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

Lecture 01: 
Introduction and 
Personal Informatics

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

University of Washington
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
A Whole Lot of Administrivia

Today we have a lot to cover

- Course Mechanics and Project Overview
- Some Perspectives
- Assignment 1: Project Proposal

Background in Personal Informatics
GitHub Repository

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

https://github.com/uwcse440/web-cse440-au14

You will contribute when posting your projects

You can and should contribute when you see the opportunity
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
Sketching & Storyboarding

RouteMyRun
Low-Fidelity Prototyping & Testing

RideAlong
Digital Mockup
Video Prototypes

GetOut

PickUp
“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, GitHub!
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 aspects of what the CSE curriculum has taught you is important
It will be what you make it
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

<table>
<thead>
<tr>
<th></th>
<th>S.</th>
<th>M.</th>
<th>T.</th>
<th>W.</th>
<th>T.</th>
<th>F.</th>
<th>S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>T.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>O.</td>
<td>* *</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R.</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F.</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>S.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEMPERANCE.**

* Eat not to dullness.
* Drink not to elevation.

[Image of Benjamin Franklin]
Manpokei

交通巡査
11260歩—6.7km（8時間）

ビリ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）
Thousands of Health Monitoring Apps
Activity and Medical Sensing Devices

- Blood glucose meter
- Thermometer
- Blood pressure monitor
- Heart rate monitor
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

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

Walk in park instead of watching TV
Five-Stage Model of Personal Informatics

PREPARATION | COLLECTION | INTEGRATION | REFLECTION | ACTION

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

Quantified Self Talk Format

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

Analyzed 52 videos

Questions about the Quantified Self

“Understanding Quantified Selfers’ Practices in Collecting and Exploring Personal Data”
Analysis

Profiles

Visualizations

Themes

What do they track?

Top 5 items: activity, food, weight, sleep, and mood

Other items: cognitive performance, blood glucose, location, heart rate, knowledge, stress, body fat, productivity, snoring, movies, posture, medicine, skin condition, home energy usage, clothes, and public transit usage

Movies Seen in Theatres Since 2001

Clothing Log

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

Self-tracking is more than just buying a FitBit

## Motivations for Tracking

<table>
<thead>
<tr>
<th>Motivations</th>
<th>Sub-categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>To improve health</td>
<td>To cure or manage a condition</td>
</tr>
<tr>
<td></td>
<td>To achieve a goal</td>
</tr>
<tr>
<td></td>
<td>To find triggers</td>
</tr>
<tr>
<td></td>
<td>To answer a specific question</td>
</tr>
<tr>
<td></td>
<td>To identify relationships</td>
</tr>
<tr>
<td></td>
<td>To execute a treatment plan</td>
</tr>
<tr>
<td></td>
<td>To make better health decisions</td>
</tr>
<tr>
<td></td>
<td>To find balance</td>
</tr>
<tr>
<td>To improve other aspects of life</td>
<td>To maximize work performance</td>
</tr>
<tr>
<td></td>
<td>To be mindful</td>
</tr>
<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>
</tr>
</tbody>
</table>

# Data Collection and Exploration Tools

<table>
<thead>
<tr>
<th>Data Collection Tool</th>
<th>% (#)</th>
</tr>
</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>
</tr>
<tr>
<td>Pen and paper</td>
<td>21% (11)</td>
</tr>
<tr>
<td>Commercial software</td>
<td>19% (10)</td>
</tr>
<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>
</tr>
</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

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

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

Lacking Scientific Rigor

Conduct self-experimentations without control or without addressing confounding factors

And they conduct flawed experiments

Your Challenge

People invest tremendous effort for little value

Do better, help people achieve their goals

These are smart people, these are hard problems

Think big about the opportunities

Get past the technology 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
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 02: Design of Everyday Things

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

- State 1
  - Button up
  - Tracking
- State 2
  - Button Down
  - Dragging

Touchpad

- State 0
  - Release
  - Out of Range
- State 1
  - Touch
  - Tracking

Stylus

- State 0
  - Stylus Lift
  - Out of Range
- State 1
  - Stylus On
  - Tracking
- State 2
  - Tip Switch Close
  - Dragging

Touch Screen

- State 0
  - Release Contact
  - Passive Tracking
- State 1
  - Contact
- State 2
  - Selection
Buxton’s 3-State Model

Mouse

- State 1
  - Button up
  - Tracking
- State 2
  - Button Down
  - Dragging

Touchpad

- State 0
  - Release
  - Out of Range
- State 1
  - Touch
  - Tracking

Stylus

- State 0
  - Stylus Lift
  - Out of Range
- State 1
  - Stylus On
  - Tracking
- State 2
  - Tip Switch Close
  - Dragging

Touch Screen

- State 0
  - Release Contact
- State 1
  - Contact
  - Passive Tracking
- State 2
  - Selection

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**
  - Form Intention
  - Develop Action Plan
  - Execute Actions

- **Gulf of Execution**
  - Evaluate Goals
  - Interpret State
  - Observe State
  - System Change

- **Gulf of Evaluation**
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

- **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**
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

Diagram showing the flow of cold air from a thermostat to a control unit, through a valve to a cooling unit, and then to a freezer and fresh food storage areas.
A Problem with Feedback

1. Set both controls.
2. Allow 24 hours to stabilize.

Normal Settings:
- Colder Fresh Food: C and 5
- 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

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

Now does the door push or pull?

**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

Challenges arise if there is a mismatch between implied use versus intended use.
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 conceptual 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 conceptual 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

VirusScan On-Access Scan Properties - CS-SUMATRA

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, dragable 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 [ ] while dialing or storing phone numbers in the TONE mode.
- You pressed [ ] 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, * 0 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, * 0 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, * 0 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

New is common, delete is not
Is Consistent 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
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
Lecture 03: Contextual Inquiry

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
Amazing Color Changing Card Trick

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

If we’re 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 customer

Easy to make mistaken assumptions
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 or experimental settings 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

Translating from raw field observation to design ideas can be a difficult process
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
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 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
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’re 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)
It’s 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
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

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. . . ."
Context

“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 handed 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

John Kellerman
Attorney at Law

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

Don’t 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 aren’t there to get a list of questions answered

Expert / Novice
   You aren’t 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
“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
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 see 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. Observe Behavior
3. Share Interpretation
4. Refine Interpretation
5. 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
Overly disrupting the task
   Questions are great, but do not ask so many so fast that the participant stops doing their tasks
Turning it into a regular interview
   If you could have done it in a coffee shop, then you didn’t do a contextual inquiry
When All Else Fails

Remember Master/Apprentice

Remember Context

Remember Withdraw & Return
Developing Models

Contextual inquiry yields a lot of data

Does not reduce to a statistical test

Use it to distill models

Help to understand the workflow

Highlights gaps in understanding

Identify breakdowns and workarounds

Many types of models

e.g., Flow, Sequence, Artifact, Cultural, Physical
Flow Model: Secretarial Hub

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

Department’s reports
- Checks to sign

Checks to sign

Request to help with family vacation plans

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

Request for clarification

Proposal to proof and mail

Discussion of travel plans

Announcement

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

Invoices
- Request to schedule meeting with president

Request to book trip

Checks

Signed checks
Flow Model: Creative Work

Test user
- Run software and use documentation
- Report all problems

Documentation

Problem reports

Discussion of problems

U2 (Documentation writer)
- Create documentation from specifications and the actual product
- Validate documentation with developers and the actual product
- Test all examples

Marked-up drafts

Product versions

Specifications

Discussion of system problems

Discussion of review

Editor
- Check drafts for accuracy, consistent layout, grammar, and terminology
- Assign writing tasks

Drafts for review

Work assignments

Writing standards

Developer
- Write the software
- Review documentation for accuracy and completeness
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

Intent: Get back to people easily

- Leave phone message
- File in phone folder
- See list of messages
- Choose message 9: subject indicates university news relevant to department
- Read message
- Delete message
- See message 10 automatically
- Read message 10

Had to put off issue of unhappy user
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
Cultural Model: Department Store

Department store company culture

Do everything you can for the customer

We sell socks

The PC user is your customer

PC support management

Don’t enforce any standards

Standards make my life easier

Users

We are a no-risk interface

Support whatever I choose to buy

We are your one-stop shop

Business focus

U1

(PC support analyst)

We help you sell socks

External technology vendors

Use these de facto standards

We run on integrity and trust

We go out of our way for you

End customers

Use whatever new net HW we create

We sell socks
Artifact Model: Calendar

Past (seldom accessed)  Future (quick access)

Scheduled events

 Unscheduled but associated with the day

Reminders (storage with quick access)

Meetings
Appointments

Reminders

Strike out a day

Notes

Never used

Business cards (storage for later)

Rubber band
Physical Model: Work Site

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.

