

# Human-Computer Interaction



Björn Hartmann  
University of California, Berkeley  
EECS, Computer Science Division  
CS10, Spring 2012

# | My Background

1997-2002



1999-2004



Jay Haze  
Club Milk, Tokyo, 2003

2004-2009



2010



# | What is HCI?

# Human-Computer Interaction (HCI)

## Human

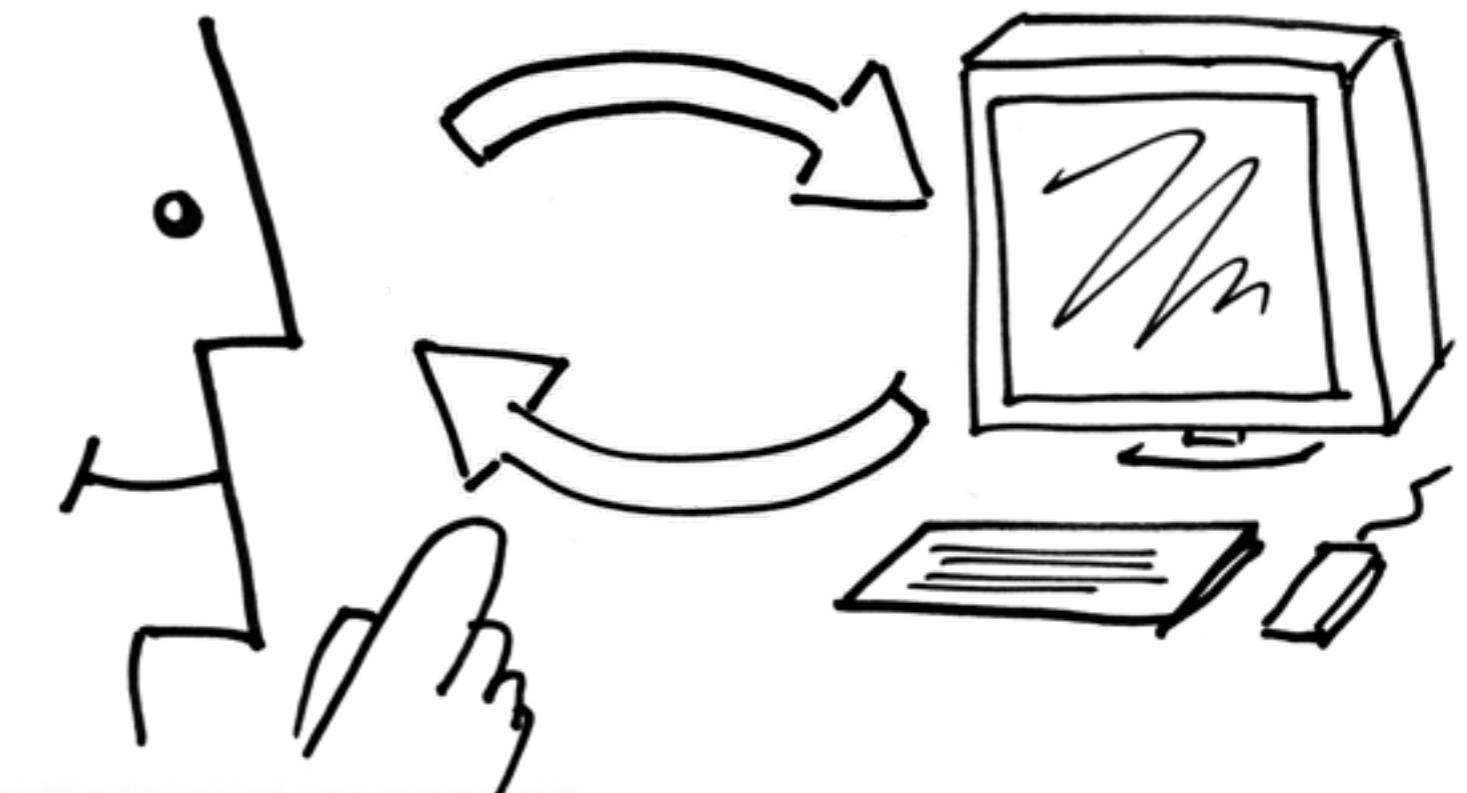
- End-user of program
- Others (friends, collaborators, coworkers)

## Computer

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

## Interaction

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



# User Interfaces (UIs)

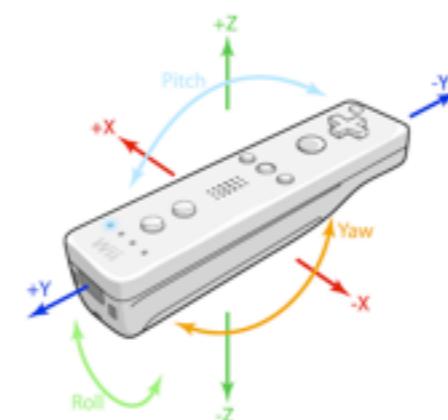
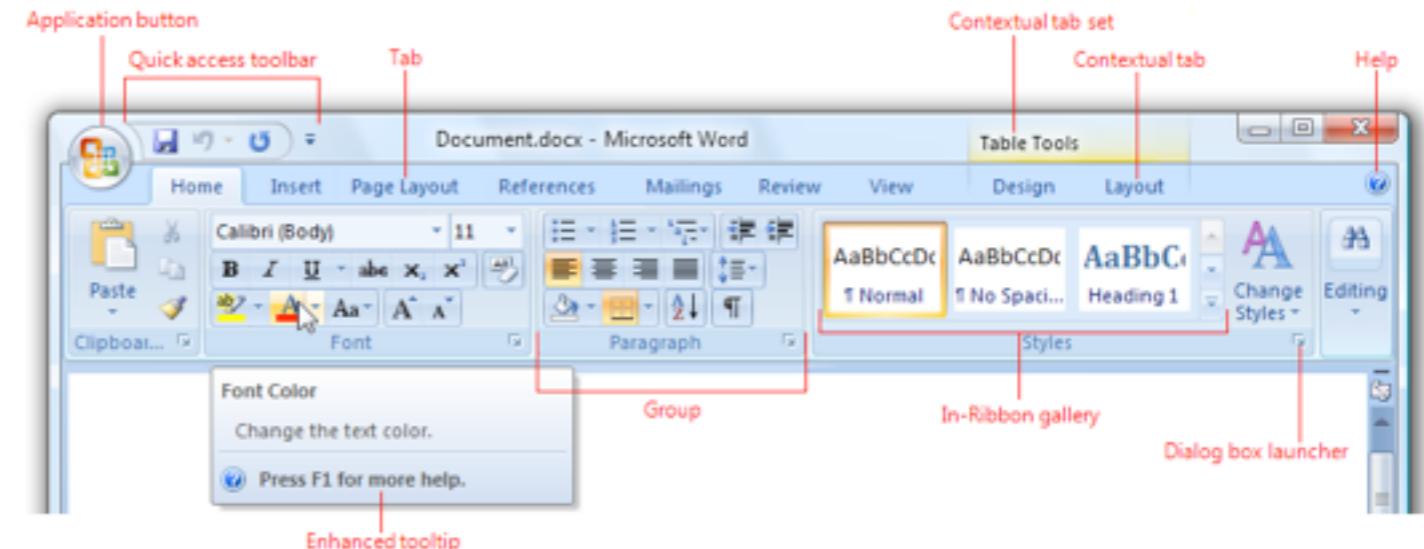
Part of application that allows

