Human-Computer Interaction

Eric Paulos
University of California, Berkeley
EECS, Computer Science Division
CS10, Spring 2013

MY **BACKGROUND** • UCB • INTEL RESEARCH • CMU • UCB

eric paulos

berkeley center for new media • electrical engineering and computer science • ucb

Top

Secret

ERIC'S

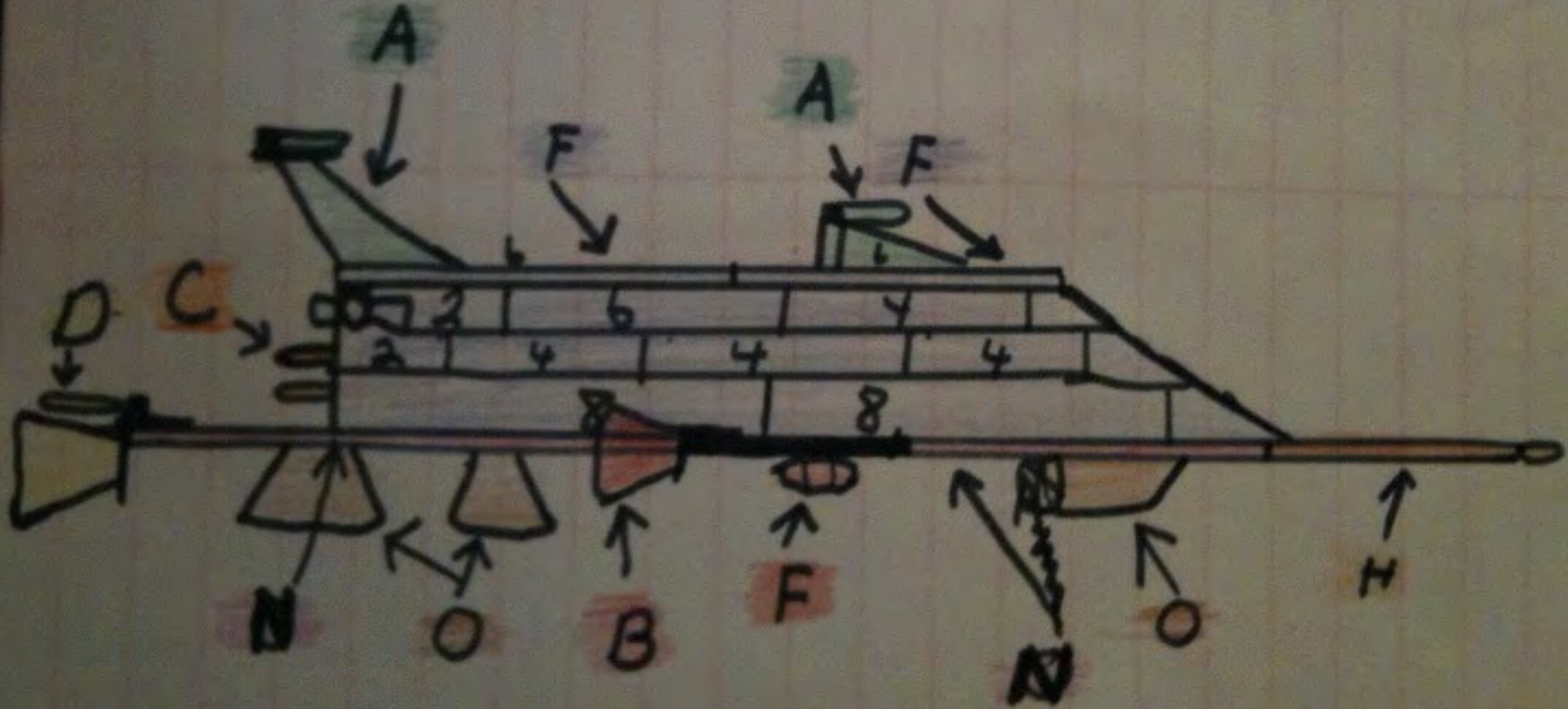
Plans

Donot

open

UNLESS

AUTHORIZED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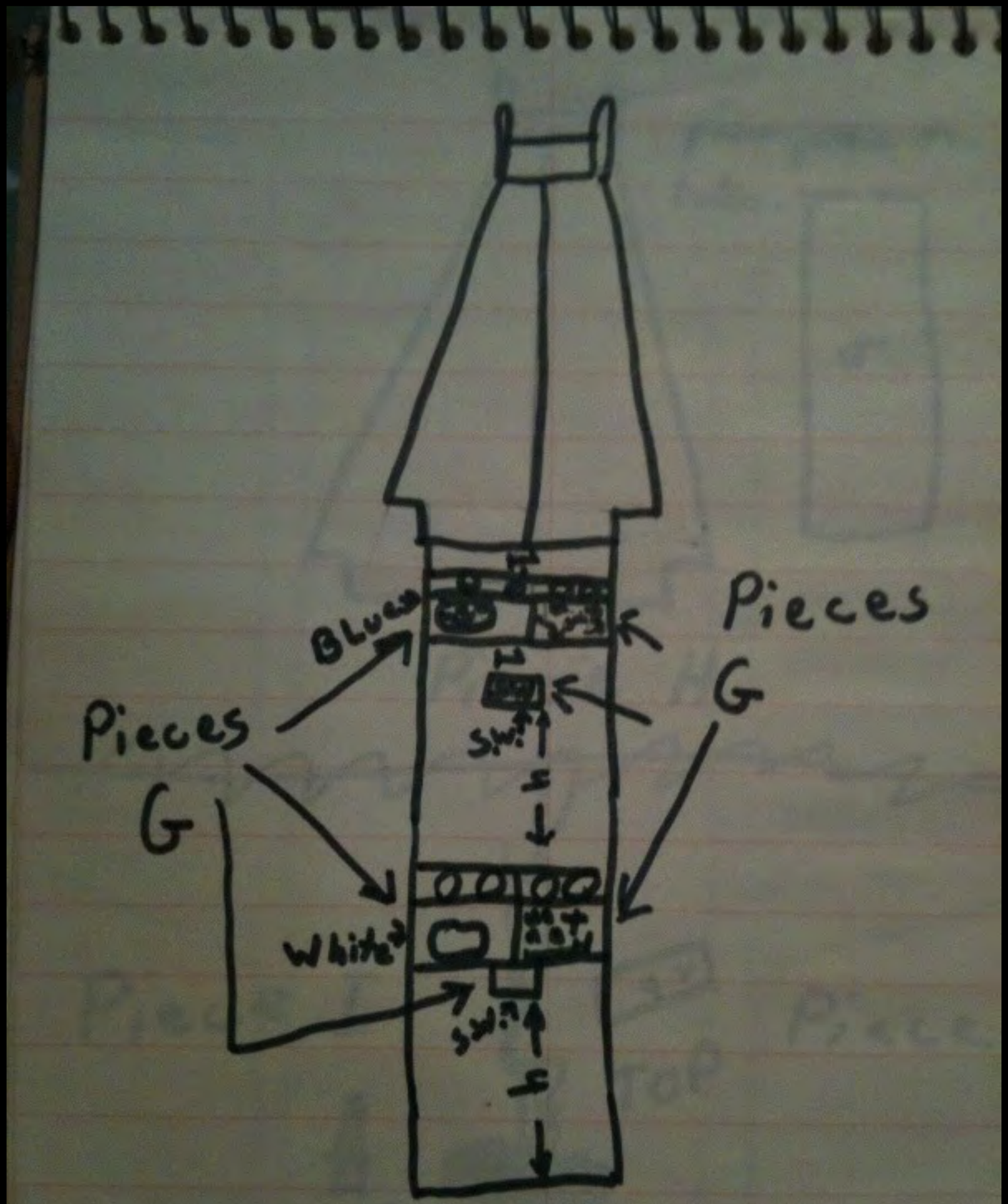
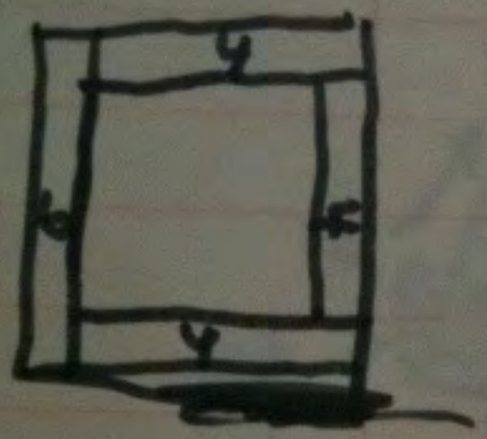
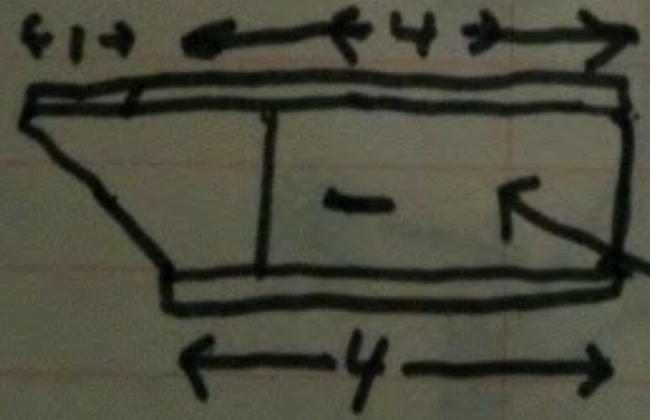

Pieces
Pieces
G
G
White

Part 0



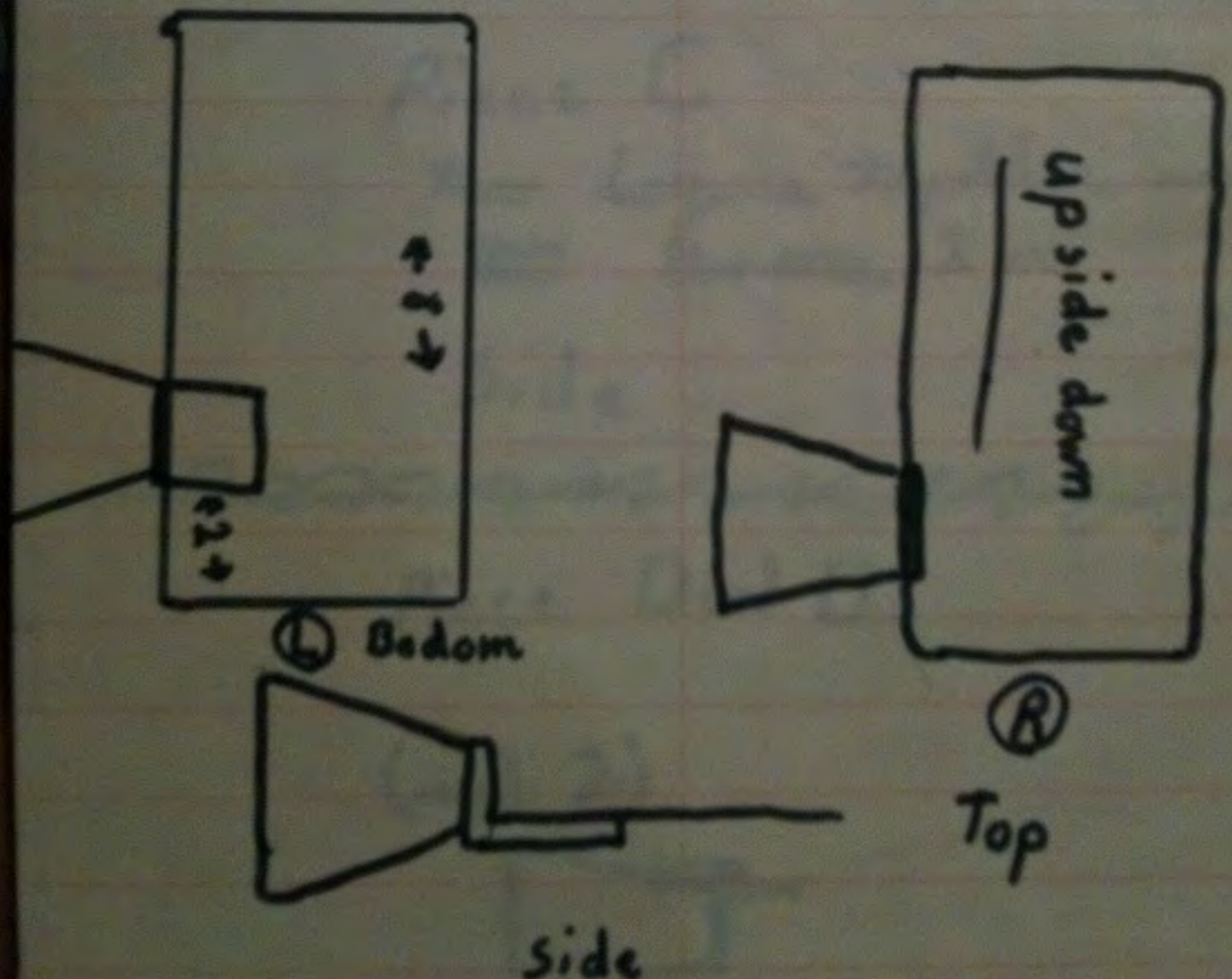
Top



SIDE

Piece B and B2

Engion and engion holder need to be reversed for right and left side




© The Leg Laboratory

ROBOTSANDNEWMEDIA.COM

#nwmediarobots

ROBOTS & NEW MEDIA SYMPOSIUM

APRIL 4
2014 / 9AM - 5PM

BANATAO AUDITORIUM
SUTARDJA DAI HALL
UC BERKELEY

For decades robots have diligently been tasked to perform a range of duties largely scoped within industrial manufacturing. More recently, we have seen the emergence of a new landscape of more social, personal, expressive, nurturing, and emotional robotic platforms. Increasingly, robots play a critical new role as extensions of ourselves, enabling our creativity, creating new objects, serving as companions, expressing emotions, empowering communities, and challenging our civil rights. What are the exciting opportunities as well as new legal, philosophical, and ethical dilemmas within this important cultural and technological milieu?

Join us as we deconstruct, debate, and explore this concept of *Robots and New Media*.

Berkeley Center for New Media

THE DOREEN B. TOWNSEND CENTER FOR THE HUMANITIES

iTRIS

Robotics is the moral degradation of the machine.

