Visualization, Interface Design & Usability

CEE 373
**Roadmap**

**SANDBOX**
- Modeling concepts, scales and approaches

**SANDBOX**
- Programming languages, software engineering & numerical methods

**DESIGN**
- Project Proposal

**IMPLEMENTATION**
- Examination of Equilibrium-based Code

**IMPLEMENTATION**
- Examination of Reaction Rate-based Code

**IMPLEMENTATION**
- Examination of Existing Models for Complex Systems

**IMPLEMENTATION**
- Visualization, Interface Design and Usability

**READINESS**
- Internal Testing and Code Freeze

**RELEASE**
- Final Presentations ("Rollout")
OBJECTIVES
1. To examine issues that may be encountered when visualization features are added.
2. To introduce common interface design principles.
3. To understand how to enhance software usability.
Technology Basics

- Super VGA was first defined in 1989. In that first version, it called for a resolution of 800 x 600 4-bit pixels.
- Display resolutions and color bit-depth are determined by the video card, not monitor.
- Common color bit-depths: "bitmap", "grayscale", "256 colors" aka "8-bit", "Thousands" aka "16-bit", "Millions" aka "24-bit" aka "RGB".
- "Raster graphics" aka "bitmapped graphics" is rendered on a matrix of pixels, typically using x-y coordinates. Think "Photoshop."
- "Vector graphics" involve the positioning and sizing of objects such as lines, shapes and curves. Objects are easily scalable and moved, but keeping track of the objects is challenging. Think "Illustrator."
Selected Issues

1. Clarity, precision and accuracy.
   • Does the full set of data get displayed or is there obscured information?
   • Do you need to overlay precision information? e.g., $\sigma^2$
   • Does the translation to the selected coordinate system have an impact on accuracy?

2. Data distortion.
   • Poor selection of axes scales can lead to distortion.
   • Coordinate rotation and tilting can also cause distortion.
   • Use of logarithmic scales.
**Advanced Topics**

1. **Visualization for data input.**
   - What kind of graphics (icons, arrows, callouts) can help during data input?

2. **Dynamic visualization during processing.**
   - What kind of visual feedback (progress bar, spinning cursor) could a user get while data is being processed by the model?

3. **Data mining.**
   - Analysis of large volumes of relatively simple data to extract important trends and new, higher level information.
   - Is all the model output data typically generated during a modeling exercise amenable to data mining? Would it be a worthwhile activity?
1. UI Guidelines.
2. Passive vs Dynamic Interface
3. Collaborative Environments.
UI Guidelines
Passive vs Dynamic Interfaces: "Dialogs"

• **Modeless.** Enables users to change settings in a dialog while still interacting with document windows; the Find window in many word processors is an example of a modeless dialog. Modeless dialogs have title bar controls (close, minimize, and zoom buttons).

• **Document modal.** Prevents the user from doing anything else within a particular document. The user can switch to other documents in the application and to other applications.

• **Application modal.** Prevents the user from doing anything else within the owner application; the user can switch to another application. Most application-modal dialogs do not have the standard title bar controls (close, minimize, zoom); the user dismisses these dialogs by clicking a push button, such as OK or Cancel.
Passive vs Dynamic Interfaces: Cursors and more...

**Cursors:** Fast, reaction-type feedback. Little space needed.

**Progress bars:** For slower (>10 s) feedback. Provides estimated wait time. Compare with the spinning wait cursor.

**Language:** Use persuasive language.
Collaborative Environments

**Change history** An overview of who has done what to where.

**Version control** How do you implement version control for multiple-concurrent efforts?

**Shared document control** Making sure there is just one "good" version being used.

**Concurrent editing** Enabling work in overlapping time spans, and merging to form final products.
Collaborative Environments

**Support and training issues** Need to identify support and training leaders, and build appropriate resources.

**Integrated communications** Need unified interface for users, developers, support, and trainers to interact.
Collaborative Environments

Centralized vs Distributed Computing

Centralized computing facilitates easier management of resources. Distributed computing is scalable and has redundancy built in (a good thing!).
1. Information Architecture and Design.
2. Interaction Design - Error Handling.
3. Surface Design - the Follow the Eye principle.
4. Embedded and External E-Support
The Elements of User Experience

A basic duality: The Web was originally conceived as a hypertextual information space; but the development of increasingly sophisticated front- and back-end technologies has fostered its use as a remote software interface. This dual nature has led to much confusion, as user experience practitioners have attempted to adapt their terminology to cases beyond the scope of its original application. The goal of this document is to define some of these terms within their appropriate contexts, and to clarify the underlying relationships among these various elements.

