13.1 Overview
13.2 General Design Issues
13.3 Architectural Issues
13.4 Information Characteristics for Presentation
13.5 Effective Human-Computer Interaction
13.6 Extension through Video and Audio
- Video at the User Interface
- Audio at the User Interface

13.7 User-friendliness
13.8 Future Trends

13.1 Overview

Multimedia User Interfaces:

- computer interfaces that communicate with users using multiple media
- media determine how and how well human-computer interaction occurs (decisive for user acceptance)

General Design Issues:

- “Appropriateness Principle“ concerning the surface presentation of information

Architectural Issues:

- Information Characteristics for Presentation
- Effective Human-Computer Interaction
- Video and Audio at the User Interface
- User-friendliness of Multimedia User Interfaces (primary goal!)
  ➔Development goes towards new user interfaces:
  1. Virtual Environments
  2. Ubiquitous Computing

Media determine how and how well human-computer interaction occurs

- Text interfaces
- Graphical user interfaces/window systems (X-Window System, MS-Windows, etc.)
- WIMP interfaces (Windows, Icons, Menus, Pointing)

Open problems:

- Computer interaction still neither natural nor effective (speech recognition, audio textbooks, etc.)
- Specification of object movement (e.g. motion video for multimedia tennis course instead of text and grahics images)

  ➔Development goes towards new user interface devices:

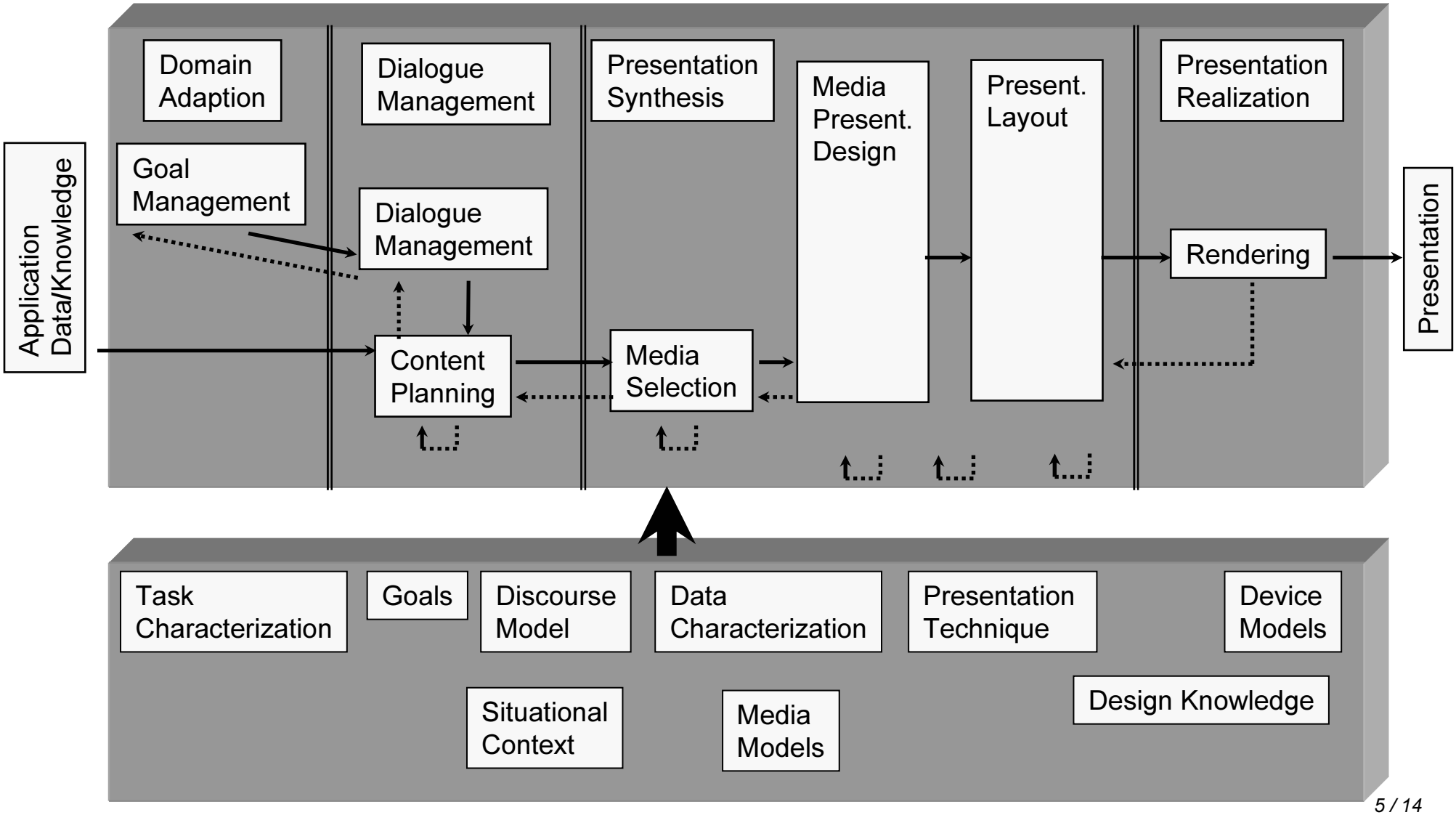
  1. Virtual Reality
  2. Ubiquitous computing