Work Site

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

Company Trailer

Computer
Sequence Model: Equipment Audit

1. Assigned to do equipment audit
2. Retrieve required form from database
3. Print form
4. Collect data at site
5. Record data on paper form
6. Type data into form on computer
7. Print completed form
8. Leave hardcopy of form with customer
9. Send electronic form to supervisor
10. Store electronic form on form database
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 03: Contextual Inquiry

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
Lecture 04: Critique

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

Hi, I’m Matt

I’m a PhD student in Computer Science & Engineering. I do research in personal informatics.

But! I also have some background in visual art.
This Quarter

You will learn how to both give and receive critique

Each skill is important and takes practice

Many sections will consist of group critiques

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

Starting today!

Critique of CI Plan
Why do Critique?

Critique helps us evaluate early, often, and cheaply

- Applicable to artifacts of many types
- Compare to other expert methods covered later, like heuristic evaluation

You are not your own worst critic!

- The room has more collective knowledge than any one of us
- It is very hard to see past your own decisions (see also: mental models, etc)

See past your infatuation
Why do 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
What is Critique?

Critique is a method of peer & expert feedback

It is not just a list of complaints

1. **Presenters** sit down with peers/experts (the critics)

2. Quickly explain their artifacts (< 2 min)

3. Critics ask questions

4. Presenters respond, also write down everything that is discussed
Critique is not Criticism

Again, it is not just a list of complaints!

Critics offer honest feedback

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

Both positive and negative

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

It is the presenter’s responsibility to sort through feedback and decide what is important

Take notes!
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 (or you should)
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

The artifact you show invites different forms of feedback
Indicate what kind of feedback you want verbally, but also in form (this course will guide you heavily here)
Tips for Presenters

Keep an eye out for design rationale

You probably made some decisions without good reasons at the time

Critique can help give a rationalization for past decisions in explaining to others

Exploit failure!

A “failed” artifact (plan, design, ...) should teach you a lot about the design space: what won’t work, and why
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 help the conversation go smoothly

They may sound silly, but they can give you a question to ask when you don’t have one and a way to ask it that doesn’t hurt others’ feelings
Tips for Critics: Hamburger method

“Bun, meat, bun”

Bun:

    Something fluffy and nice

Meat:

    The real criticism

Bun:

    Something fluffy and nice
Tips for Critics: I like, I wish, what if

I like:

    Lead with something nice

I wish:

    Some criticism (often leading off what you like)

What if:

    An idea to spark further conversation
    Better than “I think you should have done ...” or “Why didn’t you ...”: gives the presenter benefit of the doubt if they did already think of your idea
Tips for Critics: Socratic method

When all else fails, point to something and ask “why?”

- Good when you don’t know what to say
- Forces presenter to give (or make up) explanations for things, which can help build design rationale
- Not fundamentally negative and hard to get defensive about
Summary

Fall *out* of love with the things you build

Let us help you see past the infatuation

Get quick, cheap feedback from experts

Refine ideas

In brainstorming, we were not *criticizing*

In critique, we are not *defending*

You will learn to both give and receive critique

Each are skills that take practice. If you are having difficulty, please come talk to us
Let’s do it!

In sets of 2-3 groups
15 minutes per group
  1-2 minutes: present your plan
  The rest of the time: critique

Remember hamburger method, I like/I wish/what if, Socratic method

Try not to get defensive

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

Lecture 05: Task Analysis

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
Where we came from

System will fail if:

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

Your contextual inquiries have emphasized getting to know your customers and their needs
... So we know what to build now, right?

Can’t we now 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”

Design is often about tradeoffs
Examples?
Why Task Analysis?

Task analysis complements 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 customers & data?
What other tools does the customer have?
How do customers 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 easy
Broad products need several typical consumers

Background

Skills

Work habits and preferences

Physical characteristics
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

Skills?
may know how to put cards into ATM
Seattle Parking Meter

Who is going to use the system?

Work habits and preferences?

Park several times a week, a month, a year?

Physical characteristics?

Varying heights, don’t 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

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

泊車、付款並顯示

泊車付費站使用說明

插入卡並按按下鈕購買時間，或投入硬幣購買時間

按綠色按鈕打印收據

迅速將卡取出等候收據並適當顯示

僅限顯示一張收據，以便在任何時表或付費站的車位泊車，直到您的時間到期

請使用可掛起的背面，將收據貼在前座側車窗內側

平行 路側

司機 座側

斜角

如果是摩托車，請貼在車頭燈罩上

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

ĐAU XE, TRÁI TIỀN & ĐÁN BIỆN NHẬN

Hướng Dẫn về Trạm Trả Tiền Đấu Xe

Dứt thẻ vào và bấm nút để mua giờ HOẶC Bổ tiền các để mua giờ

Bấm nút XANH để in biên nhận

Rút nhanh thẻ ra chờ biên nhận và dán đúng cách

Chi đăn mét biến nhận để đấu xe tại bất cứ chỗ nào có đồng hồ hoặc trạm trả tiền cho đến khi hết giờ đấu

Đeo mảnh dán mặt sau có thể gõ ra để đắn biên nhận vào MẶT TRONG của kính bảng trước

Song song bộ lé

cóc

Đối với XE GÁN MÁY, đắn vào chup đến trước

Thắc Mắc? Hãy gọi số 684-ROAD (7623)
paystations@seattle.gov
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 customers, 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 A’s insurance takes longer than most
POPOVERS

2 cupfuls flour  
1/2 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, 2/3 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  
1 teaspoonful soda  
1 1/2 teaspoonfuls salt  
3 tablespoonfuls sugar

2 cupfuls sour milk  
2 eggs, beaten  
2 tablespoonfuls melted fat

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 the customer 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 customers & 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?**
Question 7

What other tools does the customer 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?
DO

ALL THE THINGS!!!
Question 8

How do customers 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 customers likely remember more details
Infrequent customers may need more help
Even for simple operations
Make these tasks possible to accomplish

Which function is performed
Most frequently?
By which customers?
Optimizing for these will improve perception of performance
Careful about initial use though
Question 10

What are the time constraints on the tasks?

What functions will customers be in a hurry for?

Which can wait?

Is there a timing relationship between tasks?
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 customers have faced or requested
  collect any necessary materials
Should provide reasonable coverage
  compare check list of functions to tasks
Mixture of simple & complex tasks
  easy task (common or introductory)
  moderate task
  difficult task (infrequent or for power customers)
What Should Tasks Look Like?

Say what customer wants to do, but not how
allows comparing different design alternatives

Be very specific – stories based on facts!
say who customers are (use personas or profiles)
design can really differ depending on who
give names (allows referring back with more info later)
characteristics of customers (job, expertise, etc.)

story forces us to fill out description w/ relevant details

Sometimes should describe a complete “job”
forces us to consider how features work together
Using Tasks in Design

Write up a description of tasks

formally or informally

run by customers and rest of the design team

get more information where needed

Manny is in the city at a bar and would like to call his girlfriend, Sherry, to see when she will be arriving at the bar. She called from a friend’s house while he in the Paul Allen Center basement, so he missed her call. He would like to check his missed calls and find the number so that he can call her back.
Using Tasks in Design

Rough out an interface design

discard features that don’t support your tasks
or add a real task that exercises that feature
major screens & functions (not too detailed)
hand sketched

Produce scenarios for each task
what customer has to do & what they would see
step-by-step performance of task
illustrate using storyboards
Scenarios

Scenarios are design specific, tasks are not Scenarios force us to

  show how features will work together
  settle design arguments by seeing examples
  but these are only examples, and sometimes need to look beyond flaws

Show users storyboards
get feedback
Caveats of User-Centered Design

Politics

“agents of change” can cause controversy
get a sense of organization & bond w/ interviewee
important to get buy-in from all those involved

Customers are not always right

cannot anticipate new technology accurately
job is to build system customers will want
not system customers say they want
be very careful about this (you are outsider)
if you can’t get customers interested, you’re probably missing something

Design/observe forever without prototyping

rapid prototyping, evaluation, & iteration is key
Summary

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’s the relationship between customer & data?
- What other tools does the customer have?
- How do users communicate with each other?
- How often are the tasks performed?
- What are the time constraints on the tasks?
- What happens when things go wrong?

Selecting tasks
- Real tasks with reasonable functionality coverage
- Complete, specific tasks of what customer wants to do
Personas
Question 1

Who is going to use the system?

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

Background

Skills

Work habits and preferences

Physical characteristics
“If you want to create a product that satisfies a broad audience of users, logic will tell you to make it as broad in its functionality as possible to accommodate the most people. Logic is Wrong.”
3 types of people

- Parent concerned about safety
- Carpenter who needs to transport tools
- Executive looking for a fast & sporty car
Principles of Personas

• More specific, more effective
• Give the person detail
• Give them a name
• Make it believable
Microsoft Kin

“Tia always wants to know what cool things her friends are up to”

• 16 years old
• From La Jolla, CA
• Loves all things pink
• 2 sisters, Diana & Ashley
• Was Juliet in last year’s school performance of “Romeo & Juliet”
Types of users

- Power Users
- Computer Literate Users
- Novice Users
Types of users

“Elise is a 33-year-old accountant who uses Microsoft Excel every day. She likes to watch ‘House of Cards’ on her iPhone before bed, but has had trouble connecting her email to her phone. She goes hiking nearly every weekend.”
Designing with Personas

- Design to make the “primary” persona(s) happy

- Avoid design choices that make personas unhappy
Why use Personas?