Web as software interface

Visual Design: graphic treatment of interface elements (the "look" in "look-and-feel")

Interface Design: as in traditional HCI: design of interface elements to facilitate user interaction with functionality

Information Design: in the Tuftan sense: designing the presentation of information to facilitate understanding

Interaction Design: development of application flows to facilitate user tasks, defining how the user interacts with site functionality

Functional Specifications: "feature set": detailed descriptions of functionality the site must include in order to meet user needs

User Needs: externally derived goals for the site; identified through user research, ethnotechno/psychographics, etc.

Site Objectives: business, creative, or other internally derived goals for the site

task-oriented

Web as hypertext system

Visual Design: visual treatment of text, graphic page elements and navigational components

Navigation Design: design of interface elements to facilitate the user's movement through the information architecture

Information Design: in the Tuftan sense: designing the presentation of information to facilitate understanding

Information Architecture: structural design of the information space to facilitate intuitive access to content

Content Requirements: definition of content elements required in the site in order to meet user needs

User Needs: externally derived goals for the site; identified through user research, ethnotechno/psychographics, etc.

Site Objectives: business, creative, or other internally derived goals for the site

information-oriented

This picture is incomplete: The model outlined here does not account for secondary considerations (such as those arising during technical or content development) that may influence decisions during user experience development. Also, this model does not describe a development process, nor does it define roles within a user experience development team. Rather, it seeks to define the key considerations that go into the development of user experience on the Web today.

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http://www.jjg.net/ia/
Information Architecture and Design.

- **IA**: The organization of information, in terms of navigation, layout and search functionality. The goal is to enable users to find the information they are seeking in a clear manner.

- **ID**: Information design is the design of information graphics, and more generally the design of visual displays of data. Its most important component is structuring information so it will be as learnable or useful as possible.

- Long-held and essential concepts of library science, now applied to web and other interactive usage models.
Information Architecture and Design.

- Top-down approach

- Bottom-up approach
Information Architecture and Design.

Layouts

• Sequential
Information Architecture and Design. Layouts

- Hierarchical
Information Architecture and Design.

Layouts

- Matrix

- Organic
Interaction Design

- Interaction design is concerned with describing possible user behavior and defining how the system will accommodate and respond to that behavior.
### Interaction Design - Error Handling

**DEALING WITH USER ERROR**

#### PREVENTION
Design system so that errors are impossible.
- Not always possible.
- Not easy to accomplish.

#### CORRECTION
Design system so that errors are difficult to make.
- Help the user identify the problem and fix it.
- If possible, fix problem on user's behalf (can be time-wasting and annoying!)

#### RECOVERY
Helpful error messages after the error happens.
- Provide way for user to recover from error, such as "undo."
- Otherwise, guess that an error has occurred and ask user to confirm action.
**Surface Design - the "Follow the Eye" principle**

- Where does the eye go first? What element of the design initially draws the user's attention?
- Does the eye-catching element reveal the primary objective of the interface?
- Smooth flow. Avoid having eyes bounce around various elements, and giving cluttered impression.
- Guided tour. The initial eye scan should "map" all the possibilities and show how to fulfill goals.
- Use contrast to draw attention.
- Use uniformity to avoid confusion.
- Use a grid-based layout, if effective, for element placement.
- Ease eye movement by making related interfaces consistent in design. For example, don't use different sizes for the OK button.
Embedded and External eSupport.

- eSupport employs technology to provide on-demand access to help information.
- The quality of eSupport principally relies on:
  - the ability of the support engineer to anticipate the questions that most users will have,
  - the ability to write understandable help articles,
  - making the information accessible.
- eSupport can be pre-emptive as well as responsive.
USABILITY

You can find tips, troubleshooting, discussions, downloads and more in our Mac OS X Tiger support area.

Service & Support

What’s New

Mac OS X Tiger Support
Ready for Tiger? Find the answers to your Tiger installation questions, discover its cool new features, learn how to troubleshoot issues, get advice from other users, and much more.

New to the Mac?
Learn how to get the most out of your new computer in our online courses:

- Mac 101
- Switch 101
- Troubleshooting 101

Product Support

Macs

Choose...

IPod & iSight

Choose...

