CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 01:
Introduction and
Personal Informatics

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
What Is This Course?

Time for a Door Quiz:

Say out loud what action you use to open the door

Push
Pull
Door Quiz
Door Quiz
Door Quiz
Door Quiz
Door Quiz
Door Quiz
Door Quiz
Door Quiz
Door Quiz
What is so Special about Computers?

Nothing! It is about good designs and bad designs

We all make push/pull decisions many times per day

We all encounter doors that do this badly

We all see signs that do not change what we do
What is so Special about Computers?

Yet we blame ourselves

Absolutely everything we encounter in the made world was designed

   Too often poorly designed

Read this book

   Be warned you cannot unread it, you become angry
Iterative Human-Centered Design

This is a course about process

This is not a course about ‘good’ interfaces or rules that you should follow in design

Rapid iteration and exploration is the most important and effective tool for effective design

“Enlightened trial and error succeeds over the planning of the lone genius” – Peter Skillman, IDEO
Project Overview

The core of this course is a group project

Propose and do an intense end-to-end design

Getting the Right Design
Getting the Design Right
Communicating the Design

Not an implementation course
Contextual Inquiry & Task Analysis

Observe practices and understand needs

Consumester

FoodWatch
Sketching & Storyboarding

Post

Trips

Past

Find

My Trips

Community

Friend's Trips

Nearby trips

RideAlong
Sketching & Storyboarding

RouteMyRun
Low-Fidelity Prototyping & Testing

RideAlong
Digital Mockup

Fitter

.calm
Video Prototypes

GetOut

PickUp
Learn by Example from Prior Projects

Aqueous:
Learn by Example from Prior Projects

IEP Connect:

https://courses.cs.washington.edu/courses/cse440/14au/projects/iepconnect/
Learn by Example from Prior Projects

Ka-Ching:

Learn by Example from Prior Projects

Soundscape:
Studio Time in Section and Lecture

This course is designed around rapid feedback

Section is primarily studio time with the staff

Groups will be formed within section
Your team will always bring a product to studio
Participation is a critical component of the course

Many in-class exercises scheduled for Tuesdays
Participation is a critical component of the course
Overview

HCI and the Project Sequence
Course Staff Introductions
Administrivia
Assignment 1: Project Proposal
  Assignment 1a: Due Tonight
  Assignment 1b: Due Tuesday
Some Reflection
Self-Tracking and Relevant Background
Who We Are

James Fogarty

BS, Virginia Tech, 2000
PhD, Carnegie Mellon, 2006
Joined UW CSE, 2006

Brief Industrial Stints

IBM, 2000
IBM Research, 2003
Microsoft Research, 2007
Who We Are

Cross-Campus HCI Efforts

DUB
MHCID

Teaching

CSE 440: Introduction to HCI
CSE 441: Advanced HCI
CSE 510: Advanced Topics in HCI
CSEP 510: Human-Computer Interaction
CSE 332: Data Structures
Who We Are

Computing

You
Who We Are

Alex Fiannaca

BS, Biochemistry and Molecular Biology
University of Nevada, Reno, 2012
MS, Computer Science & Engineering
University of Nevada, Reno, 2014

Research:

HCI and accessibility, specifically accessible technologies for people with motor impairments, alternative input modality

Interests:

Web development, reading, exploring different cuisines, backpacking (favorites including Yosemite and Tahoe Rim)
Who We Are

Lauren Milne

BA, Physics
Carleton College, 2008

Research:

Accessibility, specifically making charts and graphs more accessible people who are blind

Interests:

Triathlons, skijors with her two dogs, reads mystery novels and science fiction
Who We Are

Saba Kawas

BS, Architectural Engineering
University of Jordan, 2005

MA+D, Computer Graphics and Animation
North Carolina State University, 2009

MS, Human Centered Design & Engineering
University of Washington, 2016

Interests:

Argentine Tango, experimental cooking, foreign films, walking with birds of prey (i.e., falconry)
Who We Are

Kelsey Munsell

BA, Mass Communication &
BA, Organizational Communication
Montana State Billings University, 2014
MS, Human Centered Design & Engineering
University of Washington, 2016
Contracting with Bungie, Inc. as User Research Assistant

Interests:

Yoga, gaming, enjoying musicals downtown, discussing communication theory
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Staying in Touch

Web: http://www.cs.washington.edu/440
You are responsible for calendar

Email Us: cse440-instr [at] cs.washington.edu

Email: You are responsible for course email

Office Hours: Posted on Calendar
Also By Appointment
GitHub Repository

The website, assignments, and other materials are being run from a GitHub repository

https://github.com/uwcse440/web-cse440-au15

You will contribute when posting your projects

You can and should contribute when you see the opportunity
Grading

We provide a grading scale, but it is subjective

Design is subjective, and so is this course
Wow us with your work, not with complaining

Entire project process is designed for feedback

Milestone grades mean you did the milestone

You still must act on feedback as part of continuing to refine and develop your project

A focus on “doing the work” and “getting feedback” means final grades are more “quality of result”
Grading

Group Project: 65%

Assignment 1: 3%
Assignment 2: Getting the Right Design: 21%
  Final Report 15%, Milestones 6%
Assignment 3: Getting the Design Right: 14%
  Final Report 10%, Milestones 4%
Assignment 4: Communicating the Design: 15%
  Website 5%, Video Prototype 5%, Poster 5%

Presentations: 12%
  Getting the Right Design 5%, Getting the Design Right 5%, Individual 2%

Exam: 25%
Readings: 5%
Participation: 5%
Submissions

Many assignments are due “night before class”

This means “before I wake up”, often 5:00am
Canvas will operationalize this as 4:00am

We need your submissions as part of our preparation for in-class feedback

“Day of class”, “just before class”, or “in class” are all unacceptable, risking zero credit
“Now” vs “When You Need It” Content

This course has both, we will try to distinguish

Several assigned readings will be posted
  Intentionally minimal but critical
  May be on exam
  Small reading report required

Additional resources will be made available
  If you find others you want to share, email us!
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Project Proposal Schedule

Project Brainstorm Due Tonight
  Brainstorming in Section Tomorrow

Project Proposal Due Monday Night
  Sponsored Projects Posted Tuesday

Project Bids Due Wednesday Night
  Groups Assigned Thursday
  Brainstorming in Section Friday
Assignment 1a: Project Brainstorm

You have an assignment due tonight:

http://courses.cs.washington.edu/courses/cse440/15au/assignments/assignment1/

Propose 3 project domains, problems, goals:
These are starting points for brainstorming

Submit online:
This proves that you did your preparation
Submit via email if unable to access Canvas

Bring to section tomorrow:
You have a lot more brainstorming ahead of you
Assignment 1b: Project Proposal

You have an assignment due Monday:

http://courses.cs.washington.edu/courses/cse440/15au/assignments/assignment1/

One page of text:

Problem and Motivation
Analyze the problem or idea (e.g., a scenario)

Submit online:
Sponsored Projects will be Posted for Bidding
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Self-Tracking and Relevant Background
Some Reflection

This will not be an easy course

Students have said this was their most intense course
You have two deadlines per week, every week
But I believe in everything that is included

This course challenges some aspects of what the CSE curriculum has taught you is important
It will be what you make it
People Really Get It

<table>
<thead>
<tr>
<th>Was this class intellectually stimulating? Did it stretch your thinking?</th>
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<tbody>
<tr>
<td>Yes  No  Why or why not?</td>
</tr>
<tr>
<td>I think the first six weeks of this class should be required training for all PMs at Microsoft. Our software would benefit so much from the material shared in this class.</td>
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<table>
<thead>
<tr>
<th>Was this class intellectually stimulating? Did it stretch your thinking?</th>
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<tr>
<td>Yes  No  Why or why not?</td>
</tr>
<tr>
<td>Yes, because it put me outside of my box working on my own by requiring user studies with unknown people</td>
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</table>
People Really Get It

“Very good class that every engineer should have to take. Good perspectives and made me think outside my comfort zone.”

“The focus on projects and fieldwork was very well suited to my learning style. I greatly enjoyed this format. The theory and techniques taught in class were directly applicable to the projects we were doing and were usually timed very well. That is, usually the topics presented in lecture were relevant to the current deliverable or the next deliverable.”
"I can't believe I'm saying this, but I found the lectures a huge part of what I learned in this course. They were useful and organized, and each one had a clear message and topic. The assignments were an excellent extension of these themes."

"Fieldwork and iterative assignments really taught me how important the design process is."
Group Work is Hard Work

“the project placed groups in a realistic situation and forced us to work together effectively and practice relevant concepts/strategies”

“The group work was distracting because of the lack of unity and sense of purpose. We all had different priorities and purposes for taking the class and this made it really hard to be on the same page for the project which was the biggest part of this class.”
Group Work is Hard Work

“Have groups do a team charter - outlining what they expect from one another as teammates. I took a project management course and when working in a group with individuals you've never worked with, the team charter may help break the ice easier when everyone can say what their expectations are.”

“... I think that working effectively as a team was the most challenging part of this class ...”
And it is not for Everybody

<table>
<thead>
<tr>
<th>What aspects of this class detracted from your learning?</th>
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<tr>
<td>Finding strangers in malls &amp; coffee shops was a major hurdle</td>
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<tr>
<th>What suggestions do you have for improving the class?</th>
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<tr>
<td>Don't exclude the two most available sources of people: friends &amp; university students</td>
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Adding and Dropping

Attempting to Add

Say something to me after class
Will email today, attempt to finalize decisions

Considering Dropping

Do so before we assign teams, and tell us

Section switch availability

We may need to move people to balance sections
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Some Reflection

Self-Tracking and Relevant Background
Thousands of Health Monitoring Apps
Activity and Medical Sensing Devices

Blood glucose meter

Thermometer

Blood pressure monitor

Heart rate monitor
Medical Implants

NeuroPace
Sustainability Tracking

Kill A Watt

Belkin WeMo Water

Automatic
Location and Activity

FitBit

FitBark

Moves
Finances

Mint

It's easy to understand what's going on with your money.

You Need a Budget
Time Tracking

RescueTime

This report looks at the past 60 days and shows differences between your most and least productive days.

Use this tool to begin to gauge how different habits could change your productivity. Did you learn anything new about yourself?

Categories
- Video
- General Social Networking
- General Entertainment
- Development
- General News & Info
- General Utility
- General Business

Activities
- Facebook.com
- procasten.com
- spotify
- youtube.com
- huffingtonpost.com
- Mail
- projects.google.org

Overviews
- Entertainmen
- Social Networking
- News & Opinion

45m
Average per day

19m
Average per day

13m
Average per day
Background in Personal Informatics

Some Definitions

What is the Point?

What is the Problem?

What is Personal Informatics

“We define personal informatics systems as those that help people collect personally relevant information for the purpose of self-reflection and gaining self-knowledge. There are two core aspects to every personal informatics system: collection and reflection.”

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
What is Quantified Self

“The Quantified Self is an international collaboration of users and makers of self-tracking tools.”

“Our aim is to help people get meaning out of their personal data.”

“Self knowledge through numbers.”

What is the Point?

Gnothi seauton

“Know thyself”
Leonardo da Vinci

Odometers on the left
Pedometer on the right

To track troop activities
Benjamin Franklin

Temperance
Silence
Order
Resolution
Frugality
Industry
Sincerity
Justice
Moderation
Cleanliness
Tranquility
Chastity
Humility
### Benjamin Franklin

![Benjamin Franklin's Portrait](image)

#### Temperance

**EAT NOT TO DULLNESS.**

**DRINK NOT TO ELEVATION.**

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万歩計

交通巡査
11260歩 = 6.7km (8時間)

ピラホールのウェートレス
12550歩 = 5.5km (8時間)

エアホステス
9000歩 = 4.1km (6時間半)
Five-Stage Model of Personal Informatics

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
Five-Stage Model of Personal Informatics

Alice

20 years old

Has a family history of heart disease

Wants to be more active

Does not know how, because she is busy

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
Preparation

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
Preparation

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
Collection

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
Integration

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
Reflection

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
Action

Walk in park instead of watching TV

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
Five-Stage Model of Personal Informatics

Li I., Dey A., Forlizzi J. CHI 2010. “A Stage-Based Model of Personal Informatics Systems”
What is the Problem?

Examining serious self-trackers, as they represent the early adopters

1. What I did
2. How I did it
3. What I learned

Analyzed 52 videos

### Analysis

#### Visualizations

<table>
<thead>
<tr>
<th>Themes</th>
<th>Profiles</th>
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</table>
What do they Track?

A Diabetic Experience with Self-Quantification
Analyzing My Cancer Data
Going Vegan in December
Improving Skin Health
Cognitive Performance
15 Weeks of Self-Tracking
Diabetes, Exercise, and QS
Experience Sampling of My Stress
Hacking Your Subconscious Mind

“Understanding Quantified Selfers’ Practices in Collecting and Exploring Personal Data”
# Motivations for Tracking

<table>
<thead>
<tr>
<th>Motivations</th>
<th>Sub-categories</th>
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<tr>
<td>To improve health</td>
<td>To cure or manage a condition</td>
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<tr>
<td></td>
<td>To achieve a goal</td>
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<tr>
<td></td>
<td>To find triggers</td>
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<td></td>
<td>To answer a specific question</td>
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<td>To identify relationships</td>
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<td></td>
<td>To execute a treatment plan</td>
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<tr>
<td></td>
<td>To make better health decisions</td>
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<td></td>
<td>To find balance</td>
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<tr>
<td>To improve other aspects of life</td>
<td>To maximize work performance</td>
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<td></td>
<td>To be mindful</td>
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<tr>
<td>To find new life experiences</td>
<td>To satisfy curiosity and have fun</td>
</tr>
<tr>
<td></td>
<td>To explore new things</td>
</tr>
<tr>
<td></td>
<td>To learn something interesting</td>
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### Data Collection and Exploration Tools

<table>
<thead>
<tr>
<th>Data Collection Tool</th>
<th>%  (#)</th>
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</thead>
<tbody>
<tr>
<td>Commercial hardware</td>
<td>56% (29)</td>
</tr>
<tr>
<td>Spreadsheet</td>
<td>40% (21)</td>
</tr>
<tr>
<td>Custom software</td>
<td>21% (11)</td>
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<tr>
<td>Pen and paper</td>
<td>21% (11)</td>
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<tr>
<td>Commercial software</td>
<td>19% (10)</td>
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<tr>
<td>Commercial website</td>
<td>10% (5)</td>
</tr>
<tr>
<td>Camera</td>
<td>6% (3)</td>
</tr>
<tr>
<td>Open-source platform</td>
<td>6% (3)</td>
</tr>
<tr>
<td>Custom hardware</td>
<td>4% (2)</td>
</tr>
<tr>
<td>Other</td>
<td>10% (5)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Exploration Tool</th>
<th>%  (#)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spreadsheet</td>
<td>44% (23)</td>
</tr>
<tr>
<td>Custom software</td>
<td>35% (18)</td>
</tr>
<tr>
<td>Commercial website</td>
<td>27% (14)</td>
</tr>
<tr>
<td>Commercial software</td>
<td>12% (6)</td>
</tr>
<tr>
<td>Open-source platform</td>
<td>8% (4)</td>
</tr>
<tr>
<td>Statistical software</td>
<td>4% (2)</td>
</tr>
<tr>
<td>Pen and paper</td>
<td>2% (1)</td>
</tr>
</tbody>
</table>

Building Custom Tools

Captures smile via wearable sensing
Provides real-time feedback

Captures snoring via mobile app
Provides data visualization

Custom Visualizations

Why are they Building Custom Tools?

Desirable features are not supported

- Collect and reflect on the data using a single tool
- Perform self-experimentation

Barriers to success

- Tracking too many things
- Not tracking triggers and context
- Lacking scientific rigor

Tracking Too Many Things

“I can honestly say that I’ve made the classic newbie self-tracking mistake which is that I track everything. I didn't know exactly what to track, so I tracked caffeine, dairy, wheat, sugar, nuts, fruit, vegetables, meat, chicken, fish, alcohol supplements...”

People burn out on self-tracking

Not Tracking Triggers and Context

“I was trying to track all these symptoms and I was completely ignoring the cause...”

People lack clues on what to track
Miss information on how to improve outcome

They track the wrong information

“Understanding Quantified Selfers’ Practices in Collecting and Exploring Personal Data”
Lacking Scientific Rigor

Conduct self-experimentations without control or without addressing confounding factors

And they conduct flawed experiments

Barriers and Negative Nudges

“It was too time consuming and tedious. I also did not know what to enter if I ate out, so I often did not enter data and that compounded. I also felt embarrassed to do it in front of friends so I stopped.”

Negative Nudges:
Contrasting difficulty of entry
Judgment and choosing not to journal
Stigma and journaling
Lack or decline in social support

A Model of Lived Informatics

Extends 5-stage model to surface additional design lifecycle and challenges

Returning to a tool (e.g., short/long lapse)

Changing tools (e.g., due to burden)

Changing goals (e.g., due to discovery)

Your Challenge

People invest tremendous effort for little value

Do better, help people achieve their goals, solve real problems

Go beyond the data fetish

Understand the problems people face
Find the role for interactive technology
Some Reflection

We have high expectations

  We want you to do cool stuff

But we are also enthusiastic and we listen

  Email us, point out opportunities, ask questions

If you are not onboard, please drop now

  Please email us so that we know a spot opened

  cse440-instr [at] cs.washington.edu
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User Interface Design, Prototyping, and Evaluation

Lecture 01: Introduction and Personal Informatics

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CSE 440: Introduction to HCI  
User Interface Design, Prototyping, and Evaluation

Lecture 02: Design of Everyday Things

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday  
12:00 to 1:20
Today

Section Balance and Movement

Calendar Overview

Proposals, Bidding, Teams, Email Availability
Reading Assigned for Friday
Quarter Overview

Assignment 0

Design of Everyday Things
Assignment 0: Flash Card

Name (formal & informal)
Majors/Minors
Year (1, 2, 3, 4, 5, 6, ...)
Hometown
Interesting Fact or “What I did on my ...”

Submit PDF via Canvas
What is Interaction?

Two-Way
  one-way is a reaction
Communicative
  information is sent
Receptive
  information is received
Effective
  the parties are changed as a result
What is Interaction?

Knocking over a chair
Clicking a Submit button on a web page
Two televisions, turned on, facing each other
A computer sending data to another via a network
Typing on a computer that is turned off
Picking up a telephone and putting it to your ear
Typing ESC on a screen that does not allow it
Models of Interaction

Models of interaction allow a closer look

- Define and describe an interaction
- Isolate areas where problems occur
- Design new interaction

Two examples at different scales

- Buxton’s 3-State Model
- Norman’s Execution-Evaluation Cycle
Models of Interaction

Models of interaction allow a closer look

- Define and describe an interaction
- Isolate areas where problems occur
- Design new interaction

Two examples at different scales

- Buxton’s 3-State Model
- Norman’s Execution-Evaluation Cycle

“All models are wrong, but some are useful”

George Box
Buxton’s 3-State Model

Mouse

Touchpad

Stylus

Touch Screen
Buxton’s 3-State Model

Mouse

Touchpad

Stylus

Touch Screen

Which can support tooltip previews?
Norman’s Execution-Evaluation Cycle

1. Establish the goal.
2. Form the intention.
3. Specify the action sequence.
4. Execute the action sequence.
5. Perceive the system state.
6. Interpret the system state.
7. Evaluate the system state with respect to the goals and intentions.

Revise Goals
Turning on the Light

1. Establish the goal
   Increase light in the room
2. Form the intention
   To turn on the lamp
3. Specify the action sequence
   Walk to the lamp, reach for the knob, twist the knob
4. Execute the action sequence
   [walk, reach, twist]
5. Perceive the system state
   [hear “click” sound, see light from lamp]
6. Interpret the system state
   The knob rotated. The lamp is emitting light. The lamp seems to work
7. Evaluate the system state with respect to the goals and intentions
   The lamp did indeed increase the light in the room [goal satisfied]
Norman’s Execution-Evaluation Cycle

- Goals
- Evaluate Goals
- Interpret State
- Observe State
- System Change
- Execute Actions
- Develop Action Plan
- Form Intention
- Goals
Norman’s Execution-Evaluation Cycle

- **Goals**
  - Evaluate Goals
  - Form Intention
  - Develop Action Plan
  - Execute Actions
  - Observe State
  - Interpret State
- **Gulf of Evaluation**
- **Gulf of Execution**
Bridging the Gulfs

Gulf of Execution: “How do I do it?”
Commands and mechanisms need to match the goals, thoughts, and expectations of a person

Gulf of Evaluation: “What does it mean?”
Output needs to present a view of the system that is readily perceived, interpreted, and evaluated

People build mental models to anticipate and interpret system response to their actions

What can I do?  How do I do it?
What result will it have?  What is it telling me?
Cooper’s Mental Model Terminology

 prévu

Implementation Model
How it works
(aka Design Model, Designer’s Conceptual Model)

Manifest Model
How it presents itself
(aka System Image)

Mental Model
How a person thinks it works
(aka User Model, User’s Conceptual Model)
Cooper’s Mental Model Terminology

- **Implementation Model**
  - How it works
  - (aka Design Model, Designer’s Conceptual Model)

- **Manifest Model**
  - How it presents itself
  - (aka System Image)

- **Mental Model**
  - How a person thinks it works
  - (aka User Model, User’s Conceptual Model)

These terms are sloppy and ambiguous out in the world.
Manifest and Mental Models

Designer projects their model into an artifact

Person forms their model based on interaction

People struggle until model matches manifest model

Update mental model in response to breakdowns

Not necessarily matching the implementation model
Mental Models

Problem: freezer too cold, fresh food just right
Manifest Model

What if I want to make just the freezer warmer?
A Sensible Mental Model

“The Freezer Control controls the freezer temperature and the Fresh Food Control controls the fresh food temperature”
The Implementation Model
A Problem with Feedback

NORMAL SETTINGS
C AND 5
COLDER FRESH FOOD C AND 6-7
COLDEST FRESH FOOD B AND 8-9
COLDER FREEZER D AND 7-8
WARMER FRESH FOOD C AND 4-1
OFF (FRESH FD & FRZ) 0

1. SET BOTH CONTROLS
2. ALLOW 24 HOURS TO STABILIZE

FREEZER
A B C D E
FRESH FOOD
7 8 5 4 3
The Implementation Model

Why do we have a problem?

Can you fix the problem?
The Implementation Model

Why do we have a problem?
Cost constraints

Can you fix the problem?
Make controls correspond to a person’s mental model
Make controls correspond to the implementation model
Building the Right Model

Having the right model helps people bridge the Gulf of Execution and the Gulf of Evaluation

How can we help people build the right models:

- Affordances
- Metaphors
- Visibility
- Knowledge in the World
- Constraints
- Mapping
- Consistency
- Modes
Affordances

Visual clue to interaction

- knobs afford turning
- levers afford moving
- buttons afford pushing
Affordances

“The affordances of the environment are what it offers animals, what it provides or furnishes, for good or ill.”

Gibson, part of an ecological approach to psychology

“The term ‘affordance’ refers to the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used.”

Norman
What’s the Affordance?
Affordances
Affordances

Technology affordances are often based in affordances from the physical world
Affordances

What is the affordance here?

Where does it come from?
Affordances

What is the affordance here?

Where does it come from?
Sequential Affordance

Acting on a perceptible affordance leads to information indicating new affordances

Figure 4. Sequential affordances: one affordance leads to another. Visual information indicates grasping (A & B); tactile information indicates turning (B & C).
Sequential Affordance

Acting on a perceptible affordance leads to information indicating new affordances

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**Figure 4.** Sequential affordances: one affordance leads to another. Visual information indicates grasping (A & B); tactile information indicates turning (B & C).
Nested Affordances

Affordances due to spatial relationships revealing what actions can be done

Proximate to, contained in, part of
In Other Words

An affordance is what a thing communicates about how it can be used, often by its appearance.

“In general, when the apparent affordances of an artifact matches its intended use, the artifact is easy to operate. When apparent affordances suggest different actions than those for which the object is designed, errors are common.”

Gaver
False Affordances

When there is perceptual information suggesting an implied use that does not exist

(Just an image of a button, not one that responds)
False Affordances
False Affordances
False Affordances
False Affordances
Hidden Affordances

When there is no perceptual information suggesting an actual intended use
Hidden Affordances
Hidden Affordances

Logos linking to home is a convention, but not afforded by the page.
Confusion of the Term

“Note also that affordances are not intrinsic, but depend on the background and culture of users. Most computer-literate user will click on an icon. This is not because they go around pushing pictures in art galleries, but because they have learned that this is an affordance of such objects in a computer domain...”

Dix

Disagree. Icons do not afford “pushability” or “clickability” by their attributes. They do not give an indication of their intended use, except by convention.
Clarification on Convention

“Designers sometimes will say that when they put an icon, cursor, or other target on the screen, they have added an ‘affordance’ to the system. This is a misuse of the concept. ... It is wrong to claim that the design of a graphical object on the screen ‘affords clicking.’ ... Yes, the object provides a target and it helps the user know where to click and maybe even what to expect in return, but those aren’t affordances, those are conventions, and feedback, and the like. ... Don’t confuse affordances with conventions.”

Norman
Metaphors

Suggest an existing mental model

“horseless carriages”, “iron horses”, “wireless”

Desktop metaphor

Not an attempt to simulate a real desktop
Leverages knowledge of files, folders, trash
Explains why some windows seem hidden
Metaphors

Suggest an existing mental model

“horseless carriages”, “iron horses”, “wireless”

Desktop metaphor

Not an attempt to simulate a real desktop

Leverages knowledge of files, folders, trash

Explains why some windows seem hidden
Mail Metaphor.
Calendar Metaphor
Health Metaphor

Inform VirusScan how to respond when a virus is detected.

When a virus is found:
- **Clean infected files automatically**
  - This option instructs VirusScan to clean files automatically.

If the above Action fails:
- **Move infected files to a folder**
  - This option instructs VirusScan to automatically move all infected files to the quarantine folder.
  - The location of the quarantine folder is configured on the "General" tab under "General Settings"
Shallow or Inappropriate Metaphors

Informs a small range of possibilities, or none at all

It is just a menu and a dialog box?

What does the living room add?
Mixed Metaphors

Two or more different metaphors coexist with some supposed relation

The desktop metaphor
Windows into content

Good? Bad?
Neither? Both?

Windows are views into larger content regions
No desktop has windows
Broken Metaphors

Are not consistent, do not operate in every circumstance, or do not uphold things consistent with what the metaphor would suggest.
Mechanical-Age Metaphors

Operate as their mechanical-age counterparts did, not taking advantage of the digital domain to escape the limitations of the original
Dead Metaphors

Lost the original imagery of their meaning

- Milk
- Butter
- Cheese
- Water
- Beer
- Wine
Metaphors versus Idioms

Idioms

- rely on shared experience or custom
- are learned, often early in life
- are supported or revealed by context
- become conventions
- do not rely on metaphors

Idiomatic widgets (e.g., screen splitter, draggable title bar)

Single click to select, double click to open

Hyperlinks
Idioms

Star Trek IV: Scotty Uses a Mouse
Metaphors and Affordances

Affordances “jump start” a model for interaction
Metaphors “jump start” a model of a system

But if designed poorly, both can be damaging

- Lead to an incorrect model, undermining interaction
- Can limit designer creativity
- Can reduce the advantages of software
- Can be “cute” at the expense of functional
Visibility

Phones

How do you put somebody on hold change volume
Visibility

Location of Controls

Display

During a conversation, the call duration is displayed.
(Example: 15 minutes, 30 seconds)
- The unit is in the programming mode (p. 9, 16, 20).
- The AUTO button was pressed while dialing or storing phone numbers for the Speed Dialer (p. 16, 19).
- The LOWER button was pressed (p. 21, 23).
- The ringer is set to OFF (p. 10).
- The MUTE button was pressed during a conversation (p. 24).
- The dial lock mode is set. To cancel the mode, see page 27.
- The FLASH button was pressed while storing phone numbers.
- The PAUSE button was pressed while dialing or storing phone numbers.
- You pressed [1] while dialing or storing phone numbers in the TONE mode.
- You pressed [2] while dialing or storing phone numbers in the TONE mode.
- While storing a phone number in an UPPER memory location for the One-Touch Dialer, "O" will appear when you press a one-touch auto dial button (p. 20).
- While storing a phone number in a LOWER memory location for the One-Touch Dialer, "O" will appear when you press a one-touch auto dial button (p. 21).
- The MUTE button was pressed as a secret button while storing phone numbers (p. 18, 22).
- While programming function items, such as the dialing mode, "O" will flash as a cursor.
Visibility

Changing Ringer Volume

Press “Program”
Press “6”

Set Volume

Low - Press “1”
Medium - Press “2”
High - Press “3”

Press “Program”
Visibility

Controls available on watch with 3 buttons?

