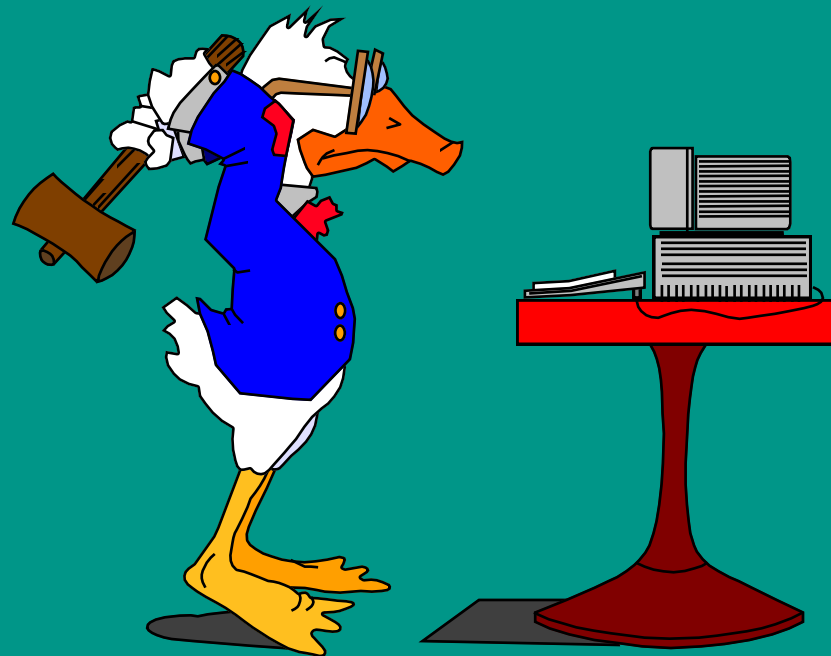


Human - Computer Interaction

Marilyn Tremaine



Design Process

The HCI Design Process

- User Interfaces are not just built by sitting down and drawing up designs for them
- Just like building a car or a washing machine, the interface design goes through a series of steps
- This is called the **User Centered Design Lifecycle**



The HCI Design Process

- The User Centered Design Lifecycle
 - specifies the steps a team needs to go through to design and evaluate a user interface
 - provides management control over the design
- A **KEY** point of the process is
 - The **USER** needs to be consulted again and again to see if we have the design **RIGHT**



The HCI Design Process

- User Centered Design Lifecycle
 - Task Analysis - gathering user data
 - Setting Usability Goals
 - Early Design - paper prototypes
 - Early Evaluation - quick user tests
 - Prototyping - computer prototypes
 - Usability Analysis - serious user testing



Overview of User-Centered Design

1. Task Analysis
2. Set Usability Goals
3. Design User Interface
4. Evaluate Design Models
5. Build Prototypes
6. Test Prototypes
7. Evaluate Results of Test



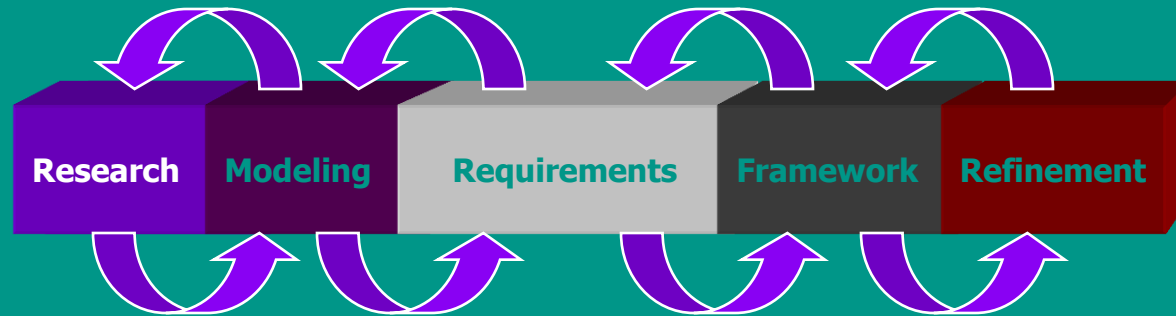
If goals
not met.



