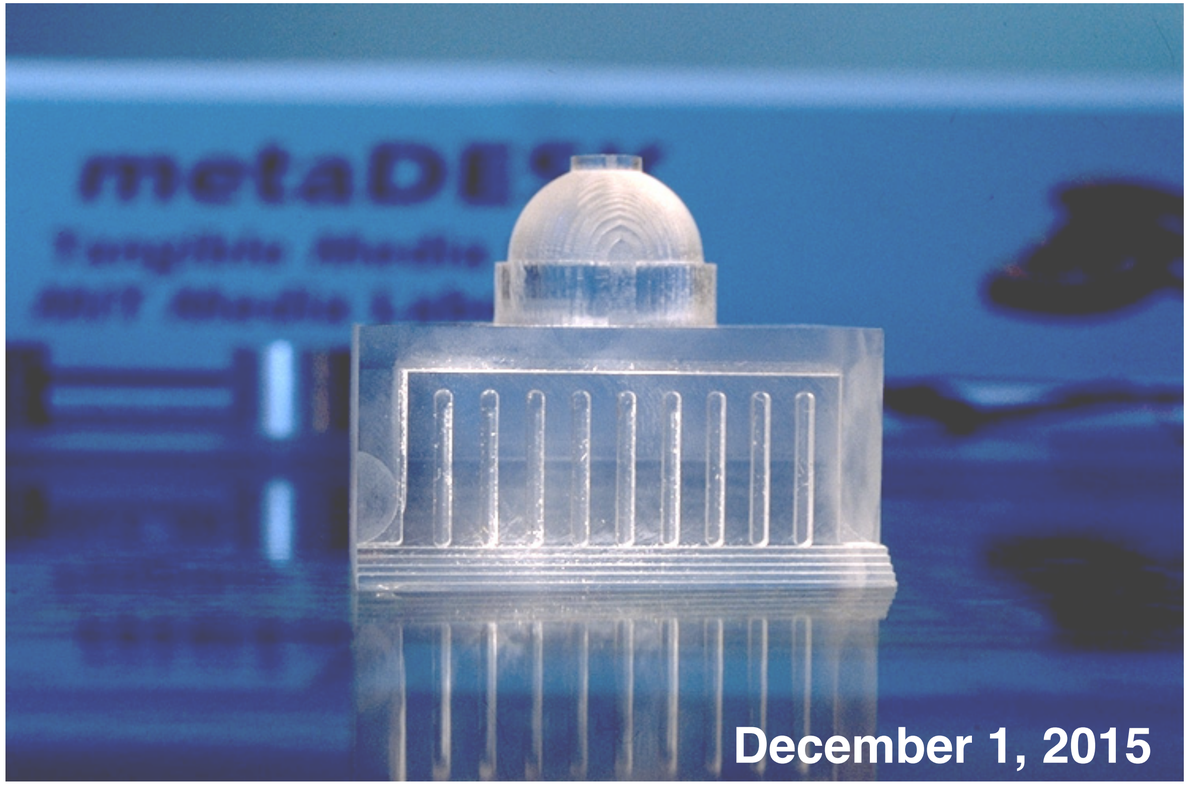
MAS.834 Tangible Interfaces

Beyond Pixels, Towards Radical Atoms

Sep. 15 - Dec. 8, 2015 (Tuesday 1-4pm) in E15-341

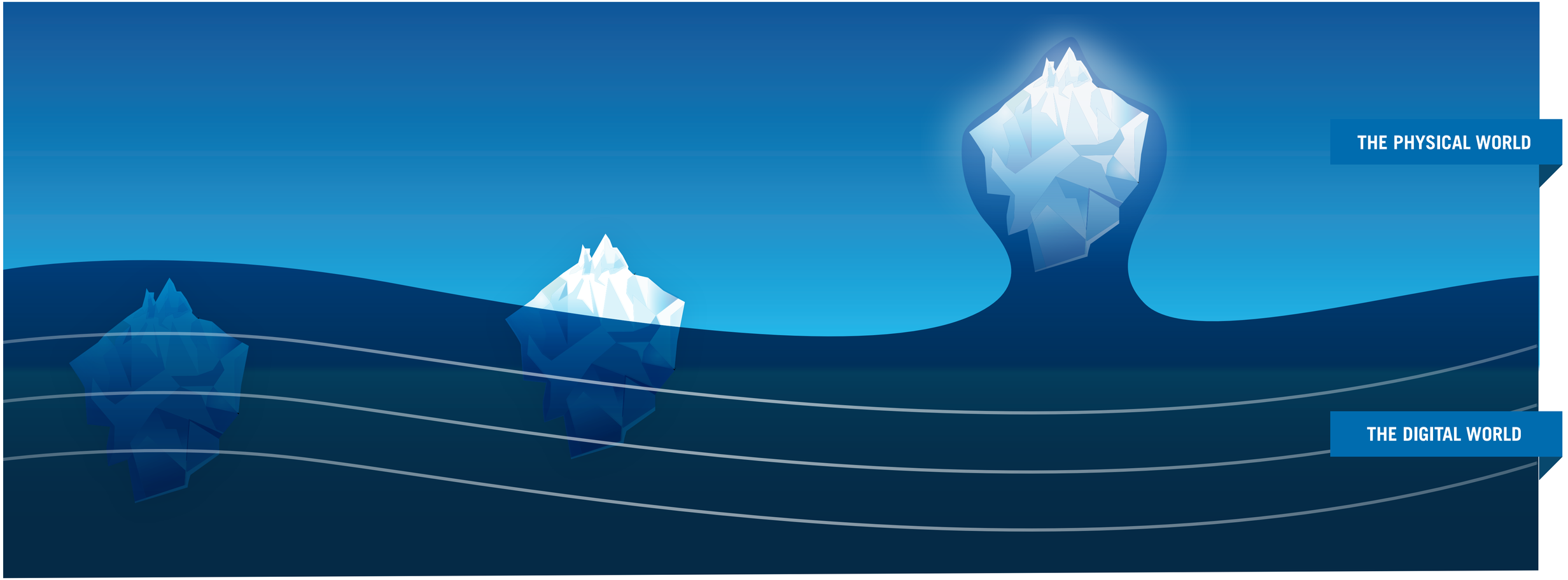


vision

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.

