CMPT 363: User Interface Design
Summer 2021

Week 7: Psychology of Everyday Things

Instructor: Victor Cheung, PhD

School of Computing Science, Simon Fraser University

Group Project Part 2

- Will be available on Canvas by tomorrow

  - Repeat Component 2 of Part 1 (i.e., context & user identification, functional & non-functional requirements)

  - Component 1: 3 LFPs and their descriptions

  - Component 2: 2 MFPs and their descriptions

  - Lesson learned

- Due on July 16, 11:59p

- Get Balsamiq for Desktop (use the license key provided in Canvas > Announcement)

- Get Figma for education (https://www.figma.com/education/)

Recap from Last Lecture

- Different (computer) user interface types

  - History, characteristics, benefits/drawbacks

  - Future

- General interface design principles

  - Visual design principles, C.R.A.P. design principles, Gestalt principles

- Prototyping tools and techniques

  - Balsamiq & Figma

# Exercise from Last Lecture – Examine The Use of C.R.A.P.
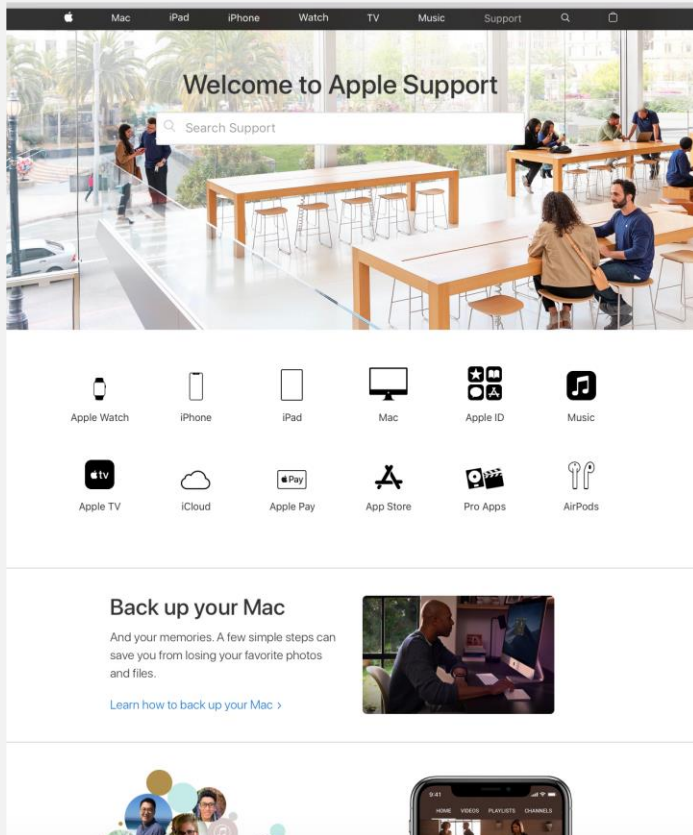
- **Contrast** – black icons & text white background, different text sizes and weighs

- **Repetition** – icons & texts in the same format

- **Alignment** – links to various products are arranged in a grid

- **Proximity** – search, links, articles grouped into their own sections

https://support.apple.com/

Today

- Design of Everyday Things
  - Fundamental Principles of Interaction, Action Cycle, Gulfs of Execution & Evaluation
- How people learn new things
  - Mental models, metaphors (next lecture)

