EECE 310 – Software Engineering

User Interface Design

Overview

- Introduction to design
- User-centered design and human capabilities
- Usability and how to achieve it
- Usability principles
- UI components

Learning Goals

- Explain why designing interfaces is hard
- Understand why designers need to consider human abilities (memory, visual perception, …)
- Explain why usability is important and how it can be achieved
- Analyze a GUI for problems using Nielsen's 10 usability heuristics and suggest aspects of the GUI that could be improved
- Given a scenario, design a UI using the most appropriate UI components

Question

- What is the most important consideration in developing a new software product?

A. Slick interface and design

B. Reliable and secure

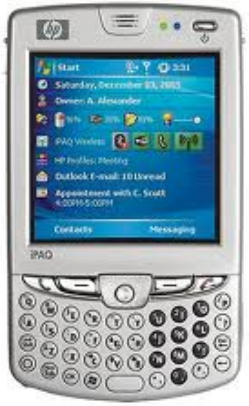
C. Fills a user need

D. Efficient and scalable

Designing interfaces is hard

How many of you can program ›ects of your

- digital watch?
- cell phone?
- microwave?
- washer and dryer?
- stereo system (home or car)?



What causes these problems?

Now, to actually set the time, one does:

- Press and hold SET. (1 key press)
- Press MODE to select the hours place. (1 key press)
- Press SPLIT/RESET to advance hours. (6 key presses on average)
- Press MODE to select the minutes place. (1 key press)
- Press SPLIT/RESET to advance minutes. (30 key presses on average).
- Press SET when done. (1 key press)

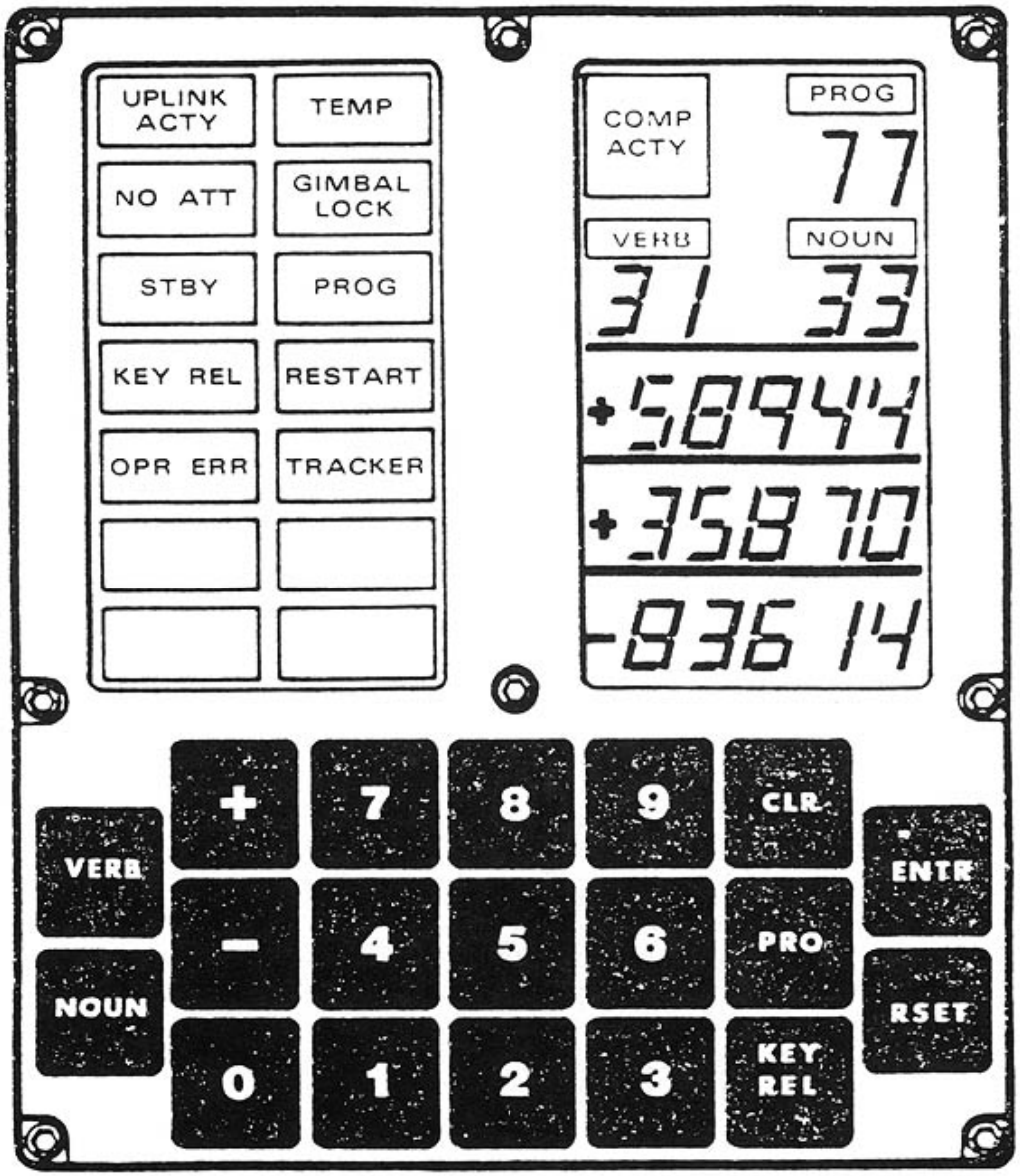
Symbolic issues…

- What does this mean?

What does this mean?

What do these symbols mean?

How much is the gas?



video: http://www.youtube.com/watch?v=EXT96N1YfbQ

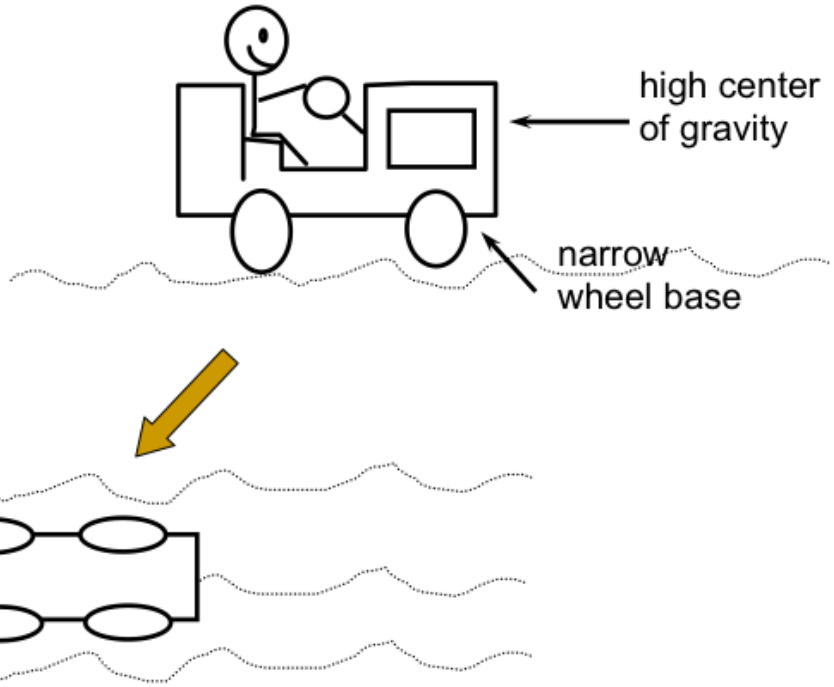
http://history.nasa.gov/computers/Ch2-7.html