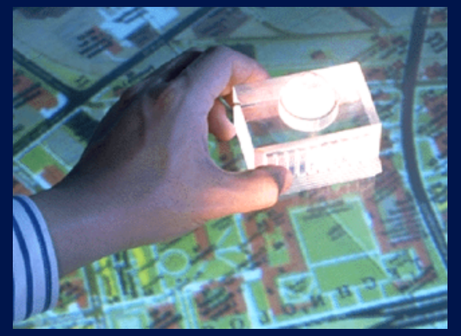

bottles

metaDESK and Tangible Geospace

Ullmer and Ishii, 1997

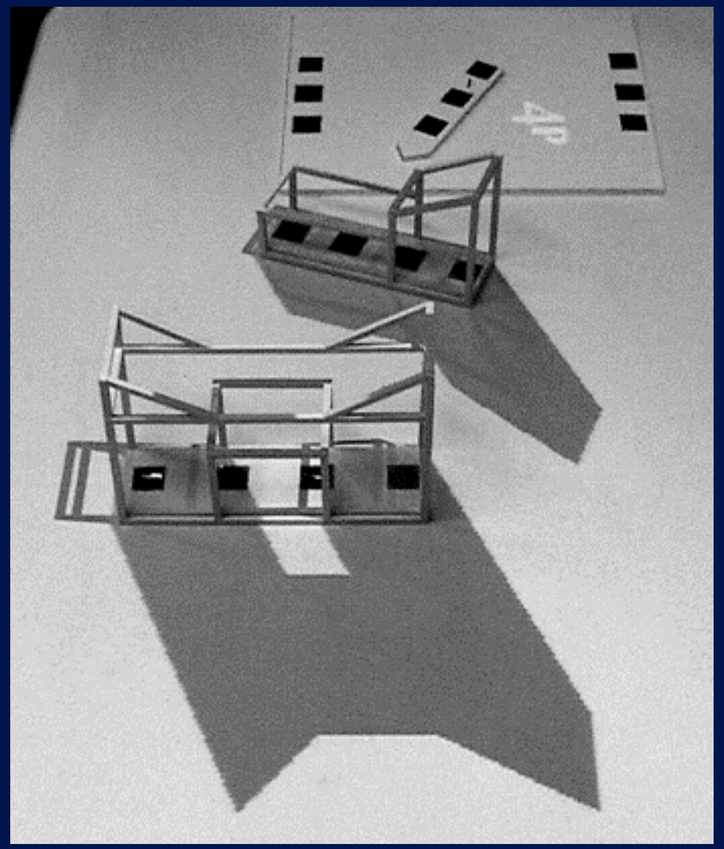
activeLENS

passiveLENS

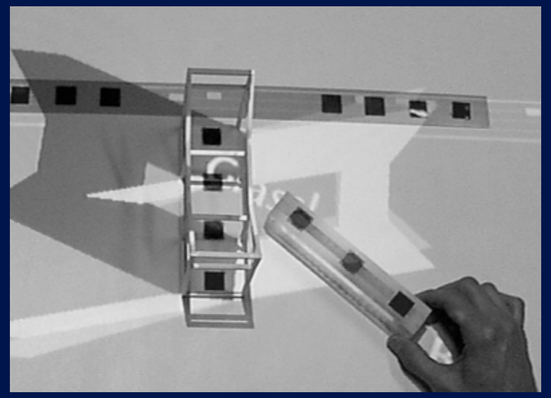


phicons
(physical icons)

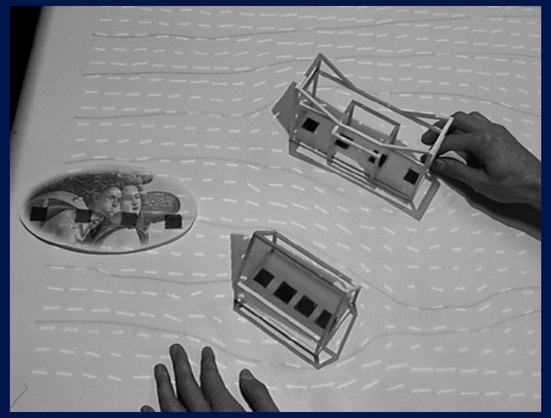
Urp:
Urban Planning Workbench
John Underkoffler and Hiroshi Ishii, 1997 - 1999