Thoroughly think about who is using your product

  Ensure the design is effective for those people

  Make the product and its impacts “real”
Cultural Probes & Diary Studies
Self-Report Data

Minimal influence on actions

Event takes place over a long period of time
Diary Study
Cultural Probe

Kaye et al. Money Talks: Tracking Personal Finances, CHI 2014
Why use Diary Studies & Cultural Probes?

Learn about your [potential] user’s habits

Artifacts reflect how people currently do something

Contextual Inquiry with a record
Experience Sampling Method
Track Your Happiness

How do you feel right now?

Very bad  Very good

Next

Productivity

Happiness

Focus

Happiness

Focused

Happiness
Why use Experience Sampling?

Learn about your [potential] user’s habits

Learn what influences these habits

Diary studies with prompting
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 06: Human Performance

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

Dowling, 1987
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
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

Sensory Buffers

- Eyes
- Ears

Long-term Memory

Working Memory

- Visual Image Store
- Auditory Image Store

Perceptual Processor

Motor Processor

Cognitive Processor

Fingers, etc.

DUB
University of Washington
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
Memory

Working memory (also known as short-term)

Small capacity (7 ± 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

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
<table>
<thead>
<tr>
<th>red</th>
<th>red</th>
<th>green</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td>yellow</td>
<td>red</td>
</tr>
<tr>
<td>green</td>
<td>green</td>
<td>green</td>
</tr>
<tr>
<td>yellow</td>
<td>blue</td>
<td>blue</td>
</tr>
<tr>
<td>blue</td>
<td>yellow</td>
<td>yellow</td>
</tr>
</tbody>
</table>
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
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
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
Fitts’s Law

\[ MT = a + b \log_2\left(\frac{A}{W} + 1\right) \]

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)

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

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 \( W \).

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
“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?

Pop-up Linear Menu

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

Pop-up Pie Menu

- Today
- Sunday
- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
Pie Menus in Use

The Sims

Rainbow 6

Maya
Fitts’s Law Examples

Which will be faster on average?

| Pop-up Linear Menu |
|-------------------|--------------------|
| Today             | Sunday             |
|                   | Monday             |
|                   | Tuesday            |
|                   | Wednesday          |
|                   | Thursday           |
|                   | Friday             |
|                   | Saturday           |

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
- Mini toolbar is close to the cursor
Bubble Cursor

Grossman and Balakrishnan, 2005
Bubble Cursor with Prefab

Dixon et al, 2012
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
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

Select 31

Gajos et al 2007
Interface Generation As Optimization

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

Are people border cautious?
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
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 Legget  -  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: @ yahoo.com
   - Password
   - Re-type Password
   - Password Strength

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

<table>
<thead>
<tr>
<th>Visual System</th>
<th>Biological Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Human Processor</td>
<td>Higher-Level Model</td>
</tr>
<tr>
<td>Fitts’s Law</td>
<td>Model by Analogy</td>
</tr>
<tr>
<td>Gestalt Principles</td>
<td>Predict Interpretation</td>
</tr>
</tbody>
</table>
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 06: Human Performance

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 07: Design Diamond

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

Reminder on Tasks

Reminder on Designs and Page Limit

Reminder on Teams

Design Diamond
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
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
  - ...

... or step back a level and motivate Uber
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
Today

Reminder on Tasks

Reminder on Designs and Page Limit

Reminder on Teams

Design Diamond
Working as Teams

We have had some absences in critiques

   It is absolutely good to stay home sick

But some have been unexpected by teams

   Revealed incomplete project knowledge

Highlights you working as groups instead of teams
Teams vs. Groups

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.
Teams vs. Groups

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.
# Teams vs. Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>Teams</th>
</tr>
</thead>
<tbody>
<tr>
<td>strong leader</td>
<td>shared leadership</td>
</tr>
<tr>
<td>individual accountability</td>
<td>individual &amp; mutual accountability</td>
</tr>
<tr>
<td>organizational purpose</td>
<td>specific team purpose</td>
</tr>
<tr>
<td>individual work products</td>
<td>collective work products</td>
</tr>
<tr>
<td>efficient meetings</td>
<td>open-ended meetings</td>
</tr>
<tr>
<td>measures performance</td>
<td>measures performance</td>
</tr>
<tr>
<td>by influence on others</td>
<td>from work products</td>
</tr>
<tr>
<td>delegates work</td>
<td>does real work together</td>
</tr>
</tbody>
</table>
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 – start w/ something achievable

A right mix of skills
technical/functional expertise (programming/design/writing)
problem-solving & decision-making skills
interpersonal skills

Agreement and mutual accountability
who will do particular jobs, when to meet & work, schedules
Working as Teams

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.
You can split up, but you have to come back together.
Use complementary skills, be mutually accountable.

The “real world” requires this too.
Working as Teams

Get to know each other
Figure out strengths of team members
Assign each person a role

responsible for seeing work is organized and done
not responsible for doing it themselves

Names/roles listed on major reports

Group Manager (coordinate team)
Documentation (coordinate writing)
Design (coordinate visual/interaction design)
Fieldwork and Testing (coordinate fieldwork and testing)
Today

Reminder on Tasks

Reminder on Designs and Page Limit

Reminder on Teams

Design Diamond
Quantity over Quality

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

Bayles and Orland, 2001
Quantity v. Quality?

“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 User Experiences
getting the design right and the right design

Bill Buxton
Sketching

Movies

Theater: Shattuck Cinemas
Phone: (510) 665-1342 Dist: 1.5 mi.
Address: 2122 Shattuck Ave Berkeley, 94709
Cost: $8.50 reg., $6.00 sen, $4.50 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-wield to match so you don't have to choose.)
Sketching

MAP SHOWING PARKING AVAILABILITY BASED ON IMPORTED DATA, IMPORTED ON MAP

- Different colors
- High lights availability

43RD
92ND
39TH
Sketching
Sketching

UBIGITOUS RICE COOKER

- LCD display shows number of cups + time remaining
- keypad 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).
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!
Sketching

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

vs.

University of Washington
Minimal Detail

Include only what is required to render the intended purpose or concept
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, the sketch will look much 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
## 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...
Idea Oscillation
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
Sketching the Mouse

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

Making the Macintosh: http://www-sul.stanford.edu/mac/index.html
Exploration of Alternatives
... a designer that pitched three 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
Some Evidence

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

- **Parallel condition**
  - Prototype
  - Feedback
  - Prototype
  - Feedback
  - Prototype
  - Feedback
  - Final

- **Serial condition**
  - Prototype
  - Feedback
  - Prototype
  - Feedback
  - Prototype
  - Feedback
  - Final

Dow et al. TOCHI 2010.
Procedure

serial prototyping condition

parallel prototyping condition

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

Serial
Parallel

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

Share multiple condition

Share best condition

Make one condition

Dow et al. TOCHI 2010.
share multiple: better, more clicks

Dow et al. TOCHI 2010.
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?

Quick-and-Dirty Prototyping

HOW: Using any materials available, quickly assemble possible forms or interactions for evaluation.

WHY: This is a good way to communicate a concept to the team and evaluate how to refine the design.

IDEO team members designing a shopping device quickly prototyped various concepts to evaluate qualities like weight, size, and orientation.
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?
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 07: Design Diamond

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 08: Storyboarding

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

Milestones

- Design Review ("1x2") Due Friday
- Getting the Right Design Due Tuesday
- Presentations Start Thursday

Class

- Storyboarding
- Design Check-In ("3x4") 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

Movie List:

- Art of War
  - Times: 10:00-1:00, 4:00-7:00-10:00
- Bitter Sweet Motel
  - Times: 11:00-1:30, 4:00-6:30-9:00
- Godzilla
  - Times: 10:30-2:00, 5:30-9:00
- The Cell
  - Times: 11:00-1:00, 3:00-5:00-7:00-9:00

Clothing Options:

- As is...
- [Sketches of clothing items]
- As it should be...
  - Outfit #1
  - Outfit #2
  - Outfit #3

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

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

- Different colors
- High lights availability

- Pacific
- 43rd
- 92nd
- 34th
- 16th
- AVE
- Full

DISTANCE
TIME
2008-4-1
Sketching and Storyboards

Attendance List:

Last Name: Lee, Benjamin
First Name: Santos, Allen
Enrollment: Schwartz, Jonah
Enrollment: Vermette, Joshua

Last Name: Lee
First Name: Benjamin
Enrollment: Santos
Enrollment: Schwartz
Enrollment: Vermette

Enrollment: 12345678
Enrollment: 23456789
Enrollment: 34567890

Go to Attendance View

Take Attendance

38 Present, 2 Absent

Done

Look Up: Sc

refresh w/new info

Back to main menu

Done

from students' PDA

highlights student
Sketching and Storyboards

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

Diagram showing a flow from one screen to another, with options for music genres such as Top 40, Alternative, Country, Metal, Rap, and Soul.
Sketching and Storyboards
Sketching and Storyboards
Sketching and Storyboards
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
Storyboards

Can be used to convey

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

Can illustrate key requirements and leave open less important details of design.

