Introduction

YING SHEN

SCHOOL OF SOFTWARE ENGINEERING

TONGJI UNIVERSITY

Course Title

Human-Computer Interaction

Lecturer

Ying Shen

- Room: 509, Jishi Building
- E-mail: yingshen@tongji.edu.cn

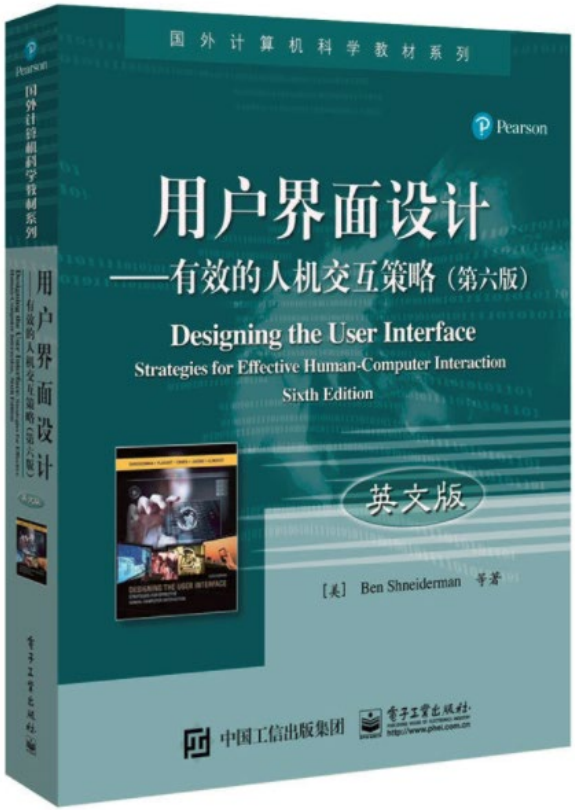
TA: TBA

Lecture Hours

8:00-11:40 am Friday

References

- Designing the User Interface: Strategies for Effective Human-Computer Interaction, Six Edition
  - Chapter 4, 5, 7, 8, 9, 10, 15, 16



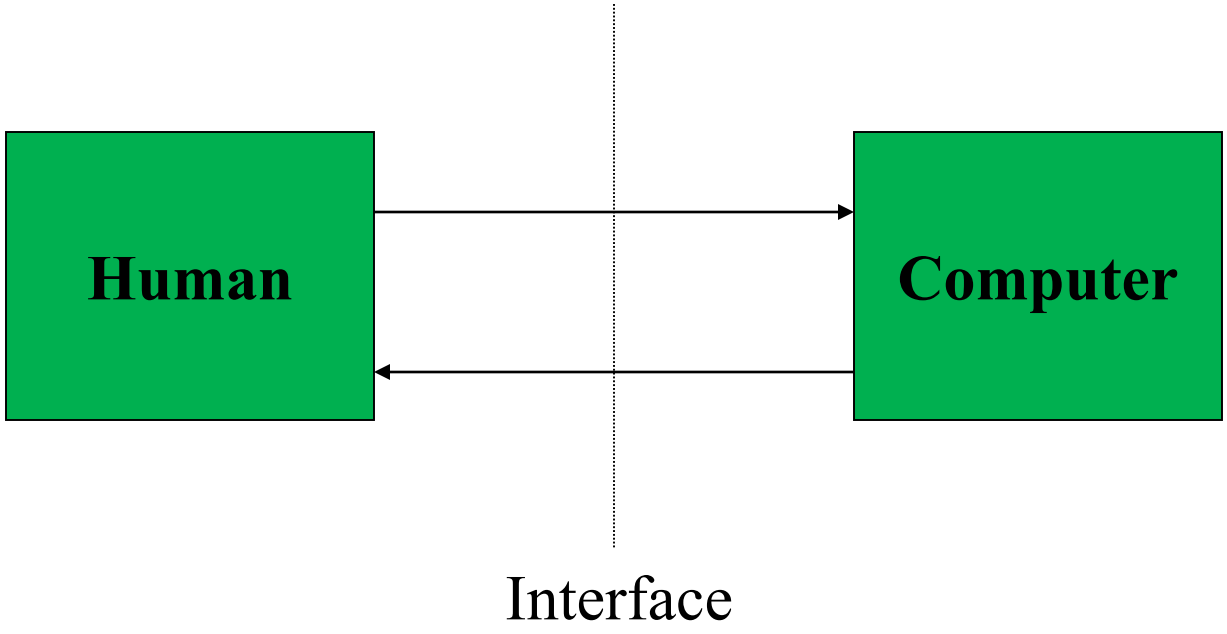
Assessment

Project	60%
Assignment	30%
Participation	10%

Course Web Page

- https://shenyingtongji.gitee.io/home/course/HCI2022Spring/index.html

What is Human-Computer Interaction?



Human-Computer Interaction

HCI: a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them (ACM SIGCHI, 2014)

- The study of how people design, implement and use interactive computer systems.
- The study of how computers affect individuals, organizations, and society.

Requirements of HCI

Ease of use

- GUI vs command language
- Online help, documentation and training

More powerful forms of communications between users and computers

- New interaction techniques
- New input and output devices

Requirements of HCI (cont'd)

Universal access to information

- Proliferation of WWW (5G)
- Information-access interfaces
  - Must be able to deal with new kinds of data, e.g., multimedia information.
  - Permit new kinds of interaction.
  - Require collaborations between HCI and database research communities.

Importance of HCI

Good HCI design is critical to

- Success of products in marketplace
- Safety, usefulness and pleasure of using computer-based systems.

Poor HCI design have led to several well-known catastrophes.

Importance of HCI (cont'd)

Good HCI design can decrease costs and increase productivity due to

- Fewer errors
- Reduced user disruption
- Decreased task time
- Reduced burden on support staff
- Elimination of training

Foundations of HCI

Computer science

Psychology

Sociology/anthropology

Linguistics

Artificial intelligence

History of HCI

Direct manipulation of graphical objects.

Windows

Hypertext

Direct manipulation of graphical objects

First demonstrated by Ivan Sutherland in Sketchpad (1963)

- Use light pen to manipulate objects.

Most of the direct manipulation techniques are developed in Xerox PARC in 1970's.

"Direct Manipulation" was first coined by Ben Shneiderman (University of Maryland).

Windows

Tiled windows

- First demonstrated by Engelbart.
- Other systems: COPILOT, Emacs.

Overlapping windows

- First proposed by Alan Kay
- Used in the Smalltalk system (Xerox PARC)

Hypertext

Original idea is credited to Vannevar Bush (“As we may think”, 1945)

The term “hypertext” is first coined by Ted Nelson.

Ben Shneiderman’s Hyperties

- First system where highlighted items in the text could be selected to go to other pages.

Apple Hypercard further popularizes the idea to a wide audience.

Tim Berners-Lee’s adoption of hypertext in browser leads to spectacular growth of the World Wide Web.