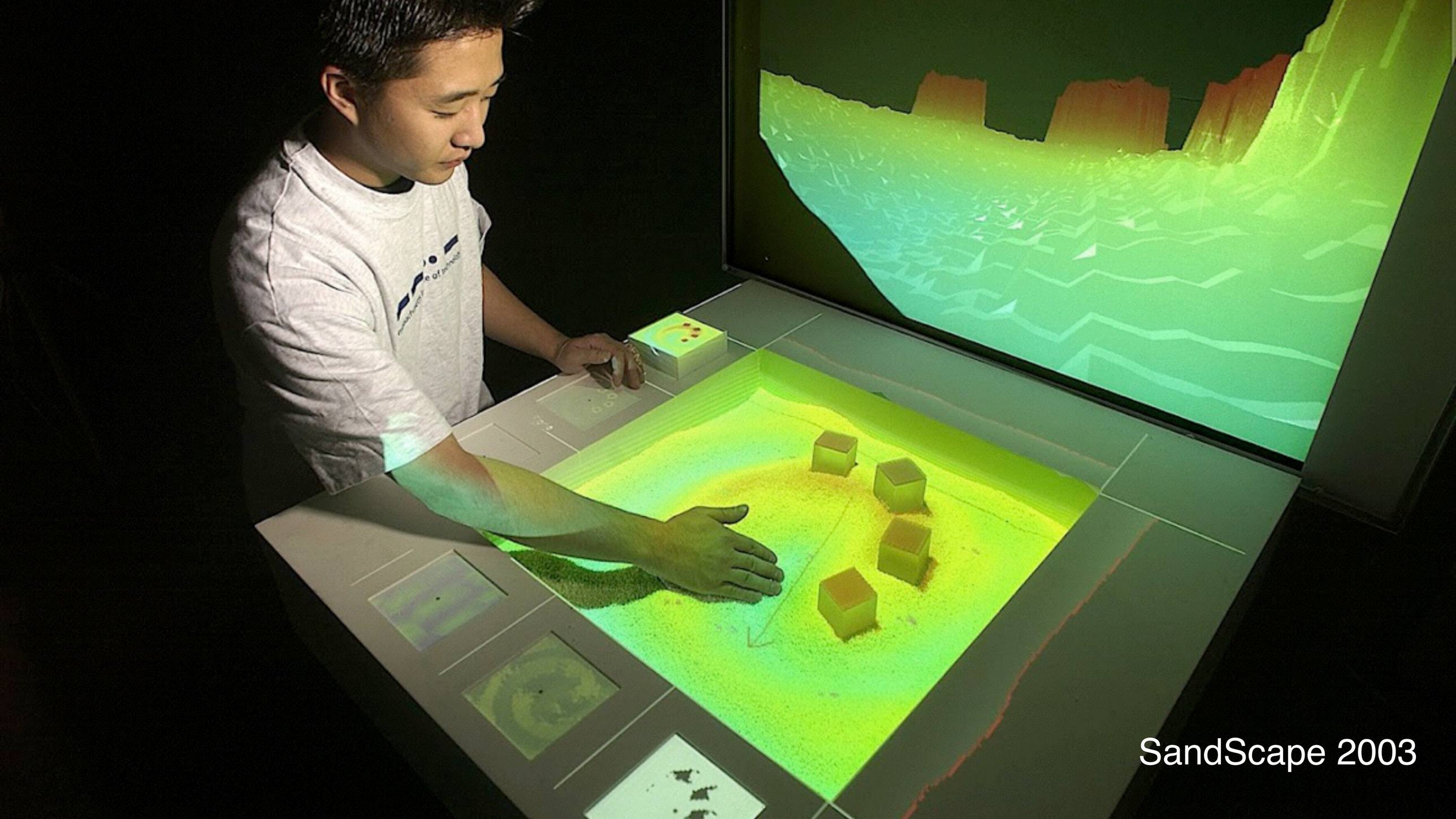
digital shadows



light reflections



wind



SandScape 2003

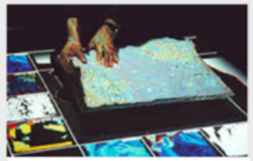

inFORM 2013
Daniel Leithinger, Sean Follmer, Alex Olwal, and Hiroshi Ishii


TRANSFORM
Tangible Media
MIT Media Lab
MIT
Media
Lab

Radical Atoms: Dynamic Shape Displays & Programmable Materials

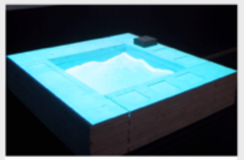
static / passive → **kinetic / active**

deformable tangibles



Illuminating Clay

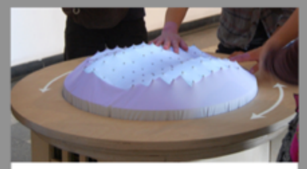
CHI '02



SandScape

Ars Electronica '02

shape changing tangibles

