

# **Human-Computer Interaction**

**”Interaction Styles, Multimedia, Hypertext & WWW”**

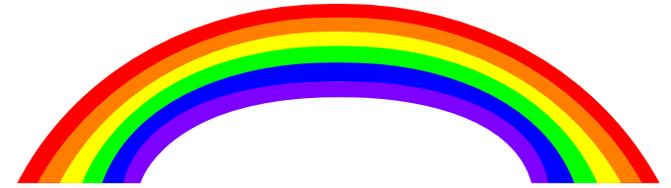
**BSc/CQU**

## **Lecture 3**

(December 7, 2001)

Tralvex (Rex) Yeap MAAAI MSCS

# Outline



- ✓ Quick Review of Lecture 2
- ✓ Assignment 1 Presentation by Group A
- ✓ **M6. Interaction Styles**
- ✓ **M7. Multimedia, Hypertext and The WWW**
- ✓ Class Activity 1: Reading
- ✓ Class Activity 3: Reading
- ✓ Additional Handouts for L3
- ✓ What's in Store for Lecture 4

## Quick Review on Lecture 2

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- ✓ 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

# Modules for Lecture 3

Corresponding chapters in Textbook/Resource Book



|     |                                      |                             |
|-----|--------------------------------------|-----------------------------|
| M6. | <b>Interaction Styles</b>            | Chapter 13,<br>16 (332-341) |
| M7. | Multimedia, Hypertext<br>and The WWW | pp. 255-257<br>pp. 319-322  |

# M6: Interaction Styles

## Introduction

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- ✓ Different ways that **users** communicate or interact with **computer systems**
  - **Issuing** instructions
  - **Choosing** system functions
  - **Manipulating** graphical objects
  
- ✓ The **choice of interaction styles** has a **profound effect** on how users use computer systems.

# M6: Interaction Styles

## Primary Interaction Styles

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- ✓ Command language
- ✓ Natural language
- ✓ Menu selection
- ✓ Form fill-in
- ✓ Direct manipulation
  - WIMP/Widget-based interaction
  - Information Visualisation
- ✓ Virtual Reality
- ✓ Ubiquitous Computing
- ✓ Wearable Computing

# M6: Interaction Styles

## Command Language

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- ✓ Designed with **single characters, words** or **abbreviations** to send instructions directly to the computer.
  
- ✓ Supports user initiative
  - ✓ Users have **freedom to use commands** at different places or different situations
  - ✓ Users have more options for commands
    - use of parameters
    - Example: `dir` `dir/w` `dir/p` `dir/?` ...

# M6: Interaction Styles

## Command Language (cont)

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- ✓ Supports **scripting** capability
  - allows creation of user-defined macros.
  - automatically executes a series of commands.
- ✓ Appeals to **experienced** users, but not novices.
- ✓ Requires **substantial training** and **memorization**.
- ✓ **Difficult to retain**
- ✓ **Poor error handling**

# M6: Interaction Styles

Command Language: DOS & Unix commands



```
C:\ Command Prompt

UNIX(r) System U Release 4.0 (cabot)

login: robocup
Password:
Last login: Sat Jul 29 12:14:38 from patents
Sun Microsystems Inc. SunOS 5.5.1 Generic May 1996
cabot(robocup)41: pwd
/usr52/robocup
cabot(robocup)42: cd contest
(robocup@cabot) contest [43] -> ls
./          noda-client-1.0/  sserver-4.06/
../         sserver-2.78/
(robocup@cabot) contest [44] -> logout

Connection to host lost.

C:\WINNT>cd system32
C:\WINNT\system32>cd\
C:\>_
```

# M6: Interaction Styles

## Natural Language

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### ✓ **Good for**

- ✓ **Voice** input/output
- ✓ Users with **moderate computer skills**
  - users do not need to learn command syntax
- ✓ Systems in **special environments**

### ✓ **Problems**

- ✓ **Natural language understanding (by computers)**
- ✓ **Ambiguity**
  - may require clarification dialog frequently.

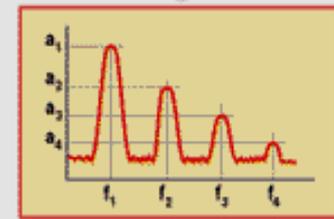
# M6: Interaction Styles

## Natural Language: ask.com & NLP/S->T



http://ask.com

### From speech to text



$f_1, a_1$     $f_2, a_2$     $f_3, a_3$     $f_4, a_4$

| 1st   | 2nd    | 3rd    | 4th    | Phoneme |
|-------|--------|--------|--------|---------|
| 200,4 | 350,3  | 1000,3 | 2500,1 | a       |
| 270,6 | 1200,2 | 3600,1 | 5000,1 | e       |
| 320,5 | 640,2  | 1100,2 | 2300,1 | i       |

# M6: Interaction Styles

## Menu Selection

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### ✓ Emphasize on

#### ✓ Structures

- The designer **predefines** the structure. Strive to be comprehensible and natural to use.

#### ✓ Selections

##### ✓ The user makes **choices**.

- Task-oriented
- System matches the user's choice with system's functions.

