Human-Computer Interaction

”Design Methods, Iterative ‘DTE’ & I/O Devices”

BSc/CQU

Lecture 2

(November 29, 2001)

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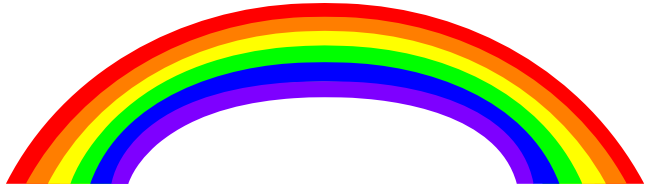
Outline



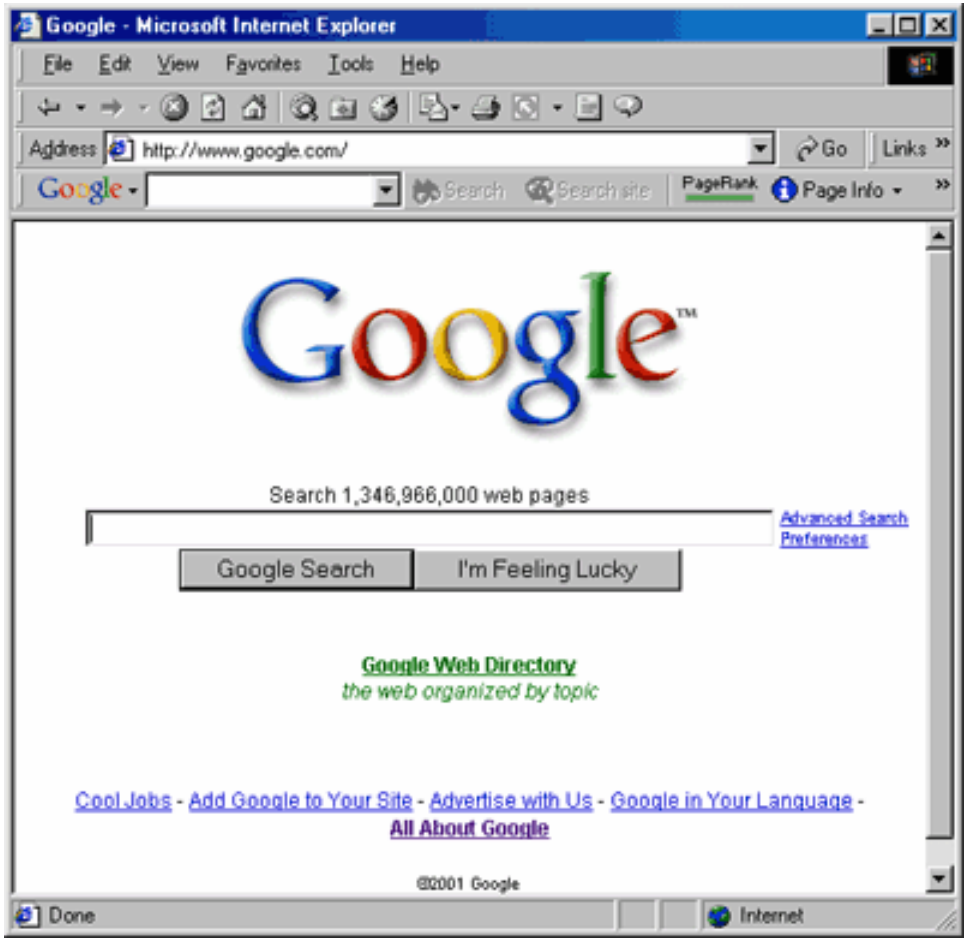
- ✓ Quick Review of Lecture 1
- ✓ Internet Search Tutorial
- ✓ **M3. Design Methods and HCI**
- ✓ M4. Iterative Design, Testing and Evaluation
- ✓ **M5. Input / Output Devices**
- ✓ Class Activity 1: Reading
- ✓ Class Activity 2: Reading
- ✓ Class Activity 3: Assignment 2
- ✓ Additional Handouts for L2
- ✓ What's in Store for Lecture 3

Quick Review on Lecture 1

- ✓ N-ways Introduction
  - Personal Information and Background
  - Students' Information and Background
- ✓ Course Outline:
  - Requirements and Expectation
  - Module Assessment
  - Recommended Books
  - Layout of Course
  - Strategies for Local Lectures
  - Virtual Office Hours
- ✓ Course Delivery Methods
- ✓ General Reference for the Course
- ✓ Organization of HCI Website
- ✓ Modules for Lecture 1
- ✓ **M1: Introduction to HCI**
- ✓ M2: Human Aspects
- ✓ Class Activity 1: Reading
- ✓ Class Activity 2: Reading

Search Engine Video Tutorial

Google.com



Internet Search Tutorial (cont)

Other Highly Praised & Effective Search Engines…

- ✓ http://ask.com
- ✓ http://altavista.com
- ✓ http://northernlight.com
- ✓ http://dogpile.com

- ✓ Emerging potential Search Engine Winner

1. Wisenut.com

2. Vivisimo.com

Modules for Lecture 2

Corresponding chapters in Textbook/Resource Book

M3.	**Design Methods and HCI**	Chapter 17, 19, 20
M4.	Iterative Design, Testing and Evaluation	Chapter 29-34
M5.	**Interaction devices, Response time and Display Rates**	Chapter 11, 12

HCI & Hollywood

Final Fantasy (The Movie, 2001; http://finalfantasy.com)

Pop Quiz:
List at least 4
HCI interfaces

Module 3: Design Methods and HCI

"**HCI design** is an engineering **process** of designing interactive computer systems so that they are **efficient**, **pleasing**, **easy to use** and **do what people want**"

Sutcliffe, 1995, p.2 "Human-Computer Interface Design", 2nd edition.

M3: Design Methods and HCI

Overview: What is Design?

