

# Human-Computer Interaction



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EECS, Computer Science Division  
CS10, Spring 2012

# | My Background



1997-2002



(cc) SnapsterMax

<http://www.flickr.com/photos/myworldinpixels/558060045>



1999-2004



Jay Haze  
Club Milk, Tokyo, 2003



2004-2009





2010





# | What is HCI?



# Human-Computer Interaction (HCI)

## Human

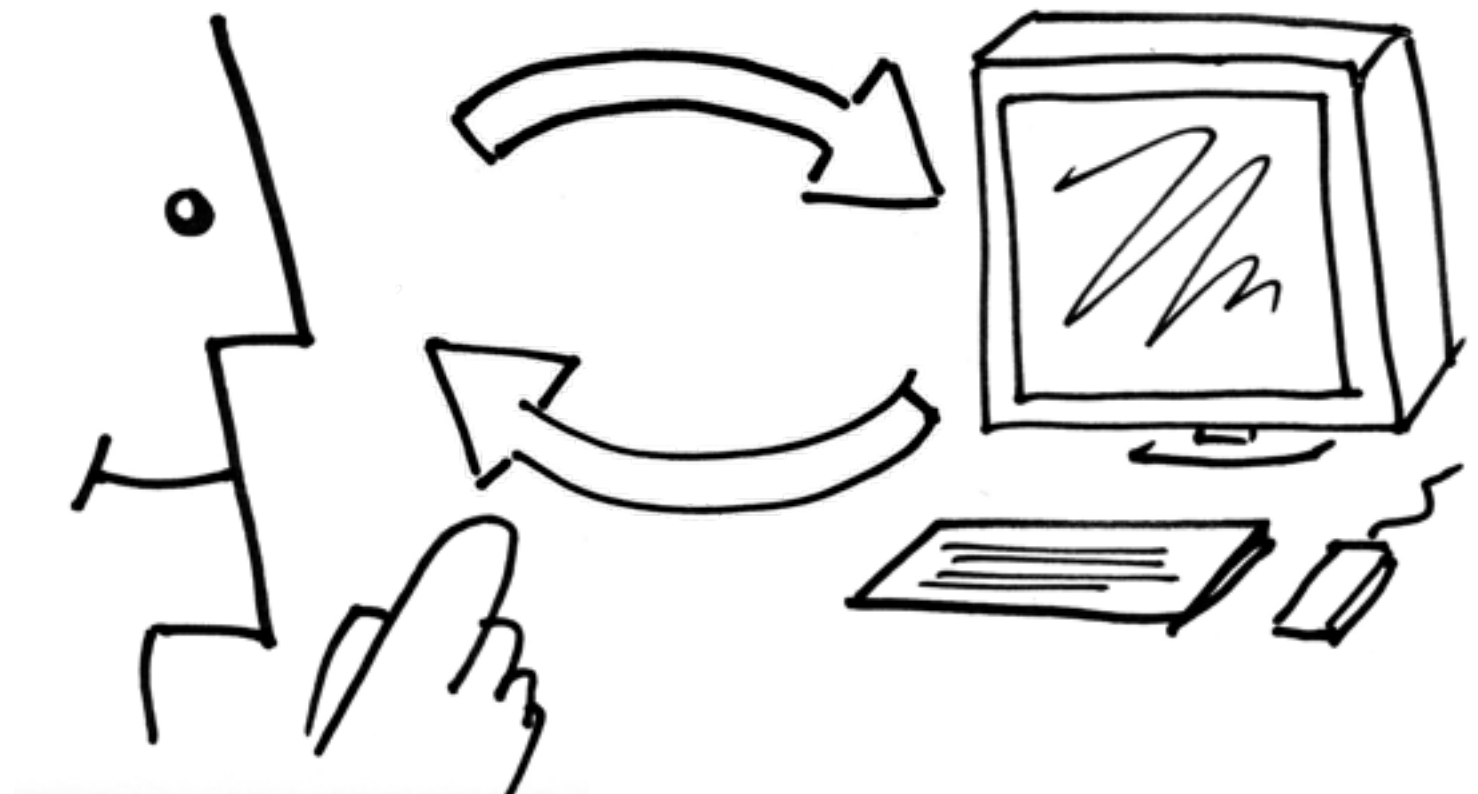
- End-user of program
- Others (friends, collaborators, coworkers)

## Computer

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

## Interaction

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





# User Interfaces (UIs)

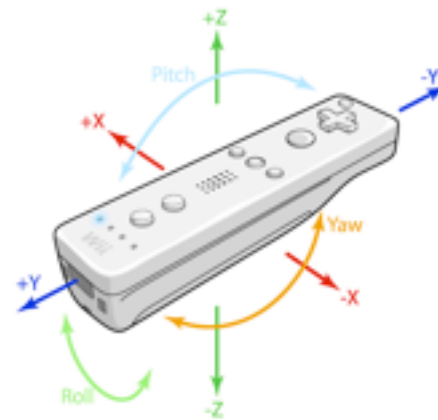
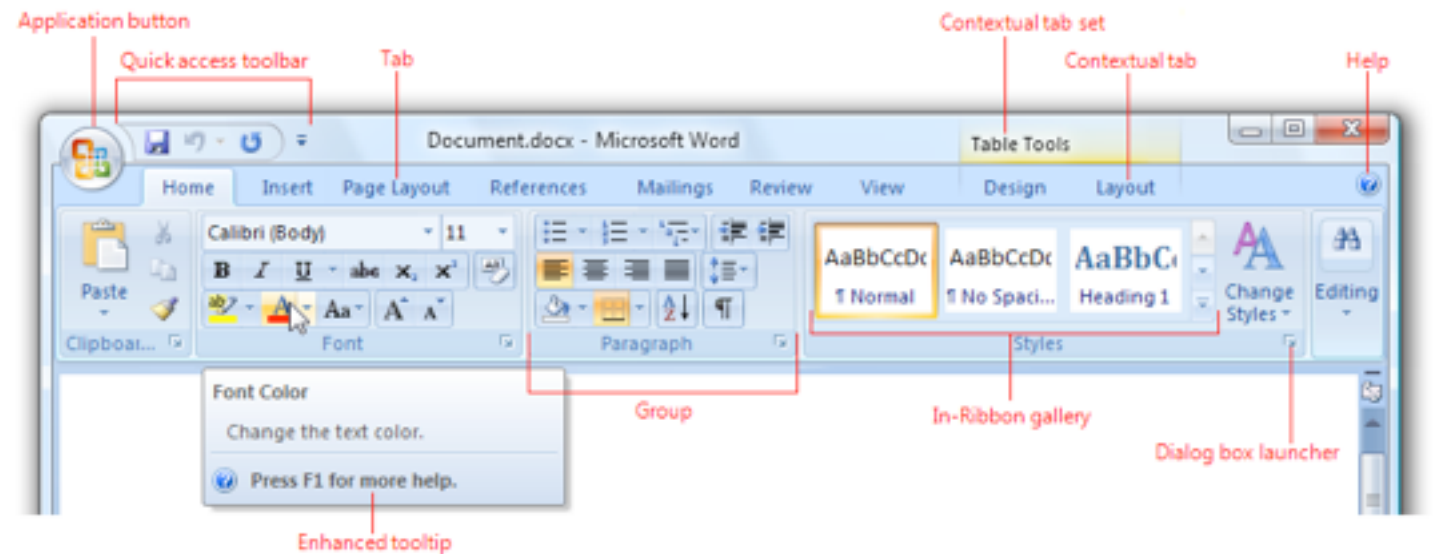
## Part of application that allows

- 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



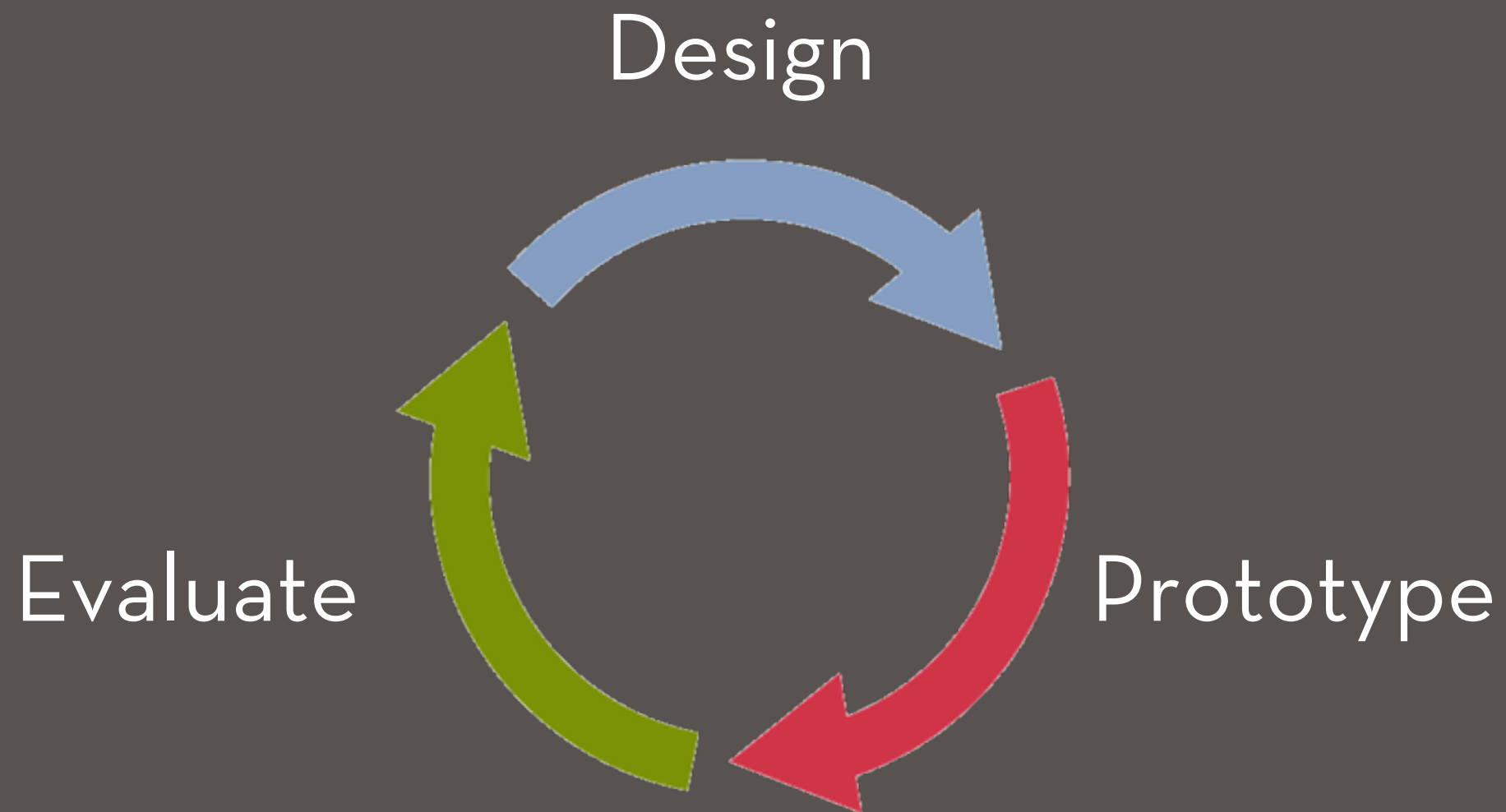
engineer



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

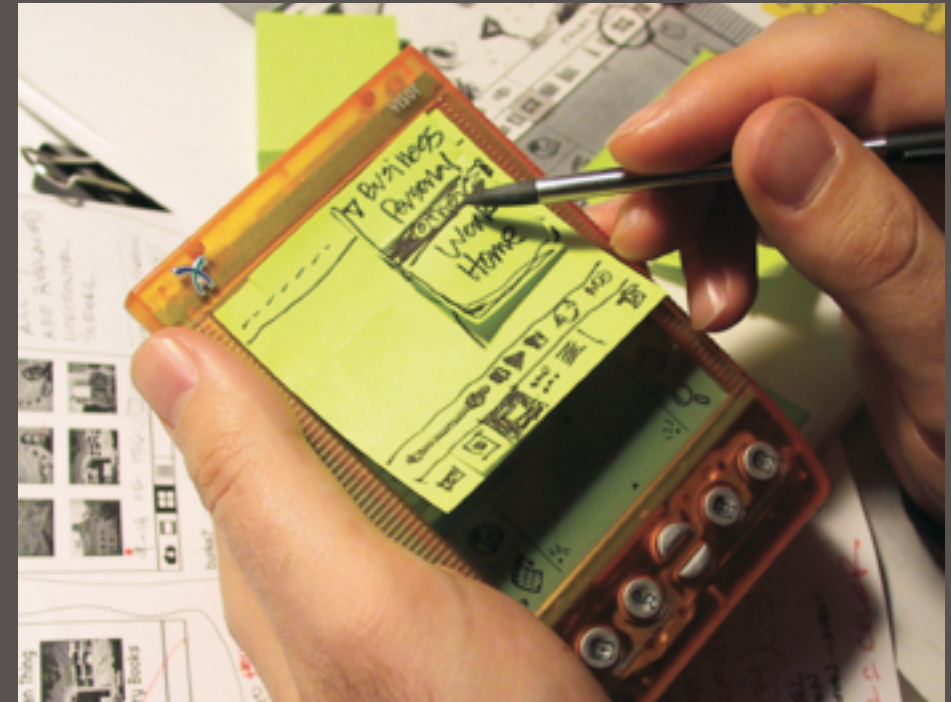
Low-fidelity techniques:

Paper prototyping

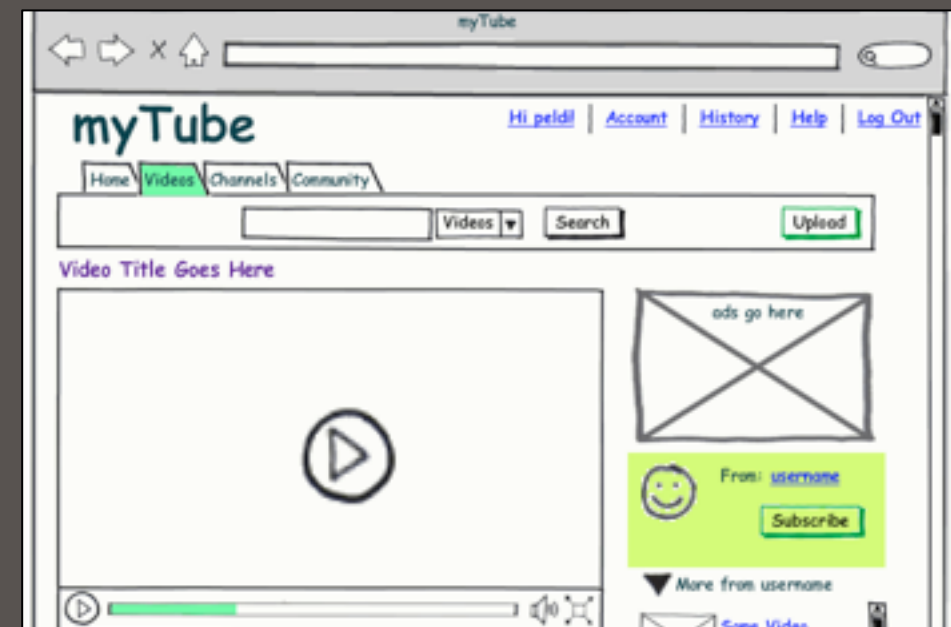
Video prototypes

Interactive prototypes:

HTML, Javascript, Flash, ...

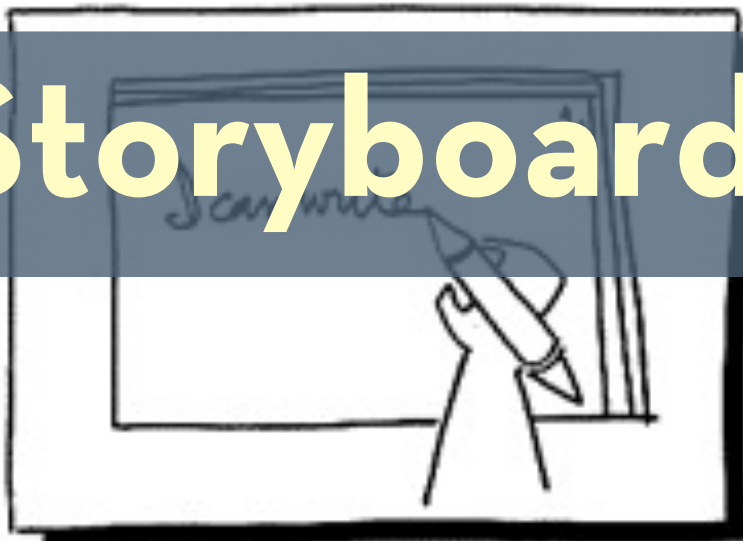


Moggridge, Designing Interactions, p.704

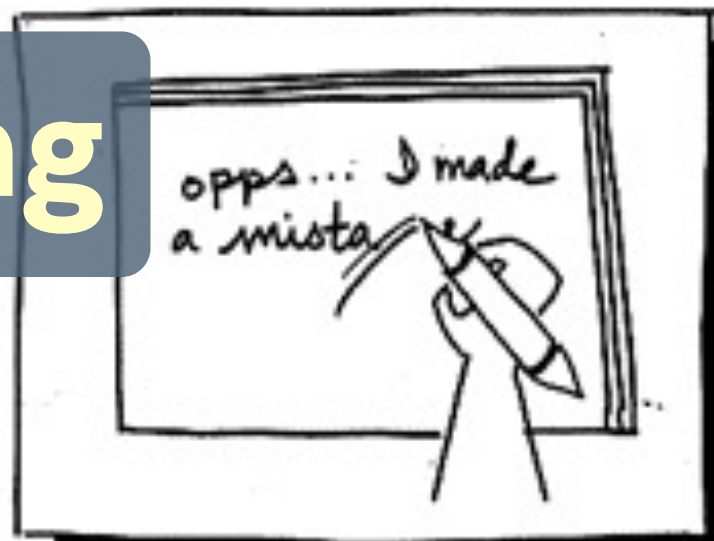


<http://www.balsamiq.com/products/mockups/examples#wiki>

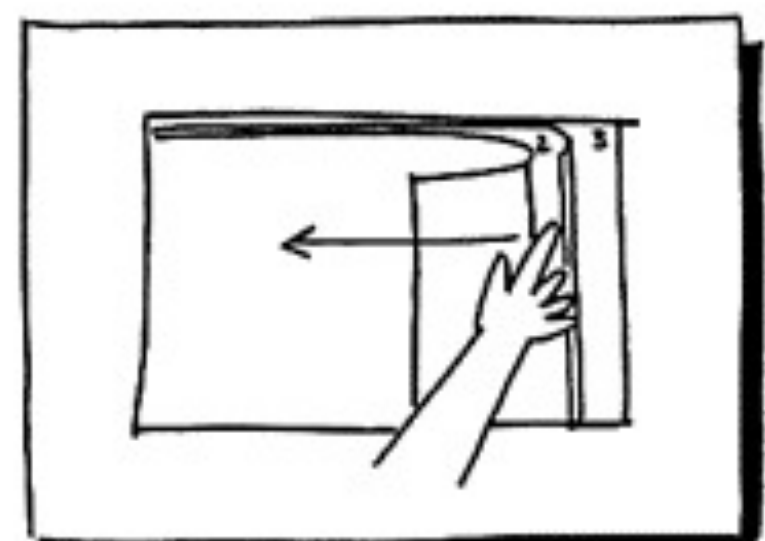
# Storyboarding



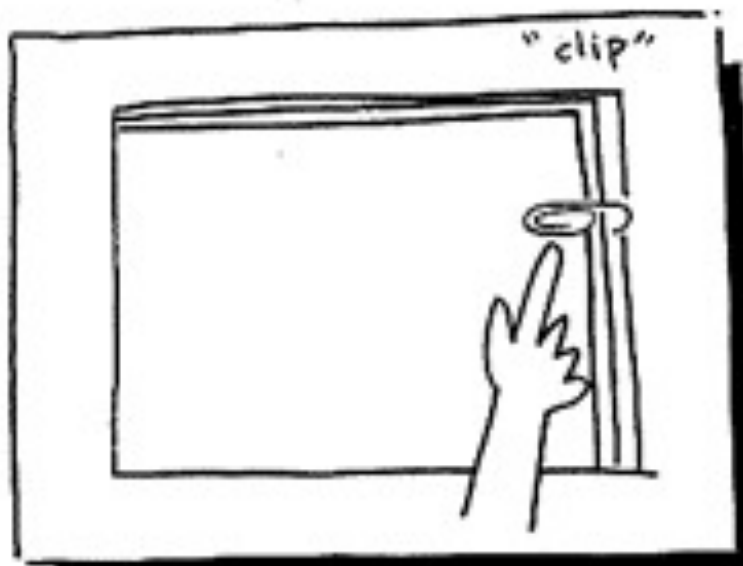
L. can write into her notebook.



She can flip over her pen and erase.



L. can flip to the next page.



L. marks her place.



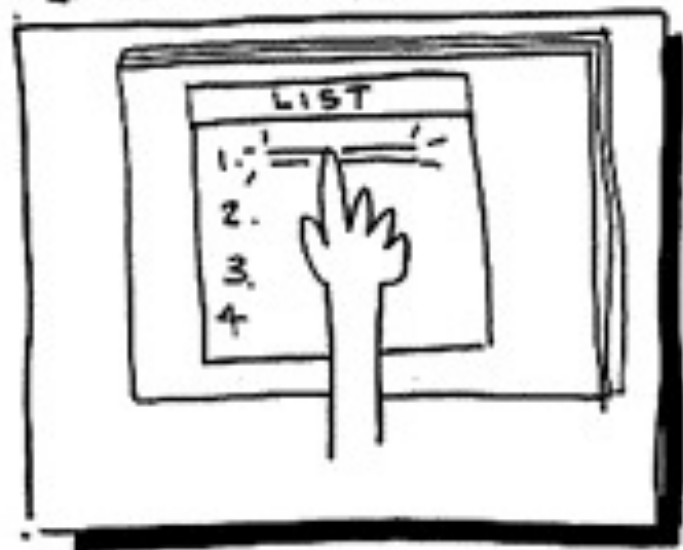
L. marks a phone number.



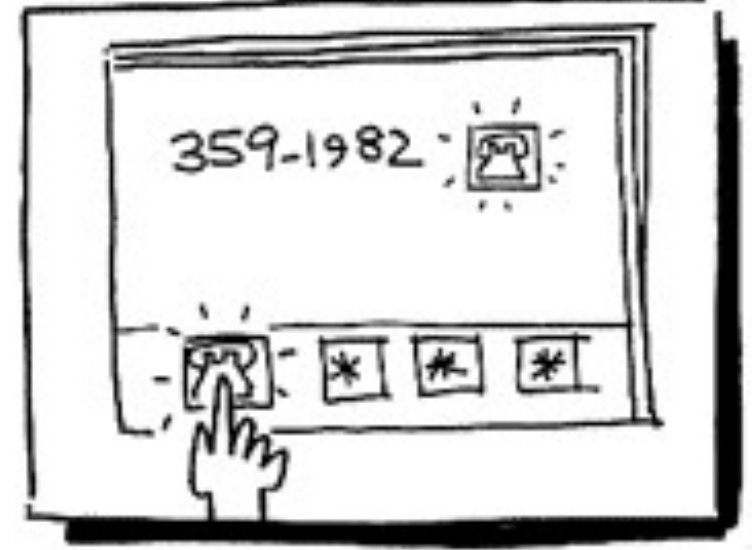
L. shifts to the InBox Section.



L. adds comments



L. brings up a list.



L. looks for phone numbers.







# | 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.*

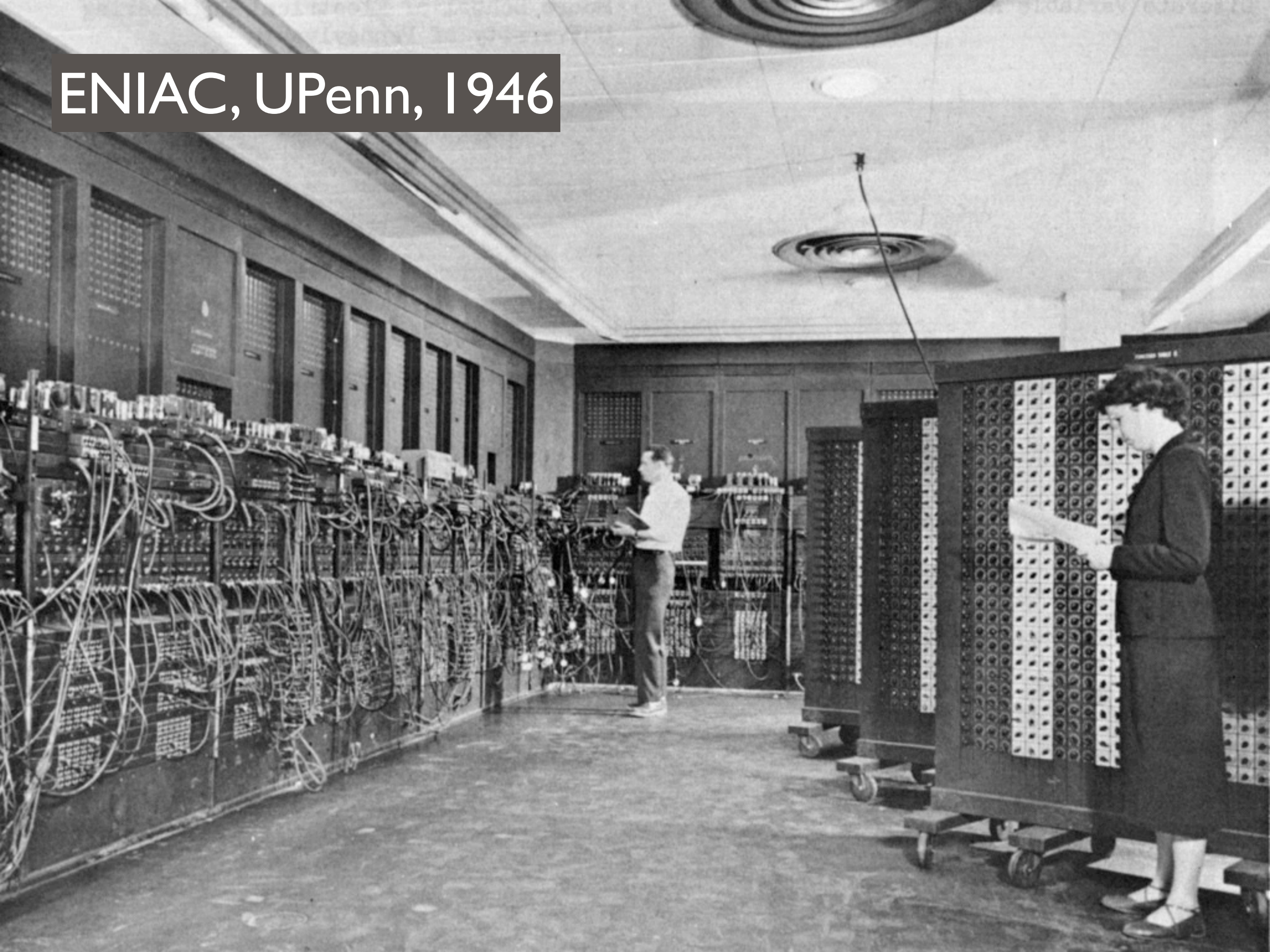
*The average time spent on the user interface portion is 45% during the design phase, 50% during the implementation phase, and 37% during the maintenance phase.”*