Cognitive Considerations in Design

- Don Norman – researcher & professor at UCSD, co-founder & consultant at the Nielsen Norman Group
  - The Psychology of Everyday Things (POET), 1988
  - Updated to Design of Everyday Things (DOET), several updates since 1990
- Main topics from the book
  - Discoverability & understanding
  - Affordances, constraints, feedback, mappings
  - Mental models
  - Action cycle & gulfs of execution & evaluation
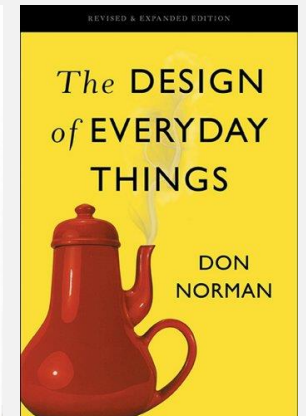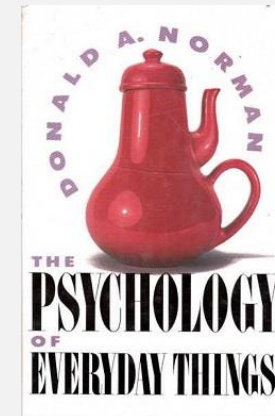
Discoverability & Understanding

- Two of the most important characteristics of good design

- Discoverability: The quality of letting the user to figure out what actions are possible and where and how to perform them (p3)

  - In computer interfaces, this is mostly achieved by visuals, less ideal ways are written or verbal instructions

- Understanding: The state of the user to know what does it all mean, how is the product supposed to be used, and what do all the different controls and settings mean?

  - In computer interfaces, this is mostly achieved by visual & feedbacks

All Artificial Things Are Designed

- Artificial things with physical forms: layout of furniture, paths of a hike, controls of a stove

- Artificial things with intangible forms: services, lectures, procedures, user interface configuration

- Industrial design: creates & develops concepts & specifications that optimize the function, value and appearance of products & systems for the benefit of both user & manufacturer. Emphasizes forms & materials

- Interaction design: enhances people's understanding of what can be done, what is happening, and what has just occurred. Emphasizes understandability & usability

- Experience design: improves the quality & enjoyment of the total experience. Emphasizes emotional impact

8

Design is Important & Non-Trivial

- Design done well → brilliant, pleasurable products, returning loyal customers

- Design done badly → unusable products, leading to frustration & irritation, or not how users wanted, loss of sales

- Why is it difficult?
  - Machines don't have the rich history of experiences that human share
  - Machines need precision & accuracy to operate
  - Most rules followed by machines are known only by the designers/developers

Evolution of Wrist Watches (An Example)

- Expensive instruments with one simple job: tell time

- Tools through digitalization and better technology: do more time-related jobs (e.g., alarm, timer, world-time)

- Multi-use platform for enhancing various activities and lifestyles (e.g., easy access to information, reminders)

- As technology advances, we are facing the challenge of incorporating more functions while keeping things easy to learn & use

Role of An (Interface) Designer for Technologies

- A good designer must understand both technology & psychology

  - *Design things for the way people are, not the way you like them to be* (paraphrased from Ch. 1 p7)

- More important in modern lives because of pervasiveness of technology and automation

  - Need to focus on cases where things go wrong (and communicate them well), not just on when things work as planned

- HCD enables that by putting human needs, capabilities, and behaviour first, then designs to accommodate those

  - Applies to all kinds of design

  - Requires good knowledge about the target users

Fundamental Principles of Interaction

- **Affordance** – relationship between the properties of an object and the capabilities of the agent (user) that determine how the object could possibly be used (possible action)

- **Signifiers** – a mechanism to communicate where the action should take place

- **Mapping** – relationship between control elements and their results

- **Feedback** – a mechanism to communicate the results of an action

- **Conceptual model** – an explanation of how things works (usually highly simplified, some times even inaccurate)

Affordance

- Affordance changes when either of these changes (and is thus defined by):

  - The qualities of the object (e.g., weight, shape, materials, look)

  - The abilities of the agent (e.g., motor skills, strength, senses)

- For example, a chair "affords" (is-for) support and in particular sitting and lifting, but not lifting when it's too heavy
  https://www.youtube.com/watch?v=NK1Zb_5VxuM

Perceived Affordance

- A distinction between real affordance (from the physical aspect of the object) & perceived affordance (from the perception of the user based on cultural constraints/conventions)

A magazine is an iPad that does not work
https://www.youtube.com/watch?v=aXV-yaFmQNk

5min+5min Break

What does a cup afford?

