

Human Interface by multimedia

Linguistic information

Non-linguistic information

Image, table, video, gender, age, physique, behavior, eye movement, voice characteristics, expression, emotion, etc.

These various information are indispensable to be precisely transmitted without distortion and loss, in other words, 'transmission of presence' is important in which we feel as if we were there.



Future communication : *Multimedia or multi-modal interface*

Superb interface: Various media are efficiently used and well-balanced in the whole system

Human - computer communication

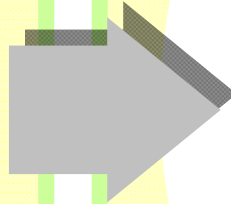
Present

**Human → Computer
information
transmission**

*Keyboard, tablet,
mouse etc.*

**Computer → Human
information
transmission**

Display, printer etc.



Future

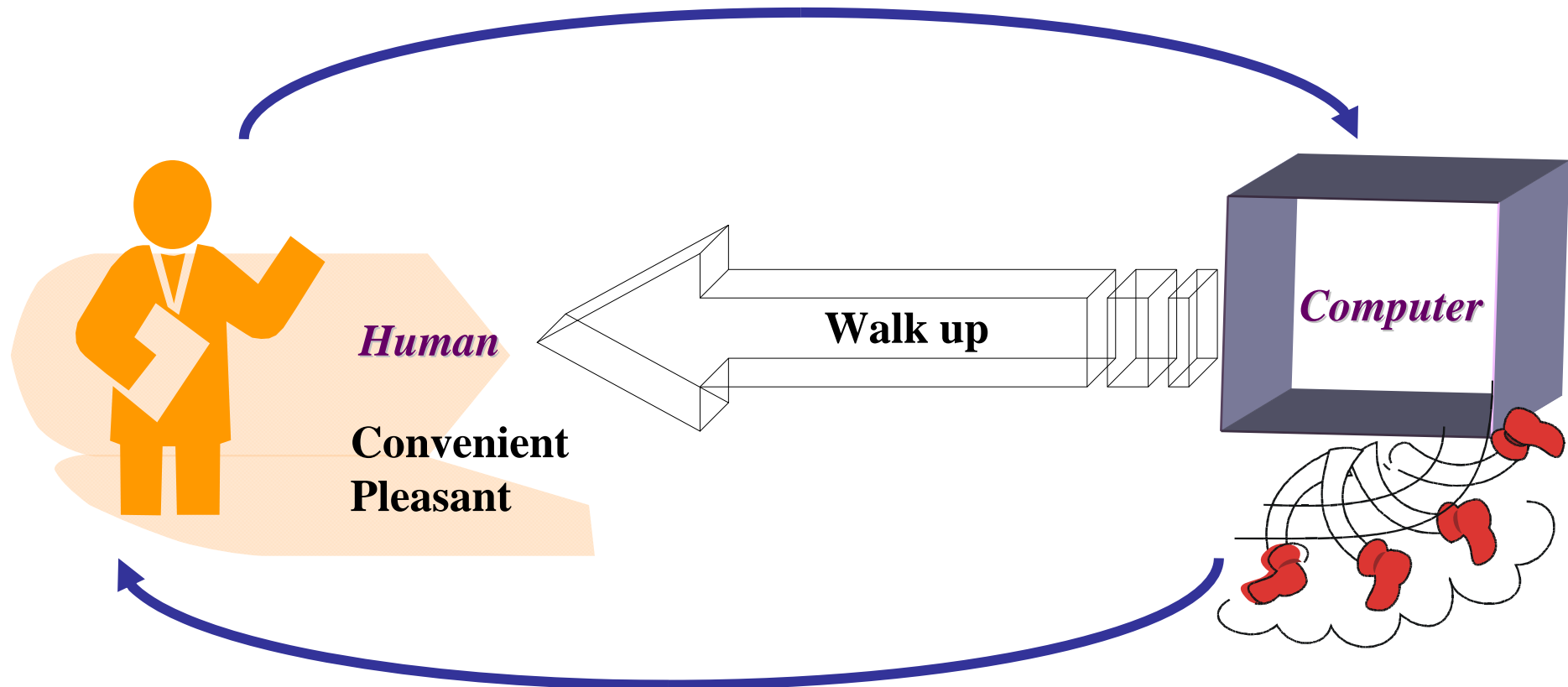
- *Understanding and production of speech and image information*
- *Interface accepting errors*
- *Interface which always offers help when users are confused*
- *Customized interface which can automatically learn and predict users knowledge and thinking process, and automatically correct errors*
- *Interface which explains global information by illustrations and figures, and details by linguistic information*

“ Sensitive Interface ”

Human-centered interface

Recognition/understanding

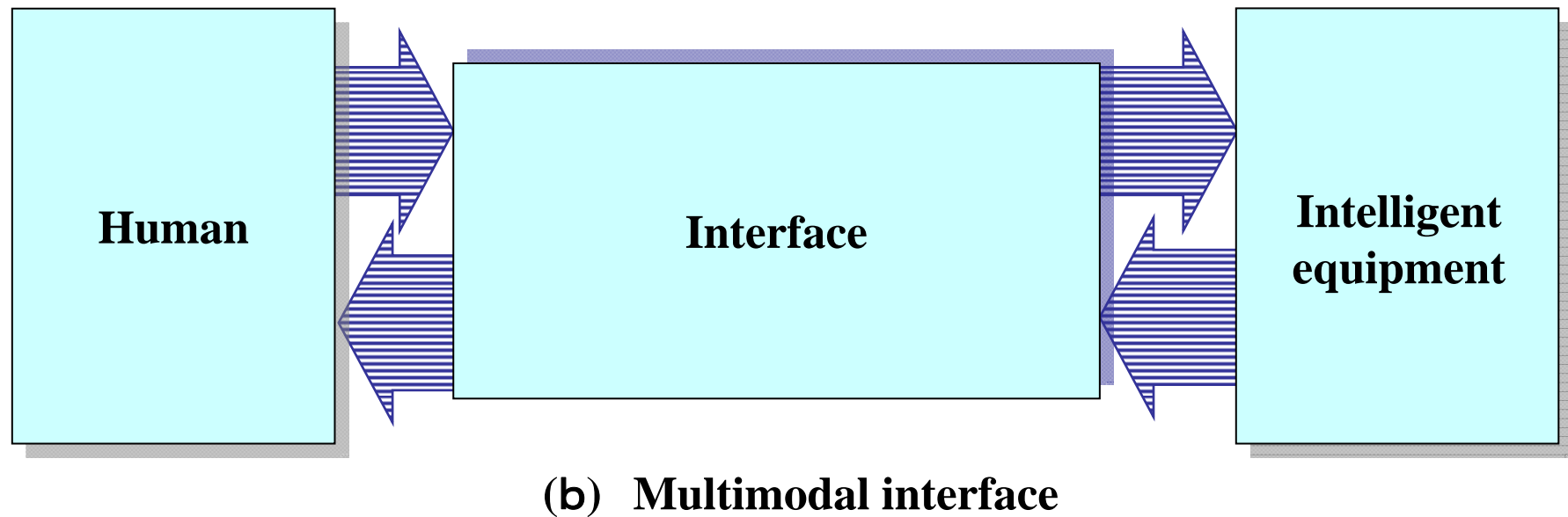
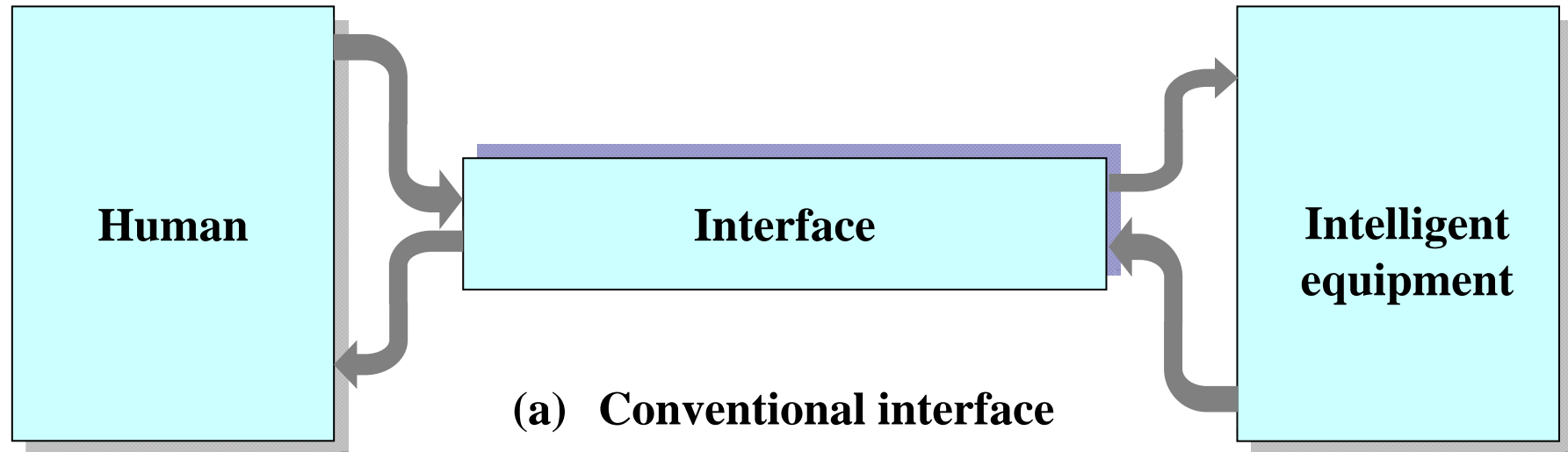
Spoken language, image, gesture



