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

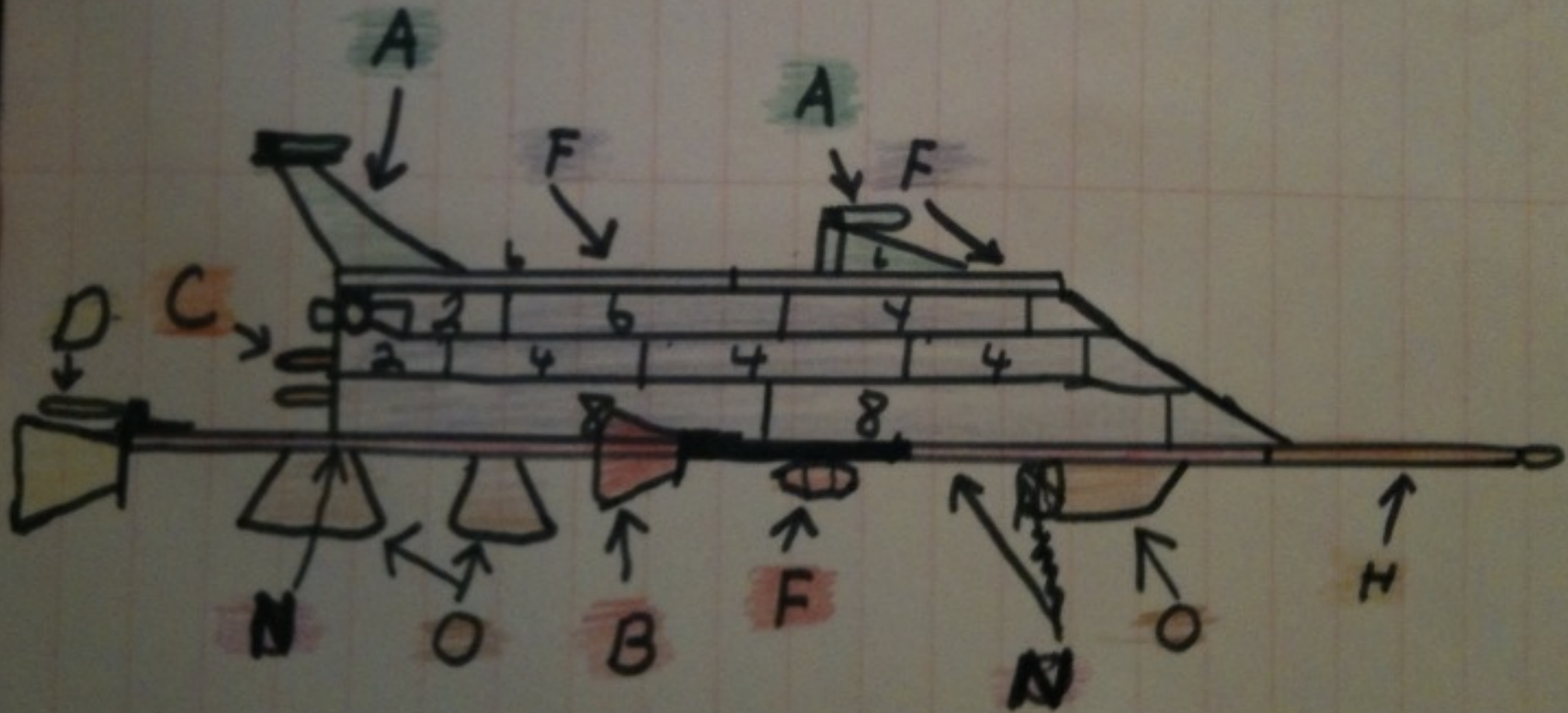
Plans

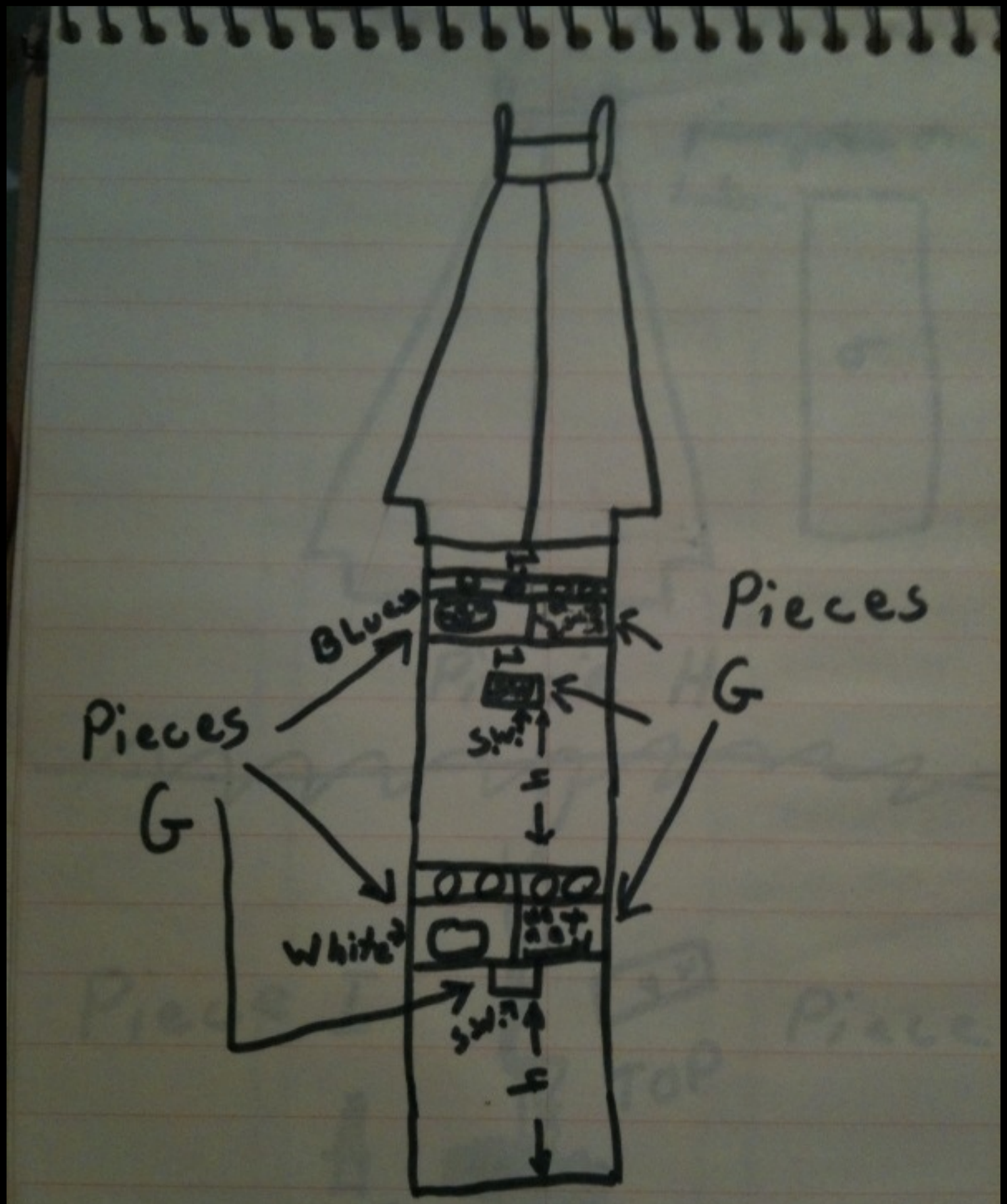
Donot

open

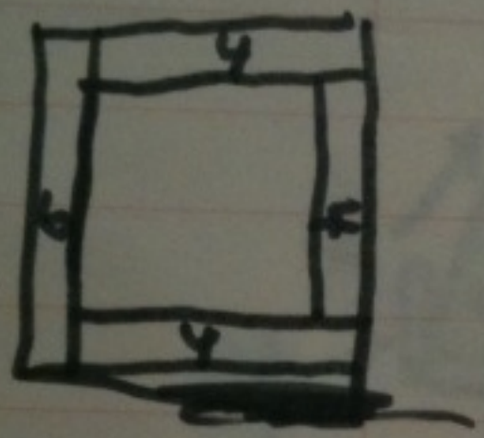
UNLESS

AUTHORIZED

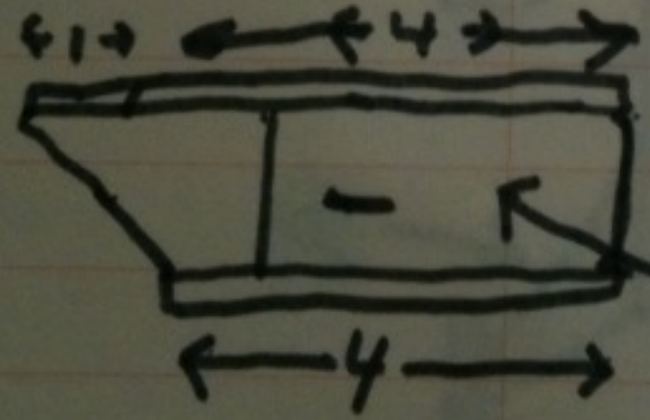

A
F
A
F
D
C
2
6
4
2
4
4
4
8
8
N
O
B
F
N
O
H


Pieces
G
Pieces
G
Blue
White
S.W.
S.W.