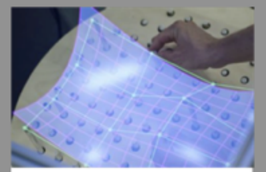


Relief

TEI '09, UIST '11

Recompose

UIST '11



SUBLIMATE

CHI '13

inFORM

UIST '13, UIST '14

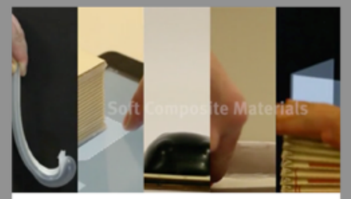
TRANSFORM

Milano Design Week '14, CHI '15

programmable materials

Jamming UI

UIST '12

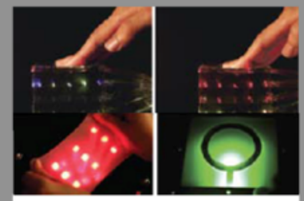


PneUI

UIST '13

jamSheets

TEI '14



OptiElastic

UIST '14

bioLogic

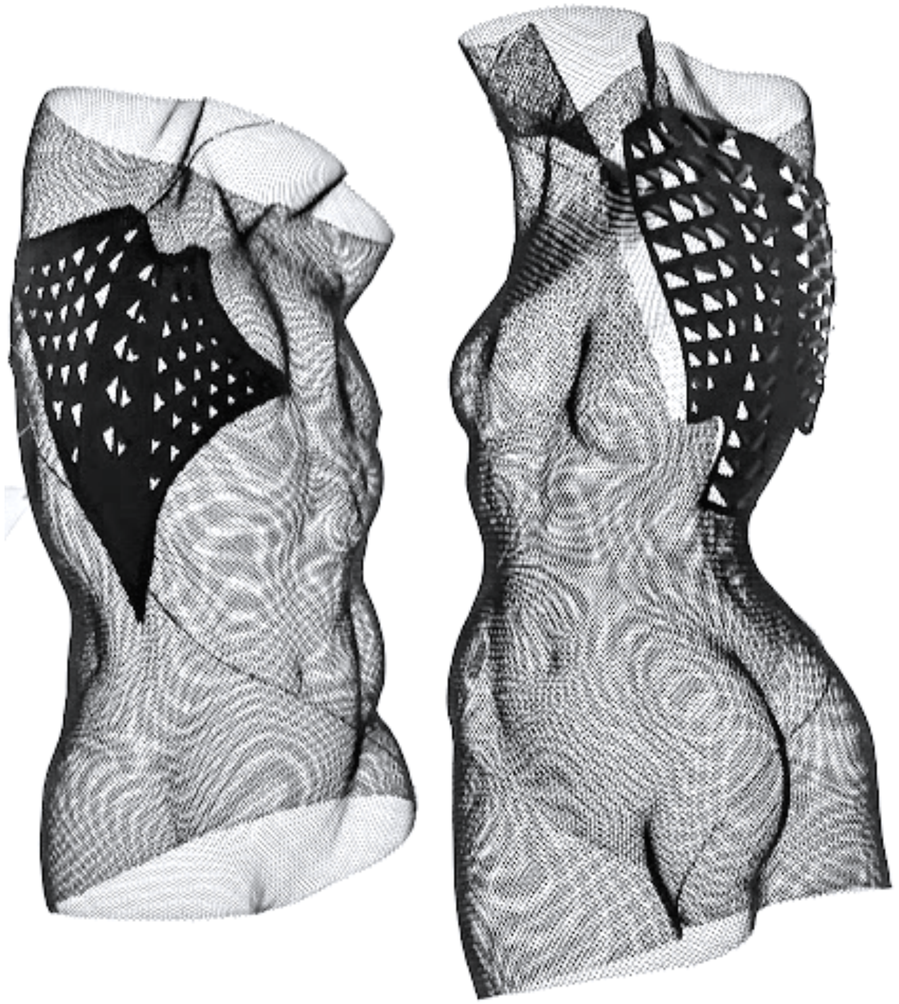
UIST '14, CHI '15

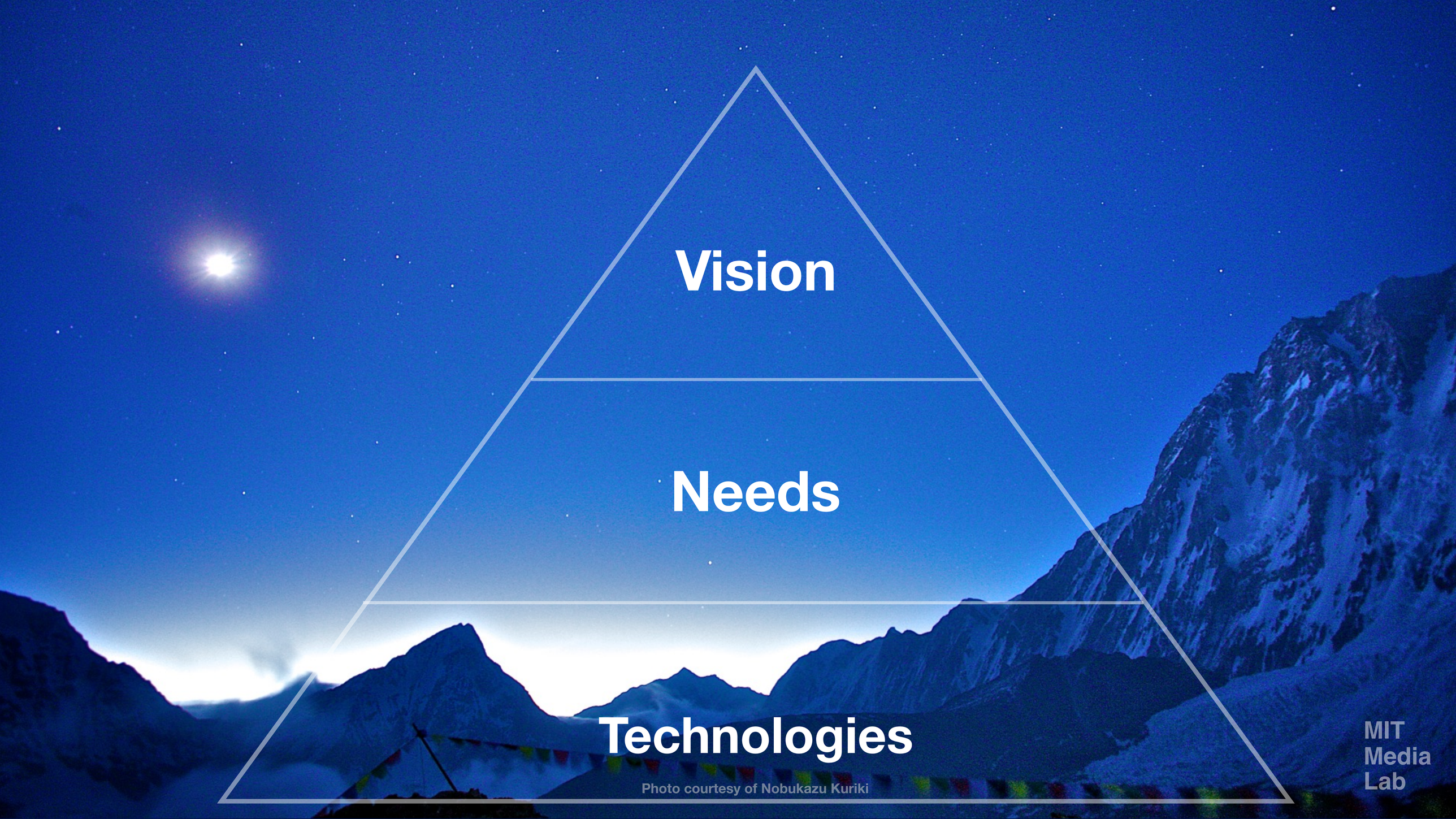

ROLLING PERFECT RED
MAKES A PERFECT SPHERE

“Bio is the new Interface”