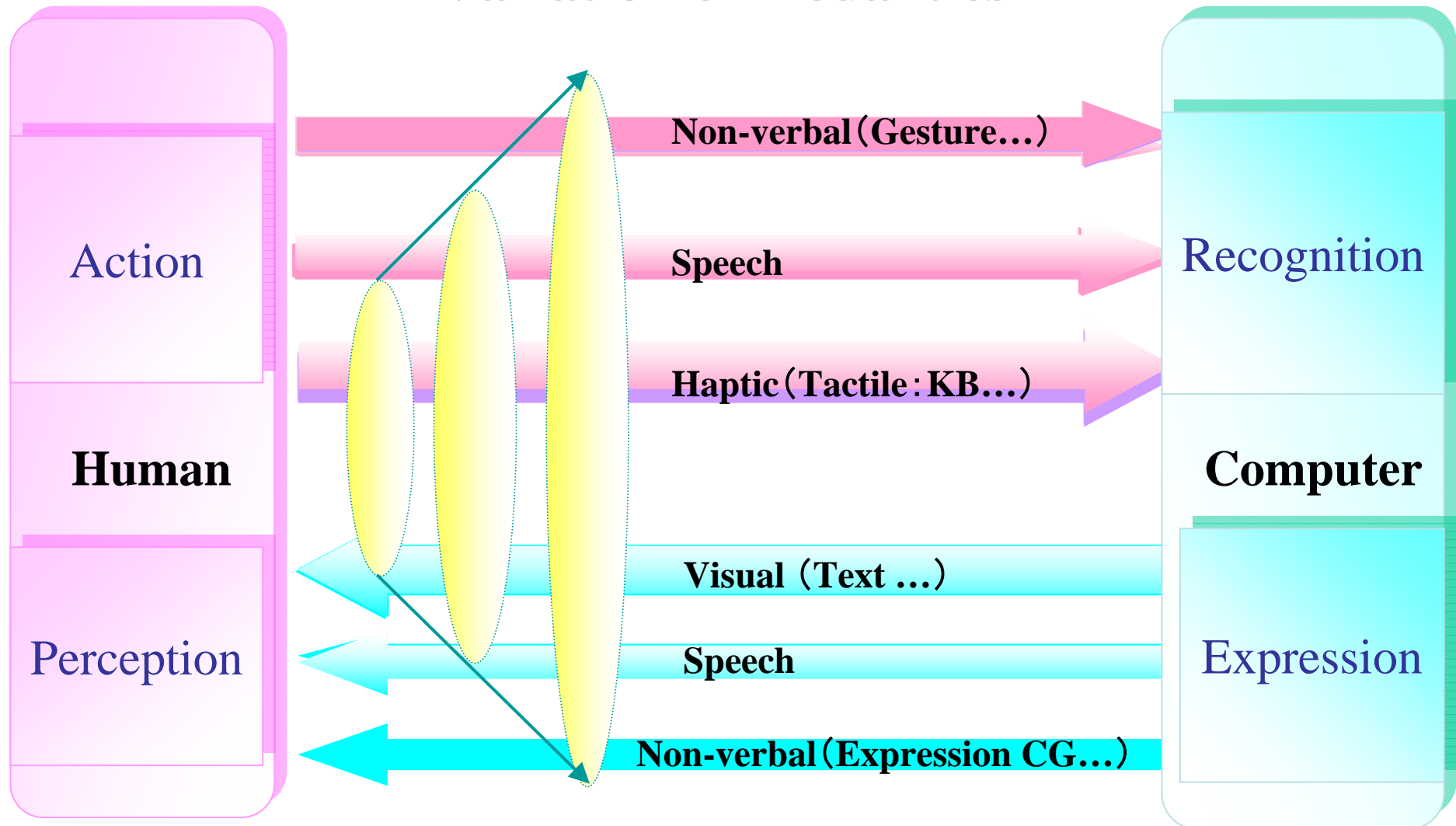
Production/synthesis

Image, sentence, speech, CG

Conventional interface and multimodal interface



Variation of modalities



Non-verbal information for communication

Group	Examples	Functions
Peripheral language	Prosodic information, voice quality Pitch structure (pitch, loudness) Time structure (speed, pause) Amplitude structure (loudness) Non-verbal speech Ear-con	Transmission of emotional information Regulator Acceptance, agreement, doubt, surprise, reject Continuation of speech Oralization
Physical activity	Facial expression Gaze, blink, pupil Nodding Body gesture/hand movement Lips Posture	Emblem, illustration, emotion, regulator, adaptation <div style="text-align: center;"> ↓ HI </div> Sign, instruction, illustration, operation, expression of emotion, adjustment, admiration
Place	Personal distance, space, touch Personal relation Various relation Others (physical characteristics, physiological action/phenomenon, clothes, ornament, make-up, etc.)	Formation of relationship

Various types of input/output equipment

Input/output equipment	Function
Keyboard Mouse Tablet Microphone Image scanner Video camera	Input of written language Input of coordinates (direction of movement and distance) Input of coordinates Speech input Two-dimensional input of picture/printed materials Visible scenery input
Display (CRT) Flat display Plasma panel Liquid crystal panel Liquid crystal projector Printer DVD	TV image/computer output display TV image/computer output display Projection to a wide screen Output to papers Recording into disks

Image of multimedia communication

Function of communication

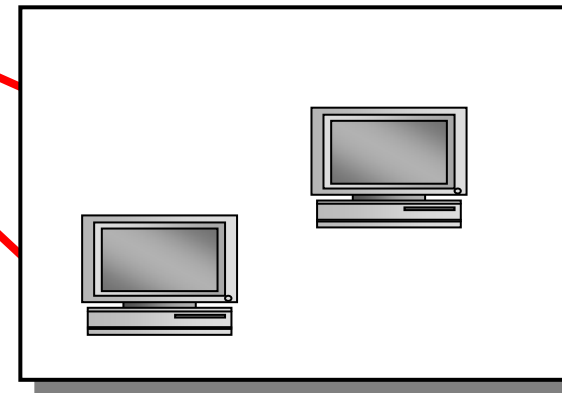
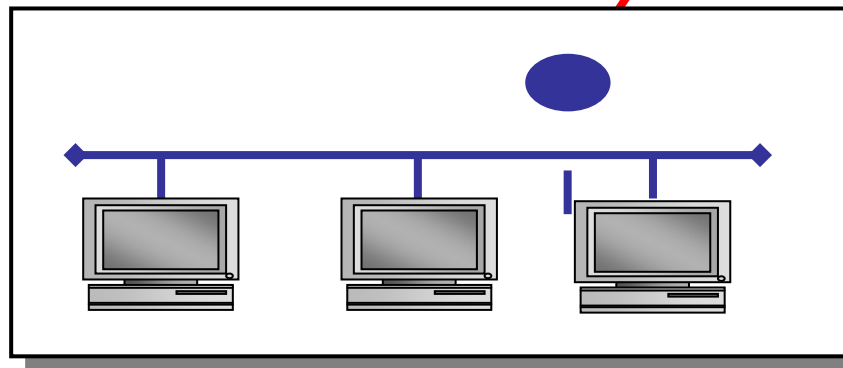
Input/output equipment

- Microphone
- Speaker
- Video camera
- Display
- Keyboard
- Mouse (pen)

Speech conversation
Video
Text (chat)
Hand-written image (white board)
Application sharing