HCI in the future

Voice interaction

VR/AR

…

HCI Applications

Multimedia information retrieval

Entertainment

Education

Interface for security enforcement

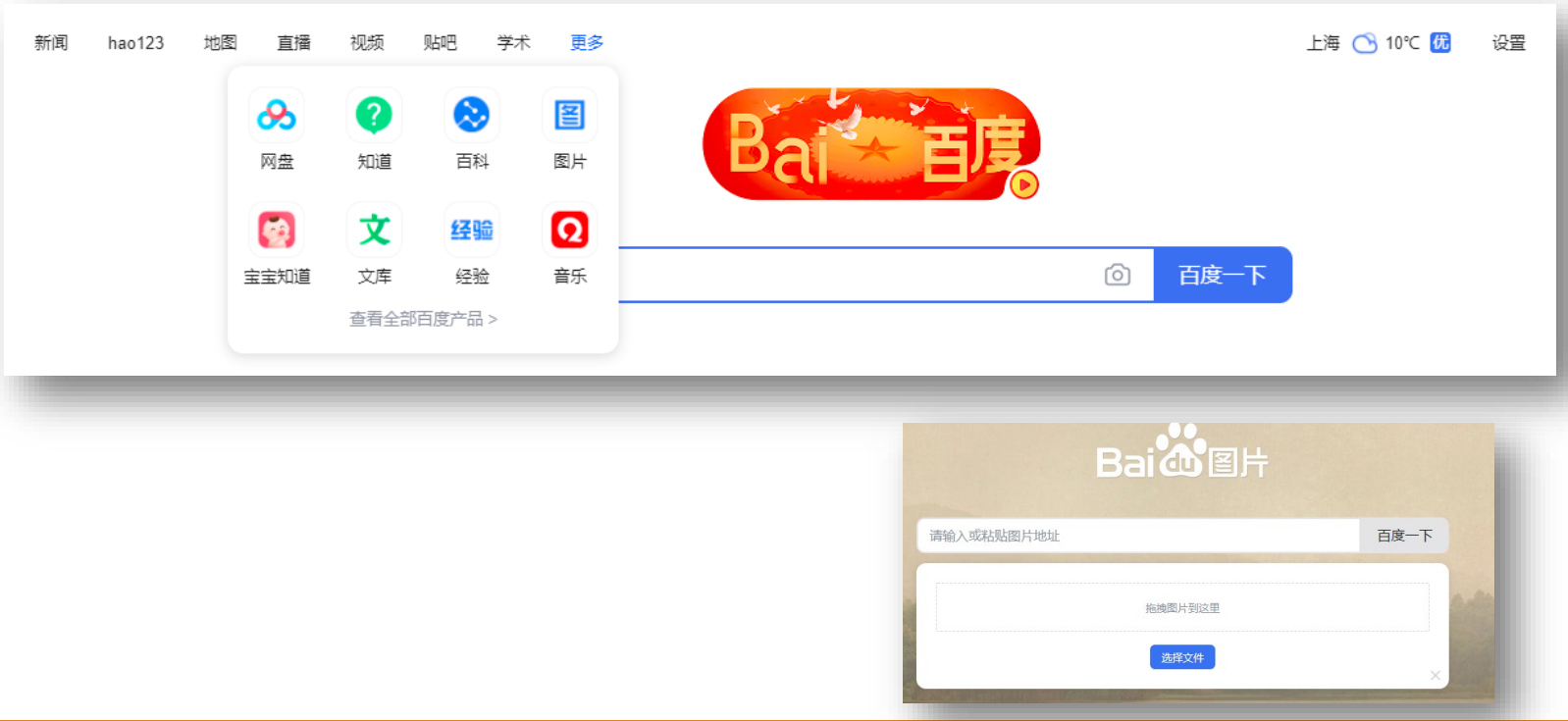
Information visualization

Computer-mediated communication

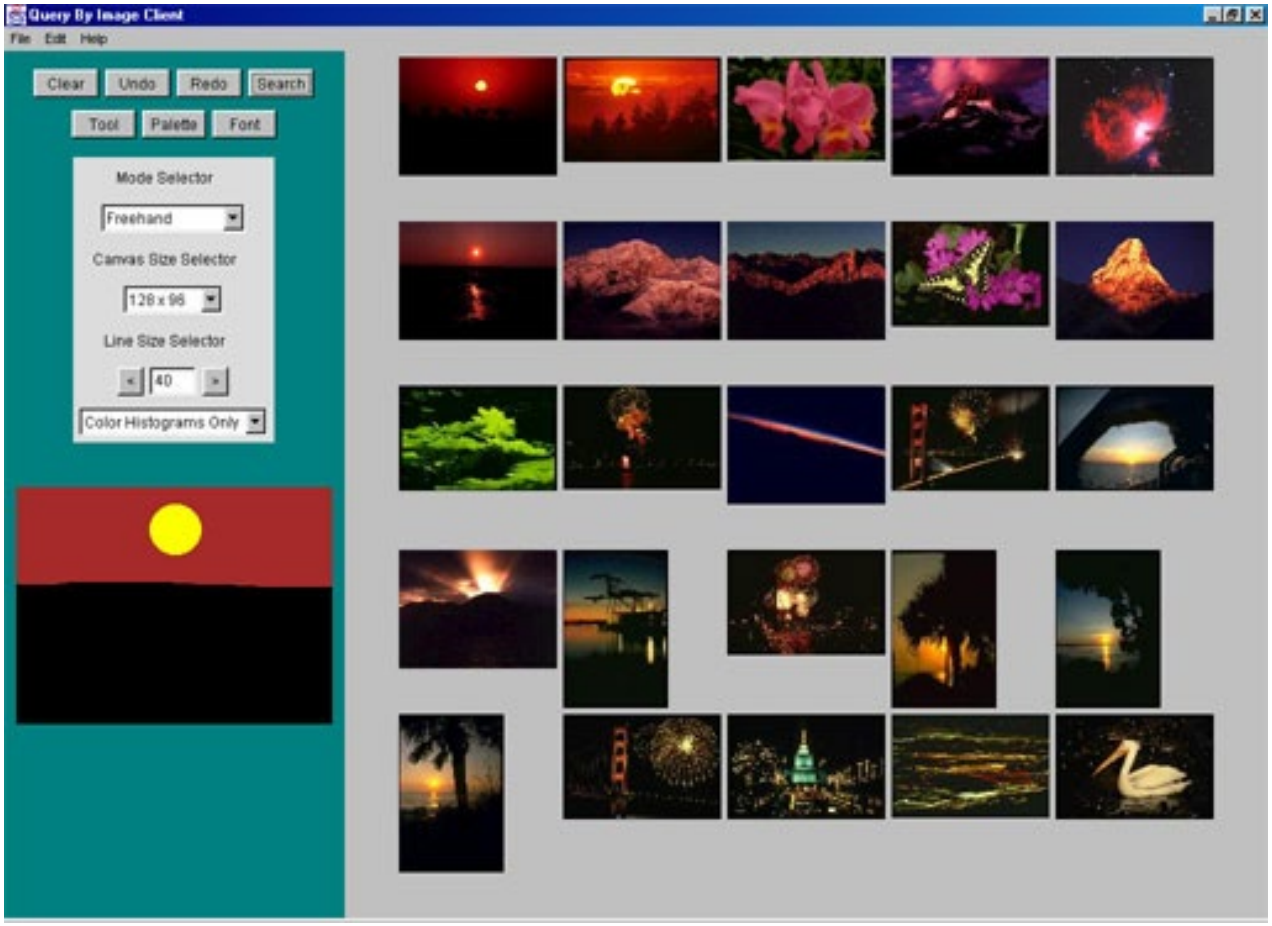
Multimedia Information Retrieval

In many cases, multimedia contents cannot be easily characterized by specific keywords.