Design refers to

- ✓ **Process** of developing a product
- ✓ Various **representations** of the product that are produced during the design process
- ✓ Preece p.352, states

  "**Simulating** what we **want** to make (or do) **before** we **make** (or do) it as many times as may be necessary to feel confident in the final result" - Jones 1981,p.8

M3: Design Methods and HCI
Fundamentals

The designer/s must

- ✓ **understand** the requirements of the product
  - look at **similar** products
  - discuss **user needs** with users
  - discover **problems** with **current designs**

- ✓ **develop** the product
  - produce a **variety of representations** until suitable model/prototype is produced

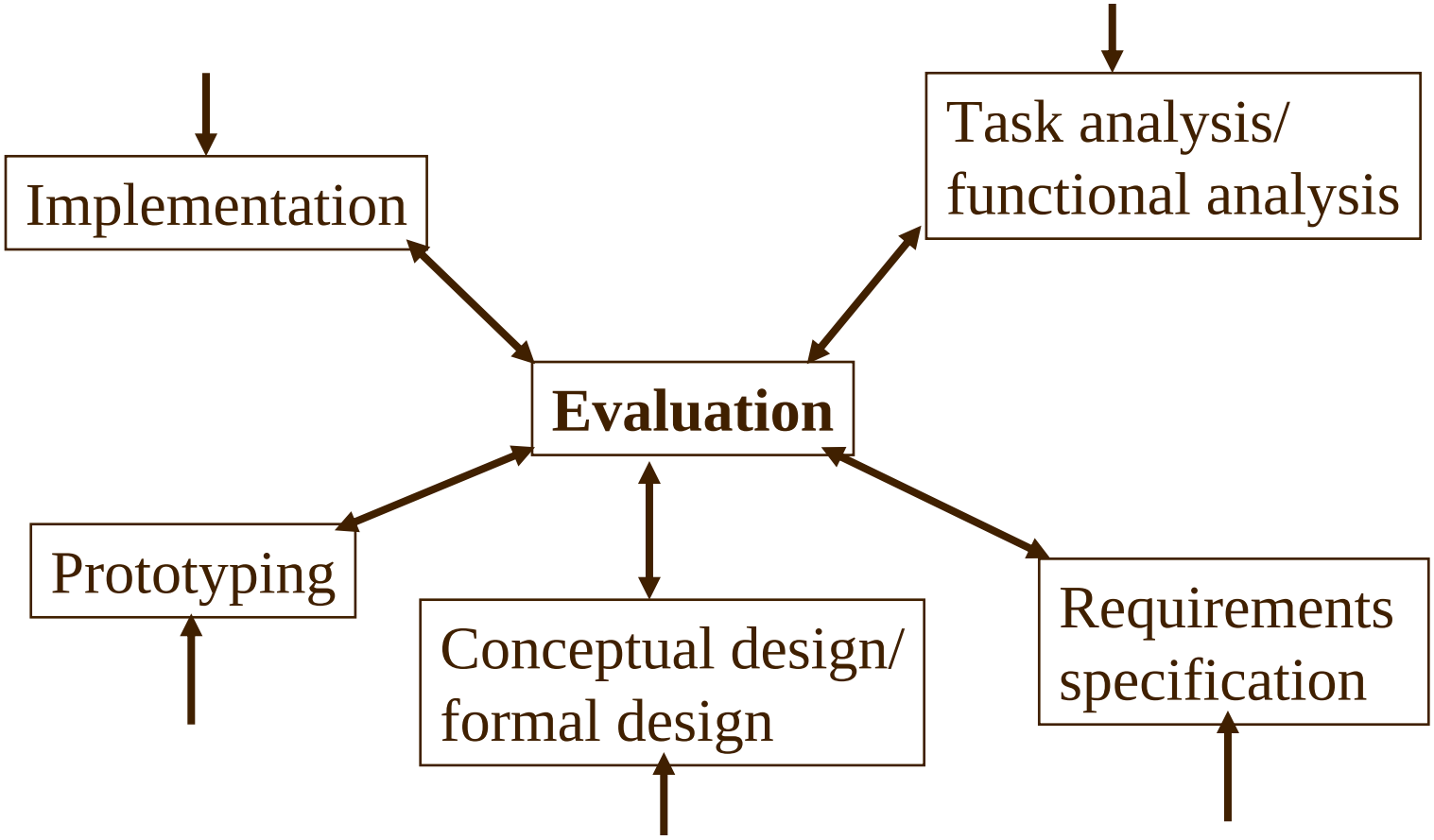
M3: Design Methods and HCI

Software Engineering Design

- **Traditional** view of software engineering
  - linear approach: **Waterfall** model
  - utilises validation,verification and testing at end of each stage
- **Spiral** model (Boehm 1988)
  - **several iterations** of analysis, design and implementation
- **W model** (Harrison, 1992)
  - **Two** iterations only

M3: Design Methods and HCI

HCI Software Design: Star Model



The Star Model (Harson and Hix, 1989,1993)

M3: Design Methods and HCI

HCI Software Design: Star Model (cont.)

- ✓ Orientated for interactive systems **usable by people**
- ✓ Based on **actual design practise** among HCI designers
- ✓ **Rapid prototyping**
- ✓ ***Bottom-up*** approach rather than *top down*
- ✓ **Evaluation** is central to model
- ✓ **Incremental development** to final product

M3: Design Methods and HCI
User Centred Design

- **User-centred design** means focusing on **usability**:

  (1) **Learnability**: ease of **learning**

  (2) **Throughput**: ease of **use**

  (3) **Flexibility**: accommodate **change** of tasks

  (4) **Attitude**: engenders **positive** approach by users

M3: Design Methods and HCI

Usability study

- ✓ Check with users that **usability requirements** are established
  - initiated at **start** of design process, and
  - done at **all stages** throughout a system's development.
  - **checked again** in the **formal evaluation** process.

- ✓ **Tools** : observation, questionnaires, interviewing.

M3: Design Methods and HCI

Four principles of user-centred design

- ✓ **Focus** on **users** and their **tasks early** in the design process.
- ✓ **Measure reactions** by using **prototypes** of manuals, **interfaces** and **other simulations** of the system.
- ✓ Design **iteratively** (keep redoing previous steps).
- ✓ Consider **all usability factors** together, and have **one control group** responsible for them.

M3: Design Methods and HCI

Three main types of Analysis in user-centred design

- ✓ User analysis

  - to determine the **scope** of the **user population**

- ✓ Task analysis

  - **user tasks** and **sub-tasks**, **learnability** of system, user **cognitive knowledge**