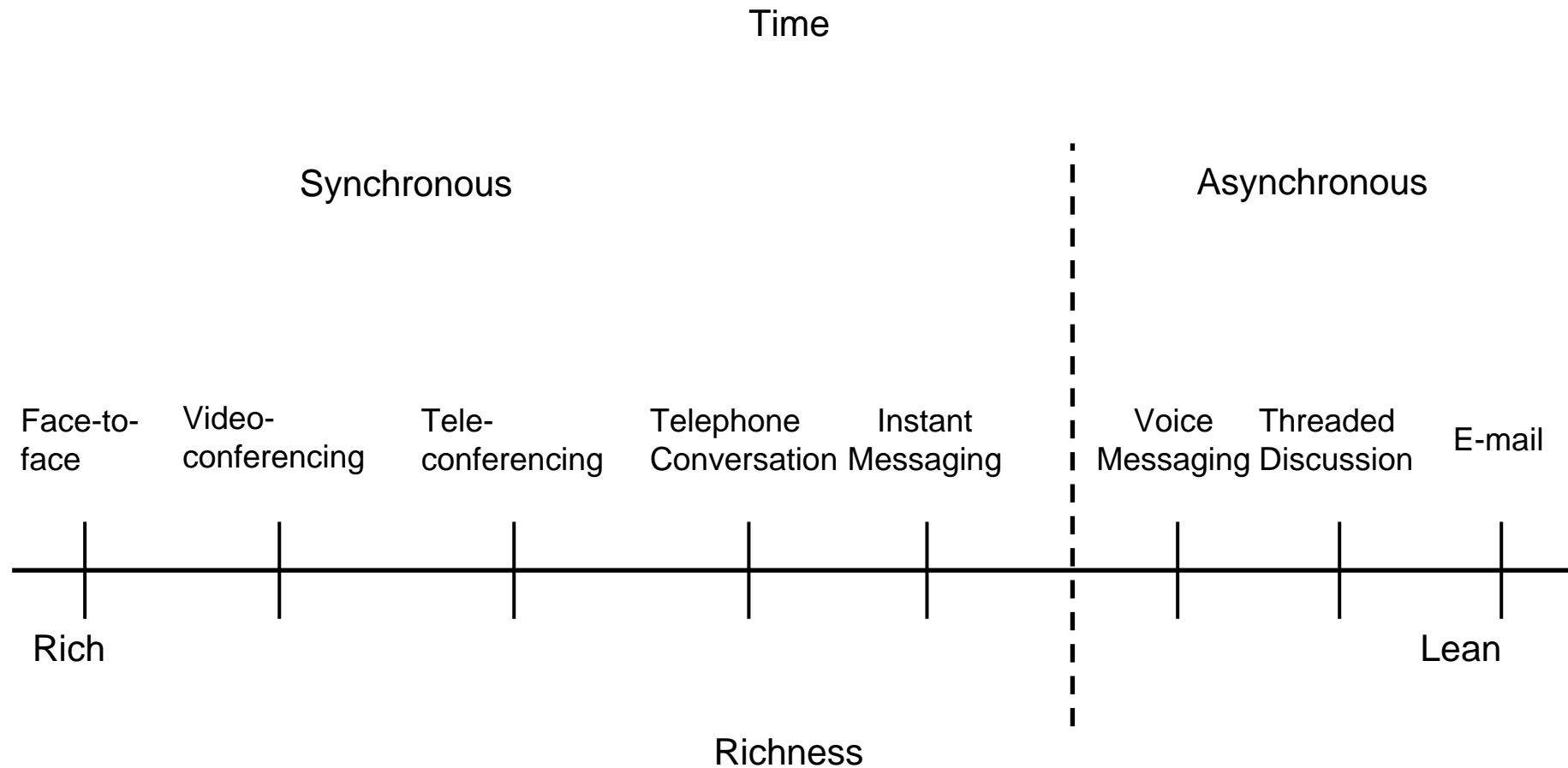
INTERNET

*Multiple party
communication is
possible*





Communication function can be selected according to needs and available input/output equipment.

Information Richness Theory.



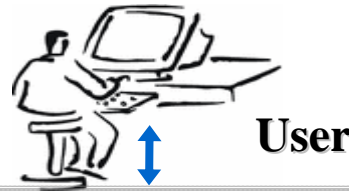
Features of mass-media

Group	Speed	Amount of information	
Radio/TV	 Quick	 Highly newsworthy	Internet
Newspaper			
Weekly magazine			
Monthly magazine			
Movie news			
Video			
CD			
Books			
	Slow	Highly commentary Less newsworthy	

Amount of information and transmission speed of various media

Variety of media	Quantity of information	Transmission rate (bit/s)	
		No compression	Compressed
Newspaper	0.32M bit/page (20,000 characters)		
Telephone	230Mbit/H	64K	16K (4)
Music (CD)	4.3Gbit/H	1.4M	256K (5.5)
Video (VHS quality)	109Gbit/H	30M	1.5M (20)
Normal TV (Receiving quality)	360Gbit/H	100M	4M (25)
High definition TV (Studio quality)	4320Gbit/H	1.2G	30M (40)

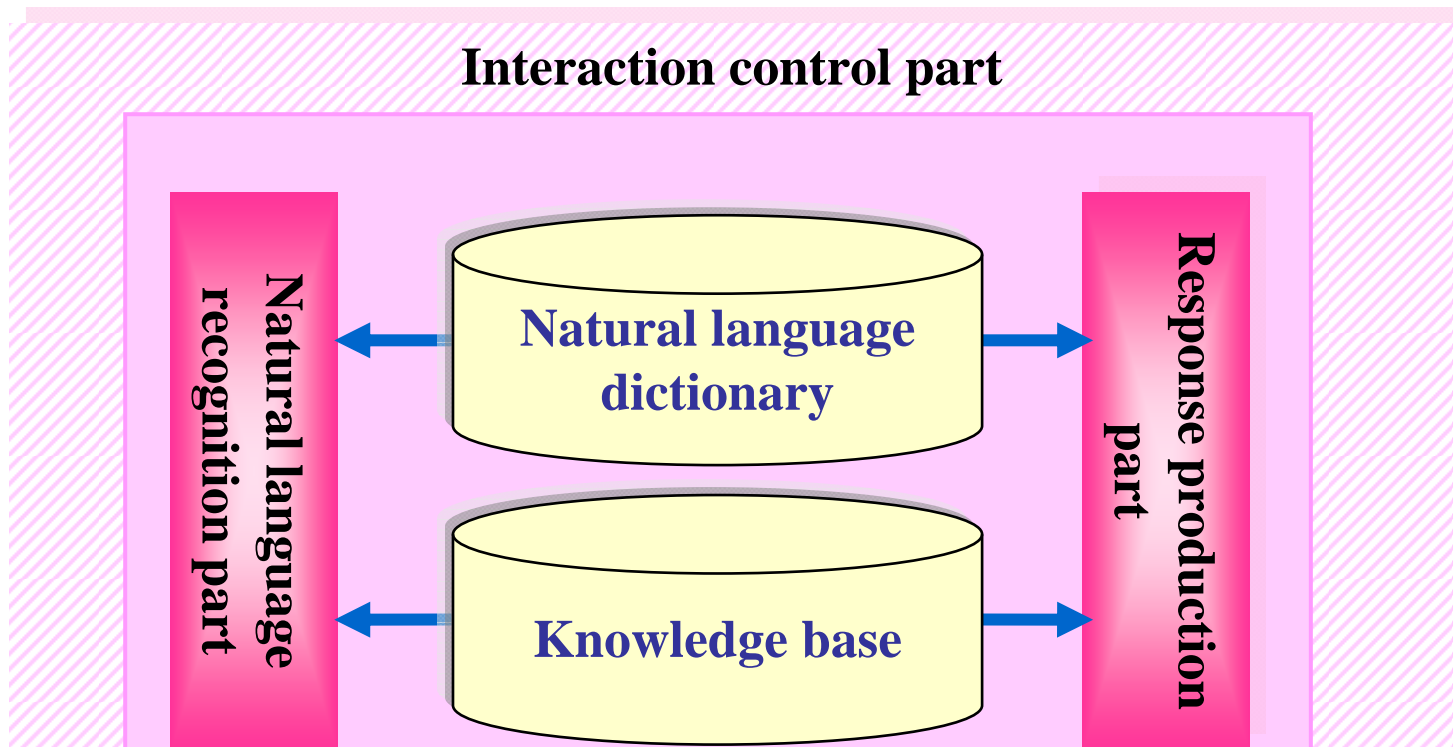
Structure of natural language interaction