# M6: Interaction Styles

## Menu Selection (cont.)

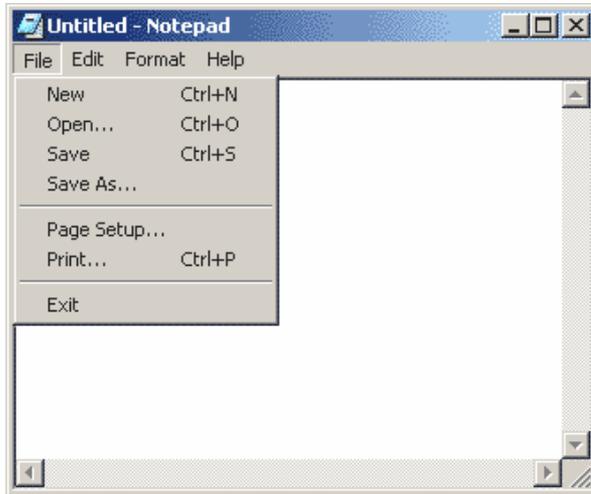
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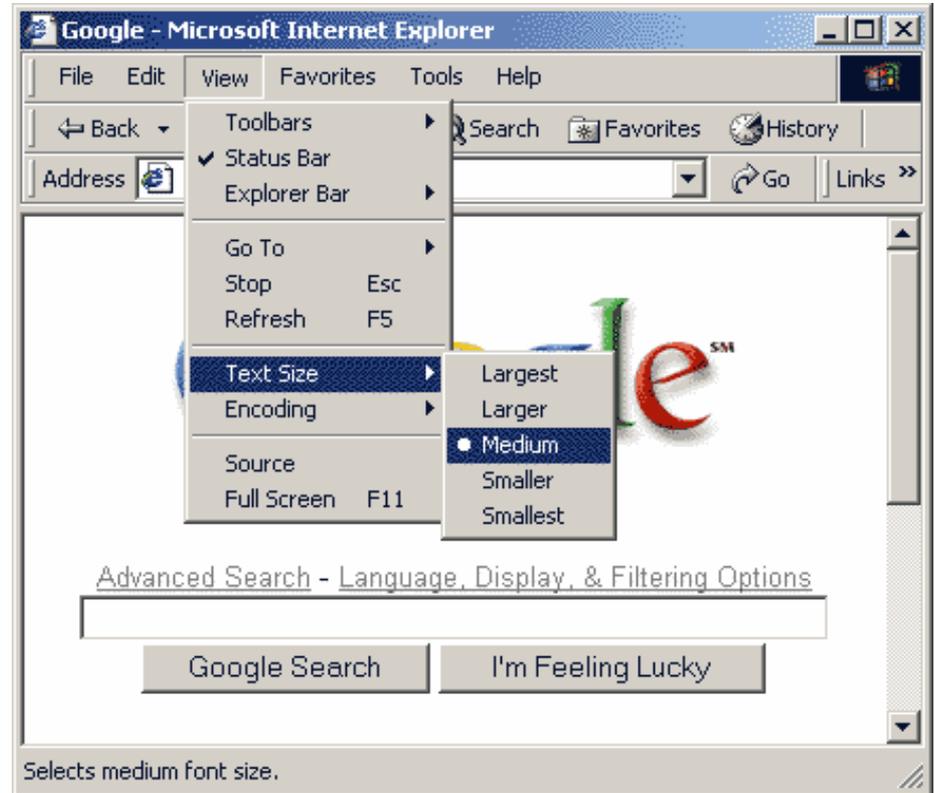
- ✓ With menu-based systems,
  - ✓ users can **only select**.
  - ✓ users can **not change** the structures.
  - ✓ user can **navigate** through the structure.
  - ✓ users can **not add** any new controls.