Affordances in Screen-Based Interfaces

- All screen displays afford touching (real affordance), but touch-sensitivity has to be communicated through signifier/feedback (e.g., a UI component that looks/works like a button) or conventions (e.g., by watching others do it) – as perceived by the user

  - That is, the interactivity of touch-screen interfaces is related to perceived affordance, not real affordance

- Norman's 4 principles for screen interfaces (https://jnd.org/affordances_and_design/)

  - Follow convention (e.g., location of common action buttons)

  - Use words & graphics to describe the desired action

  - Use metaphor (e.g., a slider-looking UI component controls a sliding parameter)

  - Follow a coherent conceptual model so learning can be applied to other parts

Signifiers

- Any mark or sound, any perceivable indicator that communicates appropriate behaviour to the user
  - E.g., instructions, trail marks, warning sounds
- Can be deliberate & intentional ("push" sign on a door), or accidental & unintentional (visible trail left by people who walked passed previously)

Mapping

- Particularly important in the design of control layouts and displays. Some "powerful" strategies include:

  - Spatial correspondence – location/action matches with the effect (e.g., stove switches, steering wheels)

  - Groupings & proximity – related controls are grouped together & close to what they are controlling (e.g., power switch closer to power supply)

  - Cultural – operation follow conventional understanding (e.g., up is more, down is less)

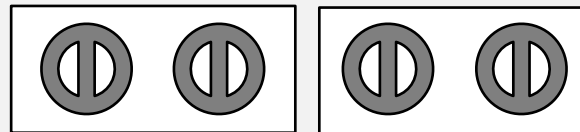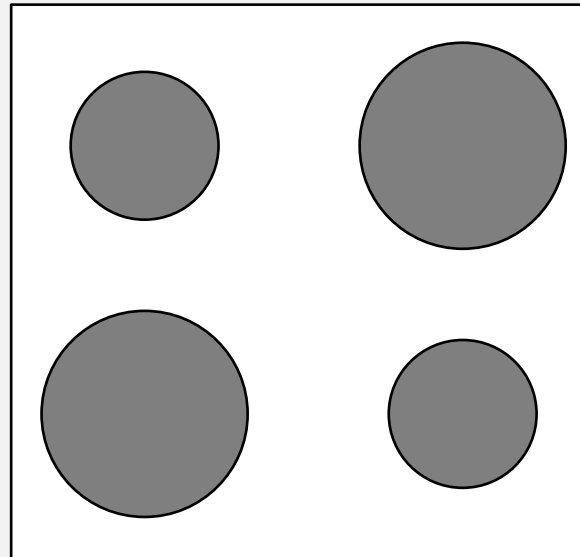 - Visual similarity – controls are visually similar to their physical counterpart (e.g., a virtual dial for a temperature control)
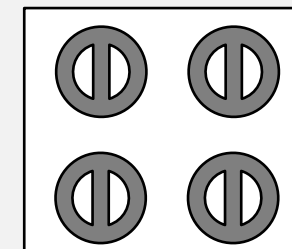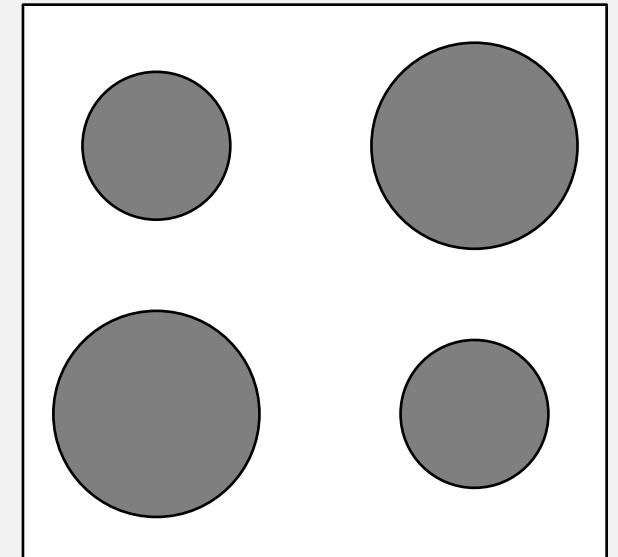
Levels of Spatial Mapping
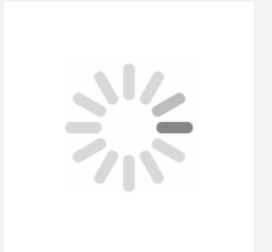
Arbitrary
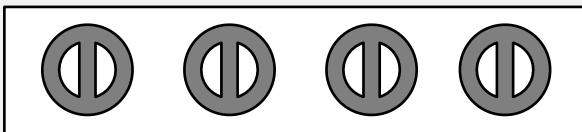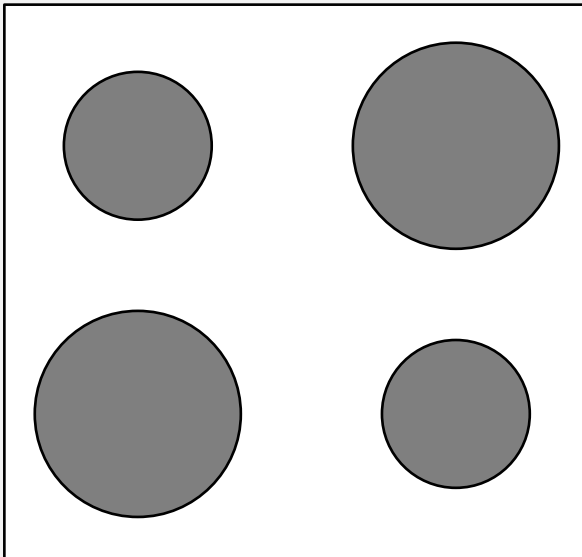
Partial

