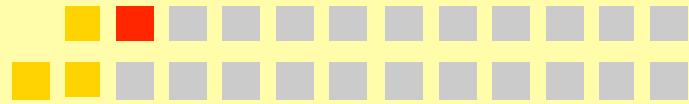


week

03



Tangible Bits

Implications for user interfaces

Lecture Outline

- Designing Interactions
- Tangible User Interfaces
- Midterm project and group forming exercise

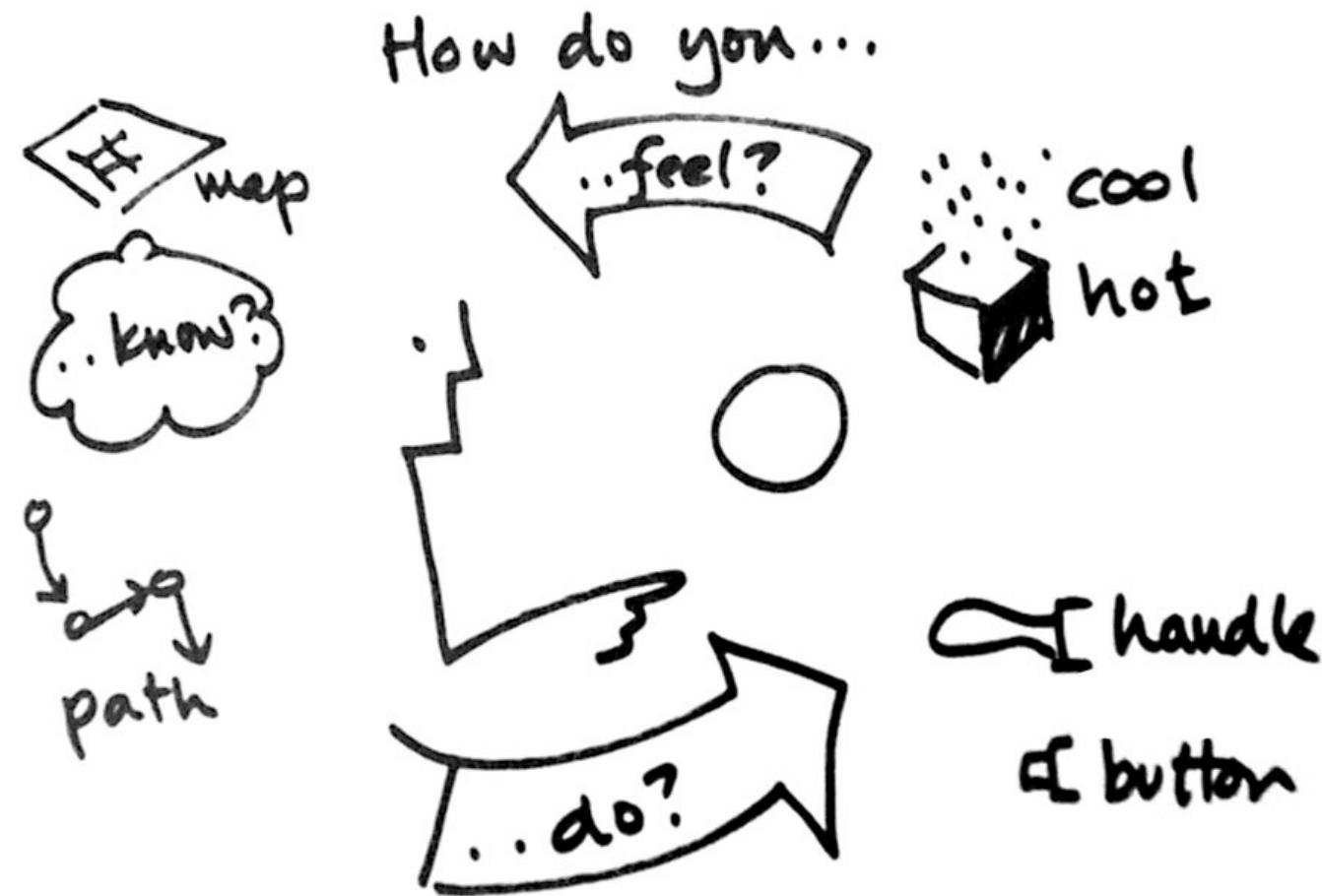
Designing Interactions

From designers' perspective

The term “interaction design” was coined by Moggridge in late 1980’s. Until then, design was mostly design of physical things, but now it includes computer interface design.

[Bill Moggridge, co-founder of IDEO]