In the past…

typical terrain:
un-surfaced
rough
hilly

original design:

early tractors



used to be called "Driver's Error" …

but, accidents became infrequent when designs changed to low center of gravity & wider wheel bases

Our approach now…

- Make the tractors hard to tip…
- (make the interface easy to use and understand)

Group activity

- What is UI design?
- What is a good UI design?

(UI) Design is important

- Many so-called human errors and "machine misuse" are actually **errors in design**.
- Designers decide on a **range of users** as the design audience.
- But, design is **difficult** for a variety of reasons that go beyond design.

Good design avoids wasting the time of the users.

What is?

- Interface
- Design

Interface - visual

Interface – physical

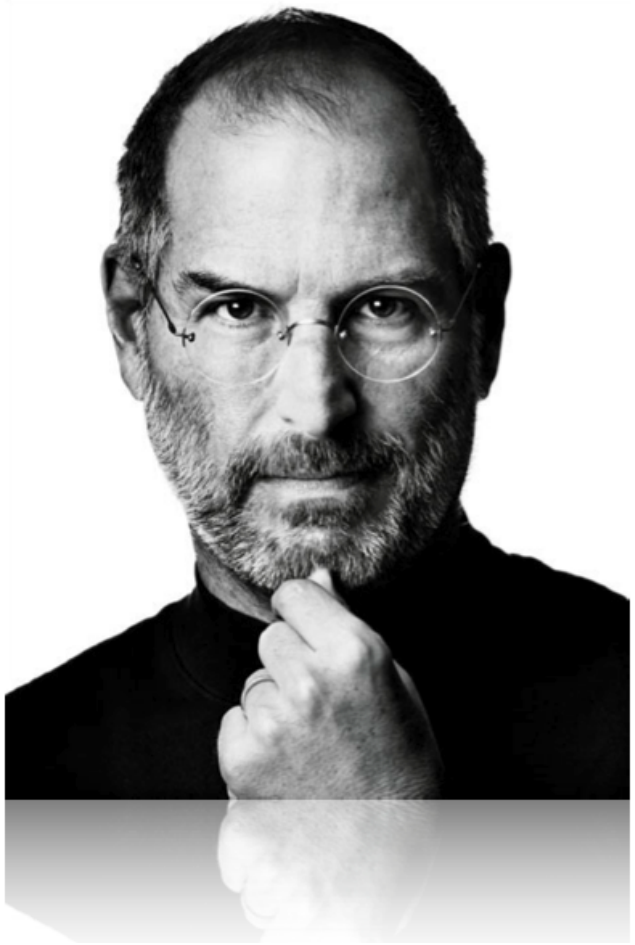
Design: attractive, not that functional

2007
Balenciaga Collection

Design: functional, not that attractive

Design: combine both?

What is design?



Design is not just what it looks like and feels like.

Design is how it works.

User-centered vs activity-centered?

- Design for an activity: coordinated set of tasks.
- Does technology adapt to people? Or vice-versa?

User-Centered Design!

- Why?
  - Cost saving
  - Competitive market
  - User expectations
- What?
  - Memory
  - Abilities
  - Color
  - Ergonomics

Human Capabilities

Some facts on memory

- Associations are built by repetition.
- Scaffold model (more likely to remember items that have many associations).
- Recognition is easier than recall.
- Working memory has small capacity.
- Long-term memory has large capacity.

Human Capabilities

Visual Perception

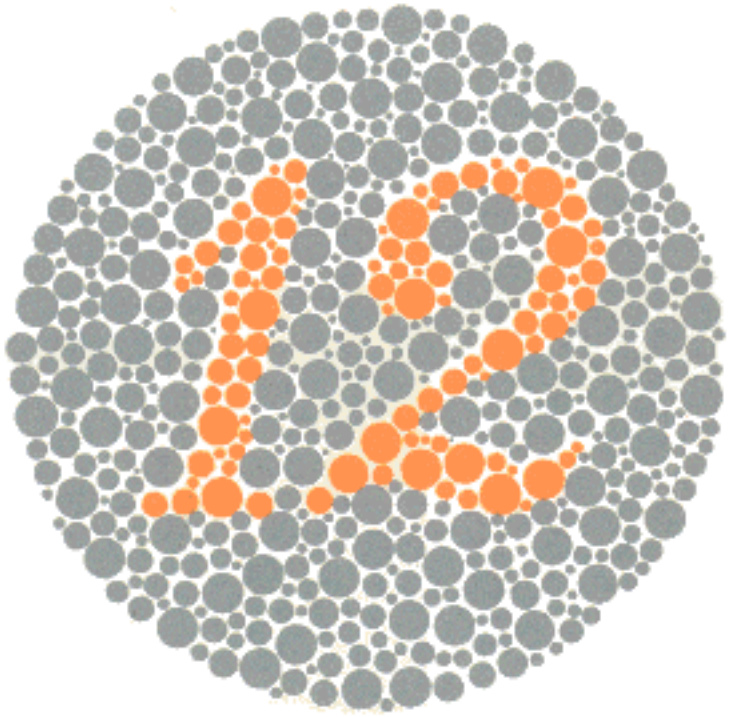
- We excel at pattern recognition.
- We automatically try to organize visual displays and look for cues.
- Motion, grouping, contrast, color can make different parts of a display more or less salient.

