CSE 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

Lecture 17:
Closing Thoughts

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234

Today

Informal Prototyping Fun

Experimental Design and Statistics Background

Usability Evaluation Considered Harmful

Presentation Feedback

Exam Q&A

Video Critiques

Informal Prototyping

Sketches are informal

- allowing rapid iteration and greater exploration

Paper prototypes extend that to testing

- person simulates the computing

These are core ideas, central to practice

- so we taught them and you did them

Informal Prototyping

Two related ideas, each can be extended

- keep representation lightweight and fast
- Wizard of Oz simulation for prototype functionality

Heavily explored in research

- think when you might benefit, go looking for ideas

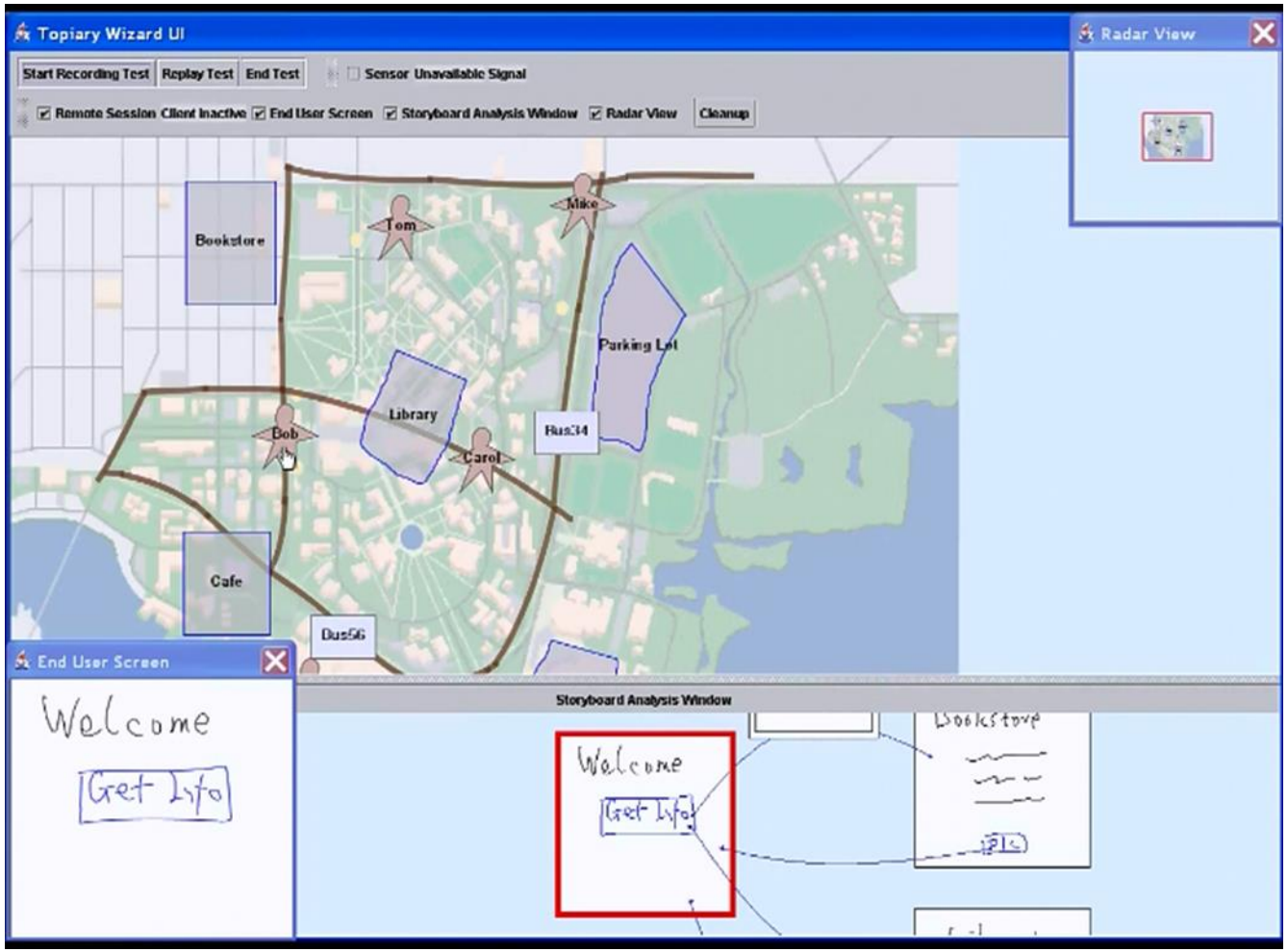
Classic Examples: DENIM

Lin et al, CHI 2000

Classic Examples: DENIM

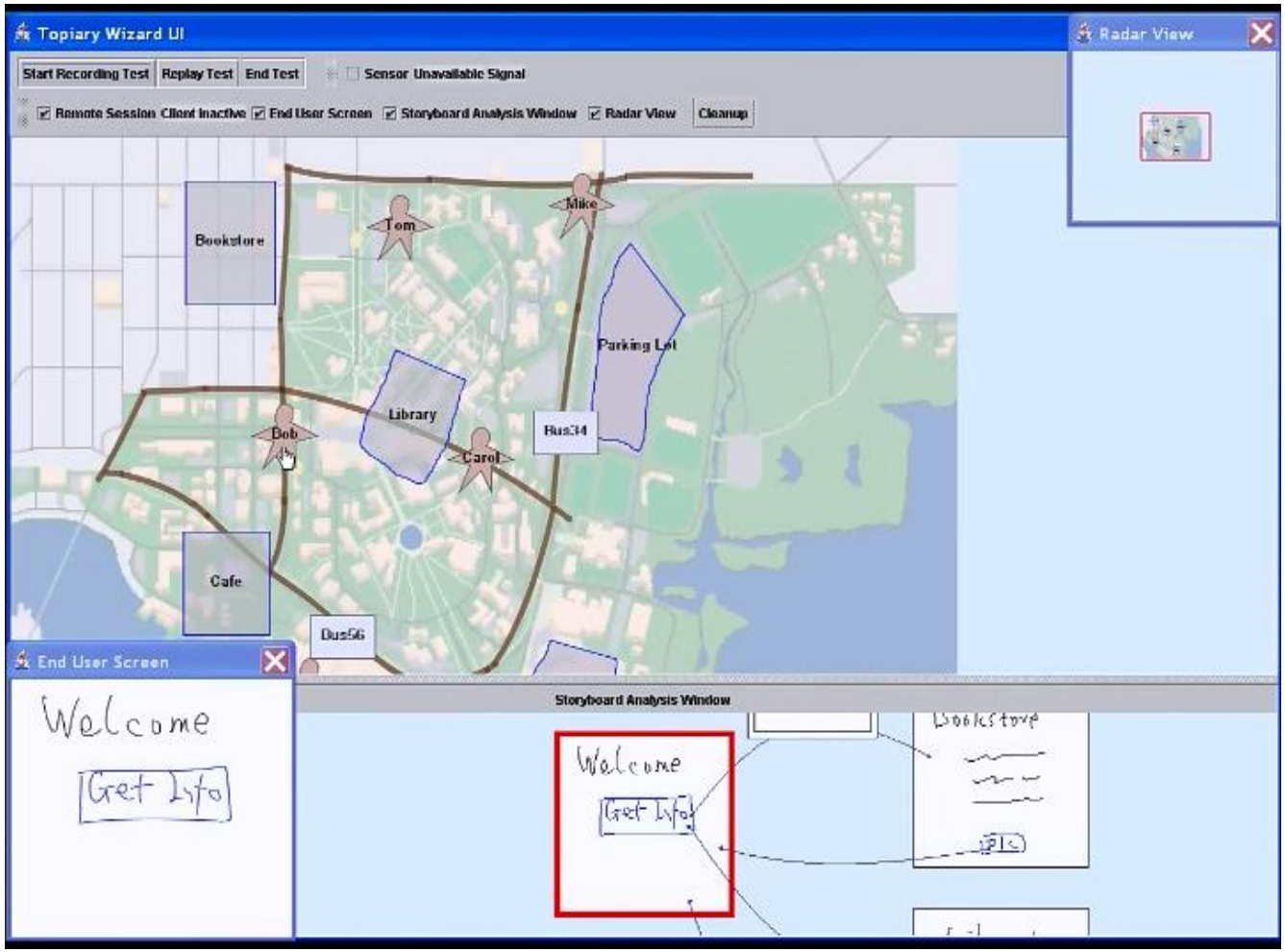
Lin et al, CHI 2000

Classic Examples: Topiary



Li et al, UIST 2004

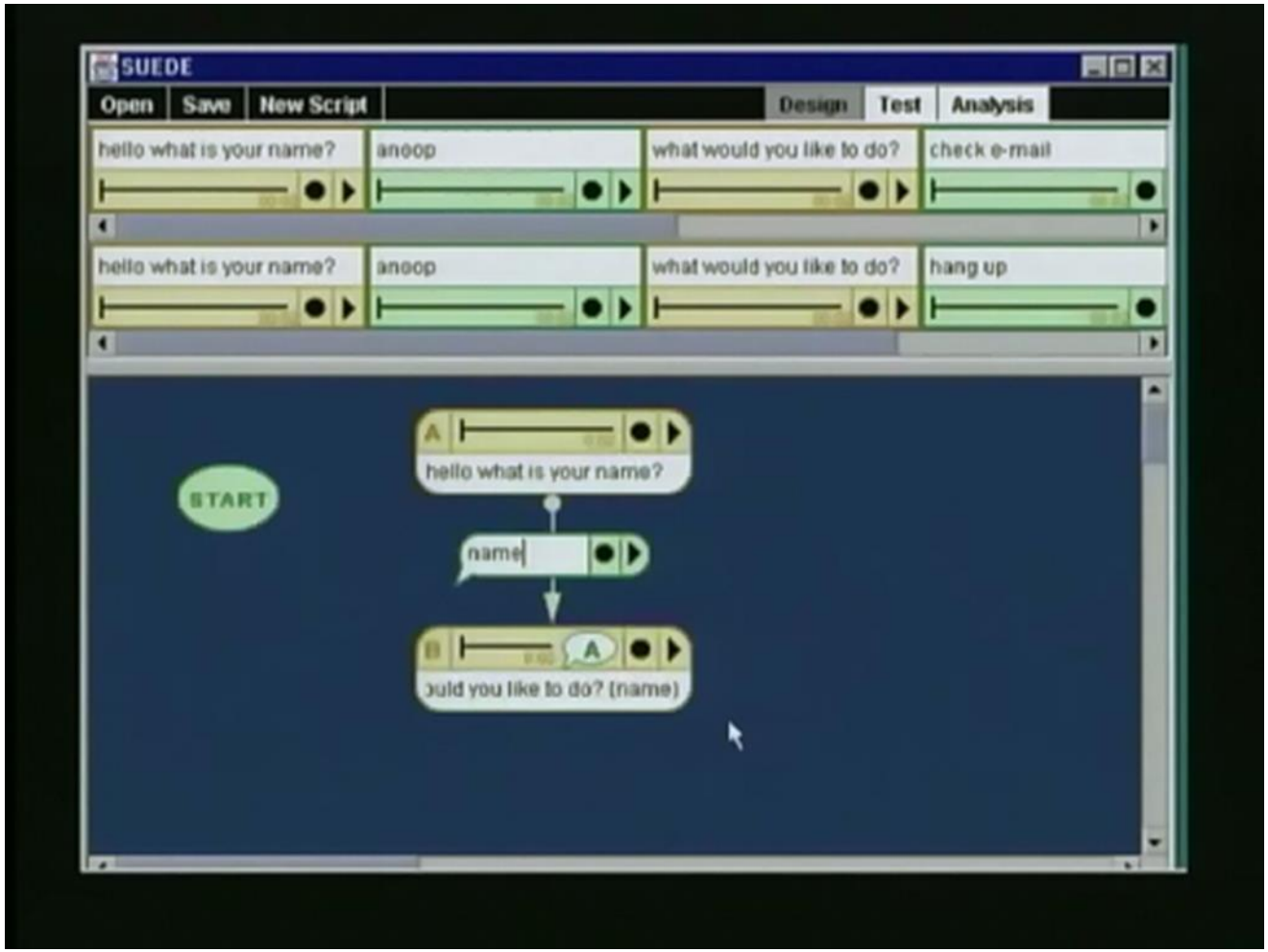
Classic Examples: Topiary



University of Washington

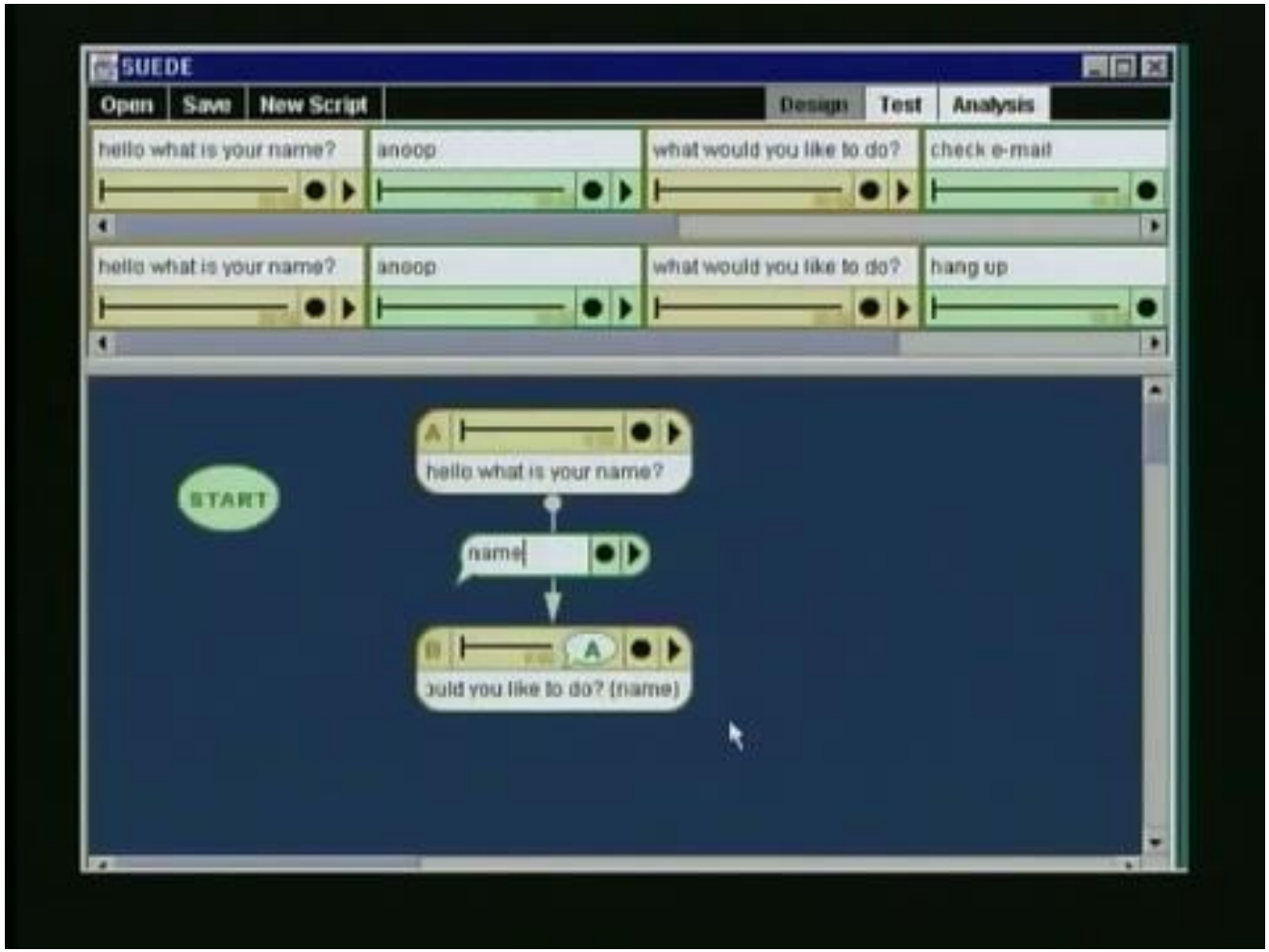
Li et al, UIST 2004

Classic Examples: SUEDE



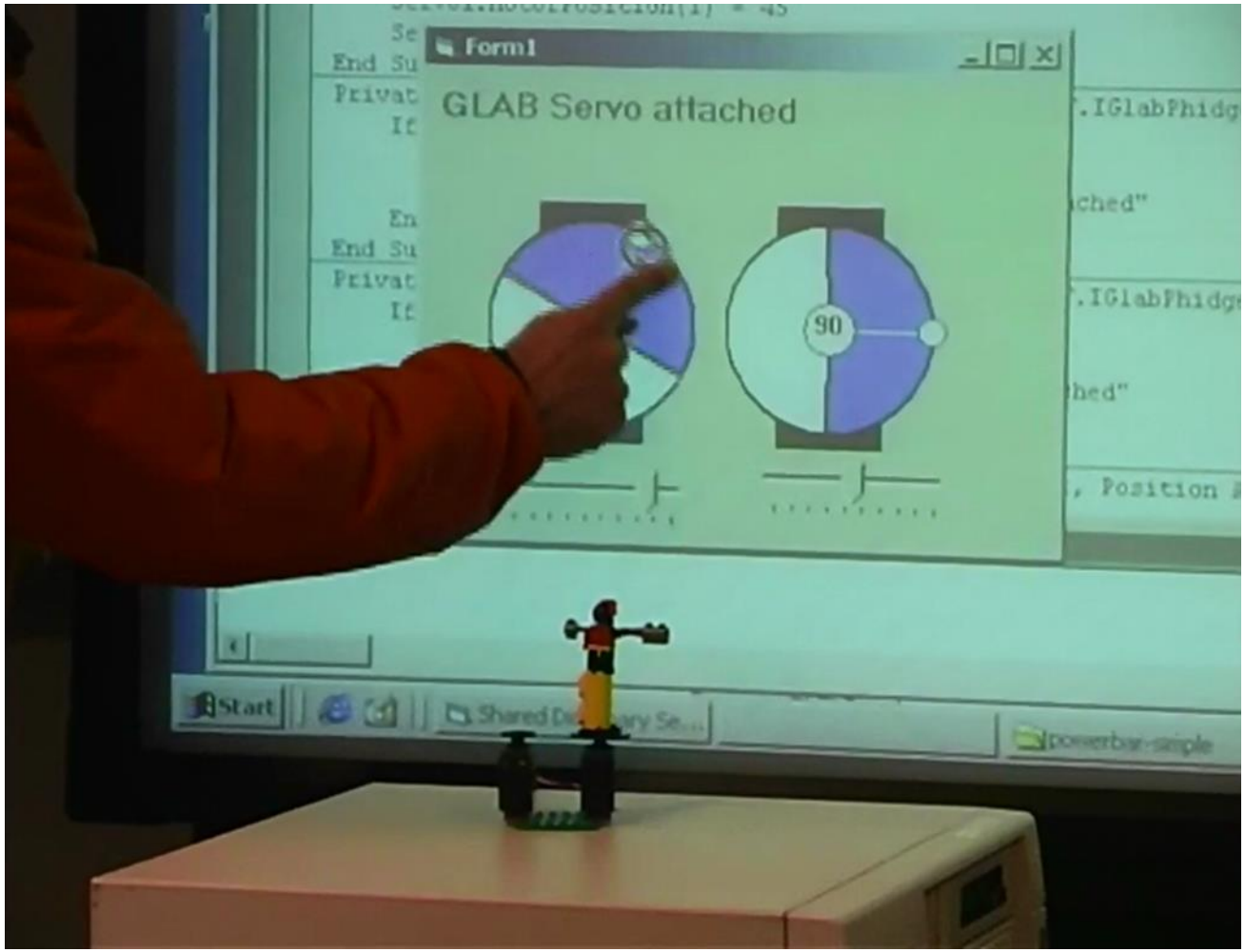
Klemmer et al, UIST 2000

Classic Examples: SUEDE



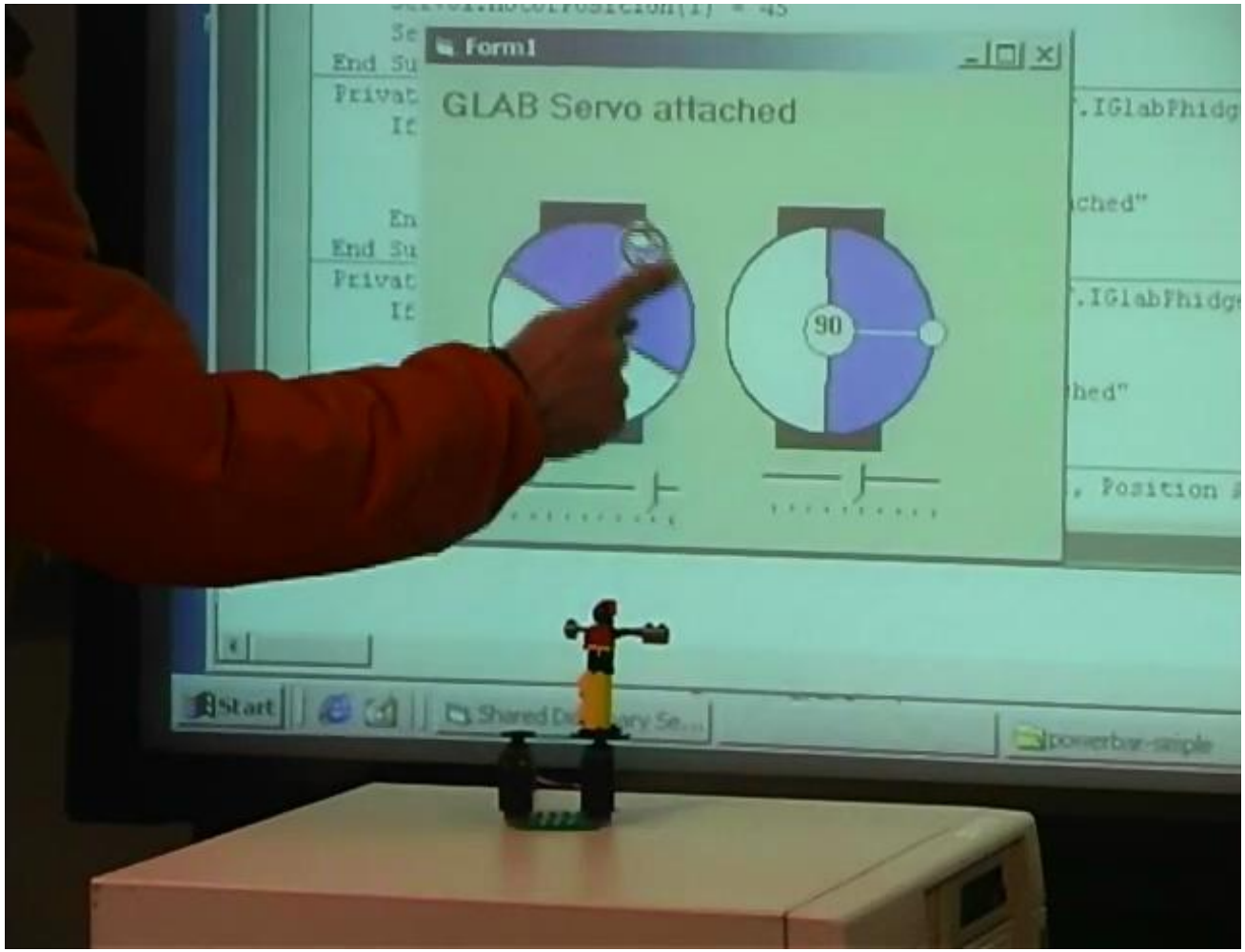
Klemmer et al, UIST 2000

Classic Examples: Phidgets



Greenberg and Fitchett, UIST 2001

Classic Examples: Phidgets



Greenberg and Fitchett, UIST 2001

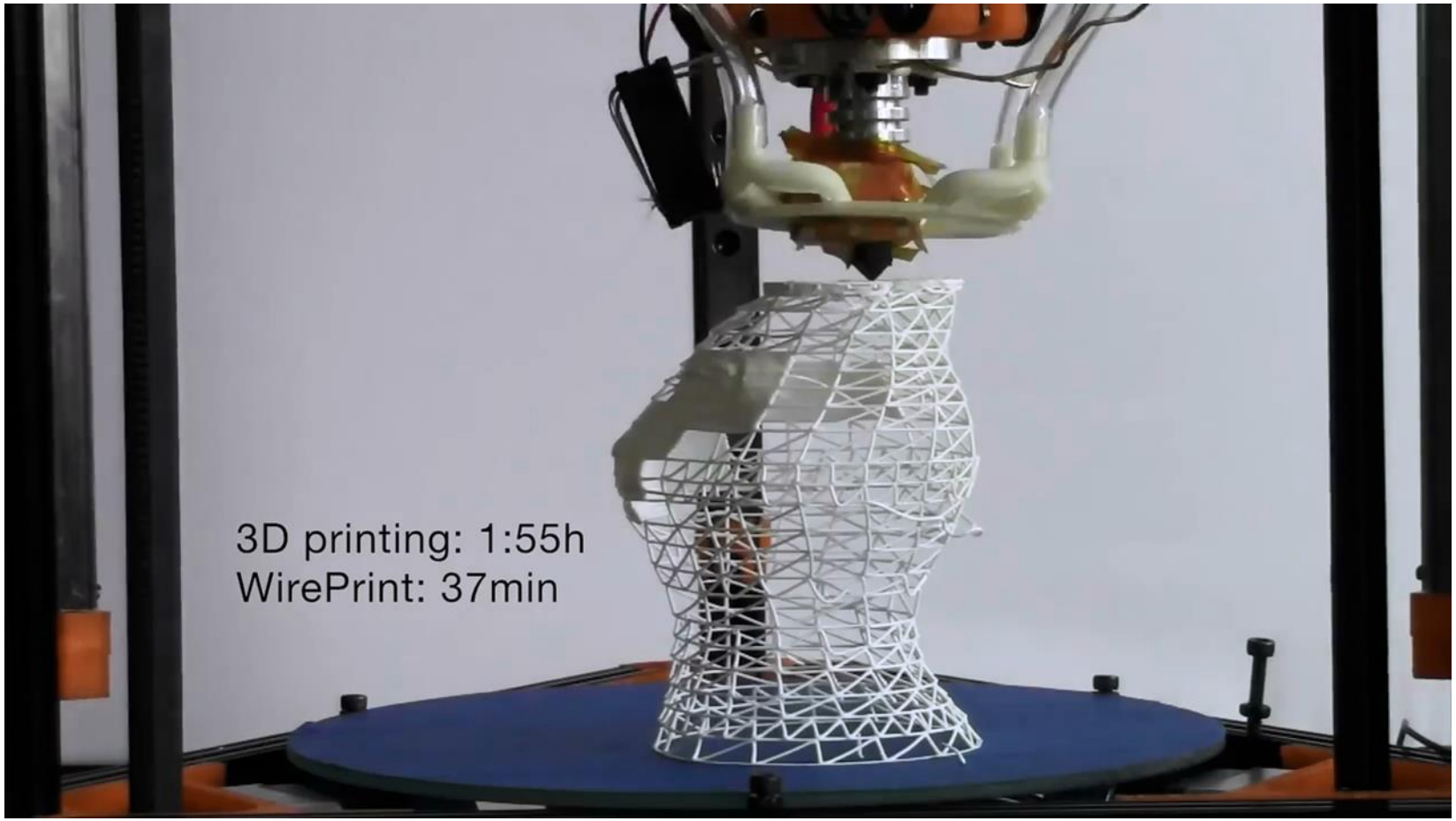
Rapid Fabrication: Constructables

Mueller et al, UIST 2012

Rapid Fabrication: Constructables

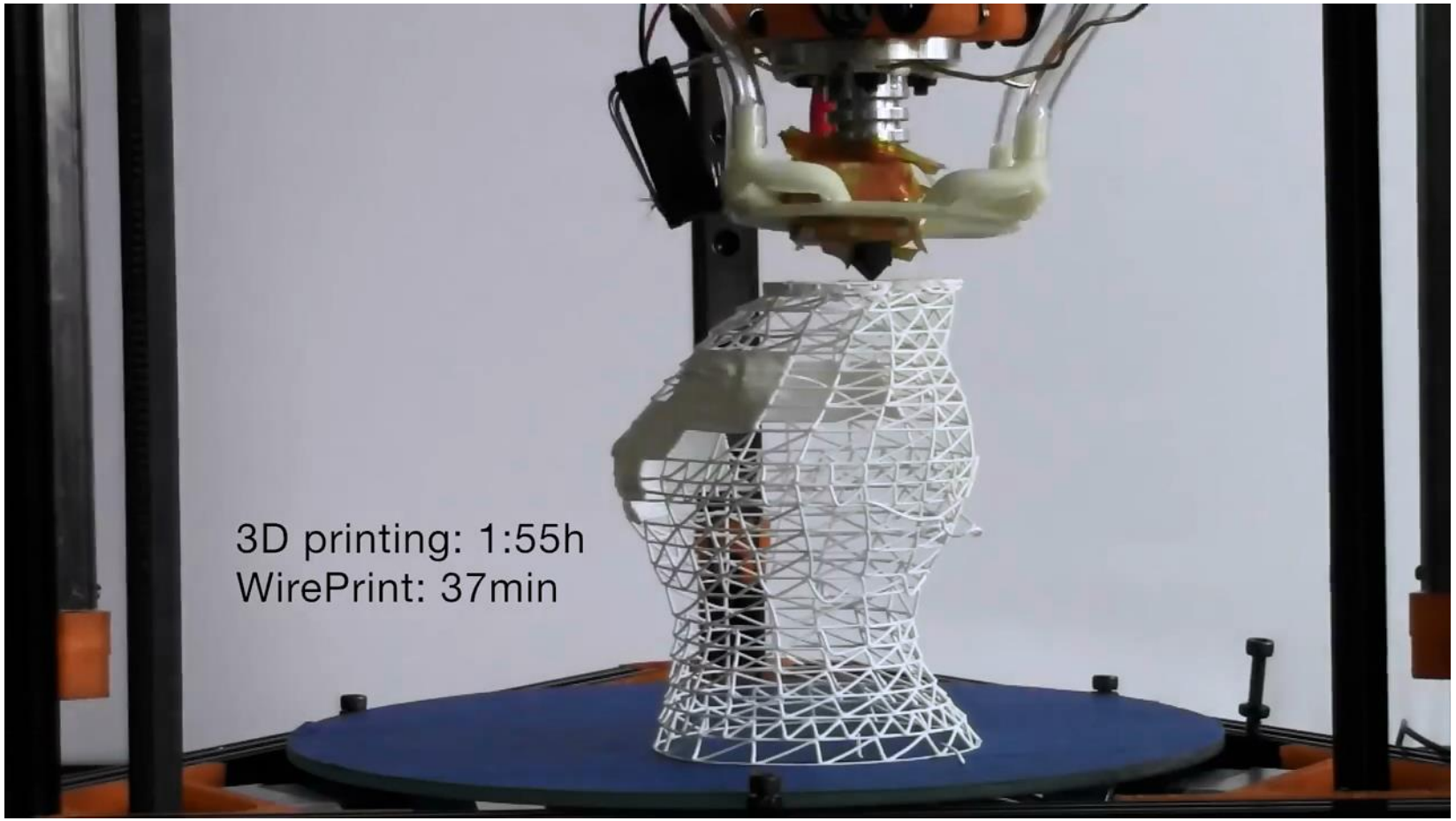
Mueller et al, UIST 2012

Rapid Fabrication: WirePrint



Mueller et al, UIST 2014

Rapid Fabrication: WirePrint



Mueller et al, UIST 2014

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Remember our Fitts's Law study?

This course has focused on quickly getting information to allow you to improve design

Rich methods for experimental design and statistics needed when measurement is goal

- Know some of this exists, learn it if you need it
- These slides are a bag of keywords

One starting point

- https://depts.washington.edu/aimgroup/proj/ps4hci/

Experimental Design and Statistics

Even seemingly simple experiment can
be difficult or impossible to correctly analyze

Design and analysis are inseparable

Consider your experiment and analyses together

so you do not run an experiment you cannot analyze

Design finds a difference, statistics test it

Causality and Correlation

We cannot prove causality

- We can only show strong evidence for it
- Always something outside the scope of an experiment that could be the true cause

We can show correlation

- Treatment changes, so does outcome
- Hold all things equal but for one
- Eliminate possible rival explanations

A negative result means little or nothing

Internal and External Validity

Internal Validity

Convincingly link treatments to effects and the experiment has high internal validity, it shows an effect

External Validity

An experiment likely to generalize beyond the things directly tested is said to have high external validity

Often at odds with each other

Achieving Control

