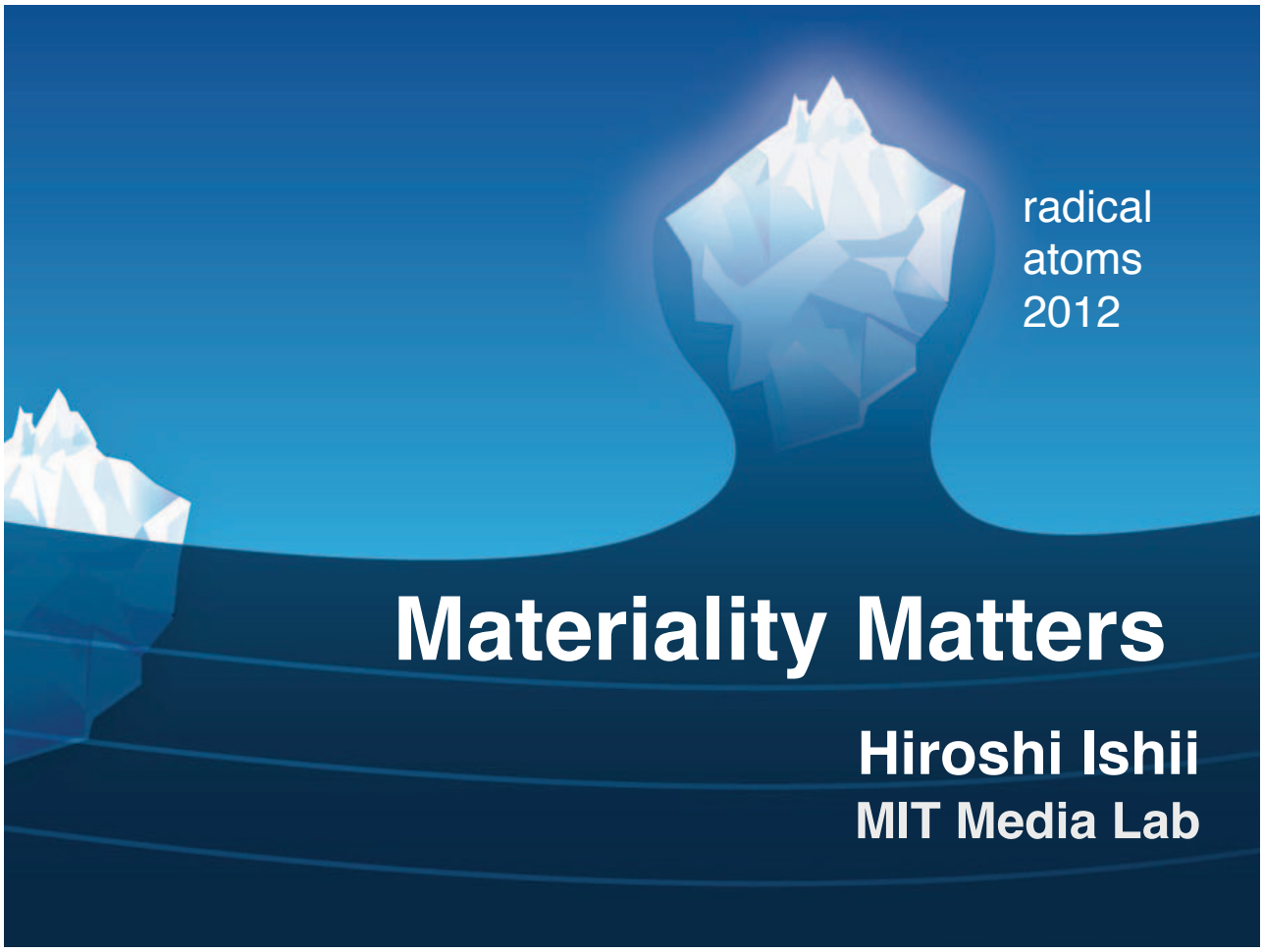
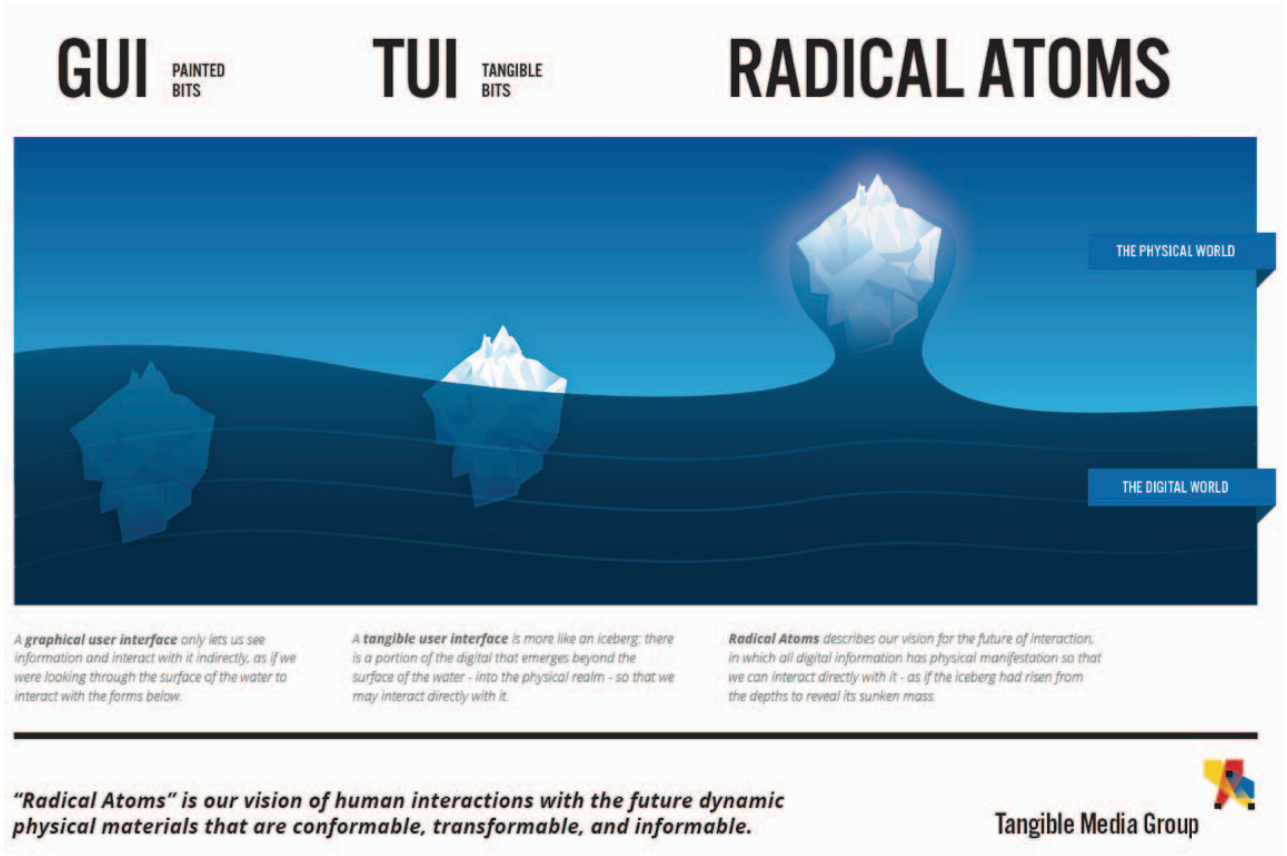
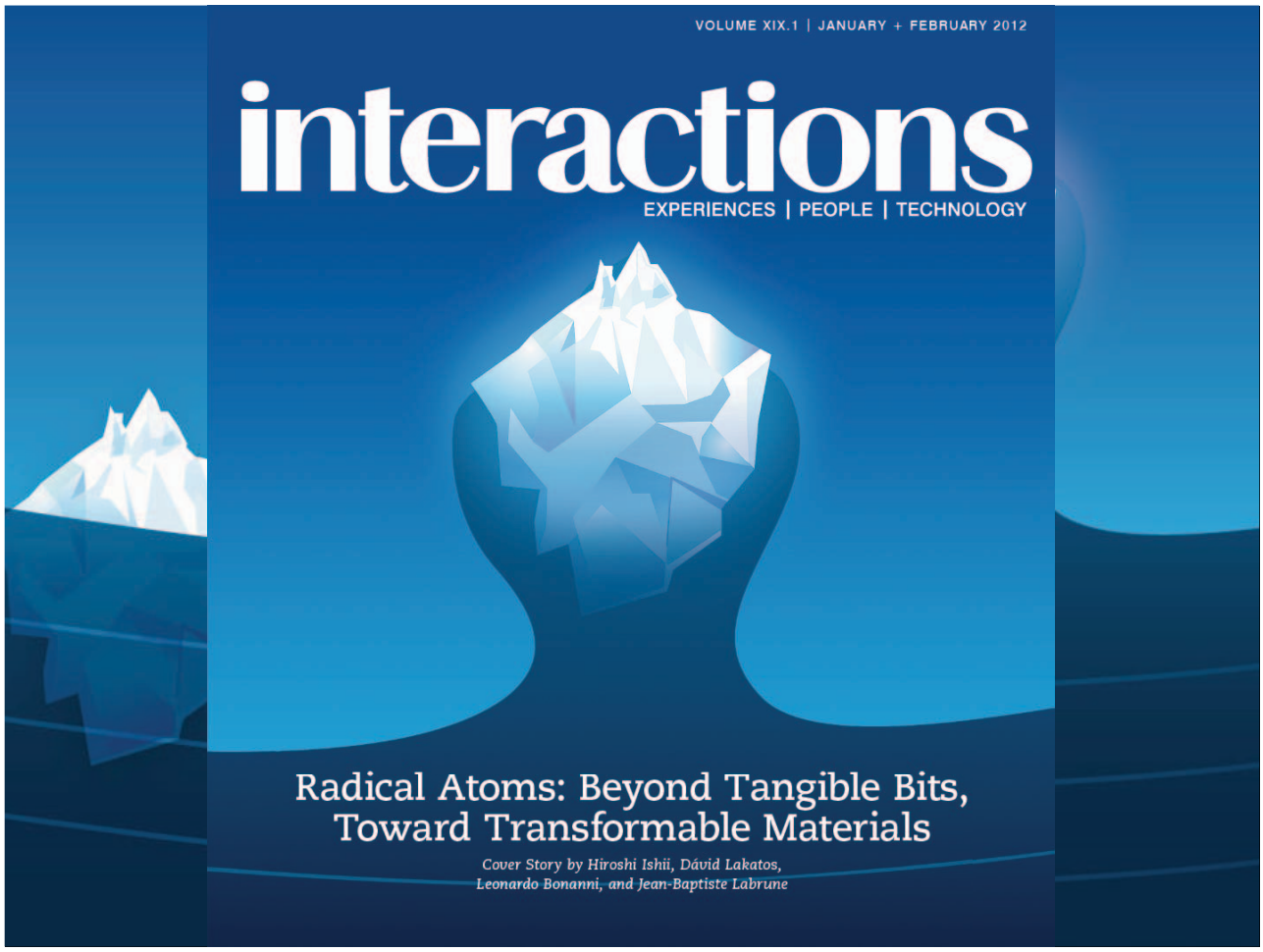