- People to interact with computer
- Computer to communicate results

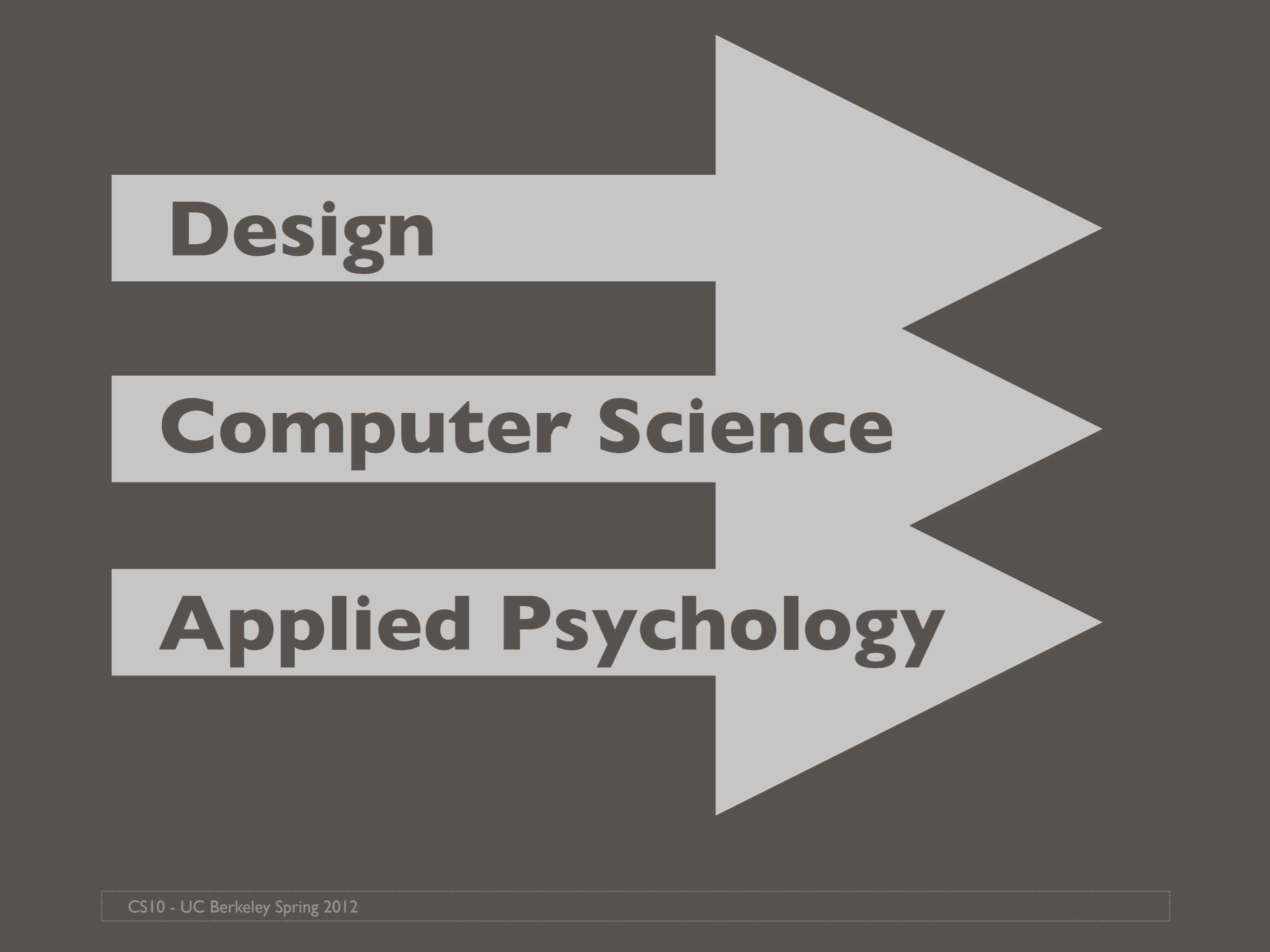
Can include hardware design

- Buttons, sliders, other sensors

**HCI =  
design,  
prototyping,  
implementation &  
evaluation of UIs**



<http://www.reactable.com>



# **Design**

# **Computer Science**

# **Applied Psychology**

artist



scientist



designer

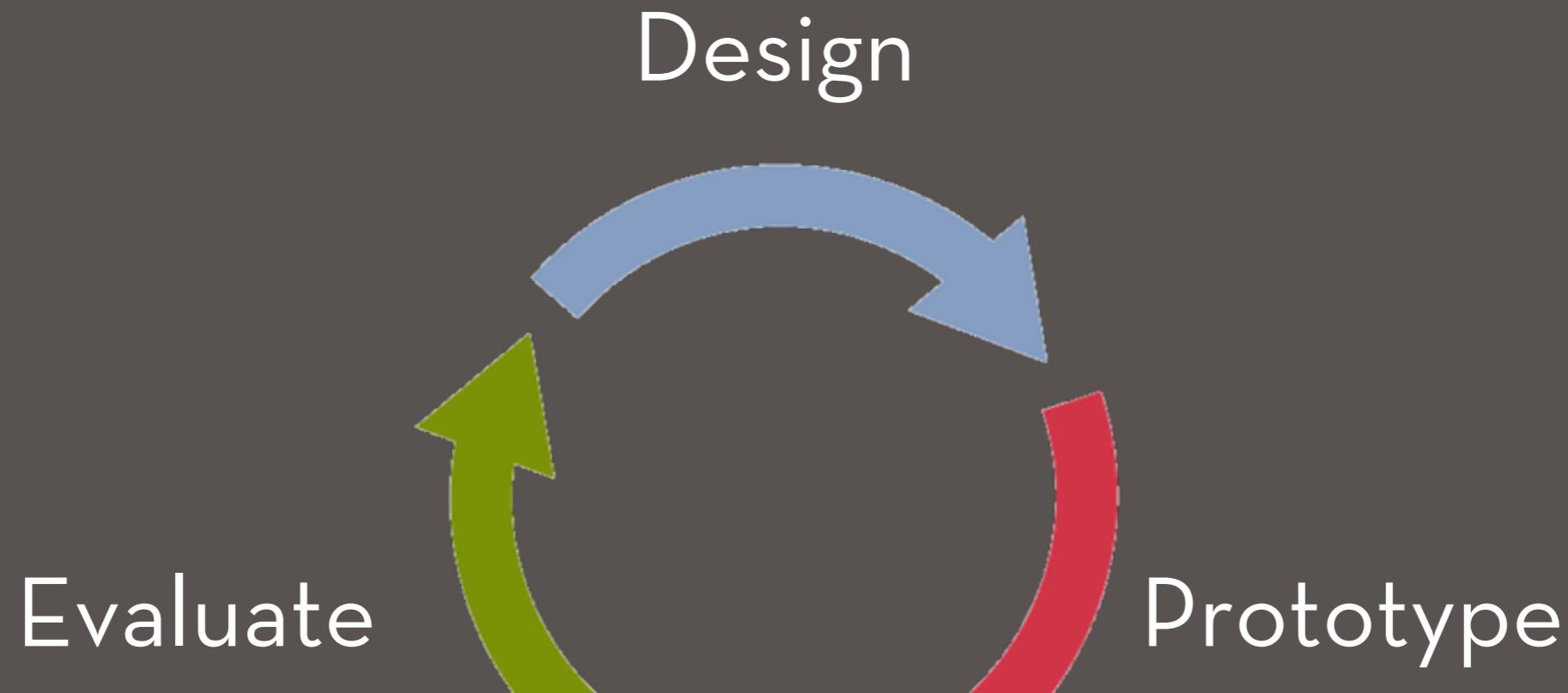


engineer



Rich Gold, *The Plenitude*, MIT Press

# Iterative Design Cycle



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

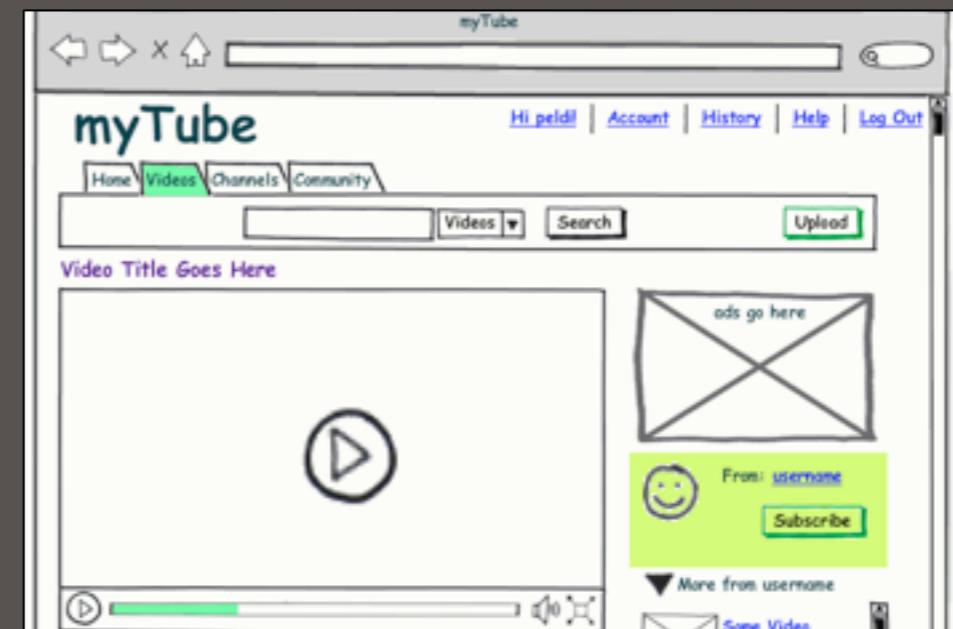
Rapidly build a mockup  
of your UI

Low-fidelity techniques:  
Paper prototyping  
Video prototypes

Interactive prototypes:  
HTML, Javascript, Flash, ...

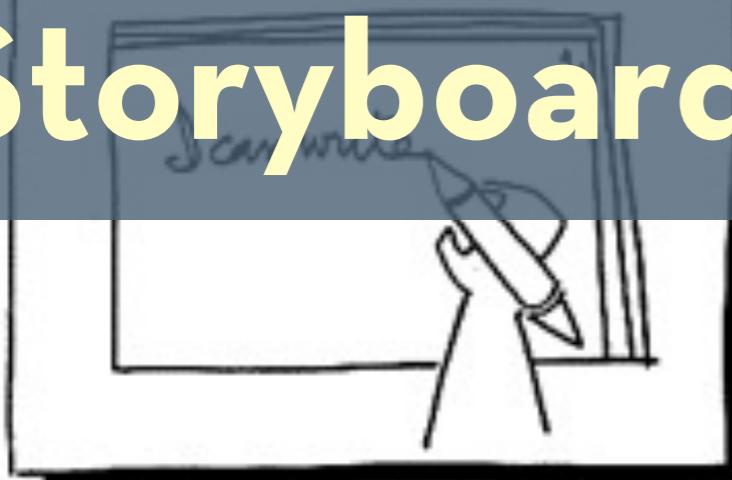


Moggridge, Designing Interactions, p.704



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

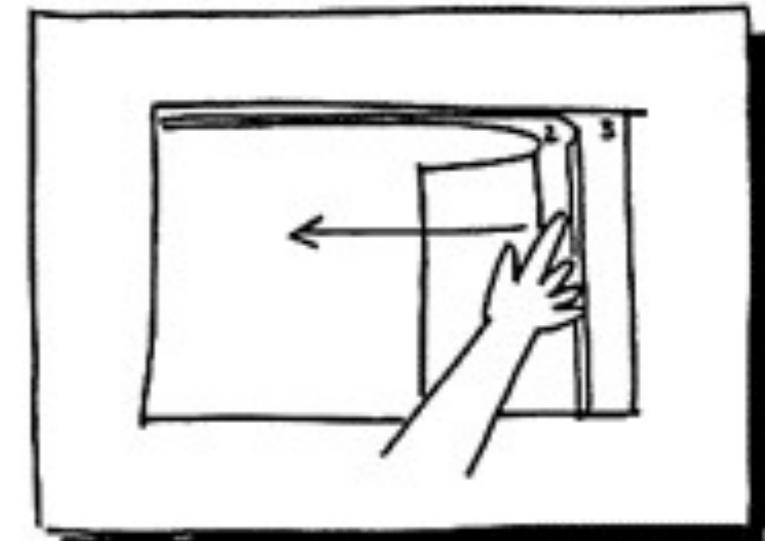
# Storyboarding



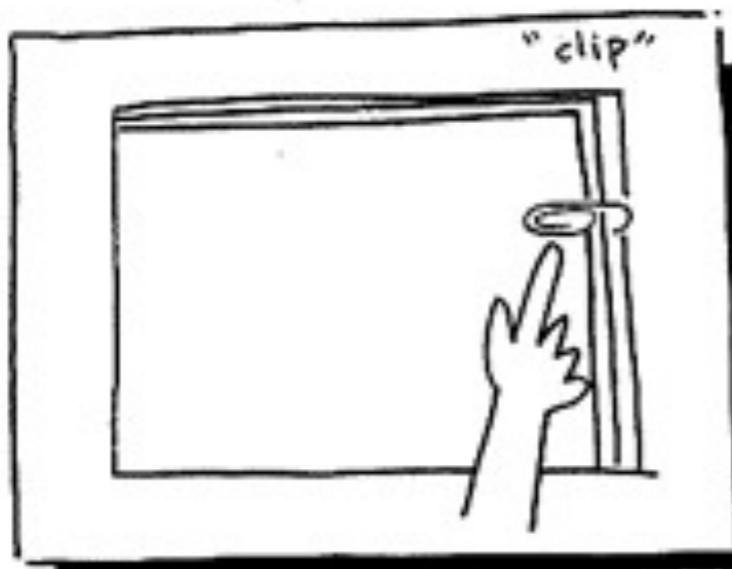
L. can write into her notebook.



She can flip over her pen and erase!



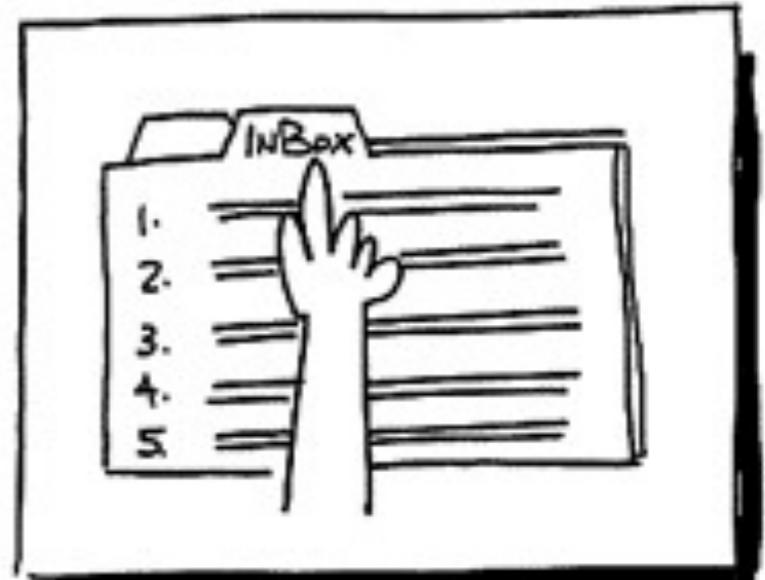
L. can flip to the next page.



L. marks her place.



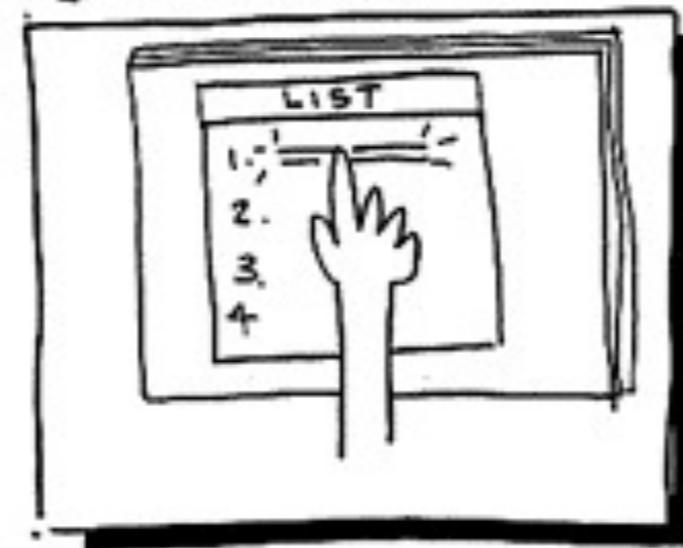
L. marks a phone number.



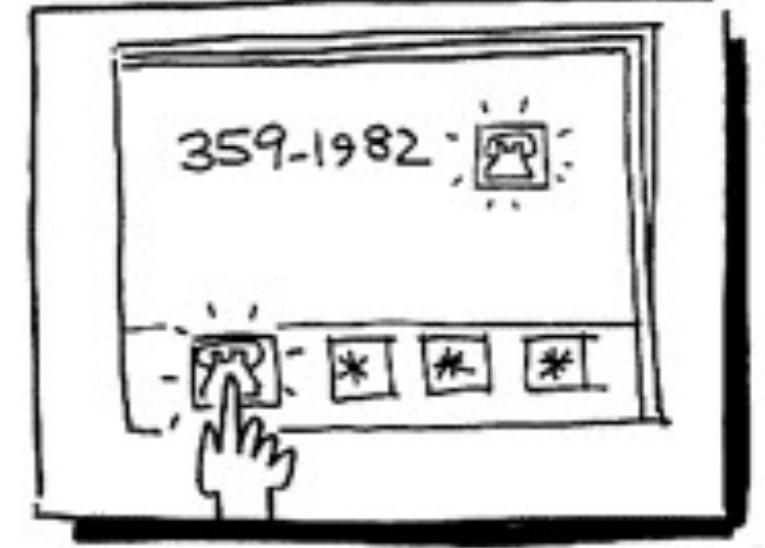
L. shifts to the InBox Section.



L. adds comments



L. brings up a list.



L. looks for phone numbers.



KODAK iAF

KODAK iAF 1000

# | 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?

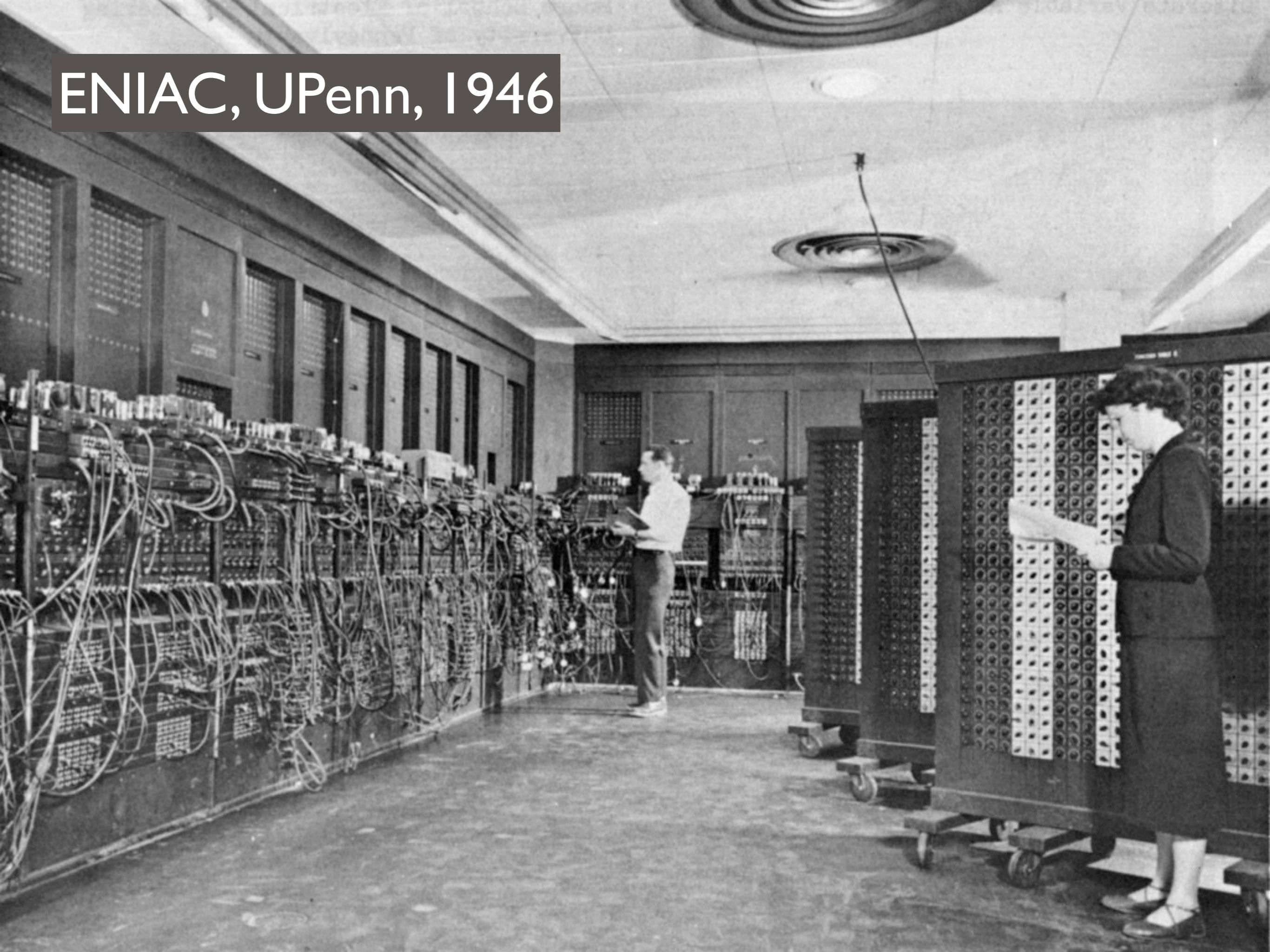
*“The results show that in today’s applications, an average of 48% of the code is devoted to the user interface portion.*