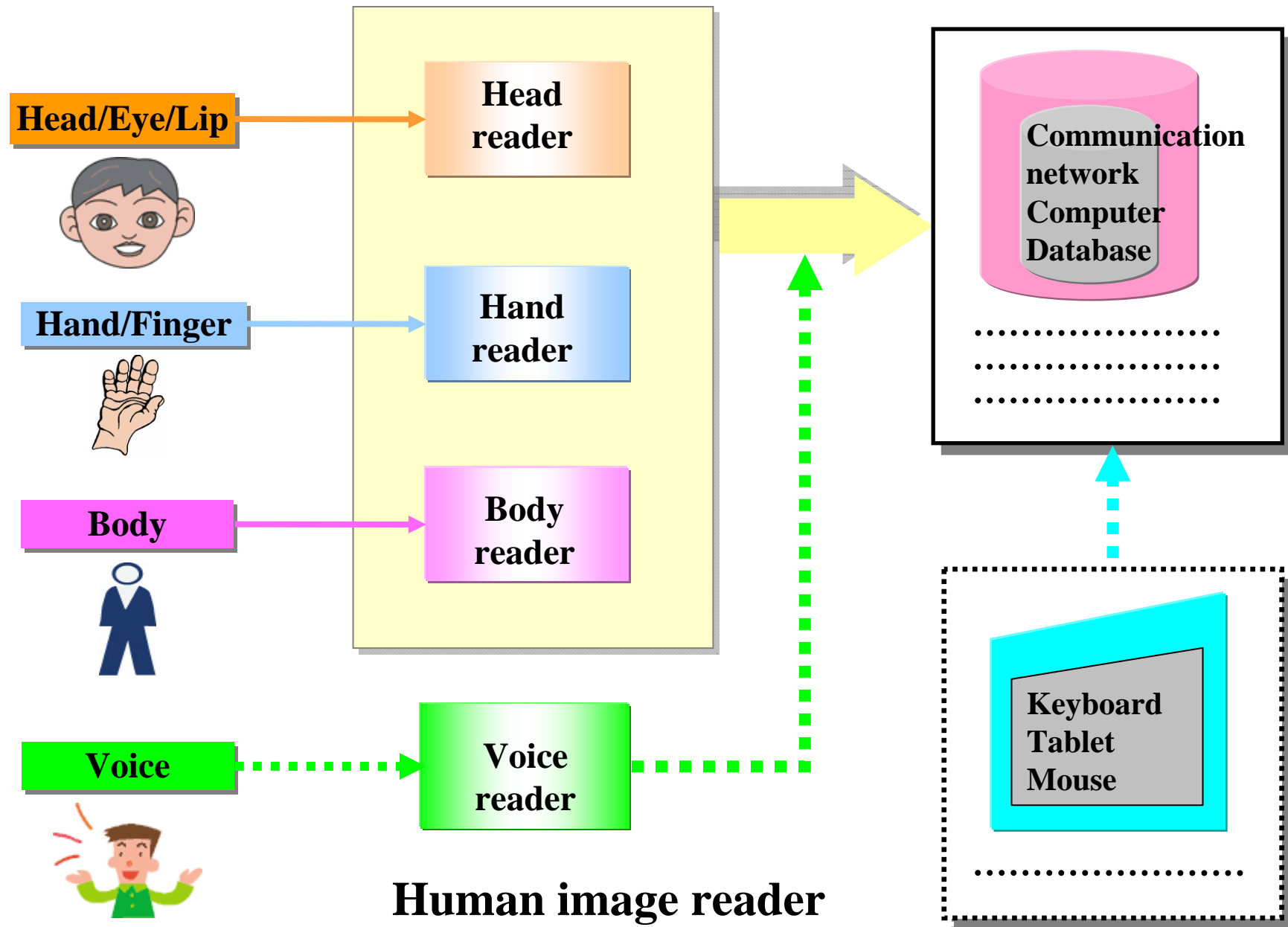
User

Interaction by natural language

Interaction control part



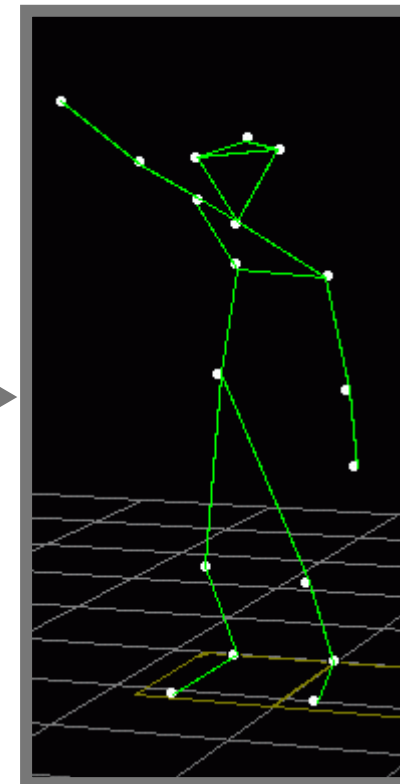
Targeted computer system



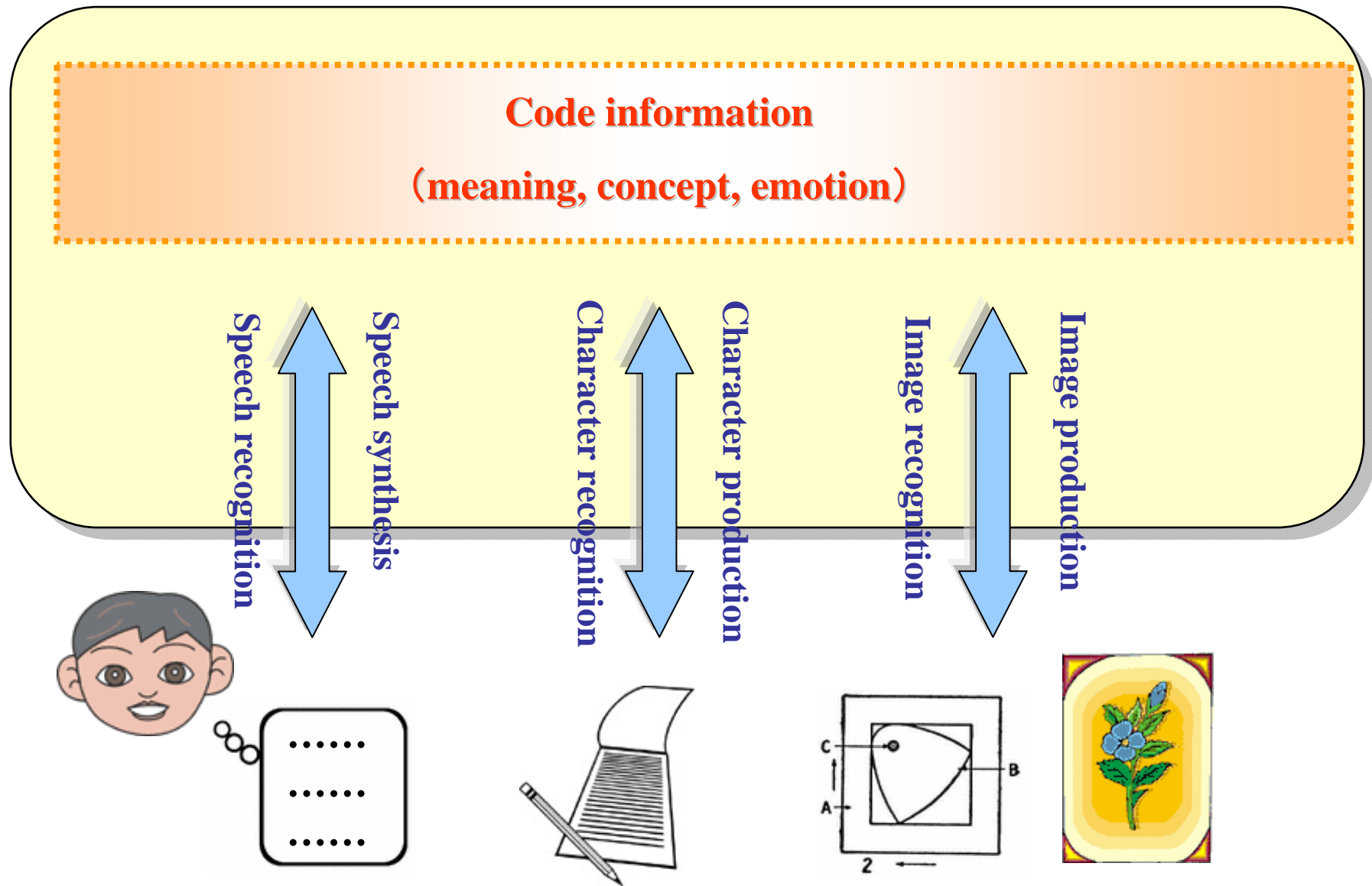


3D-position
measurement equipment

Reproduction of actions by motion capture