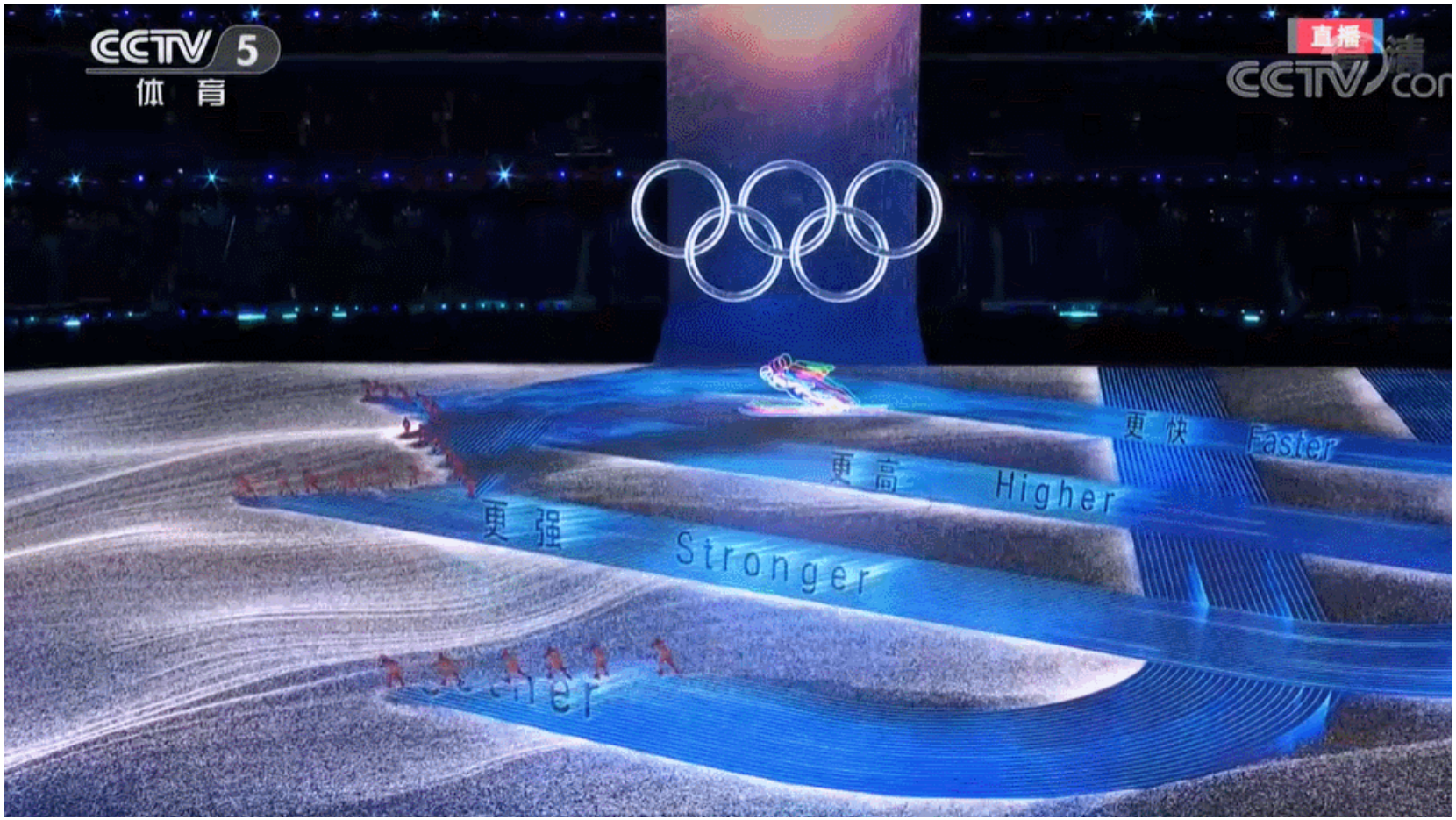
Interfaces equipped with alternative querying mechanisms, such as example-based query specification, are required for effective retrieval.