*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

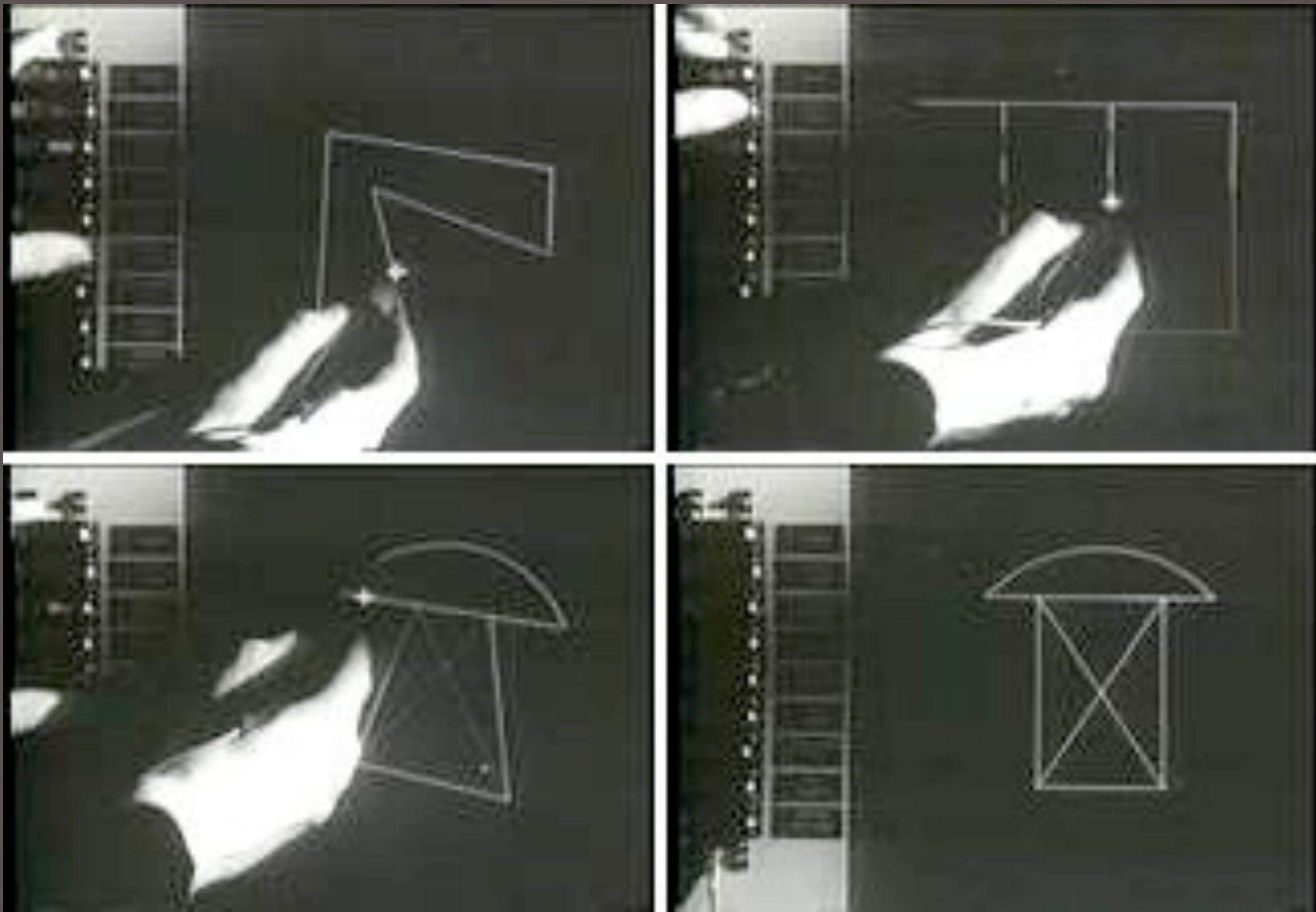


(cc) Flickr user John Chuang  
<http://www.flickr.com/photos/13184584@N08/1362760884/>

# When was pen input invented?

- A. 1964
- B. 1973
- C. 1986
- D. 1995
- E. 2001





Ivan Sutherland, Sketchpad, MIT, 1963/64

LINK

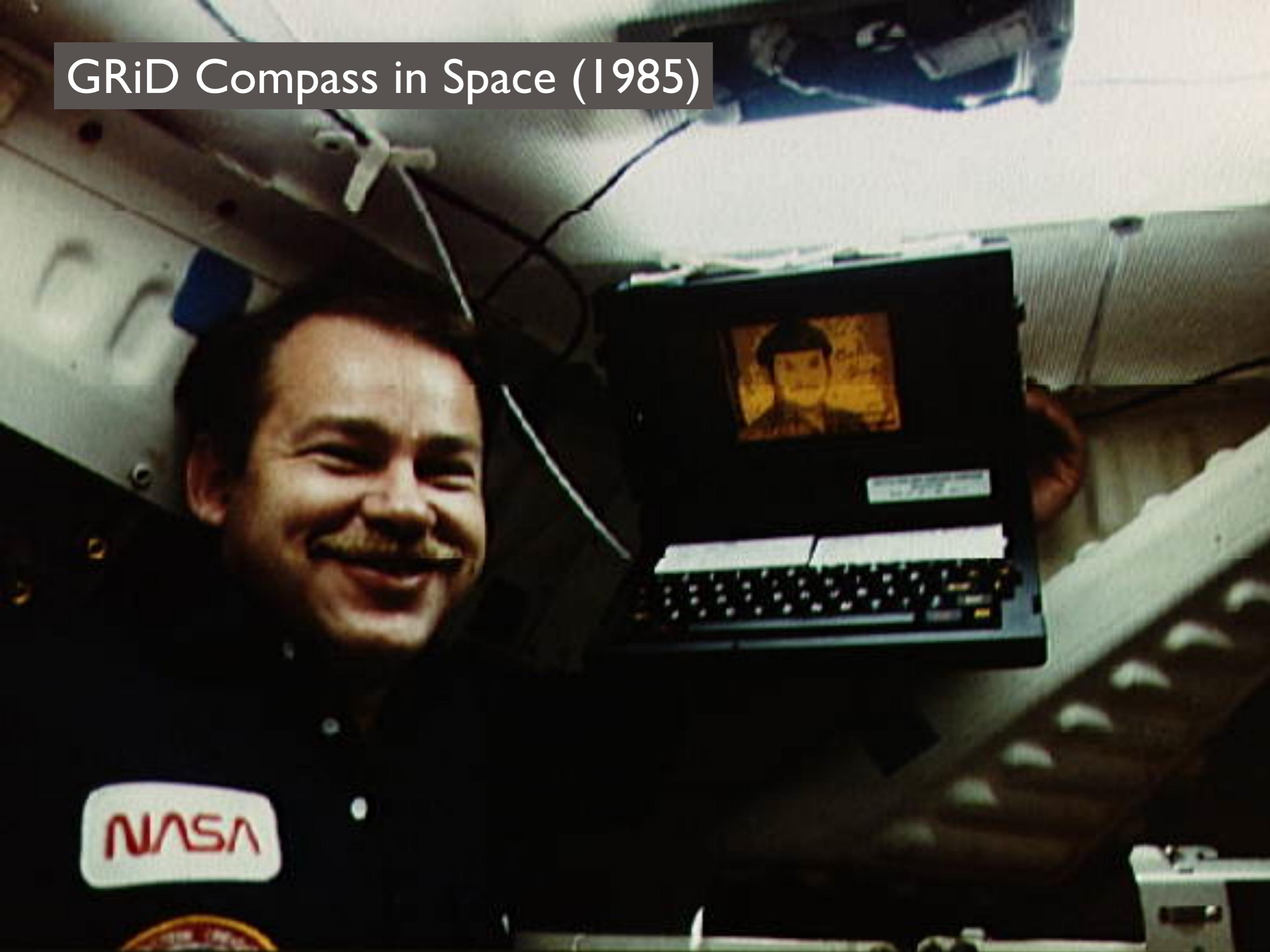


Earlier today...

# The new iPad



# GRiD Compass in Space (1985)





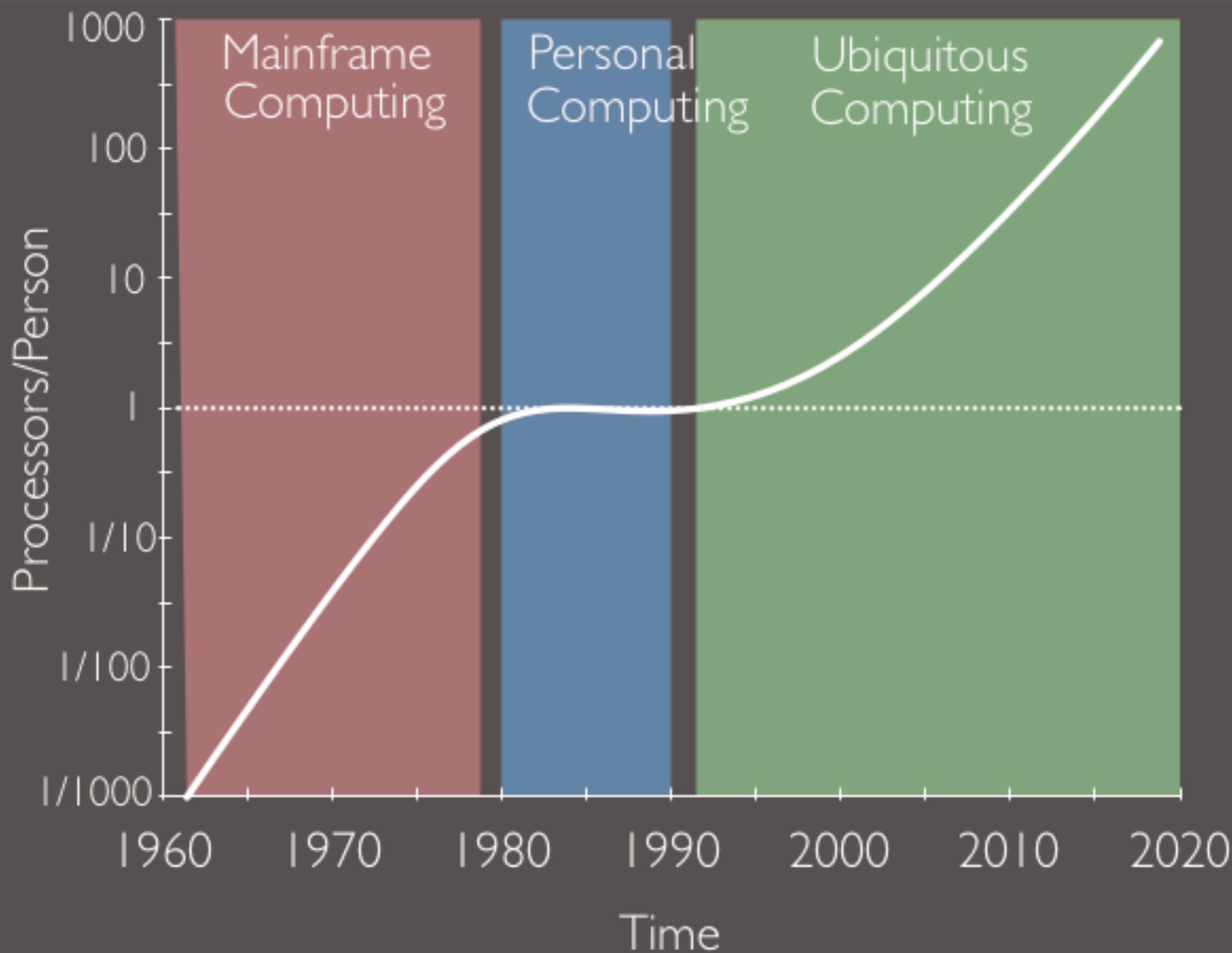
IBM Simon  
1992

<http://www.dipity.com/bjoern/personal>

# | What has changed?

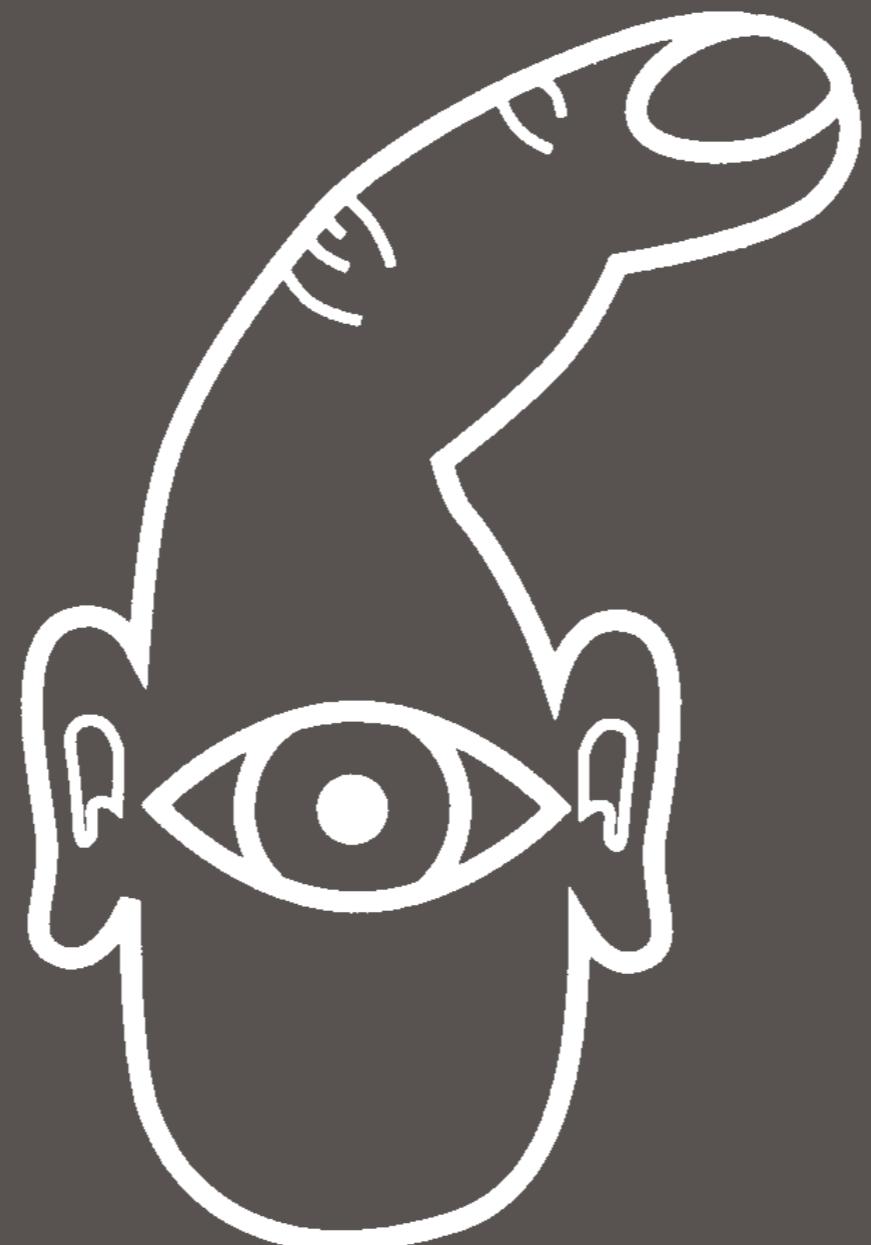
“For every ant in the world today,  
there are 100 transistors.”