# M6: Interaction Styles

## Menu Selection: Notepad & IE



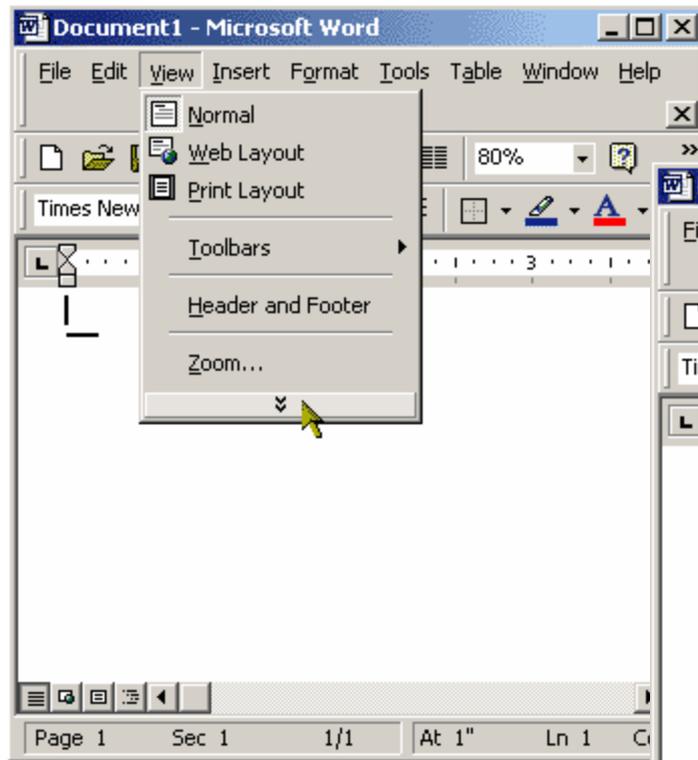
Notepad: Simple Menu



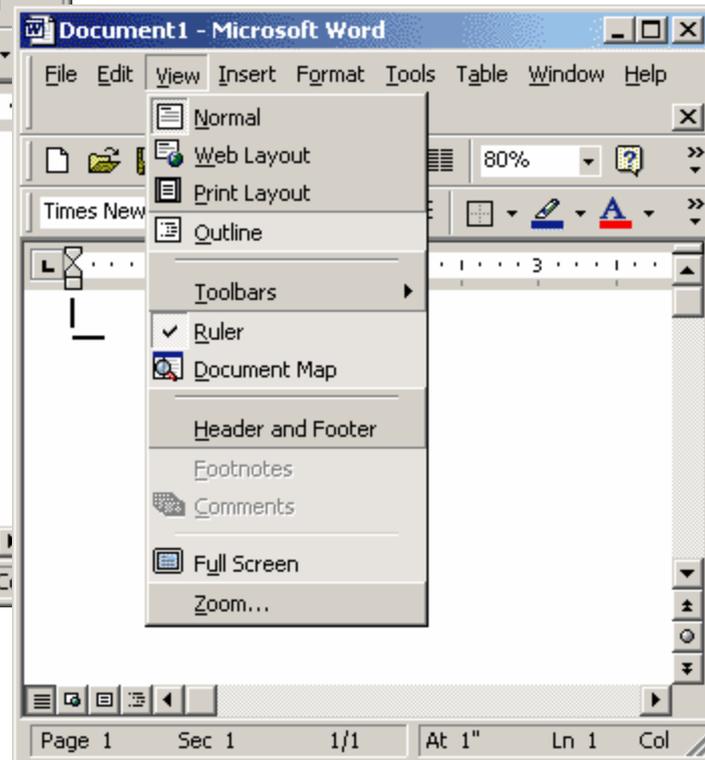
MS Internet Explorer: Extended Menu

# M6: Interaction Styles

## Menu Selection: Microsoft Word 2000



Word2000: Extended-Hidden Menu (latest)



# M6: Interaction Styles

## Form fill-in



- ✓ Resembles familiar **paper forms**
- ✓ **Simplifies data entries** with pre-defined structures
- ✓ Gives **convenient assistance**
- ✓ **Problems**
  - ✓ visual layout and organization
  - ✓ screen space

A screenshot of a Microsoft Internet Explorer browser window displaying a web page titled "T. Rex GuestBook". The browser's address bar shows "http://trilves.com/guestbook". The page content includes a "Guestbook" heading, a "View Guestbook" link, and a form with the following fields: "Name:", "Email:", "Homepage URL:" (with "http://" pre-filled), "Homepage Title:", "How did you find me?:" (with a dropdown menu showing "Somewhere out there..."), "Where are you from (Sin?):", "Your famous Quote/Philosophy:" (with a checkbox for "Check here if you would like this to be a private quote/message!"), and a large text area for the quote. At the bottom of the form are "Submit" and "Clear" buttons. Below the form, it says "It may take a few seconds to process after submitting...". At the very bottom of the page, it says "Created in March 31, 1997. Last Revised: October 30, 1997". The browser's status bar at the bottom shows "Done" and "Internet".

# M6: Interaction Styles

## Direct manipulation: Introduction

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What is it?

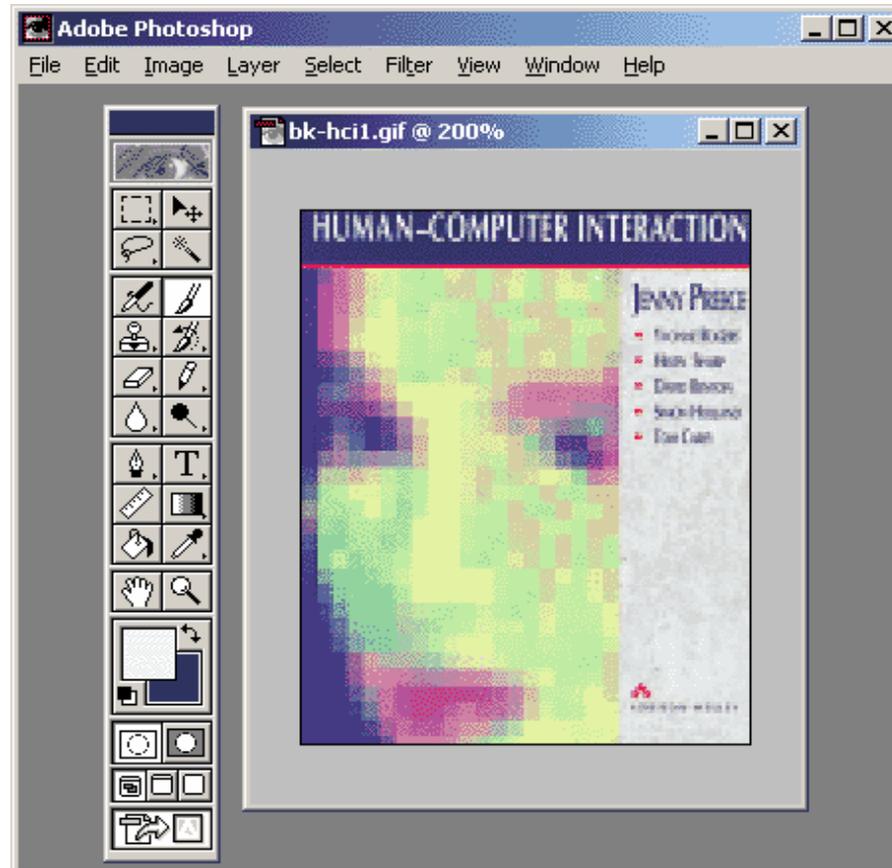
- ✓ **Continuous representation** of object of interest
- ✓ **Physical actions** not syntax or commands
- ✓ Response is **immediate**
- ✓ Easily **reversible, visible action**