Description:
EXT. FOREST - MS LUKE & LEIA - TRACKING

Elements:
- Forest: X
- Leia: X
- Biker #3: X
- Biker #4: X

Notes:

Shot #/Sequence: BC 28

Frame Count: 50
Page: #
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
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

Truong et al, 2006
1. How Much Detail?

Guideline: too much detail can lose universality

Scott McCloud
1. How Much Detail?
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.
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?
5. Passage of Time

Guideline: Only use if necessary to understand
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

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

Week 1:
- I'm going to use my phone to keep track of my fitness goals.

Week 2:
- 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

Week 1:
- I'm going to use my phone to keep track of my fitness goals.

Week 2:
- 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?
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

FROM APATHY TO ADVOCACY

AFTER A LONG WORKDAY, JEN DECIDES TO CHECK TRAFFIC BEFORE HEADING HOME...

UH! YOU'VE GOT TO BE KIDDING.

I'D RATHER WAIT THAN DRIVE IN THIS.

Huh... they're promoting some sort of transit plugin.

WHY DON'T I GIVE IT A SHOT?

ONE WEEK LATER...

SOUNDS GOOD. WHAT'S THE BEST WAY TO DRIVE THERE FROM MY PLACE?

NOT SURE... JUST GOOGLE IT.

WILL DO. CYA LATER.

Huh, I didn't know this route. The bus is then.

ALVERTO SUGGESTS: TAKE THE BUS AND SAVE MONEY!

AREN'T YOU ALWAYS TELLING ME ABOUT YOUR WEEKEND BIKE RIDES?

WHY NOT BIKE?

MORE BIKE LANES DOWNTOWN WOULD MAKE MY COMMUTE A LOT SAFER. I SHOULD DO THE CRITICAL MASS RIDE.

More bike lanes downtown would make my commute a lot safer. I should do the Critical Mass Ride.

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.

Gukeisen et al, 2007
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
Route Maps

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

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

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

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
Most Important Trick: Stop Motion

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

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

Consumester

Video Prototype

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

Split Presentation, Simple Effects

“PickUp”

Still-Frame, More Effects

“Graffiti Karma”
Split Presentation, Simple Effects

Daniel Swisher
Ian Crofoot
Mitchell Ishimitsu
Sunil Garg

PickUp
It's more than a game it's a community
CSE 440 Video Prototype

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/vidoprototyping/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 Times: 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?
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
James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 09: History

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

Milestones

Design Review ("1x2") Due Tonight
Getting the Right Design Due Tuesday
Presentations Start Thursday

Class

HCI History
Design Feedback
Why do we do HCI in CSE?

Every engineering discipline includes the study of breakdowns and the design of improved solutions that address those breakdowns.
Tacoma Narrows
# O-Rings

### History of O-Ring Damage in Field Joints (Cont)

<table>
<thead>
<tr>
<th>SRM No.</th>
<th>O-Ring Temp (°F)</th>
<th>SRM No.</th>
<th>O-Ring Temp (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>66</td>
<td>A</td>
<td>70</td>
</tr>
<tr>
<td>B</td>
<td>69</td>
<td>B</td>
<td>68</td>
</tr>
<tr>
<td>A</td>
<td>69</td>
<td>B</td>
<td>69</td>
</tr>
<tr>
<td>A</td>
<td>72</td>
<td>B</td>
<td>70</td>
</tr>
<tr>
<td>B</td>
<td>70</td>
<td>A</td>
<td>70</td>
</tr>
<tr>
<td>B</td>
<td>63</td>
<td>A</td>
<td>70</td>
</tr>
<tr>
<td>B</td>
<td>67</td>
<td>A</td>
<td>63</td>
</tr>
<tr>
<td>B</td>
<td>78</td>
<td>A</td>
<td>67</td>
</tr>
</tbody>
</table>

*No Erosion*

Information on this page was prepared to support an oral presentation and cannot be considered complete without the oral discussion.
O-Rings

O-ring damage index, each launch

26°-29° range of forecasted temperatures (as of January 27, 1986) for the launch of space shuttle Challenger on January 28

Temperature (°F) of field joints at time of launch
Tractors
Tractors
Older tractors with narrow front ends are easily upset.

Tractor upsets cause more fatalities than other farm accidents.

Injuries often include a broken or crushed pelvis.
Tractors

Tractor upsets used to be dismissed as driver error

But such accidents are less frequent because modern designs have:

- roll cage
- low center of gravity
- wider wheel bases
Human Factors Tradition

Emerges during and after WWII, as highly trained people are failing to effectively control the machinery they operate

(pilots are crashing planes)

The phrase “human factors” now often has a connotation of studying factory workers, ergonomics, or other physical tasks

(ask me about Grudin article if you’re interested)
1988: Iran Air Flight 655

In 1987, USS Stark was struck by two missiles launched by an Iraqi Mirage F-1, killing 37 with no weapons fired in self-defense during the attack.

In 1988, the crew of the USS Vincennes Combat Information Center confusingly reported the plane as ascending and descending at the same time (there were two "camps").
1988: Iran Air Flight 655

The Airbus’s original track, number 4474, had been replaced by the *Sides* track, number 4131, when the computer briefly recognized them as one and the same. Shortly thereafter, track 4474 was re-assigned by the system to an American A-6, several hundred miles away, following a descending course at the time. Apparently not all the crew in the CIC realized the track number had been switched on them.
Why do we do HCI in CSE?

Every engineering discipline includes the study of breakdowns and the design of improved solutions that address those breakdowns.

Understanding how and why human interaction breaks down is fundamental to designing better computing systems.

This study must include computer scientists, as we are the ones creating the technology.
A History Question

Who invented hypertext? When?
Computing in 1945

Harvard Mark I, 55 feet long, 8 feet high, 5 tons
Computing in 1945

Harvard Mark I, 55 feet long, 8 feet high, 5 tons
Computing in 1945

Ballistics calculations
Physical switches
(no microprocessor)
Paper tape
Simple arithmetic
& fixed calculations
(before programs)
3 sec. to multiply
Computing in 1945

First computer bug
( Harvard Mark II )
Adm. Grace Murray Hopper
A Little About Vannevar Bush

Name rhymes with “Beaver”
Faculty member at MIT
Coordinated WWII effort
with 6000 US scientists

Social contract for science

Federal government funds universities
Universities do basic research
Research helps economy and defense
As We May Think

Published in the Atlantic Monthly in 1945

http://www.theatlantic.com/magazine/print/1945/07/as-we-may-think/3881/

Motivated in part by defining a scientific grand challenge as WWII was ending
As We May Think

“There is a growing mountain of research. ... The investigator is staggered by the findings and conclusions of thousands of other workers—conclusions which he cannot find time to grasp, much less to remember, as they appear. Yet specialization becomes increasingly necessary for progress, and the effort to bridge between disciplines is correspondingly superficial.”
As We May Think

“The world has arrived at an age of cheap complex devices of great reliability; and something is bound to come of it.”

“Had a Pharaoh been given detailed and explicit designs of an automobile, and had he understood them completely, it would have taxed the resources of his kingdom to have fashioned the thousands of parts for a single car, and that car would have broken down on the first trip to Giza.”
MicroPhotography

Describes a combination of photocells, facsimile transmission, and electron beam technology

Enables capturing a photograph into micro form

“It would be a brave man who would predict that such a process will always remain clumsy, slow, and faulty in detail.”
MicroPhotography

“Assume a linear ratio of 100 for future use. Consider film of the same thickness as paper, although thinner film will certainly be usable. Even under these conditions there would be a total factor of 10,000 between the bulk of the ordinary record on books, and its microfilm replica. The Encyclopedia Britannica could be reduced to the volume of a matchbox. A library of a million volumes could be compressed into one end of a desk.”
Memex
Memex

“If the user wishes to consult a certain book, he taps its code on the keyboard...”