Human Capabilities

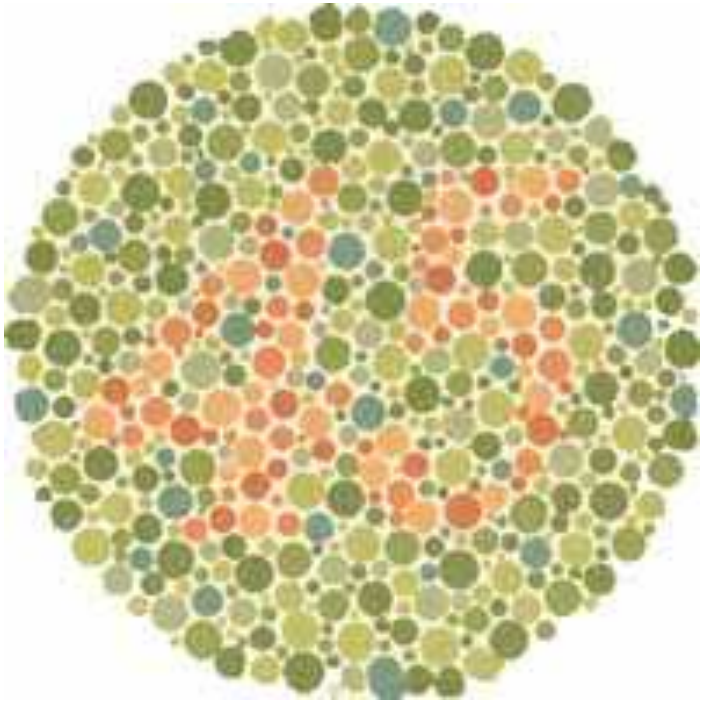
Learning

- Incrementally presented information accelerates learning.
- Some users like to explore systems to learn; others will not.
- Workers focus on accomplishing tasks, not learning software.

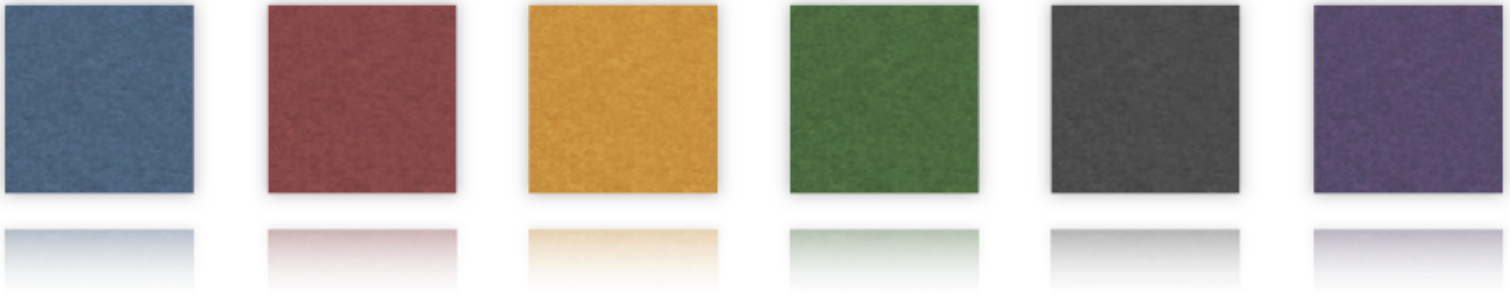
What nr do you see?



And here?



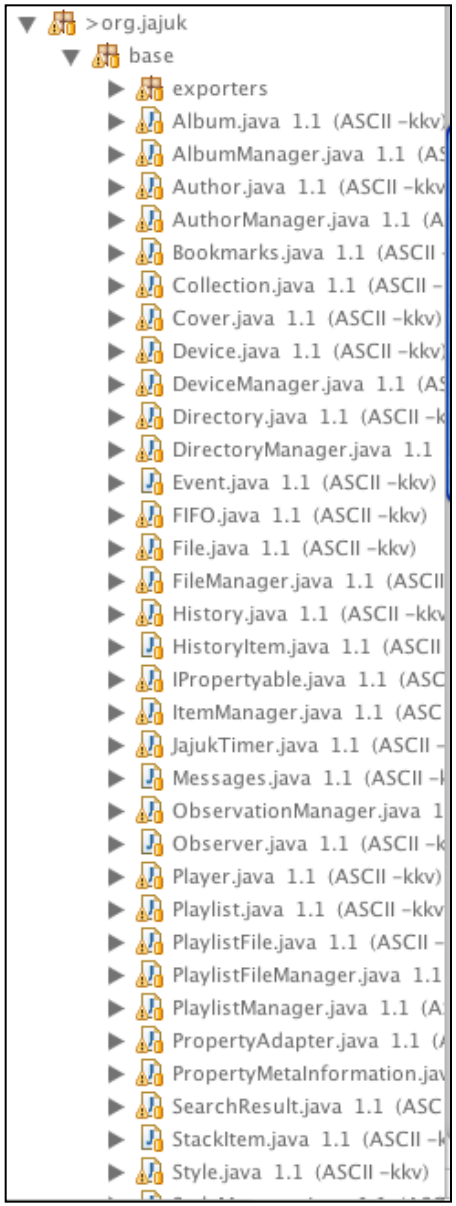
Human Limitations

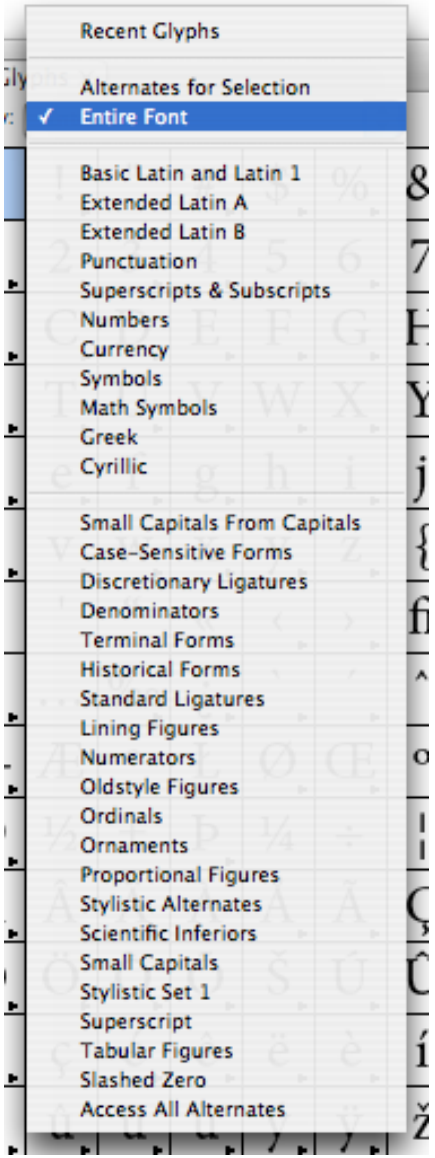


- Red-green color blindness (protonopia & deuteranopia)
  - 8% of males
  - 0.4% of females
- Blue-yellow color blindness (tritanopia)
  - Far more rare
- Guideline: don't depend solely on color distinctions
  - use redundant signals: brightness, location, shape