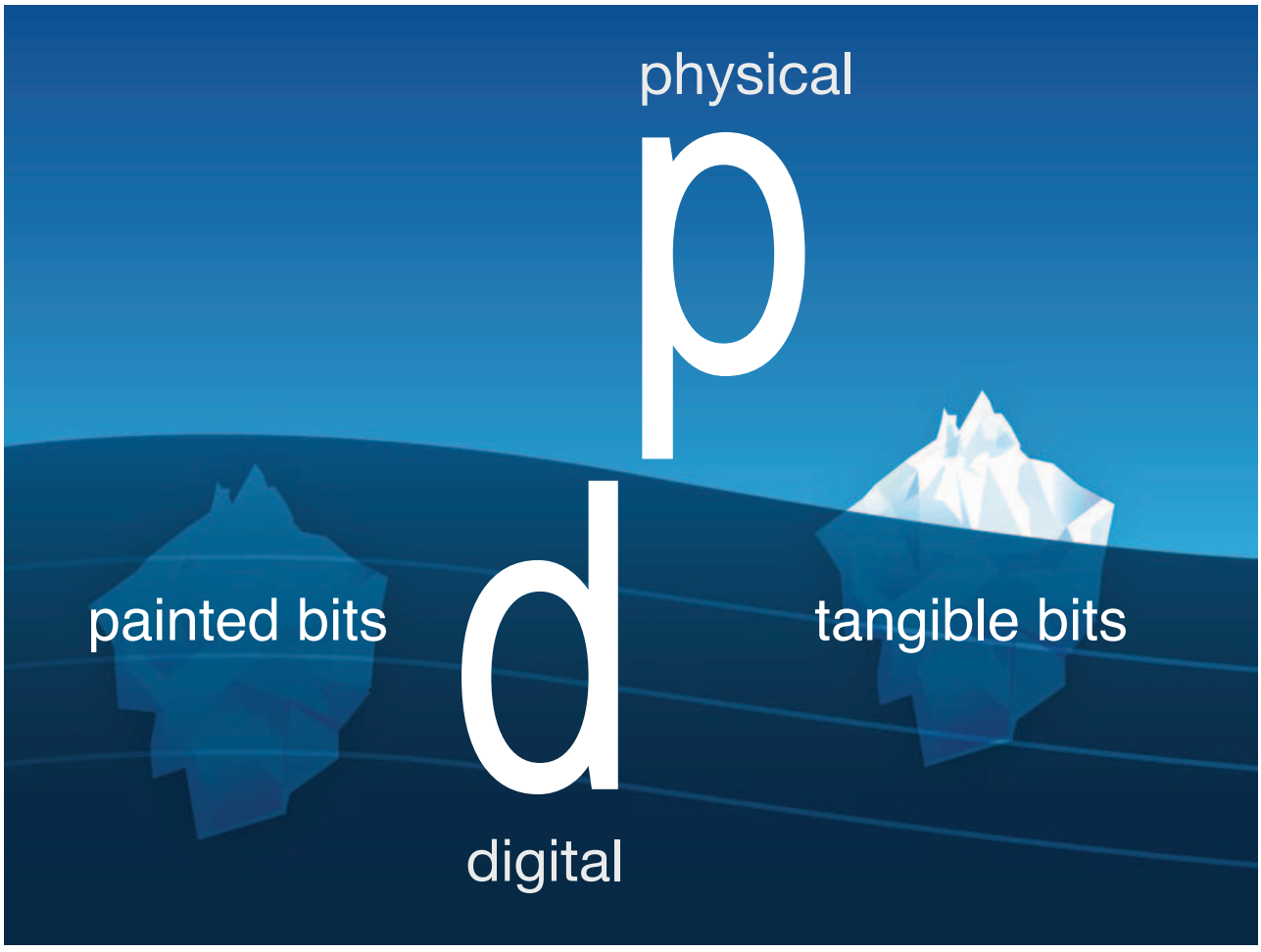
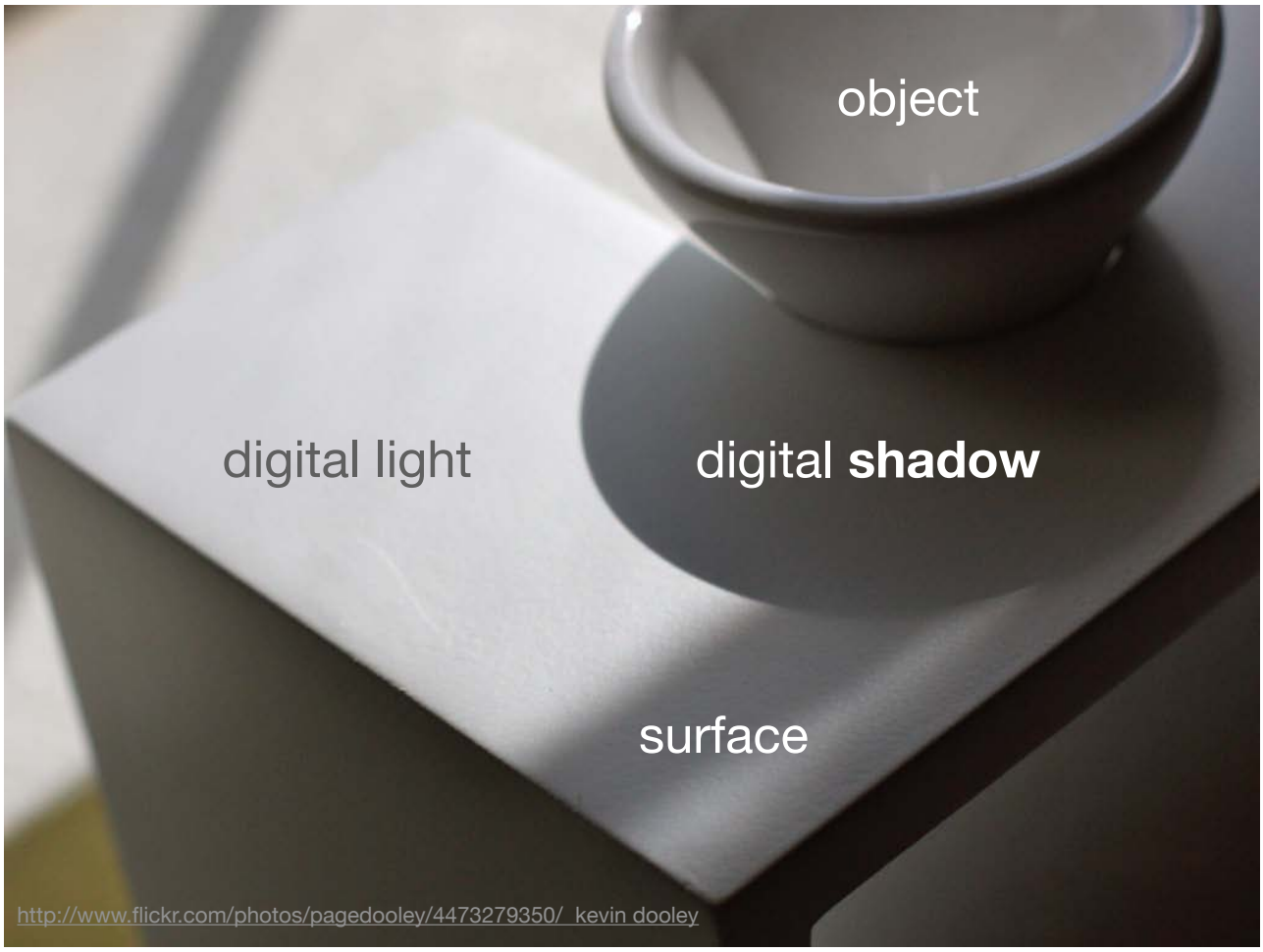

