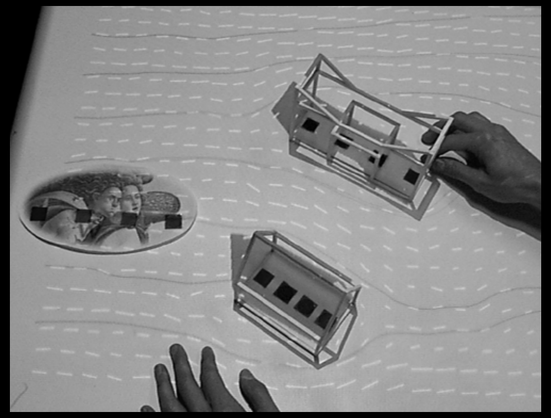
John Underkoffler and Hiroshi Ishii, 1997 - 1999



digital shadows



light reflections

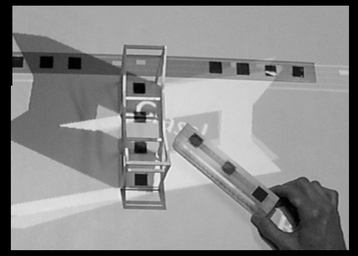


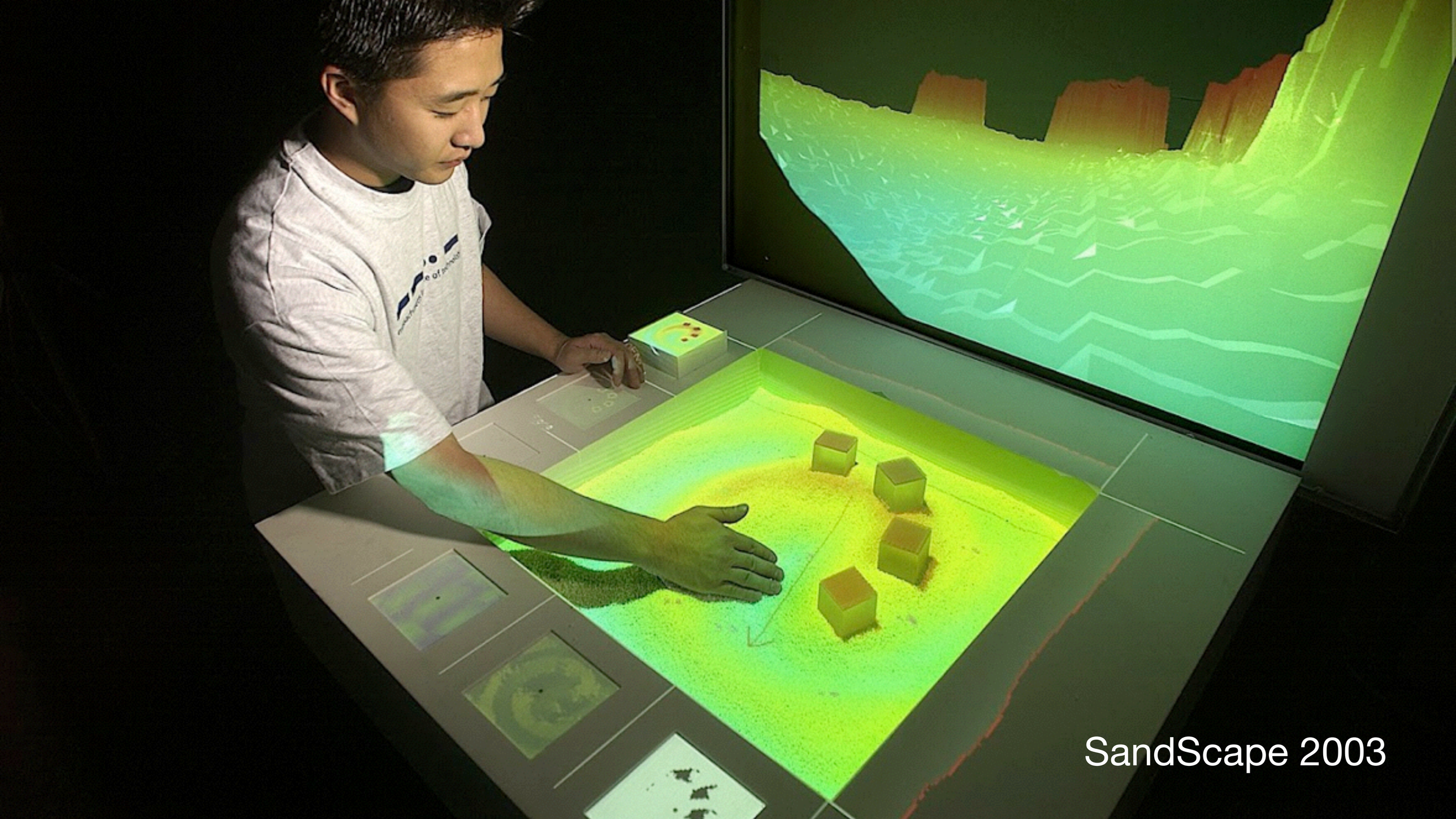
wind

Urp:

Urban Planning Workbench

John Underkoffler and Hiroshi Ishii, 1997 - 1999





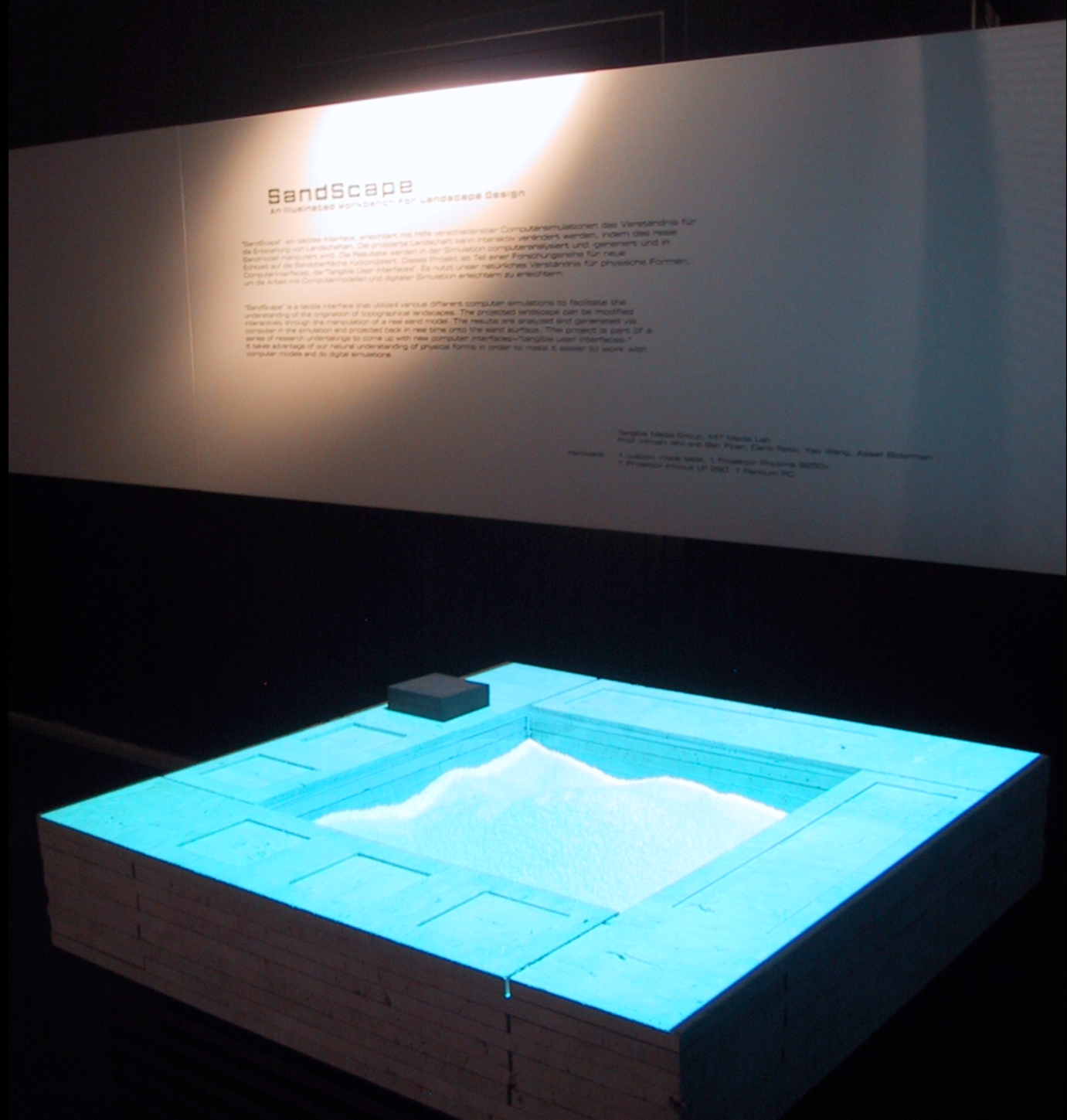
SandScape 2003

SandScape

Ars Electronic Center

Hiroshi Ishii,
Carlo Ratti,
Ben Piper,
Yao Wang, and
Assaf Biderman

Tangible Media Group
MIT Media Laboratory



SandScape

Ars Electronic Center

Hiroshi Ishii,
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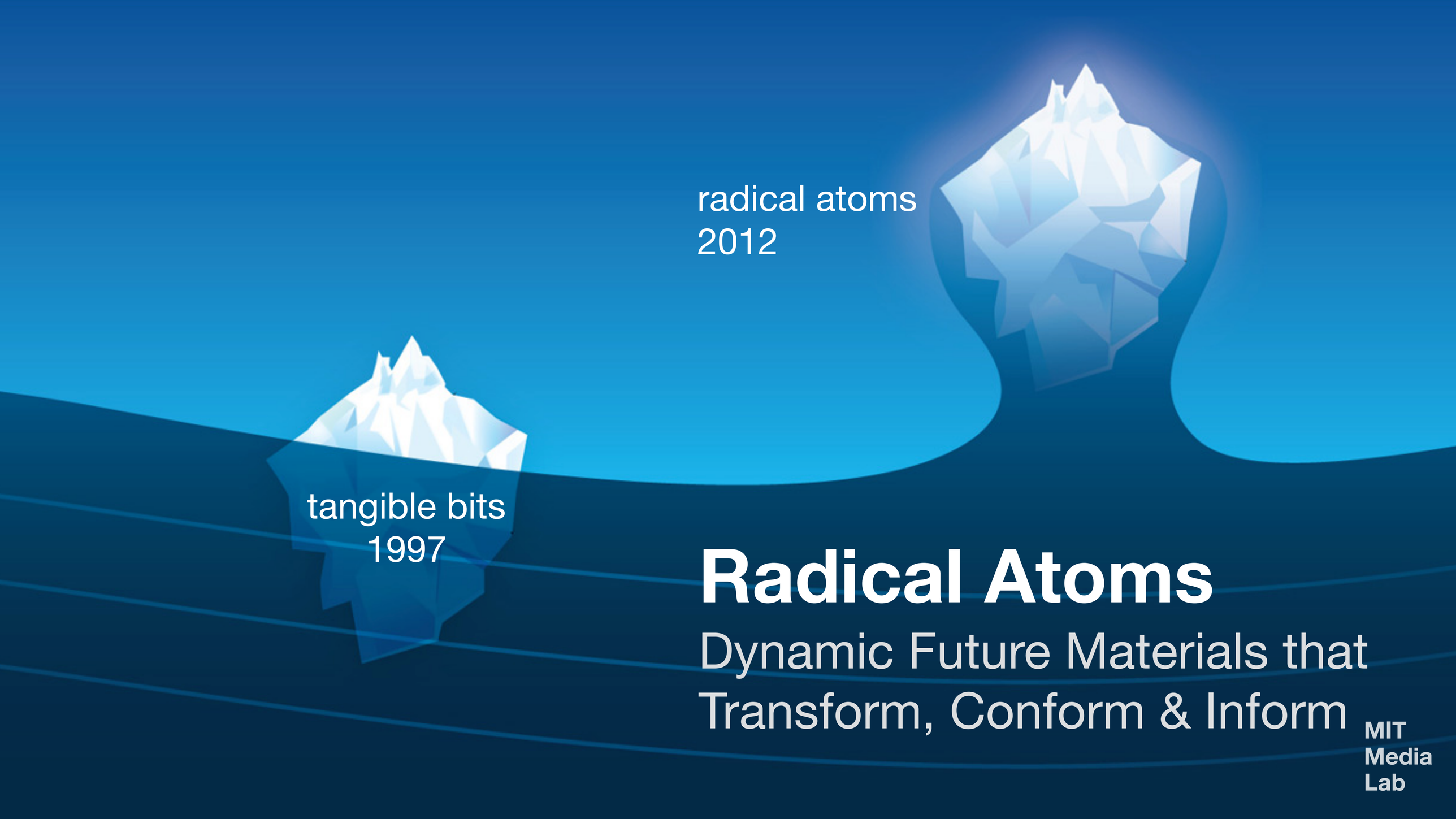
MIT Media Laboratory


radical atoms
2012
tangible bits
1997
Radical Atoms
Dynamic Future Materials that
Transform, Conform & Inform
MIT
Media
Lab

VOLUME XIX.1 | JANUARY + FEBRUARY 2012

interactions

EXPERIENCES | PEOPLE | TECHNOLOGY

Radical Atoms: Beyond Tangible Bits, Toward Transformable Materials

Cover Story by Hiroshi Ishii, Dávid Lakatos, Leonardo Bonanni, and Jean-Baptiste Labrune

