Radical Atoms

Beyond Tangible Bits

April 9, 2009 CHI 2009

Hiroshi ISHII
Tangible Media Group
MIT Media Laboratory

Painted Bits (GUI)

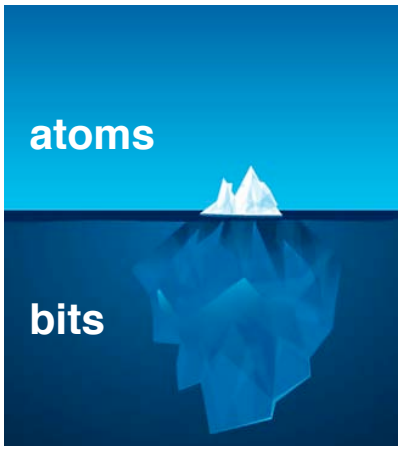
physical remote control (mouse)
screen - pixels

digital **bits: information**

Tangible Bits (TUI)

physical

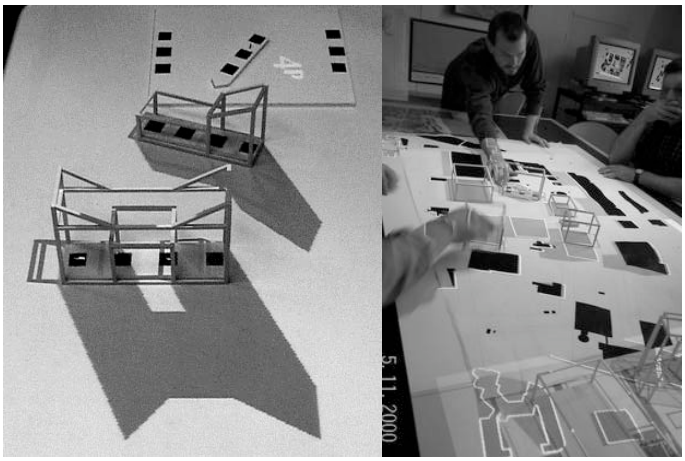
digital



I/O Bulb & Luminous Room

Dr. John Underkoffler

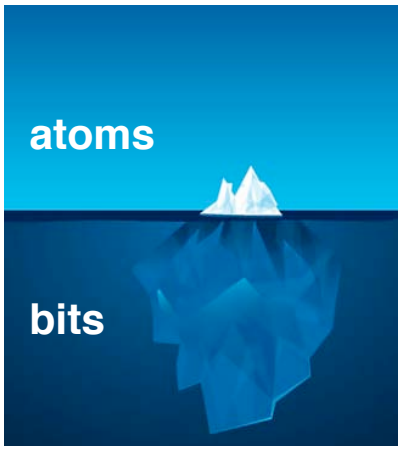
Tangible Media Group, MIT Media Lab 1998