*– 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





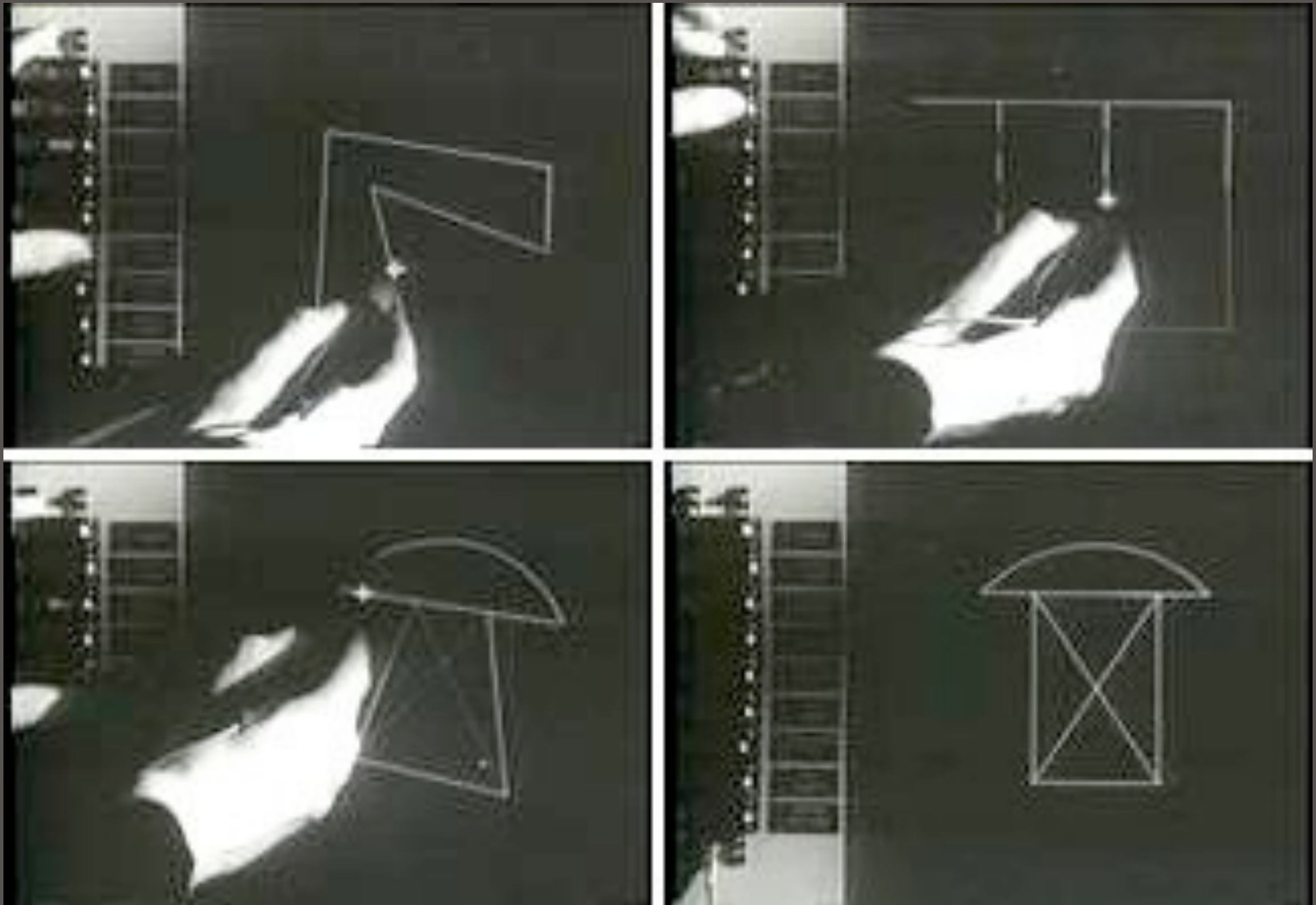
(cc) Flickr user John Chuang  
<http://www.flickr.com/photos/13184584@N08/1362760884/>



# | When was pen input invented?

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





Ivan Sutherland, Sketchpad, MIT, 1963/64







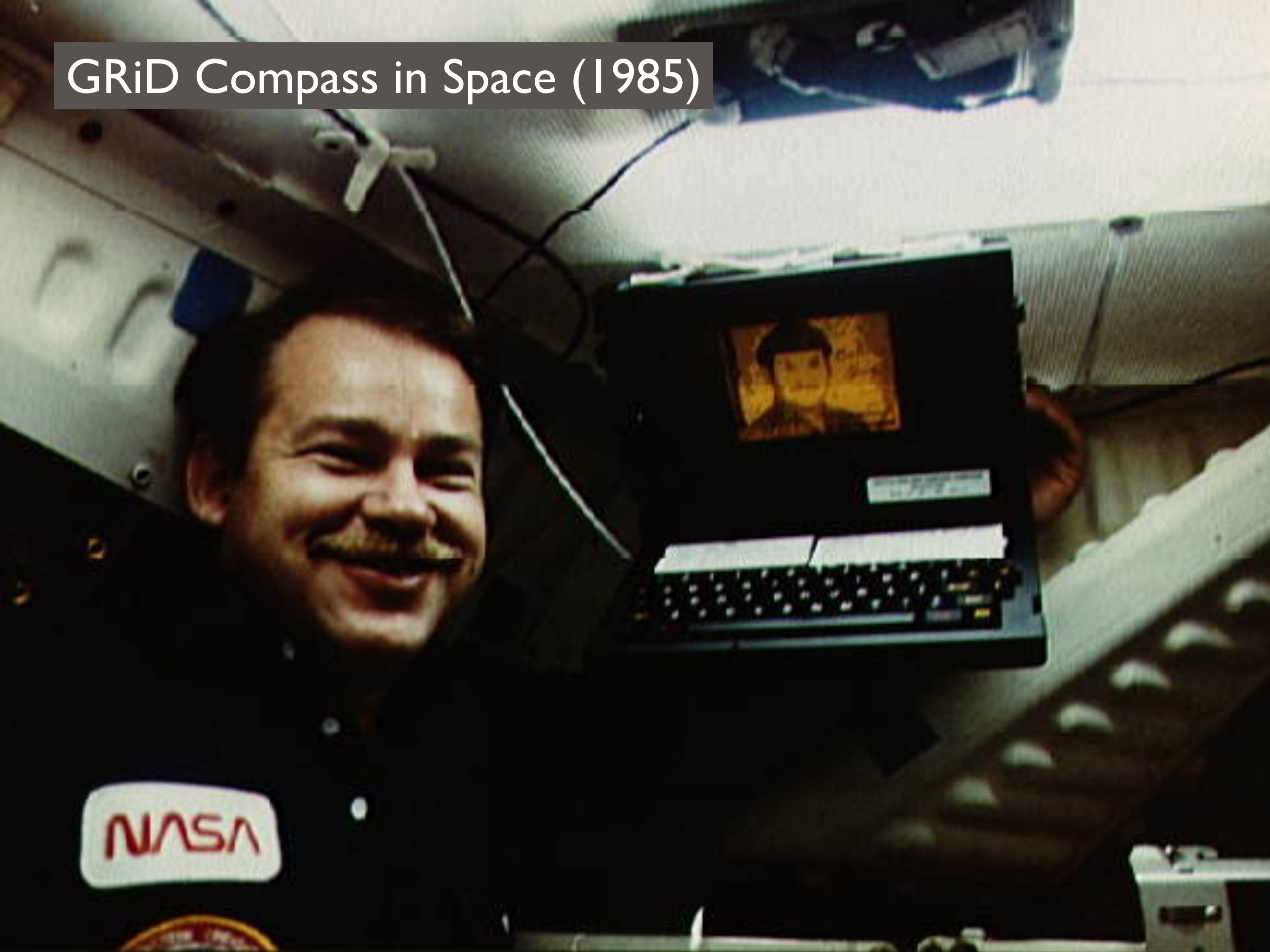


Earlier today...

