Project Status

Looking Forward

2d: Design Research Review due last night
2e: Task Review due Thursday 10/19
2f: Design Check-In (3x4) Due Monday 10/23
2g: Design Review (1x2) Due Thursday 10/26
“Getting the Right Design” Report and Presentation

Other Assignments

All Reading Assignments Now Posted
Reading 2 Due this Saturday 10/21
Reading 5 Can Be Done Anytime, Sooner is Better
Denny 303 on Tuesday 10/24
James Away on Tuesday 10/24
Today

Finish with tasks, personas, and scenarios

Review core design terminology
Selecting Tasks

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

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

Be specific, stories based in concrete facts
say who person is (e.g., using personas or profiles)
design can really differ depending on who
give ‘names’ (allows referring back with more info later)
characteristics of person (e.g., job, expertise)
story forces us to fill in description with details

Sometimes describe a complete “accomplishment”
forces us to consider how features work together
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 his phone’s GPS for directions. He leaves the apartment with his roommates at 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 ridesharing
Using Tasks in Design

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

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

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

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

Scenarios are design specific, tasks are not

Scenarios force us to show how things work together settle arguments with examples but these are only examples, and may need to look beyond flaws

Show people storyboards topic for next Thursday
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
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
- Park Friday night in Ballard
- Park at the airport
Today

Finish with tasks, personas, and scenarios

Review core design terminology
Design Terminology

Design of Everyday Things reviews a common and useful vocabulary of design.

We will use these in feedback and conversations without even realizing that we are doing it.

You should know these terms and recognize them in practice.
Objectives

Be able to:

Describe Norman’s execution-evaluation cycle, including the Gulfs of Execution and Evaluation.

Define implementation, manifest, and mental models, describe their relationships and how they are created.

Describe and identify examples of affordances, including false and hidden affordances.

Describe and identify examples of metaphors.
Objectives

Be able to:

In terms of mental models, describe and differentiate affordances, metaphors, and idioms.

Describe and identify examples of visibility, constraints, and mappings.

In terms of mental models, describe and identify examples of consistency, including internal and external consistency.

In terms of mental models, describe the effect of modes.
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

1. Goals
2. Form Intention
3. Develop Action Plan
4. Execute Actions
5. Observe State
6. Interpret State
7. Evaluate Goals
8. System Change
9. Go back to Goals
Norman’s Execution-Evaluation Cycle

Gulf of Execution

- Goals
  - Form Intention
  - Develop Action Plan
  - Execute Actions
  - System Change

Gulf of Evaluation

- Goals
  - Evaluate Goals
  - Interpret State
  - Observe State

Interpret State

State

Evaluate Goals

Form Intention

Goals
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
  (Design Model, Designer’s Conceptual Model)

- Manifest Model
  How it presents itself
  (System Image)

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

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

Manifest Model
How it presents itself
(System Image)

Mental Model
How a person thinks it works
(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
Matching the implementation model is not necessary
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
A Problem with Feedback

1. Set both controls.
2. Allow 24 hours to stabilize.
The Implementation Model

Why is there a problem?

Can you fix the problem?
The Implementation Model

Why is there 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

“Design depends largely on constraints.”
Charles Eames
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:

<table>
<thead>
<tr>
<th>Affordances</th>
<th>Metaphors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility</td>
<td>Knowledge in the World</td>
</tr>
<tr>
<td>Constraints</td>
<td>Mapping</td>
</tr>
<tr>
<td>Consistency</td>
<td>Modes</td>
</tr>
</tbody>
</table>
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, 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.

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

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

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

Norman
Metaphors

Suggest an existing mental model

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

Desktop metaphor

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

Suggest an existing mental model

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

Desktop metaphor

Not an attempt to simulate a real desktop

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Explains why some windows seem hidden
Mail Metaphor
Calendar Metaphor