Limitation of Tangible Bits

rigid
static

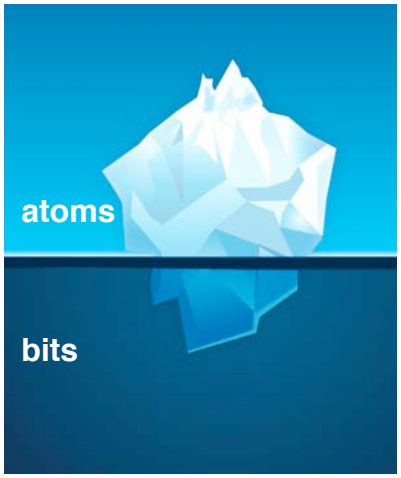
malleable
programmable
dynamic pixels



Hiroshi ISHII / Tangible Media Group

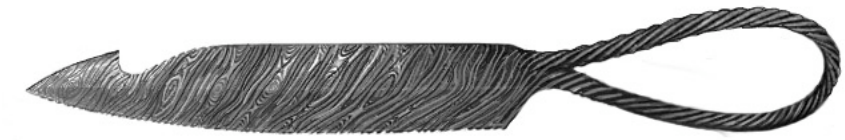
Radical Atoms

malleable
transformable
reconfigurable
programmable



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

rice cakes

- **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

Polypod
Mark Yim

Dynamic Materials
Programable Matters

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

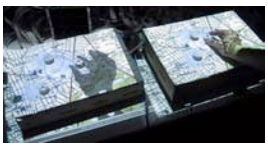
From Tangibles to Radical Atoms

- **Kinetic Tangibles**
  - inTouch - Curlybot - Topobo
  - Kinetic Sketchup - Bosu
- **Tabletop Tangibles**
  - Sensetable - Actuated Workbench - PICO
  - Illuminating Clay / SandScape => *Dynamic Clay*
- **Retractable Remote Control** (ALPS Electric)

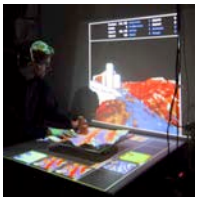
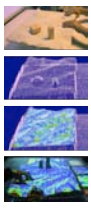
Tabletop Tangibles

Tangible Media Group

- **Sensetable – Actuated Workbench – PICO**

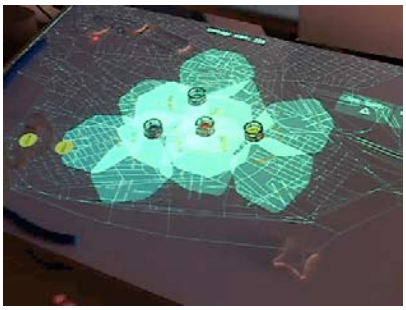



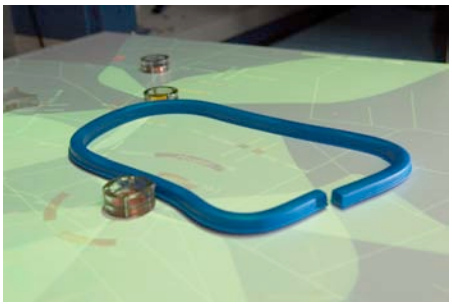

- **Illuminating Clay / SandScape => *Dynamic Clay***


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

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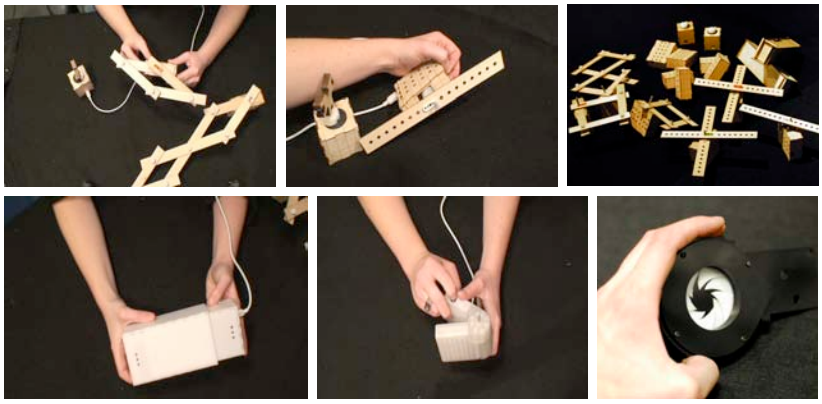
- inTouch – Curlybot – Topobo