- *Gordon Moore, 2003*



Era	Ratio Computers:People	HCI Focus
Mainframe Computing	1:many	Human Factors
Personal Computing	1:1	Psychology, Cog. Science
Ubiquitous Computing	many:1	Collaboration, Rich Interaction

# | Research Directions



(c) Dan O'Sullivan



## Booker the Penguin



Computer required during gameplay

# Air Guitar Hero



I wish I knew you

I like your picture

You are cool

I was paid to link to you

I want your reflected glory

Everybody else links to you

I'd vote for you

Can I date you?

We met at a conference and it seemed like the thing to do.

yes

no

I like you

I kind of like you

I really like you

I know you

I feel socially obligated to link to you

I beat you on Xbox Live

Hi, Mom

I have fake alter egos



Try Beta



Log in / create account



# WIKIPEDIA

The Free Encyclopedia

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### Today's featured article



The "[Morotai Mutiny](#)" was an incident in April 1945 involving members of the [Australian First Tactical Air Force](#) based on the island of

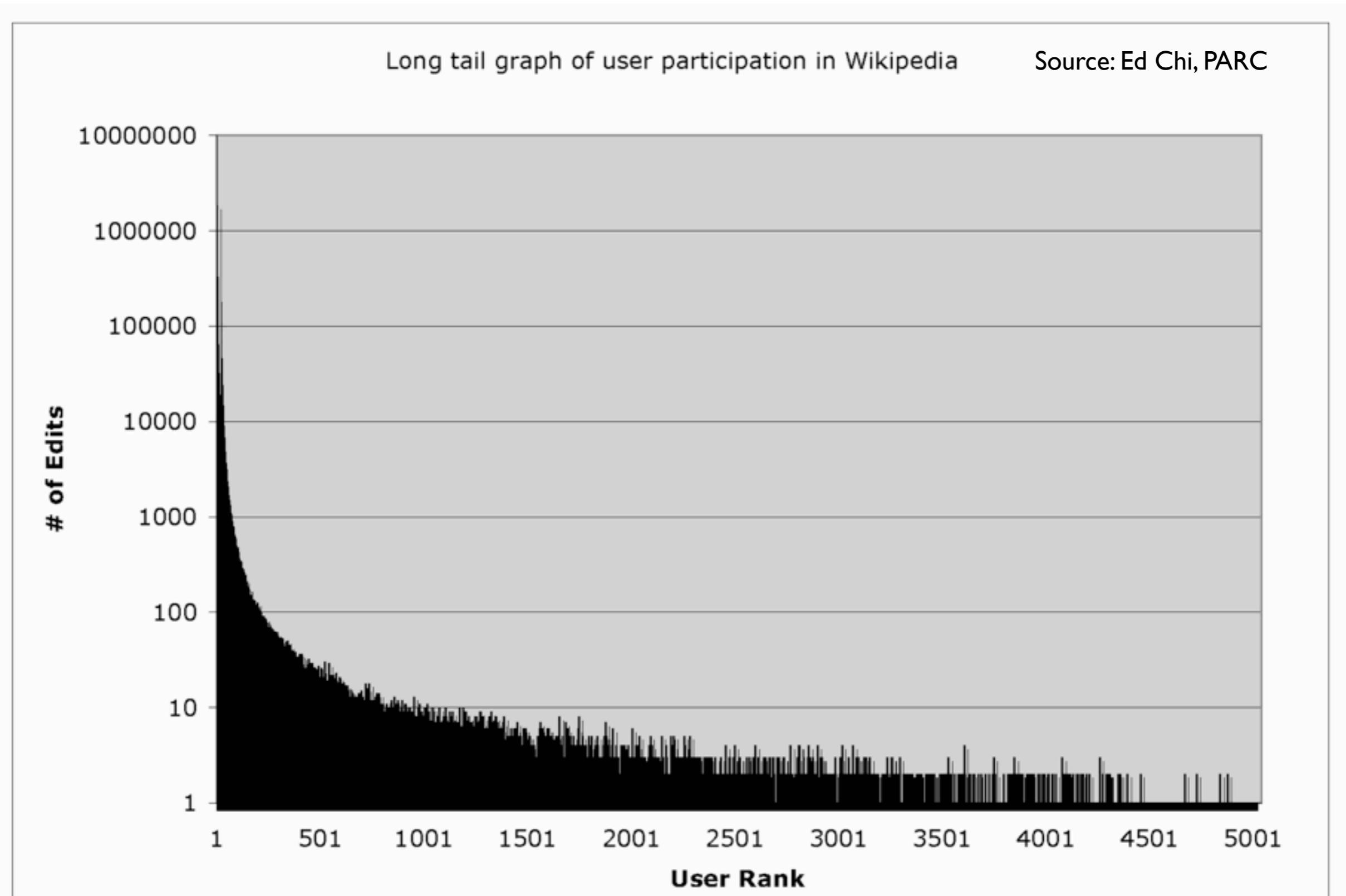
[Morotai](#), in the [Dutch East Indies](#). Eight senior pilots, including Australia's leading [flying ace](#), Group Captain [Clive Caldwell](#), tendered their resignations to protest what they perceived as the relegation of Royal Australian Air Force (RAAF) [fighter](#) squadrons to strategically unimportant [ground attack](#) missions. A government investigation vindicated the "mutineers", and three high-ranking officers at

### In the news

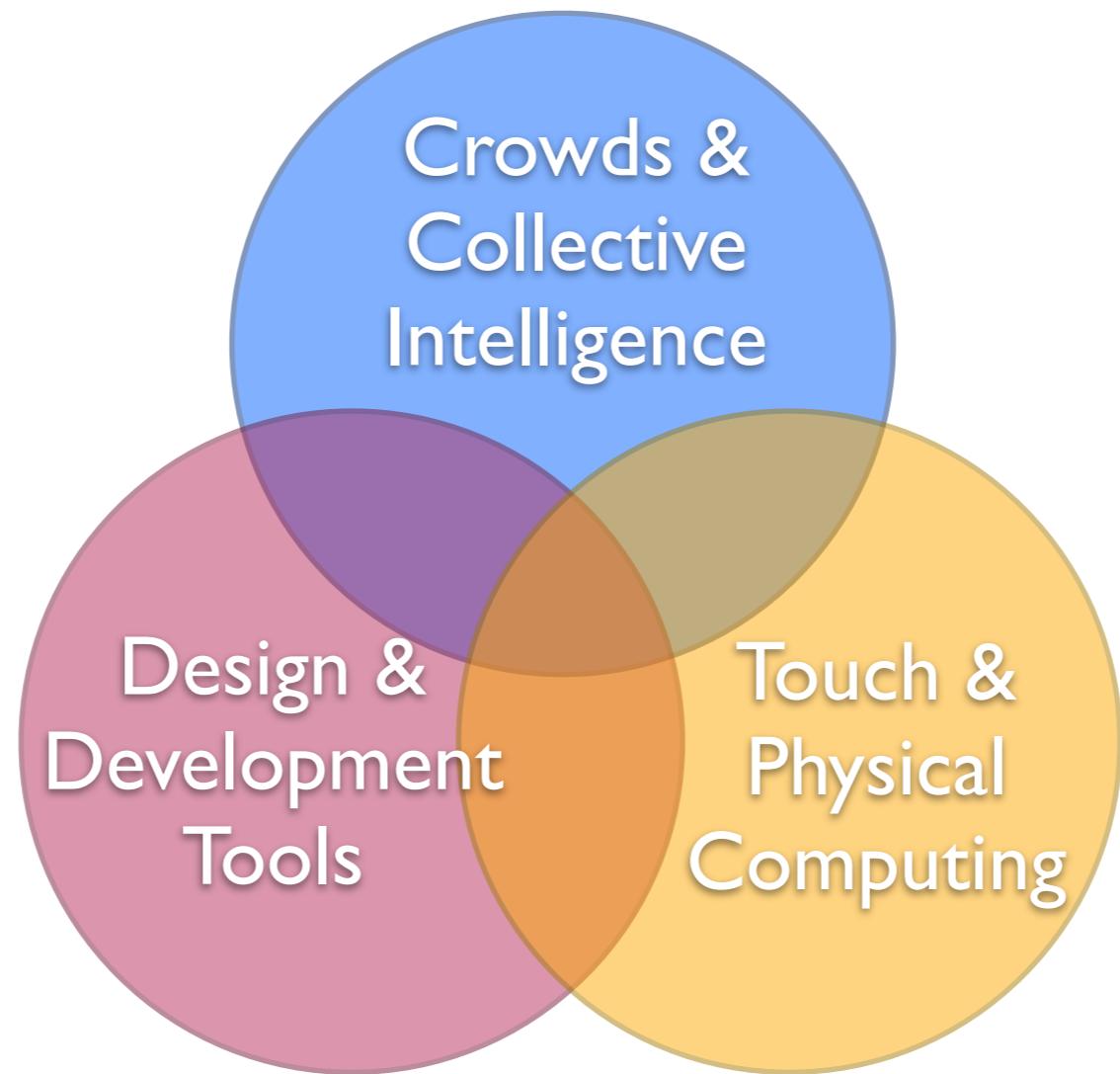
- Venezuelan boxer [Edwin Valero](#) is found dead from an apparent suicide at the age of 28.
- A [state funeral](#) is held for Polish President Lech Kaczyński and First Lady Maria Kaczyńska in Kraków, a week after their [fatal plane crash](#).
- A [series of bomb attacks](#) kills more than 48 people in Kohat District, Pakistan.
- [Volcanic ash](#) from the eruption of