MIT Media Lab

Evolution of Tangibles Bits Towards Radical Atoms (1)

static / passive => kinetic / dynamic

2D tabletop discrete tangibles

metaDESK

concept demo: phicon
= container + controller
CHI '97, UIST '97

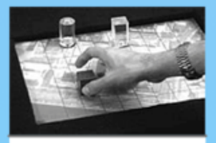
Urp

urban planning
workbench
CHI '99, SIGGRAPH '98

Sensetable

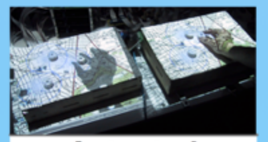
tabletop TUI platform:
objects tracking +
video projection
CHI '01

translation of discrete objects



PSyBench

synchronized actuated
workbenches
CSCW '98



Actuated Workbench

computer-actuated pucks as
display & control
UIST '02

PICO

mechanical intervention of
actuated pucks by users
CHI '07

anti-gravity tangibles

levitation of objects

ZeroN

levitated tangibles
UIST '11

kinetic tangible toolkits

design of motions

Kinetic Sketchup

Bosu

motion prototyping tool kits
with physical transformability
DIS '10

embodied kinetic tangibles

tele-sync of objects

intouch

distributed synchronized
objects (haptic phone)
CSCW '98

record & play of motions

curlybot

record & play toy
CHI '00

topobo

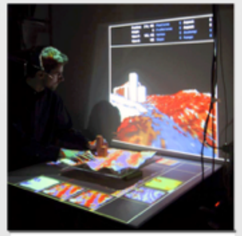
constructive assembly +
record & play
CHI '04, '06, '08

Evolution of Tangibles Bits Towards Radical Atoms (2)

static / passive => kinetic / dynamic

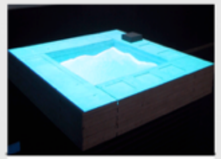
2.5D deformable and transformable tangibles

transformation with shape display



Illuminating Clay

landscape design tool using augmented clay
CHI '02



SandScape

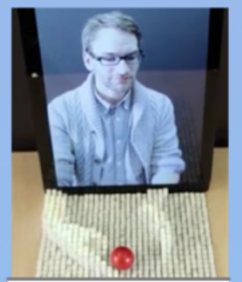
landscape design tool using augmented sand
Ars Electronica '02

Relief

2.5D interactive shape display
TEI '09, UIST '11

Recompose

gesture-controllable 2.5D shape display
UIST '11



inFORM

dynamic physical affordance & tele-operation
UIST '13 & '14

SUBLIMATE

virtual & physical rendering
CHI '13

TRANSFORM

transformative table with 3 inFORM engines for Milano Design Week 2014

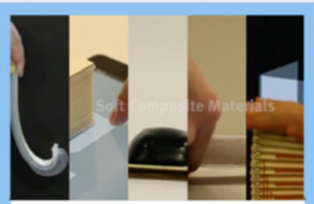
artistic expression

programmable materials

transformation and property changes with augmented tangible materials

Jamming UI

deformable stiffness changing UI using particle jamming
UIST '12

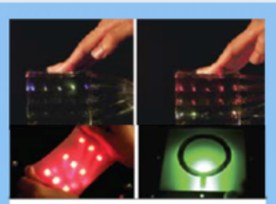


PneUI

shape-changing pneumatically actuated soft materials
UIST '13

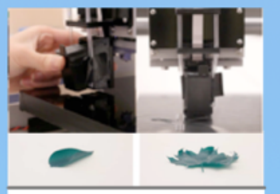
jamSheets

deformable stiffness-tunable thin sheet interfaces
TEI '14



OptiElastic

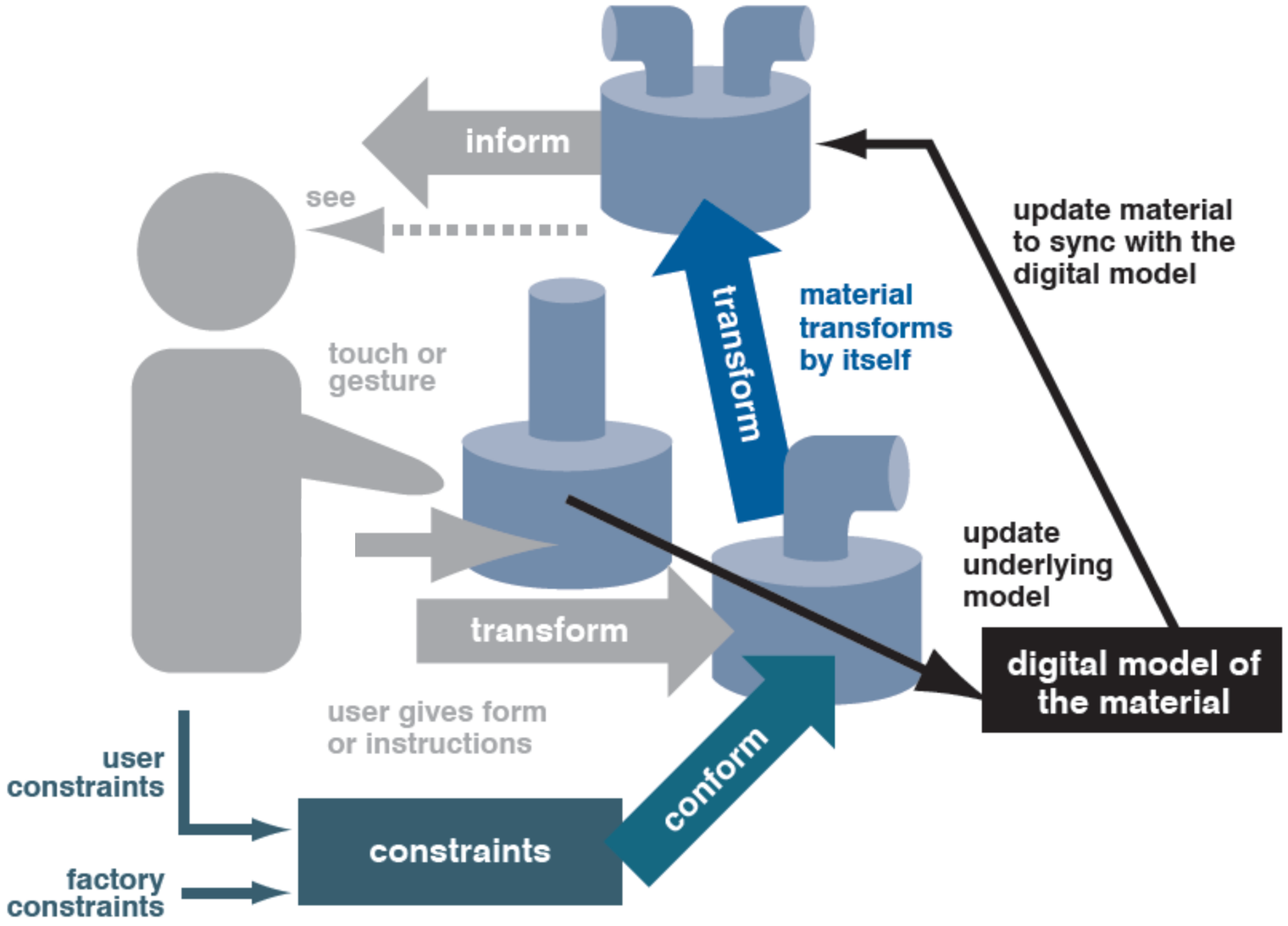
illuminating and sensing soft material using optical fiber or elastic waveguide
UIST '14



bioPrint bioLogic

automatic deposition system for bacteria spore actuators
UIST '14 & CHI '15

Interactions with Radical Atoms



Radical Atoms

Forging Atoms to Conform, Transform, and Inform

Damascus Steel Knife http://en.wikipedia.org/wiki/Damascus_steel

Our Vision of Interactions with Dynamic Physical Material

Radical Atoms



- Vision-Driven Design Research on Interactions with Dynamic Physical Material that can
  - **Conform** to structural constraints,
  - **Transform** structure & behavior, and
  - **Inform** new abilities.

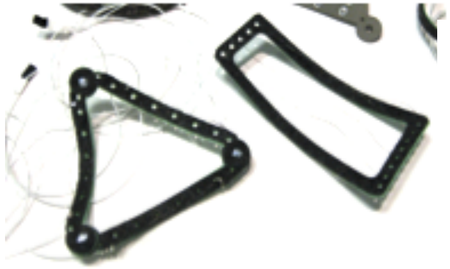
Dynamic Materials
Conform / Transform

- **Material**

  Shape Memory Alloy

  NiTiNol

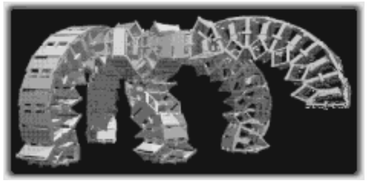
- **Robotics**



BOSU
Amanda Parkes

Surflex
Marcelo Coelho

topobo
Raffle & Parkes



Polypod
Mark Yim

Dynamic Materials

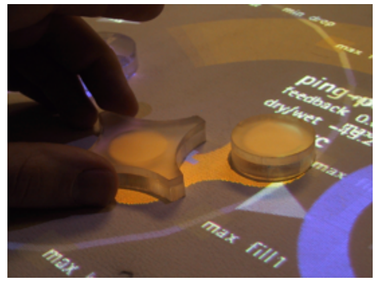
Programable Matters

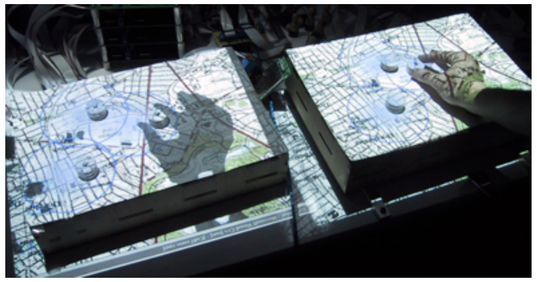
- Nanotech
- Computer Science
- Robotics
- Biology
- Material Sciences

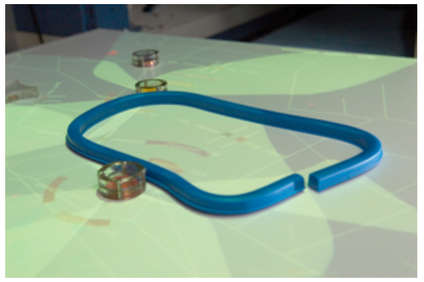
Tabletop Tangibles

Tangible Media Group

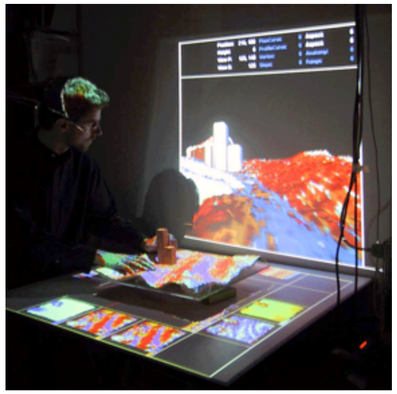
- Sensetable – Actuated Workbench – PICO

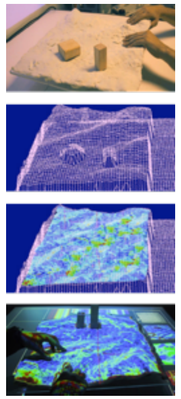


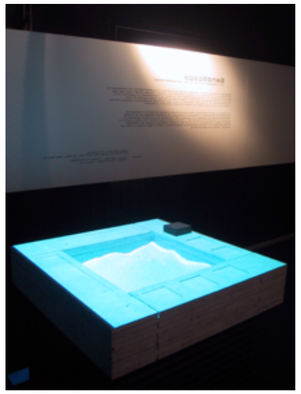


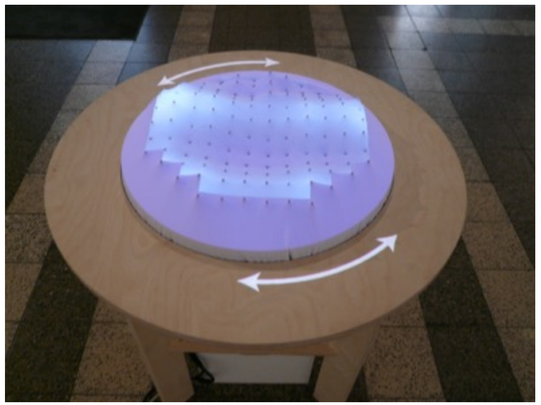


- Illuminating Clay / SandScape => Relief (dynamic clay)



