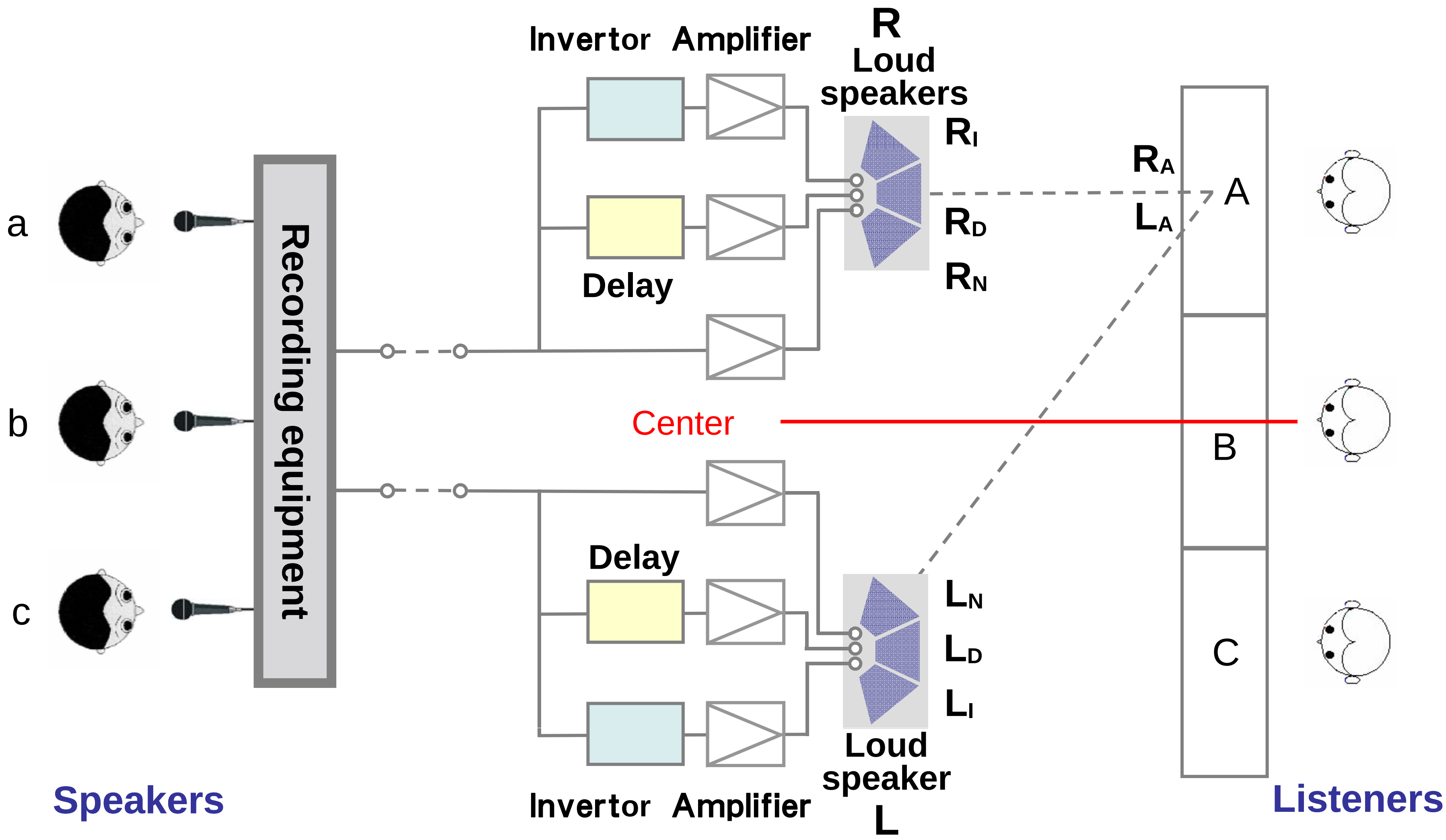
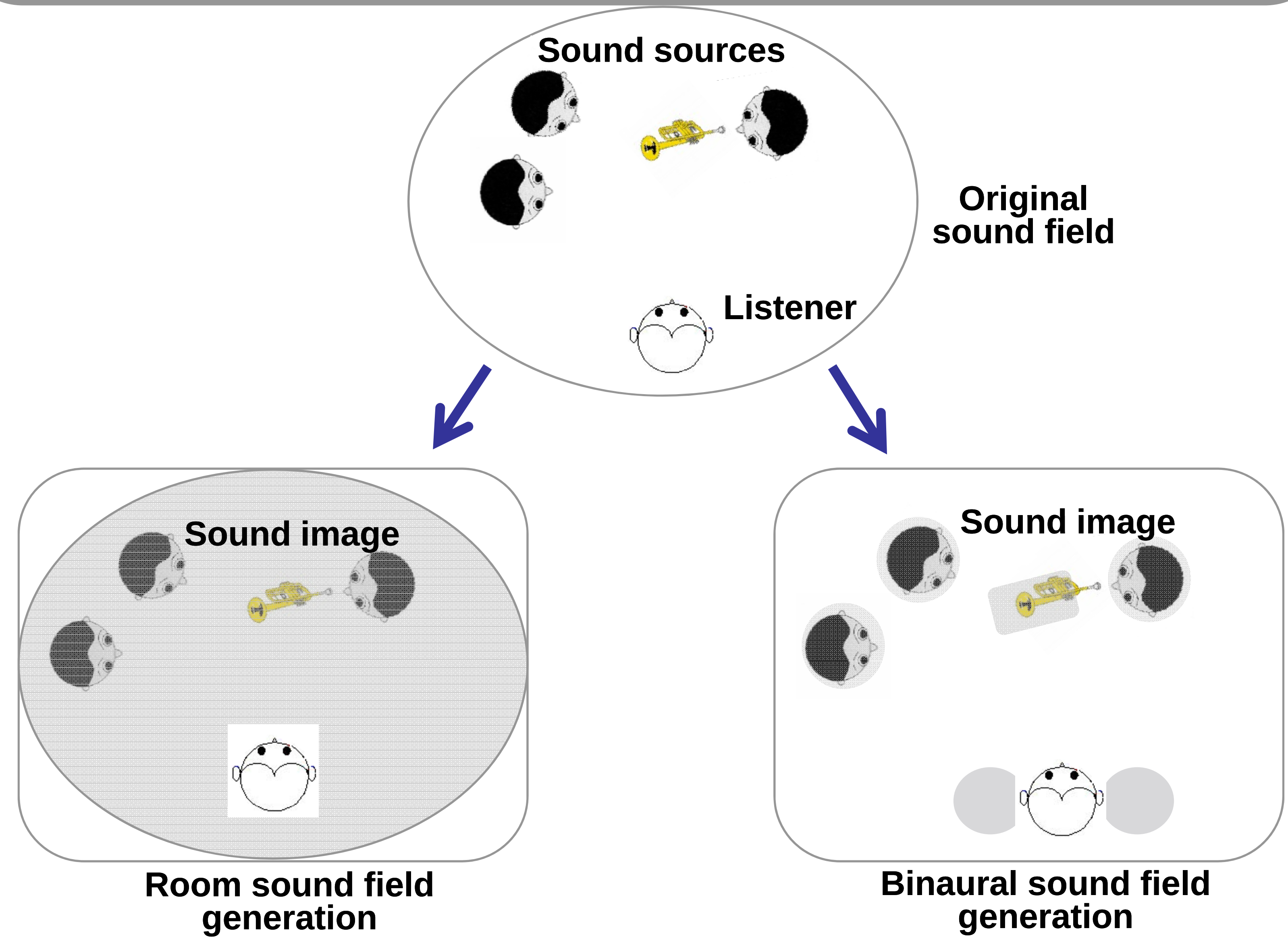
Sound image localization in stereo transmission

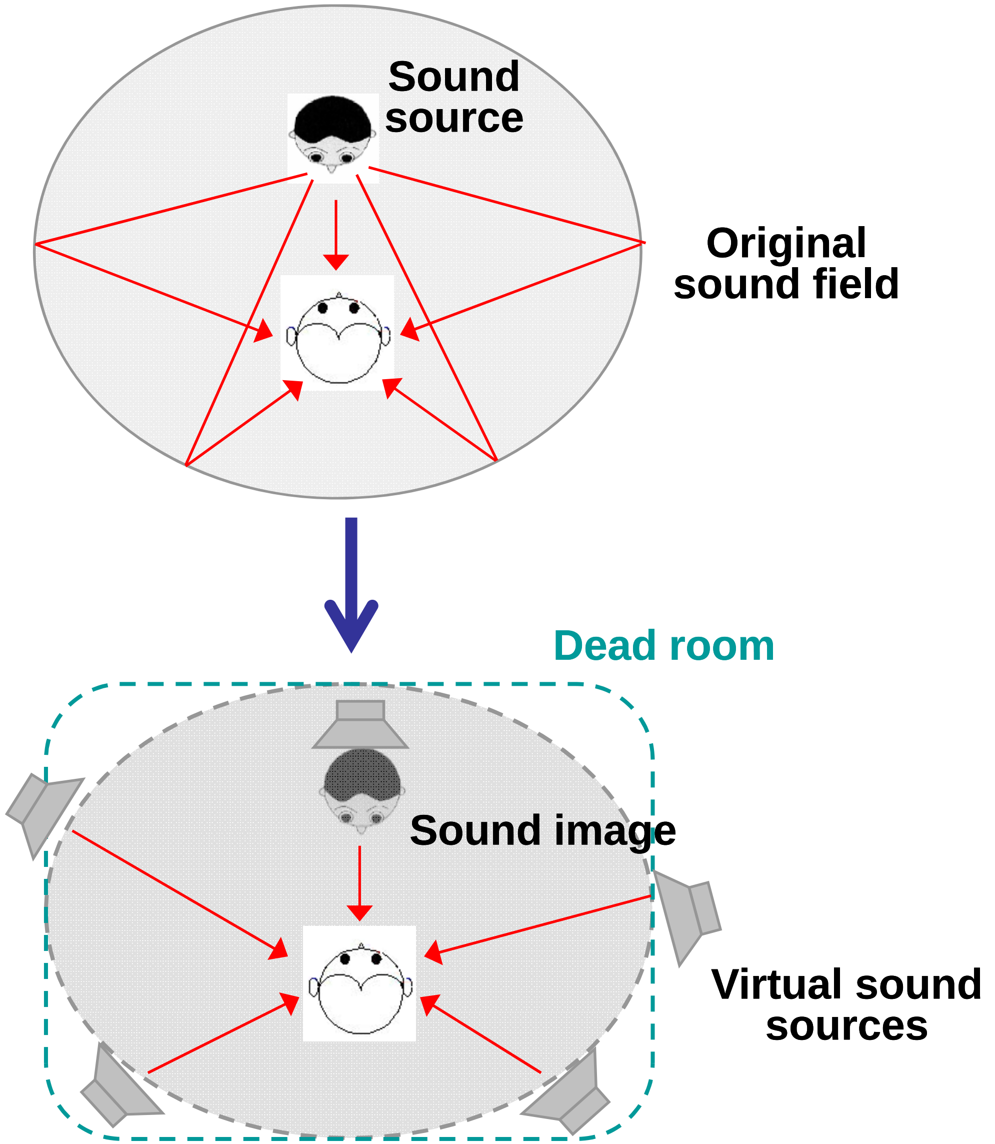
precedence effect



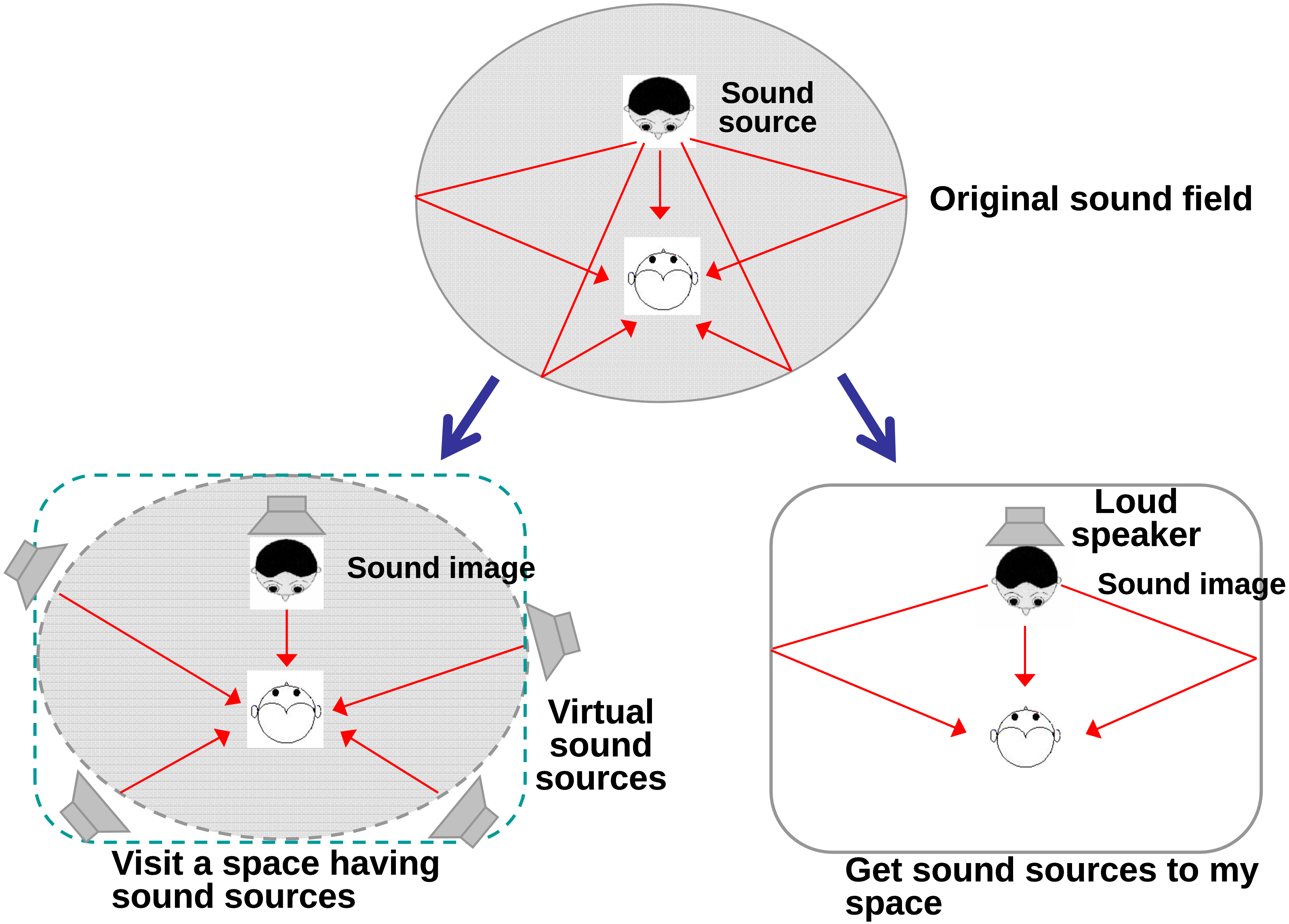
From two-dimensional sound field reproduction to three dimensional sound field generation