Interaction Loop

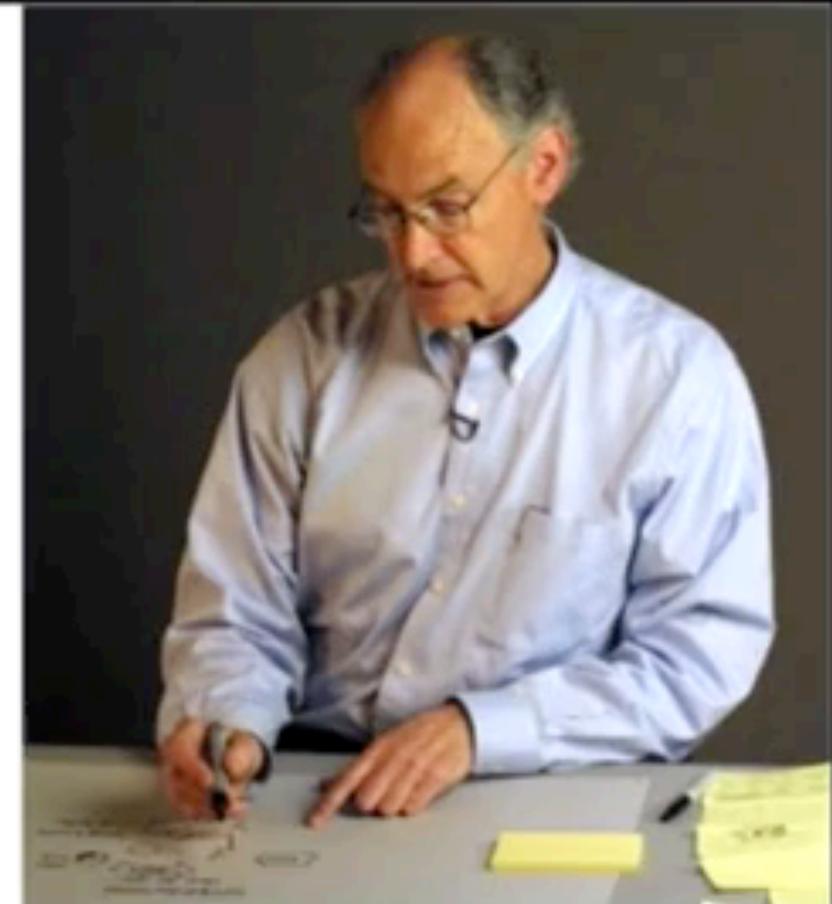


Bill Verplank

Interaction Design Questions

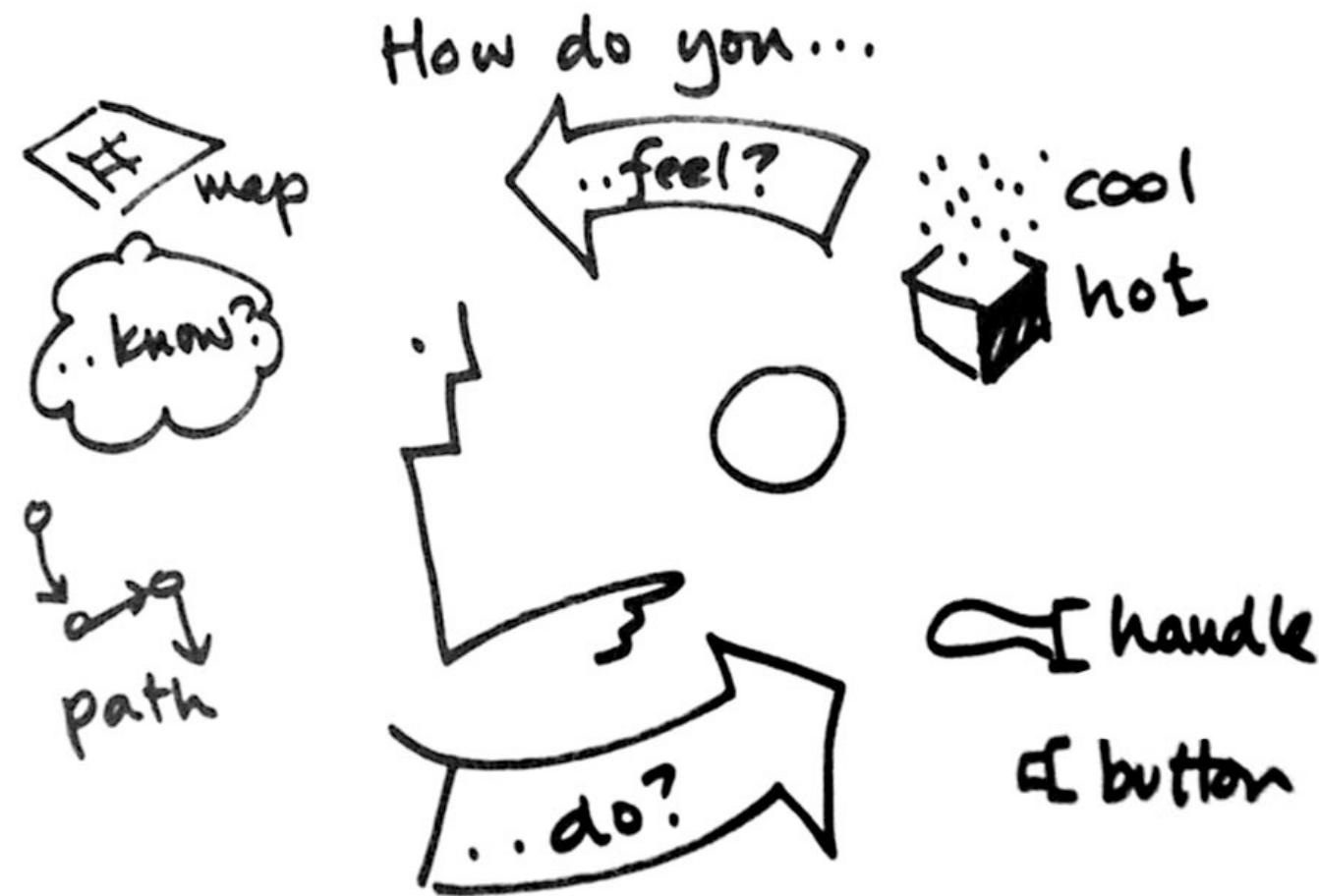
Interview February 2001

My PC



Chapter 2

Interaction Loop



Design as Communication

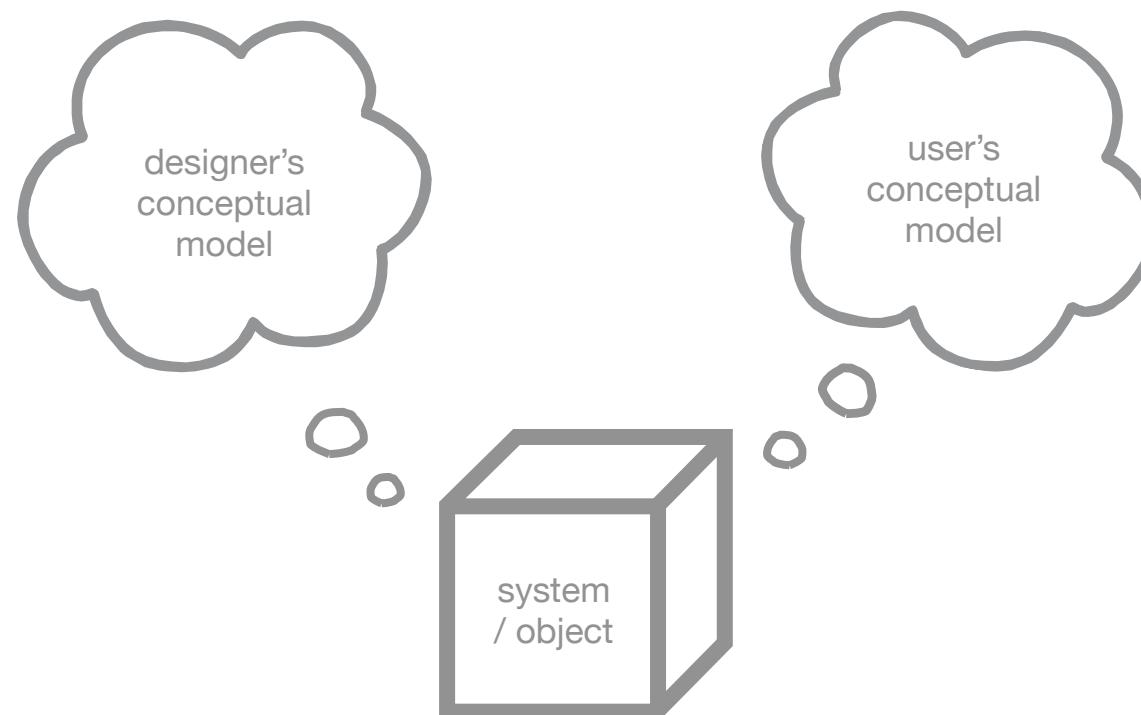
Design is a conversation between designer and user, even though the designer is no longer present once the user enters the scene.

Norman (2004)

Design as Communication

Design is a conversation between designer and user, even though the designer is no longer present once the user enters the scene.

Norman (2004)



Design as a Form of Mediated Communication

Human-computer interaction can be thought of as a form of **mediated communication** between the end user and the system designer, who must structure the system so that it can be understood by the user, and so that the user **can be led through a sequence of actions** to achieve some end result. (Dourish, 2004)

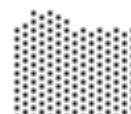
File Edit View Special

System Tools 1

4 items

665K in disk

115K available



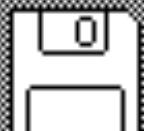
System Folder



Utilities Folder



System Tools 1



The Mac 512

System Folder

15 items

665K in disk

115K available



System



Finder



MultiFinder



Scrapbook File



Clipboard File



General



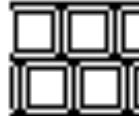
Sound



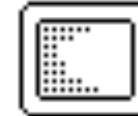
Mouse



DA Handler



Key Layout



Monitors



Keyboard



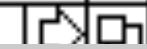
Color



Startup Device Easy Access

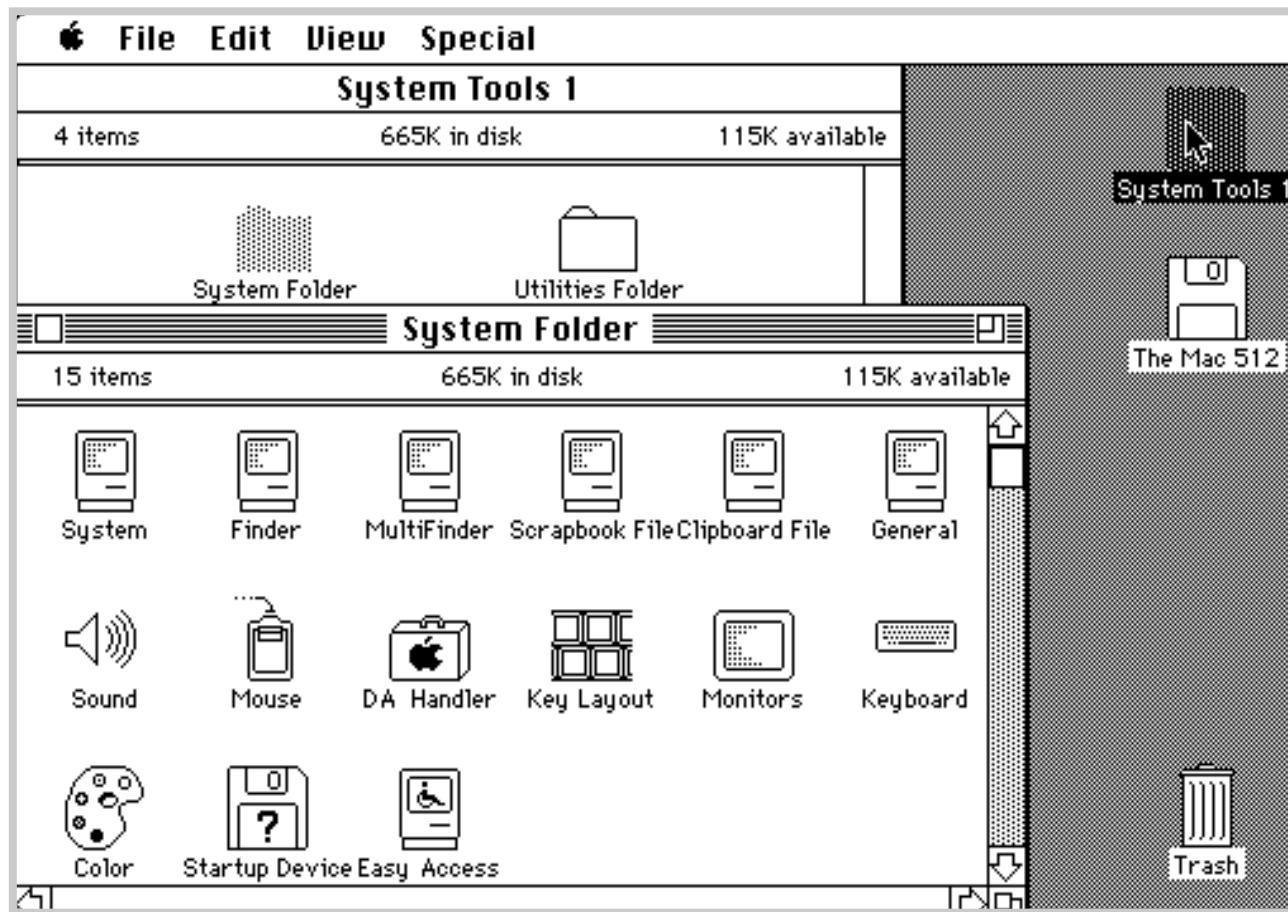


Trash



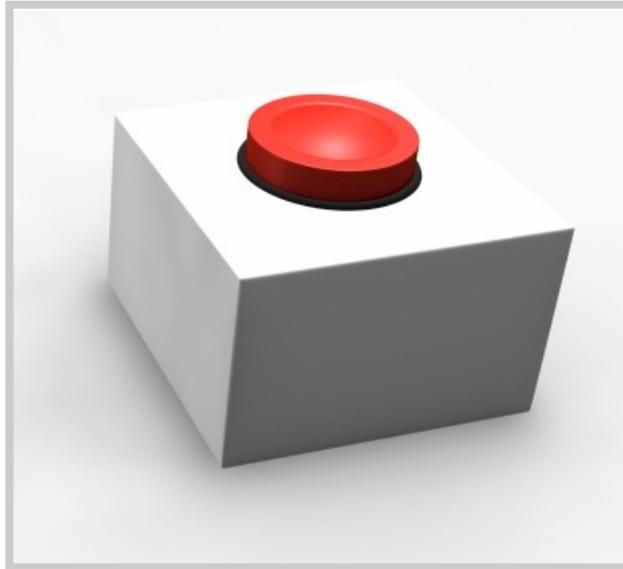
Designed affordances

Messages from designer to user, attracting attention to the set of desired possible actions. (Norman, 2004)