Human Limitation

- Information overload





Usability and Software Design

- usability: the effectiveness with which users can achieve tasks in one software environment. Studying and improving usability is part of Human-Computer Interaction (HCI)

- usability and good UI design are closely related
- a bad UI can have unfortunate results…

Exercise:
UI Design Principles

Form your lab groups,

- Discuss 5 good principles of UI design everyone should follow
- Write them down and hand in

Usability Principles

- Nielsen's 10 Principles of UI Design (Jakob Nielsen)
- Shneiderman's 8 Golden Rules
- Tog's 16 Principles

Nielsen's Principles - #1

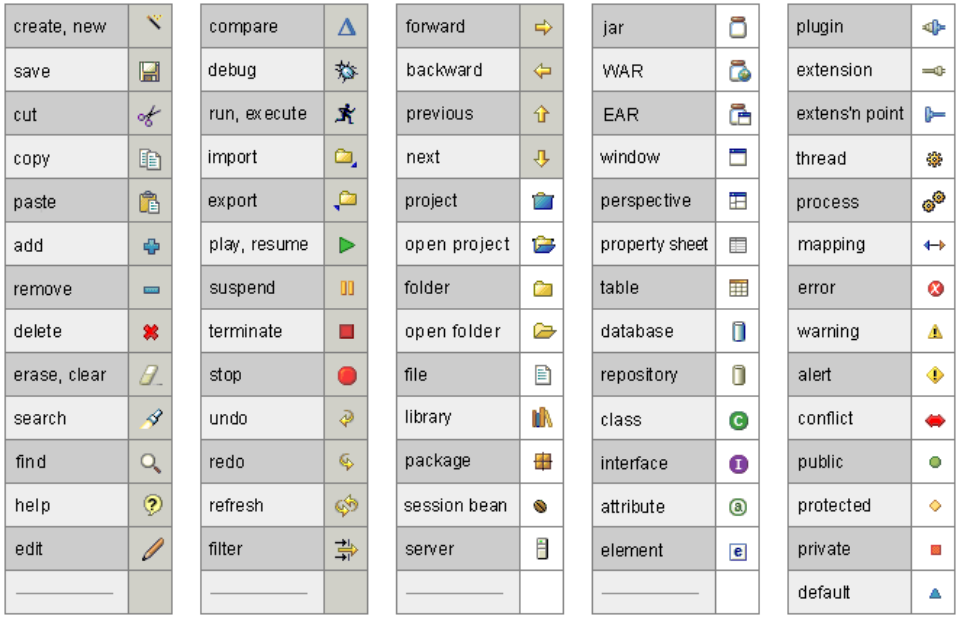
Match the Real World

- System should speak the **users' language**, with words, phrases and concepts **familiar** to the user, rather than system-oriented terms
- Follow real-world conventions
- Make information appear in natural and logical order
- Examples:
  - Files and folders on a desktop

Nielsen's Principles - #2

Consistency and Standards

- Users should **not** have to wonder whether different words, situations, or actions **mean the same thing**. Follow platform conventions.

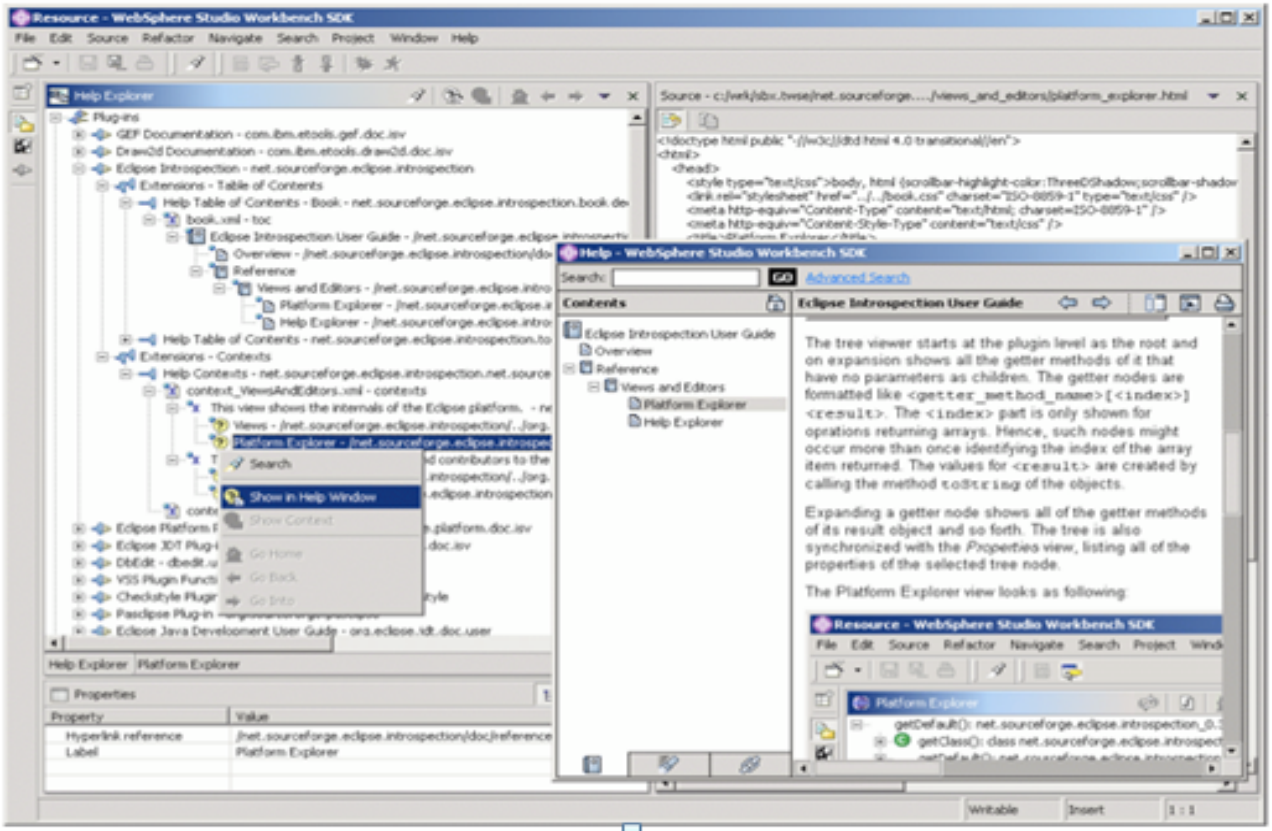


- Eclipse's icons guidelines
- Mac, Windows, Gnome and KDE guidelines

Nielsen's Principles - #3

Help and Documentation

- Help should be **searchable**, focused on user's **task**, **concrete** and **short**.