Tangible Media Group

bioLogic Exhibit at
MIT Media Lab E14 lobby
~ end of December 2015




Vision
Needs
Technologies
Photo courtesy of Nobukazu Kuriki
MIT
Media
Lab

Lifespan

Vision > 100 years

Needs ~10 years

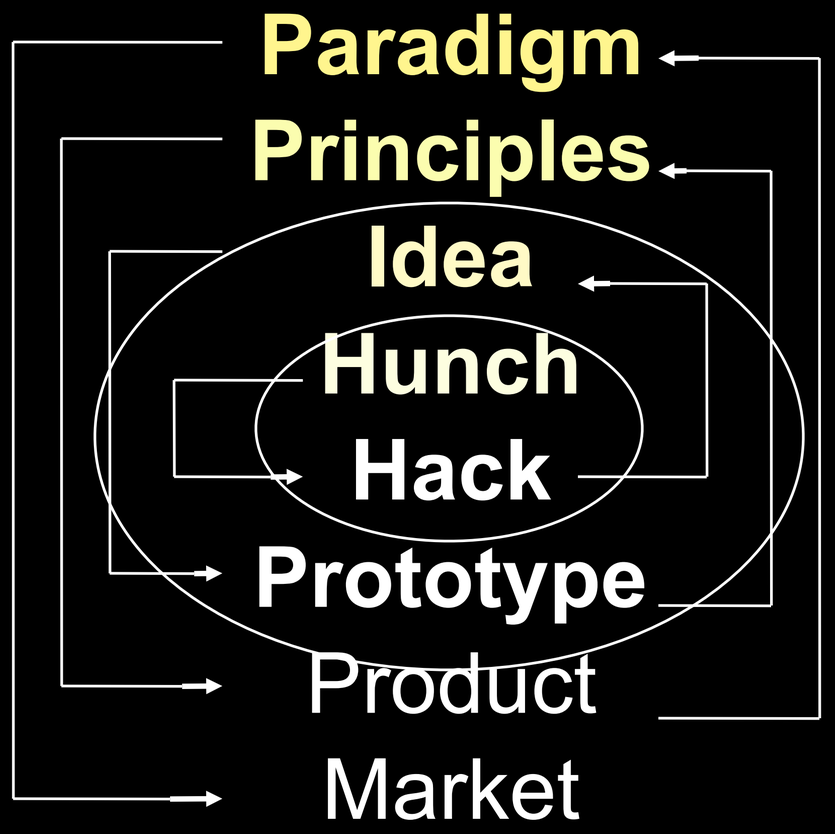
Technologies ~1 year

Photo courtesy of Nobukazu Kuriki

MIT Media Lab

Design Evolution

Bill Verplank 1998



GUI, Ubiquitous Comp, Collective Intelligence

WYSIWYG (GUI) / WYSIWIS (CSCW), I/O Coincidence

Digital Shadow, Sublimate, Gaze Awareness

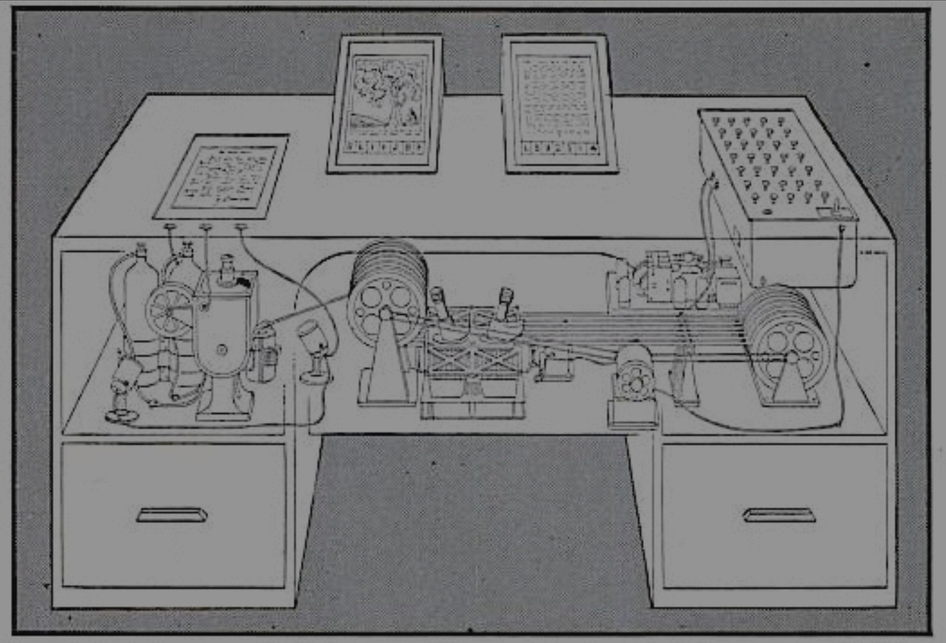
NLS, Alto, Collab, inFORM, ClearBoard

iPhone, Google, Twitter, FB

Web, Mobile Comp., SNS

Vannevar Bush

Memex - “As we may think” 1945

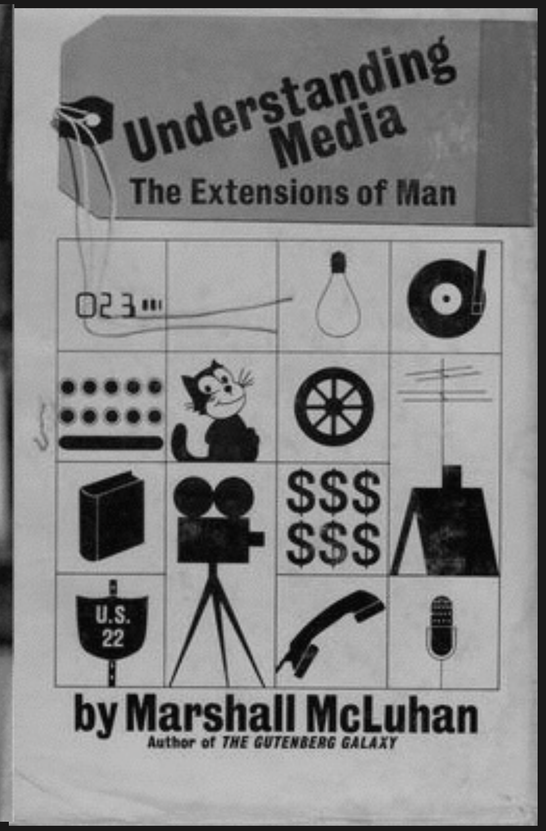


MEMEX in the form of a desk would instantly bring files and material on any subject to the operator's fingertips. Slanting translucent viewing screens magnify supermicrofilm filed by code numbers. At left is a mechanism which automatically photographs longhand notes, pictures and letters, then files them in the desk for future reference.