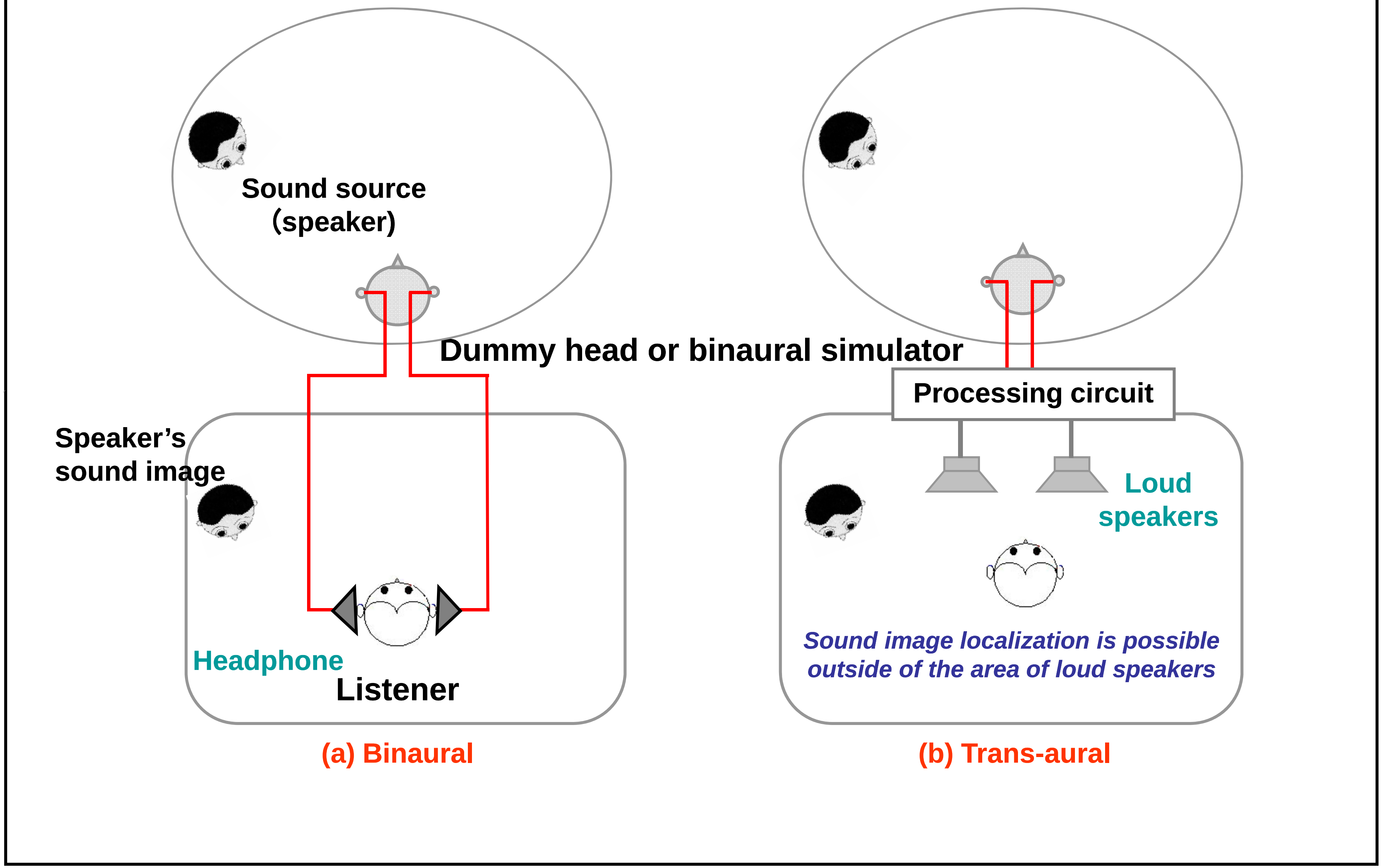
Room sound field generation



Room sound field generation

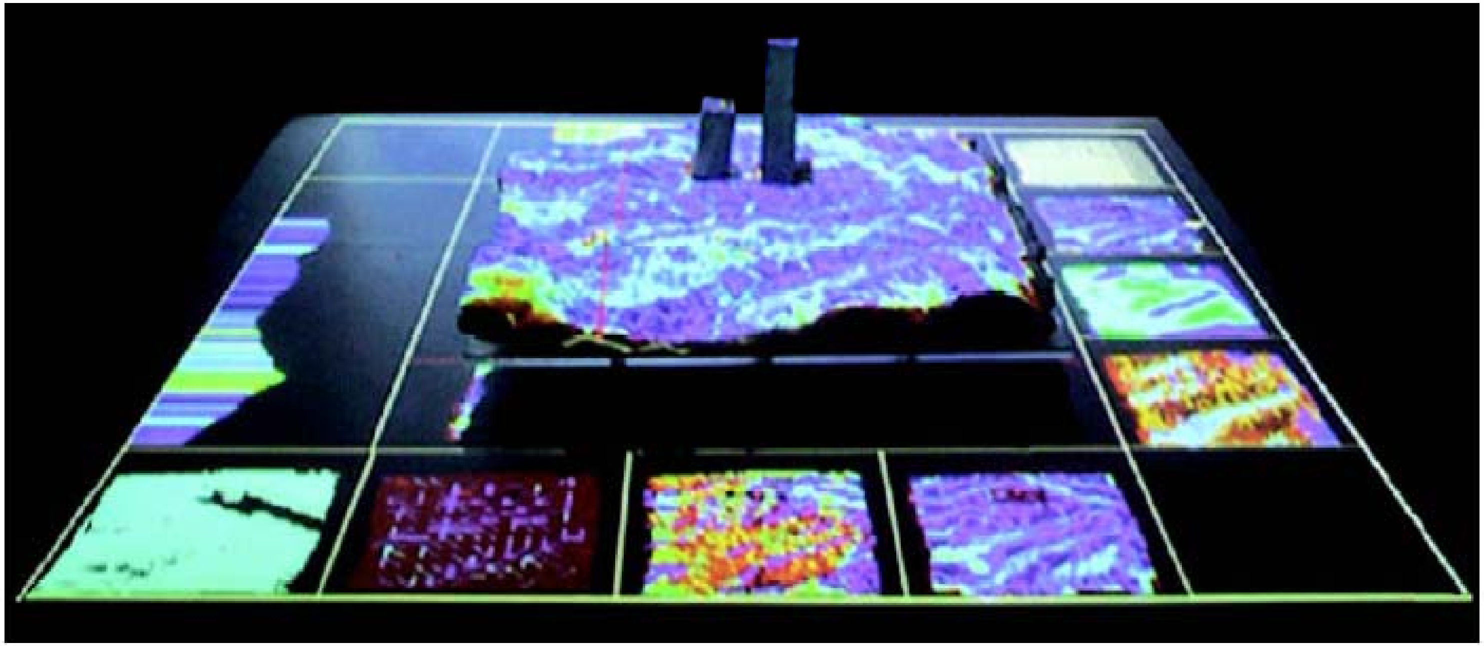


Sound field generation by binaural and trans-aural stereo



Illuminating Clay

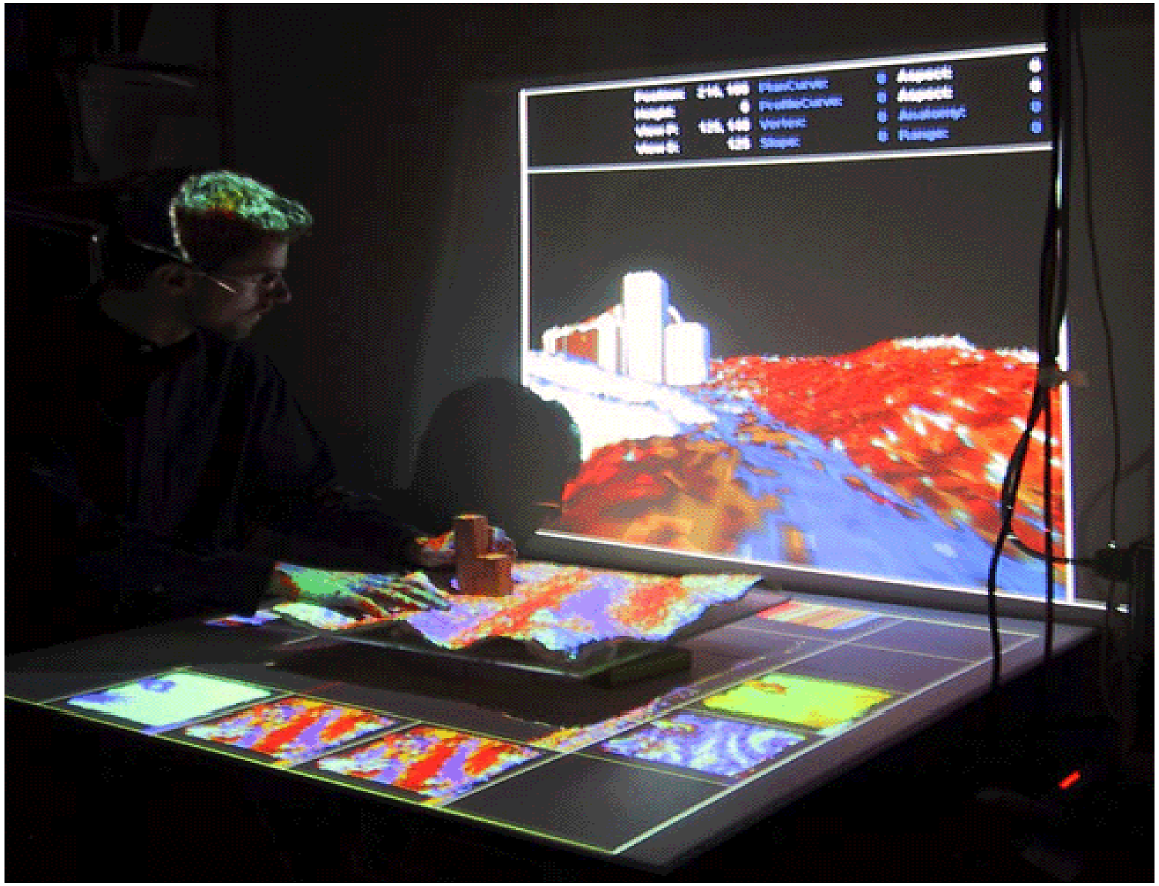
TUI workbench for landscape design



(a) Geographical feature of the landscape model made of clay is measured in real time by 3-dimensional laser scanner and input to a computer. Computed slope angle is color-coded and projected.

Illuminating Clay

TUI Workbench for landscape design



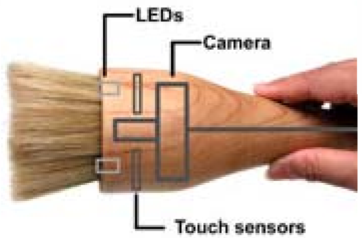
(b) In addition to the projection to the three dimensional physical model made of clay, three dimensional view is projected on to a vertical screen.

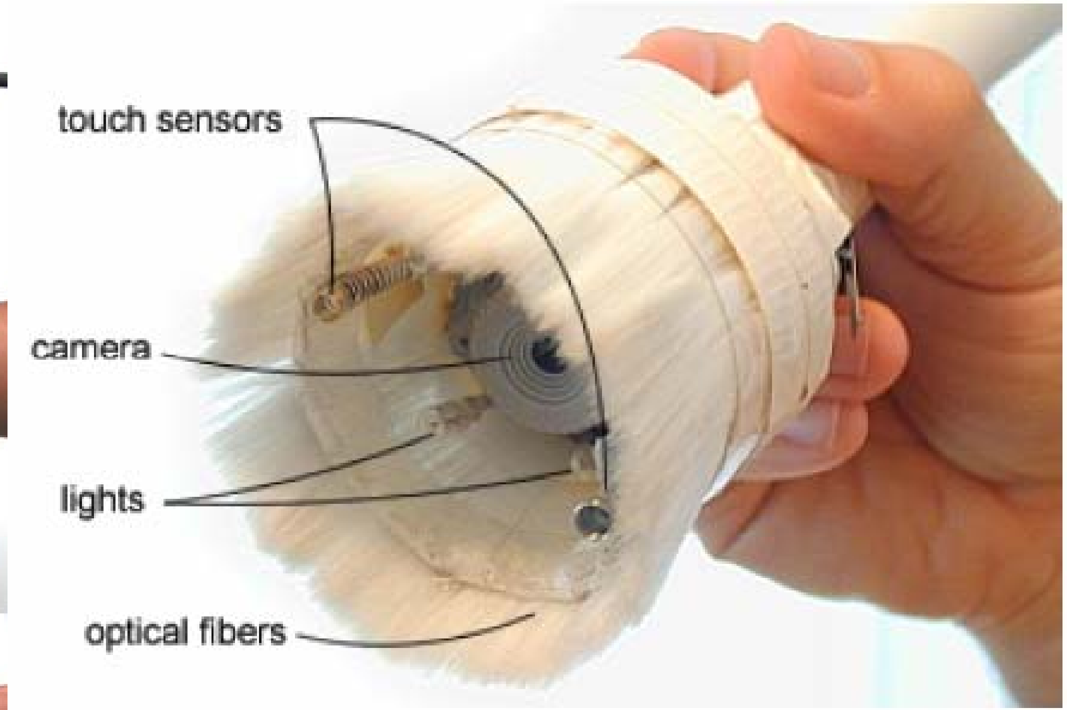
MusicBottles

Opening a bottle to release the sound of the cello.

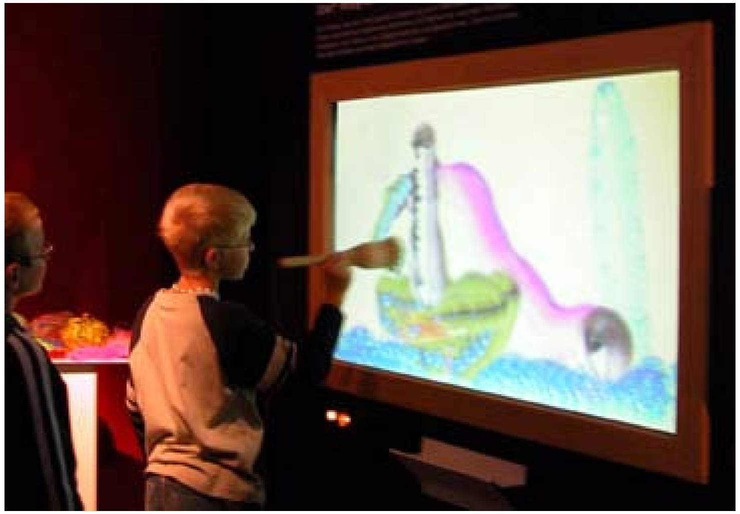
Jazzbottle

The I/O Brush tips





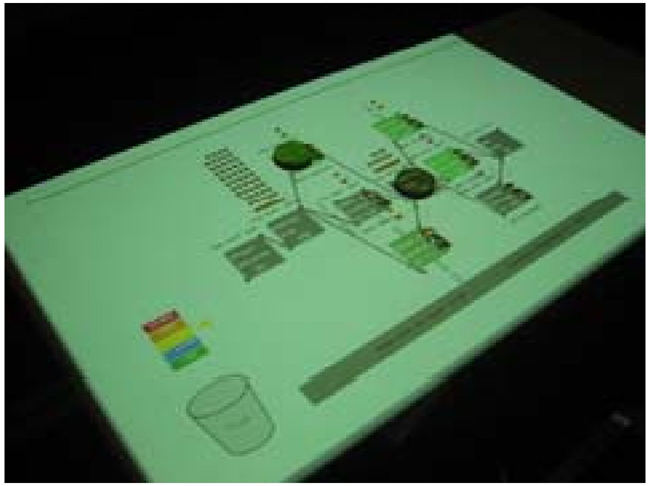
The I/O Brush tips



The I/O Brush tips

Children's works of art.
Top row: typical doodling work by the children.
Bottom row (from left) :"A Bunny," "Rainbow," "Balloon," "Rainbow"

AirportSim



AirportSim aids an airport manager interested in efficiency to distribute resources throughout a model airport.