Nielsen's Principles - #4

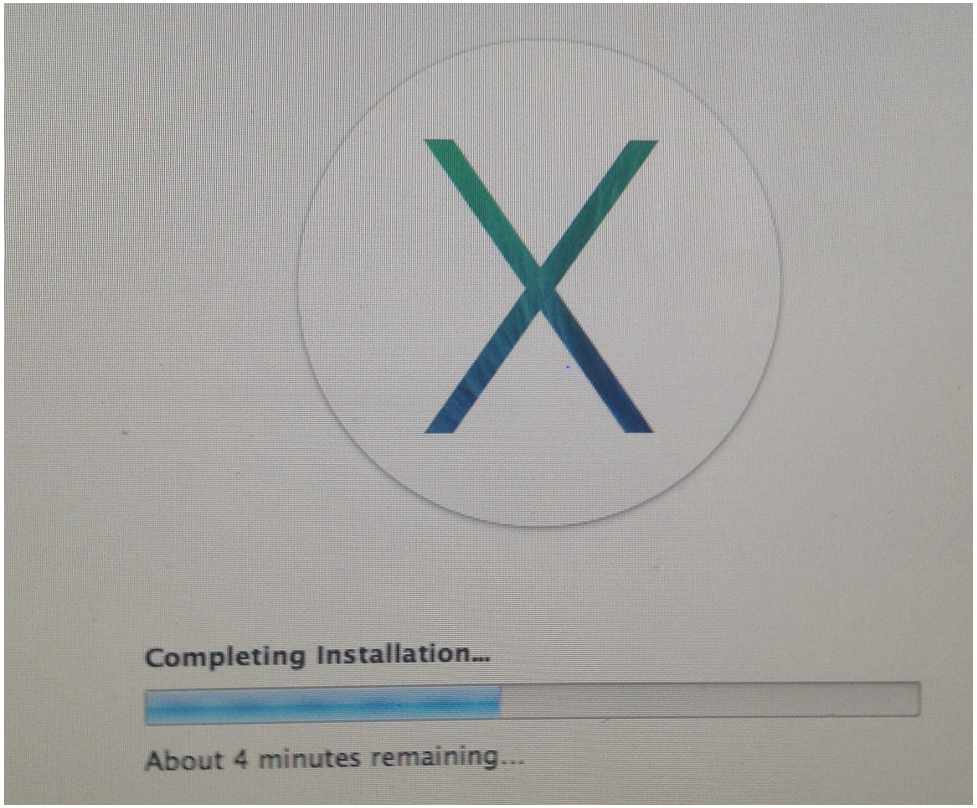
User Control and Freedom

- Provide "emergency exit" without having to go through extended dialogue
- Support **undo** and **redo**
- Enable users to go back to the state they exited from

Nielsen's Principles - #5

Visibility of System Status

- Keep users informed about **what is going on**, through appropriate feedback within reasonable time



Nielsen's Principles - #6

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 (shortcuts)**.

Keyboard shortcuts

Print

Keyboard shortcuts help you save time by allowing you to never take your hands off the keyboard to use the mouse. *You'll need a Standard 101/102-Key or Natural PS/2 Keyboard to use the shortcuts.*

To turn these case-sensitive shortcuts on or off, click Settings, and then pick an option next to **Keyboard shortcuts**.

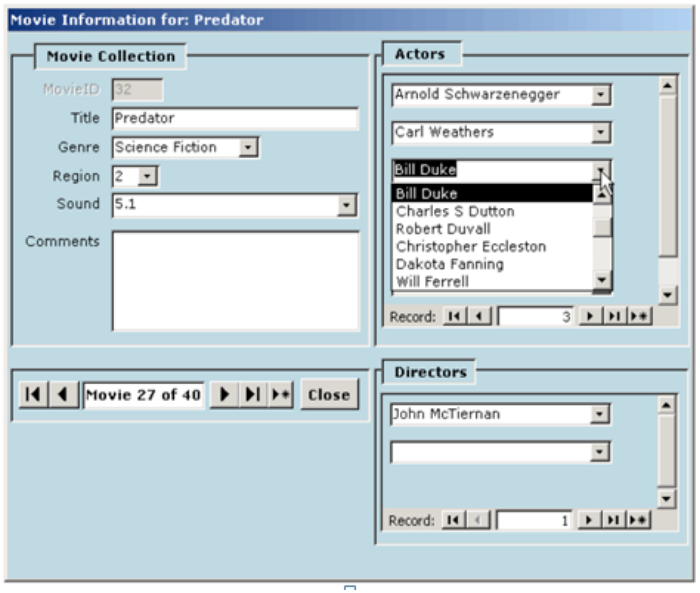
Shortcut Key	Definition	Action
c	Compose	Allows you to compose a new message. **<Shift>** + **c** allows you to compose a message in a new window.
/	Search	Puts your cursor in the search box.
k	Move to newer conversation	Opens or moves your cursor to a more recent conversation. You can hit **<Enter>** to expand a conversation.
j	Move to older conversation	Opens or moves your cursor to the next oldest conversation. You can hit **<Enter>** to expand a conversation.

- e.g. gmail shortcuts

Nielsen's Principles - #7

Error Prevention

- preventing errors is better than good error messages
- eliminate error-prone conditions or check and present users with confirmation option
- Example: form validation



Nielsen's Principles - #8

Recognition rather than recall

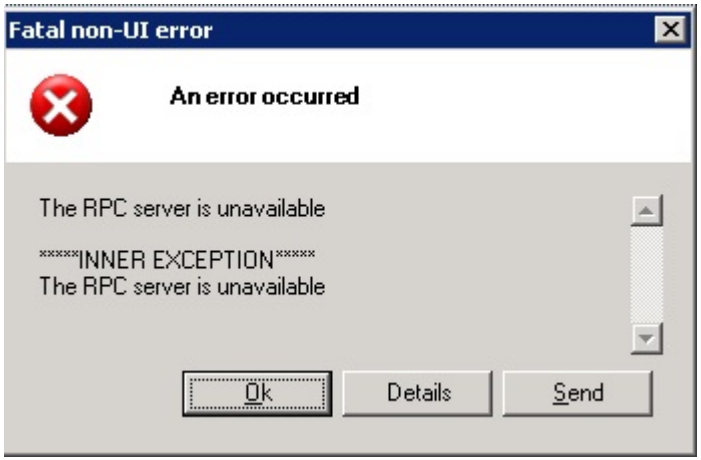
- Minimize user's memory load by making objects, actions, and options visible (and recognizable).