Full

# Feedback

- Must be immediate, informative, at the right amount, unobtrusive

  - Example 1: when user clicks a button the button looks pressed, or make a sound

  - Example 2: when user starts something and the system needs time to process/load, show it

- Exercise: how do you make a loading (waiting) process feel better?

Making The Loading Process Feel Better

Source: https://codemyui.com/
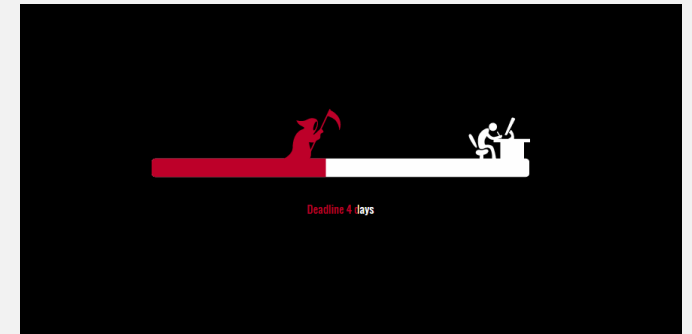
Conceptual Model

- Sometimes called "mental model" as they reside in the user's mind, can be different from user to user

- Comes from perceived structure, for example, folders & desktop in a computer

  - Shaped by signifiers, affordance, constraints, and mappings

  - Reinforced by experience, training, and instruction

- Also lets the user to predict how things will behave, and figure out what to do when things not go as planned

*Example of a design for car seat setting, the similarity with the actual seat shapes a seat mental model in the user's mind, making it easy to understand and operate.*

How People Do Things

Action Cycle & Gulfs of Execution & Evaluation

How People Do Things

- Norman's Action Cycle
  - 2 aspects: (1) execution (do something), and (2) evaluation (comparing what happened to what was desired)