If goals met.



Goal-Oriented Design Process



- Research – discovery about users and their needs
- Modeling – usage and workflow patterns
- Requirements – functional and technical necessities
- Framework – interaction methodology
- Refinement – analysis, inspection, validation, and modification

Vocabulary

- Definitions of Terms
 - Functionality
 - Storyboard
 - Paper Prototype
 - Rapid Prototyping
 - Usability Testing



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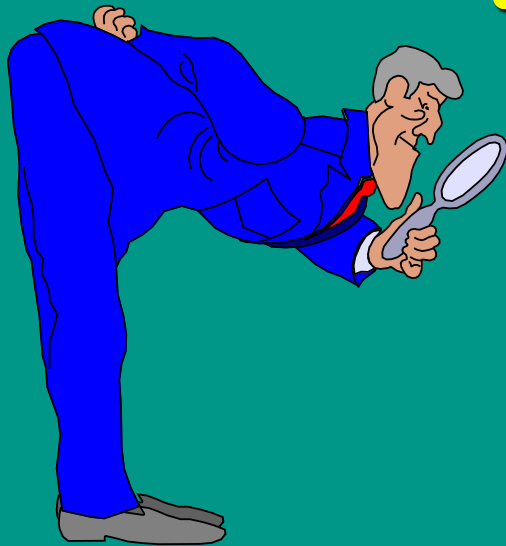
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Task Analysis



- High-level understanding of
 - what users will do with the product being designed
 - the words that are used to name things in the users work place
 - the tasks the user performs

Purpose of Task Analysis

- Appropriate task descriptions will help designer think about better ways to do task
- Appropriate task descriptions will also capture information that may otherwise be lost in the new design



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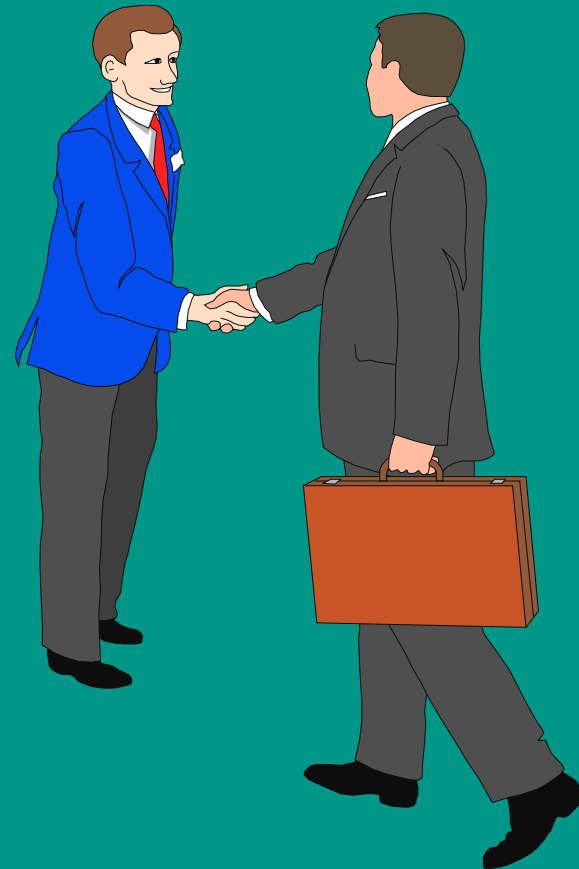
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Characteristics of Usability Goals

1. Negotiated between users & designers
2. Public
3. Measurable
4. A design commitment



Negotiation of Usability Goals

Computerized workstation for
radiologists and other physicians:



How long should their training be?

Quantitative Usability Goals

How do we judge satisfaction of radiologists with using the mouse?

Behavioral measures: Can they do it?

Training time, errors, difficulties

Satisfaction measures: How do they like it?