1. Who wrote "Pride and prejudice"?
2. Did Jane Austin write "Pride and prejudice"?

Nielsen's Principles - #9

Help users recognize, diagnose, and recover from errors

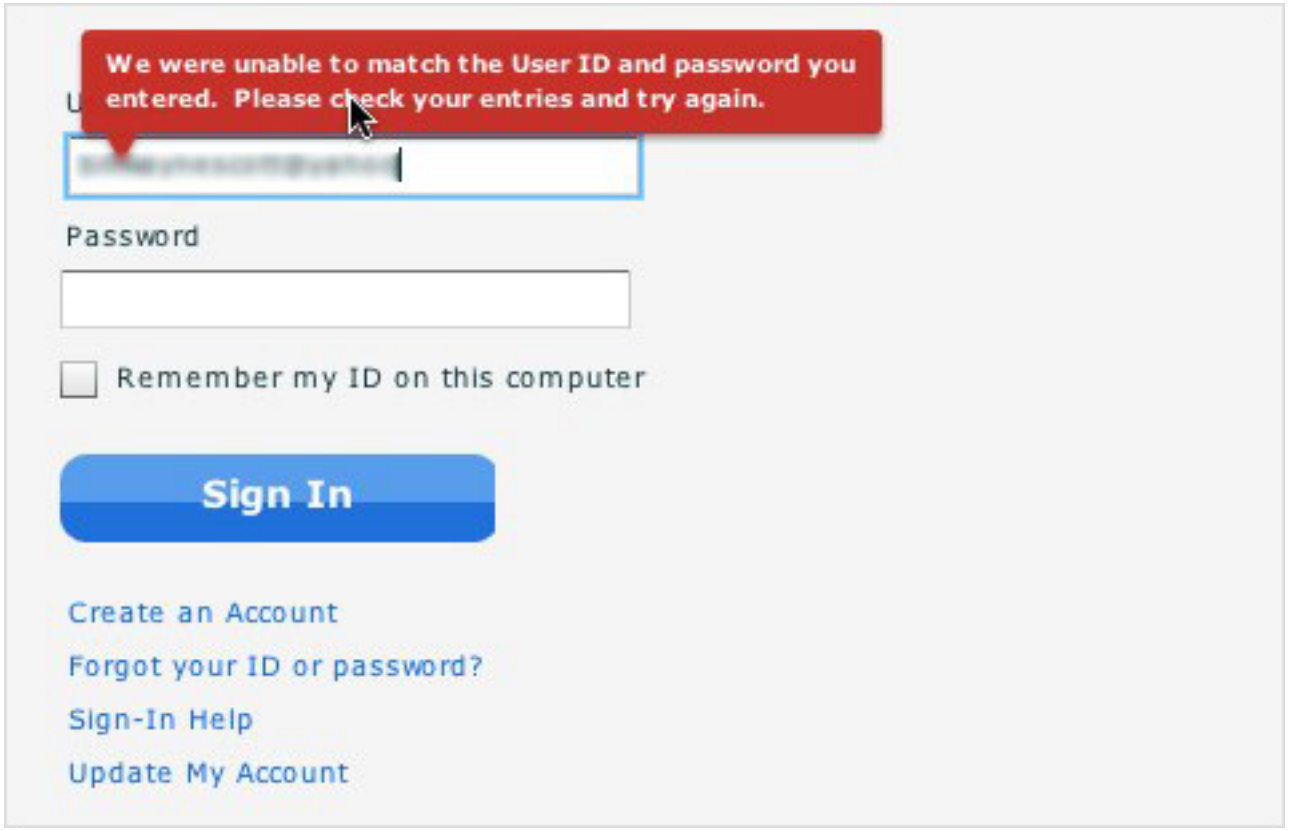
- Error messages in plain language (no codes), precise, and constructive



This example violates this principle!