“Frequently-used codes are mnemonic, so that he seldom consults his code book;”

“He can add marginal notes and comments ... even ... by a stylus scheme”

“All this is conventional...”
Memex

“It affords an immediate step, however, to associative indexing”

“tying two items together is the important thing”

“Before him are the two items to be joined, projected onto adjacent viewing positions. At the bottom of each there are a number of blank code spaces, and a pointer is set to indicate one of these on each item. The user taps a single key, and the items are permanently joined.”
Memex

“Thereafter, at any time, when one of these items is in view, the other can be instantly recalled merely by tapping a button below the corresponding code space. Moreover, when numerous items have been thus joined together to form a trail, they can be reviewed in turn, rapidly or slowly, by deflecting a lever like that used for turning the pages of a book.”
Memex

“Wholly new forms of encyclopedias will appear, ready made with a mesh of associative trails running through them, ready to be dropped into the memex and there amplified.”

Memex is the first proposed hypertext system
A History Question

Who invented desktop computing? When?
Macintosh in 1984 is well known

On January 24th, Apple Computer will introduce Macintosh. And you’ll see why 1984 won’t be like “1984”

http://courses.cs.washington.edu/courses/cse440/videos/history/Apple1984.mp4
Alan Kay on Early Interface Work

Narrator is Alan Kay, speaking in 1987

This video is almost 20 years old
It was a historical account when it was filmed

Speaks to four systems

Sketchpad
NLS
GRAIL
Dynabook

http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987.m4v
Ivan Sutherland’s Sketchpad

http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987-Sketchpad.m4v
Ivan Sutherland’s Sketchpad

http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987-Sketchpad.m4v
Ivan Sutherland’s Sketchpad

When do we think this was done?
Ivan Sutherland’s Sketchpad

When do we think this was done?
Ivan Sutherland’s Sketchpad

When do we think this was done?

1962

- Windows
- Constraints (i.e., non-procedural)
- Prototype/Instance Inheritance (i.e., object-oriented)
Doug Engelbart’s NLS (Online System)

http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987-NLS.m4v
Doug Engelbart’s NLS (Online System)
Doug Engelbart’s NLS (Online System)

When do we think this was done?
Doug Engelbart’s NLS (Online System)

When do we think this was done? 1968

Invention of the mouse
First working hypertext system
Chording keyboard to reduce hand movement
Remote collaboration

Analog Mouse leads to heavy moding
Reactions include accusations of “faking it” and claims of irrelevance because “terminal can do that”
GRAIL

http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987-GRAIL.m4v
GRAIL
GRAIL

When do we think this was done?
When do we think this was done? 1968

Window handles
Modeless interaction via direct action
Gesture recognition

Proposed for end-user programming via flow charts
Dynabook
Dynabook

http://courses.cs.washington.edu/courses/cse440/videos/history/AlanKay1987-Dynabook.m4v
Xerox to Apple and Microsoft

XEROX Alto 1973
Xerox Alto
Xerox Alto

--- BEGINNING ---
Anonymous.1.
Battleship.cr
Battleship.RUN.
BeepBeep.RUN.
BuildKal.cm.
Calculator.dat.
Calculator.run.
Chess.log.
Chess.run.
Cw.Cm.
CompileKal.com.
CRT Test.RUN.
DMT.boot.
EditBuild.run.
empress.run.
Executive.Run.
Fly.run.
galaxy.boot.
garbage.3.
Go.run.
GoFont.ALA.
Inverses.Run.
junk.
junk grues.
Kal.bpl.
Kal.cm.
Kal.A.cm.
Kal.M.cm.
Kineto4.RUN.
LookKal.cm.
MasterMind.RUN.
mate.run.
Mesa.Type.script.
Muscle.run.
NEPTUNE.RUN.
obel.run.
Polish.copy.run.
POLYgons.RUN.

No DISK <SYSDIR> *.*
Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979
Xerox to Apple and Microsoft

XEROX Alto 1973

Steve Jobs visits PARC in 1979

XEROX STAR 1981
Xerox Star
Xerox Star
Xerox Star

XEROX 8010 Star Information System

Star provides integrated text and graphics. A variety of typesizes and styles may be used.

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peas</td>
<td>$0.39</td>
</tr>
<tr>
<td>Beans</td>
<td>$0.50</td>
</tr>
</tbody>
</table>

NAME

<table>
<thead>
<tr>
<th>NAME</th>
<th>SIZE</th>
<th>VERSION OF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Temporary title page</td>
<td>1 Page</td>
<td>10/30/84 13:29</td>
</tr>
<tr>
<td>A Copyright and abstract</td>
<td>2 Pages</td>
<td>11/20/84 16:14</td>
</tr>
<tr>
<td>B Front matter</td>
<td>4 Pages</td>
<td>10/31/84 22:09</td>
</tr>
<tr>
<td>Chapter 1</td>
<td>11 Pages</td>
<td>10/30/84 13:56</td>
</tr>
<tr>
<td>Chapter 2</td>
<td>15 Pages</td>
<td>10/31/84 22:49</td>
</tr>
<tr>
<td>Chapter 3</td>
<td>21 Pages</td>
<td>11/02/84 15:41</td>
</tr>
<tr>
<td>Chapter 4</td>
<td>36 Pages</td>
<td>10/31/84 21:47</td>
</tr>
<tr>
<td>Chapter 5</td>
<td>15 Pages</td>
<td>11/02/84 15:45</td>
</tr>
<tr>
<td>Chapter 6</td>
<td>7 Pages</td>
<td>10/30/84 19:02</td>
</tr>
<tr>
<td>Chapter 7</td>
<td>13 Pages</td>
<td>10/31/84 22:10</td>
</tr>
<tr>
<td>References</td>
<td>3 Pages</td>
<td>10/31/84 21:58</td>
</tr>
<tr>
<td>Styles</td>
<td>5 Pages</td>
<td>10/22/84 11:42</td>
</tr>
</tbody>
</table>
Xerox to Apple and Microsoft

XEROX Alto 1973
Steve Jobs visits PARC in 1979
XEROX STAR 1981
Apple Lisa 1981
Apple Lisa
Apple Lisa
Apple Lisa
Apple Lisa
Xerox to Apple and Microsoft

XEROX Alto 1973
Steve Jobs visits PARC in 1979
XEROX STAR 1981
Apple Lisa 1981
Apple Macintosh 1984
Macintosh
Macintosh
Macintosh
Xerox to Apple and Microsoft

XEROX Alto 1973
Steve Jobs visits PARC in 1979
XEROX STAR 1981
Apple Lisa 1981
Apple Macintosh 1984
Windows 1.0 1985
Windows 1.0
Windows 1.0

floppy drive configuration as it conserves disk space. To use this feature change the "Spooler=yes" in the [windows] section of the WIN.INI file to read "Spooler=no".

Note: Setting Spooler=no will disable printing from Windows Terminal

RUNNING BATCH (.BAT) FILES FROM WINDOWS
If you run a standard application from a batch file you should create a PIF file for the batch file. The PIF file should have the same PIF options set as the application. The Memory Required and Memory Desired options for the batch PIF file should always be set to 32K. This is independent of the memory requirements for the application.

Batch files should be run from the MS-DOS Executive.

RUNNING WINDOWS WRITE ON A TWO FLOPPY SYSTEM
Several precautions should be observed when using Windows
Windows 1.0
Xerox to Apple and Microsoft

XEROX Alto 1973
Steve Jobs visits PARC in 1979
XEROX STAR 1981
Apple Lisa 1981
Apple Macintosh 1984
Windows 1.0 1985
Windows 2.0 1987
Windows 2.0 (1987)
Xerox to Apple and Microsoft

XEROX Alto 1973
Steve Jobs visits PARC in 1979
XEROX STAR 1981
Apple Lisa 1981
Apple Macintosh 1984
Windows 1.0 1985
Windows 2.0 1987
Windows 3.0 1990
Windows 3.0
Windows 3.0
Windows 3.0
Xerox to Apple and Microsoft

XEROX Alto 1973
Steve Jobs visits PARC in 1979
XEROX STAR 1981
Apple Lisa 1981
Apple Macintosh 1984
Windows 1.0 1985
Windows 2.0 1987
Windows 3.0 1990

Bill Gates: "Hey, Steve, just because you broke into Xerox's house before I did and took the TV doesn't mean I can't go in later and take the stereo"
HCI Turing Awards

Sutherland wins 1988 Turing Award

Engelbart wins 1997 Turing Award

Alan Kay wins 2003 Turing Award

(in part for SmallTalk and OOP, though he says OOP is linked to the GUI)
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 09: History

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 10:
Paper Prototyping and Testing

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

Presentations on Thursday / Friday

Prototyping / Testing Readings Posted

Paper Prototypes over Weekend

Bring Prototypes to Class Tuesday

In-Class Inspection Methods
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

Welcome to ESP.
Your Telehears session is Tues. Sept. 21st @ 10am
Your current schedule is empty. Please click on Add a course to continue.