– JG Ballard

REGISTER AT
ROBOTSANDNEWMEDIA .COM

STRATAGEMS

IDENTIFY

the core metaphors of a field

RECOGNIZE

what the metaphors **exclude** or **marginalize**

INVERT

the metaphor to bring the marginalized to the center

BUILD

a new alternative that embodies the inversion

PERSONAL TELEPRESENCE 1995

processor: **Intel Pentium (66 MHz)**

browser: **Mosaic**

search engine: **Alta Vista**

social networking: **The Well / Usenet**

mobile platform: **Palm Pilot**

```
00fe7  info-cpm at BRL, AUTREY-HUNLEY a     fa.info-cpm          17-Jul-82 07:25
00fe8  Help with hard disk and SDS syst     fa.info-cpm          17-Jul-82 10:30
00fe9  Cursor movement                      fa.editor-p          17-Jul-82 10:42
00fea  Rings and food                       net.games.rogue      17-Jul-82 10:45
00feb  Super natural Bug?                   net.games.rogue      17-Jul-82 10:57
00fec  VW Joke                              net.auto.vw          17-Jul-82 11:50
00fed  Did you hear about                   net.jokes            17-Jul-82 12:29
00fee  Re: VAX UNIX magtape lockout - (     net.unix-wizar       17-Jul-82 12:36
00fef  SF-LOVERS Digest   V6 #17            fa.sf-lovers         17-Jul-82 13:13
00ff0  IT                                 1 net.nlang            17-Jul-82 13:53
00ff1  Public domain programs in commer     fa.info-cpm          17-Jul-82 15:12
00ff2  6502 simulator                       fa.info-cpm          17-Jul-82 15:19
00ff3  Who's Crazier? (Take 2)              net.misc             17-Jul-82 17:20
00ff4  Bladerunner and The Bradbury         net.movies           17-Jul-82 17:33
00ff5  bad saves                            net.games.rogue      17-Jul-82 18:32
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00ff7  Number theory problem                net.general          17-Jul-82 19:37
00ff8  kids...                              net.jokes            17-Jul-82 19:38
00ff9  CP/M ED 1.4                          fa.info-cpm          17-Jul-82 20:19
00ffa  Epson Modification                   net.micro            17-Jul-82 20:30
00ffb  Netnews spreads to BTL Indian Hi     net.news.newsite     17-Jul-82 21:02
00ffc  x**x**x**x... : Where did I go w   1 net.math             17-Jul-82 21:09
00ffd  [Steven E. Hills:  Epson Modific     fa.info-terms        17-Jul-82 21:21