Wearable PC

IBM's wearable PC with an HMD and a controller

Wearable PC

Radio Vest with directional speakers and microphone

The Soundbeam Neckset with directional speakers and microphone

(http://www.media.mit.edu/~nitin/NomadicRadio/WhatNR.htm)

Features provided by Ubicomp vs. Wearables

Feature	Ubicomp	Wearables
Privacy		X
Personalization		X
Localized information	X	
Localized control	X	
Resource management	X	

(http://rhodes.www.media.mit.edu/people/rhodes/papers/wearhive.html)

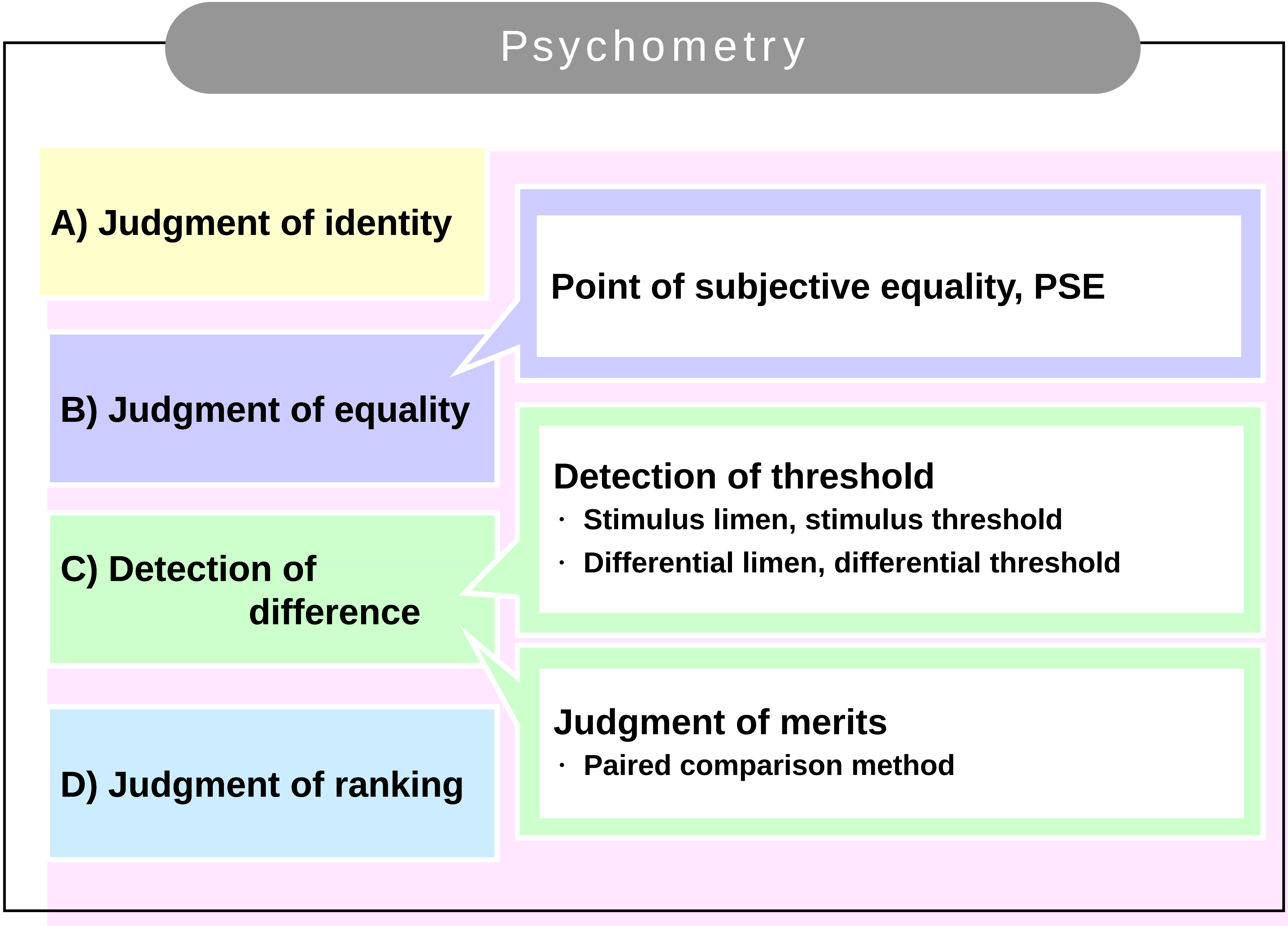
Psychological scaling

a) Nominal scale

b) Ordinal scale

c) Interval scale

d) Ratio scale


Psychometry
A) Judgment of identity
B) Judgment of equality
C) Detection of difference
D) Judgment of ranking
Point of subjective equality, PSE
Detection of threshold
・ Stimulus limen, stimulus threshold
・ Differential limen, differential threshold
Judgment of merits
・ Paired comparison method

Psychometry

Evaluation of degree

Category threshold
- Detection limen
- Permissible limen
- Tolerable limen

Category judgment

Rating
5. imperceptible
4. perceptible but not annoying
3. slightly annoying
2. annoying
1. extremely annoying

Direct judgment of quantity

Size estimation

Examples of rating scales

Category	Unipole scale	Dipole scale
Very good (Excellent)	7	+3
Good	6	+2
Slightly good	5	+1
Normal (Fair)	4	0
Slightly bad (Slightly poor)	3	−1
Bad (Poor)	2	−2
Very bad (Very poor)	1	−3

Psychometry methods

Adjustment method

Method of limit

- Upward series
- Downward series

Constant method

Random order

Difference limen and Weber-Fechner's law

Difference limen, DL; just noticeable difference, jnd): ΔI

Weber's law: $\dfrac{\Delta I}{I} = k$ (k : Weber ratio)

Perceptual quantity: R

Weber-Fechner's law: $\Delta R = K \dfrac{\Delta I}{I}$

$$R = K \log \frac{I}{I_0}$$

Principal methods of psychological scaling

Name of measuring method				How to do	Judgment by subjects
Indirect scaling	jnd accumulation method (differential limen method)			Differential limen is accumulated for scaling	Threshold
	Mixed model (Interval scaling)	Paired comparison		Merit of arbitrary pairs of samples is judged	Merit
		Rank order method		Many samples are ranked at the same time	Ranking
		Category decision method		Each sample is rated into one of the multiple categories	Degree
Direct scaling	Interval scaling	Equal division	Equal interval	All the samples are ordered with equal intervals	Interval
			Bisection	Equal intervals are made by repeating bisection of two stimuli	
		Distance estimation		Perceptual difference between stimuli is directly judged	
		Category estimation		Perception of each stimuli is classified into a category	
		Category construction		Each stimuli is adjusted to a perceptual category	
	Ratio scaling	Ratio estimation		Perceptual ratio of two stimuli is judged	Ratio
		Ratio construction		A stimulus B is adjusted to a stimulus A with a given ratio	
		Size estimation		Perceptual ratio of a stimulus B to a stimulus A is judged	
		Size construction		A stimulus B with a given ratio with stimulus A is searched	