Questionnaire for Mouse Use

We would like your impression of how easy you found the following items:

**Very
easy**

**Very
difficult**

Clicking an image to select it.	1	2	3	4	5
Dragging an image to the view box	1	2	3	4	5
Scrolling in the right direction.	1	2	3	4	5
Scrolling one item at a time.	1	2	3	4	5
Moving the mouse between screens.	1	2	3	4	5
Visually locating cursor after changing screens.	1	2	3	4	5

Frequency of Response Based on 15 Physicians

	Very easy				Very difficult
	1	2	3	4	5
Clicking an image to select it.	9	3	3	0	0
Dragging an image to the view box	9	5	1	0	0
Scrolling in the right direction.	8	5	2	0	0
Scrolling one item at a time.	5	2	5	1	2
Moving the mouse between screens.	6	6	2	1	0
Visually locating cursor after changing screens.	3	3	3	5	1

Usability goal: 2/3 physicians should rate the feature 1 or 2.

Usability Measures

- Time to learn
- Speed of performance
- Error rate
- Retention over time
- Subjective satisfaction

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Designing the User Interface

- Basic Interface Operation decided at this stage
 - input/output devices selected (mouse, touch screen, keyboard)
 - Basic functions the interface is to perform are set
 - Often designs are copied (stolen) from similar interfaces

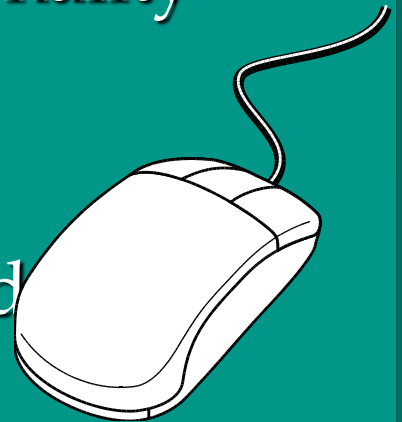
Designing the User Interface

- Conceptual Models selected for interface
 - Expectations of how parts of the interface are to “look and feel” to user established
 - Models match those supplied by user
- Importance and grouping of functions decided
 - What buttons appear together
 - The sequence of steps needed to do a task decided



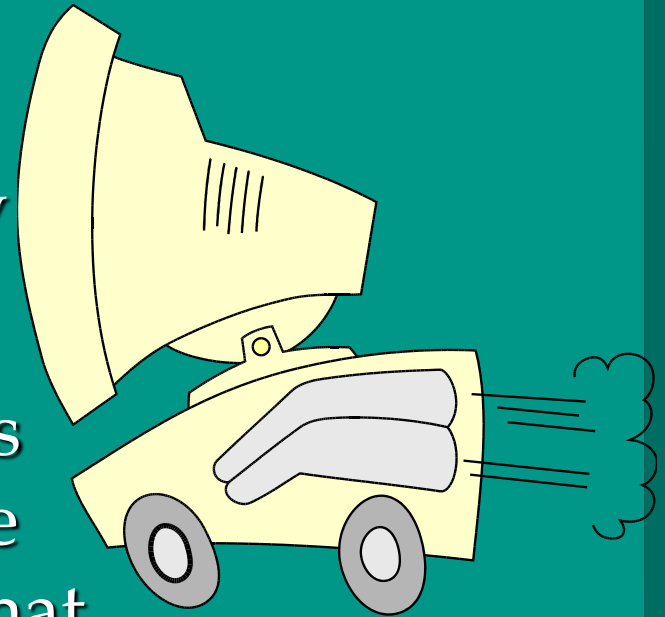
Selecting Interface Features

- Usually a designer has little choice
 - Much of what is designed depends on software already in use
 - Microsoft Word 6.0 follows Microsoft Word 5.1 with only some functionality added
 - Most Input/Output Devices of today involve mice and keyboard



Setting Interface Constraints

- The functionalities for the design come from the task analysis
 - Users participate in the selection of the tasks they want the system to do
 - Much paper illustration is done at this stage because the users do not know what the system is capable of



Example: Designing the Radiograph Viewing System

- Mice and a large viewing screen were selected
 - Doctors rarely type and usually dictate their results
 - Radiograms are usually large and need the highest resolution possible