(Simplified version)
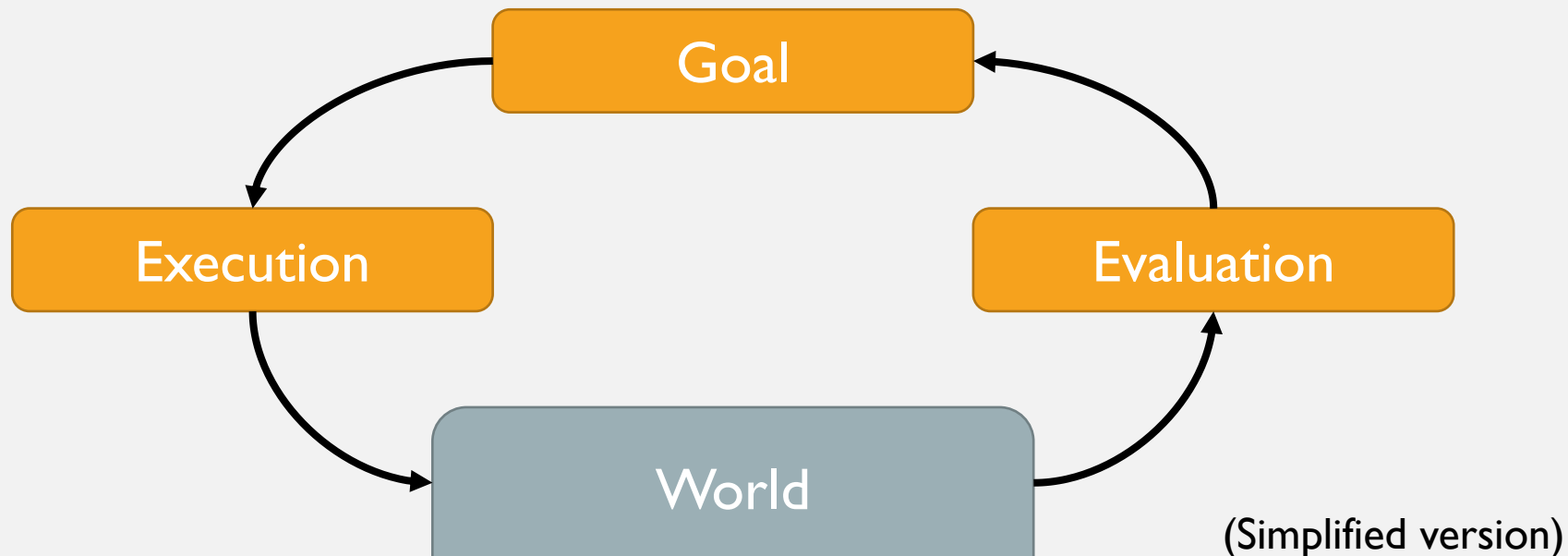
How People Do Things – Execution

- Start with a goal (e.g., turn on the lights, boil some water, change the temperature of the room, buy something)
  - Plan (intend to act, think of options, determine one)
  - Specify (think of sequences of action/steps to carry out that plan & achieve that goal)
  - Perform (carry out the specified steps)
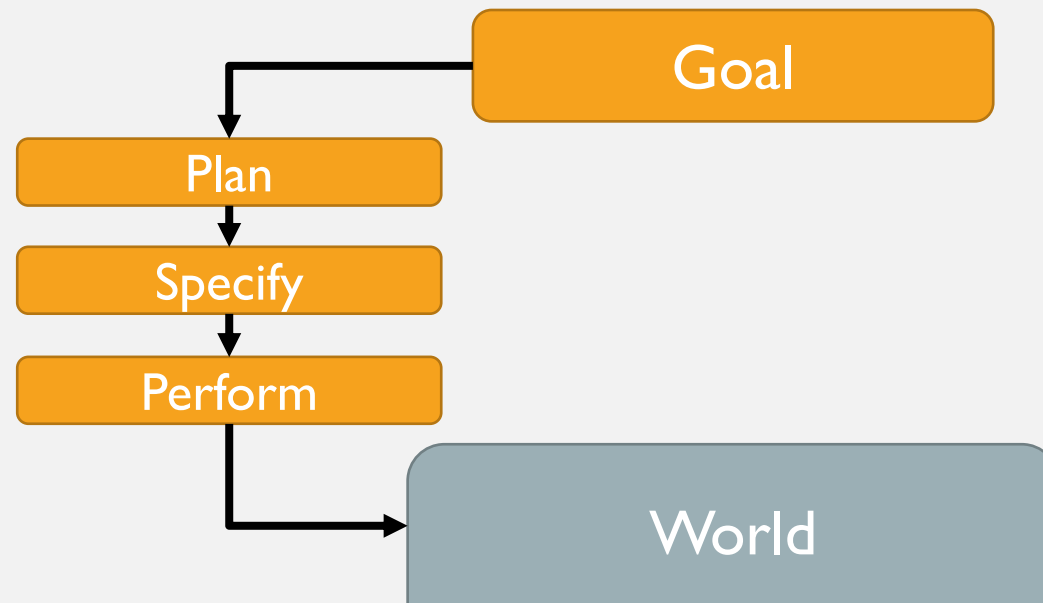
How People Do Things – Evaluation