Part 0



Top

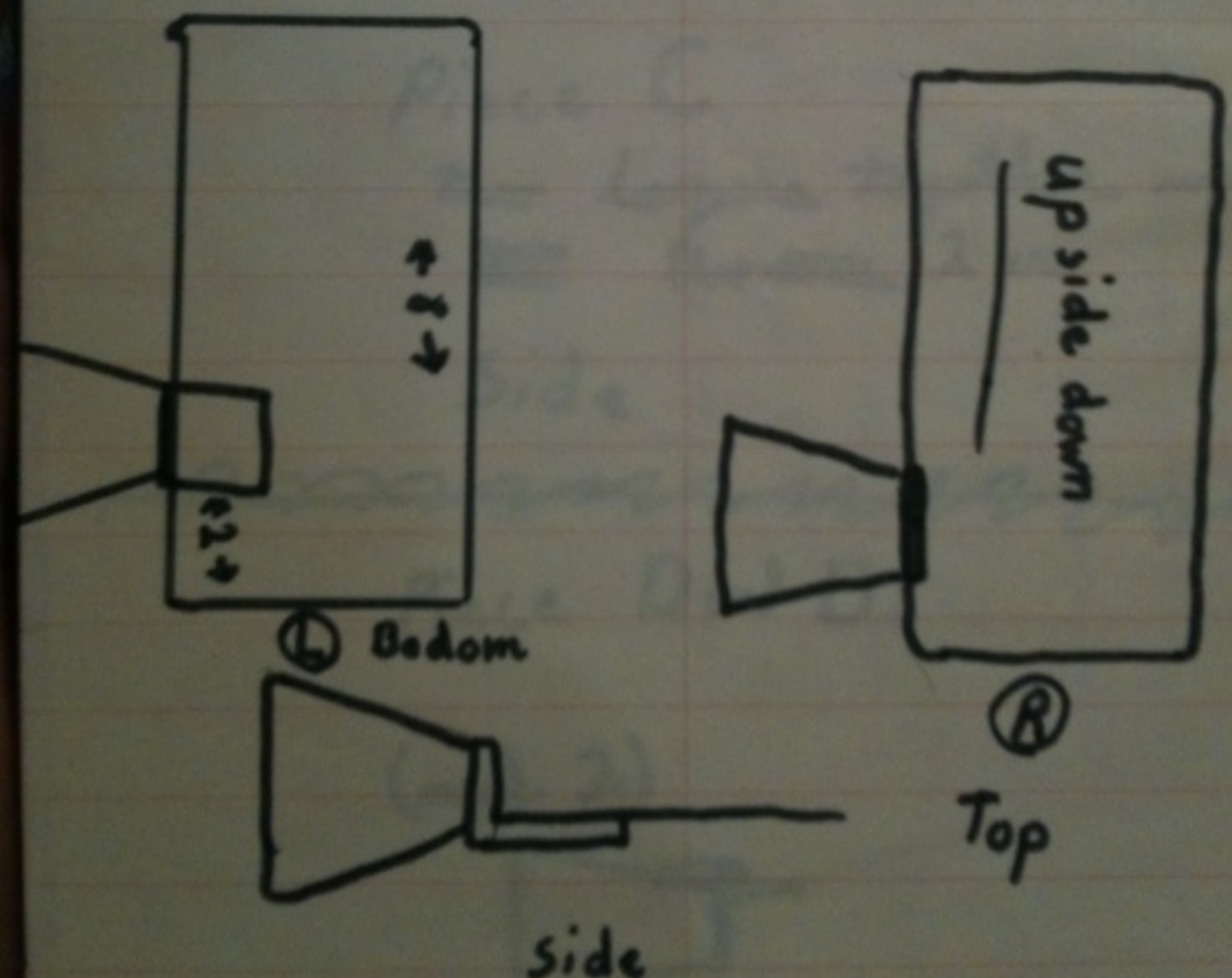


put a door on each side

SIDE

Piece B and B2

Engine and engine holder need to be reversed for right and left side



© The Leg Laboratory

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
00ff6  CP/M ED.COM 1.4                      fa.info-cpm          17-Jul-82 19:21
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>
```

Propeller
(not visible)

Camera

Mic

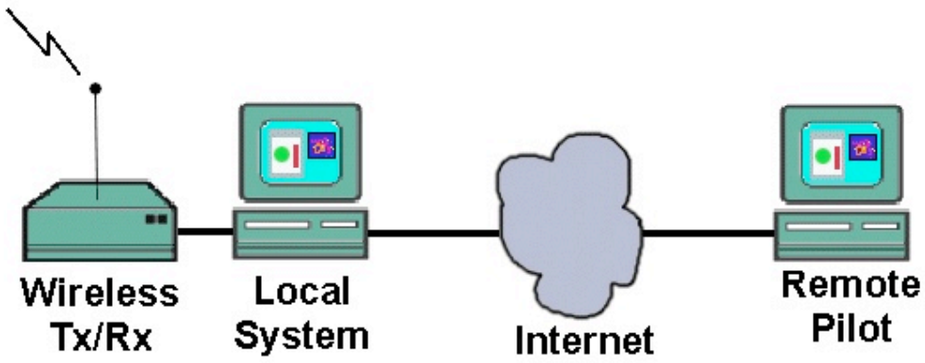
Battery

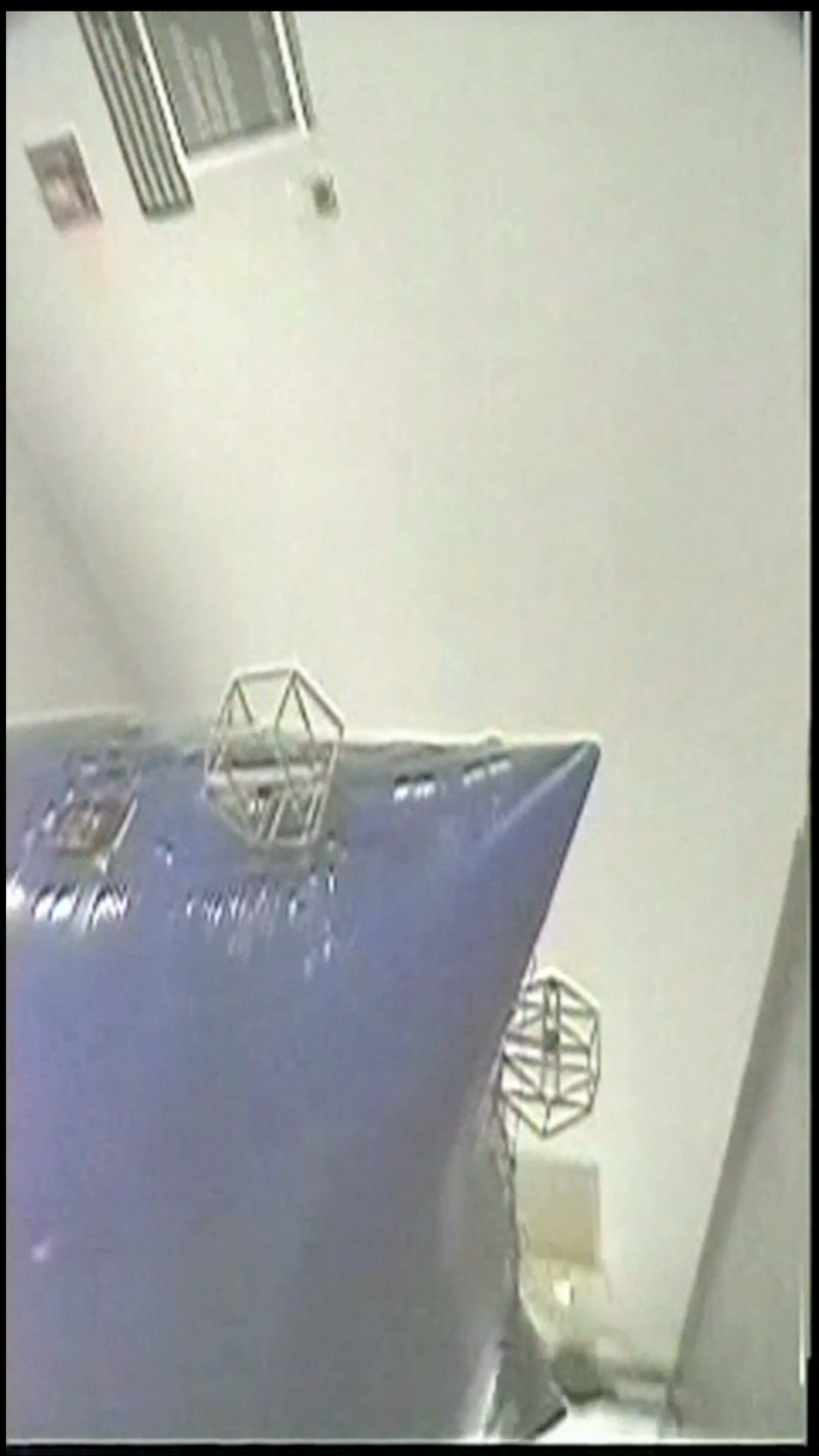
Speaker

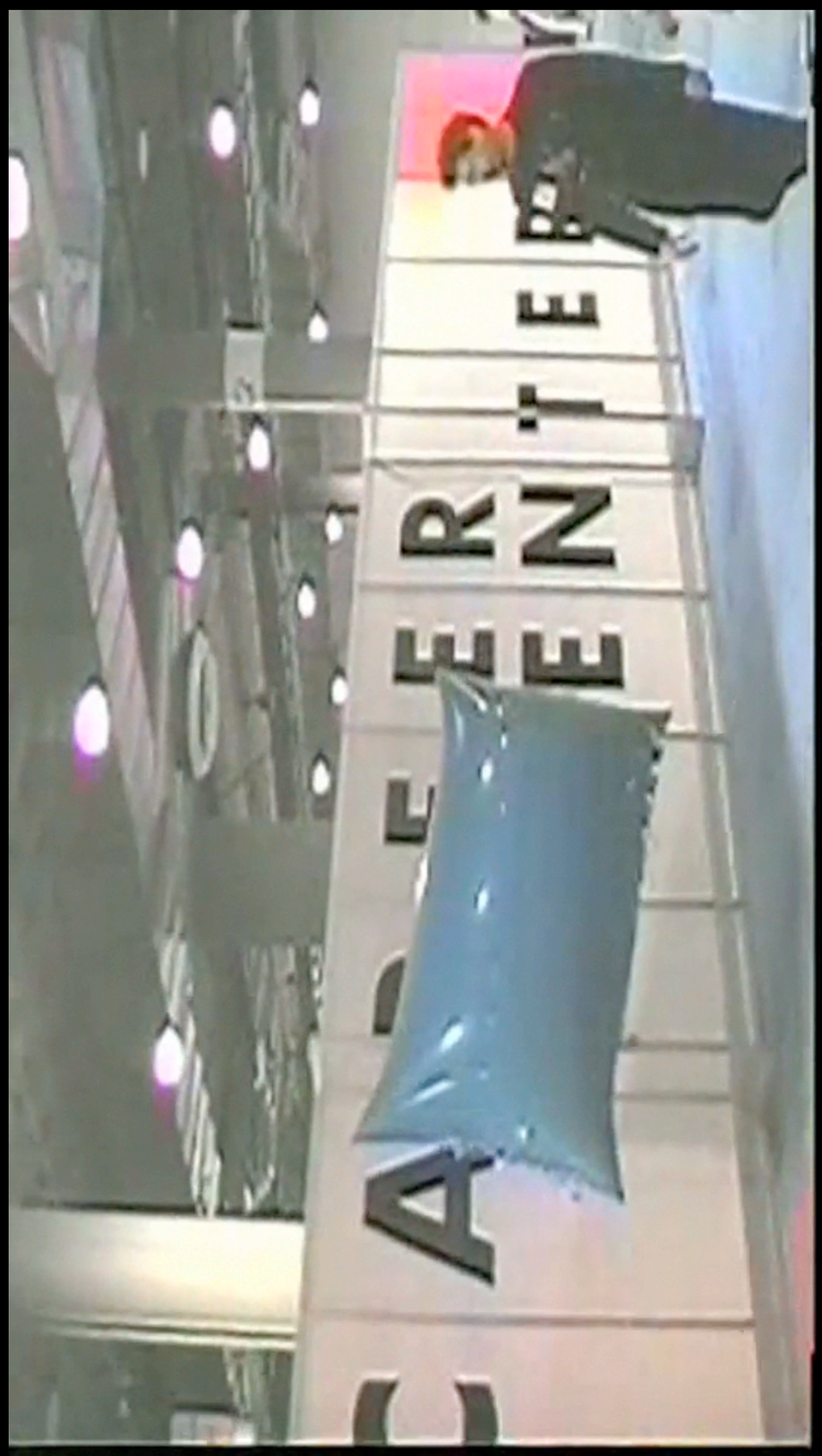
Rx/Tx

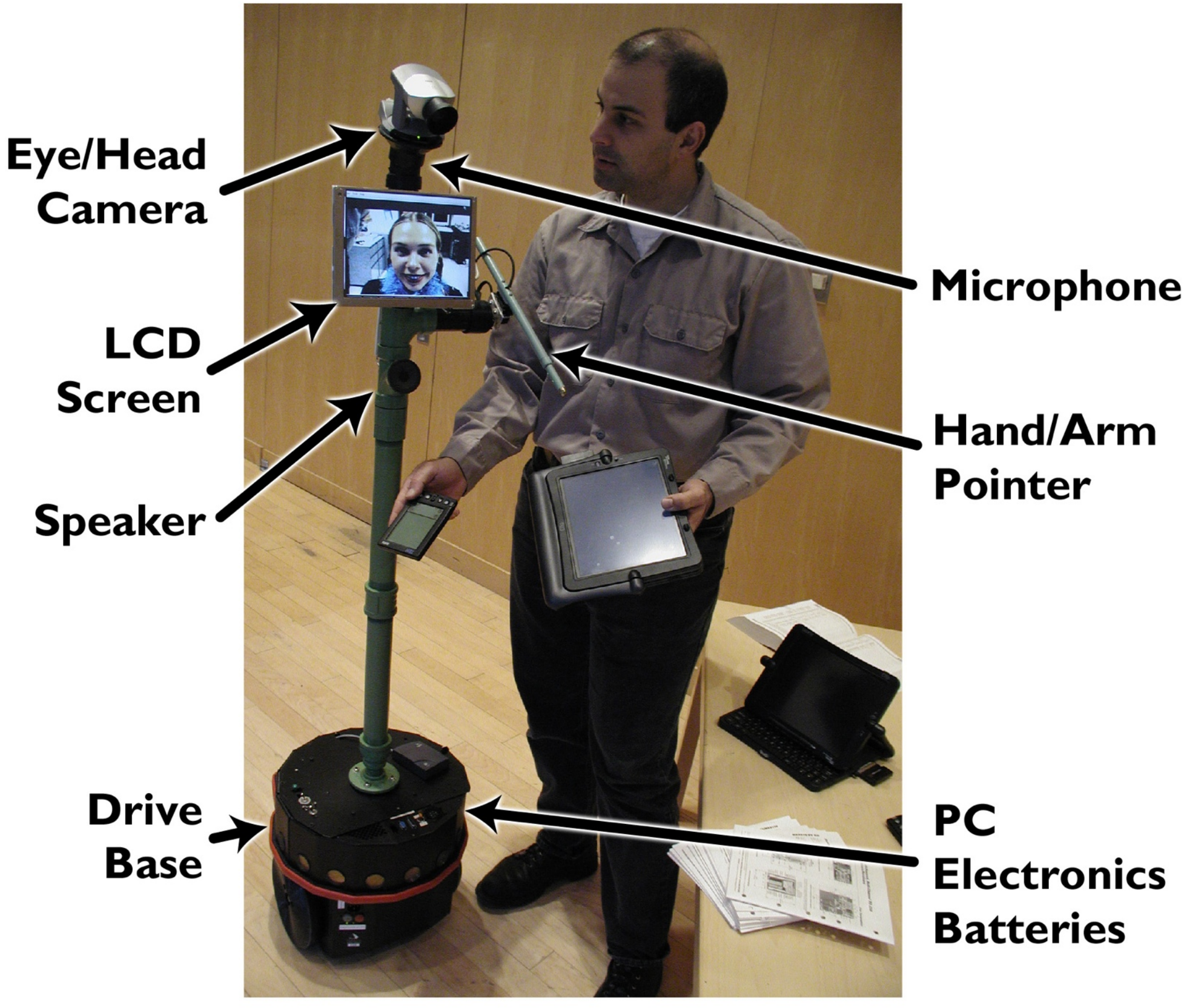
Custom
electronics

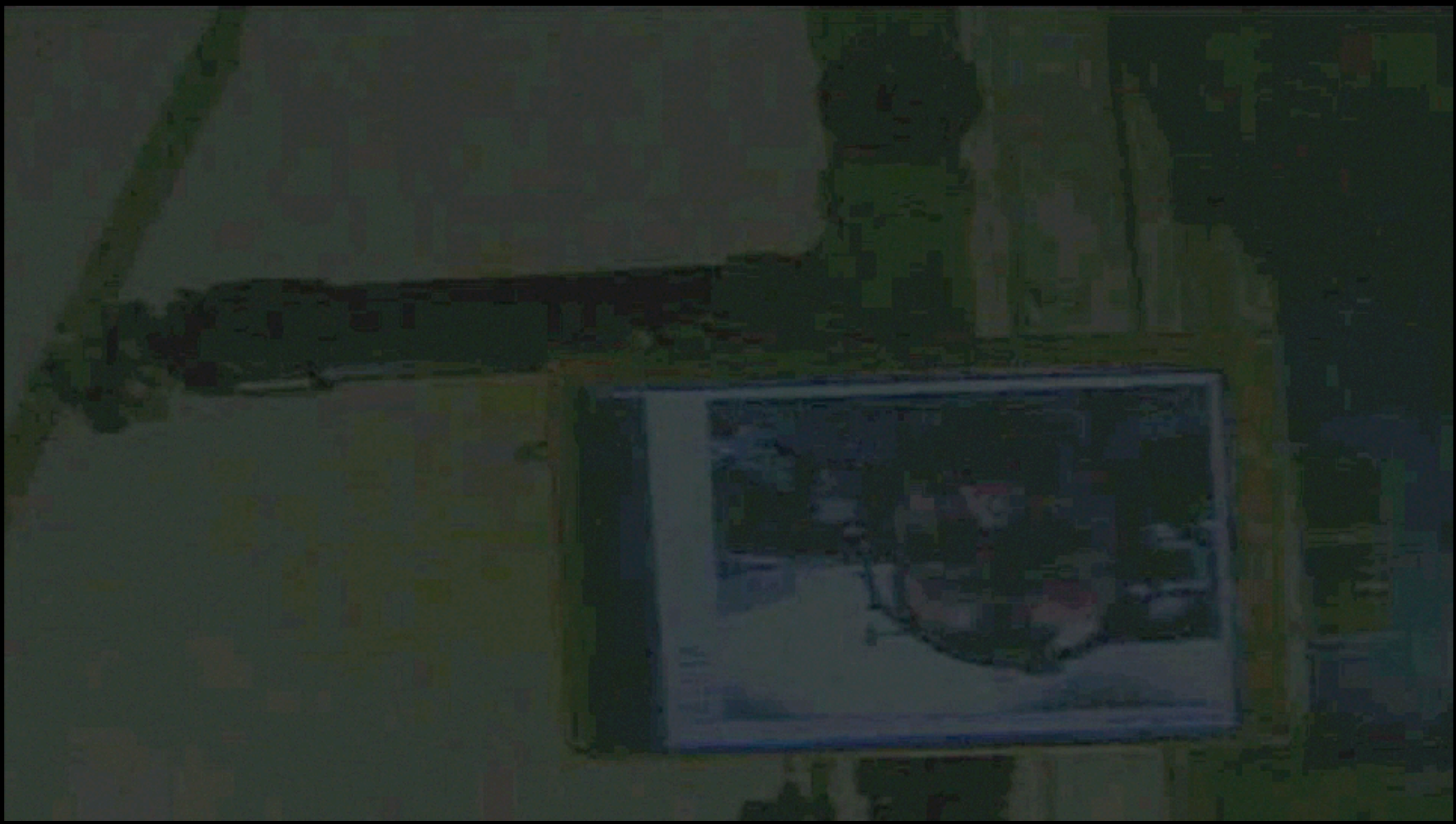
Propeller








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



CAP. 8,000 LBS.

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)

60 cm

PC Power
connector (C1)

Keyboard / Mouse

Advantech Part
#1700060200

COM1
COM2
COM3
COM4

microphone
jack (J1-F)

speaker
jack (J2-F)

Advantech Part
#1700160000

Videum VO
Capture Card

video capture
hardware

RCA video
jack (J3-F)

Advantech PCM-9574

Advantech Part
#1701400181

VGA

Advantech Part
#1700160150

+12 volts
GND
GND
+5 volts

Terminal Strip
(T1)

20cm
long

Laser Diode