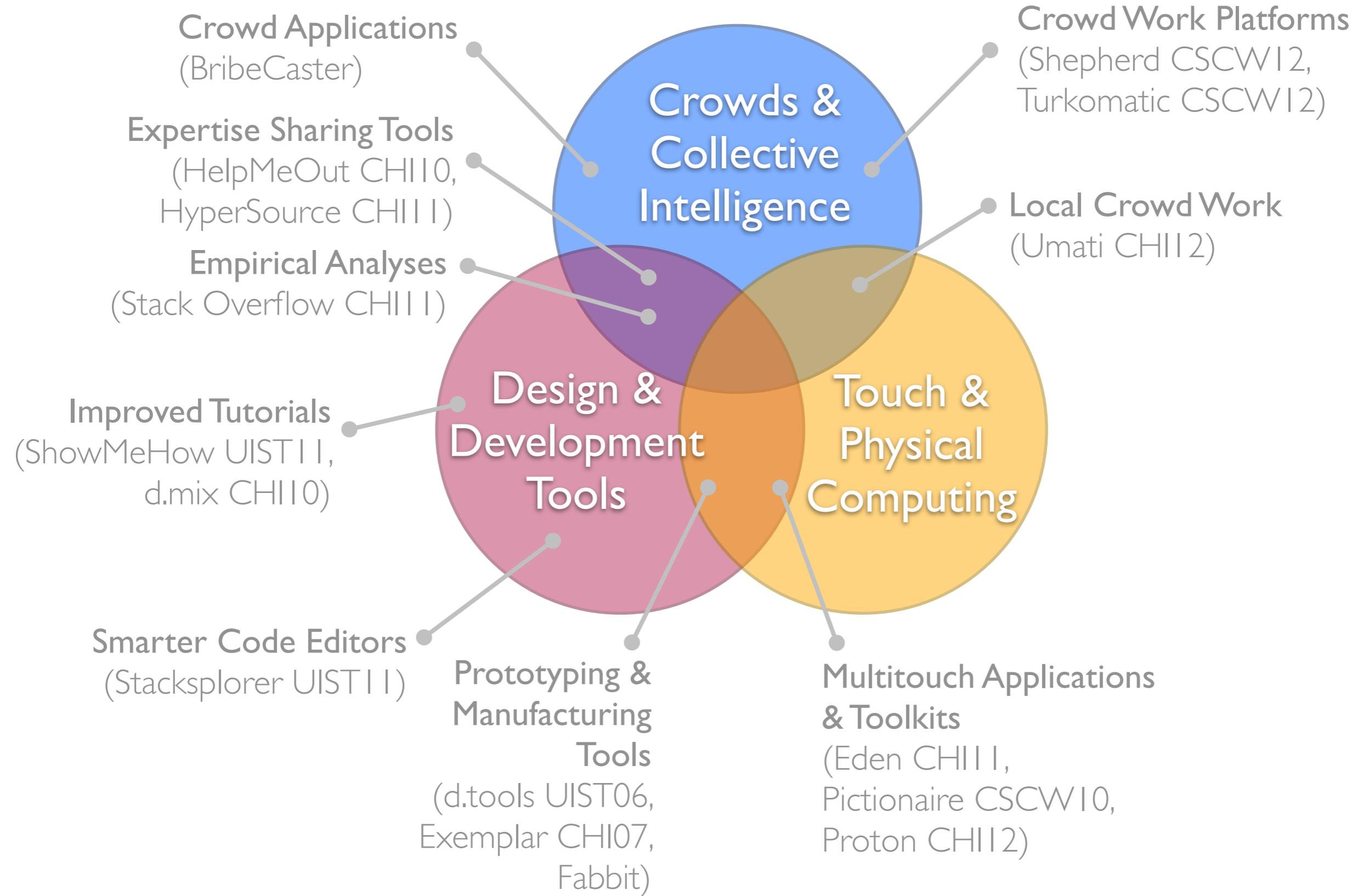


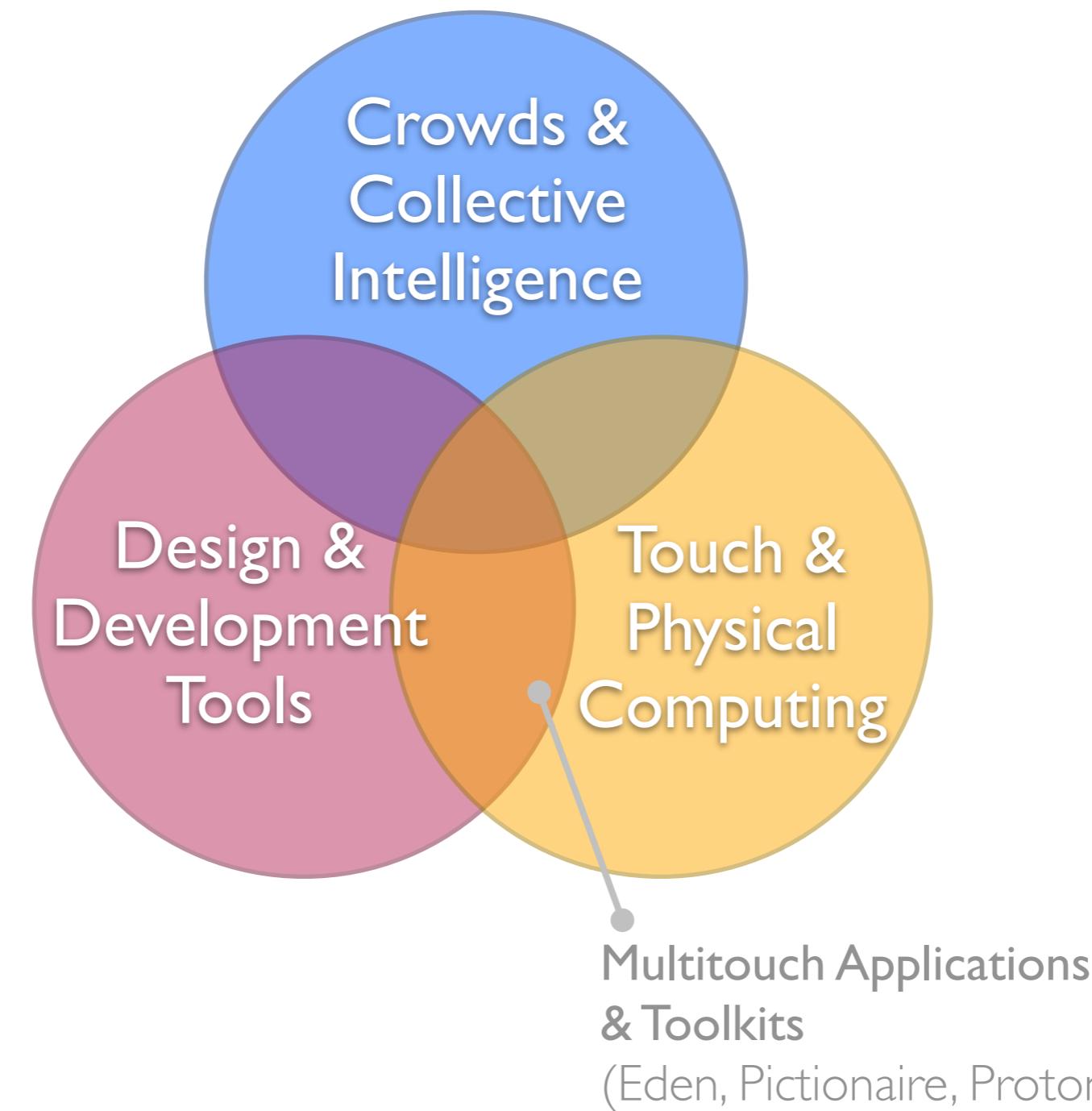
# Zipf / Power Law Distribution



# | HCI Research at Berkeley







# Supporting Co-Located Design



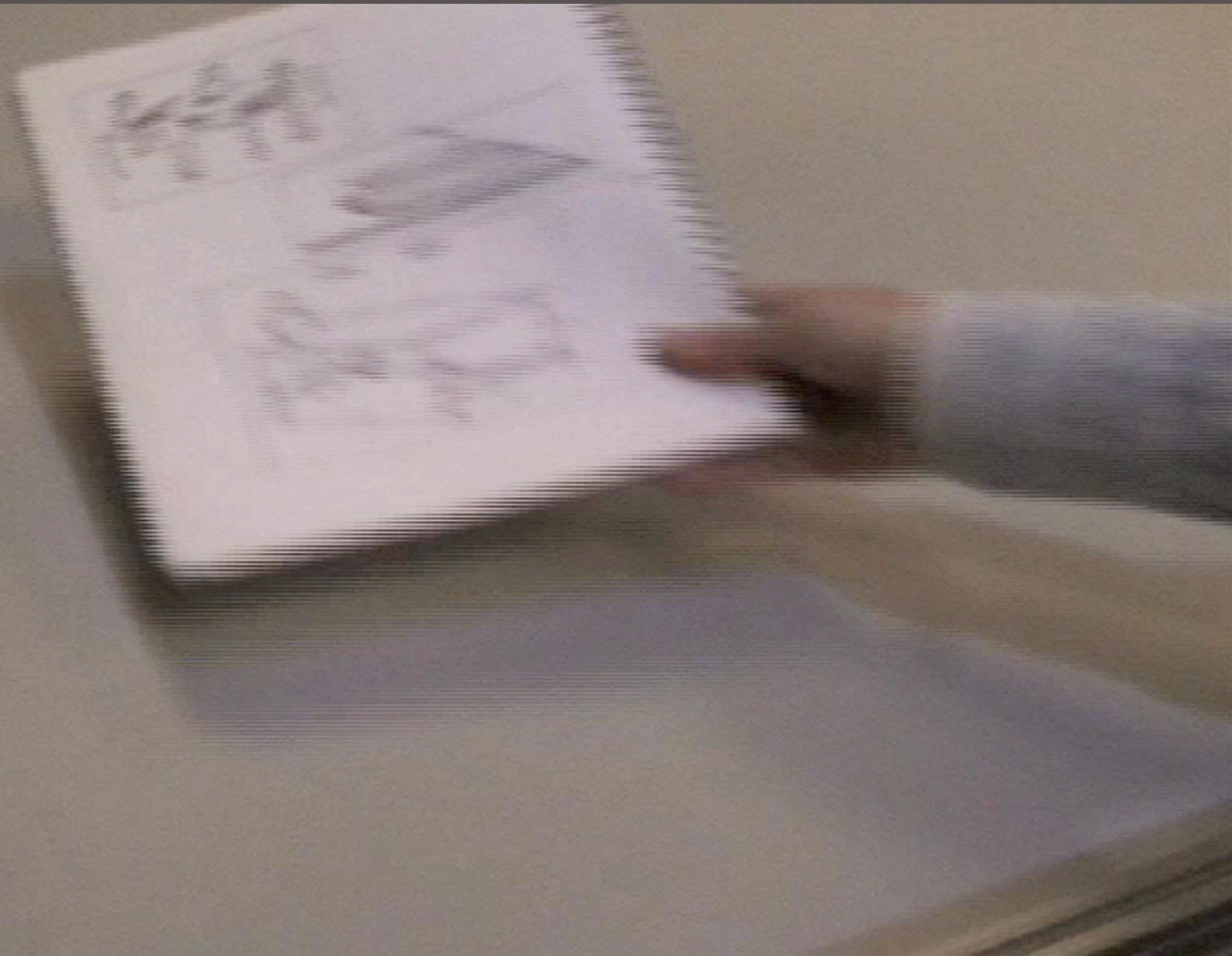
## **Question:**

How might we help design team members manage information more fluidly across digital and physical boundaries ?