Too many and they are not visible

Compare to controls on simple car radio

Number of controls ≈ Number of functions

Controls are labeled and grouped together
Knowledge in the World
Constraints

Prevent some actions while allowing others

Prevent errors before they can happen

Disruptive error messages are a last resort
Constraints
Constraints
Constraints
Mapping

Correspondence between an interface and the corresponding action in ‘the world’

Minimize cognitive steps to transform action into effect, or perception into comprehension (i.e., execution and evaluation)
Very Bad Mapping
Slightly Better Mapping
Good Mapping
Not this Stove
Great Mapping
Mapping
Mapping
Mapping
Mapping
Consistency

Interfaces should be consistent in meaningful ways
Ubiquitous use of same keys for cut/copy/paste

Types of consistency

Internal (i.e., within itself)
e.g., same terminology and layout throughout

External (i.e., with other applications)
e.g., common widget appearance
e.g., design patterns common across applications
Is Consistent Always Better?

Should “new” & “delete” be in the same place?
Is Consistent Always Better?

Should “new” & “delete” be in the same place?

New is common, delete is not
Is Consistent Always Better?
Is Consistency Always Better?
Is Consistency Always Better?
Is Consistency Always Better?
Modes

Modes force people to divide their model
Active versus Passive Modes

Active modes require constant action to maintain.
Once that action has retired, so does the mode.
e.g., Shift

Passive modes require action to set, and a separate action to unset, or to set again.
e.g., CAPS LOCK

Active modes are generally preferred.
Standardization

If all else fails, standardize

- Fewer things to memorize
- Reduced learning time
- Adapt to new situations faster

e.g., keyboard layout not optimal, but standard
Norman’s Seven Principles for Design

Use knowledge in the head and in the world
Simplify the structure of tasks
Making things visible
Get the mappings right
Exploit the power of constraints
Design for error
When all else fails, standardize
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 02: Design of Everyday Things

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Lecture 03: Contextual Inquiry

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Amazing Color Changing Card Trick

The colour changing card trick
Why did I show you that?
Why did I show you that?

If we are focusing on the wrong thing, we can completely miss other important things.

Our assumptions and pre-conceptions play a huge role in how we focus our attention.

Today is about this danger when understanding the context for which you design technology.
“You Are Not the Customer”

Seems obvious, but...

- You have different experiences
- You have different terminology
- You have different ways of looking at the world

Easy to think of self as typical

Easy to make mistaken assumptions
Today

Project Progression

Ethnography
Contextual Inquiry
Distilling Models
Alternative Approaches to Understanding
Project Progression

Group Formation Today
- Please watch your email this afternoon
- Seating in section and in Tuesday lecture

Project Milestones
- Brainstorm in tomorrow’s section
- Contextual inquiry plan (1 page, what is your plan)
- Contextual inquiry check-in (1 page, in progress)
- Contextual inquiry review (4 pages of results and task analysis)

Reading Due Before Section
IEP Collect

Teacher Contextual Inquiry

Participants:

- Two Special Education Teachers
- One General Education Teacher

Successful IEP:

- "My experience of really strong IEP’s occurs when parents feel empowered to be part of the process."

Tracking Progress:

- "I do everything from writing on sticky notes to writing on masking tape stuck to my leg to using a tablet to record daily observations."

- "A good IEP requires a lot of goals, and if you multiply that by many students it is hard to track all the students in detail."
IEP Collect

Parent Contextual Inquiry

Participants:
- Two parents whose children formerly had IEPs
- One parent with two children that currently have IEPs
- One guardian of a student with an IEP

The Process:
- “The lingo and paperwork are confusing, they come with 17 people and you are there by yourself.”

Communication:
- “right now I come in doing all the communications to get information”

Tracking
Today

Project Progression

Ethnography
Contextual Inquiry
Distilling Models
Alternative Approaches to Understanding
Ethnography

Traditional science attempts to understand a group or individual objectively

Understand the subject of study from the outside in a way that can be explained to “anyone”

Ethnography attempts to understand a group or individual phenomenologically

Understand the subject of study as the subject of study understands itself
Ethnography

Emerged in 1920s as a new anthropology method, exploring why groups think and act as they do.

Learn local language, record myths, customs, and ceremonies in much greater detail than prior work.

You will likely never perform an ethnography.
Four Ethnographic Principles

Natural settings
Holism
Descriptive
Member point-of-view
Four Ethnographic Principles

Natural Settings

Conducted in the setting of the participant

Focus on naturally occurring, everyday action

Cannot use laboratory, experimental settings, or a phone call to gather this type of data

You really do have to go out there and see it
Four Ethnographic Principles

Holism

Behavior can only be understood in its larger social context; that is, holistically.
Four Ethnographic Principles

Descriptive

Study how people actually behave, not how they ought to behave.

Defer judgment.
Four Ethnographic Principles

Member Point-of-View

See through participant eyes in order to grasp how they interpret and act in their world.
Four Ethnographic Principles

Member Point-of-View

See through participant eyes in order to grasp how they interpret and act in their world.
Design Ethnography

Quicker than traditional ethnography
Days, weeks, or months, not years

Sometimes “concurrent ethnography”
The ethnography is being done at the same time that design is under way

Goal is to generate insights informing design
Sometimes via “ethnographically inspired methods”

Translating from raw field observation to design ideas can be a difficult process
Today

Project Progression

Ethnography
Contextual Inquiry
Distilling Models
Alternative Approaches to Understanding
Contextual Inquiry

Applied design ethnography

“The core premise of Contextual Inquiry is very simple: go where the customer works, observe the customer as he or she works, and talk to the customer about the work. Do that, and you can’t help but gain a better understanding of your customer.”

Hugh Beyer and Karen Holtzblatt
What is your relationship?

In a scientist/subject relationship:

The scientist does stuff
The subject responds in some way
The scientist collects data, goes back to their office, and analyzes the data to gain understanding

This is not very appropriate for gaining phenomenological understanding
User, Subject, or Participant?

Only two groups refer to their customers as users.

In traditional science, “subjects” are “subjected to” experiments as a researcher develops understanding.

In ethnographically-oriented design methods, “participants” instead “participate” in helping the researcher develop understanding.

This isn’t simple PC, it’s a mindset that matters.
What is your relationship?

In an interviewer/interviewee relationship:

- The interviewer asks a question
- The interviewee responds immediately
- At a pause, the interviewer asks another question from a list
- When all the questions are answered, the interview is over

This would only be appropriate for gaining phenomenological understanding if you knew what questions to ask in advance

Implying you have phenomenological understanding
What is your relationship?

In a master/apprentice relationship:

- The master is doing stuff
- The master explains what they are doing
- The apprentice asks clarification questions
- The master answers

This relationship is at the heart of contextual inquiry.
Master/Apprentice Relationship

Seeing the work reveals structure

Many instances and many interviews reveal the picture

Every current activity recalls past instances

A customer describing how she learned a feature told us, “I looked it up in the documentation.” But when we asked her to look it up again, she was able to show us: “I looked the function up in the index and scanned the section. I saw this icon in the margin that I recognized from the screen, so I read just this paragraph next to it. It told me all I needed to know.” The documentation provided the context she needed to recover a detailed story, and the detail revealed aspects that had been overlooked—that the icon was her visual cue to the relevant part of the page.
Unique or One of Many?

“Take the attitude that nothing any person does is done for no reason; if you think it’s for no reason, you don’t yet understand the point of view from which it makes sense. Take the attitude that nothing any person does is unique to them, it always represents an important class of customers whose needs will not be met if you don’t figure out what’s going on.”

(p. 63, Contextual Design)
Not Quite Master/Apprentice

The goal is not to learn to do the task

Instead, the goal is to learn how the participant does the task in order to learn how to support it

And for the researcher to enlist the participant’s active assistance in understanding the task
Not Quite Master/Apprentice

In a contextual inquiry relationship:

- The participant is doing stuff
- The participant explains what they are doing
- The researcher offers an interpretation
- The participant agrees or corrects

Partners

- Not really an interview
- Not really an apprentice
Principles of Contextual Inquiry

Context
Must be done in the setting of the participant.

Partnership
Master/apprentice model; investigator is humble.

Interpretation
Observed facts must be regarded for their design implications. Raw facts without interpretation are not very useful.

Focus
Themes that emerge during the inquiry. You cannot pay attention to all facets of someone’s work at all times.
Context

Go to the workplace & see the work as it unfolds

People summarize, but we want details

Keep it concrete when people start to abstract

“Do you have one? May I see it?”
Context

Imagine studying how a student writes a paper
Why not just ask?
Context

Imagine studying how a student writes a paper
Why not just ask?

May not remember details
- Getting roommate to read drafts

May skip critical difficulties
- Trouble locating references on the Web
Context

Avoid summary data by watching work unfold

We once asked a secretary how she started her day. Her answer was, “I guess I just come in and check my messages and get started.” She wasn’t able to go beyond this brief summary overview. It was the first thing in the morning and she had just arrived at the office, so we asked her to go ahead and do as she would any other morning. She unhesitatingly started her morning routine, telling us about it as she went:

“First I hang up my coat, then I start my computer. Actually, even before that I’ll see if my boss has left something on my chair. If he has, that’s first priority. While the computer’s coming up, I check the answering machine for urgent messages. There aren’t any. Then I look to see if there’s a fax that has to be handled right away. Nope, none today. If there were, I’d take it right in and put it on the desk of whoever was responsible. Then I go in the back room and start coffee. Now I’ll check the counters on the copier and postage meter. I’m only doing that because today’s the first of the month. . . .”
“One customer said he would not use a manual’s index to find the solution to a problem: ‘It’s never in the index.’ He could not say what led him to this conclusion, what he had looked up and failed to find. All his bad experiences were rolled up into one simple abstraction: it’s not there. But when we watched him looking things up, we could see that he was using terms from his work domain, but the index listed parts of the system.”
Context

“A customer was unable to describe how she made her monthly report. When asked to create it, she pulled out her last report and started filling in the parts.”
Context

Ground in an instance

Span time by replaying past events in detail

Look for holes

Ask questions to fill them

Use artifacts for context

If story has not yet ended, go back to a story that did

Customer: When I got this problem report I gave it to Word Processing to enter online—

(Why did she decide to give it to Word Processing? Did she do anything first?)

Interviewer: So you just banded it on automatically as soon as you got it?

C: No, it was high priority, so I read it and decided to send a copy to the Claims department.

(How did she decide it was high priority? Is it her decision?)

I: How did you know it was high priority?

C: It has this green sticker on it.

(Someone else made the decision before the report ever got here. Who and when?)

I: Who put on the green sticker?

C: That's put on by the reporting agency. They make the decision about whether it's high priority and mark the report.

(We can better pursue how the reporting agency makes the decision with them; we'll only get secondhand information from this user. Instead of trying to go further backward, look for the next missing step forward: doesn't Claims get a more personal communication than just the report?)

I: Did you just send it on to Claims, or did you write them a note about why they needed to see it?

C: Oh, I always call Claims whenever I send them one of these reports.
Partnership

Traditionally, interviewer has too much power
   You don’t know what will turn out to be important
Apprenticeship model tilts power back too far
   You aren’t there to learn the skill
Interviewer should create a partnership
   Alternate between watching and probing
Partnership

Withdrawal and return

Researcher observes action that indicates something meaningful

The researcher asks about this, and the pair withdraw from the task

Discuss the question

Then return to the task

In one interview with a user of page layout software, the user was positioning text on the page, entering the text and moving it around. Then he created a box around a line of text, moved it down until the top of the box butted the bottom of the line of text, and moved another line of text up until it butted the bottom of the box. Then he deleted the box.

Interviewer: Could I see that again?
Customer: What?
I: What you just did with the box.
C: Oh, I’m just using it to position this text here. The box doesn’t matter.
I: But why are you using a box?
C: See, I want the white space to be exactly the same height as a line of text. So I draw the box to get the height. (He repeats the actions to illustrate, going more slowly.) Then I drag it down, and it shows where the next line of text should go.
I: Why do you want to get the spacing exact?
C: It’s to make the appearance of the page more even. You want all the lines to have some regular relationship to the other things on the page.
Partnership

Do not squash design ideas if they arise
This is design, not dispassionate science

Get instant feedback

If it works, you understand the work practice and have a solution

If it fails, you can improve your understanding of the work

Find the issues behind design ideas
Partnership

Avoiding Other Relationship Models

Interviewer / Interviewee
   You are not there to get a list of questions answered

Expert / Novice
   You are not there to answer questions

Guest / Host
   Move closer, ask questions, be nosy
Interpretation

Chain of Reasoning

- Fact, Hypothesis, Implication for Design, Design Idea

Design is built upon interpretation of facts

- Design ideas are end products of a chain of reasoning
- So interpretation had better be right

Share interpretations with users to validate

- Will not bias the data
- Teaches participant to see structure in the work
Interpretation

Instead of asking open ended questions...

“Do you have a strategy to start the day?”
“Not particularly.”

... give participants a starting point

“Do you check urgent messages first, no matter where they are from?
“Actually, things from my boss are important, because they are for me to do. Messages or faxes may be for anybody.”

Participants fine-tune interpretations

Probe contradictions until assumptions fit
Interpretation

Non-verbal cues can confirm or negate

Yes and Nos

“Huh?” – way off
“Umm, could be” – usually means no, just being polite
“Yes, but...” or “Yes, and” – depends on what follows

Commit to hearing what people actually say

Most have not ever had people actually pay careful attention to what they are doing
Focus

Everybody has a focus, you cannot prevent it

- Entering focus
- Project focus

Because you will have a focus, be mindful of that focus and use it to your advantage

Brainstorm and define your focus
Focus

Focus defines the point of view

Clear focus steers the conversation

Everyone in the team should have an entering focus

Focus lets the interviewer sees more

Focus reveals detail

Focus conceals the unexpected

Focus on one, and lose the other

Start with a focus and then expand
Focus

Opportunities to expand focus:

Surprises, contradictions, idiosyncrasies

Nothing any person does is for no reason

Nods

Question assumptions even if they match
“Do they really do that? Why would they do that?”

What you don’t know

Treat the interview as an opportunity to learn new stuff
Even if the participant is not knowledgeable, the extent of their knowledge / misinformation will be useful
The Stages of a Contextual Inquiry

1. Interview / Warm Up
2. Transition
3. Observe Behavior
4. Share Interpretation
5. Refine Interpretation
6. Wrap-up
Explain the Rules

Be sure you explain “the rules” of how you’ll be interacting during the contextual inquiry.

If this isn’t completely clear, the encounter may devolve into a traditional interview (since this relationship is more familiar to people).
How to Screw it Up

Slipping into abstraction
  Keep it concrete, in the work, in the details
Not being inquisitive or nosy enough
  If you have the impulse to ask, do it right away
Being too pushy with interpretation
  If you ignore corrections, participant will shut down
With the wrong person
  They need to be willing to partner with you
How to Screw it Up

Not being inquisitive or nosy enough

If you have the impulse to ask, do it right away

Turning it into a regular interview

If you could have done it in a coffee shop, then you didn’t do a contextual inquiry

Multiple people present

Can be good if they talk, surface their thoughts
Bad if they do not talk, are not forthright
How to Screw it Up

Overly disrupting the task

If you change the task, your data is less useful
Remember withdrawal and return, maybe schedule
Retrospective methods might be necessary
(e.g., going through artifacts, prior critical incident)

Being stuck in your focus

Important to have a focus, expectations of what you expect to be important in your inquiry
But can learn by attending to misconceptions
When All Else Fails

Remember Master/Apprentice

Remember Context

Remember Withdraw & Return
Today

Project Progression

Ethnography

Contextual Inquiry

Distilling Models

Alternative Approaches to Understanding
Developing Models

Contextual inquiry yields a lot of data

- Does not reduce to a statistical test

Use it to distill models

- Highlights gaps in understanding
- Identify breakdowns and workarounds

Many types of models

- e.g., Flow, Sequence, Artifact, Cultural, Physical

No model is perfect, these highlight different things
Flow Model: Secretarial Hub

President
- Run the business
- Keep abreast of what’s going on
- Sign checks
- Go on trips

Department's reports
Checks to sign

U1 (Secretary)
- Keep office organized
- Ensure bills paid on time
- Do final proof, print, and distribution of documents
- Manage and coordinate schedules
- Handle logistics of trips

Worker
- Do the work of the business
- Meet with management

Vendor
- Invoice for services

Sales manager
- Run the sales department
- Travel to sales offices

Marketing manager
- Run the marketing department
- Produce proposal

Proposal to proof and mail
Discussion of travel plans
Announcement

Bulletin board
- Announce events of general interest
- Hold documents that manage shared projects

Request for clarification

Requires lots of iterations

Signed checks
Request to help with family vacation plans
Request to schedule meeting with president
Invoices
Checks
Request to book trip
Sequence Model: Doing Email

- **Intent:** Handle emergencies
  - Trigger: Return to the office
  - Scan message list for important message—Use sender, subject
  - Choose urgent message
  - Read message about unhappy user
  - Decide more into needed
  - Make phone call
  - **(crossed out)** Had to put off issue of unhappy user
  - Leave phone message
  - File in phone folder
  - See list of messages

- **Intent:** Get back to people easily
  - Choose message 9: subject indicates university news relevant to department
  - Read message
  - Delete message
  - See message 10 automatically
  - Read message 10
Sequence Model: Equipment Audit

Assigned to do equipment audit

- Retrieve required form from database
  - Print form
    - Collect data at site
      - Record data on paper form
        - Type data into form on computer
  - Print completed form
    - Leave hardcopy of form with customer
      - Send electronic form to supervisor
        - Store electronic form on form database
Cultural Model: Developer

Marketing
- Our new features are top priority
- If I say do X, you figure out what that means

Competitors
- We have 50 new features; catch up

U9 (Developer)

Base technology group
- You aren’t our primary user; we’ll fix bugs for you in our own time
- Our technology is standard; use it even if it doesn’t work

Customer support
- Our bug reports are top priority
Artifact Model: Calendar

- Past (seldom accessed)
- Future (quick access)

- Scheduled events
- Unscheduled but associated with the day
- Reminders (storage with quick access)

- Business cards (storage for later)
- Meetings
- Appointments
- Strike out a day
- Notes
- Never used

- Rubber band
Physical Model: Work Site

Work Site

- Maybe outside
- Large area (up to square mile)
- Tight spaces
- Climbing
- Awkward positions

Company Trailer

Computer

Approximately a 5 minute walk. If doing an audit at a site under construction, then safe path frequently changes and may need to wait for construction equipment to pass.
Affinity Diagrams

Generated during group session

Each observation, idea, note to a post-it

Notes are hierarchically organized into themes, based on project focus
Today

Project Progression

Ethnography
Contextual Inquiry
Distilling Models
Alternative Approaches to Understanding
Interviews

Similar to contextual inquiry, without context

Set a focus, develop questions

Interpret responses

Repeat and rephrase
Ask for an example
Determine steps in a sequence
Probe terms and concepts
Ask when it did not happen as expected
Interviews

Similar to contextual inquiry, without context

Set a focus, record and take notes, have two people

Develop questions

Avoid leading

Interpret responses

Repeat and rephrase, probe terms and concepts

“can you give an example”, “tell me more”,

“what do you mean”, “why was that important”

Ask when it did not happen as expected
Participant Data Capture

Diaries

Experience Sampling
Value Sensitive Design

To be useful or usable is not the same as supporting important human values

Examples?
Value Sensitive Design

To be useful or usable is not the same as supporting important human values

Examples?

<table>
<thead>
<tr>
<th>Privacy</th>
<th>Freedom from Bias</th>
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<tbody>
<tr>
<td>Trust</td>
<td>Human Safety</td>
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<tr>
<td>Accountability</td>
<td>Universal Access</td>
</tr>
<tr>
<td>Ownership and Property</td>
<td>Sustainability</td>
</tr>
</tbody>
</table>
Value Suitabilities

Value Sensitive Design is an interactional theory

Values are not inherent in a given technology
But a technology is not value neutral

Some technologies are more suitable than others for supporting given values

Value Sensitive Design investigates stakeholders, values, and value suitabilities

Direct and indirect stakeholders
Tripartite Method

Conceptual Investigations
Analyses of the values involved in a system

Technical Investigations
Identify or develop technical mechanisms
Investigate suitability to support values

Empirical Investigations
Investigate who the stakeholders are, which values are important to them, and how they prioritize these values
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 03: Contextual Inquiry

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 04: Critique

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
ABC News and IDEO’s Deep Dive

ABC News and IDEO’s Deep Dive

Things to see in this video:

- brainstorming
- inquiry
- sketching
- critique

Today is mostly about critique, but critique is key in this overall process

Why build a shopping cart with no bottom?
ABC News and IDEO’s Deep Dive

ABC News and IDEO’s Deep Dive
Learning to Give and Receive Critique

You will learn how to both give and receive critique.

Each is important
Each is a skill developed through practice

Many activities will consist of group critiques

Each group will present an artifact
Other class members and staff will offer critique

Starting today with critique of the CI Plan
Why Critique?

Critique helps evaluate early, often, and cheaply

Applicable to artifacts of many types
Compare to other expert inspection methods

You are not your own worst critic

We collectively know more than any one of us
It is hard to see past your own decisions
Design requires getting past our own infatuation

A design can feel like our love, our baby...
Why Critique?

Critique is not just for design

It applies to many artifacts and domains
Why Critique?

Critique is not just for design

It applies to many artifacts and domains
visual art, writing, design, code (i.e. code review)

Over time, you should gather people who can give you high-quality critique in everything you do

You may meet some of those people in this class
Critique is About Improvement

<table>
<thead>
<tr>
<th>IDEAL</th>
<th>REALISTIC</th>
<th>SOLUTION</th>
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<tbody>
<tr>
<td>OBJECTIVES</td>
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FEEDBACK

http://alistapart.com/article/design-criticism-creative-process
What is Critique?

Critique is a method for feedback

It is not just a list of complaints

1. Presenters sit down with critics
2. Quickly explain their artifacts (e.g., less than 2 minutes)
3. Critics give feedback, ask questions
4. Presenters respond, take notes on what is discussed
Critique is Neither Criticism nor Design

Seriously, not just a list of complaints

Critics offer honest feedback

Both positive and negative

Presenters should be able to learn what works well and what is problematic about their artifact

It is then presenter’s responsibility to sort through feedback, decide what is important, and how to act

You must take notes for later review
Tips for Presenters

Critique can be hard, especially at first

Try to avoid being defensive

You are not your work, separate yourself

Remember the expertise you bring

Even if “the room” knows more about design, you know more about your problem / artifact and your rationale for the current design
Tips for Presenters

Taking advice is not giving up authorship

You still make the final decisions
A half-baked suggestion does not contain all the details of a finished solution

Design your critique

What you show invites different forms of feedback
Verbally indicate what kind of feedback you want, but also provide an artifact of appropriate form
This course will guide you in a variety of forms
Tips for Presenters

Keep an eye out for design rationale

You probably made some decisions without thinking through good reasons at the time
Critique can help give a rationalization for past decisions as you explain the artifact to others

Exploit failure

A “failed” artifact (e.g., plan, design) should teach you about the design space, what won’t work, and why
The goal is to improve, this requires failure
Tips for Critics

There are many strategies for giving critique

Hamburger method
I like, I wish, what if
Socratic method

These provide ways to give critique that can help the conversation go smoothly

Can give you a question to ask when you do not otherwise have one, provide a way to ask that is productive and less likely to create defensive reaction
Tips for Critics: Hamburger Method

“Bun, meat, bun”

Bun:
- Something fluffy and nice

Meat:
- Criticism on how to improve

Bun:
- Something fluffy and nice

Not a “shit sandwich”
Positives need to be genuine, enable learning from both positive and negative aspects of the artifact
Tips for Critics: I Like, I Wish, What If

I Like:

Lead with something nice

I Wish:

Some criticism, often leading from what you like

What If:

An idea to spark further conversation, better than: “I think you should have...” or “Why didn’t you ...”

Gives the presenter benefit of the doubt if they did already think of your idea, can present rationale
Tips for Critics: Socratic Method

Identify an aspect of the design and ask “Why?”

- Can be good if unsure what else to say
- Forces presenter to give, or develop, explanations for decisions, which can help build design rationale
- Not fundamentally negative and hard to get defensive
Tips for Critics

Limit your use of personal pronouns (e.g., “you”)

  Critique is about the artifact, not the designer

A designer deserves honest feedback

  Both positive and negative
  Including clarity and rationale

Help with actionable suggestions

  But it is not your design

  Perhaps several possible ways of thinking
Summary

Fall out of love with the things you build
  Let others help you see past the infatuation
Get feedback early, often, and cheaply
Focus on improvement
  In brainstorming, we were not criticizing
  In critique, we are not defending
You will learn to both give and receive critique
  If you are having difficulty, please come talk to us
Critiquing Project 2b: CI Plans

High-Level Thoughts and Reactions:

Defining the people

Getting out there, leveraging local expertise

Defining the problem, the opportunity

What motivates an activity, getting to the why

Not just what they are doing, also what they are not

Policies versus practices

Leading questions on values
Critiquing Project 2b: CI Plans

Split into subgroups, optional if 3 or fewer people
Find another group (e.g., look next to you)
15 minutes

1 to 2 minutes explaining the artifact
5 to 6 minutes critiquing
Reverse roles
Repeat with another group, if time allows

Remember to take notes, sharing with your group

Remember to submit via Canvas
Some potential foci and tradeoffs in critique:

What is the problem being addressed?
What is the method?

Contextual inquiry, interview, ...

Who are the participants?

Multiple types of stakeholders, a particular focus, ...

What is the focus / are the foci?