radical
atoms
2012
Materiality Matters
Hiroshi Ishii
MIT Media Lab


GUI PAINTED BITS
TUI TANGIBLE BITS
RADICAL ATOMS
THE PHYSICAL WORLD
THE DIGITAL WORLD
A graphical user interface only lets us see information and interact with it indirectly, as if we were looking through the surface of the water to interact with the forms below.
A tangible user interface is more like an iceberg: there is a portion of the digital that emerges beyond the surface of the water - into the physical realm - so that we may interact directly with it.
Radical Atoms describes our vision for the future of interaction, 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.
"Radical Atoms" is our vision of human interactions with the future dynamic physical materials that are conformable, transformable, and informable.
Tangible Media Group


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


physical
p
painted bits
d
tangible bits
digital


object
digital light
digital **shadow**
surface
http://www.flickr.com/photos/pagedooley/4473279350/ kevin dooley


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

digital augmentation viewer & glasses

http://petitinvention.wordpress.com/2008/02/10/future-of-internet-search-mobile-version/
(c) Mac Funamizu “Looking Glass”

Materialize

digital information to interact with directly

painted bits

tangible bits

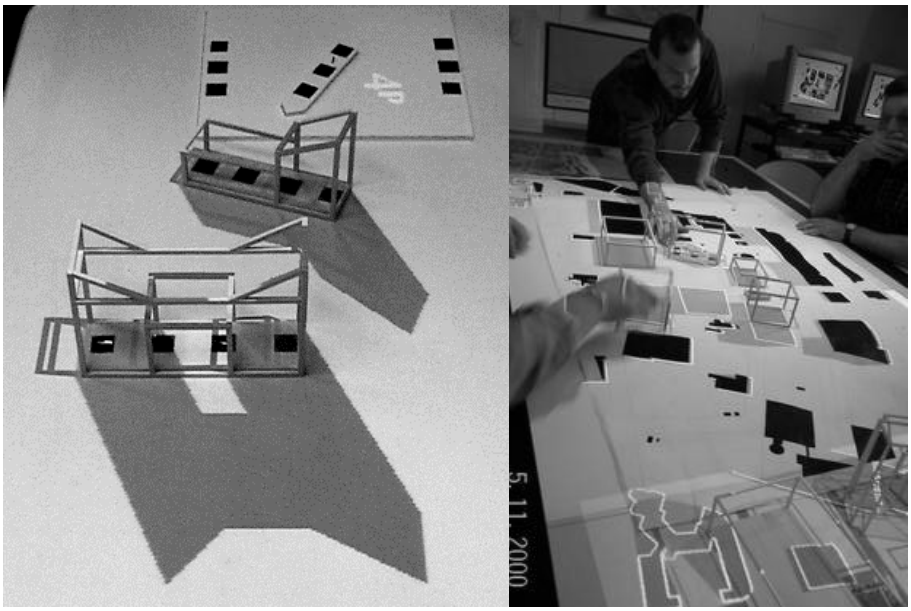
1997

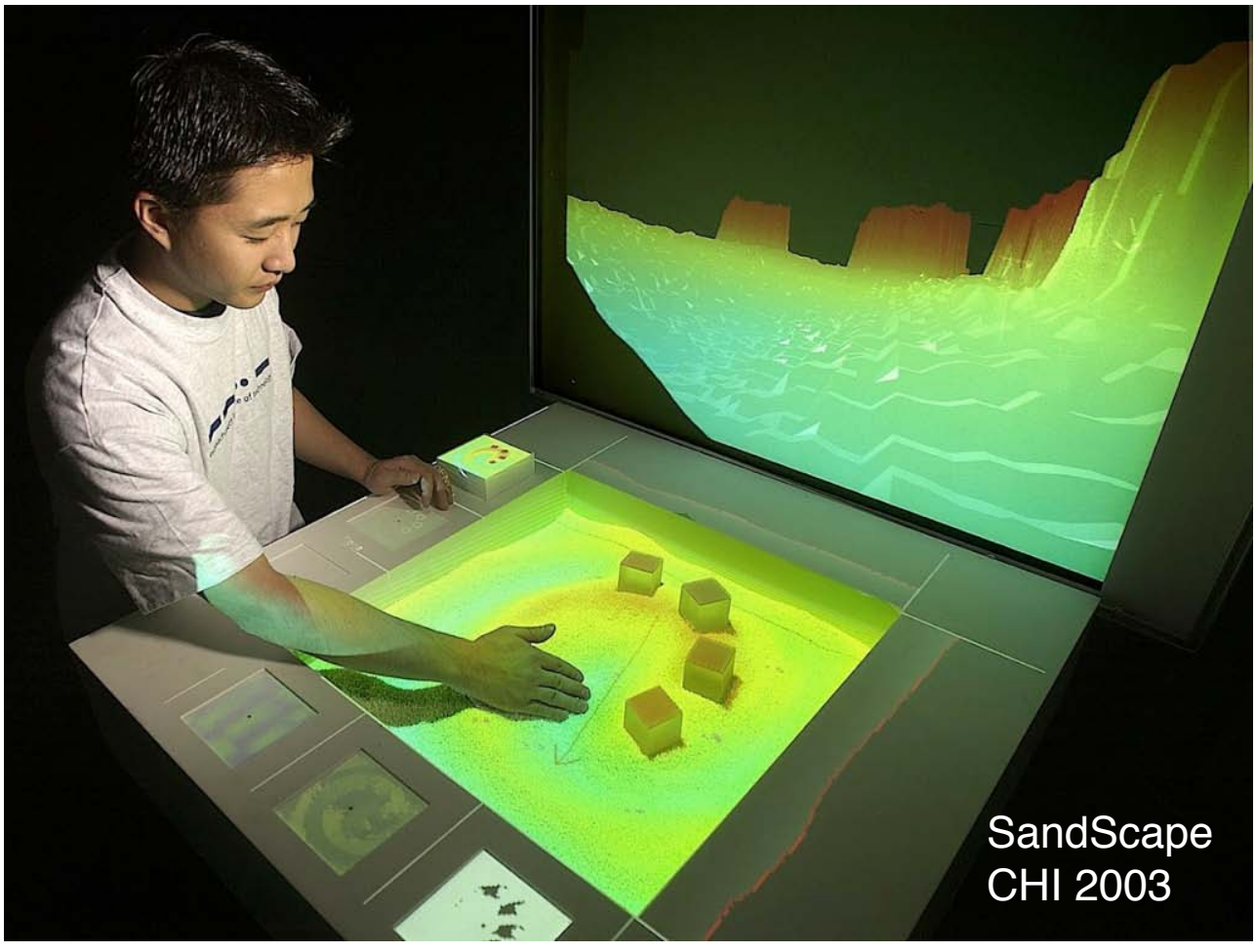
GUI

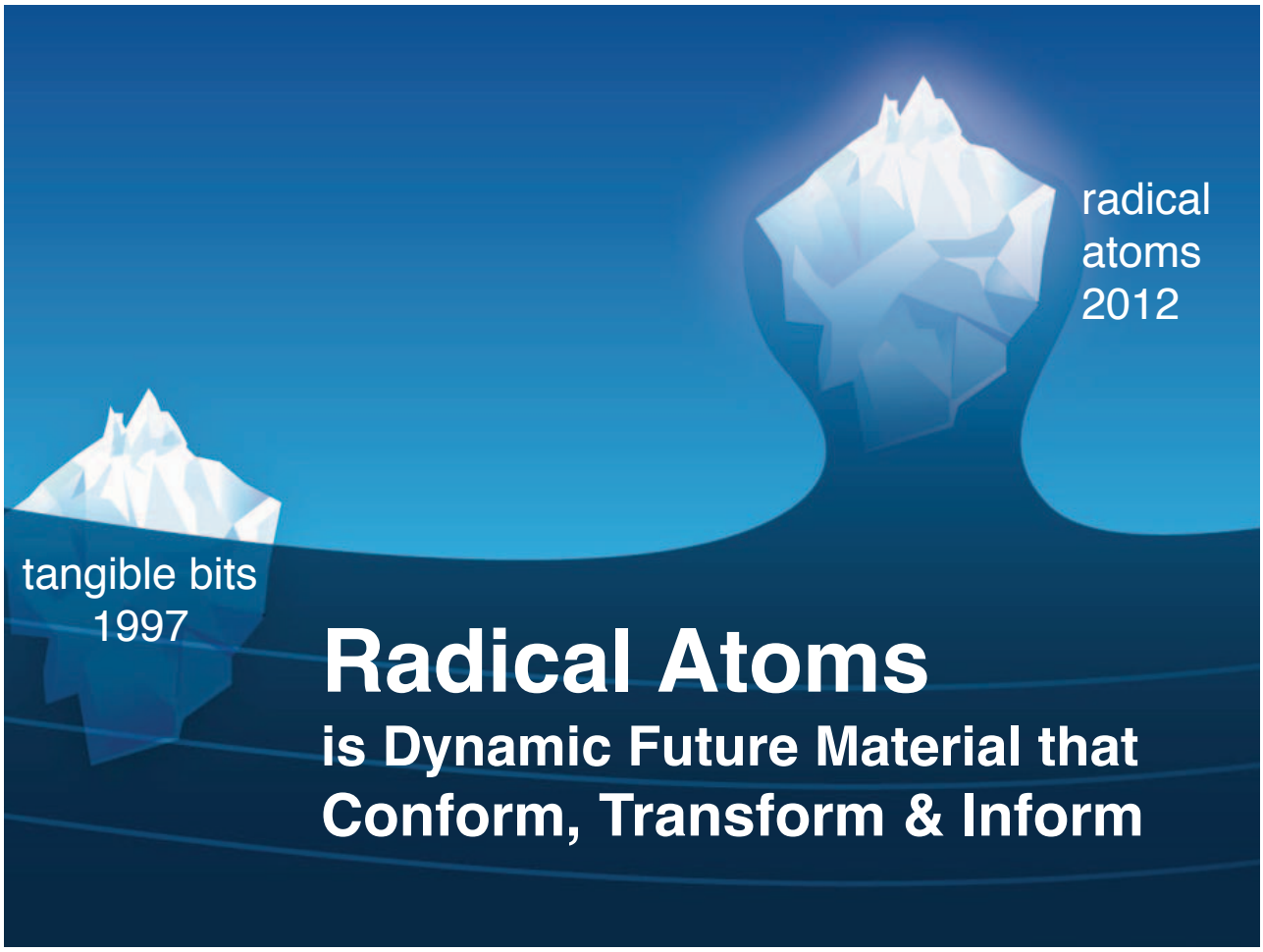
TUI

I/O Bulb & Luminous Room

John Underkoffler & Hiroshi Ishii CHI 99







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**

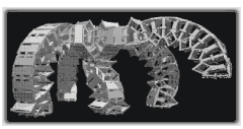
  Shape Memory Alloy

  NiTiNol
- **Robotics**

BOSU
Amanda Parkes

Surflex
Marcelo Coelho

topobo
Raffle & Parkes



Polypod
Mark Yim

Dynamic Materials

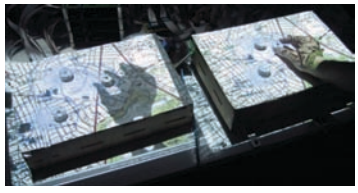
Programable Matters

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

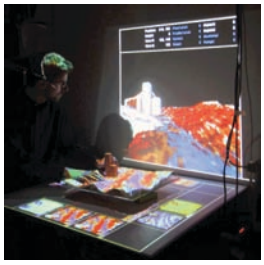
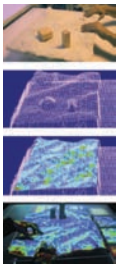
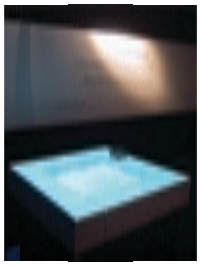
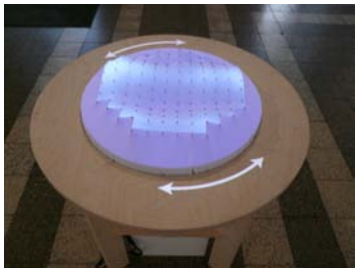
Tabletop Tangibles