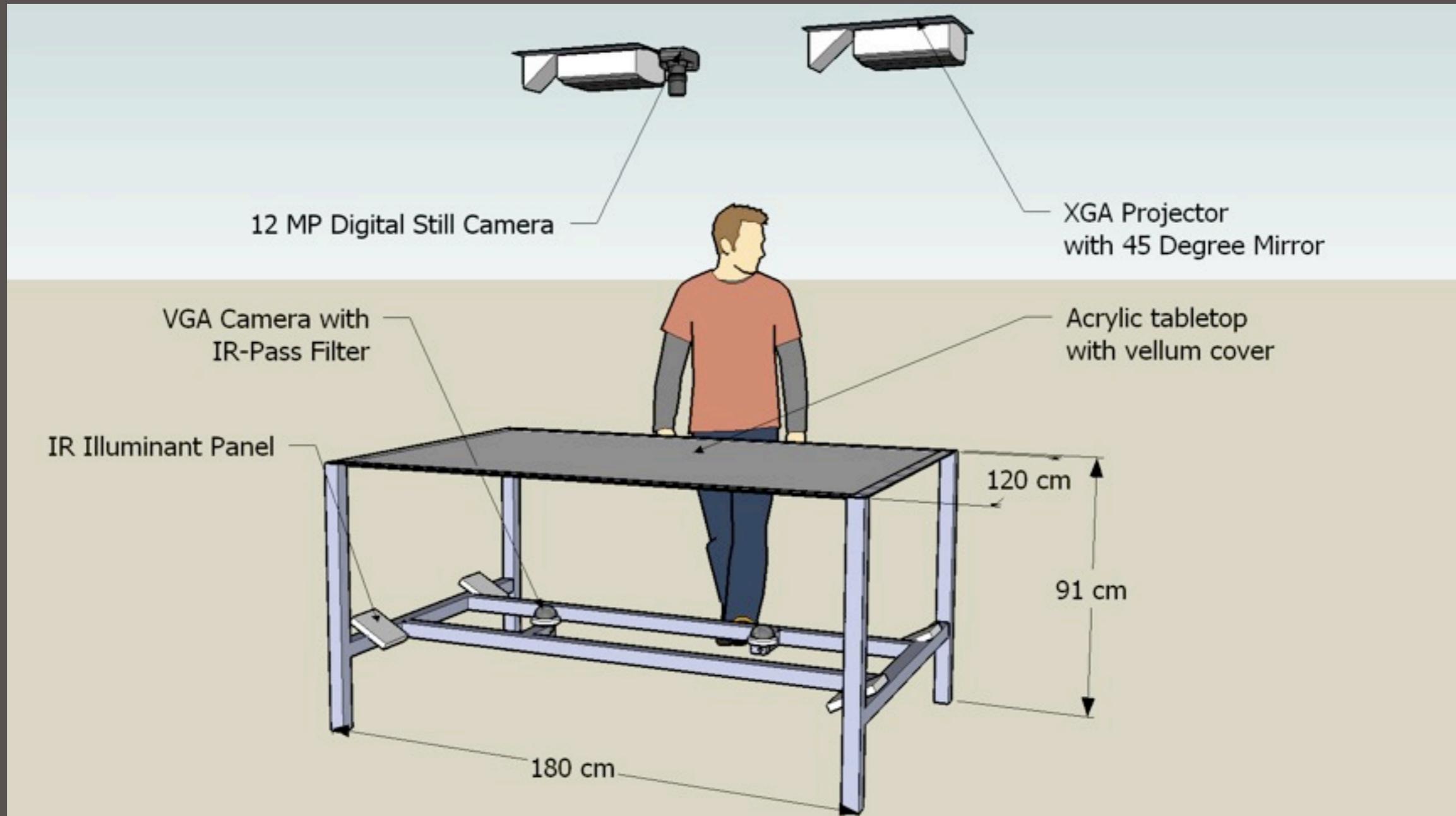


CANYO  
PLC-XL50

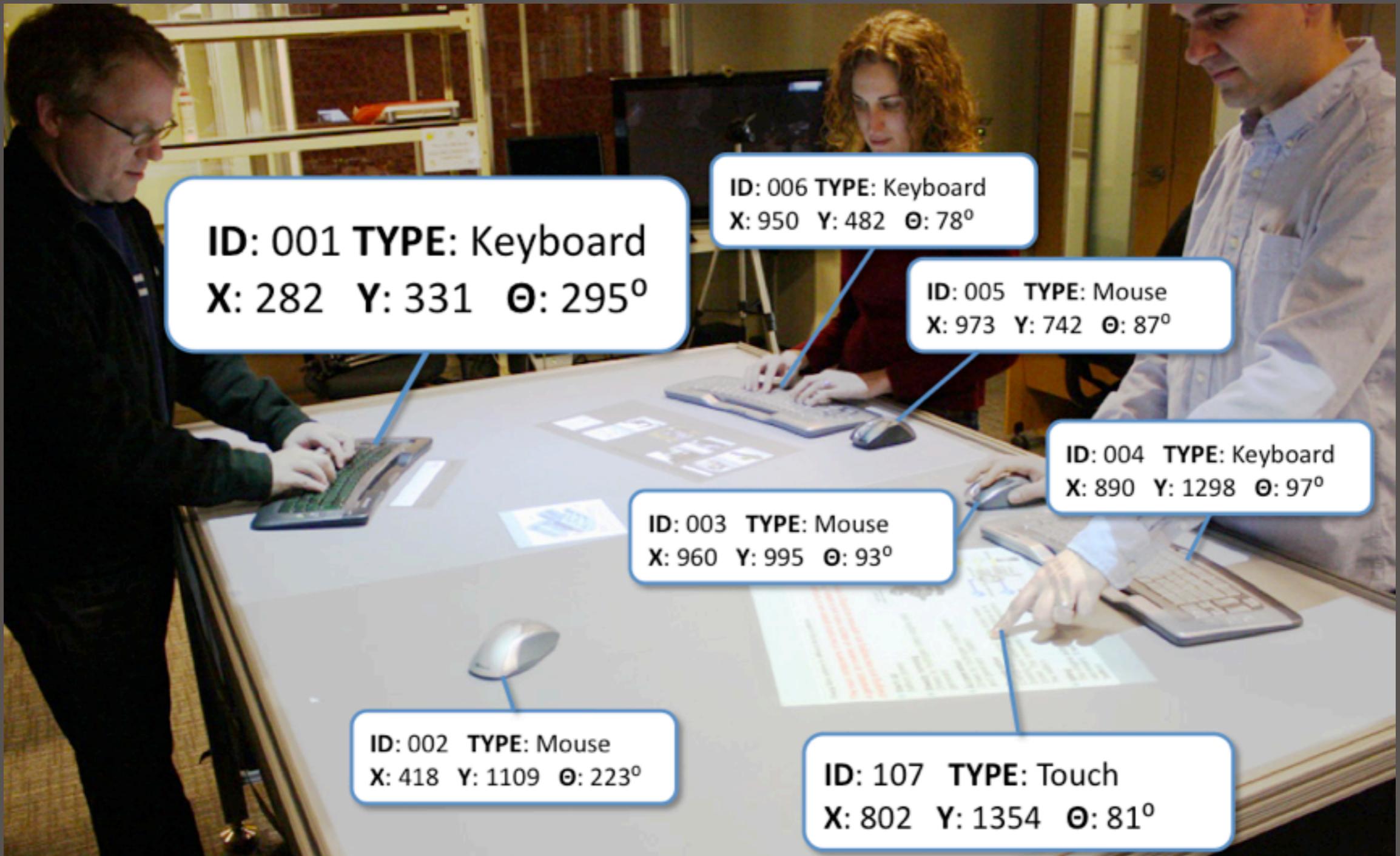




# Table Infrastructure



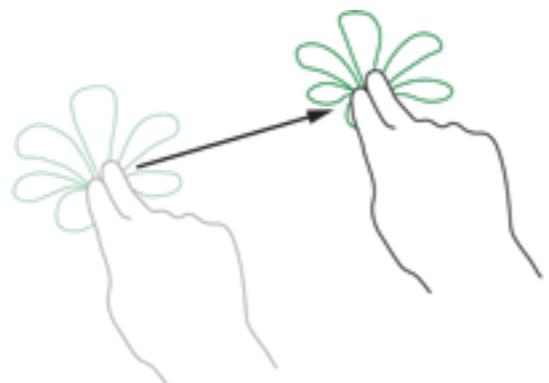
# The FourBySix Table



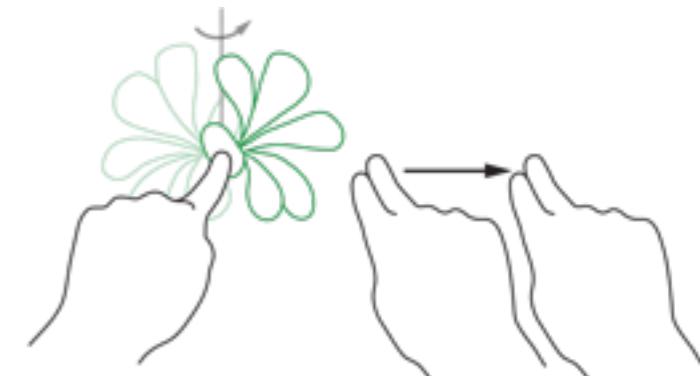
# Object Manipulation

XY

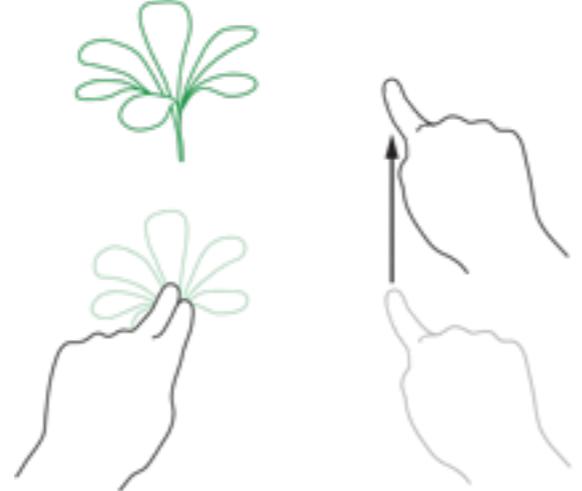
Translation



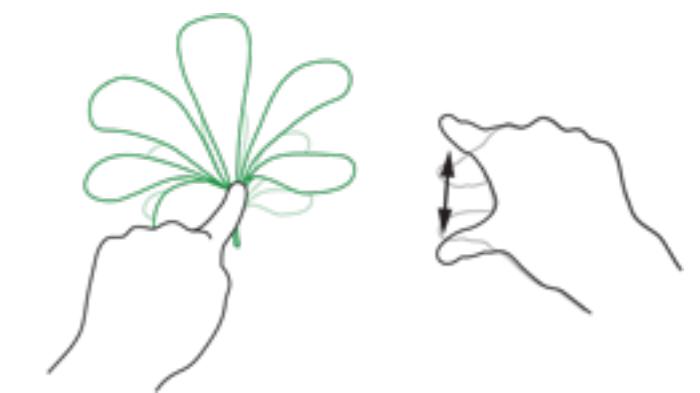
World Z  
Rotation



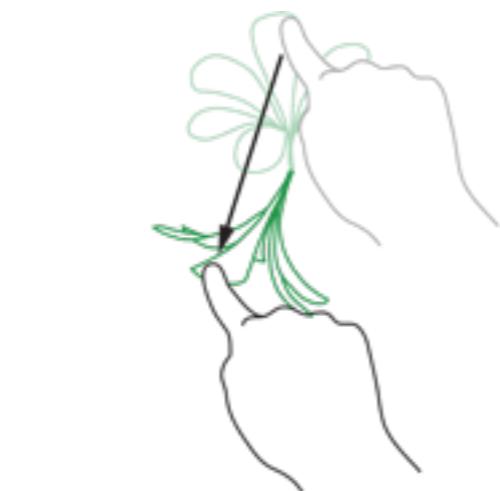
Z Translation



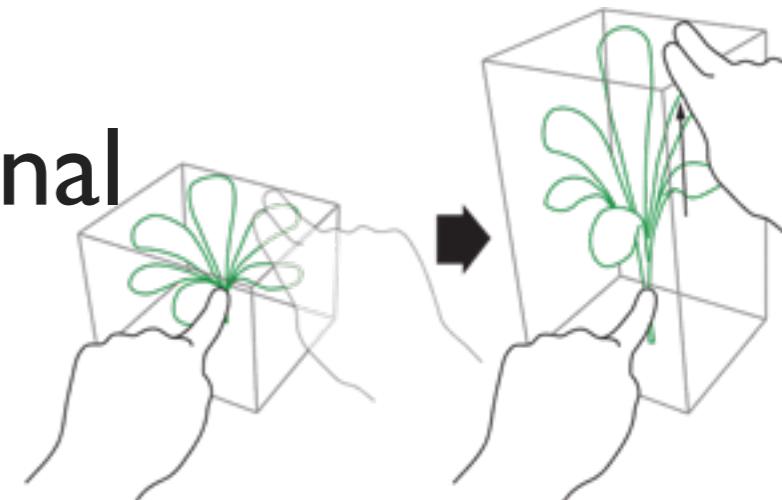
Uniform Scale



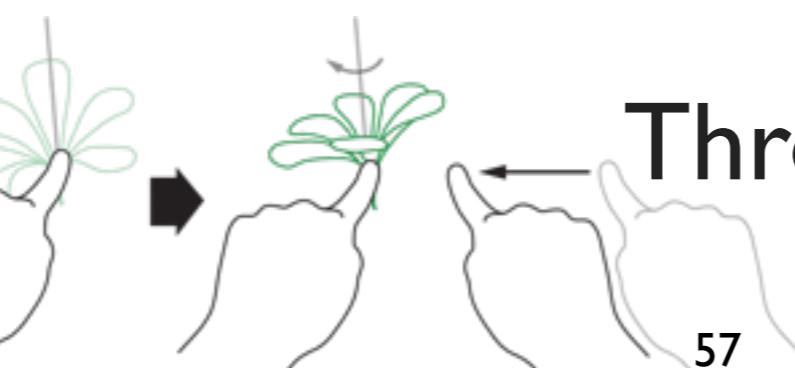
Arcball  
Rotation



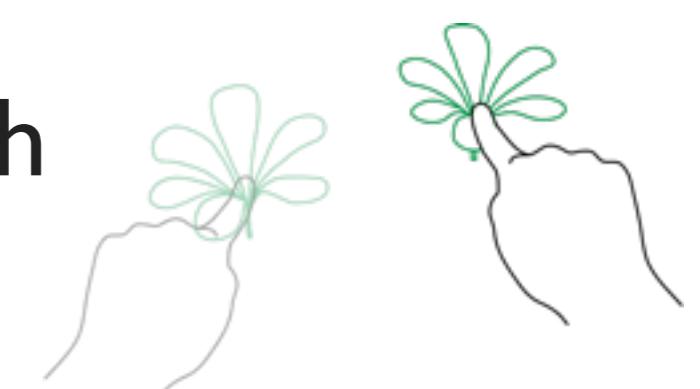
One-Dimensional  
Scale

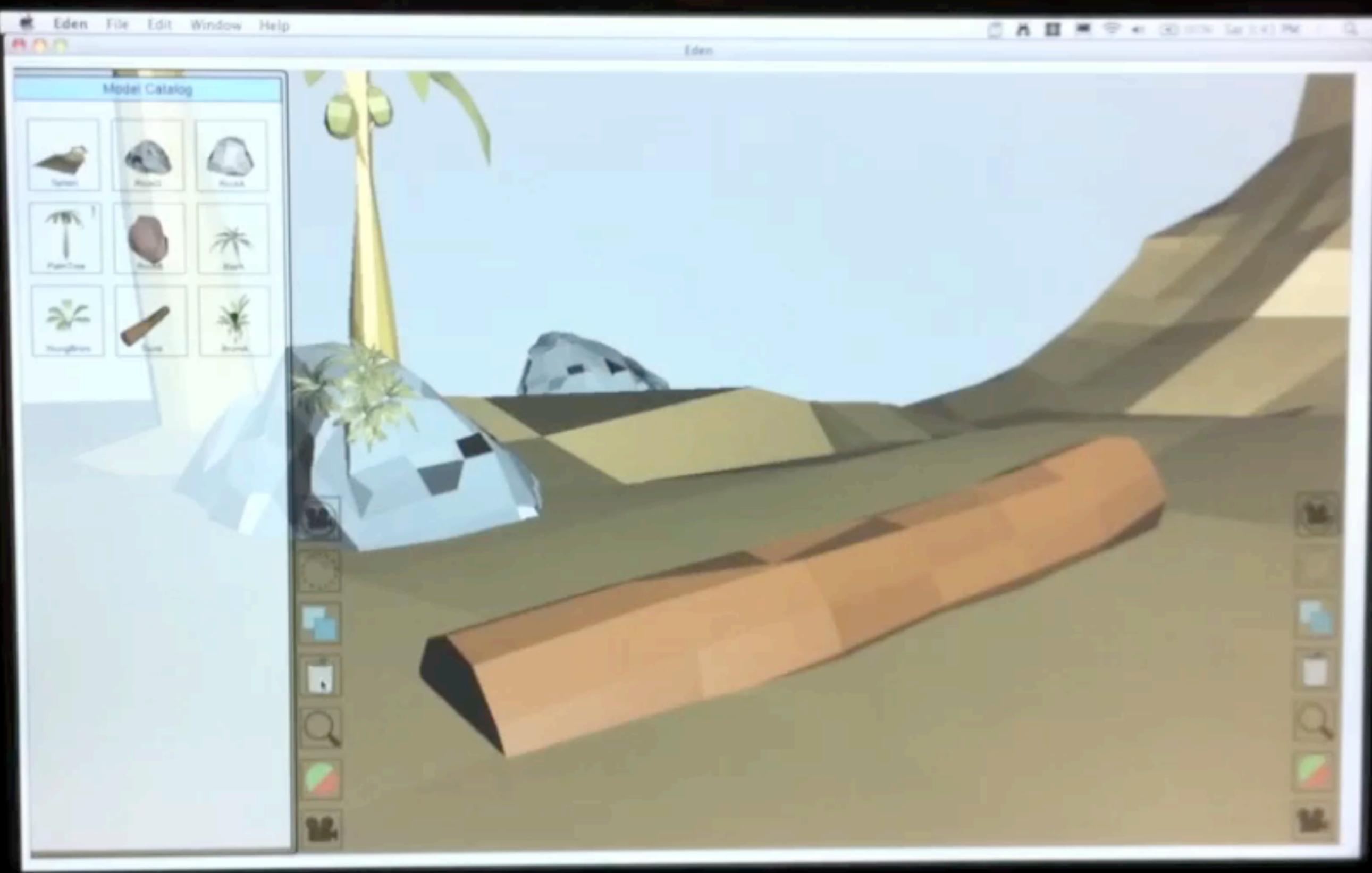


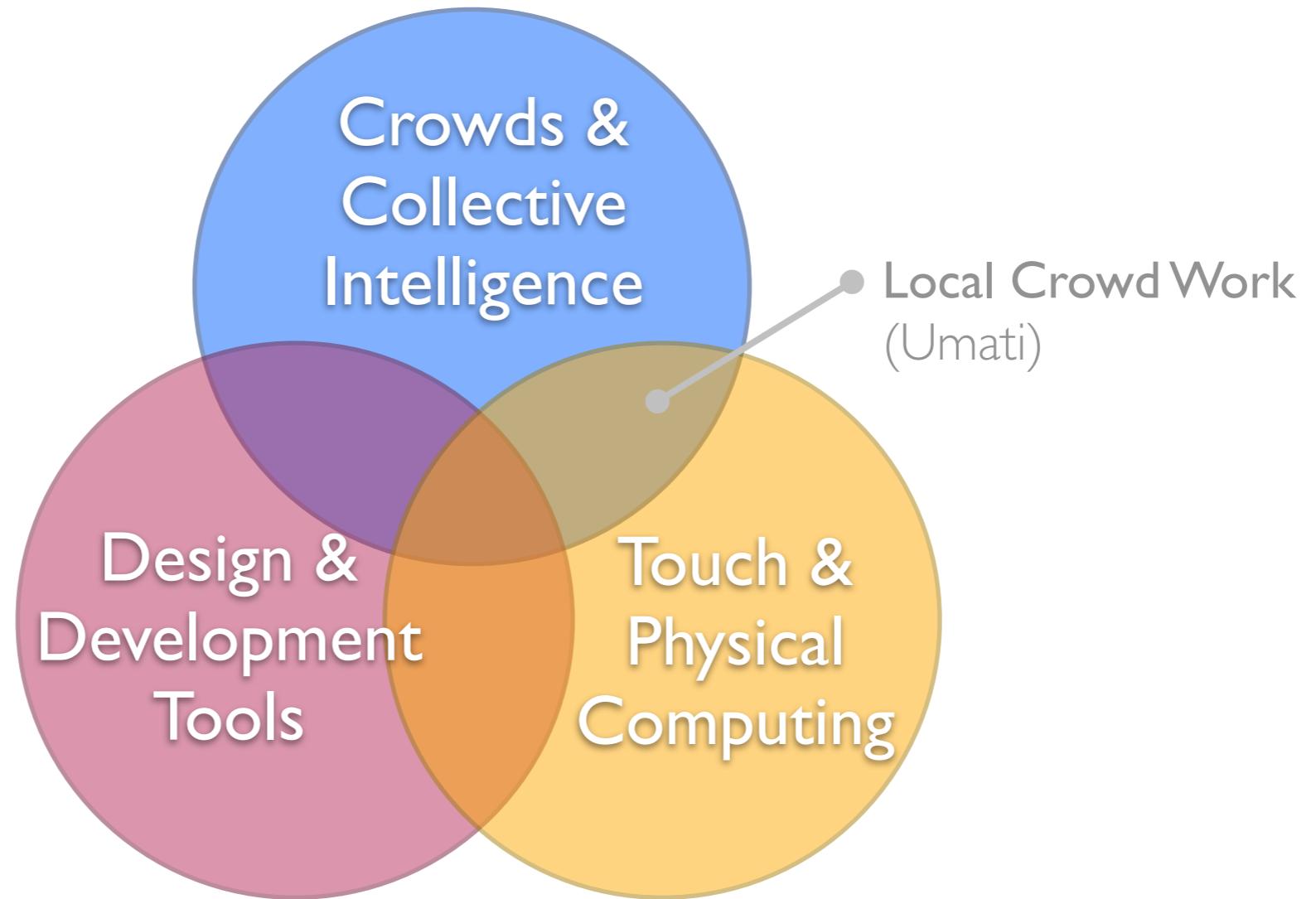
Local Z  
Rotation

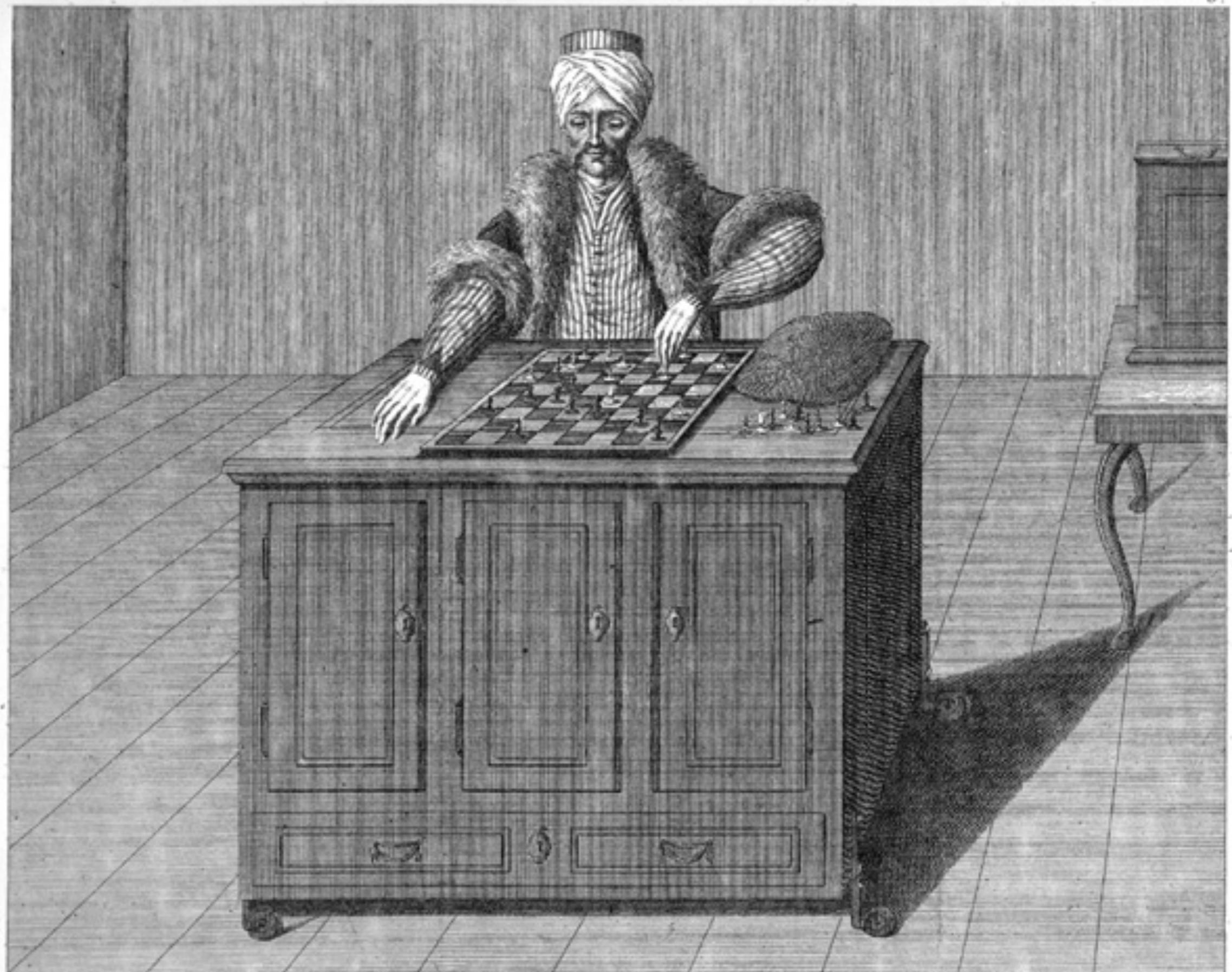


Throw-and-Catch









W. de Kompolen del.

Chr. à Meichel excud, Basilea.

P. G. Pintz sc.

Der Schachspieler im Spiele begriffen. | Le Joueur d'Echecs tel qu'on le voit pendant le jeu.

[All HITs](#) | [HITs Available To You](#) | [HITs Assigned To You](#)

Search for  containing  that pay at least \$  for which you are qualified  **GO!**

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Requester: [Dolores Labs](#)

HIT Expiration Date: Jan 31, 2011 (6 days 23 hours) Reward: \$0.02

Time Allotted: 60 minutes

HITs Available: 9763

### [Copy Text from Business Card](#)

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Requester: [Oscar Smith](#)

HIT Expiration Date: Jan 24, 2011 (1 hour 59 minutes) Reward: \$0.02

Time Allotted: 10 minutes

HITs Available: 77

### [Copy Text from Business Card](#)

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Requester: [Oscar Smith](#)

HIT Expiration Date: Jan 24, 2011 (1 hour 59 minutes) Reward: \$0.02

Time Allotted: 10 minutes

HITs Available: 34

### [Click the button when the event occurs in the movie](#)

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Requester: [nimrod shoam](#)

HIT Expiration Date: Jan 27, 2011 (2 days 23 hours) Reward: \$0.10

Time Allotted: 60 minutes

HITs Available: 1

### [Business Event data entry](#)

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Requester: [Andy Guy](#)

HIT Expiration Date: Feb 3, 2011 (1 week 2 days) Reward: \$2.10

Time Allotted: 1 hour 52 minutes

HITs Available: 1

### [WHERE ARE YOU? A 5-second HIT from techlist. Instant automatic approval.](#)

[View a HIT in this group](#)

Requester: [techlist](#)