news>
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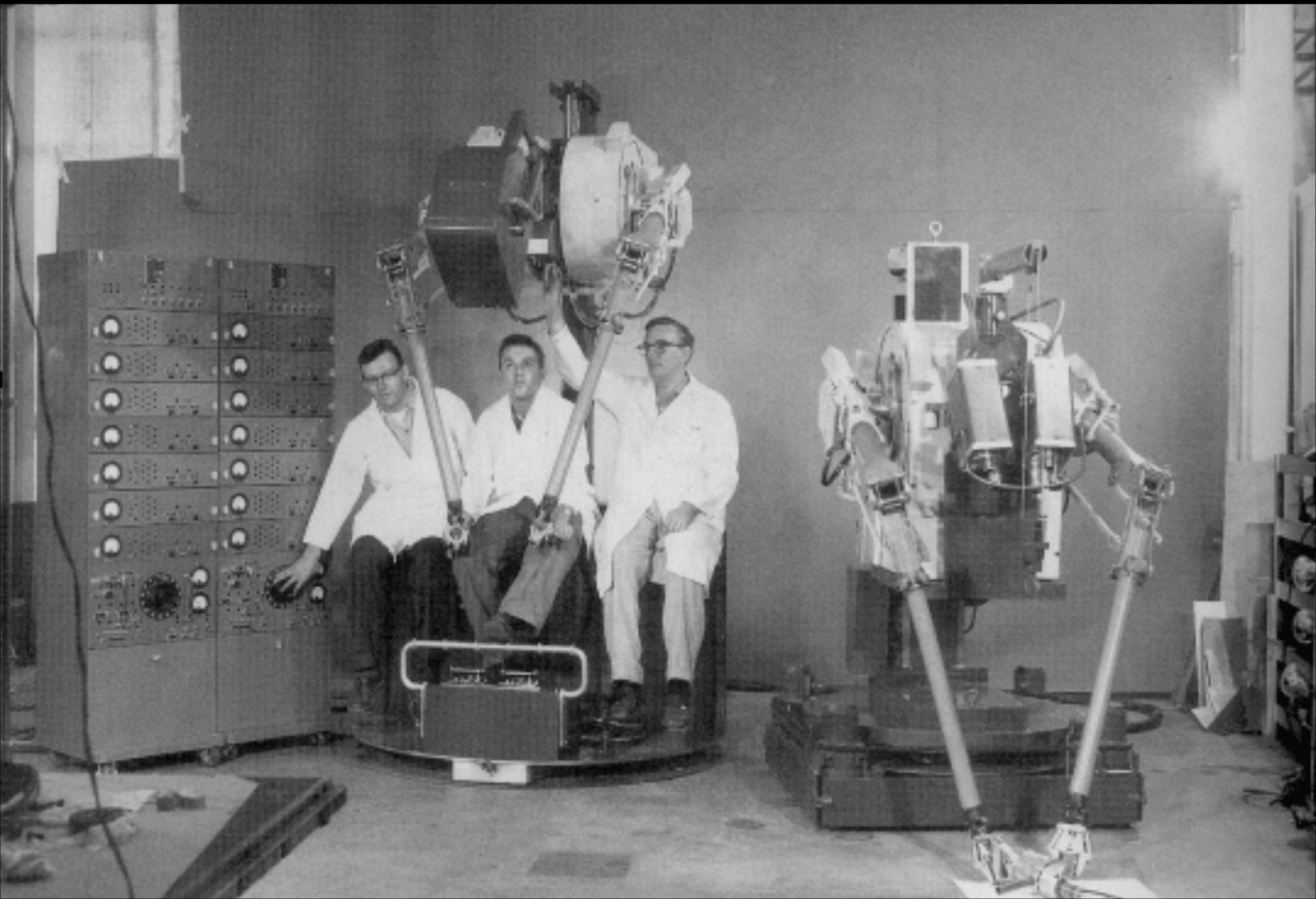
HIGH COST

HIGHLY TRAINED OPERATOR



REPAIR AND INSPECTION TASKS

TELEPRESENCE

HIGH COST

LOW COST

EXPERT OPERATOR

NO TRAINING

REPAIR & INSPECTION

HANGING OUT

Propeller
(not visible)

Camera

Mic

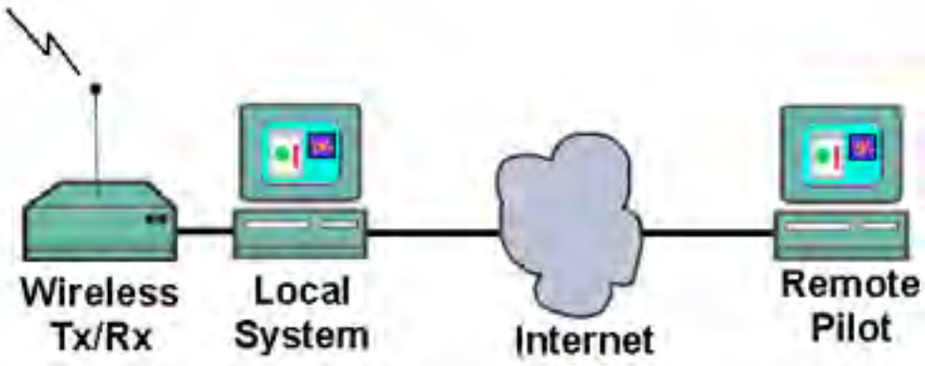
Battery

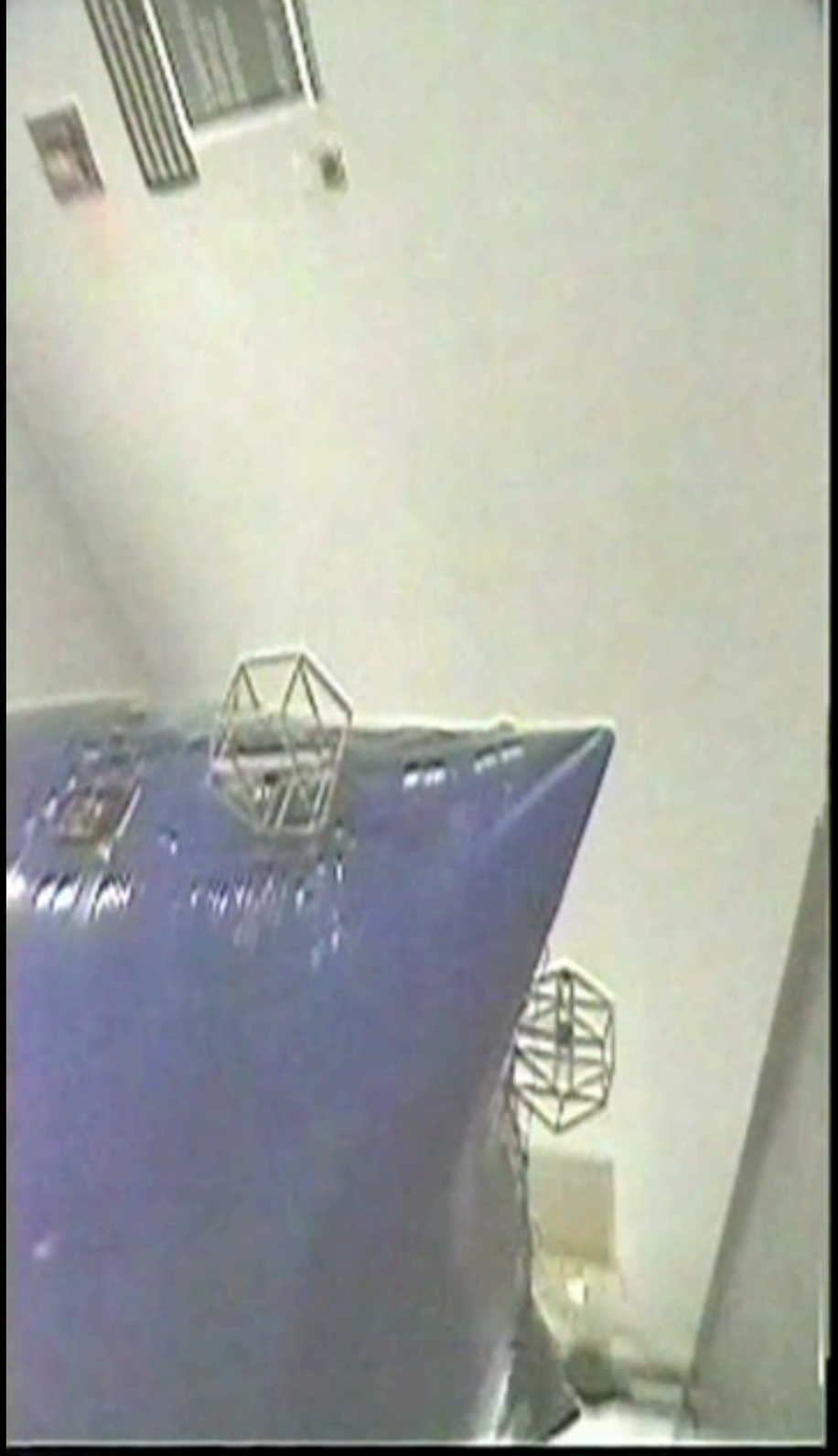
Speaker

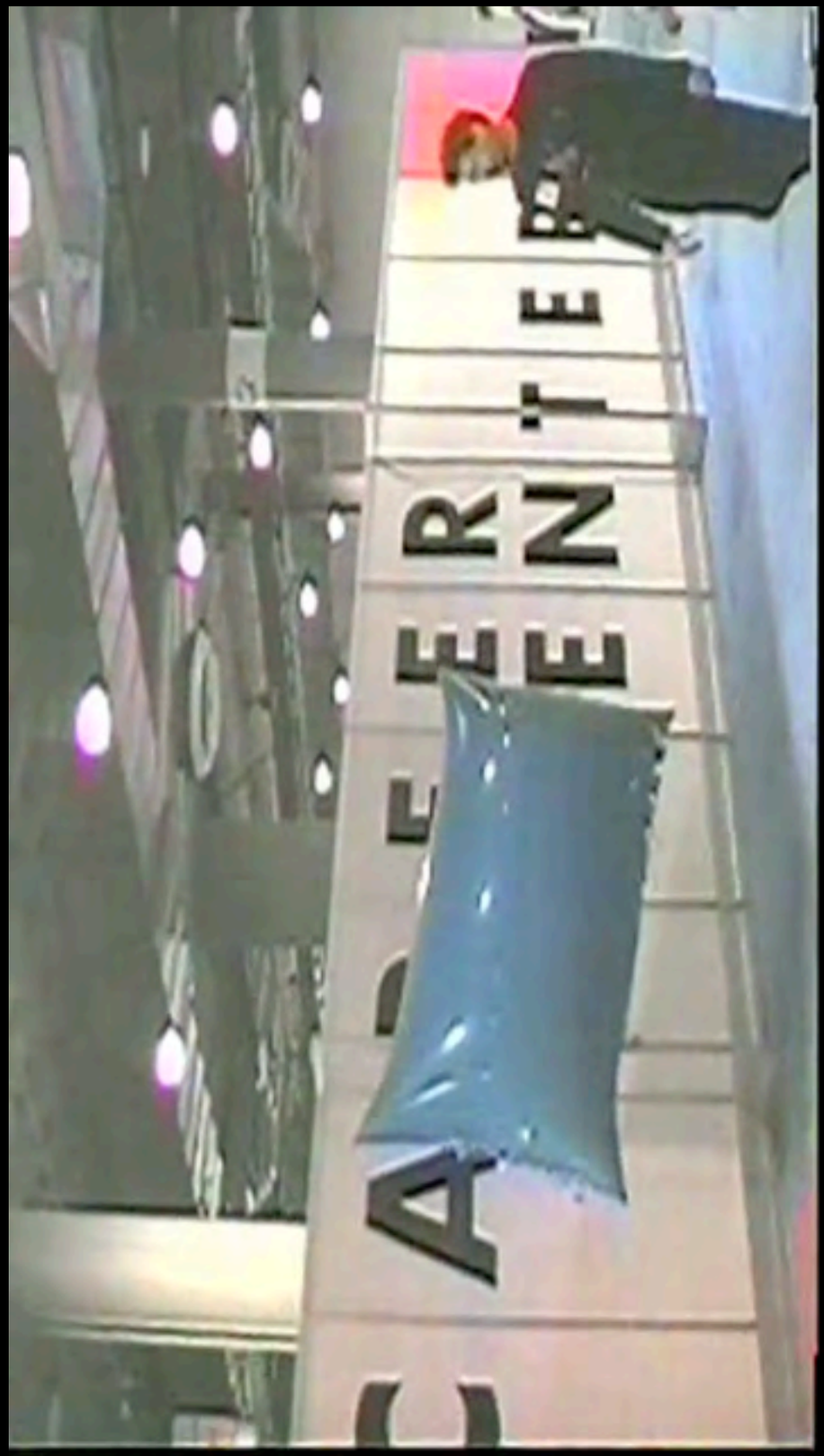
Rx/Tx

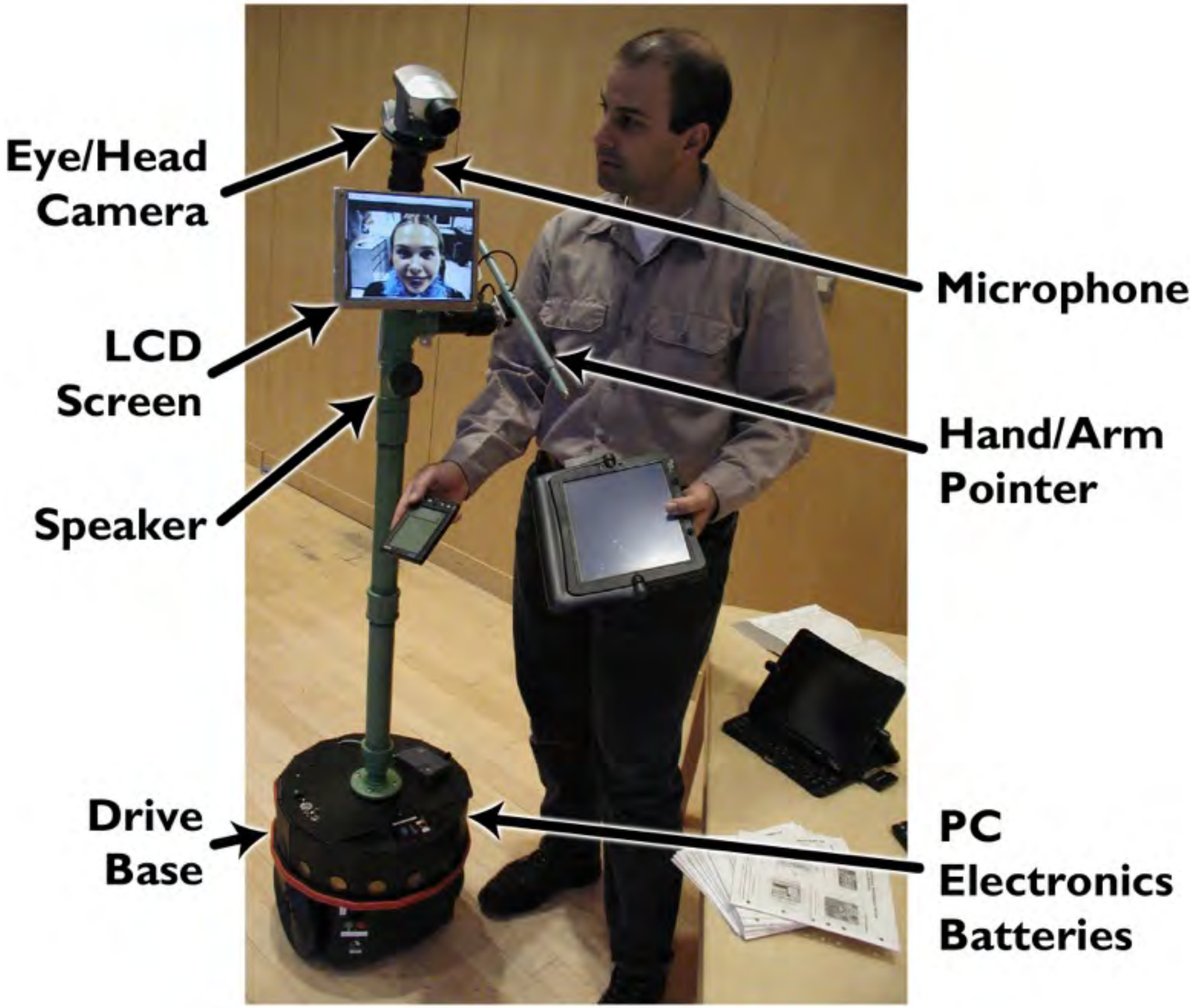
Custom
electronics

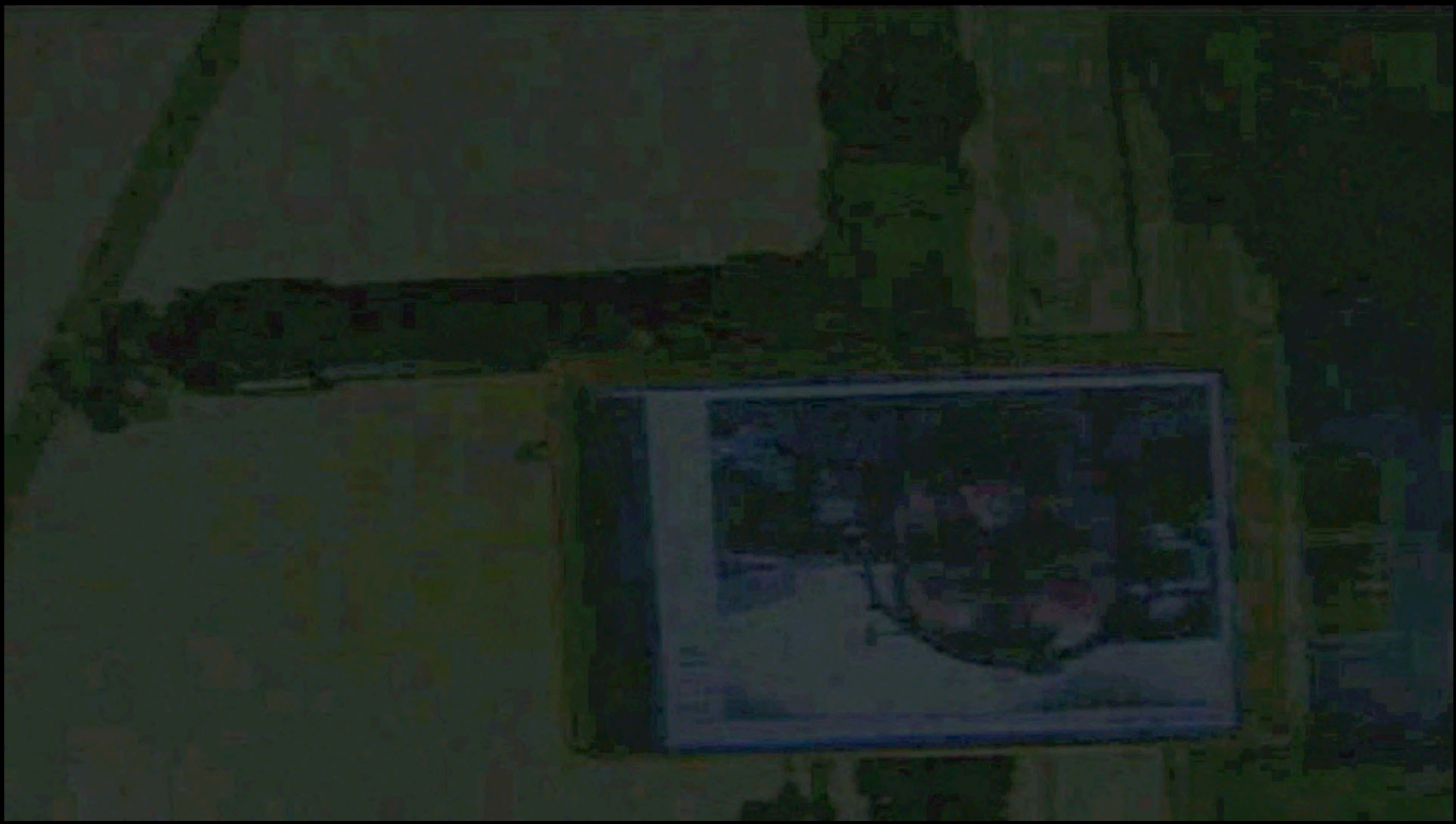
Propeller








Eye/Head
Camera
LCD
Screen
Speaker
Microphone
Hand/Arm
Pointer
Drive
Base
PC
Electronics
Batteries




CAP. 8,000 LBS.


HUAHUAN
SF Weekly
SF Weekly

Wireless 802.11
Networking PC Card

To PRoP Base
Serial Port

Molex HCS-125
(C3-F)

Molex HCS-125
(C2-F)

Inside
Technologies
MM/104

Wireless Link

Serial Cable
3 feet long

+12 volts

GND

GND

+5 volts

Terminal Strip
(T1)

PC Power
connector (C1)

60 cm

Keyboard / Mouse

Advantech Part
#1700060200

COM1

microphone
jack (J1-F)

speaker
jack (J2-F)

Advantech Part
#1700160000

COM1
COM2
COM3
COM4

Videum VO
Capture Card

video capture
hardware

RCA video
jack (J3-F)

Advantech Part
#1701400181

VGA

Advantech Part
#1700160150

Advantech PCM-9574

+12 volts

GND

GND

+5 volts

Terminal Strip
(T1)

Laser Diode

LOGIC_PWR
GND
RELAY0_OUT
PWR
TX
RX
OUT0
OUT1

COM3

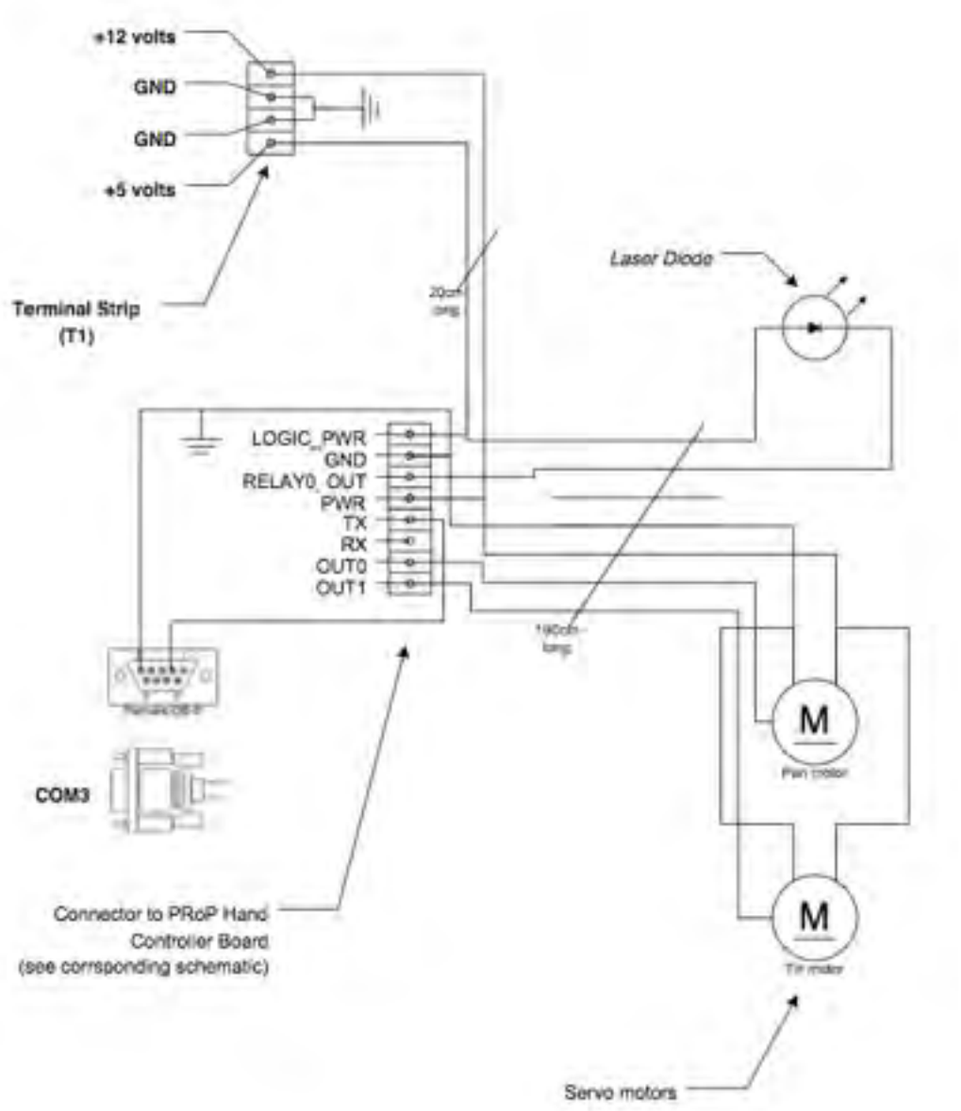
Connector to PRoP Hand
Controller Board
(see corrsponding schematic)

M

M

Servo motors


End


+12 volts
GND
GND
+5 volts
Terminal Strip
(T1)
Laser Diode
20cm
(IPS)
LOGIC_PWR
GND
RELAY0_OUT
PWR
TX
RX
OUT0
OUT1
180cm
long
M
Pan motor
M
Tilt motor
COM3
Connector to PRoP Hand
Controller Board
(see corrsponding schematic)
Servo motors

1980

PRoP

1994

1997

PEBBLES

1998

Care-O-bot

2002

Co-Worker

Care-O-bot 2

RP-7

2003

2005

TiLR

Giraff

2006

2007

ConnectR

Care-O-bot 3

2008

2009

QA

Texai

Roti

R.Bot-100

2010

Robosem

EngKey

VGo

QB

2011

Luna

AVA

Jazz Connect

TELO

2012

Beam

Double

RP-VITA

HELO

What is HCI?

Human-Computer Interaction (HCI)

Human

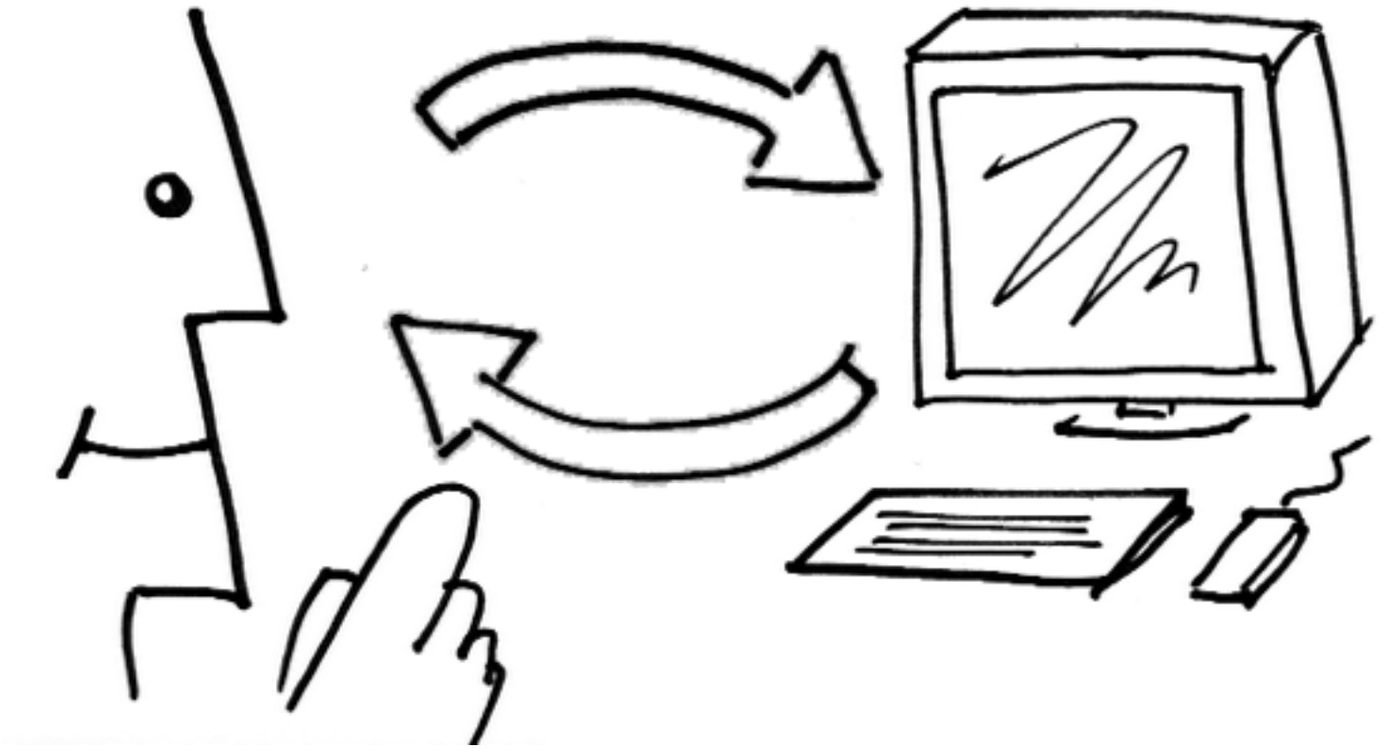
- End-user of program
- Others (friends, collaborators, coworkers)

Computer

- Machine program runs on