- ✓ Environmental analysis

  - to determine the **physical** and **user support** environment

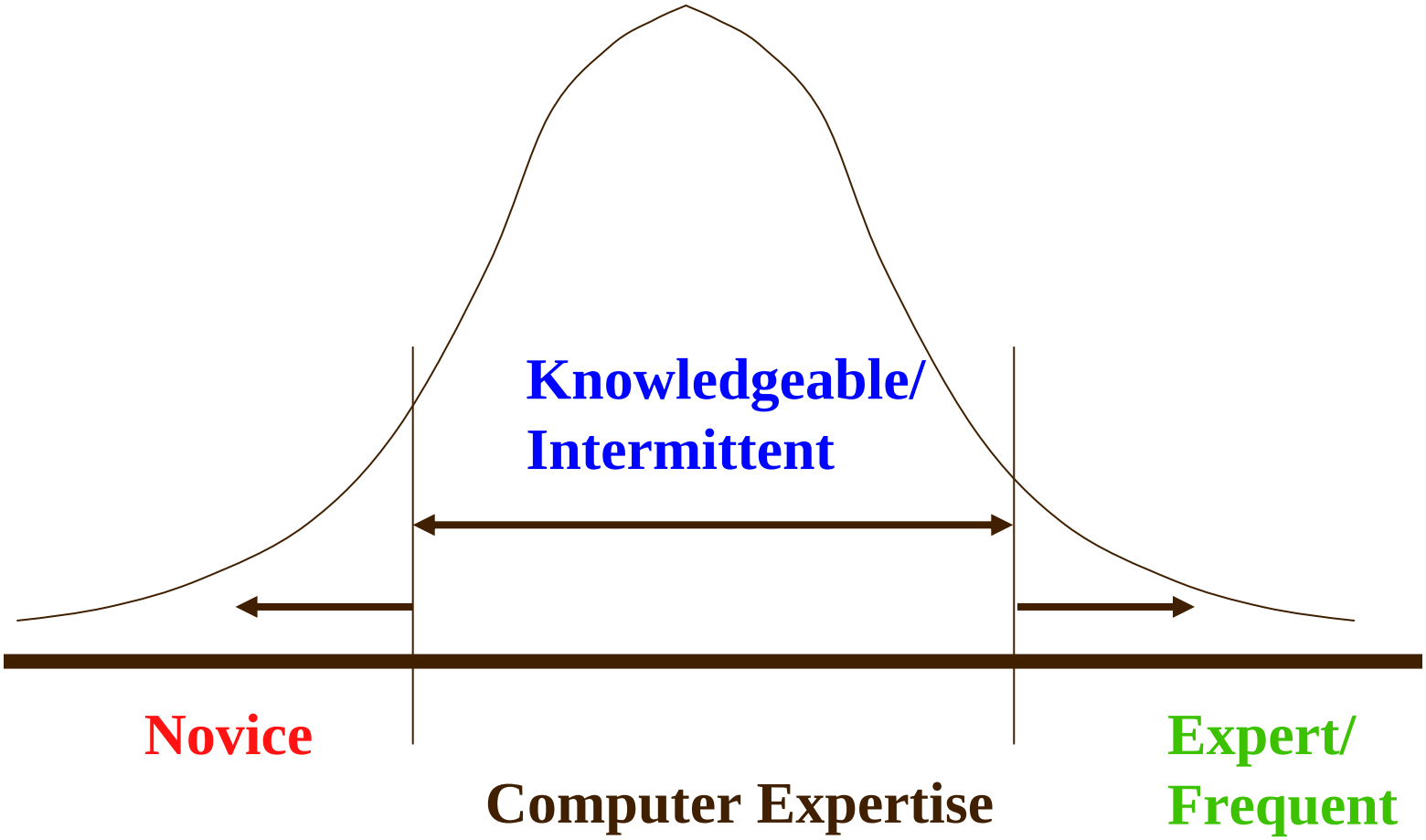
M3: Design Methods and HCI

User Analysis: User Classification

- Typical **user classification** scheme
  - Novice
  - Knowledgeable/intermittent
  - Expert/Frequent
- Classification allows us to **generalize** to our user population
  - Novices have certain characteristics in common, expert users the same…
- Not possible to design for individuals
  - The “average person” myth

M3: Design Methods and HCI

User Analysis: User Classification (cont.)



M3: Design Methods and HCI

Task Analysis: Introduction

- **General definition**: Process of **analyzing the way** people perform their job.
- Task analysis techniques focus on understanding **users' work tasks.**
- It **clarifies** and **organizes** knowledge about work, whether computerized or not.
- We can then use these to **accurately design systems** that **do what users must** to do to accomplish their work goals.

M3: Design Methods and HCI

Task Analysis: Goal & Task

- **Goal**
  - Definition: State of a system that the human wishes to achieve, a **desired state of the system**
- **Task**
  - **Goal** may be comprised of **multiple tasks**: a **structured set** of activities required in which actions are undertaken in some **sequence**
- Example:
  - **Goal**: Clean dishes
  - **Task**: Wash dishes by hand **OR** use dishwasher **OR** use paper plates

M3: Design Methods and HCI

Task Analysis: Hierarchical Task Analysis (HTA)

- Hierarchical task analysis:
  - **Breaks down tasks** into smaller, more specific units
  - Makes work that users perform **explicit**.
  - Results are a **hierarchy** of **tasks** and **subtasks** and **plans** that describe the **order** in which work is done.
- HTA describes a task in terms of a **hierarchy of plans** and **actions**.
- It involves **iterative decomposition** of tasks into smaller ones and includes as output:
  - A **hierarchy** of tasks and sub-tasks
  - **Plans** describing the order, conditions and iterations for the tasks

M3: Design Methods and HCI

Task Analysis: HTA (cont.)