Avoiding other plausible explanations

- Often referred to as confounds

General Strategies

- Remove and/or exclude
- Measure and adjust
- Spread effect equally over all groups
  - Randomization (assign randomly)
  - Blocking (assign balanced)

Variable Terminology

Factors: Variables of interest

- one variable is a single-factor experiment

Levels: Variation within a factor

- not necessarily binary

Independent Variables

- variables you control

Dependent Variables

- outcome measures
- (they depend on your independent variables)

Factorial Designs

May have more than one factor

Factors may have multiple levels

A 2x2x3 study has
two factors of two levels each
and a third factor with three levels

Text entry method {Multitap, T9} x
Number of hands {one, two} x
Posture {seating, standing, walking}

Potential dependent variables?

Within and Between Subjects

Within-Subjects Designs

- Each participant experiences multiple levels
- Much more statistically powerful
- Much harder to avoid confounds

Between-Subjects Designs

- Each participant experiences only one level
- Requires more participants
- Avoids possible confounds, easier to analyze

Carryover Effects

Learning, fatigue

anything that transfer between within-subject tasks

Counterbalanced designs help mitigate

e.g., Latin square

A	B	C	D
C	D	A	B
D	C	B	A
B	A	D	C

p values

The statistical significance of a result is generally summarized as a *p* value (*N* is not enough)

p is the probability the null hypothesis is true (there is no difference)

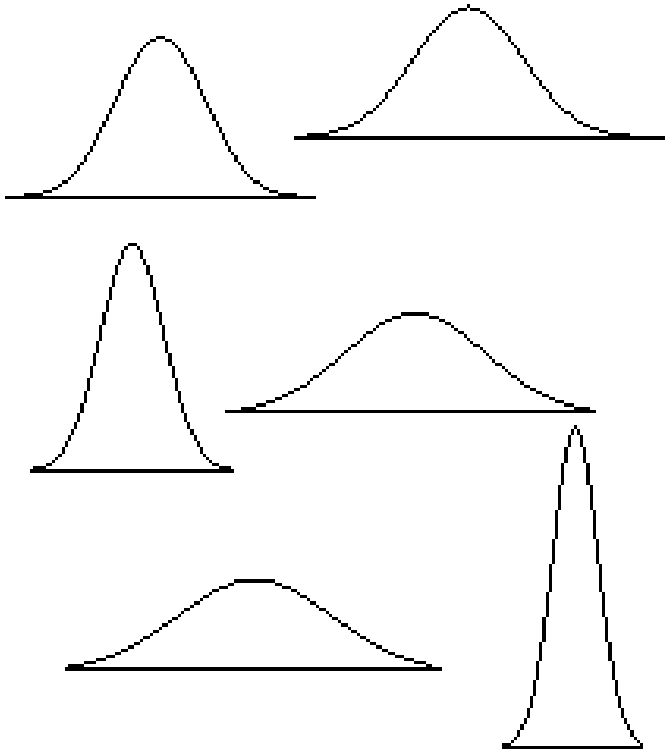
The same experiment, run 1 / *p* times, would generate this result by random chance

$p < .05$ is an arbitrary but widely used threshold of statistical significance

p and Normal Distributions

Given a mean and a variance, assuming a Gaussian distribution allows estimating the likelihood of a value

Thus, parametric tests (most common tests) assume data is from normal distributions



Some Tests

t test

- single factor, possibly multiple levels

F test

- multiple factors
- linear regressions fits equation to variables
- main effects (impact of single factor)
- interactions (relationship between factors)

Chi Square test

- comparing proportions

Non-Parametric tests

- data from non-normal distributions

Concern for Fishing

Bad form to simply test things until you find something significant, then to report that

- Comparisons should be theoretically motivated

Recall the definition of *p*

- Unprincipled comparisons increase risk of falsely identifying a result

Because if you test enough things, something is bound to be significant

- See Tukey's Honestly Significant Difference
- See Sequential Bonferroni Procedure

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Usability Evaluation Considered Harmful

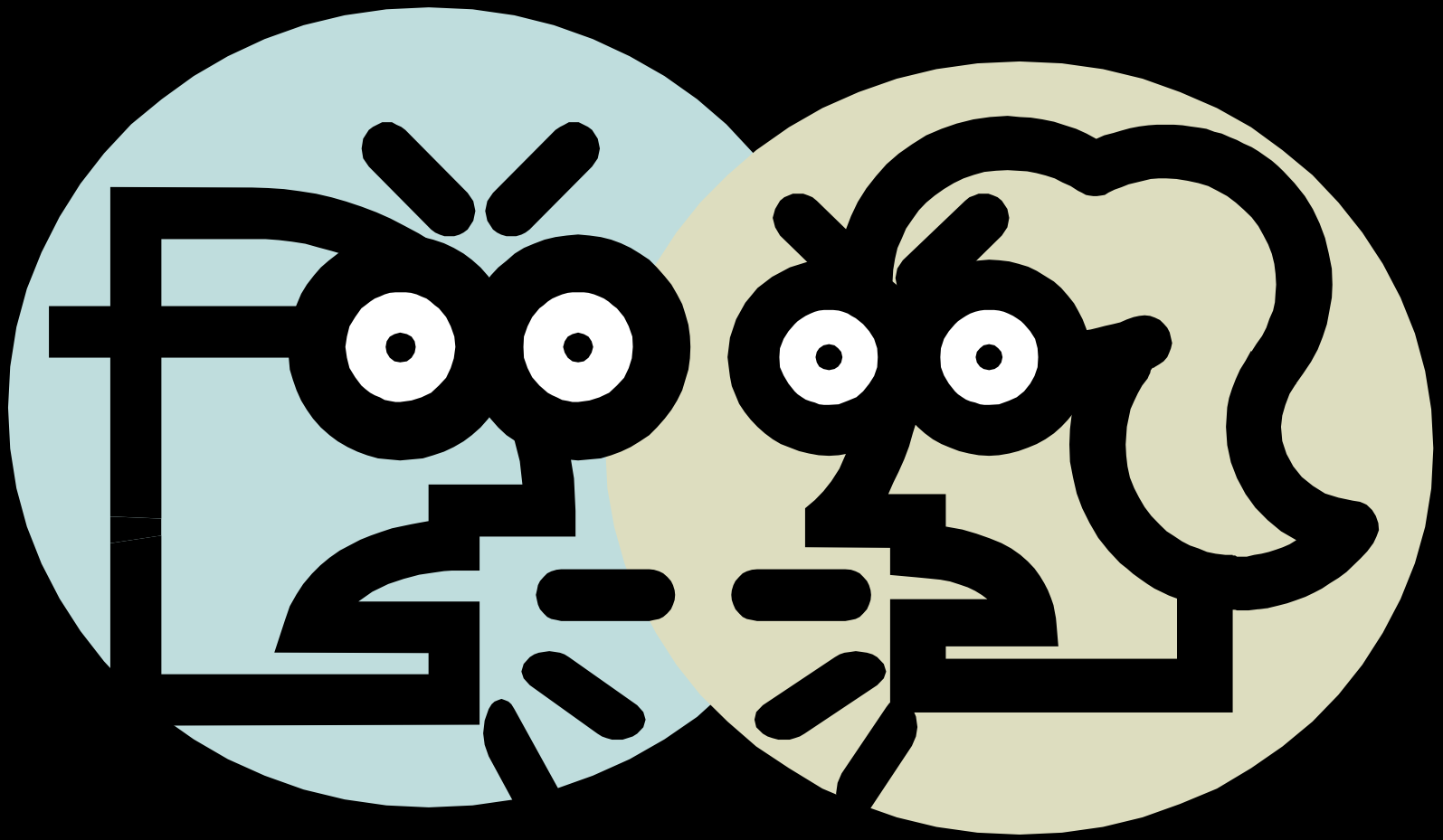
http://dx.doi.org/10.1145/1357054.1357074

Usability Evaluation Considered Harmful
Some of the time

Saul Greenberg
University of Calgary

Bill Buxton
Microsoft Research

Warning: Opinions Ahead



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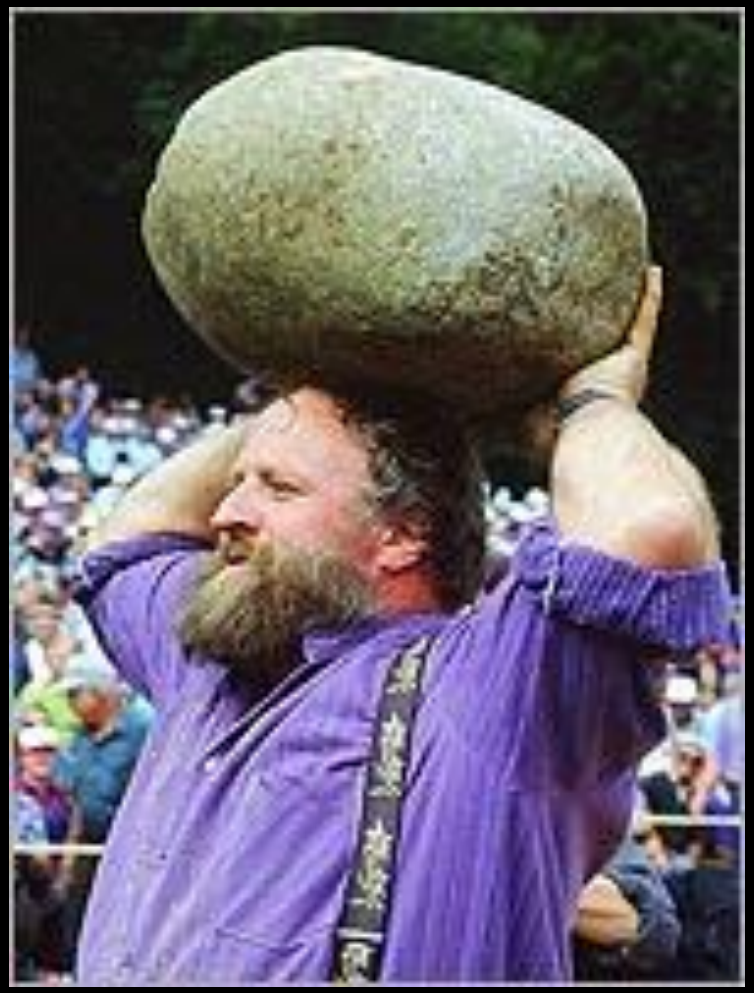

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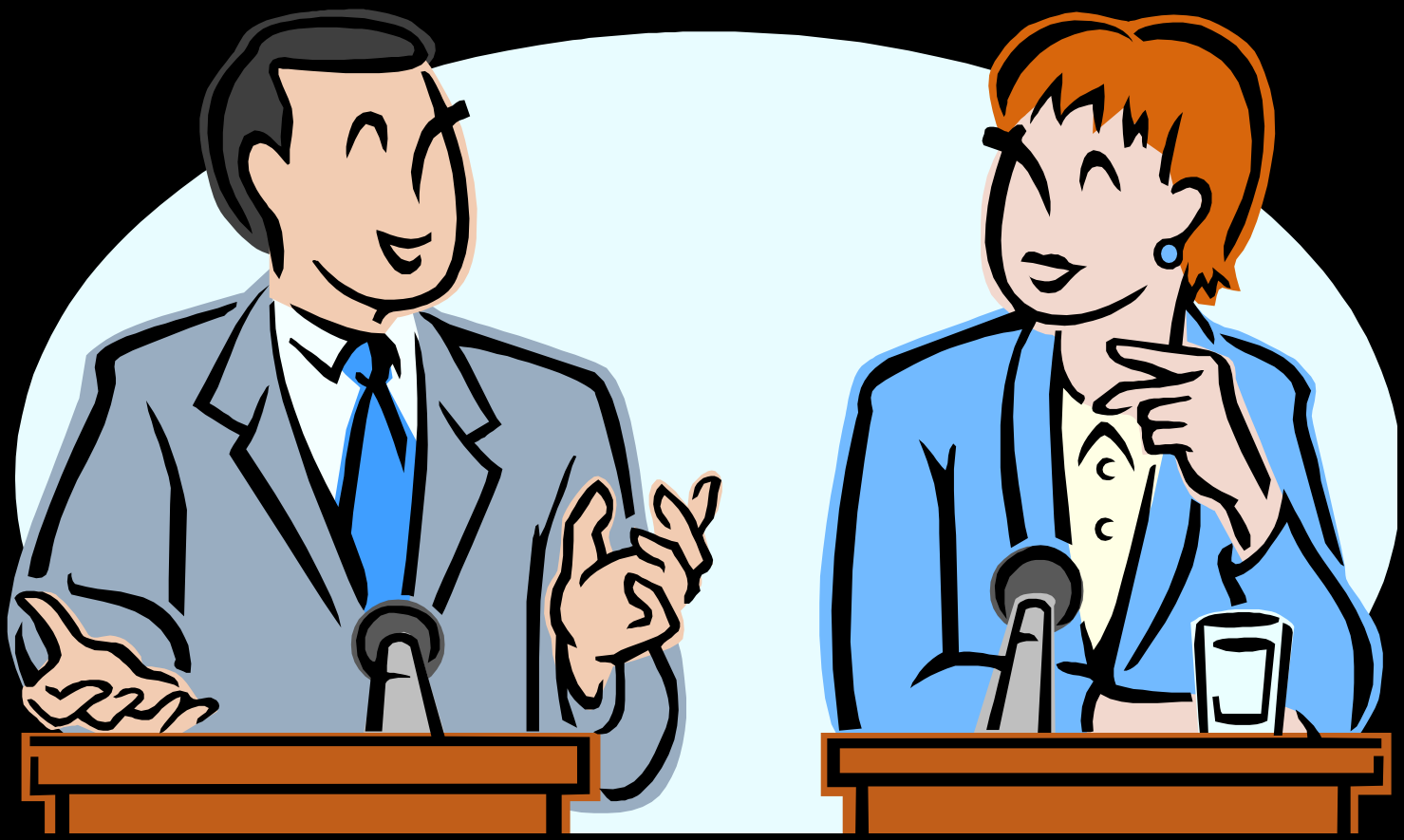

An anti usability rant?