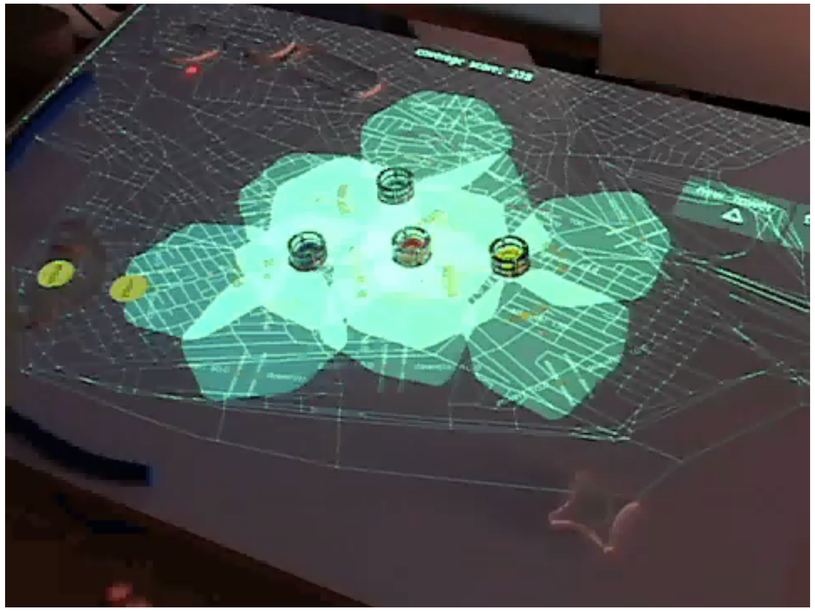


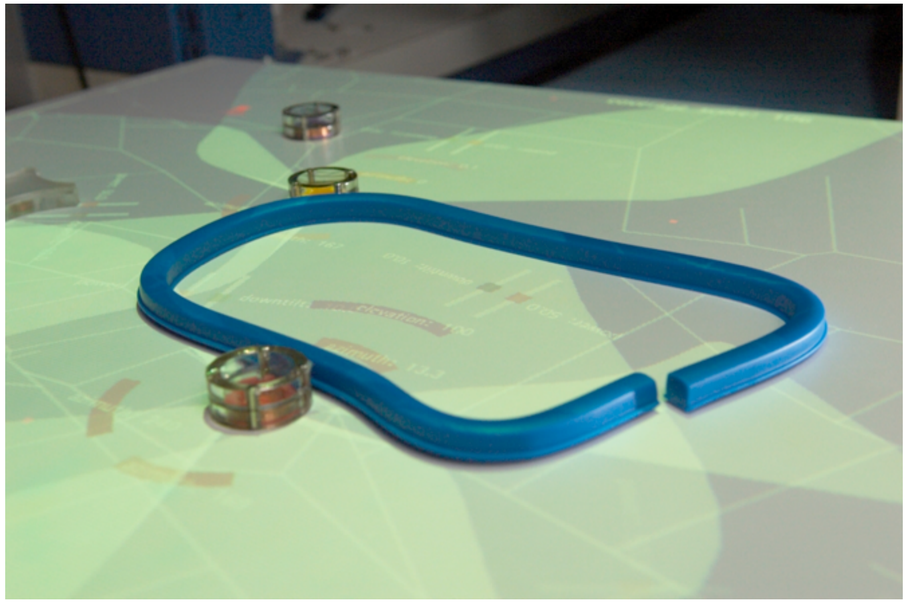




PICO: Tabletop Tangibles

James Patten and Hiroshi ISHII CHI 2007





- **Mechanical constraints, coupled with computer-controlled actuation, provide a novel and effective way to interact with computers.**

Kinetic Tangibles

Tangible Media Group

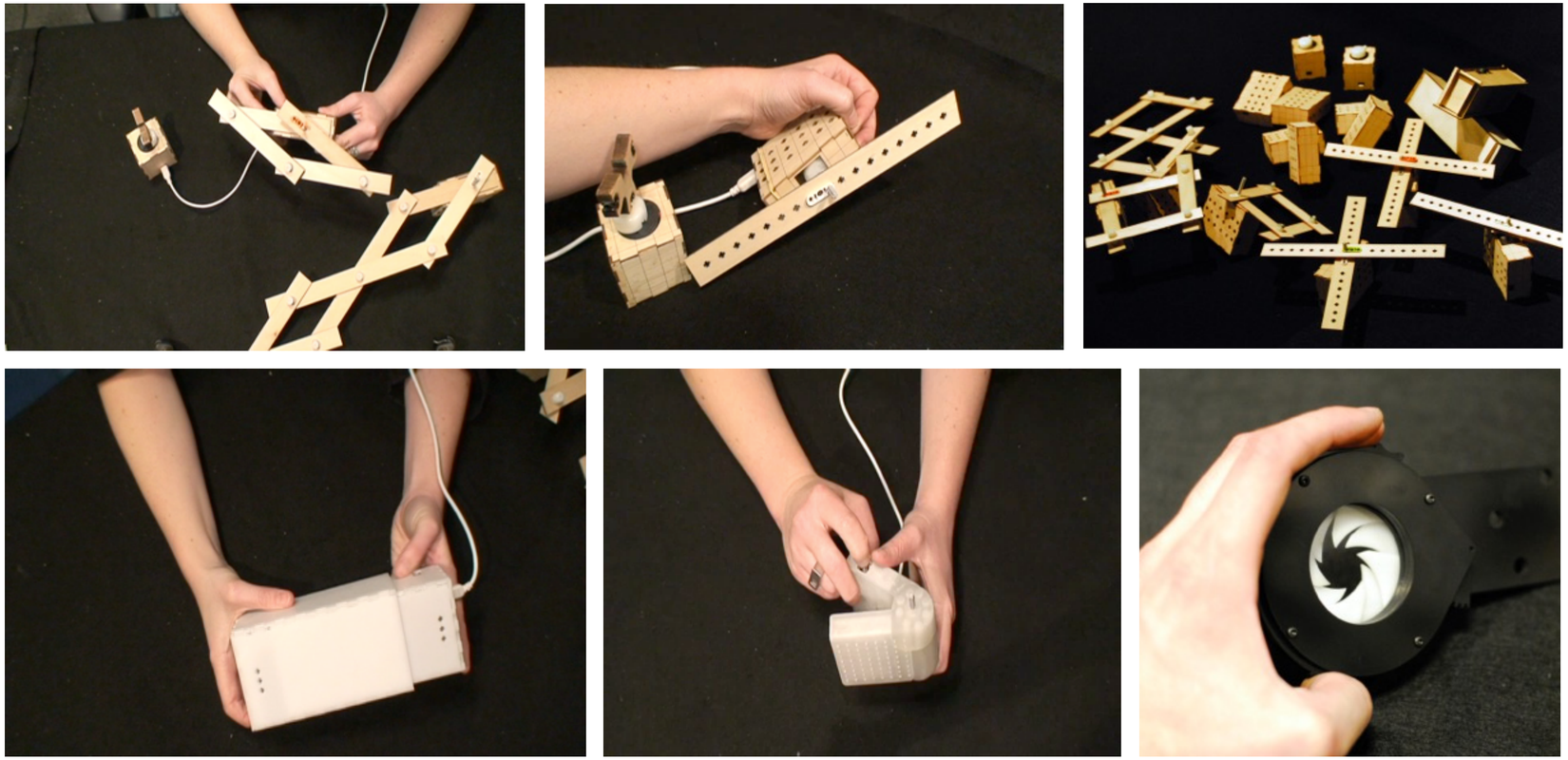
- inTouch – Curlybot – Topobo



- Kinetic Sketchup – BOSU


Kinetic Sketchup

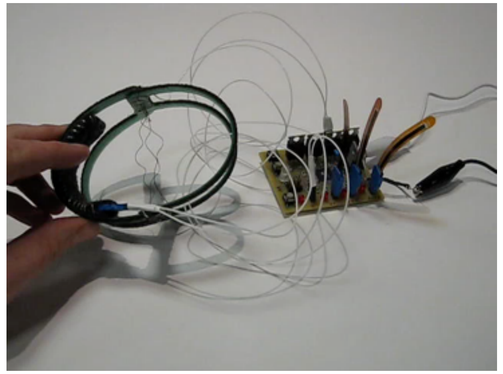
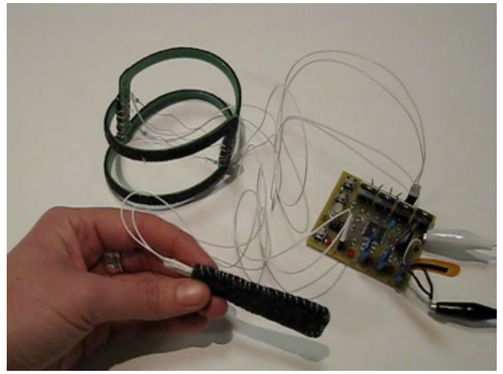
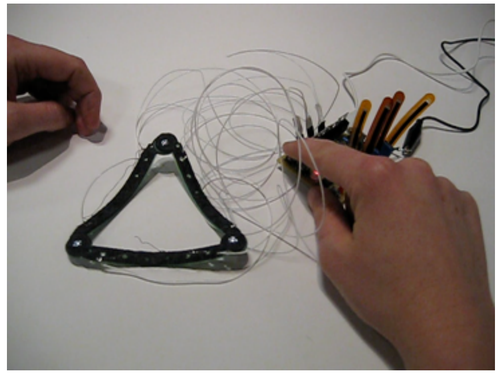
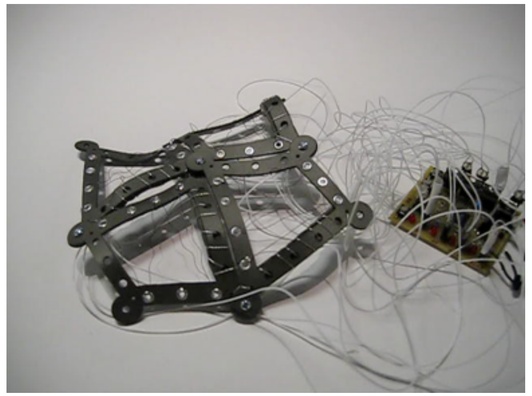
Amanda Parkes and Hiroshi ISHII 2009



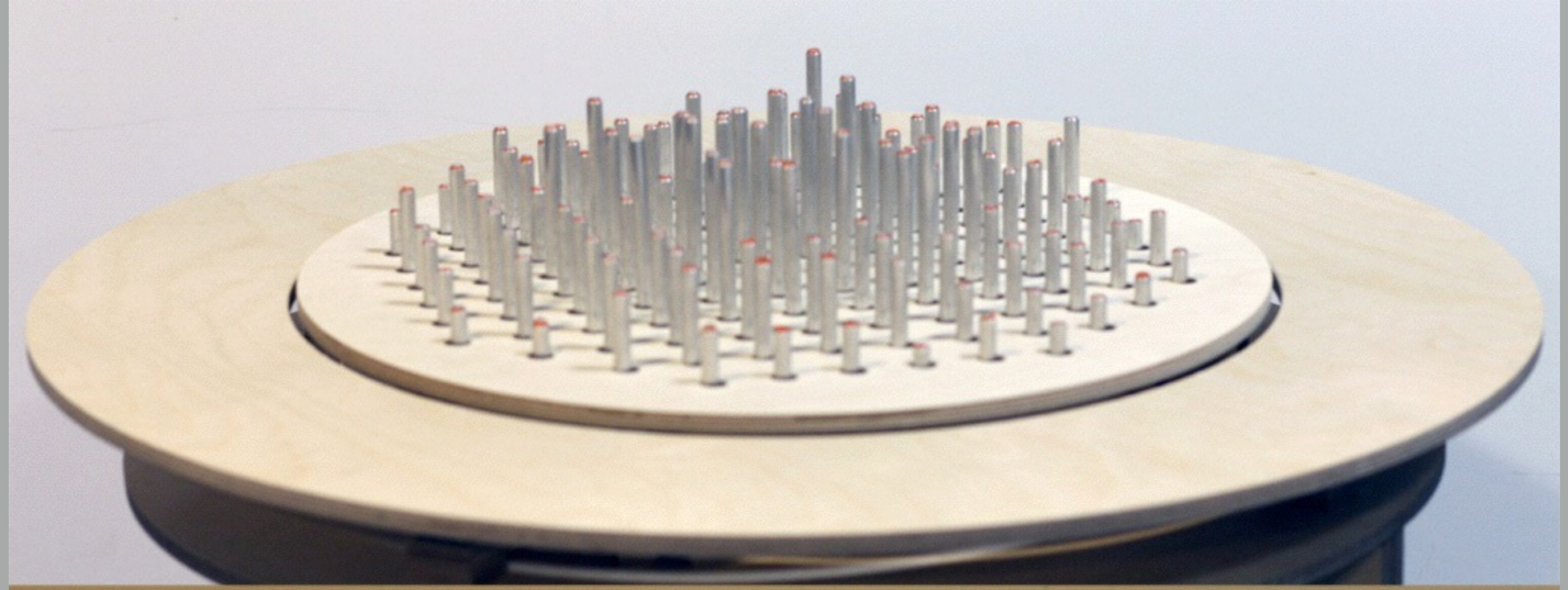
- Gestural recording functionality with varying mechanical and behavioral controls