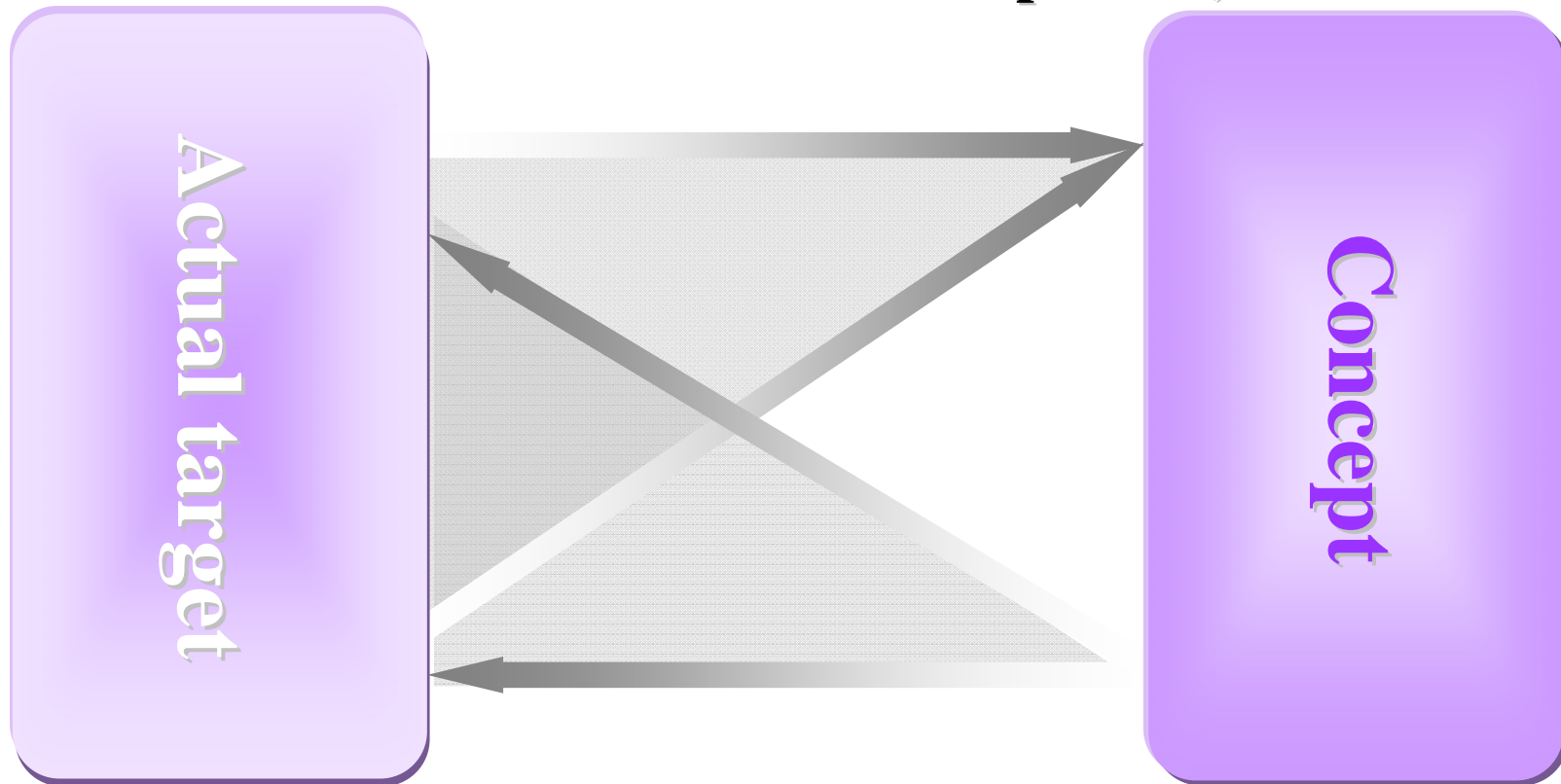


Model modification



Media conversion technology and human interface

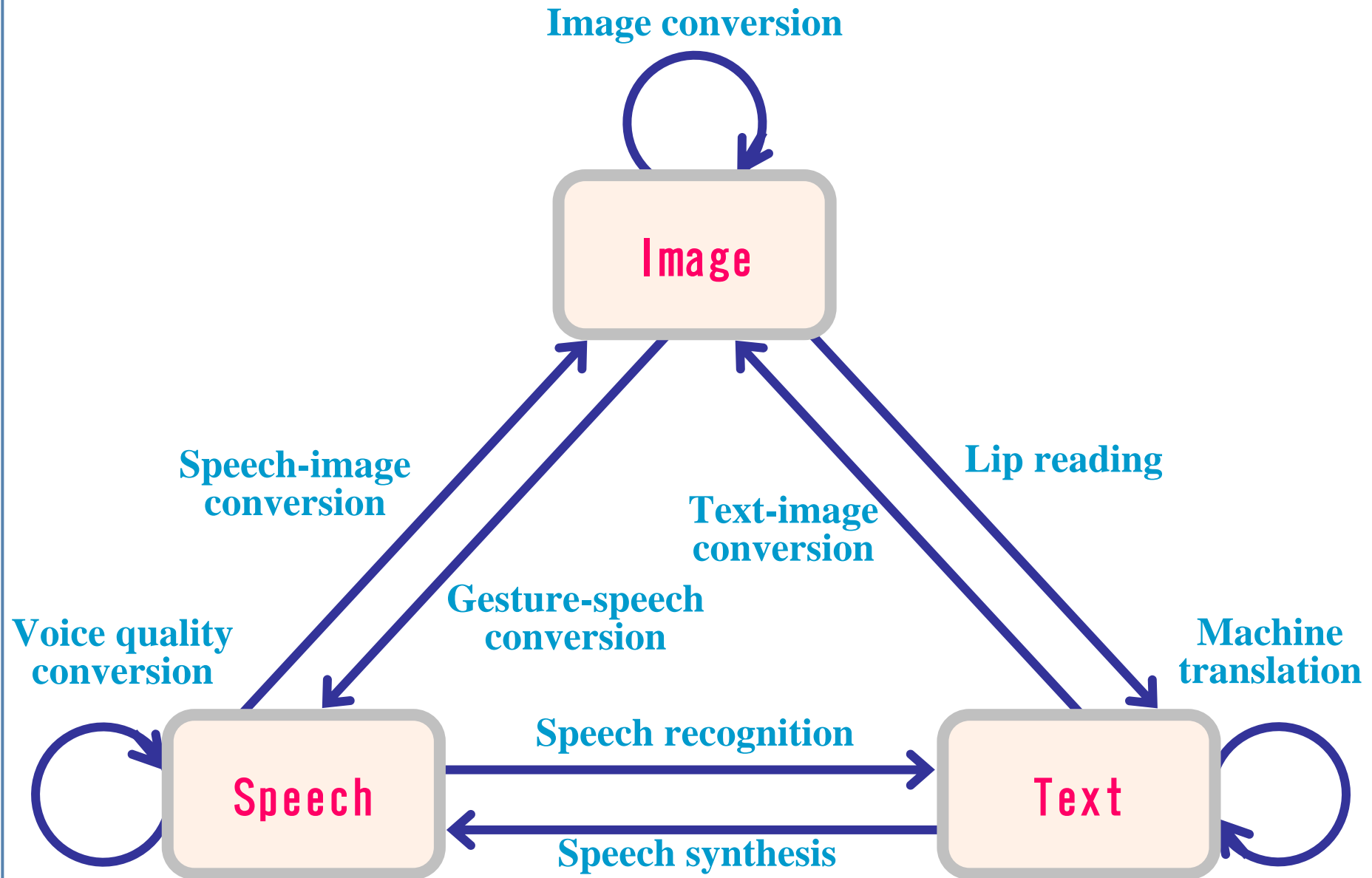
Recognition
(Information reduction process)

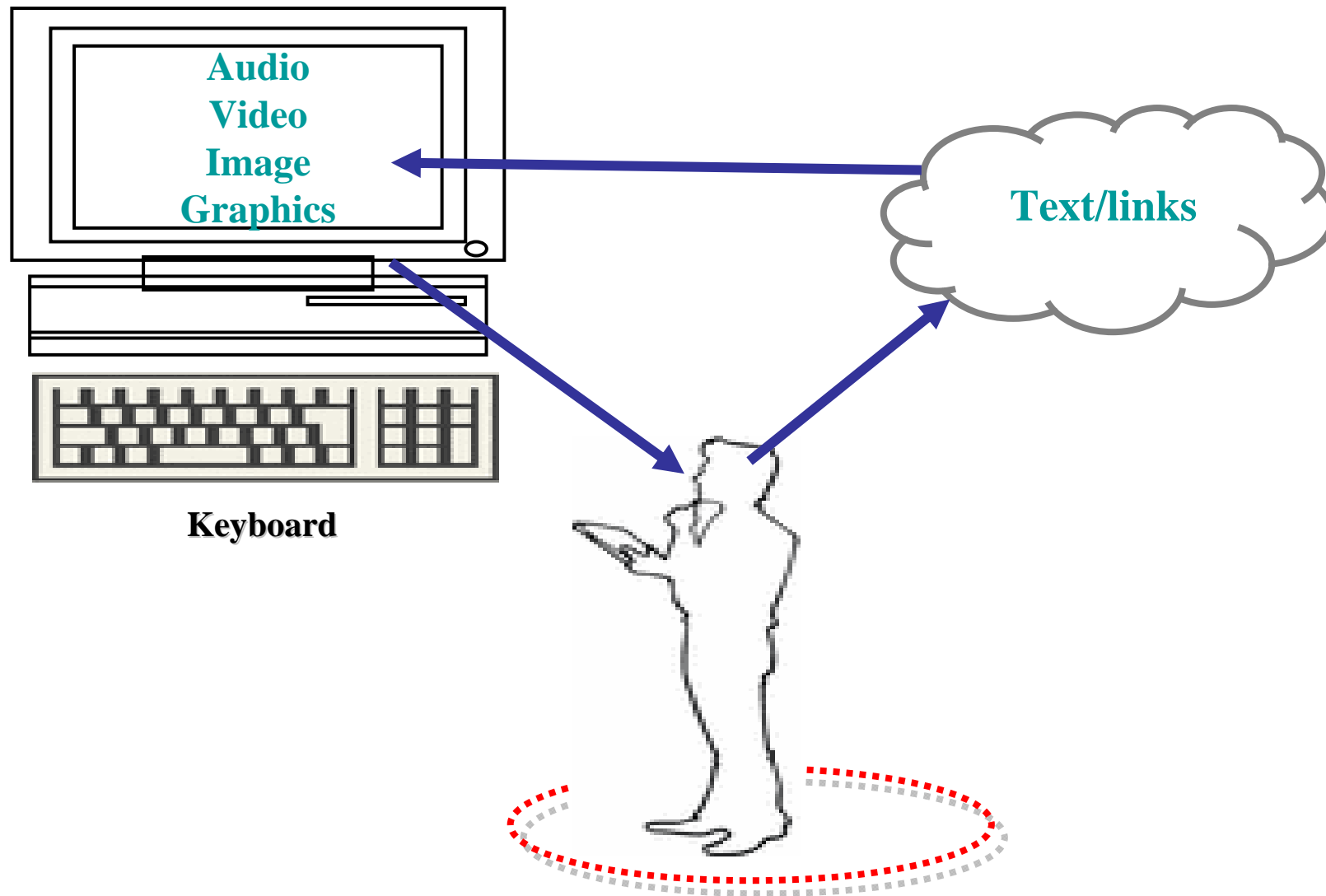


Production
(Information addition process)