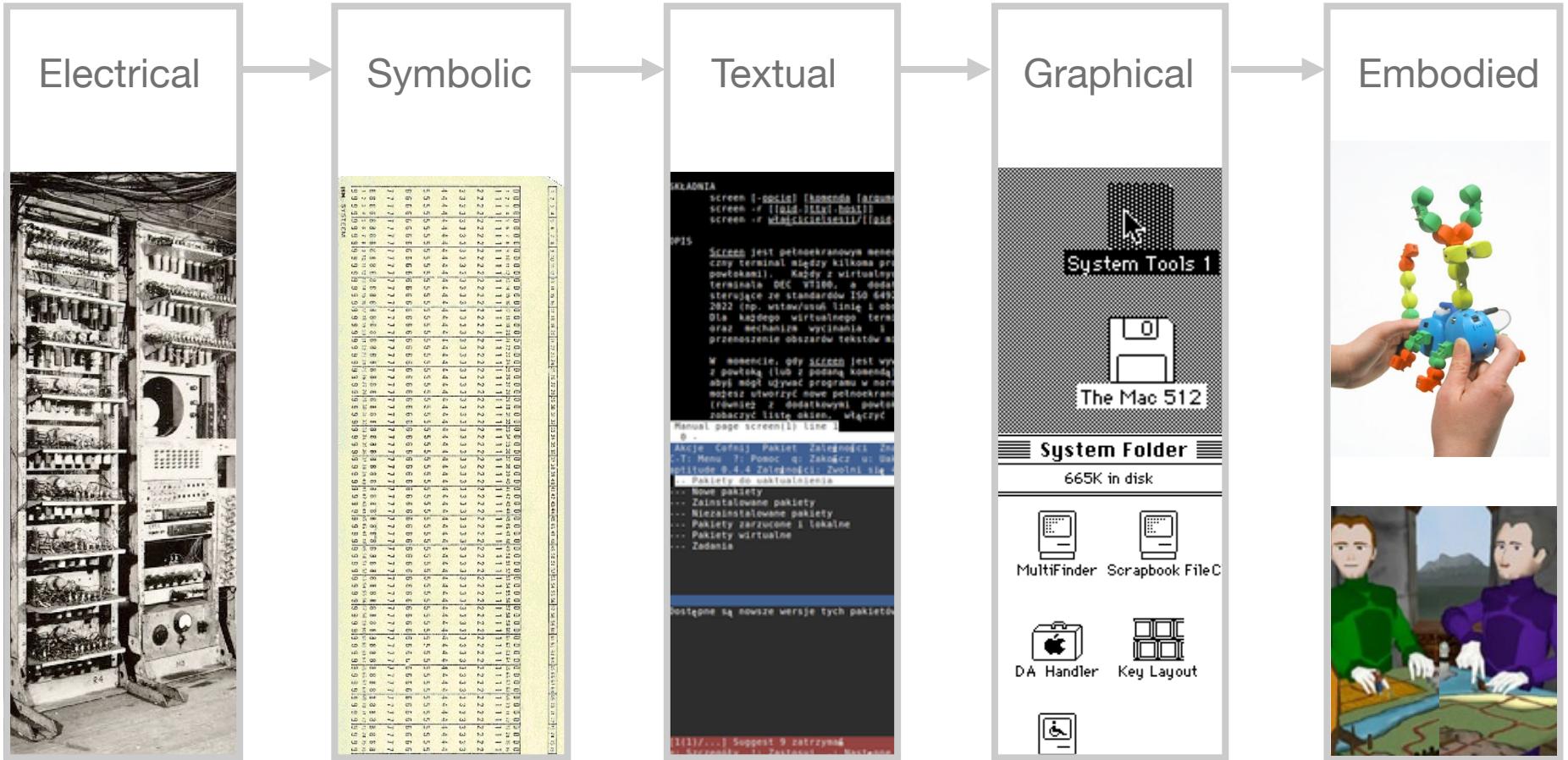


Designed affordances

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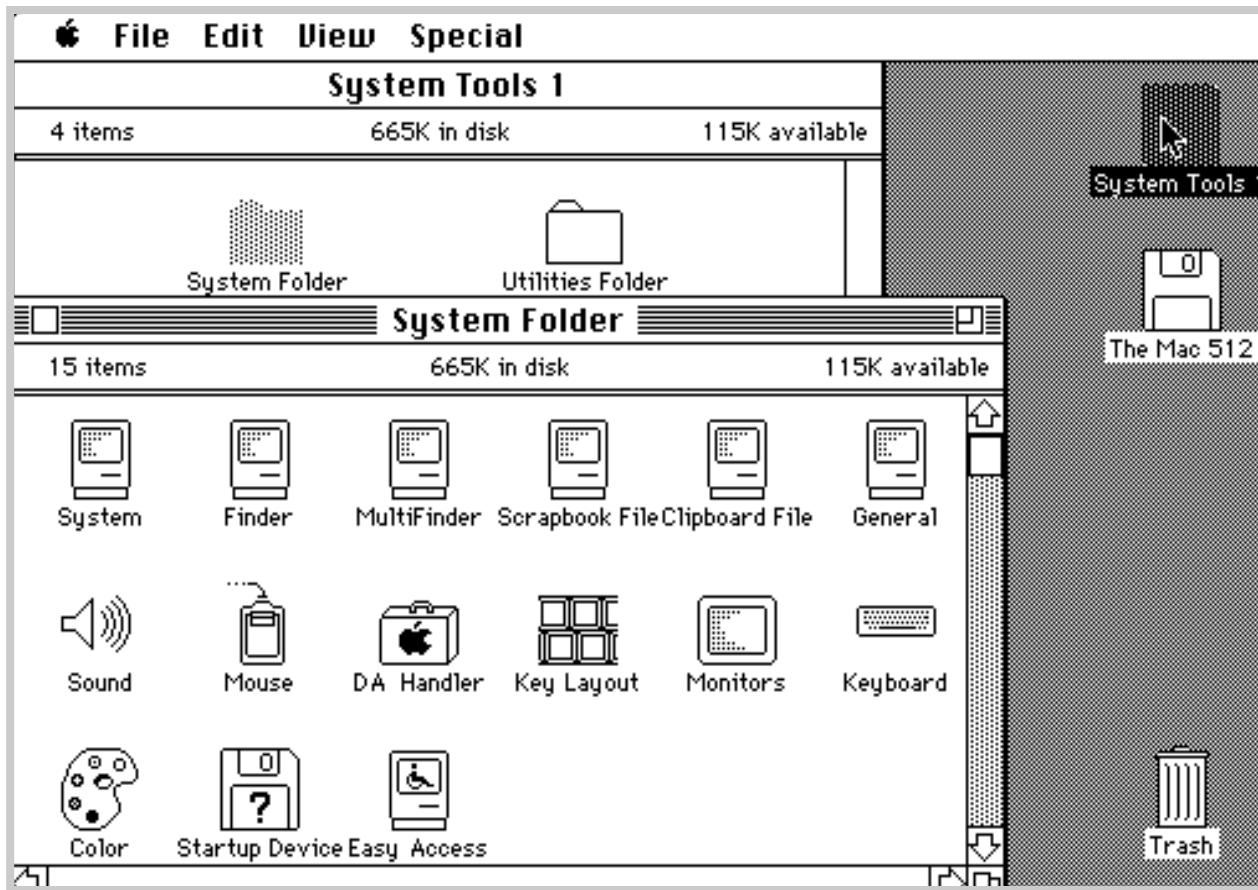


Historical Development of UI



Historical Development of HCI

Graphical



Macintosh System 4.2, 1987

- **Peripheral Attention**

Primary space, secondary space (e.g., windows and dashboards)

- **Pattern recognition and spatial reasoning**

Opportunities to arrange data spatially

- **Information density**

A picture really can be worth a thousand words (e.g., diagrams)

- **Visual metaphors**

File cabinets, trashcans, desktop tools

User Interfaces: The Current State of Affairs

Hands, eyes, tools, and interactions

“The computer is inherently a tool for the mind—not the hands.”
From *Abstracting Crafts* (McCullough, 1996)

Eyes are in charge and hands are underemployed



Evaluation of a commercial mouse in late 1980's
[Moggridge, 2006]

Eyes are in charge

Seeing objectifies the world. Eyes guide tools, read notations, appraise designs. Eyes see wholes, and compare many objects simultaneously. Eyes are the great monopolists of the senses. McCullough (1996)



Hands bring us knowledge of the world



They are the most subtle, sensitive, probing, differentiated, and the **most closely connected to the mind**.
They deserve to be admired.
McCullough (1996)

Hands are underrated



By pointing, by pushing and pulling,
by picking up tools, hands act as
conduits through which we **extend**
our will to the world.
McCullough (1996)