- Kinetic Sketchup – Bosu

Kinetic Sketchup

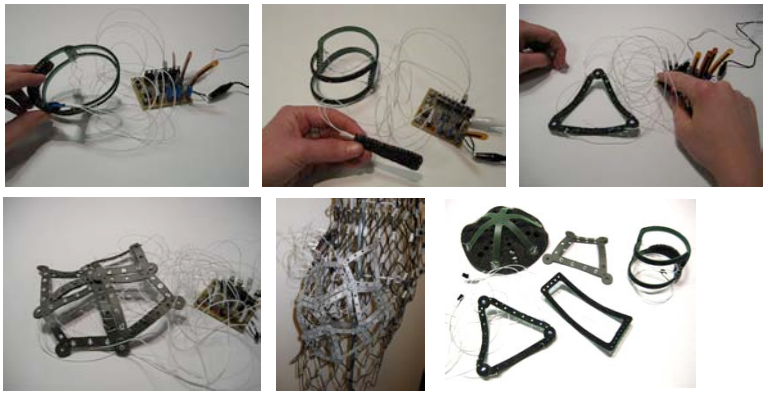
Amanda Parkes and Hiroshi ISHII 2009



- 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

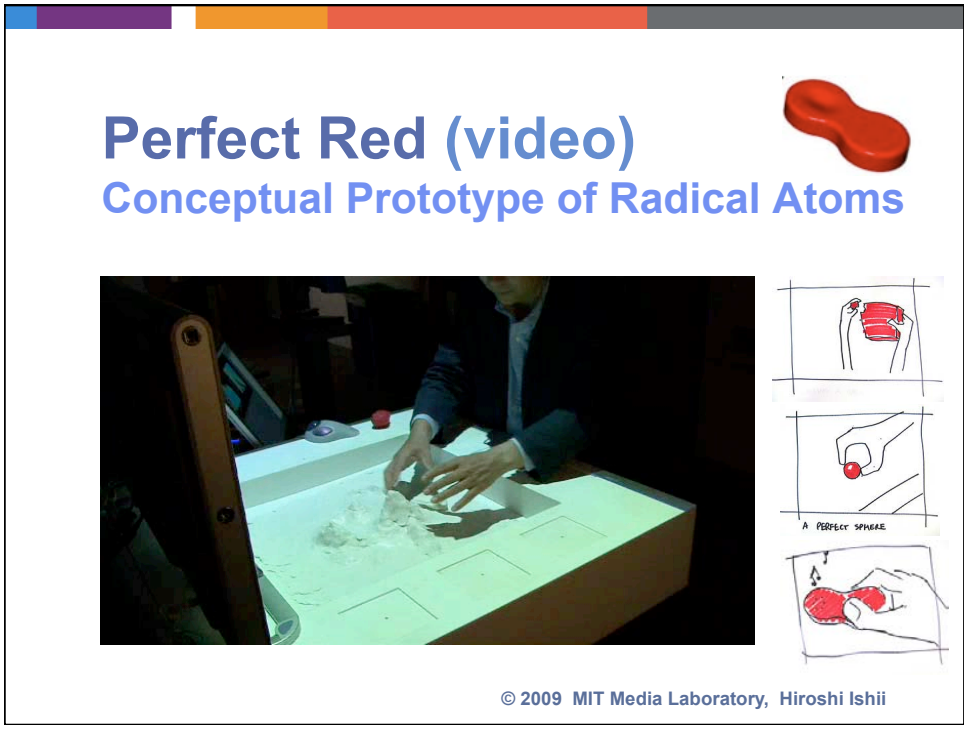
Retractable Remote Control
(ALPS Electric)

Radical Atoms
Future Application Scenarios

- Urban Planning / Architectural Design
- Sketching & Drawing
- Product Design ---- **PerfectRed**
- Vehicle
- Furniture
- …..

Perfect Red Story Board

Leonardo Bonanni



Perfect Red (video)

Conceptual Prototype of Radical Atoms

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

Acknowledgement

- Tangible Media Group and Media Lab colleagues
  - Jean-Baptiste Labrune
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  - Keywon Chung
  - Daniel Leithinger
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- Neal Stephenson
- Prof. Ainissa Ramirez (Yale Univ, Material Sci.)

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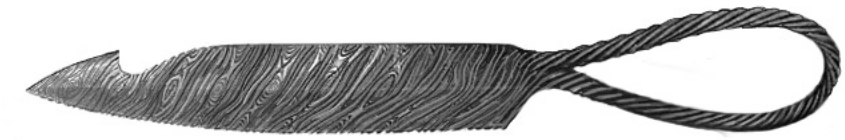
Forging Atoms to Conform, Transform, and Inform



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