Tangible Media Group

- Sensetable – Actuated Workbench – PICO

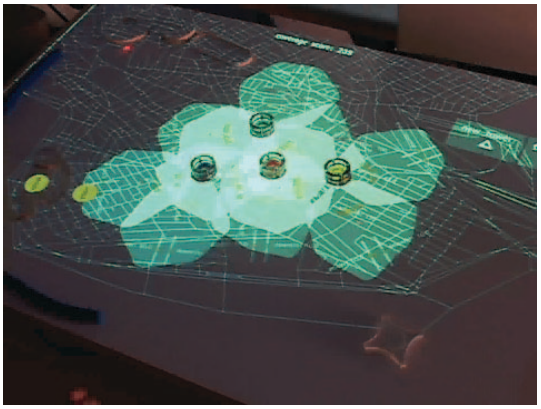



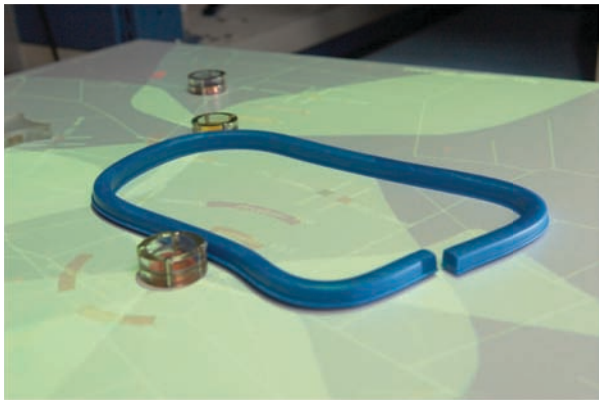

- Illuminating Clay / SandScape => Relief (dynamic clay)

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

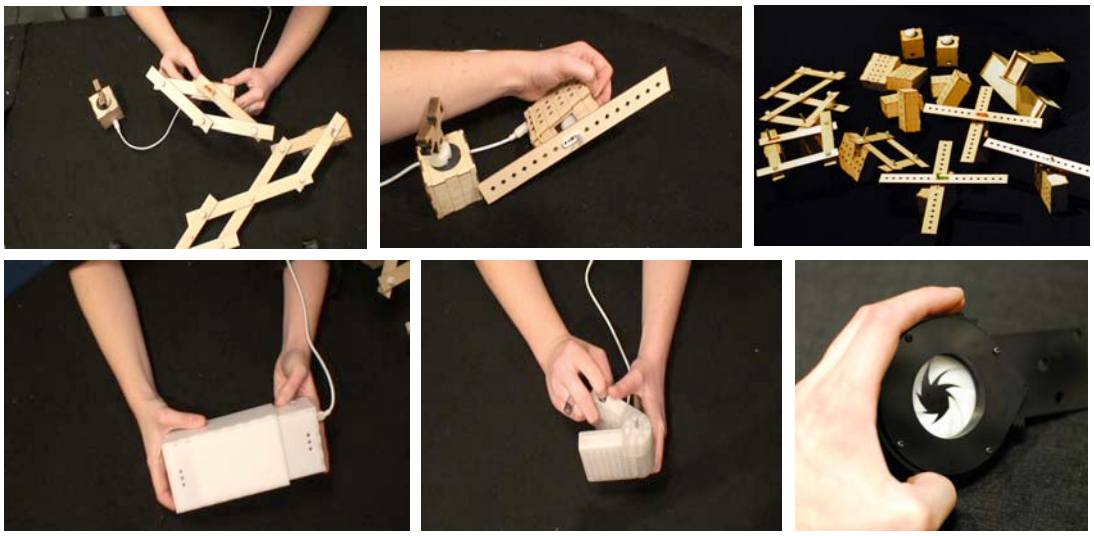
Tangible Media Group

- inTouch – Curlybot – Topobo

- Kinetic Sketchup – BOSU

Kinetic Sketchup

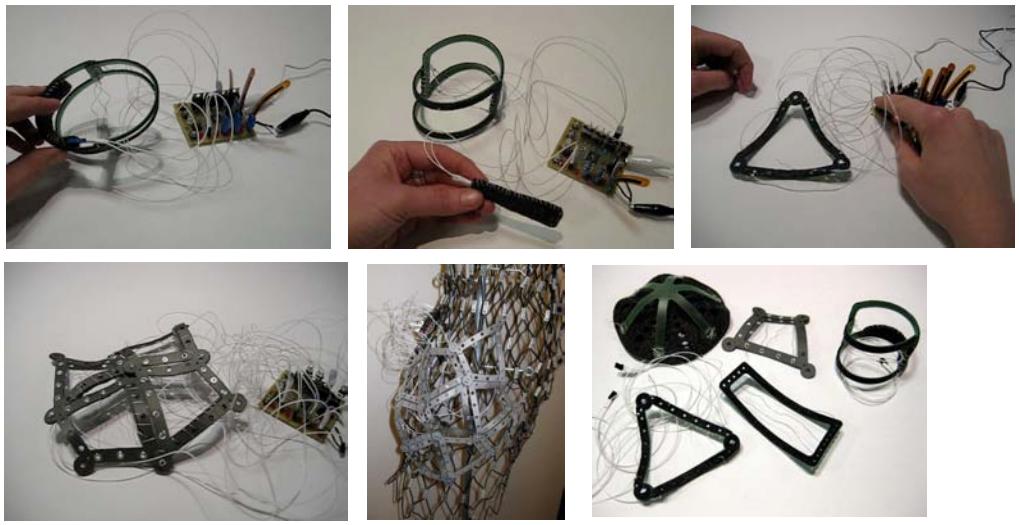
Amanda Parkes and Hiroshi ISHII 2009



- Gestural recording functionality with varying mechanical and behavioral controls

BOSU: Kinetic Tangibles

Amanda Parkes and Hiroshi ISHII 2009

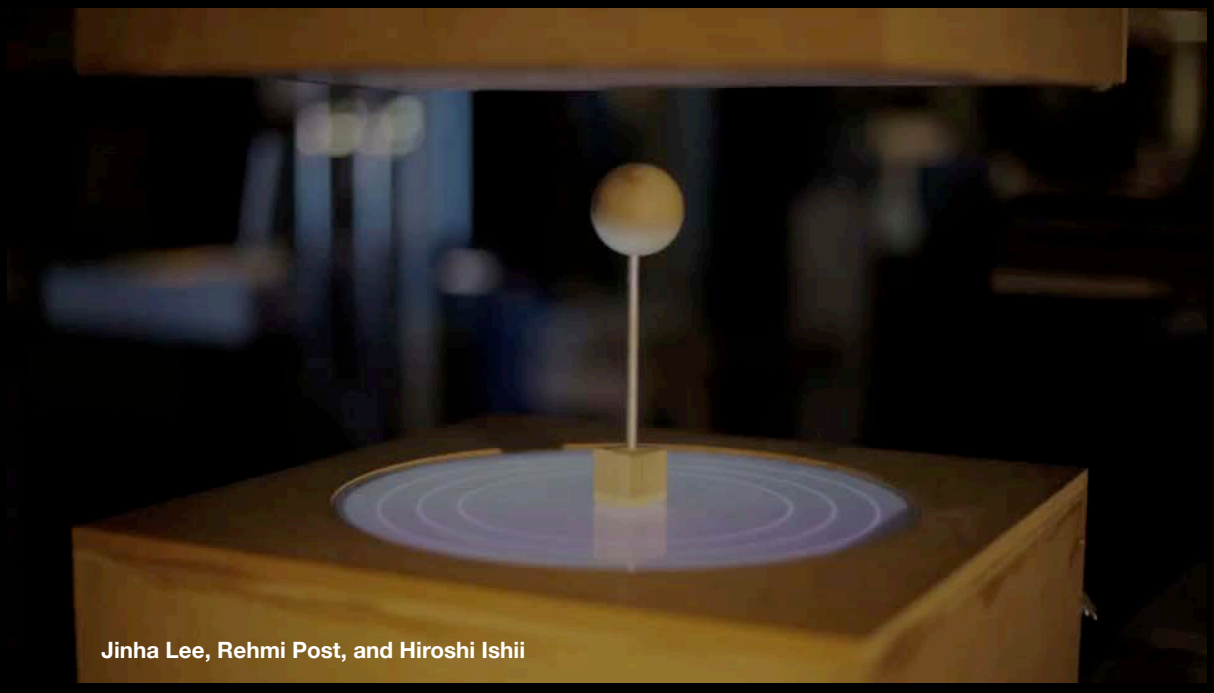


- Dynamic modeling tools offering kinetic memory in soft materials

TimeScape
based on Relief

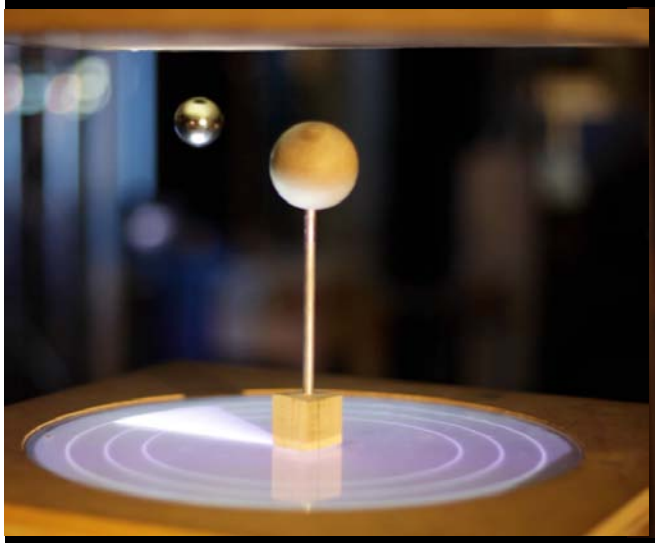
Daniel Leithinger, Jinha Lee, Sean Follmer, Austin Lee, Matthew Chang & Hiroshi Ishii