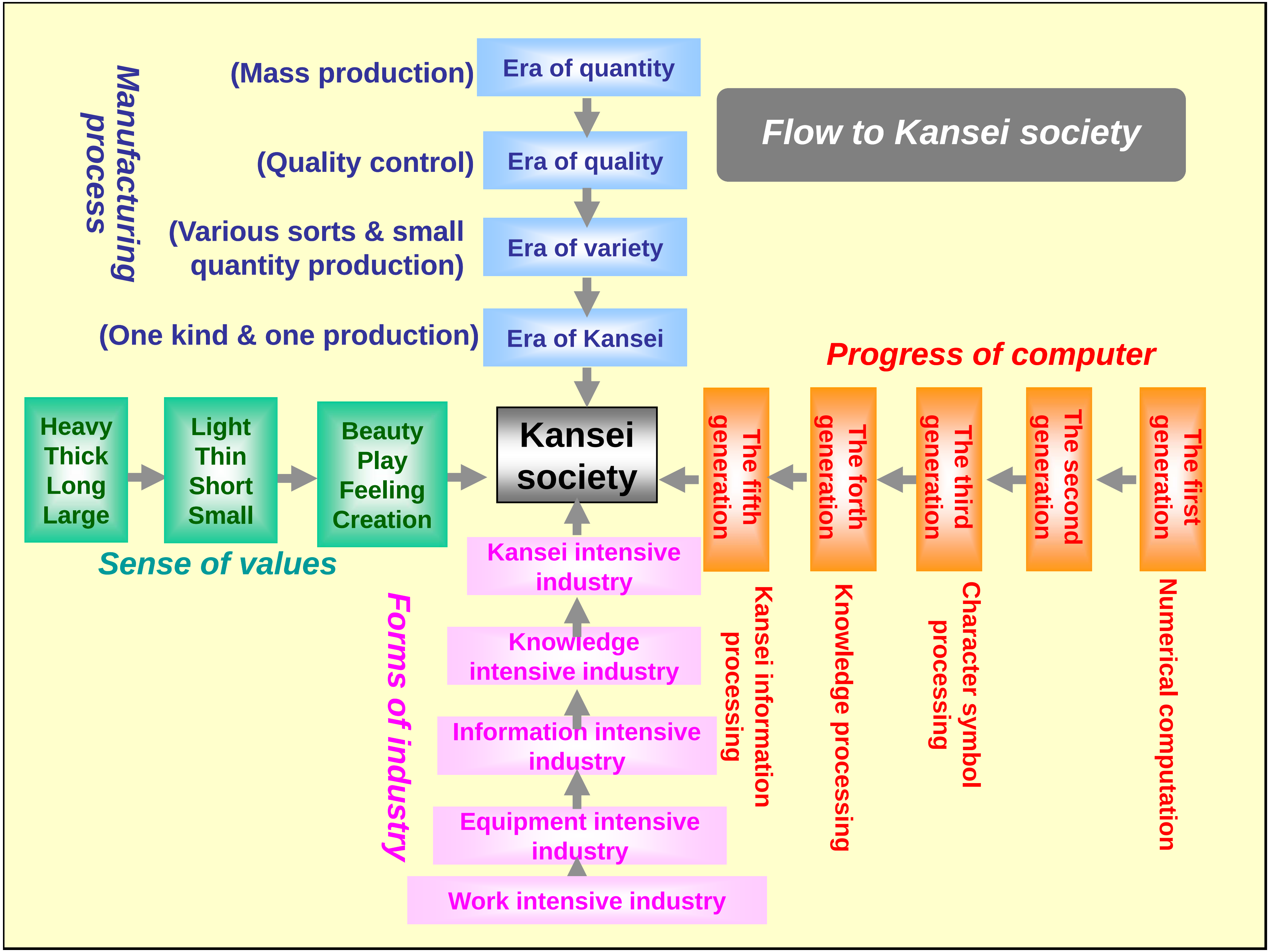
Multidimensional scaling, MDS

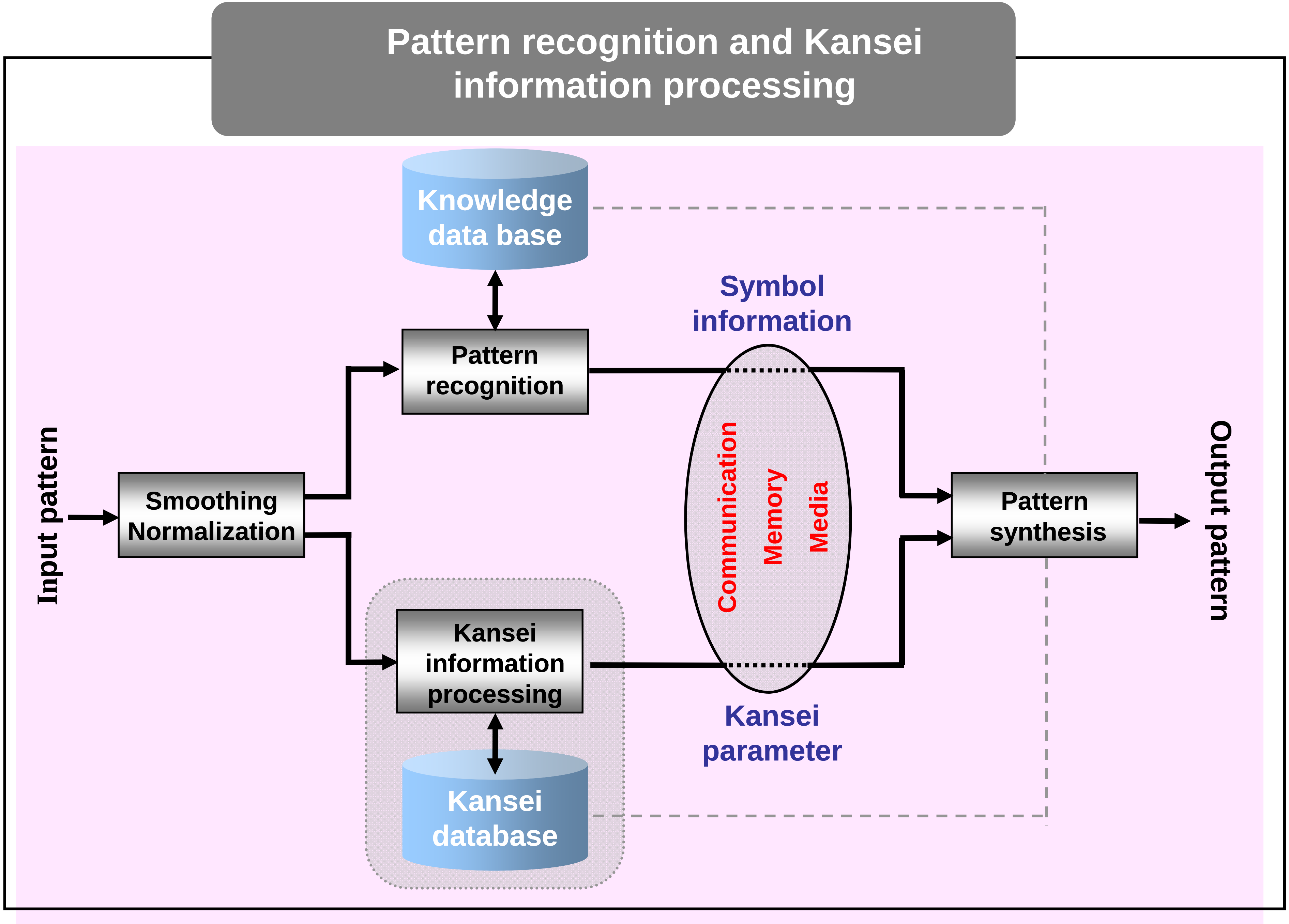
a) Torgerson’s quantitative scaling

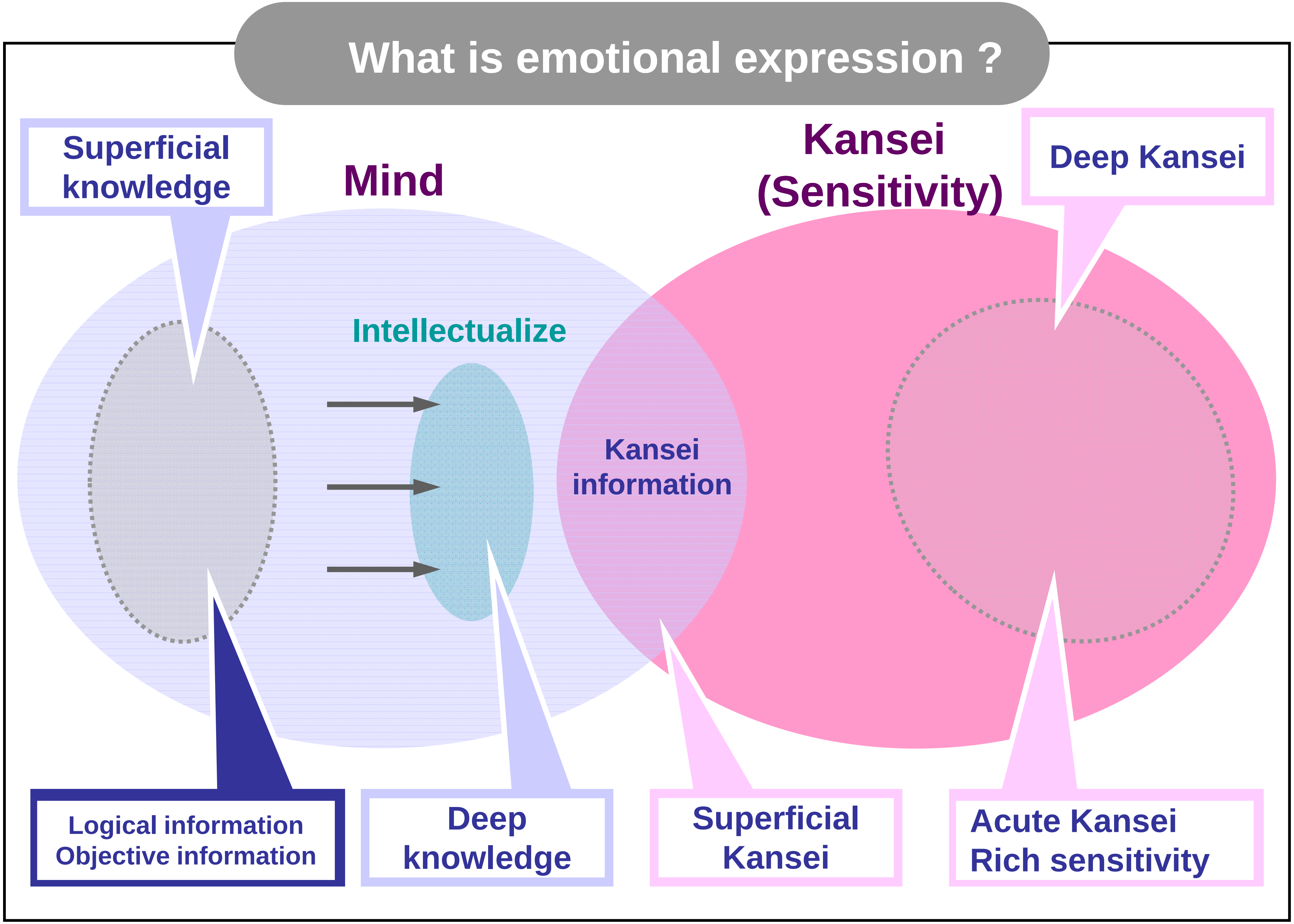
Interval scaling

b) Kruskal’s non-quantitative scaling

Ordinal scaling


Flow to Kansei society
Manufacturing process
(Mass production)
Era of quantity
(Quality control)
Era of quality
(Various sorts & small quantity production)
Era of variety
(One kind & one production)
Era of Kansei
Kansei society
Heavy Thick Long Large
Light Thin Short Small
Beauty Play Feeling Creation
Sense of values
Progress of computer
The fifth generation
The forth generation
The third generation
The second generation
The first generation
Kansei information processing
Knowledge processing
Character symbol processing
Numerical computation
Forms of industry
Kansei intensive industry
Knowledge intensive industry
Information intensive industry
Equipment intensive industry
Work intensive industry


Pattern recognition and Kansei information processing
Knowledge data base
Symbol information
Pattern recognition
Input pattern
Smoothing Normalization
Communication
Memory
Media
Pattern synthesis
Output pattern
Kansei information processing
Kansei parameter
Kansei database



What is emotional expression ?
Superficial knowledge
Mind
Kansei (Sensitivity)
Deep Kansei
Intellectualize
Kansei information
Logical information
Objective information
Deep knowledge
Superficial Kansei
Acute Kansei
Rich sensitivity

Overview of human information processing

Humans are limited in their capacity to process information. This has important implications for design.

Information is received and responses are produced via a number of input and output channels:

- **Visual channel**
- **Auditory channel**
- **Haptic channel**
- **Movement**

Information is stored in memory:

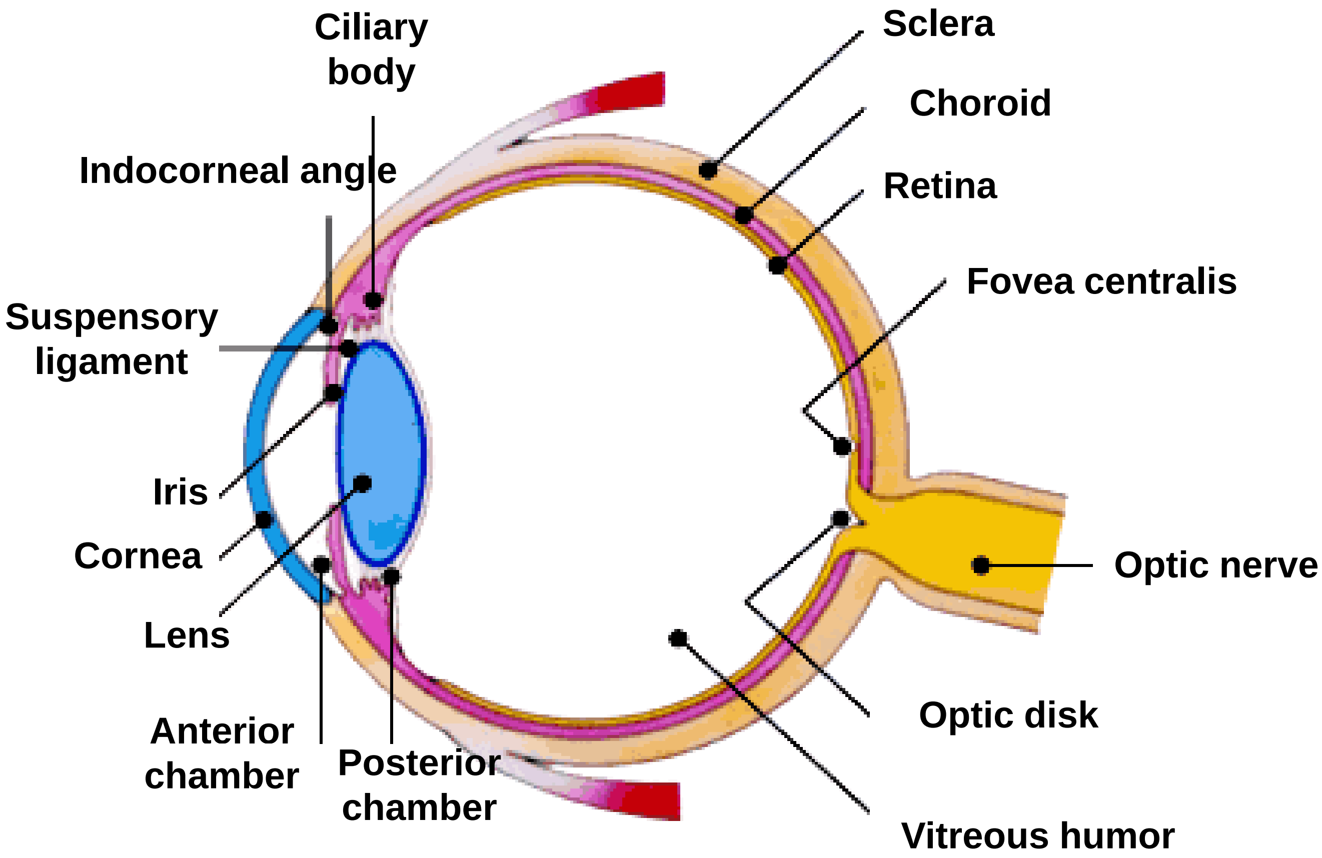
- **Perceptual memory**
- **Short-term (working) memory**
- **Long-term memory**

Information is processed and used:

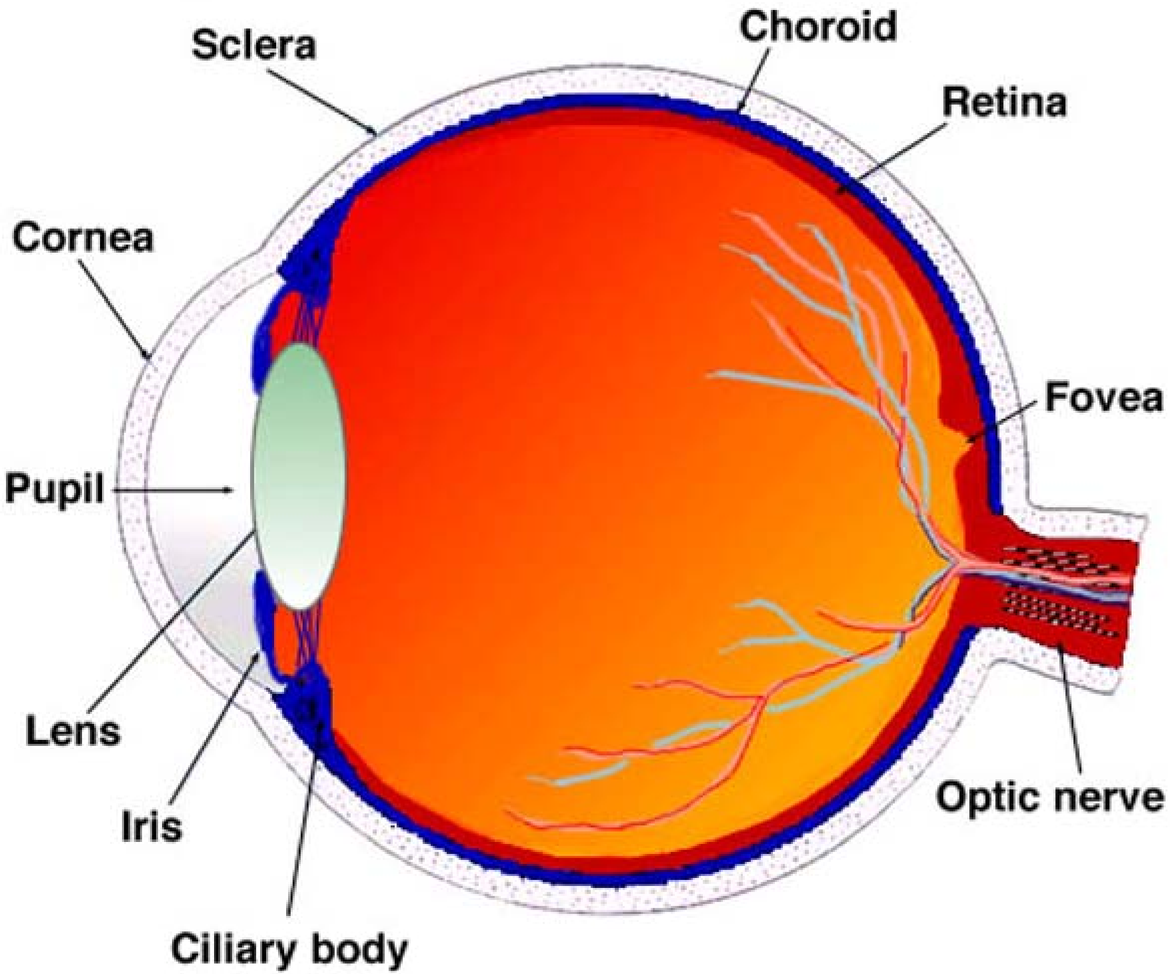
- **Reasoning**
- **Problem solving**
- **Skill acquisition**
- **Error**

Users share common capabilities but there are individual differences which should not be ignored.

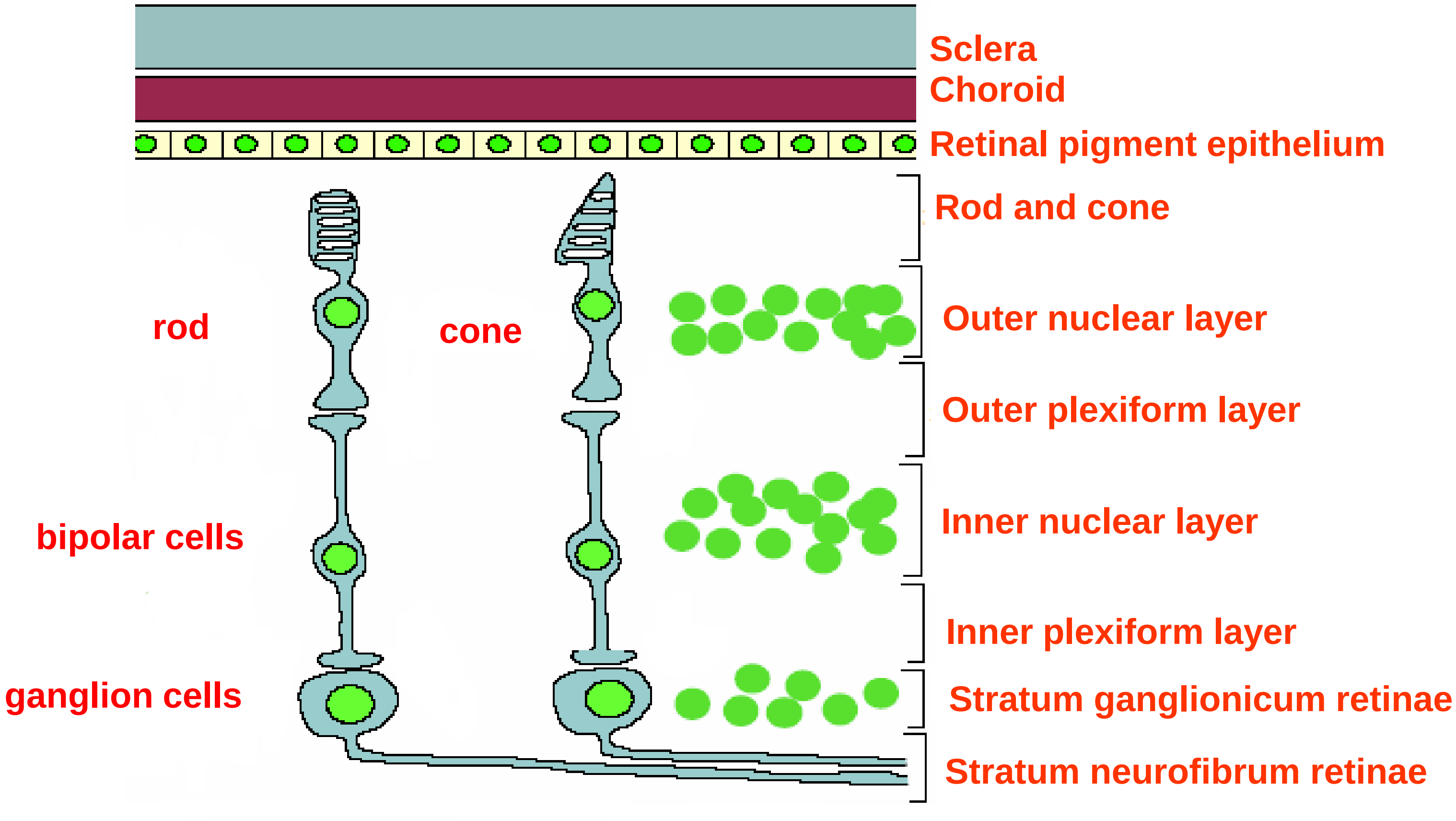
The human eye



The human eye

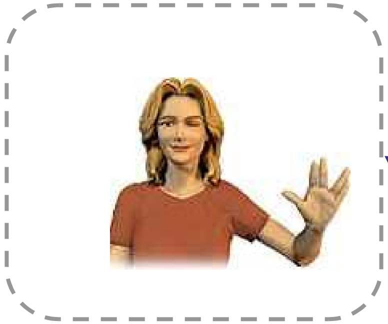


Cross section of the retina

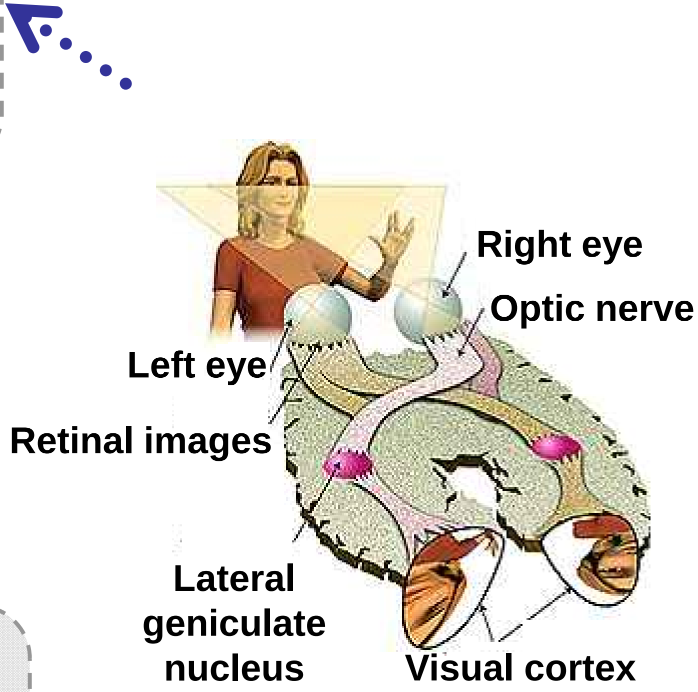


Rod: 120,000, 000 in an eye, high sensitivity, no color vision, poor eyesight
Cone: 65,000,000 in an eye, low sensitivity, color vision, high eyesight, around fovea