How will this inform design?
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 05: Task Analysis
James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Today’s Plan

Things To Talk About
Groups vs. Teams
Task Analysis
Plantr Task Analysis
Tasks in Design
Course Notes and Reminders

Room Switch

1:30 section now in MGH 254

Reading 2 for Tomorrow
Project Progression

Context Inquiries Should Be In Progress

At Least 1 inquiries due Tomorrow
At Least 3 inquiries due Tuesday, with analysis (first of your “larger” milestones)

Then we switch to tasks and design ideas

6 tasks due Friday 10/23
3x4 designs x tasks due Tuesday 10/27
1x2 design x tasks due Friday 10/30

Look at prior projects for where we are going
Aways and Team Responsibility

Many of us have legitimate times to be away

We pay attention to participation
  It is an element of your grade
  We will gather peer feedback

But your real commitment is to your team
  Be sure you communicate your aways
  Be sure you manage your commitments
  Let us know if there are issues
Structure of Section

Sections focus on critique

Bring your artifacts, be ready to present them

Bring paper, keep the laptops put away

Rotation of 2 staff and 3 teams in each section

For some random assignment of teams A, B, C:

Time: 0 15 30

Staff 1: Ac Ba Cb

Staff 2: Bc’ Ca’ Ab’
Themes in Questions and Feedback

You are not doing science
  You seek innovative insight, not knowledge or truth

Do the best design work you can
  May need additional inquiries
  May be using other methods
  May find that self-tracking is not the opportunity

We designed this project sequence, but be flexible

Capture and keep your raw work products
  Our collection is minimal, but you will want them
### Structure to Ease Observation / Diaries

<table>
<thead>
<tr>
<th>Time</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
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</table>

**Need**

| Mon | Tue | Wed | Thu | Fri | Sat | Sun | 12am-1am | 1am-2am | 2am-3am | 3am-4am | 4am-5am | 5am-6am | 6am-7am | 7am-8am | 8am-9am | 9am-10am | 10am-11am | 11am-12pm | 12pm-1pm | 1pm-2pm | 2pm-3pm | 3pm-4pm | 4pm-5pm | 5pm-6pm | 6pm-7pm | 7pm-8pm | 8pm-9pm | 9pm-10pm | 10pm-11pm | 11pm-12pm |
|-----|-----|-----|-----|-----|-----|-----|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| You needed: | Info. | Assist. | Other |

**What did you need?**

- To know if the stroller could be used on a hike.
- Don't say no to Trail.

**Why did you need it?**

- Wanted to take baby to park but it must be ice-free.

**Where were you?**

- At home.

**What were you doing?**

- Planning shopping.

**When did you need it?**

- 9-10am.

**What I needed was very important.**

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<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
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Today’s Plan
Things To Talk About
Groups vs. Teams
Task Analysis
Plantr Task Analysis
Tasks in Design
The Discipline of Teams

Teams produce both individual contributions and collective work-products.

Teams establish a social contract that relates to their purpose and guides and obligates how they must work together.

“We hold ourselves accountable” is a strict requirement, whether or not a “boss” does.
Groups vs. Teams

There is a place for groups:

Working groups are both prevalent and effective in large organizations where individual accountability is most important. The best working groups come together to share information, perspectives, and insights; to make decisions that help each person do his or her job better; and to reinforce individual performance standards. But the focus is always on individual goals and accountabilities.
Groups vs. Teams

Teams differ fundamentally from working groups... they require both individual and mutual accountability. Teams rely on more than group discussion, debate, and decision; on more than sharing information and best practice performance standards. Teams produce discrete work-products through the joint contributions of their members. This is what makes possible performance levels greater than the sum of all the individual bests of team members.

A team is more than the sum of its parts.
Groups vs. Teams

Groups
- strong leader
- individual accountability
- organizational purpose
- individual work products
- efficient meetings
- measures performance by influence on others
- delegates work

Teams
- shared leadership
- individual & mutual accountability
- specific team purpose
- collective work products
- open-ended meetings
- measures performance from work products
- does real work together

Examples we have seen?
Keys to Team Success

Common commitment
  requires a purpose in which team members believe

Specific performance goals
  comes directly from the common purpose
  helps maintain focus, starts with something achievable

A right mix of skills
  technical/functional expertise (e.g., writing/visual/coding)
  problem-solving & decision-making skills
  interpersonal skills

Agreement and mutual accountability
  who will do particular jobs, when to meet & work, schedules
Why this Reading?

School has taught you to succeed as an individual

Too many projects are done in groups

  Drawing boundaries between code responsibilities

This class requires you to work as teams

  Do not try to divide it up and stitch it together
  Use complementary skills, be mutually accountable
  Have faith in your teammates and their execution

The “real world” requires this too
Why this Reading?

As you read, think about prior groups and teams

In this class, you are a “team that does things”

Pay attention to “teams that recommend things”

HCI is often a minority interest
Need to work to ensure the impact of your work
Involve stakeholders early, not just at the end
Organize as a team:

- Get to know each other
- Figure out strengths of team members
- Consider assigning each person a primary role:
  - Responsible for seeing work is organized and done
  - Not responsible for doing it themselves
- Be proud, include names/roles in artifacts:
  - Group Manager (coordinate big picture)
  - Documentation (coordinate writing)
  - Design (coordinate visual/interaction design)
  - Testing (coordinate iterative testing)
Today’s Plan

Things To Talk About
Groups vs. Teams
Task Analysis
Plantr Task Analysis
Tasks in Design
Tasks Matter

System will fail if:

- It is inappropriate for the customer
- It does not meet customer needs

Your contextual inquiries will emphasize getting to know your customers and their needs

Can’t you then just make ‘good’ interfaces?
Why Task Analysis?

‘Good’ has to be interpreted in the context of use
Might be acceptable for office work, but not for play
Infinite variety of tasks and customers

Guidelines are too vague to be generative
e.g., “give adequate feedback”
Can be used to critique, but not to generate

Design is often about tradeoffs

Examples we have seen?
Why Task Analysis?

Task analysis is a lens on the information you obtain through methods like contextual inquiry.

Use what you learned in your inquiry to answer the questions in the task analysis.

Your assignments order the two, but in practice you should iteratively decide how to best draw upon all relevant methods throughout a process.
11 Task Analysis Questions

Who is going to use the system?
What tasks do they now perform?
What tasks are desired?
How are the tasks learned?
Where are the tasks performed?
What is the relationship between people & data?
What other tools do people have?
How do people communicate with each other?
How often are the tasks performed?
What are the time constraints on the tasks?
What happens when things go wrong?
Question 1

Who is going to use the system?

Identity
In-house or specific customer is more defined
Broad products need several typical consumers

Background

Skills

Work habits and preferences

Physical characteristics and abilities
Seattle Parking Meter

Who is going to use the system?

Identity?
People who park in Seattle
Business people, students, elderly, tourists

Background?
Have used parking meters before
May have an ATM or credit card
Have used other fare machines before
Seattle Parking Meter

Who is going to use the system?

Skills?
May know how to put cards into ATM

Work habits and preferences?
Park several times a week, a month, a year

Physical characteristics and abilities?
Varying heights, do not make it too high or too low

Anything else?
PARK, PAY & DISPLAY
Parking Pay Station Instructions

Insert card and push BLUE button to buy time OR
Insert coins to buy time

Push GREEN button to print receipt

Remove card quickly wait for receipt and display properly

Display one receipt only to park in any meter or pay station space until your time expires

Use the removable backing to tape receipt to INSIDE of a front-seat side window

PARALLEL curbside

For MOTORCYCLES, tape to headlight cover

Questions? Call 684-ROAD (7623)
paystations@seattle.gov

Dub
University of Washington

有問題嗎？請致電 684-ROAD (7623)
paystations@seattle.gov

SDOT Seattle Department of Transportation

DAU XE, TRẢ TIỀN & DẤN BIỂN NHÂN
Hướng dẫn về Trả Tiền Đầu xe

Bút thử vò và bấm nút để mua giờ HOÀC
Bấm các nút để mua giờ

Bấm nút XANH để in biên nhận

Rút nhanh thẻ ra chờ biên nhận và dán đúng cách

Chỉ dẫn một biên nhận để đầu xe tại bất cứ chỗ nào có đồng hồ hoặc trái tiền

Dùng miếng dán mặt sau có thể gọi ra để dán biên nhận vào MẶT TRONG của kính bằng trước

SONG SONG bö lẻ

Đối với XE GÁN MÁY, dán vào chup đèn trước

Thắc mắc? Hãy gọi số 684-ROAD (7623)
paystations@seattle.gov

SDOT Seattle Department of Transportation

Driver’s side

ANGLE

司機座側

斜角

如果是摩托车，请贴在车头灯罩上
Question 2 and Question 3

What tasks do they now perform?
What tasks are desired?

Important for both automation and new functionality
Relative importance of tasks?
Observe people, see it from their perspective

Automated Billing Example
small dentists office had billing automated
assistants were unhappy with new system
old forms contained hand-written margin notes
e.g., patient’s insurance takes longer than most
POPOVERS

Beat well

2 cupfuls flour
2 eggs

% teaspoonful salt
2 cupfuls milk

2 teaspoonfuls melted fat

Beat eggs slightly. Sift flour and salt, and add alternately with milk to eggs. Add melted fat. Beat with egg beater until smooth and full of bubbles. Fill hot greased cast aluminum or iron pans or glass or earthenware custard cups, % full of popover batter. Place immediately in a hot oven of 450° F. and bake for 30 min. Then lower temperature to 350° F. and bake for 15 min. longer. Makes 9 popovers.

CORNBREAD

2 cupfuls cornmeal
2 cupfuls sour milk
1 teaspoonful soda
2 eggs, beaten
1% teaspoonfuls salt
2 tablespoonfuls melted fat
3 tablespoonfuls sugar

Sift dry ingredients together. Mix milk with beaten eggs and add to dry ingredients. Stir well together and add melted fat. Pour into a hot greased baking pan or muffin tins and bake in hot oven of 400° F. for 20-25 min. Makes 24 pieces.
Question 4

How are the tasks learned?

What does a person need to know?

Do they need training?

academic

general knowledge / skills

special instruction / training
Question 5

Where are the tasks performed?
Office, laboratory, point of sale?
Effects of environment on customers?
Are people under stress?
Confidentiality required?
Do they have wet, dirty, or slippery hands?
Soft drinks?
Lighting?
Noise?
Question 6

What is the relationship between people & data?

**Personal data**
- Always accessed at same machine?
- Do people move between machines?

**Common data**
- Used concurrently?
- Passed sequentially between customers?
- Remote access required?
- Access to data restricted?

Does this relationship change over time?
Question 7

What other tools does a person have?
More than just compatibility

How customer works with collection of tools
Automating lab data collection example:
how is data collected now?
by what instruments and manual procedures?
how is the information analyzed?
are the results transcribed for records or publication?
what media/forms are used and how are they handled?
Question 8

How do people communicate with each other?

Who communicates with whom?

About what?

Follow lines of the organization? Against it?
Question 9

How often are the tasks performed?
Frequent use likely remember more details
Infrequent use may need more help
Even for simple operations
Make these tasks possible to accomplish
Which function is performed
Most frequently?
By which people?
Optimizing for these will improve perception of performance
Careful about initial use scenario
Question 10

What are the time constraints on the tasks?

What functions will people be in a hurry for?

Which can wait?

Is there a timing relationship between tasks?
  e.g., pregnancy in web search
Question 11

What happens when things go wrong?
How do people deal with task-related errors?
practical difficulties?
catastrophes?
Is there a backup strategy?
What are the consequences?
Selecting Tasks

Real tasks people have faced or requested
  collect any necessary materials
Should provide reasonable coverage
  compare check list of functions to tasks
Mixture of simple and complex tasks
  easy tasks (common or introductory)
  moderate tasks
  difficult tasks (infrequent or for power use)
What Should Tasks Look Like?

Say what person wants to do, but not how
  - allows comparing different design alternatives
Be specific, stories based in concrete facts
  - say who person is (e.g., using personas or profiles)
    - design can really differ depending on who
    - give names (allows referring back with more info later)
    - characteristics of person (e.g., job, expertise)
  - story forces us to fill in description with relevant details
Sometimes describe a complete “accomplishment”
  - forces us to consider how features work together
Using Tasks in Design

Write up a description of tasks formally or informally run by people and rest of the design team get more information where needed

Manny is in the city at a restaurant and would like to call his friend Sherry to see when she will be arriving. She called from a friend’s house while he was in the bus tunnel, so he missed her call. He would like to check his missed calls and find the number to call her back.
Task: Park in a New Neighborhood

Peter is going to brunch on a Sunday with his roommates. He is trying a new place he found on Yelp. He has the address for the place and he is using a smartphone GPS for directions. He leaves the apartment with his roommates at around 8:30am and he wants to beat the crowd so they won’t have to wait in line. He is driving a Toyota Corolla that he has owned for five years. It is a rainy day and he doesn’t have an umbrella.
Hierarchical Task Analysis

Steps of the task execution (detailed in a hierarchy)

- park in new neighborhood
  - determine destination
  - drive to destination
  - locate parking spot
  - secure parking spot
  - park

- enter address in GPS
  - follow directions
  - arrive at destination

...
Hierarchical Task Analysis

Steps of the task execution (detailed in a hierarchy)

- park in new neighborhood
  - determine destination
  - drive to destination
  - locate parking spot
  - secure parking spot
  - park
- enter address in GPS
  - follow directions
  - arrive at destination
  - ...
Today’s Plan

Things To Talk About
Groups vs. Teams
Task Analysis
Plantr Task Analysis
Tasks in Design
Plantr Task Analysis

1. Who is going to use the system?

Anyone who owns indoor plants is a potential user of Plantr. All of the plant owners that we interviewed forgot to water their plants at some point regardless of age, experience, and background. Even Lucy, who spent most of her time at home because she worked from home, struggled with timely watering.
Plantr Task Analysis

2. What are the currently possible tasks?

When people purchase a plant, they often look up information about the proper lighting and temperature conditions for their plants. Additionally, people must find out how much and how frequently to water and fertilize their plants.
Plantr Task Analysis

3. What are currently unavailable, desired tasks?

People want a way to remember to water and care for their plants. Forgetting to water plants was the most cited reason for plant death, and the only task that participants in our inquiries mentioned completing on a regular basis.
Plantr Task Analysis

4. How are tasks learned?

Most people learned how to take care of their plants through trial and error. Some consulted the Internet, nursery staff, or friends for more information on plant care.
Plantr Task Analysis

5. Where are the tasks performed?

Tasks like watering and fertilizing are performed at the plant's location. People keep plants in their workplace, like Jack, or at home, like Lucy and Caroline. Getting information about plant care was performed in a variety of places. People who consult the Internet could be anywhere with a platform that supports web browsing and Internet access. Those who go to the nursery to talk to plant experts are required to go to a specific location to talk to someone in person.
Plantr Task Analysis

6. What is the relationship between a person and data?

We identified three different types of data: a plant's current state, information about plants, and data that reflects the person's plant care history. A plant's current state is data on the moisture level of its soil and the general appearance of the plant (e.g., color, stiffness/limpness of leaves, etc.). People use this information to determine the plant's needs. Caroline and Lucy watered their plants when the soil felt dry or the leaves began to droop.
Plantr Task Analysis

6. What is the relationship between a person and data?

People consulted various plant care information databases when they wanted to know how to care for their plants. People used their personal history of plant care to determine how to take care of plants. Caroline said that she used to underwater plants, but she learned from her mistake and now tries to water them more often. People also base their buying decisions based upon their plant care history. Caroline noted that she tries to buy plants that require minimal water.
Plantr Task Analysis

7. What other tools do people have?

Caroline, Lucy, Jack, and Kacy all have smart phones and computers. People also have a water source, pots, and soil for their plants. Most people probably have access to a nursery or library.
Plantr Task Analysis

8. How do people communicate with each other?

Plant owners communicate on online forums and message boards. People who happen to be in the nursery at the same time might talk to each other about plant care. Likewise, people who have friends with indoor plants may share plant care tips.
Plantr Task Analysis

9. How often are the tasks performed?

Watering is performed with a frequency between twice a week (Jack) and twice a month (Caroline). Fertilizing is performed less frequently, between once every two weeks to once every three months. Plants do not become sick often enough to make a good estimate about how often people try to get help.
Plantr Task Analysis

10. What are time constraints on the tasks?

Plants must be watered with some regularity, so if people do not water their plants for long enough, the plants will start to die. Likewise, if plants are in need of attention for other reasons - pH imbalance, environment too dry - and they do not receive attention within some amount of time, they will die. Watering, caring, and learning how to care for a plant takes time. People who are very busy might not have the time or attention required for plant care.
Plantr Task Analysis

11. What happens when things go wrong?

When plants became "sick", people take action, seek help, or ignore the problem until the plant dies. When people forget to water plants, they usually notice that the plant needs water and give it water. Sometimes people may not realize that a plant needs water until it is too late.
Today’s Plan

Things To Talk About
Groups vs. Teams
Task Analysis
Plantr Task Analysis
Tasks in Design
Using Tasks in Design

Rough out an interface design
discard features that do not support your tasks
or add a real task that exercises that feature
major elements and functions, not too detailed
hand sketched

Produce scenarios for each task
what person does and what they see
step-by-step performance of task
illustrate using storyboards
Scenarios

Scenarios are design specific, tasks are not
Scenarios force us to
show how things work together
settle arguments with examples
but these are only examples, and
sometimes need to look beyond flaws

Show people storyboards
nice mechanism for feedback
Tasks in Your Projects

Say what is accomplished, not how

Real tasks that people currently encounter, or new tasks your design will enable

Reasonable coverage of the interesting aspects of your problem and your design space

Range of difficulty and complexity

Park at the zoo, Friday night in Ballard, at the airport
Tasks, Personas, and Scenarios

**Task**: a design-agnostic objective

**Persona**: a fictional person with a backstory

**Scenario**: narrative that demonstrates a persona completing a task using a particular design

**Use Case**: in software engineering, describes requirements using one or more scenarios
Combine with Other Methods

Personas
Brainstorming
Affinity Diagramming
Concept Mapping
Competitive Analysis

“If you want to create a product that satisfies a broad audience ..., logic will tell you to make it as broad in its functionality as possible to accommodate the most people. Logic is Wrong.”
## Combine with Other Methods

<table>
<thead>
<tr>
<th>Personas</th>
<th>Example Personae:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>Parent concerned about safety</td>
</tr>
<tr>
<td>Affinity Diagramming</td>
<td>Carpenter transporting tools</td>
</tr>
<tr>
<td>Concept Mapping</td>
<td>Executive wants a sporty car</td>
</tr>
<tr>
<td>Competitive Analysis</td>
<td>More specific is effective</td>
</tr>
</tbody>
</table>

- Give the person detail
- Give them a name
- Make it believable

- Careful of stereotyping

- Web littered with examples
Combine with Other Methods

Personas
Brainstorming
Affinity Diagramming
Concept Mapping
Competitive Analysis
Combine with Other Methods

Personas
Brainstorming
Affinity Diagramming
Concept Mapping
Competitive Analysis
Combine with Other Methods

Personas
Brainstorming
Affinity Diagramming
Concept Mapping
Competitive Analysis
Combine with Other Methods

Personas
Brainstorming
Affinity Diagramming
Concept Mapping
Competitive Analysis
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 05: Task Analysis

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 06: Design Diamond

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Quantity versus Quality

One class told they will be graded on quality, another on quantity
Quantity versus Quality

The quantity class produces better pots. Why?
Quantity versus Quality

The quantity class produces better pots. Why?

“While the quantity group was busily churning out piles of work—and learning from their mistakes—the quality group had sat theorizing about perfection, and in the end had little more to show for their efforts than grandiose theories and a pile of dead clay”
Sketching User Experiences

“Bill Buxton brings design leadership and creativity to Microsoft. Through his thought-provoking personal examples he is inspiring others to better understand the role of design in their own companies.”

Bill Gates—Chairman, Microsoft Corp.
Sketching

Theater: Shattuck Cinemas
Phone: (510) 665-1342
Distance: 1.5 mi.
Address: 2122 Shattuck Ave
Berkeley, 94709
Cost: $8.50 regular, $6.00 senior, $4.50 matinee

Art of War ★★★★
(10:00)-(11:00) 4:00-7:00-10:00

Bittersweet Motel ★★★★
(11:00)-(1:30) 4:00-6:30-9:00

Godzilla ★★
(10:30)-(2:00) 5:30-9:00

The Cell ★★★
(11:00)-(1:00) 3:00-5:00-7:00-9:00

Store for the Style-Challenged

As it should be...

Outfit #1

Outfit #2

Outfit #3

(pre-selected to match so you don't have to choose.)
Sketching
Sketching
Sketching

UBIGITOUS RICE COOKER

- LCD display shows number of cups & time remaining
- Touch pad for cups of rice input
- Eject button opens drawer

"Just another drawer in your kitchen"

The uncooked rice is stored in a hidden reservoir. Water is acquired through a hose attached to your water source (similar to an espresso machine).
Sketching

A process that enables you to think through ideas and convey design ideas to others very early in the design phase.
Quintessential Activity of Design
Design as Choice

Elaboration
palette of choices

Reduction
heuristics to choose
Design as Choice

Two openings for creativity

- Palette of choices
- Heuristics used to choose

Why is your contextual inquiry so important?

- What you learn directly informs both of these, shaping everything you do this entire quarter
The Design Diamond

start → generate → select → intentional!

danger! → danger! → danger! → danger!
Properties of Sketches

- Quick
- Timely
- Inexpensive
- Disposable
- Plentiful
- Clear Vocabulary
- Distinct Gesture
- Minimal Detail
- Appropriate Refinement
- Suggest and Explore
- Ambiguous
Quick

A sketch is quick to make, or at least gives that impression
Timely

A sketch can be provided when needed
Inexpensive

Cost must not inhibit the ability to explore a concept, especially early in design
Disposable

If you cannot afford to throw it away, then it is not a sketch

Investment is in the process, not the physical sketch

But they are not "worthless"
Plentiful

Sketches do not exist in isolation

Meaning and relevance is in the context of a collection or series
Clear Vocabulary

The way it is rendered makes it distinctive that it is a sketch (e.g., style, form, signals)

Could be how a line extends through endpoints
Distinct Gesture

Fluidity of sketches gives them a sense of openness and freedom.

Opposite of engineering drawing, which is tight and precise.
Minimal Detail

Include only what is required to render the intended purpose or concept
Minimal Detail

When we abstract an image through cartooning, we're not so much eliminating details as we are focusing on specific details.

By stripping down an image to its essential "meaning," an artist can amplify that meaning in a way that realistic art can't.
Appropriate Degree of Refinement

Make the sketch as refined as the idea

If you have a solid idea, make the sketch look more defined

If you have a hazy idea, make the sketch look rougher and less defined
Suggest and Explore Rather than Confirm

Sketch should act as a catalyst to the desired and appropriate behaviors, conversations, and interactions
Ambiguity

Intentionally ambiguous

Value comes from being able to be interpreted in different ways, even by the person who created them

Sketches have holes
Sketching as Conversation

Mind
knowledge, new knowledge

Create

Sketch representation

Interpret

Requires ambiguity
# Sketch vs. Prototype

<table>
<thead>
<tr>
<th>Sketch</th>
<th>Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invite</td>
<td>Attend</td>
</tr>
<tr>
<td>Suggest</td>
<td>Describe</td>
</tr>
<tr>
<td>Explore</td>
<td>Refine</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>Propose</td>
<td>Test</td>
</tr>
<tr>
<td>Provoke</td>
<td>Resolve</td>
</tr>
<tr>
<td>Tentative, non committal</td>
<td>Specific Depiction</td>
</tr>
</tbody>
</table>

The primary differences are in the intent
ABC News and IDEO’s Deep Dive
Sketching the Mouse

Making the Macintosh: http://www-sul.stanford.edu/mac/index.html
Sketching the Mouse
Physical Sketching
Physical Sketching
Physical Sketching

traditional workflow

to

low-fi fabrication

3D model

3D model

low-fi fabricated

low-fi fabricated

low-fi fabricated

hi-fi fabricated
Physical Sketching
Physical Sketching
Idea Oscillation

\[
\begin{align*}
\text{start} & \quad \text{generate} \quad \text{select} \\
\text{danger!} & \quad \text{danger!} \quad \text{danger!} \\
\text{intentional!} & \quad \text{danger!} 
\end{align*}
\]
Critiquing Sketches is Important

Ideas are both good and bad

- Both are useful in design
- By making clear what is a bad design, we can avoid actually implementing it
- Bad ideas help you justify your good ideas

Feedback can turn a good idea into a great idea

Sketching generates too many ideas to implement
Idea Oscillation
Iteration Toward a Design
Exploration of Alternatives
Exploration of Alternatives

... a designer that pitched 3 ideas would probably be fired. I'd say 5 is an entry point for an early formal review (distilled from 100's). ... if you are pushing one you will be found out, and also fired. ... it is about open mindedness, humility, discovery, and learning. If you aren't authentically dedicated to that approach you are just doing it wrong!

Alistair Hamilton
VP Design
Symbol Technologies
The Converging Path
Is this a sketch? Why or why not?
Is this a sketch? Why or why not?
Is this a sketch? Why or why not?
Is this a sketch? Why or why not?
Is this a sketch? Why or why not?
Is this a sketch? Why or why not?
Is this a sketch? Why or why not?
Is this a sketch? Why or why not?
Some Evidence

Task:

Create a web banner ad for Ambidextrous magazine.
Feedback in Parallel or Serial

Parallel condition

Serial condition

Dow et al. TOCHI 2010.
Procedure

serial prototyping condition

parallel prototyping condition

Dow et al. TOCHI 2010.
Parallel: more diverse, better, more clicks

Dow et al. TOCHI 2010.
Share one or share your best?

- Prototype
  - Feedback
  - Final
  - Share multiple condition

- Prototype
  - Feedback
  - Final
  - Share best condition

- Prototype
  - Feedback
  - Final
  - Make one condition

Dow et al. TOCHI 2010.
Share Multiple: better, more clicks

- Make one
- Share best
- Share multiple

Clicks per million impressions

Expert quality rating (0-7)

Dow et al. TOCHI 2010.
Some Evidence

Greater divergence in designs
  Prevents sticking with the first idea
  Allows mashing ideas together

Alternatives facilitate feedback
  Enable comparison
  Can improve tone of critique
Sketching and the Design Diamond

The design diamond is fundamental to understanding what you are doing here

Much of your education, including in CSE, has taught you to focus on having the right answer

Here it matters what you do long before the end

Most ideas get thrown out, including yours

Better ideas are great criticism, and frequently would never have come about otherwise
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 06: Design Diamond

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Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 07: Human Performance
James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Some Reminders

Task Analysis Critique Tomorrow
  do tasks reveal insight into the underlying problem
  do tasks expose an interesting design space

Keep your design options open

Our critique is not your answer
  we cannot pave a path to insight
  we will not always be consistent in our response
Today

Human Performance

Visual System
Model Human Processor
Fitts’s Law
Gestalt Principles
These are Examples of What?

Popsicle-stick bridge

\[ x = x_0 + v_0 t + \frac{1}{2} a t^2 \]

ACT-R

Goffman’s Negotiated Approach

Norman’s Execution-Evaluation Cycle
Models

We have said models describe phenomena, isolating components and allowing a closer look

Today is a closer look at modeling humans

**Capture essential pieces**

Model should have what it needs but no more
Thus avoid underfitting or overfitting model

**Allow us to measure**

Collect data, put in model, compare model terms

**Allow us to predict**

The better the model, the better the predictions
Creating a Model

How would you go about creating a model?
Creating a Model

How would you go about creating a model?