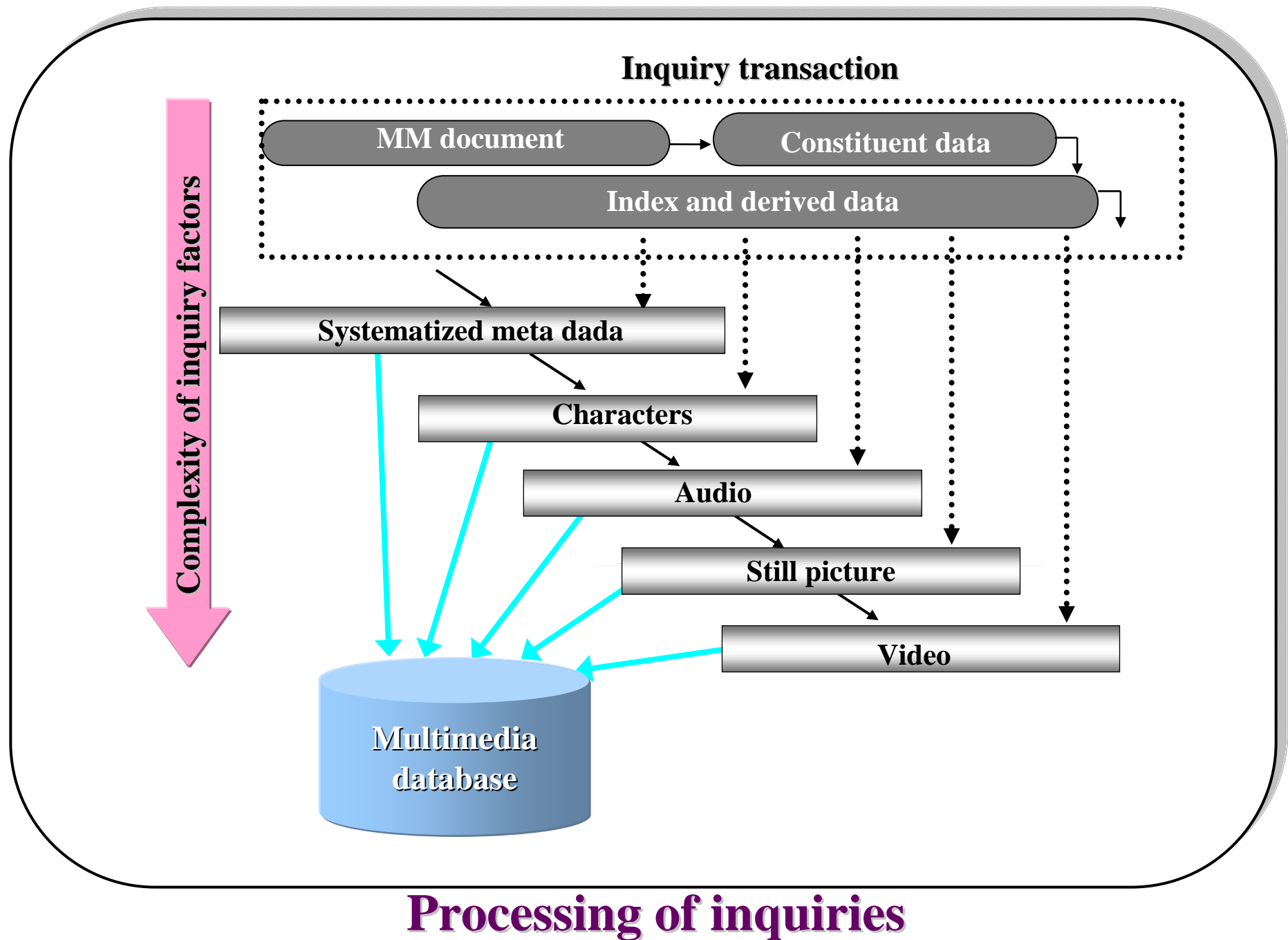
**Information reduction and addition in recognition and
production**

Media conversion

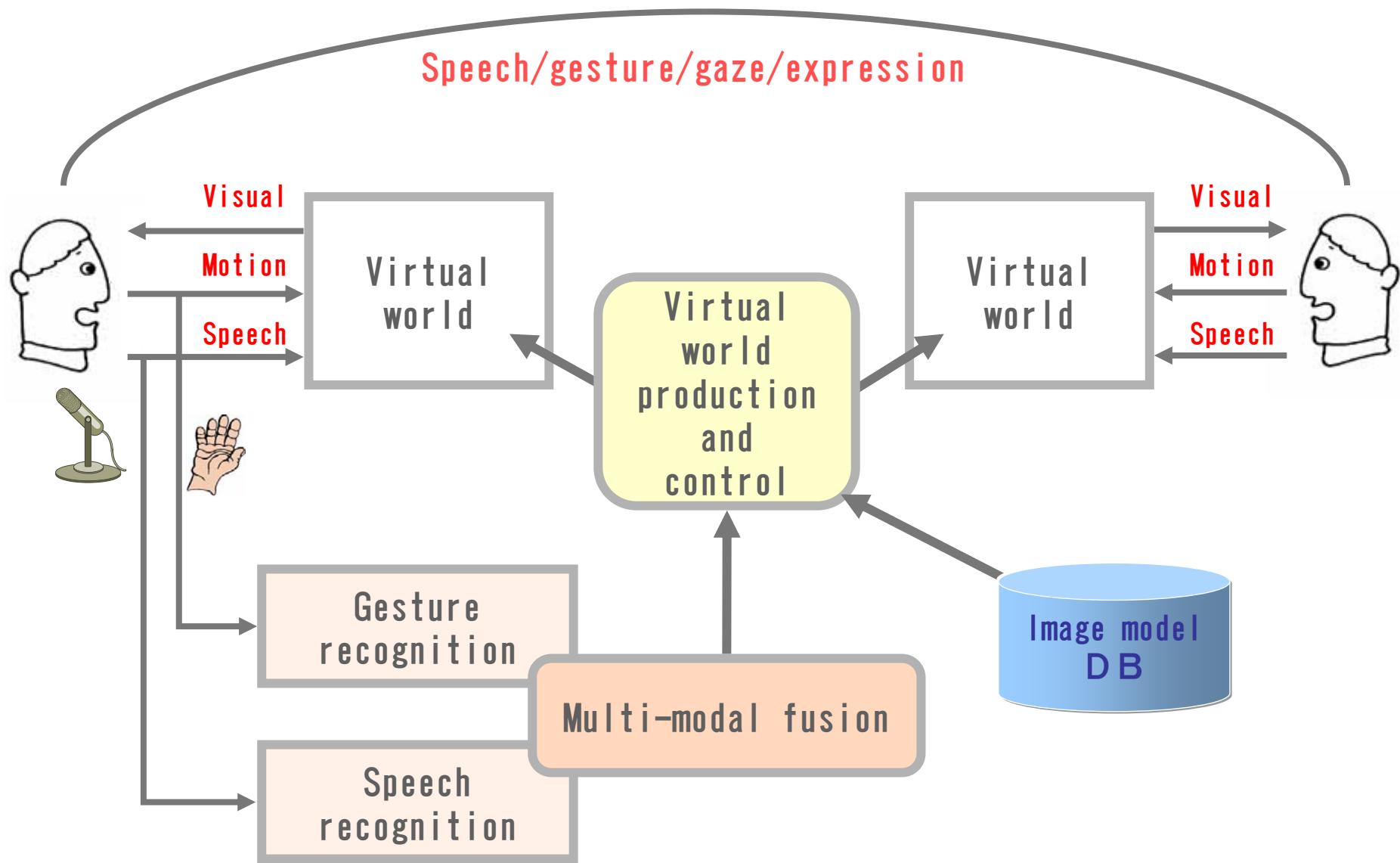




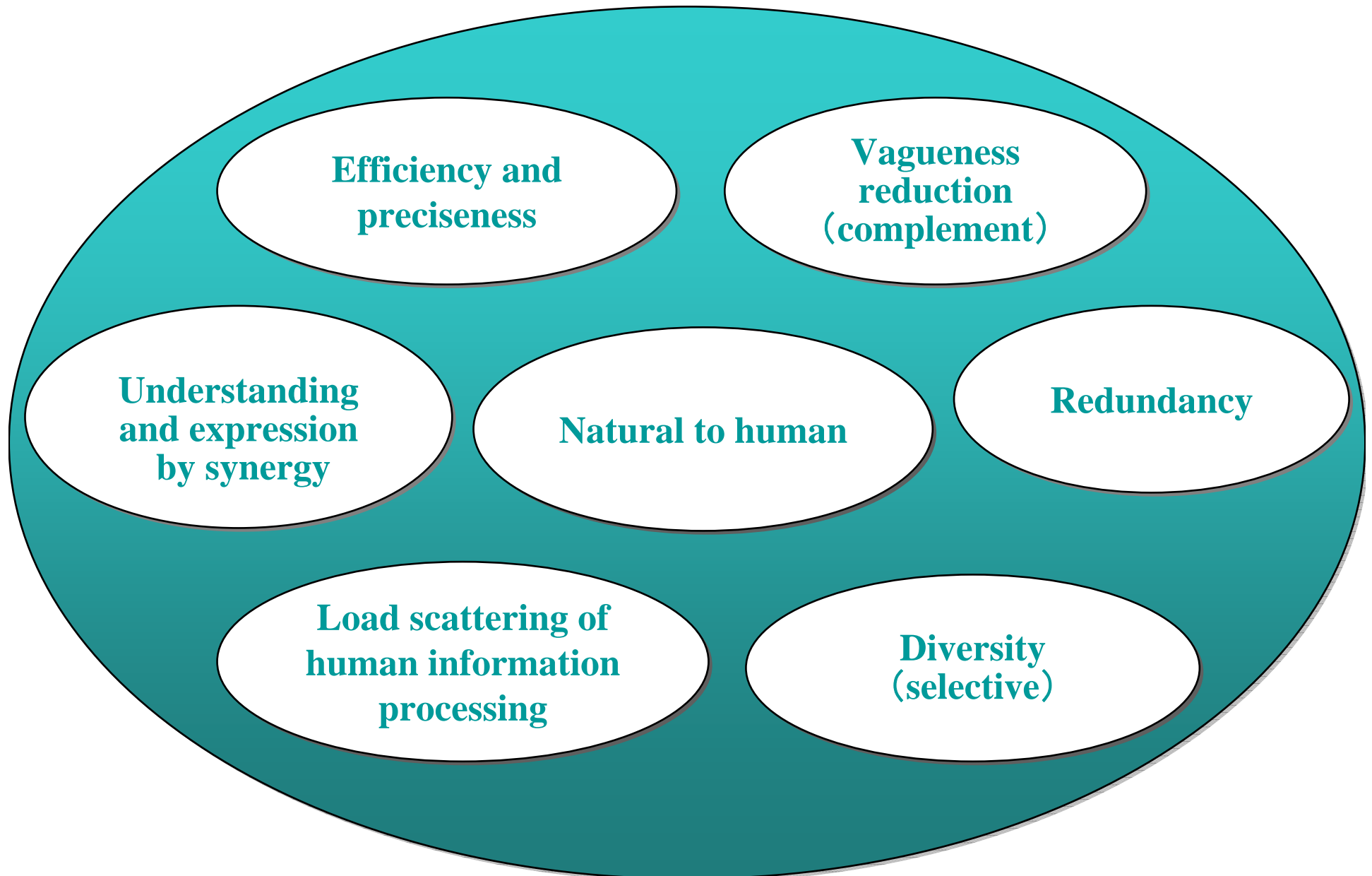
Evolution of index



Interaction through computer world



Special features of multimodal interface



What do you expect for machines ?