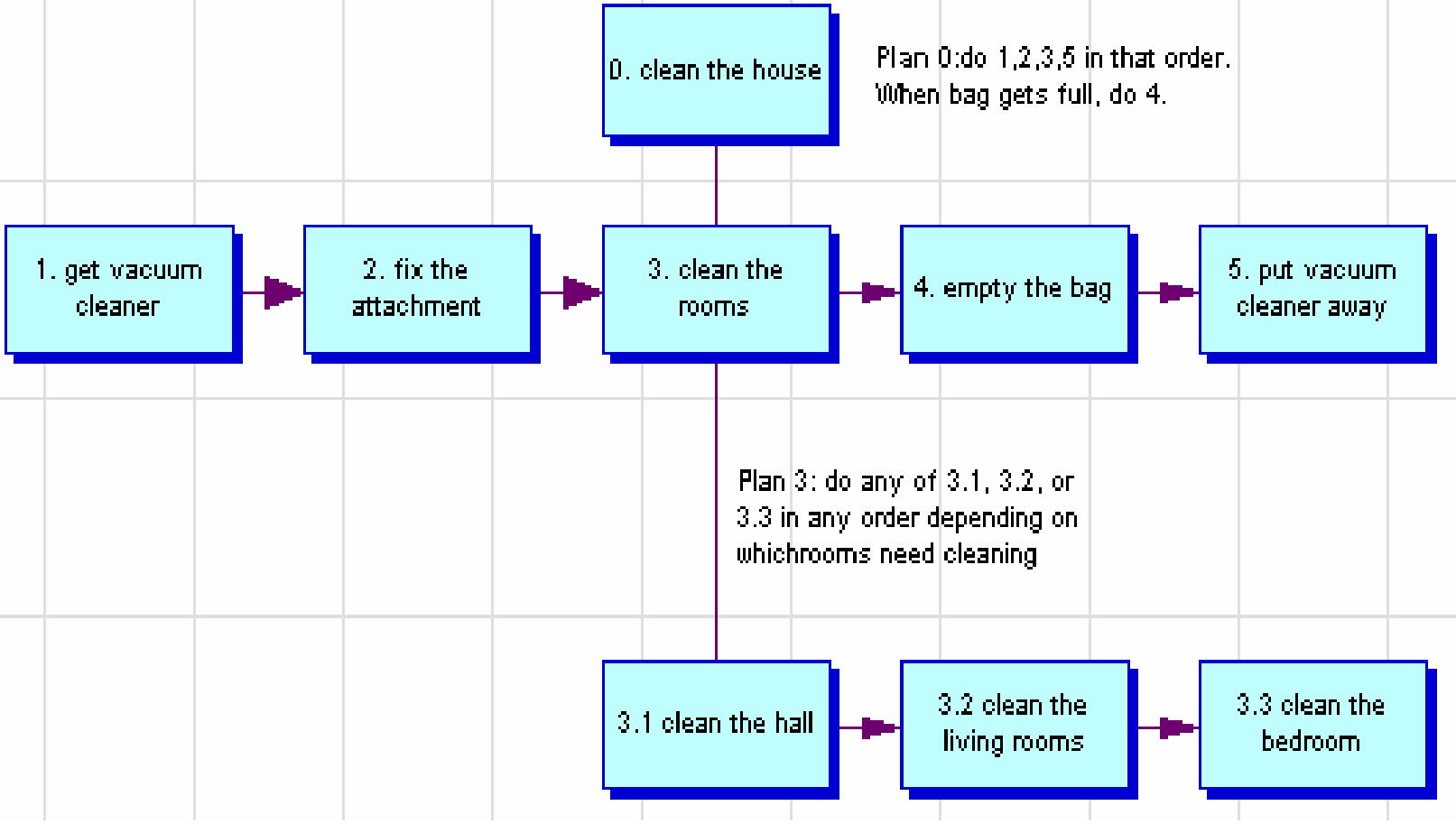
GOAL: A CLEAN HOUSE

0. in order to clean the house
    1. get the vacuum cleaner out
    2. fix the appropriate attachment
    3. clean the rooms
        - 3.1 clean the hall
        - 3.2 clean the living rooms
        - 3.3 clean the bedrooms
    4. empty the dust bag
    5. Put the vacuum cleaner and attachments away

Plan 0: do 1,2,3,5 in that order. When bag gets full, do 4.
Plan 3: do any of 3.1, 3.2, or 3.3 in any order depending on which rooms need cleaning.

M3: Design Methods and HCI

Task Analysis: HTA (cont.)



M3: Design Methods and HCI

Task Analysis: Procedure for Doing HTA

(1) Identify the **main task**.

(2) Identify the **sub-tasks** (using direct observation, expert opinion, documentation, etc)

(3) Look at each **sub-task** and see if it can be **sub-divided**.

(4) Apply some sort of **stopping rule** when dividing into sub-tasks

(5) Examine the first effort at the HTA for **errors** and **omissions**:

- check it with **others**,
- check if any **obvious things are missed**, for example, if something is turned off, it should have been turned on.

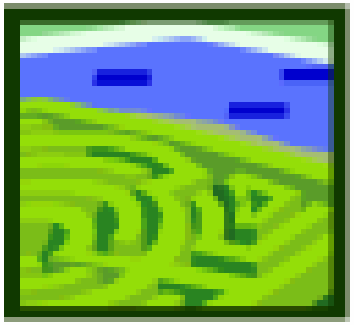
(6) See if the **structure is appropriate**:

- Is it **unbalanced**?
- Are there **too many detailed tasks** at the top?
- Are **sub-tasks grouped under the right task**?

Link to CA1

Module 4: Iterative Design, Testing and Evaluation

- ✓ Iterative development and participatory design
- ✓ Simulations and prototypes
- ✓ Observing and monitoring users
- ✓ Controlled experiment
- ✓ Design reviews and walk-throughs
- ✓ Comparison of methods
- ✓ Useability laboratories



M4: Iterative Design, Testing and Evaluation
About Iterative Design

- **Iterative design** involves
  - **early testing** of prototypes
  - **revisions** based on **feedback** from users
  - **incremental refinements** suggested by tests

- **Iterative design** was one of the four principles of user-centred design given in module 3. (M3: Four principles of user-centred design)

- **Participatory design** in the workplace **incorporates users** not only as experimental subjects but as a **member of the design team.**

M4: Iterative Design, Testing and Evaluation
Participatory design

Three characteristics:

- ✓ **Improve** the **work environment** and **task** by the introduction of the design. This makes design and evaluation **context** or **work orientated** rather than system orientated.
- ✓ **Collaboration** is central to the design: the user is included in the design team and can contribute to every stage of the design.
- ✓ **Approach is iterative**: the design is subject to evaluation and revision at each stage.

M4: Iterative Design, Testing and Evaluation

Simulations and prototypes

- **Pen-and-paper**
  - wording, layout, sequencing
  - inexpensive, rapid and usually effective
- **Wizard of Oz**:
  - mockup of computer system
  - a person provides the system response
- **Storyboarding**
  - models interactive screen displays
  - paper layout of total system

M4: Iterative Design, Testing and Evaluation

Observing and monitoring users

- ✓ Videotaping
- ✓ Informal observation
- ✓ Verbal reports
- ✓ Automatic logging
- ✓ Interviews
- ✓ Questionnaire (survey) construction

M4: Iterative Design, Testing and Evaluation
Expert Reviews

- **Team of experts** in field of HCI (and content) to **inspect** and **use system looking for problems.**
- Informal to **formal reviews.**
- **Report** on problems identified.
- Can be done at **all stages** of development, at differing levels of complexity.
- Good results with **3 to 5 experts** in field (75% error identification).

M4: Iterative Design, Testing and Evaluation

Styles of Expert Reviews

- ✓ Heuristic evaluation
  - Critique for conformance to a set of standards eg. eight golden rules.
  - 2 or more passes to inspect flow and screen designs
- ✓ Guidelines review
- ✓ Consistency inspection
- ✓ Formal usability inspection
- ✓ Cognitive walkthrough

M4: Iterative Design, Testing and Evaluation
Problems with Expert Review

- Experts are **not users** and have **difficulty** in understanding this viewpoint, **particularly for novice users.**

- Also experts **may not** understand the **task domain**, hence the need for content experts.

M4: Iterative Design, Testing and Evaluation
Walkthroughs

- ✓ Look for **incompatible approaches** with software and equipment
- ✓ Test product for **defects**
- ✓ Look for ways of **improving** product
- ✓ Use a **checklist**
- ✓ Test various **pathways** with user scenarios

M4: Iterative Design, Testing and Evaluation

Comparison of methods

Technique	Purpose	Appropriate use	Practical consideration
Observation			
Videotaping			
Automatic logging			

M4: Iterative Design, Testing and Evaluation

Comparison of methods (cont.)

Technique	Purpose	Appropriate use	Practical consideration
Verbal Reports			
Questionnaire			
Controlled experiments			
Reviews and walkthroughs			

M4: Iterative Design, Testing and Evaluation
Useability Laboratory

- ✓ Staff of **professionals**, **trained** in HCI techniques.
- ✓ Useability-laboratory testing is effective because **real users perform real tasks** under the **eye** of experienced observers.
- ✓ **Interrelationship** with the **developers** and **users** with the **laboratories** from **early stages** of design and development.