Analog parallel information processing



Outer landscape



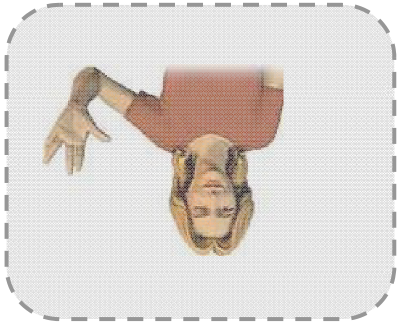
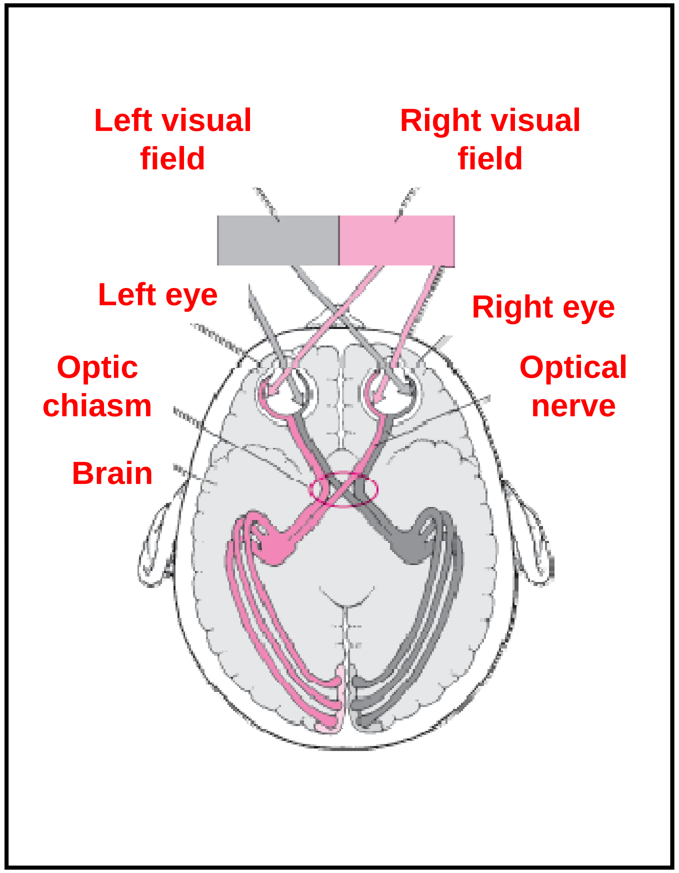
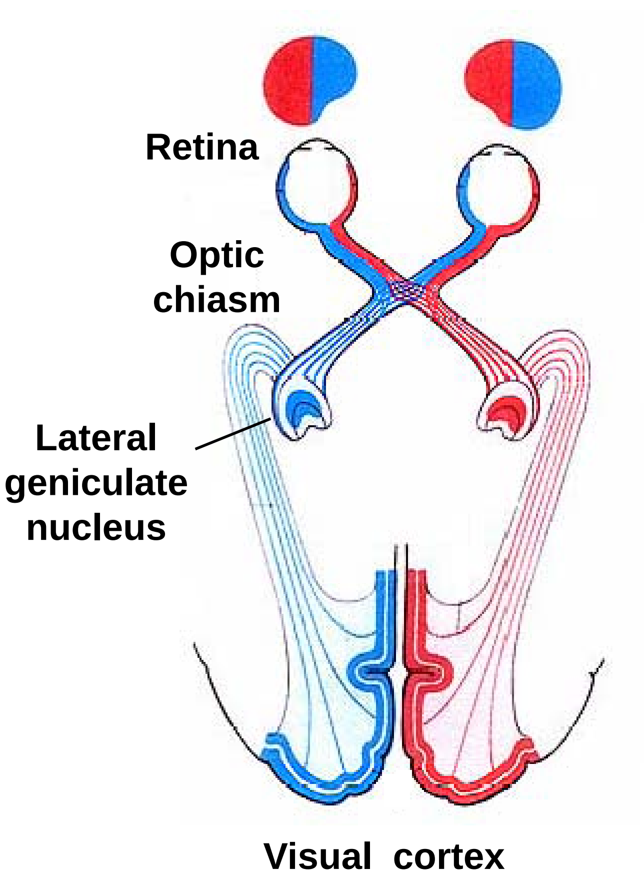


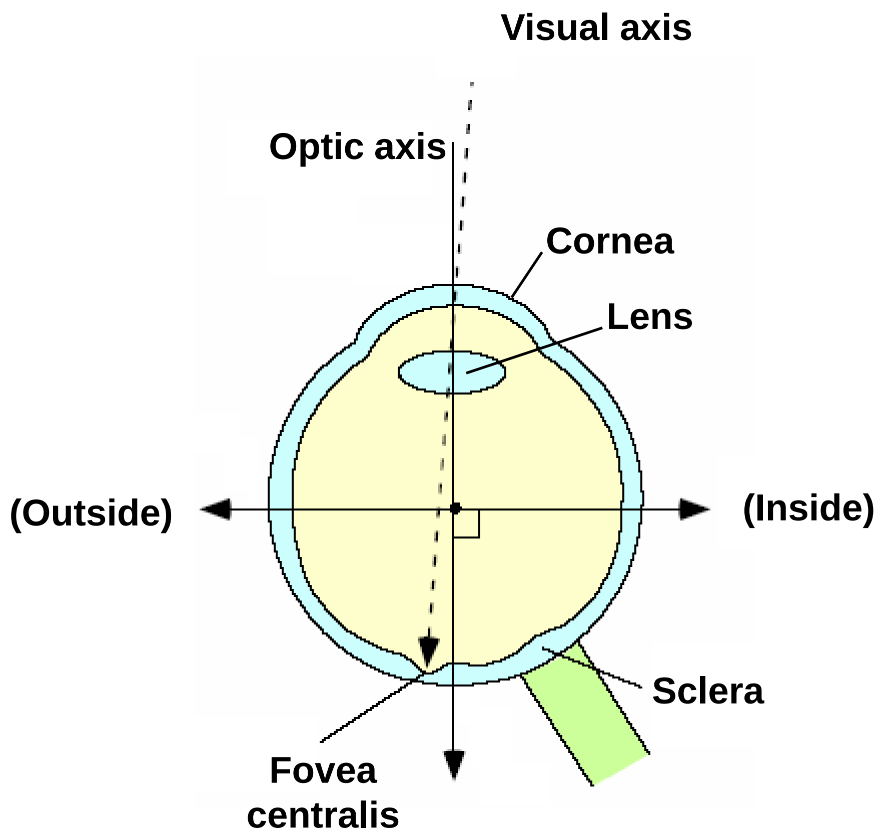
Image on the retina



Analog parallel information processing 2



Visual system



Cross section of the eyeball

Design Focus

Getting noticed

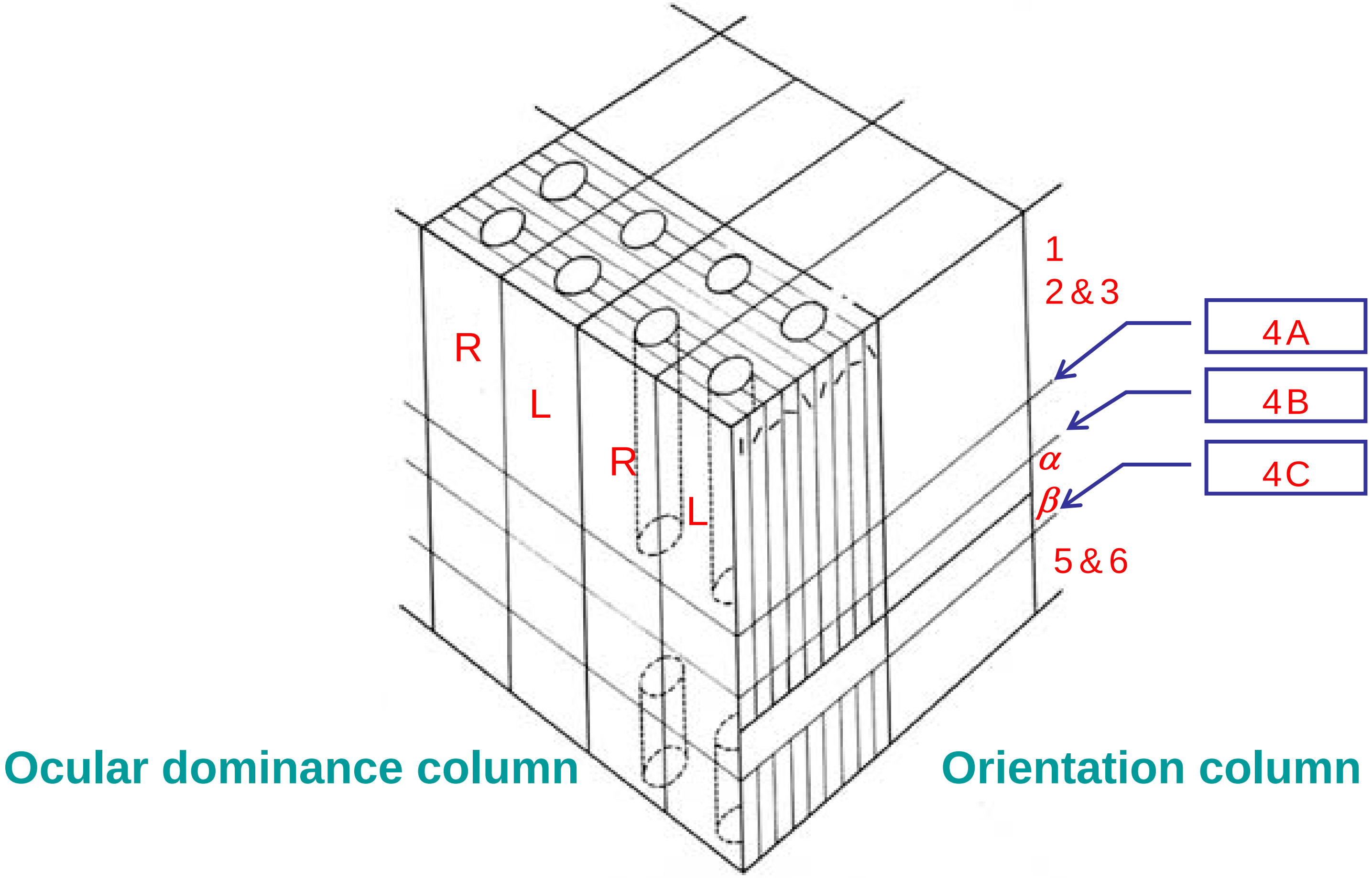
The extensive knowledge about the human visual system can be brought to bear in practical design. For example, our ability to read or distinguish falls of inversely as the distance from our point of focus. This is due to the fact that the cones are packed more densely towards the centre of our visual field. You can see this in the following image. Fixate on the dot in the centre. The letters on the left should all be equally readable, those on the right all equally harder.

A B C D E F ● H I J K

This loss of discrimination sets limits on the amount that can be seen or read without moving one’s eyes. A user concentrating on the middle of the screen cannot be expected to read help text on the bottom line.

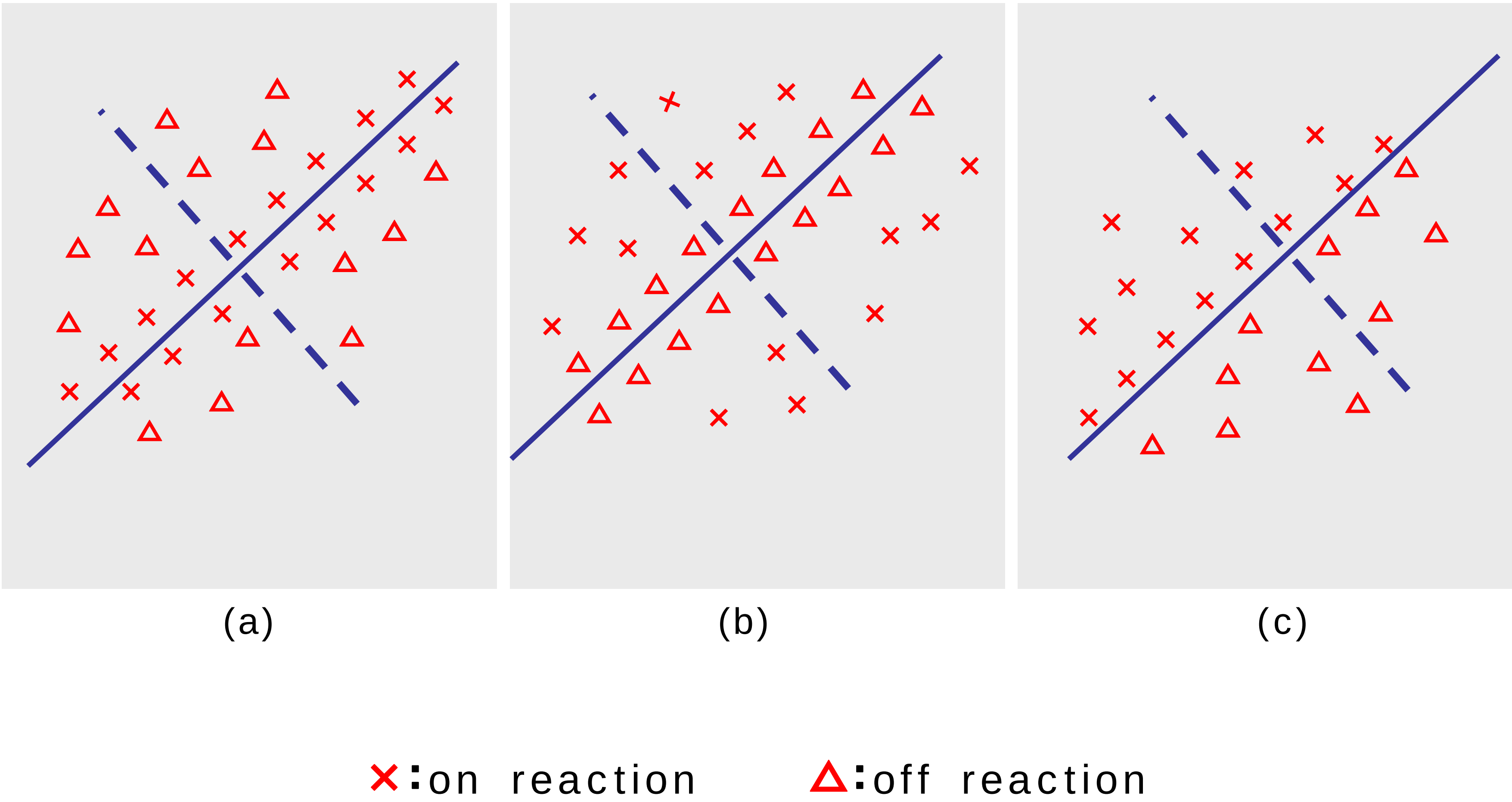
However, although our ability to discriminate static text diminished, the rods, which are concentrates more in the outer parts of our visual field, are very sensitive to changes; hence we see movement well at the edge of our vision. So if you want a user to see an error message at the bottom of the screen it had better be flashing ! On the other hand clever moving icons, however impressive they are, will be distracting even when the user is not looking directly at them.