1. Dwarfs (human-like agents)

2. Substitutes of pencils, papers, desks, racks and whiteboards

- Make it easy to handle existing computers
 - Metaphor of files and a trash can
 - Visualization
- Make a new media on a machine
 - Hyper-text, hyper-media
- Make a virtual reality on a machine
- Make an environment to support group work among people
 - CSCW (Computer Supported Cooperative Works)

3. New tools having functions different from existing tools in a machine

- Support system for creative activities

Interface metaphor

- **Understanding by metaphor**
- **GUI widget : visual components**
- **It is not always easy to find an appropriate metaphor**
- **It is possible to cause misunderstanding**

Affordance

- **Possible operations are attributed to the shape of the object**
- **Push button affords the action of pushing**
- **Influenced by culture and education (example: faucet levers)**

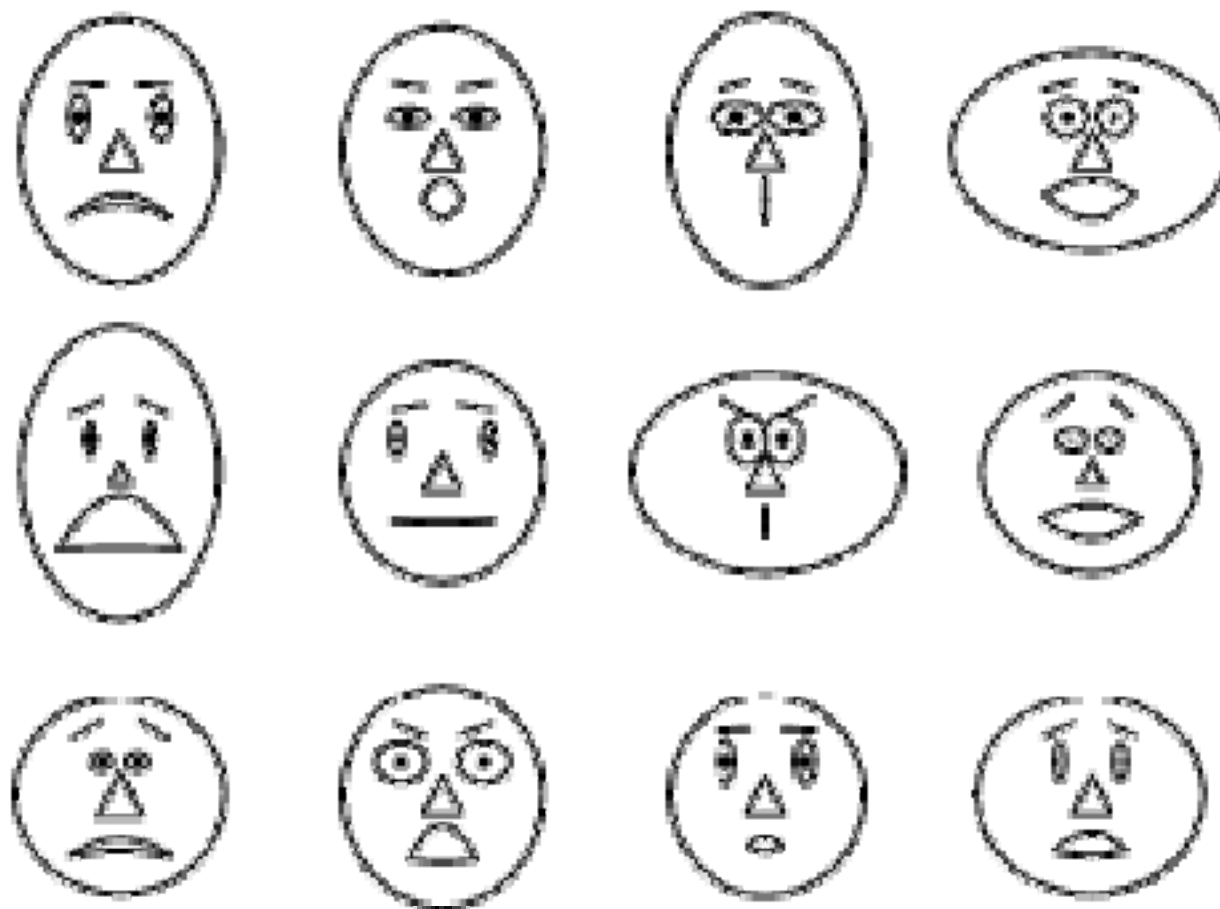
Use of Metaphors

Metaphor	Application	Examples
Typewriting (typing, using keyboard)	Word processor	Word
Document (elements of a document and their attributes and operations)	Desktop publishing	PageMaker, Etude
Ledger sheet (matrix structure for numbers)	Spreadsheet	Lotus 1-2-3, Excel
Drawing (with paper, pencil, and palettes)	Drawing and painting	MacPaint, MacDraw, Paintbrush
Table of data (managing data organized in rows and columns)	Database	QBE, Access

Guidelines on Metaphor Design

- Make use of common metaphors that have readily anticipated characteristics
- Determine which of the metaphor characteristics are essential
- Make explicit any mismatch between system functions and features of the metaphor
- Provide analogies that explain to the user the implications of the metaphors
- Do not mix major metaphors
- Use terms that refer to the source object of the metaphor
- Ensure that the tone of the metaphor matches the attitude that the user should have towards the system
- Preserve in the metaphor the order of the actions that are common in the source object

Chernoff faces convey quantitative data.



Examples of affordance



↑ A door affording “pushing”



↑ A door affording “pulling”



↑ A door affording right/left opening



↑ A faucet affording cold water by blue and hot water by red

Direct manipulation interface

- GUI, metaphor, affordance
- WYSIWYG
(What You See Is What You Get)
- Visualization of information

Interface agent

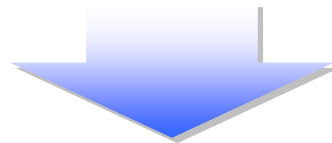
- A group of autonomously working software

Software agent



Physical agent

- Accept customization and tuning
- Adaptable
- Difficult to get the sense of direct manipulation



Integration

Conditions of direct manipulation

(by Ben Schneiderman)

- **Related objects are always shown on the screen**
- **Using physical manipulation, such as mouse movement and push button, instead of using commands following fixed format**
- **Manipulation should be quick and reversible, and the reaction needs to be immediately observed**

Features of metaphor and direct manipulation

Merits

- 1. Easy to understand, since it is based on the world knowledge that everybody has.**
- 2. No many things to newly learn.**

Demerits

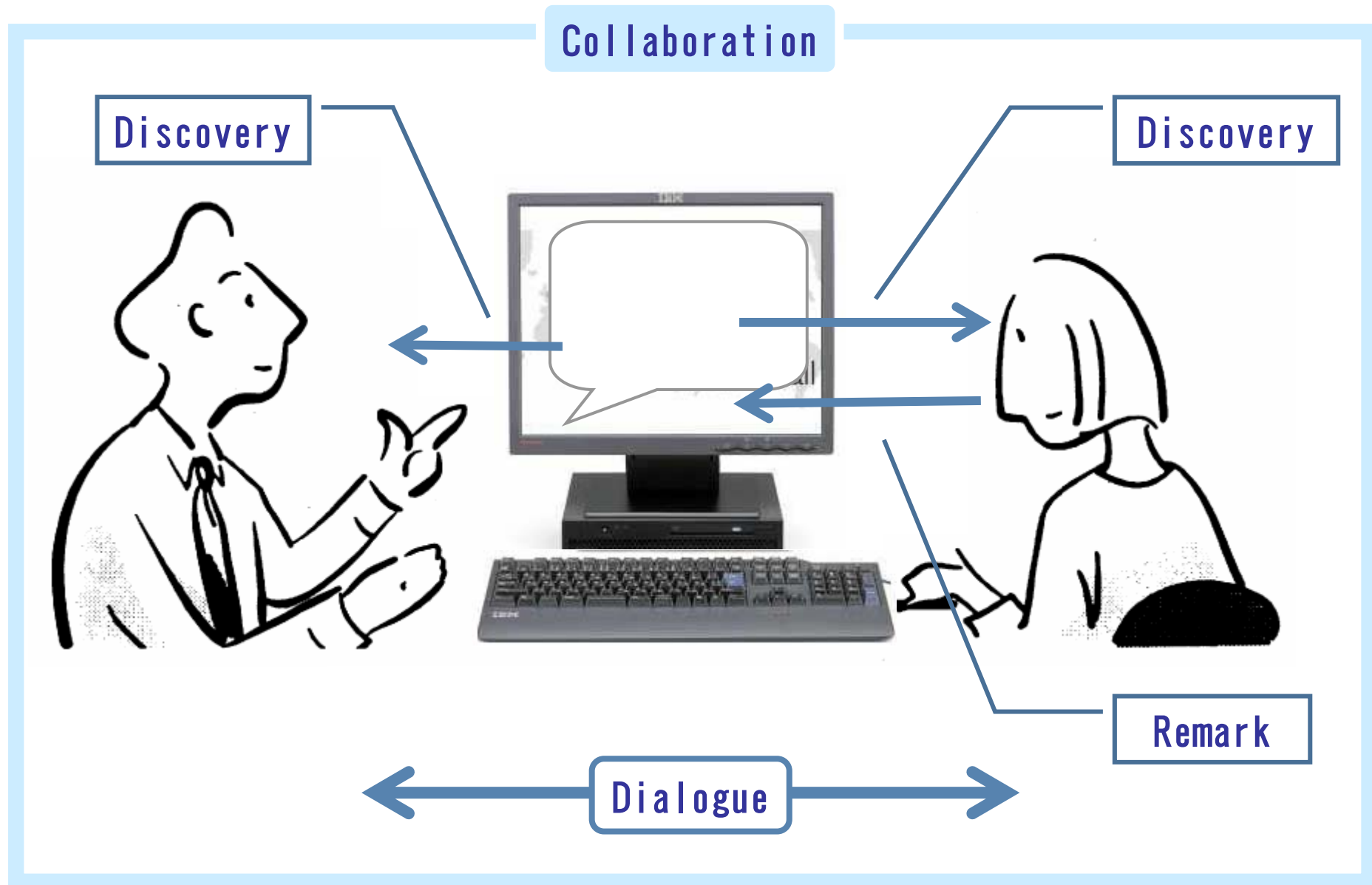
Restricted by the practiced world and difficult to make progress.