ZeroN
UIST 2011

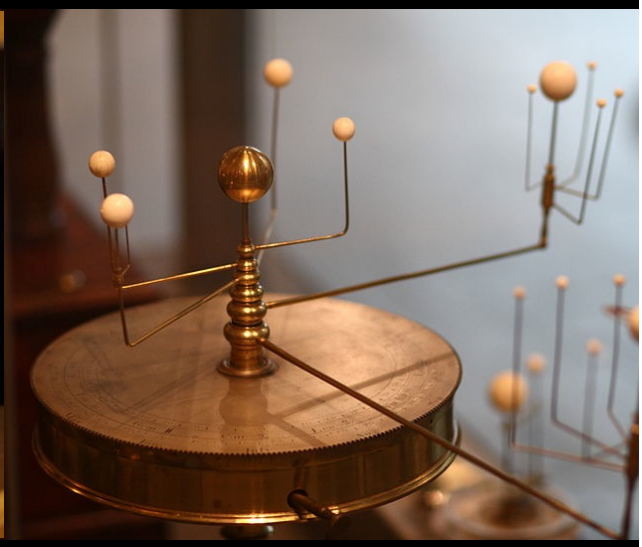


Jinha Lee, Rehmi Post, and Hiroshi Ishii

ZeroN



Orrery



Q: affordance / legibility

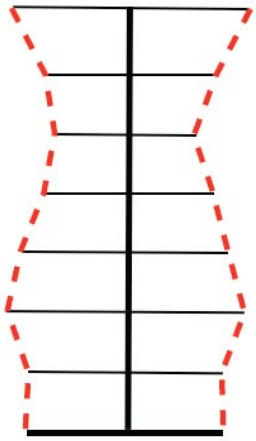
Amphorm

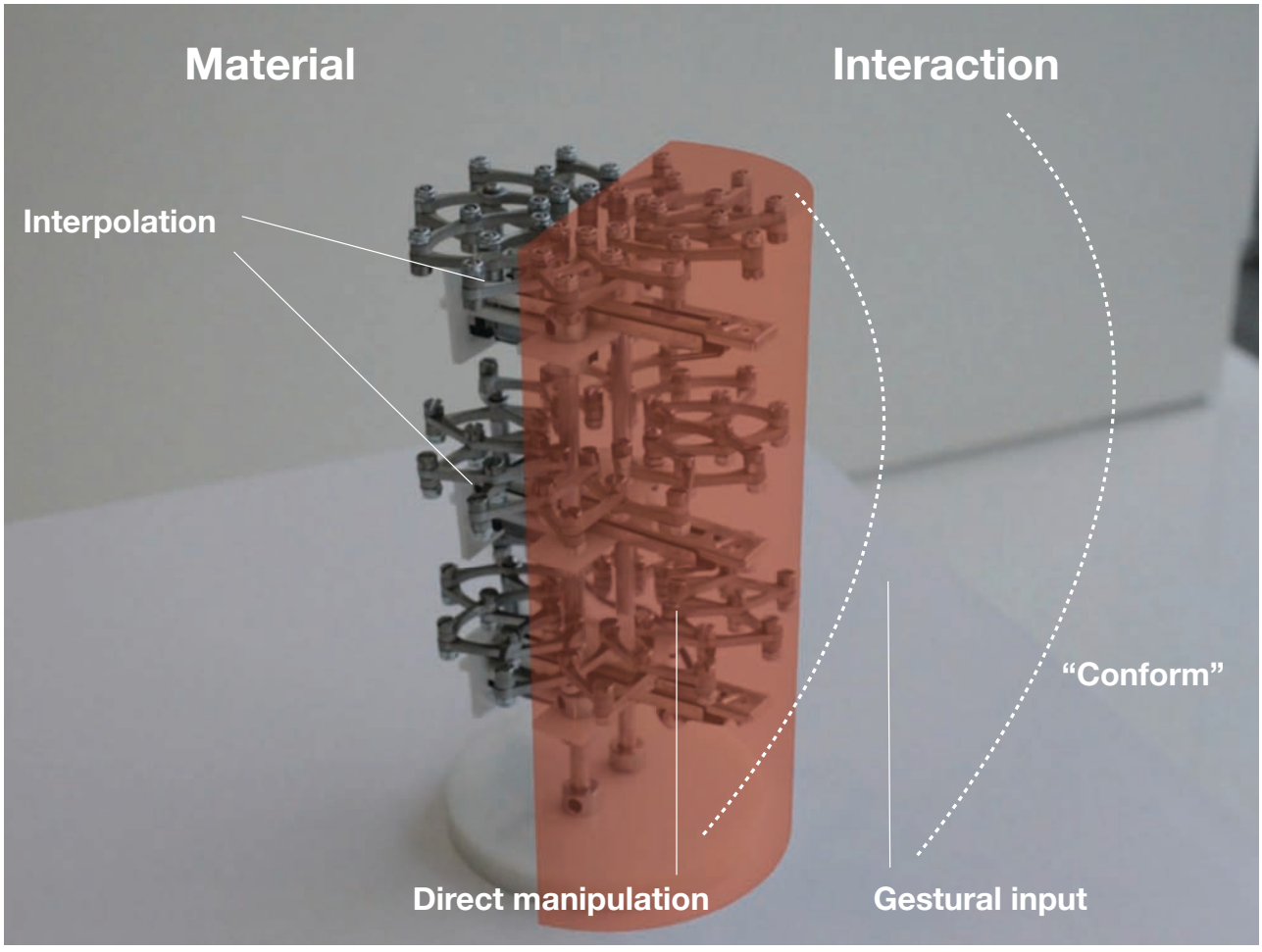
(Amphora + Form)
Vase that uses kinetic elements to transform its shape in sync with a digital model