Column structure of Cerebral visual area



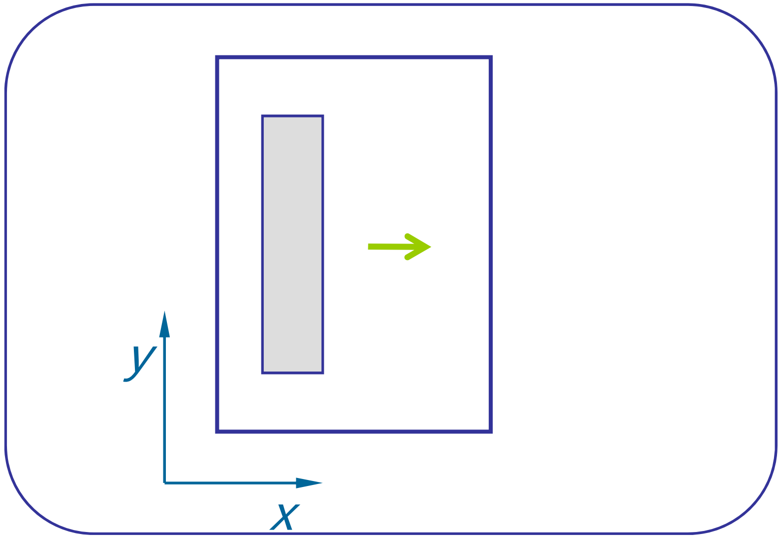
(Livingston and Hubel, 1984)

Receptive field of simple cells

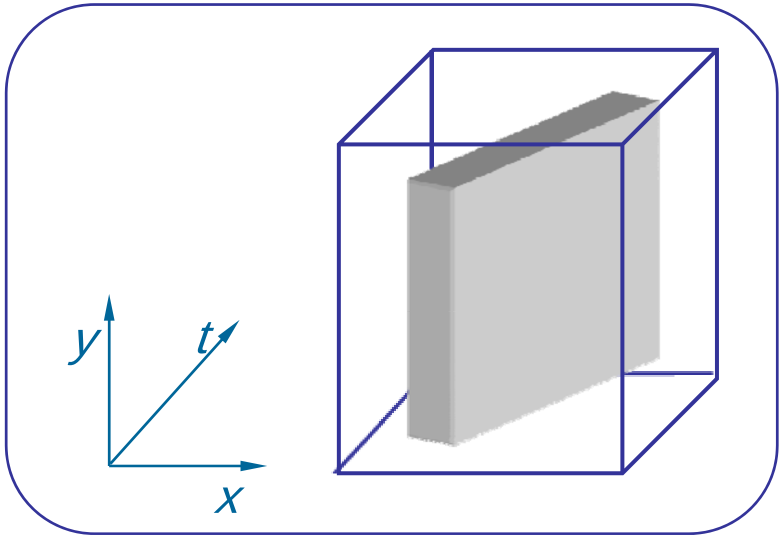


(*Hubel and Wiesel, 1962*)

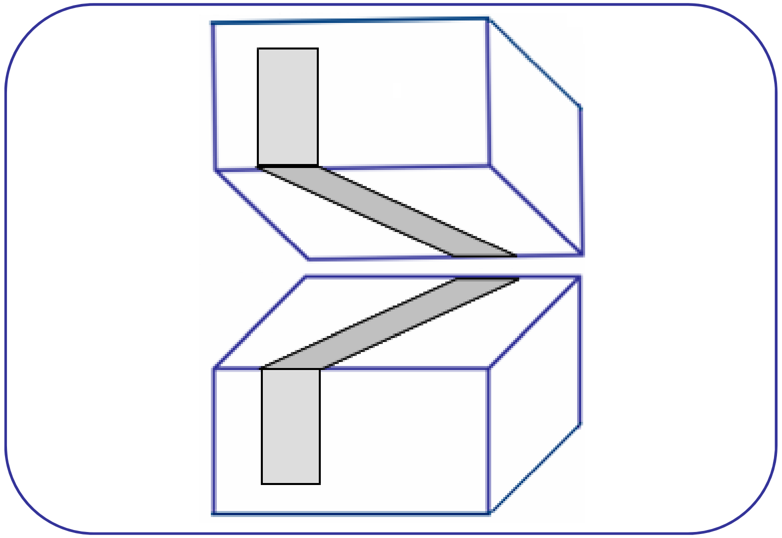
Motion detection by Gradient method



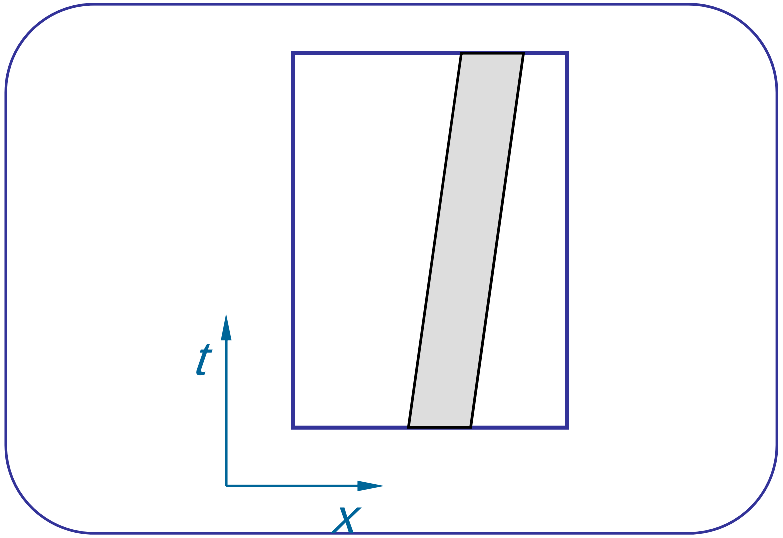
(a) Constant speed motion in x-direction