From computer to meta-media

(Trend of technical support systems for office information processing)

1970 1st generation	1980 2nd generation	1990 3rd generation	2000 4th generation
Support of text and table processing			
	Support of multiple documents		
		Comprehensive support by hyper-media	

Visual Programming



Hyper-media

Hyper-text

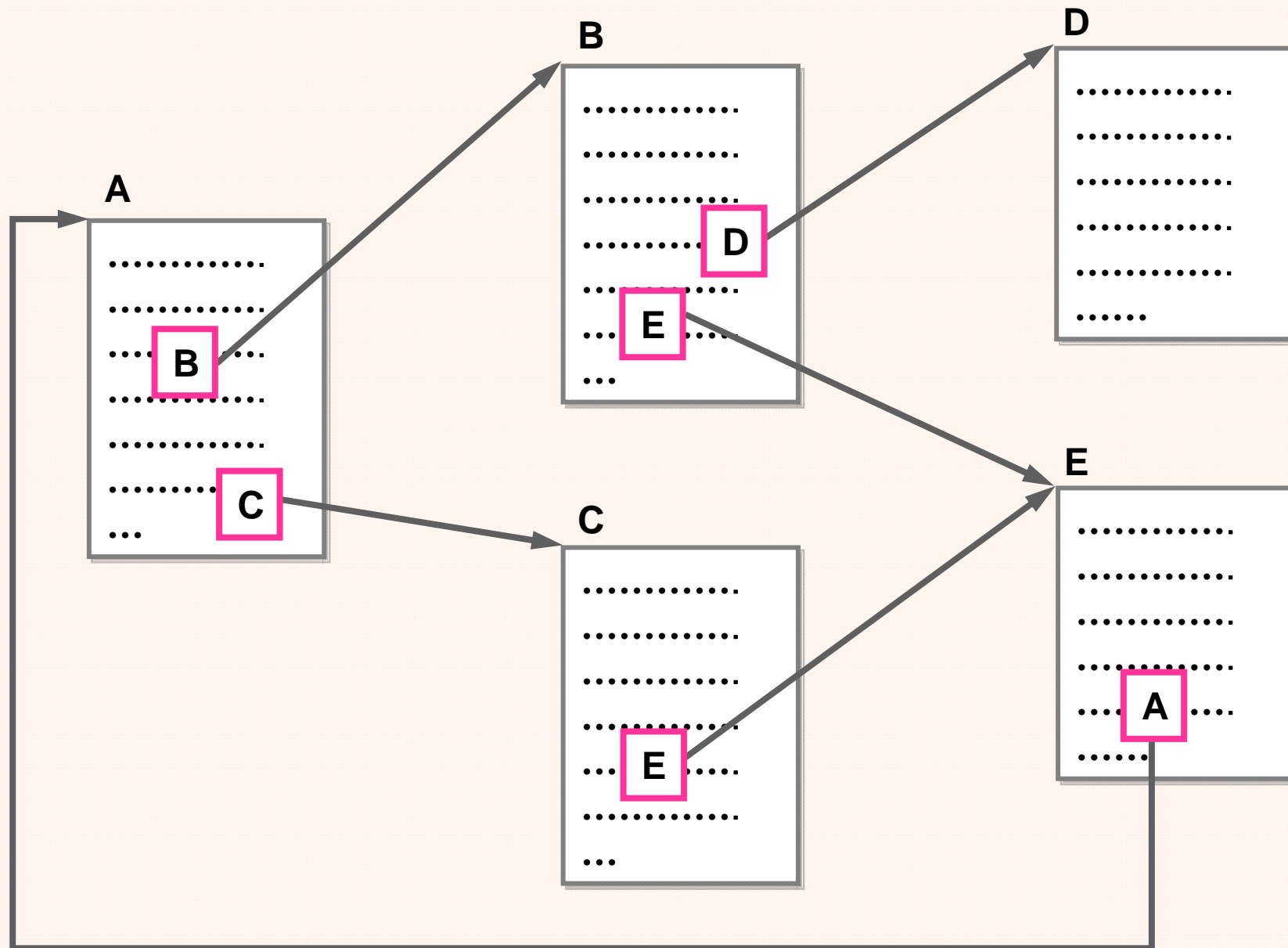
- Information which used to be described by linear or tree structure is described by network structure using links with related information.
- Based on GUI interface using a display with full use of graphics and icons, and a mouse (a kind of object-based user interface)

Hyper-media

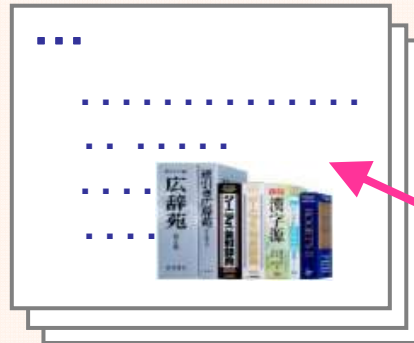
- Handling images, videos, and speech as node information.
- Direct manipulation which sequentially retrieves and refers multimedia information
- Examples : Knowledge Navigator (Voice Navigator)

Future : Intelligent object having autonomous behavioral ability and learning ability

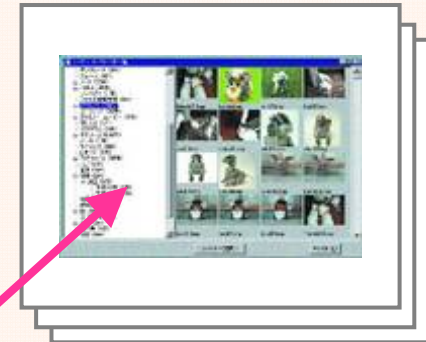
Hyper-text



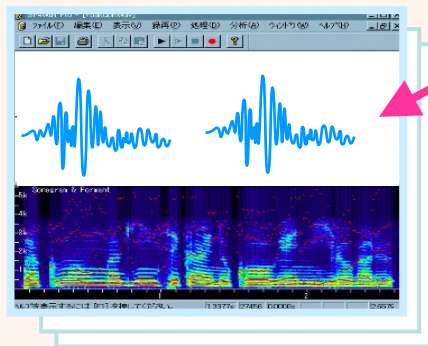
Hyper-media



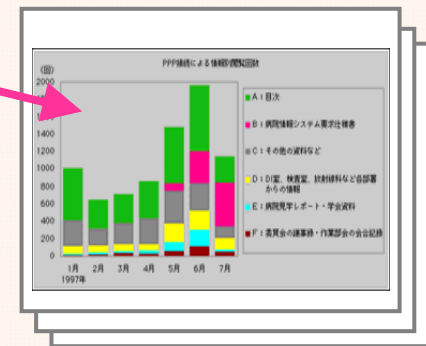
Dictionaries



Videos

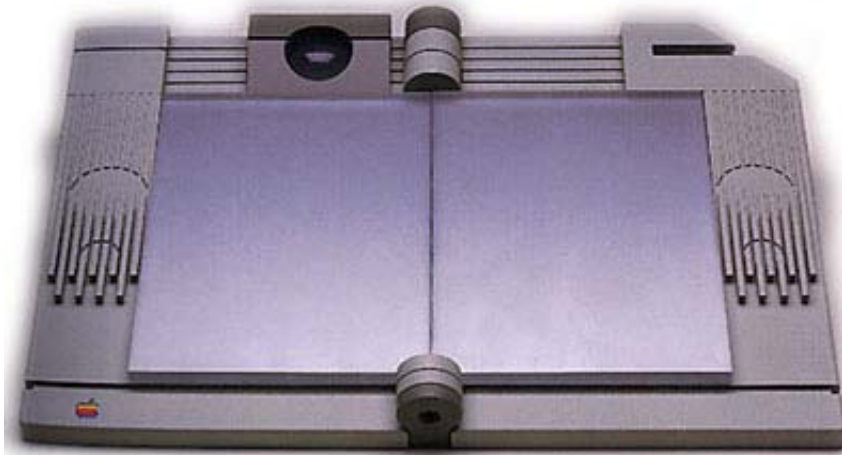


Speech



References

Knowledge Navigator



<Apple, 1988>

Hyper-text/Hyper-media

Merits

1. Easy to trace the reference
2. Easy to make new relevant references
3. Information is structured
4. Easy to grasp global information by browsing
5. Easy to give various functions to a single document (media)
6. Information can be modularized
7. Information becomes consistent
8. Useful for group work

Demerits

1. Easy to get lost
2. Cognitive load becomes higher