- Often split: clients & servers

Interaction

- User tells the computer what they want
- Computer communicates results



User Interfaces (UIs)

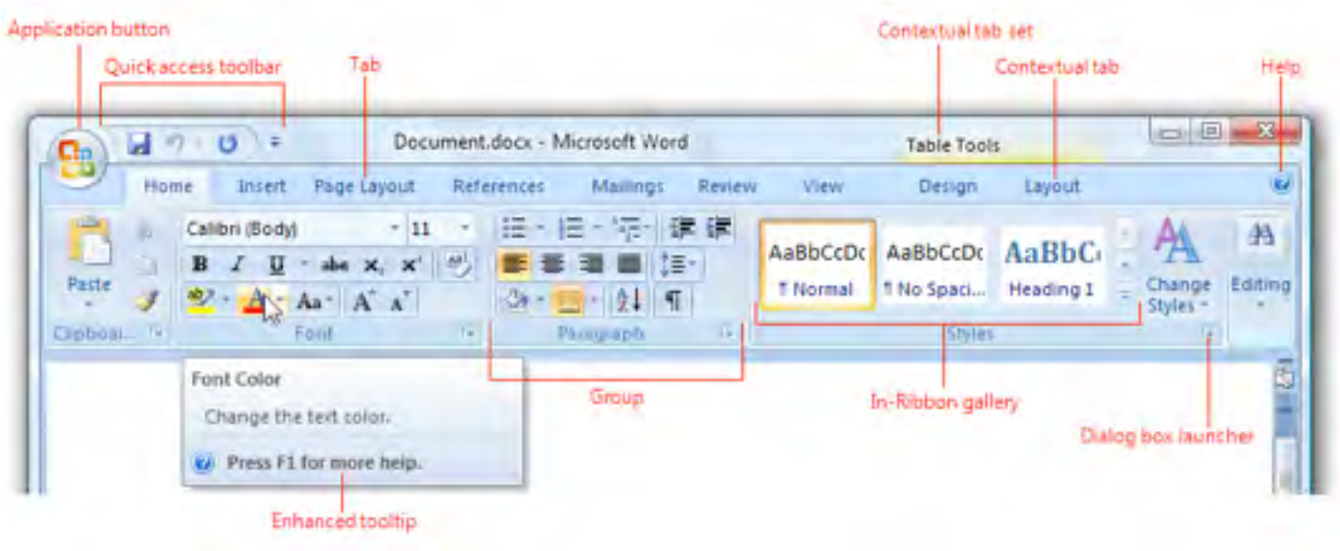
Part of application that allows

- People to interact with computer
- Computer to communicate results

Can include hardware design

- Buttons, sliders, other sensors

HCI =
design, prototyping, implementation & evaluation of UIs

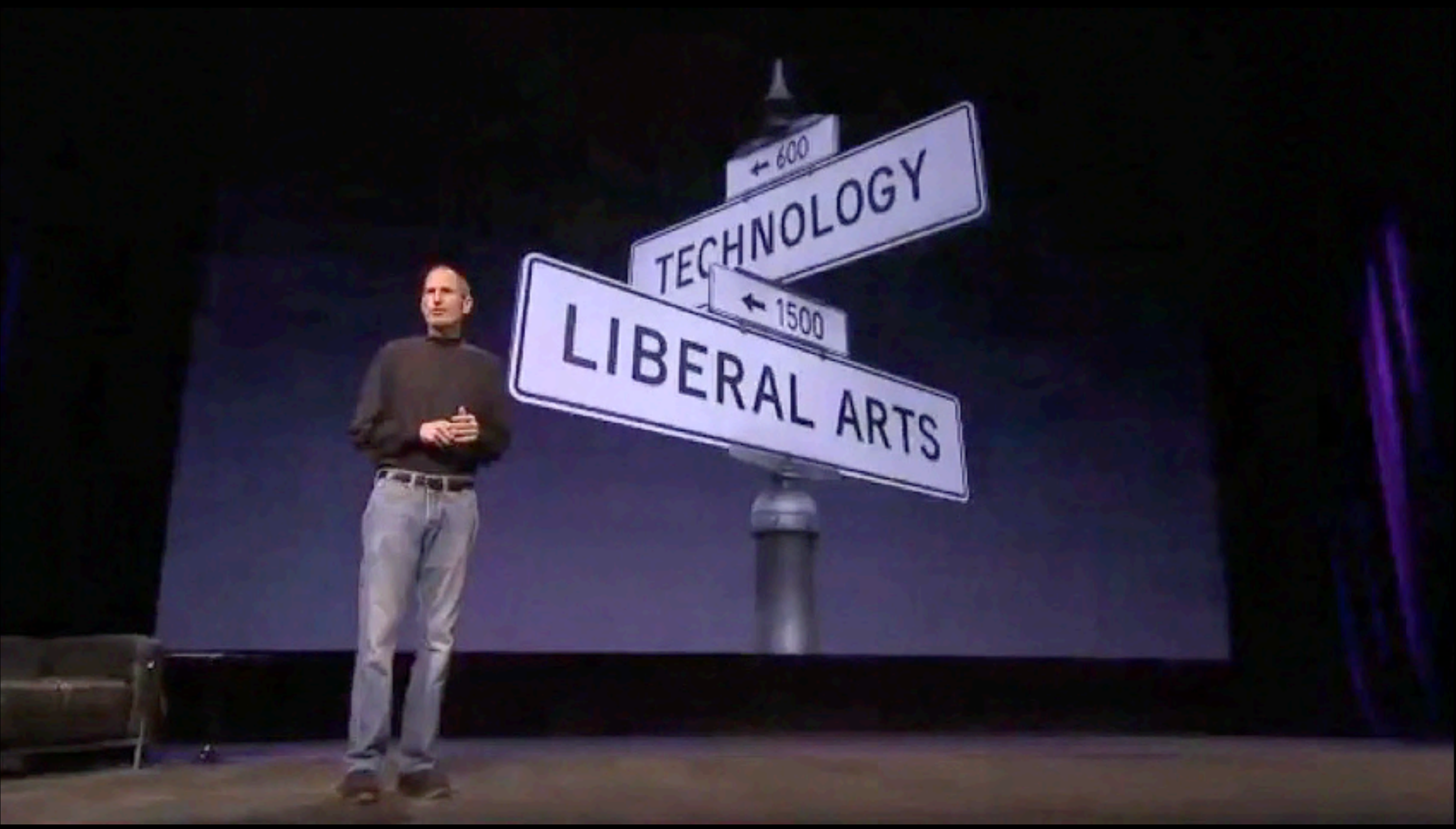


http://www.reactable.com

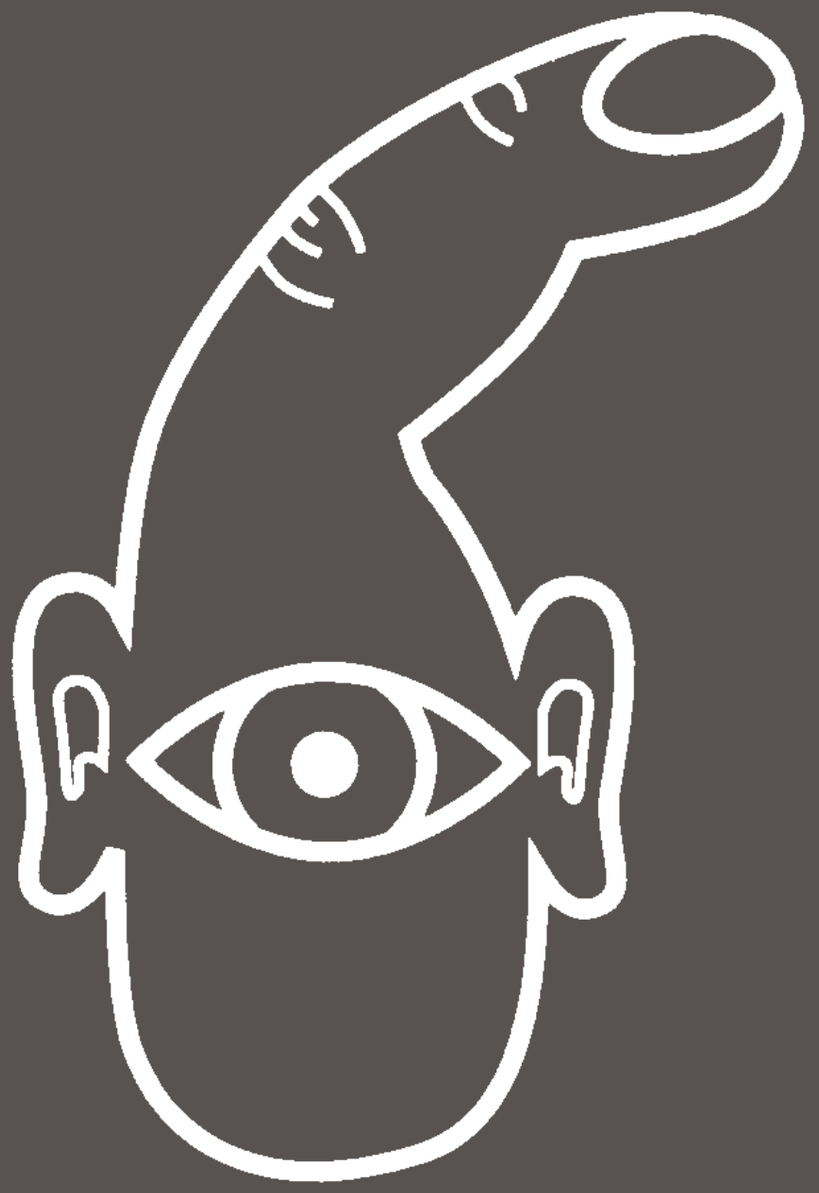
Design

Computer Science

Applied Psychology


600
TECHNOLOGY
1500
LIBERAL ARTS

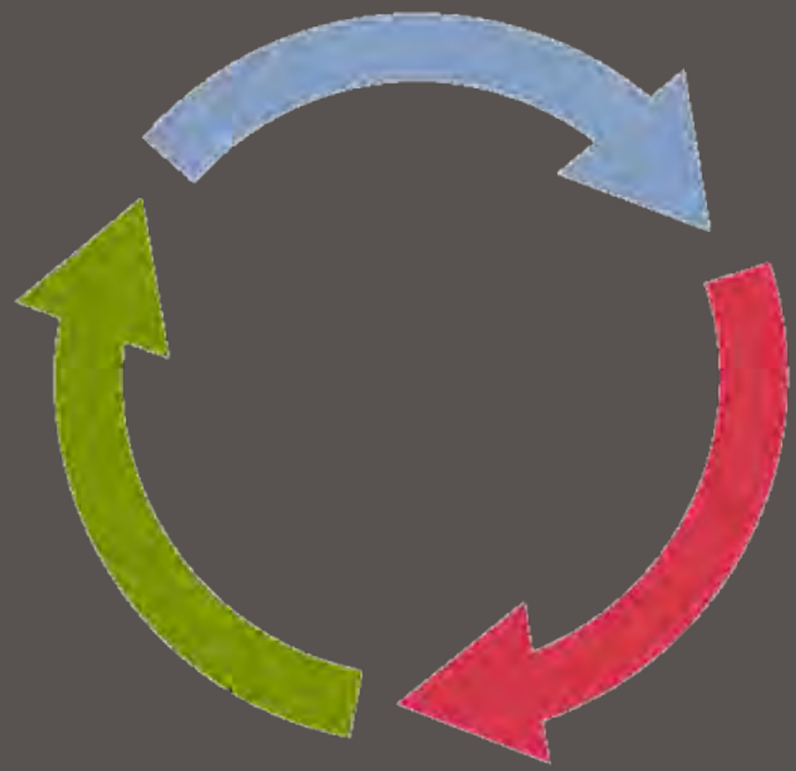
Rich Gold, *The Plenitude*, MIT Press



(c) Dan O'Sullivan

Iterative Design Cycle

Design



Evaluate

Prototype

Getting it right the first time is hard!

Understanding Users

Observe existing practices

Create scenarios of actual use

Build models to gain insight into work processes

CS247, Stanford, 2006

http://www-personal.umich.edu/~chrisli/m2.html

Prototyping Interfaces

Rapidly build a mockup of your UI

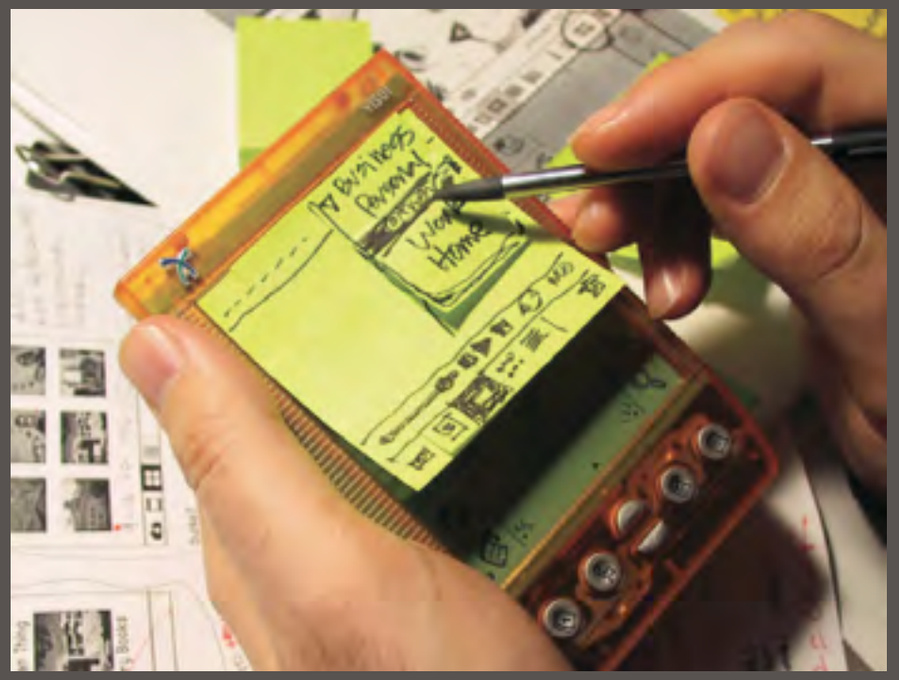
Low-fidelity techniques:

Paper prototyping

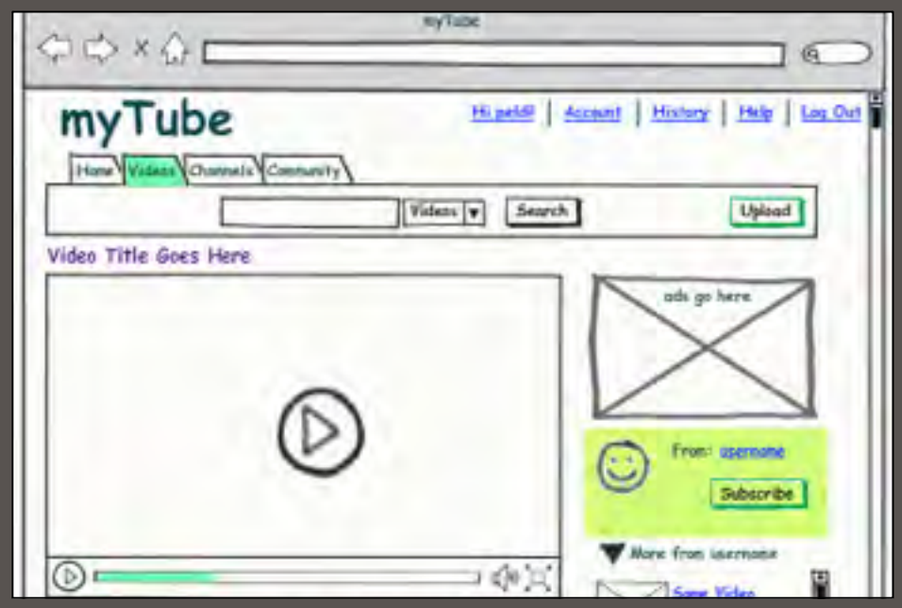
Video prototypes

Interactive prototypes:

HTML, Javascript, Flash, ...

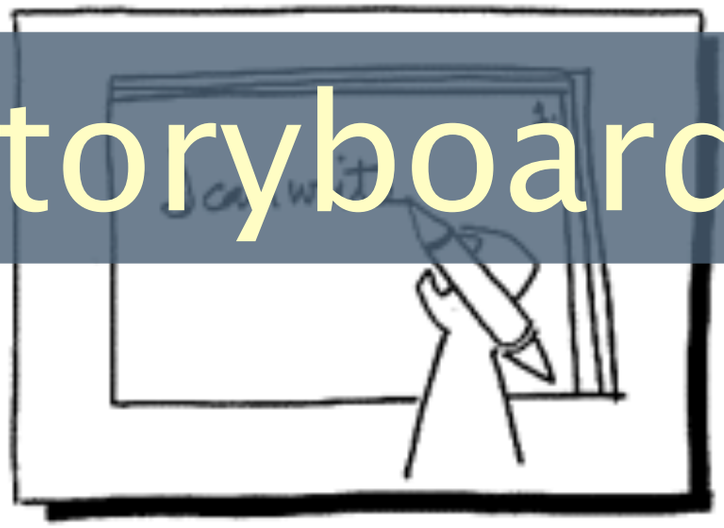


Moggridge, Designing Interactions, p.704



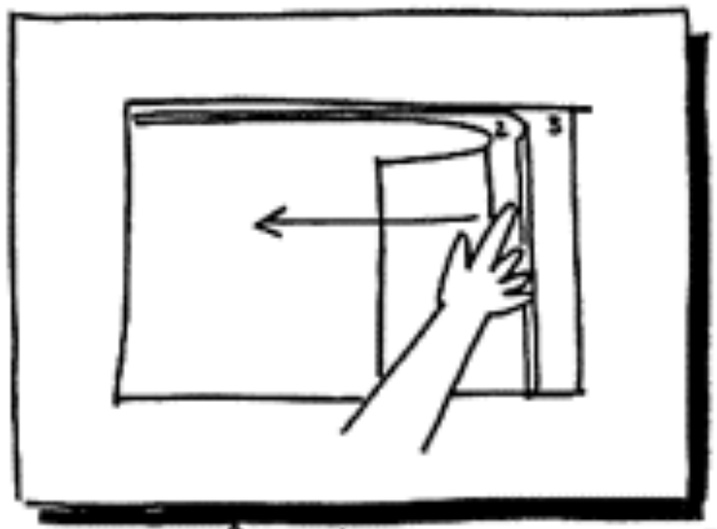
http://www.balsamiq.com/products/mockups/examples#wiki

Storyboarding

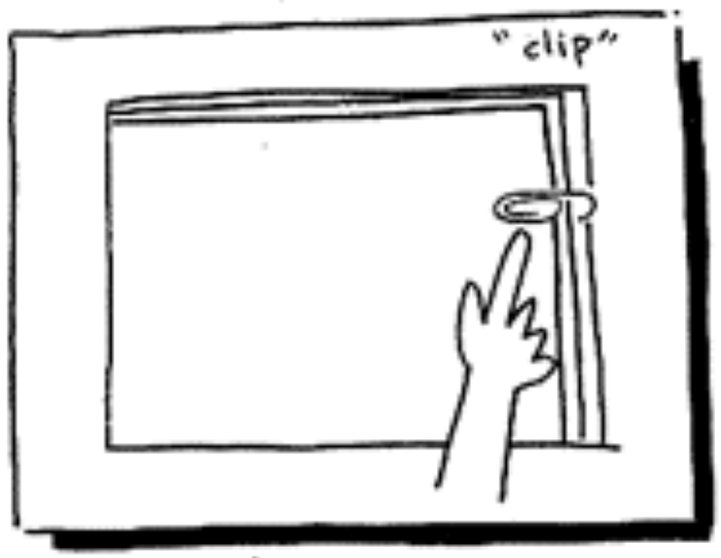


L. can write into her notebook.

She can flip over her pen and erase.

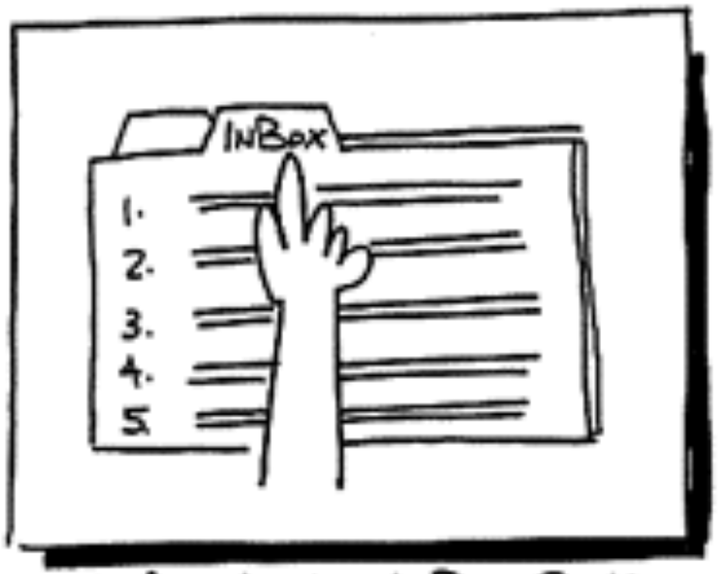


L. can flip to the next page.



L. marks her place.

L. marks a phone number.



L. shifts to the InBox Section.

L. adds comments

L. brings up a list.

L. looks for phone numbers.


KODAK UEP

Evaluation

Formative

Are we building the right thing?

What should be different in the next iteration?

Summative

Does it work? Is it better than existing solutions?

Can this teach us something about how people or the world work?

http://www.laurasmith.info/UsabilityTest.jpg

Techniques

Analytically, expert walkthroughs, laboratory studies,...

Why study user interfaces?

How much of an application's source is devoted to user interface code?