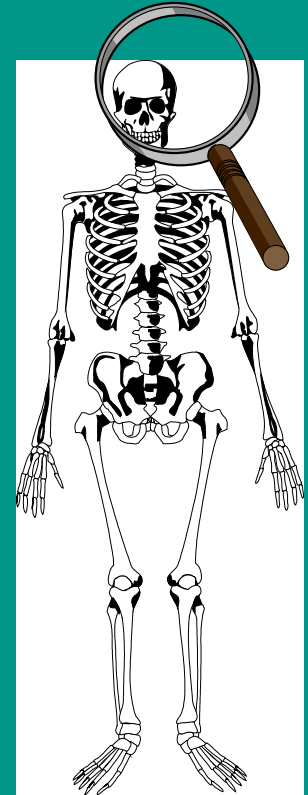


Example: Designing the Radiograph Viewing System

- Alternative designs included:
 - A voice notation system (too expensive)
 - A touch screen (too expensive and resolution not fine enough)
- Pull Down Menus were initially selected
 - Doctors did not like moving the mouse
 - Doctors often did not see the menus

Example: Designing the Radiograph Viewing System

- The Conceptual Model of a “Radiograph Light Table” used in the design
 - Doctors were highly familiar with the functioning of the light table
 - Doctors had trouble understanding the zoom function - this was resolved by placing a virtual magnifying glass over the radiogram



Example: Designing the Radiograph Viewing System

- The type of viewing the doctor conducted on the radiogram depended on the type of problem being scanned for
 - Doctors wanted to measure tumors but not broken bones
 - Menu functions were organized according to the type of radiogram and purpose of scan

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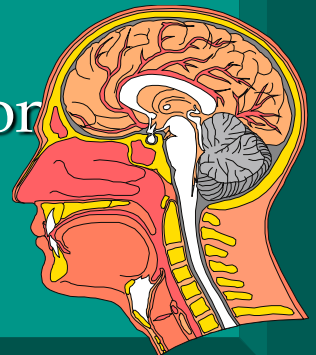
Evaluating Design Models

- Various Quick Methods Exist for Evaluating Designs that are not yet built
 - Cognitive Walkthroughs
 - Heuristic Evaluation
 - User Walkthroughs
 - Back of the Envelope Modeling
 - Computer Simulations



Cognitive Walkthroughs

- Designers imagine using the system by viewing a drawing of each planned screen display
 - Three questions are asked
 - is the correct action evident? - **affordance**
 - will the user connect the action to what they are trying to do? - **mapping**
 - will the user interpret the system's response correctly? - **feedback**



User Walkthroughs

- Users are given set of hand drawn displays and shown the accomplishment of different tasks with the interface
 - Users ask questions and are videotaped
 - Questions are asked of the user such
 - What do you think this does?
 - What would you select to do this task?
 - What do you think just happened?



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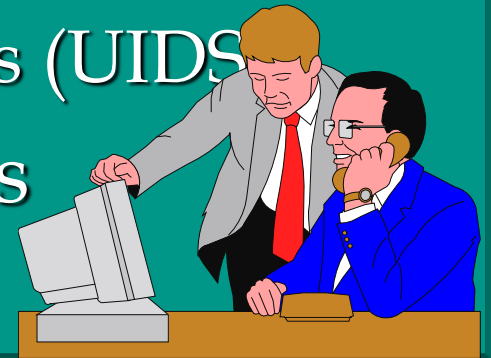


If goals met.



Rapid Prototyping

- Computer Programs exist that allow us to quickly build a graphical user interface
- These programs are called
 - User Interface Management Systems (UIMS)
 - Rapid Prototyping Systems
 - User Interface Design Systems (UIDS)
- A good example of a UIDS is
 - Visual Basic



Rapid Prototyping

- Partial Program in Visual Basic that puts a button on the screen

```
Private sub cmdPush Click()
```

```
    'Display the Exit Button
```

```
    lblMessage.Caption = "Exit"
```

```
End Sub
```

Advantages of Rapid Prototyping

- Without it we wouldn't be able to evaluate the user interface and **CHANGE IT!!!**
- In Addition
 - saves programming costs
 - used to document design
 - used to communicate to management & users
 - used to generate new design ideas



MONEY

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not met.