Multimedia Search Engine

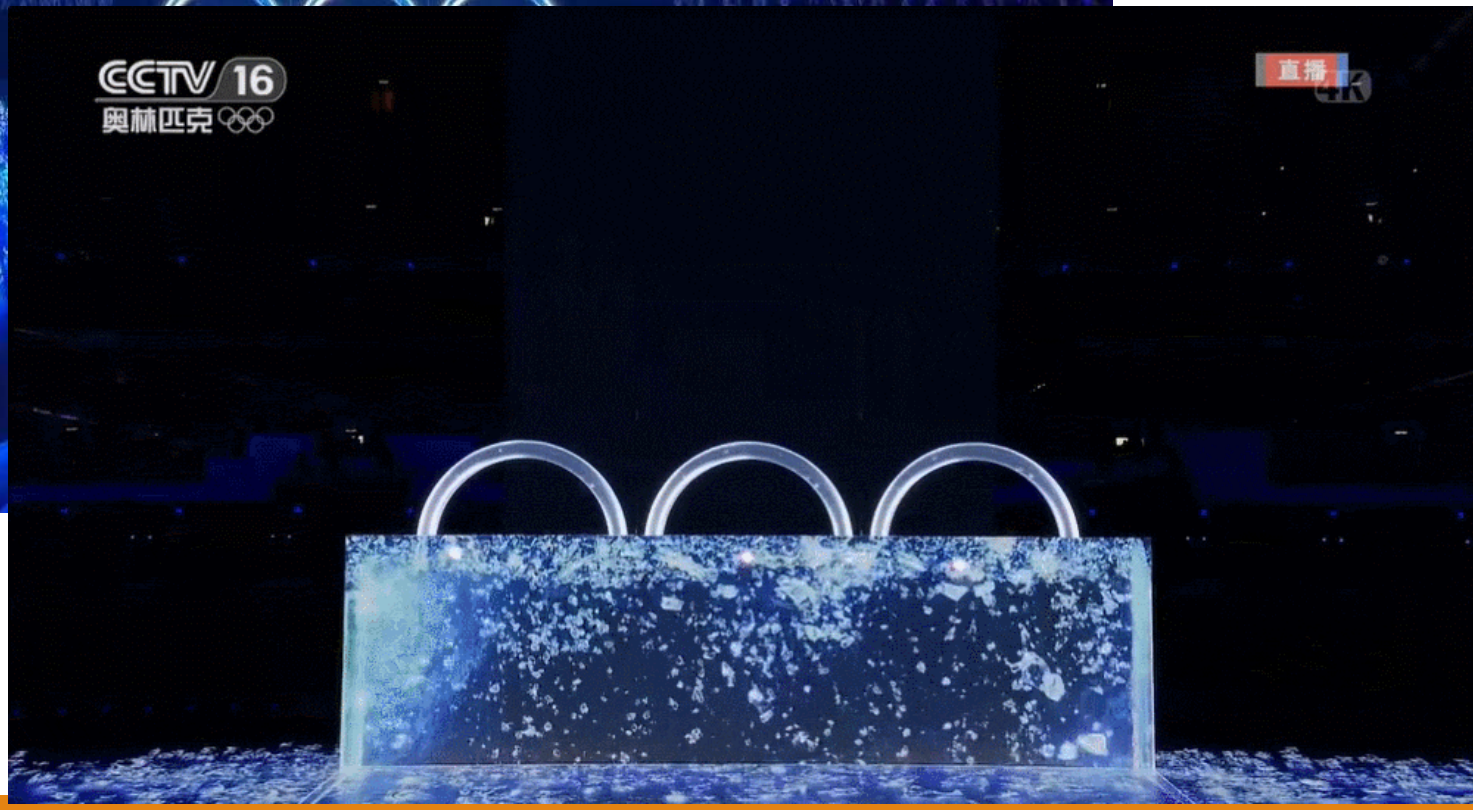


Entertainment



Entertainment

Entertainment

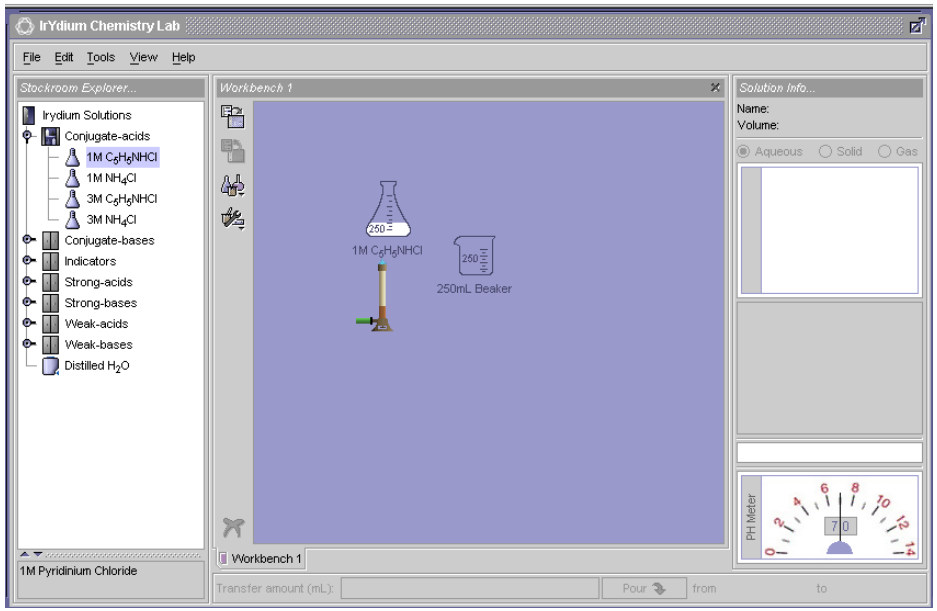


Entertainment

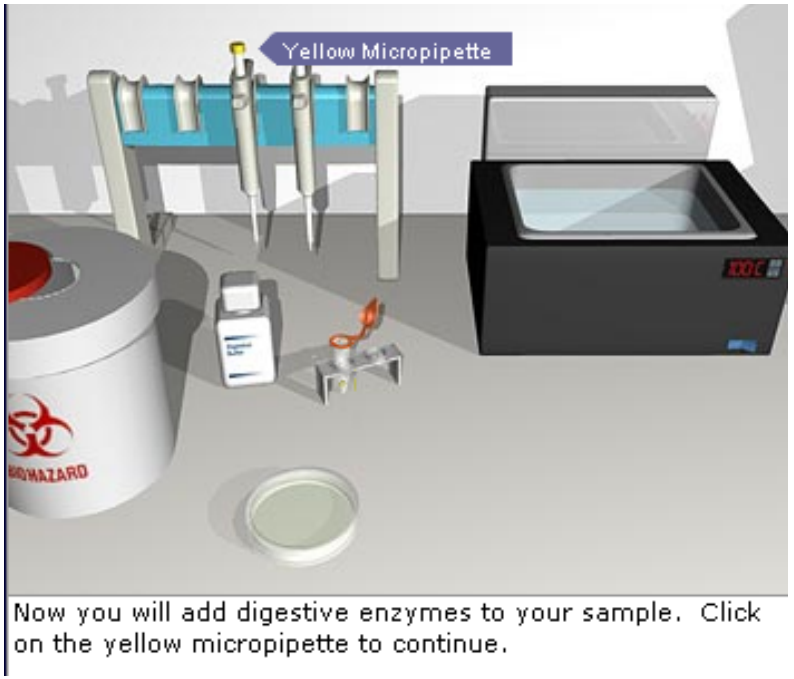
CG techniques in movies

Education

Direct Manipulation Examples



Chemistry



Biology

Interface for Security Enforcement

User authentication based on a set of biometric features:

- Fingerprints
- Iris
- Speech patterns
- Facial characteristics

Non-intrusive techniques are preferable to intrusive techniques.

Interface for Security Enforcement

Information Visualization

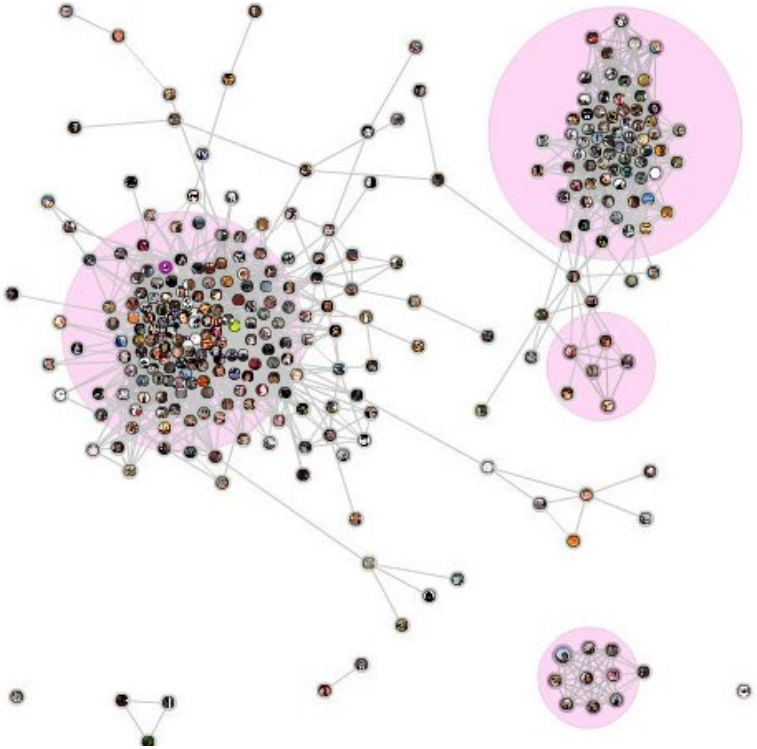
Presentation of large data sets in a suitable graphical formats for trend exploration.