One approach:

- Observe, Collect Data, Find Patterns,
- Draw Analogies, Devise Model,
- Test Fit to Data, Test Predictions, Revise

Fundamentally an inductive process

- From specific observations to broader generalization
Today

Some example models of human performance

Visual System
Model Human Processor
Fitts’s Law
Gestalt Principles

Biological Model
Higher-Level Model
Model by Analogy
Predict Interpretation
Human Visual System

Light passes through lens, focused on retina

Blind Spot?
Blind Spot

Use right eye, look at letters
Blind Spot

Use left eye, look at cross
Visible Spectrum
Retina

Covered with light-sensitive receptors

**Rods (120 million)**
- Sensitive to broad spectrum of light
- Sensitive to small amounts of light
- Cannot discriminate between colors
- Sense intensity or shades of gray
- Primarily for night vision & perceiving movement

**Cones (6 million)**
- Used to sense color
Retina

Center of retina has most of the ...
Retina

Center of retina has most of the cones

Allows for high acuity of objects focused at center
Retina

Center of retina has most of the cones

Allows for high acuity of objects focused at center

Edge of retina is dominated by ...
Retina

Center of retina has most of the cones

  Allows for high acuity of objects focused at center

Edge of retina is dominated by rods

  Allows detecting motion of threats in periphery
Retina

Center of retina has most of the cones

  Allows for high acuity of objects focused at center

Edge of retina is dominated by rods

  Allows detecting motion of threats in periphery

What does that mean for you?
Retina

Center of retina has most of the cones

  Allows for high acuity of objects focused at center

Edge of retina is dominated by rods

  Allows detecting motion of threats in periphery

What does that mean for you?

  Peripheral movement is easily distracting
Retina

Center of retina has most of the cones
  Allows for high acuity of objects focused at center

Edge of retina is dominated by rods
  Allows detecting motion of threats in periphery

What does that mean for you?
  Peripheral movement is easily distracting
Color Perception via Cones

Photopigments used to sense color

3 types: blue, green, “red” (actually yellow)

Each sensitive to different band of spectrum

Ratio of neural activity stimulation for the three types of gives us a continuous perception of color
Color Sensitivity

[Graph showing the relative absorbance of blue, green, and red cones at different wavelengths. The graph indicates the peak absorbance wavelengths for blue (437 nm), green (533 nm), and red (564 nm) cones.]
Distribution of Photopigments

Not distributed evenly

Mainly reds (64%), Very few blues (4%)
Insensitivity to short wavelengths (i.e., blue)

No blue cones in retina center

Fixation on small blue object yields “disappearance”

Lens yellows with age, absorbs short wavelengths
Sensitivity to blue is reduced even further
Color Sensitivity & Image Detection

Most sensitive to center of spectrum

To be perceived as the same, blues and reds must be brighter than greens and yellows

Brightness determined mainly by red and green

\[ Y = 0.3 \text{ Red} + 0.59 \text{ Green} + 0.11 \text{ Blue} \]

Shapes detected by finding edges

We use brightness and color difference

Implication

Blue edges and shapes are hard
Color Sensitivity & Image Detection

Most sensitive to center of spectrum

To be perceived as the same, blues and reds must be brighter than greens and yellows

Brightness determined mainly by red and green

\[ Y = 0.3 \text{ Red} + 0.59 \text{ Green} + 0.11 \text{ Blue} \]

Shapes detected by finding edges

We use brightness and color difference

Implication

Blue edges and shapes are hard
Focus

Different wavelengths of light focused at different distances behind eye’s lens

Constant refocusing causes fatigue

Saturated colors (i.e., pure colors) require more focusing than desaturated (i.e., pastels)
Focus

Different wavelengths of light focused at different distances behind eye’s lens

Constant refocusing causes fatigue

Saturated colors (i.e., pure colors) require more focusing than desaturated (i.e., pastels)
Color Deficiency

Trouble discriminating colors

Affects about 9% of population

Two main types

Different photopigment response most common

Reduces capability to discern small color differences

Red-Green deficiency is best known

Lack of either green or red photopigment, cannot discriminate colors dependent on red and green

Also known as color blindness
Red-Green Deficiency Test
Dual / Redundant Encoding

Apples to Apples

Pandemic

http://danielsolisblog.blogspot.com/2011_03_01_archive.html
Add/Update Shipping Information

We found an error while verifying your shipping address. We've marked the problem in red for you.

Update the address book of

Required information is marked in GREEN CAPS.
HELP for questions about shipping.

NICKNAME: MYSELF
   Have a nickname for the person you're shipping to.
   You may change or delete this information at any time.

FIRST NAME: DOUGLAS

LAST NAME: 

ADDRESS: 245 SAN JOSE RD
   (International use only)

CITY: LOS GATOS

STATE/PROVINCE: California
   Includes AZ and PR. Use "other" if country is not USA or Canada.

ZIP/POSTAL CODE: 95333

COUNTRY: Select a country

SHIPPING METHOD: In the U.S.: Standard UPS (2 business days plus)
   International: Canada Post (4-10 business days)
Today

Some example models of human performance

Visual System
Model Human Processor
Fitts’s Law
Gestalt Principles

Biological Model
Higher-Level Model
Model by Analogy
Predict Interpretation
The Model Human Processor

Developed by Card, Moran, & Newell (1983)

Based on empirical data

Summarizing human behavior in a manner easy to consume and act upon

Same book that named human computer interaction
The Model Human Processor

- Long-term Memory
- Working Memory
  - Visual Image Store
  - Auditory Image Store

Sensory Buffers

Perceptual Processor

Motor Processor

Cognitive Processor

Fingers, etc.
Basics of Model Human Processor

Sometimes serial, sometimes parallel

Serial in action and parallel in recognition

Pressing key in response to light
Driving, reading signs, hearing all simultaneously

Parameters

Processors have cycle time, approximately 100-200ms
Memories have capacity, decay time, and type
A Working Memory Experiment
BMCIACSEI
BM  CIA  CSE I
IBM   CIA   CSE
Memory

Working memory (also known as short-term)

Small capacity ($7 \pm 2$ “chunks”)

6174591765 vs. (617) 459-1765

IBMCIACSE vs. IBM CIA CSE

Rapid access (~ 70ms) and decay (~200 ms)

Pass to LTM after a few seconds of continued storage

Long-term memory

Huge (if not “unlimited”)

Slower access time (~100 ms) with little decay
Activation Experiment

Volunteer
Activation Experiment

Volunteer

Start saying colors you see in list of words
  When slide comes up, as fast as you can
  There will be three columns of words

Say “done” when finished
  Everyone else time how long it takes
Activation Experiment

Do it again

Say “done” when finished
Activation Experiment

Do it again

Say “done” when finished
Model Human Processor Operation

Recognize-Act Cycle of the Cognitive Processor

On each cycle, contents in working memory initiate actions associatively linked in long-term memory.
Actions modify the contents of working memory.

Discrimination Principle

Retrieval is determined by candidates that exist in memory relative to retrieval cues.
Interference created by strongly activated chunks.

See also Freudian slips.
Perceptual Causality

How soon must the red ball move after cue ball collides with it?
Perceptual Causality

Stimuli that occur within one cycle of the perceptual processor fuse into a single concept

Requirement

If you want to create the perception of causality, then you need to be sufficiently responsive

Caution

Two stimuli intended to be distinct can fuse if the first event appears to cause the other
Today

Some example models of human performance

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<td>Gestalt Principles</td>
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</tbody>
</table>
Fitts’s Law (1954)

Models time to acquire targets in aimed movement

- Reaching for a control in a cockpit
- Moving across a dashboard
- Pulling defective items from a conveyor belt
- Clicking on icons using a mouse

Very powerful, widely used

- Holds for many circumstances (e.g., under water)
- Allows for comparison among different experiments
- Used both to measure and to predict
Fitts’s Law (1954)

Models time to acquire targets in aimed movement

- Reaching for a control in a cockpit
- Moving across a dashboard
- Pulling defective items from a conveyor belt
- Clicking on icons using a mouse

Very powerful, widely used

- Holds for many circumstances (e.g., under water)
- Allows for comparison among different experiments
- Used both to measure and to predict

James’s use of ’s is correct, but others may say Fitts’ Law
Reciprocal Point-Select Task

Amplitude

Width
Closed Loop versus Open Loop

What is closed loop motion?

What is open loop motion?
Closed Loop versus Open Loop

What is closed loop motion?
- Rapid aimed movements with feedback correction
- Fitts’s law models this

What is open loop motion?
- Ballistic movements without feedback correction
- Example: Throwing a dart
- See Schmidt’s Law (1979)
Model by Analogy

Analogy to Information Transmission
Shannon and Weaver, 1959
Model by Analogy

Analogy to Information Transmission
Shannon and Weaver, 1959

The Interface

Your Knowledge
Fitts’s Law

MT = a + b \log_2(A / W + 1)

What kind of equation does this remind you of?
Fitts’s Law

MT = a + b \log_2(A / W + 1)

What kind of equation does this remind you of?

y = mx + b

MT = a + bx, where x = \log_2(A / W + 1)

x is called the Index of Difficulty (ID)
As “A” goes up, ID goes up
As “W” goes up, ID goes down
Index of Difficulty (ID)

\[ \log_2(A / W + 1) \]

Fitts’s Law claims that the time to acquire a target increases linearly with the log of the ratio of the movement distance (A) to target width (W)

Why is it significant that it is a ratio?
Index of Difficulty (ID)

\[ \log_2 (A / W + 1) \]

Fitts’s Law claims that the time to acquire a target increases linearly with the log of the ratio of the movement distance (A) to target width (W)

Why is it significant that it is a ratio?

Units of A and W don’t matter
Allows comparison across experiments
Index of Difficulty (ID)

\[ \log_2 \left( \frac{A}{W} + 1 \right) \]

Fitts’s Law claims that the time to acquire a target increases linearly with the log of the ratio of the movement distance \((A)\) to target width \((W)\)

ID units typically in “bits”

Because of association with information capacity and somewhat arbitrary use of base-2 logarithm
Index of Performance (IP)

MT = a + b \log_2(A / W + 1)

b is slope

1/b is called Index of Performance (IP)

If MT is in seconds, IP is in bits/second

Also called “throughput” or “bandwidth”

Consistent with analogy of the interaction as an information channel from human to target
A Fitts’s Law Experiment
Experimental Design and Analysis

Factorial Design

Experiment with more than one manipulation

Within vs. Between Participant Design

Statistical power versus potential confounds

Carryover Effects and Counterbalanced Designs

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<td>C</td>
<td>B</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

Latin Square Design

https://depts.washington.edu/aimgroup/proj/ps4hci/
“Beating” Fitts’s law

It is the law, right?

\[ MT = a + b \log_2(A / W + 1) \]

So how can we reduce movement time?

- Reduce A
- Increase W
Fitts’s Law Related Techniques

Put targets closer together

Make targets bigger

Make cursor bigger
  - Area cursors
  - Bubble cursor

Use impenetrable edges
Fitts’s Law Examples

Which will be faster on average?

<table>
<thead>
<tr>
<th>Pop-up Linear Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today</td>
</tr>
<tr>
<td>Sunday</td>
</tr>
<tr>
<td>Monday</td>
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<tr>
<td>Tuesday</td>
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<td>Thursday</td>
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<td>Friday</td>
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<tr>
<td>Saturday</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pop-up Pie Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today</td>
</tr>
<tr>
<td>Sunday</td>
</tr>
<tr>
<td>Monday</td>
</tr>
<tr>
<td>Tuesday</td>
</tr>
<tr>
<td>Wednesday</td>
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<tr>
<td>Thursday</td>
</tr>
<tr>
<td>Friday</td>
</tr>
<tr>
<td>Saturday</td>
</tr>
</tbody>
</table>
Pie Menus in Use

The Sims

Rainbow 6

Maya
Fitts’s Law Examples

Which will be faster on average?

Pop-up Linear Menu

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Today</td>
<td>Sunday</td>
</tr>
<tr>
<td>Monday</td>
<td>Tuesday</td>
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<tr>
<td>Wednesday</td>
<td>Thursday</td>
</tr>
<tr>
<td>Friday</td>
<td>Saturday</td>
</tr>
</tbody>
</table>

Pop-up Pie Menu

What about adaptive menus?
Fitts’s Law in Windowing

Windows 95: Missed by a pixel
Windows XP: Good to the last drop

Macintosh Menu
Fitts’s Law in MS Office 2007

Larger, labeled controls can be clicked more quickly

Magic Corner: Office Button in the upper-left corner
Bubble Cursor

Grossman and Balakrishnan, 2005
Bubble Cursor with Prefab

Dixon et al, 2012
Bubble Cursor with Prefab

Dixon et al, 2012
Fitts’s Law and Keyboard Layout

Zhai et. al (2002) pose stylus keyboard layout as an optimization of all key pairs, weighted by language frequency

\[ MT = a + b \log_2 \left( \frac{D_{ij}}{W_j} + 1 \right), \]

\[ t = \sum_{i=1}^{27} \sum_{j=1}^{27} \frac{P_{ij}}{IP} \left[ \log_2 \left( \frac{D_{ij}}{W_j} + 1 \right) \right], \]
Hooke’s Keyboard

Optimizes a system of springs
Metropolis Keyboard

Random walk minimizing scoring function
Considering Multiple Space Keys

FITALY Keyboard
Textware Solutions

OPTI Keyboard
MacKenzie and Zhang 1999
Considering Multiple Space Keys

FITALY Keyboard
Textware Solutions

OPTI Keyboard
MacKenzie and Zhang 1999

Correct choice of space key becomes important
Requires planning head to be optimal
ATOMIK Keyboard

Optimized keyboard, adjusted for early letters in upper left and later letters in lower right.
Using Motor Ability in Design

Pointing

Dragging

List Selection

Gajos et al 2007
Interface Generation As Optimization

$($()\) = \text{Estimated task completion time}$
Manufacturer Interface

Font Formatting

Type, Style and Size

Font | Style | Size
--- | --- | ---
Arial | Regular | 8
Arial Black | | 
Comic Sans MS | Italic | 9
Courier New | Bold | 10
Franklin Gothic Medium | BoldItalic | 11

Underline style: (none)

Effects

- Strikethrough:
- Double Strikethrough:
- Superscript:
- Subscript:
- Shadow:
- Outline:
- Small Caps:
- Emboss:
- All Caps:
- Engrave:
- Hidden:

Preview

Times New Roman

Ok | Cancel
Person with Cerebral Palsy
Person with Muscular Dystrophy
Interface Generation As Optimization

In a study with 11 participants with diverse motor impairments:

- Consistently faster using generated interfaces (26%)
- Fewer errors using generated interfaces (73% fewer)
- Strongly preferred generated interfaces
Fitts’s Law Related Techniques

Gravity Fields
- Pointer gets close, gets “sucked in” to target

Sticky Icons
- When within target, pointer “sticks”

Constrained Motion
- Snapping, holding Shift to limit degrees of movement

Target Prediction
- Determine likely target, move it nearer or expand it
Fitts’s Law, Edge Targets, and Touch
Fitts’s Law, Edge Targets, and Touch

Avrahami finds edge targets are actually slower with touch devices, at same physical location

The effect of Target Type on Reaction Time

<table>
<thead>
<tr>
<th>Target Type</th>
<th>Reaction Time (msec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center</td>
<td>590</td>
</tr>
<tr>
<td>Inner</td>
<td>620</td>
</tr>
<tr>
<td>Horizontal Edge</td>
<td>640</td>
</tr>
<tr>
<td>Vertical Edge</td>
<td>660</td>
</tr>
<tr>
<td>Corner</td>
<td>700</td>
</tr>
</tbody>
</table>

Are people border cautious?
Today

Some example models of human performance

Visual System
Model Human Processor
Fitts’s Law
Gestalt Principles

Biological Model
Higher-Level Model
Model by Analogy
Predict Interpretation
Gestalt Psychology

Described loosely in the context of this lecture and associated work, not a real definition

Perception is neither bottom-up nor top-down, rather both inform the other as a whole
Gestalt Psychology

You can still see the dog...
Gestalt Psychology

You can still see the dog...
Spinning Wheel

Follow the red dots vs follow the yellow dots
Blind Spot Interpolation

Use right eye, look at letters
Painful Image Warning
Difficult to Reconcile
Proximity

Objects close to each other form a group
Proximity

Using Lies in Research
By Nate Bolt  •  March 8, 2011

While it might be an uncomfortable topic, uncovering the lies behind a product or interface can be one of the most effective ways to turn ailing projects around.

Considerations for Mobile Design (Part 2): Dimensions
By David Leggett  •  March 1, 2011

In part two of this series, David helps readers adapt their design regimes to the (typically) small screens of mobile devices. Using responsive design, our experiences adapt to a variety of conditions.

A Simple, Usable Review
By Paul Seys  •  February 24, 2011

In this detailed review, Paul Seys describes an up-and-coming UX title that’s jam-packed with lessons for designers both new and established. Follow along to learn how author Giles Colborne’s teaches his readers the essence of great design.
Proximity

1. Tell us about yourself...
   - My Name: First Name [Owoh]
   - Gender: [Select One]
   - Birthday: [Select Month] [Day] [Year]
   - I live in: United States
   - Postal Code

2. Select an ID and password
   - Yahoo! ID and Email: [Email address]
   - Password
   - Re-type Password

3. In case you forget your ID or password...
   - Alternate Email
   - Security Question 1: [Select One]
     - Your Answer
   - Security Question 2: [Select One]
     - Your Answer
Similarity

Objects that are similar form a group
Similarity
Proximity and Similarity
Proximity and Similarity

After discovering that one of these accesses a menu, people will expect they all access a menu. They are the same.
Closure

Even incomplete objects are perceived as whole

Increases regularity of stimuli
Closure

The Sims

Rainbow 6
Symmetry

Objects are perceived as symmetrical and forming around a center point.

If you fight symmetry, be sure you have a reason.
Continuity

Objects are perceived as grouped when they align

Remain distinct even with overlap

Preferred over abrupt directional changes

what most people see

not this
Continuity
Models from Different Perspectives

Some example models of human performance

Visual System
Model Human Processor
Fitts’s Law
Gestalt Principles

Biological Model
Higher-Level Model
Model by Analogy
Predict Interpretation
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 07: Human Performance

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 08: Storyboarding and Video Prototyping

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Today

Milestones

Use This Week to Refine and Decide
Design Review (“1x2”) Due Friday
Reading 3 Due Friday
Getting the Right Design Due Tuesday
Presentations Start Thursday

Class

Storyboarding and Video Prototyping
Design Check-In (“3x4”) Peer Critique
Tasks in Design

Tasks guide your exploration of a design

Creating scenarios for each task illustrates

what a person does
what they see
step-by-step performance of task
Sketching

Theater: Shattuck Cinemas
Phone: (510) 665-1342
Dist: 1.5 mi
Address: 2122 Shattuck Ave
Berkeley, CA 94709
Cost: $8.50 reg, $6.00 sen, $4.00 matinee

Art of War ★★★☆
(10:00)-(1:00) 4:00-7:00-10:00

BitterSweet Motel ★★★★★
(11:00)-(1:30) 4:00-6:30-9:00

Godzilla ★★
(10:30)-(2:00) 5:30-9:00

The Cell ★★★★
(11:00)-(1:00) 3:00-5:00-7:00-9:00

Store for the Style-Challenged

As it should be...

Outfit #1
Outfit #2
Outfit #3

(pre-selected so you don't have to choose.)
Sketching

MAP SHOWING PARKING AVAILABILITY BASED ON INPUTTED DATA, INPUTTED ON MAP.

- Different colors
  - high lights availability

43rd
92nd
39th
PACIFIC
AVE
Sketching and Storyboards
Sketching and Storyboards

Scenario 1: "I want to listen to alternative music"

Diagram showing navigation through music genres with options for country, metal, alternative, rap, soul, and top 40.
Sketching and Storyboards
Sketching and Storyboards

[Diagram of user interface and flow]
Illustrating Time

Storyboards come from film and animation

Give a “script” of important events
leave out the details
concentrate on the important interactions
Storyboards

Can be used to explore

Much faster and less expensive to produce

Can therefore explore more potential approaches

Notes help fill in missing pieces of the proposal

Relative to film, these function as sketches
Storyboards

Can be used to convey

Effective storyboards can quickly convey information that would be difficult to understand in text

Imagine explaining this in text, for various audiences
Storyboards

Can illustrate key requirements and leave open less important details of design
Basic Storyboard
Storytelling

Stories have an audience

Other designers, clients, stakeholders, managers, funding agencies, potential end-users

Stories have a purpose

Gather and share information about people, tasks, goals
Put a human face on analytic data
Spark new design concepts and encourage innovation
Share ideas and create a sense of history and purpose
Giving insight into people who are not like us
Persuade others of the value of contribution
Stories Provide Context

Characters
Who is involved

Setting
Environment

Sequence
What task is illustrated
What leads a person to use a design
What steps are involved

Satisfaction
What is the motivation
What is the end result
What need is satisfied

Details of interface features and components are not necessarily surfaced, they can often be developed and conveyed more effectively with other methods.

Can help surface details that might otherwise be ignored.

Grocery store application:
- use with one hand while pushing a shopping cart
- privacy of speech input
- split attention
Amal’s Guide to Storyboarding

- Cities →
  - S.F.
  - S.J.
  - HLA.

No!

Don’t use this to illustrate all the UI features & components.!

*This is what paper prototyping is for!

Red & Sean were bored after going to the bluegrass festival, & decided to find out what else they could do...

Dude, what do we do?!

<Red>
Do we OK on my iPhone?

<Sean>
Instead, show why & when features would be used.
Amal’s Guide to Storyboarding

Let’s try out Burmese Superstar. Amal rated it, & it sounds cool!

Sure!

& show satisfactions

& finally, be creative! You don’t need to be an artist to get a point across.
Amal’s Guide to Storyboarding

Let’s try out Burmese superstar. Amal rated it, & it sounds cool! Sure.

Show satisfactions

& finally, be creative! You don’t need to be an artist to get a point across.
## Storytelling

### Good stories
- Understand audience
- Provide context of use
- Are well-motivated
- Memorable
- Evokes a reaction
- Evokes empathy
- Illustrate experience
- Convey emotions
- Short and to-the-point

### Bad stories
- Do not account for audience
- Boring or un-engaging
- Fantastical or unrealistic
- Wrong story for purpose
- Too long to hold attention
- tl;dr
Elements of a Storyboard

Visual storytelling

5 visual elements
Level of detail
Inclusion of text
Inclusion of people and emotions
Number of frames
Portrayal of time

To better characterize design intuitions: gather and analyze artifacts
semi-structured interviews
survey focused on identified elements

Truong et al, 2006
1. How Much Detail?

Guideline: too much detail can lose universality

Scott McCloud
1. How Much Detail?

Sketching People

Star people by Bill Verplank

(c) 2009 SACHA CHUA

Keith Haring
1. How Much Detail?
1. How Much Detail?

Unnecessary details distract from the story.
2. Use of Text

Guideline: It is often necessary, but keep it short
2. Use of Text

Guideline: It is often necessary, but keep it short

1. At home, Mary checks her blood pressure.
2. After a few simple key presses, her blood pressure readings get sent to a clinic.
3. The information is made available to her doctor.

Short text is more effective, less likely to over-explain.

Watch for cases where text induces weird biases.
3. Include People and Emotions

Guideline: Include people experiencing the design and their reactions to it (good or bad)

Remember, the point of storyboards is to convey the experience of using the system
4. How Many Frames?

Guideline: 4-6 frames is ideal for end-users

- Less work to illustrate
- Must be able to succinctly tell story
- Potentially longer for design clients

More is not always better

- May lose focus of story
- May lose attention
4. How many frames?
4. How many frames?

People found the extra panels were not needed
5. Passage of Time

Guideline: Only use if necessary to understand
5. Passage of Time

Guideline: Only use if necessary to understand

Inclusion of the clock distracts
Storyboards for Comparing Ideas

**Authoritative**

Cell phone is used to keep track of one’s fitness goal.

**Supportive**

Cell phone is used to keep track of one’s fitness goal.
Storyboards for Comparing Ideas

Cooperative

Let's use our cell phones to keep a record of the number of days that we exercise!

1st Week

2nd Week

Okay! Let's work together to meet a goal of exercising for at least 2 weeks.

Yeah! We are almost there. Good job!

Competitive

Let's compete to see who exercises more.

1st Week

2nd Week

Okay, let's do it!

Let's see who wins next week.

Yeah! I win this week!
Storyboards for Comparing Ideas

**Negative Reinforcement**

- I'm going to use my phone to keep track of my fitness goals.
- Oh no! My virtual garden on my phone is ugly. I need to exercise to keep the flowers alive!
- Now I have lots of flowers in my garden!

**Positive Reinforcement**

- I'm going to use my phone to keep track of my fitness goals.
- Each time I exercise, I will get another item added to my garden.
- Now I have a full garden!
Examples and Tricks in Storyboarding
Drawing is Hard

Will a picture work instead?

- It is so dark Jane can hardly read her book.
- She gestures in front of her special pendant to turn on the lights.
- The lights turn on!
- Finally, she can read happily.
Existing Images from Other Sources

http://designcomics.org/

http://www.pdclipart.org/
Blur Out Unnecessary Detail

Using image editing software to simplify photos into sketches
Tracing Photos

Baudisch and Chu, 2009
Mapping the Space of Interaction
Comic Presentation

Thought bubbles argue for the design

Field trial participants not only reported changing their behavior – reducing single occupant trips by around 10% – but they also told us about encouraging their peers and colleagues to do the same during and after the field trial.
Selective Use of Color
Route Maps
Route Maps

You... Central Park
2 hours until dinner
with Simon

What to do?

You enable geocaching mode
on your phone and spend
the next two hours exploring

Dinner!
Route Maps

Friday:
- Dinner
- Groceries

Elliot Bay Book Co
- looks interesting but you're late
- Save location!
- Downtown meeting
- no time to stop on the way back

Saturday:
- Elliot Bay Book Co
- Where would you like to go?
- coffee

home
Route Maps

The movie is over and you are hungry, but you don't know the area...

Eventually settling on a diner and getting directions through your phone.

You check your phone for a list of places people often go from here...

And discuss the food options with your friends.
Value of Animation or Video
Can illustrate critical timing
Can be more engaging than written or storyboard
Can more easily convey emotion (e.g., voice, music)
Can show interactive elements more clearly
Can be self-explanatory
If done well, can be an effective pitch

But you need to keep it quick and effective
Most Important Trick: Stop Motion

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Mackay-StopAction.mp4
Most Important Trick: Stop Motion

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Mackay-StopActionResult.mp4
Video Prototypes

May build upon paper prototypes, existing software, and images of real settings

Narration optional

Narrator explains, actors move or illustrate interaction

Actors perform movements and viewer expected to understand without voice-over
Steps to Create a Video Prototype

Review field data

Review ideas from brainstorm

Create text for usage scenarios

Develop storyboard, with each scene on a card, illustrating each action/event with annotations explaining what is happening
Steps to Create a Video Prototype
Steps to Create a Video Prototype

Shoot a video clip for each storyboard card
  Avoid editing in the camera, just shoot your scenes

Use titles to separate clips
  Like a silent movie

Digital changes these tradeoffs a little, but respect the spirit of doing this quickly to get point across
  If you make an error, just reshoot it
Prototyping Microsoft Surface

Prototyping Microsoft Surface

Lessons from Prior Video Prototypes

Narration, Pace, and Flair

Three versions of “Don’t Forget”

Using Projectors and Simple Props

“Buddy Map”

Watch for Pace and Scene Relevance

“Consumester”
Narration, Pace, and Flair

Don't Forget
by Carolyn Holmes and Fred Potter

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Don't-Forget-1.mp4
Narration, Pace, and Flair

Don't Forget!