A. 10%

B. 20%

C.35%

D.50%

E. 75%

Why study user interfaces?

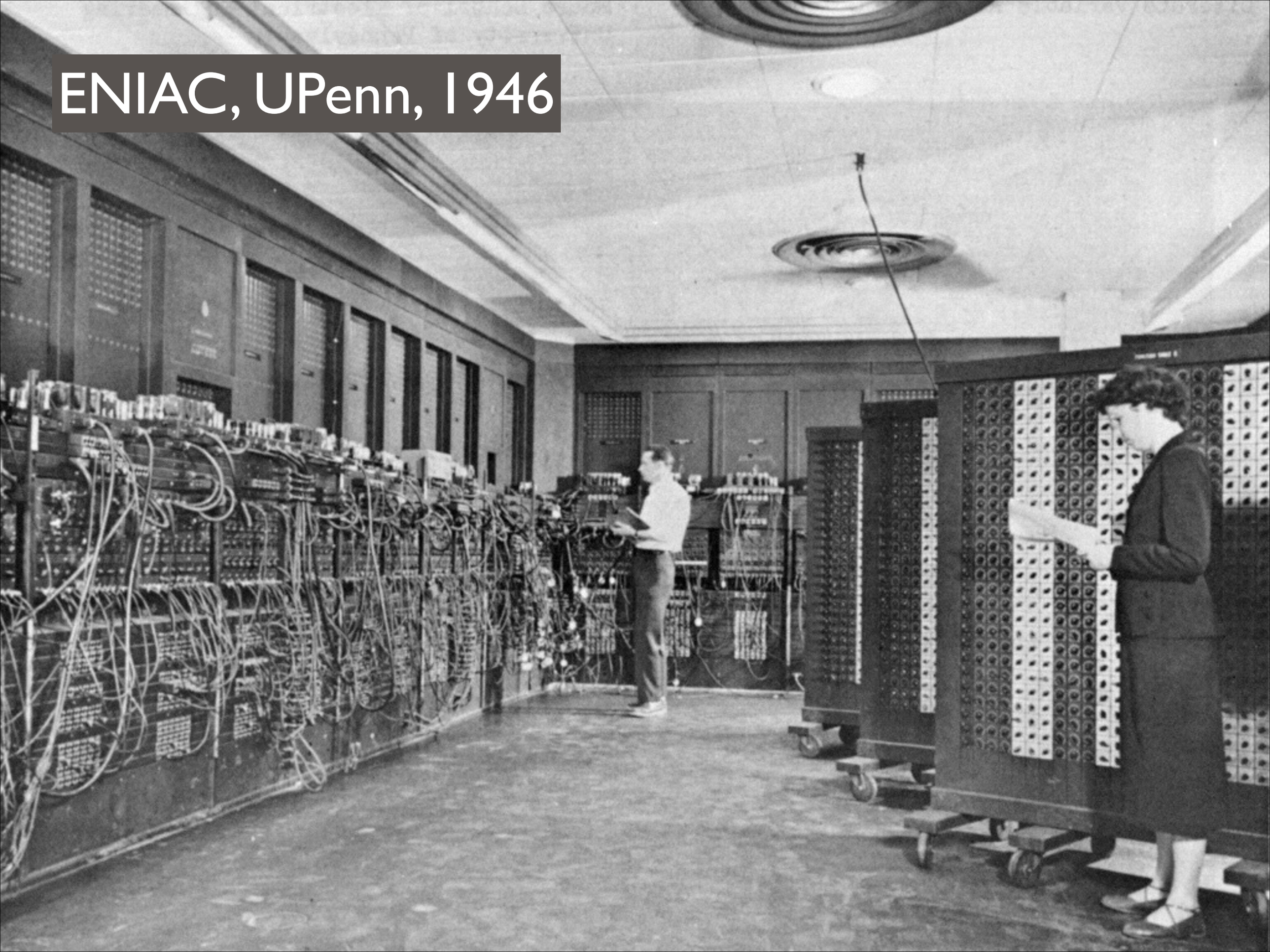
"The results show that in today's applications, an average of 48% of the code is devoted to the user interface portion.

The average time spent on the user interface portion is 45% during the design phase, 50% during the implementation phase, and 37% during the maintenance phase."

– Myers & Rosson, CHI'92

History

ENIAC, UPenn, 1946



When was the mouse invented?

A. 1948

B. 1963

C. 1978

D. 1984

E. 1991

Doug Engelbart &
Bill English, SRI, 1963

(cc) Flickr user John Chuang
http://www.flickr.com/photos/13184584@N08/1362760884/

When was pen input invented?

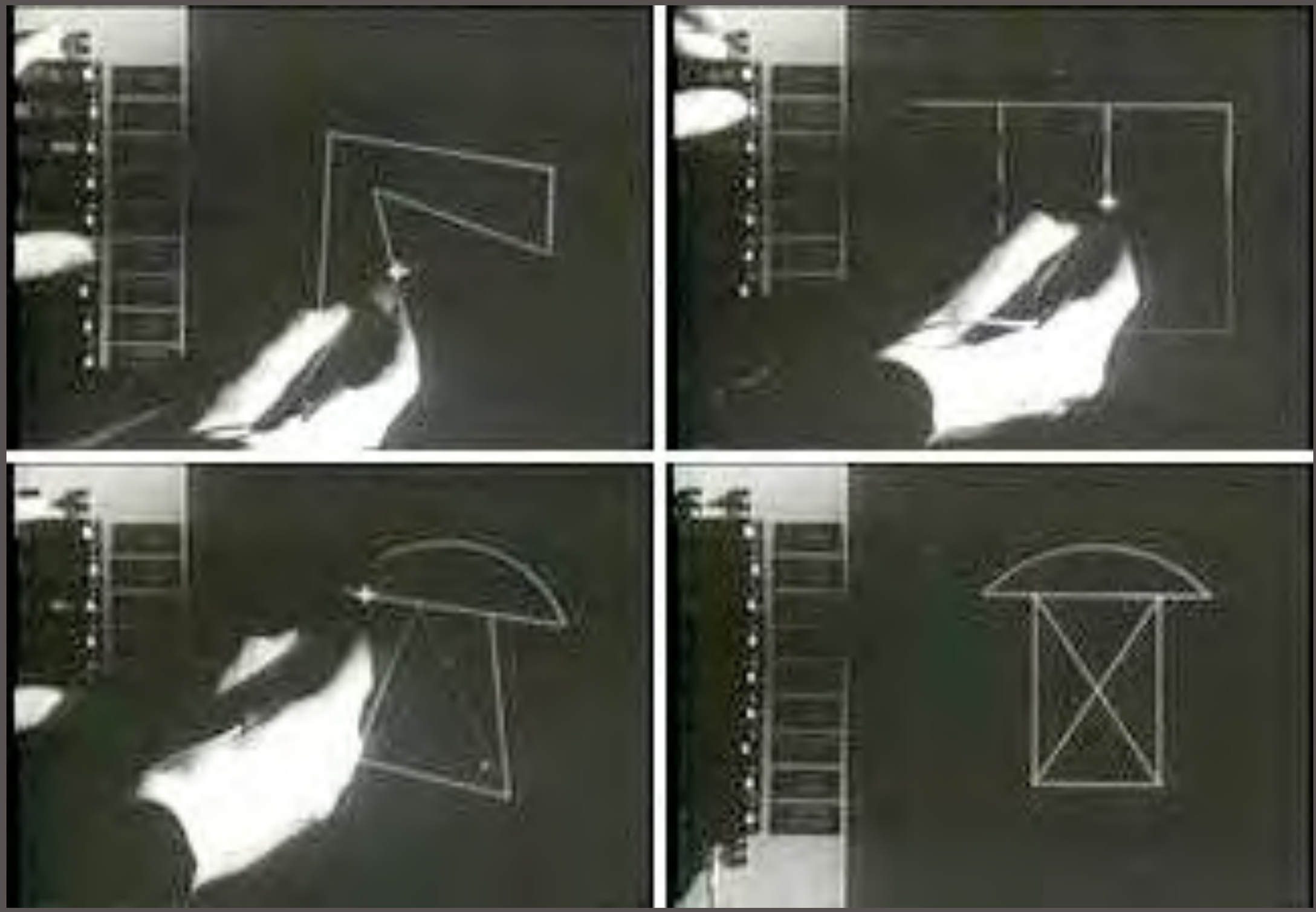
A. 1964

B. 1973

C. 1986

D. 1995

E. 2001



Ivan Sutherland, Sketchpad, MIT, 1963/64


INK

digibarn.com


The new iPad

Which company introduced the touch screen phone?

A. Nokia

B. Apple

C. Microsoft

D. IBM

E. Samsung

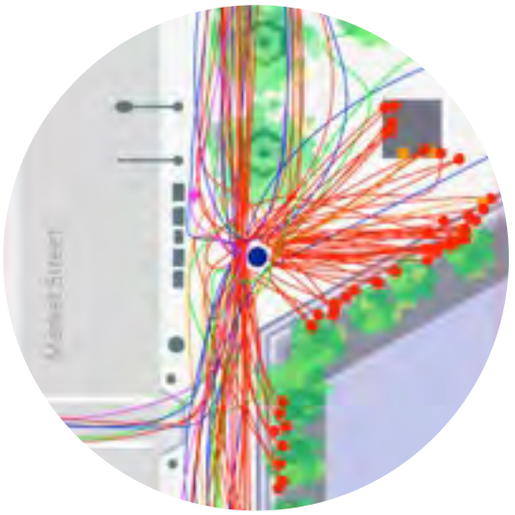
IBM Simon
1992

URBAN ATMOSPHERES

Eric Paulos
Chris Beckmann
Elizabeth Goodman
RJ Honicky
Ben Hooker
Tom Jenkins
August Joki
Chris Myers
Ian Smith
Parul Vora

intel Research


NOKIA




i hate
PORTLAND
love
PORTLAND


042


FEELS LIKE...?

JABBERWOCKY

encountering our familiar strangers

The Familiar Stranger: Anxiety, Comfort, and Play in Public Places, ACM SIGCHI 2004
Eric Paulos and Elizabeth Goodman


NOKIA
135:5P San fran
San fran


NOKIA
4152P ?

"The Familiar Stranger research was a major inspiration for helping me think about and create dodgeball and foursquare"

- Dennis Crowley, founder of Foursquare

Stanley Milgram 1971

Vito Acconci Following Piece 1969

Aspen Movie Map
Michael Naimark
1978

Street View
Google
2007

Michael Naimark & MIT Arch Machine Group
Aspen Movie Map
1978-1980

Google StreetView
2007

Videoplace
Myron Krueger
1974

Kinect
Microsoft
2010

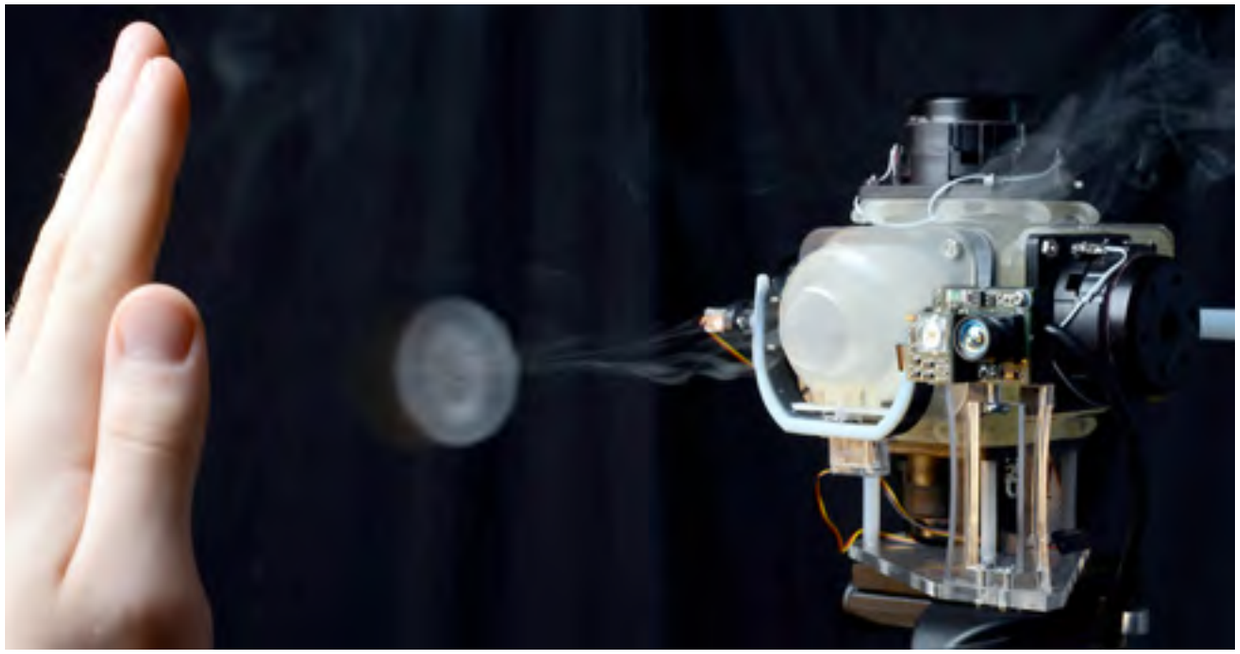
GraffitiWriter & Streetwriter
Institute for Applied Autonomy
1998-2004

Nike Chalkbot
2009

The Telegarden
Ken Goldberg
1995

FarmVille
Zynga
2009

Shockwave Vortex Cannon
Survival Research Labs
1984



Aireal
Disney Research
2013

TXTMob
Institute for Applied Autonomy
2004

Twitter
2006

“TXTmob predates twitter and was very explicitly talked about as a model to be copied and learned from in the creation of twitter”