# M6: Interaction Styles

## Direct manipulation: Example - Photoshop



Eg - icon based imagery in drawing package, desktop metaphor



# M6: Interaction Styles

## Direct manipulation: Advantages



### Advantages:

- ✓ engenders **enthusiasm**
- ✓ **novices** learn **basic functionality quickly**
- ✓ **experienced** users **work rapidly**
- ✓ **error messages** are **rarely needed**
- ✓ users can **see immediately** if their actions are furthering their goals, and how to change it
- ✓ user experiences **less anxiety**, **actions are reversible**
- ✓ **user gain confidence** since they initiate the action, feel in control and predict system responses

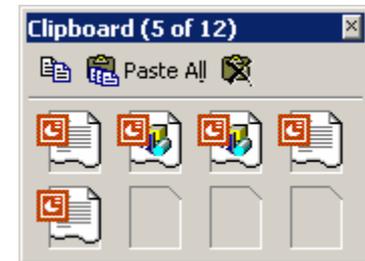
# M6: Interaction Styles

## Direct manipulation: Disadvantages



### Disadvantages

- ✓ **not all tasks** can be described as concrete objects
- ✓ **not all actions** can be performed directly
- ✓ Eg. how to make concrete the concept of a buffer
  - Apple Macintosh overcame this through *cutting*, *pasting* and *hidden clipboard*.
  - MS Office 2000 includes a multi-objects clipboard.



# M6: Interaction Styles

## Direct manipulation: WIMP interface



Windows

Icon

Menus (or Mouse)

Pointers (or Pull-down menus)

- ✓ Today's interface, in PC and desktop workstation areas - Microsoft Windows, MacOS, Unix window based systems.
- ✓ Elements of WIMP interface are called **widgets**

# M6: Interaction Styles

## Direct manipulation: WIMP interface (cont)



### ✓ Windows

- elements of the screen that act as independent terminals

### ✓ Icon :

- small picture to represent a closed window
- represent other aspects of system - waste-basket

### ✓ Menus

- menu bar, pop-up menus, pull down menus, circular menus

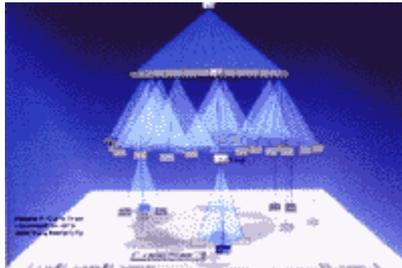
### ✓ Pointers

- point and select
- modes
- hot spot - location where the image points

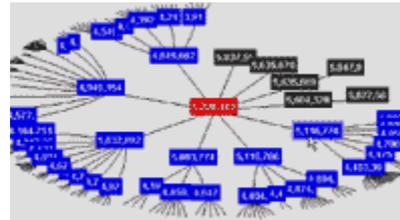
# M6: Interaction Styles

## Direct manipulation: Information Visualisation

- ✓ The visualisation / control of **textual information**.
- ✓ A variety of methods: Cone Trees, Hyperbolic Tree, Fish-Eye Views, Treemaps, Magic Lens, Thememaps, etc.
- ✓ “Information Visualisation: An Overview” by Louis Vroomen  
<http://www.crim.ca/~vroomen/writing/technical/reports/infovis.html>



3D Cone Trees



Hyperbolic Tree  
(Patents Vis)



Thememaps by cartia.com  
(E-commerce Vis – past 6 months articles)

# M6: Interaction Styles

## Virtual Reality

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### Interaction styles

- ✓ sense of **direct physical presence**: cues include **visual, aural** or **haptic** (touch)
- ✓ sensory cues in **three dimensions**
  - **sound** is used to aid navigation and location, being aware of other activities in the virtual world, eg aircraft training
- ✓ **natural interaction: gestures** typical of manipulating everyday objects
  - picking up, turning around, throwing and so on.

# M6: Interaction Styles

## Virtual Reality: **Immersion** vs Desktop



### ✓ **Immersion** - “looking in” perspective

- helmet, datagloves and 3D world, providing a subjective feeling of environment, eg. Virtual Surgery WorkBench
- VR and Hollywood: Matrix, The Thirteenth Floor



<http://www.volumeinteractions.com/>

<http://uk.imdb.com/Title?0133093>



<http://uk.imdb.com/Title?0139809>

# M6: Interaction Styles

## Virtual Reality: Immersion vs Desktop



### ✓ Desktop - “looking at” perspective

- single screen for input and output, 3d mouse and keyboard, use of shadow, changing environments to indicate motion
- eg metaphor of moving through rooms as in games (eg. Quake) and 3D web environments (eg. ipix.com)



<http://perfectstorm.warnerbros.com/cmp/flash-thestorm-fr.html>



<http://www.quake.com/>

# M6: Interaction Styles

## Ubiquitous Computing

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- ✓ **Ubiquitous Computing** proposes a world in which most everyday objects have computational devices embedded in them.
  - **Mainframe**: one computer shared by many people (1-n).
  - **PC**: One computer with one person (1-1).
  - **Ubiquitous computing**: many computers serve one person (n-1).
  
- ✓ Ubiquitous computing is roughly the opposite of virtual reality.
  - **Virtual reality** puts **people inside** a computer-generated world.
  - **Ubiquitous computing** forces the **computers to live out** here in the world with people.