- Start from the world (e.g., change in the environment, change in the state of something)
  - Perceive (observe what happened in the world)
  - Interpret (try to make sense of the observation)
  - Compare (compare what happened with what was wanted)

26
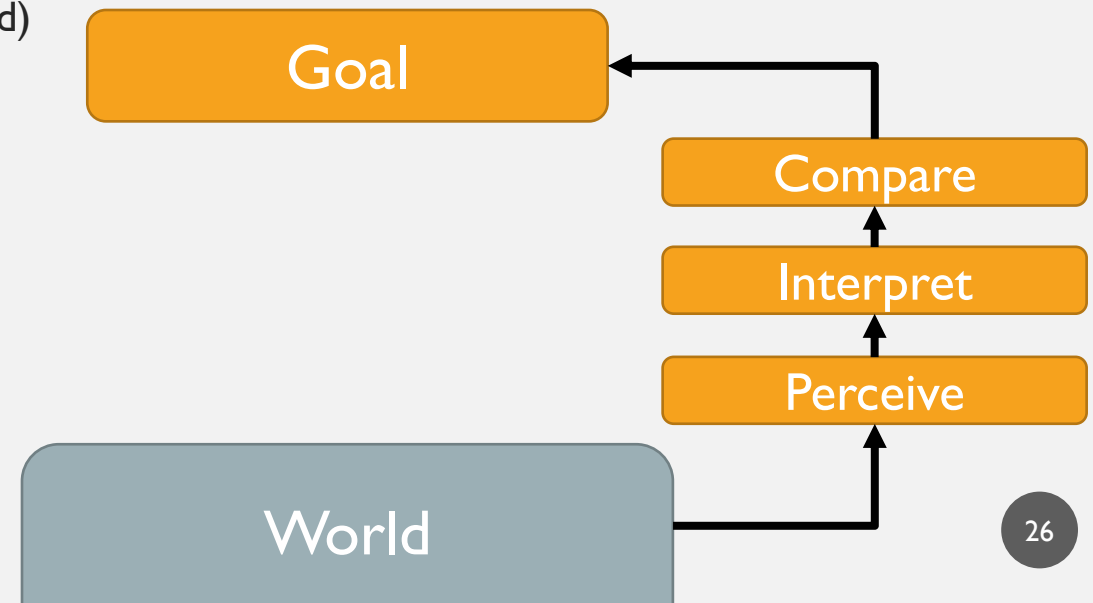
Details about Norman's Action Cycle

- A simplified framework for understanding human action and for guiding design

- Can also start from the world (aka data-/event-driven) instead of a goal (aka goal-driven)
    - For example, a notification shows up on the screen, the alarm goes off

- Not all stages are conscious (e.g., experienced driver making a turn), even the goal (e.g., you feel thirsty)

- The cycle can repeat multiple times for one task (typically when the compare stage isn't satisfactory)

- Watch it explained by Norman
https://www.youtube.com/watch?v=ahtOCfyRbRg

27

The Gulfs of Execution & Evaluation

- The **gaps** between the Goal & the World in Norman's Action Cycle

- **Gulf of Execution** – the difference between the intentions of the user (goal) and what the system allows them to do or how well the system supports those actions ("how do I work this?" "what can I do?")