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 3</td>
<td>4:00pm DCS Colloquium</td>
</tr>
<tr>
<td>10</td>
<td>1:00pm TIPS meeting (220-4400pm) DCS Colloquium</td>
</tr>
<tr>
<td>11</td>
<td>1:30pm Economics Meeting</td>
</tr>
<tr>
<td>12</td>
<td>3:00pm Meet with Shamsi</td>
</tr>
<tr>
<td></td>
<td>3:30pm Meet with Jacob</td>
</tr>
<tr>
<td></td>
<td>5:00pm Meeting with ORO/HD</td>
</tr>
<tr>
<td>13</td>
<td>HOLD FOR FACILY RETREAT</td>
</tr>
<tr>
<td>17</td>
<td>Martin Luther King Day (MLK) Day</td>
</tr>
<tr>
<td>18</td>
<td>FIRST DAY OF CLASS</td>
</tr>
<tr>
<td>19</td>
<td>12:00pm CSC 581 (11:00-12:00)</td>
</tr>
<tr>
<td></td>
<td>Meet with Shamsi</td>
</tr>
<tr>
<td></td>
<td>2:00pm Meet with Jacob</td>
</tr>
<tr>
<td></td>
<td>4:00pm Joint seminar</td>
</tr>
<tr>
<td>24</td>
<td>12:00pm Faculty Lunch (12:00-1:00) DCS Colloquium</td>
</tr>
<tr>
<td>25</td>
<td>1:00pm Third year with Shamsi</td>
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<tr>
<td></td>
<td>3:00pm Meet with Jacob</td>
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<tr>
<td></td>
<td>5:00pm Meeting with ORO/HD</td>
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Health Metaphor

Inform VirusScan how to respond when a virus is detected.

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

If the above Action fails:
- **Move infected files to a folder**

  This option instructs VirusScan to automatically move all infected files to the quarantine folder.
  The location of the quarantine folder is configured on the "General" tab under "General Settings".
Shallow or Inappropriate Metaphors

Informs a small range of possibilities, or none at all

What does the living room add?

It is just a menu and a dialog box?
Mixed Metaphors

Two or more different metaphors coexist with some supposed relation

The desktop metaphor
Windows into content

Good?  Bad?
Neither?  Both?

Windows are views into larger content regions

No desktop has windows
Broken Metaphors

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

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

Lost the original imagery of their meaning

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

Idioms

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

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

Single click to select, double click to open

Hyperlinks
Idioms

Star Trek IV: Scotty Uses a Mouse
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, undermine interaction
- Can limit designer creativity
- Can reduce the advantages of software
- Can be “cute” at the expense of functional
Signifiers

“There are trails. There are behaviors. We know how to behave by watching the behavior of others, or if others are not there, by the trails they have left behind.”

“I call any physically perceivable cue a signifier, whether it is incidental or deliberate. A social signifier is one that is either created or interpreted by people or society, signifying social activity or appropriate social behavior.”

“Social signifiers replace affordances, for they are broader and richer, allowing for accidental signifiers as well as deliberate ones, and even for items that signify by their absence, as the lack of crowds on a train platform. The perceivable part of an affordance is a signifier, and if deliberately placed by a designer, it is a social signifier.”

Norman
Visibility

Phones

How do you

put somebody on hold

change volume
Visibility

**Location of Controls**

- Headset Jack (p. 28)
- TONE Button (p. 24)
- Display (p. 5)
- MIC (Microphone) (p. 13)
- VOLUME Button (p. 14, 29)
- MUTE Button (p. 18, 22, 24)
- SP-PHONE (Speakerphone)/HEADSET Button and Indicator (p. 13, 15, 29)
- One-Touch Auto Dial Buttons (p. 20)
- LOWER Button (p. 21, 23)
- AUTO Button (p. 16)
- PROGRAM Button (p. 9, 16, 20)
- REDIAL/PAUSE Button (p. 14, 25)
- FLASH Button (p. 24)

**Display**

- (This display shows all of the possible configurations.)
- 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, “*” 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, “*” 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, “*” 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 $\approx$ 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
Constraints

Baudisch et al., Snap-And-Go
Constraints

Traditional

Snap-And-Go

Baudisch et al., Snap-And-Go
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

Removing the cover plate, then removing and swapping the switches.

Mapping
Mapping
Mapping
Mapping
Consistency

Interfaces should be meaningfully consistent
  Ubiquitous use of same keys for cut/copy/paste
  Helps in developing / applying a mental model

Types of consistency
  Internal (i.e., within itself)
    e.g., same terminology and layout throughout
  External (i.e., with other applications)
    e.g., common widget appearance
    e.g., design patterns common across applications
Is Consistent Always Better?

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

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

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

Original focus on consistency, later design for mobile form.
Is Consistency Always Better?
Is Consistency Always Better?
Is Consistency Always Better?
Modes

Modes force people to divide their model
Active versus Passive Modes

Active modes require constant action to maintain. When that action has ended, 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 06: Design of Everyday Things

Tuesday / Thursday
12:00 to 1:20

James Fogarty
Kailey Chan
Dhruv Jain
Nigini Oliveira
Chris Seeds
Jihoon Suh