“Screen” faked with pre-constructed pieces
Paper Prototype

New pieces added in response to interaction
**Paper Prototype**

Transparencies allow flexible use of text

---

<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>Gray</td>
<td>M</td>
<td>In Stock</td>
<td>1</td>
<td>$99.99</td>
<td>$99.99</td>
</tr>
<tr>
<td>23076</td>
<td>Backcountry boot</td>
<td>BL</td>
<td>8.5</td>
<td>In Stock</td>
<td>1</td>
<td>$128.00</td>
<td>$128.00</td>
</tr>
</tbody>
</table>

**Check out our no-hassle Return Policy**

**Subtotal**

<table>
<thead>
<tr>
<th>S&amp;H</th>
<th>Tax</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.95</td>
<td>6.00</td>
<td>230.89</td>
</tr>
</tbody>
</table>

**Continue Shopping**

**Checkout**
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
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
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. Let's 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 too... 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 it’s 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
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 times you would like to come (evenings, weekdays, or weekends).
*No special training, education, or experience is needed. We want:
Factory workers  Businessmen  Construction workers
City employees  Clerks  Salespeople
Laborers  Professional people  White-collar workers
Barbers  Telephone 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 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 ....

[Blank coupon]
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.
Lecture 10:
Paper Prototyping and Testing

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 12: Inspection-Based Methods

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
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
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 heuristics explains each problem
Factor analysis to identify key heuristics
Nielsen’s 10 Heuristics

Visibility of system status
Match between system and the real world
User control and freedom
Consistency and standards
Error prevention
Recognition rather than recall
Flexibility and efficiency of use
Aesthetic and minimalist design
Help recognize, diagnose, and recover from errors
Help and documentation

Nielsen, 1994
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.
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.
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.
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.
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?
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 and information
  where to find things

Visibility addresses system status and feedback
  what is going on

Problems with affordances may go here
  hidden affordance: remember where to act
  false affordance: remember it is a fake
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.
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.
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.
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
Heuristics

Time Left: 00:00:19

46%
Heuristics

Time Left: 00:00:19 searching database for matches

46%
Heuristics

Visibility of system status

pay attention to response time

0.1 sec: no special indicators needed (why?)
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
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

mailto is not a registered protocol.
Heuristics

“Mailto”, “protocol”?

Match system to real world

Speak the user’s language
Heuristics
Heuristics

Flexibility and Efficiency of Use
accelerators for experts (e.g., keyboard shortcuts) allow tailoring of frequent actions (e.g., macros)
Heuristics

Error

You have not specified a Web Browser, or Web Browser specified is incorrect!

Yes
Heuristics

Help recognize, diagnose, & recover from errors

error messages in plain language
precisely indicate the problem
constructively suggest a solution
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

User Control and Freedom
Prevent Errors
The Radiation Dosimetry Program

Please Enter Desired Dose (in Rems)  0.0001
Enter Substance  Polonium
Isotope Number  211
Heuristics

The Radiation Dosimetry Program

| Please Enter Desired Dose (in Rems) | 0.0001 |
| Enter Substance                   | Polonium |
| Isotope Number                    | 211     |

Prevent Errors
Heuristics

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

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

Prevent Errors
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
consider having 2 versions (WinZip)
Heuristics
Heuristics

Consistency & Standards
Heuristics

% rm cse440*
%

![Confirmation dialog box](image-url)
Heuristics

% rm cse440*
%

Error prevention
Recognition rather than recall
Visibility
Heuristics

<table>
<thead>
<tr>
<th>Form Title -- (appears above URL in most browsers and is used by WWW search)</th>
<th>Background Color:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q&amp;D Software Development Order Desk</td>
<td>FFFBF0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Form Heading -- (appears at top of Web page in bold type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q&amp;D Software Development Order Desk</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E-Mail responses to (will not appear on)</th>
<th>Alternate (for mailto forms only)</th>
<th>Background Graphic</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="mailto:dversch@q-d.com">dversch@q-d.com</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Text to appear in Submit button</th>
<th>Text to appear in Reset button</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send Order</td>
<td>Clear Form</td>
</tr>
</tbody>
</table>

Scrolling Status Bar Message (max length = 200 characters)

***WebMania 1.5b with Image Map Wizard is here!!***
Heuristics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Q&amp;D Software Development Order Desk</td>
<td></td>
</tr>
<tr>
<td>Form Title -- (appears above URL in most browsers and is used by WWW search)</td>
<td></td>
</tr>
<tr>
<td>Background Color: FFFBF0</td>
<td></td>
</tr>
<tr>
<td>Form Heading -- (appears at top of Web page in bold type)</td>
<td></td>
</tr>
<tr>
<td>Text Color: 000080</td>
<td></td>
</tr>
<tr>
<td>E-Mail response to (will not appear on)</td>
<td></td>
</tr>
<tr>
<td><a href="mailto:dversch@q-d.com">dversch@q-d.com</a></td>
<td></td>
</tr>
<tr>
<td>Text to appear in Submit button</td>
<td></td>
</tr>
<tr>
<td>Send Order</td>
<td>Clear Form</td>
</tr>
<tr>
<td>Alternate (for mailto forms only)</td>
<td></td>
</tr>
<tr>
<td>Text to appear in Reset button</td>
<td></td>
</tr>
<tr>
<td>Background Graphic</td>
<td></td>
</tr>
<tr>
<td>Mailto</td>
<td></td>
</tr>
<tr>
<td>CGI</td>
<td></td>
</tr>
<tr>
<td>Scrolling Status Bar Message (max length = 200 characters)</td>
<td></td>
</tr>
<tr>
<td><em><strong>WebMania 1.5b with Image Map Wizard is here!!</strong></em></td>
<td></td>
</tr>
<tr>
<td>Next Tab &gt;&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Aesthetic & Minimalist design

no irrelevant information in dialogues
Heuristics

Select an award style using the scroll bar. When you've found a style that suits you, press OKAY to create that award and open the editor.
Heuristics
Heuristics
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
Example Heuristic Violation

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 altogether.
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.
Why Multiple Evaluators?

Every evaluator doesn’t find every problem

Good evaluators find both easy & hard ones
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.
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
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".
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 $\rightarrow$ productivity; open market $\rightarrow$ sales

Single evaluator achieves poor results

only finds 35% of usability problems
5 evaluators find $\sim$ 75% of usability problems
why not more evaluators?

Nielsen, 1994
Decreasing Returns

problems found

benefits / cost

Nielsen, 1994
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 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

Designer/Developer prepares the required documents described on previous slide

Gives these documents to the usability expert

Expert reads the 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?
# Action Analysis / Cognitive Modeling

**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

<table>
<thead>
<tr>
<th>Step Description</th>
<th>Operator</th>
<th>Time (secs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select sentence</td>
<td>H</td>
<td>0.40</td>
</tr>
<tr>
<td>Reach for mouse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Point to first word</td>
<td>P</td>
<td>1.10</td>
</tr>
<tr>
<td>Click button down</td>
<td>K</td>
<td>0.60</td>
</tr>
<tr>
<td>Drag to last word</td>
<td>P</td>
<td>1.20</td>
</tr>
<tr>
<td>Release</td>
<td>K</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.90 secs</td>
</tr>
</tbody>
</table>
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
Lecture 12: Inspection-Based Methods

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 12: Testing, Patterns, Anti-Patterns
James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
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
http://pda.edmunds.com

Where Smart Car Buyers Start

Edmunds2Go!

- Vehicle Prices & Reviews
- Dealer Locator
- Auto Tools

About Us | Help

© 2000-2001 Edmunds.com Inc.
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 v Poker

Experiment run in Windows Marketplace / Game Downloads

Which image has the higher clickthrough? By how much?

A: Solitaire game

B: Poker game

A is 61% better
OUR COMPUTERS ARE DOWN, SO WE HAVE TO DO EVERYTHING MANUALLY...
Conversion rate is percentage of visits that include purchase.

Which version has a higher conversion rate?

Coupon code decreases by factor of 10.

Example from Bryan Eisenberg’s article on clickz.com
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?

B gets more than double the 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 outperforms B by a factor of 3.5!
**MSN US Home Page**

**Proposal: New Offers module below Shopping**

<table>
<thead>
<tr>
<th>Shopping</th>
<th>Shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lancôme: Free deluxe compact w/ purchase</td>
<td>• Lancôme: Free deluxe compact w/ purchase</td>
</tr>
<tr>
<td>• Special promotions at your favorite stores</td>
<td>• Special promotions at your favorite stores</td>
</tr>
<tr>
<td>• Warm fall fashion styles are here</td>
<td>• Warm fall fashion styles are here</td>
</tr>
<tr>
<td>• Save on top brand digital cameras</td>
<td>• Save on top brand digital cameras</td>
</tr>
<tr>
<td>• Free shipping on furniture for every room</td>
<td>• Free shipping on furniture for every room</td>
</tr>
</tbody>
</table>

**Advertisements**

- A smart way to buy a diamond
  - Wal-Mart: Back-to-school
  - Our editor picks budget electronics
  - Get fit & save money: Sports sale

**Offers**

- Search GM Certified
  - With our 117-Point Inspection
  - GM Certified means no worries
- Online University
  - Earn degree from a top school
  - 100% Online, Get Free Info!
- $200k Loan, Get Low Rates
  - Secure Financing and Increase Cash Flow. Click Here Now!