- Evan Henshaw-Plath first employee at Odeo and co-creator of Twitter

Homage to New York
Jean Tinguely 1960

...with Billy Klüver

The clashing point of two subjects, two disciplines, two cultures, of two galaxies, ought to produce creative chances.

- C.P. Snow *The Two Cultures* (1959)

Building Invisible Interfaces

Mark Weiser
Computer Science Lab
Xerox PARC

November 2, 1994

How to Build Invisible Technologies?

start from arts and humanties: Philosophy, Phenomenology, Anthropology, Psychology, Post-Modernism, Sociology of Science, Feminist Criticism, Your own experience...

This is the most important part of the talk.

You may not get it on first hearing. Patience.

When I am done you'll know what is wrong with:

creating an entertaining and dramatic user interface

computers magically meeting our desires

a computer idealized as an assistant

virtual reality as the ultimate user interface

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creating an entertaining and dramatic user interface

computers magically meeting our desires

a computer idealized as an assistant

virtual reality as the ultimate user interface


UNITED
STATES

If a major project is truly innovative, you cannot possibly know its exact cost and its exact schedule at the beginning.
And if in fact you do know the exact cost and the exact schedule, chances are that the technology is obsolete.

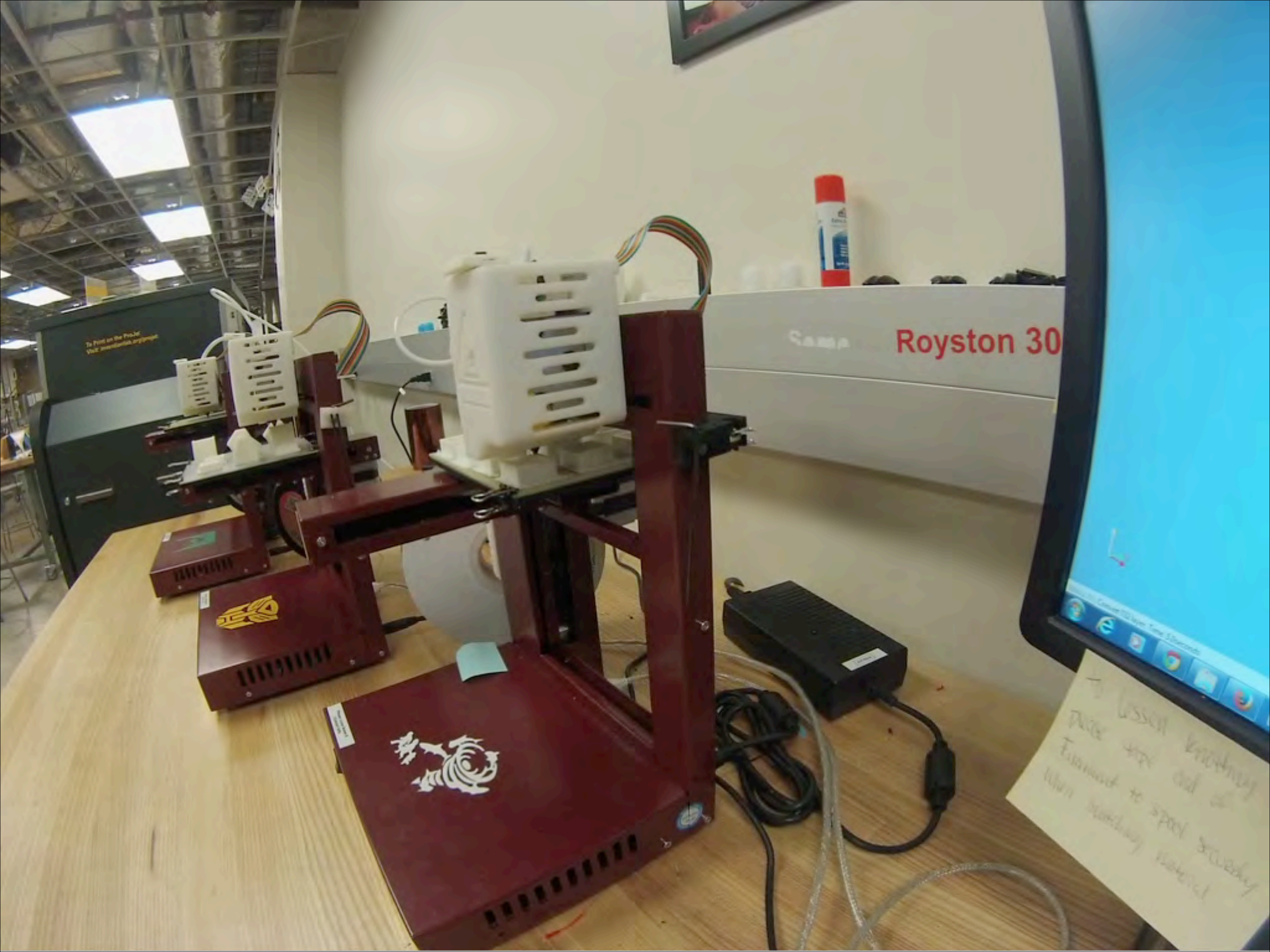
- Joseph G. Gavin, Jr.,

discussing the design of the Grumman lunar module that landed NASA astronauts Neil Armstrong and Buzz Aldrin on the moon on July 20, 1969

The world doesn’t need more people with good grades. The world needs people who see the really tough problems as puzzles, and have the tenacity and **creative capacity** to solve them

Gever Tulley, TEDxKids, 2011

CRITICAL MAKING


Royston 30

SPICE PRINTER

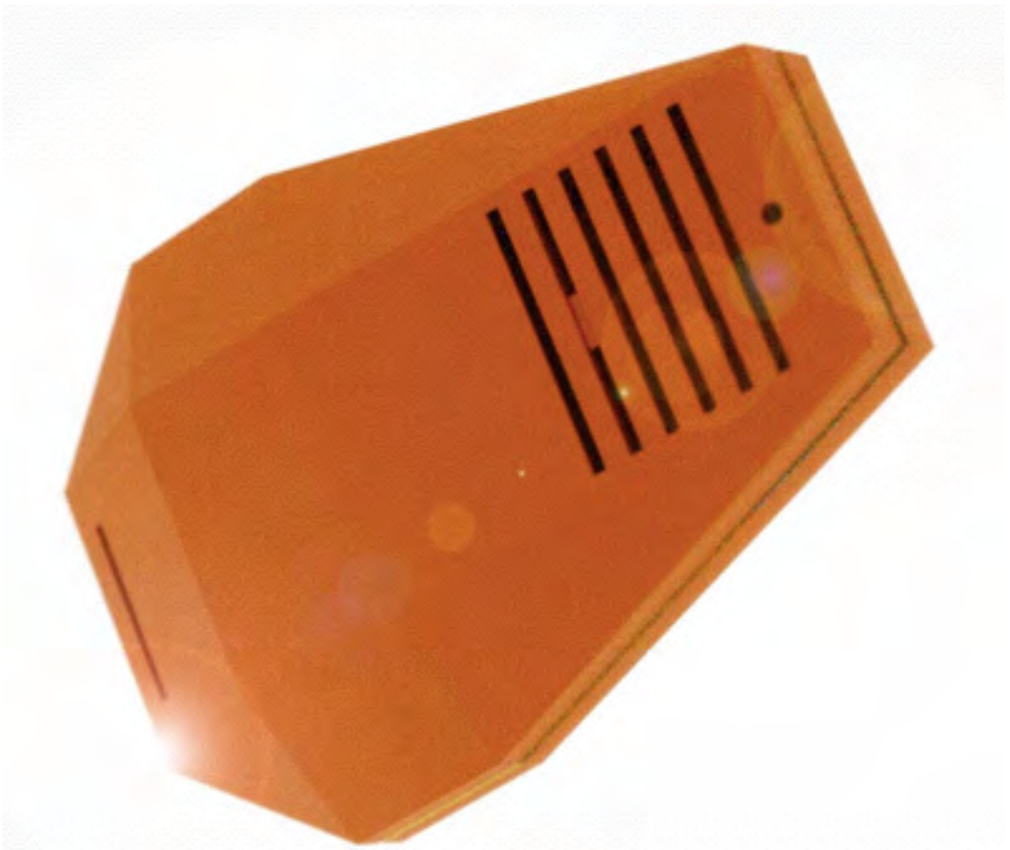
kylan nieh
victor sandberg
hurshal patel

DARK MAZE

brittany cheng
jonathan cotte
hurshal patel
curtis hwang

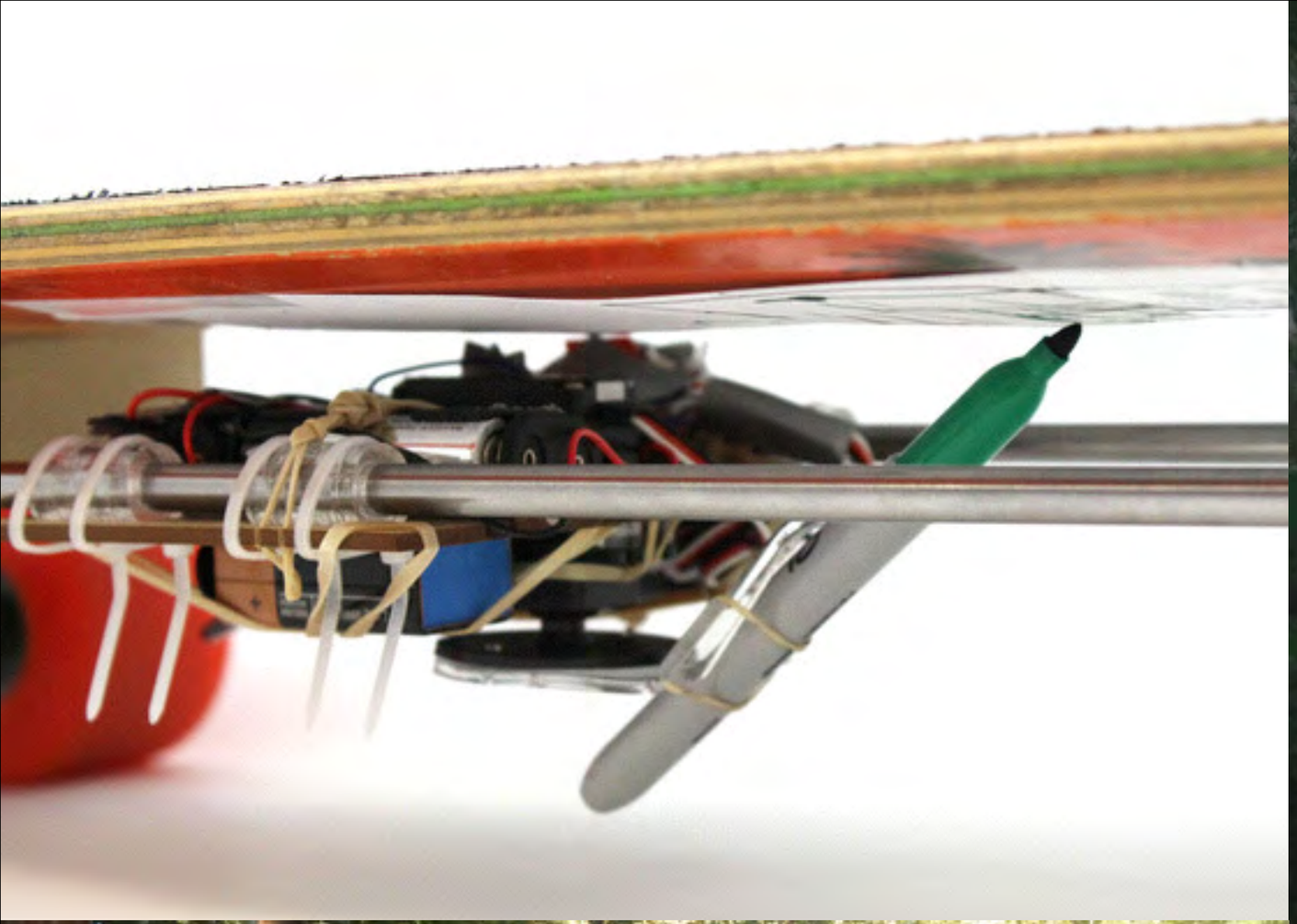
MOSSED UP

jonathan cotte
noah pitts



MY CITY

karl landin
victor sandberg
kylan nieh
alice lee




lostplayground

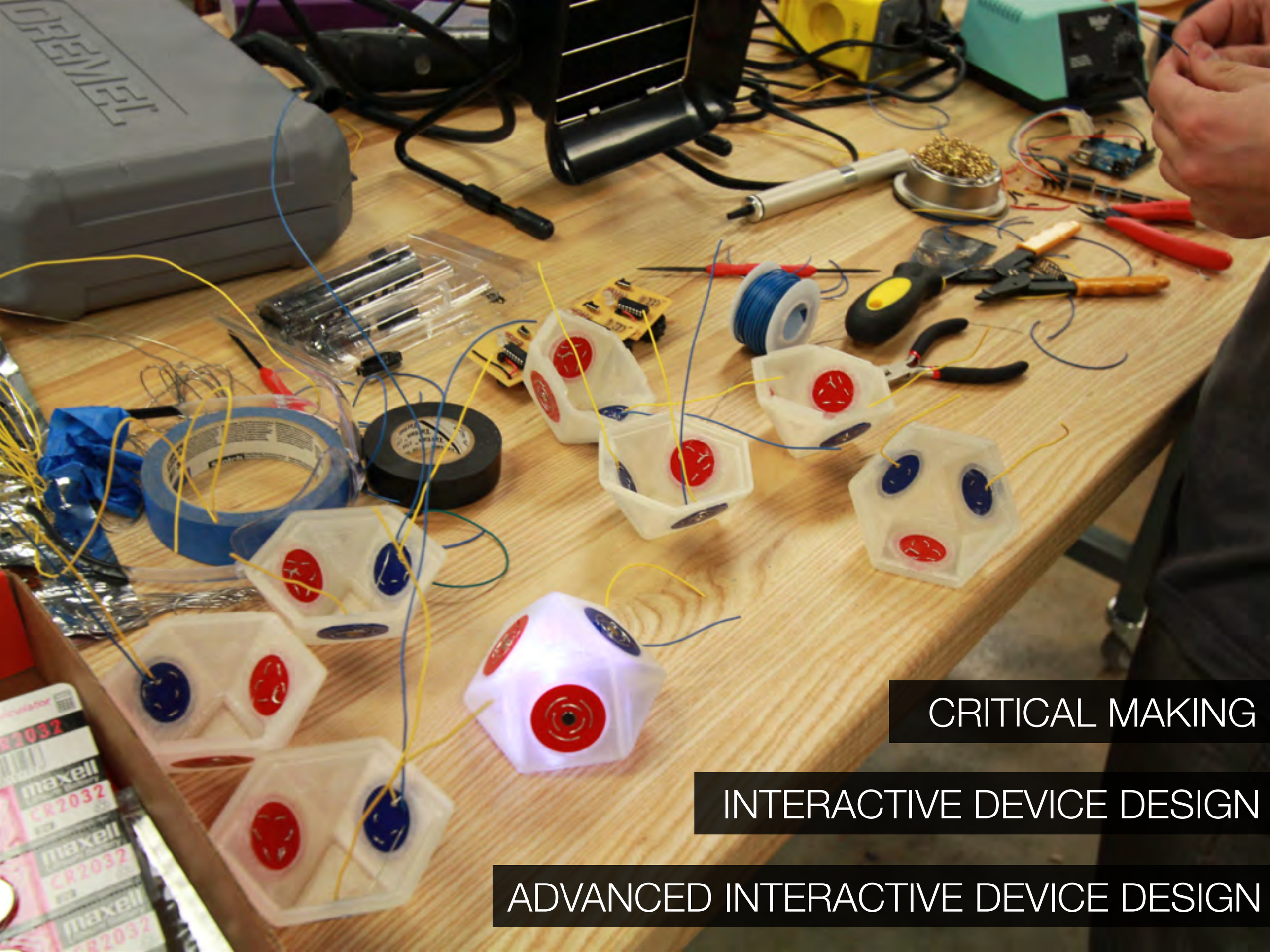

Scanning...

FREE SPEAKER