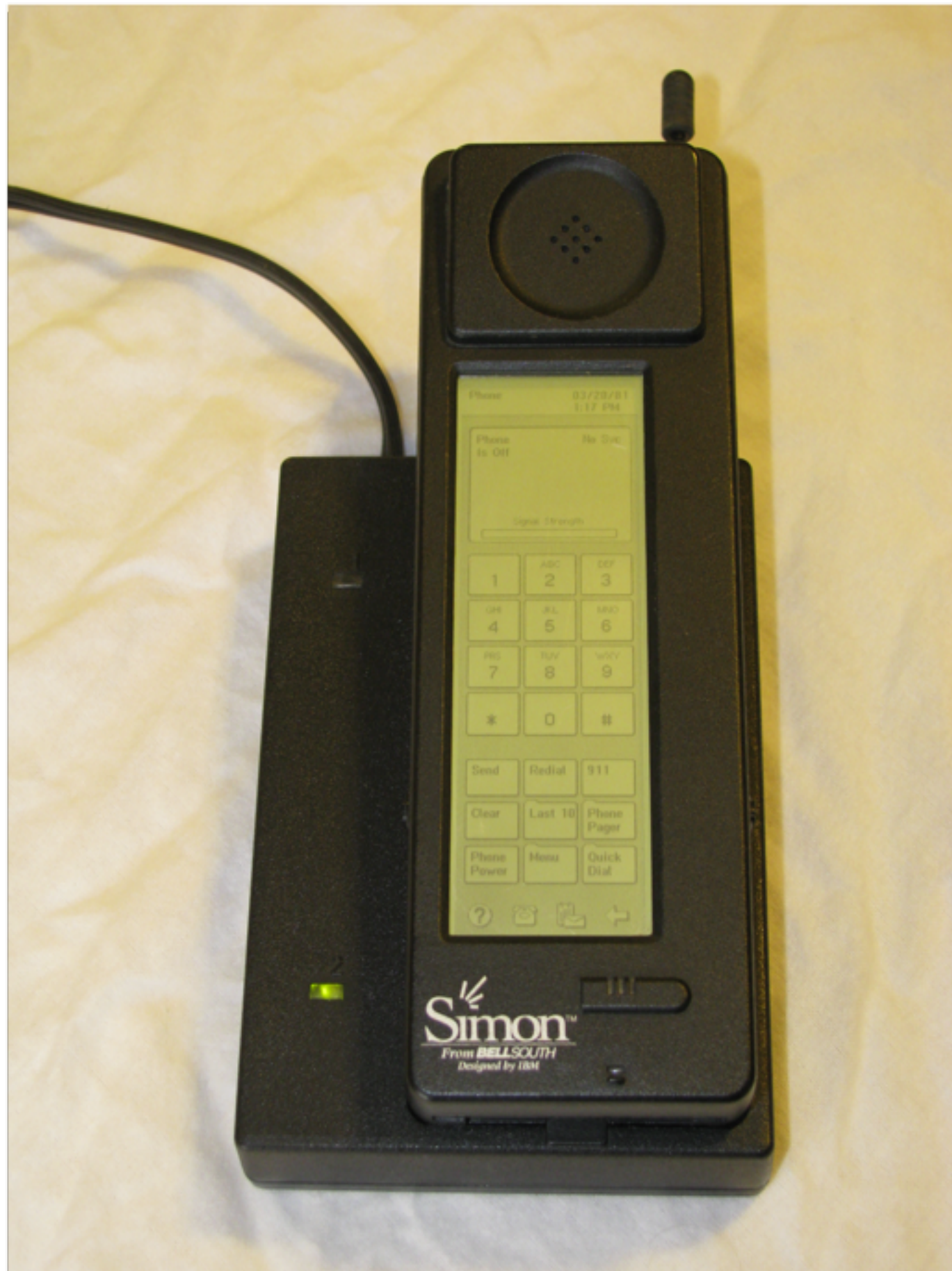
# The new iPad



# GRiD Compass in Space (1985)







IBM Simon  
1992

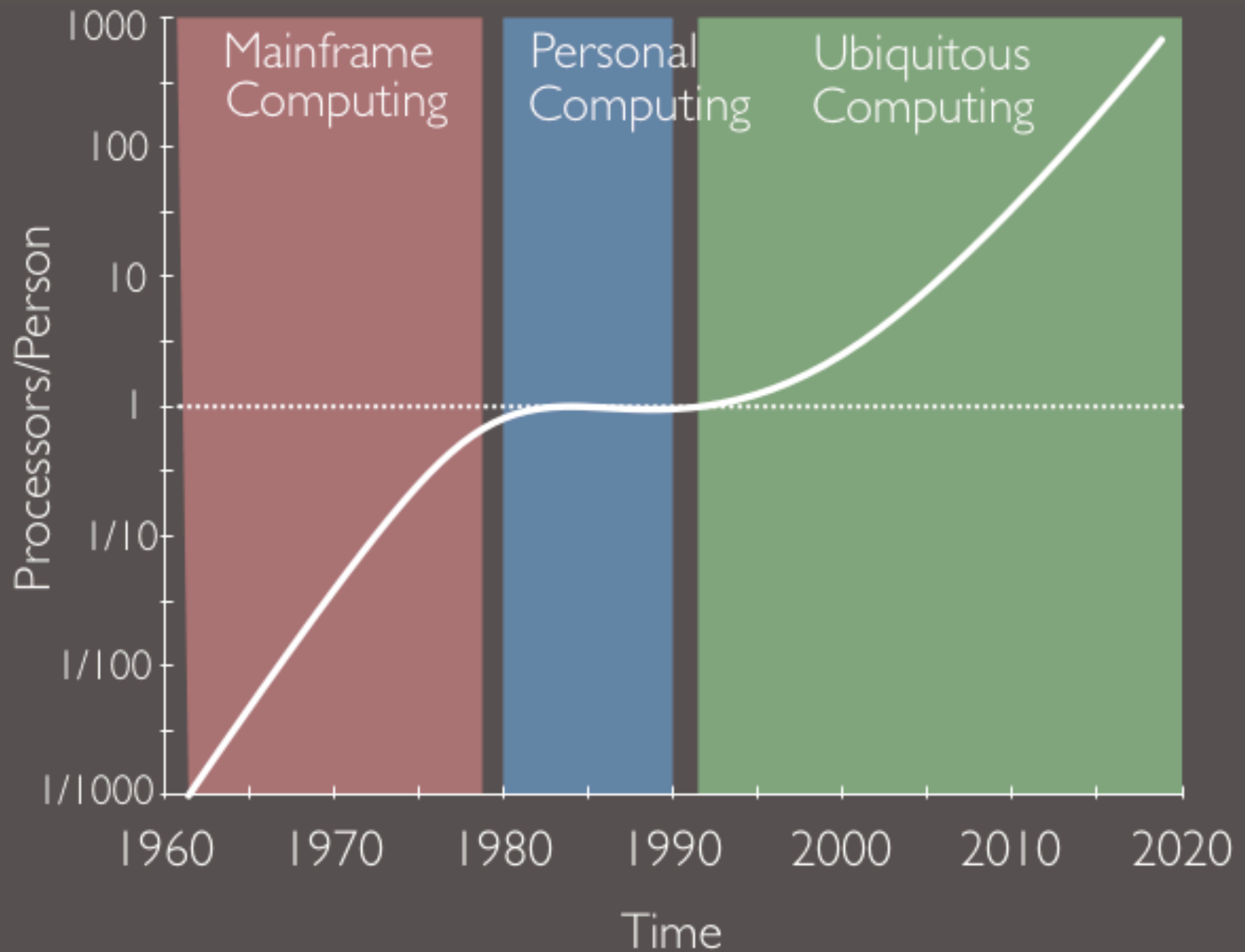
<http://www.dipity.com/bjoern/personal>



# | What has changed?

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

*- Gordon Moore, 2003*

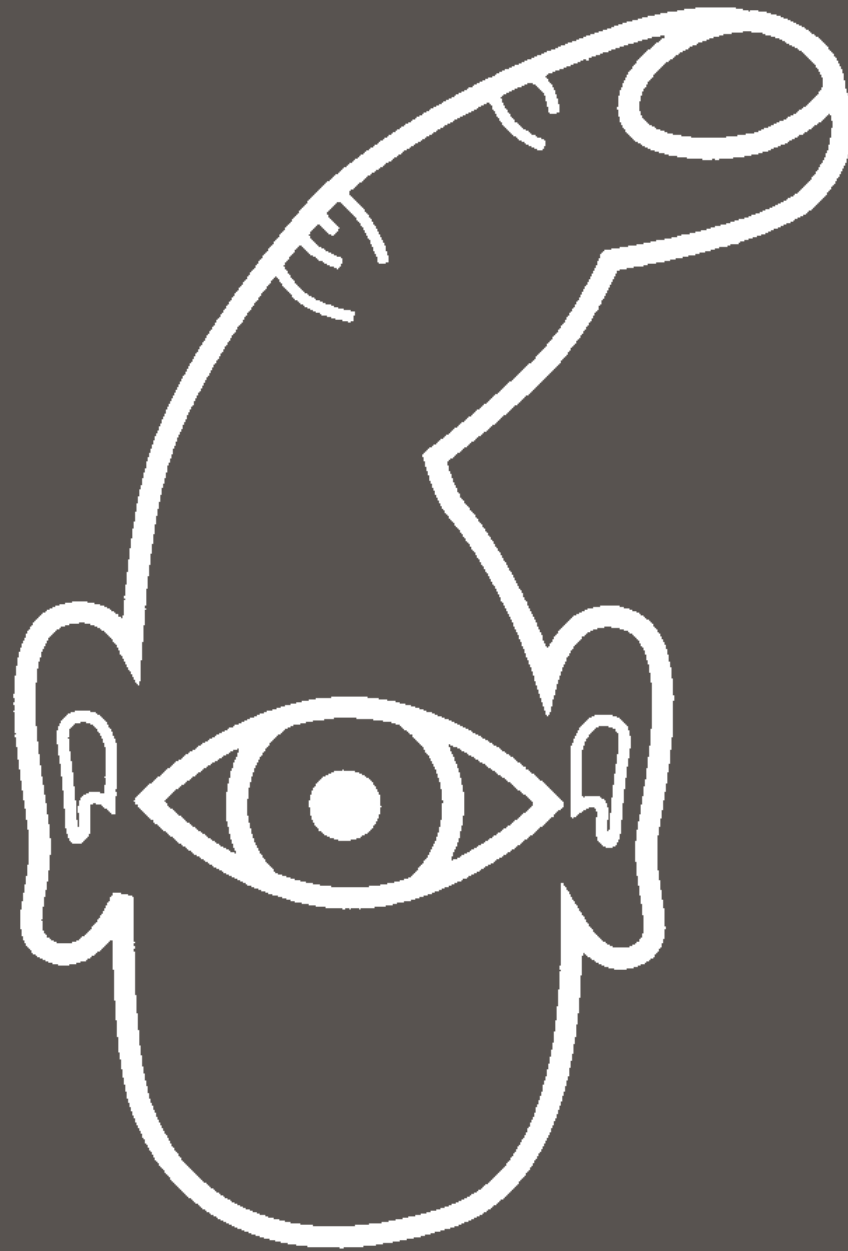




Era	Ratio Computers:People	HCI Focus
Mainframe Computing	1:many	Human Factors
Personal Computing	1:1	Psychology, Cog. Science
Ubiquitous Computing	many:1	Collaboration, Rich Interaction

# | Research Directions



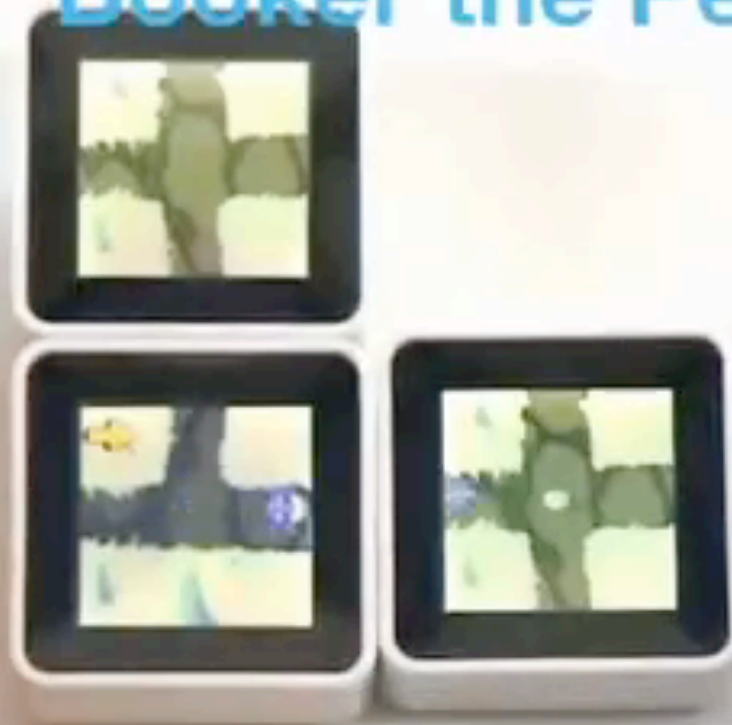


(c) Dan O'Sullivan





## 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



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## Welcome to Wikipedia,

the free encyclopedia that anyone can edit.

3,262,285 articles in English

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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



#### navigation

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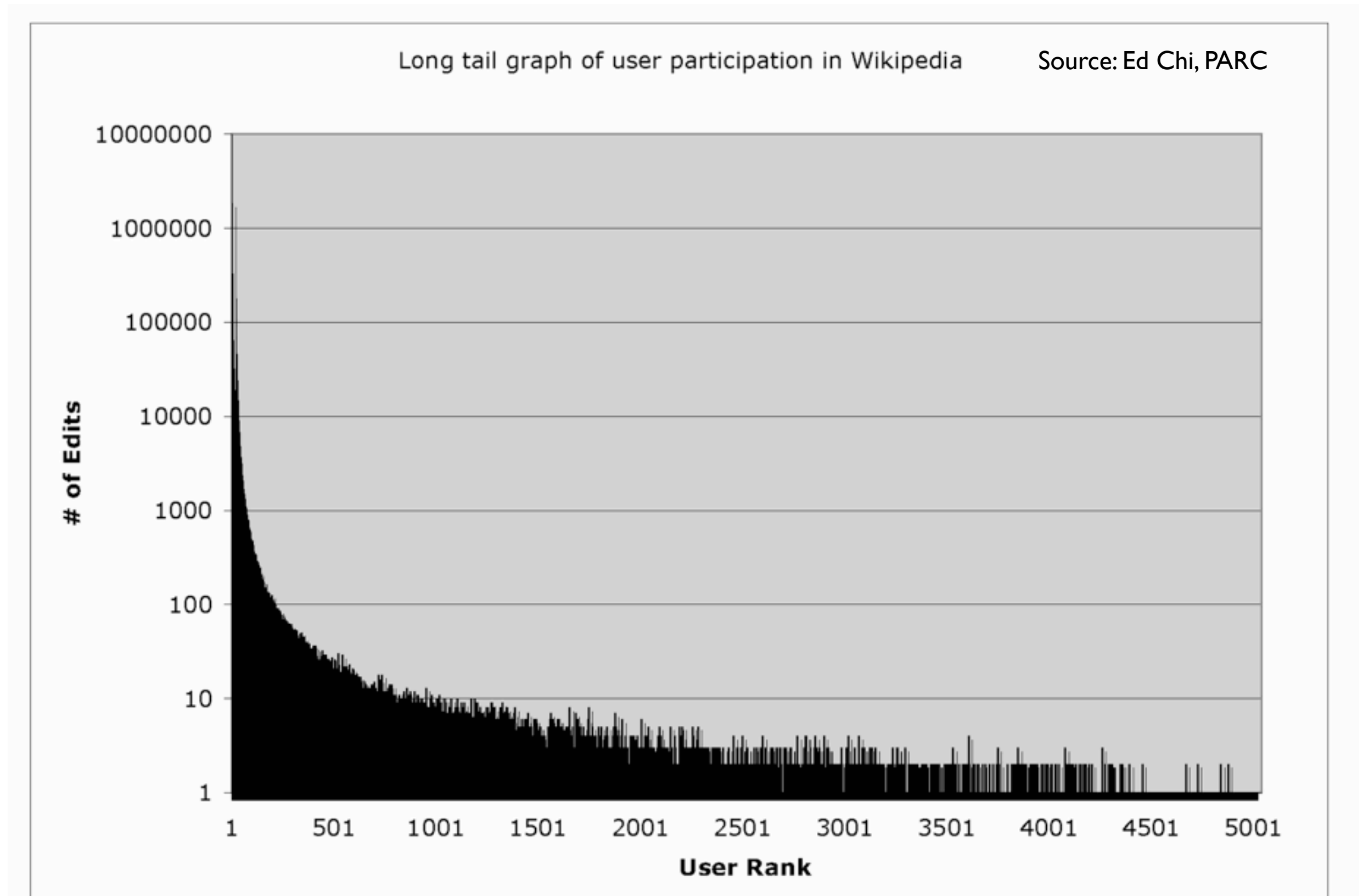
#### search