Becomes more important due to information explosion brought on by the Web.

Examples

- Visualizing communication networks.
  - Example
- Visualizing the Web itself
  - Example

Visualizing Communication Networks



Computer-mediated Communication

Communication between human users through computers.

Examples include

- E-mail
- Real-time video and audio interactions

Technological Trends

Computational devices and ubiquitous computing.

Recognition-based user interfaces.

Conversational interface

3-D Technologies.

Virtual reality and augmented reality

Computational Devices and Ubiquitous Computing

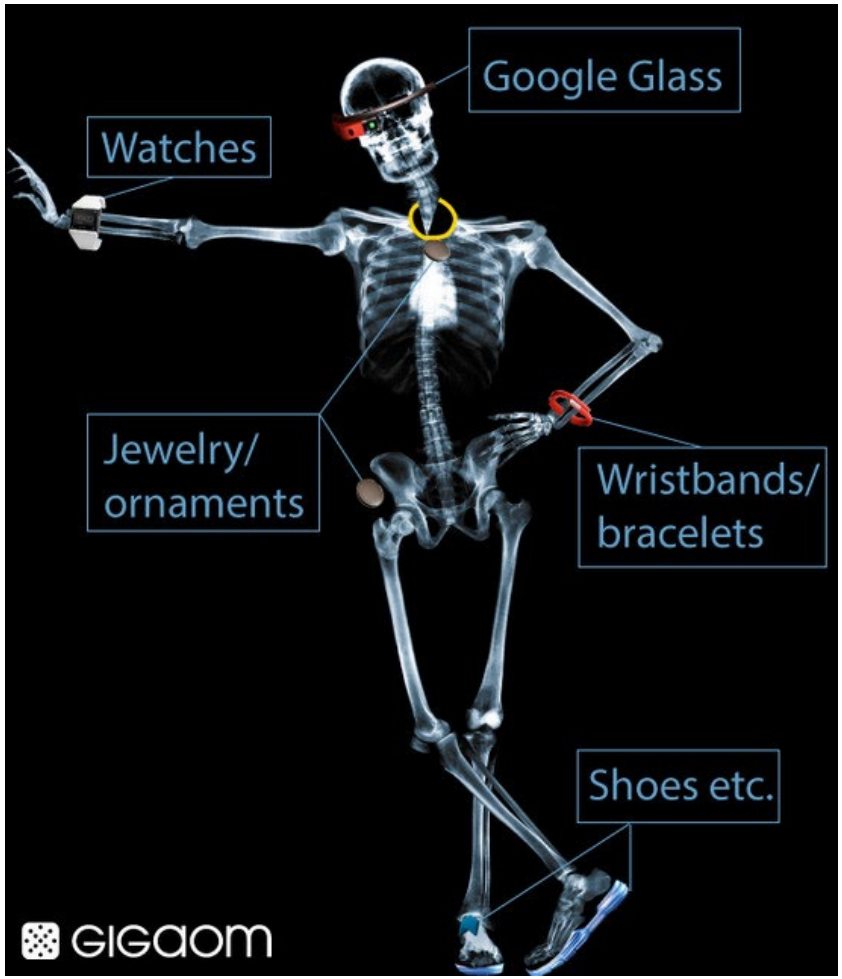
New types of computational devices in addition to workstations and PC

- Laptops
- Mobile phones
- Personal Digital Assistant (PDA)
- Wearable computers and devices.

Ubiquitous computing

- Embedding computers everywhere in our environment.
  - Example: MIT's Things That Think (TTT) project

Wearable Computers



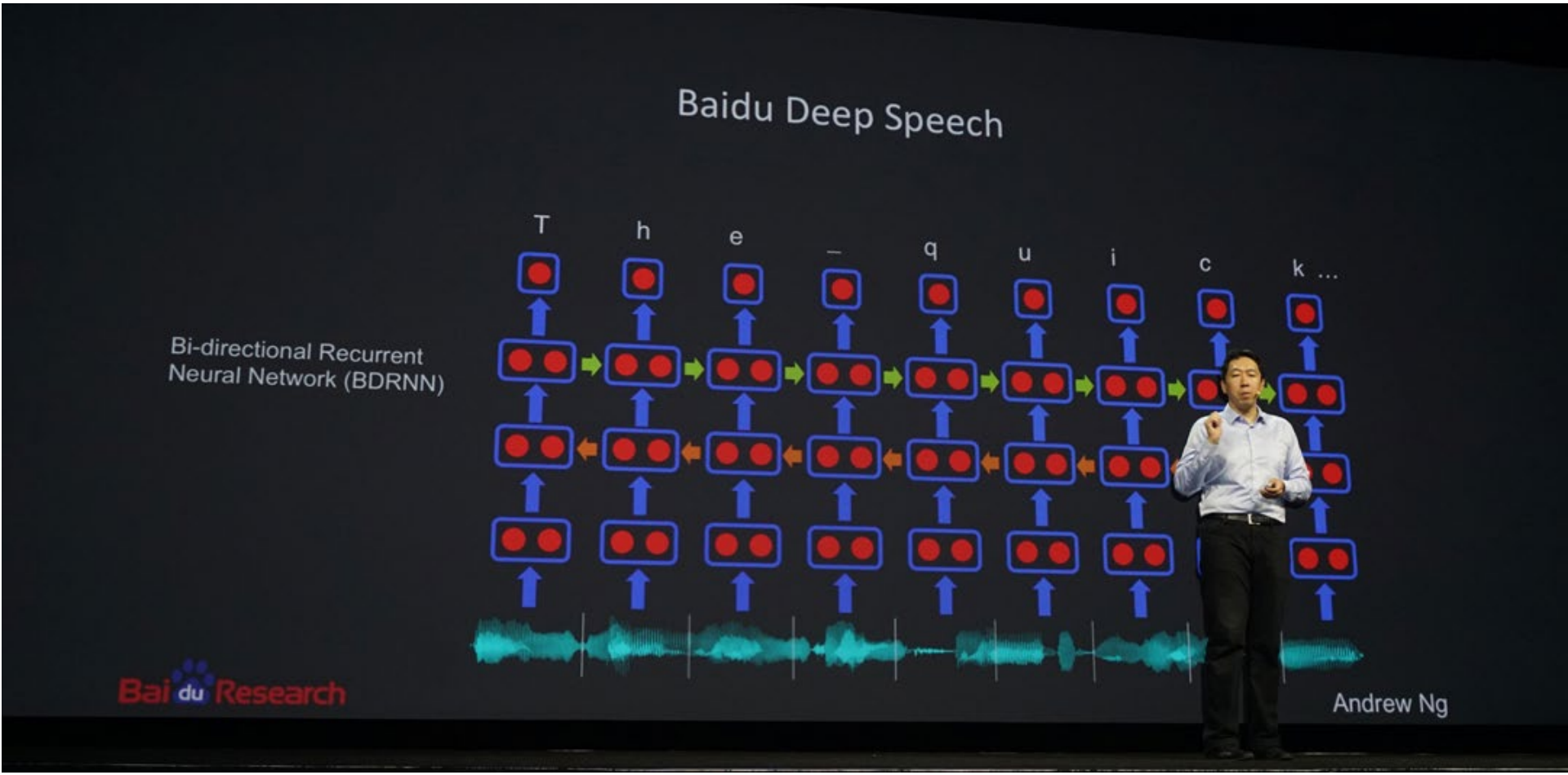
Recognition-based User Interfaces

Current user interface mainly uses keyboard and mouse for input.