(b) Expression of (a) by three dimensions

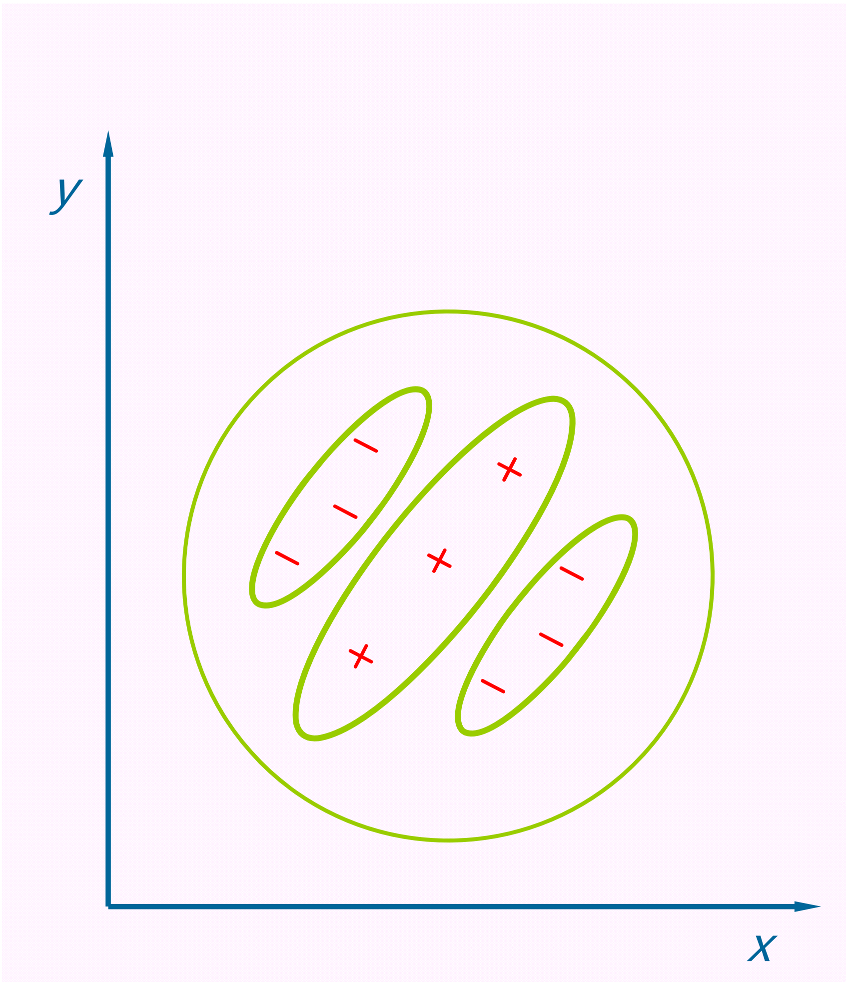


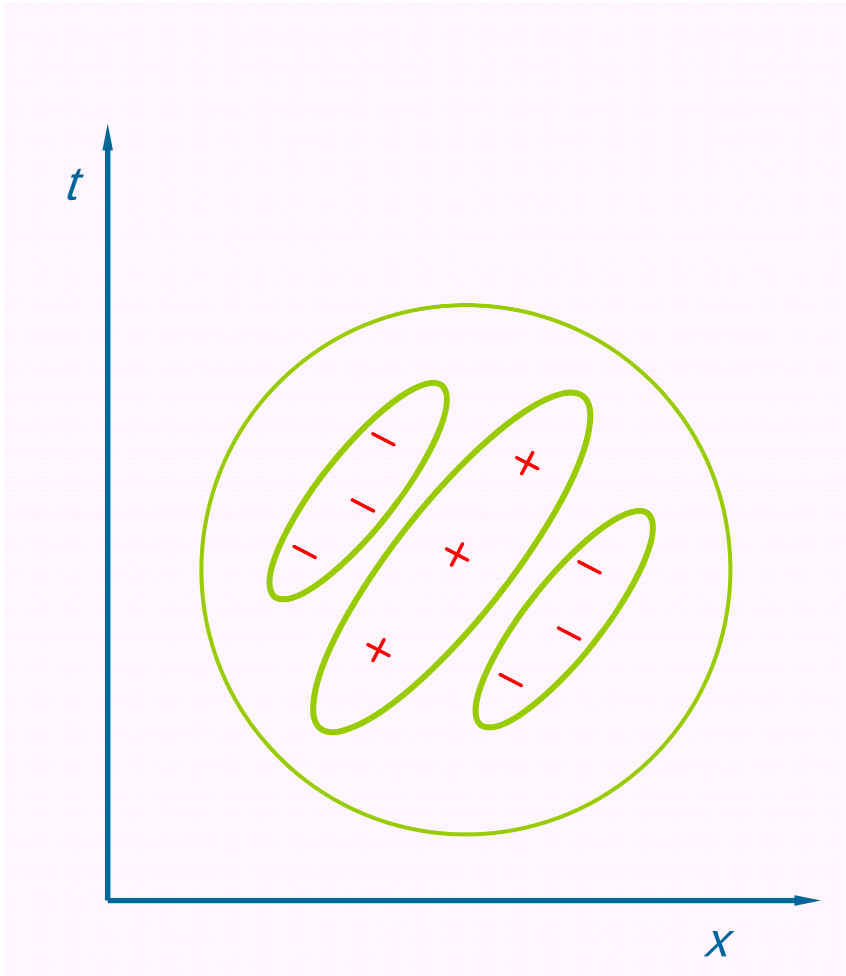
(c) Cut off (b) at a fixed y



(d) Expression of motion on $x - t$ plane

Motion detector of visual system

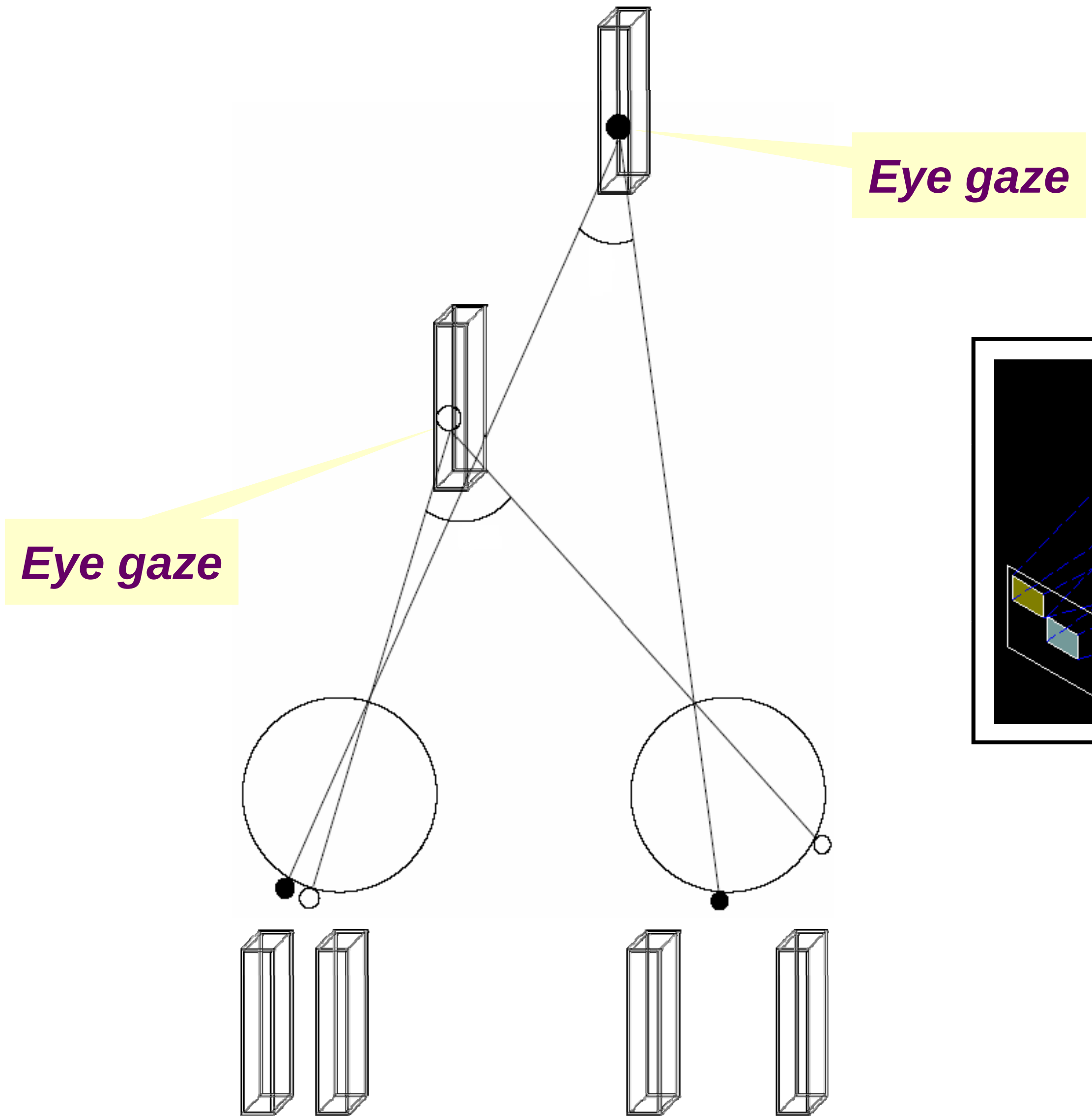


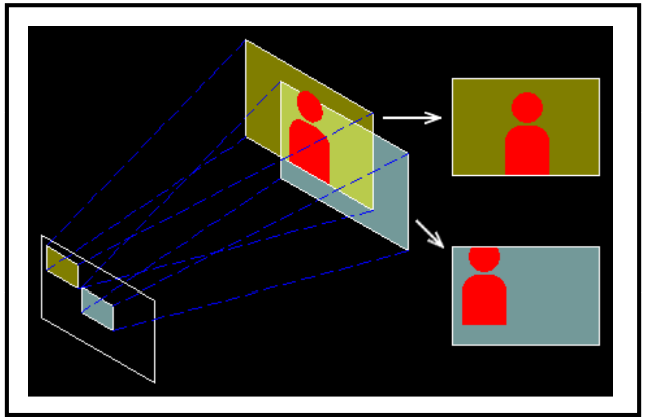


(a) **Detection of spatial inclination**
- Receptive field of simple-cells -

(b) **Detection of inclination in $x - t$ *plane***
- Motion detector -

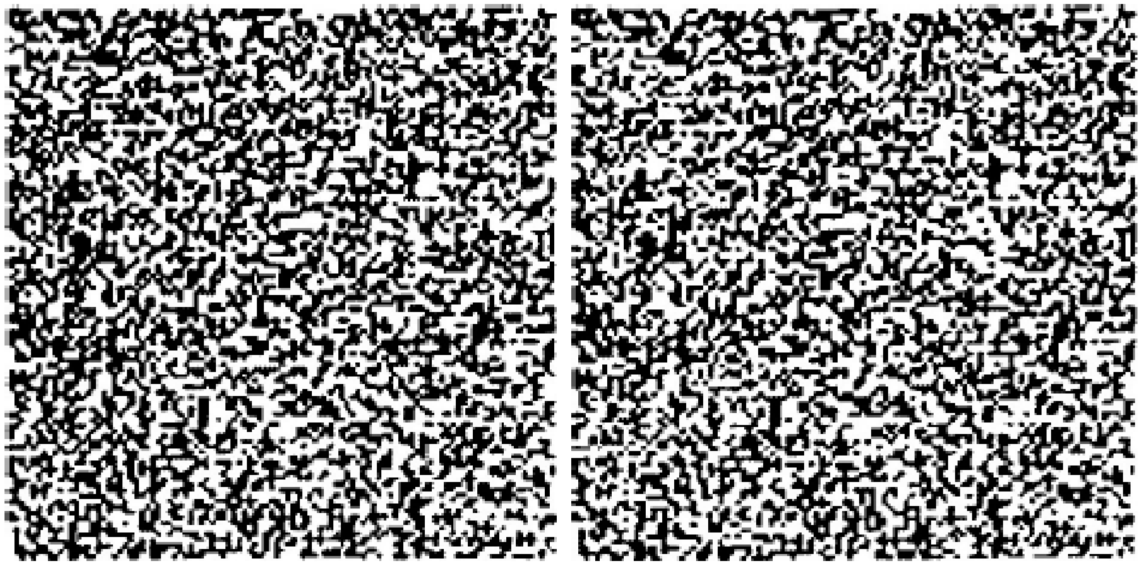
Parallax





Random dot stereogram

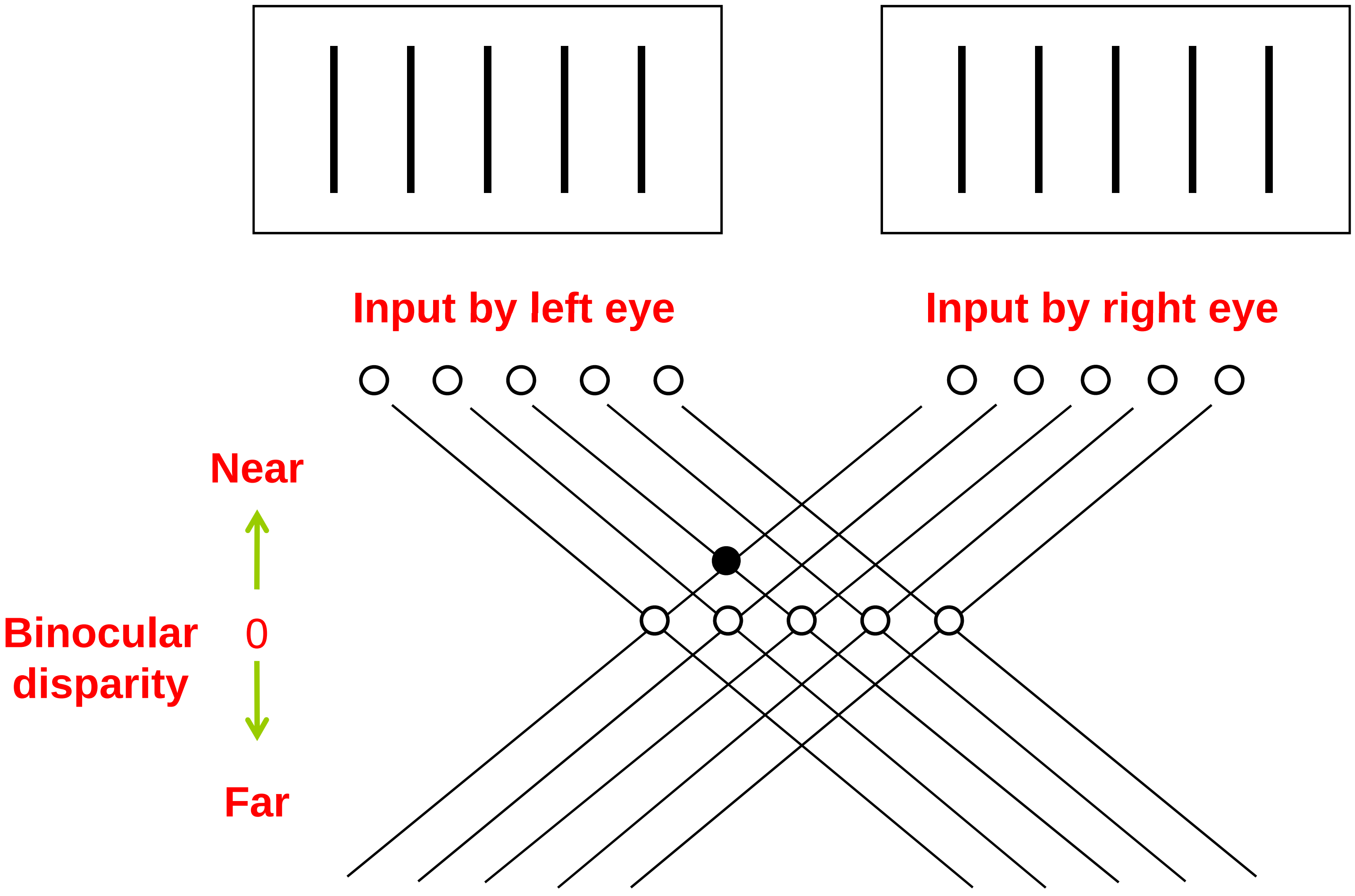
Depth perception only by a binocular 3D view method



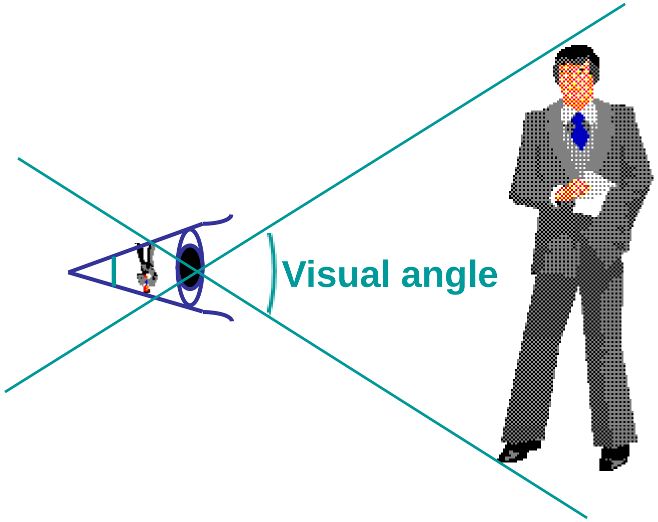
A square area will be loomed up in the center when two patterns are merged by both eyes

A model of detecting binocular disparity

Mismatch problem

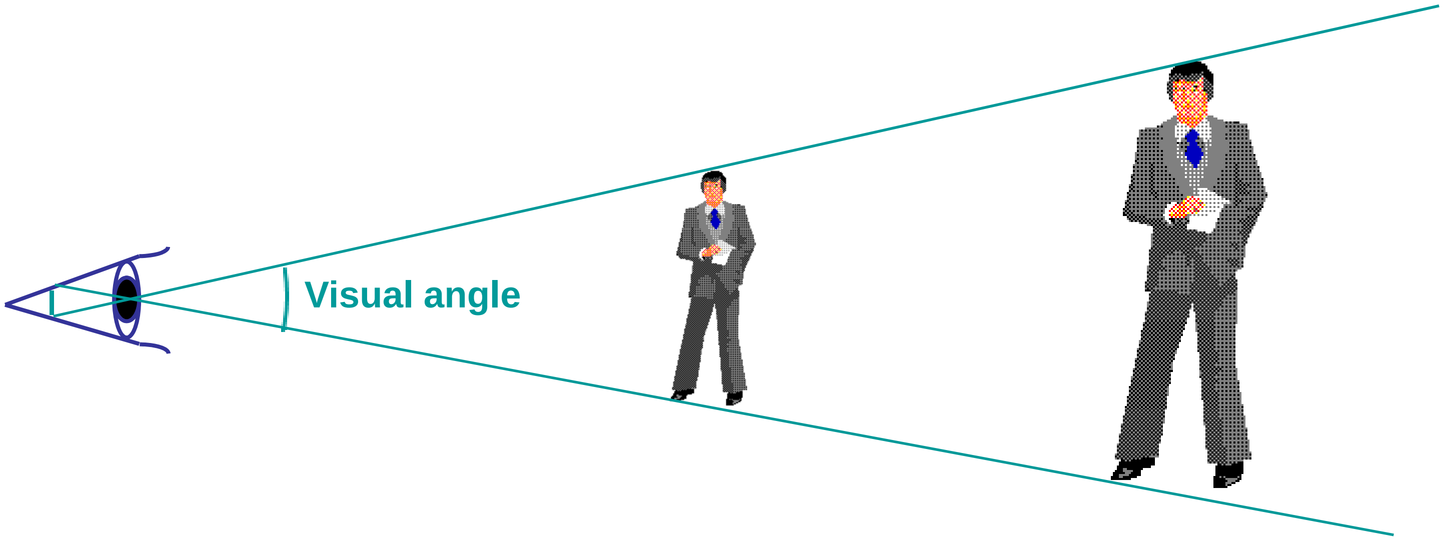


Visual angle

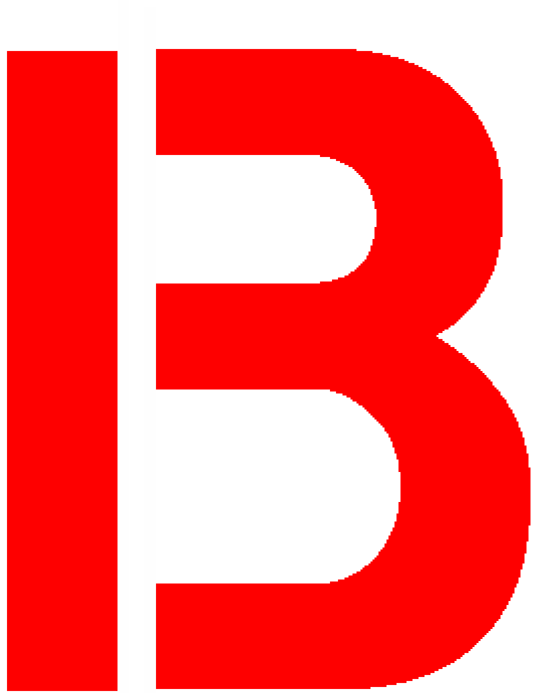


Objects of the same size at different distances have different visual angles

Objects of different sizes and different distances may have the same visual angle



An ambiguous shape?