LOGIC_PWR
GND
RELAY0_OUT
PWR
TX
RX
OUT0
OUT1

190cm
long

M
Pan motor

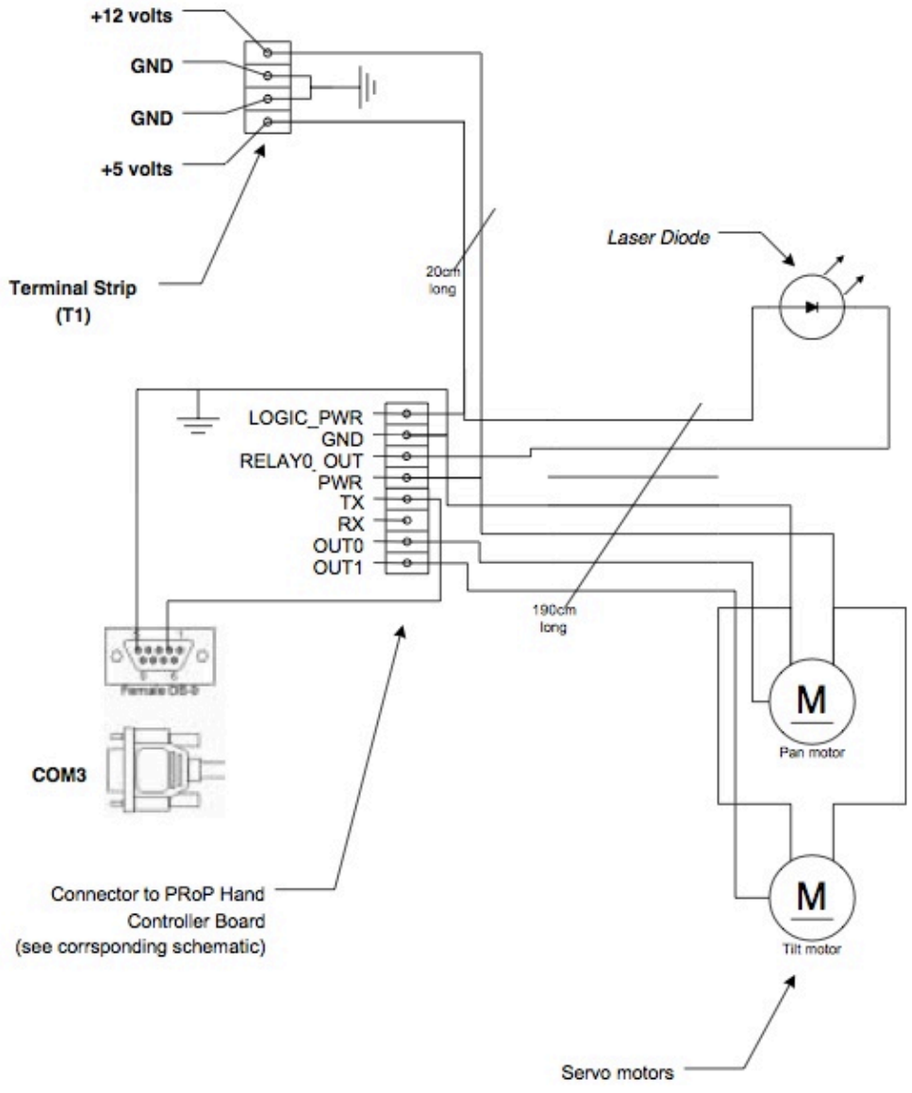
M
Tilt motor

COM3

Connector to PRoP Hand
Controller Board
(see corrsponding schematic)

Servo motors

End


+12 volts
GND
GND
+5 volts
Terminal Strip
(T1)
20cm
long
Laser Diode
LOGIC_PWR
GND
RELAY0_OUT
PWR
TX
RX
OUT0
OUT1
190cm
long
Female DB-9
COM3
Connector to PRoP Hand
Controller Board
(see corrsponding schematic)
M
Pan motor
M
Tilt motor
Servo motors

1980

PRoP

1994

PEBBLES

1997

Care-O-bot

1998

Co-Worker

Care-O-bot 2

2002

RP-7

2003

TiLR

2005

Giraff

2006

ConnectR

2007

Care-O-bot 3

2008

QA

Texai

Roti

R.Bot-100

2009

Robosem

EngKey

VGo

QB

2010

Luna

AVA

Jazz Connect

TELO

2011

Beam

Double

RP-VITA

HELO

2012

What is HCI?

Human-Computer Interaction (HCI)

Human

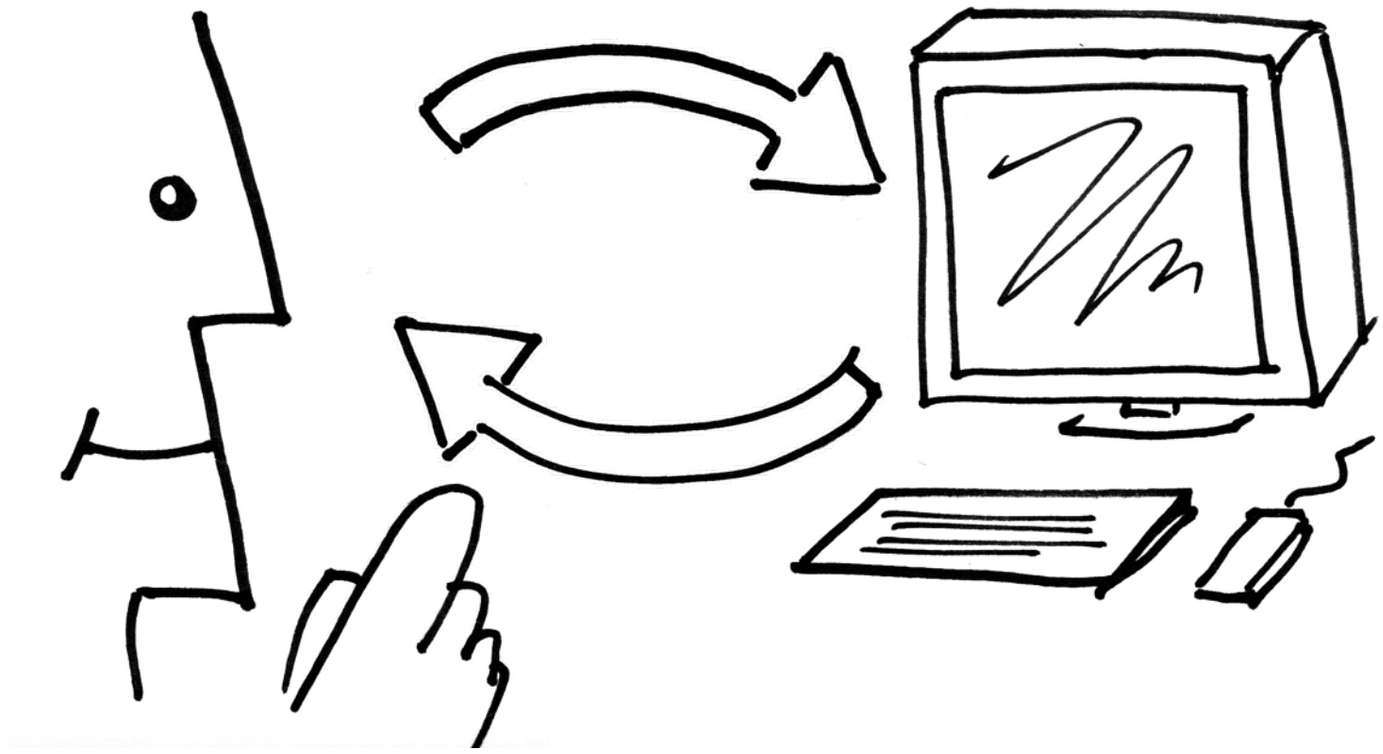
- End-user of program
- Others (friends, collaborators, coworkers)

Computer

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

Interaction

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



User Interfaces (UIs)

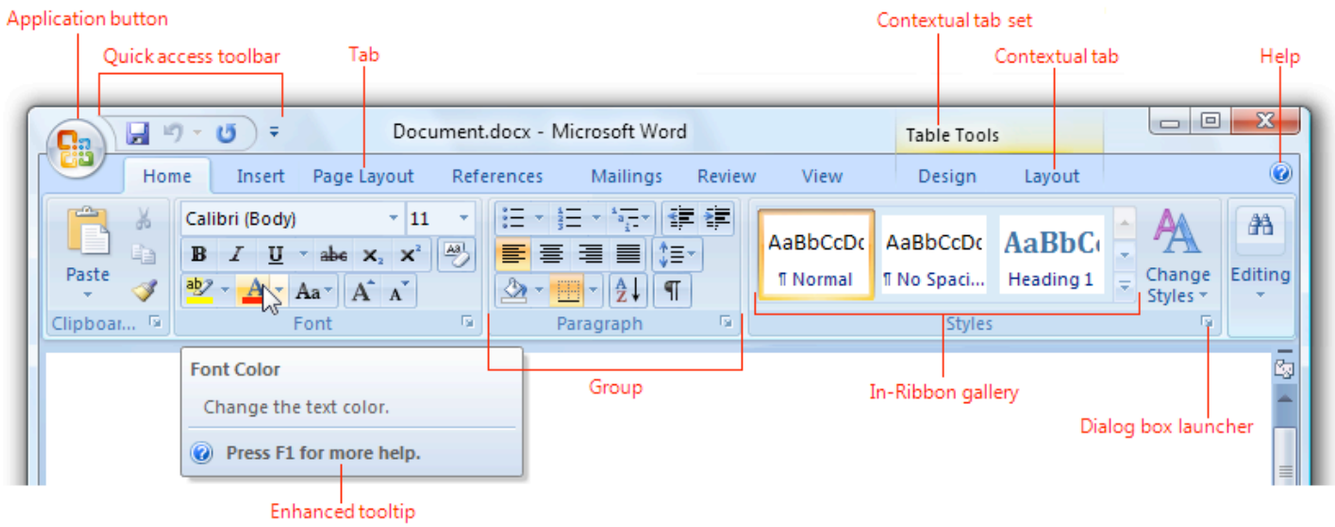
Part of application that allows

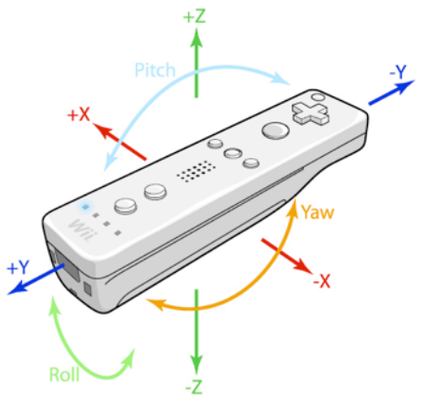