Control

Treatment
Experiment Results

Ran A/B test for 12 days on 5% of MSN US visitors

Clickthrough decreased 0.49% \((p<0.0001)\)

Page views per user-day decreased 0.35% \((p<0.0001)\)

Value of click from home page: X cents

\[ \text{Net} = \text{Expected Revenue} - \text{direct lost clicks} - \text{lost clicks due to decreased page views} \]

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
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>Song</th>
<th>Our Price</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Weezer</em></td>
<td>$6.99</td>
<td>$18.97</td>
</tr>
<tr>
<td><em>Sugar Daddy</em></td>
<td>$9.00</td>
<td>$18.98</td>
</tr>
<tr>
<td><em>The Slim Shady LP</em></td>
<td>$2.98</td>
<td>$18.97</td>
</tr>
<tr>
<td><em>Echos</em></td>
<td>$11.54</td>
<td>$24.97</td>
</tr>
<tr>
<td><em>18</em></td>
<td>$10.99</td>
<td>$18.98</td>
</tr>
</tbody>
</table>

**New CD Releases!**

*Only $11.88*

*More Hot New Releases!*

---

**Just Released: The Royal Tenenbaums** for $19.45

*Directed by Wes Anderson (Rushmore)*

This hysterical comedy about the rise and fall of an eccentric family.

**In-Stock Now!**

<table>
<thead>
<tr>
<th>Movie</th>
<th>Our Price</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Monster's Ball (DVD)</em></td>
<td>$11.25</td>
<td>$24.99</td>
</tr>
</tbody>
</table>
Weezer (2001)

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>
</thead>
<tbody>
<tr>
<td>$7.75</td>
<td>$10.20</td>
<td>custodian46 (149)</td>
<td>best buy</td>
</tr>
<tr>
<td>$8.00</td>
<td>$10.45</td>
<td>stargaze13 (3)</td>
<td>Disk, case, and liner all in excellent c</td>
</tr>
<tr>
<td>$8.25</td>
<td>$10.70</td>
<td>dazzyliz (1205)</td>
<td>SEALED NEW BMG</td>
</tr>
<tr>
<td>$8.39</td>
<td>$10.75</td>
<td><a href="mailto:nageia@hotmail.com">nageia@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

<table>
<thead>
<tr>
<th>Price</th>
<th>Total Price</th>
<th>Seller (Rating)</th>
<th>Seller Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8.00</td>
<td>$10.45</td>
<td>lucidsky (14)</td>
<td>perfect</td>
</tr>
<tr>
<td>$8.84</td>
<td>$11.29</td>
<td>steveeq1 (82)</td>
<td></td>
</tr>
<tr>
<td>$9.00</td>
<td>$11.45</td>
<td>saint.timothy (18)</td>
<td>Great shape...first class ship</td>
</tr>
</tbody>
</table>

View all Like New Items
Proceding to checkout
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

OR

Enter a new shipping address:

Name
Street address:
City
State
Select State
ZIP code
Country
USA

Use This Address

Save Changes
Quick Flow Checkouts

CSE440 Autumn 2007
User Interface Design, Prototyping, and Evaluation

Order Summary

Seller: naojia@hotmail.com (35)
Condition: Like New * Notes: Perfect condition

Item: $8.30
Media Mail: $2.45
Subtotal: $10.75
Total Merchandise: $8.30
Total Shipping: $2.45
TOTAL: $10.75

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.

Place my order!
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 California, the Chili Peppers release a new album featuring the hit song "By the Way".

In-Stock Now!

- Weezer, Weezer
  - Our Price: $6.99
  - List Price: $18.97

- Gutterflower, Goo Goo Dolls
  - Our Price: $9.00
  - List Price: $18.98

- The Slim Shady LP, Eminem
  - Our Price: $2.98
  - List Price: $18.97

- Echoes, Pink Floyd
  - Our Price: $11.54
  - List Price: $24.97

- 18, Moby
  - Our Price: $10.99
  - List Price: $18.98

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)
  - Our Price: $11.25
  - List Price: $24.99
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?
The Fold

- Hmm, what’s below here?
• Impulse buy
  • PESONALIZED 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 listeners 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
Reeling Stone (6/7/01, p.110) - 4/5 stars... Rolling Stone... excellent tunes in less than half an hour... Rivers Cuomo's shrink another hot tub...CRAB...

Customer Reviews
Rated 4.3 out of 5.0 by 29 raters.
» Read Customer Reviews
» Rate this item

Portions of this page Copyright 1948-2001 Muze Inc. Muze For personal non-commercial use only. All rights reserved. Provider 1
People with similar tastes also enjoyed...

- **Weezer (1994)**
  - **CD**, (1994)
  - **Weezer** for **$5.00** (Save $6.97)

- **Pinkerton**
  - **CD**, (1996)
  - **Weezer** for **$6.00** (Save $10.95)

- **All Killer No Filler**
  - **ECD**
  - **CD**, (2001)
  - **Sum 41, Sum 41** for **$4.29** (Save $8.68)

---

**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

_Move to WishList_ • _Remove from Cart_ • _Find another one_

**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".
- 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
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
State
If U.S. Military, enter APO/FPO for City,
Select State
ZIP code
If U.S. Military, select AE, AP or AA from bottom of list for State.
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
Quick Flow Checkouts

CSE440 Autumn 2007
User Interface Design, Prototyping, and Evaluation

Order Summary

Seller: naojia@hotmail.com (35)
Condition: Like New • Notes: Perfect condition

- Item: $8.30
- Media Mail: $2.45
- Subtotal: $10.75

Total Merchandise: $8.30
Total Shipping: $2.45
TOTAL: $10.75

**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.

Place my order!
• 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

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

activities

open alcoves
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.
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
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
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)
PROCESS

• 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?
PROCESS FUNNEL (H1)
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
<table>
<thead>
<tr>
<th>Format of Web Design Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern Name and Number</td>
</tr>
<tr>
<td>Exemplar</td>
</tr>
<tr>
<td>Background</td>
</tr>
<tr>
<td>Problem</td>
</tr>
<tr>
<td>Forces</td>
</tr>
<tr>
<td>Solution</td>
</tr>
<tr>
<td>Solution Diagram</td>
</tr>
<tr>
<td>Related Patterns</td>
</tr>
</tbody>
</table>
**Pattern Name and Number**

**H1 PROCESS FUNNEL**

---

**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.

---

**Solution**

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.

---

**Exemplar**

Figure H1.1

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**

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. Striking a balance between these various forces and their effect is challenging.

---

---

**Problem Statement**

where they are in the process funnel and how much farther they have to go.
Use Pop-Up Windows to Provide Extra Information, without Leading Visitors Out of the Process Funnel • Sometimes customers need additional information that you have not provided on a page, such as extra help or product details. Provide a link to a pop-up window (H6) containing clean product details (F2) (see Figure H1.1), context-sensitive help (H8), or information from the frequently asked questions (H7) page, to make the extra information less intrusive. Your challenge is to implement this extra content without detracting from the main purpose.

Make Sure the Back Button Always Works • Customers often use the Back button on browsers to modify answers they have typed in on previous pages. However, if the Web site is not implemented correctly, the information they have already entered may be lost when they hit the Back button, forcing them to type everything again. In the worst case, people get a cryptic error message saying that the posted information was lost. You can address this annoying problem by temporarily storing the information they type in on each page, redisplaying this information if customers hit the Back button, and then overriding the temporarily stored information on the page if it is changed.

Always Make It Clear How to Proceed to the Next Step • Some Web pages are longer than can be displayed on a customer's Web browser. The problem is that people sometimes get lost if the critical action button (K4), the one that takes them to the next step, is hidden below the fold. Place high-visibility action buttons (K5) both high and low on the page, ensuring that at least one of the critical action buttons is visible without scrolling.

Prevent Errors Where Possible, and Provide Error Messages when They Do Occur • People will always make mistakes on Web sites. You can provide good customer service by providing clear error messages and sample input to help prevent errors. Provide meaningful error messages (K1) so that customers can understand where things went wrong and how they can fix them. For example, if you design a data entry form, don't just say “An error occurred.” Instead, say “This field is required.”

Solution

Minimize the number of steps required to complete a task, keeping them between two and eight. Remove unnecessary and potentially confusing links and content from each page, while reinforcing the brand to maintain a sense of place. Use pop-up windows to provide extra information, without leading people out of the process funnel. Make sure the Back button always works so that customers can correct errors. Make it clear how to proceed to the next step.