M4: Iterative Design, Testing and Evaluation
Field testing

- ✓ **Realistic environment**
  - Microsoft Windows 2000, 750,000 beta users.
- ✓ Similar techniques to laboratories.

M4: Iterative Design, Testing and Evaluation
Methods of assessing useability

- ✓ Experimentation
- ✓ Observation
- ✓ Pilot testing
- ✓ Simulations
- ✓ Protocol analysis (verbal reports)
- ✓ Videotaping
- ✓ Automatic logging and reviews

Class Activity 1: Reading

"New Technological Windows into Mind: There is More in Eyes and Brains for Human-Computer Interaction"

New Technological Windows into Mind: There is More in Eyes and Brains for Human-Computer Interaction

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ABSTRACT

This is an overview of the recent progress leading towards a full subject-centered paradigm in human-computer interaction. At this new phase in the evolution of computer technologies it will be possible to take into account not just characteristics of average human beings, but create systems sensitive to the actual states of attention and intentions of interacting persons. We discuss some of these methods concentrating on the eye-tracking and brain imaging. The development is based on the use of eye movement data for a control of output devices, for gaze-contingent image processing and for disambiguating verbal as well as nonverbal information.

Keywords

Attention, eye movements, human-computer interaction (HCI), neuroinformatics, levels-of-processing, noncommand interfaces, computer supported cooperative work (CSCW)

INTRODUCTION

Profound technological changes are sometimes caused by events initially considered to be completely irrelevant. It seems that we may be well on the eve of such changes in human-computer interaction, and these changes will be brought about by the recent development in the research methods of cognitive neuroscience. The emerging perspective is that of "subjective age" in the development of telematics. At this new phase in the evolution of computer technologies it will be possible to take into account not just some statistical characteristics of human beings, but create technical systems sensitive to a broad spectrum of actual states and intentions of a person. We are going to discuss -- and to demonstrate -- some of these perspectives concentrating on the following domains: brain imaging methods and, particularly, eye movement research. At the end, we will shortly refer to some relevant issues in the interdisciplinary field of neuroinformatics.

ADVANCED EYE-TRACKING

A remarkable development takes place in the eye movement research. The new generation of eye-trackers replaces the nightmare situation of former laboratory studies (with subjects immobilization, prohibited speech, darkness, re-calibration of the method after every blink, etc.) by ergonomically acceptable measurement of gaze direction in a head-free condition. The new methods are fast and increasingly non-invasive [1, 7, 8, 10]. This implies that the process of eye movement registration does not interfere with other activities a person is involved in. As the gaze-direction is the only reliable (albeit not ideal) indices of the locus of visual attention there is an almost open-end list of possible applications of this methodology.

Gaze direction for a control of user- interfaces

The first and most obvious application can be called "eye-mouse". Some previous attempts of the kind have not been very successful as they failed to recognize a difference between eye movements and attention (cf. the so-called 'Midas touch problem' [8]). By building in temporal filters, introducing an explicit clutch and/or clustering the fixations resulting from fast search saccades it is possible to guaranty practically errorless use of gaze direction for operating virtual keyboards and managing graphical user interfaces (GUI) [7, 16]. The eye-mouse reduces selection time in general. Its primary application area is where it is difficult or impossible to use the hands. In particular, physically disable or elderly persons no longer in command of their limbs and speech mechanisms may improve their communication abilities with this type of system. Eye movements data can be used to control different electronic devices, including e-mail, fax, telephones, videophones and speech generators.

In contrast to the manually-controlled computer-mouse, an eye-mouse does not need an explicit visual feedback. However to ensure a high degree of reliability it has been suggested to give a visual feedback on the so-called dwell-time activation of buttons [7]. Fig.1 shows how this idea of an "Eyecon" may be realized. A small animation is made up by playing the sequence of buttons within 500 ms, each time the button is activated by a dwell. Besides from giving the user an opportunity to regret the activation, the animation in itself holds attention of the user at a precise location, which makes it possible to re-calibrate the system each time a button is used. A study of users acceptance performed on the Eyecon system found a spontaneous positive attitude towards the principle [5]. In general more than 95% of responders evaluated the interaction as "exiting", about 70% expressed their belief that they expect "to see eye tracking in the future as an everyday thing".

Figure 1

A different approach to gaze-mediated interaction is simply to leave the idea of using eye-tracking as a substitute for a mouse. Instead, the raw data may be interpreted at a higher semantic level and used in a new type of *noncommand* multimedia applications, which continuously measure the amount of attention being paid to individual objects in the display (see e.g. [9, 17]). It has been proposed to term this noncommand interaction principle "interest and emotion sensitive media" (IES) [7]. The possibility of making a coupling of ocular measurements and the stimuli material allows for a quasi-passive user influence on electronic media. This can be achieved by measuring 1) the interest of the users by identification of the areas of attention on complex templates, and 2) their emotional reactions by evaluating the blink rate and changes in pupil size (cf. [7, 19]). IES may respond to these continuous measurements at narrative nodes by editing among the branches of a multiplex script board that will in turn influence the composition and development of events being watched.

http://physik.phy.tu-dresden.de/psycho/boris.html

Class Activity 2: Reading
"Usability Heuristics for the Web"

Usability Heuristics for the Web

by Keith Instone

Jakob Nielsen's 10 usabilty heuristics appear below, with his description in bold and my Web-specific comment following.

The overriding theme for applying these heuristics to the Web is to use links effectively.

1. Visibility of system status

The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

Probably the two most important things that users need to know at your site are *"Where am I?"* and *"Where can I go next?"*

Make sure each page is branded and that you indicate which section it belongs to. Links to other pages should be clearly marked. Since users could be jumping to any part of your site from somewhere else, you need to include this status on every page.

My **Site Stress Test** is an evaluation focused on this heuristic because it is so important on the Web.

http://webreview.com/pace/print/97/10/10/usability/sidebar.html

Class Activity 3: Discussion

HCI Assignment 2: Due 13 Sep 2001

Assignment 2

Due Date: Monday, Week 8

Weighting: 25%,
Penalties will apply to late assignments unless an extension has been obtained from the lecturer.

This assignment has two parts for you to complete.

Part A: Screen Design and Evaluation (17%)

Your task is to design and test a Powerpoint prototype of a system suitable for the information kiosk for the National Arts Exposition. *Your assignment submission will be the **REPORT** you prepare for the Expo's management. Some user testing is essential.*

Specifications

The Information Kiosk System
The National Arts Exposition, which is visited by thousands of visitors each month, wants a visitor information system that can be used in information kiosks in the expo site. The site is set in a large park, spread over several buildings, with some displays in the open air. Musical performances are scheduled at particular times and set in the open-air surrounds. Restaurants, coffee shops, and tourist shops (for the sale of prints and books in art) are part of the commercial operations on the site.