Main emphasis in design of Multimedia User Interfaces (MUI) is multimedia presentation. The general issues to be considered are:

- To determine the appropriate information content to be communicated.
- To represent the essential characteristics of the information.
- To represent the communication intent.
- To choose the proper media for information presentation.
- To coordinate different media and assembling techniques within a presentation.
- To provide interactive exploration of the information presented.

➔Appropriatness Principle
"The surface presentation used by the artifact should allow the person to work with exactly the information acceptable to the task: neither more nor less"
(Norman, "Cognitive Artifacts", 1991)

13.3 Architectural Issues [RH93]



13.4 Information Characteristics for Presentation

Types (ordering information)

- coordinates vs. amount (specify points in time, space or other domains)
- intervals vs. ratio (suggests the type of comparisons meaningful among elements of coordinate and amount data types)

Relational Structures

- functional dependencies (e.g. bar chart)
- non-functional dependencies (e.g. entry in a relational database)

Multi-domain Relations

- multiple attributes of a single object set (e.g. position. colors, ...)
- multiple object sets (e.g. graphical symbols on a map)
- multiple displays (e.g. multiple windows)

Large Data Sets

- numerous attributes of collections of heterogeneous objects (e.g. presentation of semantic networks)

For presentation design the following topics must be considered:

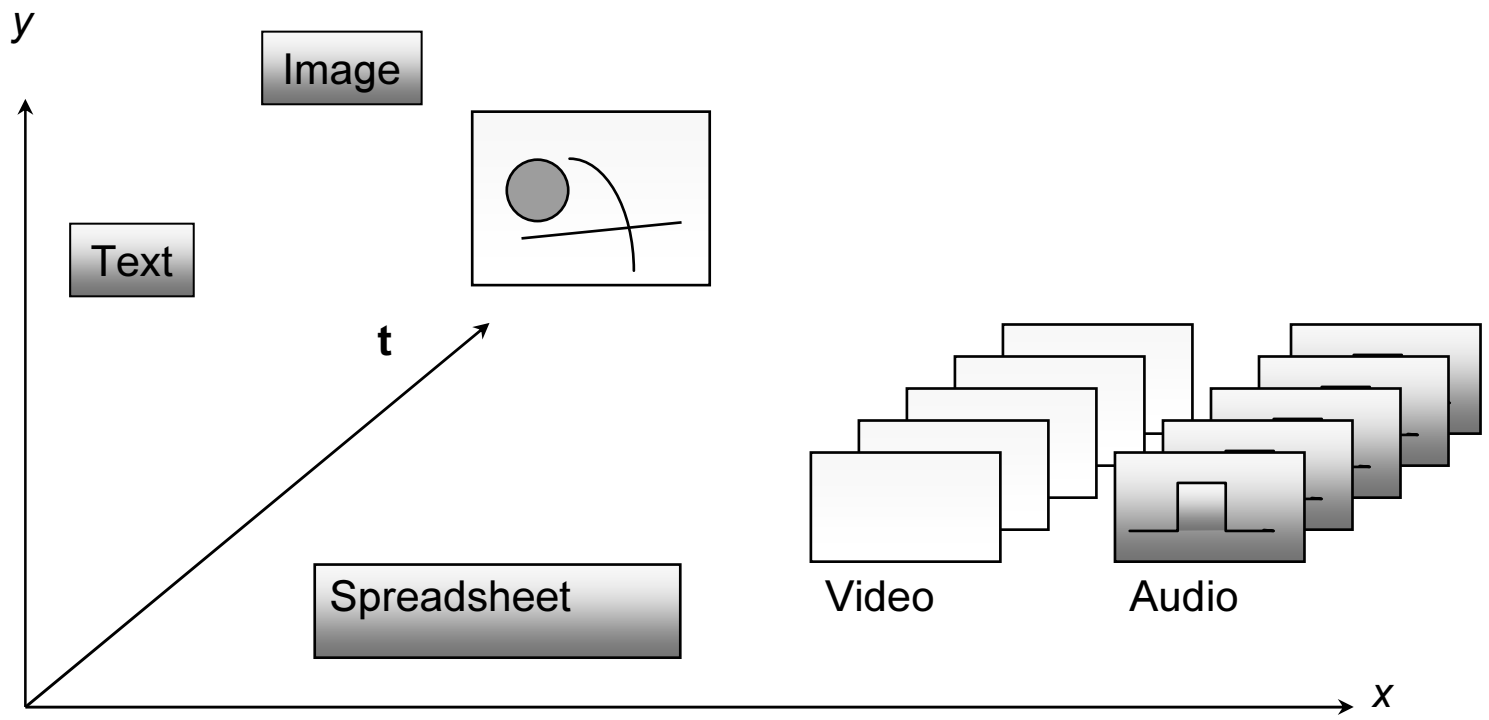
- content selection
- media selection
- coordination