- People to interact with computer
- Computer to communicate results

Can include hardware design

- Buttons, sliders, other sensors

HCI = design, prototyping, implementation & evaluation of UIs



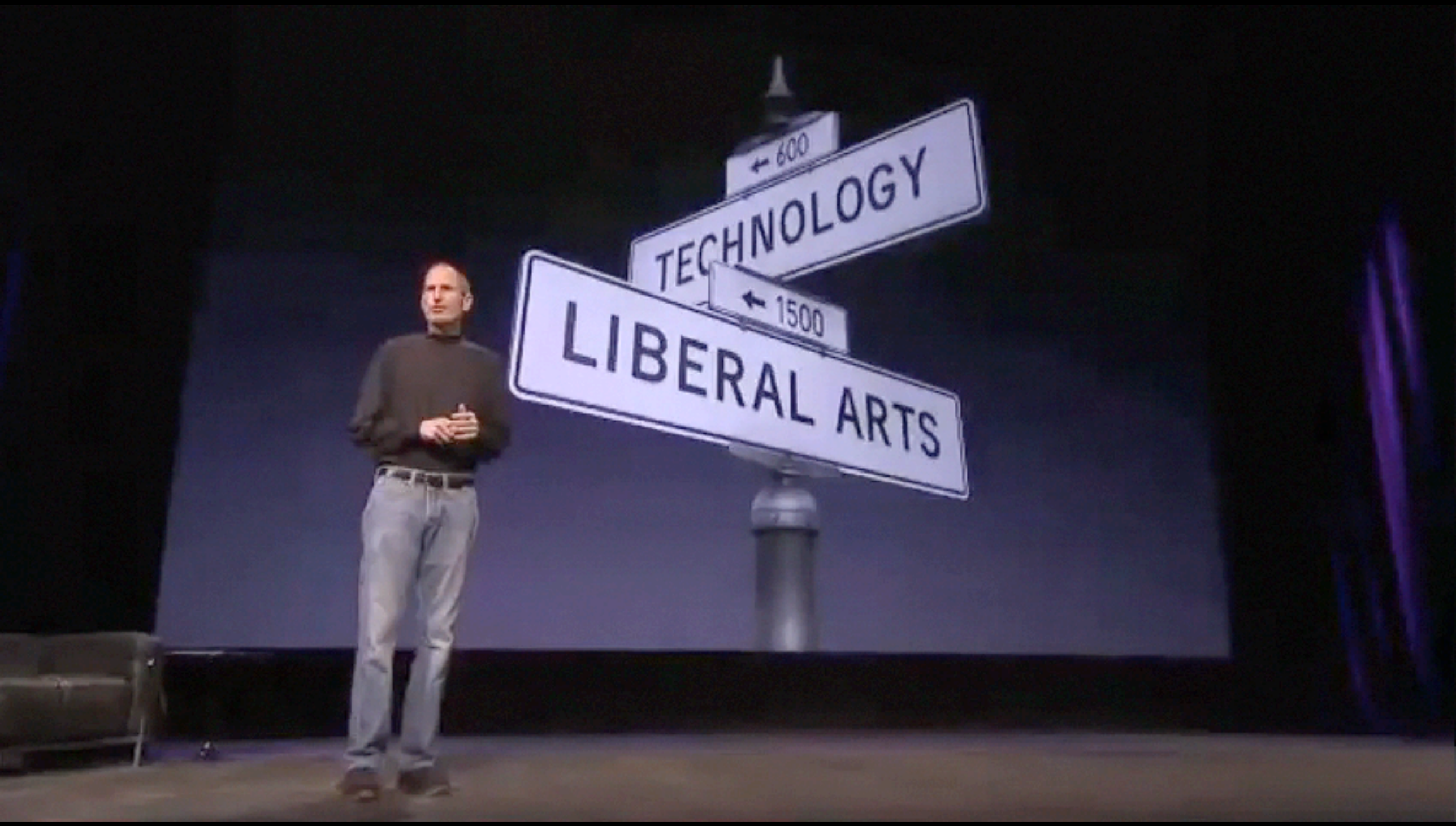


http://www.reactable.com

Design

Computer Science

Applied Psychology


← 600
TECHNOLOGY
← 1500
LIBERAL ARTS

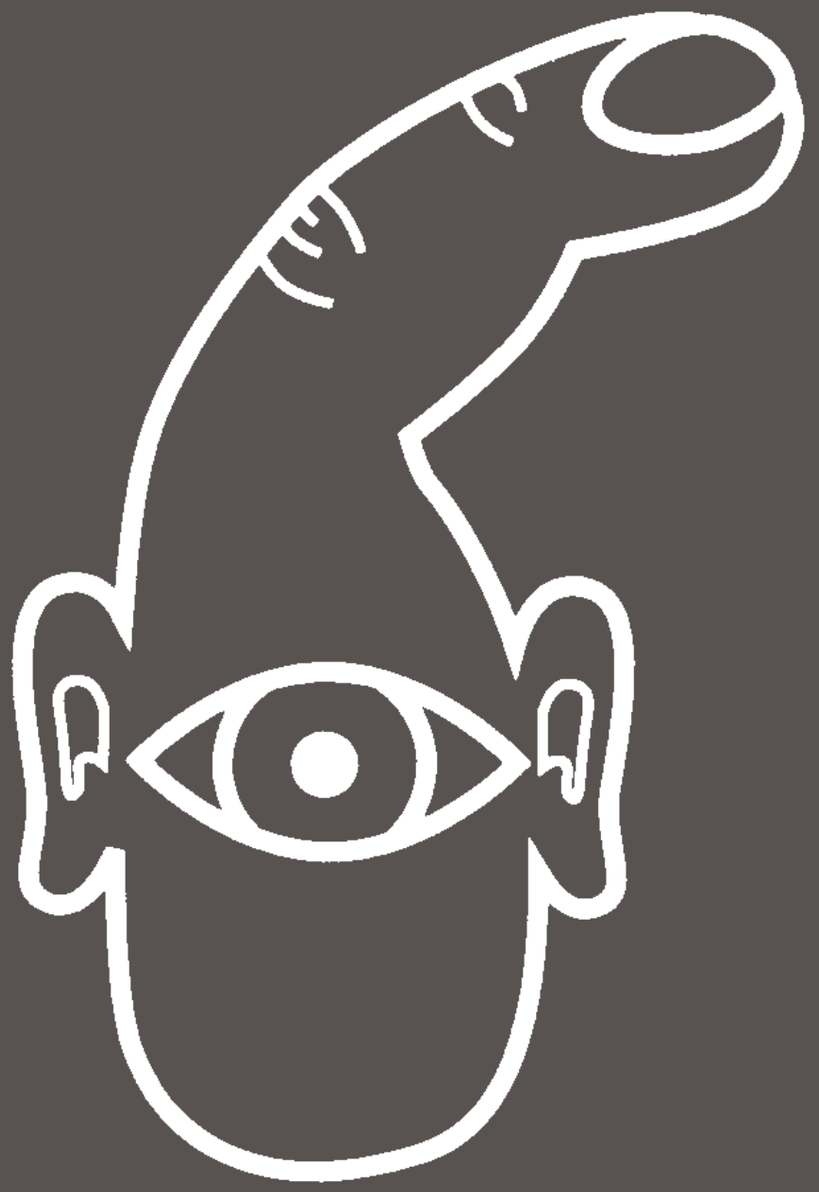
artist

scientist

designer

engineer

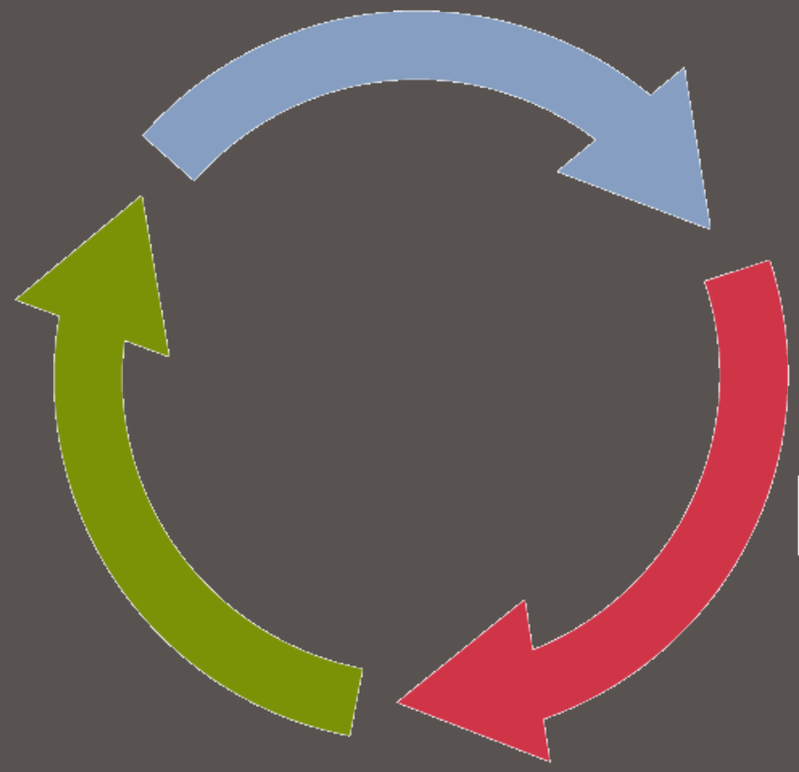
Rich Gold, *The Plenitude*, MIT Press



(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

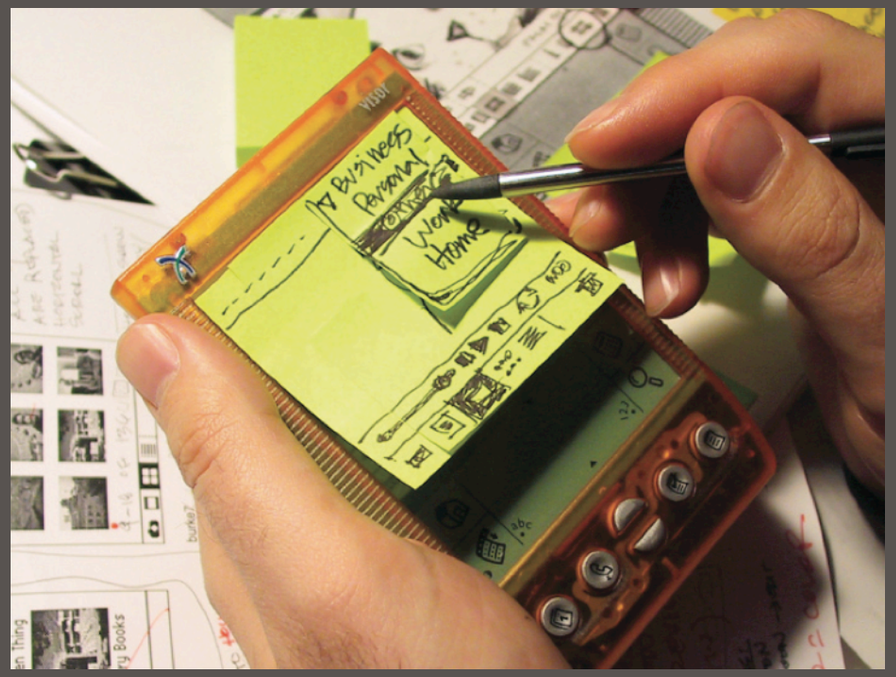
Low-fidelity techniques:

Paper prototyping

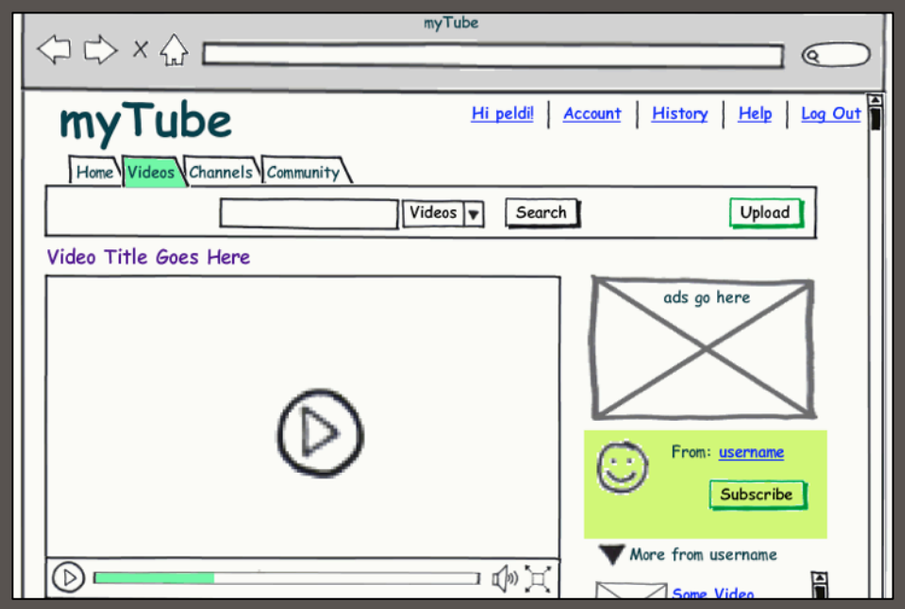
Video prototypes

Interactive prototypes:

HTML, Javascript, Flash, ...

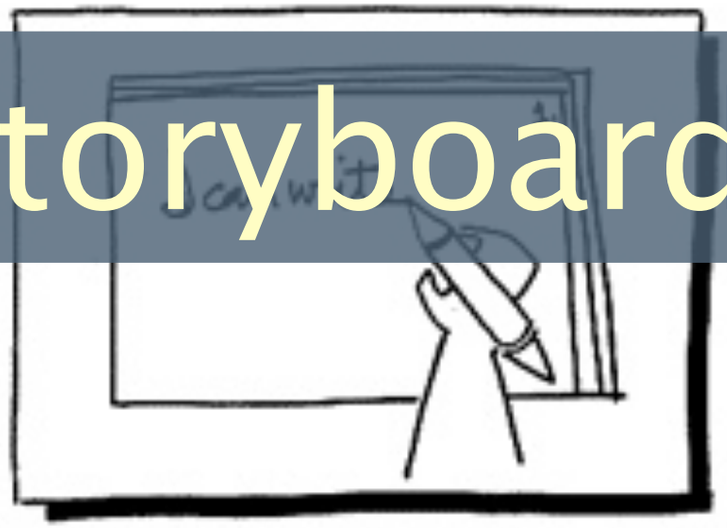


Moggridge, Designing Interactions, p.704



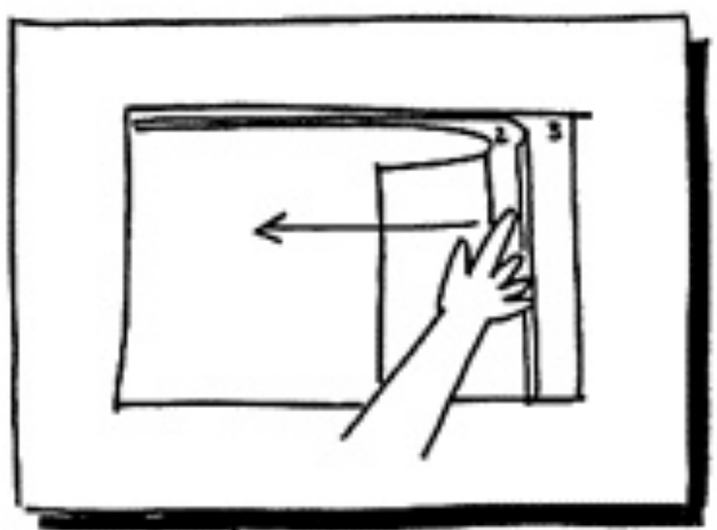
http://www.balsamiq.com/products/mockups/examples#wiki

Storyboarding

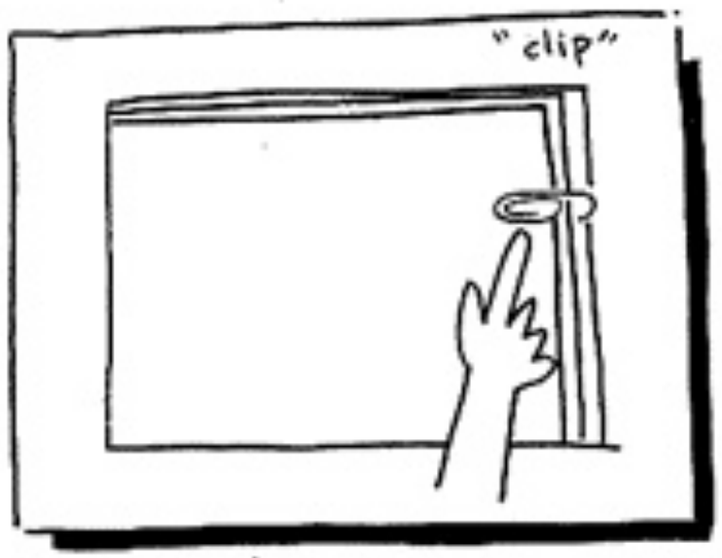


L. can write into her notebook.

She can flip over her pen and erase.



L. can flip to the next page.



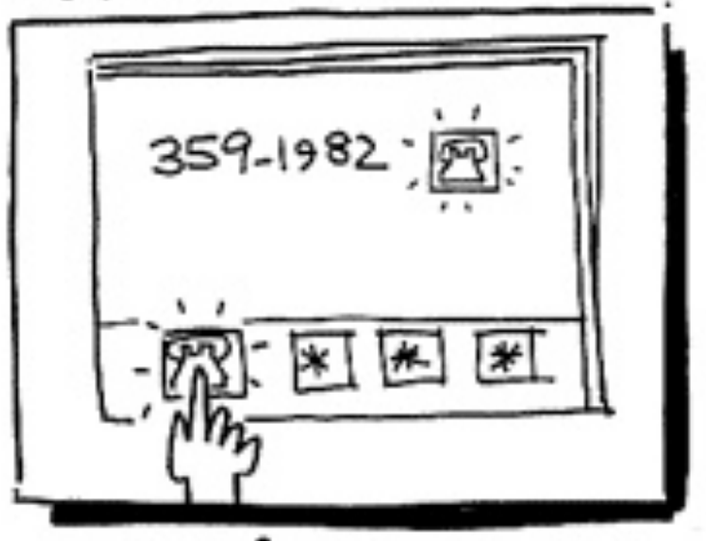
L. marks her place.

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?