BOSU: Kinetic Tangibles

Amanda Parkes and Hiroshi ISHII 2009

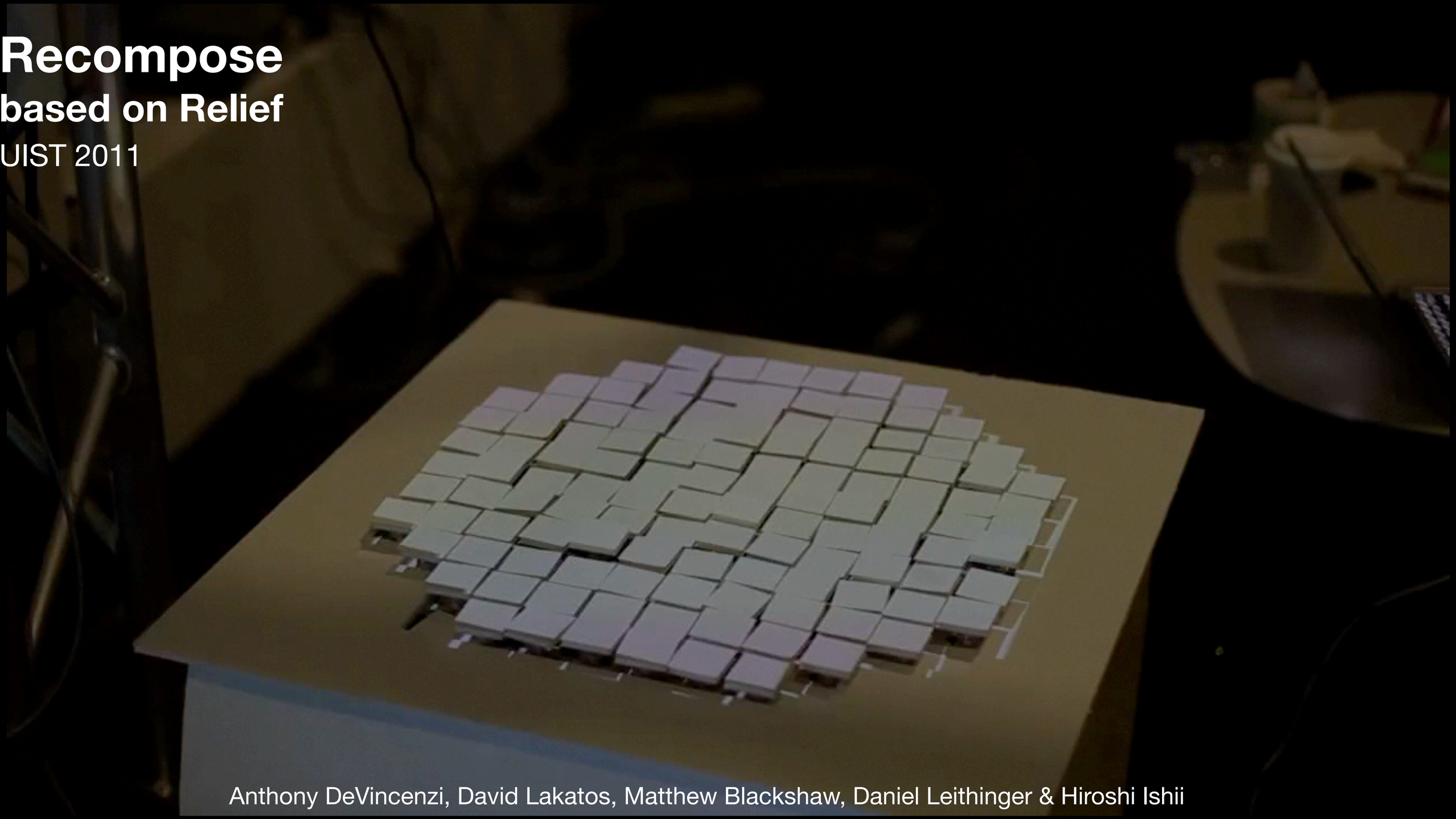
- **Dynamic modeling tools offering kinetic memory in soft materials**



Relief: A 2.5D Shape Display

Daniel Leithinger & Hiroshi Ishii

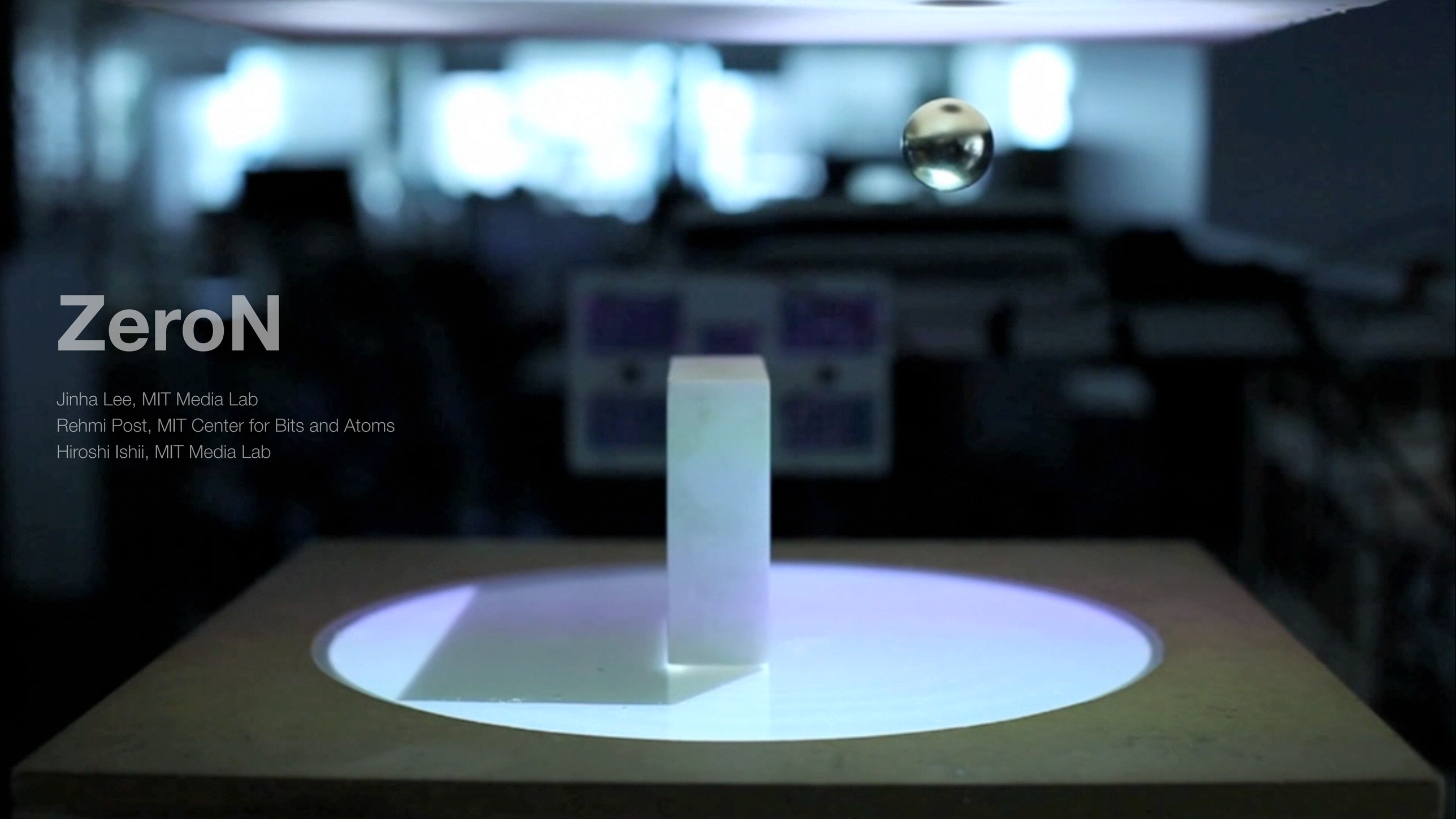
Recompose
based on Relief
UIST 2011



Anthony DeVincenzi, David Lakatos, Matthew Blackshaw, Daniel Leithinger & Hiroshi Ishii

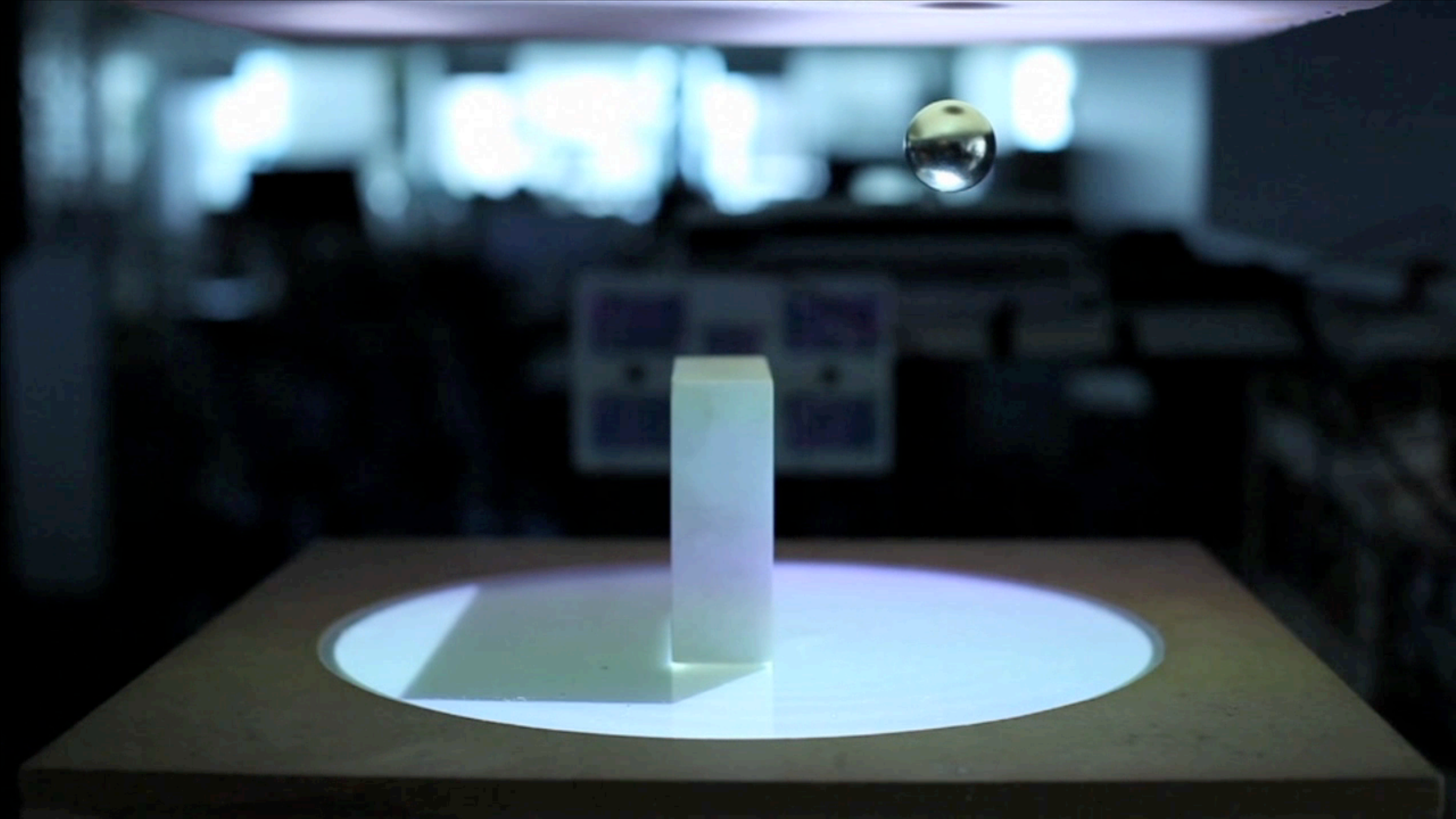
TimeScape
based on Relief

Daniel Leithinger, Jinha Lee, Sean Follmer, Austin Lee, Matthew Chang & Hiroshi Ishii