The system will:
- Display maps of the area
- Help tourists select a guided tour and then give details such as time of start, language, and duration.
- Have important safety warnings (such as fire or other environmental hazards and restrictions on pets)
- Describe different galleries, open-air displays, performances, and important attractions.
- Give details of services and commercial attractions (food, restaurants, shops, facilities).

Submission requirements

The report will cover the following topics in the same order:
- Executive summary (max. 1 page)
- Description of the problem
- Overview of the system
- Description of the approach to design
  User-centred design features, iterative design approach, star life cycle (reflection in action)
- User Analysis documentation
- Task Analysis plus Hierarchical Task Analysis (HTA) chart
- Details of suitable hardware specifications
- Four Main Screens (paper copies of Powerpoint slides) plus dialog chart
- Reasons for design chosen
- Testing: technique of evaluation, summary of outcomes
- Discussion of changes to design
- Appendices
  - User analysis checklists
  - Original screen designs.
  - Evaluation data ie surveys, questionnaires

Note: An *Executive Summary* is a brief discussion of the total project, used to inform the reader of key issues without the reader needing to read the whole document (ideal for managers). An *Overview Of The System* describes the system itself and not the total project.

Part B: Interface Evaluation (8%)

Problem
Find an interface which you don't think is particularly good – it could be for a conventional system or a World Wide Web site. The assignment will be more interesting if you can find a really bad site.

Evaluate the site using a checklist of guidelines that you have learned about in this course. If you have a menu-based system, you might start with Shneiderman's eight golden rules, then use guidelines for menus, colour etc. The evaluation (checklist) will be based on the adherence of the interface to the guidelines.

Submission requirements
Submit
- Screen dumps or printouts of at least three screens from the (single) interface you are evaluating. (Do not have three different sites.)
- Your checklist of guidelines with your evaluations.

For example:

One guideline might include
"Use terminology from user's task domain"
Against this, you would indicate whether or not the interface followed the guideline, eg Not Followed. Users of this system would include primary school children. The word "exposition" in the menu is too difficult for them to understand.

Expected Length: about 3-5 pages excluding screen dumps.

M5: Input / Output Devices
Input Devices

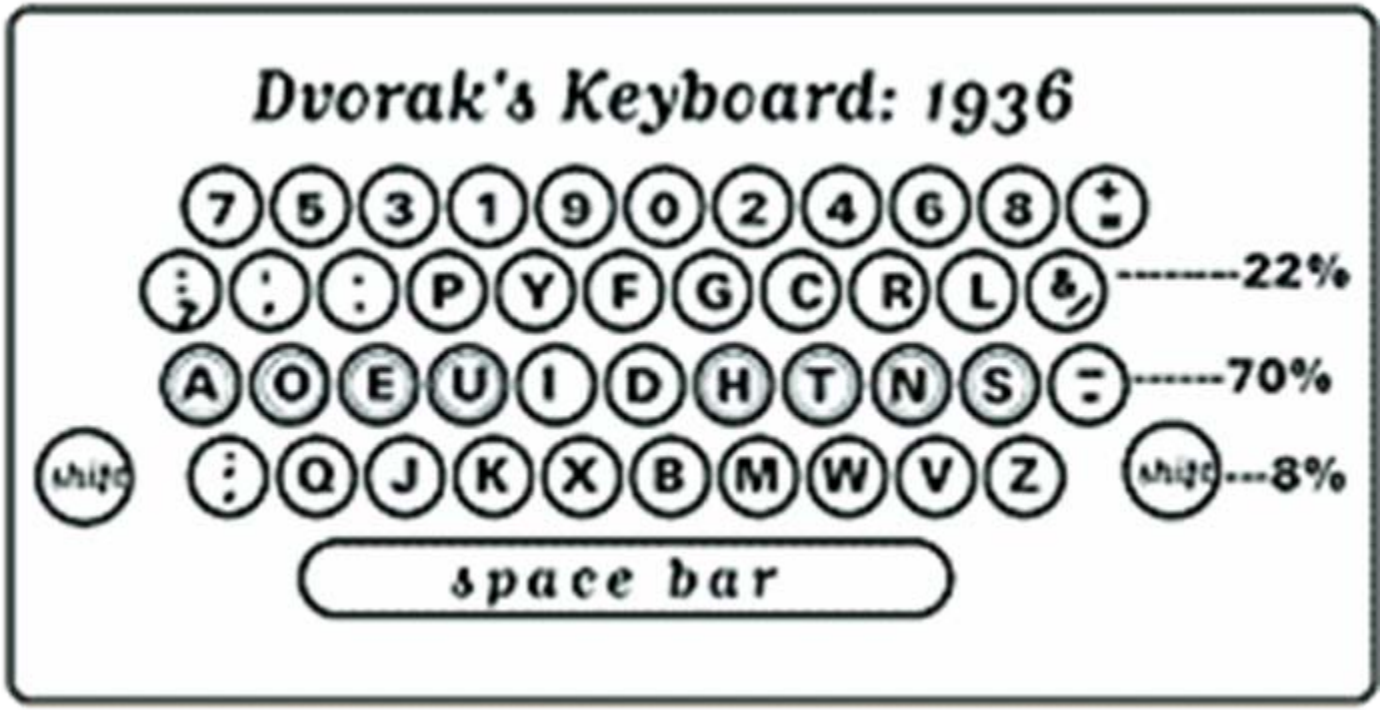
- ✓ Keyboards
- ✓ Pointing Devices
- ✓ Handwriting Recognition
- ✓ 3-d positioning
- ✓ Voice Input

M5: Input / Output Devices
Input Devices: Keyboards

- ✓ Qwerty/Dvorak keyboards
- ✓ Chorded keyboards
- ✓ Carpel tunnel syndrome
  - repetitive stress injuries (RSI)

M5: Input / Output Devices

Input Devices:Keyboard - Dvorak



Dvorak analyzed the English language and improved typing **speed by 15-20%** and typing **accuracy by 50%**

M5: Input / Output Devices
Input Devices: Chorded Keyboard

- ✓ Combination of keys at once
  - like Piano chords
- ✓ Many combinations
- ✓ Twiddler (combination mouse & chorded keyboard)
- ✓ 12 finger keys & 6 thumb keys: -> 4000 combinations