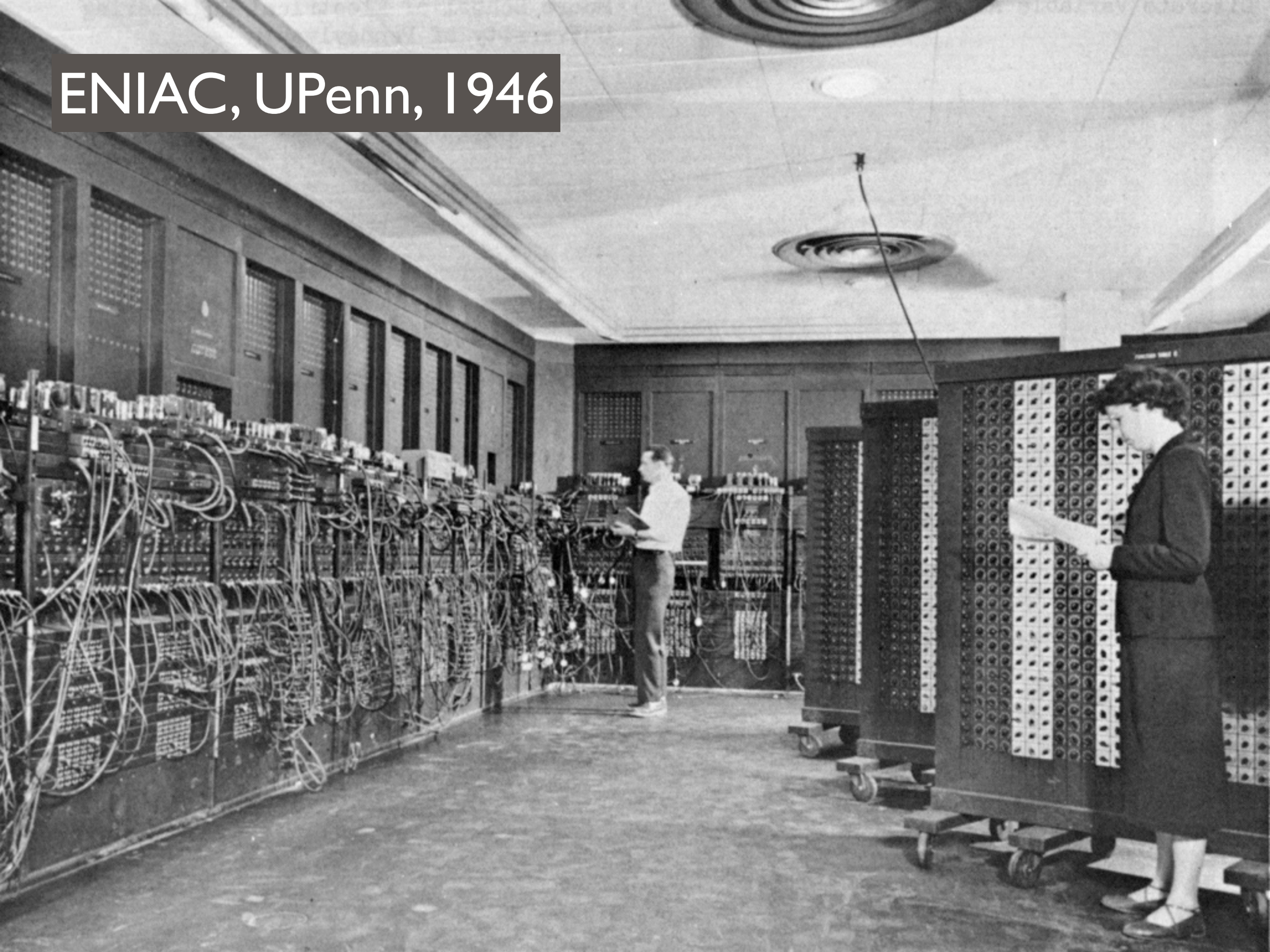
"The results show that in today's applications, an average of 48% of the code is devoted to the user interface portion.

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?

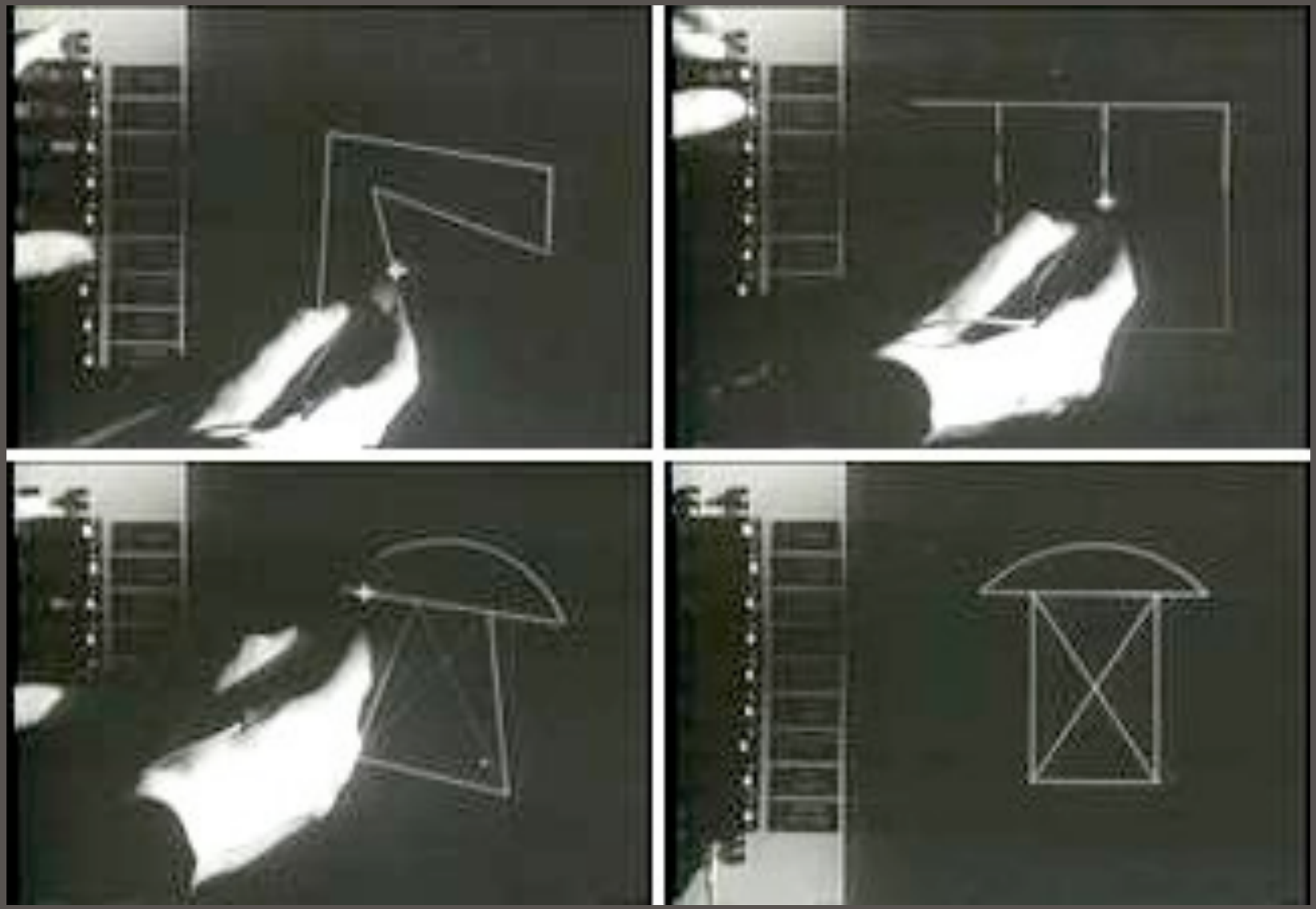
A. 1964

B. 1973

C. 1986

D. 1995

E. 2001



Ivan Sutherland, Sketchpad, MIT, 1963/64

digibarn.com

The new iPad

Which company introduced the touch screen phone?

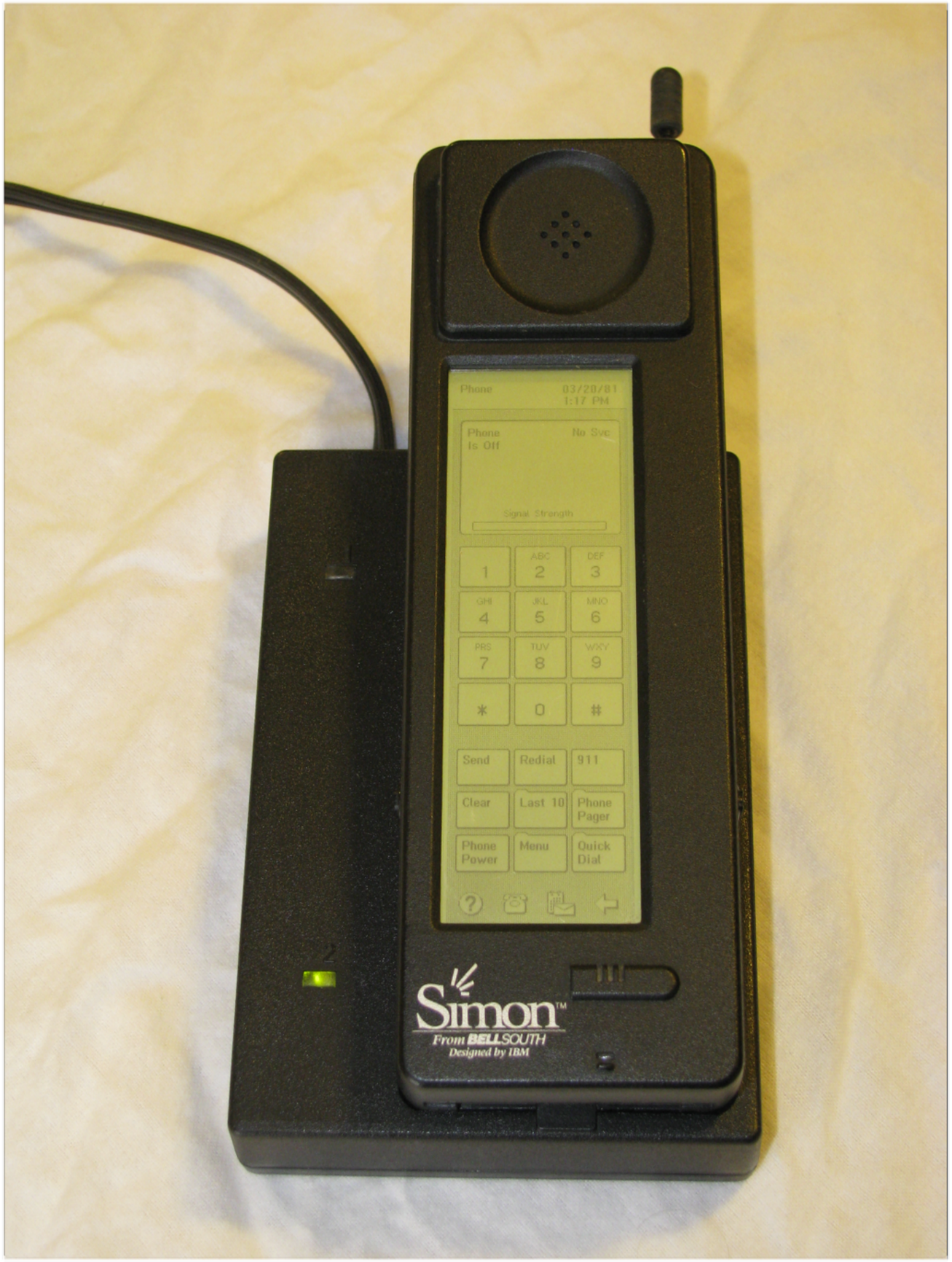
A. Nokia

B. Apple

C. Microsoft

D. IBM

E. Samsung



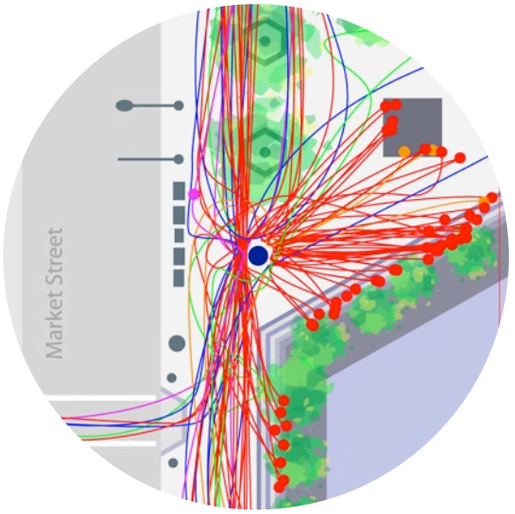
IBM Simon
1992

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


Market Street

i hate
PORTLAND
love
PORTLAND

042

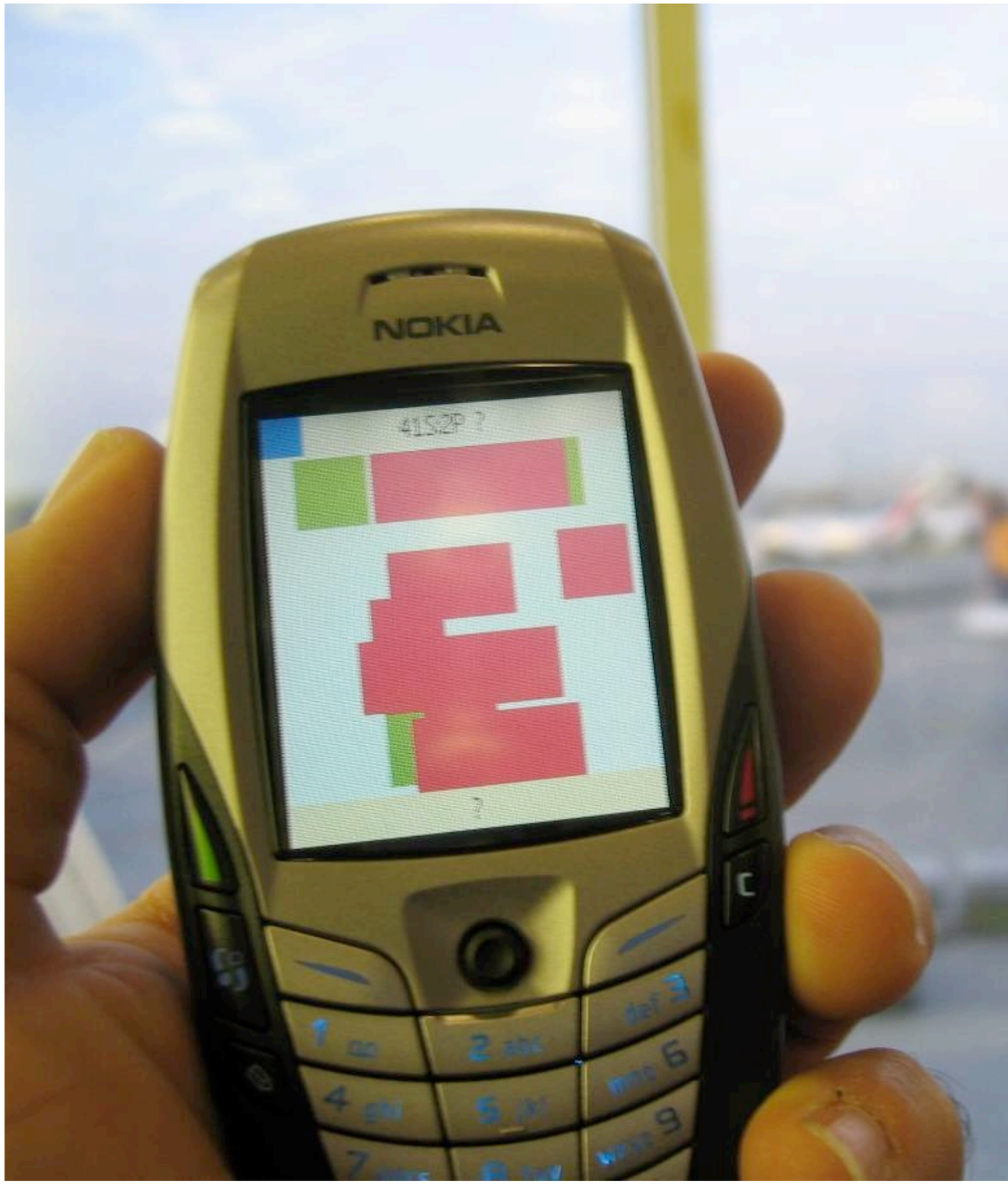
FEELS LIKE...?

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

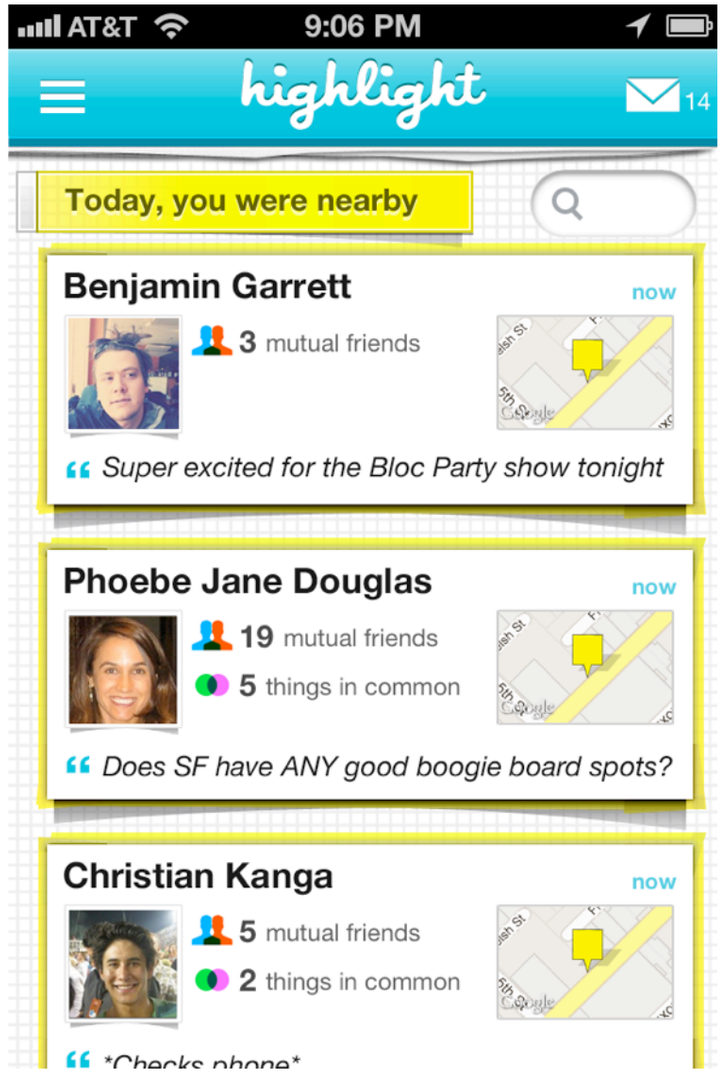

NOKIA

Nokia Sensor

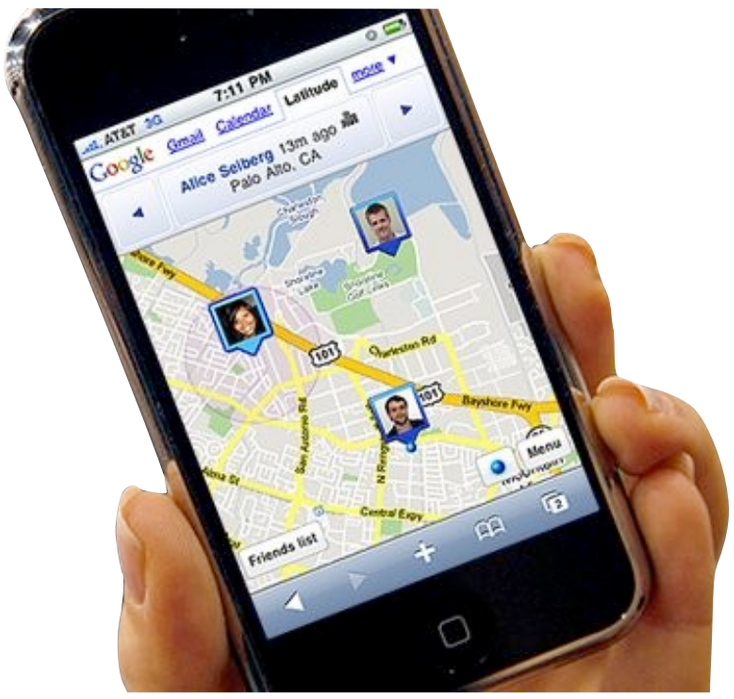
facebook

Facebook Places

Who. What. When. And now **where.**



Highlight



Google Latitude

foursquare

Sonar

Banjo

Gauss

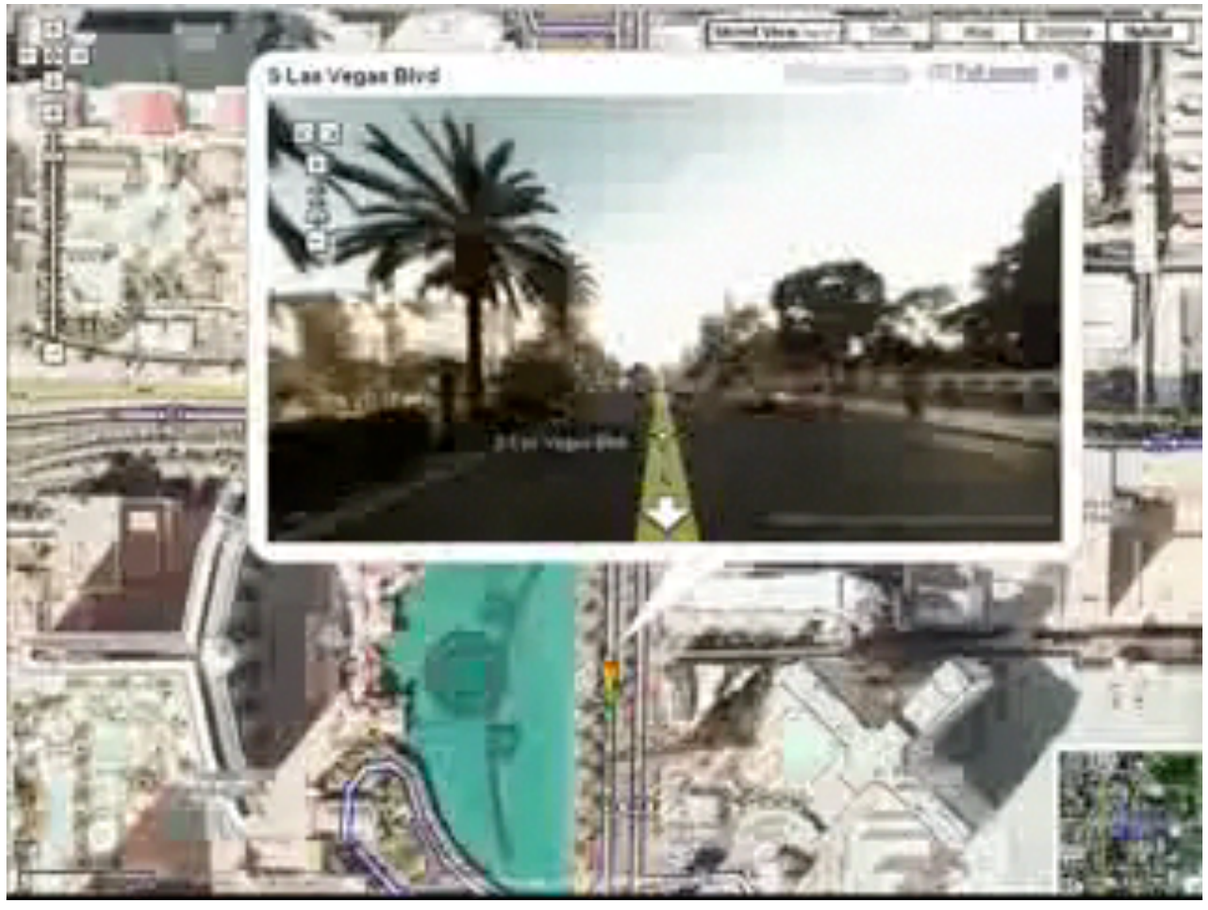
Glancee

Stanley Milgram 1971

Vito Acconci Following Piece 1969

Sophie Calle Please Follow Me 1983

Aspen Movie Map
Michael Naimark
1978