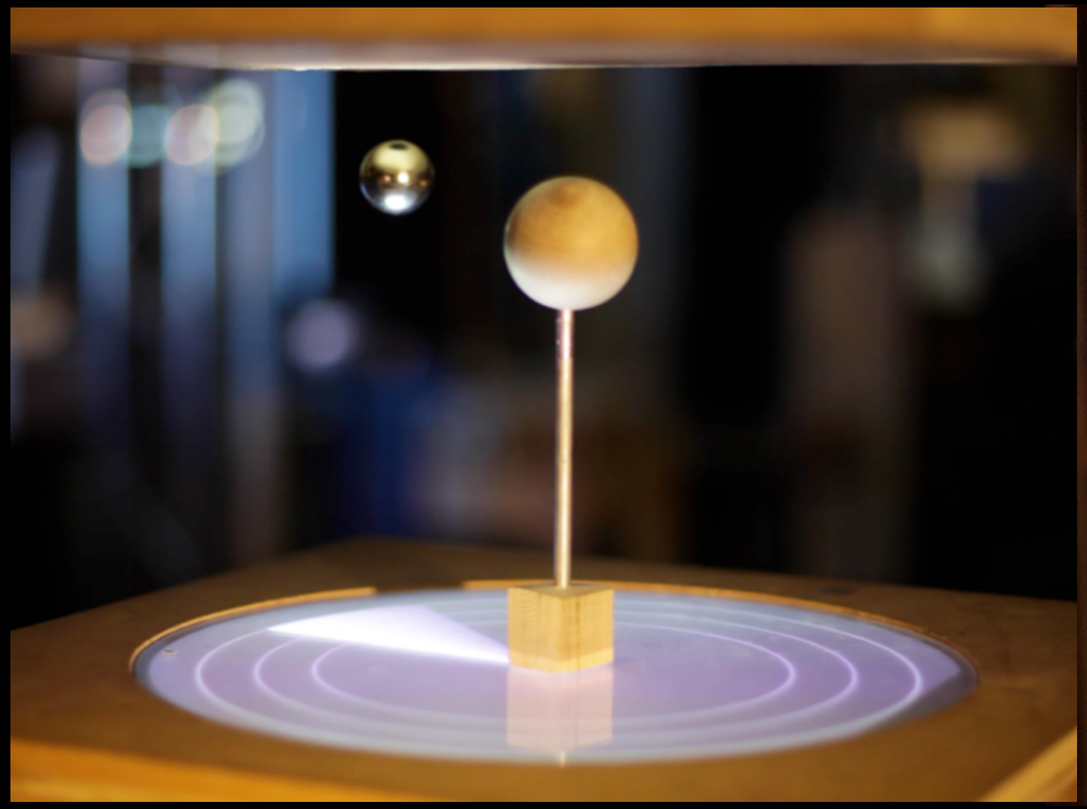


ZeroN

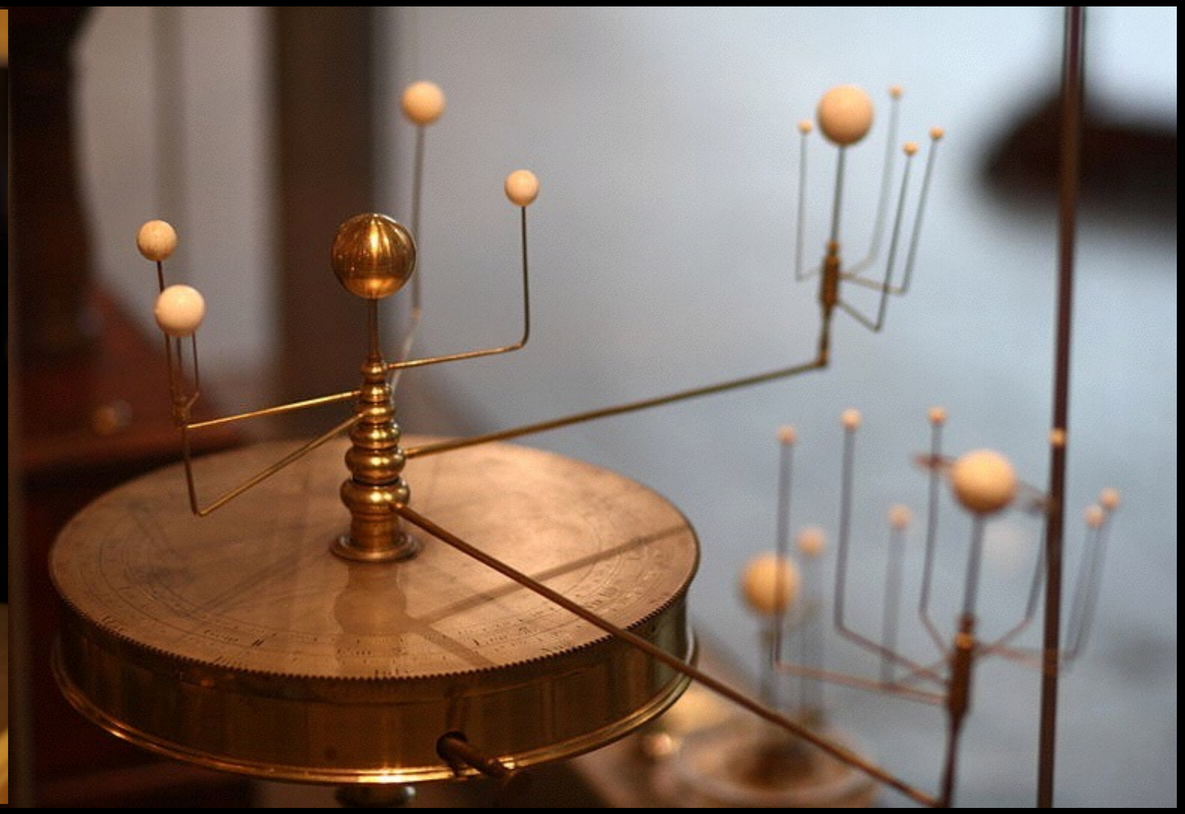
Jinha Lee, MIT Media Lab
Rehmi Post, MIT Center for Bits and Atoms
Hiroshi Ishii, MIT Media Lab



ZeroN



Orrery

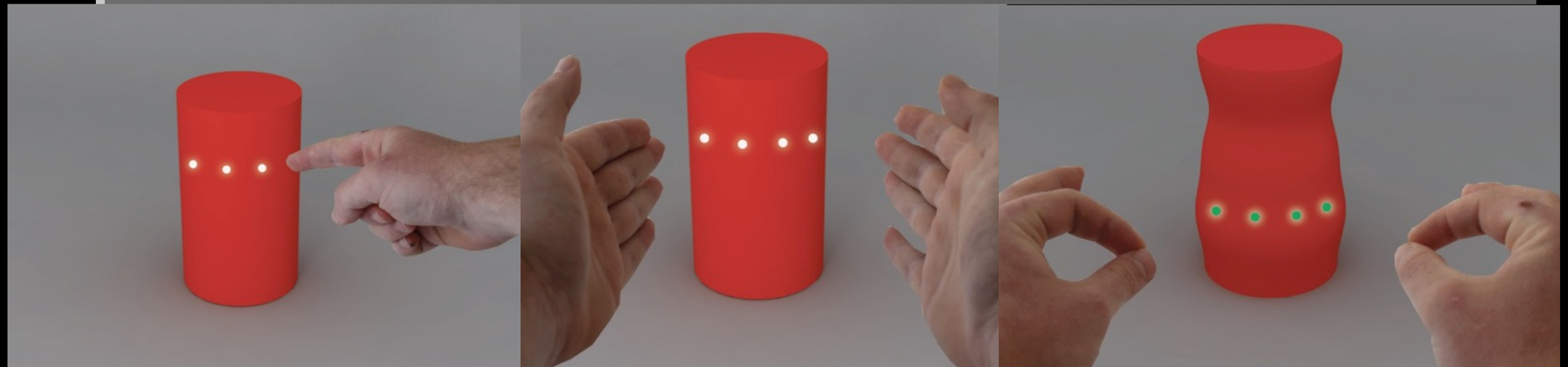


Q: affordance / legibility

Amphorm

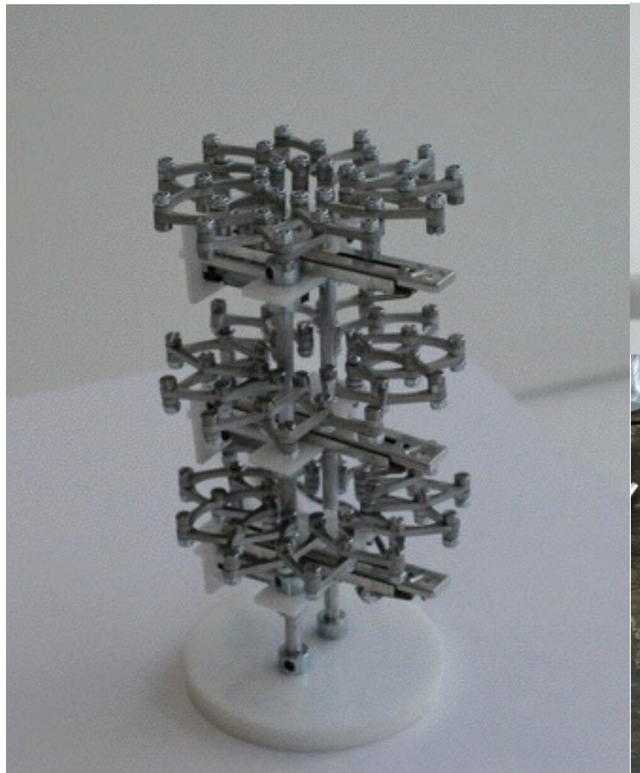
(Amphora + Form)
Vase that uses kinetic elements to transform its shape in sync with a digital model

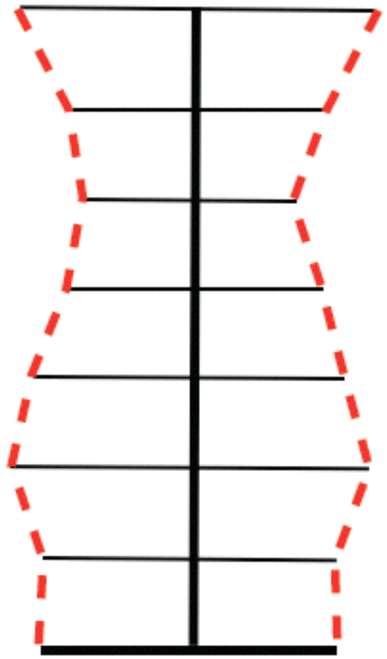
Dávid Lakatos &
Hiroshi Ishii

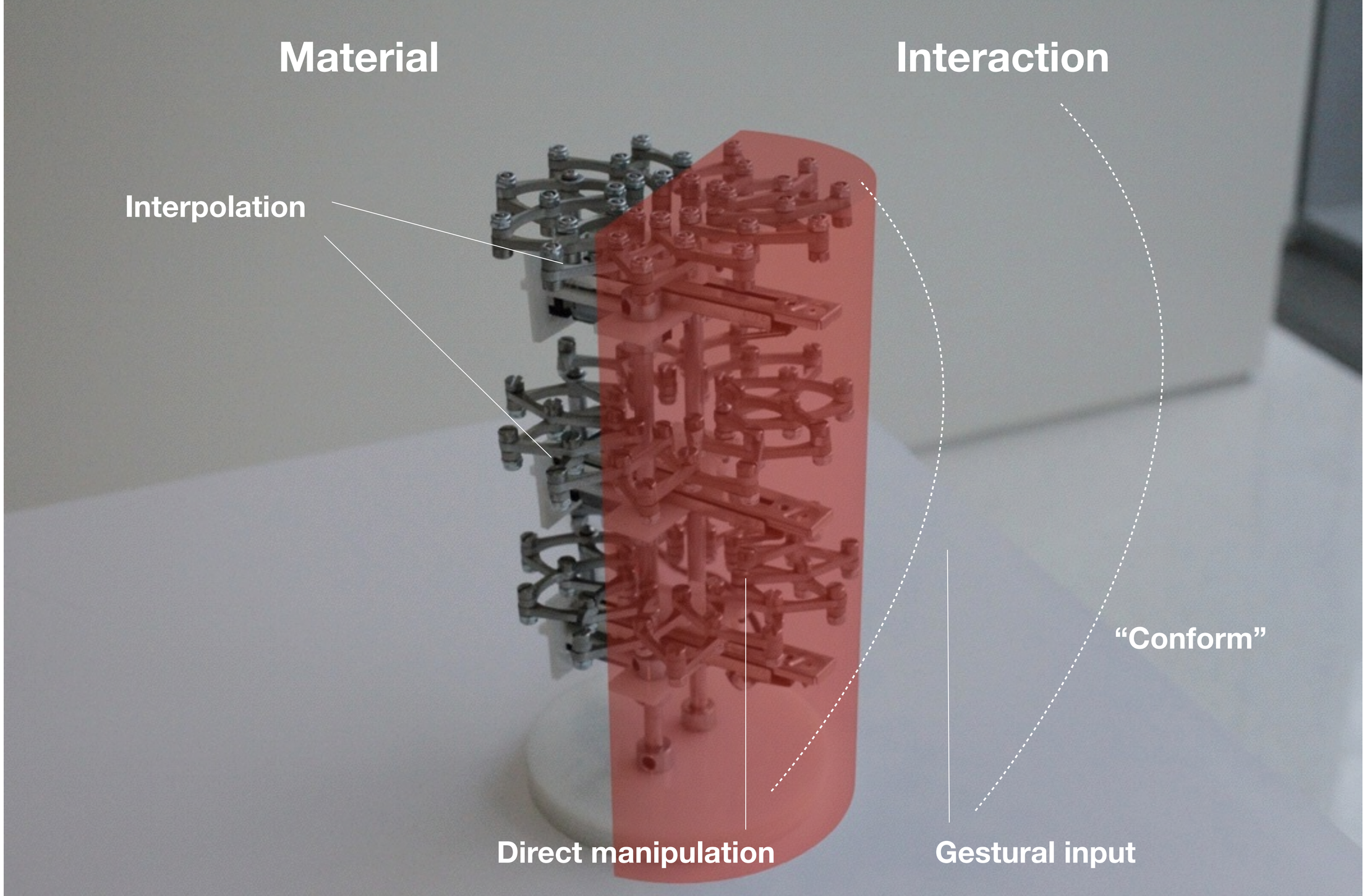


How will we interact with future dynamic materials in our environment?

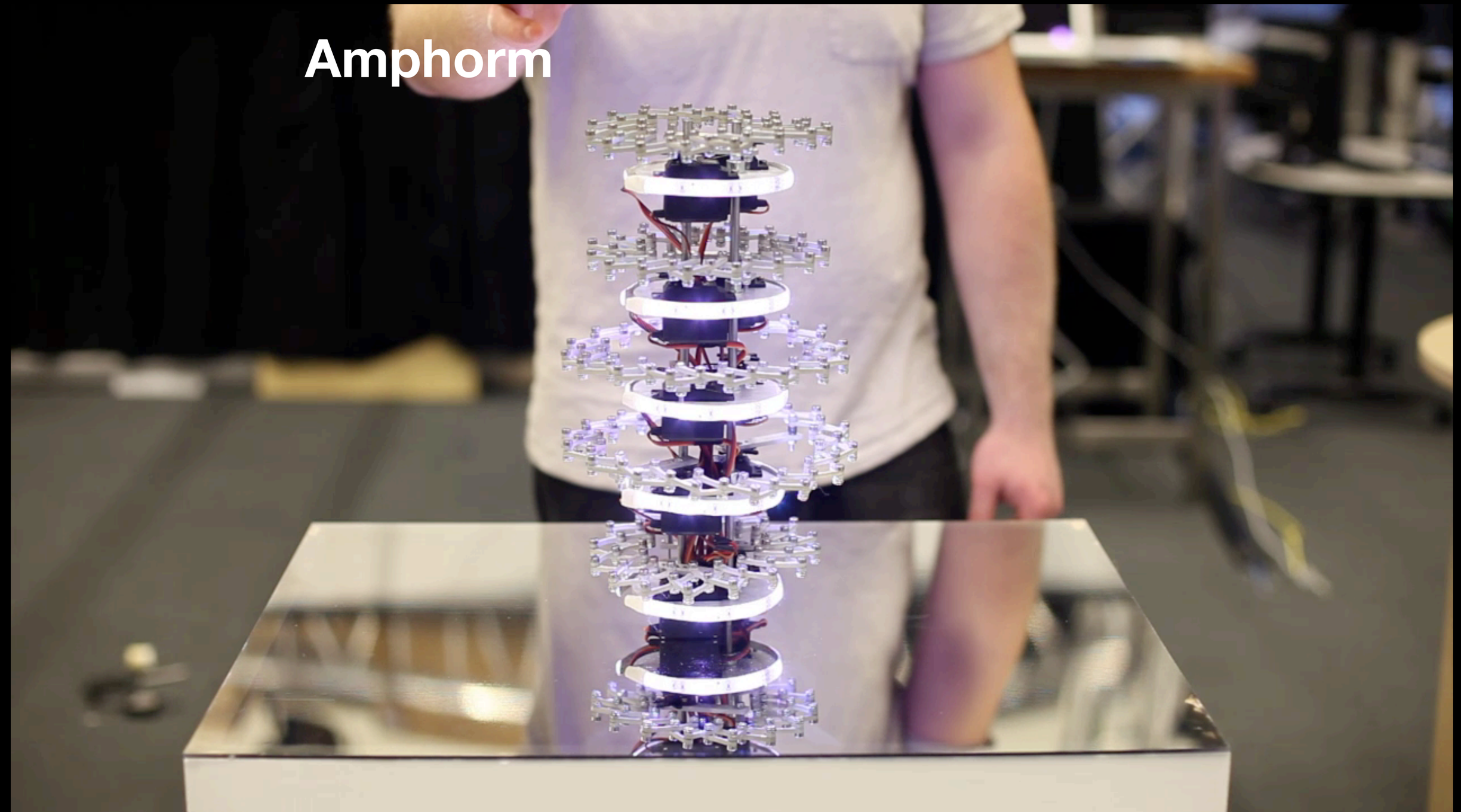
How can we experiment without these materials?