AS WE MAY THINK CONTINUED

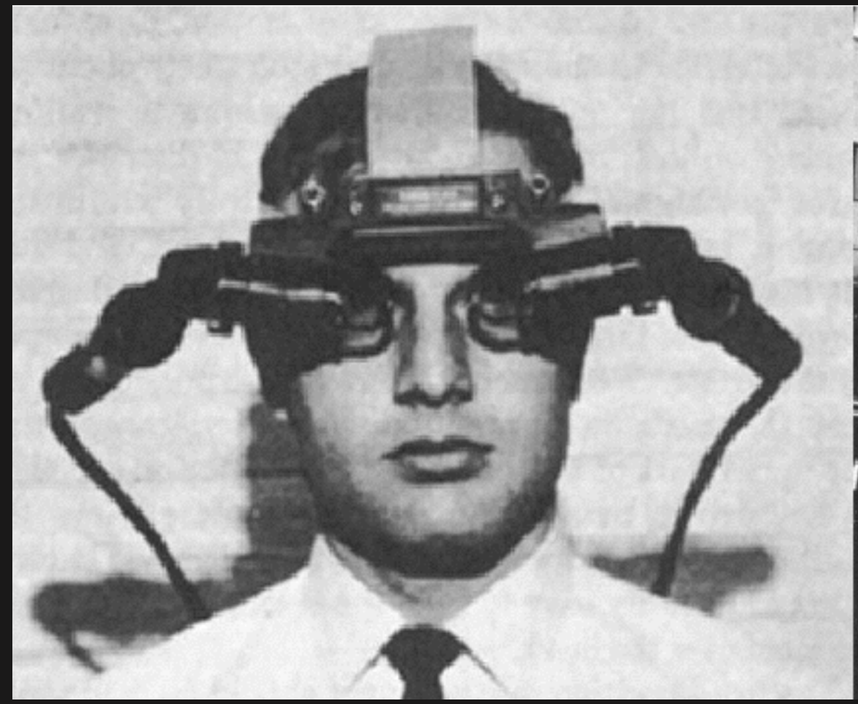
Marshall McLuhan

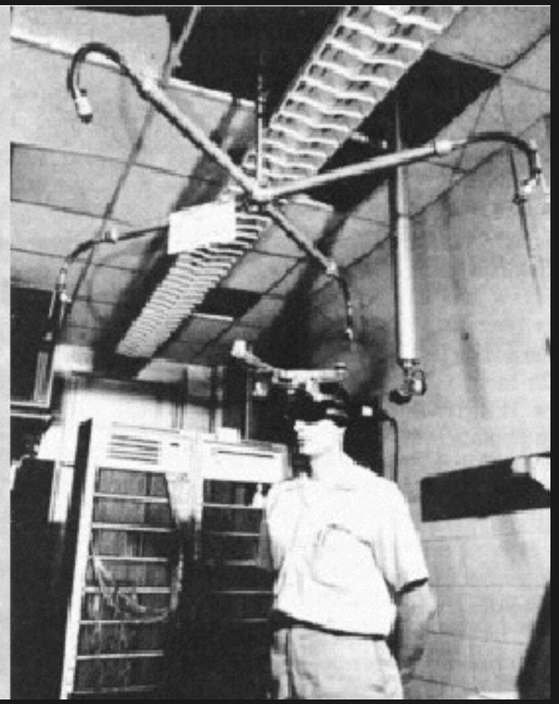
The Extensions of Man 1964



Ivan Sutherland

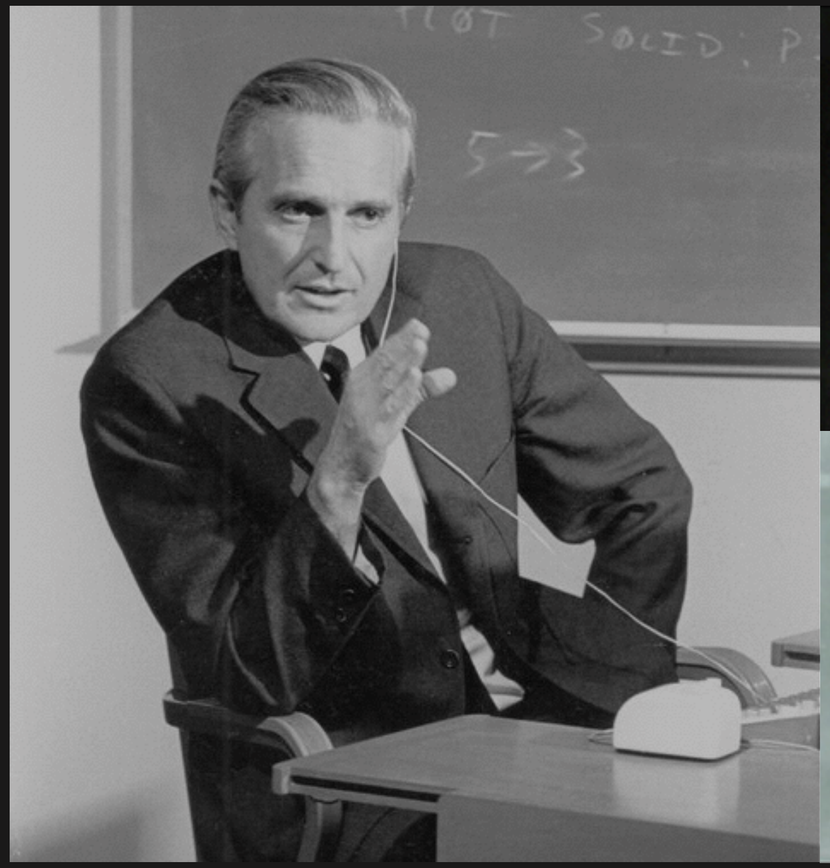
SketchPad & Ultimate Display 1965

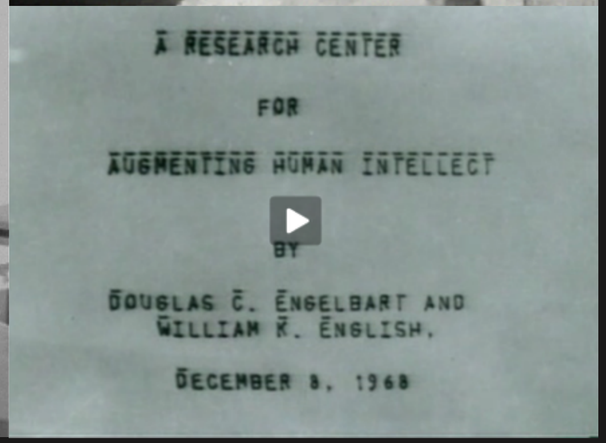




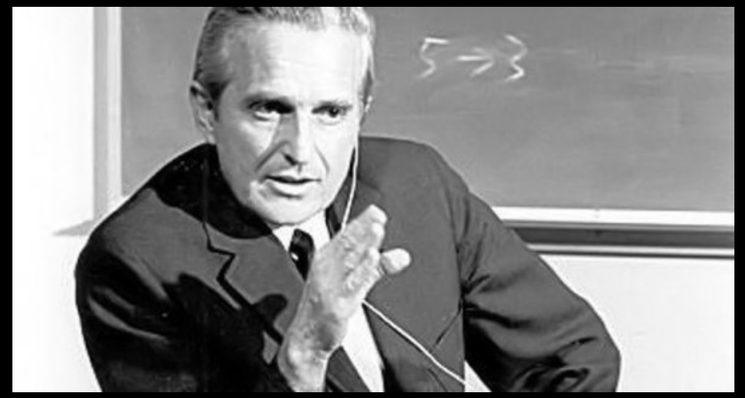
Douglas Engelbart

Collective Intelligence - NLS Demo 1968





“Collective Intelligence”
Douglas Engelbart

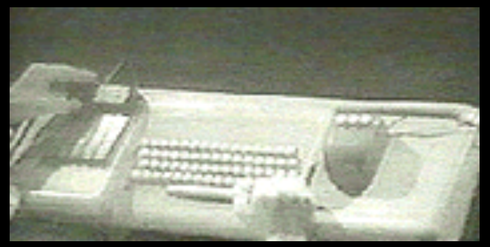


In the early 1950s, Douglas Engelbart
was struck with the notion of using computers as thinking tools
to augment the mind, ideas influenced by Vannevar Bush.

After six years of work at the Augmentation Research Center (ARC) at the SRI, he created the world's first interactive information system, NLS (oN Line System).

NLS (oN Line System)
Douglas Engelbart, 1968

- Demo at the FJCC (Fall Joint Computer Conference) in San Francisco on Dec. 8, 1968