Bill

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Saul

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Usability evaluation *if wrongfully applied*

In early design
- stifle innovation by quashing (valuable) ideas
- promote (poor) ideas for the wrong reason

In science
- lead to weak science

In cultural appropriation
- ignore how a design would be used in everyday practice

The Solution - Methodology 101

the choice of evaluation methodology - if any – must arise and be appropriate for the actual problem, research question or product under consideration

Changing how you think

- Usability evaluation
- CHI trends
- Theory
- Early design
- Science
- Cultural appropriation

Part 1. Usability Evaluation

Usability Evaluation

assess our designs and
test our systems to ensure that they actually
behave as we expect and
meet the requirements of the use

Dix, Finlay, Abowd, and Beale 1993

Usability Evaluation Methods

Most common (research):

- controlled user studies
- laboratory-based user observations

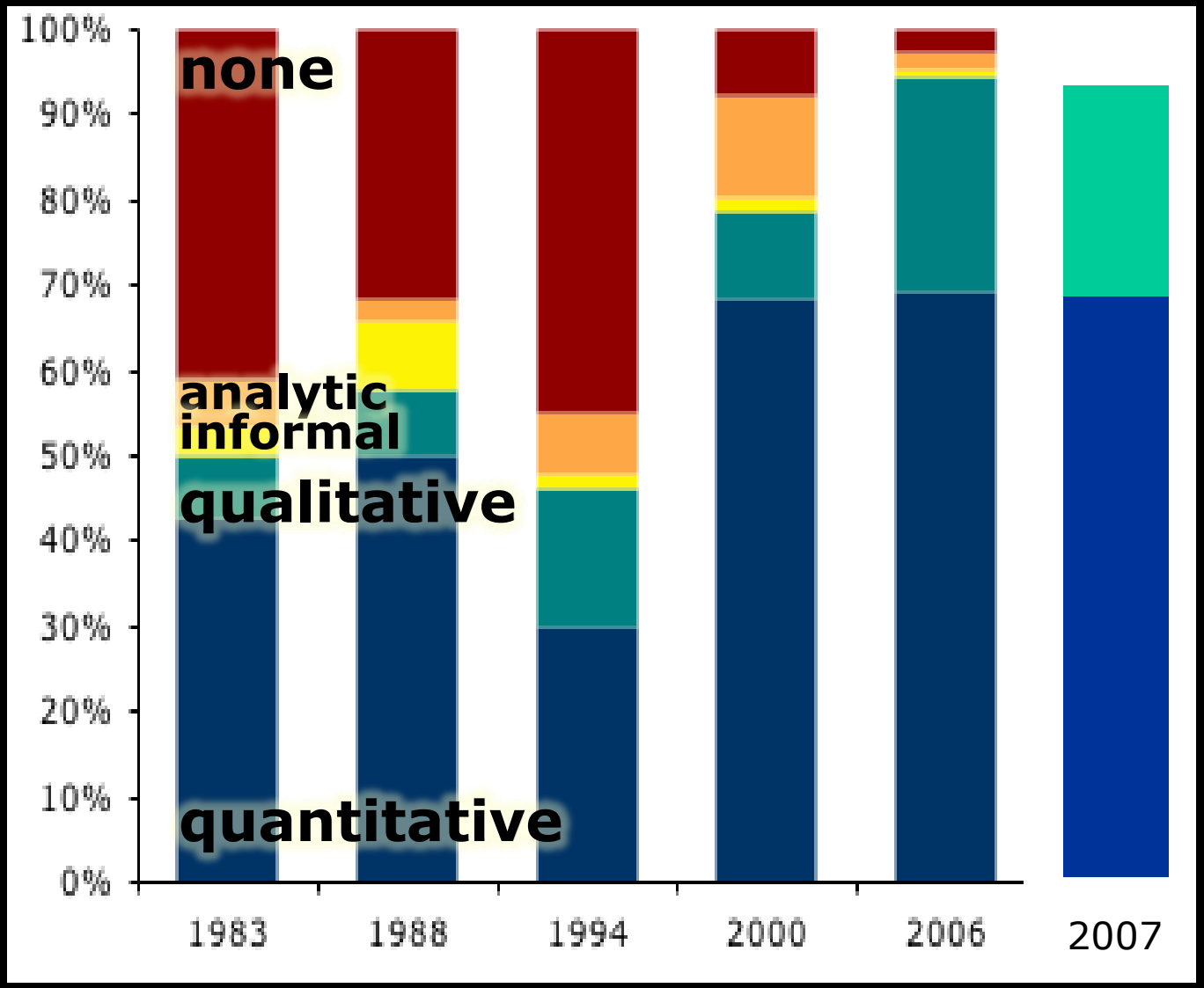
Less common

- inspection
- contextual interviews
- field studies / ethnographic
- data mining
- analytic/theory
- …

usability evaluation
other methods
©staytonevents.com

Part 2. CHI Trends

CHI Trends (Barkhuus/Rode, Alt.CHI 2007)



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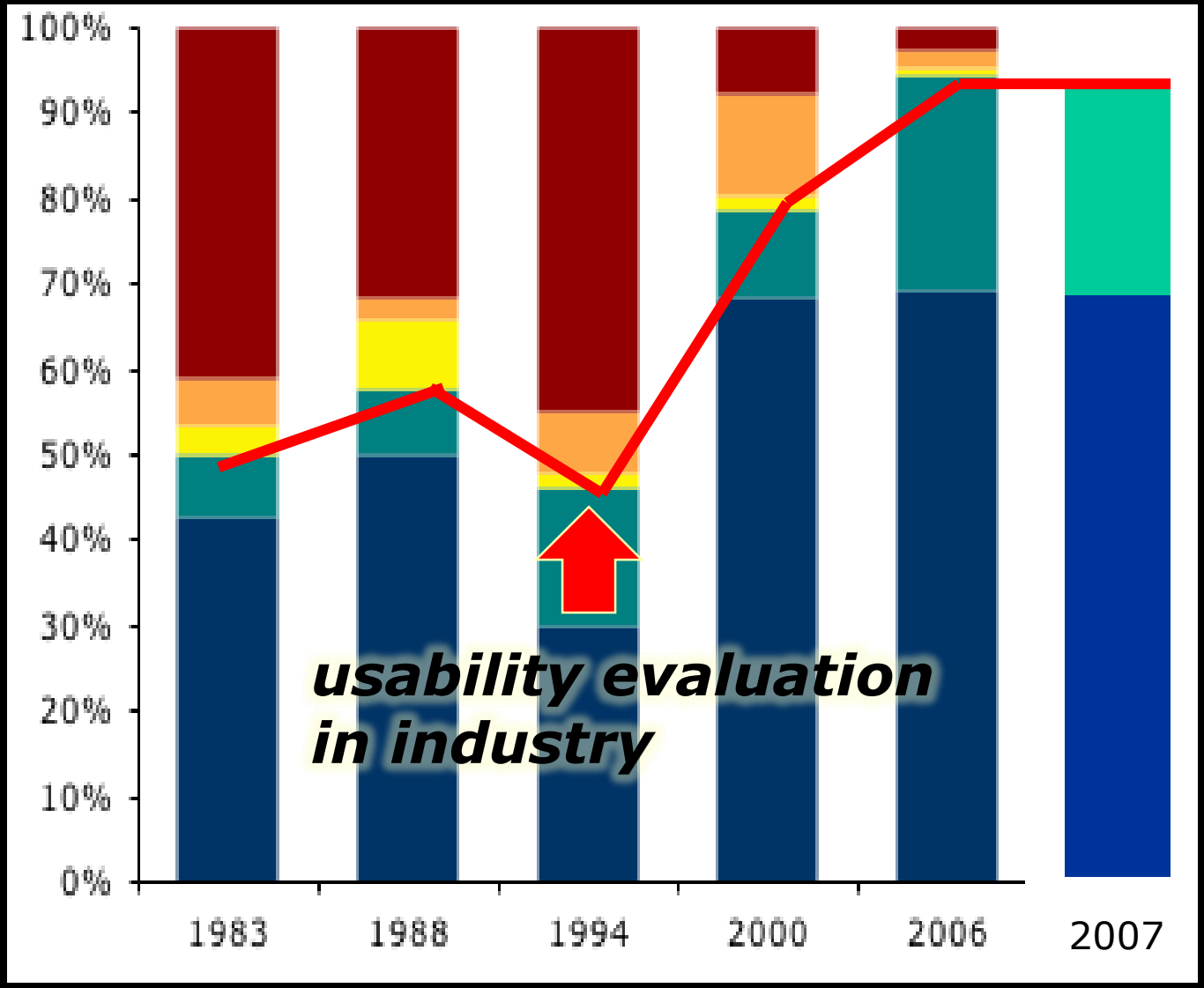
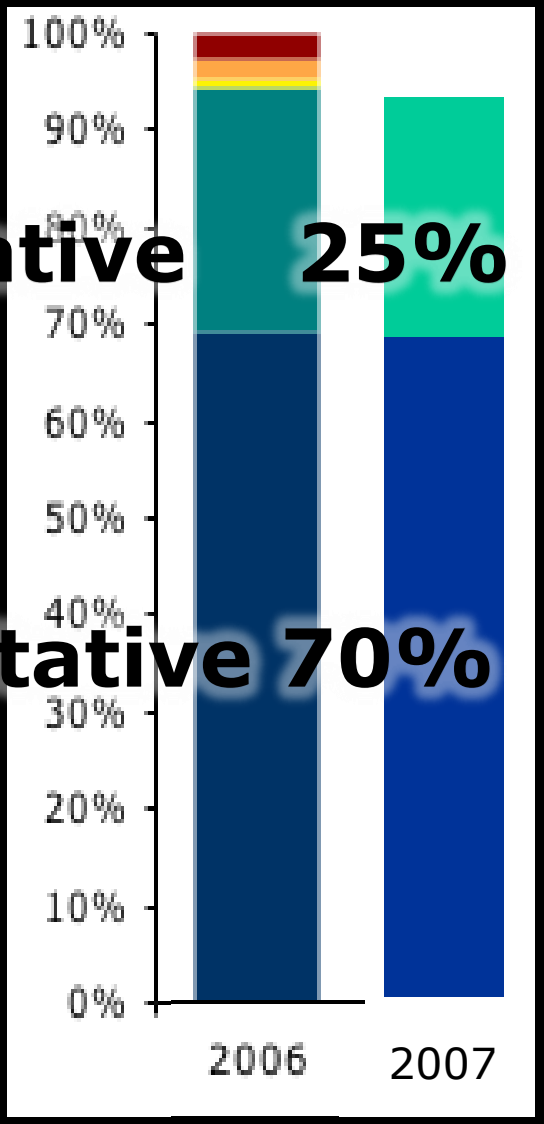


CHI Trends

User evaluation is now a pre-requisite for CHI acceptance



CHI Trends (Call for papers 2008)

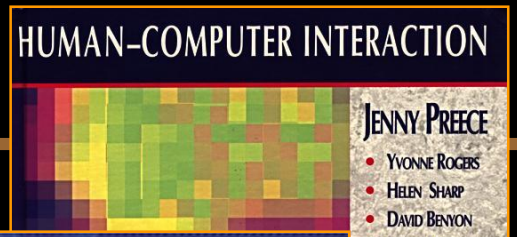
Authors

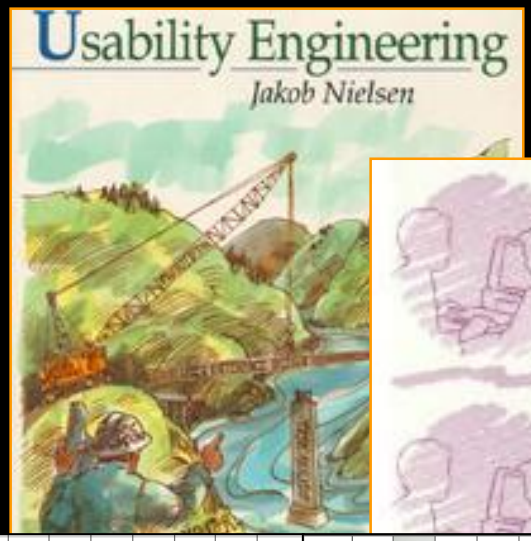
"you will probably want to demonstrate 'evaluation' validity, by subjecting your design to tests that demonstrate its effectiveness "

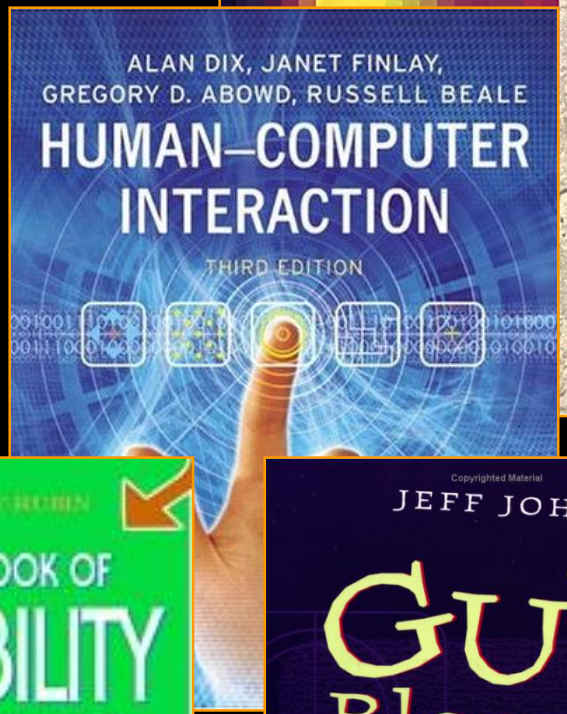
Reviewers

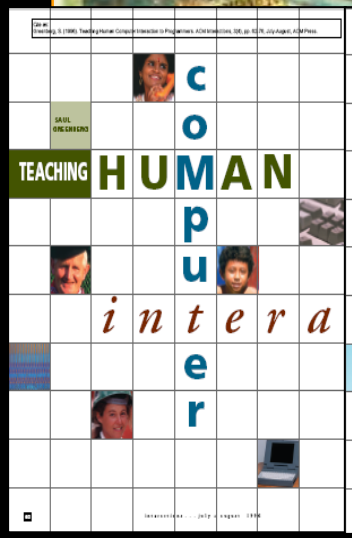
"reviewers often cite problems with validity, rather than with the contribution per se, as the reason to reject a paper"

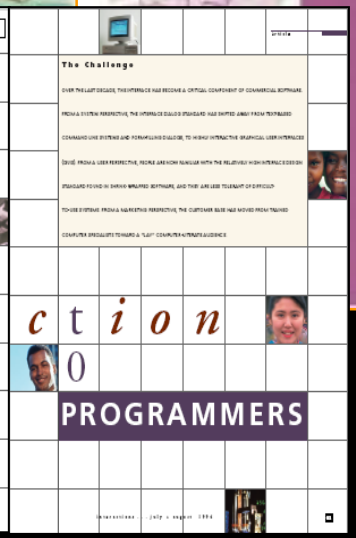
HCI Education

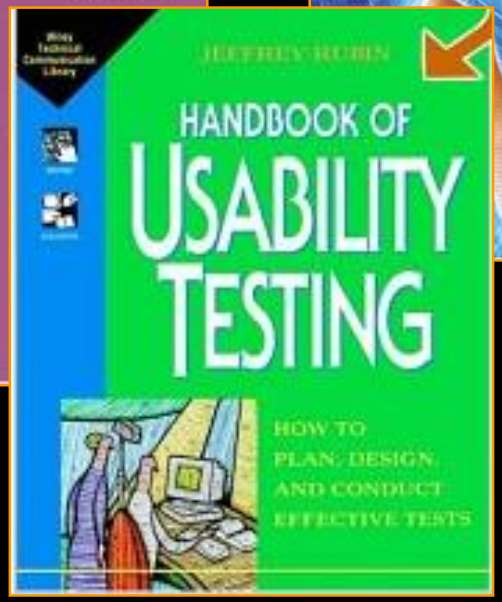


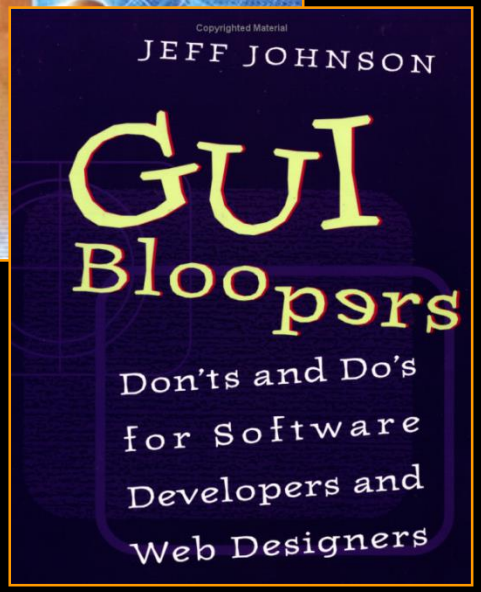












HCI Practice

Source: http://www.xperienceconsulting.com/eng/servicios.asp?ap=25

Dogma

Usability evaluation = validation = CHI = HCI

Part 3. Some Theory

Discovery *vs* Invention (Scott Hudson UIST '07)

Discovery

- uncover facts
- detailed evaluation

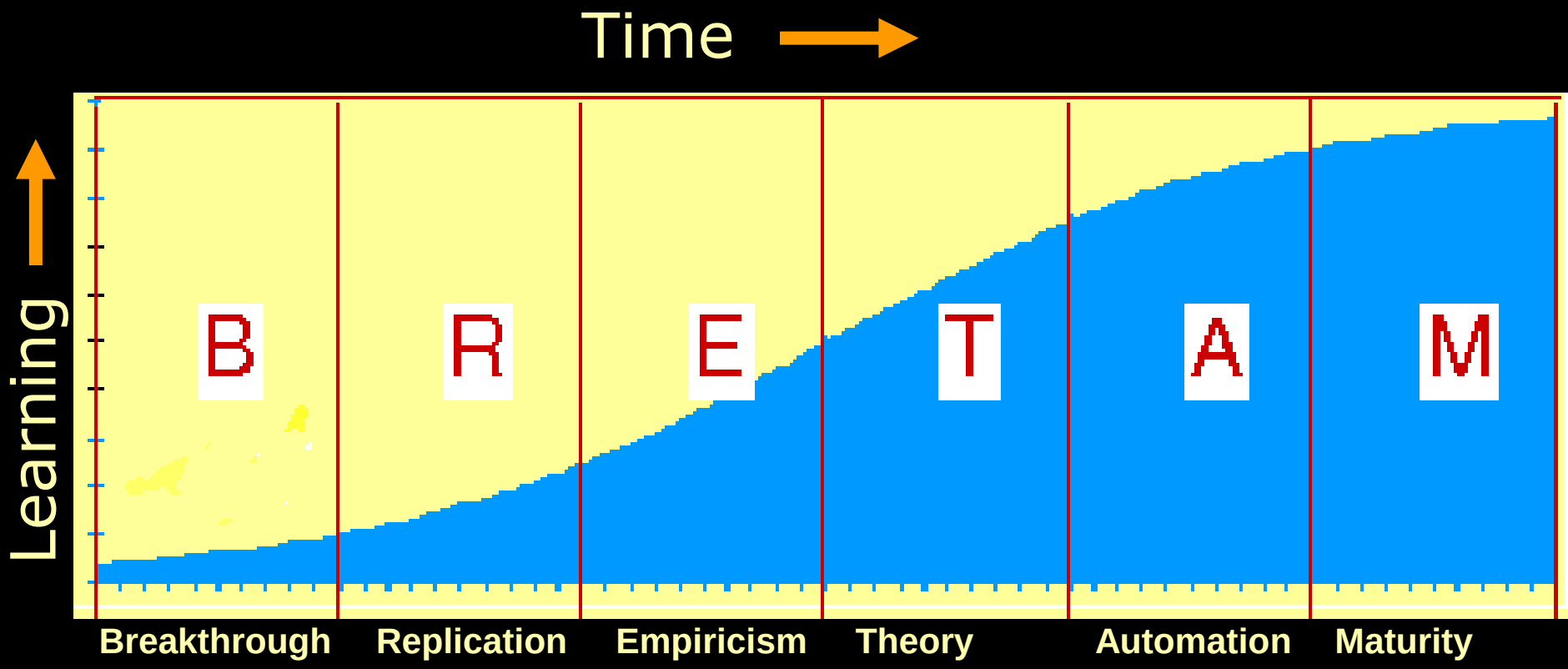
Understand what is

Invention

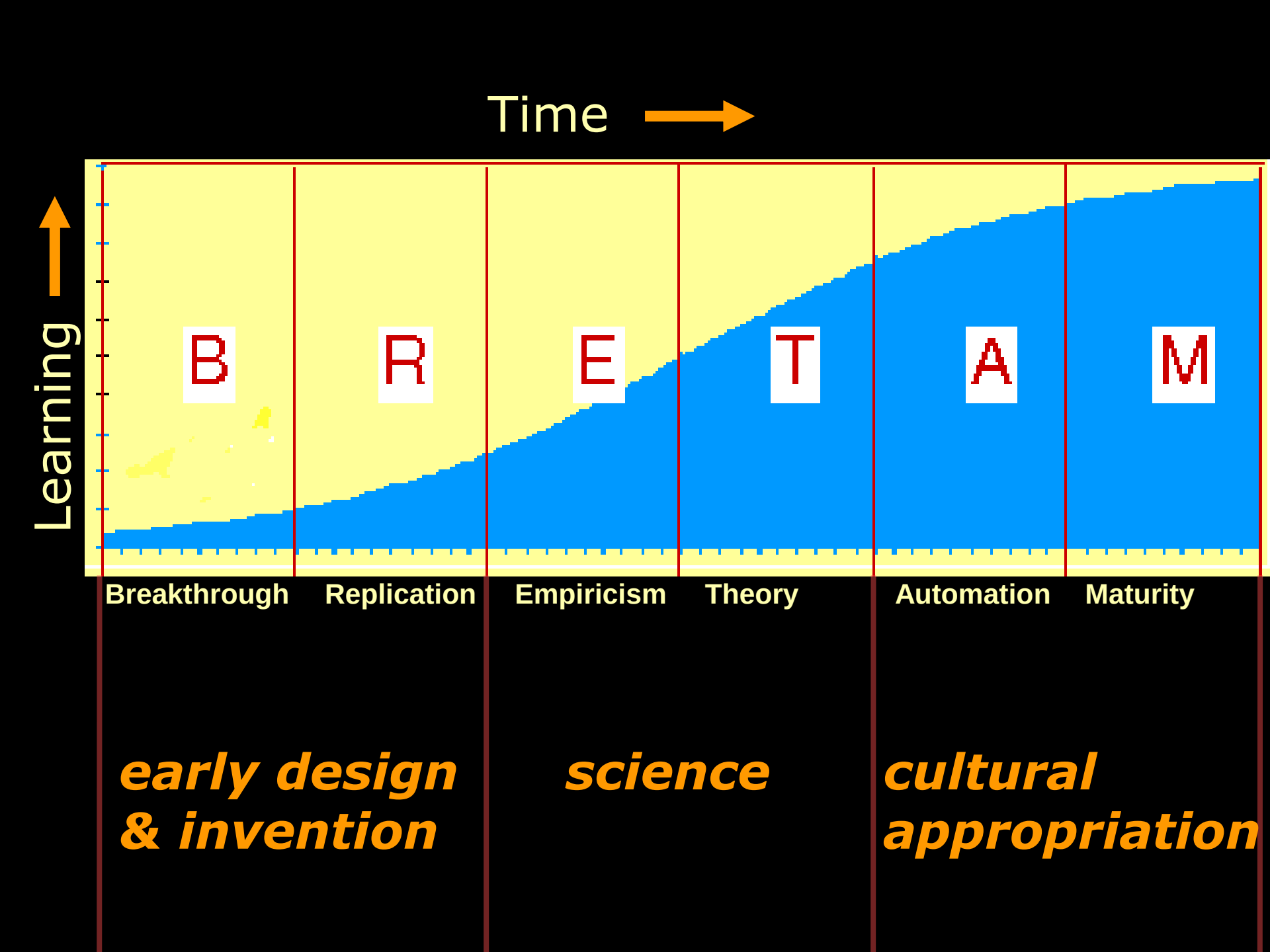
- create new things
- refine invention

Influence what will be

CHI 2008
art.science.balance.