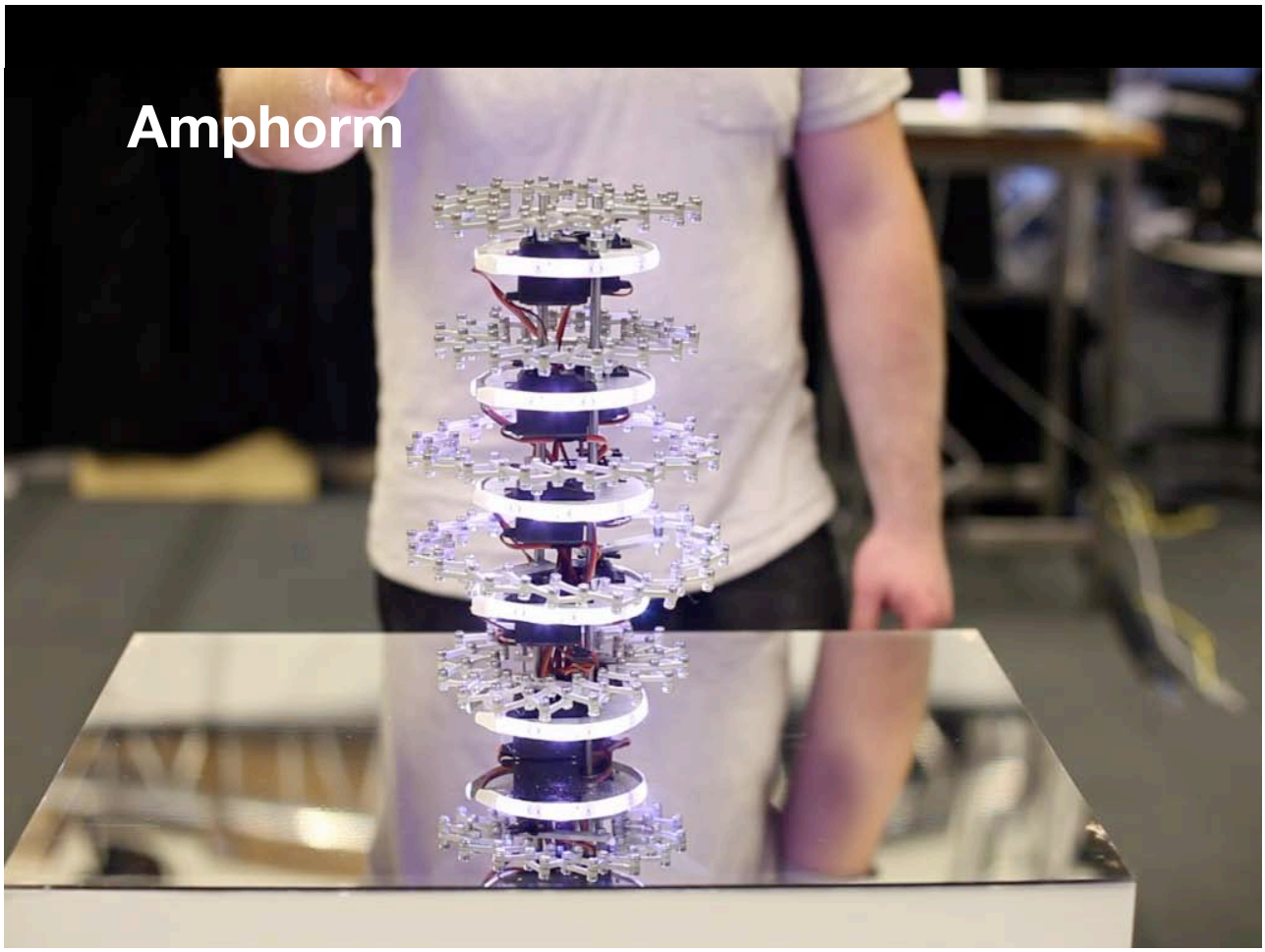
Dávid Lakatos &
Hiroshi Ishii

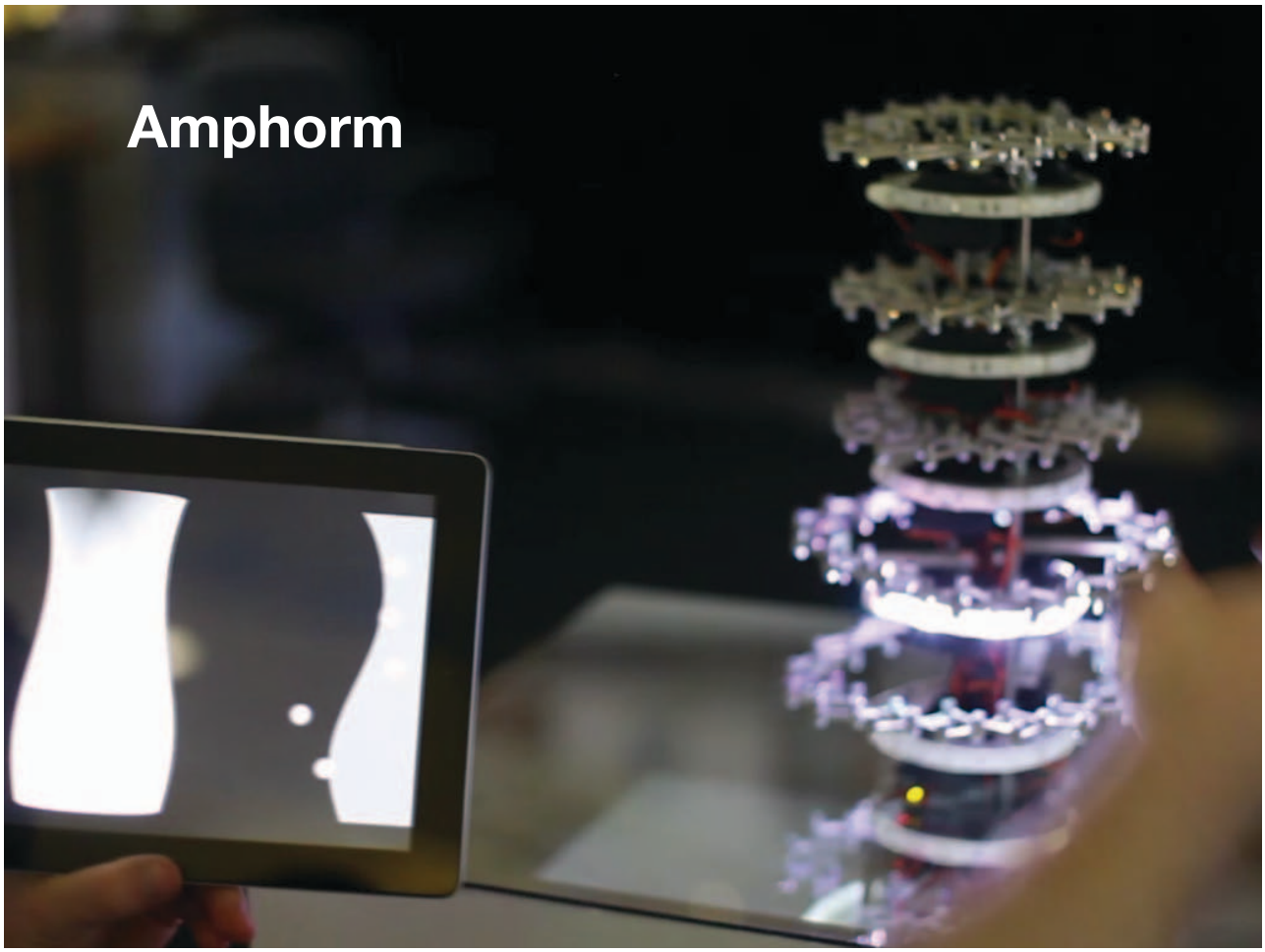
How will we interact with future dynamic materials in our environment?

How can we experiment without these materials?