Video Prototype

1 February 2007

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Don't-Forget-2.mp4
Narration, Pace, and Flair

"Don't Forget" Video Prototype
Chris Govella - Peter Woodman

http://courses.cs.washington.edu/courses/cse440/videos/videoprotoyping/Don't-Forget-3.mp4
Using Projectors and Simple Props

Team Buddy Map

Backcountry Savior

Craig Panthen : Philip Kuo : Heidi Tanamulia : Christopher White
CSE 440F : Professor Landay

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Buddy-Map-Backcountry.mp4
Watch for Pace and Scene Relevance

http://courses.cs.washington.edu/courses/cse440/videos/vidextr/Consumester.mp4
Lessons from Prior Video Prototypes

Split Presentation, Simple Effects

“PickUp”

Still-Frame, More Effects

“Graffiti Karma”
Split Presentation, Simple Effects

[Image: Pickup]

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Pickup.mp4
Still-Frame, More Effects

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Graffiti.mp4
Lessons from Prior Video Prototypes

Scenario with a Contrast

“ParkSmart” (note that screens are static images)

Playful while Keeping Pace

“Plantr”
Scenario with a Contrast

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Parksmart.mp4

But watch for pace and scene relevance
Playful while Keeping Pace

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Plantr.mp4
Range of Purposes

Illustrating Low-Level Techniques
  Microsoft Surface examples convey timing

Illustrate Designs
  Focus in this course

High-Level Visions
  StarFire, Knowledge Navigator, A Day Made of Glass
Sun’s “Starfire” (1994)

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Vision-Sun-Starfire.mp4
Apple’s “Knowledge Navigator” (1987)

Corning’s “A Day Made of Glass” (2011)

LuciaMug Sketch: A Contrast

http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Mug-Sketch.mp4
http://courses.cs.washington.edu/courses/cse440/videos/videoprototyping/Mug-HiFi.mp4
Fidelity Takes Time: Stay Low Fidelity

If you need a video, do you really need footage?

If you need an animation, do you really need Flash?

If you need a photo, do you really need to shoot?

 Completely made-up bar length
But it is probably at least this bad
Summary

Think about your audience
Think about your time constraints
Think about how much you want to tell

Think about options for presenting your story
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 08:
Storyboarding and Video Prototyping

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 09:
Paper Prototyping

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Today

Reading 3 Due Tomorrow
Design Review Tomorrow
Report on Tuesday
Presentations on Thursday / Friday
Paper Prototypes Next Weekend
Bring Prototypes to Following Tuesday

In-Class Inspection Methods
Today

Tips on Effective Presentations

Paper Prototyping
Introduce Yourself

DisTrack
Refocus yourself

Graeme Britz - Project Manager
Max Suffel - Writer/User Researcher
Angela Suhardi - Writer/Designer
Jackie Chui - Writer/Designer
Bryan Djunaedi - Writer/Designer
Koala

The recurring subscription management tool that let’s you finally take control of your recurring services and payments.

Jen Kang • Vivian Yu • Si Liu • Brendan Lee
The recurring subscription management tool that let’s you finally take control of your recurring services and payments.

Jen Kang • Vivian Yu • Si Liu • Brendan Lee
Finding

• Reimbursement is a burden...
  – More people, more difficult

• Compiling shopping list
  – mental note, notepad, or phone

• Brand and price conscious
Task

1. Making list & budgeting
2. Choosing a store & transportation
3. Shopping
4. Purchasing
5. Storing groceries
6. Managing $$$ & requesting reimbursement
Summary

- Iteration is key
- Understand how users think
- Better design ideas came from more out-of-the-box thinking
- Discretionary spending is easy but discretionary spending tracking is hard
- Users crave positive motivation
Things to Do (Tasks)

1. Ability to record running statistics such as distance run, speed, number of runs, etc.
2. Share statistics with friends
3. Create running events and invite friends
4. Send mass notifications to friends for a spontaneous run
5. Find a SmartMatch (based on various criteria) to run with
6. Write and search for reviews on the route/experience
Overall Problem: Joint Pain & Activity

- Target Audience: Athletes
  - Health conscious
  - Disciplined

- Problem: Overexertion and aggravation of injury among athletes
Running with Friends

Erica Putsche, Heidi So, Luke Chang, Linsen Wu
Contextual Inquiry - Insights

**Johnson (20, undergraduate, CSE 006 Lab)**
- Perception ≠ Observation
- Distracted by people talking and noise
- More focused at CSE Labs than at home

**Steve (25, graduate, Mercer Court)**
- Motivated by seeing people working
- Distracted by people and social media
- Takes breaks often

**George (25, graduate, Odegaaard Library)**
- Turns notifications off while studying

**Group (4 undergraduates, Yunnie Bubble Tea)**
- Distracted by each other and apps
- Use headphones (music) to focus
Our three inquiries showed us:

1. People valued the insights acquired from a mood journal.
2. People thought journaling was a hassle.
3. People were interested in what triggers their mood.
4. People want to share information with a mental health professional.
Design 1: Running separately
May add some motivation but does not provide the full experience of running with a companion

Design 2: Coordinating running events in advance
Tasks can be accomplished using Facebook events or other similar tools

Design 3: Spontaneous Running
Tasks are unique and they also address the concerns raised in our contextual inquiries. Our chosen design also provides us with an interesting opportunity to explore personal informatics
Summary

- Iteration is key
- Understand how users think
- Better design ideas came from more out-of-the-box thinking
- Discretionary spending is easy but discretionary spending tracking is hard
- Users crave positive motivation
Having Too Much Text

If you can read it
you probably will
we probably will
Be conversational, engaged
even when not talking
Notes are fine
but do not read them
Parent Contextual Inquiry

Participants:
- Two parents whose children formerly had IEPs
- One parent with two children that currently have IEPs
- One guardian of a student with an IEP

The Process:
- “The lingo and paperwork are confusing, they come with 17 people and you are there by yourself.”

Communication:
- “right now I come in doing all the communications to get information”
Overall Problem: Joint Pain & Activity

- Target Audience: Athletes
  - Health conscious
  - Disciplined

- Problem: Overexertion and aggravation of injury among athletes
Contextual Inquiry

- Dancers
  - Use of entire body
  - Diverse Injuries
- Observation
  - Warmup
  - Preventative Habits
Contextual Inquiry

4 Locations
- Odegaard Library
- CSE Undergraduate Labs
- Mercer Court
- Yunnie Bubble Tea (Ave)

3+1 Approaches
- Observation + Interview (3x)
- Interview-only (2x)
- In-group Interview (1x4)
+ Online Survey (16x)
Contextual Inquiry

- People do not want to be interrupted or distracted
- Most people do not have a liquid intake plan
- People often reach for soda, coffee, or other beverages when they feel thirsty

Pictures are Good
Pictures are Good

Contextual Inquiry

Professional (20-40s)

Family

Undergrad Student
15% of Americans between the ages of 20 and 69 experience hearing loss that may have been caused by noise at work or during leisure activities.

Motivation of Participants

Very noisy work environment

Some control over exposure levels

Moderately noisy work environment

Lacks control of his noise exposure

Dartmouth student who is exposed to noisy social environments multiple days per week

Has control over exposure levels
We can help
Tasks

- Record mood reflections
- Discover triggers and warning signs
- Discover wellness strategies
- Planning for health
- Quick mood check-ins
- Aid your health professional
Tasks

1. Engage a work session.
2. Record digital and non-digital behavior.
3. Prompt for taking breaks.
4. Reflect on recorded data relative to time and location.
5. Find a productive work place.
6. Find and implement methods/strategies to stay focused.
Tasks

Facebook, please! I am trying to study!
Check me! Check meeeeee!

Our relationship entered its decline at this point. That's when you started graphing everything. Coincidence!
Speaking of Distractions

Whether correct or not, many things distract

- Plural possessive
- a posteriori

Anything that might be sensitive
Original Tasks

Current Tasks:
- Aggregate and collect all IEP information for continuity and stakeholder accessibility.
- Encourage communication between stakeholders.
- Connect with other parents who have children with similar disabilities.

New Tasks:
- Access mini lessons to support the developmental master of IEP tasks.
- Motivational rewards system to encourage students to be active in their IEP.
- IEP videos for parents to understand how to best advocate for their child.
Initial Tasks

1. Tracking liquid intake over time (Easy)

2. Education on hydration (Easy)

3. Convenient reminders to drink water (Medium)

4. Smart beverage suggestions (Medium)

5. Finding motivation for drinking water (Hard)

6. Accurate dehydration detection (Hard)
Verb as Task

Adjust budget between different categories.
Designate spending as discretionary.
Review spending **progress** compared to goals.

Account for **future** spending.

Prevent **unwanted** habitual spending.

Check if a potential purchase **fits the budget**.
Many people make **general** budgeting goals.

**Large** items are monitored.

Small items cumulative impact **not considered**.

**Challenging** setting up budgets.

Complicated input leads to **less use**.
Task: **Reflect** on recorded data relative to time and location
Task: Find and implement methods/strategies to reduce distractions and increase focus
Design 1

Pre-shopping

EA Group Shop
Hi there!
Honey Nut Cheerio is on sale! Get it now?
sale ends Oct 31st
Add to shopping list
Dismiss

SELECT LIST:
PETER's list
Household's list

Q search

Household

P Honey Nut Cheerio 11oz. 4.19
added in Oct 30th Private

G Chocolate 1.2 99c Public
milk
added in Oct 25th

A Orange Juice 5.99 Public

Add an item
Done
Naming Designs

Tracking Liquid Intake

Education on Hydration

Convenient Reminders

Smart Beverage Suggestions

Design 1
Sensor Ball with Mobile App
Sketch 3

Main Focus:
- Student Motivation

Key Features:
- Mini lessons accessible for the student and parent to work on
- Points awarded for completion of task on the website
- Spending points for various rewards
Design 1

Legibility of Sketches
Updated Sketch

Two Tasks
- Recurring subscription management
- Insight and informed decisions
Problem

A lack of awareness about the long-term implications of noise exposure
Today

Tips on Effective Presentations

Paper Prototyping
Is My Design Good?

This is not a meaningful question
   It can and will be answered with “Yes”

At least consider asking:
   “What are three good things about this design?”
   “What are three bad things about this design?”

But really the answer is “it depends”
   Remember that designs are used for tasks
   We should ask this in the context of tasks
Fidelity in Prototyping

High Fidelity
Prototypes look like the final product

Low Fidelity
Designer sketches with many details missing

We have discussed the value of staying lightweight in sketching, but this also applies to prototyping.
High-Fidelity Prototypes Warp

Time and creativity

Require precision (e.g., must choose a font)
Specifying details takes time
Can lose track of the big picture

Perceptions of a person reviewing or testing
Representation communicates “finished”
Comments often focus on color, fonts, alignment
Low-Fidelity Prototypes

Traditional methods take too long
   Sketches → Prototype → Evaluate → Iterate

Instead simulate the prototype
   Sketches → Evaluate → Iterate

Sketches act as prototypes
   A designer “plays computer”
   Other design team members observe & record

Kindergarten implementation skills reduce barriers to participation in design and testing
Sketches
Paper Prototype
Basic Materials

Heavy, white paper
Index cards
Post-its
Tape, stick glue, correction tape
Pens and markers in many colors and sizes
Overhead transparencies
Scissors, X-Acto knife
Paper Prototype

“Screen” faked with pre-constructed pieces
Paper Prototype

New pieces added in response to interaction
Paper Prototype

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Color</th>
<th>Size</th>
<th>Status</th>
<th>Qty</th>
<th>Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>12778</td>
<td>Cashmere sweater</td>
<td>Green</td>
<td>M</td>
<td>In Stock</td>
<td>1</td>
<td>79.99</td>
<td>79.99</td>
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<tr>
<td>23076</td>
<td>Backcountry boot</td>
<td>BLACK</td>
<td>8M</td>
<td>In Stock</td>
<td>1</td>
<td>128.00</td>
<td>128.00</td>
</tr>
</tbody>
</table>

Transparencies allow flexible use of text

Check out our no-hassle return policy.

Subtotal: 267.99
Tax: 12.95
Total: 280.94

Continue Shopping  Checkout
Paper Prototype as Communication
Paper Prototype as Communication
Paper Prototype as Evaluation
Paper Prototype as Evaluation
Constructing the Prototype

Set a deadline
- Do not think too long
- Instead build it, then learn and iterate as you go

Put different screen regions on cards
- Anything that moves, changes, appears/disappears

Ready responses for actions
- Have those pull-down menus already made
- Planned tasks can guide this

Use photocopier to make many versions
Constructing the Prototype

Note the sketching continues
Constructing the Prototype

Planning what is needed given tasks
Constructing the Prototype

Prototyping physical form
Constructing the Prototype

Prototyping physical form
Constructing the Prototype

Remember your target platform constraints
Why Usability Test?

Find and fix problems in a design

- Removes the expert blind spot
- Obtain data to unify team around changes
- Uncover unexpected behaviors

Results drive changes, sometimes innovations

In the long run, this is a win-win

- Both improves design and saves money
Deciding What Data to Collect

Process data

- Observations of what people do and think
- Focused on improving this process

Summary, statistical, or bottom-line data

- Summary of what happened (time, errors, success)
- Focused on measurement
Deciding What Data to Collect

Process data

- Observations of what people do and think
- Focused on improving this process

Summary, statistical, or bottom-line data

- Summary of what happened (time, errors, success)
- Focused on measurement

Focus on process data

- Gives overview of where the problems are
- More useful than “too slow” or “too many errors”
Not a Scientific Experiment

Focus is on improving the design

- Experimental control is not as necessary
- Data measurement is not as precise
- Number of participants is fairly small

Changes can be made

- Fix the obviously broken design
- Quickly explore alternatives
- Modify the focus of testing between participants
Task-Based Usability

Set up an overall context

“We are interested in improving people’s ability to save, update, and use contacts in their mobile phones.”

Then prescribe tasks

1. Try to find the contacts list in the phone
2. View the contact information for John Smith
3. Change John Smith’s number to be 555-555-5555

Tasks can be chained to naturally lead to the next
Stages of a Usability Test

Preparation
Introducing the Test
Conducting the Test
Debriefing
Analyzing the Data
Creating the Report
Preparing for a Test

Select your participants
Friends and family are not your design targets
Understand background, consider recruiting questionnaire

Prepare tasks and paper prototype

Practice to avoid “bugs” in your prototype
Usability Test Proposal

A report that contains

Objective, Description of System, Environment and Materials, Participants, Methodology, Tasks, Test Measures

Work through it with colleagues to debug test

Reuse when presenting final report
Introducing the Test

Address Feelings of Judgment

“Today we are interested in learning about X. That’s where you come in!”

“I did not develop X. I just want to know what the problems are with X.”

“It is X being tested here, not you.”
Introducing the Test

Set Expectations for Process

“It is essential you think out loud while working with X. Tell me constantly what you are thinking, looking for, wondering, confused about, surprised, and so on. If you stop talking, I will prompt you to talk.”

“I will not be able to answer your questions when you start using X. Do you have any questions now?”
Conducting a Test

See the Gommol reading tips on a test session
Talk-Aloud Prompts

“Tell me what you are trying to do.”

“Please keep talking.”

“Tell me what you are thinking.”

“Are you looking for something? What?”

“What did you expect to happen just now?”

“What do you mean by that?”

“Talk-aloud” is similar but distinct from “think-aloud”

Most do not know or care about the difference, so you may see the terms used interchangeably
Insight Problems

When people are trying to figure something out, talking aloud can prevent needed “insight”

If your participant is really baffled, it might not be the best time to prompt them to keep talking

Wait for a natural break, and then ask “What were you thinking just there?”

Retrospective talk-aloud

Record session, talk through immediately afterward
Answering Questions

Remember the purpose of this test

- You would not be there “in real life”
- You want to see if they can figure it out
- You want to see how hard it is
- You want to see how catastrophic the outcome is

But you do not want to punish the person or completely undermine the rest of the session

- Note any help you provide as a major failure
- Do not allow observing engineers to help
Debriefing

Give them more details about what you were interested in discovering, with their help

Answer any questions they have

Now you can show them how to accomplish the tasks, talk about what you learned from the test

Thank them for their time

Appropriate to give some compensation
Analyzing and Reporting the Results

Tests yield many forms of data

Quantitative counts
  - time, success/failure
  - confusions, errors, workarounds

Observations
  - notes about when, where, why, how above occur

Participant comments and feedback
  - during session of via a questionnaire
Analyzing and Reporting the Results

Summarize the data

Make a list of critical incidents
- can be positive and negative
- include references back to original data
- try to judge why each difficulty occurred

Sort and prioritize findings
- what does data tell you
- what are the important results
- anything missing from test
Ethical Considerations

Testing is stressful, can be distressing
people can leave in tears

You have a responsibility to alleviate
make voluntary with informed consent
avoid pressure to participate
let them know they can stop at any time
stress that you are testing the system, not them
make collected data as anonymous as possible
Human Subjects Approvals

Research requires human subjects review of process

This does not formally apply to your design work

But understand why we do this and check yourself

Companies are judged in the eye of the public

Public Announcement

WE WILL PAY YOU $4.00 FOR ONE HOUR OF YOUR TIME

Persons Needed for a Study of Memory

*We will pay five hundred New Haven men to help us complete a scientific study of memory and learning. The study is being done at Yale University.
*Each person who participates will be paid $4.00 (plus 50c carfare) for approximately 1 hour's time. We need you for only one hour; there are no further obligations. You may choose the time you would like to come (evenings, weekdays, or weekends).

*No special training, education, or experience is needed. We want:
- Factory workers
- City employees
- Laborers
- Barbers
- Businessmen
- Clerks
- Professional people
- Telephone workers
- Construction workers
- Salespeople
- White-collar workers
- Others

All persons must be between the ages of 20 and 50, High school and college students cannot be used.
*If you meet these qualifications, fill out the coupon below and mail it now to Professor Stanley Milgram, Department of Psychology, Yale University, New Haven. You will be notified later of the specific time and place of the study. We reserve the right to decline any application.
*You will be paid $4.00 (plus 50c carfare) as soon as you arrive at the laboratory.

TO:
PROF. STANLEY MILGRAM, DEPARTMENT OF PSYCHOLOGY, YALE UNIVERSITY, NEW HAVEN, CONN. I want to take part in this study of memory and learning. I am between the ages of 20 and 50. I will be paid $4.00 (plus 50c carfare) if I participate.

NAME (Please Print) ..................................................
ADDRESS ..........................................................
TELEPHONE NO. ................. Best time to call you ...........
AGE .......... OCCUPATION ...................... SEX .......... 
CAN YOU COME:
WEEKDAYS ...... EVENINGS ...... WEEKENDS ..........
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 09:
Paper Prototyping

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 10: Testing

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Today

Presentations on Thursday

- Balance
- MiPhone
- Ecotopia
- Social Reconnection
- FoodPic
- TagLine

Presentations on Friday Afternoon

- Neat
- Poliscope
- Sitless
- SmartClothing
- SchoolView
- Timeout

No Section Friday Morning
Today

For Presentations

- PowerPoint or PDF
- Mind Your Time Limits
- Peer Feedback Forms

Project 3a Due for Tuesday

In-Class Design, Prototype, Test
Testing and Patterns
In-Class Design, Prototype, Test

Design and prototype a new touchscreen alarm clock to be deployed in a very high end hotel brand. Your alarm clock should be immediately usable for tired, busy, or just-don’t-want-to-be-bothered travelers who will spend zero time learning your interface.

In addition to displaying the current time, your alarm clock should include basic functionality for:

- turning the alarm on/off
- setting the wake-up time
- anything else you think is appropriate

Guests will interact with your alarm using a touch panel.
Task Design is Important

The goal of a test is to figure out how a person interacts with an interface in the wild...

There are two possible explanations for why a test does not find significant problems:

- The interface does not have significant problems
- The test itself has significant problems
Task Design is Important

Testing is not entirely in the wild

As a part of focusing the test, you often need to give a person a somewhat artificial task

The artificiality of the task may influence how people interact with an interface...

...and thus may influence the outcomes and insights gained through user testing
Bad: Artificial Subgoals

People using the design “in the wild” may not necessarily form these same subgoals.

The task should give one top-level goal, a people should form their subgoals while pursuing this.

Now you want to choose the type of paper you want to print your document on. Lets imagine that Bin “B” has the paper you want to print your paper on, please complete this task.

Now set the darkness of your copies to about 50% dark. After setting the darkness, you decide you want to print 2 sides of copies on two sides of paper. Please complete this task.
Bad: Artificial Ordering

With an artificial ordering of information or subgoals, people might not proceed in this order.

The ordering might also be biased towards the layout of the interface, which would conceal any problems with finding the appropriate control.

- Enter in 10 copies, with lightness set to 10%.
- Choose 1 sided to 2 sided, use paper source bin A.
- Cover sheet needed, using paper bin B for cover sheet.
- Set stapling feature on and collating on.
- Start printing.
Bad: Changing the Task

The task is to make copies, and this happens to involve entering information in the copier interface.

But this task description is an data entry task, “Here is some information. Put it in the interface.”

- Make 23 copies
- With collate
- Cover sheets
- Default darkness
- 1 Sided-> 1 Sided
Bad: Giving the Answers

Tells the person what terminology the interface uses, which they might not otherwise know

lighten = contrast, sorted = collated?

You are a teacher and are trying to make 40 copies of a one-sided magazine article that is 10 pages long for your class tomorrow. Due to the large number of copies, you print the article double-sided, in other words 10 page article would be printed on 5 sheets of paper. Due to the high contrast of the article, you must lighten the copy, in other words change the contrast. You then want the copies to be collated and stapled.
Good: Giving Context

Giving realistic context through scenarios can reduce the artificiality of the task

It’s your first day in the office, starting a new job. You would like to make some copies of several documents that your boss gave you to browse through. Your colleague in the next cubicle tells you that you need an access code to make copies. The code is 5150. You walk over to the copy machine at the end of the hall and realize that it is not the Xerox copier that you are accustomed to... Make 2 copies of the “Company Annual Report”.

Consider: Under-Specified Tasks

Many realistic goals are under-specified, as people have only a general idea what they want

By under-specifying the task, you can elicit realistic confusion and decision-making

You just finished fixing up the old hot rod in the garage and now its time to sell her. Make a couple copies of the pictures you took to send into the used car sales magazines. It’s ok that they’re in black and white but maybe you should lighten them up a bit. Your account billing code is 5150.
Task Design Summary

Task design is difficult and important

Poorly designed tasks mask interface failures

If you are not confident in your task descriptions, have others help you “debug” them before testing
Remote Usability Testing

Conferencing-based testing

Use tools like video conferencing, instant messaging, and screencasting to test with a remote participant

Semi-automated remote testing

Automatic logging and some analysis of usage

Controlled online A/B experiments

Carefully measure results of showing different versions to different sets of live customers
Semi-Automated Remote Usability

Move usability testing online

- participants access the “lab” via web
- answer questions & complete tasks in “survey”
- records actions or screens for playback
- can test many people completing many tasks

Analyze data individually or in aggregate

- playback individual sessions
- find general problem areas
- if needed, look more closely with traditional methods
Semi-Automated Remote Usability
Semi-Automated Remote Usability

1. Find a flat panel monitor that costs less than $1200. Please try to accomplish this task without using the search function.

<table>
<thead>
<tr>
<th>Task</th>
<th>Response(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I was able to complete the task</td>
<td>90%</td>
</tr>
<tr>
<td>I was not able to complete the task</td>
<td>10%</td>
</tr>
<tr>
<td>I think that I was able to complete the task, but I`m not sure</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Response Times**

- Fastest: 00:00:28
- Median: 00:00:41
- Average: 00:00:48.4
- Slowest: 00:01:14

2. What is the price of the monitor you just found?

**Short Freeform**

$1129
Semi-Automated Remote Usability
WebQuilt: Visual Analysis

Goals

- link page elements to actions
- identify behavior/navigation patterns
- highlight potential problems areas

Interactive graph based on web content

- designers can indicate expected paths
- color code common usability interests
- filtering to show only target participants
- use zooming for analyzing data at varying granularity
WebQuilt: Visual Analysis
WebQuilt: Visual Analysis
WebQuilt: Visual Analysis

http://pda.edmunds.com
Semi-Automated Remote Usability

Now available through a variety of services

Loop11      UserZoom
TryMyUI     Validately
Userlytics  WhatUsersDo
Usertesting.com  YouEye

Unlikely you need to bake your own
Some include mobile testing

http://www.nngroup.com/articles/unmoderated-user-testing-tools
Controlled A/B Experiments

Many names for concept
A/B tests or
Control/Treatment

Randomized
Experimental Design

Controlled experiments

Split testing

Parallel flights

(this section mostly due Ronny Kohavi)
Controlled A/B Experiments

Example: Amazon Shopping Cart Recommendations

Add an item to your shopping cart
Most sites show the cart

At Amazon, Greg Linden had idea to show recommendations based on cart items
Controlled A/B Experiments

Evaluation

    Pro: cross-sell more items
    Con: distract people from checking out

Highest Paid Person’s Opinion:
    Stop the project

Simple experiment run:
    Wildly successful

Marketplace: Solitaire vs Poker

Experiment run in Windows Marketplace / Game Downloads

Which image has the higher clickthrough? By how much?

A: Solitaire game

B: Poker game
Marketplace: Solitaire vs Poker

Experiment run in Windows Marketplace / Game Downloads

Which image has the higher clickthrough? By how much?

A: Solitaire game

A is 61% better

B: Poker game
Never Underestimate Solitaire

OUR COMPUTERS ARE DOWN, SO WE HAVE TO DO EVERYTHING MANUALLY...

SIX CHIX

BY RINA PICCOLO
Never Underestimate Solitaire

Activision Acquires Candy Crush Maker King Digital For $5.9 Billion

Activision's purchase price for the game maker is a premium to its current price but a discount to its recent IPO price.

King Digital Entertainment, the company behind popular Facebook games such as Candy Crush, seems to have decided that being a publicly-traded entity isn't all it's cracked up to be. King announced late Monday that it is being acquired by Activision Blizzard, the maker of popular console and PC games such as Call of Duty, for $5.9 billion.

The purchase price of $8.15 a share amounts to a premium of about 16% over the recent closing price for King's stock ($8.15 / 9.52 = 85.2%) - but it's about 20% lower than the price at which the company went public 18 months ago. At that
Conversion rate is percentage of visits that include purchase. Which version has a higher conversion rate?
Conversion rate is percentage of visits that include purchase

Which version has a higher conversion rate?
Checkout Page

Conversion rate is percentage of visits that include purchase

A

B

Which version has a higher conversion rate?

Coupon Code decreases by factor of 10
Office Online Feedback

Feedback A puts everything together, whereas feedback B is two-stage: question follows rating.

Feedback A just has 5 stars, whereas B annotates the stars with “Not helpful” to “Very helpful” and makes them brighter.

Which one has a higher response rate? By how much?
Feedback A puts everything together, whereas feedback B is two-stage: question follows rating.

Feedback A just has 5 stars, whereas B annotates the stars with “Not helpful” to “Very helpful” and makes them brighter.

Which one has a higher response rate? By how much? B gets more than double response rate.
Another Feedback Variant

Call this variant C. Like B, also two stage.

Which one has a higher response rate, B or C?

C
Another Feedback Variant

Call this variant C. Like B, also two stage.
Which one has a higher response rate, B or C?

C outperforms B by a factor of 3.5
MSN US Home Page
Proposal: New Offers module below Shopping

Control

Treatment
Experiment Results

Ran A/B test for 12 days on 5% of MSN US visitors
Experiment Results

Ran A/B test for 12 days on 5% of MSN US visitors

Clickthrough:
Page views per person-day:
Experiment Results

Ran A/B test for 12 days on 5% of MSN US visitors

Clickthrough: decreased 0.49%

Page views per person-day: decreased 0.35%
Experiment Results

Ran A/B test for 12 days on 5% of MSN US visitors

Clickthrough: **decreased 0.49%**

Page views per person-day: **decreased 0.35%**

Value of click from home page: X cents

Net = Expected Revenue –
Value Per Click * Direct lost clicks –
Value Per Click * Lost Due to Decreased Views
Experiment Results

Ran A/B test for 12 days on 5% of MSN US visitors

Clickthrough: decreased 0.49%
Page views per person-day: decreased 0.35%

Value of click from home page: X cents

\[ \text{Net} = \text{Expected Revenue} - \text{Value Per Click} \times \text{Direct lost clicks} - \text{Value Per Click} \times \text{Lost Due to Decreased Views} \]

Net was negative (in millions of dollars), offers module did not launch
Data Driven Methods Not Just Online

1999
Made from cardboard, the first Netflix mailer weighs more than an ounce. But with only 100,000 customers, reducing material and shipping costs is not yet a priority for the company.