Brian Gaines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Breakthrough
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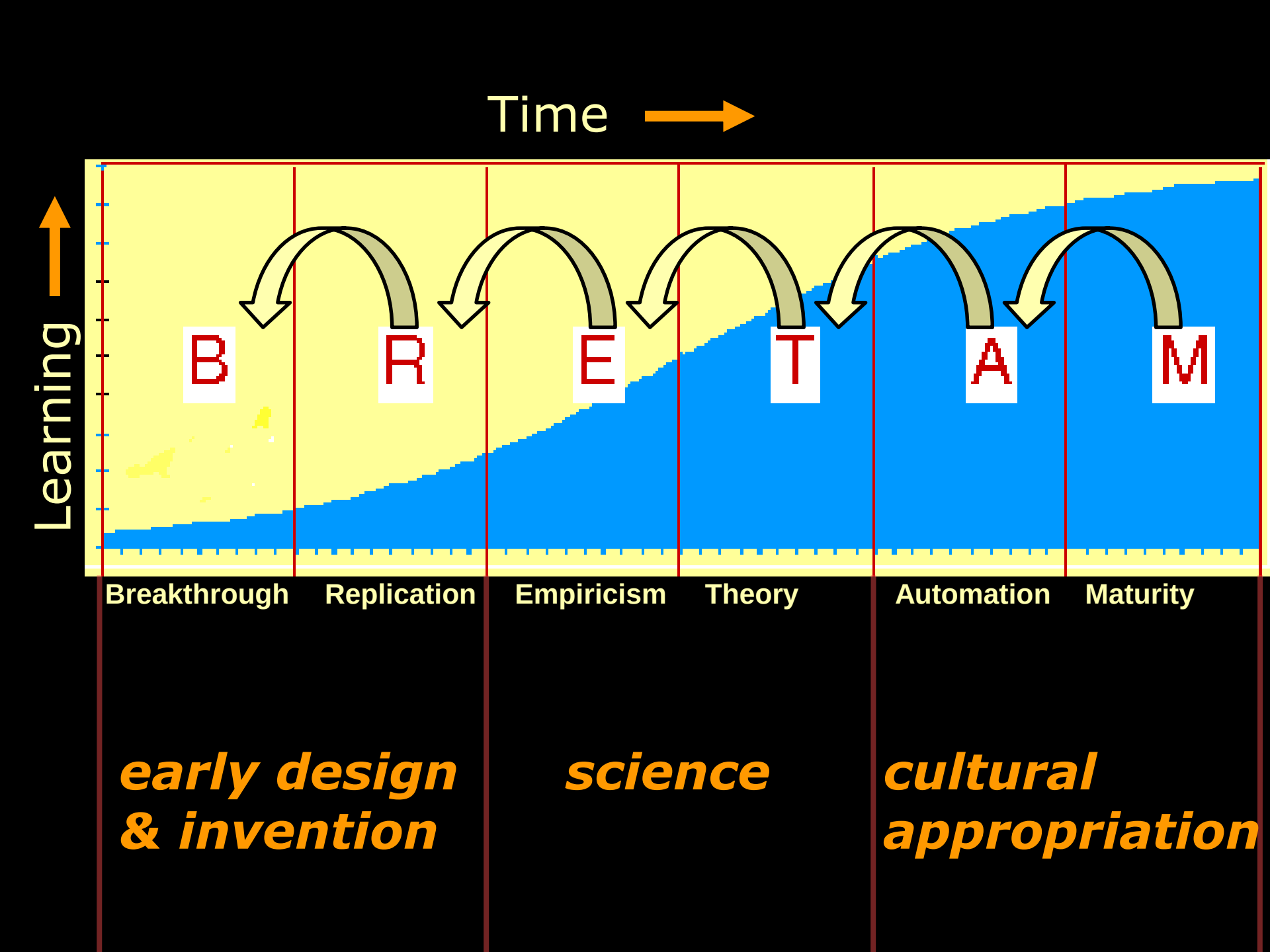
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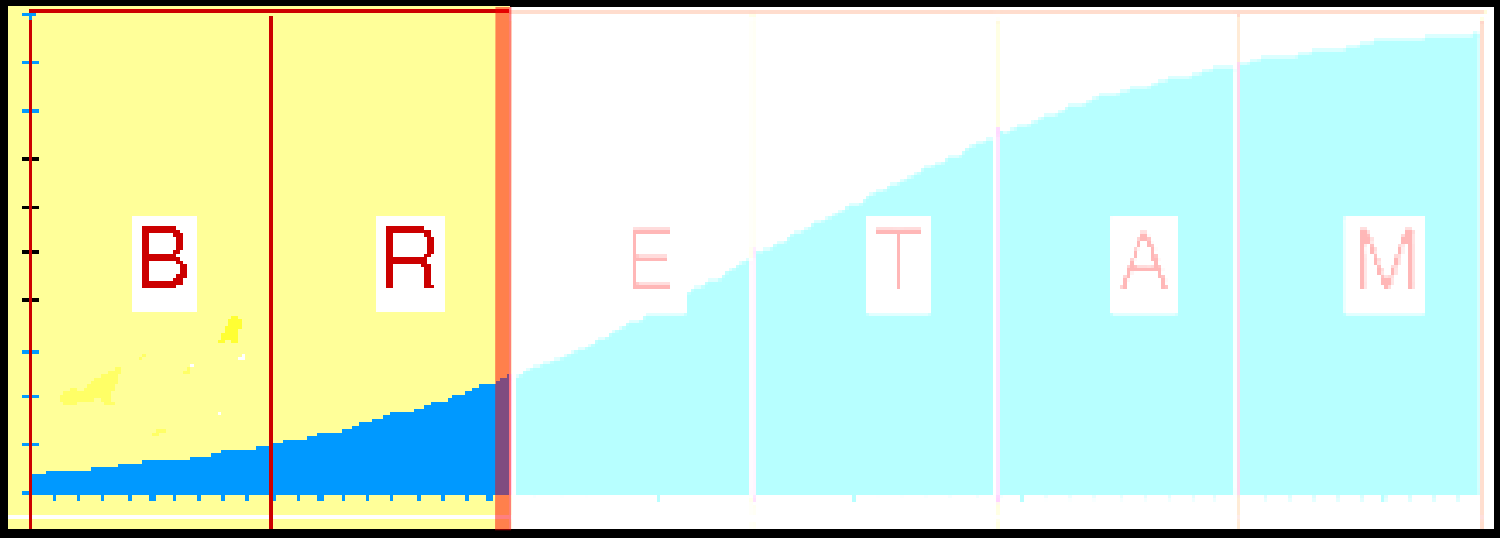
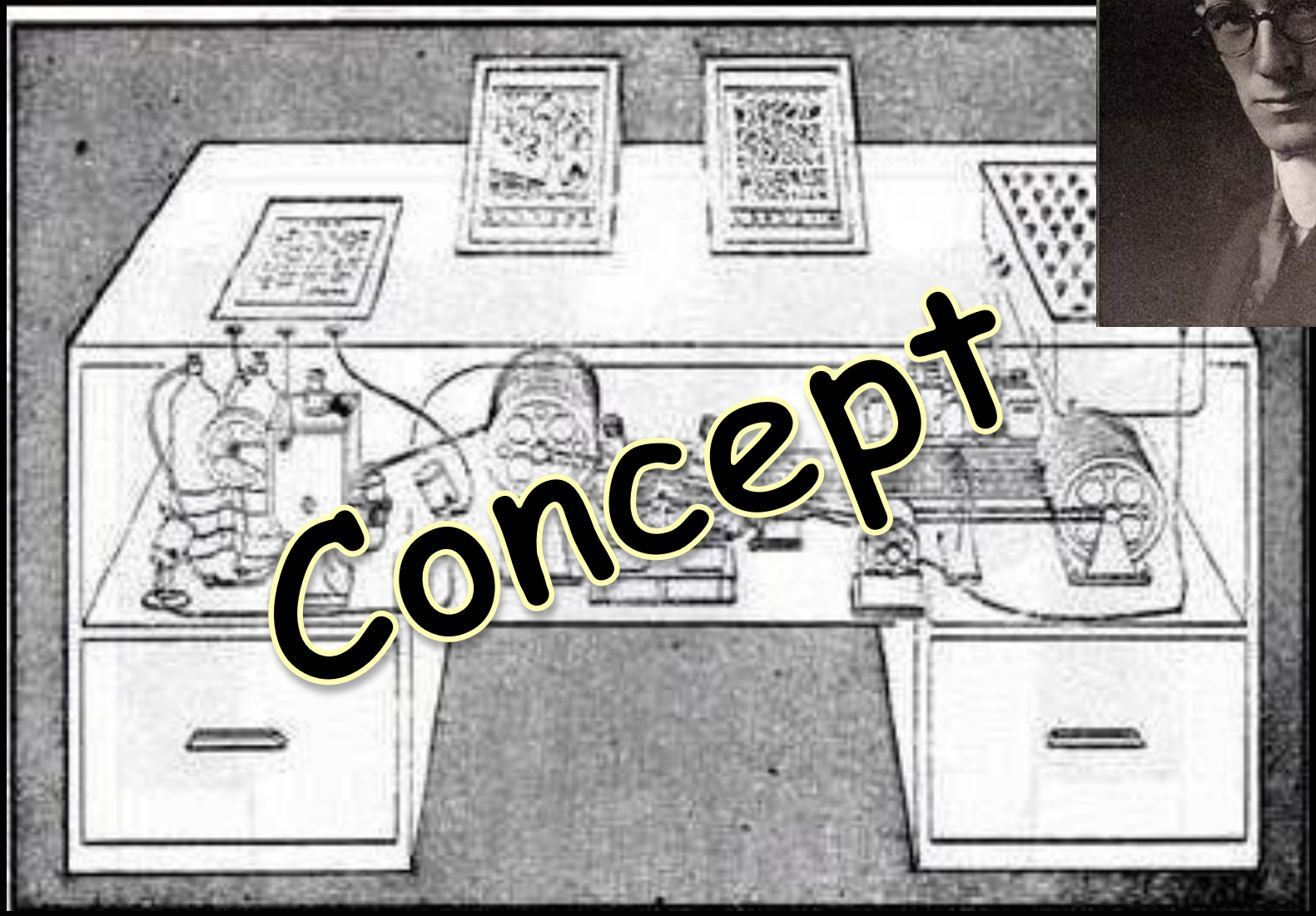
Part 4. Early Design



Breakthrough Replication

Memex Bush



Unimplemented and untested design. Microfilm is impractical. The work is premature and untested.

Resubmit after you build and evaluate this design.

We usually get it wrong

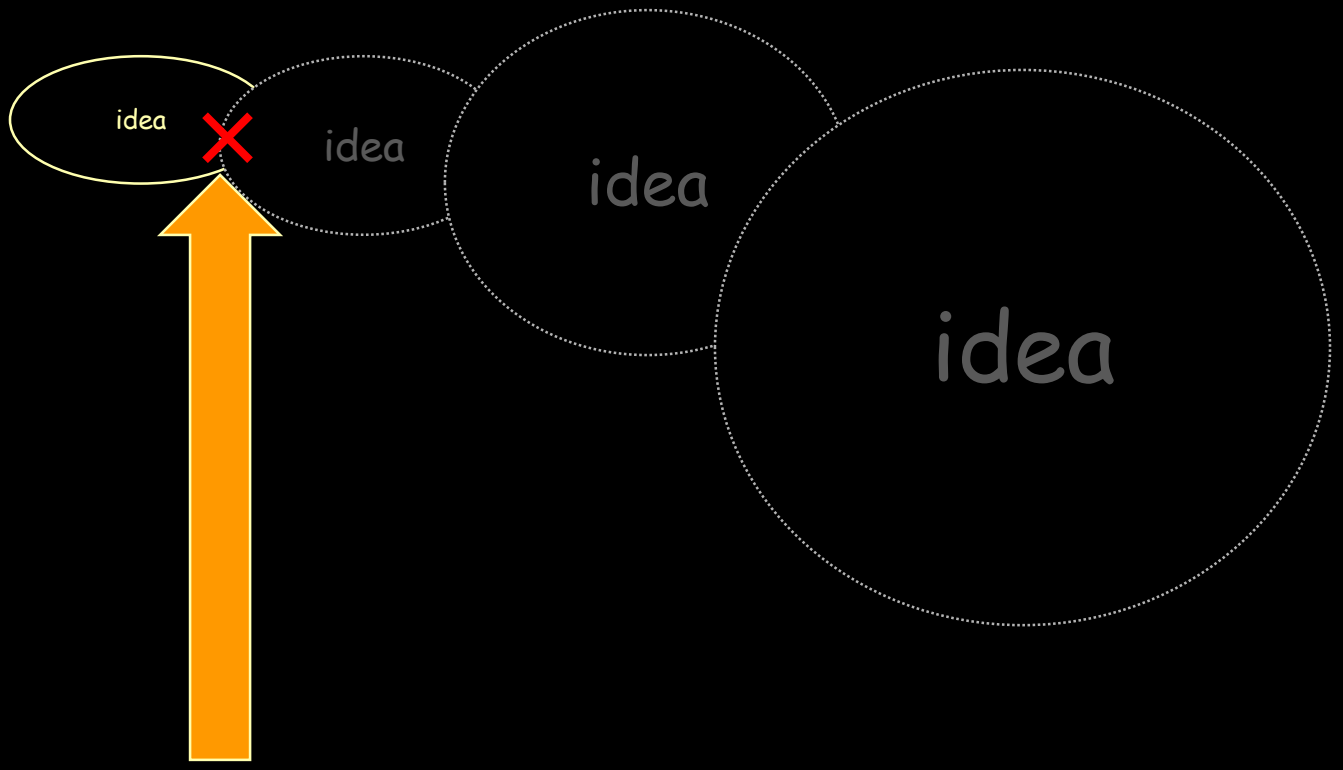
Early design as working sketches

Sketches are innovations valuable to HCI

Early design

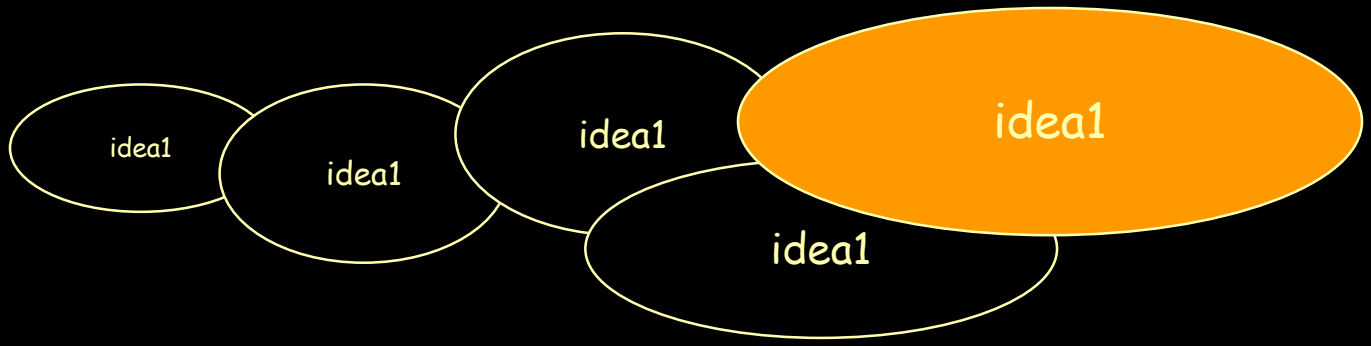
Early usability evaluation can kill a promising idea

- focus on negative 'usability problems'



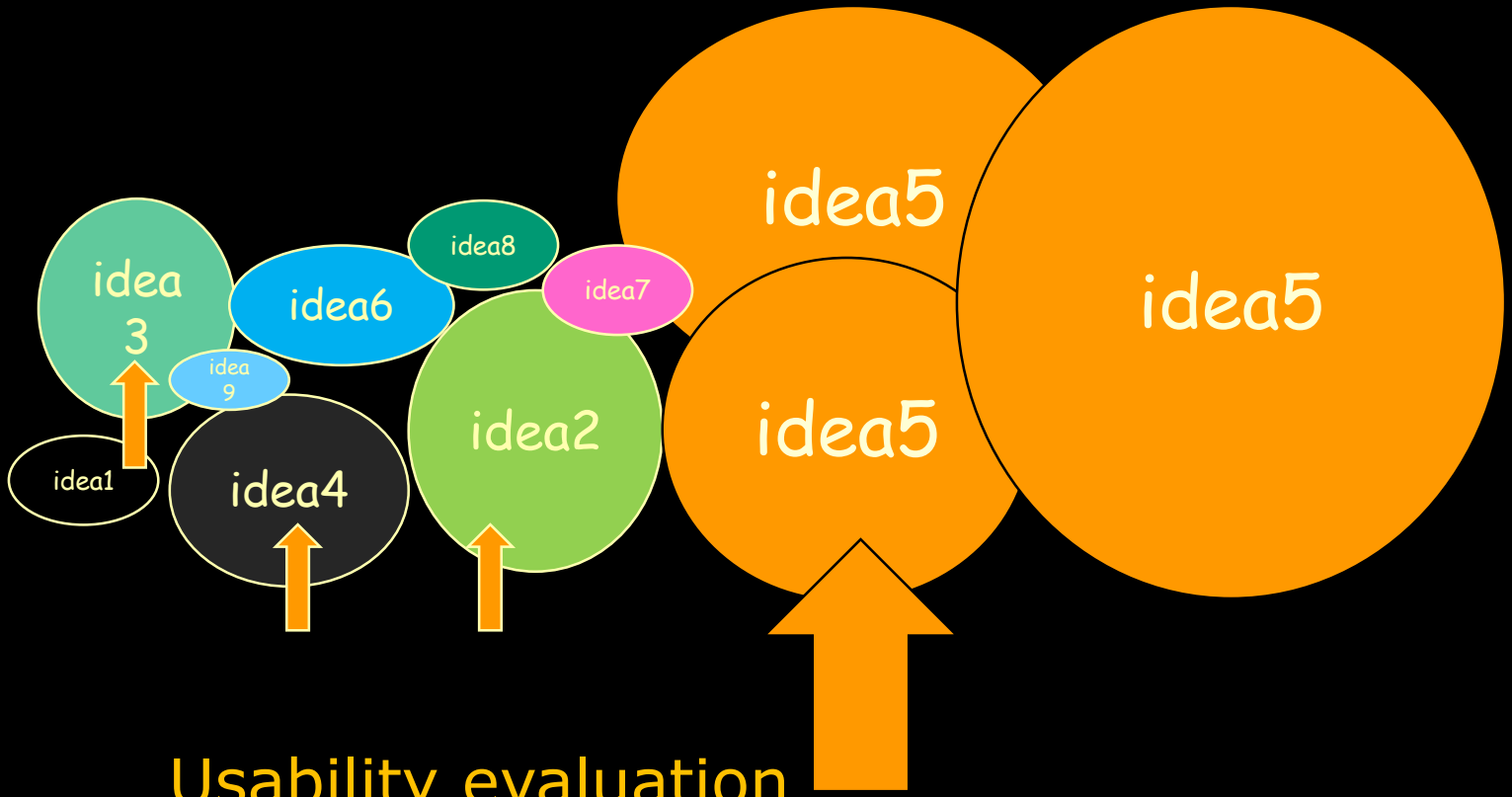
Early designs

Iterative testing can promote a mediocre idea



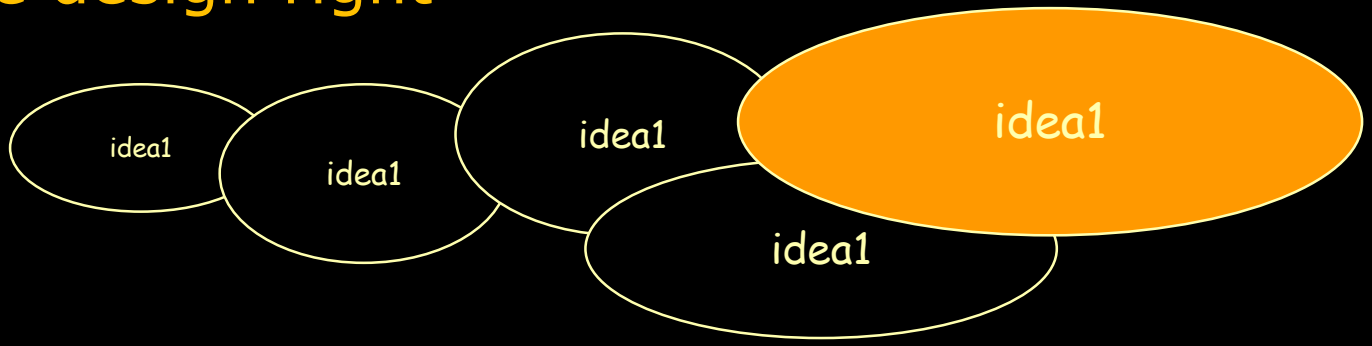
Early design

Generate and vary ideas, then reduce

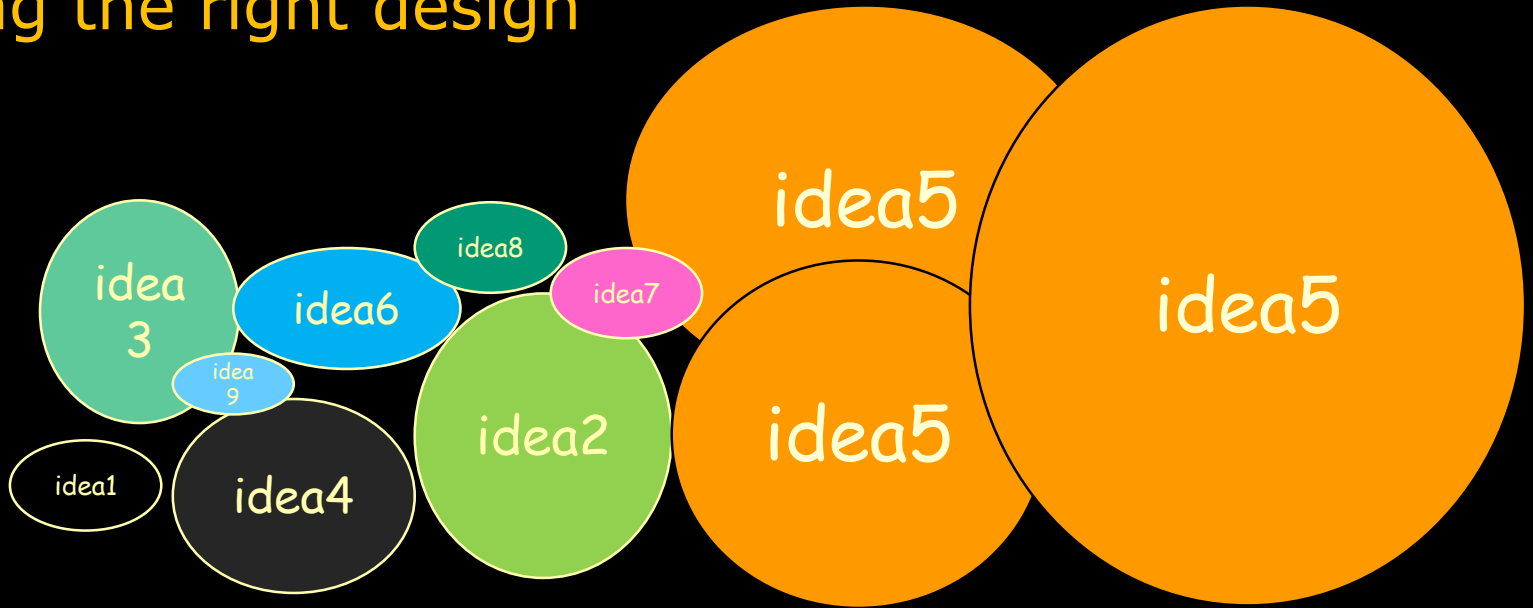


Early designs as working sketches

Getting the design right



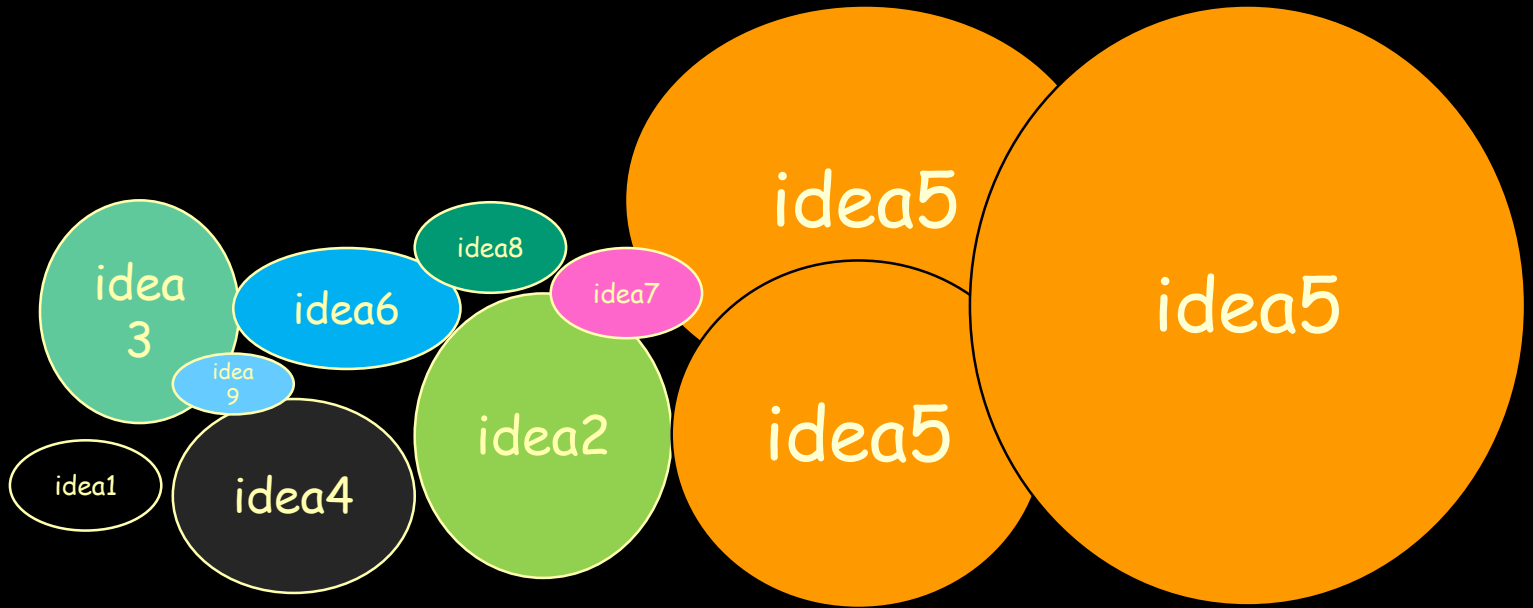
Getting the right design



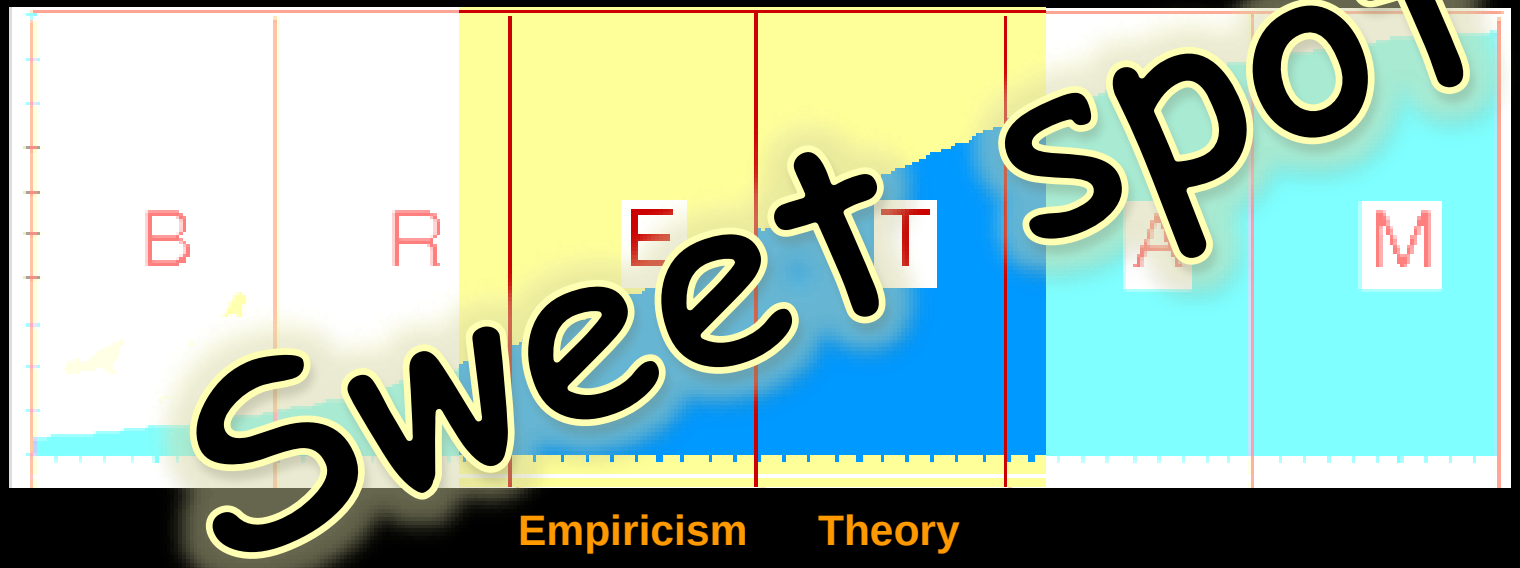
Early designs as working sketches

Methods:

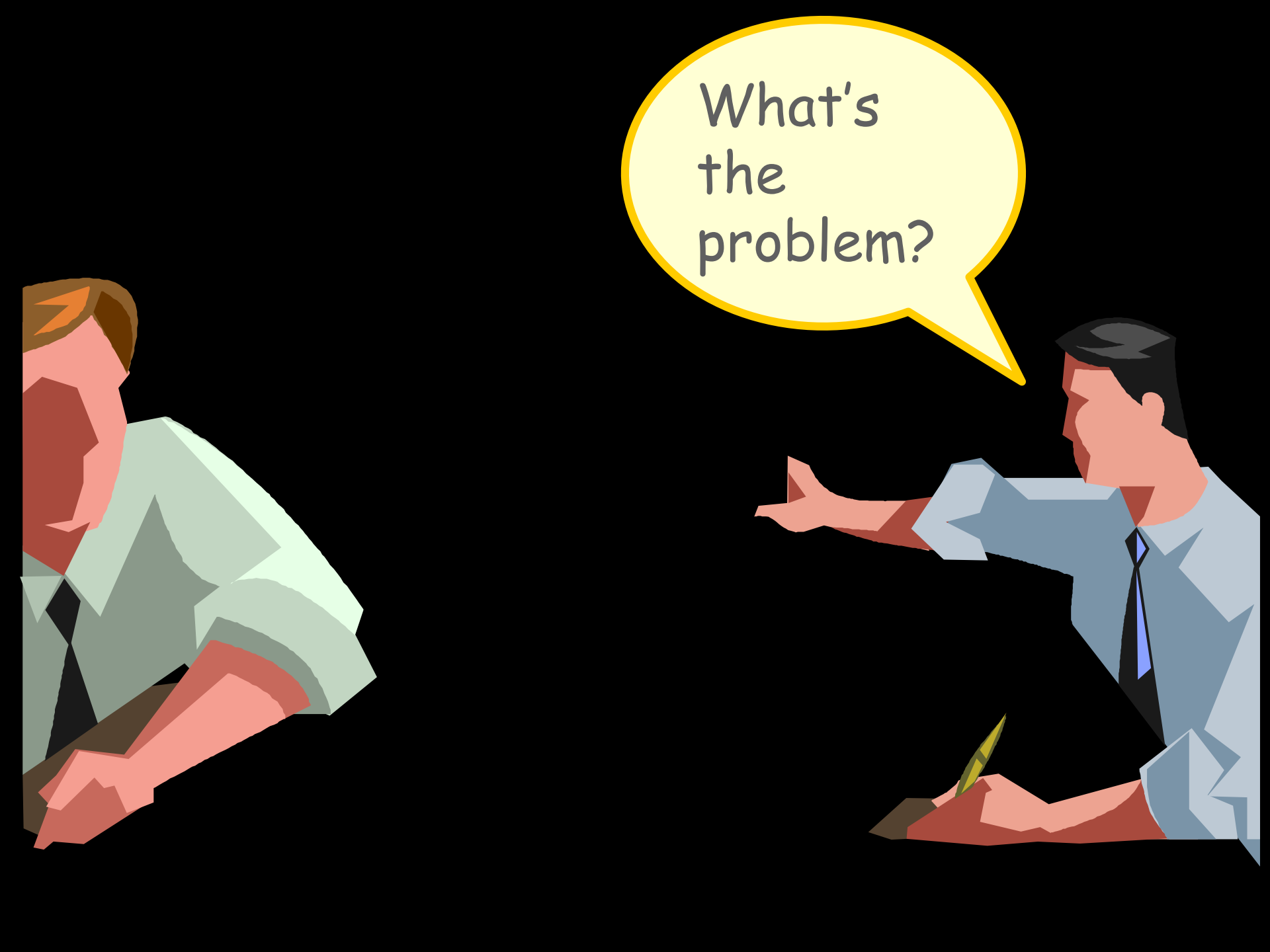
- idea generation, variation, argumentation, design critique, reflection, requirements analysis, personas, scenarios contrast, prediction, refinement, …



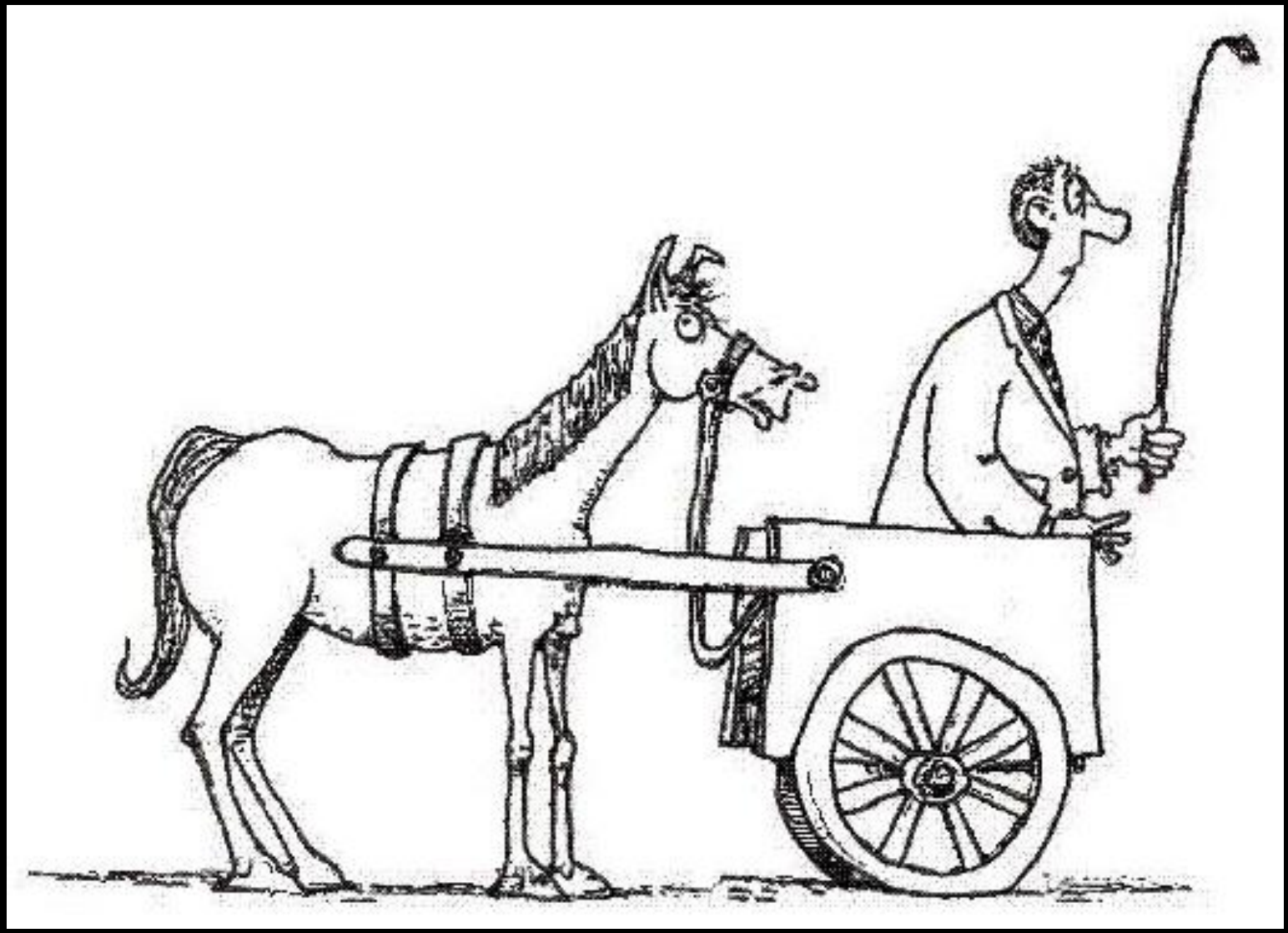
Part 6. Science



I need to do an evaluation


What's the problem?

It won't get accepted if I don't. Duh!



Source: whatitslikeontheinside.com/2005/10/pop-quiz-whats-wrong-with-this-picture.html

Research process

Choose the method *then* define a problem

or

Define a problem *then* choose usability evaluation

or

Define a problem *then* choose a method to solve it

Research process

Typical usability tests

- show technique is better than existing ones

Existence proof: one example of success

Research process

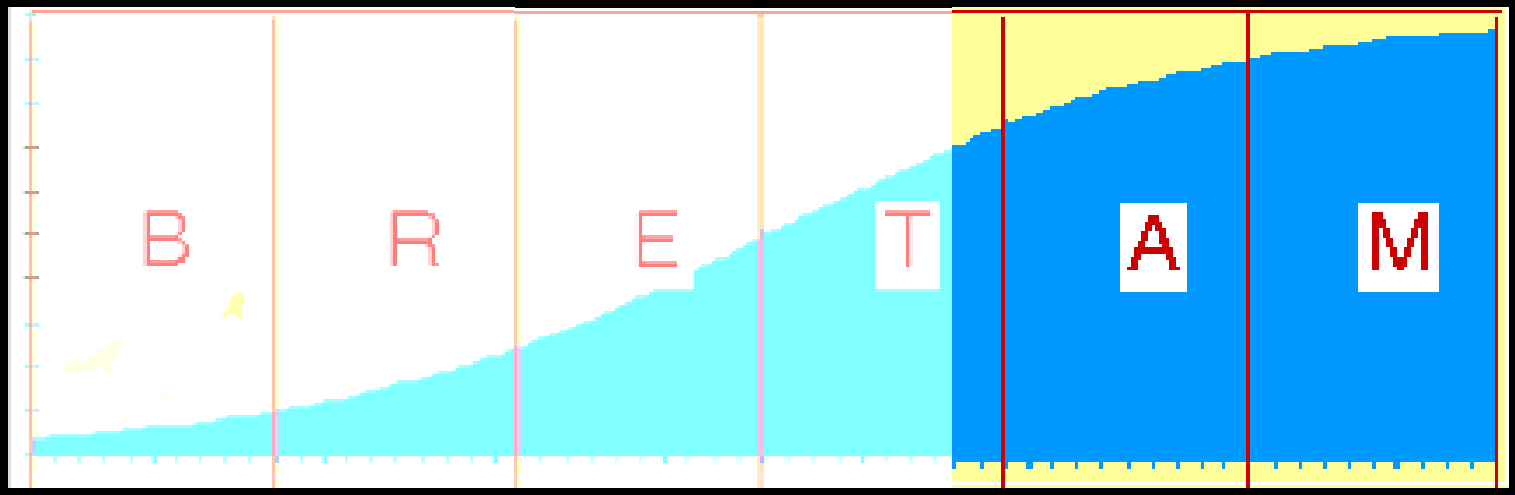
Risky hypothesis testing

- try to disprove hypothesis
- the more you can't, the more likely it holds

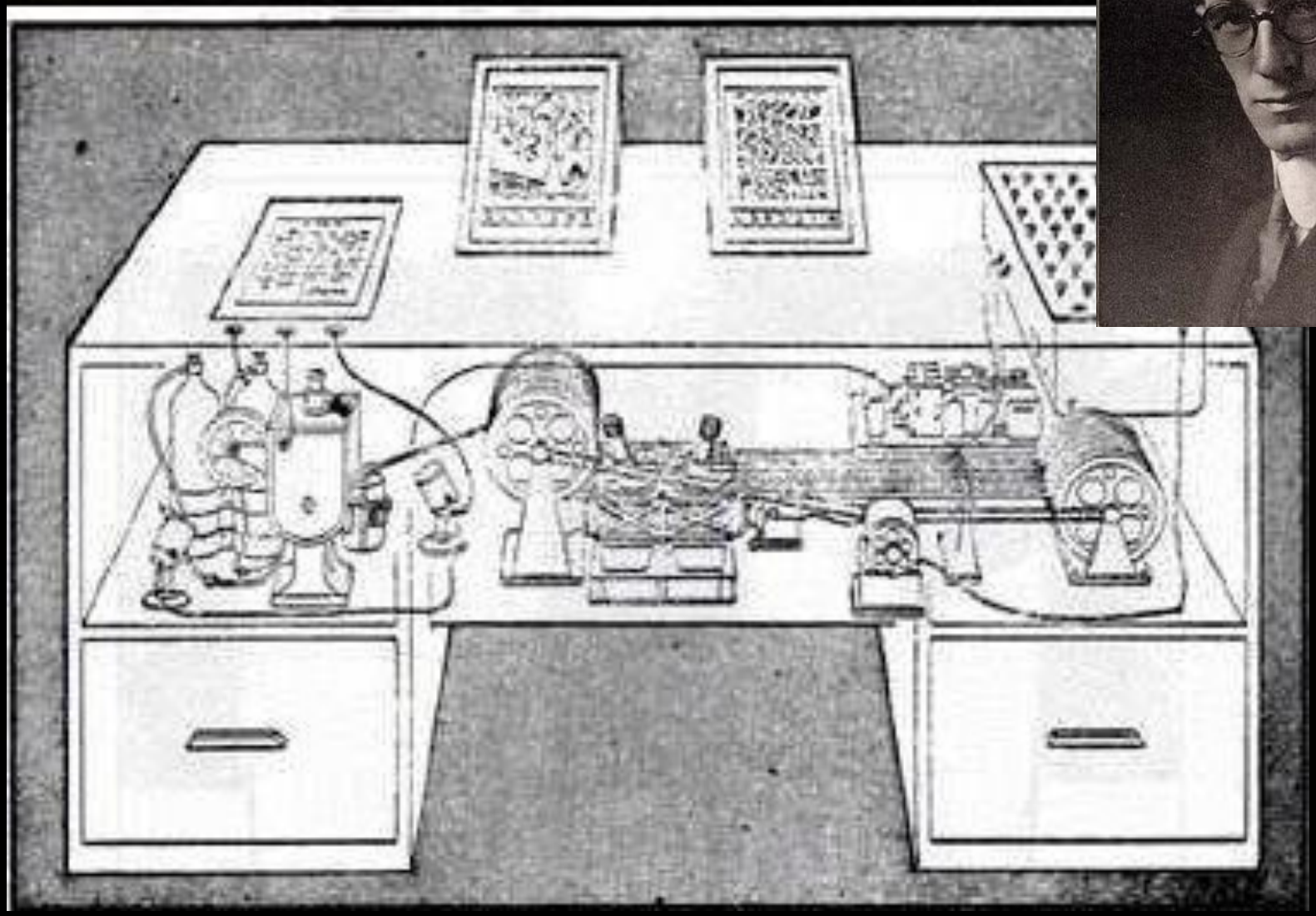
What to do:

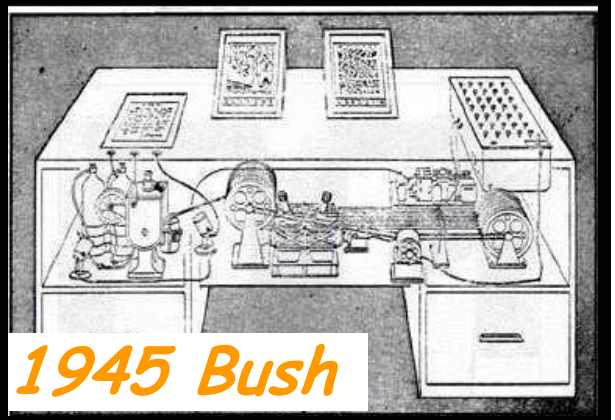
- test limitations / boundary conditions
- incorporate ecology of use
- replication

Part 6. Cultural Appropriation

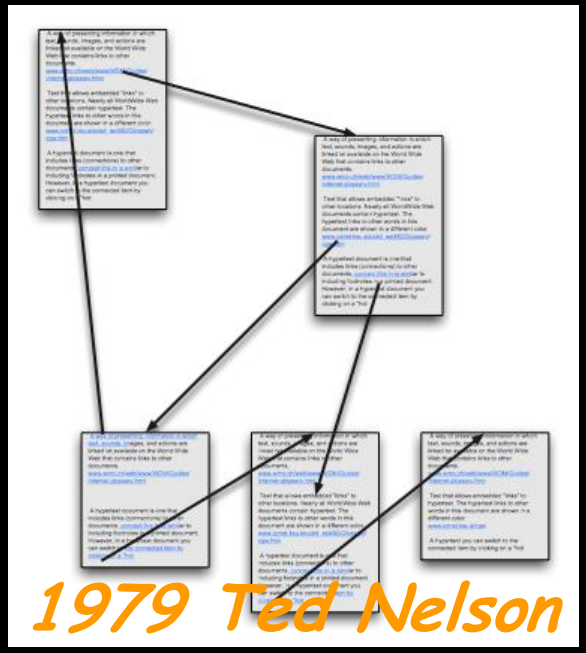


Memex Bush

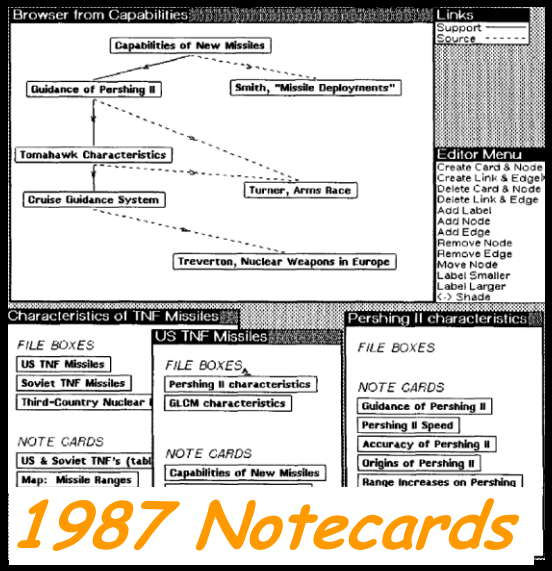




1945 Bush



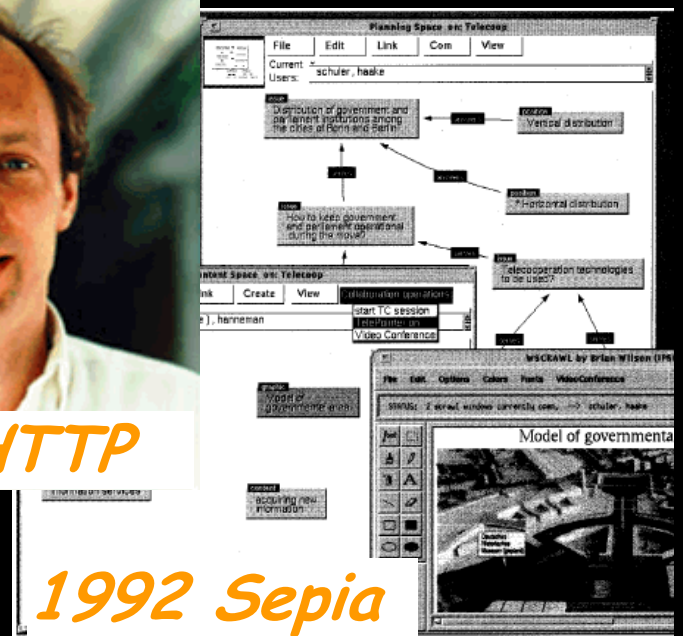
1979 Ted Nelson



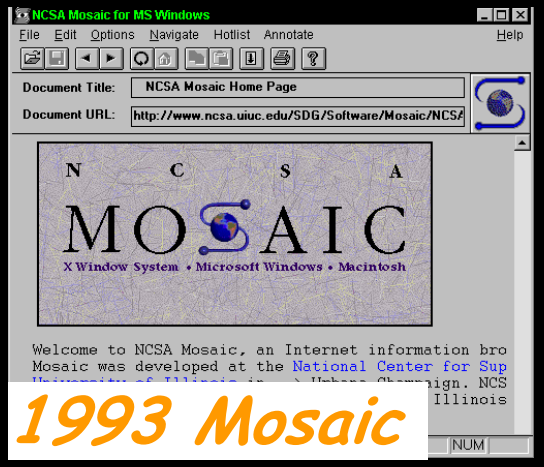
1987 Notecards

1989 ACM

1990 HTTP



1992 Sepia



1993 Mosaic

Hypertext - Wikipedia, the free encyclopedia - Windows Internet Explorer
http://en.wikipedia.org/wiki/Hypertext
Live Search
File Edit View Favorites Tools Help
Google Hypertext Go Bookmarks 134 blocked Settings SnagIt
Hypertext - Wikipedia, the free encyclopedia
Page Tools
Log in / create account
article discussion edit this page history
WIKIPEDIA
The Free Encyclopedia
navigation
Main Page
Contents
Featured content
Current events
Random article
interaction
About Wikipedia
Community portal
Recent changes
Contact Wikipedia
Donate to Wikipedia
Help
search
Go Search
toolbox
What links here
Related changes
Upload file
Special pages
Printable version
Permanent link
Cite this page
languages
Brezhoneg
Hypertext
From Wikipedia, the free encyclopedia
"Metatext" redirects here. For the literary concept, see Metafiction.
Hypertext most often refers to text on a computer that will lead the user to other, related information on demand. Hypertext represents a relatively recent innovation to user interfaces, which overcomes some of the limitations of written text. Rather than remaining static like traditional text, hypertext makes possible a dynamic organization of information through links and connections (called hyperlinks). Hypertext can be designed to perform various tasks; for instance when a user "clicks" on it or "hovers" over it, a bubble with a word definition may appear, a web page on a related subject may load, a video clip may run, or an application may open.
Contents [hide]
1 Etymology
2 Types and uses of hypertext
3 History
3.1 Early precursors to hypertext
3.2 The Memex
3.3 The invention of hypertext
3.4 Applications
3.5 Hypertext and the World Wide Web
4 Implementations
5 Academic conferences
6 Hypertext fiction
6.1 Critics and theorists
7 See also
8 References
9 External links
Etymology [edit]
The prefix hyper- ("over" or "beyond") signifies the overcoming of the old linear constraints of written text. The term "hypertext" is often used where the term hypermedia might seem appropriate. In 1992 Ted Nelson - who coined both terms in 1965 - wrote:
Internet | Protected Mode: On
100%

amazon.com

Hello. Sign in to get personalized recommendations. New customer? Start here.

