TRANSFORM
Tangible Bits ➤ Radical Atoms

SUI 2015
Los Angeles

Photo courtesy of Nobukazu Kuriki
Ideas Colliding
Opportunities Emerging
Disciplines Transcending
Arts & Sciences
Music & Technology
MirrorFugue III

Xiao Xiao
MirrorFugue III  Xiao Xiao
A Graphical User Interface only lets 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.
digital painted bits

tangible bits

physical
Tangible Bits

embody digital information to interact with directly with hands

MIT Media Lab

1997

GUI

TUI

painted bits
tangible bits
Orrery

Tangible Representation of Knowledge
A Philosopher Giving a Lecture on the Orrery (sometimes called simply The Orrery) is a painting (oil on canvas, ca. 1766) by Joseph Wright of Derby depicting a public lecture about a model solar system, with a lamp—in place of the sun—illuminating the faces of the audience.

Tangible Bits

March 1997

“Tangible Bits” paper presented at CHI ‘97 in Atlanta
bottles
musicBottles (classical)
Origin: Weather Bottle

present for my mother

soy sauce bottle
in her kitchen
Kazuko ISHII
1926 - 1998
Mark Weiser
1952 – 1999
Bottles: A Transparent Interface as a Tribute to Mark Weiser

IEICE TRANS. INF. & SYST., VOL.E87–D, NO.6 JUNE 2004

INVITED PAPER Special Section on Human Communication I
Bottles: A Transparent Interface as a Tribute to Mark Weiser

Hiroshi ISHII10, June 2004

SUMMARY This paper first discusses the reinterpretation of the concept of "ubiquitous computing" that Mark Weiser originally proposed in 1991. Weiser’s main message was not the ubiquity of computers, but the transparency of interfaces that determines users’ perception of digital technology embedded in our physical environment seamlessly. To explore Weiser’s philosophy of transparency, this paper presents the design of an interface that the glass bottle is "constantly" and "transparent" for digital information. The intention is to make the bottle interactive. Instead of scent, the bottle can be filled with essences—classical, jazz, and techno music. Opening the bottle releases the scent of a specific instrument accompanied by dynamic colored light. Physical manipulation of the bottle—opening and closing—is the primary mode of interaction for controlling its musical content. The bottle illustrates Weiser’s vision of the transparent interface that weaves itself into the fabric of everyday life. The bottle also supports the emotional aspects of glass bottles that are tangible and visual, and evoke the smell of perfume and the taste of exotic beverages. This paper describes the design parts of the bottle interface, the arrangement of musical content, the implementation of the wireless-actuated transparent technology, and the feedback from users who have played with the system.

Key words: Mark Weiser, ubiquitous computing, pervasive computing, invisible computing, transparent interface, tangible interface, tangible bottles, interactive bottles

1. Introduction

"Ubiquitous" has become a popular buzzword used by virtually every media in Japan today. Unbeknownst, however, Mark Weiser’s original concept of "ubiquitous computing" [10] was not well known, and was often misused as a label for the old idea of “anytime & anywhere computing” or as an acronym of “mobile/wireless broadband services.” This paper first discusses the core message of Weiser’s “ubiquitous computing” vision based on personal communication with him, and then presents “bottles” as a tribute to him. The bottles illustrate Weiser’s vision of profound technologies that disappear by immersing themselves into the fabric of everyday life.

2. Ubiquitous

2.1 Anytime & Anyplace?

The word ubiquitous, meaning “omnipresent,” is often interpreted as “anytime & anyplace.” However, the concept of “anytime & anyplace” is nothing especially new. This

Manuscript received December 12, 2003.

The author is with MIT Media Laboratory, E15-33A, 20 Ames Street, Cambridge, MA 02139-4307 U.S.A.
E-mail: ishi@media.mit.edu

Fig. 5 mode/bottles sampler.

Fig. 6 A weather bottle that contains the weather forecast of Switzerland.
I/O Brush
painter = color maker
I/O Brush
Kimiko Ryokai, Stefan Marti, & Hiroshi Ishii 2004
I/O Brush  History Mode
Kimiko Ryokai, Stefan Marti, & Hiroshi Ishii 2004
I/O Brush  History Mode
Kimiko Ryokai, Stefan Marti, & Hiroshi Ishii 2004

Capturing and weaving the (hi)story for every stroke
“The World as the Palette”
Colors in Barcelona
Urp:
Urban Planning Workbench
John Underkoffler and Hiroshi Ishii, 1997 - 1999

digital shadows
light reflections
wind
SandScape
Ars Electronic Center 2003

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

Tangible Media Group
MIT Media Laboratory
Radical Atoms
Dynamic Future Material that Transform, Conform & Inform

radical atoms
2012

tangible bits
1997

MIT Media Lab
Material Matters
Two Material Options Exist Today

1. Frozen Atoms:
inert, rigid, passive physical materials (incl. metal, wood, glass and plastic)

2. Intangible Pixels:
dynamic, virtual and intangible pixels (bits) trapped behind a 2D flat screen

Introducing The Third Material

3. Radical Atoms:
dynamic, physical and computational materials that transform, driven by bits
Relief: A 2.5D Shape Display
Daniel Leithinger & Hiroshi Ishii
Cooper Hewitt Design Museum
inFORM Exhibit

Daniel Leithinger,
Dr. Sean Follmer
Philipp Schoessler,
Jared Counts,
Ken Nakagaki,
David Doan,
Basheer Tome and
Prof. Hiroshi Ishii
Cooper Hewitt Design Museum
inFORM Exhibit


Daniel Leithinger, Dr. Sean Follmer, Philipp Schoessler, Jared Counts, Ken Nakagaki, David Doan, Basheer Tome and Prof. Hiroshi Ishii
AMAZING IN MOTION
CREATED BY LEXUS

A set of ambitious projects that explore the complexity and beauty of motion through film, photography and technology.