#### interaction

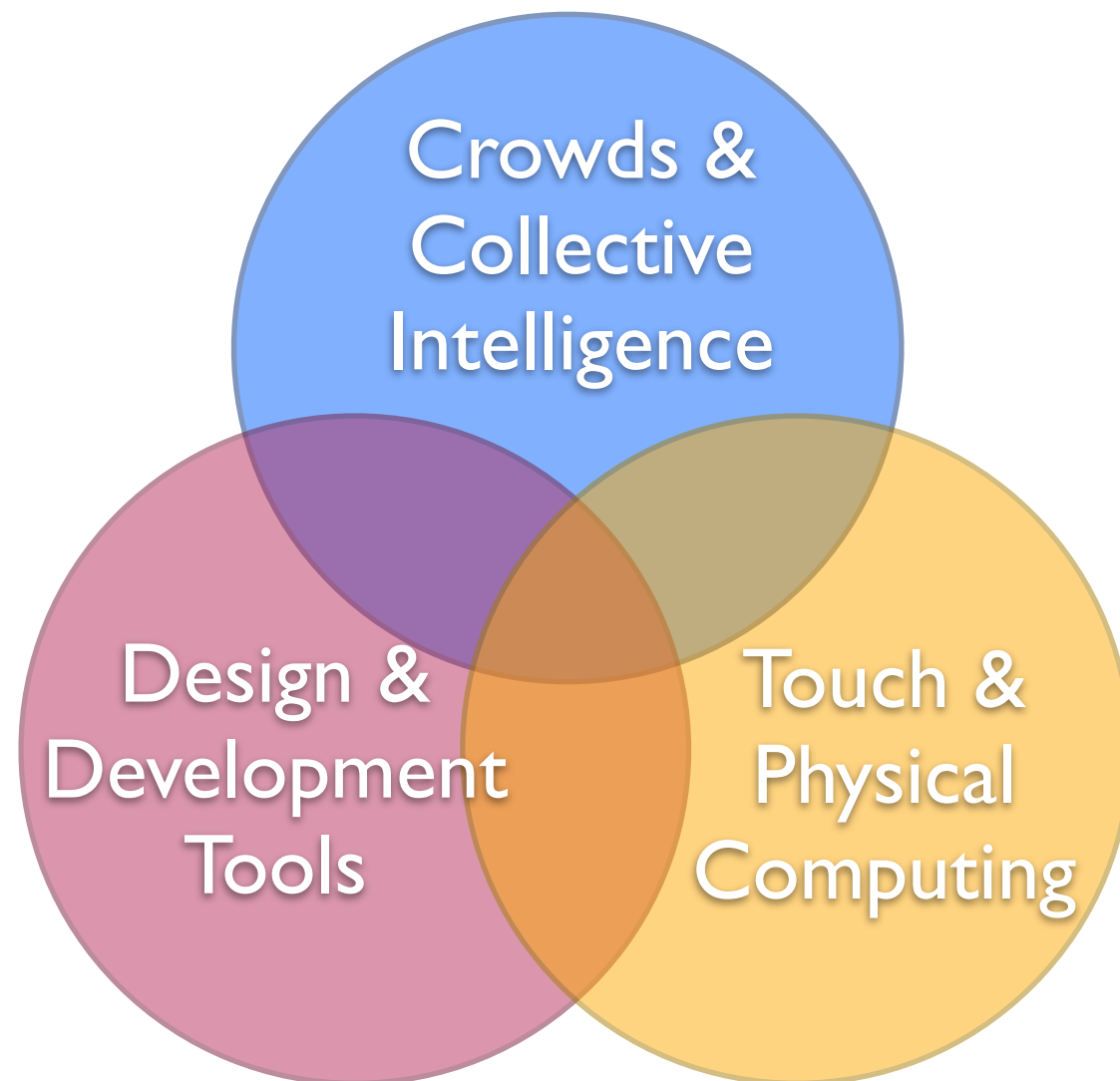
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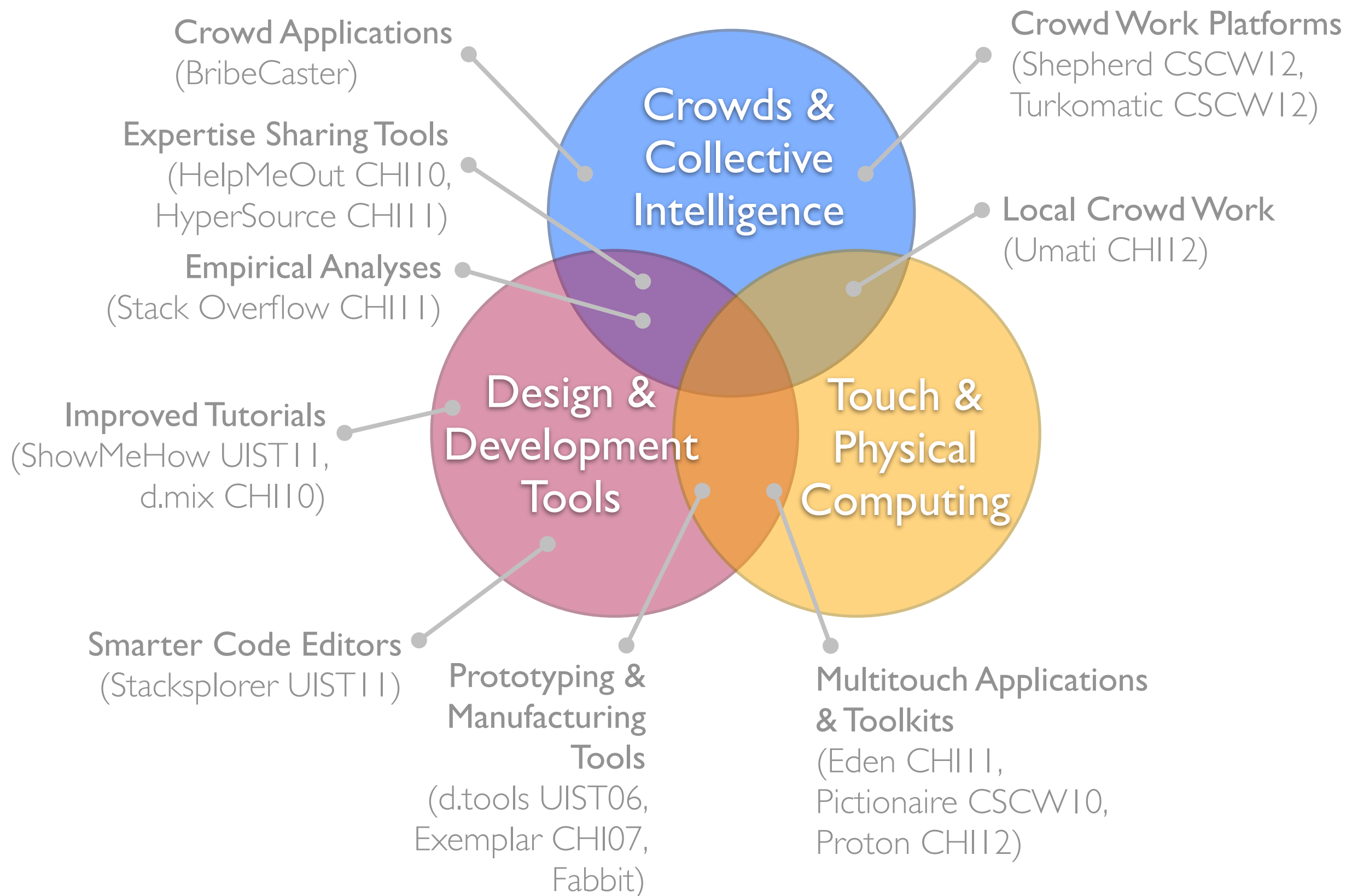
# Zipf / Power Law Distribution