2000
Thick paper replaces cardboard. DVDs are inserted and removed from the top rather than the side.

2000
Full-color printing is introduced. Top-loading is abandoned in favor of side-loading, which is judged more convenient.
Data Driven Methods Not Just Online

2000
Customers are asked to peel off a sticker to reveal Netflix’s return address. The design is eventually deemed too complex.

2000
Made from plastic instead of paper, this mailer is cheaper, but it sometimes inflates when transported on airplanes.

2001
An airhole (the black dot on the left side of the mailer) is added to prevent the package from inflating.

2001
Netflix returns to paper because it’s easier to recycle. Foam padding is added to reduce breakage.
Data Driven Methods Not Just Online

2001
Foam padding is dropped because the benefits don’t justify the cost. The company gives top-loading another try.

2001
Marking a return to side-loading, this mailer is a direct ancestor of the one the company uses today.

2003
Instead of sealing the entire top and bottom, Netflix introduces a circular sticker, affixed only on the top.

2004
A window shows the disc bar code. Speculation is that this enables storing discs in mailers prior to shipping.
Limitations

Drives hill-climbing, but not overall design

A design may be better, but is it good?

Impossible for new designs to compete

Can be difficult to scale to many features

How about we step through a larger example
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 10: Testing
James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 12: Inspection-Based Methods

Lauren Milne

Tuesday/Thursday
11 to 12
MOR 230
Today

In-Class

- Inspection-Based Methods
- Heuristic Evaluation of Paper Prototypes

Revise Prototypes

Usability Testing Check-In for Friday

- Changes from Inspection
- Changes from First Usability Test
Inspection-Based Methods

We have cut prototyping to its minimum

- Sketches, storyboards, paper prototypes
- Rapid exploration of potential ideas

But we need evaluation to guide improvement

- Evaluation can become relatively slow and expensive
- Study participants can be scarce
- May waste participants on fairly obvious problems
Inspection-Based Methods

Simulate study participants

Instead of actual study participants, use inspection to quickly and cheaply identify likely problems

Inspection methods are rational, not empirical

Today we cover two complementary methods

Heuristic Evaluation
Cognitive Walkthrough
Heuristic Evaluation

Developed by Jakob Nielsen

Helps find usability problems in a design

Small set of evaluators examine interface

- three to five evaluators
- independently check compliance with principles
- different evaluators will find different problems
- evaluators only communicate afterwards

Can perform on working interfaces or sketches
Why Multiple Evaluators?

Every evaluator doesn’t find every problem

Good evaluators find both easy & hard ones
Results of Using HE

Discount: benefit-cost ratio of 48

cost was $10,500 for benefit of $500,000

how might we calculate this value?

in-house → productivity; open market → sales

Single evaluator achieves poor results

only finds 35% of usability problems

5 evaluators find ~ 75% of usability problems

why not more evaluators?

Nielsen, 1994
Number of Evaluators?

Proportion of Usability Problems Found

Number of Evaluators

Nielsen, 1994
Decreasing Returns

Nielsen, 1994
Nielsen’s 10 Heuristics

Too few unhelpful, too many overwhelming

“Be Good” versus thousands of detailed rules

Nielsen seeks to create a small set

Collects 249 usability problems
Collects 101 usability heuristics
Rates how well each heuristic explains each problem
Factor analysis to identify key heuristics
Nielsen’s 10 Heuristics

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help recognize, diagnose, and recover from errors
10. Help and documentation
1. Visibility

Visibility of system status

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
1. Visibility

Visibility of system status

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

Refers to both visibility of system status and use of feedback

Anytime wondering what state the system is in, or the result of some action, this is a visibility violation.
Heuristics
Heuristics

Time Left: 00:00:19

46%
Heuristics

Time Left: 00:00:19  searching database for matches

46%
Heuristics

![Windows Defender is scanning your PC]

<table>
<thead>
<tr>
<th>Scan type:</th>
<th>Quick scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start time:</td>
<td>5:11 PM</td>
</tr>
<tr>
<td>Time elapsed:</td>
<td>00:00:06</td>
</tr>
<tr>
<td>Items scanned:</td>
<td>2532</td>
</tr>
</tbody>
</table>
Heuristics

Visibility of system status

pay attention to response time

0.1 sec: no special indicators needed
1.0 sec: user tends to lose track of data
10 sec: maximum duration if user to stay focused on action
longer delays absolutely require percent-done progress bars
2. Real World Match

Match between system and the real world

The system should speak the users’ language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
2. Real World Match

Match between system and the real world

The system should *speak the users’ language*, with words, phrases and concepts *familiar to the user*, rather than *system-oriented terms*. Follow real-world conventions, making information appear in a *natural and logical order*.

Refers to word and language choice, mental model, metaphor, mapping, and sequencing
Heuristics
Heuristics

Mac desktop
- Dragging disk to trash should delete, not eject it

Match system to real world
- Speak the user’s language
- Follow conventions
Heuristics
Heuristics

“Mailto”, “protocol”?

Match system to real world

Speak the user’s language
3. User in Control

User control and freedom

Users often choose system functions by mistake and will need a clearly marked “emergency exit” to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
3. User in Control

User control and freedom

Users often choose system functions by mistake and will need a clearly marked “emergency exit” to leave the unwanted state without having to go through an extended dialogue.

Support undo and redo.

Not just for navigation exits, but for getting out of any situation or state.
Heuristics
Heuristics

User control & freedom
provide “exits” for mistaken choices, undo, redo
don’t force down fixed paths
Heuristics
Heuristics

User control & freedom

provide “exits” for mistaken choices, undo, redo
don’t force down fixed paths

Wizards

must respond to question before going to next
good for beginners, infrequent tasks
not for common tasks
4. Consistency

Consistency and standards

Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
4. Consistency

Consistency and standards

Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

Internal consistency is consistency throughout the same product. External consistency is consistency with other products in its class.
Heuristics
Heuristics

Consistency & Standards
5. Error Prevention

Error prevention

Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.
5. Error Prevention

Error prevention

Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

Try to commit errors and see how they are handled. Could they have been prevented?
Heuristics

My Book RAID Manager

Caution: Changing your RAID configuration will erase all its data in the drive ( J: ), are you sure?

If you wish to continue, enter the confirmation number "029732" below and click Yes.

Confirmation Number: 029732

Yes  No
Heuristics

Prevent Errors
Heuristics

<table>
<thead>
<tr>
<th>The Radiation Dosimetry Program</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Please Enter Desired Dose (in Rems)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Enter Substance</td>
<td>Polonium</td>
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<tr>
<td>Isotope Number</td>
<td>211</td>
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</table>
Heuristics

The Radiation Dosimetry Program

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</table>

Prevent Errors
6. Recognition not Recall

Recognition rather than recall

Minimize the user’s memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
6. Recognition not Recall

Recognition rather than recall

Minimize the user’s memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

People should never carry a memory load
6. Recognition not Recall

Addresses visibility of features & information
    where to find things

Visibility addresses system status & feedback
    what is going on
6. Recognition not Recall

Problems with affordances may go here

hidden affordance: remember where to act
false affordance: remember it is a fake
Heuristics

% rm cse440*
%

Confirm Multiple File Delete

Are you sure you want to send these 4 items to the Recycle Bin?

[Yes] [No]
Heuristics

% rm cse440*
%

Error prevention
Recognition rather than recall
Visibility
7. Flexibility and Efficiency

Flexibility and efficiency of use

Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.
7. Flexibility and Efficiency

Flexibility and efficiency of use

Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

Concerns anywhere users have repetitive actions that must be done manually. Also concerns allowing multiple ways to do things.
Heuristics
Heuristics

Flexibility and Efficiency of Use

accelerators for experts (e.g., keyboard shortcuts) allow tailoring of frequent actions (e.g., macros)
8. Aesthetic Design

Aesthetic and minimalist design

Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
8. Aesthetic Design

Aesthetic and minimalist design

Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

Not just about “ugliness”. About clutter, overload of visual field, visual noise, distracting animations, and so on.
Heuristics
Heuristics

Aesthetic & Minimalist design

no irrelevant information in dialogues
Heuristics

Aesthetic & Minimalist design

no irrelevant information in dialogues
9. Error Recovery

Help users recognize, diagnose, and recover from errors

Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
9. Error Recovery

Help users recognize, diagnose, and recover from errors.

Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

Error prevention is about preventing errors before they occur. This is about after they occur.
Heuristics
Heuristics

Help recognize, diagnose, & recover from errors

error messages in plain language
precisely indicate the problem
constructively suggest a solution
Heuristics

Help recognize, diagnose, & recover from errors
10. Help

Help and documentation

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user’s task, list concrete steps to be carried out, and not be too large.
10. Help

Help and documentation

Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user’s task, list concrete steps to be carried out, and not be too large.

This does not mean that the user must be able to ask for help on every single item.
Heuristic Evaluation Process

Evaluators go through interface several times
- inspect various dialogue elements
- compare with list of usability principles

Usability principles
- Nielsen’s “heuristics”
- supplementary list of category-specific heuristics (competitive analysis or testing existing products)

Use violations to redesign/fix problems
Examples

Can’t copy info from one window to another

  violates “Minimize memory load” (H6)

  fix: allow copying

Typography uses different fonts in 3 dialog boxes

  violates “Consistency and standards” (H4)

  slows users down

  probably wouldn’t be found by usability testing

  fix: pick a single format for entire interface
Heuristics

Adobe Illustrator

You are saving this document in Adobe Illustrator 9.0 format. Saving this document in an older format may disable some editing features when the document is read back in.

Yes  No
Heuristics

What happens if you press No?

violates “User control and Freedom” (H4) “Prevent Errors” (H5)

fix: replace with “Ok” and “Cancel”
Phases of Heuristic Evaluation

1) Pre-evaluation training
give expert evaluators needed
domain knowledge & information on the scenario

2) Evaluation
individuals evaluate interface & make lists of problems

3) Severity rating
determine how severe each problem is

4) Aggregation
group meets & aggregates problems (w/ ratings)

5) Debriefing
discuss the outcome with design team
How to Perform Evaluation

At least two passes for each evaluator
  first to get feel for flow and scope of system
  second to focus on specific elements
If system is walk-up-and-use or evaluators are domain experts, no assistance needed
  otherwise might supply evaluators with scenarios
Each evaluator produces list of problems
  explain why with reference to heuristic
  be specific & list each problem separately
1. [H4 Consistency]

The interface used the string "Save" on the first screen for saving the user's file, but used the string "Write file" on the second screen. Users may be confused by this different terminology for the same function.
How to Perform Heuristic Evaluation

Why separate listings for each violation?
- risk of repeating problematic aspect
- may not be possible to fix all problems

Where problems may be found
- single location in interface
- two or more locations that need to be compared
- problem with overall structure of interface
- something that is missing

common problem with paper prototypes
(sometimes features are implied by design documents and just haven’t been “implemented” – relax on those)
Severity Rating

Used to allocate resources to fix problems
Estimates of need for more usability efforts
Combination of
  frequency
  impact
  persistence (one time or repeating)
Should be calculated after all evaluations are in
Should be done independently by all judges
Severity Rating

0 - Do not agree this is a problem.

1 - Usability blemish. Mild annoyance or cosmetic problem. Easily avoidable.

2 - Minor usability problem. Annoying, misleading, unclear, confusing. Can be avoided or easily learned. May occur only once.

3 - Major usability problem. Prevents users from completing tasks. Highly confusing or unclear. Difficult to avoid. Likely to occur more than once.

4 - Critical usability problem. Users will not be able to accomplish their goals. Users may quit using system all together.
Example Heuristic Violation

1. [H4 Consistency] [Severity 3]

The interface used the string "Save" on the first screen for saving the user's file, but used the string "Write file" on the second screen. Users may be confused by this different terminology for the same function.
Debriefing

Conduct with evaluators, observers, and development team members
Discuss general characteristics of interface
Suggest potential improvements to address major usability problems
Development team rates how hard to fix
Make it a brainstorming session
Fixability Scores

1 - Nearly impossible to fix. Requires massive re-engineering or use of new technology. Solution not known or understood at all.

2 - Difficult to fix. Redesign and re-engineering required. Significant code changes. Solution identifiable but details not fully understood.

3 - Easy to fix. Minimal redesign and straightforward code changes. Solution known and understood.

4 - Trivial to fix. Textual changes and cosmetic changes. Minor code tweaking.
Example Heuristic Violation

1. [H4 Consistency] [Severity 3] [Fix 4]

The interface used the string "Save" on the first screen for saving the user's file, but used the string "Write file" on the second screen. Users may be confused by this different terminology for the same function.

Fix: Change second screen to "Save".
Alternative Inspection-Based Methods

Cognitive Walkthrough

Helps surface different types of usability problems
Consider this as a complement to heuristic evaluation

Action Analysis

Low-level modeling of expert performance
Be aware of GOMS, but you may never encounter it
Cognitive Walkthrough

Evaluation method based on:

- A person works through an interface in an exploratory manner
- A person has goals
- The person is applying means-ends reasoning to work out how to accomplish these goals

Evaluation by an expert, who goes through a task while simulating this cognitive process.
Preparation: Need Four Things

1) User description, including level of experience and any assumptions made by the designer
2) System description (e.g., paper prototype)
3) Task description, specifying the task the expert has to carry out, from a user’s point of view
4) Action sequence describing the system display and the user actions needed to complete the given task. One system display and one user action together are one step.
Cognitive Walkthrough Process

Expert reads the user, system, task descriptions and carries out the task by following the action list.

At each step in action list, asks four questions.

Record problems similar to heuristic evaluation.
Believability

1) Will the user be trying to produce whatever effect the action has?

2) Will the user be able to notice that the correct action is available?

3) Once the user finds the correct action at the interface, will they know that it is the right one for the effect they are trying to produce?

4) After the action is taken, will the user understand the feedback given?
GOMS: Goals, Operators, Methods, Selection
Developed by Card, Moran and Newell

Walk through sequence of steps
Assign each an approximate time duration
Sum to estimate overall performance time

1. Select sentence
   Reach for mouse H 0.40
   Point to first word P 1.10
   Click button down K 0.60
   Drag to last word P 1.20
   Release K 0.60
   3.90 secs
Inspection vs. Usability Testing

Inspection is

- Is much faster
- Does not require interpreting user actions
- May miss problems or find false positives

Usability testing is

- More accurate, by definition
- Account for actual users and tasks

One approach is to alternate between them
- Find different problems, conserve participants
Class exercise

Heuristic evaluation of paper prototypes
Phases of Heuristic Evaluation

1) Pre-evaluation training
give expert evaluators needed domain knowledge & information on the scenario

2) Evaluation
individuals evaluate interface & make lists of problems

3) Severity rating
determine how severe each problem is

4) Aggregation
group meets & aggregates problems (w/ ratings)

5) Debriefing
discuss the outcome with design team
Lecture 13: Designing for Diverse Needs

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Today

Usability Testing Check-Ins Tomorrow

UIST Report

Designing for Diverse Needs
A Basic Tenet of Design

If you do not actually understand your design problem, then you cannot make the best design.
A Basic Tenet of Design

You are not designing for yourself

You bring a lot of background to the table
That background is your asset
But you also need to be mindful of it

You need to understand the context of your design and the people who will use it

What this means can vary widely
And may be beyond what you can or will do
A Basic Tenet of Design

You are not designing for yourself

You bring a lot of background to the table
That background is your asset
But you also need to be mindful of it

You need to understand the context of
your design and the people who will use it

What this means can vary widely
And may be beyond what you can or will do
Pinkification

This is a really complicated issue

But it is not new

We will start here

Then work through more obvious problems
Finally! For years I've had to rely on pencils, or at worst, a twig and some drops of my feminine blood to write down recipes (the only thing a lady should be writing ever). I had despaired of ever being able to write down said recipes in a permanent manner, though my men-folk assured me that I "shouldn't worry yer pretty little head". But, AT LAST! Bic, the great liberator, has released a womanly pen that my gentle baby hands can use without fear of unlady-like callouses and bruises. Thank you, Bic!
Bic for Her

It is very, very hard to imagine that the people who made the decision to launch “Bic for Her” were the same women expected to buy them.

http://www.forbes.com/sites/davidvinjamuri/2012/08/30/bic-for-her-what-they-were-actually-thinking-as-told-by-a-man-who-worked-on-tampons/
Apple HealthKit Launch

“with Health, you can monitor all of your metrics that you’re most interested in”
Apple Software executive Craig Federighi

Apple HealthKit Launch

“with Health, you can monitor all of your metrics that you’re most interested in”
Apple Software executive Craig Federighi

“If you’re a human who menstruates, you’re shit out luck”

“The fact that it’s a women’s issue isn’t grounds for dismissal”

Kodak, 1926

Kodak launched this black camera in 1926

It was successful, but was selling more to men

Engaged Walter Dorwin Teague to design a model that would appeal to women

His solution was to release a the camera in 5 different colors, each packed in a pseudo-silk lined box, where the box and liner matched the color of the camera

Kodak Vest Pocket Series III (1926)
Walter Dowrin Teague
Vanity Kodak (1928)
Apple launched this white iPod in 2001. It was successful, but was selling more to men. Designed a model that would appeal to women. Their solution was a smaller version of the iPod in 5 different colors.
Jonathan Ive
Apple iPod Mini (2004)

Walter Dorwin Teague
Vanity Kodak (1928)
Observations by Buxton

Same basic design brief

- Same use of color
- Same number and choice of colors
- Same simultaneous release of colors

Teague/Kodak example is a classic

- Known to any trained industrial designer
- Jonathan Ive is an extremely well trained designer
- Draws inspiration from the past
How About Less Controversial

Our perception of the trustworthiness and usability of a website is dramatically shaped by a first impression of appeal

How about we examine appeal around the world

Throw in age and gender for good fun

Reinecke and Gajos, CHI 2014
An Activity

Please rate the website you have just seen based on visual appeal.

very unappealing

very appealing
Please rate the website you have just seen based on visual appeal.
Tapir Design specialises in producing attractive, stylish websites that are accessible to all Internet users, regardless of the web browser or computer operating system that they use.
Please rate the website you have just seen based on visual appeal.

very unappealing

very appealing
Hotel Chez Lando

Welcome to Hotel Chez Lando!

Hotel Chez Lando, your first window to Rwanda. At Chez Lando, we apply the tradition of Rwandan hospitality to the needs of modern travelers; we cater to the smallest detail of your stay. Our quaint garden-style hotel is located just five minutes from Kigali International Airport and is right on the way to the heart of town.

Sixteen years after the Genocide, Hotel Chez Lando is opening its new Bar, new Restaurant with Terrace and new Meeting Hall where comfort and style meet with the national garden. The architecture of the new additions blends with its environment, elegant and modern, it is matching the new face of Rwanda.

***Special Offers***

- We offer a free breakfast, airport shuttle & Wi-Fi. Just mention the arrival time, flight name & number in your booking (price requested part in case of online booking) (VISA & Master Card Accepted)

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Hotel Chez Lando
P.O. Box 1519
Kigali Rwanda - Rwanda
+250 252 593 904 / +250 788 380 309
Email: info@chezlando.com
Please rate the website you have just seen based on visual appeal.

very unappealing

very appealing
Please rate the website you have just seen based on visual appeal.

very unappealing

very appealing
Popular Rwandan Website

Keep track of your account on the go. With SMS & Email Alerts

You want to acquire your first drive?

Carry your bank with you 24/7

Simple things that make life easier.

Send izigasi!

Banque Populaire du Rwanda Tariff Guide

Exchange rates:

<table>
<thead>
<tr>
<th>Currency</th>
<th>Selling</th>
<th>Buying</th>
</tr>
</thead>
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</tr>
<tr>
<td>CHF</td>
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<td>757.42316</td>
</tr>
</tbody>
</table>
Large Scale Data Collection

2.4 million ratings
39,975 participants
430 websites
Visual Feature Analysis

2.4 million ratings
39,975 participants
430 websites
39 image metrics describing website perceived colorfulness and complexity

Age, country, gender, education

Reinecke and Gajos, CHI 2014
Plotting Appeal by Complexity
Plotting Appeal by Colorfulness

Reinecke and Gajos, CHI 2014
Other Countries

- Germany
- Macedonia
- Hong Kong

- Colorfulness
- Complexity

Graphs showing visual appeal and colorfulness & complexity for different countries.
Reinecke and Gajos, CHI 2014
Abandoning “One Best Design”

People have different preferences

- We can study these preferences
- We can even predict these preferences

How should we think about differences

- One powerful viewpoint is social justice
Accessibility is the Law

National Federation of the Blind vs. Target, 2006

Americans with Disabilities Act, 1990

  Requires accessibility in employment, public entities and public transportation, public accommodations and commercial facilities

Rehabilitation Act, 1973

  Section 508, 1998

  Mandates federal procurement of accessible electronic and information technologies
Universal Design vs. Assistive Technology
Personal Texting by Deaf People

Teletypewriter (TTY) used by deaf people in their homes circa 1970

1990s TTY with built-in acoustic modem

SMS texting
People with Disabilities

1 billion people worldwide

15% of the population

50 million people in US

Including yourself if you are fortunate to live to develop disabilities
A Social Justice Problem

1 billion people worldwide
  15% of the population

50 million people in US

Including yourself if you are fortunate to live to develop disabilities

16% of people in the US
10% of workforce
5% of STEM workforce
1% of PhDs in STEM
Current State of Devices

Slide Rule, Kane et al, ASSETS 2008

Apple VoiceOver
Current State of Devices

Slide Rule, Kane et al, ASSETS 2008

Apple VoiceOver
Equal Access to Information

Is this access equal?
Equal Access to Information

Is this access equal?

Some dimensions to consider

Cost
Speed
Accuracy
Ease

It simply being possible is not enough
A Closer Look at Text Entry
A Closer Look at Text Entry
Contrast with Braille Input
Contrast with Braille Input
Ability-Based Design

States that all interfaces make assumptions about the abilities needed to use them

Any one-size-fits-all design is therefore inaccessible to many people

Instead of asking people to struggle to adapt, asks that interfaces adapt or be adaptable to match the abilities of each person

Wobbrock, TACCESS, 2011
Perkinput
Perkinput
Perkinput

Detect Maximum likelihood to decide which finger input each touch.

Azenkot et al, GI 2012
Update

Shift the hit distributions towards the input points.

Perkinput
Perkininput
Perkinput
Perkinput
Speed and Accuracy

**Speed**

- Perkininput
- VoiceOver

**Accuracy**

- VoiceOver
- Perkininput

---

Azenkot et al, GI 2012
Another Problem
Another Problem
PassChords
PassChords
PassChords
PassChords
PassChords
PassChords
PassChords
PassChords
Time to Authenticate

- PassChords: 2 seconds
- VoiceOver PINs: 8 seconds

Azenkot et al, ASSETS 2012
Accuracy

Failure Rate

PassChords

VoiceOver PINs

Azenkot et al, ASSETS 2012
What About Security?
What About Security?

One measure is Guessing Entropy

The minimum number of bits needed to encode the set of all possible passwords

4-digit PINS: 12.7 bits

Azenkot et al, ASSETS 2012
Finger Pattern Frequency

Note the relative absence of three-finger chords.
What About Security?

One measure is Guessing Entropy

The minimum number of bits needed to encode the set of all possible passwords

4-digit PINS: 12.7 bits
4-tap PassChords: 12.6 bits

Azenkot et al, ASSETS 2012
Speech Input

Azenkot et al, ASSETS 2013
When of my hobbies is hiking. I really enjoyed getting away...

The triangle consist of a 2 mile hike to the beach, I three-mile hike along the beach, and a 2 mile hike back.

It is a very common hike, but I knew to the northwestern if you like I need to do it.
When one of my hobbies is hiking. I really enjoyed getting away… The triangle consists of a 2 mile hike to the beach, I three-mile hike along the beach, and a 2 mile hike back. It is a very common hike, but I knew to the northwestern if you like I need to do it.
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Serial Access in Reviewing Transcript

Azenkot et al, ASSETS 2013
When one of my hobbies is hiking, I really enjoyed getting away. The triangle consists of a 2-mile hike to the beach, a 3-mile hike along the beach, and a 2-mile hike back. It is a very common hike, but if you like I need to do it.
Reviews and Edits

80% of composition time in review and edits

- Natural speech
- Speech input
- Keyboard

Words Per Minute (WPM)
Spifi
Spifi
Spifi
Spifi
Recognize Speech as N-best List

Do you need a day?
Do you need today?
Do you need it today?
Do you need to today?
Find Uncertain Words

Do you need a day?
Do you need today?
Do you need it today?
Do you need to today?
Do you need ** *******

Azenkot et al, ASSETS 2013
Split Into Phrases and Align Alternatives

Do you need a day?
today?
it today?
to today?

Azenkot et al, ASSETS 2013
Accessibility is More than Text Entry

“Sometimes you don’t follow along as well unless [you are] one on one.”

Eyes-Free Yoga, Rector et al, ASSETS 2013
Accessibility is More than Text Entry

Eyes-Free Yoga, Rector et al, ASSETS 2013
Accessibility is More than Text Entry

Eyes-Free Yoga, Rector et al, ASSETS 2013
Accessibility is More than Text Entry

OneBusAway

NW MARKET ST & BALLARD AVE NW
Step # 18120 - E bound

<table>
<thead>
<tr>
<th>route</th>
<th>destination</th>
<th>minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>DOWNTOWN SEATTLE</td>
<td>-3</td>
</tr>
<tr>
<td>44</td>
<td>UNIVERSITY OF WASHINGTON MEDICAL CENTER</td>
<td>-3</td>
</tr>
<tr>
<td>17</td>
<td>DOWNTOWN SEATTLE</td>
<td>NOW</td>
</tr>
<tr>
<td>75</td>
<td>BALLARD</td>
<td>8</td>
</tr>
<tr>
<td>44</td>
<td>UNIVERSITY OF WASHINGTON MEDICAL CENTER</td>
<td>9</td>
</tr>
<tr>
<td>18</td>
<td>DOWNTOWN SEATTLE</td>
<td>15</td>
</tr>
<tr>
<td>44</td>
<td>UNIVERSITY OF WASHINGTON MEDICAL CENTER</td>
<td>21</td>
</tr>
<tr>
<td>17</td>
<td>DOWNTOWN SEATTLE</td>
<td>22</td>
</tr>
<tr>
<td>44</td>
<td>UNIVERSITY OF WASHINGTON MEDICAL CENTER WALLINGFORD</td>
<td>35</td>
</tr>
</tbody>
</table>

Last Update: 03:57 PM

Ferris et al, 2010
Accessibility is More than Text Entry

How do you find a bus stop?
Accessibility is More than Text Entry

StopInfo, Campbell et al, ASSETS 2014
What is Disability?

Old model is medical, focused on the individual with a mindset of “fixing” an impairment

Current model understands disability is imposed by society and design not accounting for diversity

“Disability is thus not just a health problem. ...the interaction between features of a person’s body and features of the society in which he or she lives. Overcoming the difficulties...requires interventions to remove environmental and social barriers.”
What is Disability?