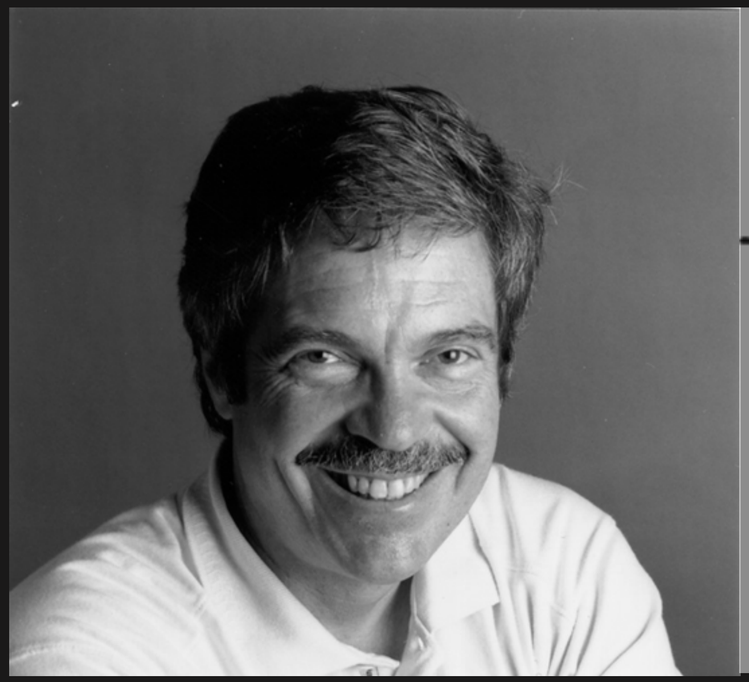


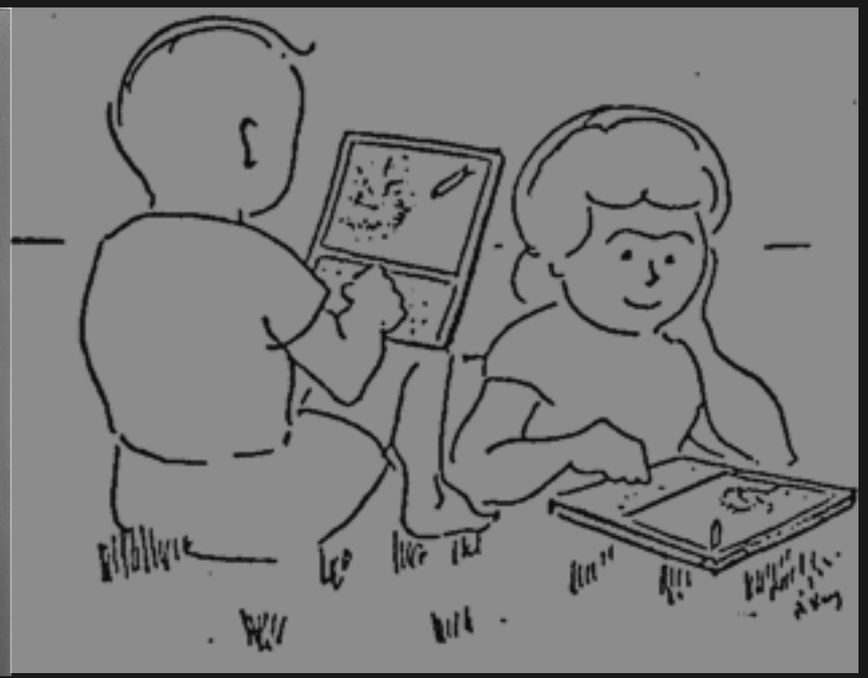
- The first knowledge machine that paved the way for the interactive personal computer as well as groupware.
  - word processing, outline processing, split windows, hypermedia, mouse, one-hand KBD, shared documents, e-mail, filtering, desktop conferencing

http://web.stanford.edu/dept/SUL/library/extra4/sloan/MouseSite/1968Demo.html#complete

Alan Kay

Dynabook 1972



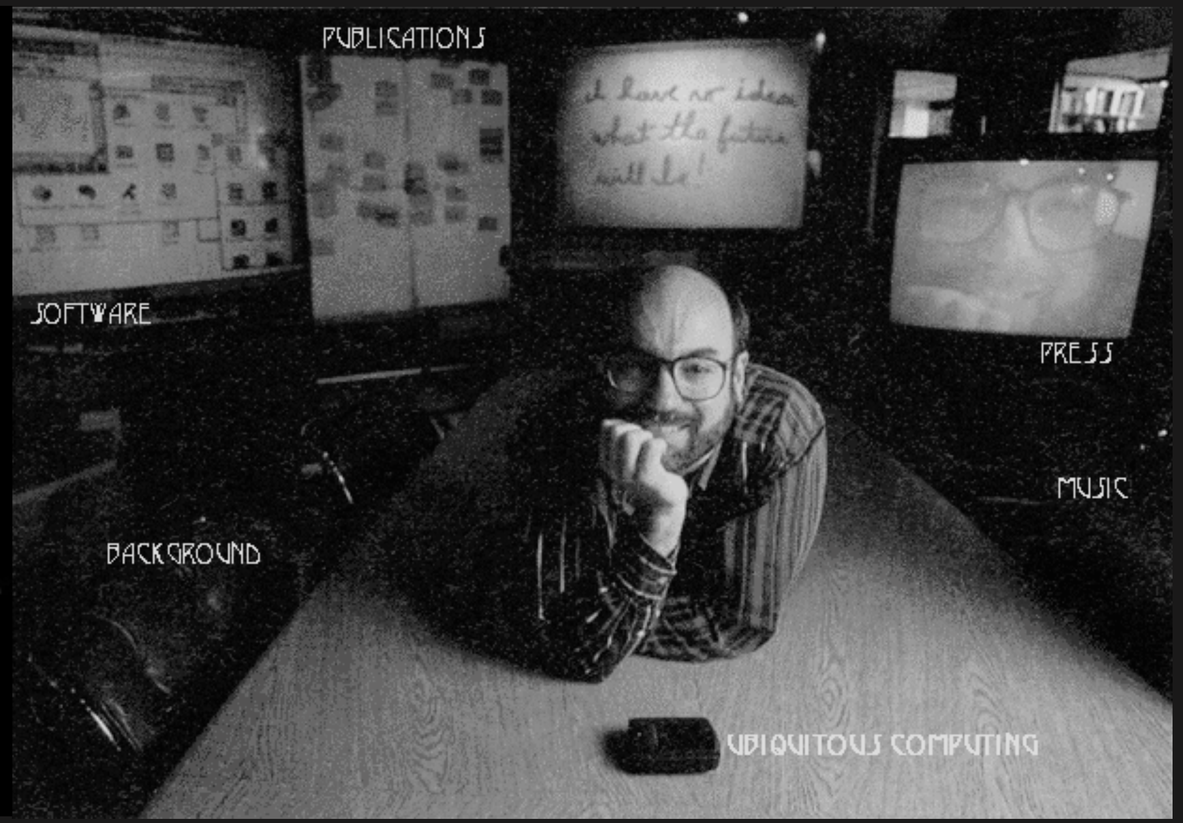


Mark Weiser

Ubiquitous Computing 1991

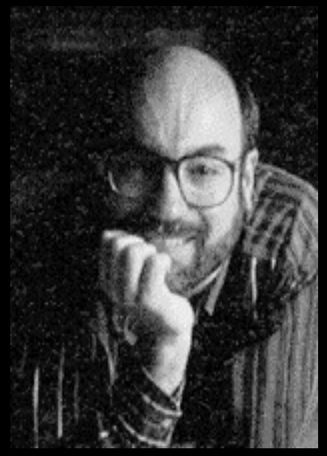
The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.

~Mark Weiser



Ubiquitous Computing
“The Computer for the 21st Century”

“The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.”



Mark Weiser

July 23, 1952 - April 27, 1999

Ubiquitous Computing
Mark Weiser, Xerox PARC, 1991

- Computers should be "transparent."
- Computational services are delivered through a variety of computational devices such as Tabs, Pads, and Boards, with the infrastructure to allow these devices to talk with each other.