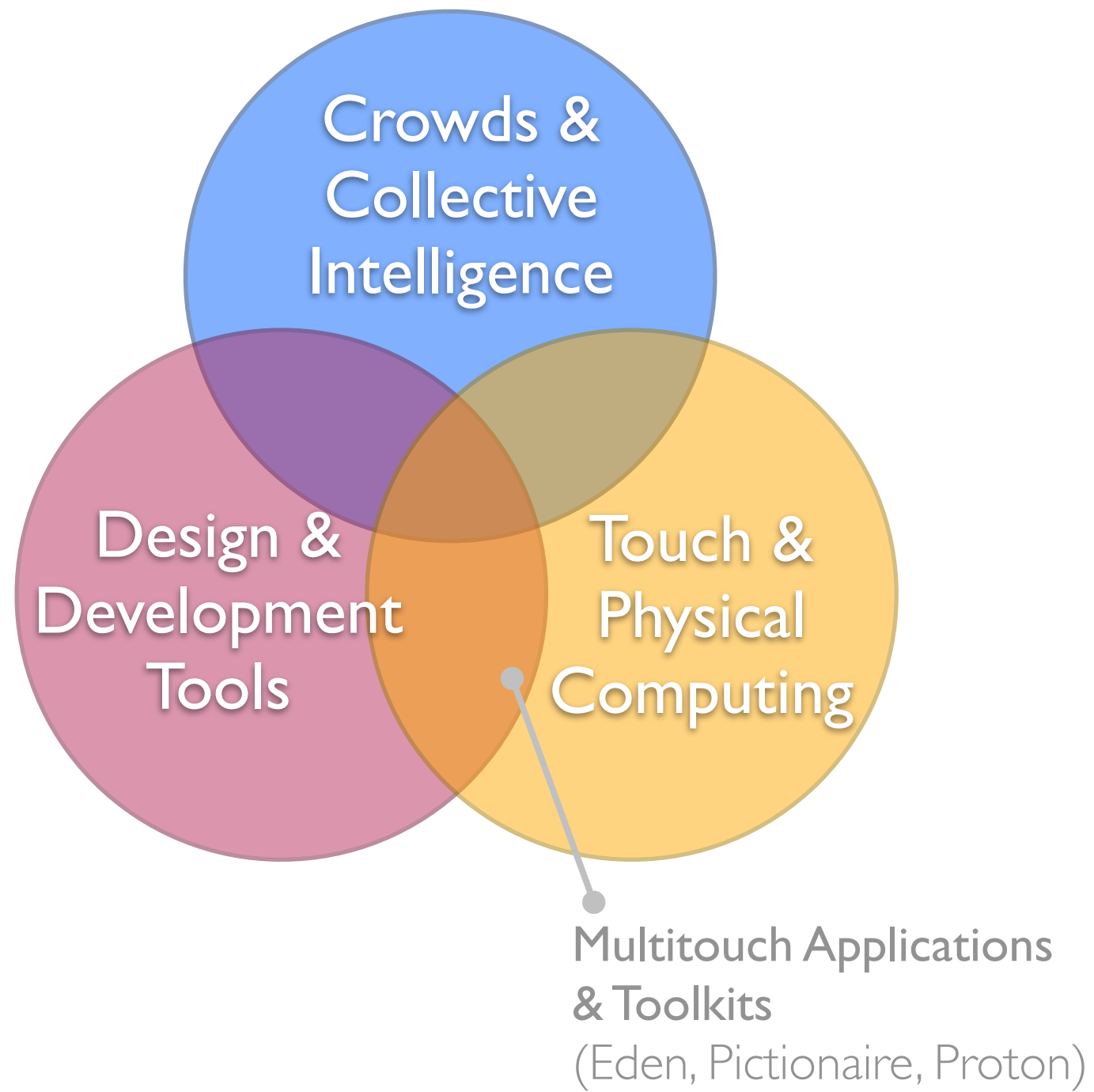


# | HCI Research at Berkeley











# Supporting Co-Located Design



## **Question:**

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

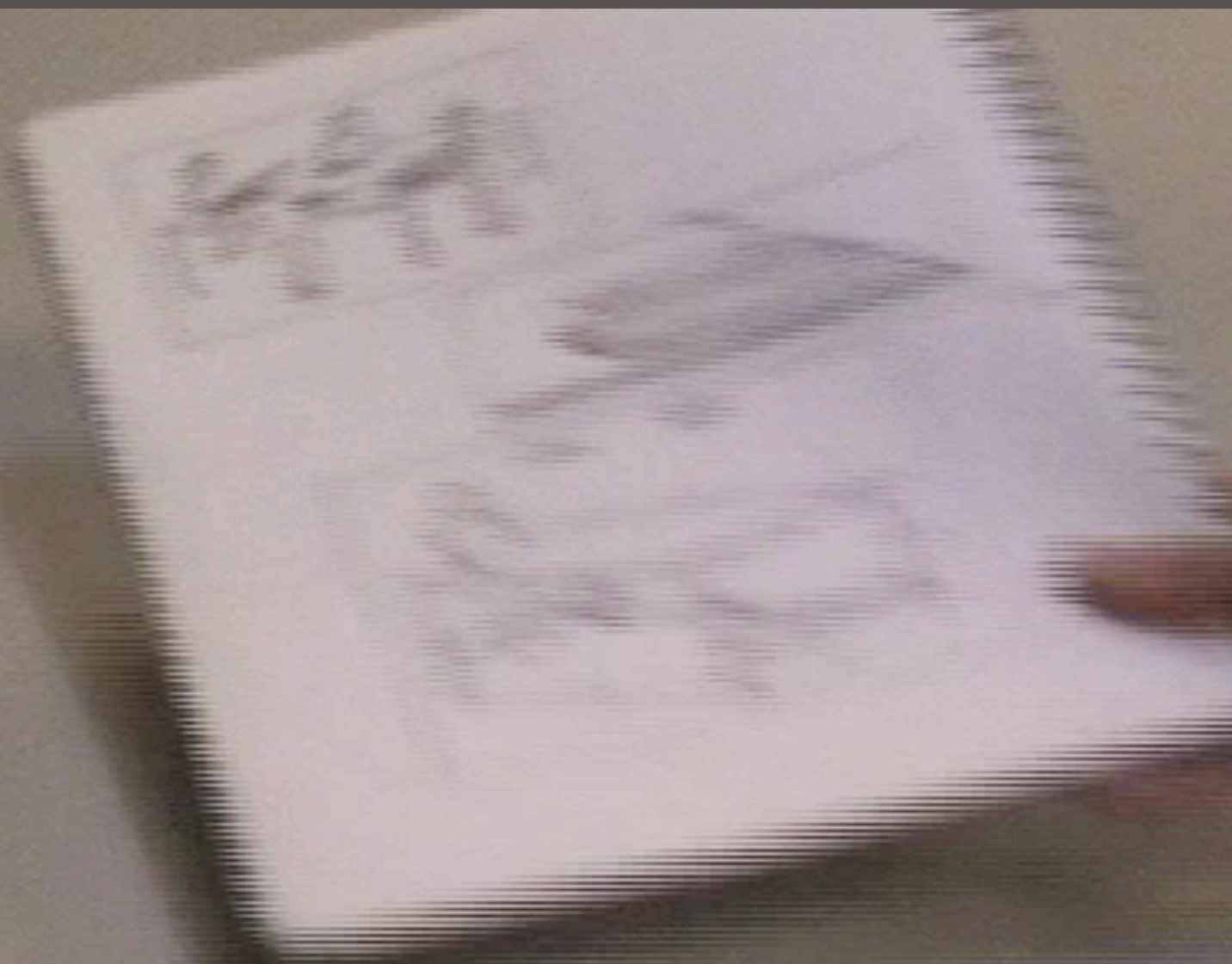




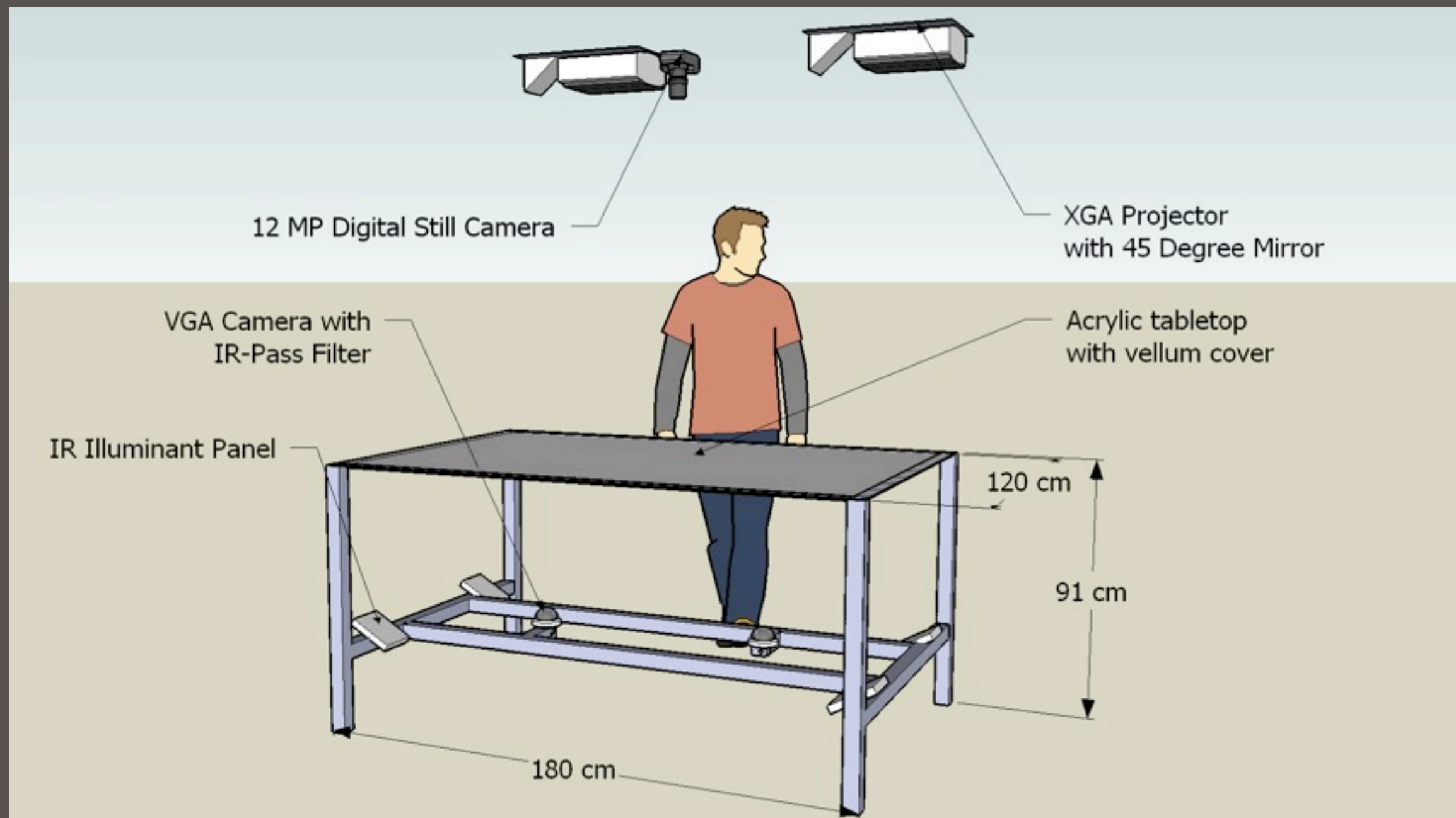








# Table Infrastructure



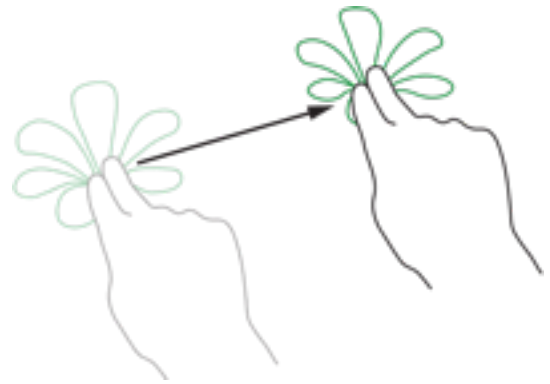


# The FourBySix Table

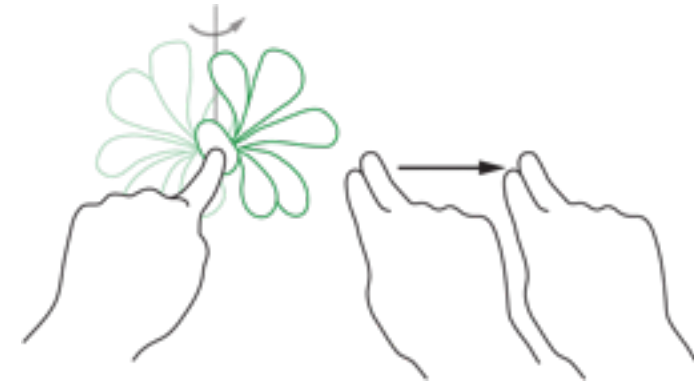


# Object Manipulation

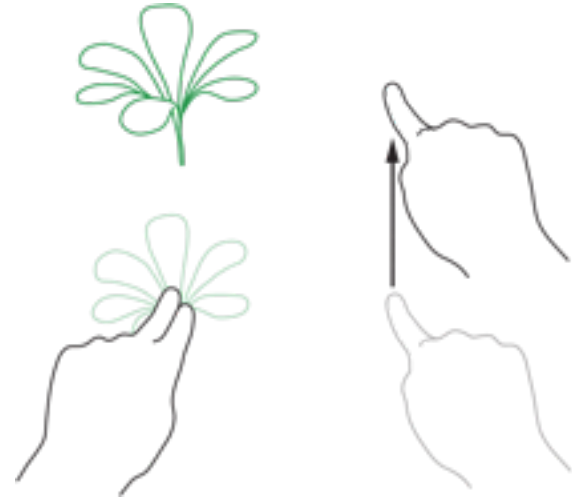
XY  
Translation



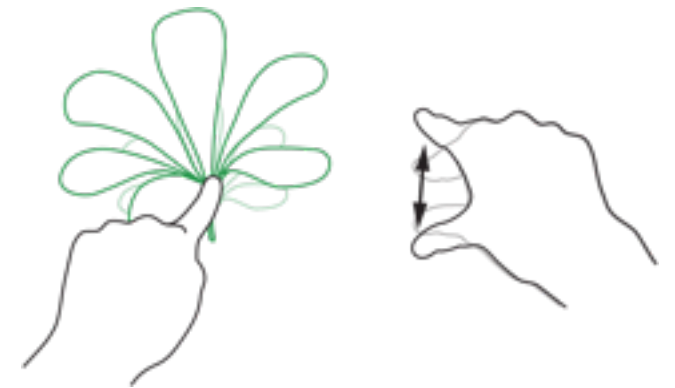
World Z  
Rotation



Z Translation



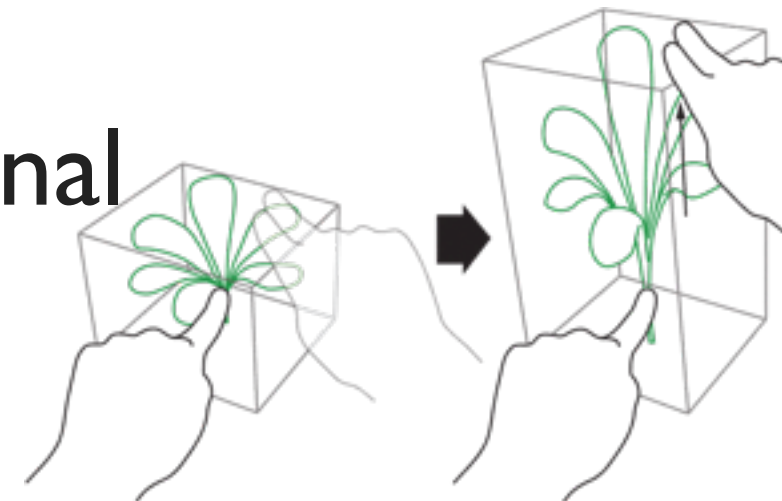
Uniform Scale



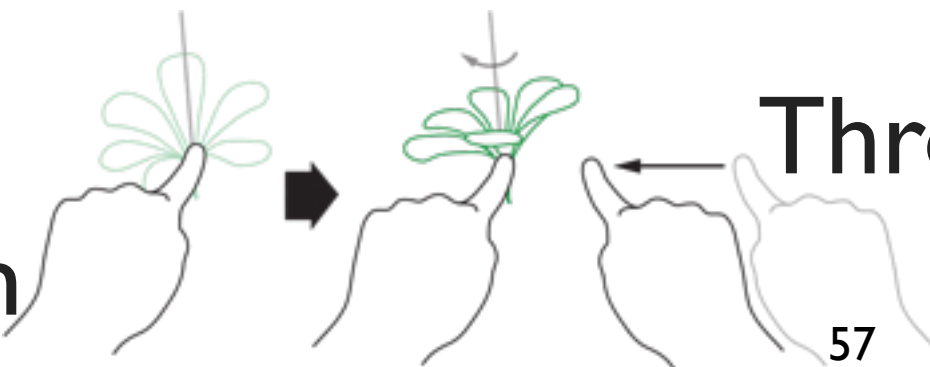
Arcball  
Rotation



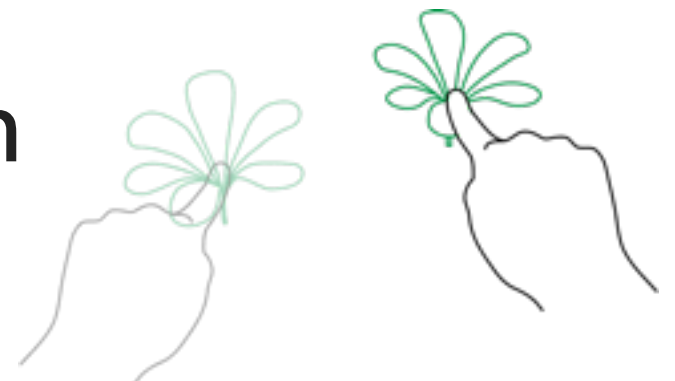
One-Dimensional  
Scale

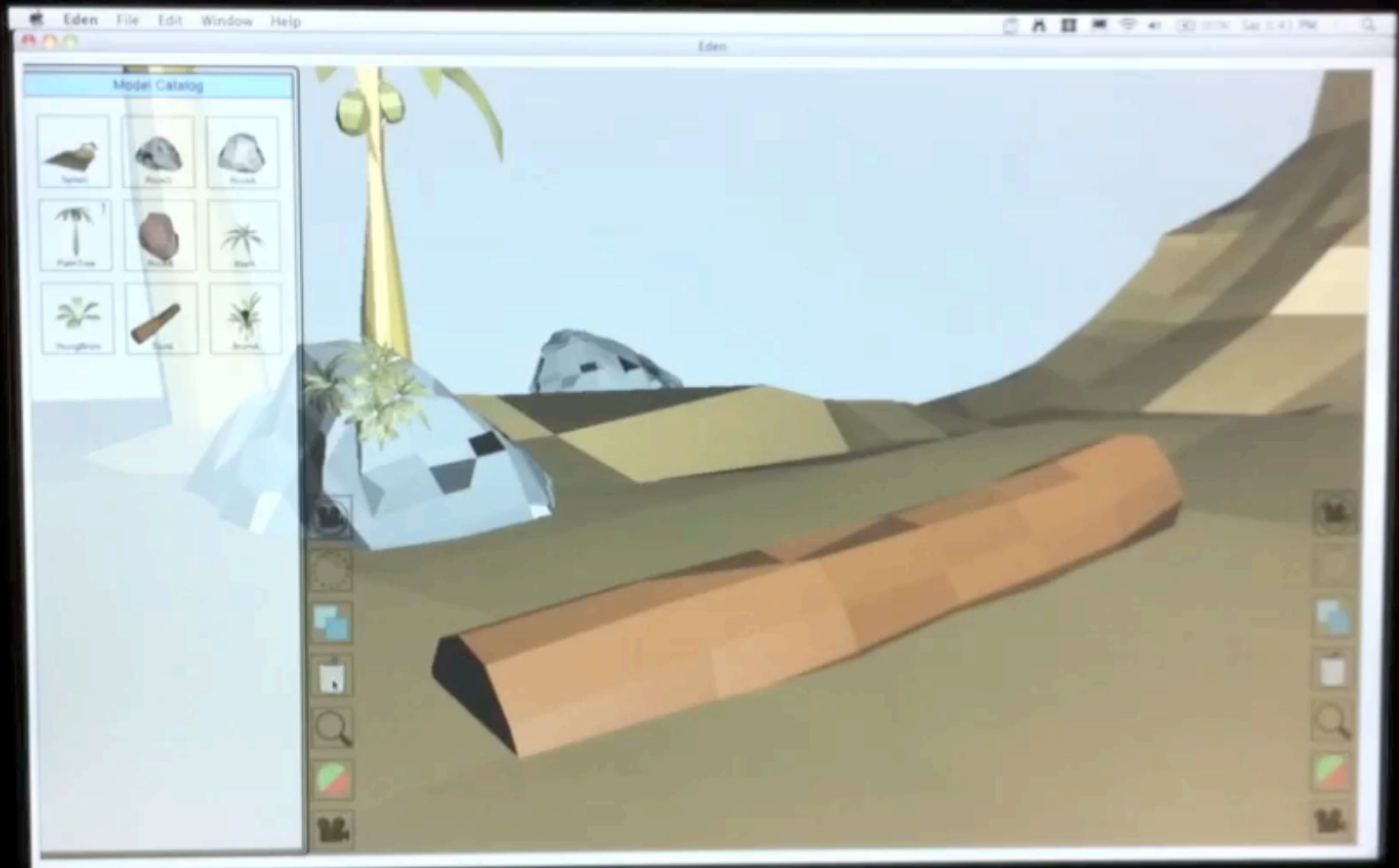


Local Z  
Rotation

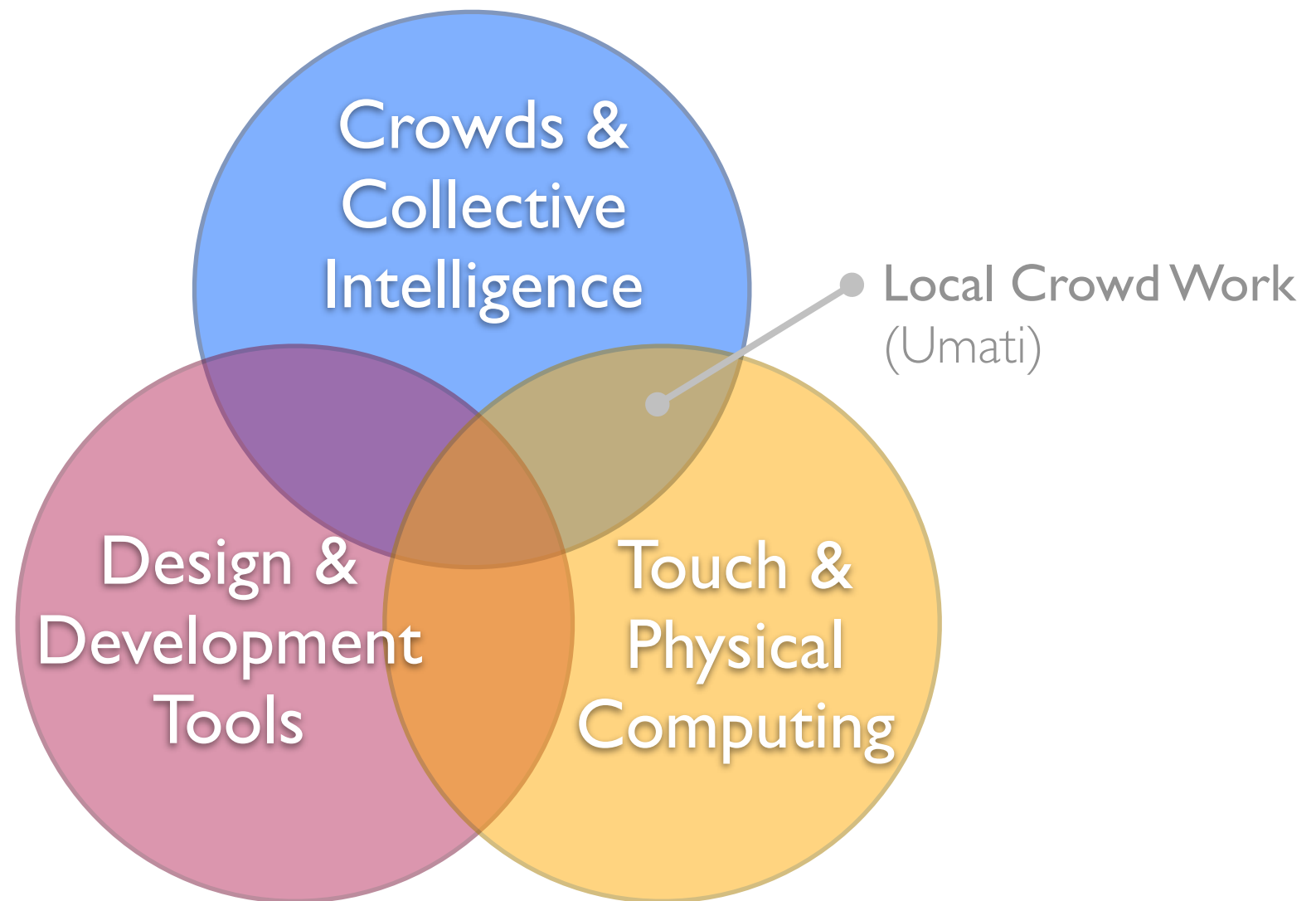


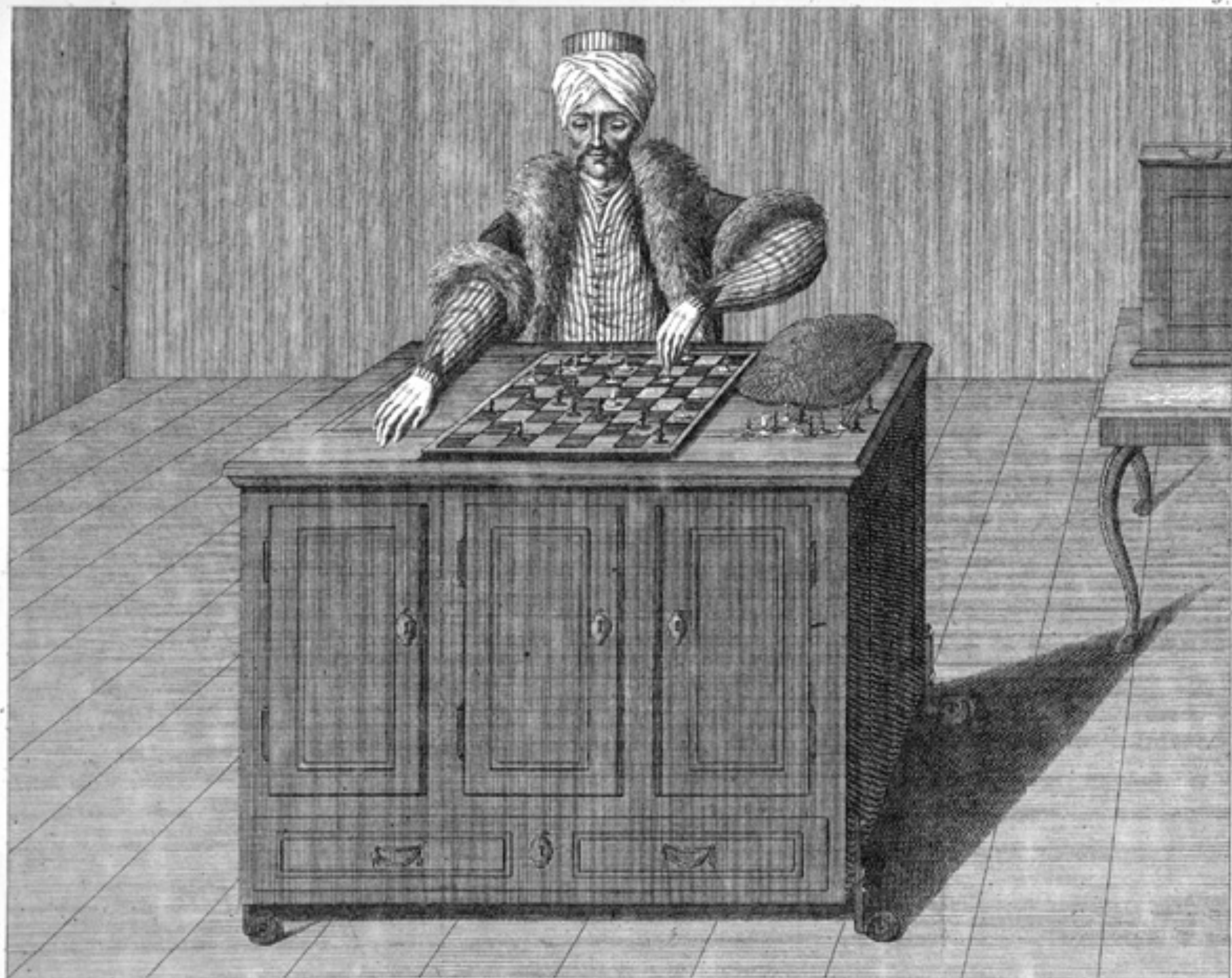
Throw-and-Catch











W. de Kampelen del.

Chr. à Meckel excud. Basileus.

P. G. Pintz sc.

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



Your Account

HITs

Qualifications

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### Verify Organizations' Websites

[View a HIT in this group](#)

**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

[View a HIT in this group](#)

**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

[View a HIT in this group](#)

**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

[View a HIT in this group](#)

**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

[Request Qualification \(Why?\)](#) | [View a HIT in this group](#)

**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?

**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!!

mimo