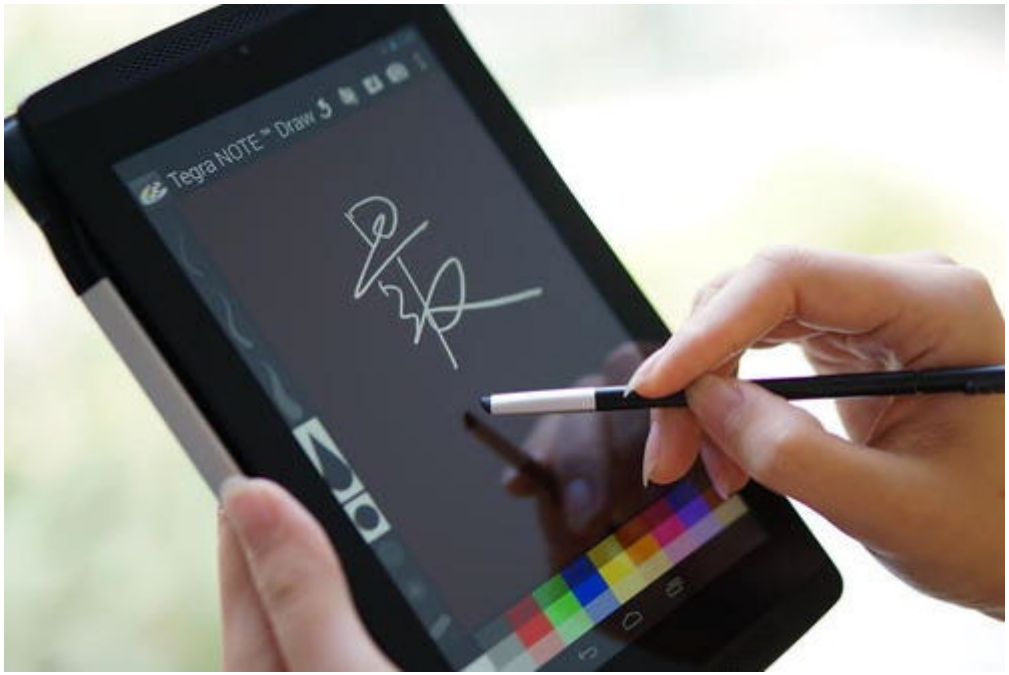
Recognition-based user interface will become more and more important

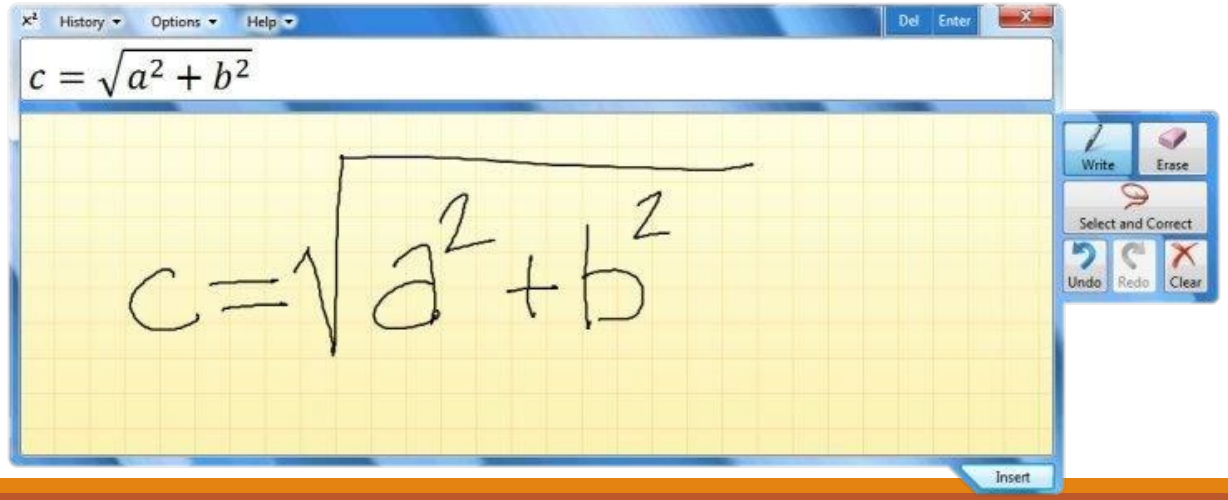
- Speech input and output
- Handwriting
- Gestures

Example: Speech Recognition

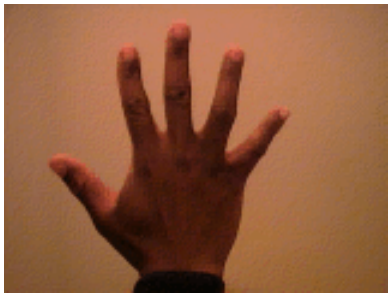
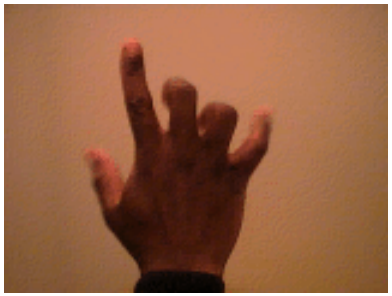
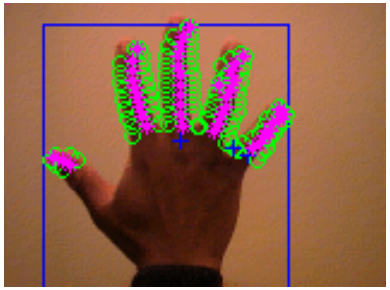
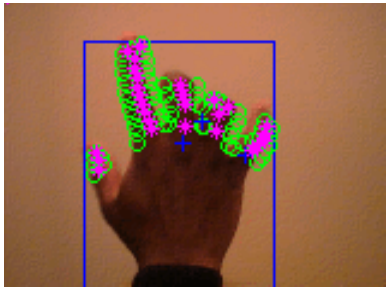


Example: Handwriting





Example: Gesture Recognition

Recognition-based User Interface

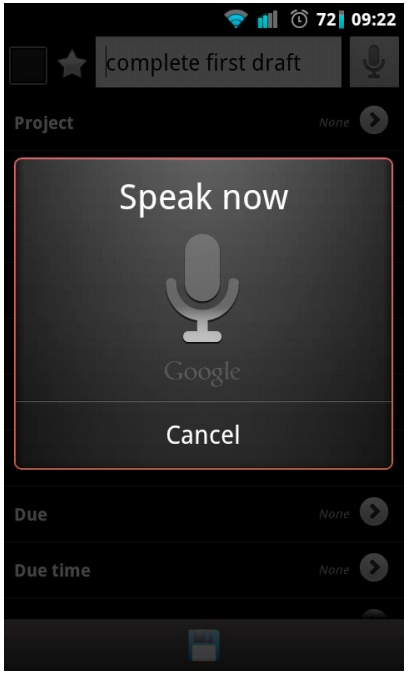
Fundamental differences from today's interfaces

- Sophisticated pattern recognition techniques are involved in the interface design.
- Interface with feedback facilities are required due to recognition error.