Eyes activate the hands and hands direct the eyes



Hand-eye coordination distinguishes humanity as the maker of things:
homo faber. McCullough (1996)

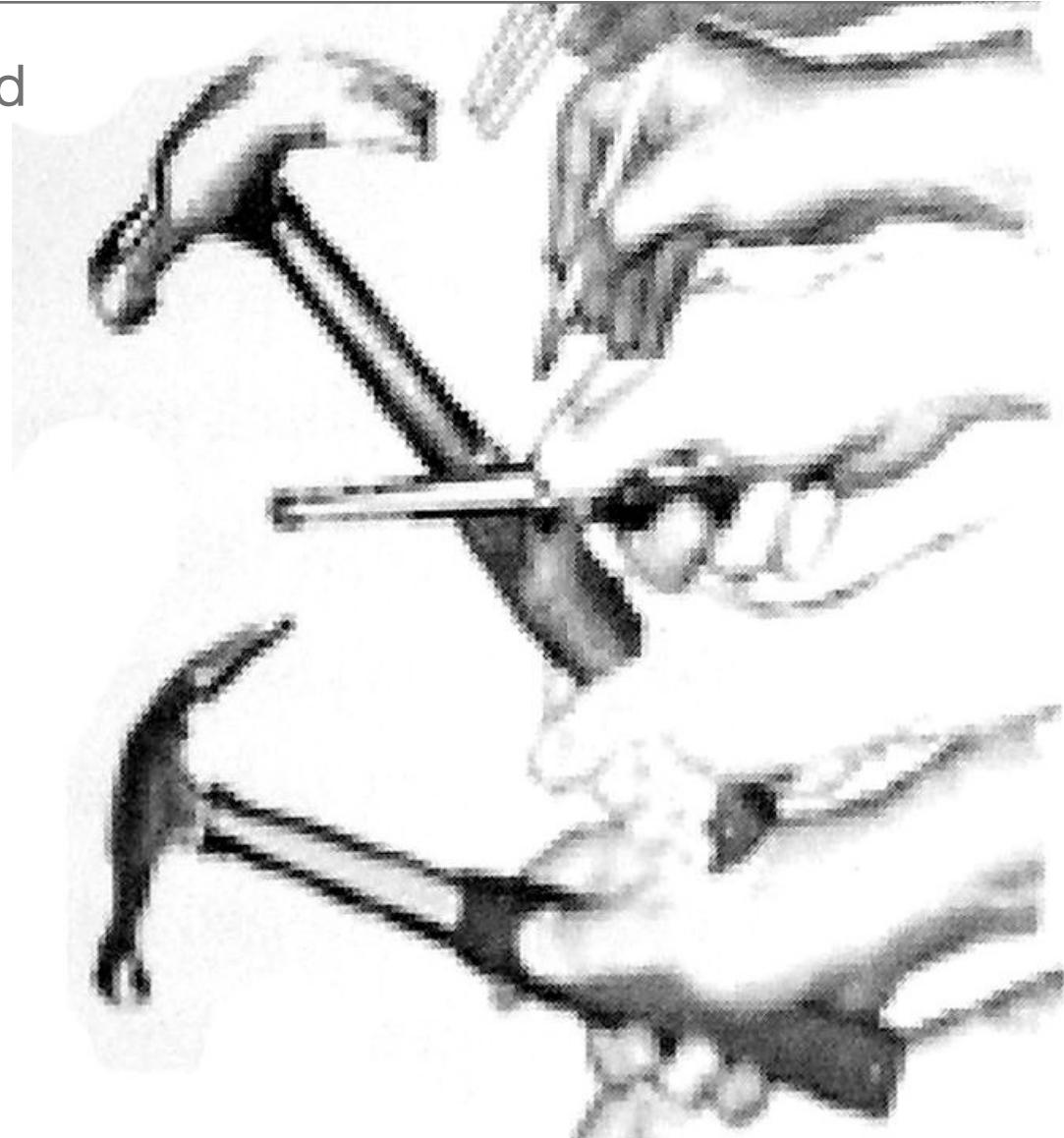
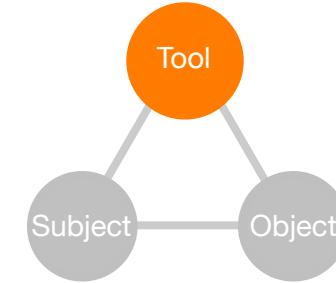
Activity Theory

Tools and Mediation

We use tools to support, to extend our powers, for overcoming the limitations of the body.

Tools direct our attention and its function becomes our focus.

Use of tools is an accumulation and transmission of social knowledge.



Combining the skillful hand with the reasoning mind

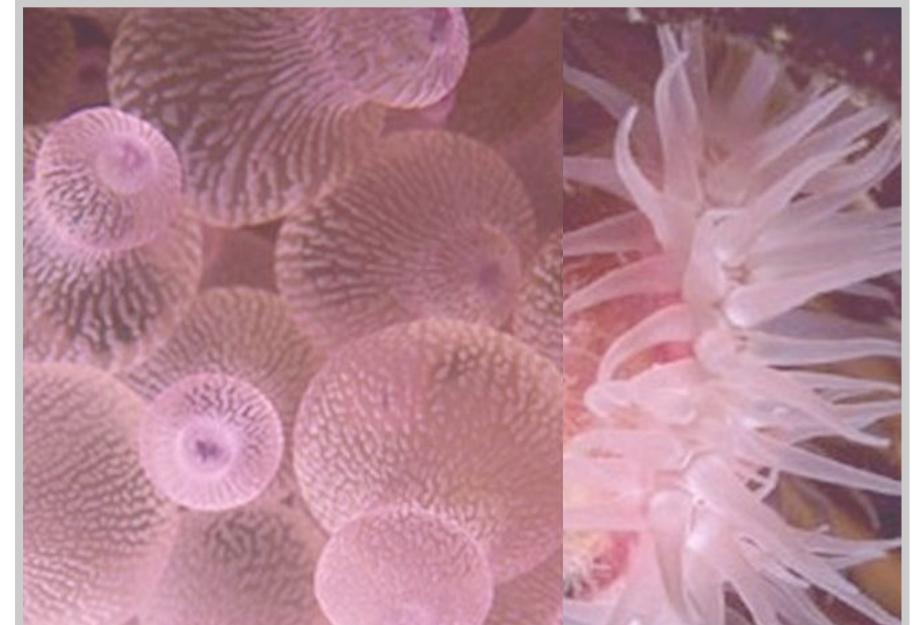
Computers let us turn the table — to apply something we know about using tools to achieve richer symbolic processing.

Tangible Bits

Seamless couplings between physicality and virtuality

“We live between two worlds: our physical environment and digital space.” [Ishii, 2007]

At the border between elements



At the border

We live on the border where bits meet atoms. In the flood of pixels from the ubiquitous GUI screens, are we losing our sense of body and places? [Ishii, 1997]



Tangible User Interfaces

Coincidence of input and output spaces

Curlybot

[Frei, Su, & Ishii, 2000]

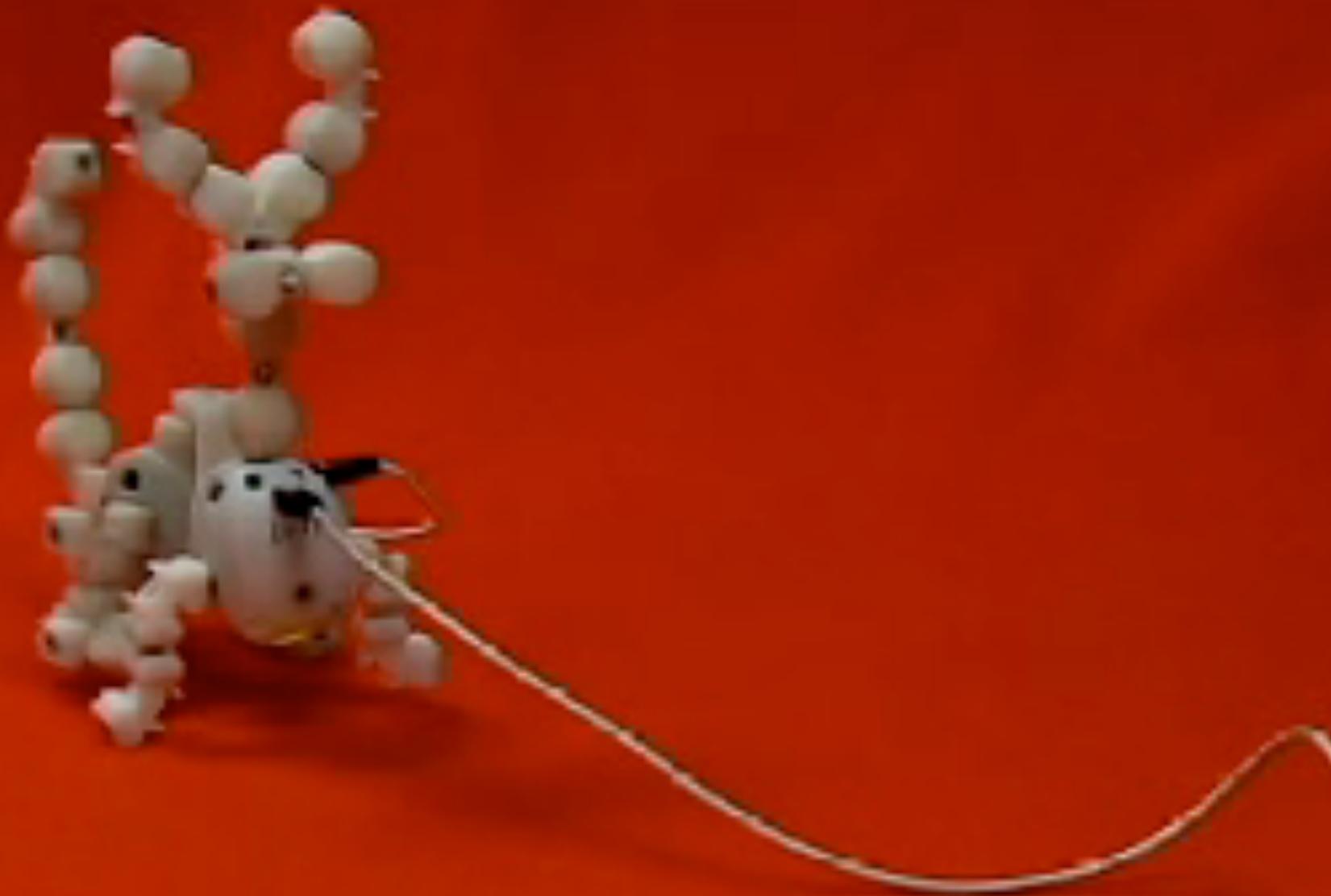




Topobo

[Raffle, Parkes, & Ishii, 2004]