The screenshot shows a software interface for a programming task. At the top, there are three buttons: "Vend", "Tasks" (highlighted in blue), and "Exit". Below these are three tabs: "Question" (highlighted in light blue), "Professor" (highlighted in pink), and "Student" (highlighted in yellow). The "Question" tab contains the following text:

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 (h: %d z:
        %d%n", h(), z); }
}

class C extends A {
    int z = 42;
    void f () { this.g (); }
}

```

The "Professor" tab contains the following text:

```

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

```

The "Student" tab contains a large text area with handwritten text:

```

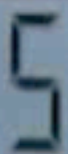
A:2
A:2
h:2 z:15
h:2 z:15

```

At the bottom of the interface, there is a "Grading Slider" with a value of 0 and a "Submit" button.

Annotations with arrows point to the following elements:

- Question**: Points to the question text in the "Question" tab.
- Field Toggles**: Points to the "Student" tab.
- Grading Rubric**: Points to the "Professor" tab.
- Student Answer**: Points to the handwritten text in the "Student" tab.
- Grading Slider**: Points to the slider control at the bottom.



Vend

Tasks

Exit

Question

Professor

Student

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

The cast (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.

Instructions

Your task is to grade these exam questions. You can zoom in by double-tapping and remove fields from view by selecting the button on the top.

OK

mimo



Question

Professor

Student

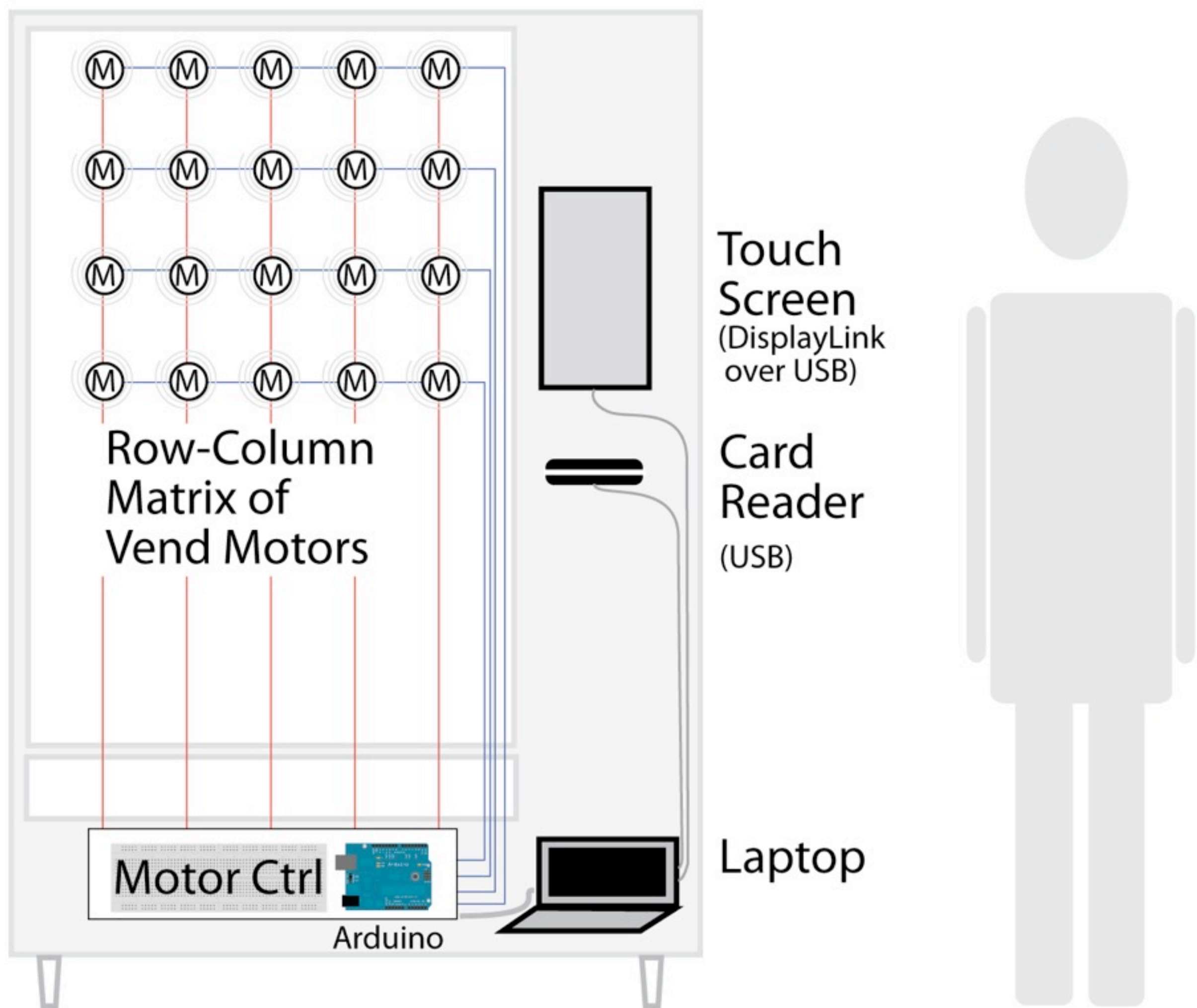
What is the result of compiling and executing the following? Briefly explain your answer.