Conversational Interface

Interfaces which can respond intelligently to human conversations.

An example of a conversational interface.



Complete System

Speech recognition

- Conversion of sound waves to discrete words.

Natural language understanding

- Understand the meaning of the words.

Natural language generation

- Generate appropriate responses.

Speech synthesis

- Generation of natural-sounding speech.

3-D Technologies

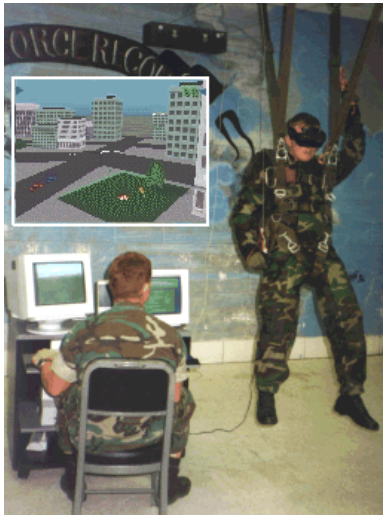
Migration from 2-D presentation space to 3-D space.

Applications areas that benefit from 3-D technologies

- Training
- Simulation
- Interactive exploration of complex data environments.

Examples

Football Training



Parachute Training

Flight Simulator

3-D Technologies (cont'd)

Previous 2-D notions need to be revised

- How to interact with information ?
- How to select objects in 3-D space ?
- How to navigate through information spaces ?

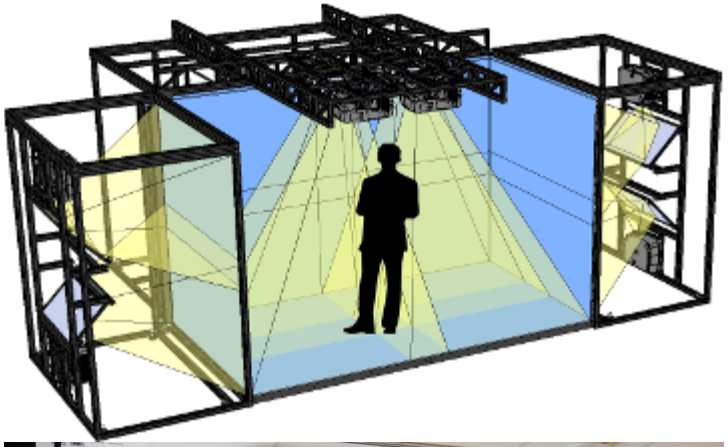
Objective: "near-real-time" interactivity to achieve the effect of direct manipulation

Virtual Reality

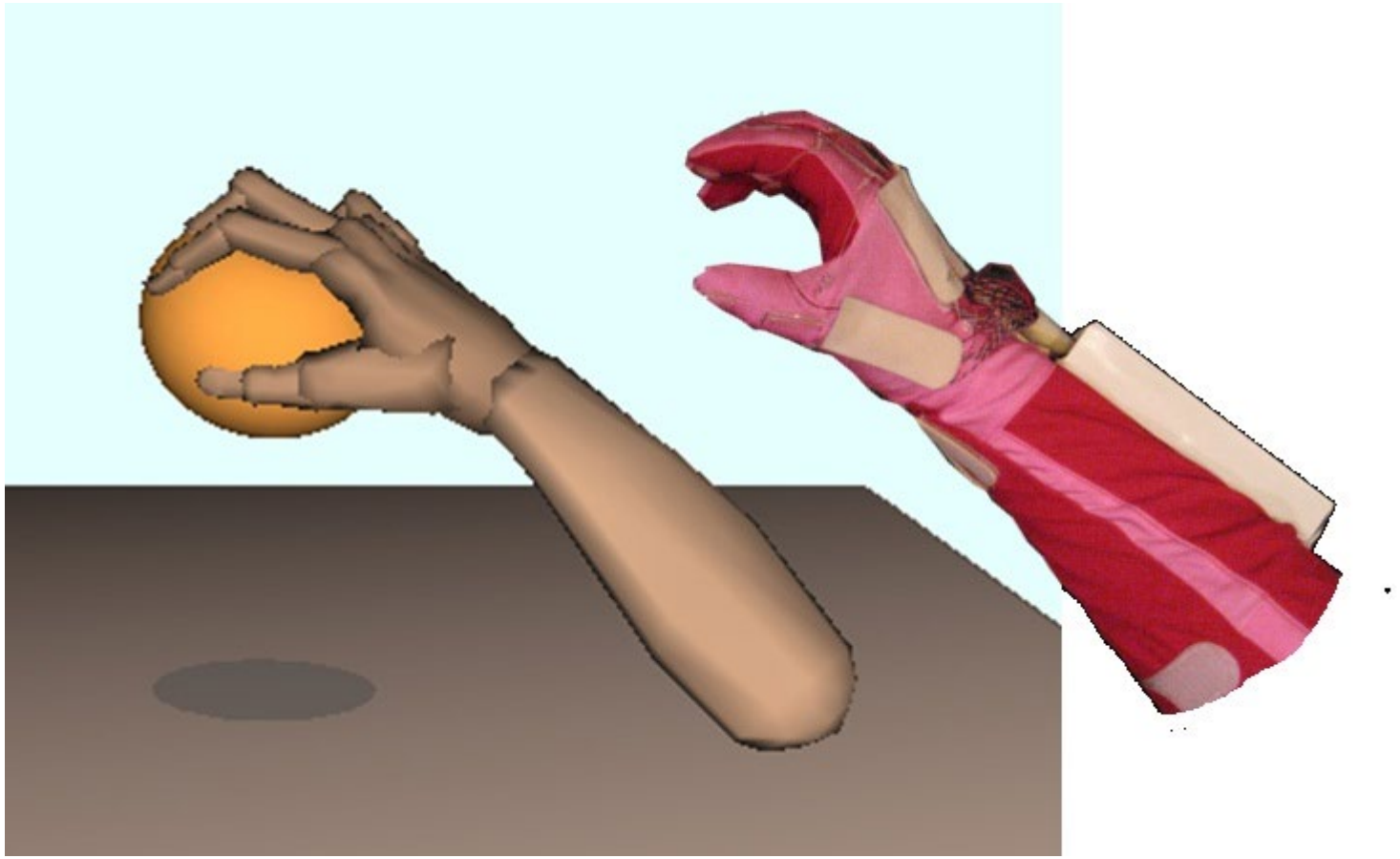
Head-Mounted Display

Binocular Omni-Orientation Monitor (BOOM)