Coincidence of input and output spaces



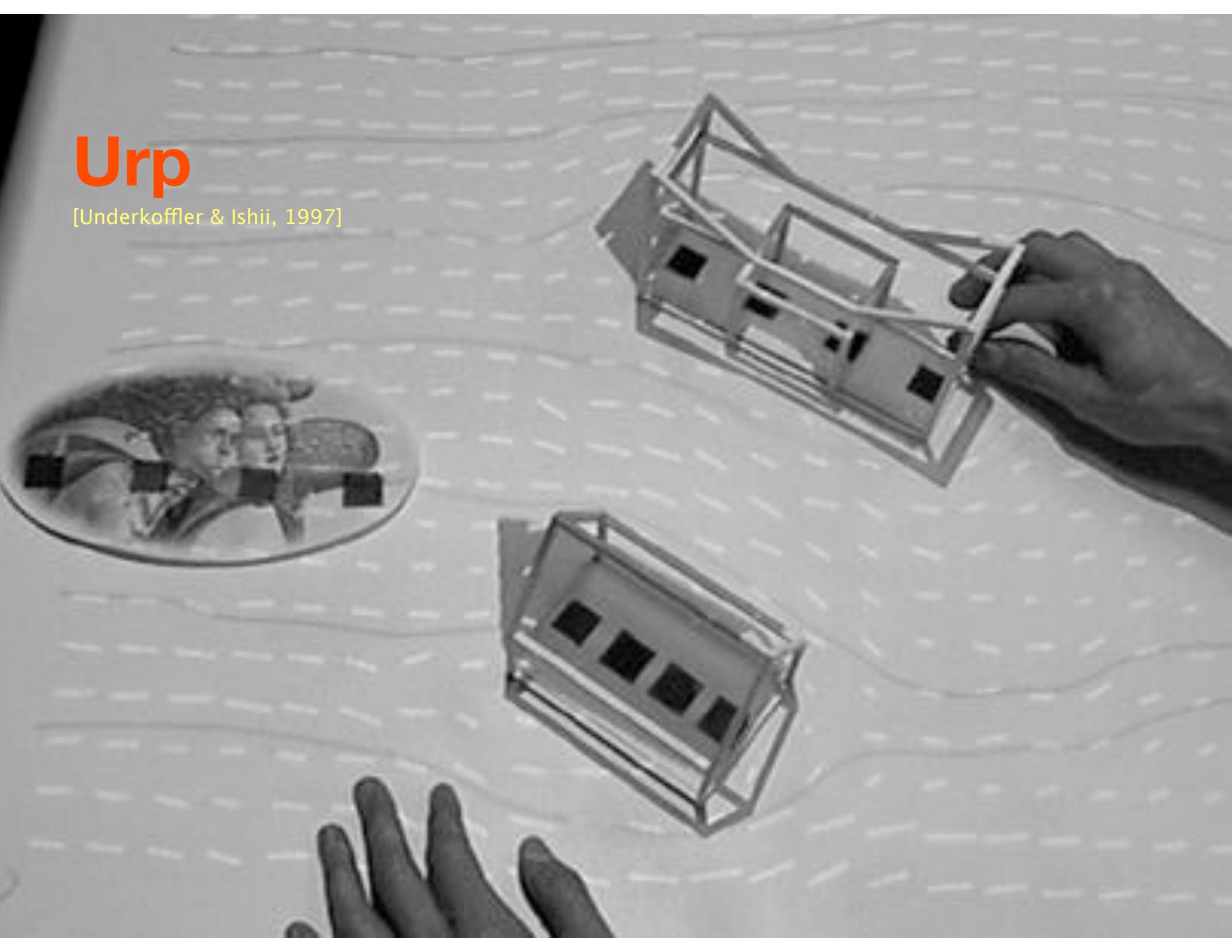
Tangible User Interfaces

Tabletop TUIs

Coupling tangible representations on tabletop to digital information and computation

Urp

[Underkoffler & Ishii, 1997]

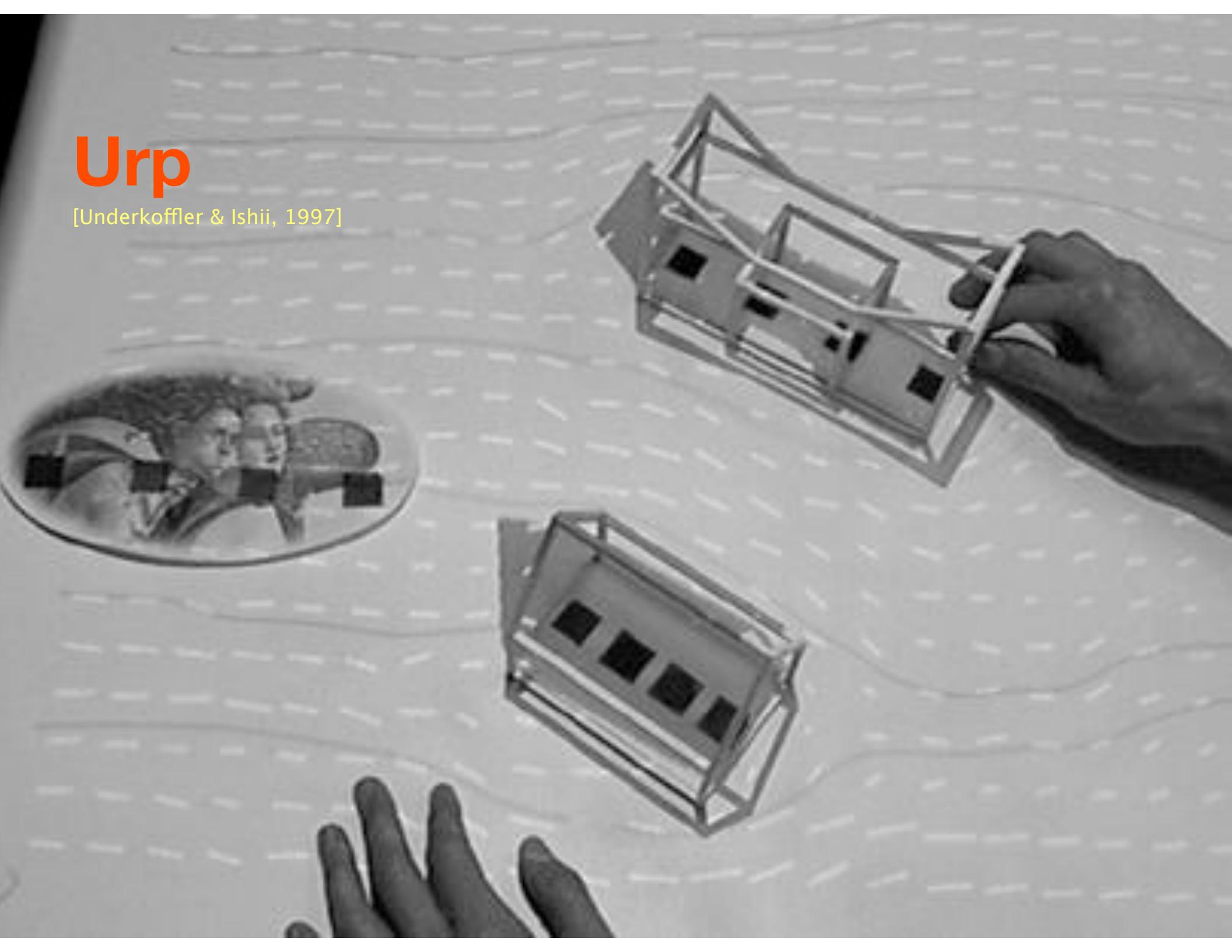


urp:

an integrated
urban planning tool
with a physical interface

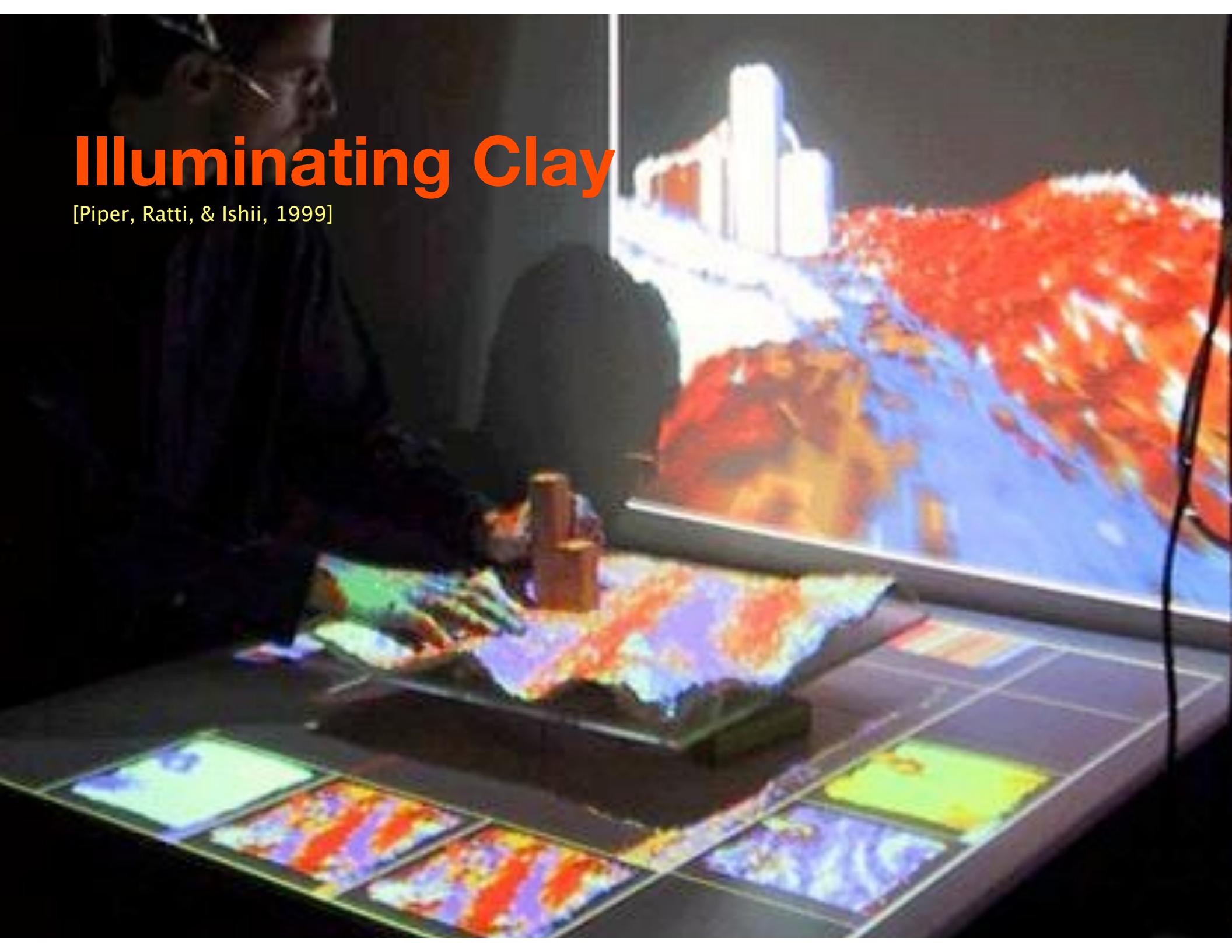
Urp

[Underkoffler & Ishii, 1997]



Illuminating Clay

[Piper, Ratti, & Ishii, 1999]

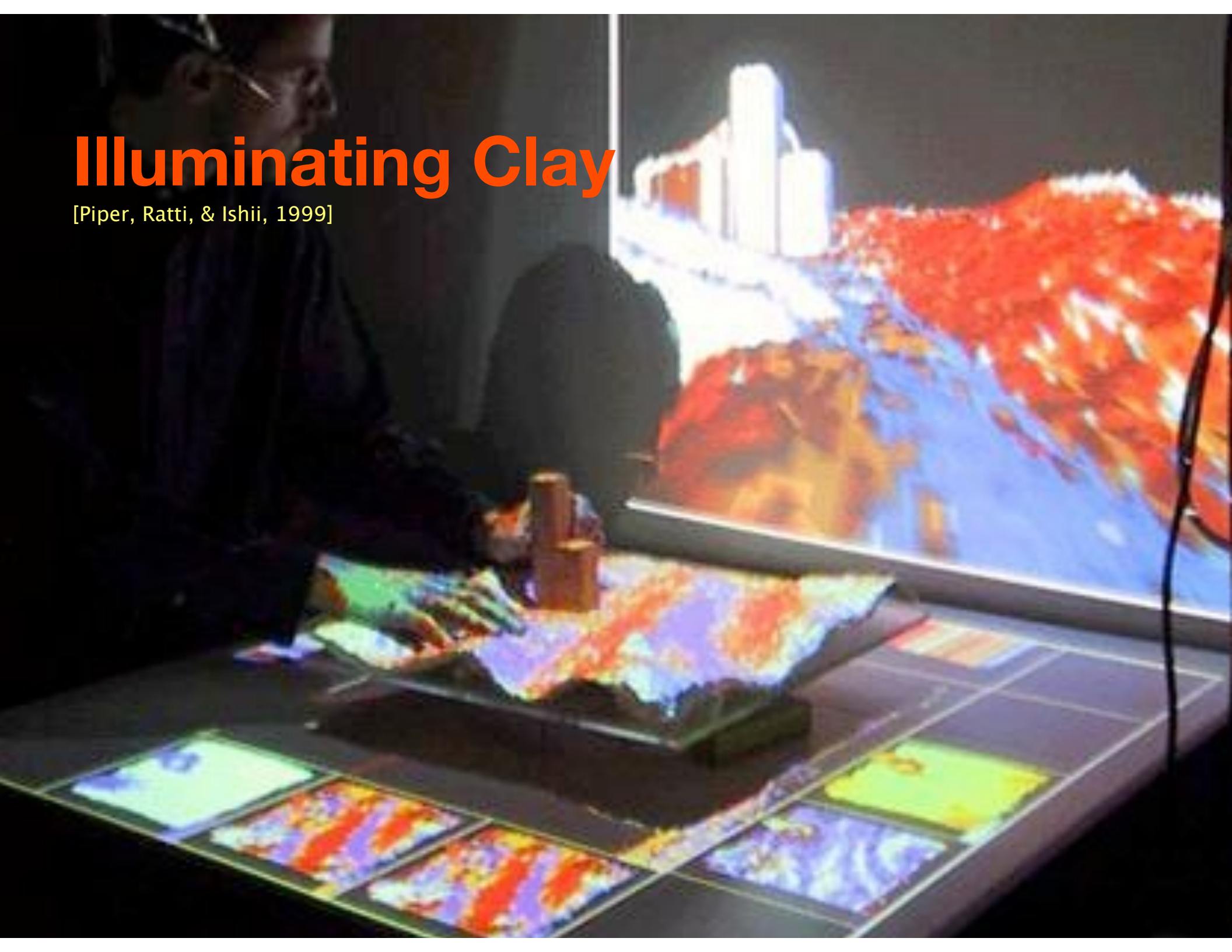


Scenario



Illuminating Clay

[Piper, Ratti, & Ishii, 1999]





形によって絵が変わる砂場で創造力を発揮

Actuated Workbench

[Pangaro, Maynes-Aminzade, & Ishii 2002]





Recompose

[Leithinger et al., 2011]