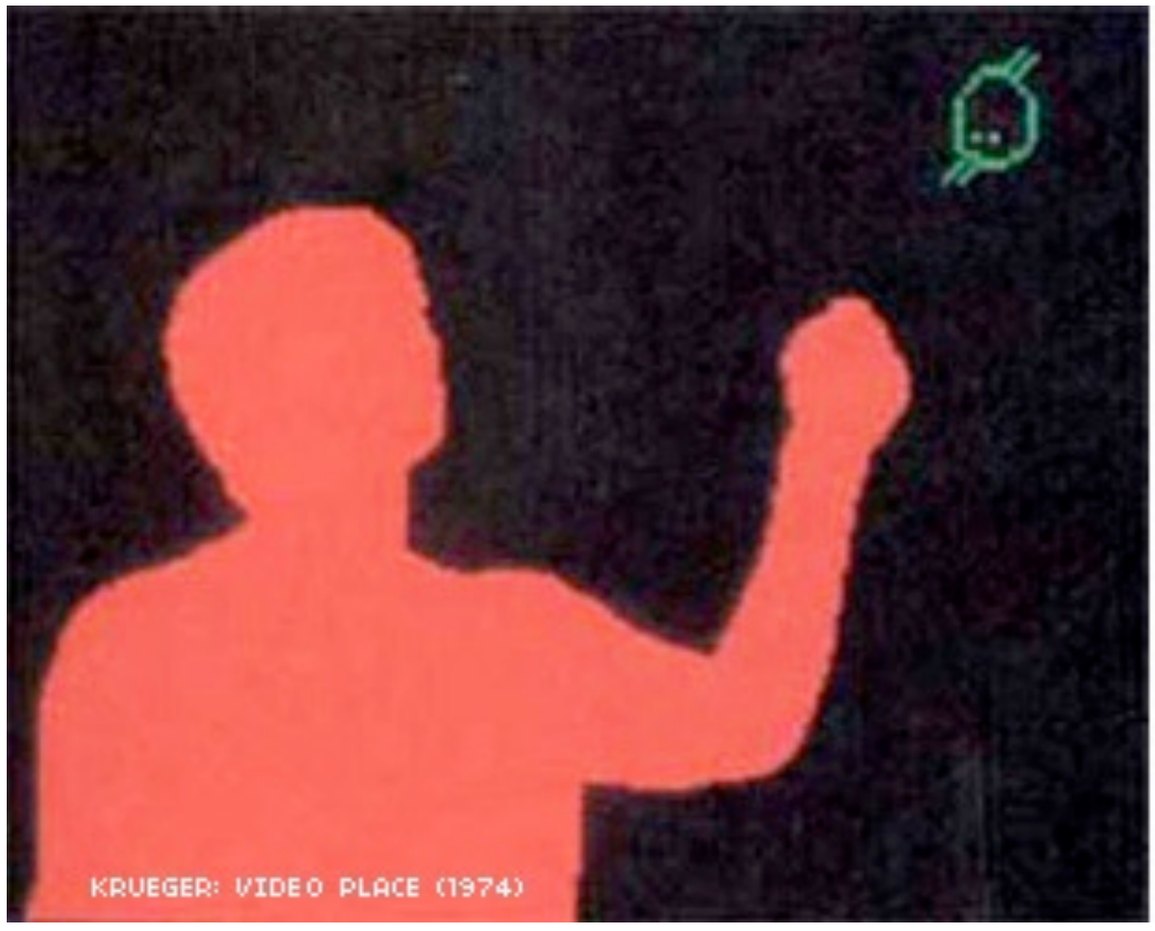
Street View
Google
2007

Michael Naimark & MIT ArchMac's Aspen Movie Map

1978-1980

Google StreetView

2007



Video Place

Myron Krueger

1974

EyeToy

Sony

2003

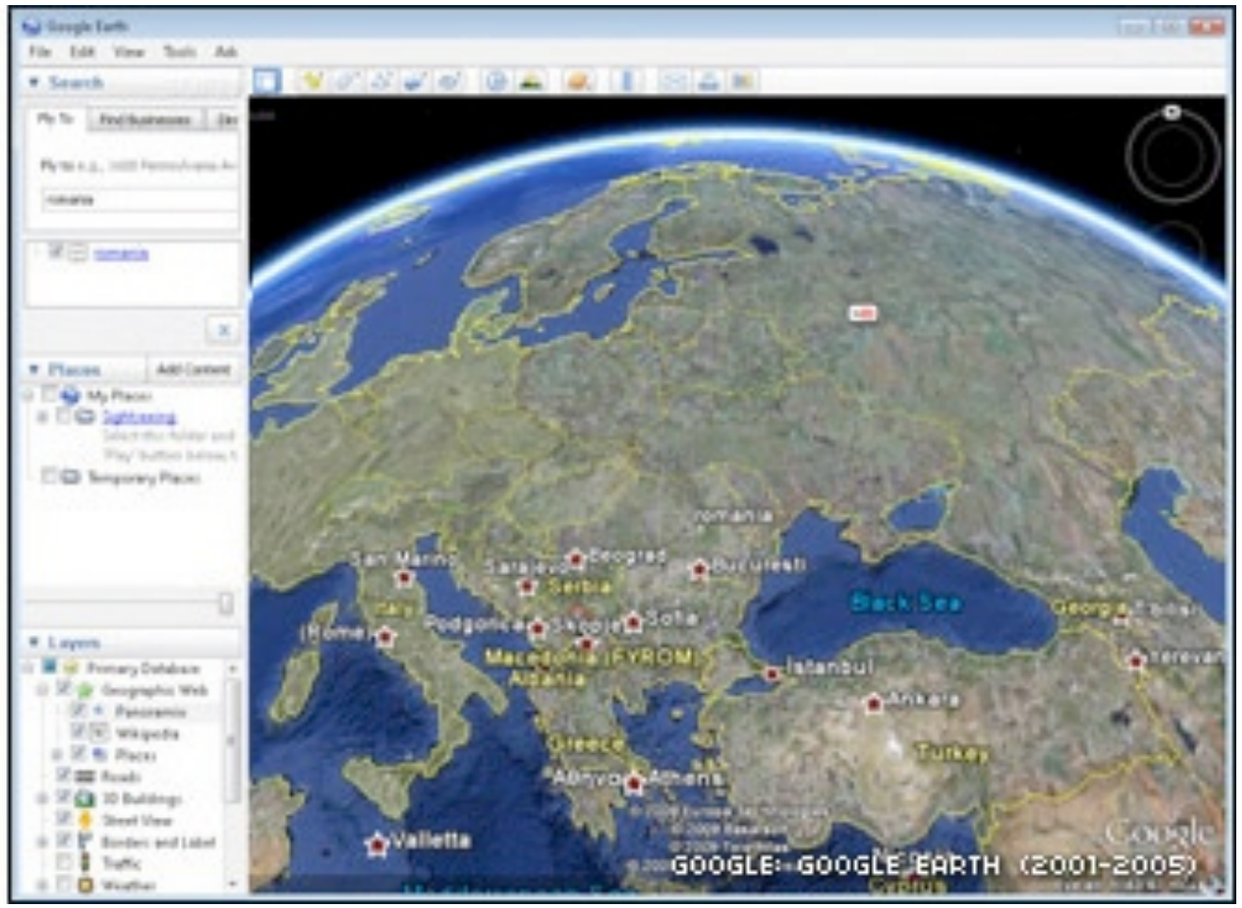
Legible City
Jeffrey Shaw
1988

E-fitzone exercise equipment
2008

Terravision

Art+Com

1996



Google Earth

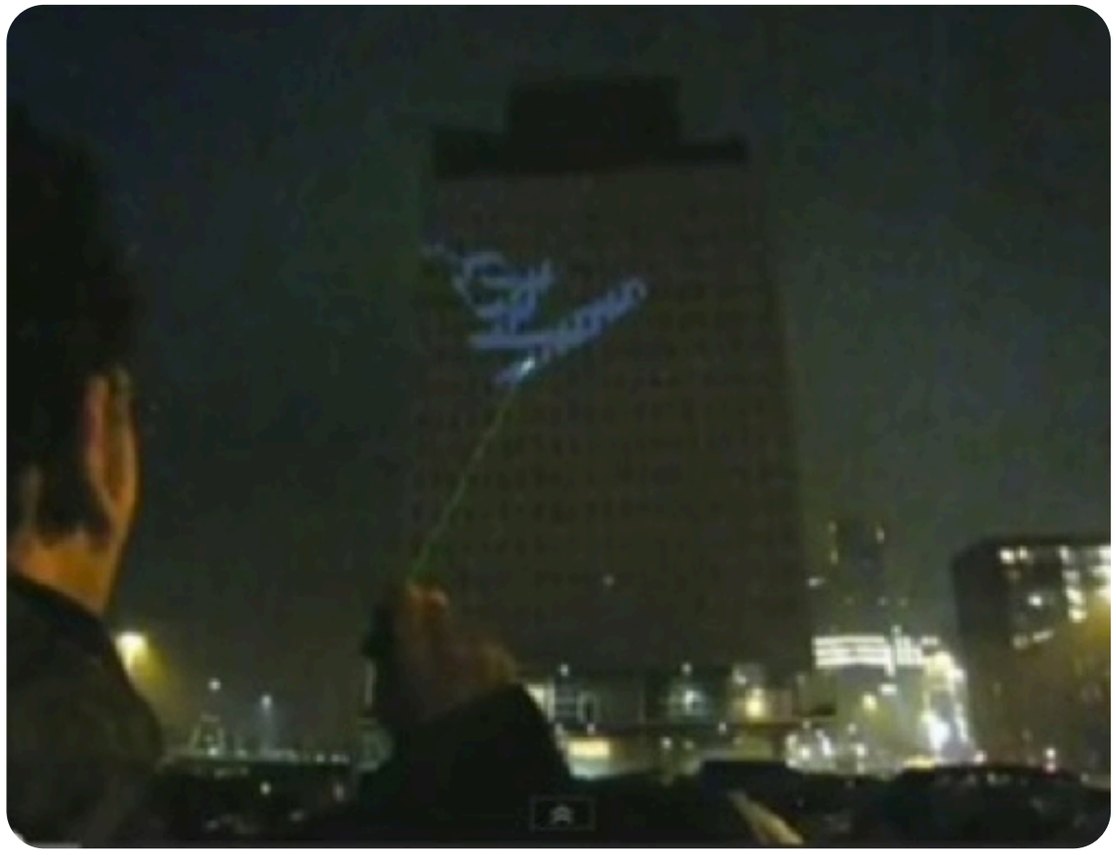
2005

GraffitiWriter & Streetwriter
Institute for Applied Autonomy
1998-2004

Nike Chalkbot
2009

The Telegarden
Ken Goldberg
1995

FarmVille
Zynga
2009



Graffiti Research Lab
L.A.S.E.R. Tag
2007

Graffiti by Agents of Change
all natural Cola by Red Bull
2009

Context Photography
Maria Håkansson and Lars Erik Holmquist
2003

Instagram
2010

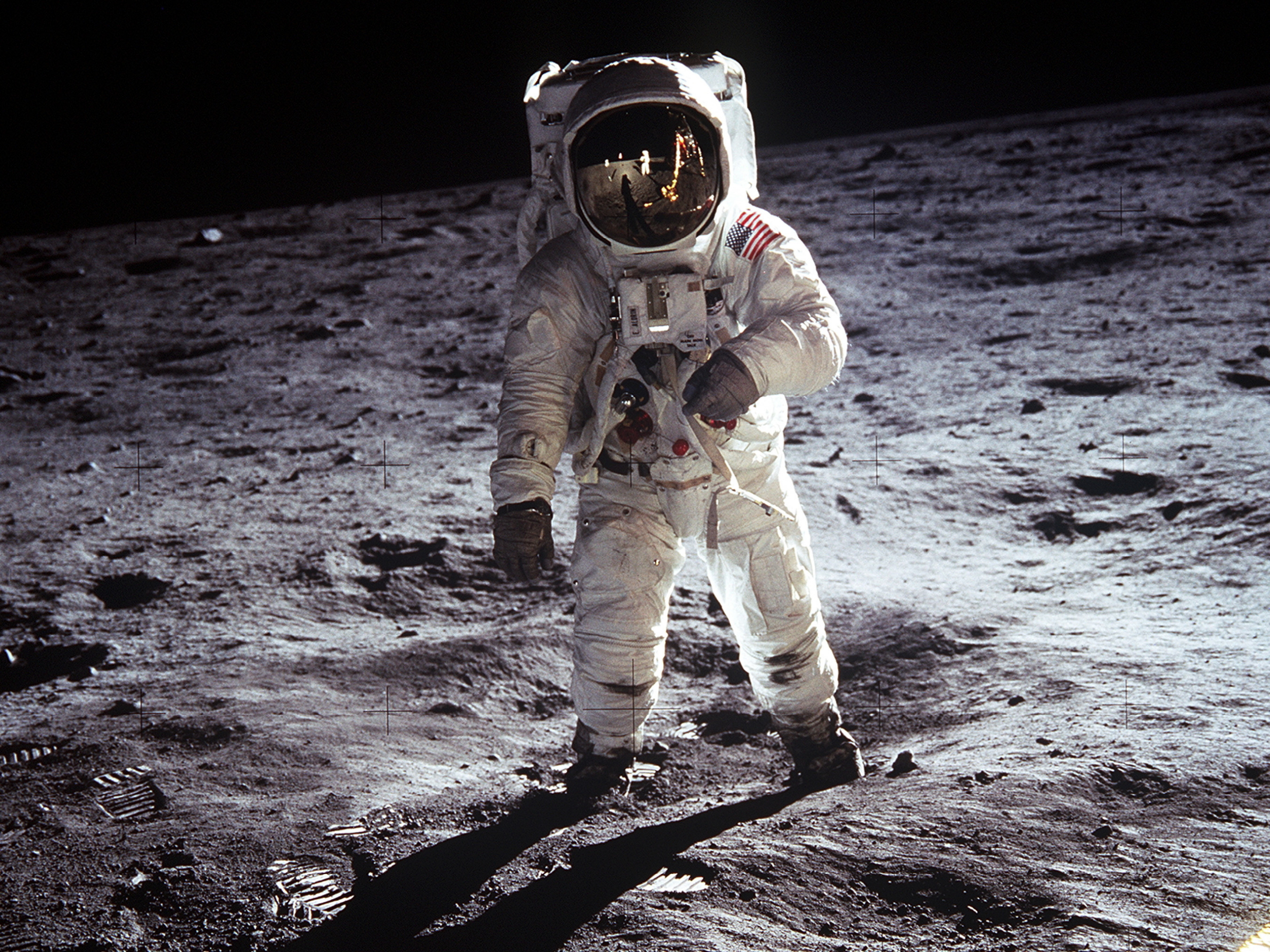
TXTMob

Institute for Applied Autonomy

2004

Twitter

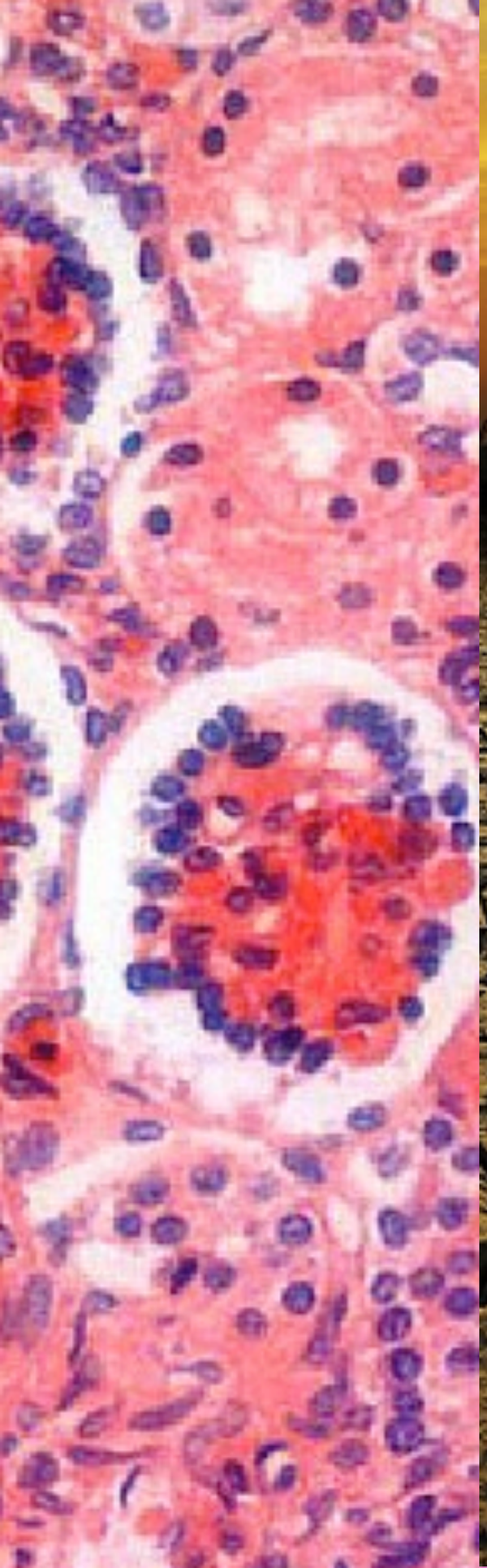
2006



GREENWICH MEAN TIME | ORBIT NUMBER | HOLD | COUNTDOWN | PROCEED | ELAPSED TIME | TIME TO RETROFIRE

KNO ZZB IOS MUC WOM

CTN HAW CAL GYM TEX CNV BDA ATS CYI



Turbulence
Job Cuts
Profit
Joble
Ecc
arket Dec

Micro Volunteerism

wicked problems

Dilemmas in a General Theory of Planning, 1973
Horst Rittel and Melvin Webber

DESIGN RESEARCH