HIT Expiration Date: Jan 24, 2011 (2 hours 45 minutes) Reward: \$0.01

# | Typical tasks

image labeling

comment spam detection

business listing verification

human OCR

| Can we crowdsource expert tasks by motivating groups of local experts?

Name: \_\_\_\_\_

**Problem 1. (7 points) Quickies.**

a. (1 point) Briefly explain the difference between an instance variable and a class variable.

b. (1 point) Can you use the `super` keyword in a static method? Explain.

c. (3 points) What is the output of this program?  
Explain why. \_\_\_\_\_

```
public class What {
    public long n;
    public void increment() {
        n++;
    }
    public static void reset(What w) {
        w.increment();
        w = new What();
        w.n = 0;
    }
    public static void main(String[] args) {
        What w = new What();
        w.n = 7;
        reset(w);
        System.out.println("The number is " + w.n);
    }
}
```

d. (2 points) What's wrong with the following code? Specifically, what does this code do? (Yes, it does compile and run.)

```
public class Soda {
    public String name;
    public Soda() {
        Soda pop = new Soda();
    }
}
```

| How about peer grading?



**SnackShop**  
**4600**

Scan your card to start  
getting snacks!!



MEMO

6 Vend Tasks Exit

Question Professor Student

The following program compiles. What does the main program (in D) print?

```
class A {  
    int z = 2;  
    void f () { this.g (); }  
    void g () { System.out.printf ("A:  
%d\n", z); }  
    int h () { return z; }  
}  
  
class B extends A {  
    int z = 15;  
    void g () { System.out.printf ("B:%d  
%d\n", h(), z); }  
}  
  
class C extends A {  
    int z = 42;  
    void f () { this.g (); }  
}
```

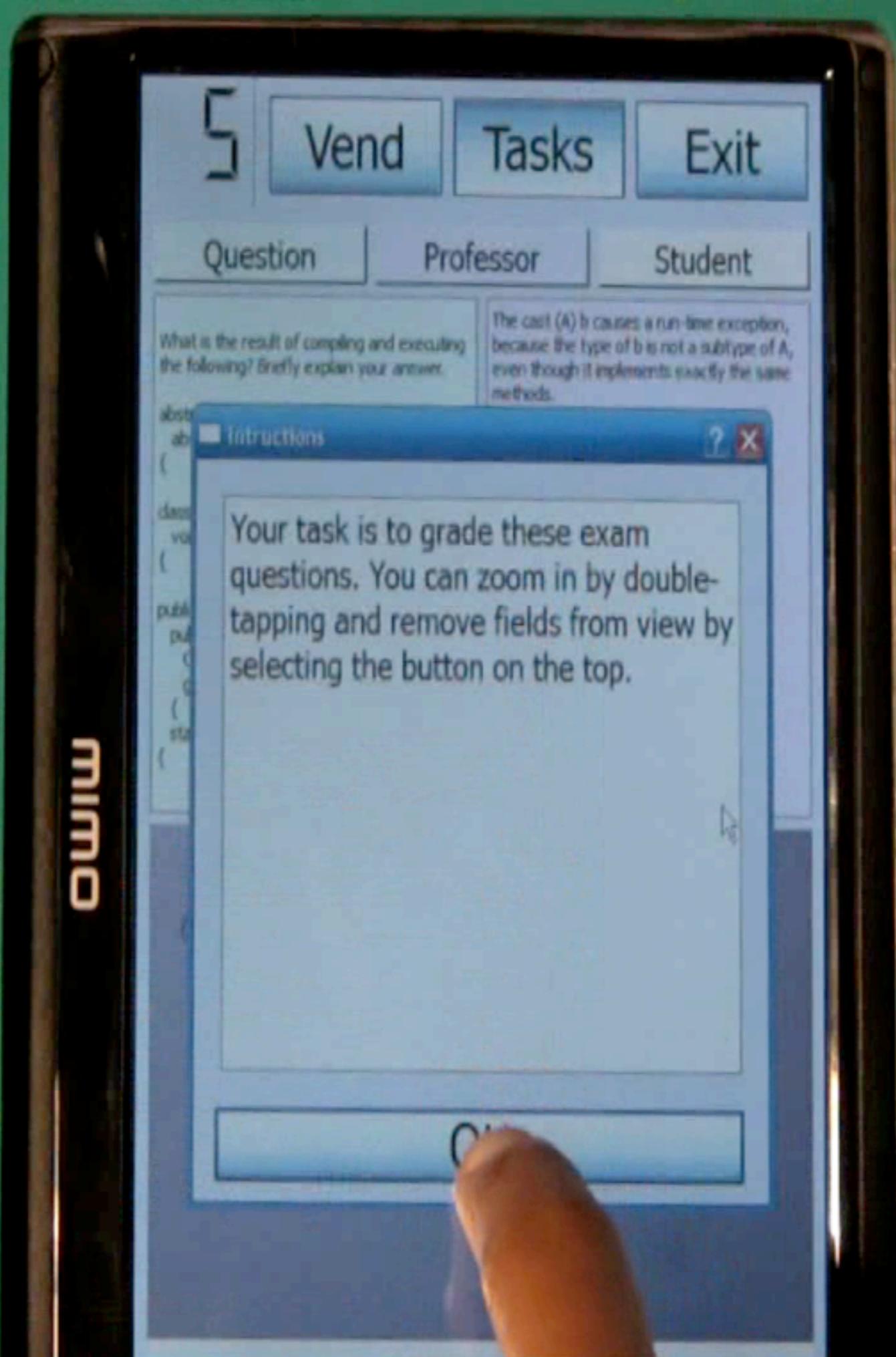
A:2  
A:2  
h:2 z:15  
h:2 z:15

Student Answer

Grading Rubric

Grading Slider

0 Submit



12

Vend

Tasks

Exit

Question

Professor

Student

What is the result of compiling and executing the following? Briefly explain your answer.

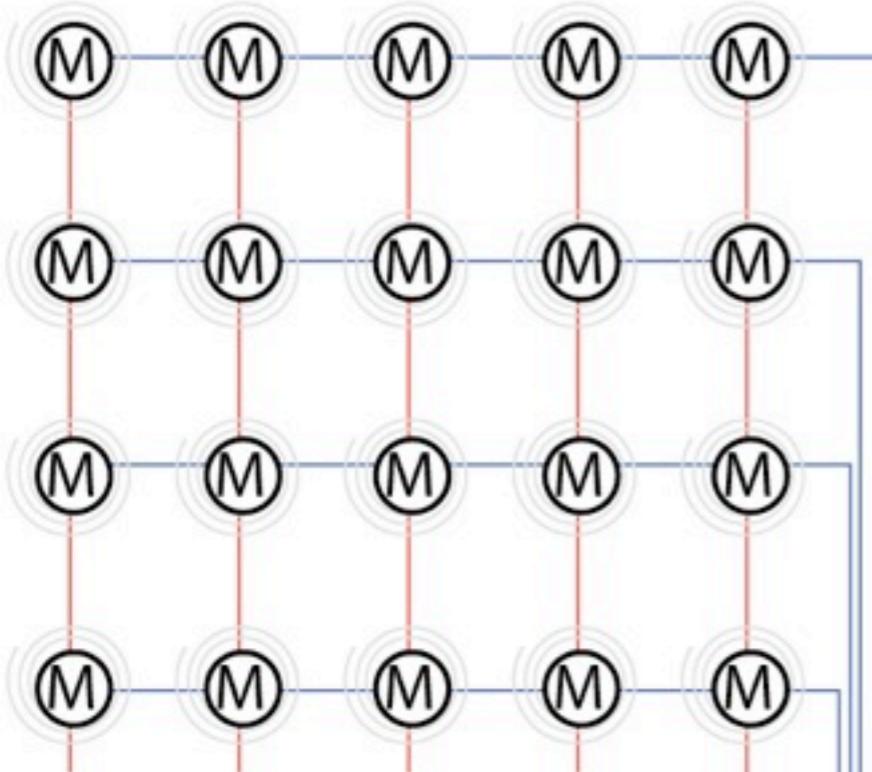
```
abstract class A {  
    abstract void f();  
}  
  
class B {  
    void f() {System.out.println("Hello, world!");}  
}  
  
public class Main {  
    public static void main (String[] args) {  
        Object b = new B();  
        g ((A) b);  
    }  
    static void g (A x) { x.f(); }  
}
```

The call (A) b causes a run-time exception, because the type of b is not a subtype of A, even though it implements exactly the same methods.