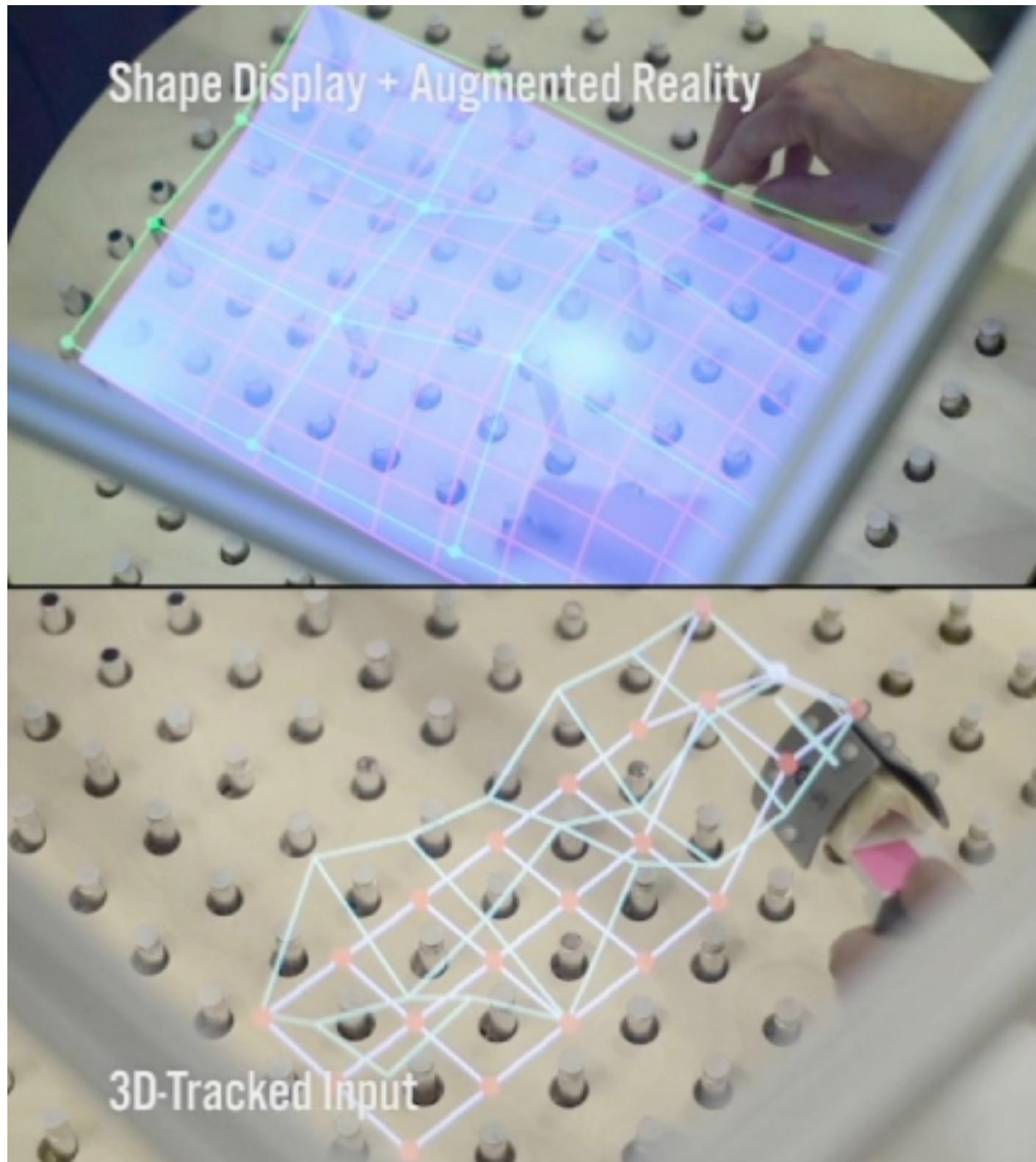
RECOMPOSE



DIRECT AND GESTURAL INTERACTION
WITH AN ACTUATED SURFACE

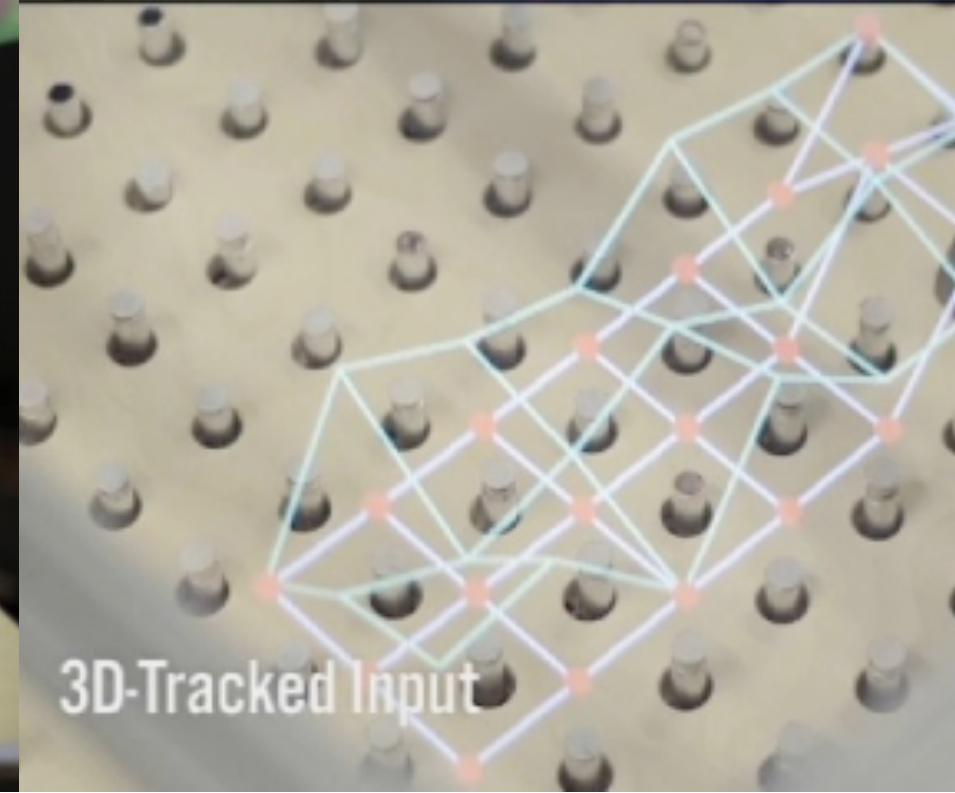
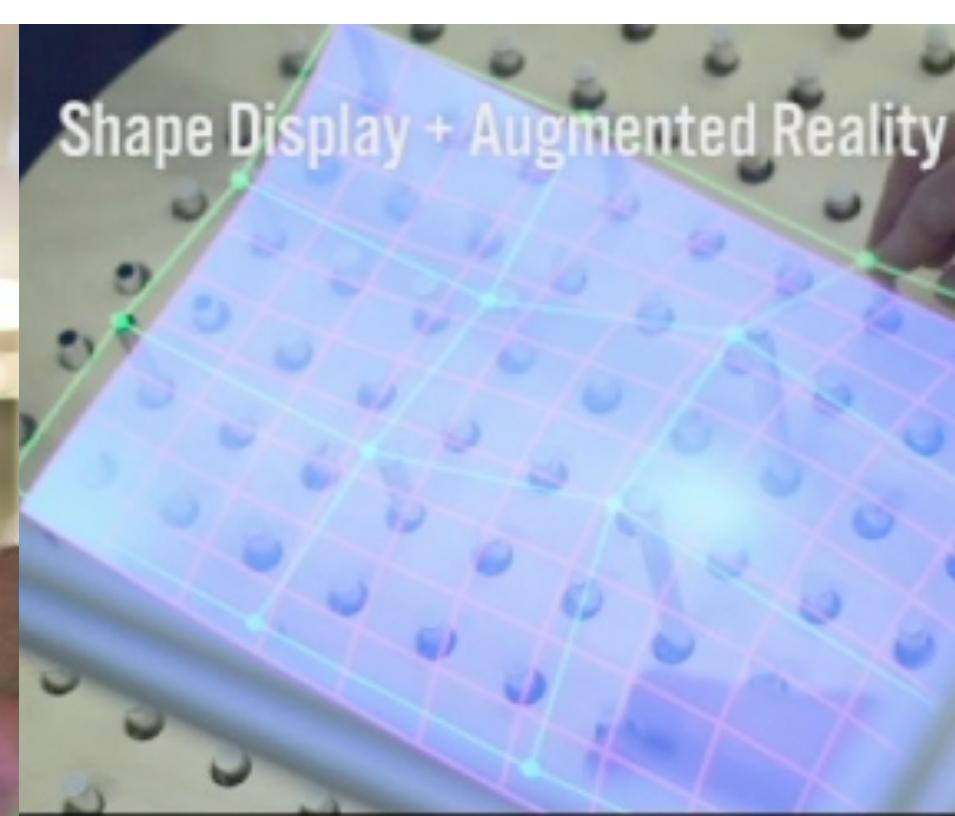
Sublimate

[Leithinger et al., 2013]



Sublime

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



Tangible User Interfaces

Augmented everyday objects

Embodiment of mechanisms for interactive control with tangible representations

Music bottles

[Ishii et al., 2000]



jazz



I/O Brush

[Ryokai, Marti, & Ishii, 2004]