ben ortiz
brandon young
cassie seo
noor al-samarrai

AUTO METER READER

zack jacobson-weaver



CRITICAL MAKING

INTERACTIVE DEVICE DESIGN

ADVANCED INTERACTIVE DEVICE DESIGN

Innovation happens when individuals go beyond their standard disciplines to learn new skills on their own

Breakthroughs often require us to become amateurs in a new field

In almost all the varied walks of life, **amateurs** have more freedom to experiment and innovate. The fraction of the population who are **amateurs** is a good measure of the freedom of a society

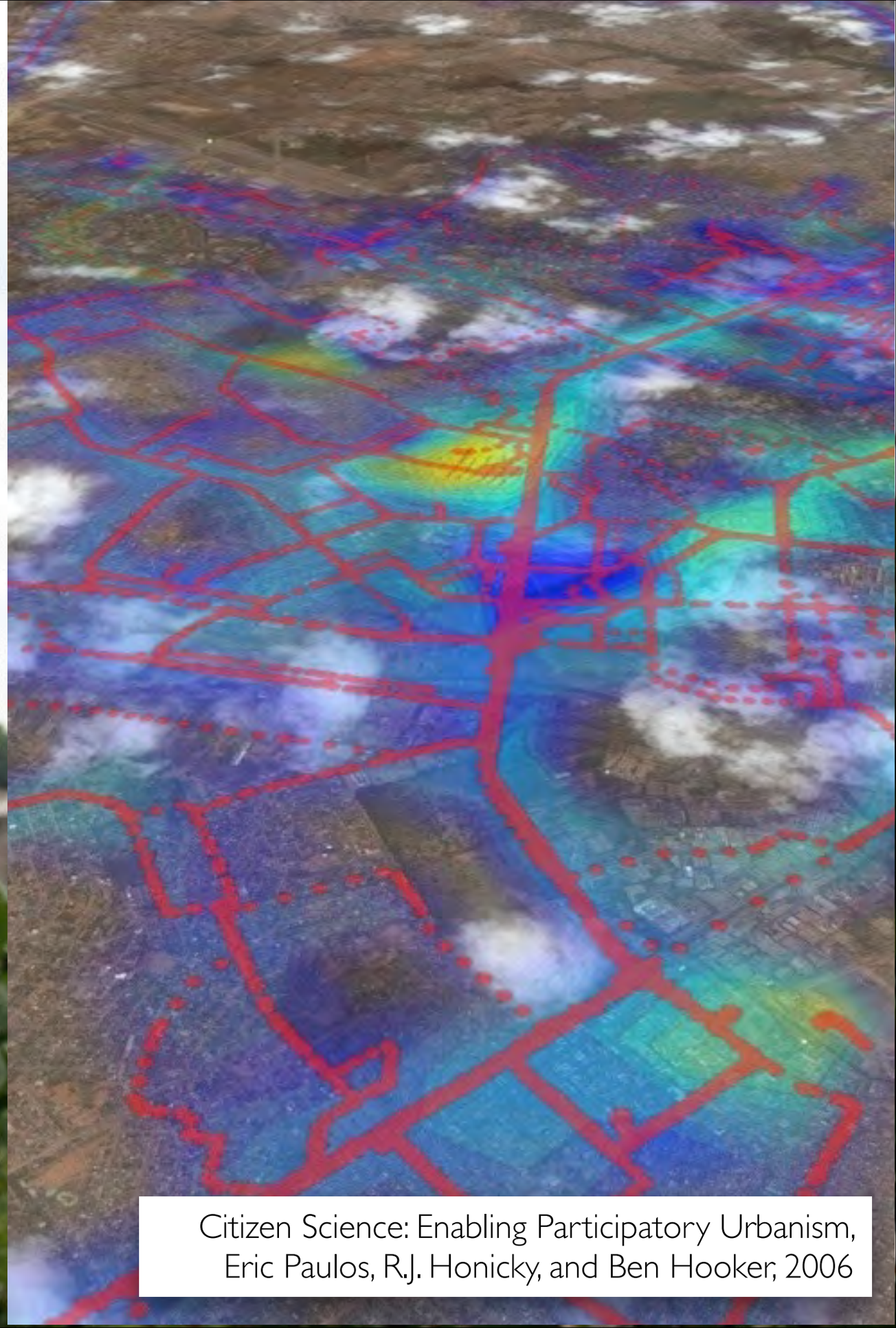
Freeman Dyson

AMATEUR

from amāre - to love

amātor - lover

Citizen Science

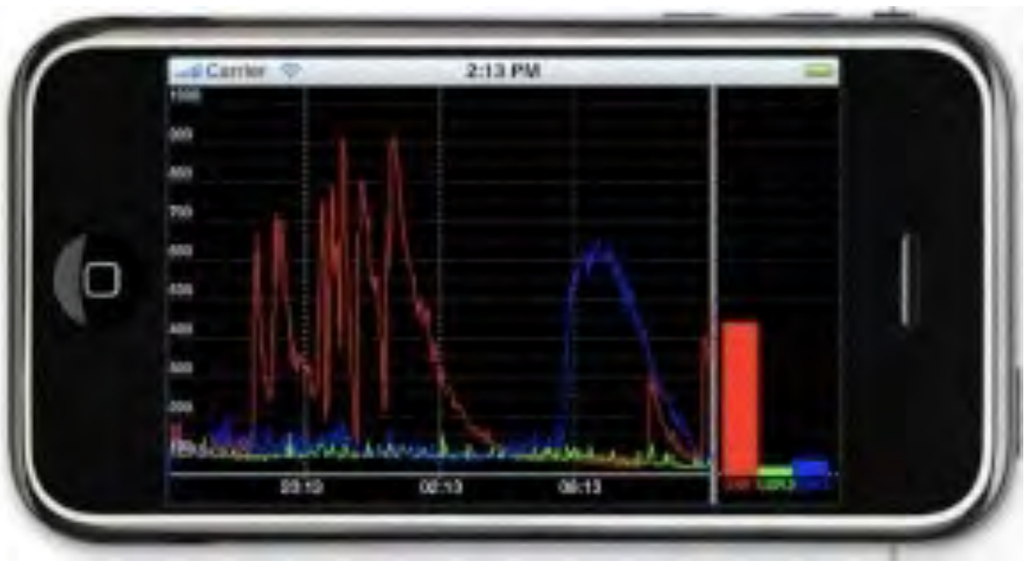


Citizen Science: Enabling Participatory Urbanism,
Eric Paulos, R.J. Honicky, and Ben Hooker, 2006

Citizen Exploration

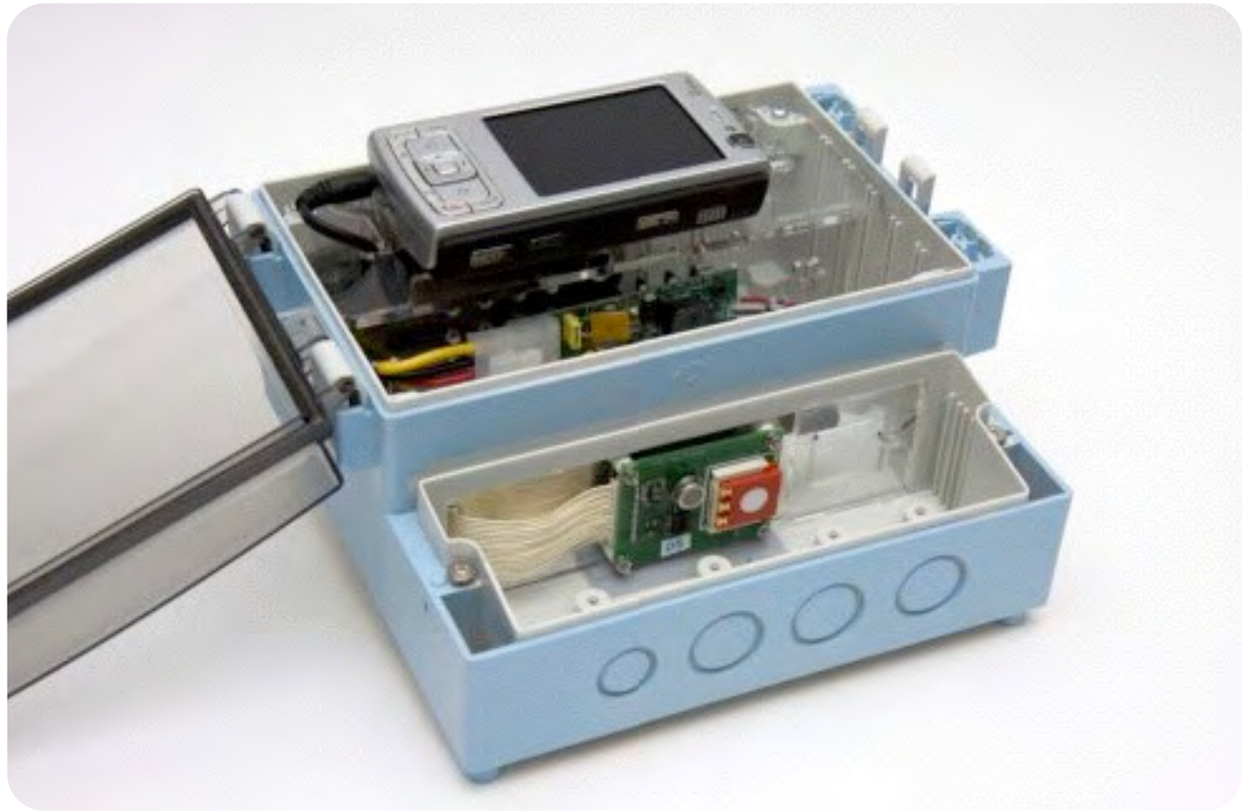
mobile infrastructure

indoor fixed



public placed

Eric Paulos
Allison Woodruff
Paul Aoki
Alan Mainwaring
RJ Honicky



CO

NOx

Ozone

Temperature

Humidity

Accelerometer

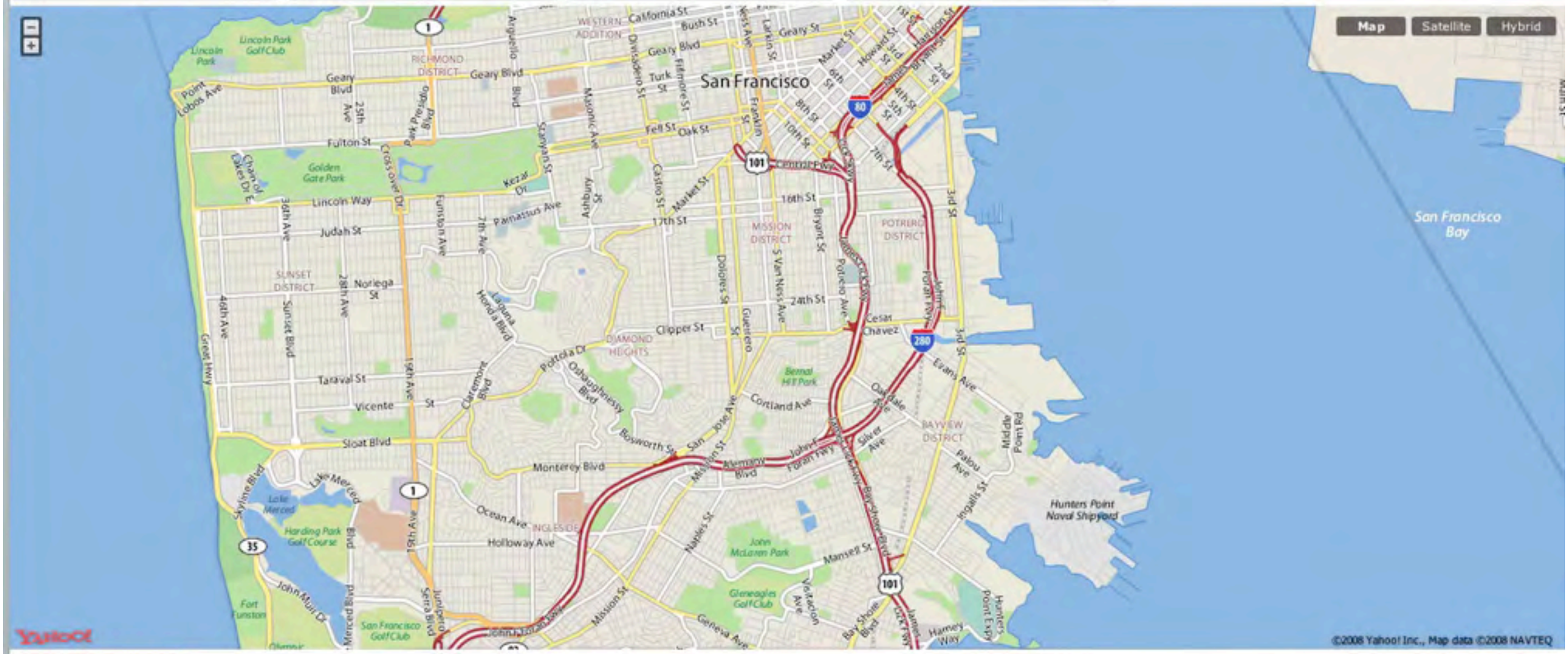
SAN FRANCISCO AIR QUALITY

SELECT MODE DAY

CHOOSE DATE Thr 24 July

CHOOSE SPEED FAST

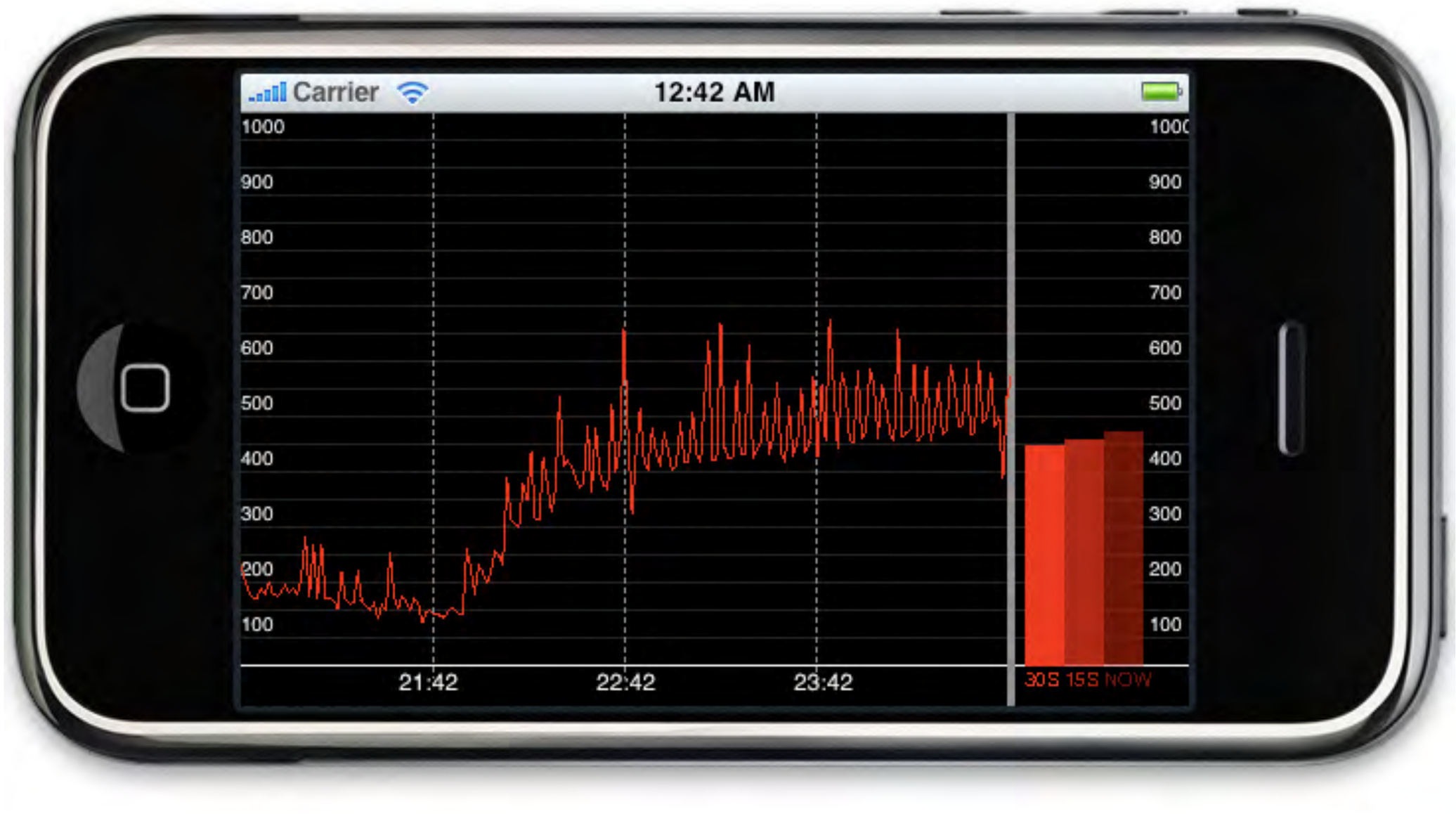
CHOOSE SENSOR Carbon Monoxide (CO)



Fri Jul 25 09:03:19

inAir

Sunyoung Kim
Eric Paulos



inAir: Measuring and Visualizing Indoor Air Quality
Sunyoung Kim and Eric Paulos, Ubicomp 2009

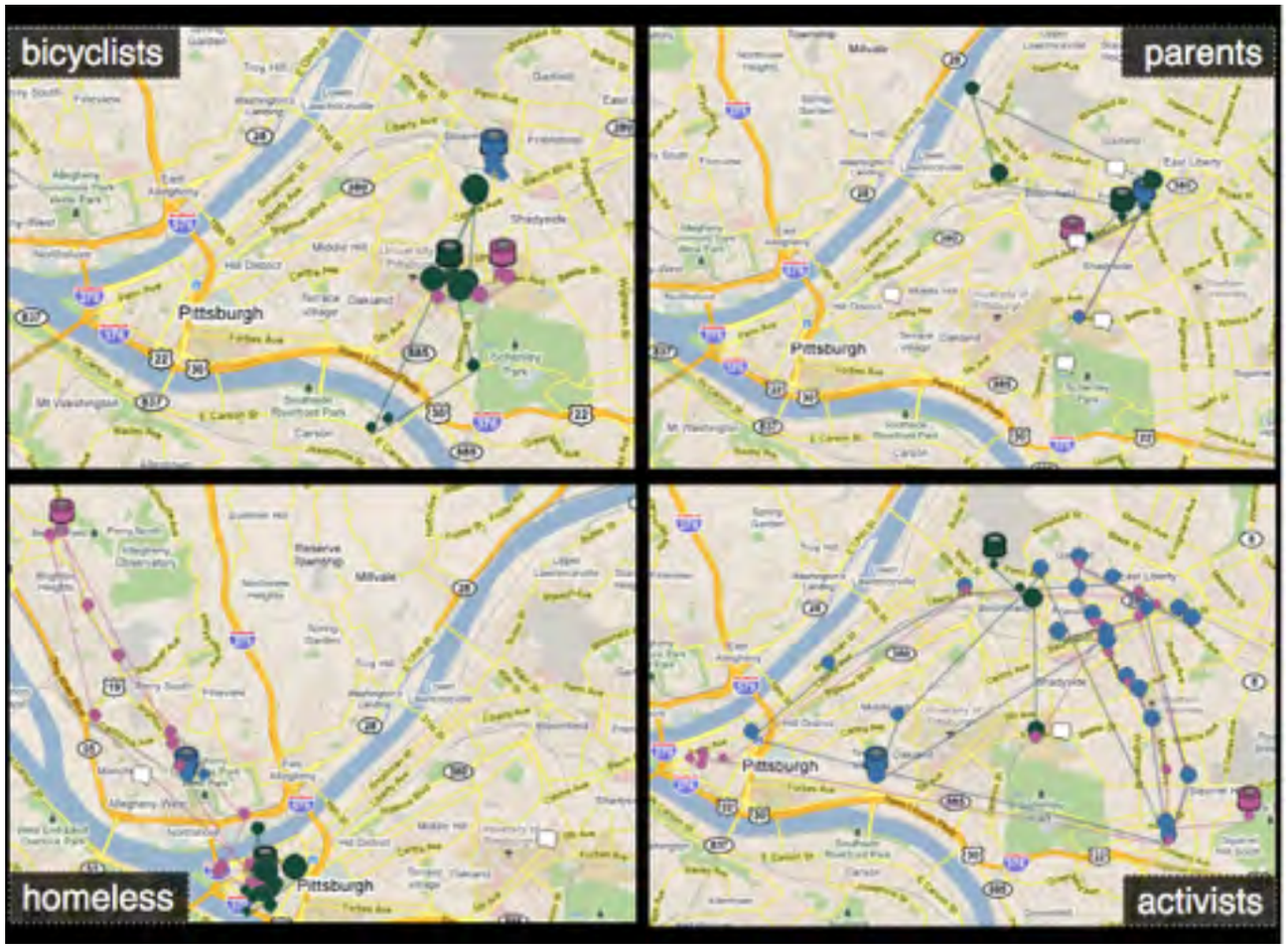
AirBoxLab

netatmo

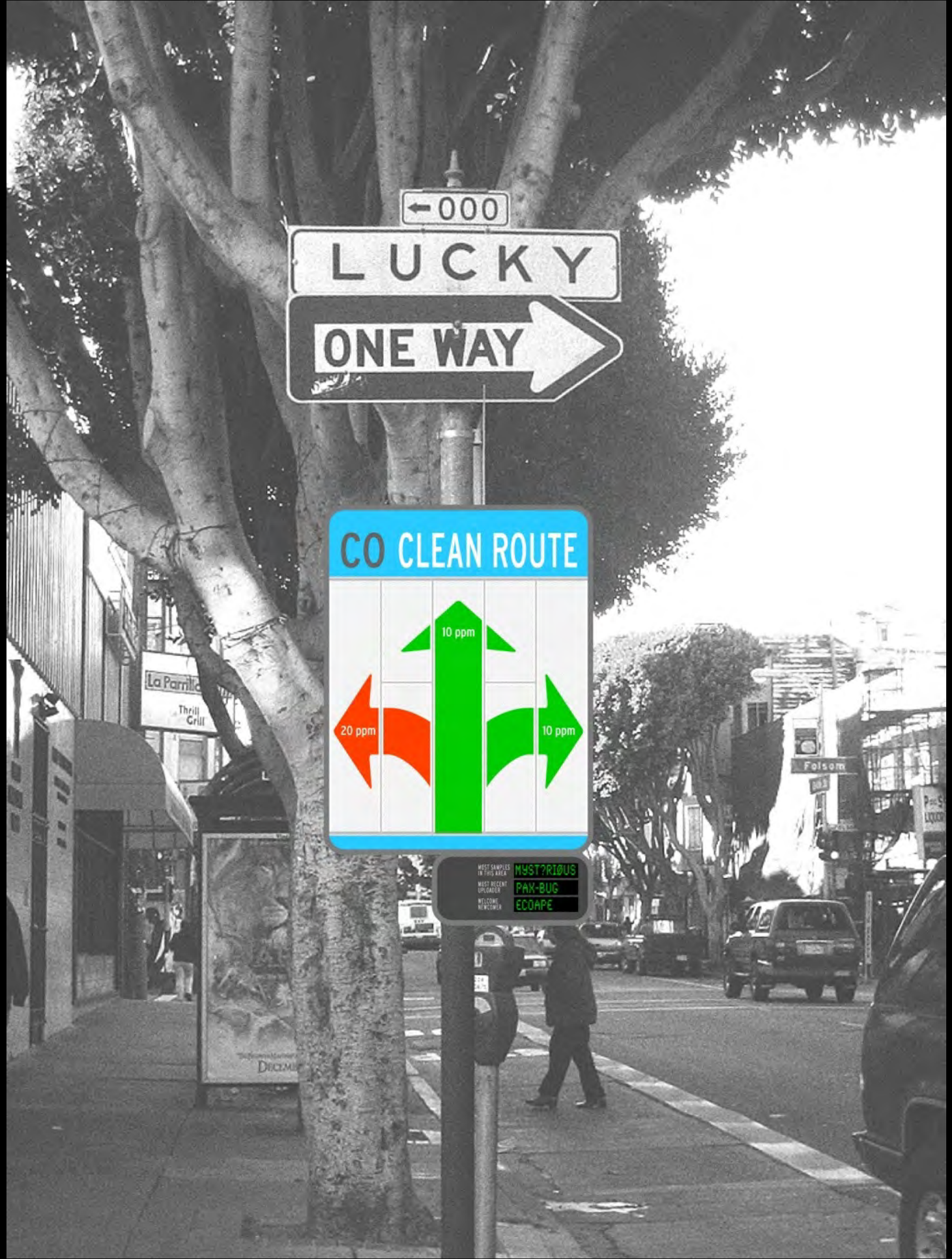
CubeSensors

Community Sensing

Stacey Kuznetsov
George Davis
Jian Cheung
Eric Paulos

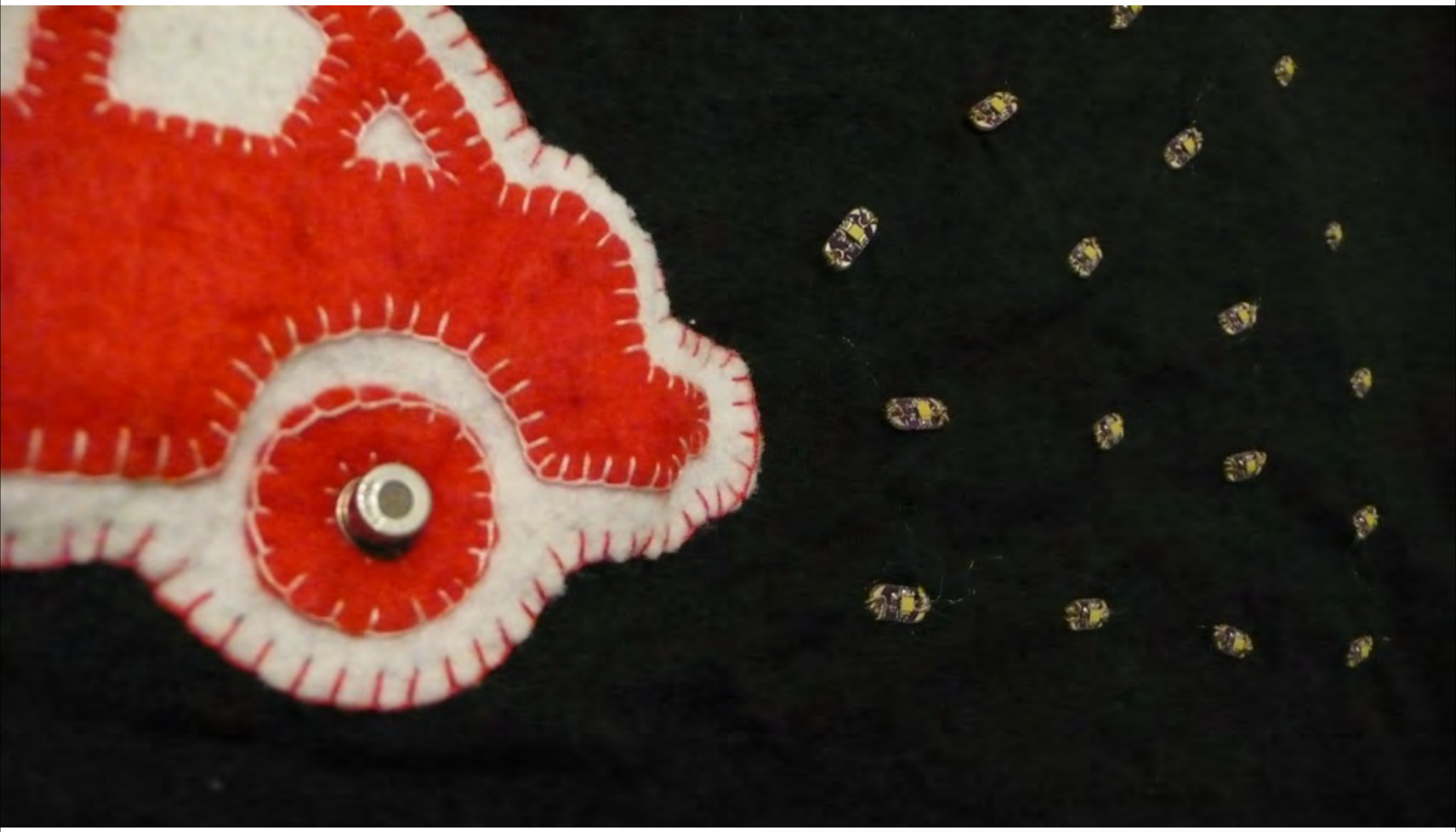


Ceci N'est Pas Une Pipe Bombe: Challenges to Urban Authoring and Participatory Sensing
Stacey Kuznetsov, George Noel Davis, Jian Chiu Cheung, and Eric Paulos, ACM SIGCHI, 2011


000
LUCKY
ONE WAY
CO CLEAN ROUTE
10 ppm
20 ppm
10 ppm
MOST SAMPLES IN THIS AREA
MYST?RIØUS
MOST RECENT UPLOADER
PAX-BUG
WELCOME NEWCOMER
ECOAPE
La Parrilla
Thrill Grill
Folsom

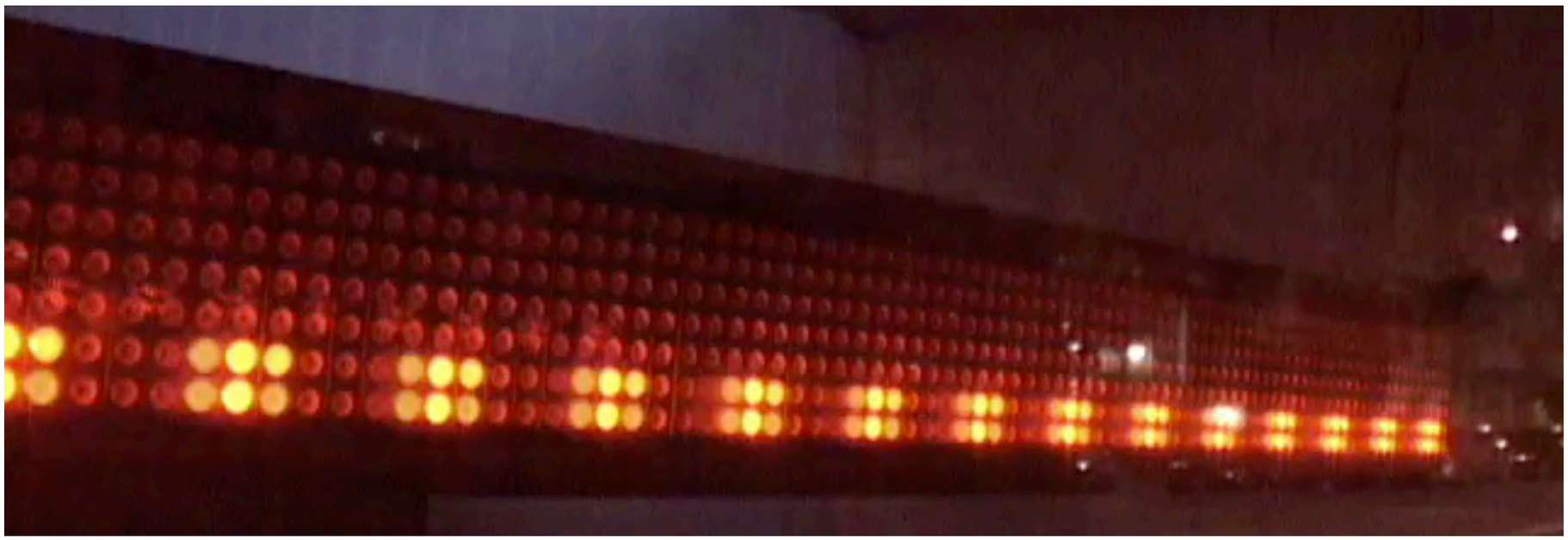
WearAir

Sunyoung Kim
Eric Paulos



WearAir: Expressive T-shirts for Air Quality Sensing
Sunyoung Kim, Eric Paulos, and Mark Gross
Tangible Embedded and Embodied Interaction, 2010

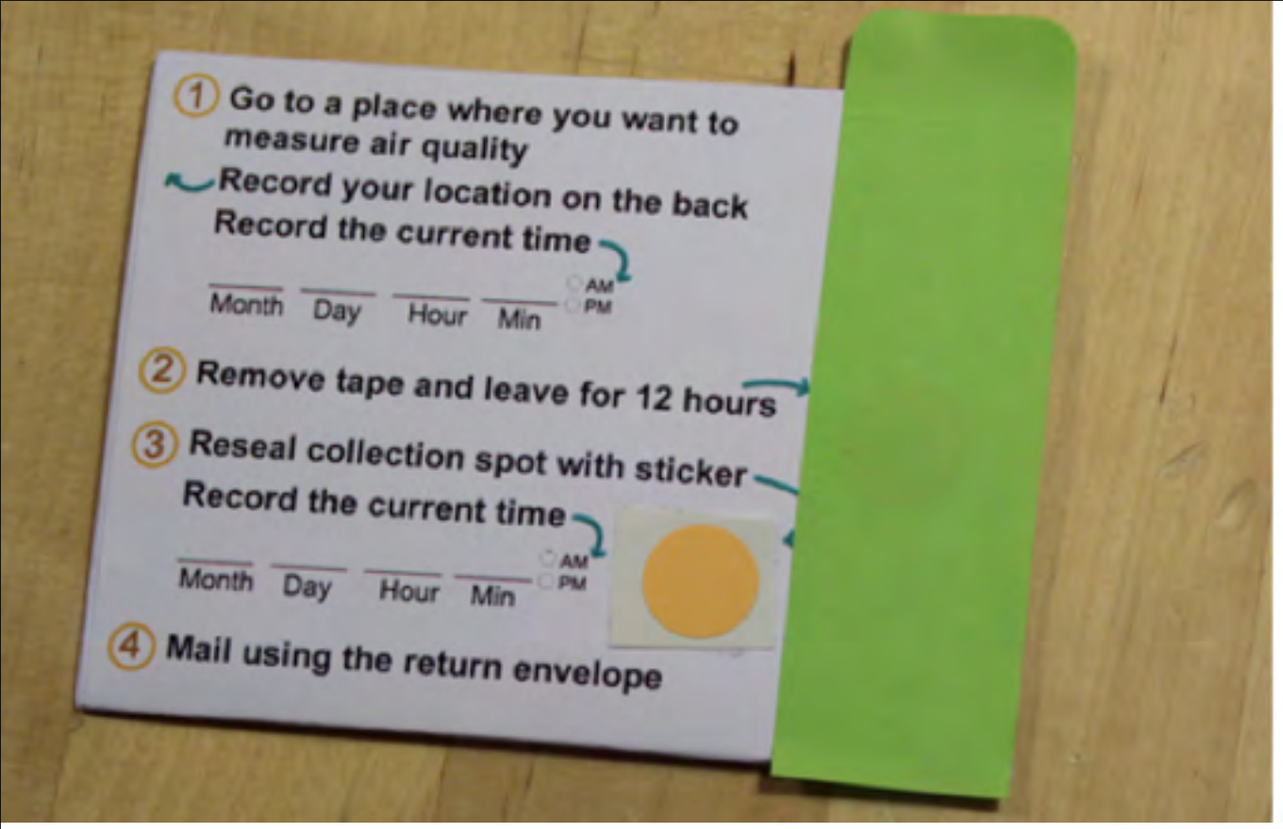

BREATHE