  - Bad examples: not able to find a way to add items to a shopping cart, not able to attach a file in an email client

- **Gulf of Evaluation** – the amount of effort the user must make to interpret the physical state of the system and how well the expectations and intentions have been met ("what happened?", "is this what I want?")

  - Bad examples: not able to see confirmation of an online order is being placed, not able to determine the task's progress

Bridging The Gulfs

- Bridge the Gulf of Execution through the use of signifiers, constraints, mappings, and a conceptual model

- Bridge the Gulf of Evaluation through the use of feedback and a conceptual model

- Example: Designing a touch-interface for shopping

  - Gulf of Execution: signifiers (e.g., buttons with a pointing hand icon), constraints (e.g., unavailable items not-interactive and grayed out), mappings (e.g., use photos of items along with text, group items of same category together, dragging items to the cart area means planning to purchase)

  - Gulf of Evaluation: feedback and conceptual model (e.g., inform user on their purchase progress as if they are shopping in a shop)

How Do People Learn New Things?

How Do People Learn New Things

- Expectation Transfer: use their expectation from familiar objects to similar new ones (e.g., typewriter to computers)
  - Look & feel, terminology, mental models
- Cultural Conventions: understanding of "norm"
  - Some are almost universal: red = danger, green = go
  - Some are not: clockwise/anti-clockwise turning on faucets, symbols on game controllers
- Observing others: mimicking what others are doing
- Reading or listening to instruction manuals
  - We know most people don't…

YOU CANT TEACH A OLD DOG NEW TRICKS...
unless the award is belly rubs, praise, and snacks.

People Are Always Trying to Make Sense of Things

- Mental models are often extracted from fragmentary evidence and reinforced by positive feedback
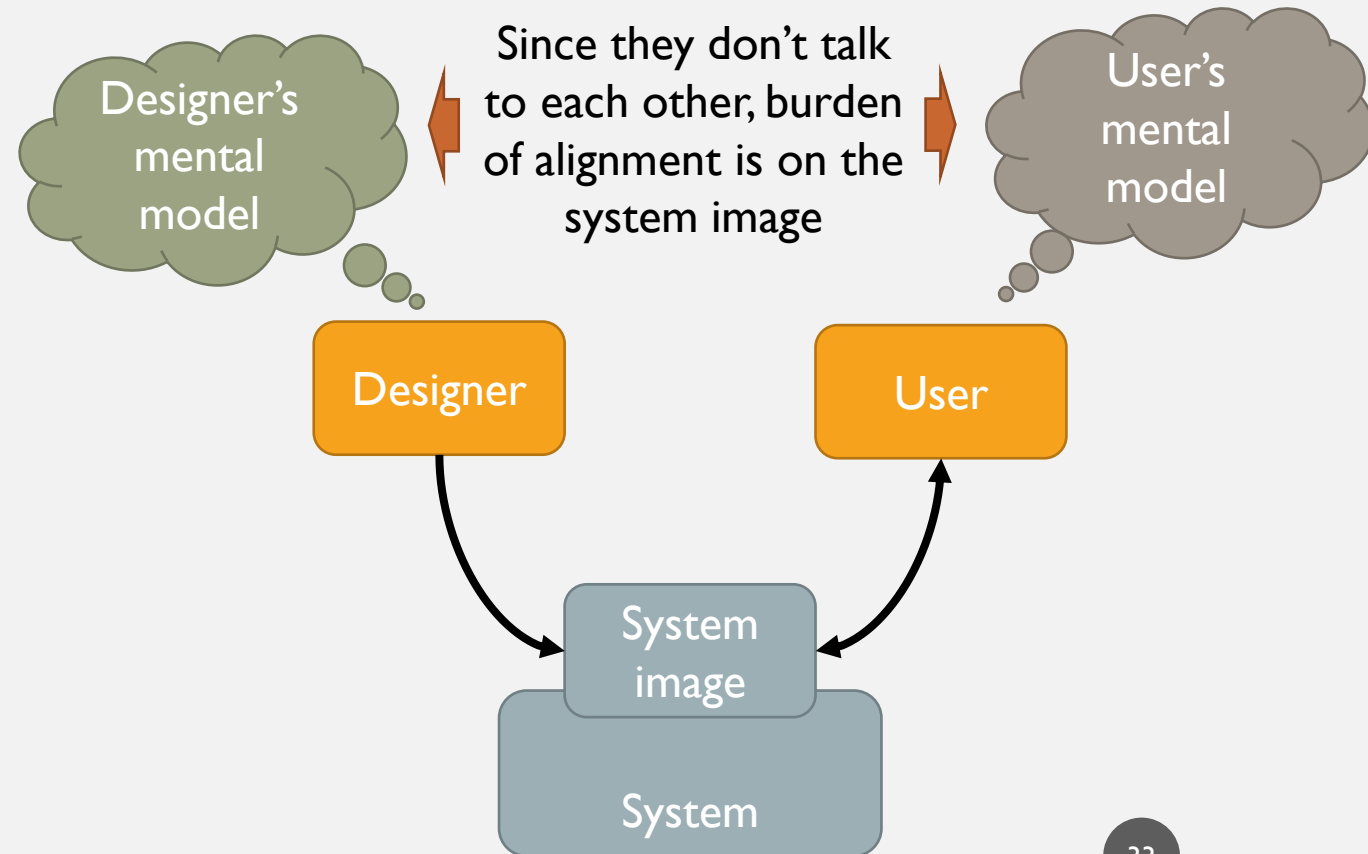 - Even when the association is inaccurate (that's how most unfounded habits form)