Amphorm


Amphorm


Amphorm


ROLLING PERFECT RED
MAKES A PERFECT SPHERE

PERFECT RED

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

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

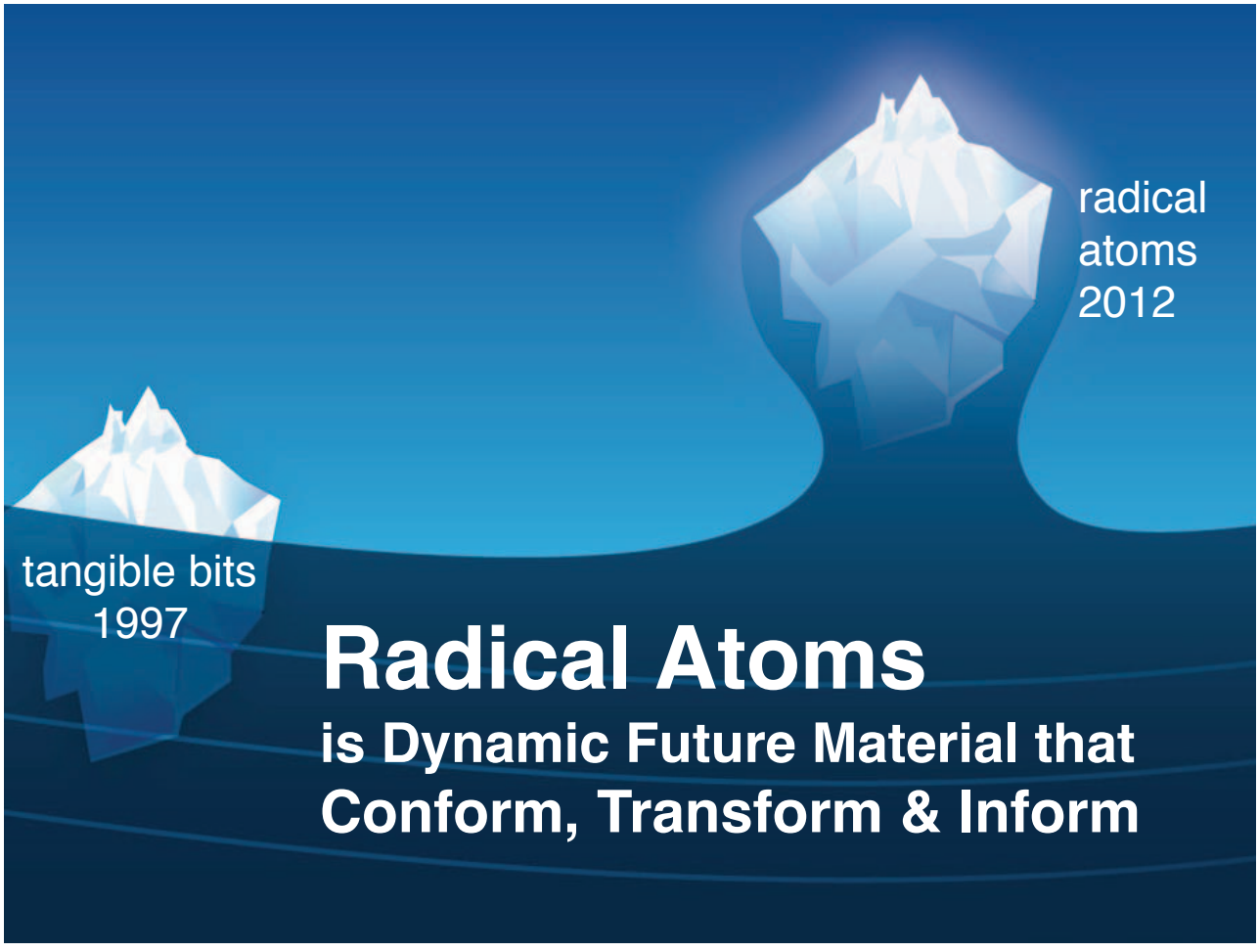
Materials, Tools, and Applications

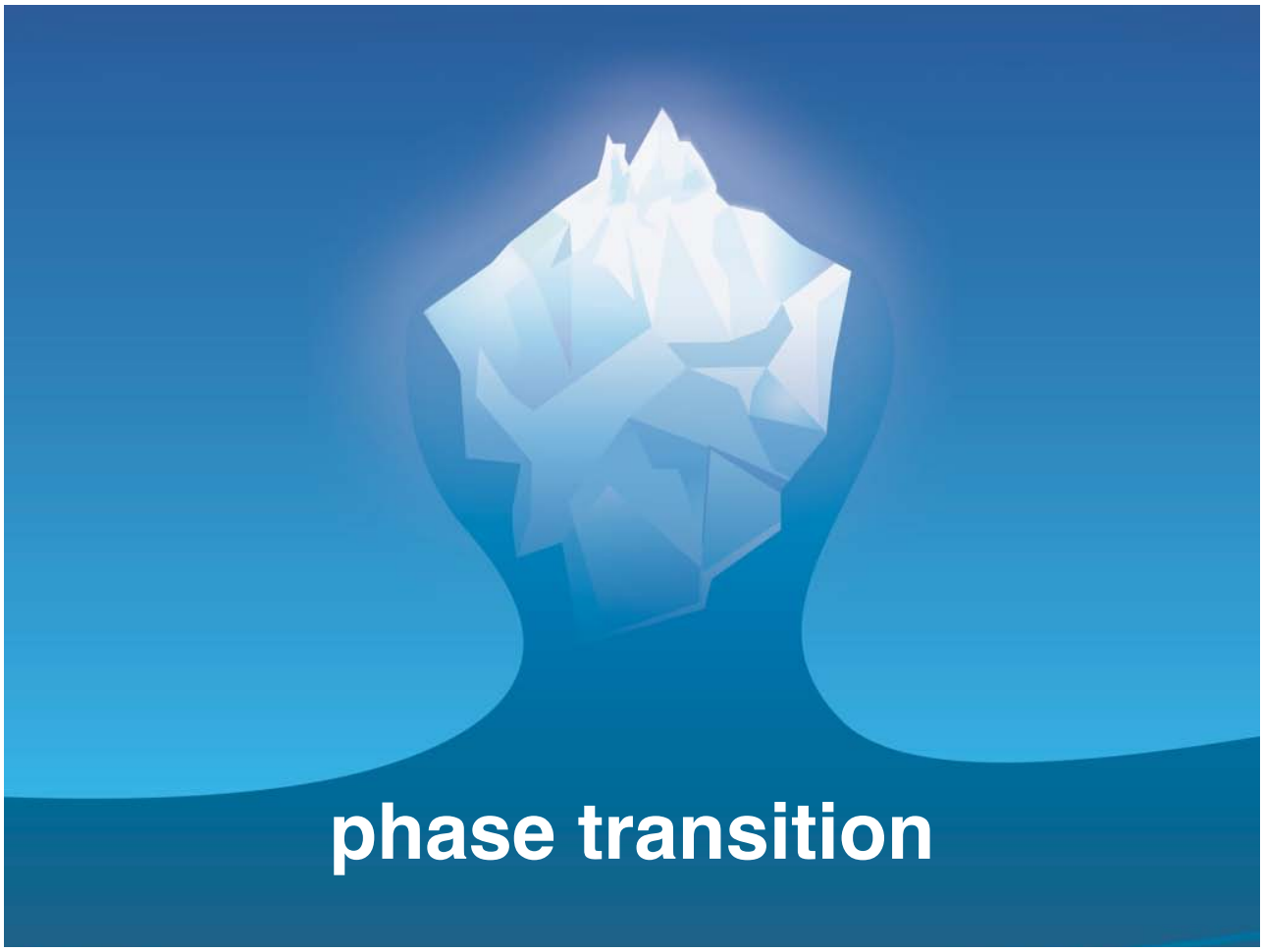
- How to Inform Atoms?
  - Direct Manipulation (with touch & gesture)
  - Special Tools (“RA oven”)
  - Context Aware (semi-automatic)
  - Programming
    - » Tangible Programming
    - » 3D CAD (GUI) & download
    - » Programming by Examples
- Killer Applications

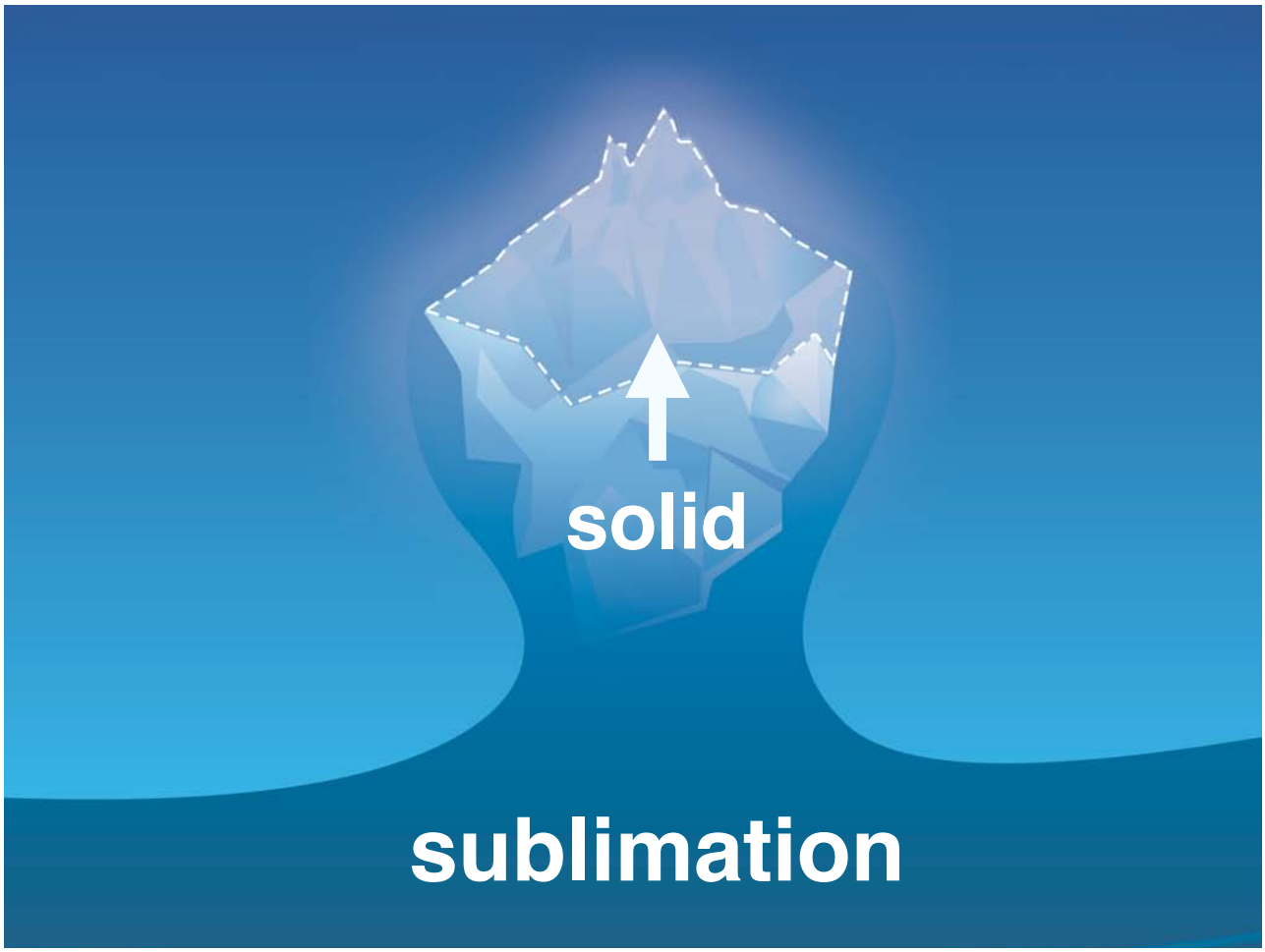
Radical Atoms

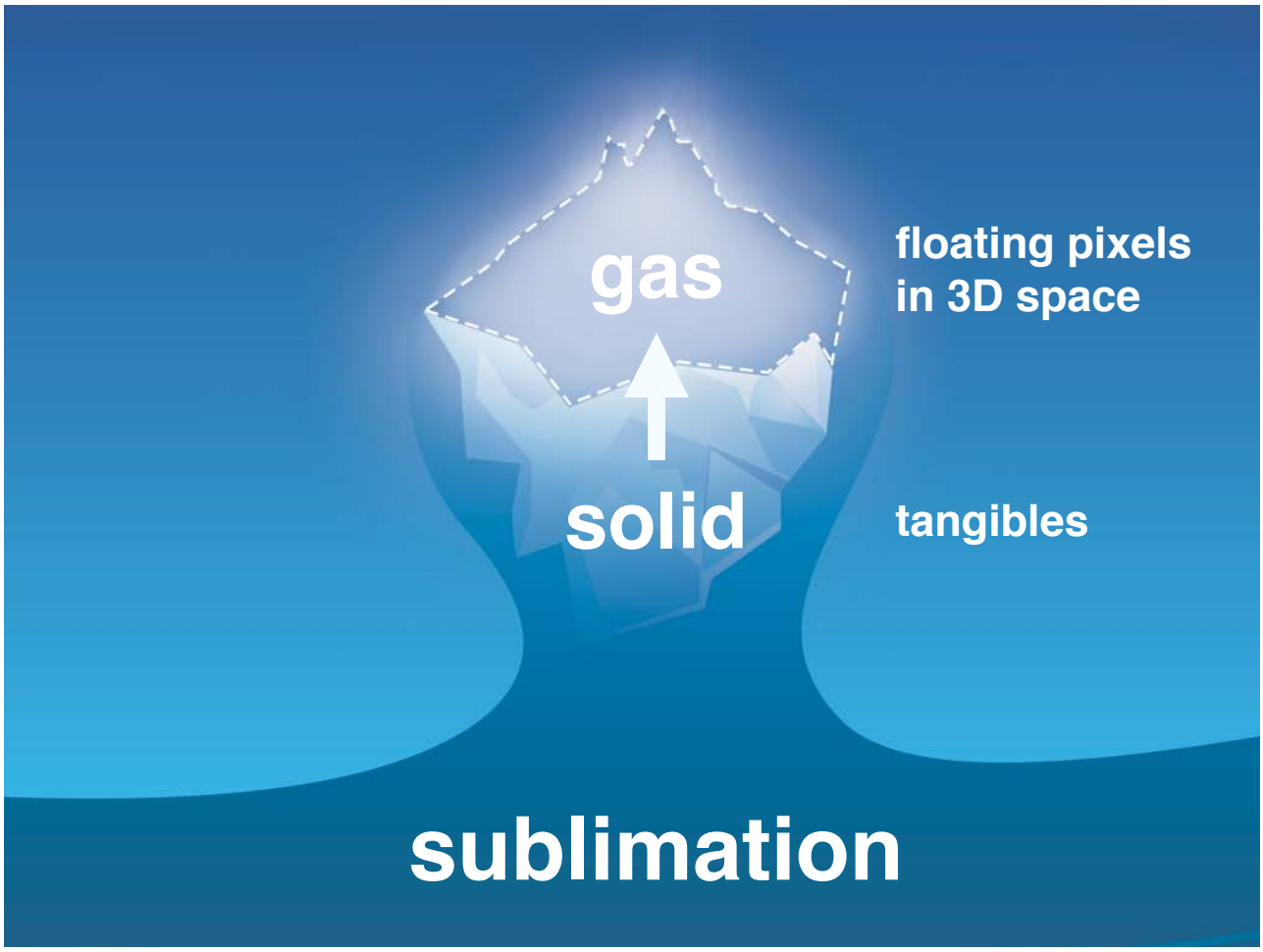
Forging Atoms to Conform, Transform, and Inform