Give Mom exactly what she wants

Your Amazon.com | Today's Deals | Gifts & Wish Lists | Gift Cards | Your Account | Help

Search: All Departments | GO | Cart | Your Lists

Shop All Departments

- Books
- Movies, Music & Games
- Digital Downloads
- Kindle
- Computers & Office
- Electronics
- Home & Garden
- Grocery, Health & Beauty
- Toys, Kids & Baby
- Apparel, Shoes & Jewelry
- Sports & Outdoors
- Tools, Auto & Industrial

Check This Out

- Mom's Day Deals — Get her the perfect gift at a great price.
- Gift Cards — Give Mom exactly what she wants.
- Summer 2009 — Shop for summer's top picks.
- Video Games Trade-In — Get an Amazon.com Gift Card.

Dear Customers,

A strange thing happened on the way to the paperless society. We humans created more paper than ever before. Computer printers (and their evil companion, the ink-toner cartridge) have proliferated, and most of us routinely print out and lug around loads of personal and professional documents. Why? It's not that buying printers or changing ink-toner cartridges is fun. It's because reading on paper is better than reading on traditional computer displays. Printing has been worth the hassle.

Kindle starts to change that. People who see Kindle's display for the first time do a double-take. It looks and reads like real paper. People who swore they would never read books on computers are reading books on Kindle in numbers far greater than we ever expected. And they're now starting to ask: If I can carry my whole library around on my Kindle, how about I carry all my personal and professional documents there too?

We're excited to announce Kindle DX, the large screen addition to the

Amazon Daily BLOG — 3 posts since yesterday — Read posts

Amazon.com Gift Cards
Give a little card, get a big smile
Buy now

Digital SLR Store
Find Top Digital SLRs, Lenses, Buying Guides, and More

Shop Amazon.com/dslr

Hello, Spring Green DS Lite

This Nintendo DS Lite handheld gaming bundle features wi-fi, touchscreen, a lightweight

BLACK JACK

POKER

ROULETTE

SLOTS

CRAPS

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FR

GER

GB

JP

PLAY IN YOUR OWN CURRENCY:

€ EUROS

£ POUNDS

$ US DOLLARS

TOTAL JACKPOT

$ 1.542.367.52

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UP TO

$300

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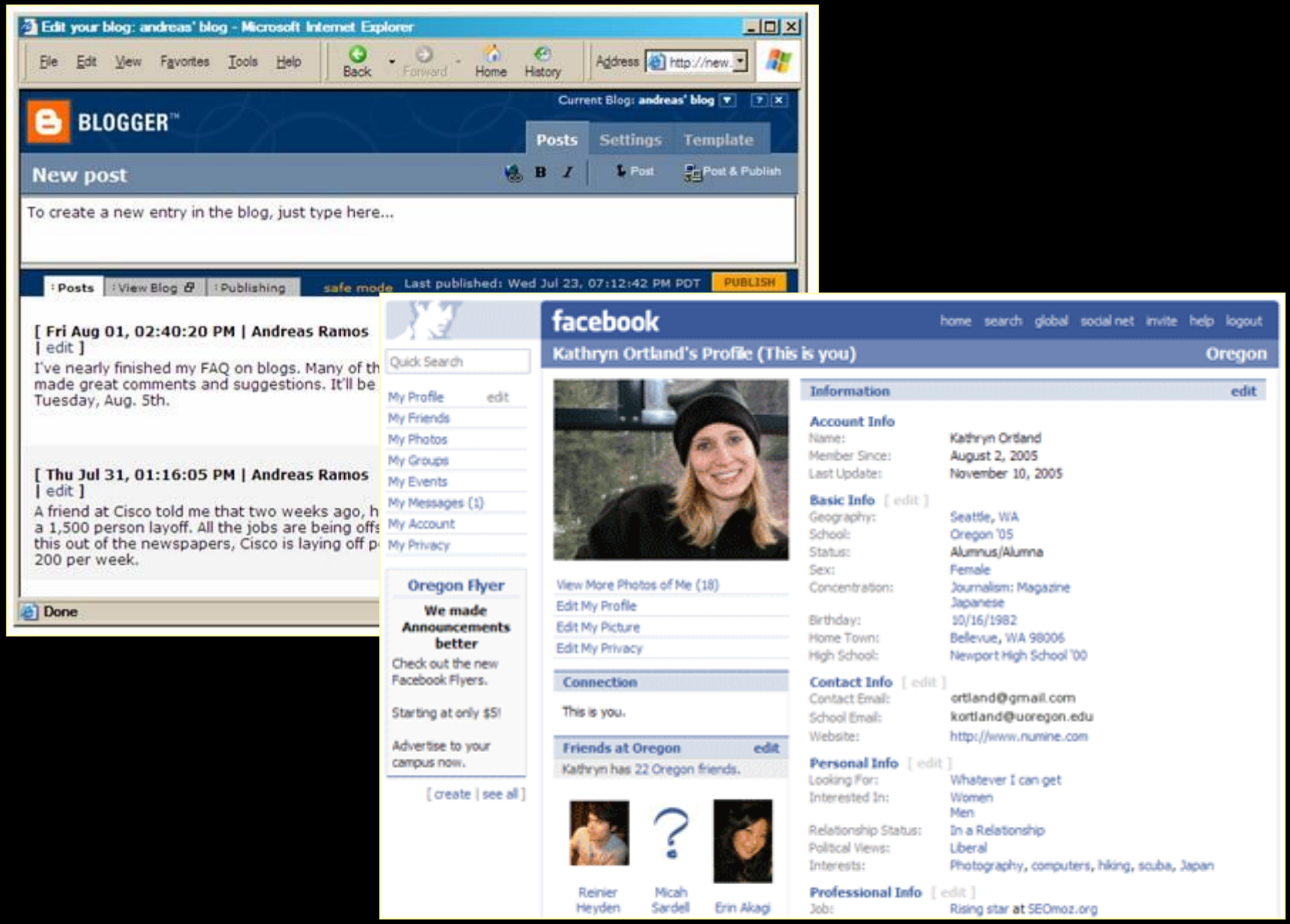
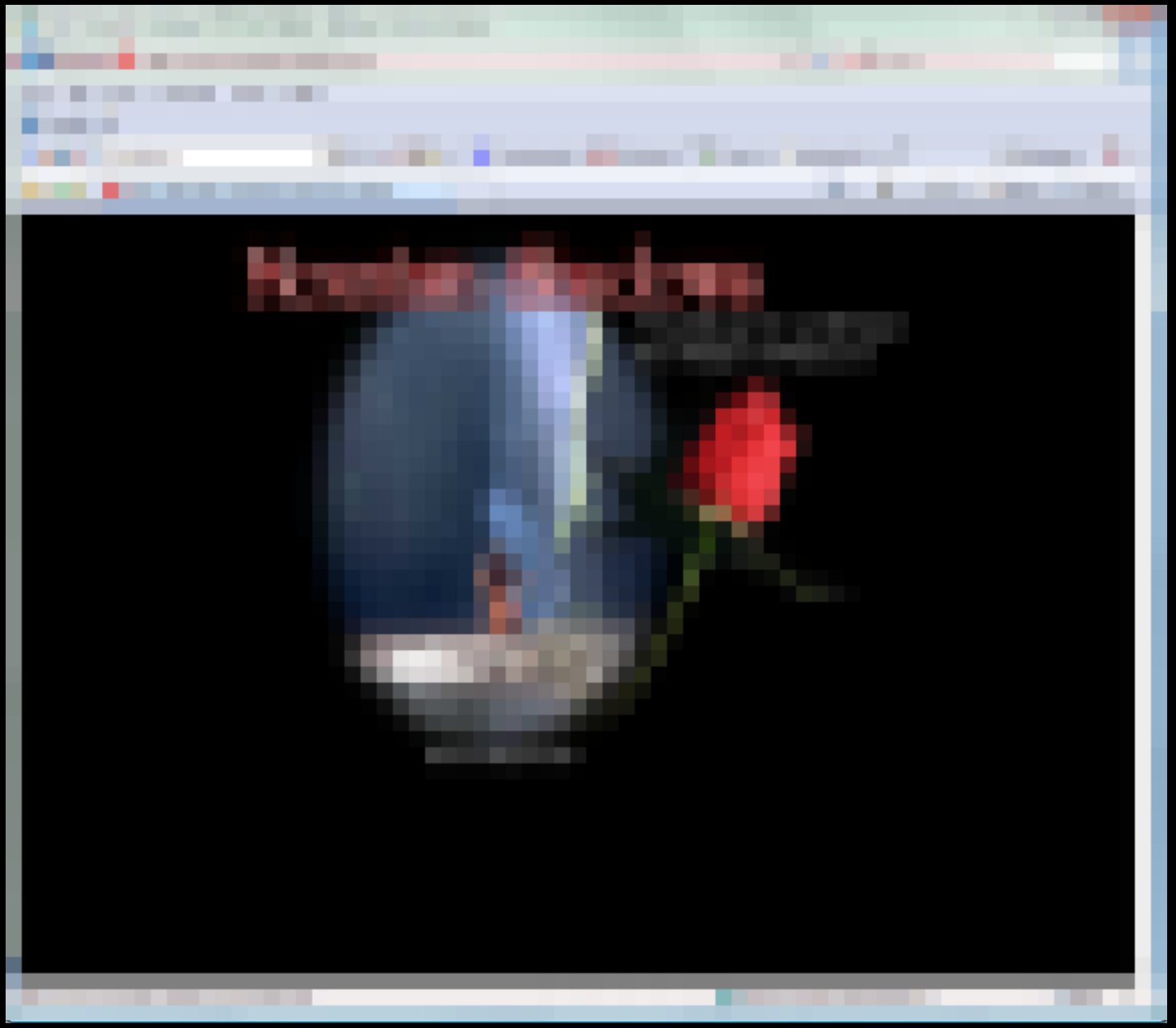

Edit your blog: andreas' blog - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Forward Home History
Address http://new
BLOGGER
Current Blog: andreas' blog
Posts Settings Template
New post
Post Post & Publish
To create a new entry in the blog, just type here...
Posts View Blog Publishing
safe mode
Last published: Wed Jul 23, 07:12:42 PM PDT
PUBLISH
[Fri Aug 01, 02:40:20 PM | Andreas Ramos
| edit]
I've nearly finished my FAQ on blogs. Many of th
made great comments and suggestions. It'll be
Tuesday, Aug. 5th.
[Thu Jul 31, 01:16:05 PM | Andreas Ramos
| edit]
A friend at Cisco told me that two weeks ago, h
a 1,500 person layoff. All the jobs are being offs
this out of the newspapers, Cisco is laying off p
200 per week.
Done
facebook
home search global social net invite help logout
Kathryn Ortland's Profile (This is you)
Oregon
Quick Search
My Profile edit
My Friends
My Photos
My Groups
My Events
My Messages (1)
My Account
My Privacy
Oregon Flyer
We made Announcements better
Check out the new Facebook Flyers.
Starting at only $5!
Advertise to your campus now.
[create | see all]
View More Photos of Me (18)
Edit My Profile
Edit My Picture
Edit My Privacy
Connection
This is you.
Friends at Oregon edit
Kathryn has 22 Oregon friends.
Reinier Heyden
Micah Sardell
Erin Akagi
Information edit
Account Info
Name: Kathryn Ortland
Member Since: August 2, 2005
Last Update: November 10, 2005
Basic Info [edit]
Geography: Seattle, WA
School: Oregon '05
Status: Alumnus/Alumna
Sex: Female
Concentration: Journalism: Magazine
Japanese
Birthday: 10/16/1982
Home Town: Bellevue, WA 98006
High School: Newport High School '00
Contact Info [edit]
Contact Email: ortland@gmail.com
School Email: kortland@uoregon.edu
Website: http://www.numine.com
Personal Info [edit]
Looking For: Whatever I can get
Interested In: Women
Men
Relationship Status: In a Relationship
Political Views: Liberal
Interests: Photography, computers, hiking, scuba, Japan
Professional Info [edit]
Job: Rising star at SEOmoz.org



Part 7. What to do

Evaluation

More Appropriate Evaluation

The choice of evaluation methodology - if any – must arise and be appropriate for the actual problem or research question under consideration

argumentation
design critiques
design competitions
visions
inventions
prediction
reflection
design rationales
…

case studies
field studies
cultural probes
extreme uses
requirements analysis
contextual inquiries
ethnographies
eat your own dogfood
…

We decide what is good research and practice

There is no them

Only us

Remember Both Sides of this Course

This course emphasize both

- Getting the Right Design
- Getting the Design Right

Many people fall into a trap of the latter

Be mindful of your methods

Today

Informal Prototyping Fun

Experimental Design and Statistics Background

Usability Evaluation Considered Harmful

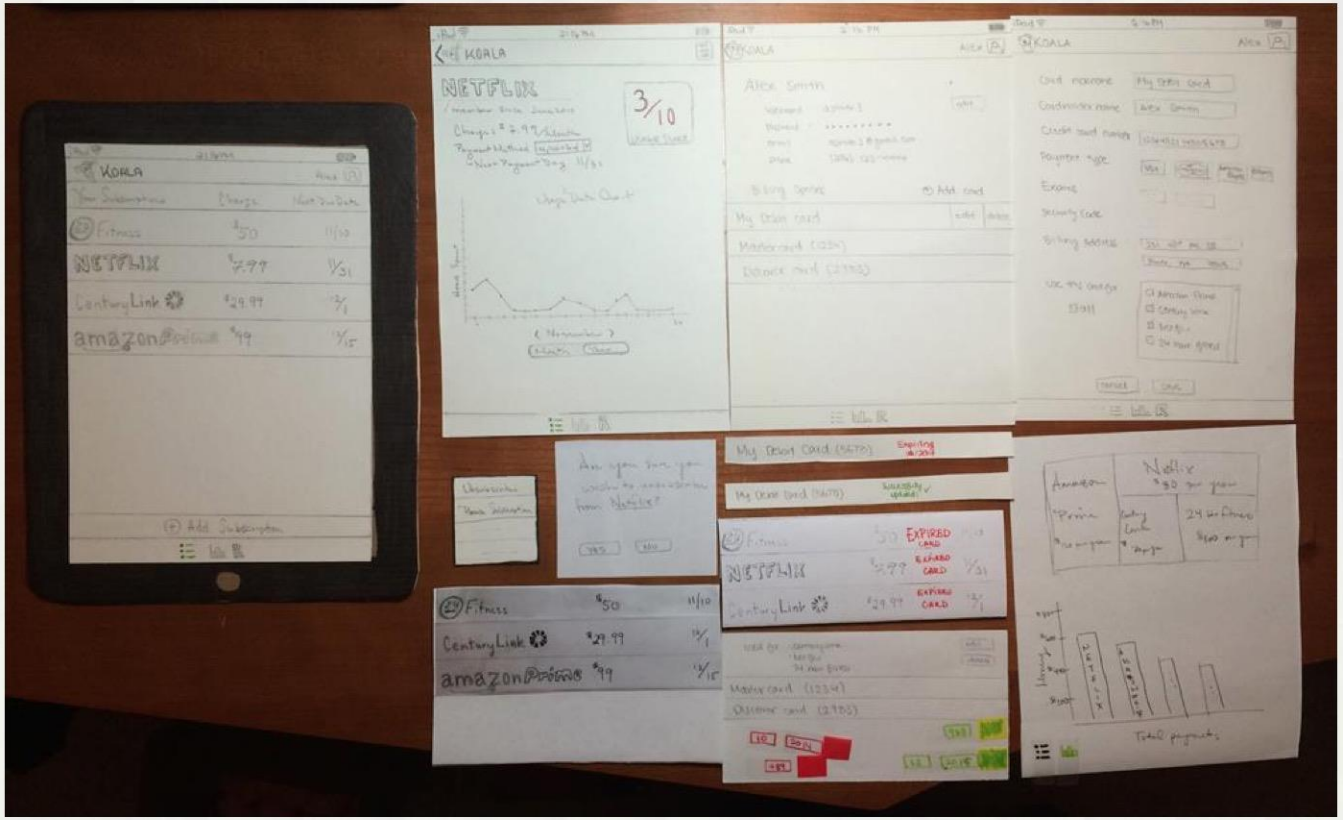
Presentation Feedback

Exam Q&A

Video Critiques

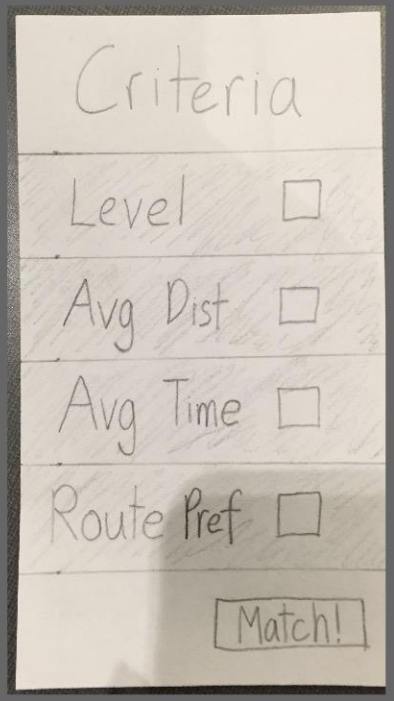
Image Contrast

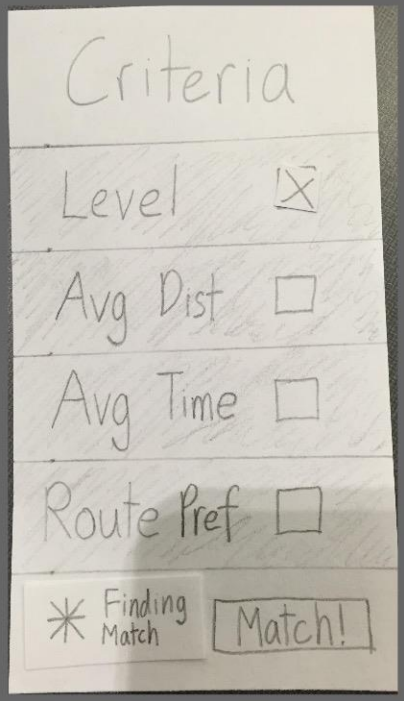
Initial Paper Prototype

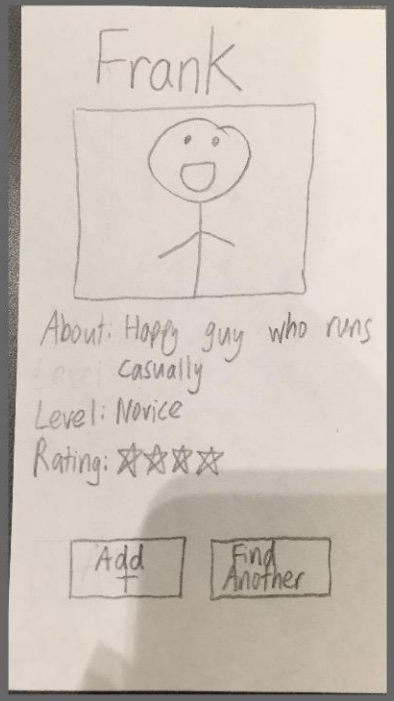


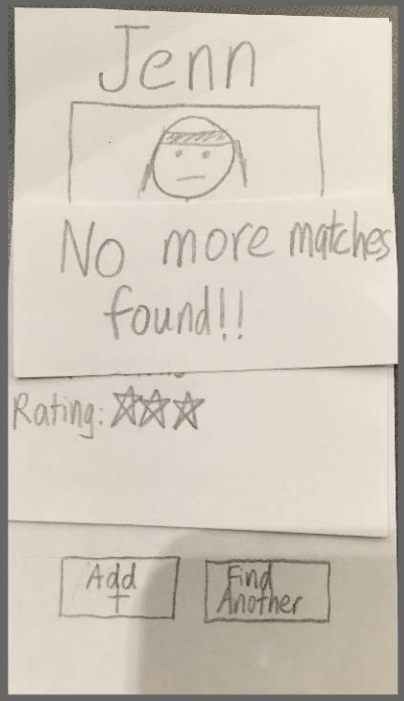
Initial Paper Prototype

Task 1: Finding a SmartMatch





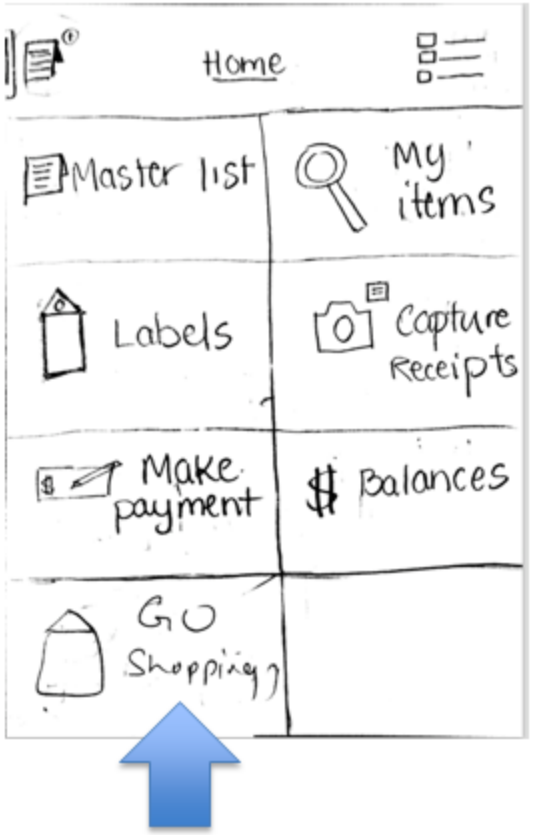




Testing - Results

Artificially Increase Contrast

- **Heuristic Evaluation**
  - High Severity Issues
  - Example: "Go Shopping" mode was useless
- **User Testing**
  - High and Medium Severity Issues
  - Example: Takes too long to get to "Add Item"
- **Design Mockup Critique**
  - Low Severity and Aesthetic Issues
  - Example: Home screen too cluttered



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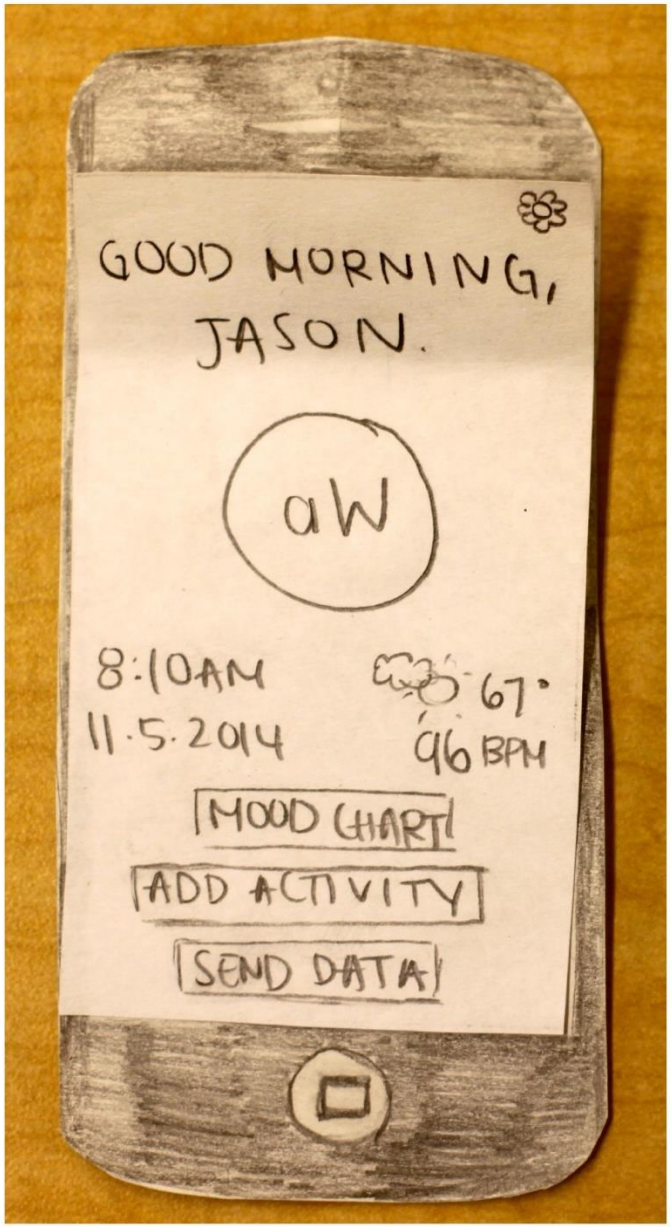