Boards

Tabs

Pads

1997

January 26, 1997

A message from
Mark Weiser
(Xerox PARC)

March 22-27, 1997

“Tangible Bits”
paper presented at
CHI ‘97 in Atlanta

Published in the Proceedings of CHI '97, March 22-27, 1997, © 1997 ACM

Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms

Hiroshi Ishii and Brygg Ullmer
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Tangible Media Group
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ABSTRACT

This paper presents our vision of Human Computer Interaction (HCI): "Tangible Bits." Tangible Bits allows users to "grasp & manipulate" bits in the center of users' attention by coupling the bits with everyday physical objects and architectural surfaces. Tangible Bits also enables users to be aware of background bits at the periphery of human perception using ambient display media such as light, sound, airflow, and water movement in an augmented space. The goal of Tangible Bits is to bridge the gaps between both cyberspace and the physical environment, as well as the foreground and background of human activities.

This paper describes three key concepts of Tangible Bits: interactive surfaces; the coupling of bits with graspable physical objects; and ambient media for background awareness. We illustrate these concepts with three prototype systems – the metaDESK, transBOARD and ambientROOM – to identify underlying research issues.

Keywords

tangible user interface, ambient media, graspable user interface, augmented reality, ubiquitous computing, center and periphery, foreground and background

INTRODUCTION: FROM THE MUSEUM

Long before the invention of personal computers, our ancestors developed a variety of specialized physical artifacts to measure the passage of time, to predict the movement of planets, to draw geometric shapes, and to compute [10]. We can find these beautiful artifacts made of oak and brass in museums such as the Collection of Historic Scientific Instruments at Harvard University (Fig. 1).

We were inspired by the aesthetics and rich affordances of these historical scientific instruments, most of which have disappeared from schools, laboratories, and design studios and have been replaced with the most general of appliances: personal computers. Through grasping and manipulating these instruments, users of the past must have developed rich languages and cultures which valued haptic interaction with real physical objects. Alas, much of this richness has been lost to the rapid flood of digital technologies.

We began our investigation of "looking to the future of HCI" at this museum by looking for what we have lost with the advent of personal computers. Our intention was to rejoin the richness of the physical world in HCI.

BITS & ATOMS

We live between two realms: our physical environment and cyberspace. Despite our dual citizenship, the absence of seamless couplings between these parallel existences leaves a great divide between the worlds of bits and atoms. At the present, we are torn between these parallel but disjoint spaces.

Figure 1 Sketches made at Collection of Historical Scientific Instruments at Harvard University

We are now almost constantly "wired" so that we can be here (physical space) and there (cyberspace) simultaneously [14]. Streams of bits leak out of cyberspace through a myriad of rectangular screens into the physical world as photon beams. However, the interactions between people and cyberspace are now largely confined to traditional GUI (Graphical User Interface)-based boxes sitting on desktops or laptops. The interactions with these GUIs are separated from the ordinary physical environment within which we live and interact.

Although we have developed various skills and work practices for processing information through haptic interactions with physical objects (e.g., scribbling messages on Post-It™ notes and spatially manipulating them on a wall) as well as peripheral senses (e.g., being aware of a change in weather through ambient light), most of these practices are neglected in current HCI design because of the lack of diversity of input/output media, and too much bias towards graphical output at the expense of input from the real world [3].

Outline of This Paper

To look towards the future of HCI, this paper will present our vision of Tangible Bits and introduce design projects including the metaDESK, transBOARD and ambientROOM systems to illustrate our key concepts. This paper is not intended to propose a solution to any one single problem. Rather, we will propose a new view of interface and raise a set of new research questions to go beyond GUI.

FROM DESKTOP TO PHYSICAL ENVIRONMENT

In 1981, the Xerox Star workstation set the stage for the first generation of GUI [16], establishing a "desktop metaphor" which simulates a desktop on a bit-mapped

Weiser’s message

Date: Sun, 26 Jan 1997 23:34:10 PST
To: ishii@media.mit.edu, ullmer@media.mit.edu
From: Mark Weiser <weiser@xerox.com>
Subject: "Tangible Bits"

Dear Hiroshi and Brygg,

I recently had a chance to read your CHI 97 paper "Tangible Bits"!
Great work! In my opinion this is the kind of work that will characterize
the technological landscape in the twenty-first century.

I do have a request. As a former professor with tenure I well understand
the need to distinguish one's work from all that comes before. And I very much
appreciate your kind acknowledgement to me. Thanks! My request is that you
help me stop the spread of misunderstanding of ubiquitous computing based
simply on its name. Ubicomp was never just about making "computers"
ubiquitous. It was always, like your work, about awakening computation
mediation into the environment. The Tabs, Pads, and Boards were simply a
way to break out of the mold while still engaging traditional computer
scientists -- although sponsoring Natalie to work on the String turned out
to be as important as any of them!

I tried to stop using ubiquitous computing because of its misleading
implication, but it keeps cropping up again, so I keep returning to it as my
umbrella name for lots of work, including Things That Think. Augmented
reality was in use for awhile, but again got balkanized in meaning. I have
started to talk about Calm Technology as a theme, but it better names a goal
than a research project. "Tangible Bits" is very nice, and maybe could
serve as an overall umbrella, but then you might lose it as the name of your
research project! I think we would all benefit if we could have an
allegiance to some one common thing, and define our differences within that.
But we struggle with what to call that allegiance.

Anyway, great work, and I hope to visit soon and have some good chats now
that Xerox has joined the Media Lab (and I am one of the two official Xerox

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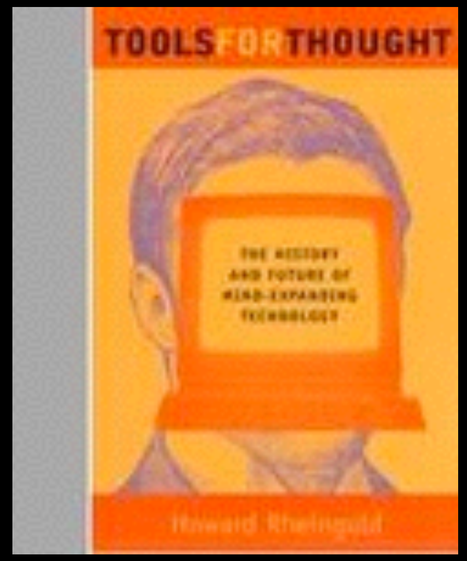
-mark

(Dr.) Mark Weiser
Chief Technologist, Xerox PARC
phone: 415-812-4406 fax: 415-812-4471
email: weiser@xerox.com info: www.ubiq.com/weiser

Tools for Thought
Howard Rheingold, MIT Press

- The History and Future of Mind-Expanding Technology
- http://www.rheingold.com/texts/tft/



The Future

is not to predict, but to invent

Alan Kay 1971

This is the century in which you can be proactive about the future; you don't have to be reactive. The whole idea of having scientists and technology is that those things you can envision and describe can actually be built.

Photo courtesy of Nobukazu Kuriki

mit media lab

Envision

Photo courtesy of Nobukazu Kuriki

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Photo courtesy of Nobukazu Kuriki

mit media lab


Thanks!
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Hiroshi Ishii
MIT Media Lab
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Media
Lab