# M6: Interaction Styles

## Ubiquitous Computing (cont)



- ✓ Its highest ideal is to make a computer so **imbedded**, so **fitting**, so **natural**, that we use it without even thinking about it.
  - ✓ **Internet as backbone**
  - ✓ Individual **PC** as “**server**”
  - ✓ Variety **cheap devices** as “**client.**”

# M6: Interaction Styles

## Ubiquitous Computing: Xerox PARC TAB (1992-1994)



<http://www.ubiq.com/parctab/>

- ✓ Communicate **wirelessly** through infrared transceivers.
  - Portable
  - Constant connectivity
  - Location reporting
  
- ✓ Runs workstation-based application.
  
- ✓ Palm Pilot was first introduced on April 1997

<http://powertotheplm.homepage.com/palmhistory.html>

# M6: Interaction Styles

## Ubiquitous Computing: Digital Ink

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<http://panopticon.ices.cmu.edu/design/Digitalink.html>

- ✓ Reinvents the computer desktop
  - **Any writing surface** - from napkins to paper can be a low-tech and socially comfortable computer interfaces.
- ✓ Carnegie Mellon University

# M6: Interaction Styles

## Wearable Computers



- ✓ A computer that is **always with you**, is **comfortable** and **easy** to keep and use, and is as **unobtrusive** as clothing.
  - ✓ Portable while operational: The most distinguishing feature of a wearable
  - ✓ Hands-free use: speech input and heads-up display or voice output, etc.
  - ✓ Sensors: In addition to user-inputs, a wearable should have sensors for the physical environment.
- ✓ "Attention-getting": A wearable should be able to convey information to its user even when not actively being used.
- ✓ **Always on:** By default a wearable is always on and **working, sensing, and acting.**

# M6: Interaction Styles

## Wearable Computers (cont)



- ✓ Unlike desktop computers, wearable computers have the potential to ‘**see**’ as the user sees, ‘**hear**’ as the user hears, and **experience** the life of the user in a “first-person” sense. They can **sense** the user's physical environment much more completely than previously possible, and in many more situations.
- ✓ The wearable computer does not rely on the user to tell it everything to do, and so it needs information from the wearer's environment.
  - ✓ Camera
  - ✓ Sound Sensors
  - ✓ Location identifiers

# M6: Interaction Styles

## Wearable Computers (cont)



- ✓ With a **desktop computer**,
  - you expect your user to be interacting with the screen directly. The **user's primary task is working with the computer.**
  
- ✓ With **wearable computers**,
  - most of the time the **user is doing something else** besides interacting with the computer.

# M6: Interaction Styles

Wearable Computers: Wearable Audio Messaging and Awareness



- ✓ A **unified messaging system** for news, email, voice mail, etc.
- ✓ **Speech synthesis and recognition** for input
- ✓ Client and remote server components communicating over the **wireless LAN**.

<http://www.media.mit.edu/~nitin/NomadicRadio/index.html>

# M6: Interaction Styles

Wearable Computers: Wearable Audio Messaging and Awareness (cont)



[http://www.media.mit.edu/~nitin/NomadicRadio/nr\\_media/nrbbc.mpg](http://www.media.mit.edu/~nitin/NomadicRadio/nr_media/nrbbc.mpg)



## M6: Interaction Styles

Wearable Computers: Information on demand - anytime, anywhere



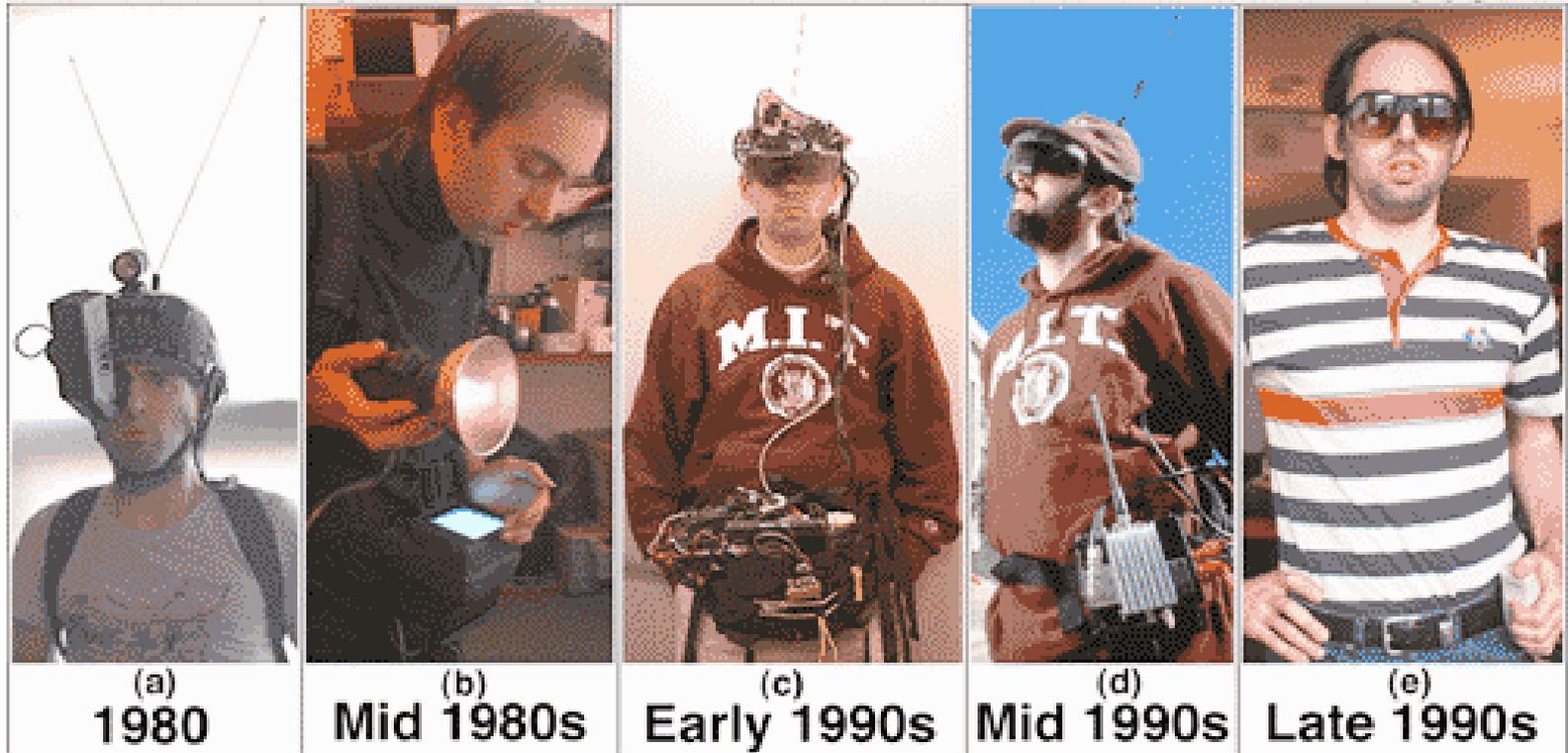
<http://www.dwave.net/~fwpc/milapps.html>