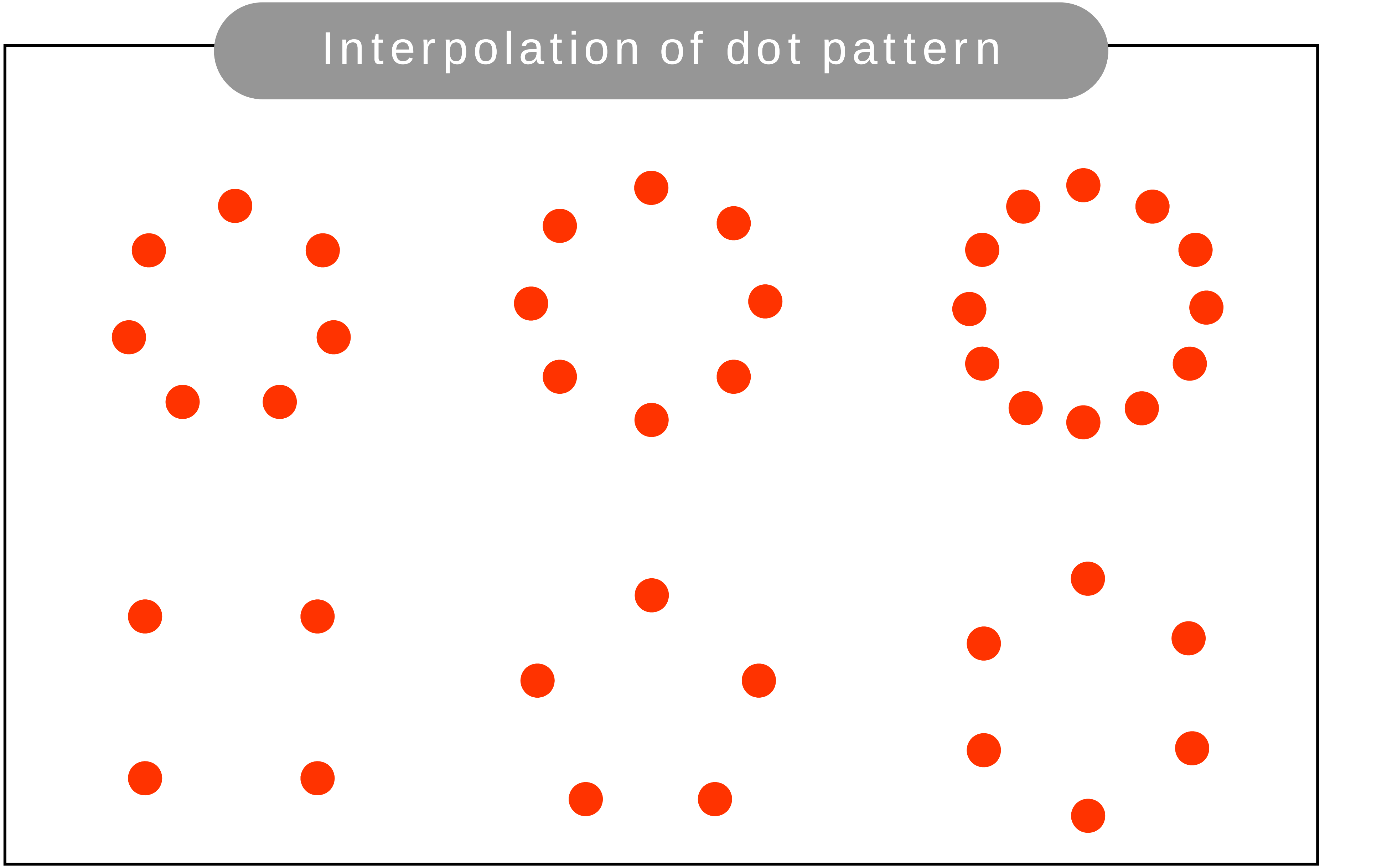


A B C

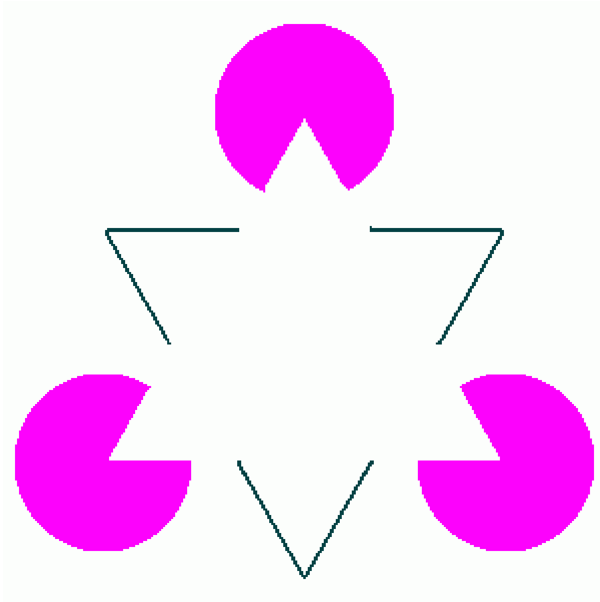
ABC

12 13 14

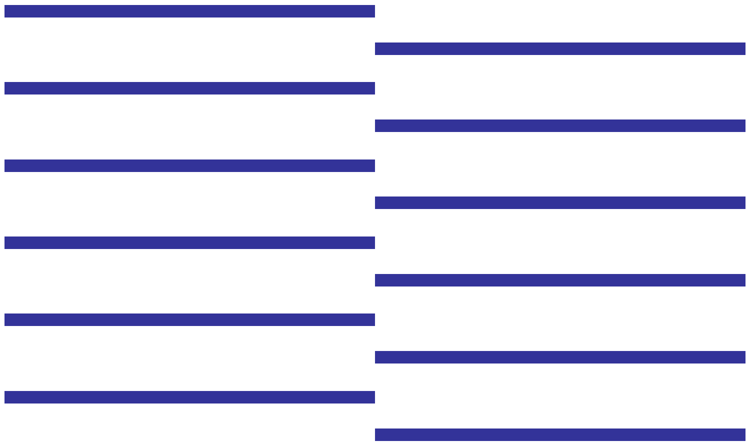
12 13 14


Interpolation of dot pattern

Examples of subjective outline by interpolation
- Virtual lines -



(a) Kanizsa triangle



(b) Subjective contour as the result of the response by the cells of V2 (secondary lateral occipital complex)

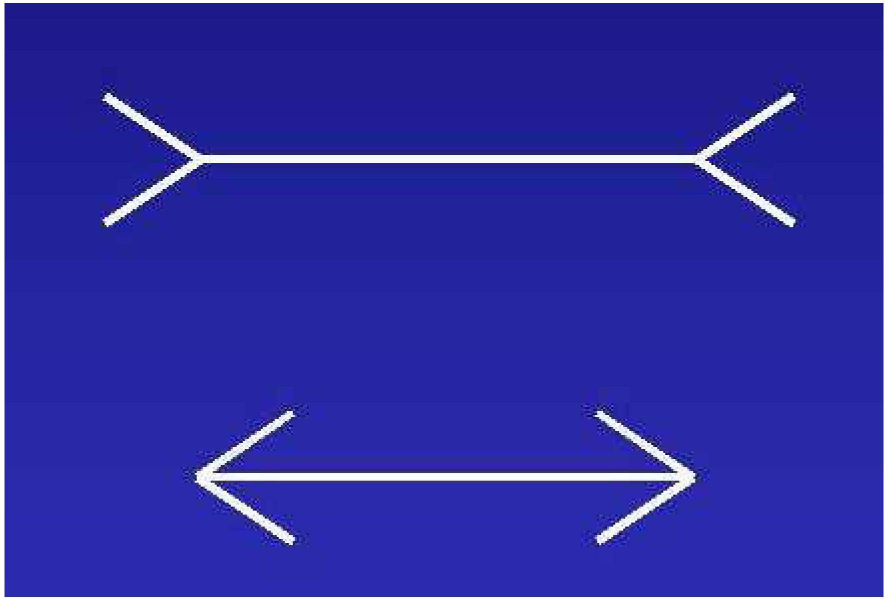
Law of gestalt (Grouping)

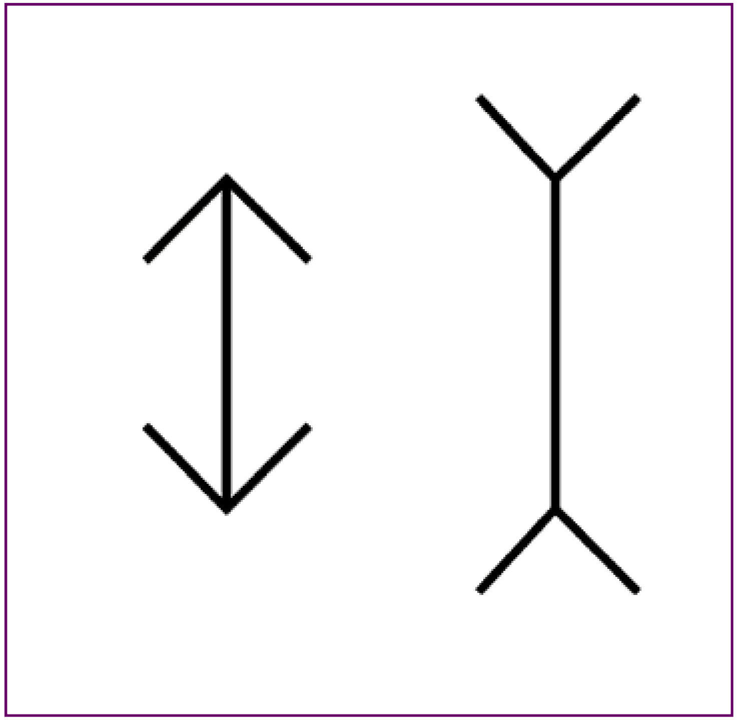
1	**Factor of proximity**	Elements close together tend to be grouped
2	**Factor of similarity**	Similar elements tend to be grouped
3	**Factor of closure**	Elements that mutually make closed forms tend to be grouped
4	**Factor of good continuity**	Elements having smooth continuity tend to be grouped
5	**Factor of good Gestalt**	Elements making simple, regular and symmetrical patters tend to be grouped
6	**Factor of common fate**	Elements having similar movement tend to be grouped
7	**Factor of no remainder**	Elements tend to be grouped so that nothing remained
8	**Factor of objective set**	Elements tend to be grouped depending on the sequence of presentation
9	**Factor of experiences**	Elements which are familiar in the past experiences tend to be grouped

Law of pregnanz

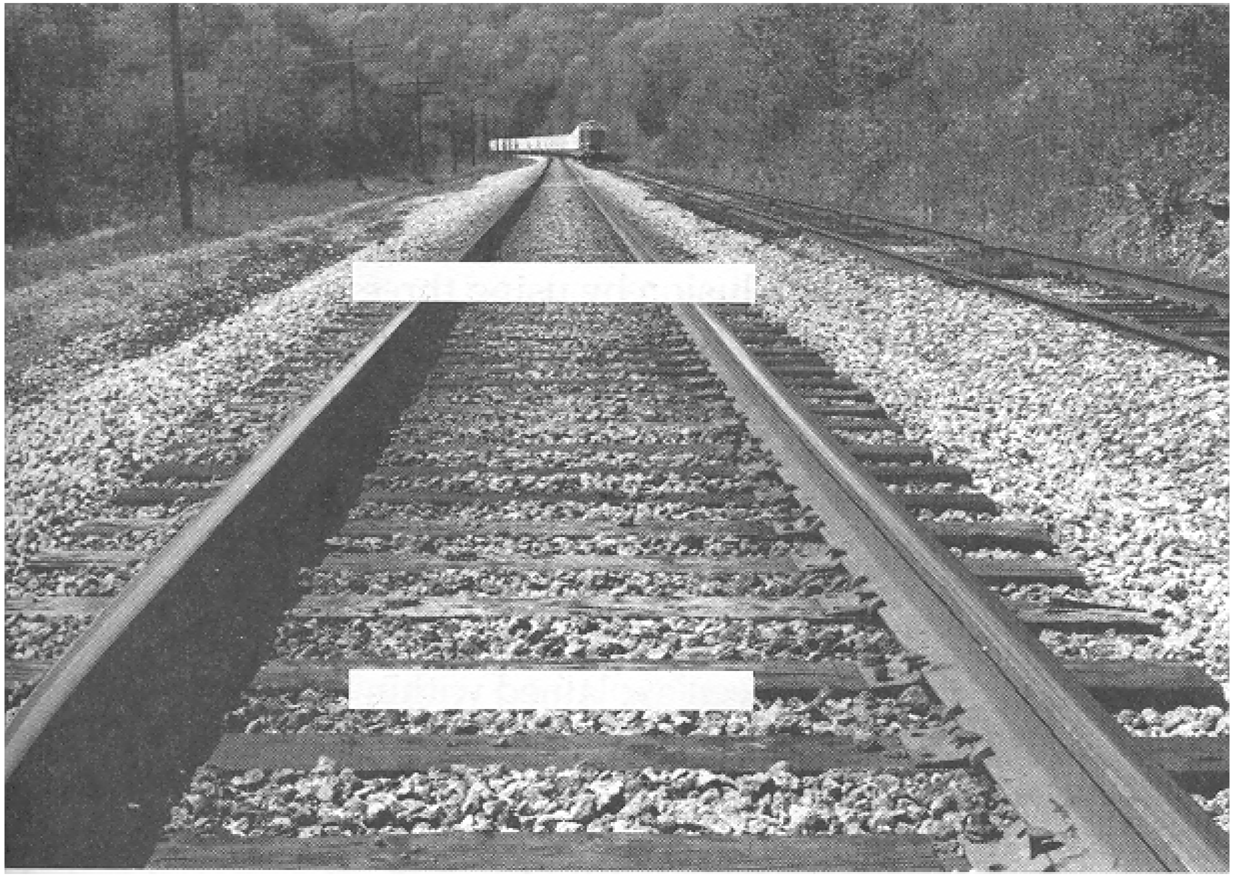
Elements tend to be grouped to make a simple, systematic and stable shape.

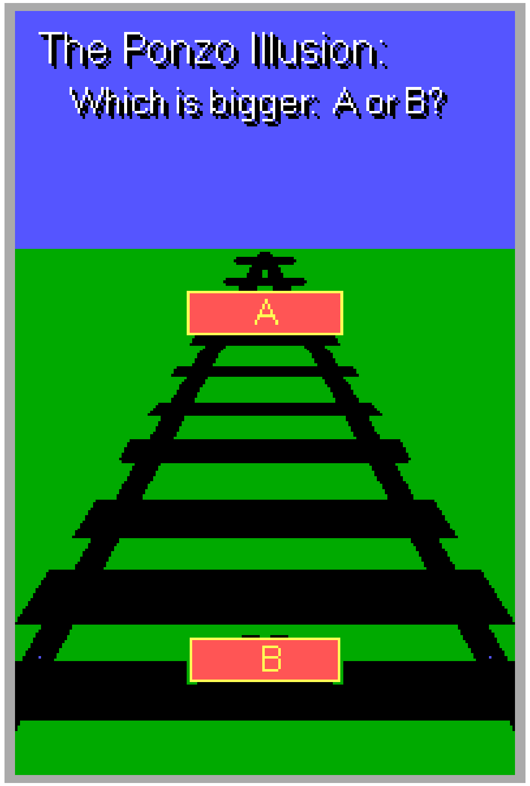
The Muller-Lyer illusion



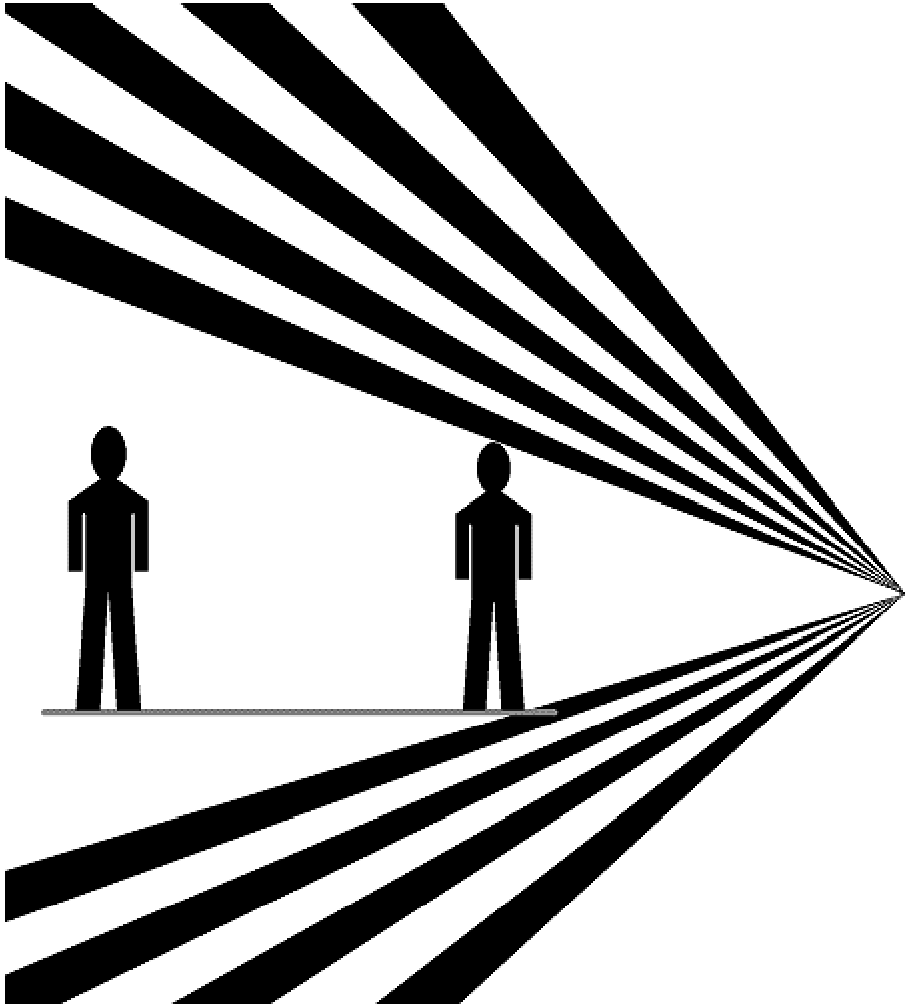


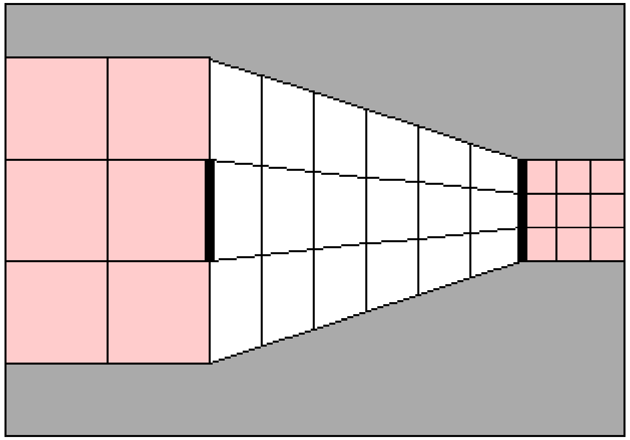
The Ponzo illusion 1





The Ponzo illusion 2





Is this text correct?

The quick brown fox jumps over the the lazy dog.