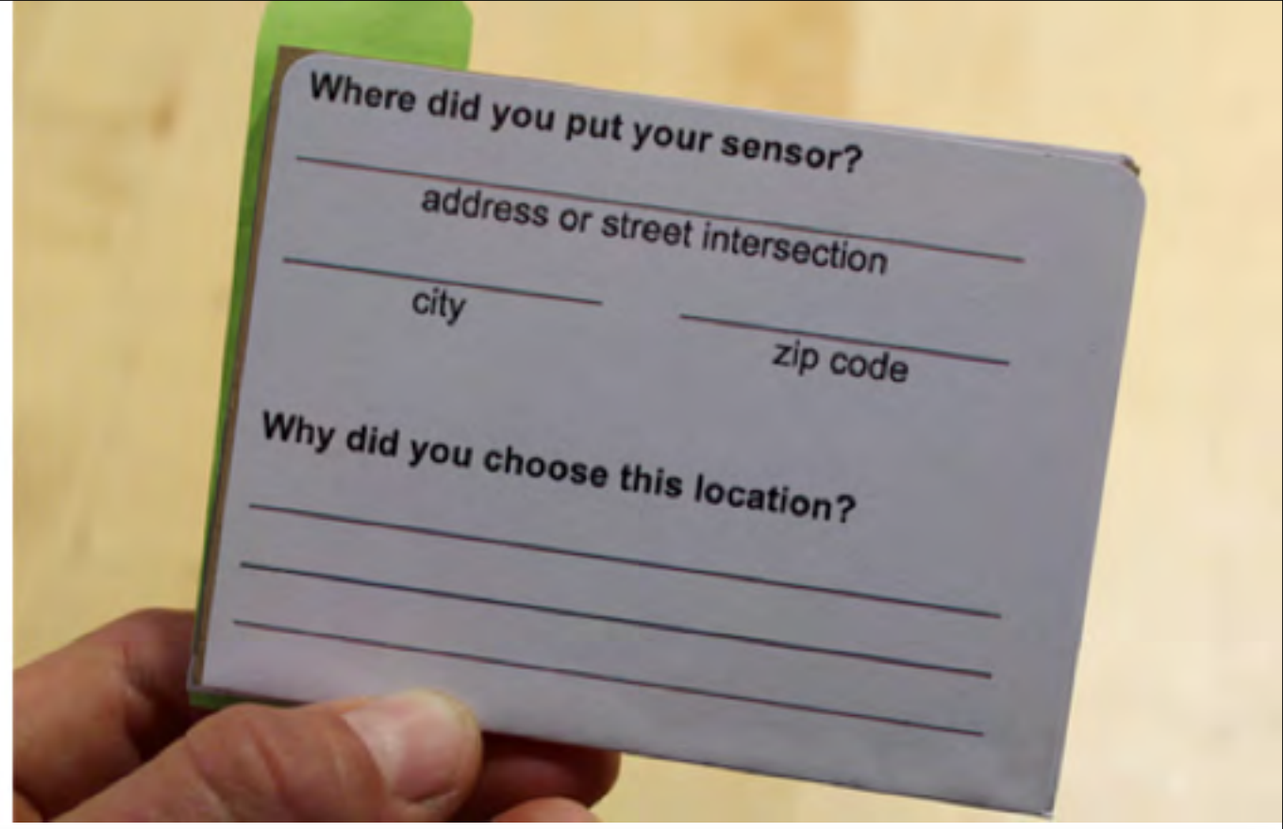



my air

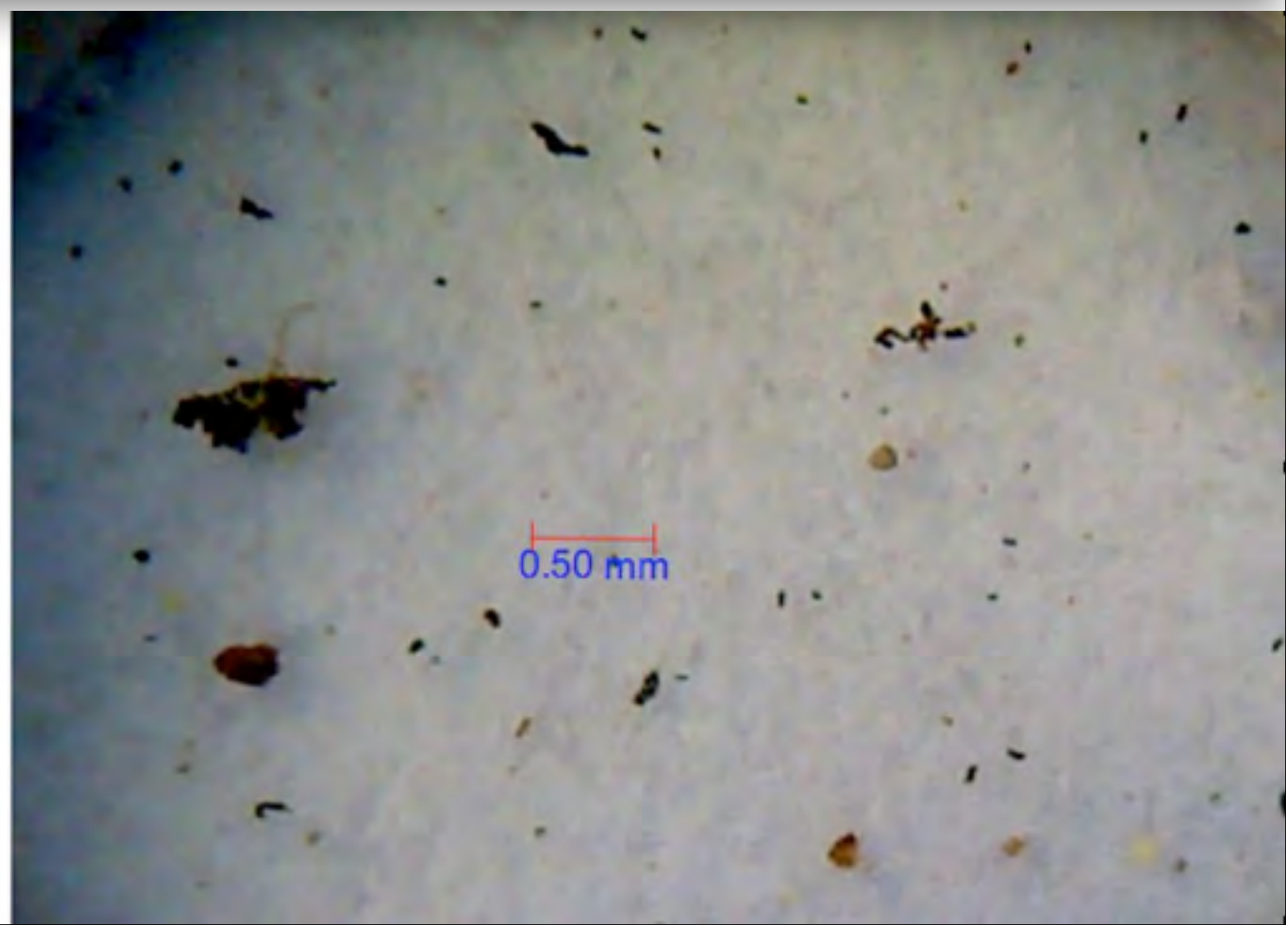
Spectacle Computing

Red Balloon, Green Balloon, Sensors in the Sky,
Stacey Kuznetsov, George Davis, Eric Paulos,
Mark Gross, Jian Cheung, Ubicomp, 2011



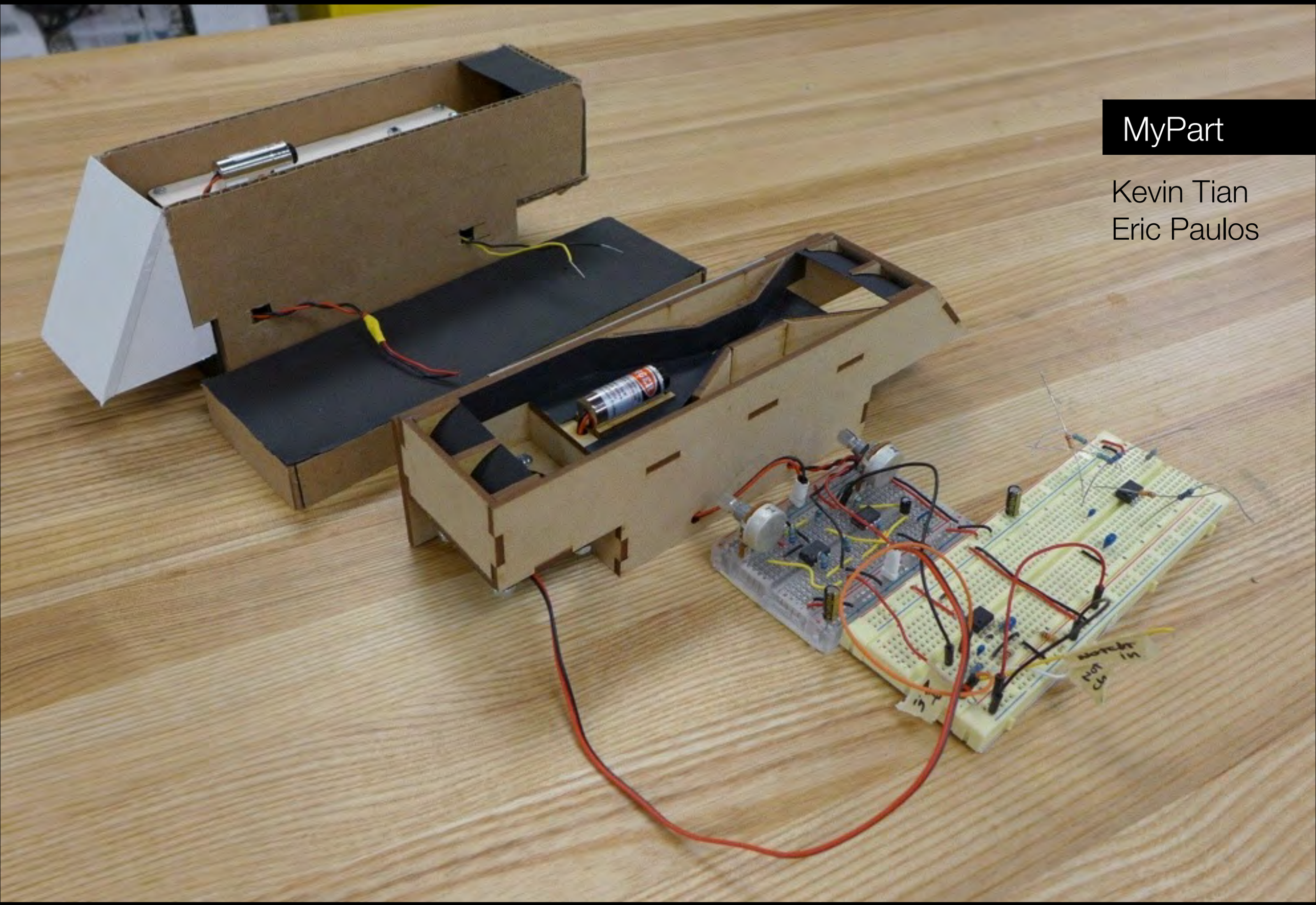


A Low-Tech Sensing System for Particulate Pollution,
Stacey Kuznetsov, Scott Hudson, and Eric Paulos, TEI 2014



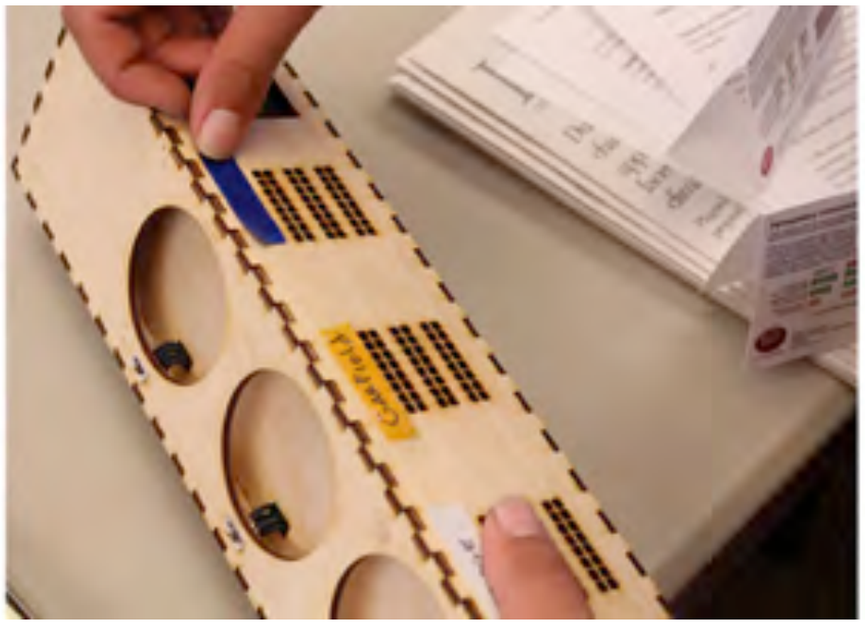
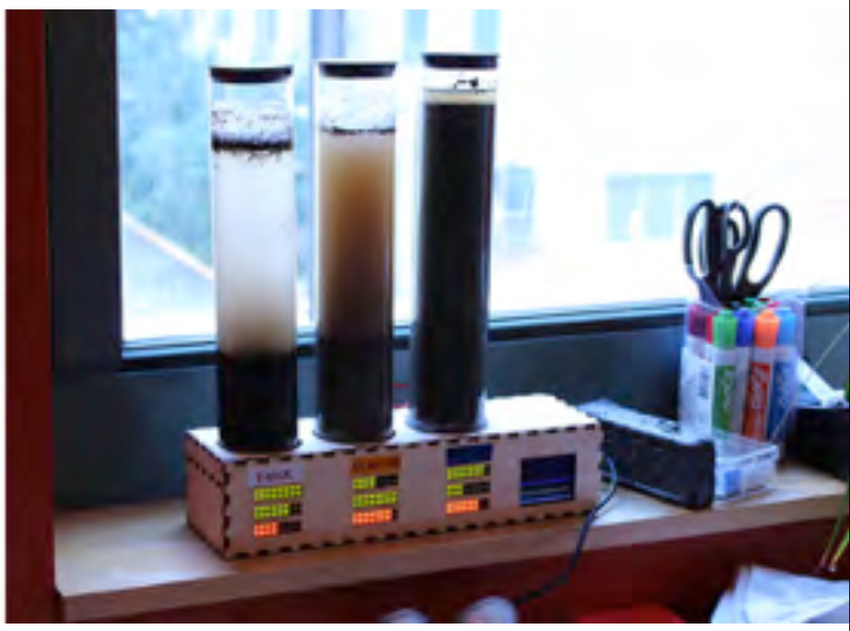
MyPart

Kevin Tian
Eric Paulos



bio markers

Nurturing Natural Sensors (Best Paper Award)
Stacey Kuznetsov, William Odom, James Pierce, Eric Paulos
Ubiquitous Computing Conference, 2011

DIY bio sensing

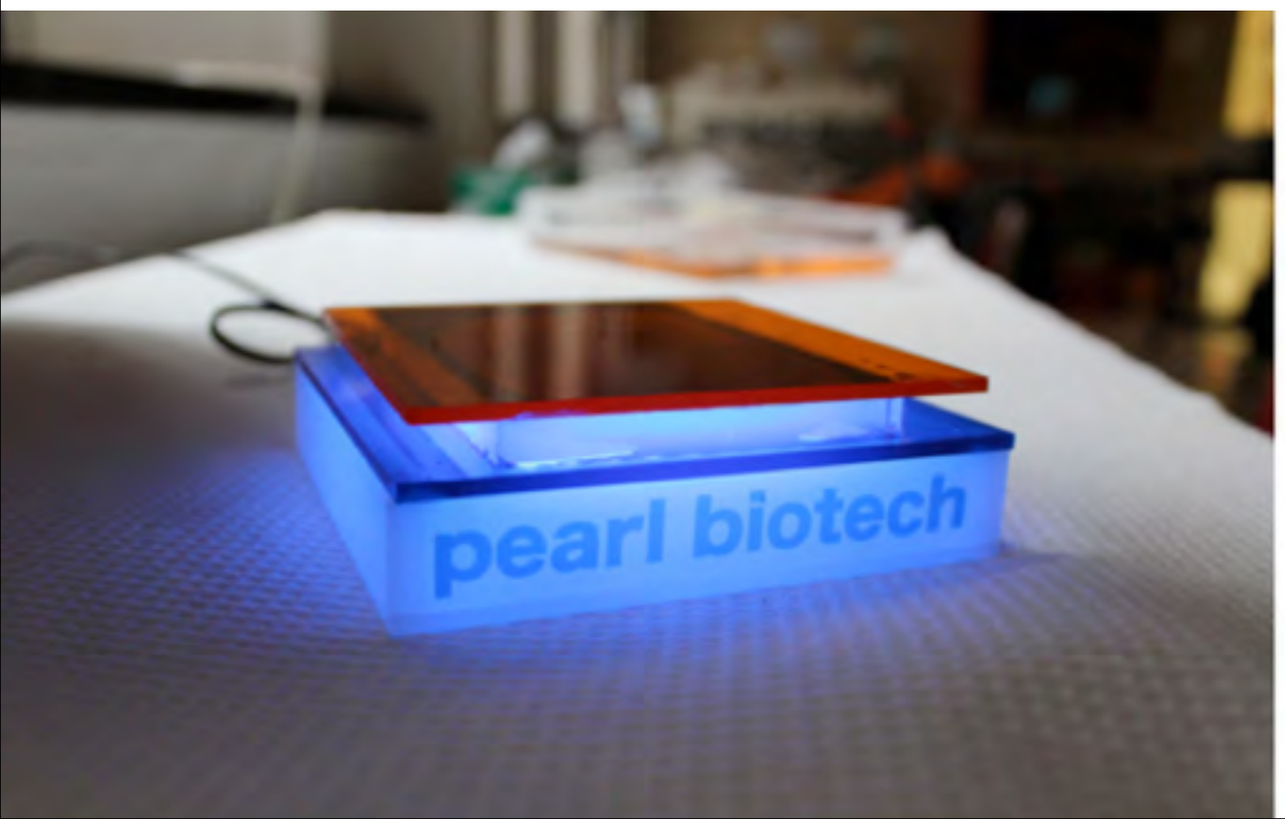
Stacey Kuznetsov
Will Harrigan-Anderson
Haakon Faste
Scott Hudson
Eric Paulos



Community Engagements with Living Sensing Systems, Stacey Kuznetsov, Will Harrigan-Anderson, Haakon Faste, Scott Hudson, and Eric Paulos, ACM Creativity and Cognition, June 2013

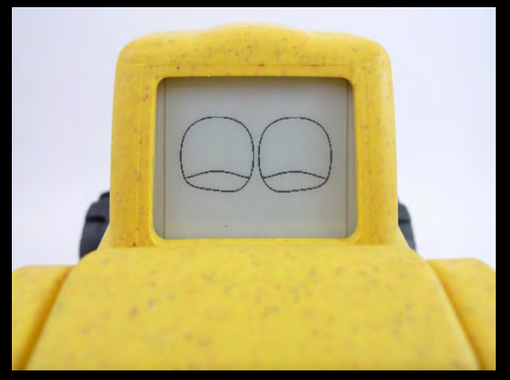
bio-electric hybrids

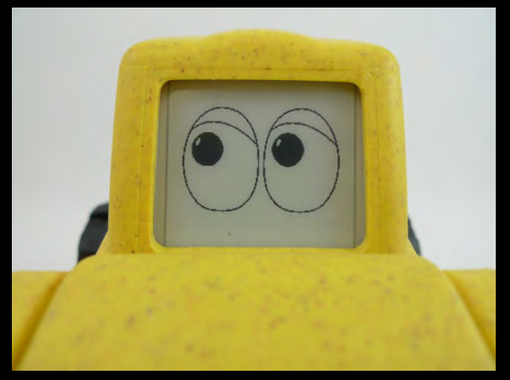
Stacey Kuznetsov

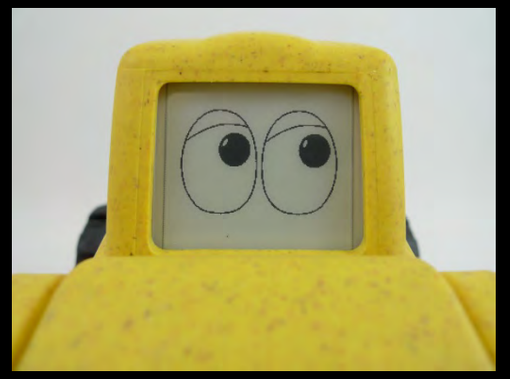


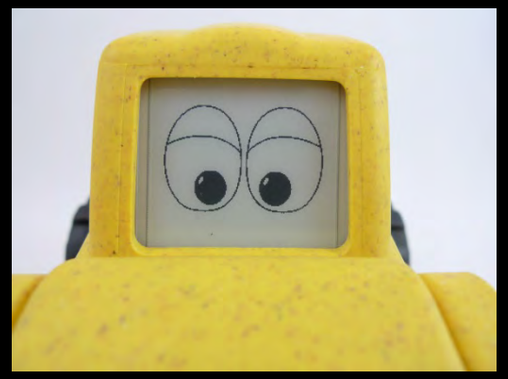
EXPLORATORY SENSORS

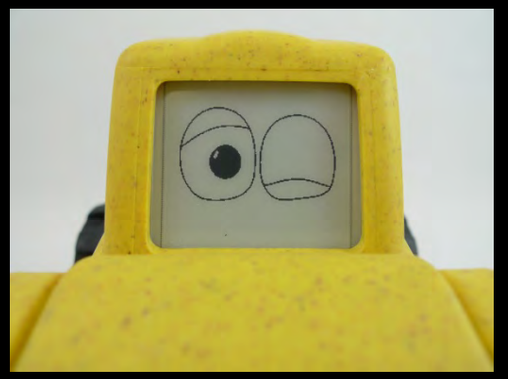
Kevin Tian
Chris Myers
Eric Paulos











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SUTARDJA DAI HALL
UC BERKELEY

For decades robots have diligently been tasked to perform a range of duties largely scoped within industrial manufacturing. More recently, we have seen the emergence of a new landscape of more social, personal, expressive, nurturing, and emotional robotic platforms. Increasingly, robots play a critical new role as extensions of ourselves, enabling our creativity, creating new objects, serving as companions, expressing emotions, empowering communities, and challenging our civil rights. What are the exciting opportunities as well as new legal, philosophical, and ethical dilemmas within this important cultural and technological milieu?

Join us as we deconstruct, debate, and explore this concept of *Robots and New Media*.

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Robotics is the moral degradation of the machine.

– JG Ballard

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