- ✓ **Hands-free** access to volumes of information, plus communication links to databases and command personnel.
- ✓ Use global positioning satellite interfaces to provide (**GPS**) themselves with their precise locations.
- ✓ Combat personnel can wear it as part of their battle dress or operation uniform.

# M6: Interaction Styles

## Wearable Computers: Steve Mann's WearCam

Steve Mann's "wearable computer" and "reality mediator" inventions of the 1970s have evolved into what looks like ordinary eyeglasses



<http://wearcam.org/>

# M7: Multimedia, Hypertext and The WWW

## Class Activity 1: Reading “Multimedia and Hypertext – The Internet and Beyond”

### Multimedia and Hypertext - The Internet and Beyond

#### 1. Defining Hypertext, Hypermedia, and Multimedia

The simplest way to define hypertext is to contrast it with traditional text. All traditional text, whether in printed form or in computer files, is processed, meaning that there is a single linear sequence defining the order in which the text is to be read. First you read page one. Then you read page two. Then you read page three. And you don't have to be much of a mathematician to generalize the formula which determines what page to read next.

Hypertext is nonsequential. There is no single order that determines the sequence in which the text is to be read.

Hypertext presents several different options to the reader, and the individual reader determines which of them to follow at the time of reading the text. This means that the author of the text has set up a number of alternatives for readers to explore rather than a single stream of information.

The same is true of factbooks in traditional printed texts, since readers have to determine upon reading the footnote marker whether to continue reading the primary stream of text or to branch off to generate the footnote. Therefore hypertext is sometimes called the “generalized footnote”. Another printed form with access structures similar to hypertext is the encyclopedia with its many cross-references.

Hypertext consists of interlinked pieces of text (or other information). These pieces can be computer screens, scrolling windows, files, or smaller bits of information, each unit of information is called a node. Whatever the grain size of these nodes, each of them may have pointers to other nodes, and these pointers are called links. The number of links is normally fixed in advance, but will depend on the content of each node. Some nodes are related to many others and will therefore have many links, while other nodes serve only as destinations for links but have no outgoing links of their own. Sometimes such nodes without further links are called leaf nodes.

The entire hypertext structure forms a network of nodes and links. Readers move about this network in an activity that is often referred to as browsing or navigating, rather than just “reading”, to emphasize that users must actively determine the order in which they read the nodes.

A hypertext link connects two nodes and is normally directed in the sense that it points from one node (called the source node) to another (called the destination node). Hypertext links are frequently associated with specific parts of the nodes they connect rather than with the nodes as a whole.

When users follow the links around the hypertext network, they will often have a need to return to some previously visited node. Most hypertext systems support this through a backarrow facility. Backtracking is just as dependent on the individual user's movement as is the order in which the nodes were visited in the first place.

#### Narrower Definitions of Hypertext

Many non-hypertext computer techniques may at least match various aspects of the definition of hypertext, but true hypertext should also make users feel that they can move freely through the information, according to their own needs. This feeling is hard to define precisely but certainly implies small overhead with respect to using the computer. This means short response times so that the text is on the screen as soon as the screen asks for it. Small overhead also requires low cognitive load when navigating, so that users do not have to spend their time wondering what the computer will do or how to get it to do what they want.

When asked whether I would view a certain system as hypertext, I would not rely so much on its specific features, commands, or data structures, but more on its ease into the “look and feel”.

#### Hypertext: Multimedia Hypertext

The traditional definition of the term “hypertext” implies that it is a system for dealing with plain text. Since many of the current systems actually also include the possibility for working with graphics and various other media, some people prefer using the term *hypermedia*, to stress the multimedia aspects of their systems. Personally, I would like to keep using the traditional term “hypertext” for all systems since there does not seem to be any reason to reserve a special term for text-only systems. Therefore I tend to use the two terms *hypertext* and *hypermedia* interchangeably with a preference to

thinking to hypertext.