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



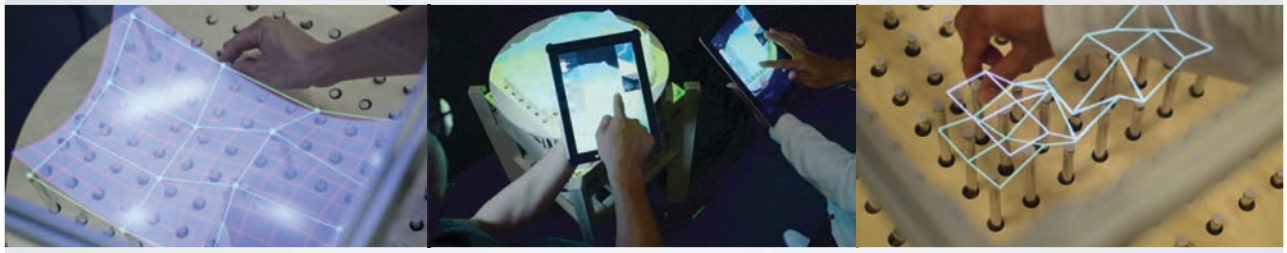

phase transition


solid
sublimation



SUBLIMATE:

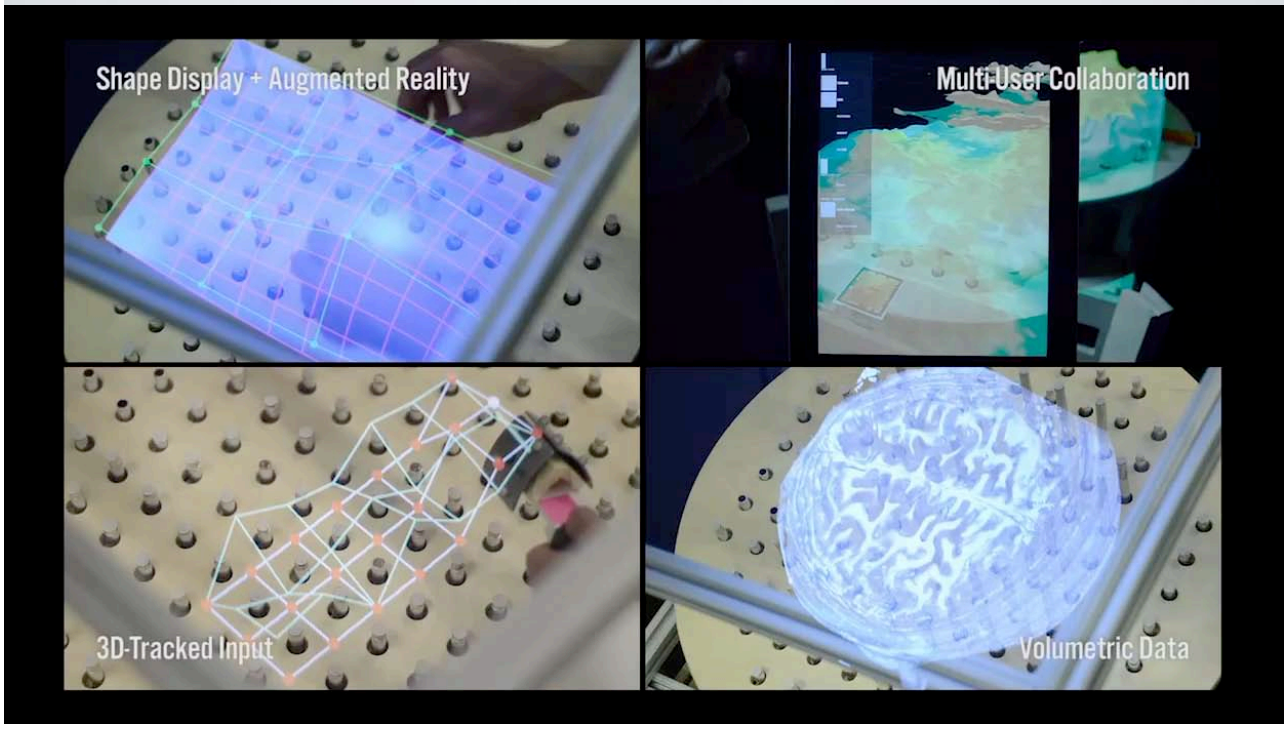
STATE-CHANGING VIRTUAL AND PHYSICAL RENDERING TO AUGMENT INTERACTION WITH SHAPE DISPLAYS



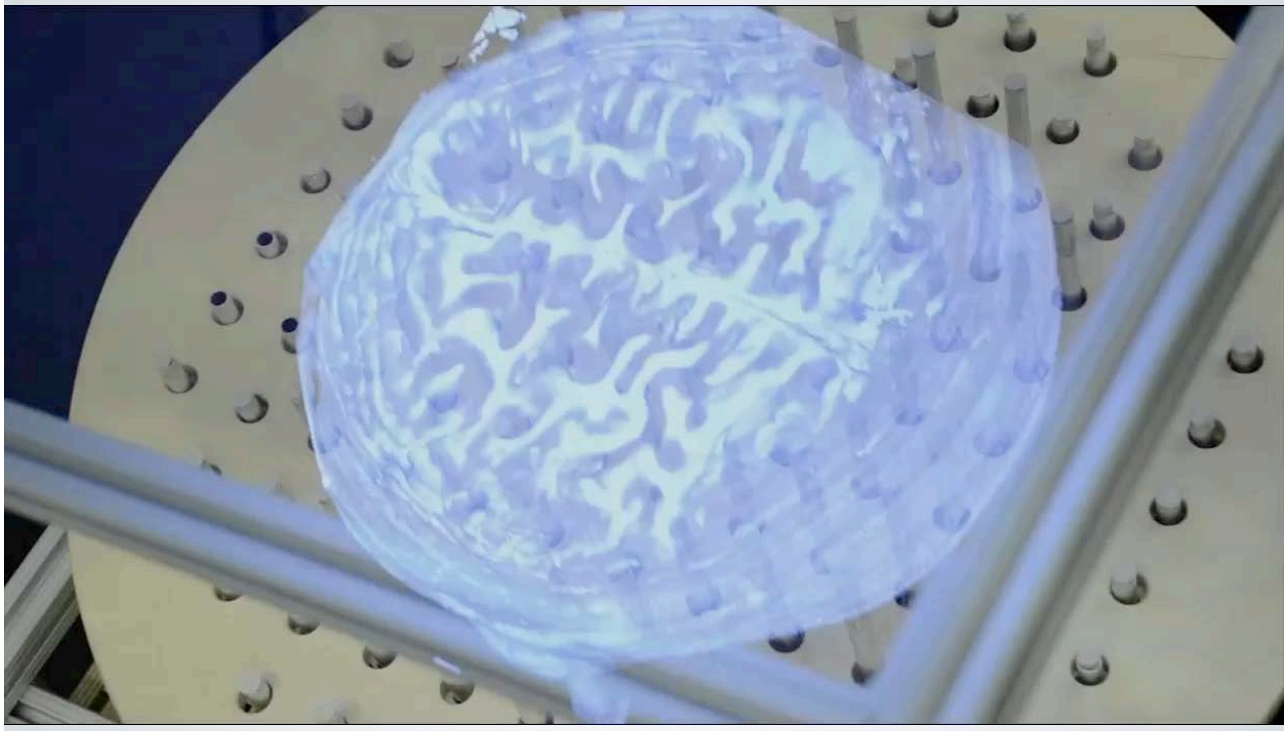
Daniel Leithinger, Sean Follmer, Alex Olwal,
Samuel Luescher, Akimitsu Hogge, Jinha Lee, Hiroshi Ishii

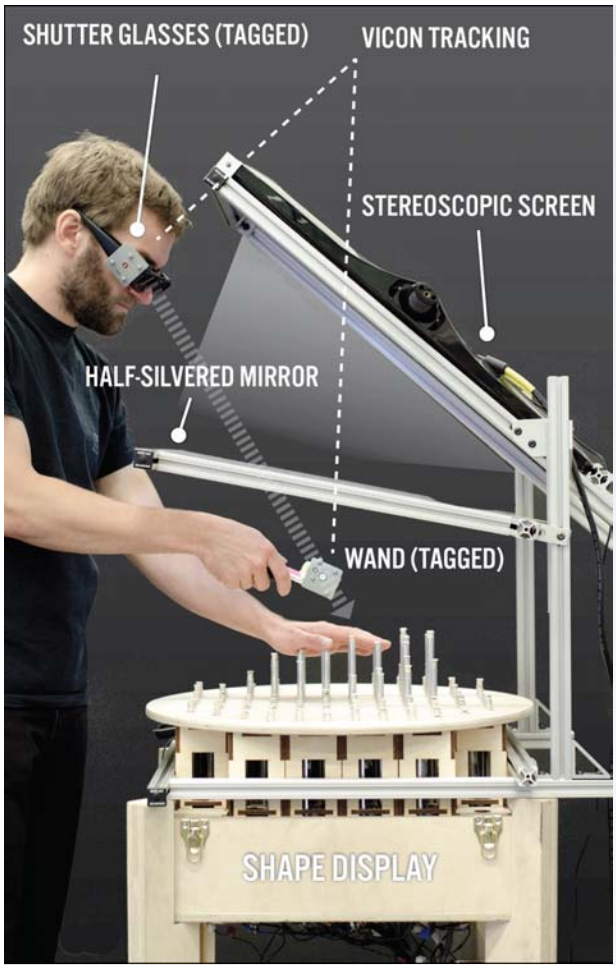
Tangible Media Group, MIT Media Lab
http://tangible.media.mit.edu

SUBLIMATE



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


Thanks!
Hiroshi Ishii
MIT Media Lab
faculty retreat 7/19/12