https://medium.com/@erskine/humans-suck-at-elevator-etiquette-8199e7c3c380

Relationships between Mental Models & Interfaces

- Designer's mental model is the designer's conception of the look, feel, and operation of the system

- System image is what can be derived from the interface as well as the documentation

- User's mental model is developed through interaction with the system via its interface

Adapted from Figure 1.11 in DOET

Designer's mental model

Since they don't talk to each other, burden of alignment is on the system image

User's mental model

Designer

User

System image

System

33

Why Do These Models Matter?

- The figure shows the disconnection between the mental models of the designer and the user

  - The bigger the difference the harder for the user to learn and use the system

  - The system image is the only way to connect the designer and the user, because

    - The mental model of the user is developed through interaction (bi-directional) with the system via this system image (composed by the interface and other documentations), and

    - The designer determines how the system image presents itself to the user

Summary

- Design of Everyday Things
  - Fundamental Principles of Interaction, Action Cycle, Gulfs of Execution & Evaluation
- How people learn new things
  - Mental models, metaphors (next lecture)

Post-Lecture Activity

- Read/watch these (and those in the slides)

  - Whitenton, K. The Two UX Gulfs: Evaluation and Execution
    https://www.nngroup.com/articles/two-ux-gulfs-evaluation-execution/

  - Benson, S. Leveraging Mental Models in UX Design
    https://www.toptal.com/designers/ux/mental-models-ux-design

  - Rekhi, S. Don Norman's Principles of Interaction Design
    https://medium.com/@sachinrekhi/don-normans-principles-of-interaction-design-51025a2c0f33

- Exercise: See next page

In-Class Activity

- Start with the goal: write an email

- Think about the 7 stages of Norman's Action Cycle

  - Plan (the action)

  - Specify (an action sequence)

  - Perform (the action sequence)

  - Perceive (the state of the world)

  - Interpret (the perception)

  - Compare (the outcome with the goal)

- How does an interface support/hinder the evaluation aspect?

Source: https://designmodo.com/gif-icons/

37