M5: Input / Output Devices
Input Devices: Pointing Devices

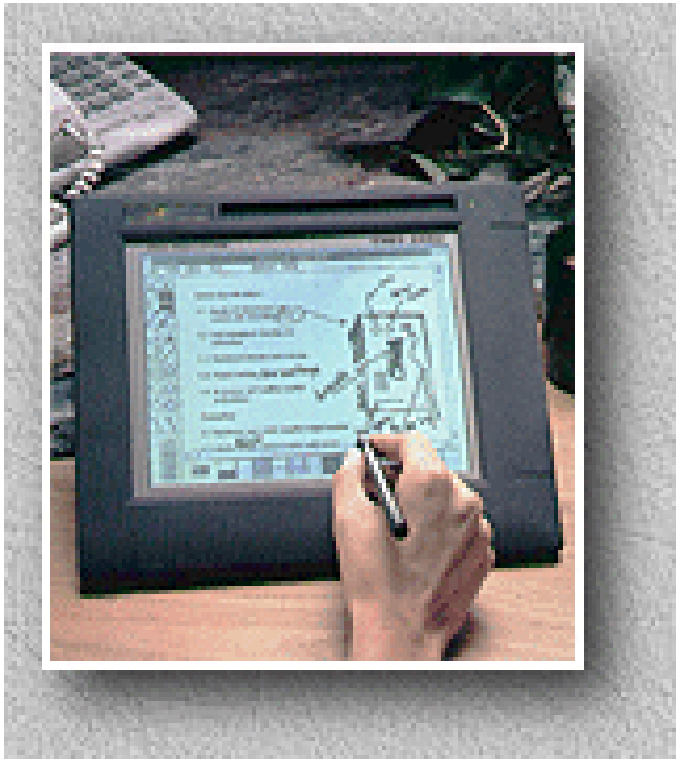
- ✓ Mouse
  - how many buttons?
  - optical vs. mechanical
- ✓ Touch screens
- ✓ Pens / Stylus
  - pads vs. LCD screens
  - proximity, pressure, or just on/off

M5: Input / Output Devices
Input Devices: Touch Screens

- Commonly used in **kiosks** and other walk-up-and use interfaces

M5: Input / Output Devices

Input Devices: Pen-based Tablets



Display tablet

Graphics tablet

M5: Input / Output Devices
Input Devices: Handwriting Recognition

- ✓ Better with display tablets
  - LCD panel with a pen
- ✓ Computationally feasible
  - need approx. 8-12 MB RAM, 50 MIP processor
- ✓ Issues
  - printing vs. cursive writing
  - custom-design alphabets for ease of recognition
    - shortcuts: Graffiti, Unistrokes, etc.

M5: Input / Output Devices

Input Devices: Graffiti

- ✓ All but one letter (X) is single stroke
- ✓ Common letters fast
  - A, E, I, O, U
- ✓ Less ambiguous than regular alphabet
  - V vs. U, Y vs. J, etc.

M5: Input / Output Devices
Input Devices: 3D Input Devices

- ✓ Logitech Magellan
  - records X, Y, Z, pitch, roll, and yaw

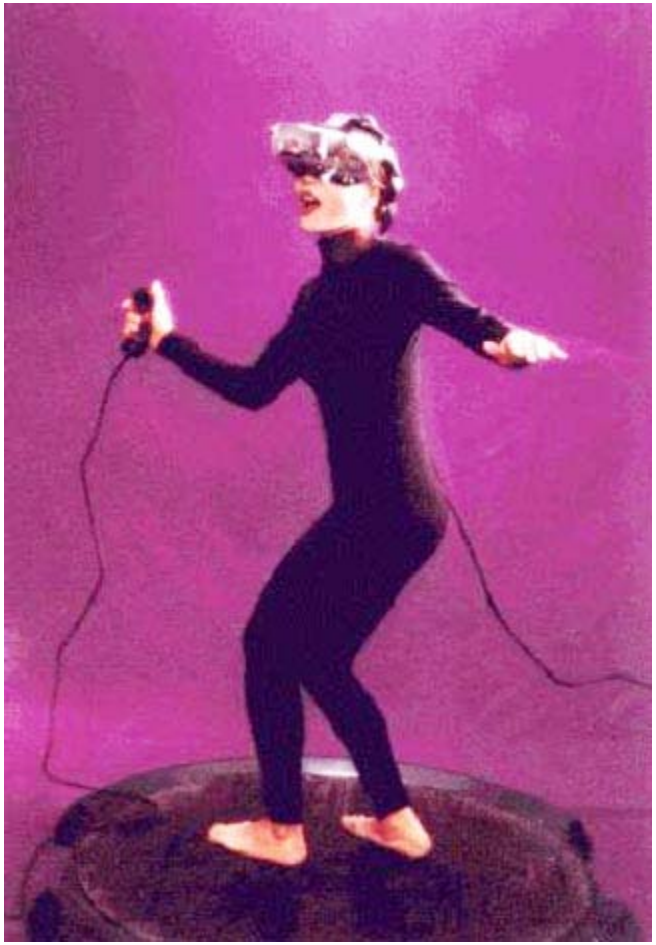
M5: Input / Output Devices

Input Devices: 3-d Input Devices (cont.)

- ✓ 6DOF mouse & head tracker

M5: Input / Output Devices

Input Devices: 3-d Input Devices (cont.)



- ✓ SpacePad
  - magnetic field transmitted up from the mat
  - track head & hand movement

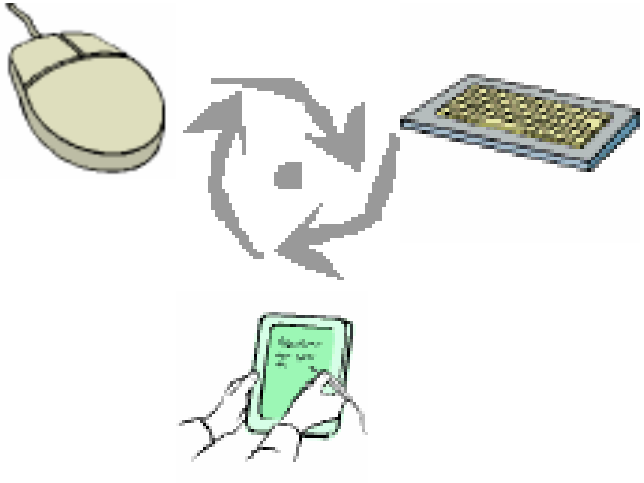
http://www.ascension-tech.com/products/spacepad/spacepad.htm

M5: Input / Output Devices
Input Devices: Voice Recognition

- ✓ Computationally possible
- ✓ What are the issues?
  - continuous vs. discrete speech
  - vocabulary size
  - trained/untrained to particular speaker
  - sound environment
    - noise & type of mike
  - context vs. commands
    - Star Trek “Computer”, Mac “Simon says”
- ✓ http://research.microsoft.com/srg/