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-in/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 (I2) 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
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 social “Little Brothers” such as employers.
# 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>
</tr>
<tr>
<td>Upfront Value Proposition (A1)</td>
<td>Active Map (B1)</td>
<td>Fair Information Practices (C1)</td>
<td>Scale of Interaction (D1)</td>
</tr>
<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>
</tr>
<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>
</tr>
<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>Context-Sensitive I/O (D6)</td>
</tr>
<tr>
<td>Personal Memory Aids (A7)</td>
<td>Notifier (B7)</td>
<td>Partial Identification (C7)</td>
<td>Active Teaching (D7)</td>
</tr>
<tr>
<td>Smart Homes (A8)</td>
<td></td>
<td>Physical Privacy Zones (C8)</td>
<td>Resolving Ambiguity (D8)</td>
</tr>
<tr>
<td>Enhanced Educational Experiences (A9)</td>
<td></td>
<td>Blurred Personal Data (C9)</td>
<td>Ambient Displays (D9)</td>
</tr>
<tr>
<td>Augmented Reality Games (A10)</td>
<td></td>
<td>Limited Access to Personal Data (C10)</td>
<td>Follow-me Displays (D10)</td>
</tr>
<tr>
<td>Streamlining Business Operations (A11)</td>
<td></td>
<td>Invisible Mode (C11)</td>
<td>Pick and Drop (D11)</td>
</tr>
<tr>
<td>Enabling Mobile Commerce (A12)</td>
<td></td>
<td>Limited Data Retention (C12)</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
Touch and Microsoft Windows

2004

2012
Consistency vs. Specialization

Beware of simply copying a design language

Consistency is your friend until it is not your friend

Not limited to platform-level decisions

One “look” for your app

Or targeted at each device
Lecture 12: Testing, Patterns, Anti-Patterns

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 14:
Designing for Diverse Needs

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

Digital Mockups Due
Getting the Design Right Reports Due
Getting the Design Right Presentations
Exam

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
Pinkification

This is a really complicated issue

  But it is not new

We will start here

  Then work to more obvious problems
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 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, 2001

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

Apple G1 iPod, October 2001
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.
Please rate the website you have just seen based on visual appeal.

very unappealing  

very appealing
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
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.
Popular Rwandan Website

![Image of the People's Bank website](image)

**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.

**Tariff Guide**

<table>
<thead>
<tr>
<th>Currency</th>
<th>Selling</th>
<th>Buying</th>
</tr>
</thead>
<tbody>
<tr>
<td>USD</td>
<td>696.824522</td>
<td>670.834572</td>
</tr>
<tr>
<td>EUR</td>
<td>984.813009</td>
<td>925.066257</td>
</tr>
<tr>
<td>GBP</td>
<td>1161.100411</td>
<td>1132.182088</td>
</tr>
<tr>
<td>CAD</td>
<td>619.531308</td>
<td>603.393456</td>
</tr>
<tr>
<td>CHF</td>
<td>777.24316</td>
<td>757.423256</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
> 50 years

< 20 years

Reinecke and Gajos, CHI 2014
Plotting Appeal by Complexity

visual complexity

visual appeal

peak appeal
Plotting Appeal by Colorfulness

visual appeal

colorfulness & complexity

colorfulness
complexity

Reinecke and Gajos, CHI 2014
Other Countries

- Colorfulness & Complexity for:
  - United States
  - Germany
  - Macedonia
  - Hong Kong
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
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
Perkinput
Perkininput
Perkinput

Detect maximum likelihood to decide which finger input each touch.

Azenkov et al, GI 2012
Perkinput

Azenkot et al, GI 2012
Perkinput
Perkinput
Perkinput
Speed and Accuracy

Speed

Accuracy

Azenkot et al, GI 2012
Another Problem
Another Problem
PassChords
PassChords
PassChords
PassChords
PassChords
PassChords
PassChords

Set new password
Confirm
Enter

Azenkot et al, ASSETS 2012
PassChords
Time to Authenticate

<table>
<thead>
<tr>
<th>Seconds</th>
<th>PassChords</th>
<th>VoiceOver PINs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

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
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 one of my hobbies is hiking, I really enjoyed getting away…

The triangle consists of a 2 mile hike to the beach, a 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

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.
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.

Serial Access in Reviewing Transcript
When one of my hobbies is hiking. I really enjoyed getting away from civilization.

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 I knew if I like to do it.

Serial Access in Reviewing Transcript

my
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.

Serial Access in Reviewing Transcript

hobbies
Reviews and Edits

80% of composition time in review and edits

- Natural speech
- Speech input
- Keyboard

Words Per Minute (WPM)

Azenkot et al, ASSETS 2013
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?
“Sometimes you don’t follow along as well unless [you are] one on one.”
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
Stop # 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?

Azenkot et al, CHI 2011
Accessibility is More than Text Entry
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
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 14: Designing for Diverse Needs
James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

Tuesday/Thursday
10:30 to 11:50
MOR 234
CSE 440: Introduction to HCI
User Interface Design, Prototyping, and Evaluation

Lecture 15: Interface Implementation
James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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

```python
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
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
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

token into syntax

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
Seeheim Model

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.
MVC 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
Tools and Interfaces

Why Interface Tools?
Case Study of Model-View-Controller
Case Study of Animation
Sapir-Whorf Hypothesis
Thoughtfulness in Tools
Luxor Jr.
Animation Case Study

Principles of Traditional Animation Applied to 3D Computer Animation

Lasseter, 1987

http://dx.doi.org/10.1145/37402.37407
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 strobeping 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.
Follow Through, Overlap, Secondary
Objects with mass must accelerate and decelerate. Interesting frames are typically at ends, tweaking perception to emphasize these poses.
Arcs
Animation: From Cartoons to the User Interface

Chang and Ungar, 1993

http://dx.doi.org/10.1145/168642.168647
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
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.
Reinforcement: Slow In Slow Out

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.
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 Support in a User Interface Toolkit: Flexible, Robust, and Reusable Abstractions

Scott E. Hudson
John F. Stasko

Georgia Institute of Technology
Atlanta, GA 30332-0080
E-mail: hudson@cc.gatech.edu, stasko@cc.gatech.edu

ABSTRACT

Animation can be a very effective mechanism to convey information in visualizations and user interface settings. However, integrating animated presentations into user interfaces has typically been a difficult task since, so far, there has been little or no explicit support for animation in window systems or user interface toolkits. This paper describes how the Artkit user interface toolkit has been extended with new animation support abstractions designed to overcome this problem. These abstractions provide a powerful but convenient base for building a range of animations, supporting techniques such as simple motion-blur, "squash and stretch", use of aligning trajectories, anticipation and follow through, and "slow-in / slow-out" transitions. Because these abstractions are provided by the toolkit, they are reusable and may be freely mixed with more conventional user interface techniques. In addition, the Artkit implementation of these abstractions is robust in the face of systems (such as the X Window System and Unix) which can not be re-used in a consistent and unambiguous manner.

Keywords: object-oriented user interface toolkit, window systems, animation techniques, dynamic interfaces, motion blur, real-time scheduling.

1 INTRODUCTION

Human perceptual capabilities provide a substantial ability to convey form and animated models of the world from moving images. As a result, in a well designed display, information can often be much more easily comprehended in a moving scene than in a single static image or even a sequence of static images. For example, the "tree diagram" display described in [Rob92] provides a clear illustration that the use of continuous motion can allow much more information to be presented and understood more easily.

However, even though the potential benefits of animation in user interfaces have been recognized for some time ([Blau89] for example, surveys a number of uses for animation in the interface and cites their benefits and [Stasko93] reviews principles for using animation in interfaces and describes a number of systems that make extensive use of animation in its interfaces), explicit support for animation is rarely, if ever, found in user interface support environments. The work described in this paper is designed to overcome this problem by showing how flexible, robust, and reusable support for animation can be incorporated into a full scale object-oriented user interface toolkit. Specifically, this paper describes how the extension mechanisms of Artkit — the Advanced Reusable Toolkit (supporting interfaces in C++) [Hen90] — have been employed to smoothly integrate animation support with other user interface capabilities.

The animation abstractions provided by the Artkit system are designed to be powerful and flexible — providing basic support that can be used to build a range of sophisticated techniques such as: simple motion-blur, "squash and stretch", use of aligning

This work was supported in part by the National Science Foundation under grants EIA-8924077, DCA-9216417, CCR-9318767 and CCR-9300039.

Permission to copy without fee all or part of this material is granted provided that the copies are not made or distributed for direct commercial advantage, the ACM copyright notice and the title of the publication and its date appear, and no copyright message accompanies these copies.

November 3-5, 1993 UIST'93 57
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

![Diagram of 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.
Phosphor: Explaining Transitions in the User Interface Using Afterglow Effects

Baudisch et al, 2006

http://dx.doi.org/10.1145/1166253.1166280
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

phosphor
Phosphor

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

Lecture 15:
Interface Implementation

James Fogarty
Daniel Epstein
Brad Jacobson
King Xia

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