is an inquiry focused on
producing
a contribution of
knowledge

NOT

to directly inform
the development
of a commercial product

wicked problems

street crime

disarm police?

repeal laws that define crime?

substitute ethical self-control for police and courts?

shoot criminals and thus reduce
the numbers who commit crimes?

give away free loot to would-be-thieves
to reduce incentive?

DESIGN	VS	DESIGN RESEARCH
affirmative		critical
problem solving		problem making
provides answers		asks questions
in the service of industry		in the service of society
for how the world is		for how the world could be
science-fiction		social-fiction
futures		parallel worlds
fictional functions		functional fictions
change the world to suit us		change us to suit the world
anti-art		applied art
research for design		research through design
applications		implications
design for production		design for debate
fun		satire
consumer		citizen
user		person
makes us buy		makes us think

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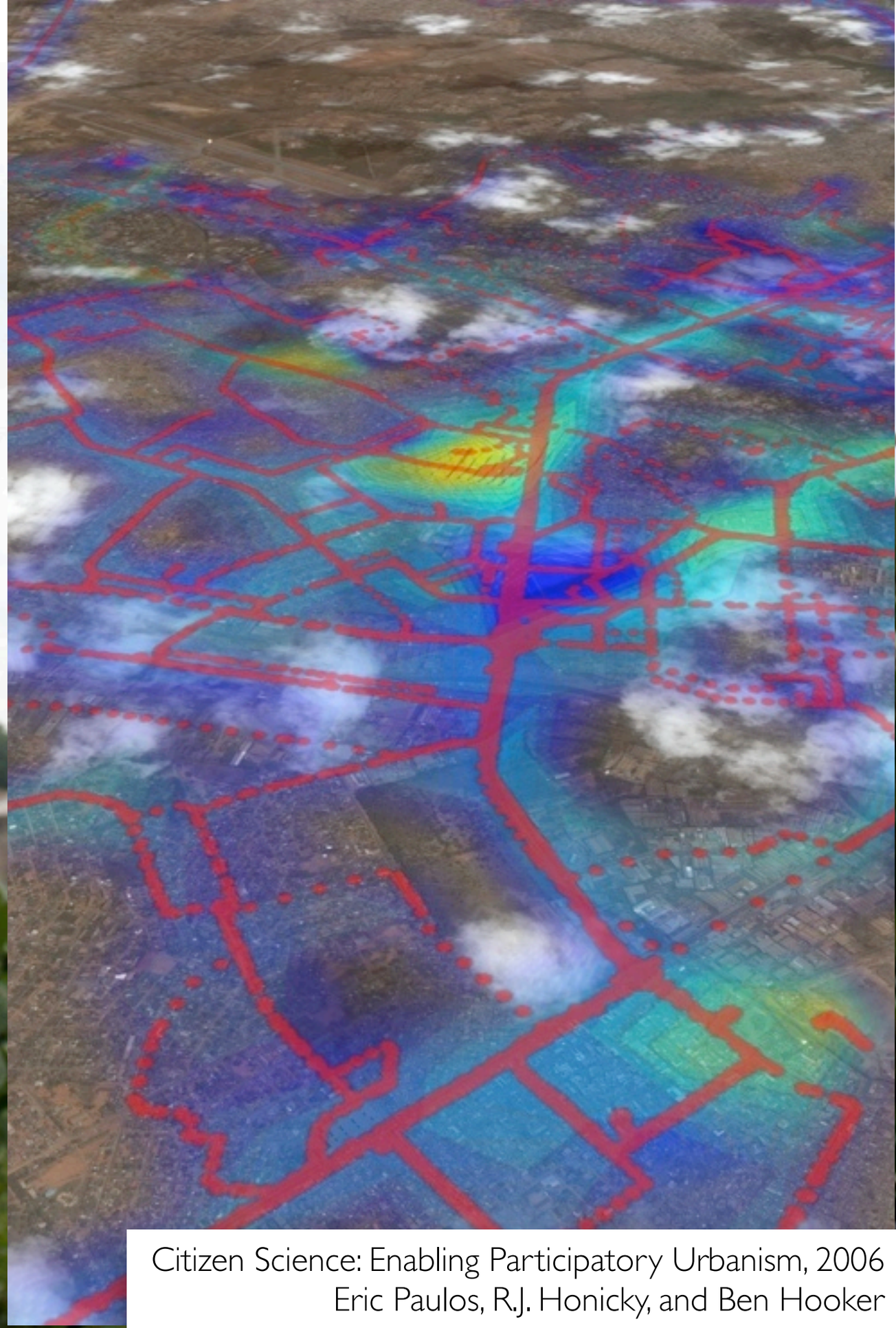
Citizen Science

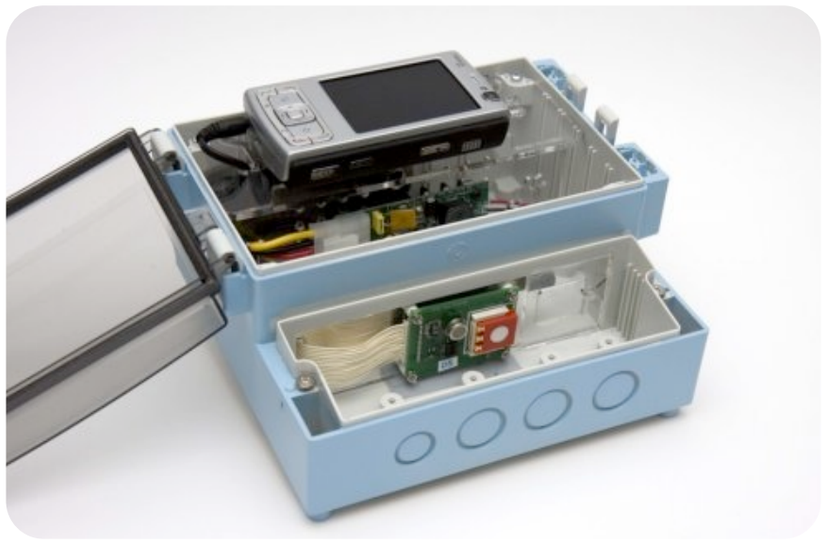


Citizen Science: Enabling Participatory Urbanism, 2006
Eric Paulos, R.J. Honicky, and Ben Hooker