One of the most important issues regarding MUI is user-friendliness. Therefore during the design of a MUI the following main issues must be considered:

- context
- linkage to the world
- evaluation of the interface
- interactive capabilities
- separability

Time as a new presentation dimension in a User Interfaces:

– "Illusion of continuity" created by presentation of a "sequence of static elements".



Implemented through a continuous sequence of individual images (video frames at frame rate of 15 fps and higher)

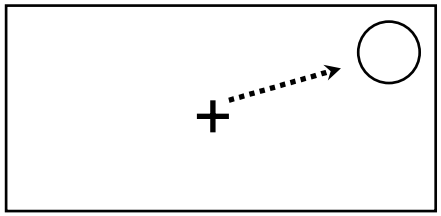
Hardware, software and heterogeneous $\geq$ 30 fps solutions available for coding and decoding of the frames

Example: Remote Camera Control Application

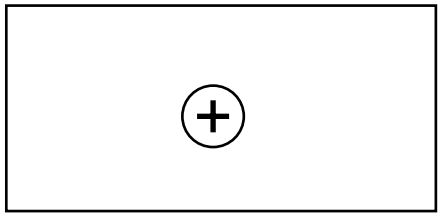
- Application Specification
- Camera is remotely controlled by a computer. The camera receives control information from the computer and sends the video data back.
- User Interface
- Camera control through:
  - keyboard
  - buttons in window system
  - scroll bars
  - mouse, joystick, etc.

Direct Manipulation of the Video Window:

Absolute Positioning:

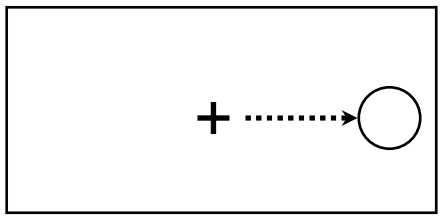


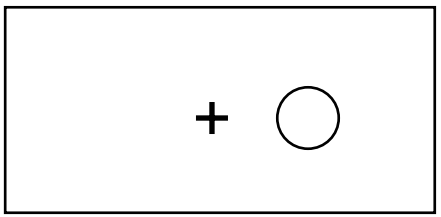
User positions cursor
on an object
+ double mouse-click



Result: Clicked object
becomes new center of window

Relative Positioning:





Camera moves toward the pointed object;
different moving speeds are possible

Speech Analysis

- speaker-dependent (training of the system needed, more words recognized)
- speaker-independent (no training needed, limited set of words recognized)

Dimension of Space

- monophony (all audio sources have the same spatial location)
- stereophony (allows bilateral listening to hear lower intensity sounds)
- quadrophony ➔ concept of two or more separate channels

Audio Windows

- audio windows as the graphical representation of audio locations
- one audio window per audio source
- changing the position of the audio window on the desktop changes the location of the audio source

13.7 User-friendliness

User-friendliness is the main property of a good user interface and requirements of applications differ.

Generally applicable criteria are:

- easy to learn instructions
- easy to remember instructions
- context-sensitive help functions
- effective instructions
  - present logically connected functions together
  - use graphics instead of text
  - quick activation of actions
  - useful for both professional and sporadic users
- aesthetics
- effective implementation support
- entry elements
- meaningful location of functions
- presentation
- dialogue Boxes

  - alphabetically ordered
  or
  - logically grouped

- additional design criteria, e.g. show progress in time intensive tasks
- design-specific criteria

1. Virtual Environments:

- Computer-based systems that are 3D rather than 2D
- Interactive as opposed to passive
- Use one or more devices that attempt to provide a sense of spatial “presence” to the user (visual, auditory, or tactile)
- Devices include
  - head-tracked displays and stereo displays (both visual and audio)
  - hand trackers
  - haptic displays (address the user’s sense of touch and temperature)
- Systems can not only involve synthesized material (e.g. computer graphics) and Recorded material (e.g. video), but the surrounding real world itself (augmented reality)

2. Ubiquitous computing:

- Environment in which a large number of computers will be seamlessly integrated into our immediate surroundings, connected by wireless networks
- Users no longer aware of the computers presence (analogy to electric motor)
- People as well as computers are tracked as they move about
- Computers adapt transparently to the preference of the person using it
- Main components
  - inexpensive, low-power, mobile computers and displays
  - software infrastructure for ubiquitous applications
  - high-capacity wireless networks that tie everything together