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Usability Testing

- Real users are given realistic tasks to perform on a prototype of the computer system being built
- Observations of the users collect
 - user errors
 - user performance time
 - user misunderstandings



Usability Testing

- Questionnaires administered to the users collect
 - user satisfaction with the interface
 - user's understanding of the interface
 - missing capabilities in the interface



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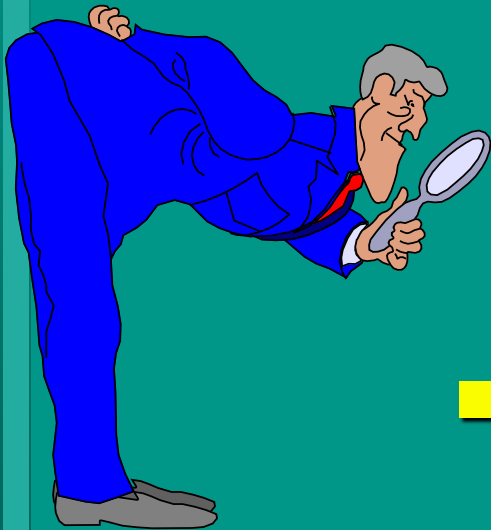
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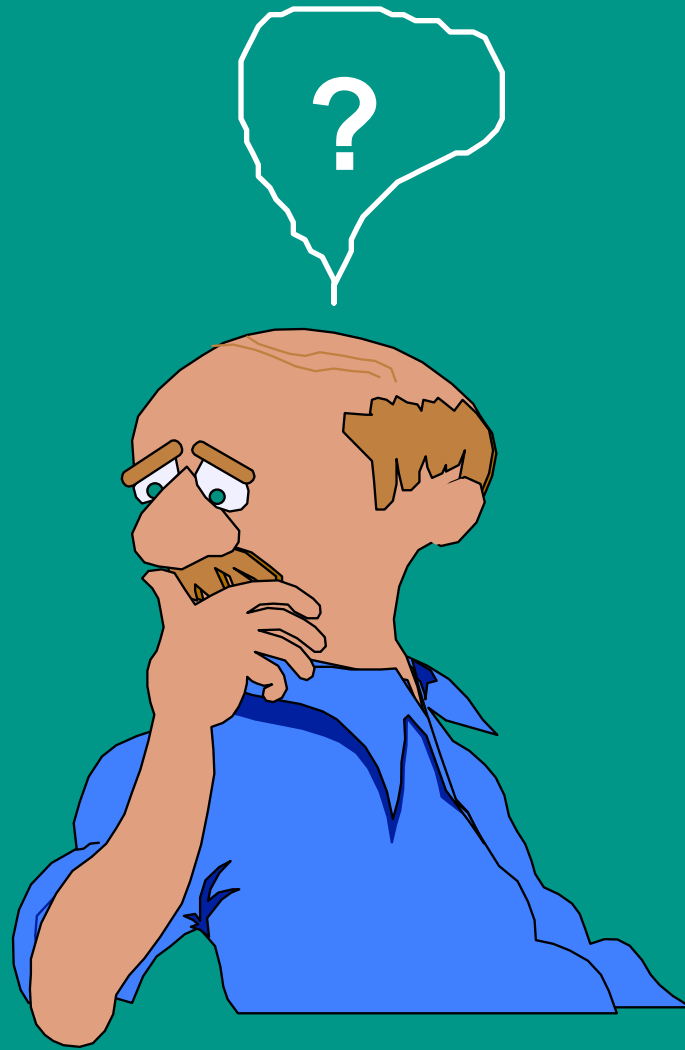
Evaluating the Results of the Usability Tests

- The results are compared to the usability goals set earlier in the project
- The results should be quantitative
 - they need to be compared to the earlier minimum performance levels that were set
- The usability study may also indicate new problems

Evaluating the Results of the Usability Tests



- If usability goals are not met:
 - Change design, or
 - Negotiate change in usability goals (if change is too costly)
- If usability goals are met
 - Freeze design, or
 - Negotiate change in usability goals if new problems uncovered



Questions?