Runtime error because no g method defined  
(g((A)B)) gives an error

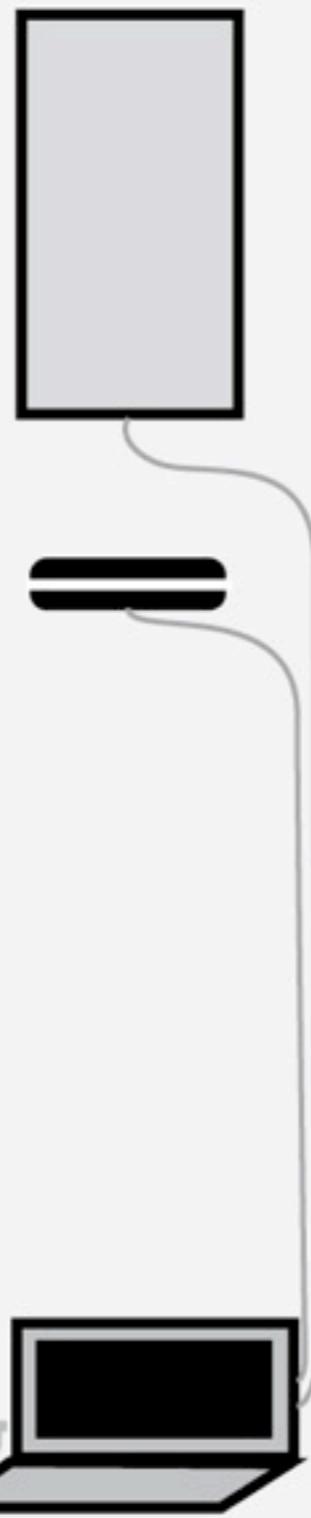
0

Submit



Row-Column  
Matrix of  
Vend Motors

Motor Ctrl  
Arduino



Touch  
Screen  
(DisplayLink  
over USB)

Card  
Reader  
(USB)

Laptop



I Week  
300+ Unique Users  
7500+ Answers Graded

---

\$200 of Candy

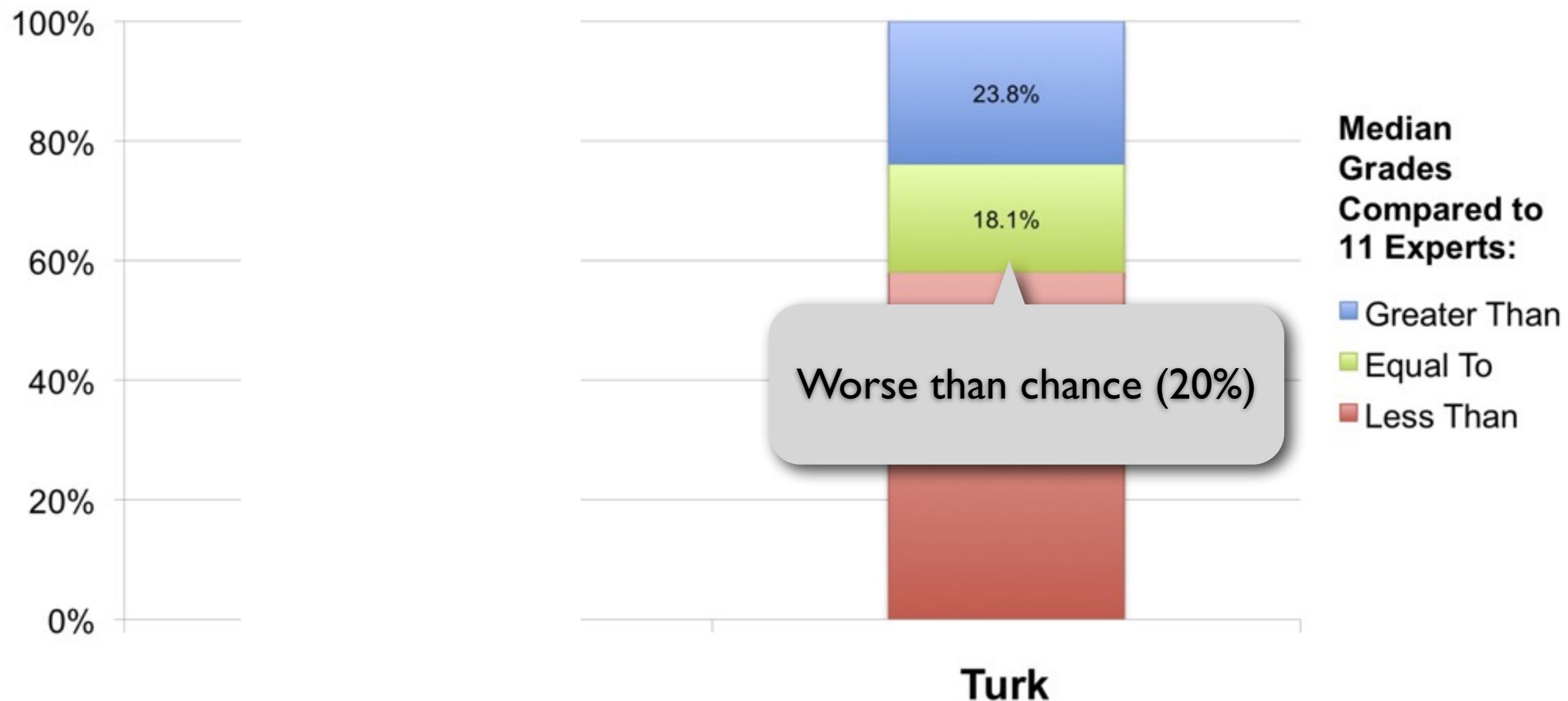
# | How Good are the Answers?

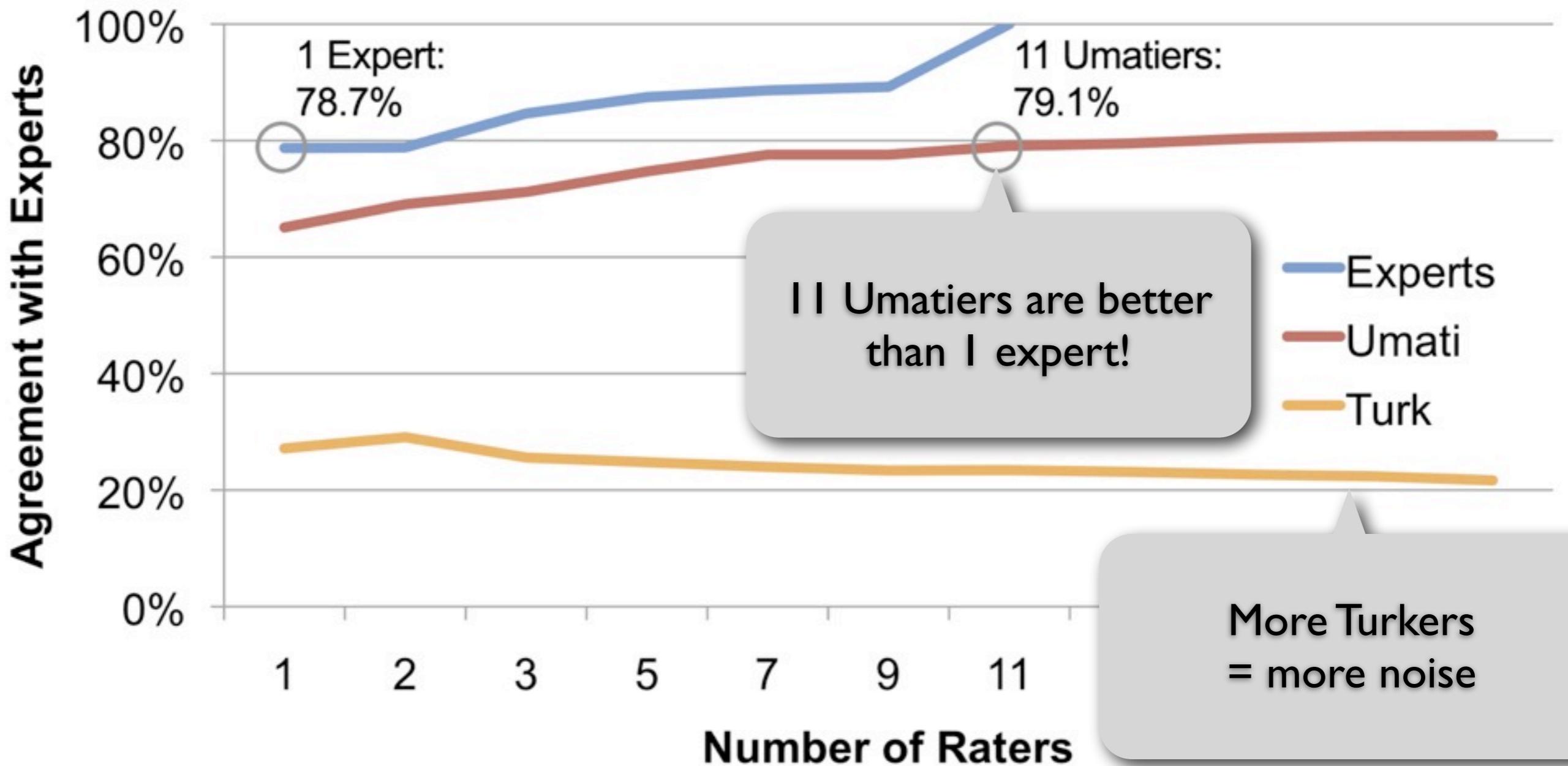
Gold Standard:

|| Expert Graders (TAs, CS PhD students)

Sanity Check:

Mechanical Turk (w/ and w/o qualification)







### News

#### December 2011: Three CHI papers

Full papers on communitysourcing, workflow comparison, and multitouch architecture were (conditionally) accepted to CHI2012.

#### December 2011: Presentations

Final presentations/demos for CS260 are open to the public. They will be held on 12/6 at 4pm in 510 Soda.

#### December 2011: Research Awards

We received research awards from Adobe and Google.

#### October 2011: Two CSCW papers + two posters

Two crowdsourcing papers on Turkomatic and Shepherd were accepted to CSCW, as well as two posters on Bribecaster and Dazzle.

#### August 2011: NSF Award

We received an NSF award for Fabbit: Fabrication and Brokering Through Information Technology

#### June 2011: Two UIST Papers

Two full papers on ShowMeHow and Stacksplorer accepted to UIST.

#### May 2011: Two HCOMP Papers + two posters

Two full papers on pricing and two systems demos from our crowdsourcing class will be presented at HCOMP.

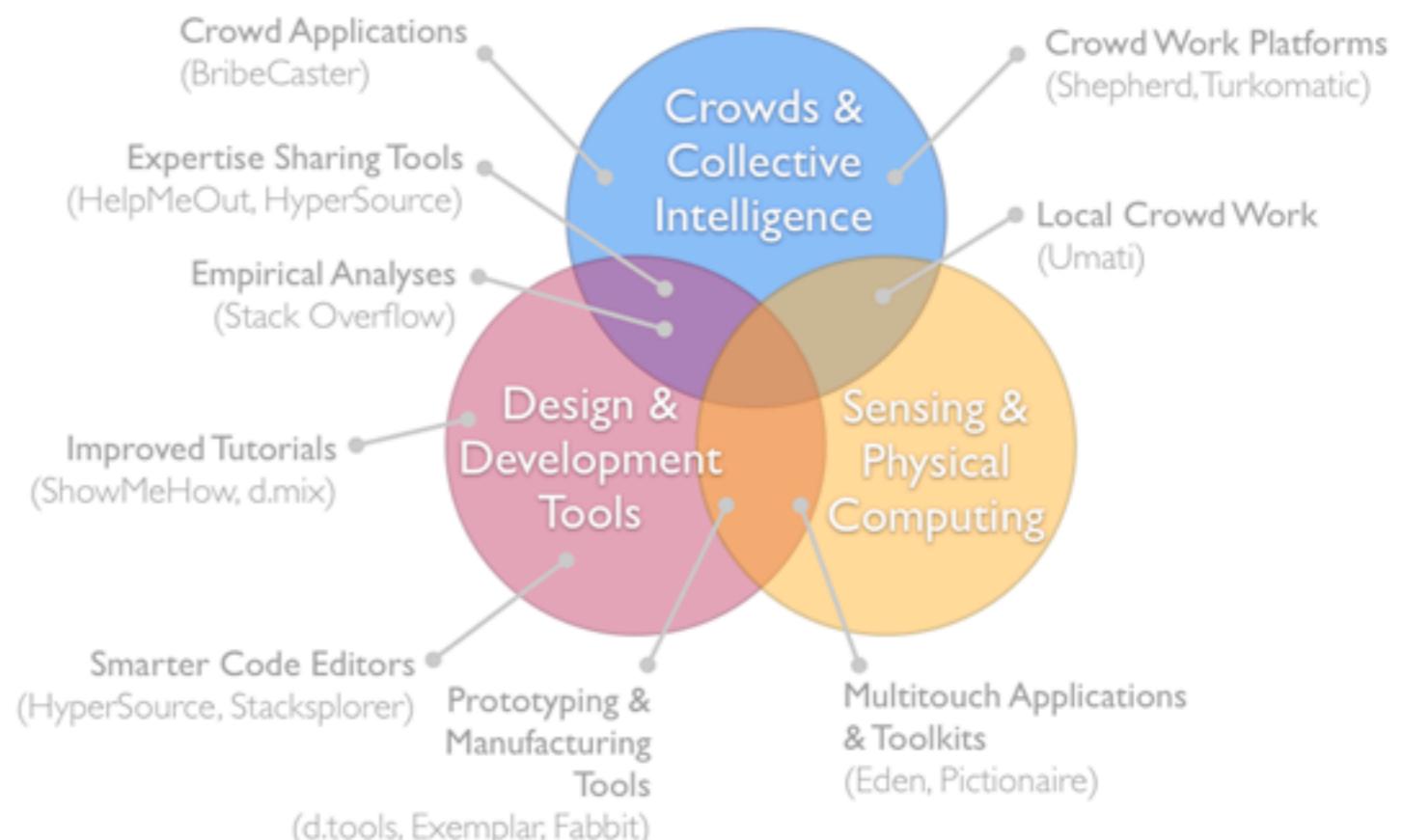
#### May 2011: CHI Paper Awards

Our two full papers will receive Honorable Mention Awards at CHI.

#### Contact info

Office Hours: Wed 4-5pm

My research in Human-Computer Interaction lies at the intersections of three domains: crowdsourcing; design tools; and physical computing. Research systems center on tools for designers and programmers, with emphasis on amateurs and DIY groups.



I am a co-director of the Berkeley Institute of Design. I collaborate with many excellent research groups in our department such as the Visual Computing Lab; the Parallel Computing Lab; and the Swarm Lab. I am also affiliated with the Berkeley Center for New Media, and the new Cal Design Lab. I co-initiated the Course Thread in Human-Centered Design. I received my PhD from the Stanford Computer Science department in

# | Human-Computer Interaction Redux

...is concerned with the design, implementation, and evaluation of user interfaces.

Mobile, social & ubiquitous computing: now is an incredibly exciting time to work in HCI!

Want more?

**CS160** User Interface Design

Course Thread in Human-Centered Design  
<http://coursethreads.berkeley.edu>



bjoern@eecs.berkeley.edu

[www.cs.berkeley.edu/~bjoern](http://www.cs.berkeley.edu/~bjoern)