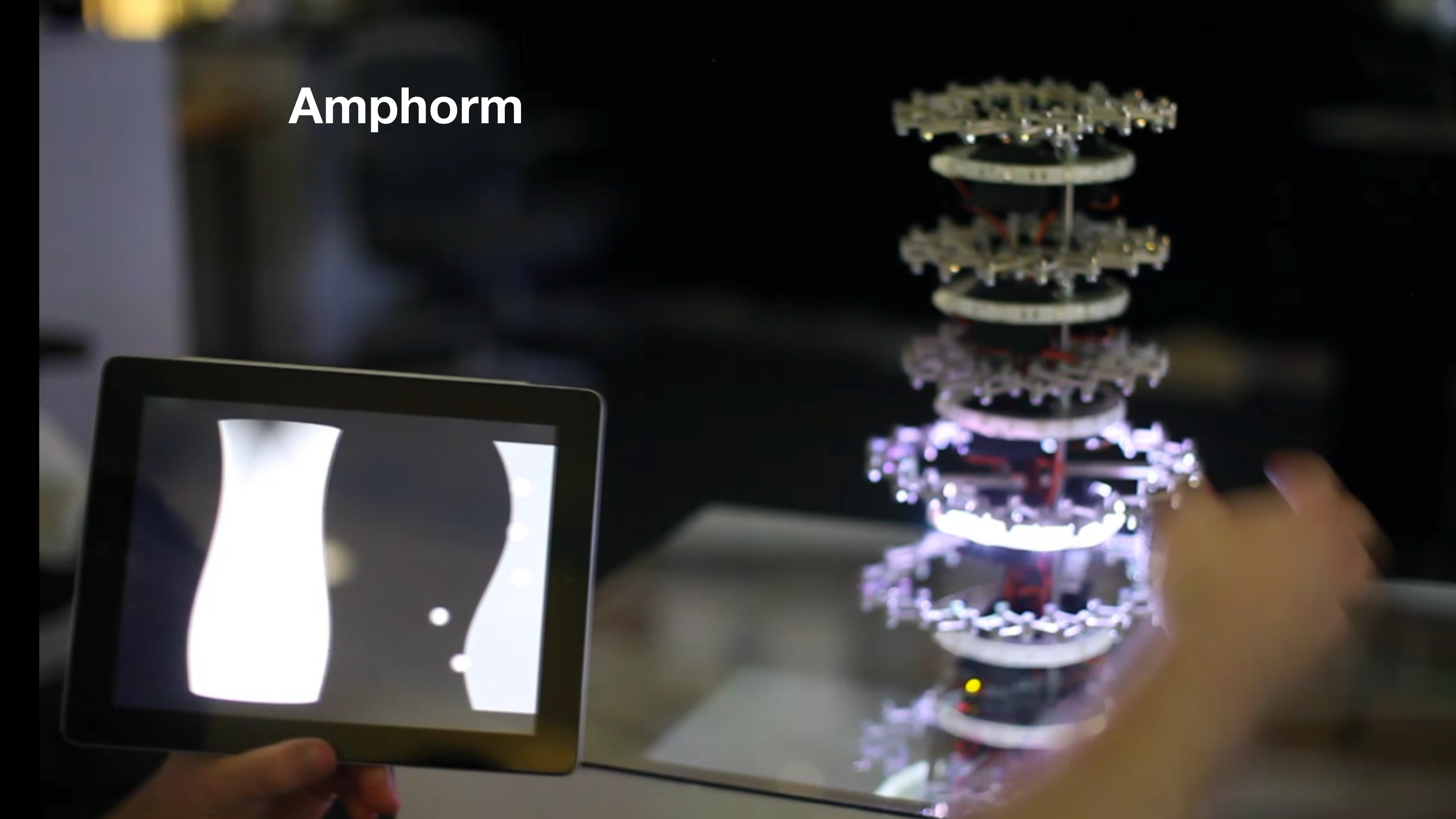



Material
Interaction
Interpolation
“Conform”
Direct manipulation
Gestural input

Amphorm

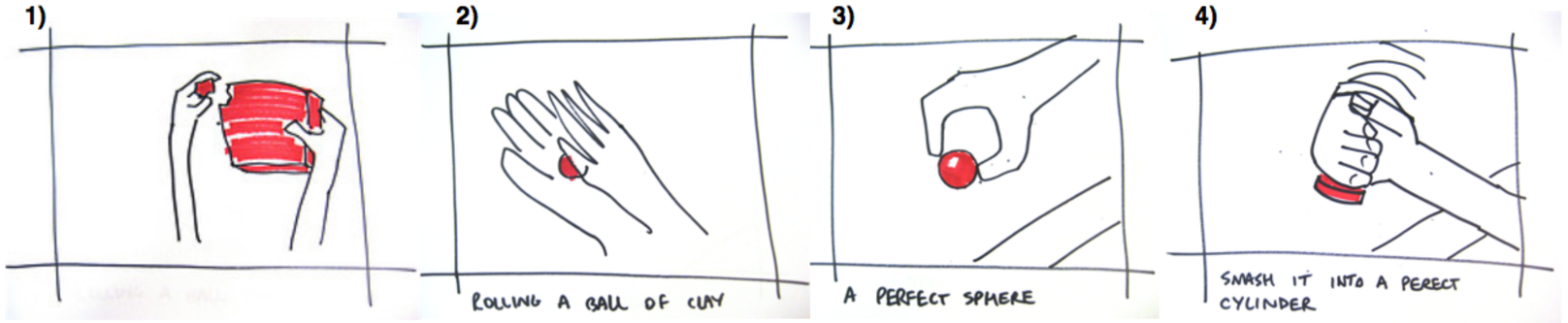


Amphorm



Amphorm

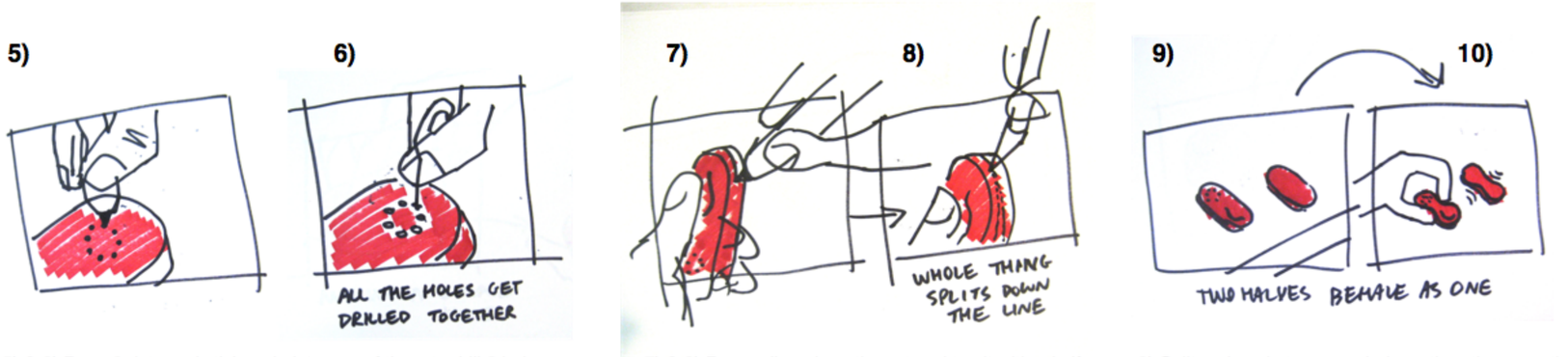

ROLLING PERFECT RED
MAKES A PERFECT SPHERE



1) Tear off a piece of perfect red

2) & 3) Roll a ball of clay to let it snap to a perfect sphere

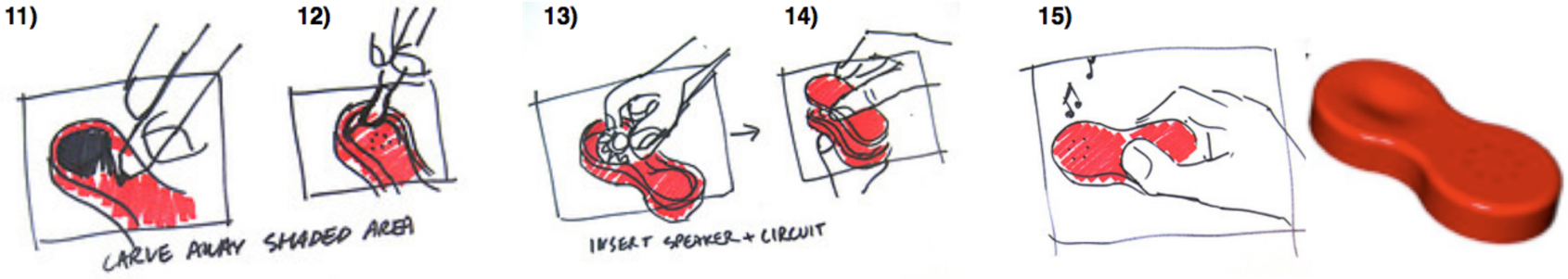
4) smash a ball into a perfect cylinder



5) & 6) Draw 8 dots and stick a pin into one of them to drill 8 holes

7) & 8) Draw a line along the cut and tap it with a knife

9) Split a piece in two even halves, then the operations performed on one part are mirrored in the other



11) & 12) Cave away shaded area with chisel and mirror it another piece

13) & 14) Insert materials and put two mirrored pieces together

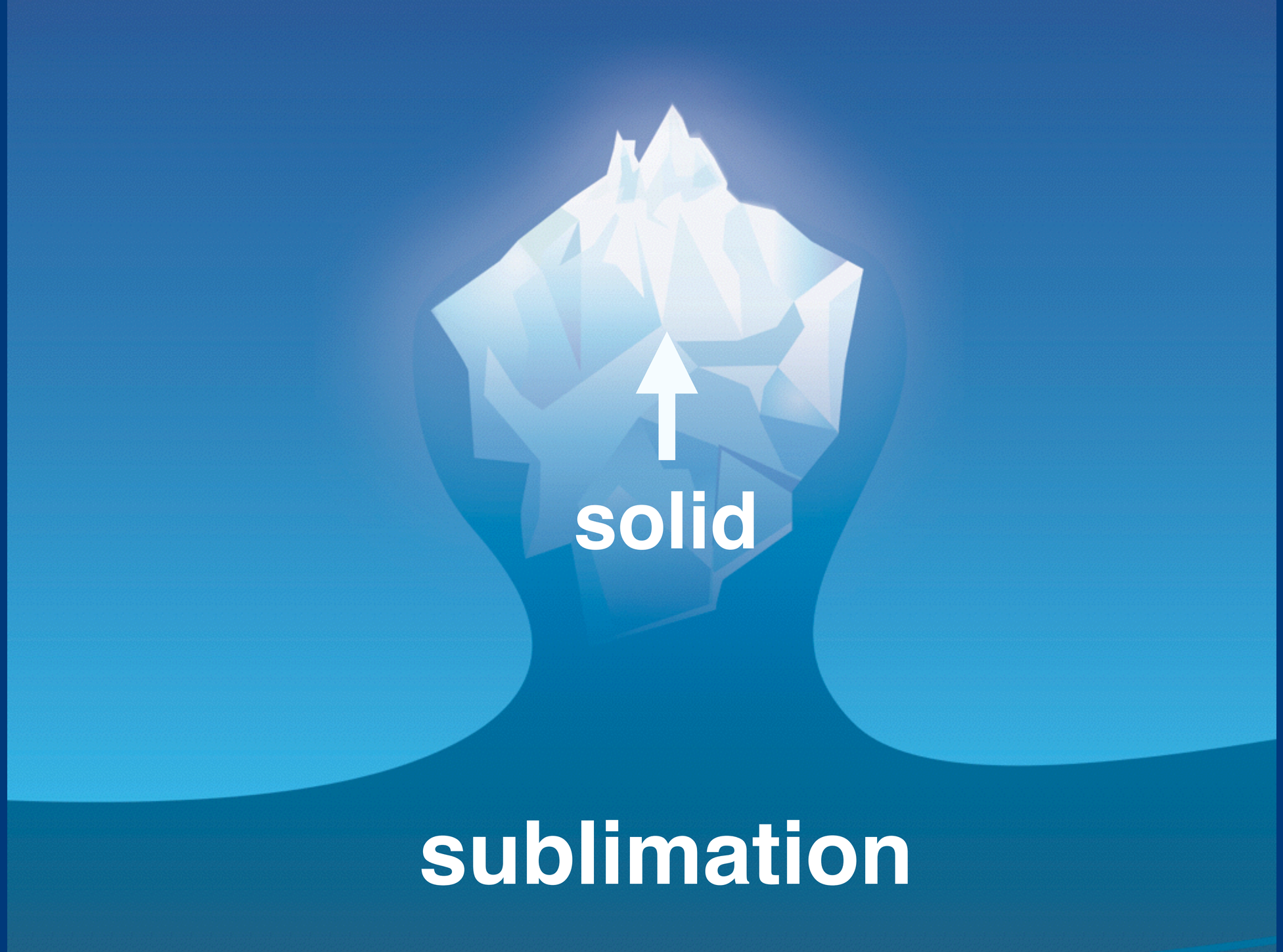
15) final rattle created with Radical Atoms