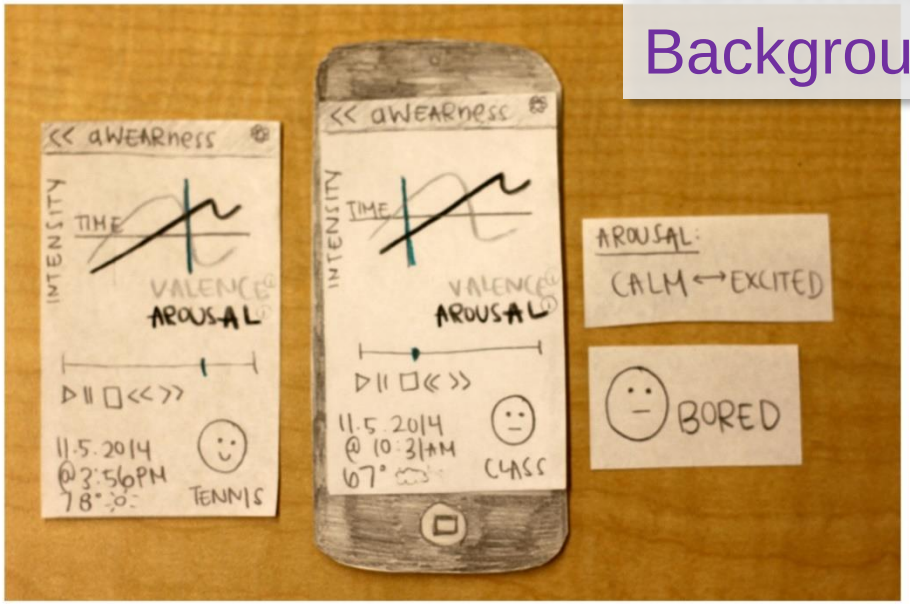

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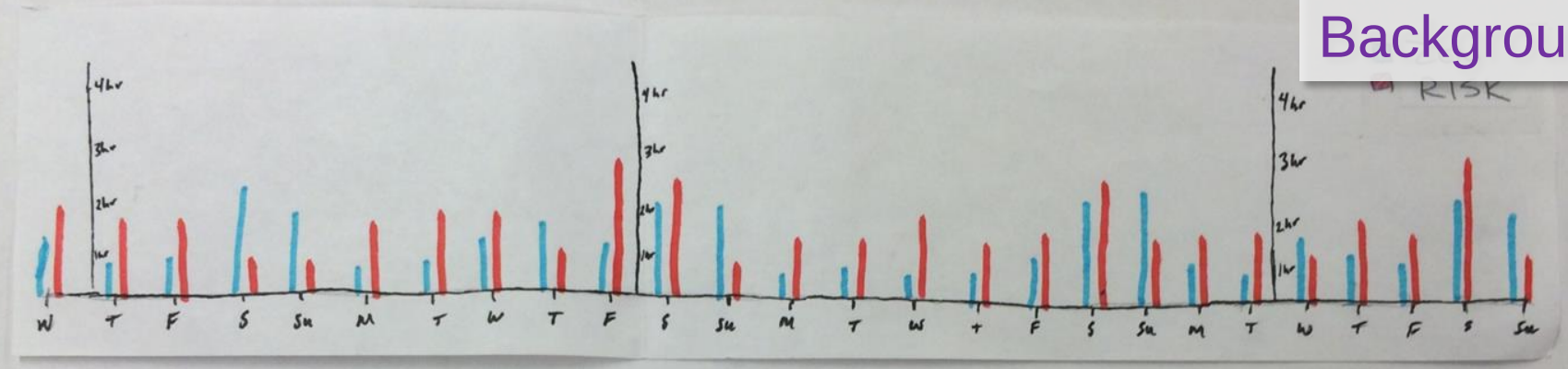
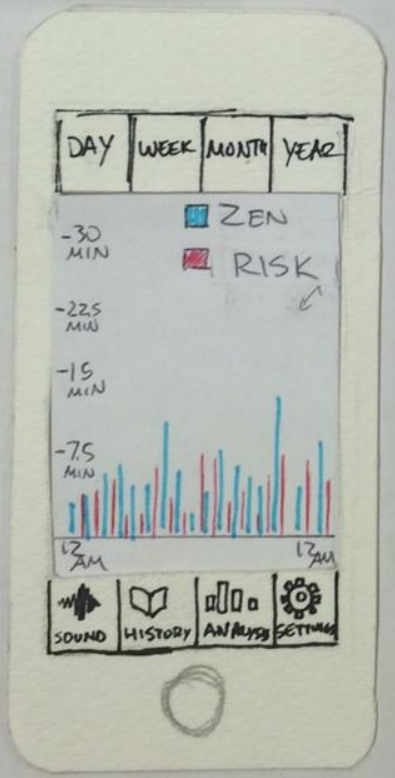
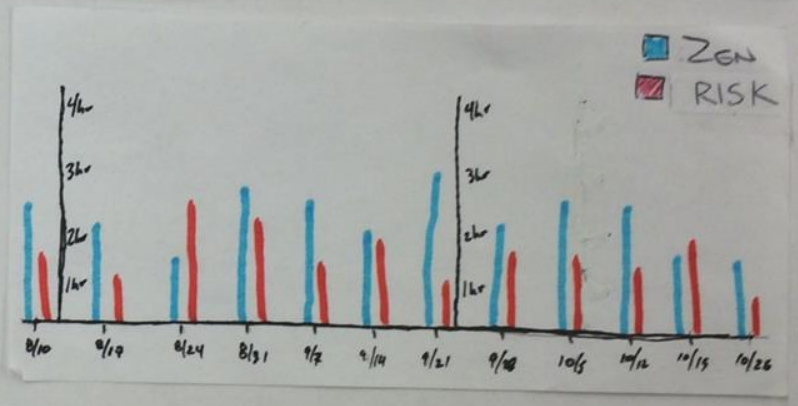