Being multimedia is not enough for a program to be hypermedia, but it is possible to use quite sophisticated multimedia capabilities to good effect as part of a hypermedia system.

Hypertext is a natural technique for supporting multimedia interfaces since it is based on the interlinking of nodes that may contain different media. Typical media in hypermedia nodes are text, graphics, video, and sound.

One difficulty with representing video in hypertext is the question of how to name links. The most traditional solution has been to use plain text as the hypertext anchor leading to the playing of a piece of video, but that is not a very hypermedia-like choice. The link to a video clip may be represented by a minimized version of the clip or a part of it (Henderson and Dourouhot 1993). Thus the anchors are actually small moving images in their own right called window (moving) icons, since users are often able to recognize a piece of films by viewing the movements it contains.

The use of sound in hypertext introduces yet another linkage problem (Caffin and Smith 1995). It is fairly easy to have a sound as the destination for a hypertext link; the sound plays when the anchor is activated. But in many applications one also wants to anchor departure points in the sound itself.

If the user wants to jump around to the music, the interface design issues become more problematic, and it would be very difficult for the user to activate a specific piece of music directly. It is unfortunately impossible simply to click on the sound in the same way as one can click on a word or a graphic image. Instead one has to provide the user with a visual (or aural) representation of the sound on which to click. In the case of music an obvious surrogate would be a picture of the notes of the text of the vocals but for other sounds a less intuitive representation has to be used.

Hypertext is fundamentally different from traditional databases from a user perspective, however. A normal database such as the database of employees in a company has an extremely regular structure defined by a high-level data definition language. All of the data follow this single structure, so we might have ten thousand employee records all of which have the same fields for name, address, salary, telephone extension, etc.

#### Hypertext and Regular Computer Applications

Even though many hypertext systems are also hypermedia systems and include many multimedia effects, the fact that a system is multimedia-based does not make it hypertext. The nature of text and graphics is not enough in itself. Many multimedia systems are based mostly on displaying various film strips to a passive user who does not get to navigate an information space. Only when users interactively take control of a set of dynamic links among units of information does a system get to be hypertext. It has been said that the difference between multimedia and hypermedia is clear to that between watching a travel film and being a tourist yourself.

#### The Hype about Hypertext

One of the most important advantages of hypertext is that it is a method for bringing three technologies and industries that have been separate until recently: publishing, computing, and broadcasting in the form of television and film.

Hypertext provides the opportunity to publish information structures to the general public in much the same way as books or newspapers are currently published. These information structures would be based primarily on moving images, in the tradition of the film and animation industries, and would be under computer control to allow user interaction.

Hypertext can only be done on a computer, whereas most other current applications of computers might just as well be done by hand.

A hypertext system works in collaboration with the user, who has the intelligence to understand the semantic content of the various nodes and determine which of its outgoing links to follow.

A hypertext is under the control of the user, who can customize it by adding links and annotations. Most other computer systems are nonflexible and can be modified only by specialists.

Hypertext has the potential to save great amounts of money in certain applications, mainly because of the smaller storage space and on the cost of updating the information. These savings are one important reason many computer manufacturers now prefer to ship technical documentation in hypertext format.

# Class Activity 2: Reading

## Web Reviews - Internet World magazine's "Deconstructing" series



Papers and Essays by Jakob Nielsen Page 2 of 2

- [The multi-lingual of the telephone](#): Voice is just another datatype (1997)
- [International usability testing](#) (1996)
- [Delectable User Interfaces](#) (1996)
- [The Death of File Systems](#) (1996)
- [How to fix the severity of usability problems](#) (1995)
- [History of Usability](#) (1995) and a report from the first hypertext conference, [Hypertext95](#)
- [Iterative design of Sun's website in 1995](#) (May 1995)
- [Homepage Times](#): The three important limits (1994)

**Users First!**

My regular usability columns on ZDNet. See the [full list of Users First](#) columns, including articles about [cheap user tests](#), [usability](#), and [learning usability](#).

**Website Reviews**

Reviews for Internet World magazine's "Deconstructing" series:

- [Howard Johnson](#)
- [My Way](#)
- [Web Mart](#)
- [SCL](#)
- [ibound.com](#)
- [Newsweek](#)
- [Papa](#)
- [Voxer](#)
- [MSN.it](#)
- [Netmarket](#)
- [AOL.com](#)
- [The Atlantic Monthly](#)
- [Toshiba's Website](#)
- [Museum of Modern Art](#)
- [Microsoft](#)
- [Roadcast.com](#)
- [RealNetworks](#)
- [Praxso](#) (online shopping service)
- [Sun Java Memory News](#)
- [NFL.com](#) - America Online's website, not the service itself
- [New York Times](#) - note: review of the Times's original design
- [Microsoft](#)
- [Cathie.com](#)
- [Webpage.com](#)
- [Music Download](#)
- [Harris & Noble](#)

Review of the original design of [Site](#) magazine (the Alertbox for July 1996).

<http://www.useit.com/papers/> 7/29/2000

Internet World Home Page main frame Page 1 of 3

INTERNET WORLD IN PRINT Issue Date: June 15, 2000

**DECONSTRUCTING...**



**Hojo.com**

**Howard Johnson's Site is Plagued by Problems, From a Slow Home Page to Muddled Navigation and Extraneous Content**

**Joseph Squire**

The most difficult sites to review are the ones where the positive and negative attributes seem to cancel each other out. Howard Johnsons, however, posed no such dilemma. This site's a real stinker.