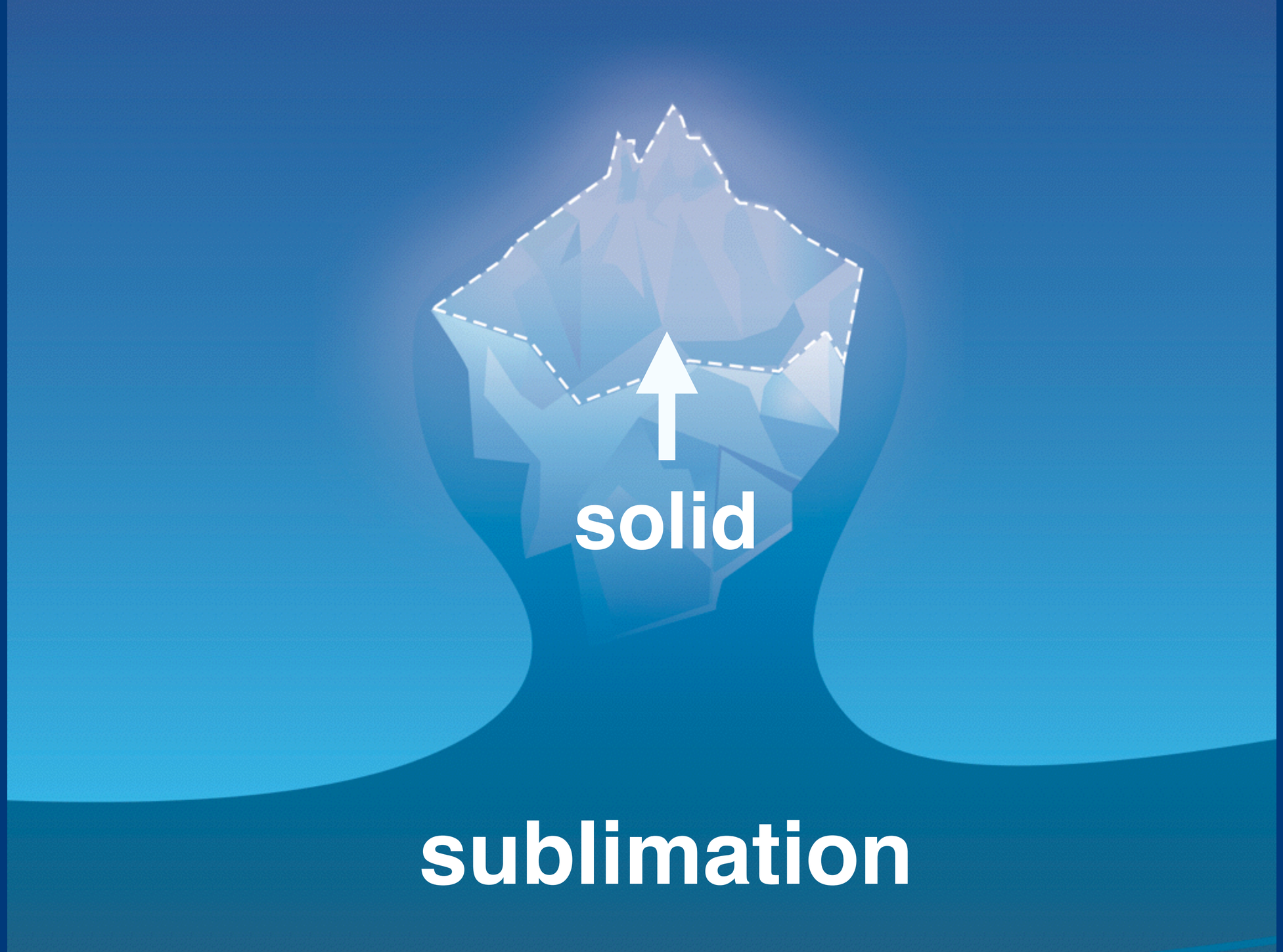
Making a Rattle with Perfect Red - Story Board by Leonardo Bonanni

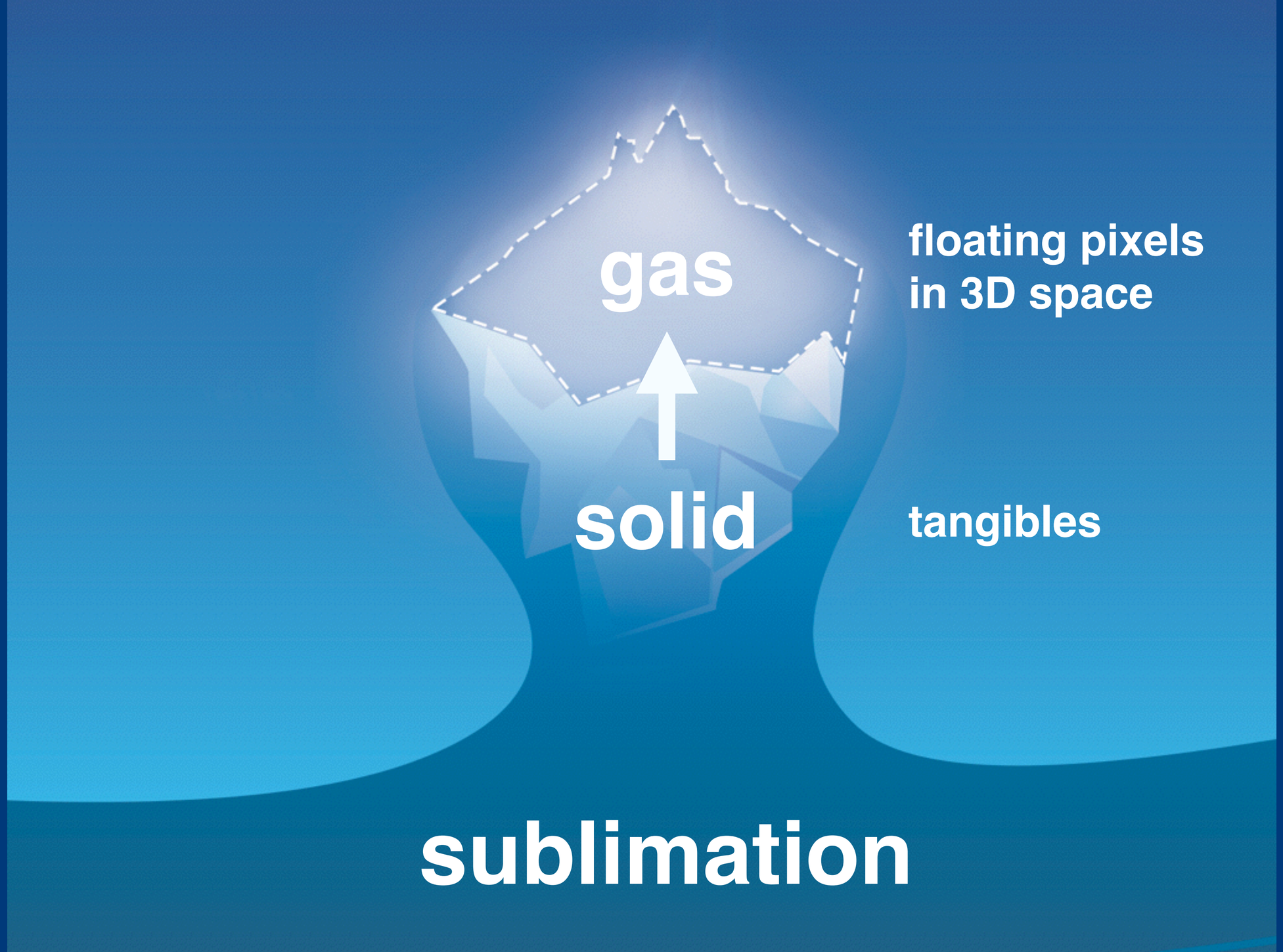
PERFECT RED

towards **Radical Atoms**: exploring form-giving with shape memory clay


phase
transition

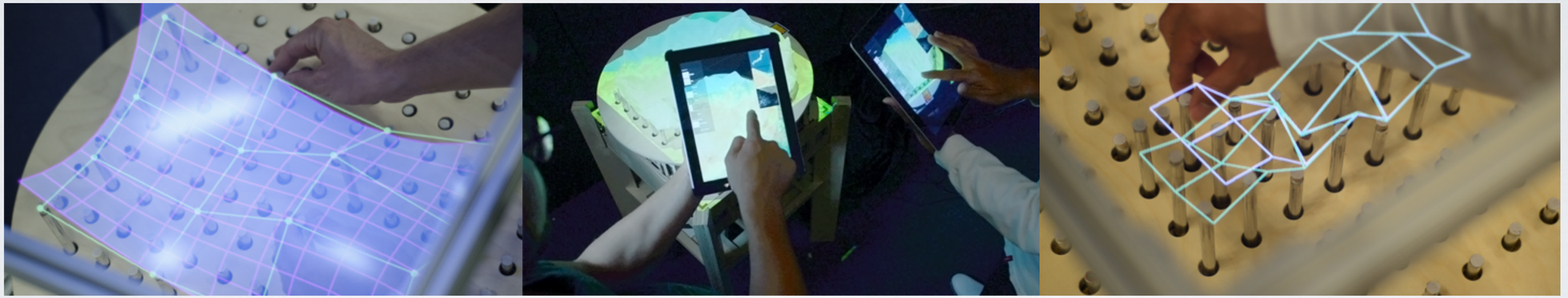

solid
sublimation


solid
sublimation


gas
floating pixels
in 3D space
solid
tangibles
sublimation

SUBLIMATE:

STATE-CHANGING VIRTUAL AND PHYSICAL RENDERING TO AUGMENT INTERACTION WITH SHAPE DISPLAYS



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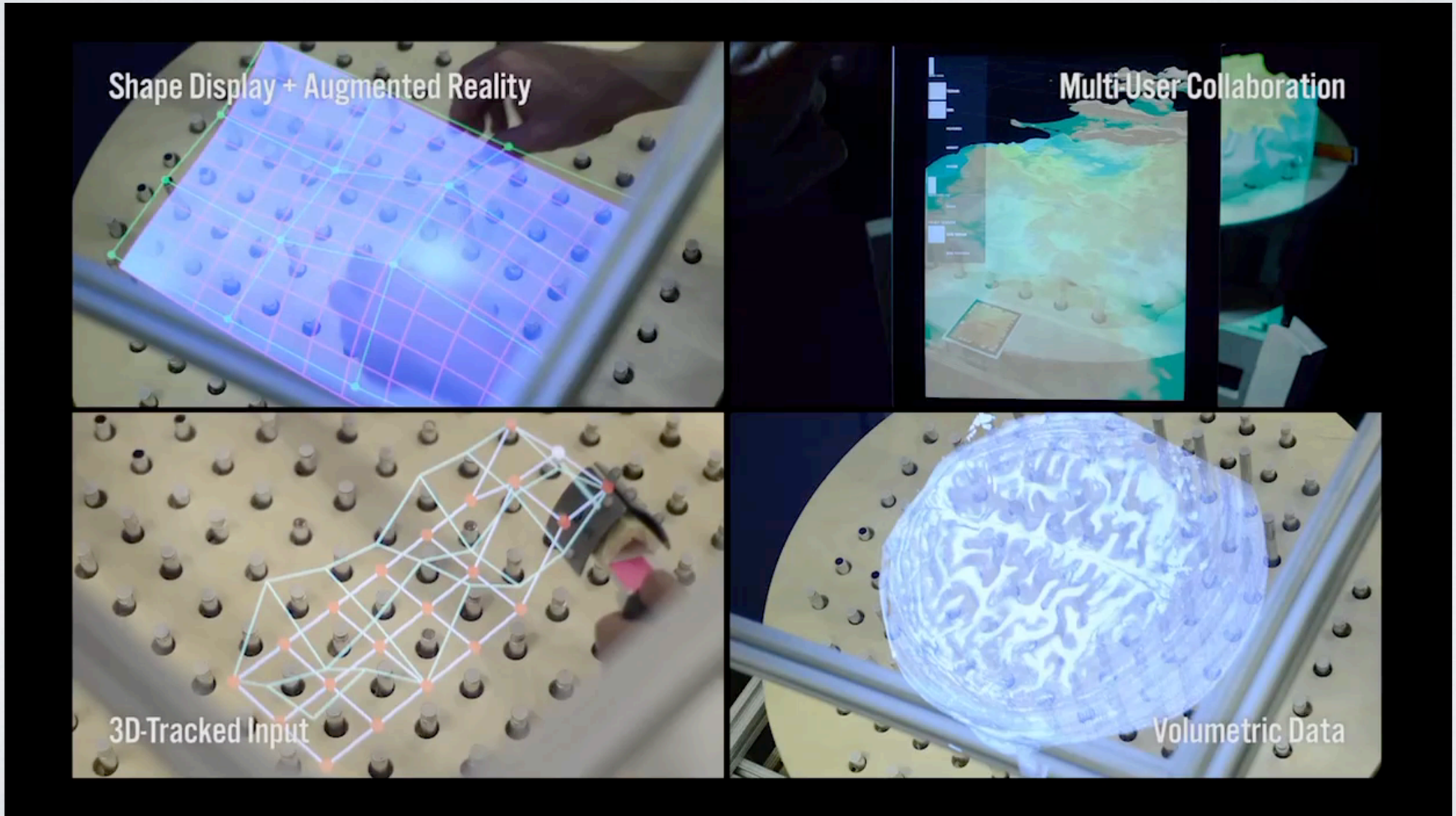
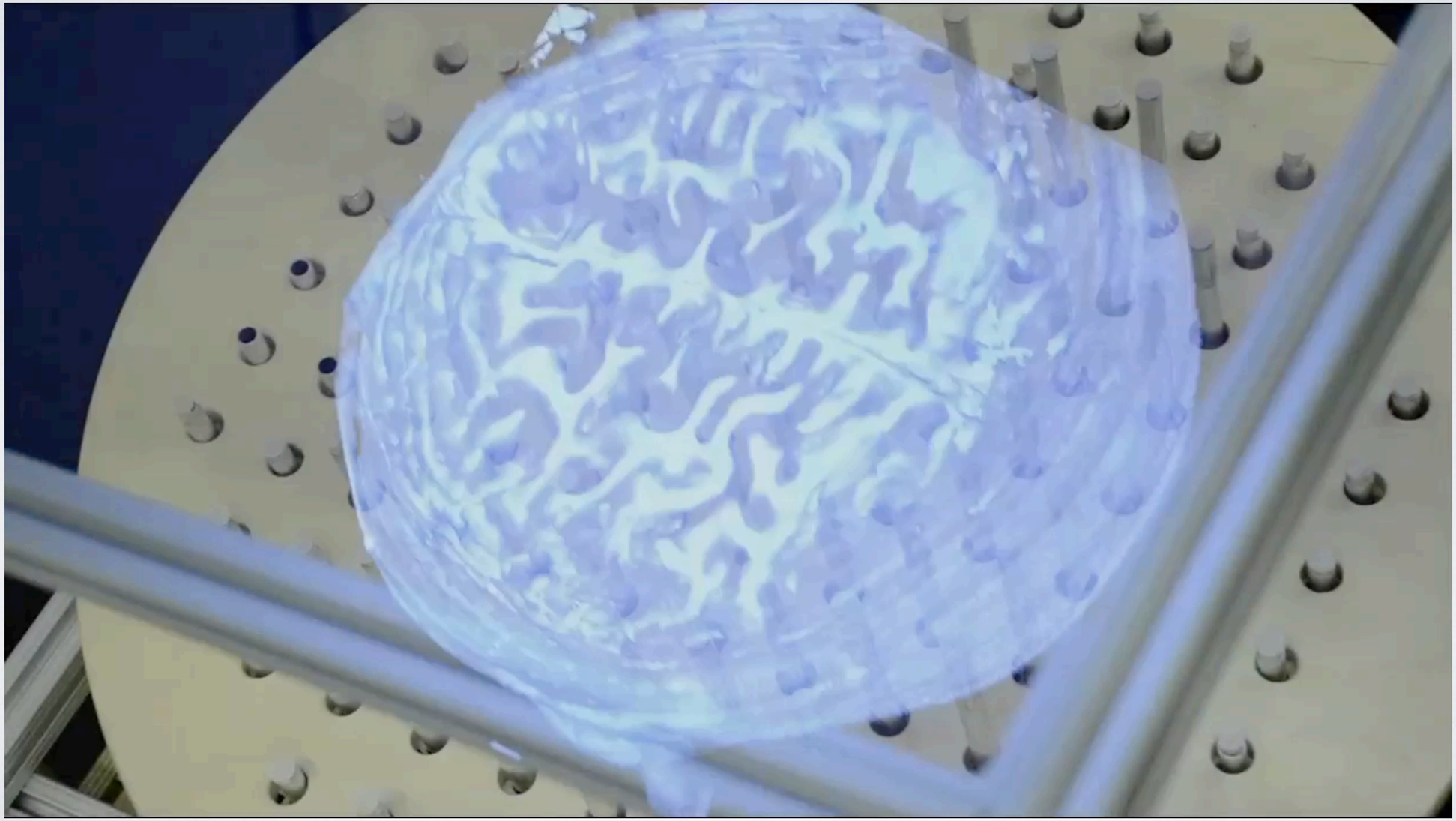
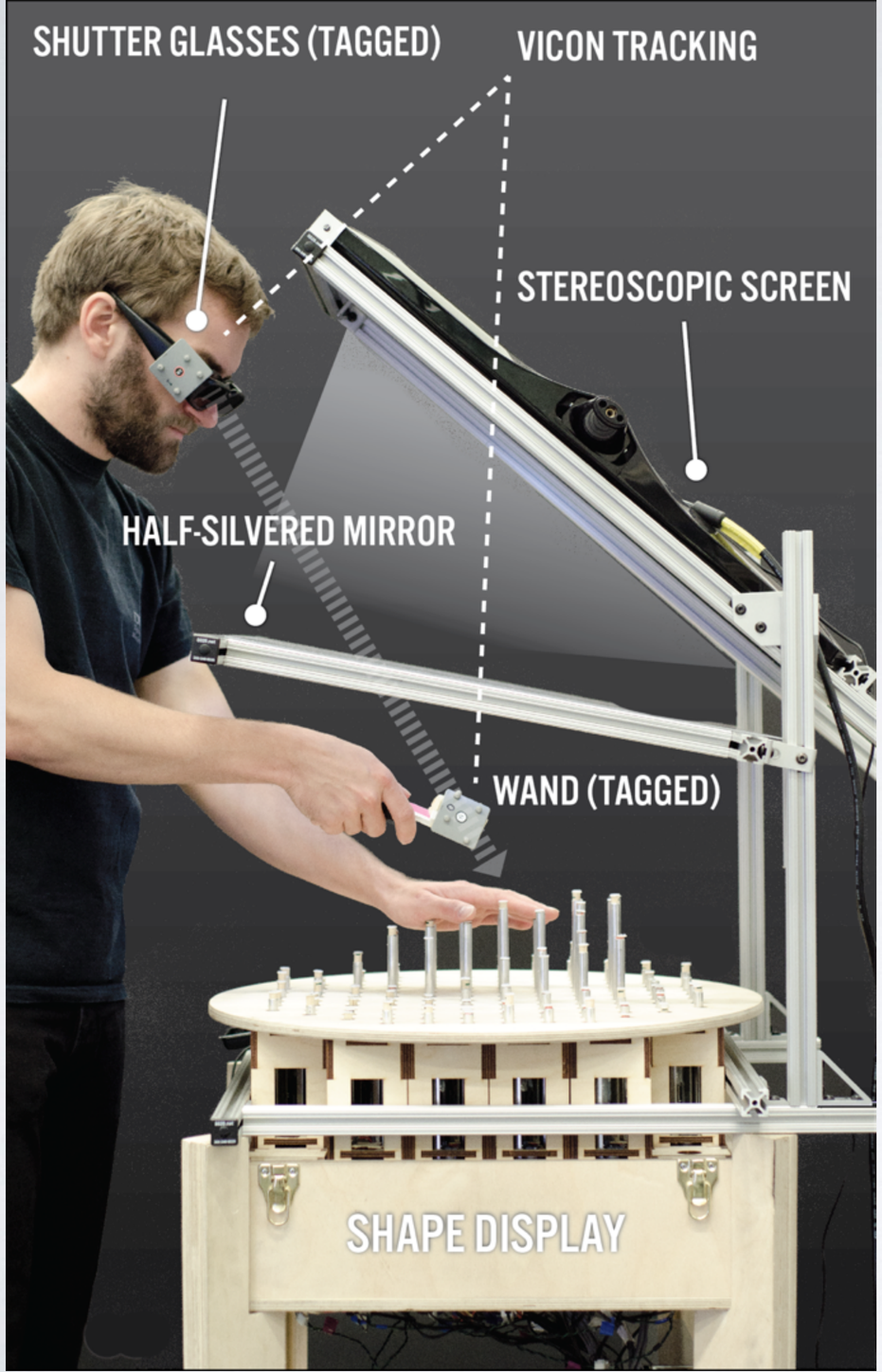
http://tangible.media.mit.edu

SUBLIMATE


Shape Display + Augmented Reality
Multi-User Collaboration
3D-Tracked Input
Volumetric Data

VOLUMETRIC




SHUTTER GLASSES (TAGGED)
VICON TRACKING
STEREOSCOPIC SCREEN
HALF-SILVERED MIRROR
WAND (TAGGED)
SHAPE DISPLAY


TOP-DOWN PROJECTION
PROJECTION SCREEN
TABLET
MARKER TRACKING
AR MARKERS
SHAPE DISPLAY

Radical Challenges

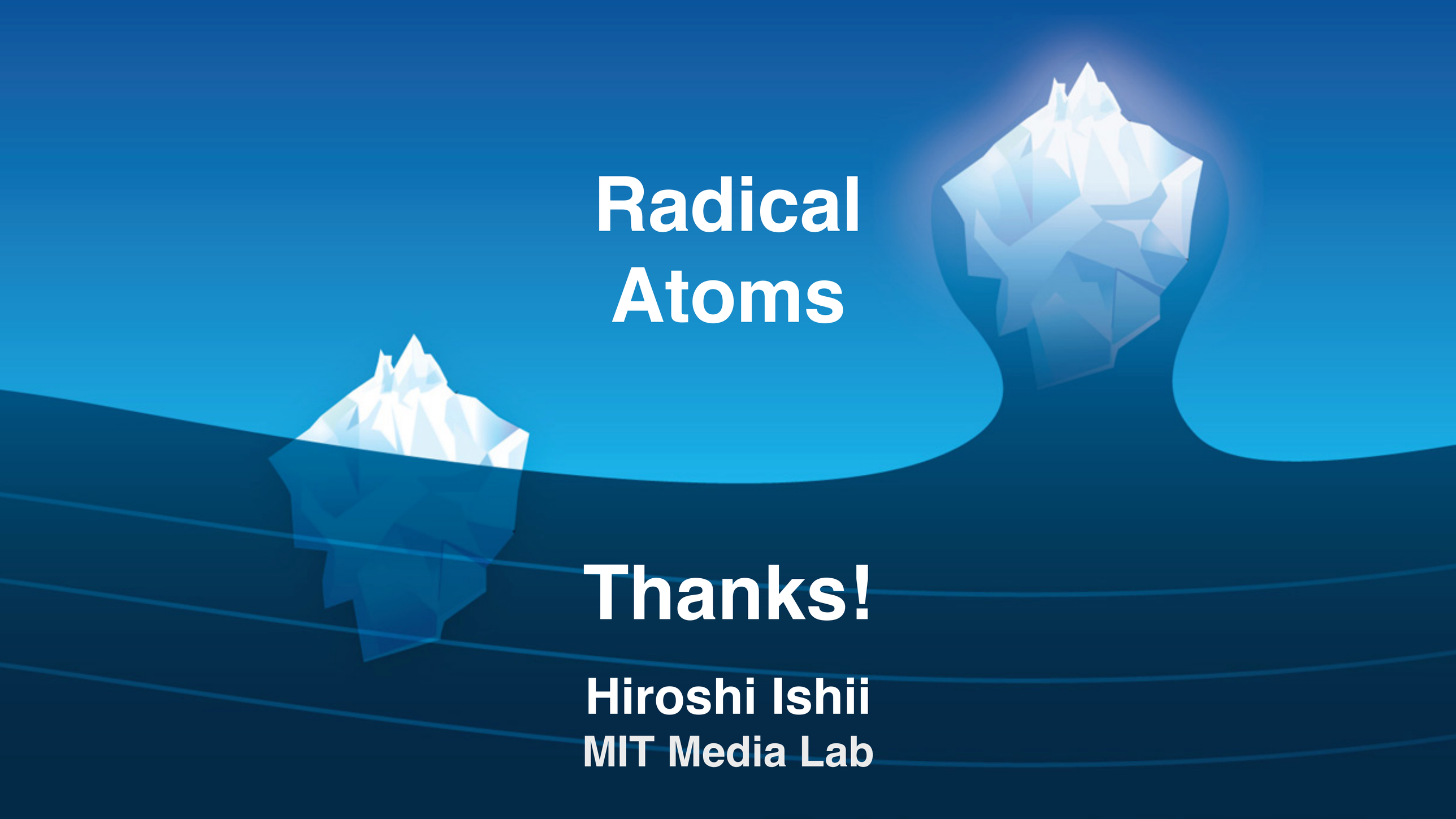
- Designing with dynamically controllable material
- Challenging static affordances with dynamic abilities
  - Identify dynamic material
  - Understand material abilities
  - Predict range of abilities
- Redefining human cognitive invariants

Dynamic Abilities

- Shape-shifting
- Color-changing
- Rapid solidification
- Rapid liquefaction (melting/ freezing)
- Rapid sublimation/deposition
- Anti-gravitational

Radical Atoms: Challenges
Materials, Tools, and Applications

- How to Inform Atoms?
  - Direct Manipulation (with touch & gesture)
  - Special Tools (“RA oven”)
  - Context Aware (semi-automatic)
  - Programming
    - » Tangible Programming
    - » 3D CAD (GUI) & download
    - » Programming by Examples
- Killer Applications


Radical
Atoms
Thanks!
Hiroshi Ishii
MIT Media Lab