Impairment

a problem in body function or structure

Activity Limitation

a difficulty encountered by a person in executing a task or action

Participation Restriction

a problem experienced by a person in involvement in life situations
A Basic Tenet of Design

You are not designing for yourself

You need to understand the context of your design and the people who will use it

We need diversity in who is doing design

As a field, our work suffers because of this failing
It is very, very hard to imagine that the people who made the decision to launch “Bic for Her” were the same women expected to buy them.
It is very, very hard to imagine that the people who made the decision to launch “Bic for Her” were the same women expected to buy them.

There are lots of ways to make an awful mistake, but some of the worst could be avoided if consumer companies were staffed by actual consumers. Entrepreneurs rarely make this kind of mistake because they tend to start businesses to solve their own problem. That’s why they rarely look as silly as Bic does right now.

http://www.forbes.com/sites/davidvinjamuri/2012/08/30/bic-for-her-what-they-were-actually-thinking-as-told-by-a-man-who-worked-on-tampons/
A Social Justice Problem

1 billion people worldwide
15% of the population

50 million people in US
Including yourself if you are fortunate to live to develop disabilities

16% of people in the US
10% of workforce
5% of STEM workforce
1% of PhDs in STEM

“Entrepreneurs ... tend to start businesses to solve their own problem”

Diverse participation is critical in effective design
Lecture 13: Designing for Diverse Needs

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 14: Patterns
James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Today

Course Progress

- Mockups Due Friday
- Exam Tuesday
- Report, Website, Presentations After Break
- Reading 5 Posted

Patterns

Peer Critique of Usability Testing Results
Limitations of Testing

Drives hill-climbing, but not overall design

A design may be better, but is it good?

Impossible for new designs to compete

Can be difficult to scale to many features

How about we step through a larger example
New CD Releases!
only $11.88

Red Hot Price for the Chili Peppers' New CD: $11.88!
Evolving after the popularity of Californication, the Chili Peppers release a new album featuring the hit song "By the Way".

In-Stock Now!
Weezer, Weezer

Gateway Desktop Under $400!
$399.00
Includes an 800MHz Intel Celeron processor, 256MB RAM, 20GB hard drive, DVD-ROM drive, and more!

Save Over $100 on Dell Latitude CPx!
$639.00
Get the best quality at the best price with the Dell Latitude CPx featuring an Intel Pentium III@ 500 MHz processor, 256 MB RAM and 12 GB hard drive.

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Just Released: The Royal Tenenbaums for $18.45
Wes Anderson (Rushmore) directs a motley crew of talented actors in this hysterical comedy about the rise and fall of an eccentric family.

In-Stock Now!
Monster's Ball (DVD)
$11.25 $24.99
Weezer (2001)

Weezer

Our best price: $6.99

List Price: $18.97 (Save: $11.98)

Find out more...
Full product info, Product Reviews

Not ready to buy?
Add to your Wish List, Preorder this item, May we also suggest...

Like New Sorted by Price

<table>
<thead>
<tr>
<th>Price</th>
<th>Total Price</th>
<th>Seller (Rating)</th>
<th>Seller Comments</th>
</tr>
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<td>Disk, case, and liner all in excellent c</td>
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<td>$8.25</td>
<td>$10.70</td>
<td>dazzyliz (1205)</td>
<td>SEALED NEW BMG</td>
</tr>
<tr>
<td>$8.35</td>
<td>$10.75</td>
<td><a href="mailto:naoija@hotmail.com">naoija@hotmail.com</a> (35)</td>
<td>Perfect condition</td>
</tr>
</tbody>
</table>

Standard shipping (USPS Media Mail) for this item is $2.30.

About this album:
- Song List
- Album Credits
- Album Notes
- Editorial
- Customer Reviews

About the Artist:
- Other Works

Spread the Word:
- Write a Review
- Email a Friend

Very Good Sorted by Price

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<td></td>
</tr>
<tr>
<td>$9.00</td>
<td>$11.45</td>
<td>saint.timothy (18)</td>
<td>Great shape...first class ship</td>
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</tbody>
</table>
Redeeming a Gift Certificate or Coupon?

**Shopping Cart**

**Weezer (2001)** Weezer, Weezer (Music)
CD, Release Year: 2001  
Seller: naolia@hotmail.com (35)  
Condition: Like New • Notes: Perfect condition

- Item: $8.30
- Media Mail: $2.45  
(Change Shipping Method)

**Total:** $10.75

**Gift Certificates and Coupons**

Redeeming your Half.com Gift Certificate or Coupon is easy. Just enter your Claim Code in the box to the right and click "Redeem".
Checkout

Enter your User ID and Password.

Are you a half.com user having trouble signing in? Get help now.

eBay User ID

You can also use your registered email.

eBay Password

Forgot your password?
Learn how to protect your account

Secure Sign In or Register Now

Keep me signed in on this computer unless I sign out. Learn more.

Having problems signing in? Get help now.

For more information about sign in, visit sign in help.
Step 1 - Choose Shipping Address

Ship my order to:

Jason Hong
387 Soda Hall Computer Science UC Berkeley
Berkeley, CA 94720

Use This Address

OR

Enter a new shipping address:

Name
Street address
City
State
Select State
ZIP code
Country
USA

Save Changes
Testing in a Larger Design

OK, SO THE STRATEGY BEHIND THIS REDESIGN IS-
WAIT, DID YOU INCREASE THE BORDER SIZE??
HOLY CRAP! WE BETTER ISOLATE AND RE-TEST!

BUT... THAT CHANGE IS JUST PART OF A LARGER DESIGN...

CALM DOWN, PIXEL-BOY. WE'VE GOT SCIENTIFIC WAYS TO HANDLE THIS.

3 MONTHS LATER...

SEE? THAT BORDER WOULD HAVE COST US 0.012%. THANK GOODNESS I STOPPED YOUR SLOPPY "REDESIGN."

ABSOLUTELY. ONCE AGAIN OUR BUSINESS IS SAFE.

OK/Cancel
The Smartest Place to Buy and Sell  Books, Music, Computers, Electronics, DVDs & more...

New CD Releases!
only $11.88

More Hot New Releases!

Red Hot Price for the Chili Peppers' New CD: $11.88!
Evolving after the popularity of Californication, the Chili Peppers release a new album featuring the hit song "By the Way".

In-Stock Now!

<table>
<thead>
<tr>
<th>Music</th>
<th>Our Price</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weezer, Weezer</td>
<td>$6.99</td>
<td>$18.97</td>
</tr>
<tr>
<td>Gutterflower, Goo Goo Dolls</td>
<td>$9.00</td>
<td>$18.98</td>
</tr>
<tr>
<td>The Slim Shady LP, Eminem</td>
<td>$2.98</td>
<td>$18.97</td>
</tr>
<tr>
<td>Echoes, Pink Floyd</td>
<td>$11.54</td>
<td>$24.97</td>
</tr>
<tr>
<td>18, Moby</td>
<td>$10.99</td>
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Includes an 800MHz Intel Celeron processor, 256MB RAM, 20GB hard drive, DVD-ROM drive, and more!

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Wes Anderson (Rushmore) directs a motley crew of talented actors in this hysterical comedy about the rise and fall of an eccentric family.

In-Stock Now!

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<td>$11.25</td>
<td>$24.99</td>
</tr>
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</table>

More great deals...
• What site is this?
  – Logo in top-left corner denotes the site
  – Another logo at top-right to reinforce
  – examples of SITE BRANDING
- What kind of site is this?
  - Shopping cart icon
  - Tab row content & categories on left
  - Prices in content area
  - UP-FRONT VALUE PROPOSITION
  - example of PERSONAL E-COMMERCE
• What can I do here?
  – Welcome for new visitors
  – Tab row / Search on top
  – “Categories”
  – Prices
  – Examples of OBVIOUS LINKS
Most important info visible without scrolling

ABOVE THE FOLD
• What site am I at?
  – Logo in upper-left reinforces brand, can click to go to home
  – Same font, layout, color scheme also reinforces
  – examples of SITE BRANDING (E1)
• Where am I in the site?
  – “Home > Music” are LOCATION BREAD CRUMBS
  – TAB ROW says “Music”
  – Album cover, “Product Highlights”, and CD cover
• Can I trust these sellers?
  - Who am I buying from?
  - Are they reputable?
  - What about shipping?
NEW: Counting Crows: Hard Candy $11.88 Save 37%!

Home > Music

Weezer (2001)
Weezer

Our best price: $6.99
List Price: $18.97 (Save: $11.98)

Find out more...
Full product info, Product Reviews

Not ready to buy?
Add to your Wish List, Preorder this item, May we also suggest...

Like New Sorted by Price

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<td>dazzyliz (1205)</td>
<td>SEALED NEW BMG</td>
</tr>
<tr>
<td>$8.88</td>
<td>$10.86 Media Mail</td>
<td>hotdoggie (35)</td>
<td>Excellent condition</td>
</tr>
</tbody>
</table>

Very Good Sorted by Price

<table>
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<td>$11.45 Media Mail</td>
<td>sainttimothy (18)</td>
<td>Great shape...first class ship</td>
</tr>
</tbody>
</table>

• The Fold
  - Hmm, what’s below here?
• Impulse buy
  • PERSONALIZED RECOMMENDATIONS
• About this album
• Lots of unused space
• Still more info below…
Album Notes
Weezer: Rivers Cuomo (vocals, guitar); Brian Bell (guitar); Matt Sharp (bass); Patrick Wilson (drums). Recorded at Cello Studios, Los Angeles, California in December 2000. In 1994 Weezer burst onto the music scene, reaching platinum status with their debut, and in the process proving that there was still room in an airbrushed MTV world for unrepentant power pop played by decidedly non-airbrushed guys. Following a brief sojourn into semi-deconstructionism, 1997’s PINKERTON, the four men who make up Weezer serve up a third offering, WEEZER 2001, returning to the sound and producer of their successful debut. Nowhere does producer Ric Ocasek define his trademark refined power pop style more than with Weezer. Unlike the immediate, obvious pop hooks of the string of singles on the first album, though, the songs on WEEZER 2001 may take a few listens to settle in. However, once the subtle-yet-undeniable refrains of such tracks as "Crab," "Don't Let Go," and first single "Hash Pipe" make their way into your skull, they're there to stay, as furious, fuzzy, layered guitars compliment Rivers Cuomo's raw, vulnerable vocals. While this disc clocks in at less than a half-hour long, it packs more hooky wallop than many double live albums.

Product Reviews

Editorial Reviews
Spin (01/01/2002)
Ranked #9 in Spin's Albums of the Year 2001
Ranked #13 in AP's 25 Best Albums of 2001

Excellent tunes in less than half an hour... Rolling Stone (6/7/01, p.110) - 4 out of 5 stars
Rivers Cuomo's shrink another hot tub... B

Customer Reviews
Rated 4.3 out of 5.0 by 29 raters.
» Read Customer Reviews
» Rate this item

- Is this product any good?
  - Editorial reviews
  - Customer reviews
  - RECOMMENDATION COMMUNITY
People with similar tastes also enjoyed...

**Redeeming a Gift Certificate or Coupon?**

**Shopping Cart**

**Weezer (2001)** Weezer, Weezer (Music)
CD, Release Year: 2001
Seller: naolia@hotmail.com (35)
Condition: Like New • Notes: Perfect condition

Move to WishList • Remove from Cart • Find another one

---

**Gift Certificates and Coupons**

 Redeeming your Half.com Gift Certificate or Coupon is easy. Just enter your Claim Code in the box to the right and click "Redeem."
• What site am I at?
  – Logo in upper-left
  – Colors, layout, font
  – examples of SITE BRANDING
Where am I in the site?

- Last link clicked was “Buy!”
- “Shopping Cart” and “Proceed to Checkout” reinforce that this is “the right page”
- SHOPPING CART
• Cross-selling
  – Possibly a pleasant surprise
  – Impulse buy
  – CROSS-SELLING & UP-SELLING
• What am I going to buy?
  – Easy to remove
  – Easy to move to wishlist
• How much will it cost?
  – Shipping costs there, no nasty surprises
• SHOPPING CART
• What can I do?
  – “Proceed to Checkout”
    HIGH VISIBILITY ACTION BUTTON
    – Visually distinct
    – 3D, looks clickable
    – Repeated above and below fold
Checkout

Enter your User ID and Password.

Are you a half.com user having trouble signing in? Get help now.

eBay User ID

You can also use your registered email.

eBay Password

Forgot your password? Learn how to protect your account

Secure Sign In or Register Now

Keep me signed in on this computer unless I sign out. Learn more.

Having problems signing in? Get help now.

For more information about sign in, visit sign in help.
• What if I don’t have a User ID?
• What if I forgot my password?
• SIGN-IN/NEW ACCOUNT options
Step 1 - Choose Shipping Address

Ship my order to:

Jason Hong  
387 Soda Hall Computer Science UC Berkeley  
Berkeley, CA 94720

OR

Enter a new shipping address:

Name
Street address
City  
If U.S. Military, enter APO/FPO for City.  
State  
Select State  
If U.S. Military, select AE, AP or AA from bottom of list for State.
ZIP code
Country  
USA

Save Changes
• What site?
  – Logo, layout, color, fonts

• Where in site?
  – Checkout, step 1 of 3
  – “Choose shipping address”
  – QUICK-FLOW CHECKOUT
• Note what’s different
  – No tab rows
  – No impulse buys
  – Only navigation on page takes you to next step

• This is a PROCESS FUNNEL
  – Extraneous info and links removed to focus customers
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Seller: <a href="mailto:naojia@hotmail.com">naojia@hotmail.com</a> (35)</td>
<td>Media Mail: $2.45</td>
</tr>
<tr>
<td>Condition: Like New * Notes: Perfect condition</td>
<td>Subtotal: $10.75</td>
</tr>
<tr>
<td></td>
<td>Total Merchandise: $8.30</td>
</tr>
<tr>
<td></td>
<td>Total Shipping: $2.45</td>
</tr>
<tr>
<td></td>
<td>TOTAL: $10.75</td>
</tr>
</tbody>
</table>

**Ship To**

Jason Hong  
387 Soda Hall Computer Science UC Berkeley  
Berkeley, CA 94720  
[Edit / Change Shipping Address](#)

**Bill to**

MasterCard ending with 0155  
Expires 11/2003  
Zipcode: 94709  
[Edit / Change Billing](#)

Use this shipping and billing information as my Speedy Checkout settings.
• Last step of process
  – Step 3, “Place Order”
  – “Place my order” button

• Two HIGH-VISIBILITY ACTION BUTTONS for fold
• No nasty surprises
  – Can see order
  – Total price is same as shopping cart
  – ORDER SUMMARY
- Easy to change shipping and billing
- Easy to save this info
  - Easier to setup info in context of specific task
Design equals Solutions

Design is about finding solutions

Designers often reinvent

Hard to know how things were done before
Why things were done a certain way
How to reuse solutions
Design Patterns

Design patterns communicate common design problems and solutions
Design Patterns

Design patterns communicate common design problems and solutions

First used in architecture [Alexander]

How to create a beer hall where people socialize?

Somewhere in the community at least one big place where a few hundred people can gather, with beer and wine, music, and perhaps a half-dozen activities, so that people are continuously criss-crossing from one to another.

criss-cross paths

open alcoves

activities
Design Patterns

Somewhere in the community at least one big place where a few hundred people can gather, with beer and wine, music, and perhaps a half-dozen activities, so that people are continuously criss-crossing from one to another.

- criss-cross paths
- activities
- open alcoves
Using Design Patterns

Not too general and not too specific

use a solution “a million times over, without ever doing it the same way twice”

Design patterns are a shared language

for “building and planning towns, neighborhoods, houses, gardens, and rooms”

Beer hall is part of a center for public life
Beer hall needs spaces for groups to be alone ALCOVES
A Web of Design Patterns

(8) Mosaic of Subcultures

(31) Promenade

(33) Night Life

(90) Beer Hall

(95) Building Complex

(179) Alcoves

(181) The Fire
Web Design Patterns

Communicate design problems & solutions

how to create navigation bars for finding relevant content

how to create a shopping cart that supports check out

how to make e-commerce sites where people return & buy
NAVIGATION BAR (K2)

Problem: Customers need a structured, organized way of finding the most important parts of your Web site.
NAVIGATION BAR (K2)

Solution diagram

Captures essence on how to solve problem

- Link to home
- First-level navigation
- Second-level navigation
Pattern Groups

Patterns organized by group

- Site genres
- Navigational framework
- Home page
- Content management
- Trust and credibility
- Basic ecommerce
- Advanced ecommerce
- Completing tasks
- Page layouts
- Search
- Page-level navigation
- Speed
- The mobile web
PROCESS FUNNEL (H1)

Problem:

Need a way to help people complete highly specific stepwise tasks

Ex. Create a new account
Ex. Fill out survey forms
Ex. Check out
PROCESS FUNNEL (H1)
• **What’s different?**
  - No tab rows
  - No impulse buys
  - Only navigation on page takes you to next step

• **What’s the same?**
  - Logo, layout, color, fonts
PROCESS FUNNEL (H1)

Problem:

What if users need extra help?
CONTEXT-SENSITIVE HELP (H8)
FLOATING WINDOWS (H6)
FLOATING WINDOWS (H6)
PROCESS FUNNEL (H1)

Solution Diagram
Patterns Support Creativity

Patterns come from successful examples

sites that are so successful that lots of people are familiar with their paradigms

interaction techniques/metaphors that work well across many sites (e.g., shopping carts)

Not too general and not too specific

you need to specialize to your needs

Patterns let you focus on the hard, unique problems of your design situation
Principles, Guidelines, Templates

Patterns help design without over-constraining

unlike principles, patterns are not too general

unlike guidelines, patterns discuss tradeoffs, show good examples, and tie to other patterns

unlike style guides, patterns not too specific, can be specialized to a design

unlike templates, patterns illustrate flows and relationships among different pages
**Background**

All Web applications that lead visitors through stepped tasks—personal e-commerce (A1), self-service government (A4), Web apps that work (A10), and enabling intranets (A11)—need ways to help people succeed at completing the tasks.

**Problem**

Customers often need to complete highly specific tasks on Web sites, but pages with tangential links and many questions can prevent them from carrying out these tasks successfully. People enjoy completing the tasks they start. Yet all kinds of distractions—including links that lead off the critical path, extra steps, and extra content—can inadvertently lead them away from accomplishing their goals. These diversions can have legitimate purposes, however, such as providing continuity, giving visitors opportunities to explore, providing instructions, or providing extra details. Sticking a balance between these goals can be challenging.

**Exemplar**

Dell uses a process funnel consisting of several logical steps that guide customers to quickly configure and purchase a personal computer. Information in a pop-up window shows additional details but keeps customers in the funnel so that they can continue to completion.

**Forces & Solution**

Required to Complete a Task: Customers need to take many steps. A process funnel should be straightforward. Anything less than three steps is not a process funnel, and eight steps is unmanageable. If there are more than eight steps, try to split the process into two or more separate process funnels, or try combining multiple steps into one page. However, this is not always a viable solution because one choice may precede another, and not every page can hold all the information that customers might need at certain points.

Provide a Progress Bar to Let Customers Track Their Progress: Showing a progress bar for how much farther they have to go can be helpful. It is often not worth your time to try to make a progress bar clickable because doing so is unlikely to benefit for customers.

Remove Unnecessary Links and Context-Width Reinforcement: Removing links and content unrelated to the task at hand will reduce the chance of distractions. By indicating where the links are, it becomes easier for users to locate them when they need to. Removing all navigation bars (A2), tabbed pages (A5), and embedded links (A7), leaving buttons (A4) that help visitors reach their goals, take away any content that is superfluous to the task.

Forces: Reinforcing the Web site brand to minimize any disorientation customers might feel from sudden changes in navigation options. Use the same language, look, and logo throughout the Web site so that no one knows they’re still on the same site.
Web Design Patterns

Solution Summary

Bus Stops

Solution Diagram

Related Patterns

Consider These Other Patterns

Many kinds of Web sites use process funnels, including sites for personal e-commerce (A1), self-service government (A4), web apps that work (A10), and enabling intranets (A11). Customers use process funnels when they finalize purchases through quick-flow checkout (F1), when they create new accounts through sign-up/new account (H2), and when they post new messages to a recommendation community (G4), to name some examples.

Remove navigation bars (K2), tab rows (K3), irrelevant action buttons (K4), location bread crumbs (K6), and embedded links (K7) to ensure that customers stay on their paths. However, keep strong site branding (E1) so that customers still know where they are.

Design process funnels to prevent errors (K12), and provide meaningful error messages (K13) when errors do occur.

Track your customers through persistent customer sessions (H5) to avoid problems with the Back button, and to save customer-entered information.

Move extra content, such as context-sensitive help (H8) and frequently asked questions (H7), to pop-up windows (H6) to keep the main task page on the screen. Make the next action visible by keeping it above the fold (L2) and by using high-visibility action buttons (K5).
Pre-Patterns

Patterns require broad adoption and examples

Many version of the same basic idea
Shown successful in many contexts
That is what makes them patterns

This is challenging in novel domains

Pre-patterns are based in weaker evidence

Can help speed diffusion of techniques and results
Can help see relationships among ideas
UbiComp Pre-Patterns

Literature review

Button-up card sorting of lessons from literature

Cut down based on critique by other researchers

---

**Figure 1. AT&T Wireless Find Friends service notifies your friend if you ask for his or her location.**

**Synopsis**

Systems can provide feedback about what is being monitored and recorded.

**Background**

This pattern is one part of providing Appropriate Privacy Feedback to individuals.

**Problem**

How can systems provide feedback about what is being monitored, as well as the current state of the system?

**Solution**

There are at least two different times that notification can be used, during an access and afterwards.
UbiComp Pre-Patterns

B6 • FIND A FRIEND

Figure 1. AT&T Wireless’ mMode service allows customers to add friends to a friend list, find out who is nearby, and call or send messages to them. Users can make themselves invisible whenever they want.

• BACKGROUND
This pattern discusses services that allow people to find where their friends are while allowing those friends some level of privacy. This pattern is useful for GUIDES FOR EXPLORATION AND NAVIGATION (A5).

• PROBLEM
People would like to know where their friends are, for impromptu communication and gatherings. At the same time, those people may not always want to be tracked.

Displaying people’s location • There are several different ways of displaying a person’s location. A straightforward approach is to simply show the location in text, for example “near corner of Euclid Ave and Hearst Ave” or “in Soda Hall”. Another approach is to show the data on a map, or possibly even an ACTIVE MAP (B1) that is constantly updated.

Figure 2. UC San Diego’s ActiveCampus project shows your friends’ location in real time. While useful, this visualization raises many privacy concerns.

Managing privacy concerns • There are many privacy concerns about find-a-friend applications due to the potential for abuse. This is not just the fear of “Big Brother,” but also societal “Little Brother” implications.
# UbiComp Pre-Patterns

<table>
<thead>
<tr>
<th>A – Ubiquitous Computing Genres</th>
<th>B – Physical-Virtual Spaces</th>
<th>C – Developing Successful Privacy</th>
<th>D – Designing Fluid Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describes broad classes of emerging applications, providing many examples and ideas</td>
<td>Associating physical objects and spaces with information and meaning; location-based services; helping users navigate such spaces</td>
<td>Policy, systems, and interaction issues in designing privacy-sensitive systems</td>
<td>How to design for interactions involving dozens or even hundreds of sensors and devices while making users feel like they are in control</td>
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<tr>
<td>Upfront Value Proposition (A1)</td>
<td>Active Map (B1)</td>
<td>Fair Information Practices (C1)</td>
<td>Scale of Interaction (D1)</td>
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<tr>
<td>Personal Ubiquitous Computing (A2)</td>
<td>Topical Information (B2)</td>
<td>Respecting Social Organizations (C2)</td>
<td>Sensemaking of Services and Devices (D2)</td>
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<tr>
<td>Ubiquitous Computing for Groups (A3)</td>
<td>Successful Experience Capture (B3)</td>
<td>Building Trust and Credibility (C3)</td>
<td>Streamlining Repetitive Tasks (D3)</td>
</tr>
<tr>
<td>Ubiquitous Computing for Places (A4)</td>
<td>User-Created Content (B4)</td>
<td>Reasonable Level of Control (C4)</td>
<td>Keeping Users in Control (D4)</td>
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<tr>
<td>Guides for Exploration and Navigation (A5)</td>
<td>Find a Place (B5)</td>
<td>Appropriate Privacy Feedback (C5)</td>
<td>Serendipity in Exploration (D5)</td>
</tr>
<tr>
<td>Enhanced Emergency Response (A6)</td>
<td>Find a Friend (B6)</td>
<td>Privacy-Sensitive Architectures (C6)</td>
<td>Active Teaching (D7)</td>
</tr>
<tr>
<td>Personal Memory Aids (A7)</td>
<td>Notifier (B7)</td>
<td>Partial Identification (C7)</td>
<td>Resolving Ambiguity (D8)</td>
</tr>
<tr>
<td>Smart Homes (A8)</td>
<td></td>
<td>Physical Privacy Zones (C8)</td>
<td>Ambient Displays (D9)</td>
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<tr>
<td>Enhanced Educational Experiences (A9)</td>
<td></td>
<td>Blurred Personal Data (C9)</td>
<td>Follow-me Displays (D10)</td>
</tr>
<tr>
<td>Augmented Reality Games (A10)</td>
<td></td>
<td>Limited Access to Personal Data (C10)</td>
<td>Pick and Drop (D11)</td>
</tr>
<tr>
<td>Streamlining Business Operations (A11)</td>
<td></td>
<td>Invisible Mode (C11)</td>
<td></td>
</tr>
<tr>
<td>Enabling Mobile Commerce (A12)</td>
<td></td>
<td>Limited Data Retention (C12)</td>
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<td></td>
<td></td>
<td>Notification on Access of Personal Data (C13)</td>
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<td></td>
<td></td>
<td>Privacy Mirrors (C14)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Keeping Personal Data on Personal Devices (C15)</td>
<td></td>
</tr>
</tbody>
</table>
Patterns

When you see advice, consider its depth

- Result of an individual study
- Pre-pattern based on some meta-analysis
- Established pattern

Be aware of misapplying patterns

- And be aware of anti-patterns
Touch and Microsoft Windows

2004

2012
Consistency vs. Specialization

Beware of simply copying a design language

Consistency is your friend until is it not your friend

Not limited to platform-level decisions

One “look” for your app

Or targeted at each device
Dark Patterns

A Dark Pattern is an interface that has been carefully crafted to trick people into doing things, such as buying insurance with their purchase or signing up for recurring bills.

Disguised Ads

Ads that are disguised as other kinds of content or navigation, in order to get users to click on them
Dark Patterns

A Dark Pattern is an interface that has been carefully crafted to trick people into doing things, such as buying insurance with their purchase or signing up for recurring bills.

Friend Spam

A site or game asks for your credentials, then goes on to publish content or send out bulk messages.
Dark Patterns

After Lawsuit Settlement, LinkedIn’s Dishonest Design Is Now A $13 Million Problem

HOPEFULLY, THIS WILL BE A LESSON TO OTHER COMPANIES WHO USE DARK UX PATTERNS TO TRICK THEIR USERS.

Anyone who has ever signed up, or even known anyone who has signed up, for LinkedIn has probably found themselves on the receiving end of dozens of follow-up emails, inviting you to “expand your professional network.” Even worse, they’re virtually impossible to opt-out of. It’s a scummy use of dark UX patterns by a company that should know better. Now, LinkedIn is going to be paying for it as part of a class-action lawsuit, to the tune of $13 million.