Intriguing Elegance through Careful Juxtaposition of Opposing Elements

Design vs Technology
Stillness vs Motion
Nature vs Machine
Design vs Technology
TRANS-Disciplinary

Finding opportunity in conflict between disciplines
Breaking down old paradigms to create new archetypes

“auf-heben”

http://www.talkingcranes.com/blog/poles-must-engage
TRANSFORM
Tangible Media
MIT Media Lab
inFORM ENGINES
Designed by Daniel Leithinger & Sean Follmer, and Rendered by Amit Zoran
The three panels of the triptych were sold separately in the mid-1970s.[9] Bacon was unhappy that the panels had been split up, writing on a photograph of the left-hand panel that it was "meaningless unless it is united with the other two panels."
TRANSFORM can be considered a kinetic triptych. As in paintings, each piece of a triptych can stand for itself (is an artwork in itself) yet they belong together. In contrast to triptych paintings, the kinetic triptych can interact with its single parts and seamlessly change its meaning and the onlookers focus of attention.
The biggest challenge was instead of trying to hide the complex machine,
Inspirations

- Nature
  Wave & Dune

- Escher
  Perpetual Motion

- Sand Castle
April 8-13, 2014 in Milan
5000 visitors interacted
100 said “Amazing!” to me
TRANSFORM
Lexus Design Amazing 2014 Milan
MIT Media Lab | Tangible Media Group
CHI 2015 Golden Mouse Award

TRANSFORM

AS ADAPTIVE AND DYNAMIC FURNITURE

LUKE VINK • VIIRJ KAN • KEN NAKAGAKI • DANIEL LEITHINGER
SEAN FOLLMER • PHILIPP SCOESSLER • AMIT ZORAN • HIROSHI ISHII
Milano Design Week 2014
TRANSFORM Exhibit
04/08-13/14, Milano, Italia

Prof. Hiroshi Ishii
Daniel Leithinger
Dr. Sean Follmer
Dr. Amit Zoran
Philipp Schoessler
Jared Counts
Milano Design Week 2014
TRANSFORM Exhibit
04/08-13/14, Milano, Italia

TRANSFORM won Platinum A’DESIGN AWARD 2015
04/15/15
the team

Prof. Hiroshi Ishii  
*Concept Design*

Daniel Leithinger  
*Engine Design*

Sean Follmer  
*Engine Design*

Amit Zoran  
*Product Design*

Philipp Schoessler  
*Motion Design*

for more information about the project and the process, go to:
tangible.media.mit.edu/project/transform
Beyond Tangible Bits, Towards Radical Atoms

Radical Atoms
Dynamic Future Material that Transform, Conform & Inform
Evolution from Tangible Bits towards Radical Atoms  2005-2015
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)
PneUI (2013): Programmable Materials (1)
PneUI Team

Lining Yao, Ryuma Niiyama, Jifei Ou
Sean Follmer, Clark Silva, Hiroshi Ishii

Tangible Media Group
MIT Media Lab
jamSheets (2014): Programmable Materials (2)
BioLogic  CHI 2015

Natto 納豆

Bacillus subtilis natto

The Bacterium Bacillus subtilis taken with a Tecnai T-12 TEM.
BioLogic (2015)

Bacillus subtilis natto cells as natural nano-actuators and nano-sensors

The bacterium Bacillus subtilis taken with a Tecnai T-12 TEM. Taken by Allon Weiner, The Weizmann Institute of Science, Rehovot, Israel, 2006.
TRANS-DISCIPLINARY

← GROW + BUILD

NATURE-DERIVED + MAN-MADE
TRANS-DISCIPLINARY

Finding opportunity in conflict between disciplines
Deconstructing the old paradigms to create new archetypes
Transforming beyond preconceived concepts
NASA Deployed the Hubble Space Telescope in 1990

Unconstrained Perspective
Perspective of Hubble Space Telescope

http://hubblesite.org/gallery/album/star/pr2010013a/

NASA, ESA, and M. Livio and the Hubble 20th Anniversary Team (STScI)

Pillar and Jets HH 901/902
Hubble Space Telescope • WFC3/UVIS

http://hubblesite.org/gallery/album/star/pr2005037a/

NASA, ESA, and J. Hester (Arizona State University)

Crab Nebula • M1
Hubble Space Telescope • WFPC2
Voyager 1 Deployed in 1977
Unconstrained Perspective
Planets from the Voyager 1’s Perspective

Unconstrained Perspective
People could only see the world from their own perspective
Towards Holistic Worldview:

Enhance  

Expand  

Escape
Holistic Perspective & Heuristic Focus
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
Envision
Envision
Embody
Inspire
Today

Photo courtesy of Nobukazu Kuriki
http://kurikiyama.jp
What do you want to pass on to those living in 2200?

How do you want to be remembered?

What do you want your legacy to be?

Photo courtesy of Nobukazu Kuriki
http://kurikiyama.jp
2200 future

Photo courtesy of Nobukazu Kuriki
Life has set end point
寿命有限

But the future is never-ending
未来無限
Technology soon becomes obsolete

But true vision is ever-lasting

“Cradle of Stars” by Scott Cresswell
TRANSFORM
Tangible Bits ▶ Radical Atoms

SUI 2015
Los Angeles

石井 裕
Hiroshi Ishii
MIT Media Lab
Thanks!

石井 裕
Hiroshi Ishii
MIT Media Lab

@ishii_mit