Portables/Wireless

Choose...

Power Macs

Choose...

Search
Advanced Search | Help

AppleCare products
Extend your service and support coverage with AppleCare.

- Learn about AppleCare products
- Enroll your AppleCare agreement
- View your support agreements
- Complimentary support information

Service & upgrades
Your repair or upgrade options, including our DIY program.

- Do-It-Yourself parts & service
- Check your repair status

Order status
Look up your order status and shipping time for online orders.
Summary

- Visualization
- Interface Design
- Usability
Interesting stories behind...

INVENTIONS & DISCOVERIES
In 1991, inventors Andrew Bell, Dr David Brown and Dr Nicholas Terrett (also Pfizer employees at Kent) discovered that chemical compounds belonging to the pyrazolopyrimidinone class were useful in treating heart problems such as angina. Terrett was named in the 1991 British patent for Sildenafil (tradename Viagra) as a heart medicine, and some experts consider him as the father of Viagra. By 1994, Nicholas Terrett and colleague Peter Ellis discovered during the trial studies of Sildenafil as a heart medicine that it also increased blood flow to the...
Plunkett and his technician assistant, Jack Rebok, were testing the chemical reactions of the refrigerant gas tetrafluoroethylene (TFE). One pressurized cylinder of the gas, which they themselves had filled earlier, failed to discharge when its valve was opened. They set the cylinder aside, but Rebok later noticed it was too heavy to be empty, and suggested they cut it open to see what had gone wrong. Plunkett agreed, despite the risk of an explosion; and they discovered that the gas inside the cylinder had inexplicably solidified into a white powder. Intrigued, Plunkett put his scheduled work aside and began to test the properties of this substance. It was much more lubricant than other slippery solids, like graphite; and in addition, it proved inert to virtually all other chemicals and had an extremely high melting point.
Grégoire, an avid fisherman, decided to coat his fishing gear with Teflon to prevent tangles. His wife, Colette, had another idea: Why not coat her cooking pans? Grégoire agreed to try it, and he was successful enough to be granted a patent in 1954. The Grégoires were so happy with the results that they set up a business in their home. Starting around 1955, Marc coated pans in their kitchen and Colette peddled them on the street. French cooks, despite their customary reverence for tradition, snapped them up. Encouraged by this reception, the Grégoires formed the Tefal Corporation in May 1956 and opened a factory.
George worked at Weber Brothers Metal Works outside Chicago, welding large metal spheres together to make buoys. It was in these very spheres that his idea took shape. He knew a rounded cooking bowl with a lid was the key to success. He added three legs to the bottom, a handle to the top, and took the oddity home.
Interesting stories behind...

- The secret of nitroglycerin emerged at last in the 1970s, when researchers realized that it works by reacting in the body to form a messenger molecule called nitric oxide, or NO.
- Nitric oxide was regarded as an environmental pollutant and little else: at best a chemically reactive nuisance, at worst a poison. In the exhaust fumes of cars it reacted readily with oxygen to produce smog, increasing the risk of asthma. When discharged into the atmosphere from power station chimneys it contributed to the ecological damage from acid rain...The notion that such a noxious little molecule should also hold a key to a healthy body and mind was counter-intuitive, and is still disconcerting to some people.
- The molecule governs blood pressure, through a recently recognised process that contradicts textbook wisdom. It causes penile erections by dilating blood vessels, and controls the action of almost every orifice from swallowing to defecation. The immune system uses nitric oxide in fighting viral, bacterial and parasitic infections, and tumours. Nitric oxide transmits messages between nerve cells and is associated with the processes of learning, memory, sleeping, feeling pain, and, probably, depression. It is a mediator in inflammation and rheumatism.
- However, in the very first experiment designed for this new study in May 1978, an accidental finding as a result of a technician's error completely changed the course of research in my laboratory. The accidental finding was that on the preparation of rabbit aorta being used in the experiment, the muscarinic agents acetylcholine and carbachol induced relaxation rather than the expected contraction. Why this accidental finding was so exciting, how it led to our discovery of the endothelium-derived relaxing factor (EDRF), and how that factor was eventually identified as nitric oxide...
Inventing & Discovering in Environmental Modeling

• Inventing conceptual models and solutions (mostly done)
• Elevating sophistication of environmental modeling software based on state of the art technologies (rate-limited)
• Search for un-met needs and build to suit
• Discovery of new data patterns and behaviors
• Where else can we go?