Presented in San Jose’s U.S. District Court, the key issue in Perkins v. LinkedIn is spam. Namely, during the user sign-up process, LinkedIn claims that it ‘will not store your password or email anyone without your permission.” Despite this, LinkedIn sends automated follow-up email reminders on a new user’s behalf to any contacts harvested from their webmail accounts, which are presented in such a way as to appear as if they came directly from the user.

Under California law, the sitting judge says has deemed this illegal. Consequently, if you were a member of LinkedIn’s “add connection” program between September 2011 and October 2014, you can submit a claim to a BPIW.
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 14: Patterns

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 15: Interface Implementation
James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20
Today

Exam Q&A Time and Place
Comments on Mockups
A Story About Art
Comments on Presentations

Understanding Tools and Interfaces
Fogarty Adventures in Bad Visuals

Needed to Present for UW Innovation Award

Needed a storyboard, but am visually inept

First experience with oDesk/Upwork
Initial Specification

Unsure What to Do

Jane talks to her sister (could be changed to brother if it’s easier to get a distinct character here)

They had similar issue, for them it turned out to be a need to control stress and get more exercise

People talking about what’s causing Jane’s issue is a recurring thing, look ahead to see that

Stressed person icon is recurring, look ahead to see that
Guidance on Desired Style

Desired Style

What can I buy that is healthy and easy to prepare?

But not this black on white color, see color and presentation slide.
Unsure What To Do
Unsure What To Do
Unsure What To Do
Final Version

Unsure What to Do

- Consults Brother
- Had Similar Symptoms
- Shares his Triggers
- Stress & Exercise
Two Storyboards

Before Our Advances
After Our Advances

Three Iterations
Less Than Three Hours Time
Approximately $300
Before

Meet Jane

- Severe Symptoms
- Missing Work
- Needs Help
Before

Unsure What to Do

- Consults Brother
- Had Similar Symptoms
- Shares his Triggers
- Stress & Exercise
Before

Tracking Mood and Physical Activity

- Buys a Fitness Band
- Tracks Mood
- Tracks Physical Activity
Before

Making Sense of the Data

- Lots of Data
- Mood Over Time
- Activity Over Time
- But No Understanding
Before

Maybe Her Doctor Can Help

- Did not Track Symptoms
- Did not Track Food
- Elimination Diet
- Difficult to Follow
- Lengthy Process
- Possibly Inconclusive
After

Revisiting Jane

Most Common Triggers
- Food
- Stress

Suitable Sensors / Apps
After

Appropriate Capture

- Tracks for a Baseline
- Automated Reminders
- Low-Burden Tracking
- Timely Symptom Input
After

Jane’s Personal Hypotheses

Possible Triggers
- Lactose
- Caffeine
- Stress

Confounding Effect
After

Self-Experimentation

Self-Experimentation
Lactose
Caffeine
Jane Has Her Answer
Engaging Clinician with Data

Data is Actionable

Personalized Interventions
Fogarty Adventures in Bad Visuals

Needed to Present for UW Innovation Award

Needed a storyboard, but am visually inept

First experience with oDesk/Upwork

Presentation matters

In the real world, you can spend money on this
Today

Exam Q&A Time and Place
Comments on Mockups
A Story About Art
Comments on Presentations

Understanding Tools and Interfaces
Overall Message

Happy with talks, especially on Friday

Prep, Calibration, Environment

Want everybody to keep improving

Room to improve in relating elements of your work, referring to reasons for design decisions
Timing

“An 8 minute time limit will be strictly enforced”

<table>
<thead>
<tr>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:40</td>
<td>10:00</td>
</tr>
<tr>
<td>8:30</td>
<td>10ish</td>
</tr>
<tr>
<td>8:45</td>
<td>10:15</td>
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<tr>
<td>9:00</td>
<td>11:00</td>
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<tr>
<td>9:00</td>
<td>11:45</td>
</tr>
<tr>
<td>9:45</td>
<td>13:00</td>
</tr>
</tbody>
</table>
# Tasks

<table>
<thead>
<tr>
<th>Categorize Time Spent</th>
<th>Set Goals For Each Category</th>
<th>Share Schedule and Free Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>What qualifies as work or play?</td>
<td>How much time should you spend on each activity?</td>
<td>Who should be notified? Who is free right now?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Decide What To Do While Waiting</th>
<th>Adapt Correctly To Schedule Changes</th>
<th>Get Reminders for Flexible Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>What can get accomplished within that time?</td>
<td>What can be pushed back and what has a solid deadline?</td>
<td>When is the best time for lunch?</td>
</tr>
</tbody>
</table>
Star People!
Hard to Follow

---

**Storyboards**

1. **What a busy schedule!**
   - A person with a busy schedule.

2. **Synced**
   - A sync message on a device.

3. **Lunch Time!**
   - Lunch time reminder.

4. **That was a busy day. I should relax.**
   - Person relaxing.

5. **I almost forgot!**
   - Reminder for an appointment.

6. **Location:** Office
   - Location of an office.

7. **Commuting:** 70 mph
   - Commuting speed.

8. **You are busy.**
   - A message indicating the person is busy.

9. **You are free.**
   - A message indicating the person is free.

10. **3 Friends are also free via Facebook.**
    - Notification of available friends.

11. **Tennis!!**
    - Tennis being played.
Selected Design

- Simplest overall design of the three
- Most aesthetically pleasing due to effective organization and spacing
- Easy way to set goals without any outside pressure on what you choose
- Firmly addresses the most important user need of tracking overall usage
Storyboard 2:

1. David likes the new song released recently, so he shares it on the SR app.

2. When he posts it, he adds tags and defines the group of people he wants it to be seen.

3. Daniel then gets a message showing that David likes the music.

4. Daniel then messages David about his idea of the song.
Focus on the Right Thing

Contextual Inquiries

Suzzallo Library

Husky Union Building

Paccar Hall

One person still uses food journaling consistently and has a positive experience.
One person stopped food journaling because she reached her goal and had a nutritionist.
The third person loves taking pictures of her food and just seeing what she’s been eating.
Had them take us through their process during mealtime, motivations, difficult, benefits
Initial Paper Prototype
Initial Paper Prototype

Task 1: Finding a SmartMatch
Testing - Results

- **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
GOOD MORNING, JASON.

aw

8:10AM  67°F  96 BPM
11.5.2014

MOOD CHART
ADD ACTIVITY
SEND DATA

TIME
INTENSITY

VALENCE
AROUSAL

AROUSAL
CALM - EXCITED

BORED

Activity added
10:00

Calendar

Date: 11/5/2014

10:30 AM

TENNIS
Background
**Final Paper Prototype**

**IEP-Connect Classroom**

**Many Screens on One Slide**

<table>
<thead>
<tr>
<th>K.F. &gt; Goals</th>
<th>Accommodations</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Students &gt; K.F.</td>
<td></td>
</tr>
</tbody>
</table>

**In Progress**

Write Paragraph Under 7m Enter

Make Eye Contact

IEP Goal: Student will maintain eye contact appropriately during conversation

0

<table>
<thead>
<tr>
<th>C</th>
<th>0</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>Enter</td>
</tr>
</tbody>
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</table>

Previously Tracked

Write Paragraph 18 m Remove

Score on Math Test 75 % Remove

0

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<td></td>
</tr>
</tbody>
</table>

Previously Tracked

Leave [ ] Confirm

Score on Math Test 75 % Remove

0
Final Paper Prototype

Task2 - Record Water Intake

Many Screens on One Slide
Fewer Screens, Show Connections
Fewer Screens, Show Connections
IMPROVED DESIGN

Sunday, November 2nd, 2014

Overall Sessions

Distracted  Productive

Session 1 (9 am - 1:20 pm) - 4 h 20 m

2 h 10 m  20 m
Facebook  Conversations

1 h 50 m
MatLab

Click on activity for more actions.
IMPROVED DESIGN

Sunday, November 2\textsuperscript{nd}, 2014

Session 1 (9 am - 1:20 pm) - 4 h 20 m
- 2h 10 m Facebook
- 20 m Conversations
- 1 h 50 m MatLab

Click on activity for more actions.
IMPROVED DESIGN

Sunday, November 2nd, 2014

Overall Sessions

- Distraught
- Productive

Session 1 (9am - 1:20pm) - 4h 20m
- 2h 10m Facebook

Session 2
- 20m Conversations
- 1h 50m MatLab

Click on activity for more actions.
IMPROVED DESIGN

Sunday, November 2nd, 2014

Overall

Sessions

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Productive

Session 1 (9 am - 1:20 pm) - 4h 20 m

2h 10 m

facebook

20 m

conversations

1 h 50 m

MatLab

Click on activity for more actions.
IMPROVED DESIGN

Sunday, November 2nd, 2014

Overall | Sessions
--- | ---

Distracted | Productive

Session 1 | Session 2

80% | 40%

Session 1 (9am - 1:20 pm) = 4h 20m

2h 10m | 20m

facebook | conversations

1h 50m | MatLab

Click on activity for more actions.
IMPROVED DESIGN

Sunday, November 2nd, 2014

Overall: Sessions
- Distracted
- Productive

Session 1 (9 am - 1:20 pm) - 4 h 20 m
- 2h 10 m
  - facebook
- 20 m
  - conversations
- 1h 50 m
  - MatLab

Click on activity for more actions.
Transition as Animation

Initial Paper Prototype

Task 1: Is Netflix worth it?

1. View the Koala homepage
2. Navigate to Netflix Detailed View
3. View your Usage Score for Netflix
4. Go to Settings
5. Click “Unsubscribe”
6. Return to homepage
Initial Paper Prototype

*Task 1: Is Netflix worth it?*

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Initial Paper Prototype

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Today

Exam Q&A Time and Place
Comments on Mockups
A Story About Art
Comments on Presentations

Understanding Tools and Interfaces
Tools and Interfaces

Why Interface Tools?
Case Study of Model-View-Controller
Case Study of Animation
Sapir-Whorf Hypothesis
Thoughtfulness in Tools
Sequential Programs

Program takes control, prompts for input

Person waits on the program

Program says when it is ready for more input, which the person then provides
Sequential Programs

while true {
    print “Prompt for Input”
    input = read_line_of_text()
    output = do_work()
    print output
}

Person is literally modeled as a file
Event-Driven Programming

A program waits for a person to provide input

All communication done via events
  “mouse down”, “item drag”, “key up”

All events go to a queue
  Ensures events handled in order
  Hides specifics from applications
Basic Interactive Software Loop

do {
    e = read_event();
    dispatch_event(e);
    if (damage_exists())
        update_display();
} while (e.type != WM_QUIT);

Nearly all interactive software has this somewhere
Basic Interactive Software Loop

Have you ever written this loop?
Basic Interactive Software Loop

Have you ever written this loop?

Contrast with:

“One of the most complex aspects of Xlib programming is designing the event loop, which must take into account all of the possible events that can occur in a window.”

Understanding Tools

We use tools because they

- Identify common or important practices
- Package those practices in a framework
- Make it easy to follow those practices
- Make it easier to focus on our application

What are the benefits of this?
Understanding Tools

We use tools because they

- Identify common or important practices
- Package those practices in a framework
- Make it easy to follow those practices
- Make it easier to focus on our application

What are the benefits of this?

- Being faster allows more iterative design
- Implementation is generally better in the tool
- Consistency across applications using same tool
Understanding Tools

Why is designing tools difficult?

- Need to understand the core practices and problems
- Those are often evolving with technology and design

Example: Responsiveness in event-driven interface

- Event-driven interaction is asynchronous
- How to maintain responsiveness in the interface while executing some large computation?
Understanding Tools

Why is designing tools difficult?

Need to understand the core practices and problems
Those are often evolving with technology and design

Example: Responsiveness in event-driven interface

Cursor:

WaitCursor vs. CWaitCursor vs. In Framework

Progress Bar:

Data Races vs. Idle vs. Loop vs. Worker Objects
Fundamental Tools Terminology

Threshold vs. Ceiling

Threshold: How hard to get started
Ceiling: How much can be achieved
These depend on what is being implemented

Path of Least Resistance

Tools influence what interfaces are created

Moving Targets

Changing needs make tools incomplete or obsolete

Myers et al, 2000
http://dx.doi.org/10.1145/344949.344959
Tools and Interfaces

Why Interface Tools?
Case Study of Model-View-Controller
Case Study of Animation
Sapir-Whorf Hypothesis
Thoughtfulness in Tools
Model-View-Controller

How to organize the code of an interface?

This is a surprisingly complicated question, with many unstated assumptions requiring significant background to understand and resolve
Seeheim Model

Results from 1985 workshop on user interface management systems, driven by goals of portability and modifiability, based in separating the interface from application functionality

Buxton, 1983
http://dx.doi.org/10.1145/988584.988586
Seeheim Model

Lexical - Presentation
External presentation of interface
Generates the display, receive input

Syntactic - Dialog Control
Parsing of tokens into syntax
Maintain state

Semantic - Application Interface Model
Defines interaction between interface and rest of software

e.g., "add" vs. "append" vs. "^a" vs. e.g., how to make a "menu" or "button"
e.g., interface modes
e.g., drag-and-drop target highlighting
Seeheim Model

 lexical
 Presentation

 Syntactic
 Dialogue Control

 Semantic
 Application Interface Model

 USER

 APPLICATION
Seeheim Model

Lexical
Presentation

Syntactic
Dialogue Control

Semantic
Application Interface Model

USER  APPLICATION

Huh?
Seeheim Model

Rapid Semantic Feedback

In practice, all of the code goes in here
Model-View-Controller

Introduced by Smalltalk developers at PARC
Partitions application to be scalable, maintainable
View / Controller Relationship

In theory:

Pattern of behavior in response to input events (i.e., concerns of the controller) are independent of visual geometry (i.e., concerns of the view)

Controller contacts view to interpret what input events mean in context of a view (e.g., selection)
View / Controller Relationship

In practice:

View and controller often tightly intertwined, almost always occur in matched pairs

Many architectures combine into a single class
Model-View-Controller

MVC separates concerns and scales better than global variables or putting everything together

Separation eases maintenance
  Can add new fields to model, new views can leverage, old views will still work
  Can replace model without changing views

Separation of “business logic” can require care
  May help to think of model as the client model
Model-View-Collection on the Web

Core ideas manifest differently according to needs

For example, backbone.js implements client views of models, with REST API calls to web server

Web tools often implement views as templates
Model View View-Model

Design to support data-binding by minimizing functionality in view

Also allows greater separation of expertise
Tools and Interfaces

Why Interface Tools?
Case Study of Model-View-Controller
Case Study of Animation
Sapir-Whorf Hypothesis
Thoughtfulness in Tools
Luxor Jr.
Luxor Jr.
Animation Case Study

Principles of Traditional Animation Applied to 3D Computer Animation

Lasseter, 1987

http://dx.doi.org/10.1145/37402.37407

"There is a fantastic mystery in animation — it's really very simple and yet exciting that it's simple, it is the beauty that is the world in Art." — Walt Disney, Walt Disney Studios, June 13, 1937 (13).

ABSTRACT

This paper describes the basic principles of traditional 3D hand animation and their application to 3D computer animation. The discussion begins by identifying the fundamental principles that are independent of the animation medium. This simplifies the adoption of traditional principles to 3D computer animation. The principles described are:

- Character Design
- Motion Design
- Camera Design

The last two years have seen the appearance of reliable, user-friendly, keyboard-driven animation systems that work interactively with such computer animation software as Alias/Wavefront's (Wavefront Technologies Inc.), Silicon Rainbow's (Silicon Rainbow Inc.), and Pixar's rendering (Pixar Computer Graphics Research Inc.) systems. These systems have enabled people to create high-quality computer animations at a fraction of the cost and with significantly improved visual quality compared to traditional animation.

Much of this new technology will be due to hardware and software enhancements that have been made to extend the capabilities of traditional animation. In fact, the essence of computer animation is to improve upon processing old computer techniques. Such an approach has broad appeal for its use by both artists.

This paper will discuss the fundamental principles of traditional animation and how they apply to 3D computer animation.
Squash and Stretch
Squash and Stretch
Squash and Stretch

FIGURE 4a. In slow action, an object’s position overlaps from frame to frame which gives the action a smooth appearance to the eye.

FIGURE 4b. Strobing occurs in a faster action when the object’s positions do not overlap and the eye perceives separate images.

FIGURE 4c. Stretching the object so that its positions overlap again will relieve the strobing effect.
Timing

Just two drawings of a head, the first showing it leaning toward the right shoulder and the second with it over on the left and its chin slightly raised, can be made to communicate a multitude of ideas, depending entirely on the Timing used. Each inbetween drawing added between these two "extremes" gives a new meaning to the action.

NO inbetweens........... The Character has been hit by a tremendous force. His head is nearly snapped off.

ONE inbetweens......... The Character has been hit by a brick, rolling pin, frying pan.

TWO inbetweens........ The Character has a nervous tic, a muscle spasm, an uncontrollable twitch.

THREE inbetweens..... The Character is dodging a brick, rolling pin, frying pan.
Timing

FOUR inbetweens........... The Character is giving a crisp order, "Get going!" "Move it!"

FIVE inbetweens........... The Character is more friendly, "Over here." "Come on-hurry!"

SIX inbetweens........... The Character sees a good looking girl, or the sports car he has always wanted.

SEVEN inbetweens........... The Character tries to get a better look at something.
Timing

EIGHT inbetweens.......... The Character searches for the peanut butter on the kitchen shelf.

NINE inbetweens..........The Character appraises, considering thoughtfully.

TEN inbetweens.......... The Character stretches a sore muscle.
Anticipation
Staging

FIGURE 6. Andre’s scratch was staged to the side (in "silhouette") for clarity and because that is where his itch was.
Staging

FIGURES 7-8. In Luxo Jr., all action was staged to the side for clarity.
Pose-to-Pose, Slow In, Slow Out

Objects with mass must accelerate and decelerate. Interesting frames are typically at ends, tweaks perception to emphasize these poses.
Arcs
Luxor Jr.
Luxor Jr.
Animation Case Study

Animation: From Cartoons to the User Interface

Chang and Ungar, 1993

http://dx.doi.org/10.1145/168642.168647

You must learn to respect that golden atom, that single frame of action, that 1/24th of a second, because the difference between lightning and the lightning bug may hinge on that single frame.

— Chuck Jones [10]

ABSTRACT
User interfaces are often based on static presentations, a model ill-suited for conveying change. Consequently, events on the screen frequently startle and confuse users. Cartoon animation, in contrast, is exceedingly successful at stopping the auditors—even the most bizarre events are easily comprehended. The self-user interface has served as a model for the application of cartoon animation techniques as a means of making the interface easier to understand and more pleasant to use. Animation is an effective and innovative way to make self objects more vivid. Use of cartoon-style motion blur allows self objects to move quickly and still maintain their comprehensibility. Self objects arrive and depart smoothly, without sudden materializations and disappearances, and they rise to the front of overlapping objects smoothly through the use of dissolve. Anticipating action with a small counter motion and pacing the speed of transitions faster than the eye perceives results in smoother and cleaner movements. Despite the differences between user interfaces and cartoons—cartoons are frivolous, passive entertainment and user interfaces are serious, interactive tools—cartoon animation has much to lend to user interfaces to realign both affective and cognitive bases.

KEYWORDS: animation, user interfaces, cartoons, motion blur, self

1 INTRODUCTION
User interfaces are often based on static presentations—a series of display math showing a new state of the system. Typically, there is much design time going into the details of how parameters are set without the user or any part of the interface is graphically represented. This means that changes are not conveyed to the user; therefore, the user is unable to change the system. In contrast, the animation model allows the user to see the changes directly. The user can determine what is happening, what will happen, what is happening, or what has happened.

For example, consider Microsoft’s Windows interface [1]. Using a window by clicking the box and dragging the box to the front. This is an example of the user can quickly determine what is happening. The use of animation in the interface can provide a significant improvement in user interface design.

Moving objects from one location to another is yet another example. Most current systems let the user move an outline of the object, and then, when the user is finished, the screen usually changes in two places: the object in the old position and the object in the new position. Suddenly, the object moves from one place to another without the user being aware of it. This can cause confusion, and in some cases, the user may not even notice that the object has moved. In contrast, an animation-based interface provides a more natural and intuitive way for the user to move objects from one location to another. The user can see the object move smoothly, and the changes are immediately visible. This provides a more natural and intuitive way for the user to interact with the interface.


November 3-5, 1993 UST’93
Frames Three Principles

Solidity
Desktop objects should appear to be solid objects

Exaggeration
Exaggerate physical actions to enhance perception

Reinforcement
Use effects to drive home feeling of reality
Solidity: Motion Blur

- No Motion Blur
- Motion Blur

(time)
Solidity: Arrival and Departure
Solidity: Arrival and Departure
Exaggeration: Anticipation

Figure 7. Objects anticipate major actions with a quick contrary motion that draws the user eye to the object in preparation for the main motion to come.
Figure 8. Objects ease out of their beginning poses and ease into their final poses. Although these motions are slower than that during the main portion of the movement, they are still quite fast.
Reinforcement: Arcs

Figure 9. When objects travel under their own power (non-interactively), they move in arcs rather than straight lines.
Reinforcement: Follow Through

Figure 10. When objects come to a stop after moving on their own, they exhibit follow through in the form of wiggling back and forth quickly. This is just suggested by the “wiggle lines” in the figure—in actuality, the object moves back and forth, with motion blur.
Animation Case Study

Animation Support in a User Interface Toolkit: Flexible, Robust, and Reusable Abstractions
Hudson and Stasko, 1993
http://dx.doi.org/10.1145/168642.168648
Events and Animation

Figure 5. Animation Event Translation and Dispatch
Not Just an Implementation

Provides tool abstractions for implementing previously presented styles of animation

Overcomes a fundamental clash of approaches

Event loop receives input, processes, repaints

Animations expect careful control of frames, but the event loop has variable timing
Events and Animation

Figure 5. Animation Event Translation and Dispatch
Transition Object

Figure 3. Parts of a Transition Object
Pacing Function

Figure 4. Two Example Pacing Functions
Computing a Frame

Figure 8. Translation from Time to Space
Animation Case Study

Based on increased understanding of how animation should be done in the interface, increasingly mature tools develop

Now built into major commercial toolkits (e.g., Microsoft’s WPF, JavaFX, jQuery)

Once mature, begins to be used as a building block in even more complex behaviors
Animation Case Study

The Kinetic Typography Engine: An Extensible System for Animating Expressive Text

Lee et al, 2002

http://dx.doi.org/10.1145/571985.571997
Kinetic Typography Engine

Kinetic Typography

Johnny Lee, Jodi Forlizzi, Scott Hudson
Carnegie Mellon University
Human-Computer Interaction Institute
2002
Kinetic Typography Engine

Kinetic Typography

Johnny Lee, Jodi Forlizzi, Scott Hudson
Carnegie Mellon University
Human-Computer Interaction Institute
2002
Kinetic Typography Engine

Goals of Kinetic Type

- Emotional content
- Creation of characters
- Direction of attention

Based on existing work

Animation Composition

*Figure 6. Waveform addition by chaining*

*Figure 7. Waveform scaling by functional composition with amplitude*
Animation Case Study

Prefuse: A Toolkit for Interactive Information Visualization
Heer et al, 2005
http://dx.doi.org/10.1145/1054972.1055031

D3: Data-Driven Documents
Bostock et al, 2011
http://dx.doi.org/10.1109/TVCG.2011.185
Tools and Interfaces

Why Interface Tools?
Case Study of Model-View-Controller
Case Study of Animation
Sapir-Whorf Hypothesis
Thoughtfulness in Tools
Sapir-Whorf Hypothesis

Language is not simply a way of voicing ideas, but is the very thing which shapes those ideas.

Tools not only make it easy to build certain types of software, they push you to think in terms of the types of software they can support.

You must be aware of this when choosing tools, designing applications, and creating new tools.
Animation Case Study

Phosphor: Explaining Transitions in the User Interface Using Afterglow Effects

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ABSTRACT
Sometimes users fail to notice a change that just took place on their display. For example, the user may have accidentally deleted an icon or a remote collaborator may have changed settings in a control panel. Animated updates can help, but they force users to wait for the animation to complete. This can be cumbersome, especially in situations where users did not need an explanation. We propose a different approach. Phosphor objects show the outcome of their transition instantly, at the same time they explain their change to the user. Manipulating a phosphor widget, for example, leaves an afterglow that illustrates how the icon moved. The parallax of initial movement and afterglow supports both types of users. Users who already understood the transition can continue interacting without delay, while those who are inexperienced or may have been distracted can take time to view the effects at their own pace. We present a framework of transition designs for widgets, icons, and objects in sharing programs. We evaluate phosphor objects in two user studies and report significant performance benefits for phosphor objects.

ACM Classification: H5.2 [Information interfaces and presentation] User Interface, H5.2 [Information interfaces and presentation], User Interfaces

Figure 1: These phosphor widgets use green afterglow effects to show how they have changed. The wider tabbed “volume” panel was dragged all the way to the left. Two of the checkmarks in the right row were unchecked. The combobox was set from 1 to 2.

INTRODUCTION
Computer users sometimes make mistakes, such as accidentally deleting an item or moving it into the wrong folder. Similarly, unexpected changes may occur in collaborative sessions. Users trying to replicate a process demonstrated by a collaborator may have difficulty that they missed some of the steps. This is particularly difficult for actions that leave no trace, such as shortcut commands.

The potential changes that users need to keep track of increase with increasing user interface complexity, more concurrently running applications, larger screens, and more advanced input devices. Phosphors can help users keep track of changes to GUI elements with increasing user interface complexity, more concurrently running applications, large screens, and advanced input devices. Phosphors can help users keep track of changes to GUI elements.

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PHOSPHOR USER INTERFACE OBJECTS
We propose extending user interface transitions without forcing users to wait. We define a phosphor transition as a transition that:
1. shows the outcome of the change instantly;
2. explains the change in terms using a diagrammatic depiction.

The space of interactive diagrammatic depictions encompasses a great number of possible changes. In this paper, we concentrate on a specific subset based on the notion of afterglows. Figure 1 shows an example. What is next?
Phosphor

Animation can help people follow interface transitions

But the right speed is crucial
   Too fast increases error rate
   Too slow increases task time

The right speed depends on familiarity, distraction, etc.
   It cannot be determined
Phosphor shows the outcome immediately, then explains the change in retrospect using a diagrammatic depiction.
Phosphor
Challenging Assumptions of Tools

Phosphor breaks from the assumptions that have evolved into current transition tools.
Tools and Interfaces

Tools embody expertise and assumptions

Tools evolve based on emerging understanding of how to address categories of problems

Be conscious of your tool decisions

Try to think about designs before tying to a tool
Choose good and appropriate tools
Understand what you are getting in a tool
Push yourself to think outside the tool
Prefab

Options

Specify where music is stored and change rip settings.

Rip music to this location
C:\Users\Morgan Dixon\Music

Rip settings
Format:
Windows Media Audio

- Copy protect music
- Rip CD when inserted
  - Only when in the Rip tab
  - Always
- Eject CD when ripping is complete

Audio quality:
Smallest Size

Uses about 56 MB per CD (128 Kbps).

Learn about copy protection
Compare formats online

OK  Cancel  Apply  Help
Prefab
Prefab

Prefab uses pixel-level analysis to modify existing applications from the outside, using only pixels.

Prefab is informed by how toolkits work, but not linked to any particular toolkit implementation.

Allows trying and fielding new ideas that are not supported by existing applications or toolkits.
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 15:
Interface Implementation

James Fogarty
Alex Fiannaca
Lauren Milne
Saba Kawas
Kelsey Munsell

Tuesday/Thursday
12:00 to 1:20