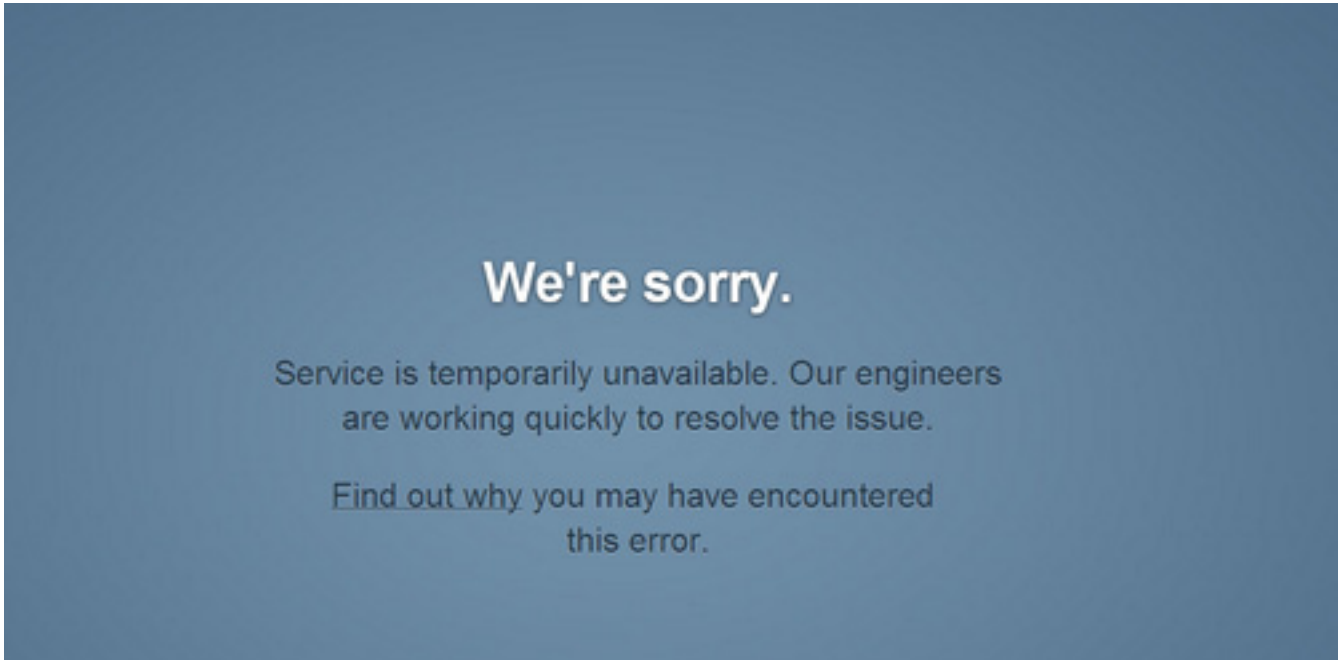
Nielsen's Principles - #9

Help users recognize, diagnose, and recover from errors



Nielsen's Principles - #9

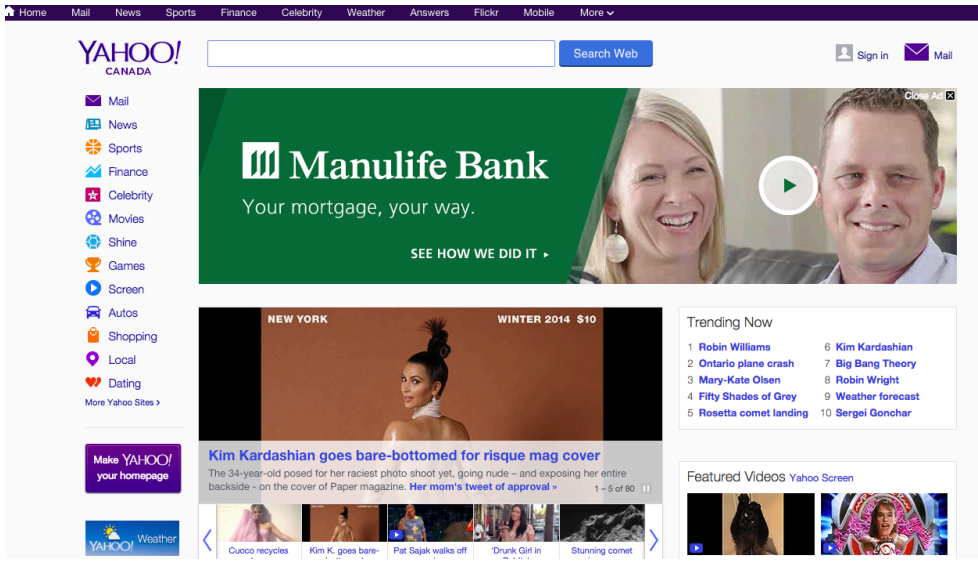
Be humble (admit your faults) and communicate with your users