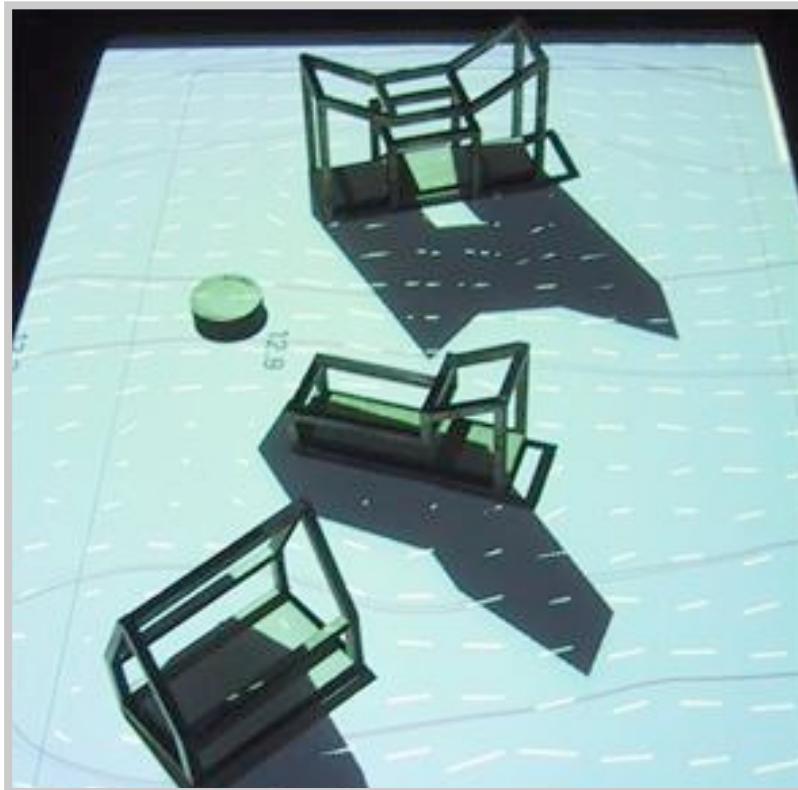


TUI vs. GUI

TUI

Tangible bits

Coincidence of input and output space

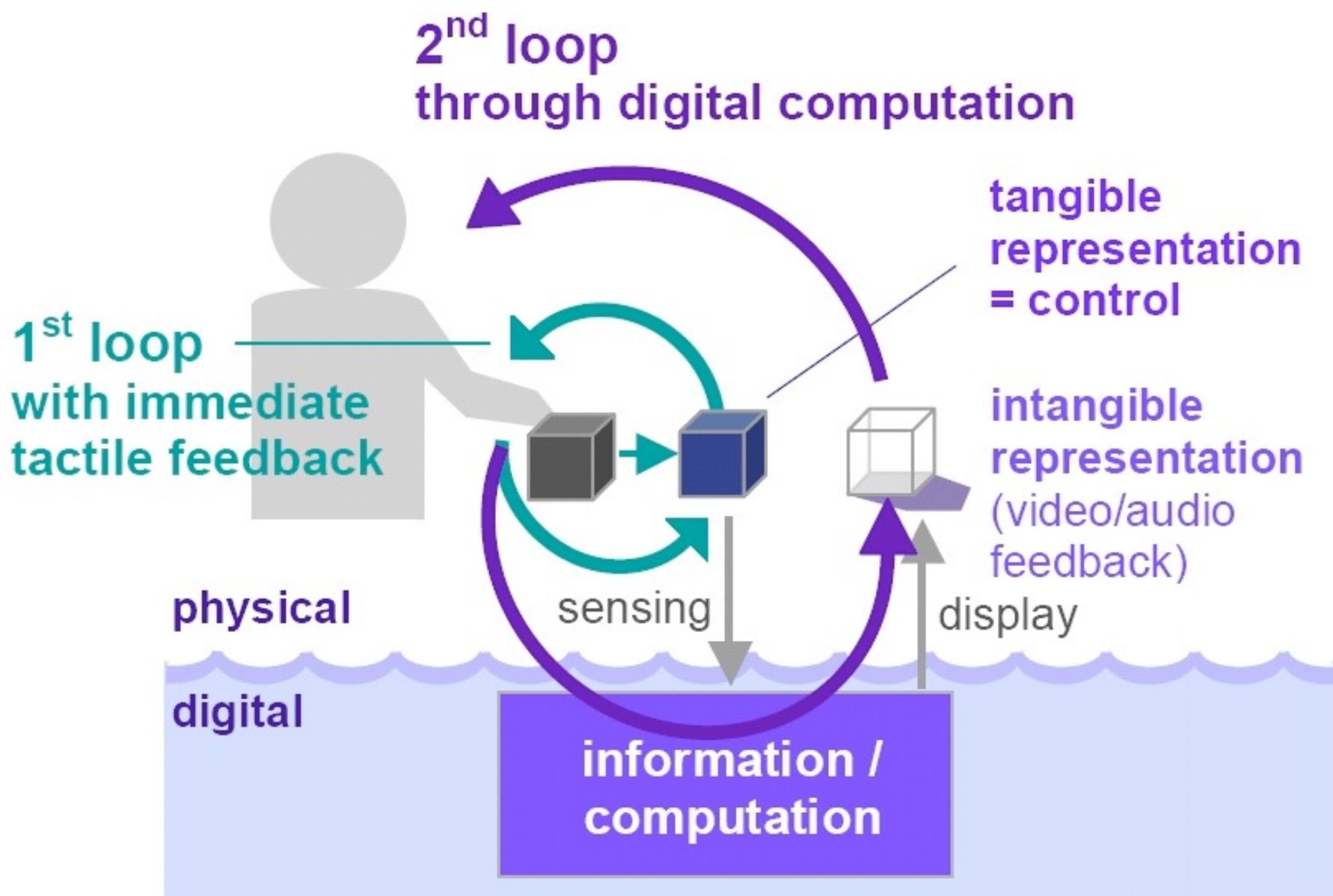


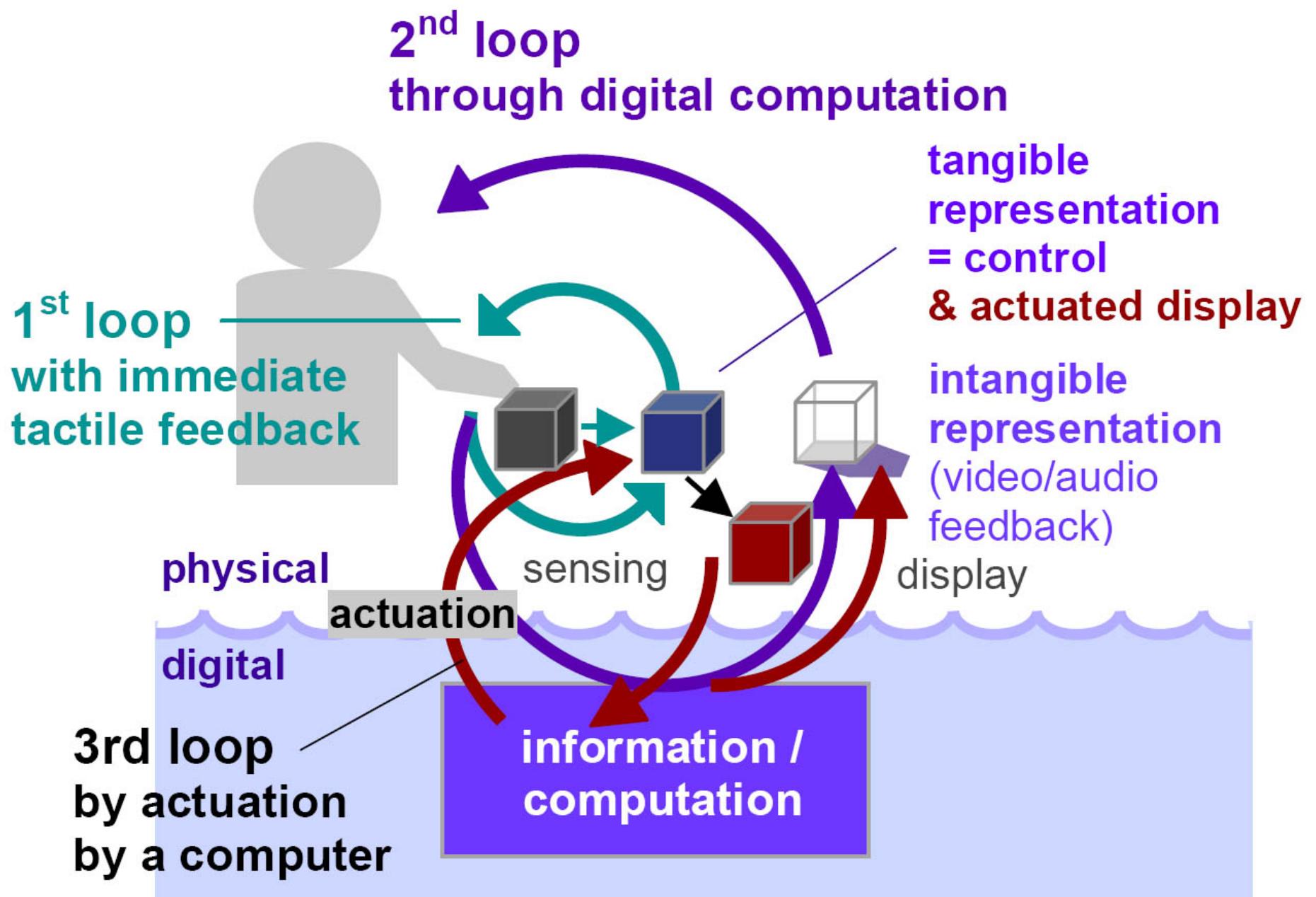
GUI

Painted bits

Generic remote control







TUI Interaction Loop

Combining the skillful hand with the reasoning mind

Next Monday

- Tokens, tools, and containers
- Taxonomy of Tangible User Interfaces

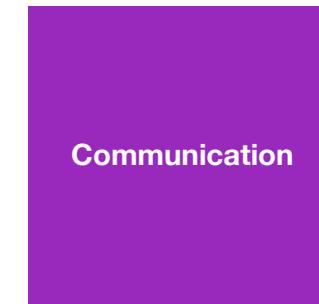
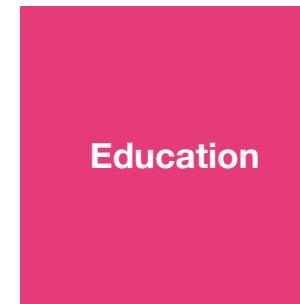
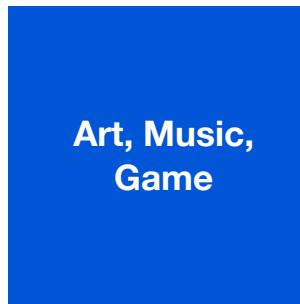
Midterm Project

Design a Tangible User Interface that takes advantage of your hands and body to manipulate digital information. Apply it to a topic of your research interest (e.g., tool for communication, learning/education, design, etc.). Your project may be based on a completely new design or redesign of familiar everyday objects.

- **9/25** Form a group (maximum of **3** members) for your project and write a 1-page proposal and post it on the course website
- **10/9** Progress sketches due (post your sketches on the course website)
- **10/20 & 10/27** In-class midterm project presentation.
Present your idea and optional mockups

Group forming exercise

1. Select topics you are interested in developing Tangible User Interface for.



2. Meet at least 15 people.
3. Form a group (**3** people max).

Group forming exercise