• **Loading problems.** For starters, the Hojo site absolutely refused to load

[http://www.internetworldnews.com/article\\_bot.asp?inc=061500/6.15/Decon&issue=6.15](http://www.internetworldnews.com/article_bot.asp?inc=061500/6.15/Decon&issue=6.15) 7/29/2000

# Students' Assignment 1 Presentation



## Format of Presentation

- ✓ **Presentation (Content 70%, Delivery 15%, Q&A 15%)** by presenting Group
- ✓ **Q&A Session**
  - **One Question** from each **reviewing group** (round-robin basis, eg. B, C)
  - **Another Question** from each **reviewing group** (round-robin basis)
  - **Open Q&A**, question(s) from any reviewer
- ✓ **Conclusion** from presenting group
- ✓ **Offline: 1-pg constructive critique** from reviewing team by Wed (MSWord)

- 
- ✓ **7<sup>th</sup> December 2001, Presentation by Group A**

## Additional Handouts for Lecture 3



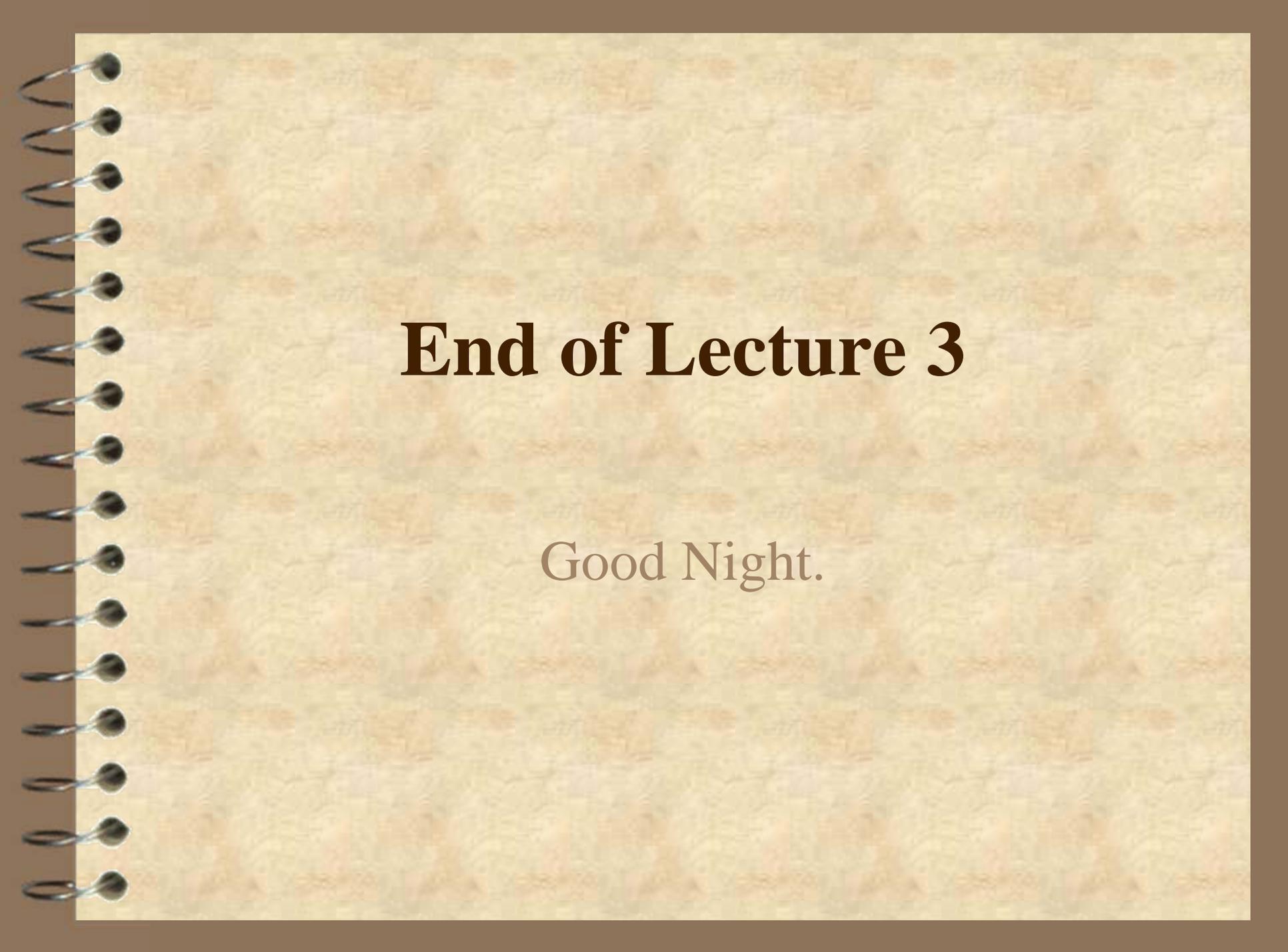
- ✓ 1. Multimedia and Hypertext – The Internet and Beyond by Jakob Nielsen.
- ✓ 2. Web Reviews - Internet World magazine's "Deconstructing" series.

## What's in Store for Lecture 4

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- ✓ M8. Perception, Representation and Windowing System
- ✓ M9. Design and Graphics Design in Computer Human Interaction
- ✓ Assignment 1 Presentation by Group B
- ✓ Assignment 3 Discussion

A spiral-bound notebook with a light beige, textured cover. The spiral binding is on the left side. The text is centered on the page.

**End of Lecture 3**

Good Night.