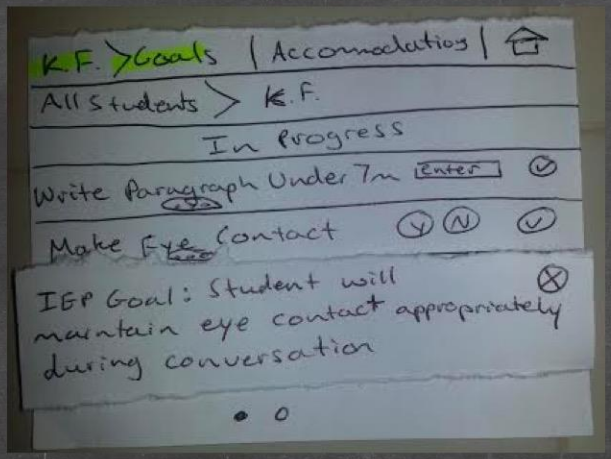


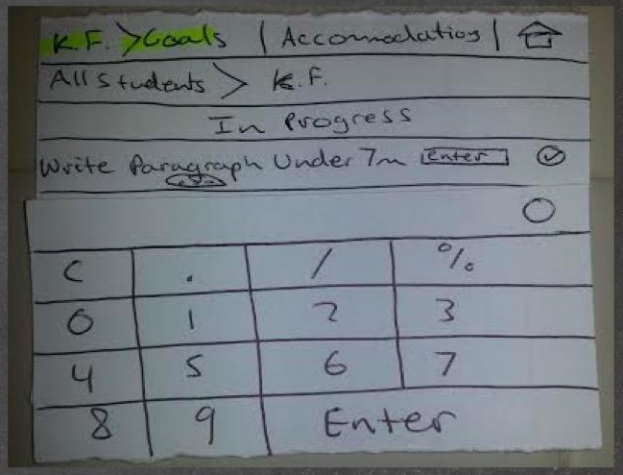


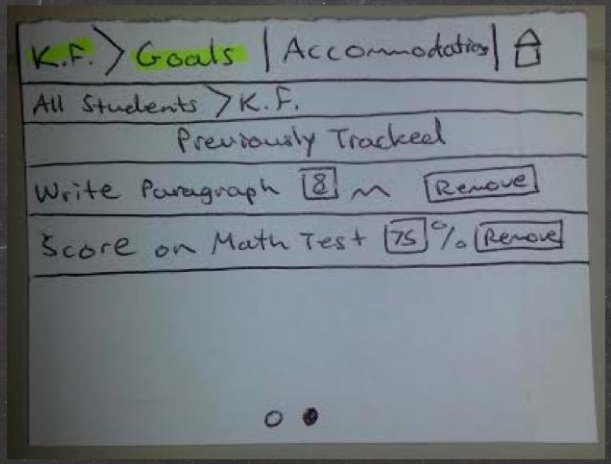
Final Paper Prototype

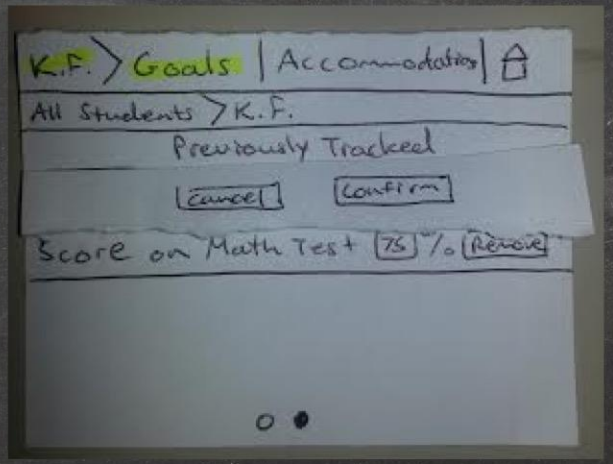
IEP-Connect Classroom

Many Screens on One Slide





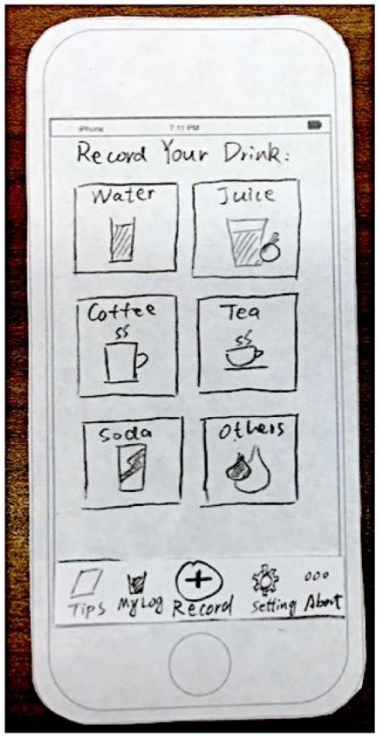


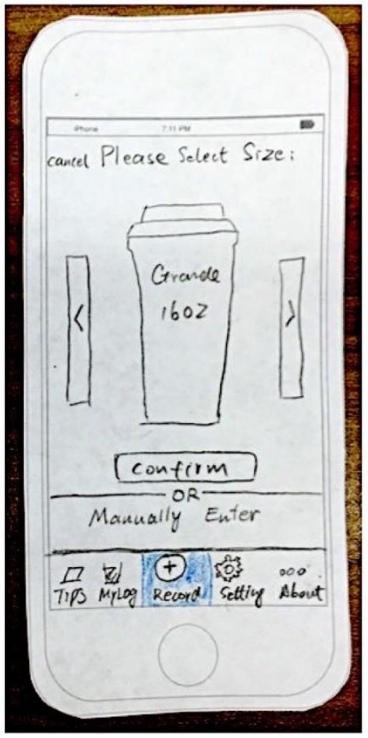


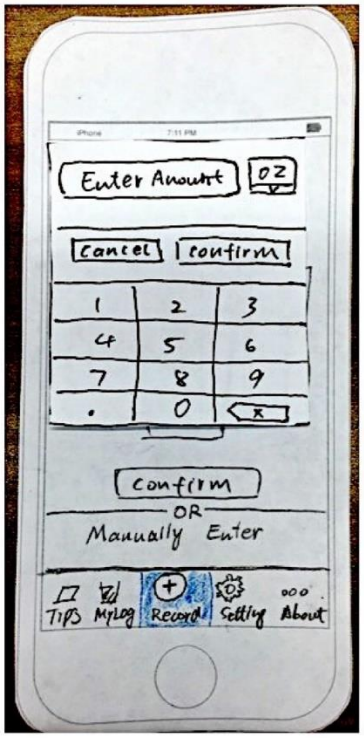
Final Paper Prototype

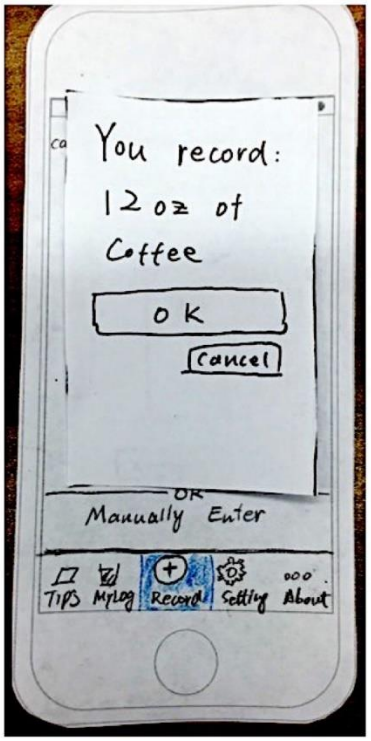
Task2 - Record Water Intake

Many Screens on One Slide

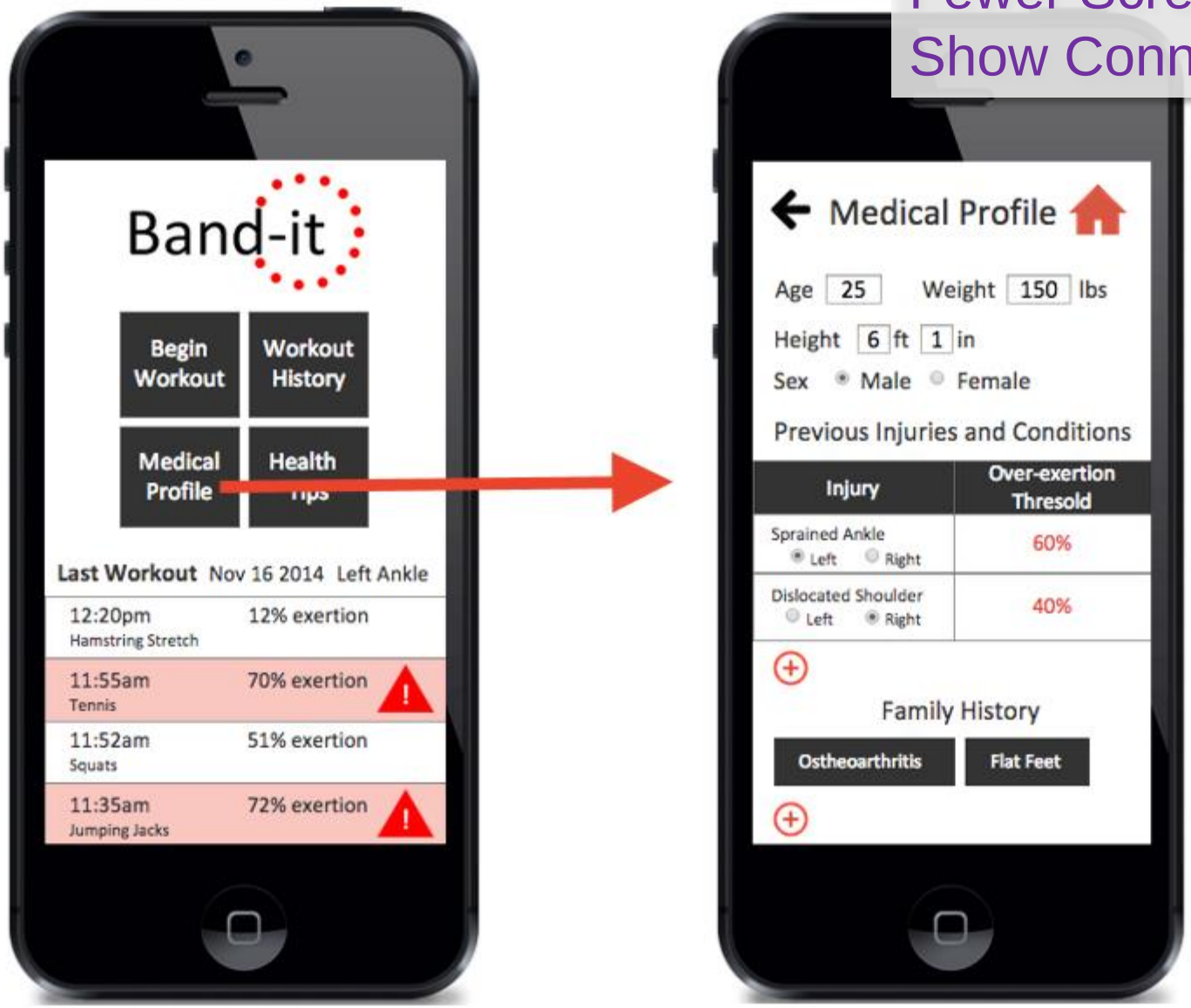








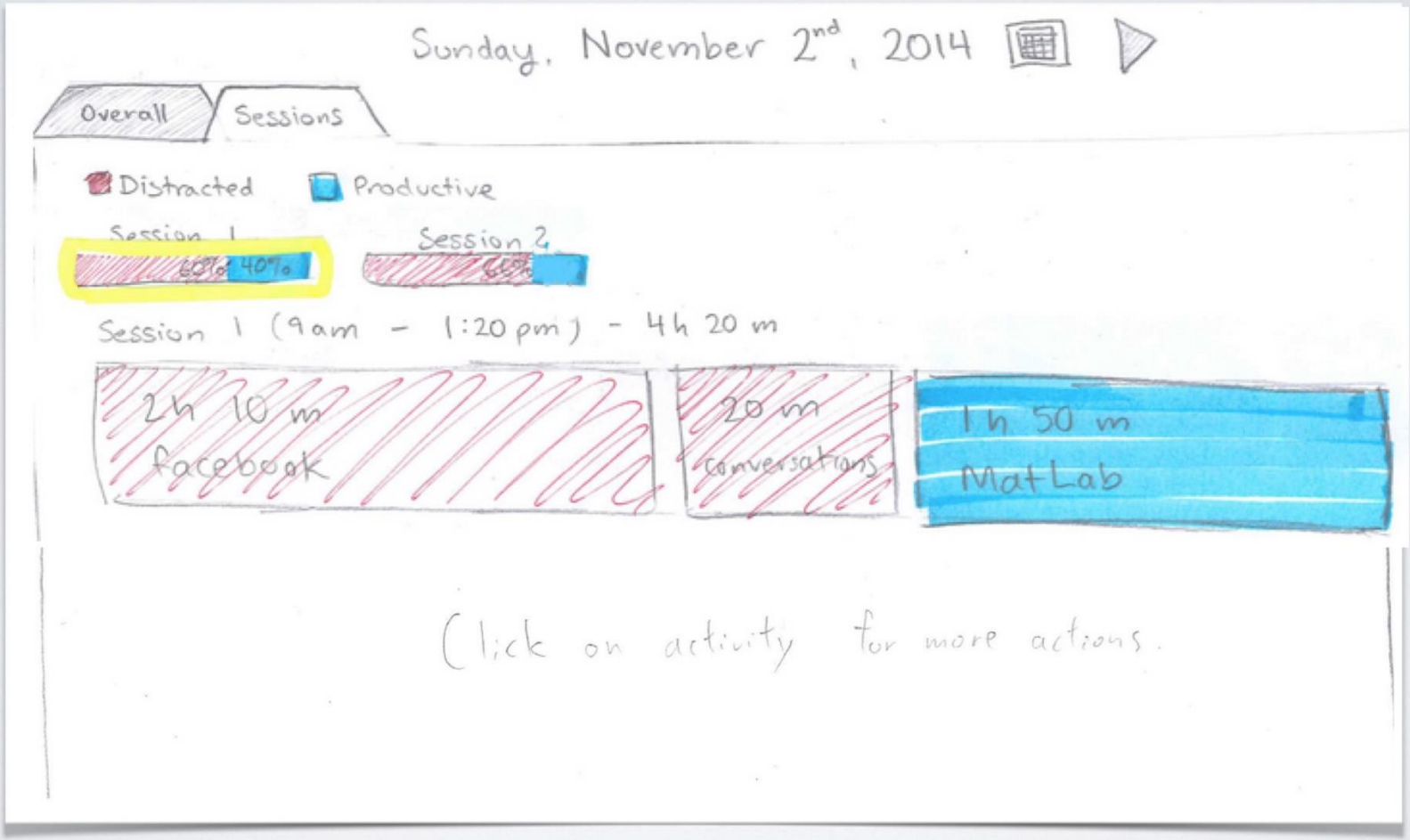
Fewer Screens, Show Connections



Fewer Screens, Show Connections

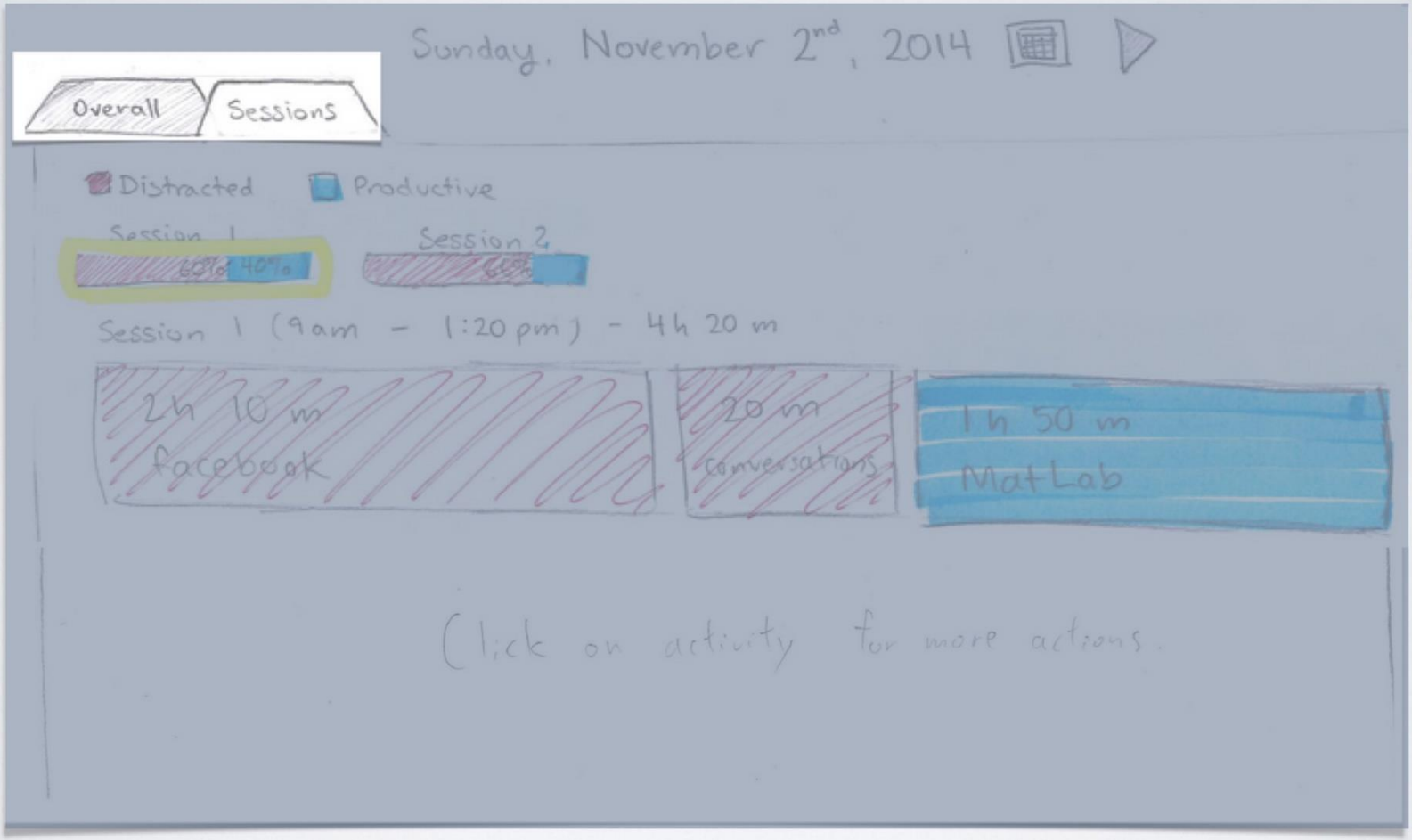
Highlighting

IMPROVED DESIGN



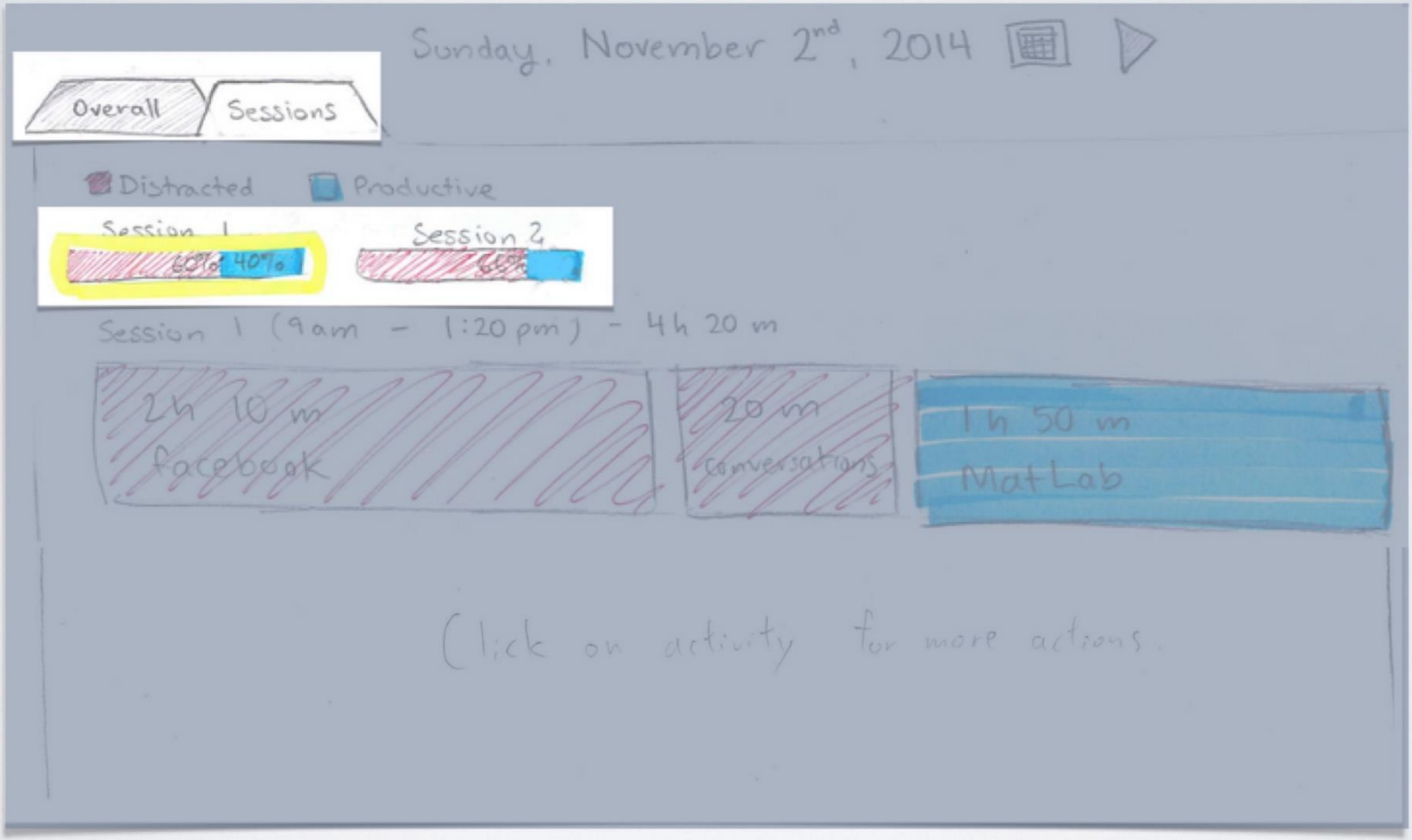
Highlighting

IMPROVED DESIGN



Highlighting

IMPROVED DESIGN



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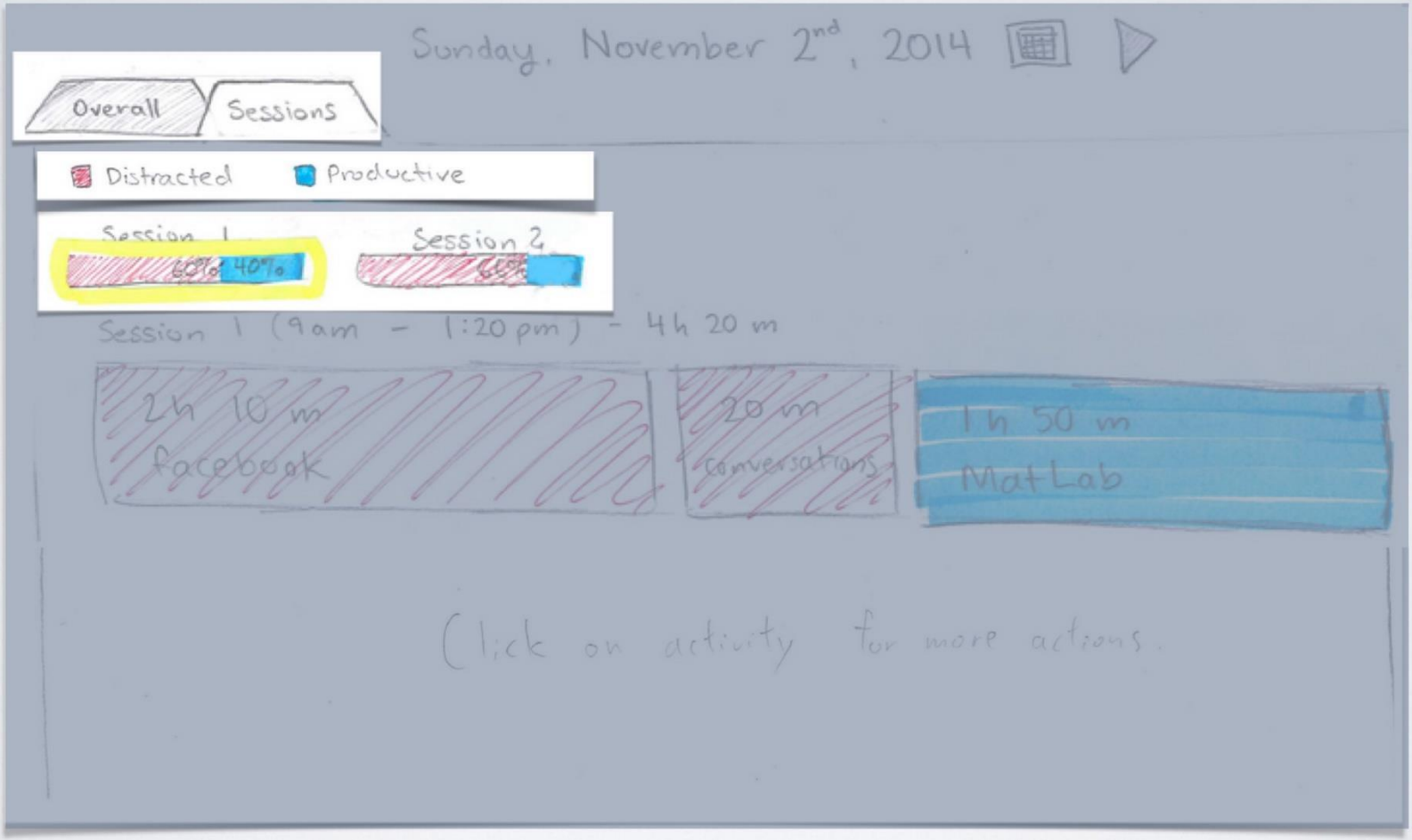

Highlighting

IMPROVED DESIGN

Highlighting

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Transition as Animation

Initial Paper Prototype

Task 1: Is Netflix worth it?

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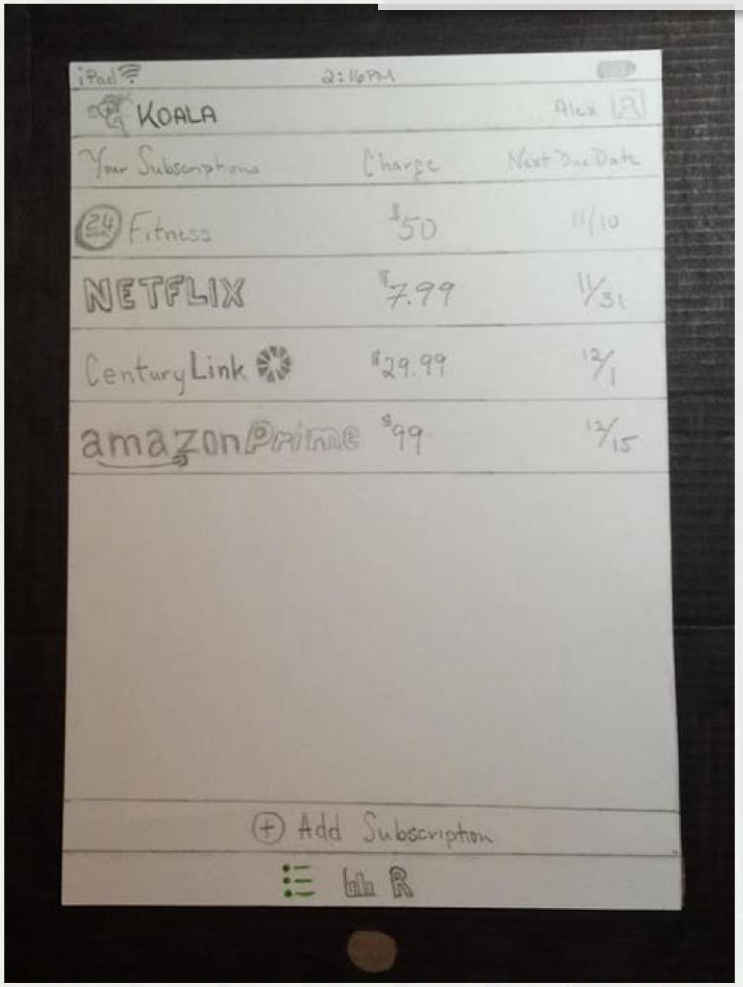
2. Navigate to Netflix Detailed View
3. View your Usage Score for Netflix
4. Go to Settings
5. Click “Unsubscribe”
6. Return to homepage



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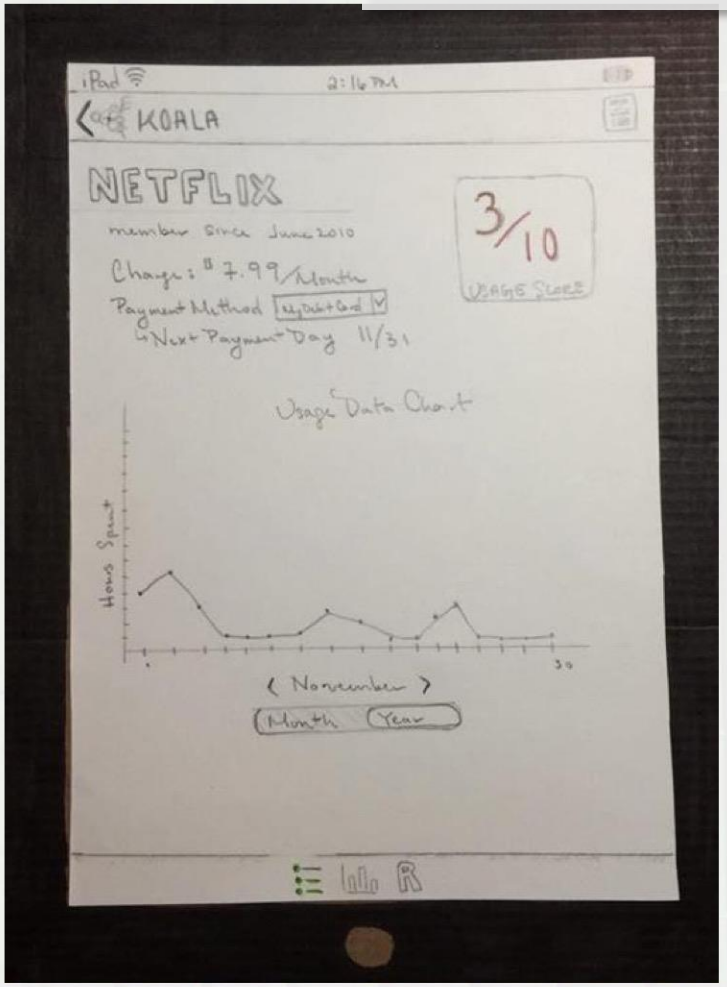

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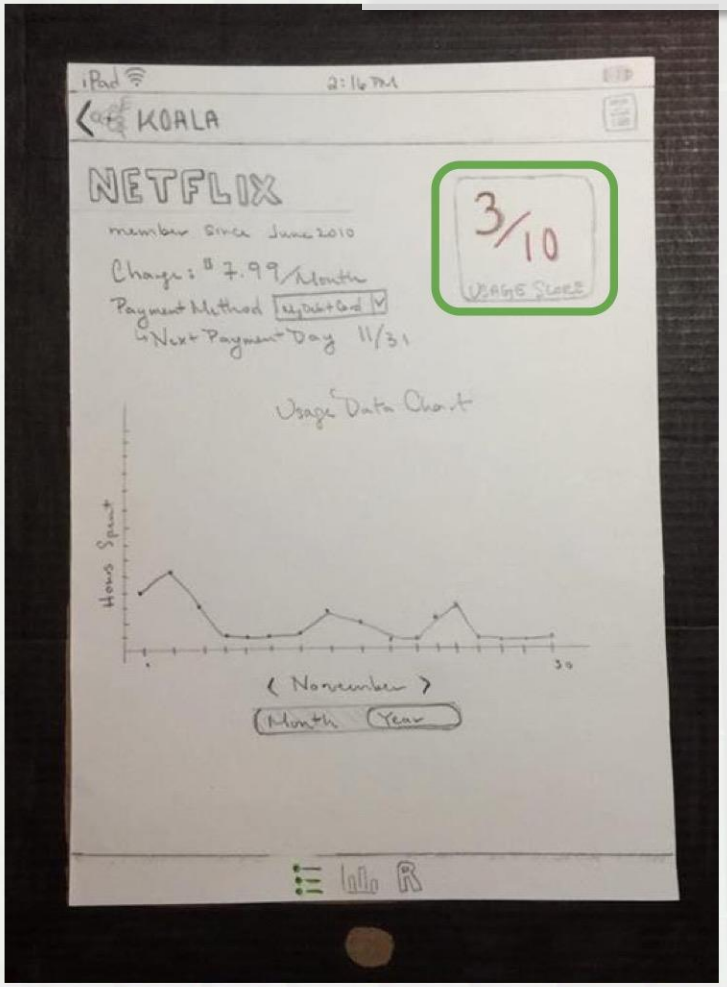

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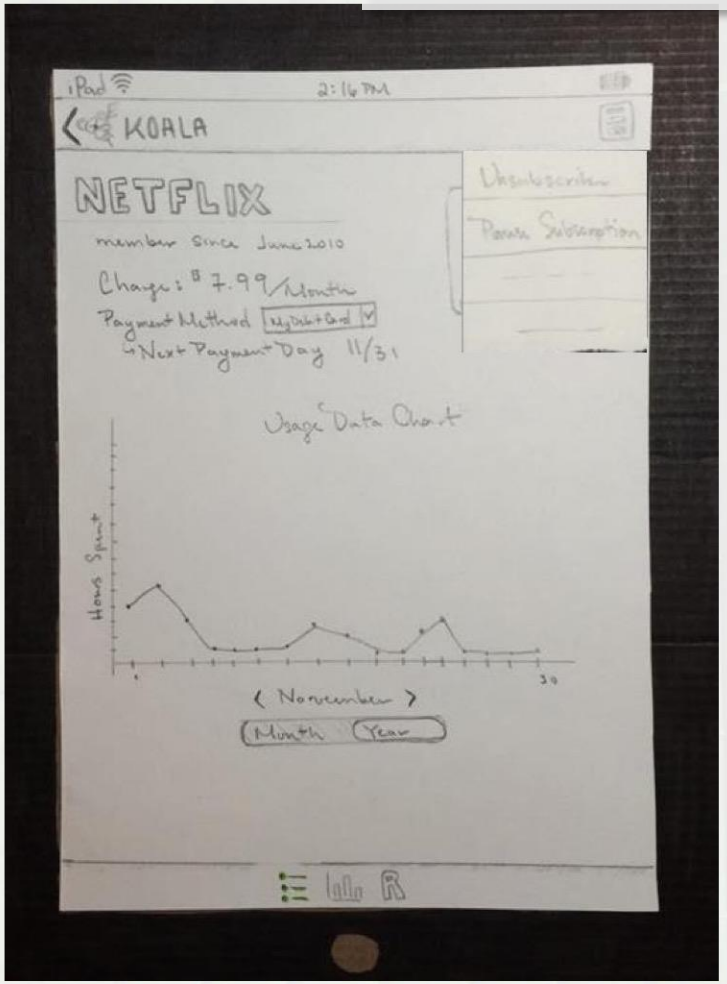

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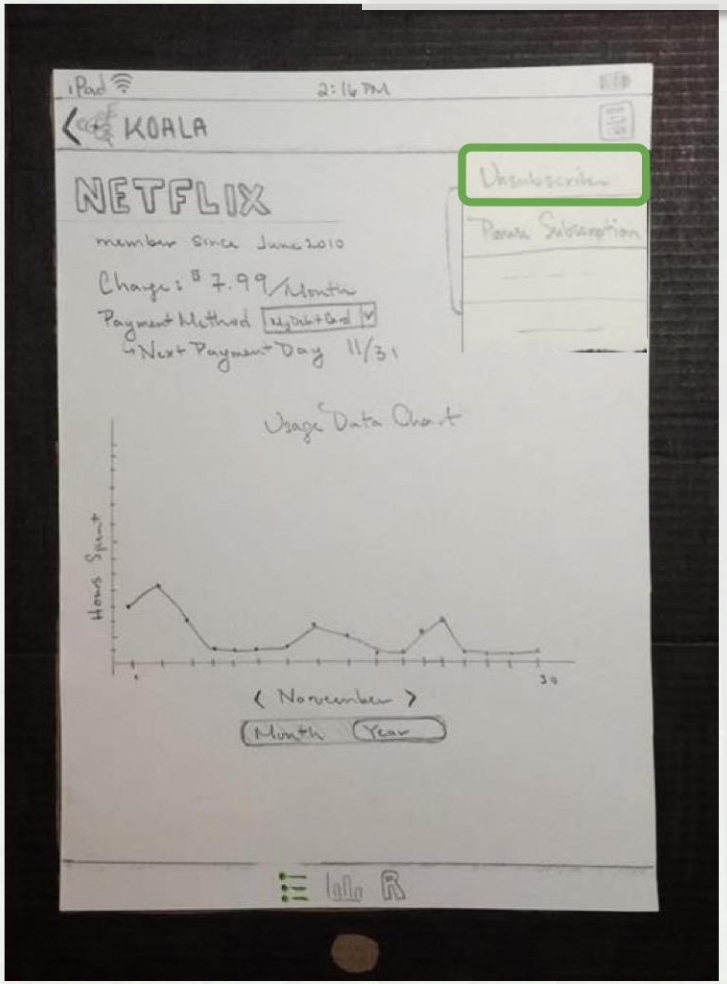

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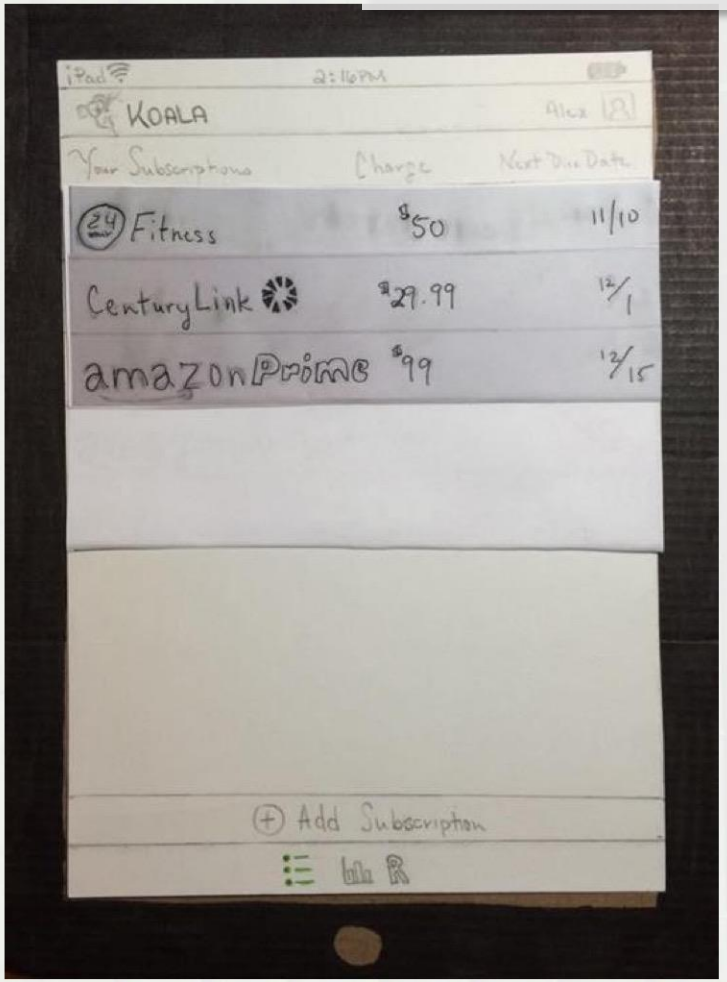


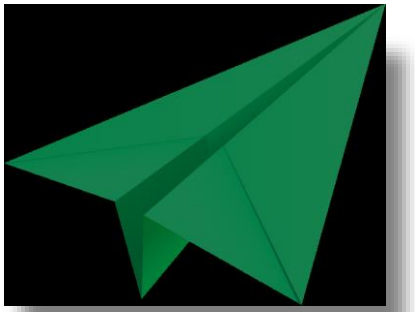
VIEW**PROGRESS**

Interface Animation

PROBLEM

Gratuitous Animation

~~LUNCH -$5.49~~
COFFEE **-$3.49**
MOVIES **-$11.20**
~~COFFEE -$3.89~~
~~ICE CREAM -$4.42~~
DINNER **-$7.79**
~~COFFEE -$4.89~~
BOWLING **-$10.20**
~~KIT KAT -$0.99~~
~~BRUNCH -$11.42~~
BEER **-$4.00**



Today

Informal Prototyping Fun

Experimental Design and Statistics Background

Usability Evaluation Considered Harmful

Presentation Feedback

Exam Q&A

Video Critiques

CSE 440: Introduction to HCI

User Interface Design, Prototyping, and Evaluation

Lecture 15:
Interface Implementation

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234