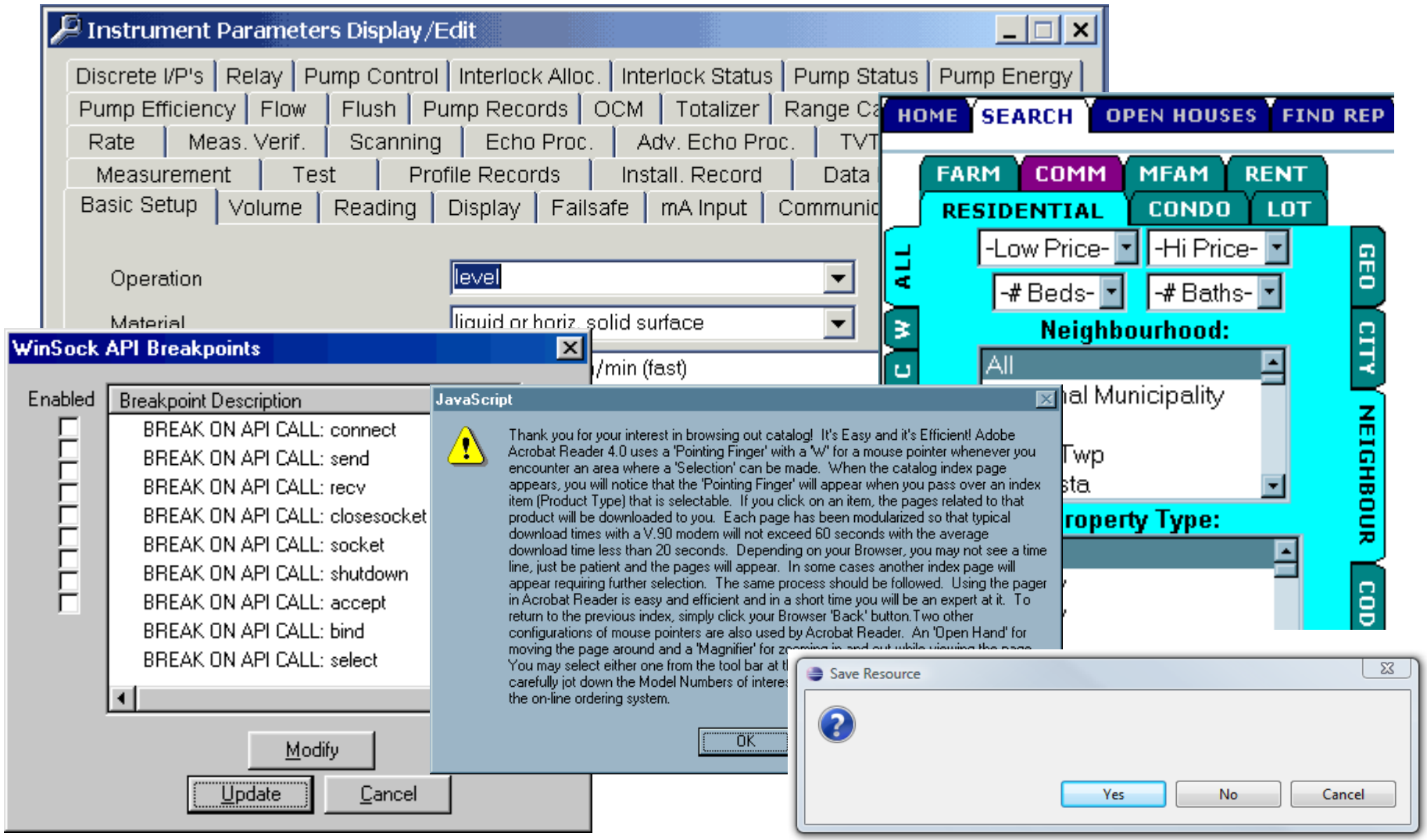
Nielsen's Principles - #10

Aesthetic and Minimalist Design

- Dialogues should not contain information which is irrelevant or rarely needed



UI Hall of Shame



http://homepage.mac.com/bradster/iarchitect/new.htm

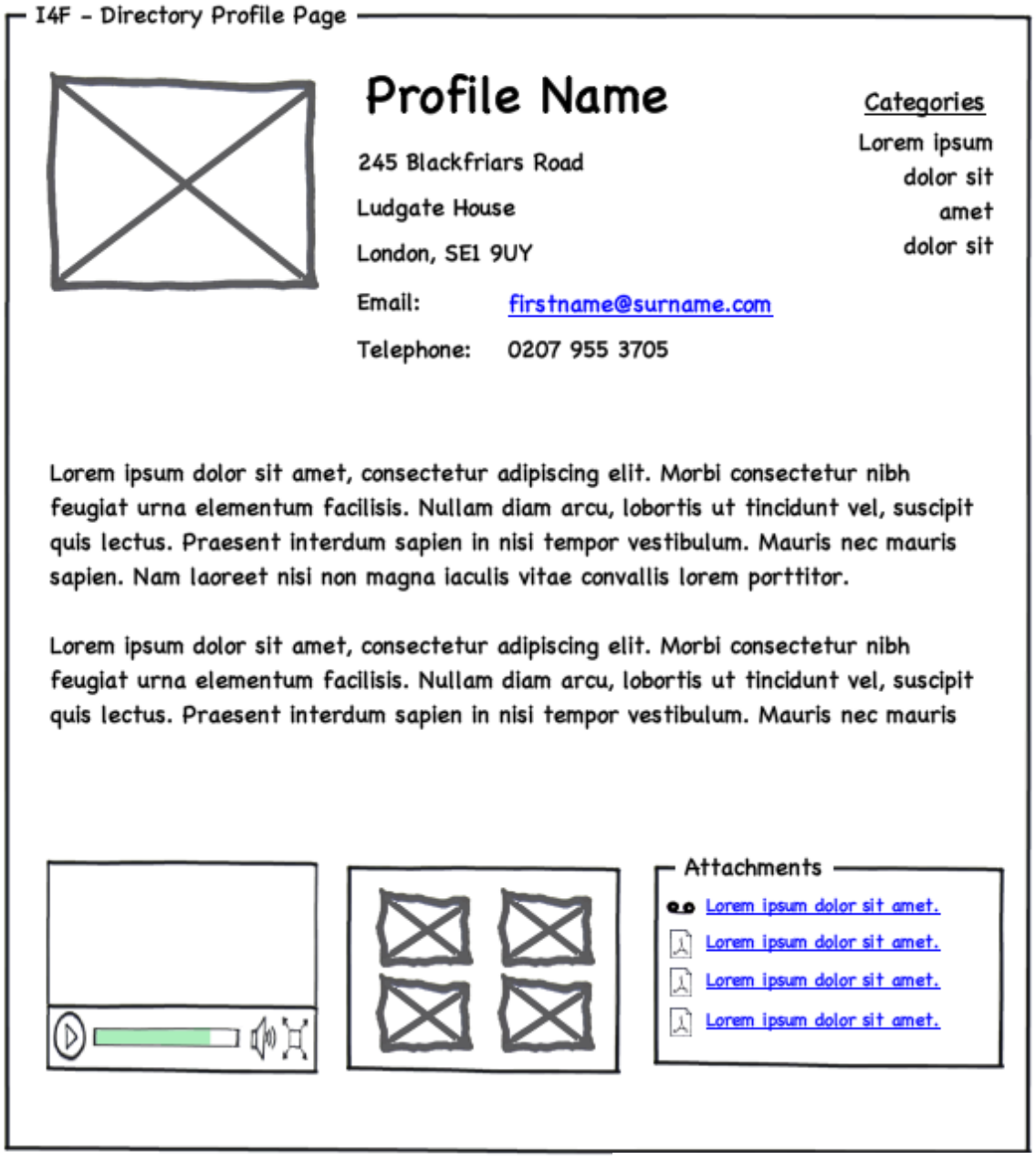
Achieving Usability?

Achieving Usability

- Some methods to achieve good usability:
  - User testing / field studies – having users use the product and gathering data
  - Evaluations and reviews by UI experts
  - Prototyping
    - Paper prototyping
    - Code prototyping
- Good UI design focuses on the user – not on the developer or on the system environment

UI Prototyping

- Creating a scaled-down or incomplete version of a system to demonstrate or test aspects of it
- Reasons to do prototyping:
  - aids UI design
  - provides basis for testing
  - team-building
  - allows interaction with user to ensure satisfaction

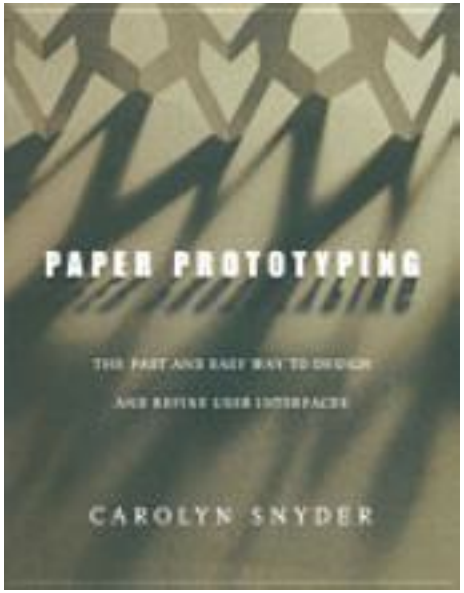


Wireframes or mockups

e.g., http://www.balsamiq.com/

Benefits of Prototyping

- much faster to create than code
- easier to change than code
- encourages feedback, since it feels less permanent or final
- focuses on big things vs. small (like the font)
- implementation neutral
- can be done by non-technical people
- shows us "what" is in the UI, but also "how" the user can achieve their goals in the UI; helps uncover requirements



Exercise

Your next project is developing a web-based retail system for a client who has international customers in North America and Europe.

- What UI design decisions are important to make this a success?

Internationalization

- Languages: English, French, German, etc
- Currency: USD, CAD, Euro, Pound
- Time zones:
  - Daylight saving time?
  - PDT, CET, etc
- Date Formats: 2/23/2014, 23/2/2014, etc
- Character encodings: UTF, ISO 8859-1, etc
- Decimals: 2,234 versus 2.234?
- Use locales
  - Externally modifiable variables in code

Summary

- User Interface Design
  - Creative, but requires engineering
  - Can affect product success
  - Can cause happy/unhappy customers
  - Is as important as functionality
- UI design principles can help ensure success
- Different UI components for different situations

Resources

- Nielson's UI principles

http://www.nngroup.com/articles/ten-usability-heuristics/

Group exercise

- In a hockey pool each person chooses a virtual team of hockey players from various real teams, and gets points when those players score.
- Create a paper prototype for the screen that would be shown when selecting the players for your individual pool.
- Include at least one interaction element (e.g. what happens when you click on a player's name?)
- Do a rough usability test within the group.

Class activity

- Draw a UI for a library search that has the following features
  - ability to enter a search string as an author, title, subject
  - ability to search magazines and/or books
  - ability to display multiple results, and to order them by either availability or earliest date of publication (but not both)

- You should use the most appropriate UI component (button, list, checkbox, scrollbar, etc.) for each feature.

From Razmov

An example UI

- What can w… e right components
  - Let's assu… itle, author, r…