Prius Effect

indoor fixed

mobile infrastructure



public placed

Eric Paulos
Allison Woodruff
Paul Aoki
Alan Mainwaring
RJ Honicky

CO

NOx

Ozone

Temperature

Humidity

Accelerometer

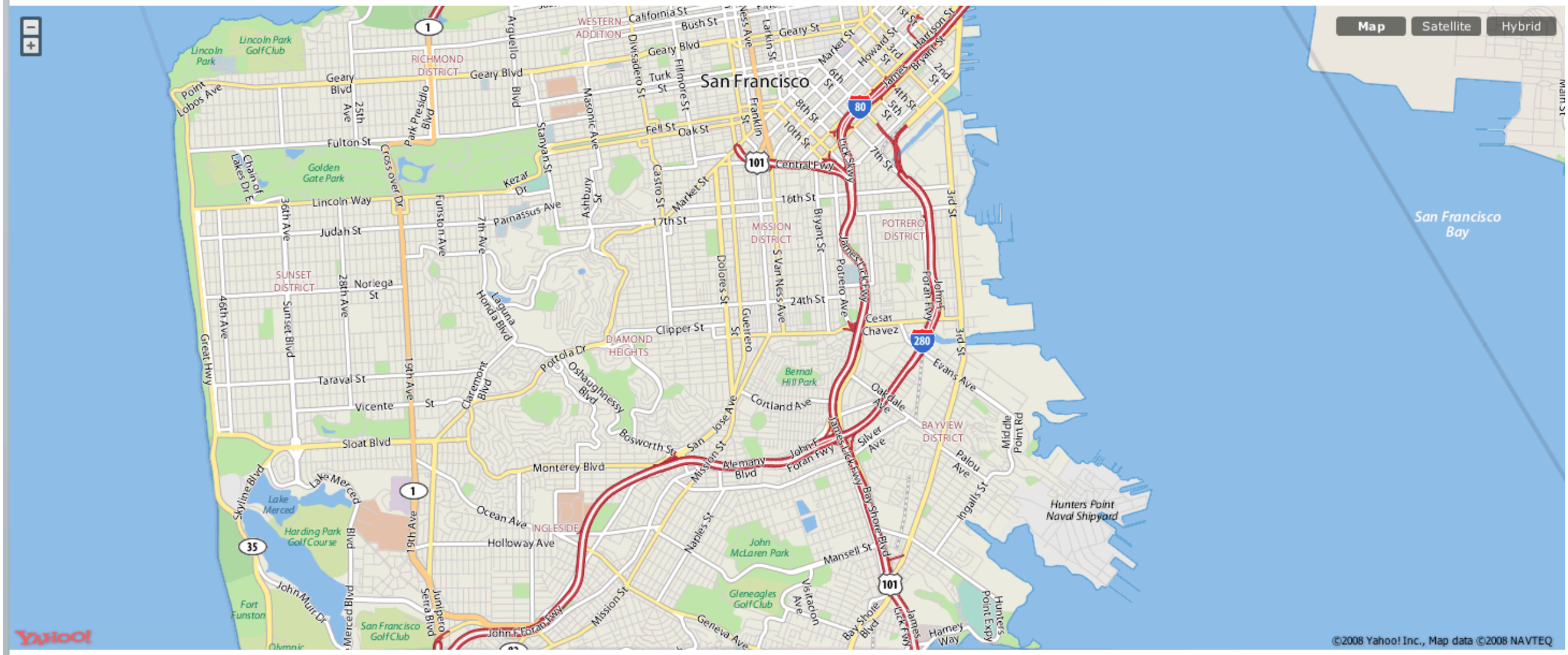
SAN FRANCISCO AIR QUALITY

SELECT MODE DAY

CHOOSE DATE Thr 24 July

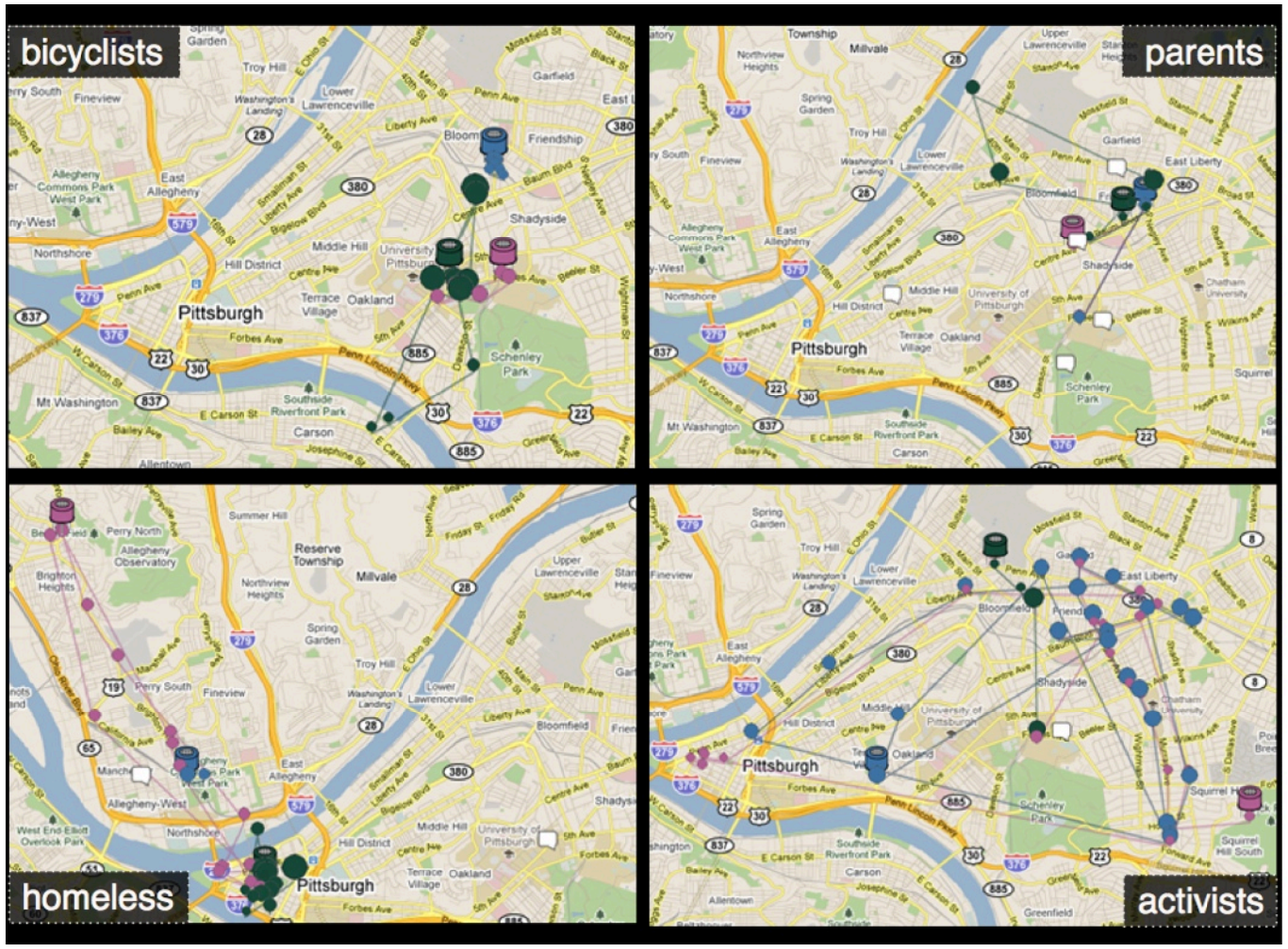
CHOOSE SPEED FAST

CHOOSE SENSOR Carbon Monoxide (CO)

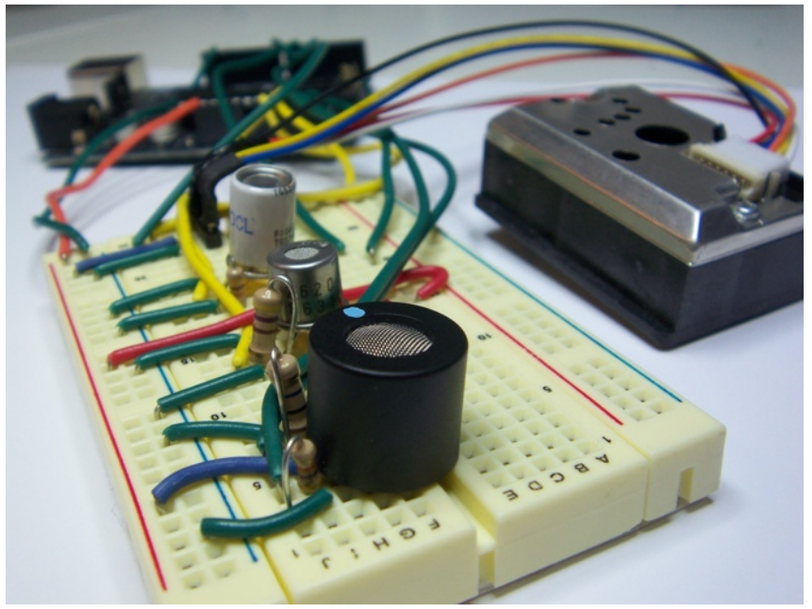


Fri Jul 25 09:03:19

Community Sensing

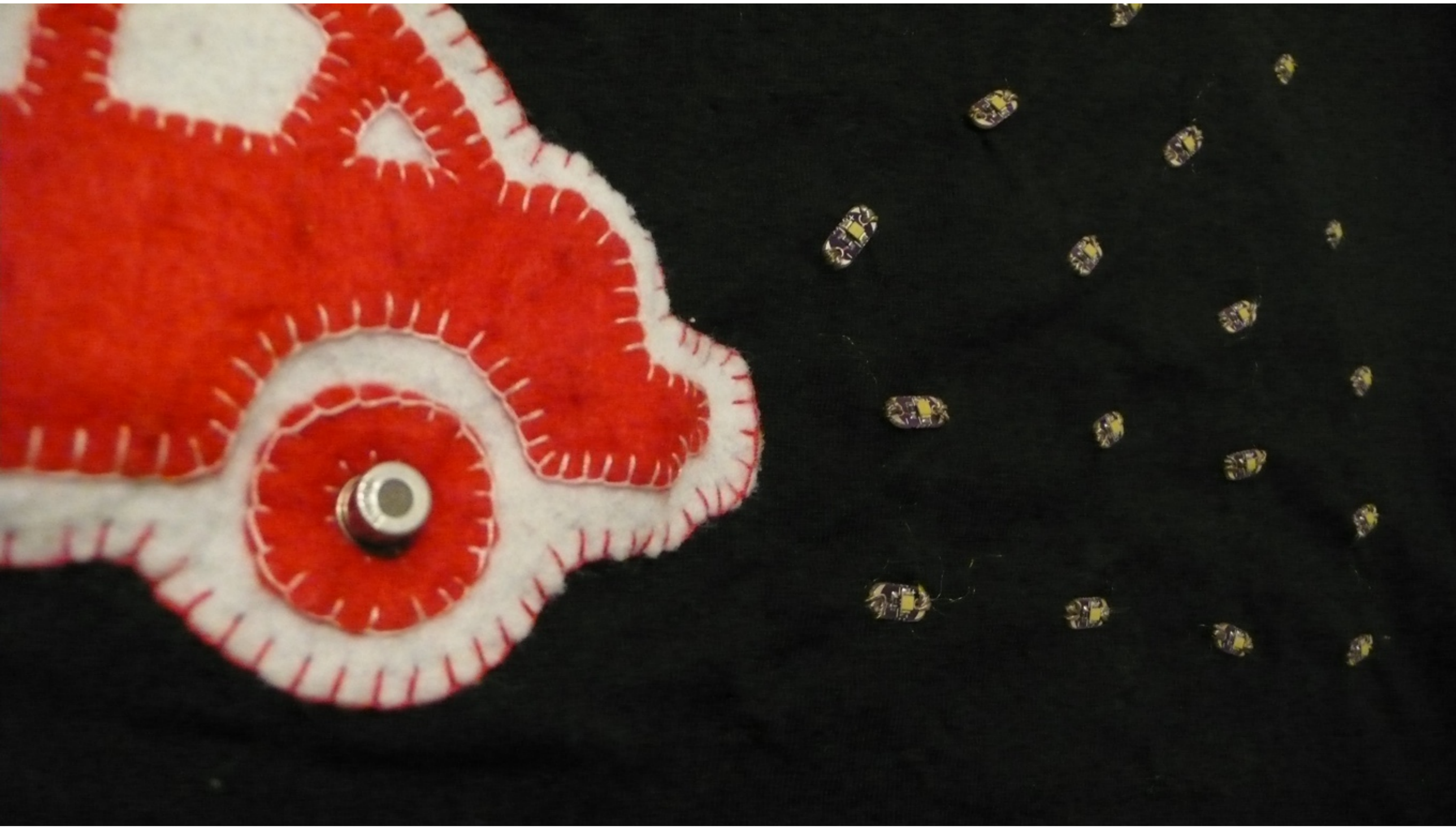


Empowering civic engagement with place based community shared environmental sensors



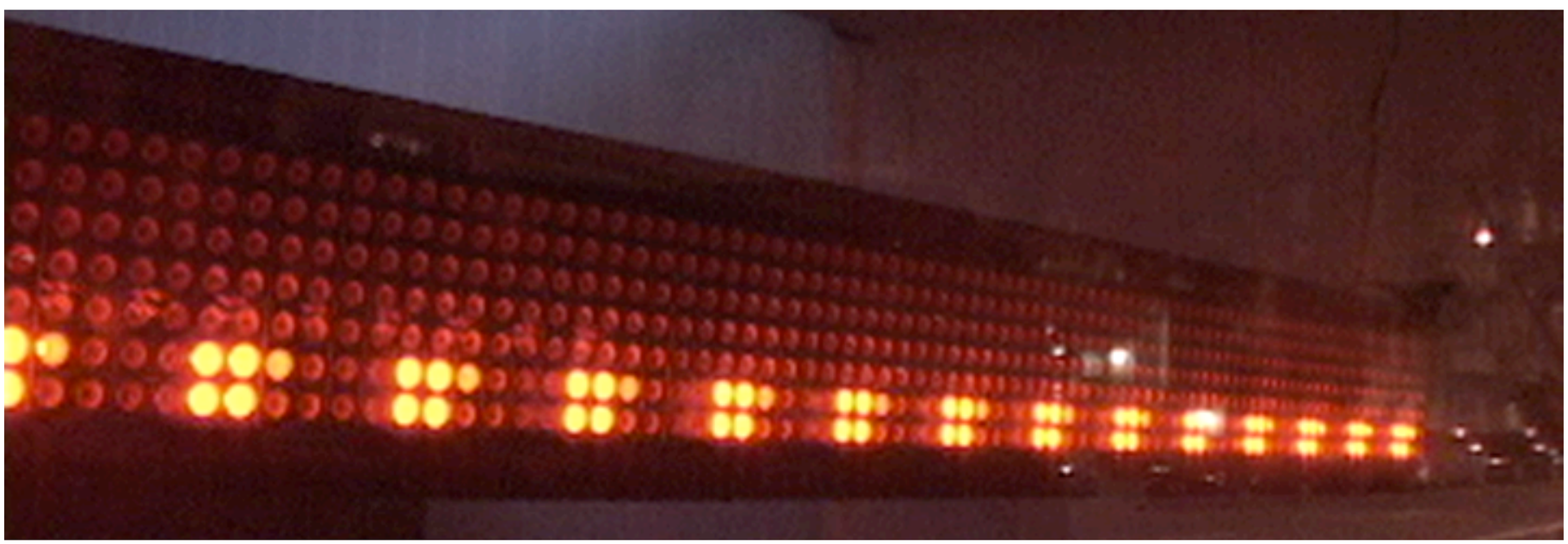
Ceci N'est Pas Une Pipe Bombe: Challenges to Urban Authoring and Participatory Sensing
Stacey Kuznetsov, George Noel Davis, Jian Chiu Cheung, and Eric Paulos, ACM SIGCHI, 2011

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

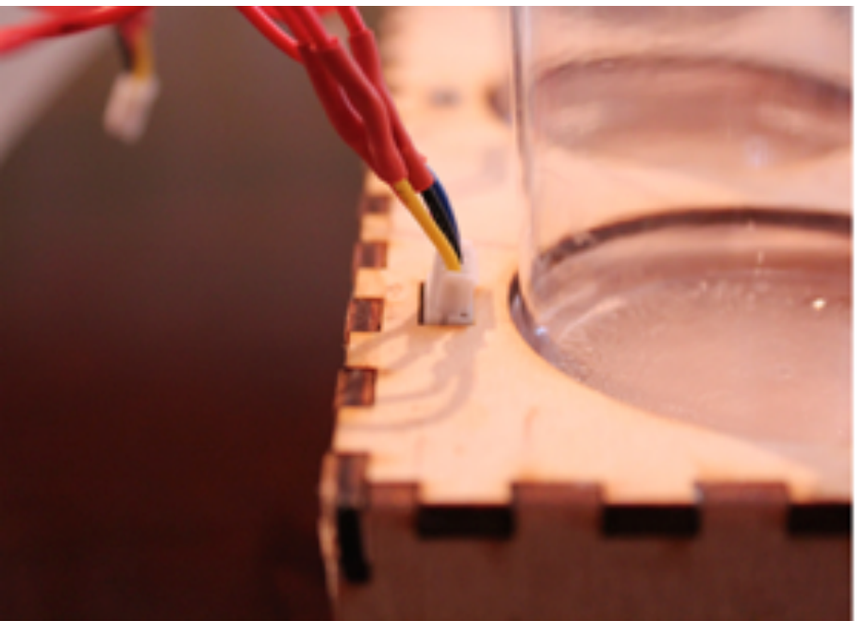
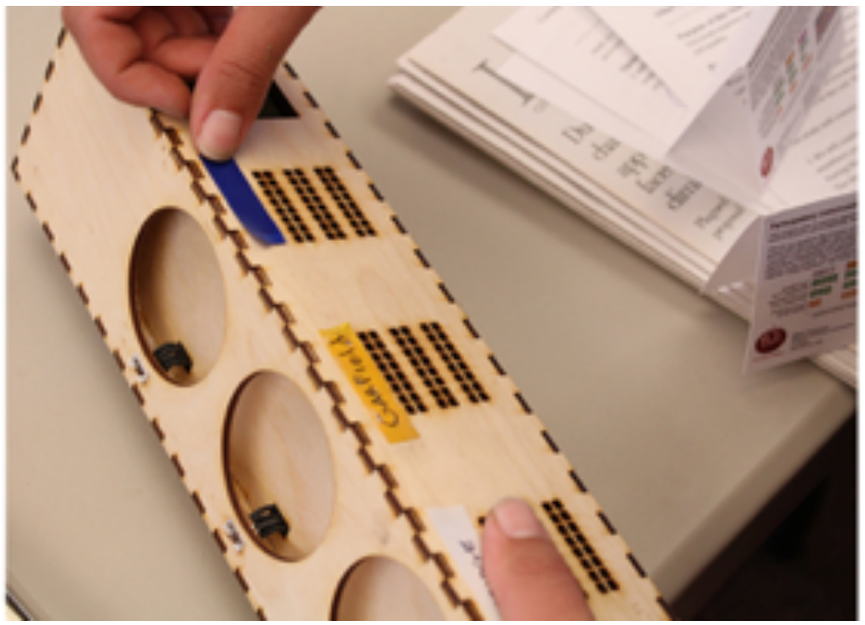
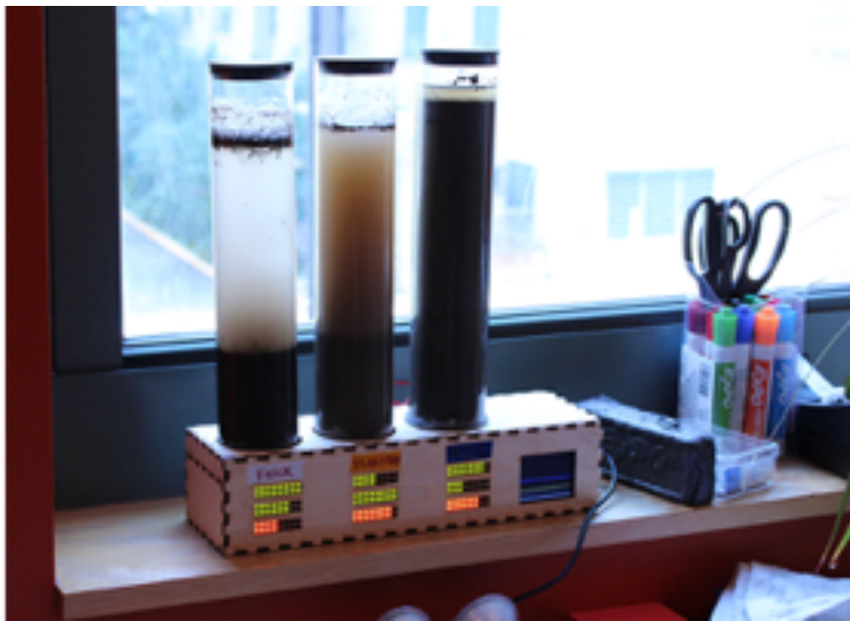


WearAir: Expressive T-shirts for Air Quality Sensing
Sunyoung Kim, Eric Paulos, and Mark Gross
Tangible Embedded and Embodied Interaction, 2010

BREATHE



Spectacle Computing

diy bio sensing

thanks

@epaulos