M5: Input / Output Devices
Input Devices: Interactions Between Devices

- ✓ Mouse / keyboard
- ✓ Pen / keyboard
- ✓ Pen / voice



M5: Input / Output Devices
Output Devices

- ✓ 2D/3D displays
- ✓ Dynamic visualizations
- ✓ Audio output

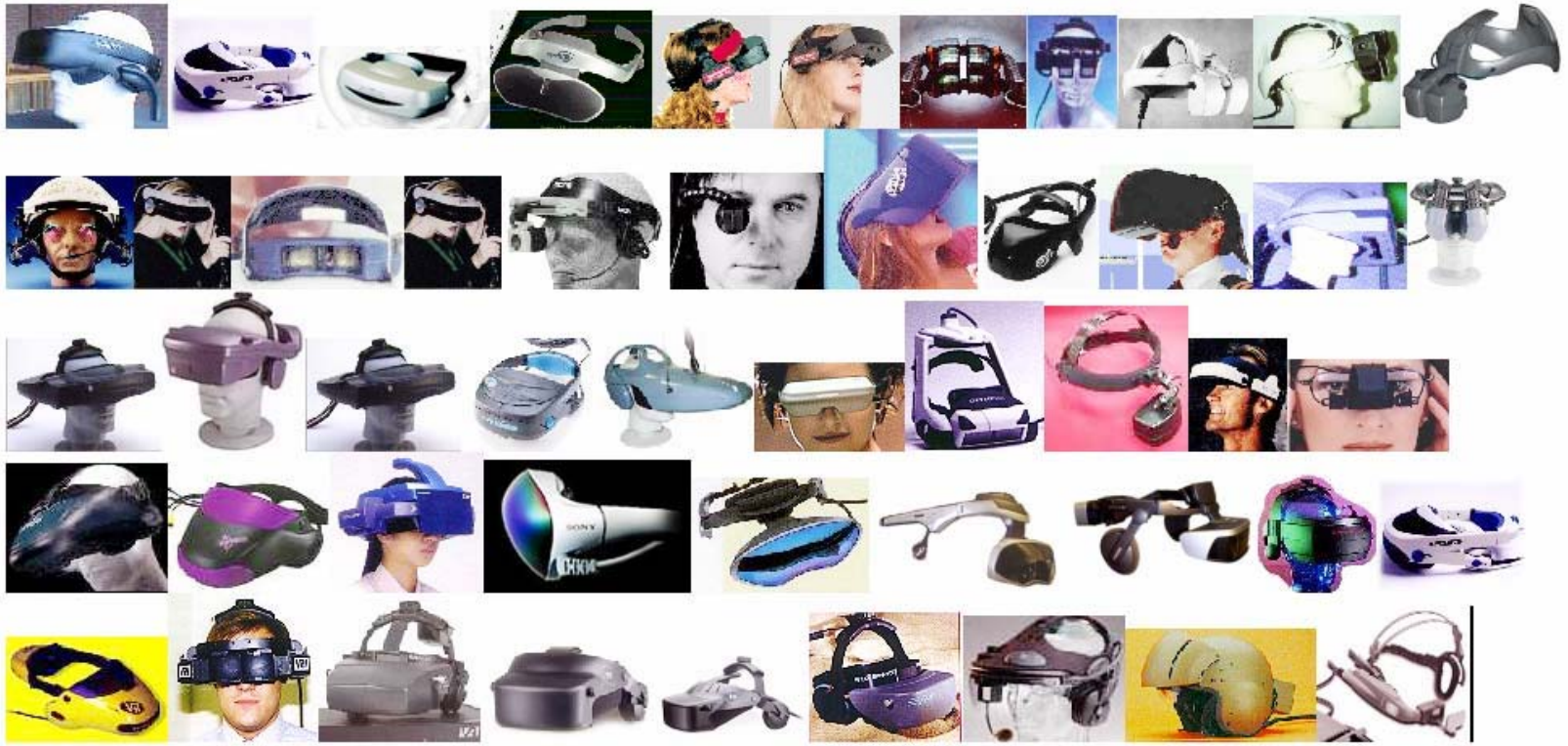
M5: Input / Output Devices

Output Devices: 2D/3D Displays

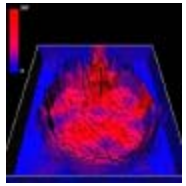
- ✓ 2D graphics very well understood
  - optimized by hardware vendors
- ✓ 3D graphics hardware
  - glasses or head-mounted displays
  - special displays
  - special chips
- ✓ Realistic 3D animations
  - VRML - Virtual Reality Modeling Language
  - used to require expensive HW (SGI Reality Engine)

M5: Input / Output Devices

Output Devices: Head-Mounted Displays



M5: Input / Output Devices
Output Devices: Dynamic Visualizations



- ✓ Animation
  - realistic 3D scenes require ~ 1M polygons/sec.
- ✓ Video
  - widely supported on the desktop
  - need better editing/integration tools
  - compositing tools

M5: Input / Output Devices

Output Devices: Video Standards

- ✓ Motion JPEG (1-4 bit/pixel)
  - excellent quality, video editing
- ✓ MPEG (.5-2 bit/pixel)
  - good to excellent quality, video playback
- ✓ H.261 (.05-2.5 bit/pixel)
  - average quality, video conferencing (e.g., MBONE)

M5: Input / Output Devices

Output Devices: Audio Output

- What range can humans perceive?
  - 0 - 20 kHz frequency range
  - sample at 2 times highest frequency
    - Nyquist rate
- Many standards
  - telephony (200-3,400 Hz, 8 kHz)
  - teleconferencing (50-7,000 Hz, 16 kHz)
  - **CD (20-20,000 Hz, 44.1 kHz)**
  - DAT (20-20,000 Hz, 48 kHz)

M5: Input / Output Devices
Future Possibilities

- ✓ Direct brain connections
- ✓ Haptic output devices
  - using touch for output
  - Impulse Engine 2000
    - joystick w/ force feedback
    - simulate the feel of
      - texture, springs, liquids, gravitational fields, etc.

Additional Handouts for Lecture 2

- 1. “New Technological Windows into Mind: There is More in Eyes and Brains for Human-Computer Interaction” by Velichkovsky & Hansen
- 2. “Usability Heuristics for the Web” by Keith Instone
- 3. “Design Principles” by Mark D. Huang
  - o **Shneiderman's** "Eight Golden Rules of Dialog Design“
  - o **Mayhew's** "General Principles of User Interface Design“
  - o **IBM's** "Design Principles for Tomorrow“

  http://www.cc.gatech.edu/classes/cs6751_97_winter/Topics/design-princ/
- 4. “Web Design Guidelines Design in action” from IBM Easy

  http://www-3.ibm.com/ibm/easy/eou_ext.nsf/Publish/572PrintView
- 5. Search Engine Secrets

What's in Store for Lecture 3

- ✓ Module 6. Interaction Styles
- ✓ **Module 7. Multimedia, Hypertext and The World Wide Web**
- ✓ Assignment 3 Discussion

End of Lecture 2

Good Night.