```
abstract class A {  
    abstract void f();  
}  
  
class B {  
    void f() { print("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 `g((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.

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







I Week

300+ Unique Users

7500+ Answers Graded

---

\$200 of Candy

# | How Good are the Answers?

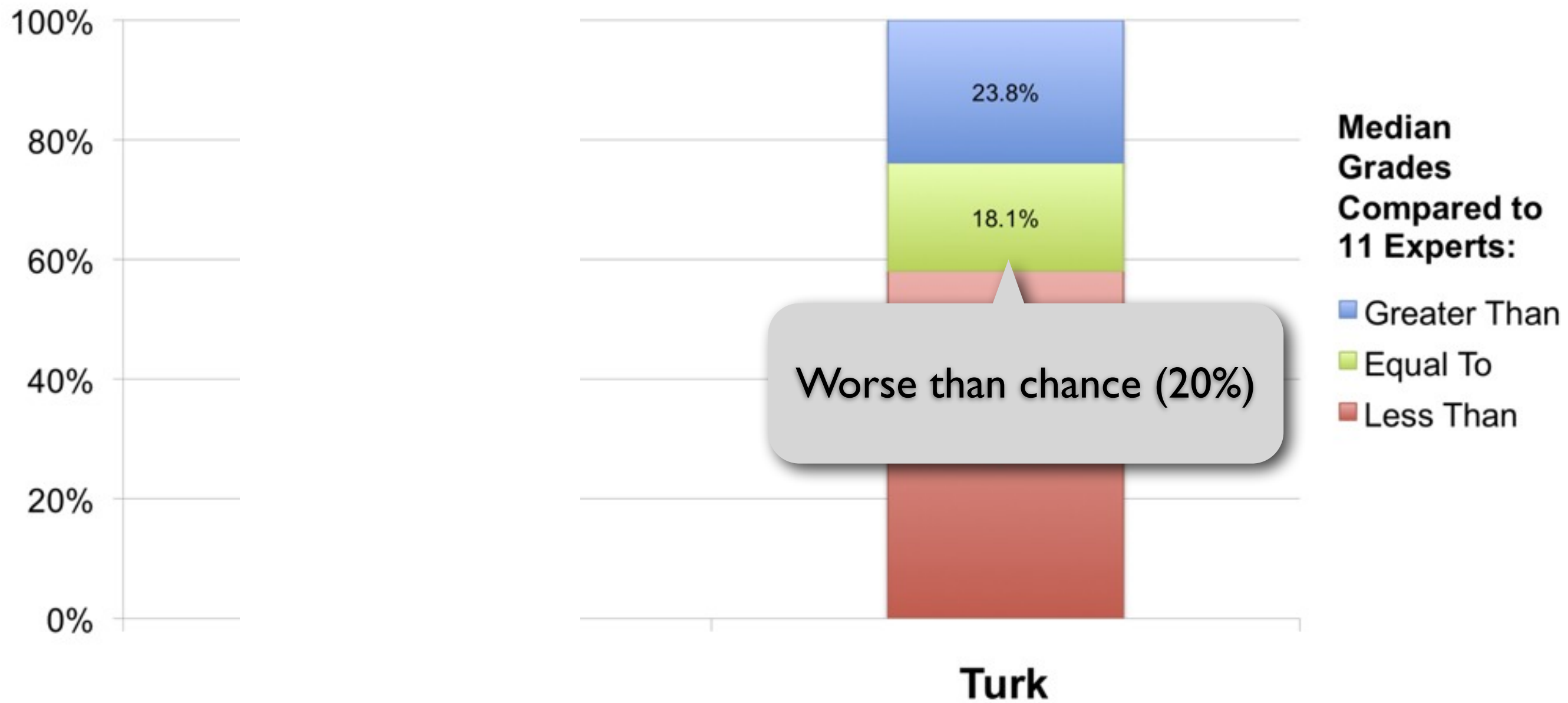
Gold Standard:

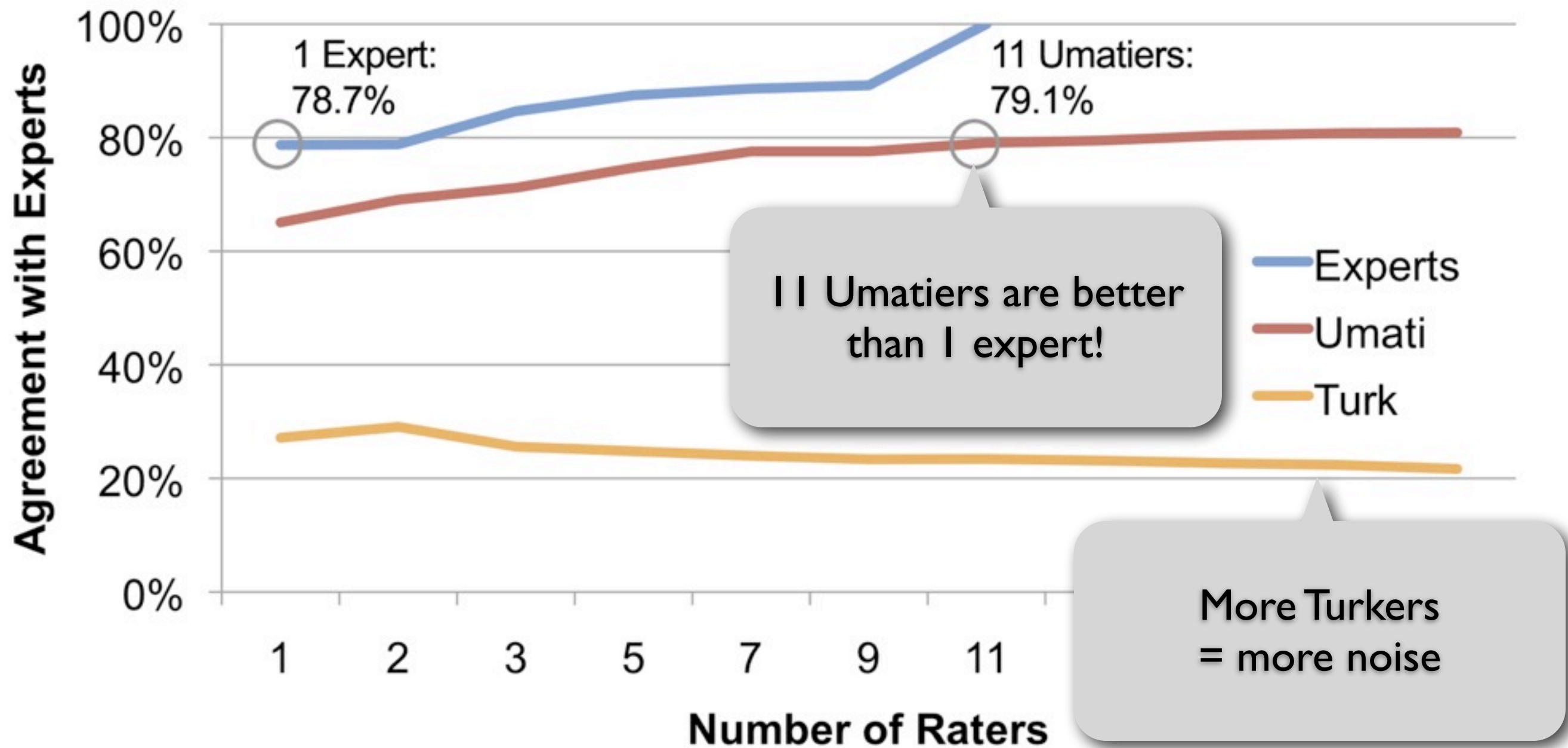
|| Expert Graders (TAs, CS PhD students)

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 Stacksporer 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.

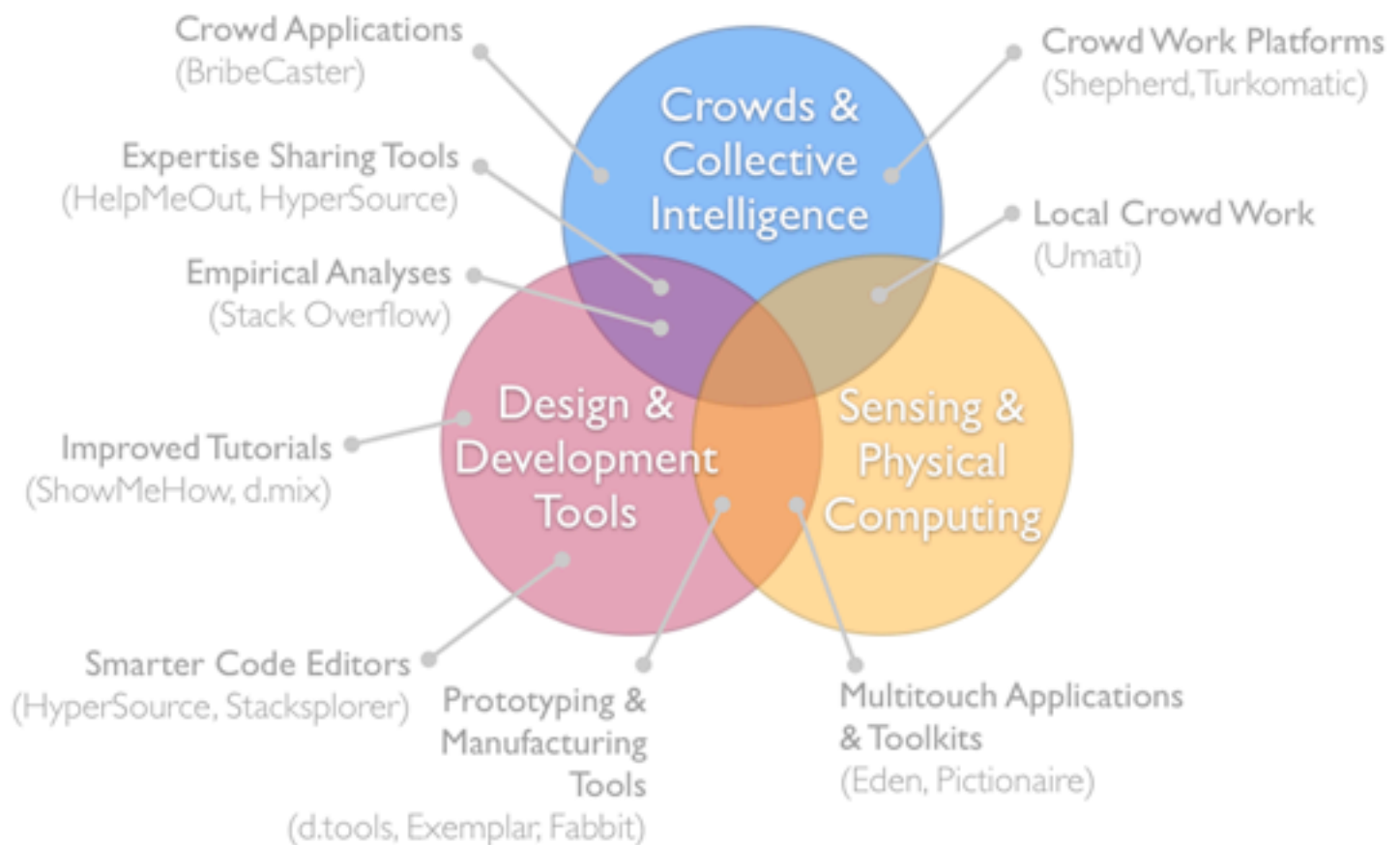
#### May 2011: CHI Paper Awards

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>