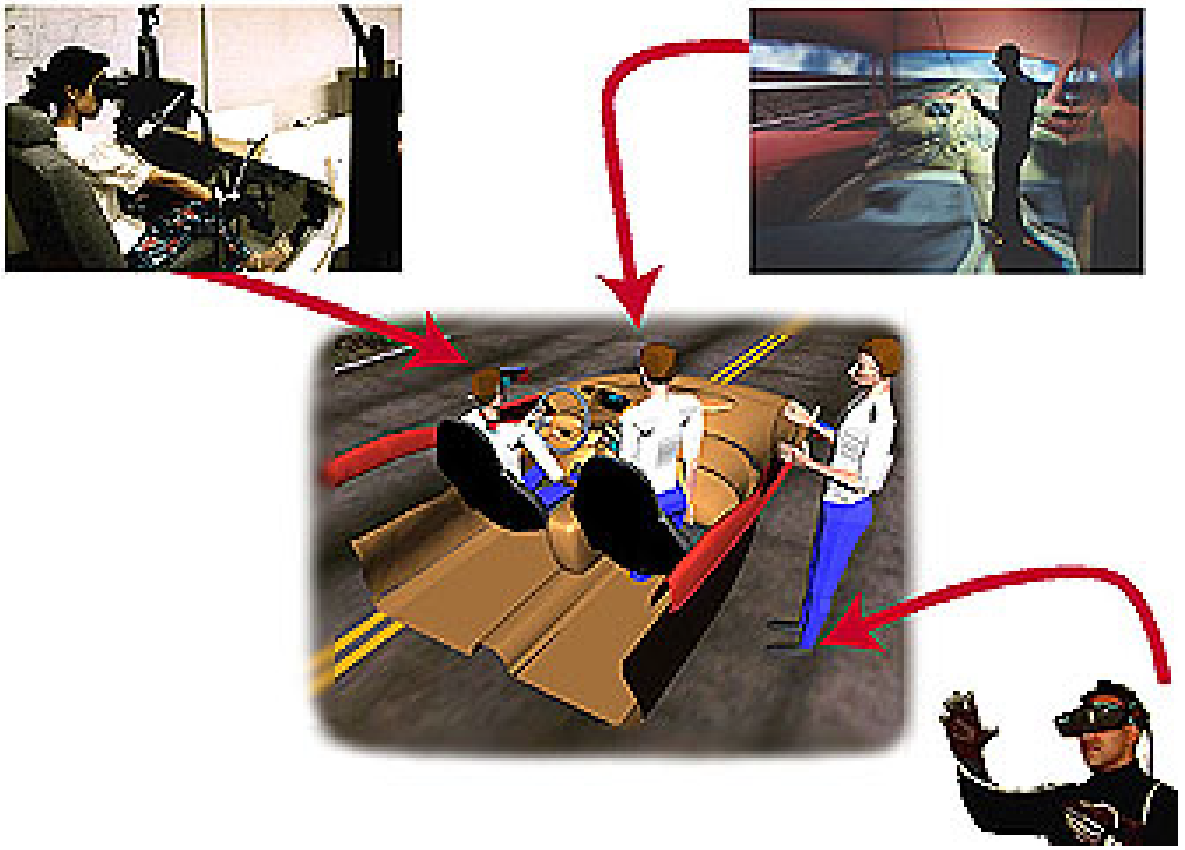
Cave Automatic Virtual Environment (CAVE)



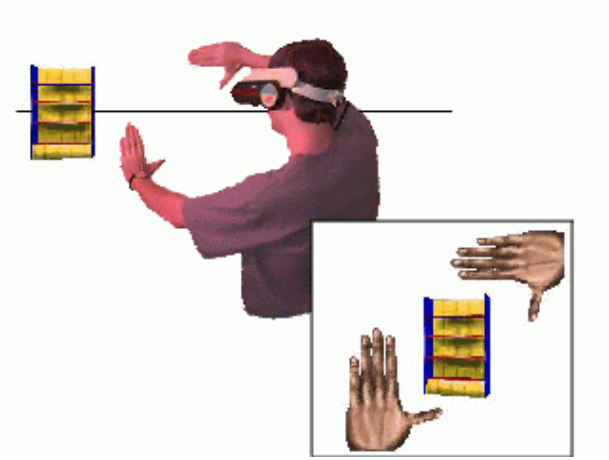
Data Glove

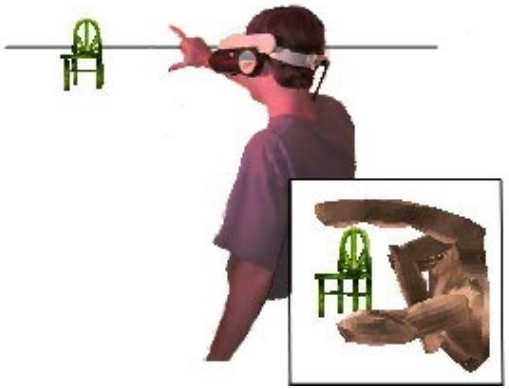


Collaborative virtual environment



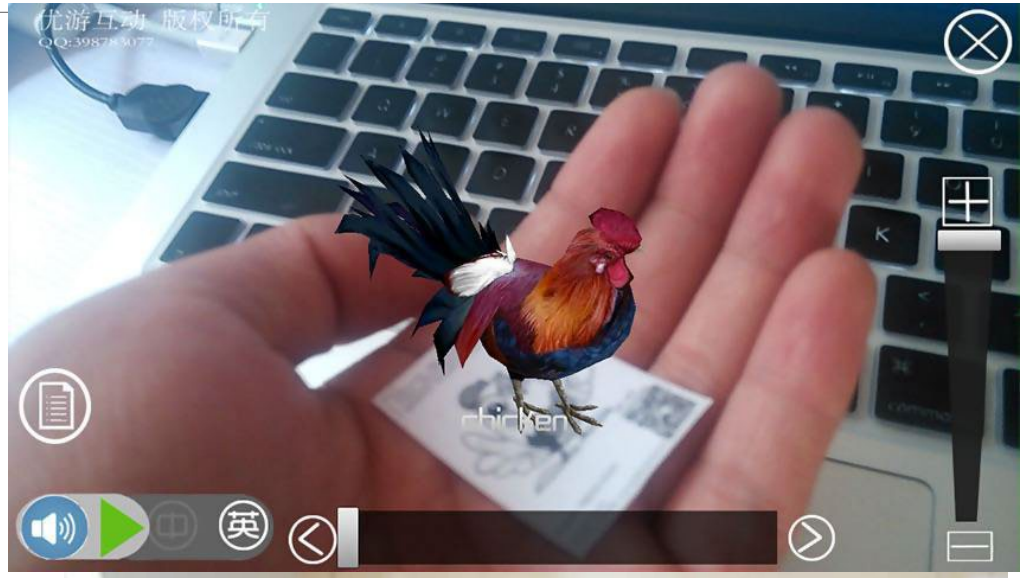
Selecting Objects in 3-D Space





Browser in 3-D space

Augmented Reality



Augmented Reality