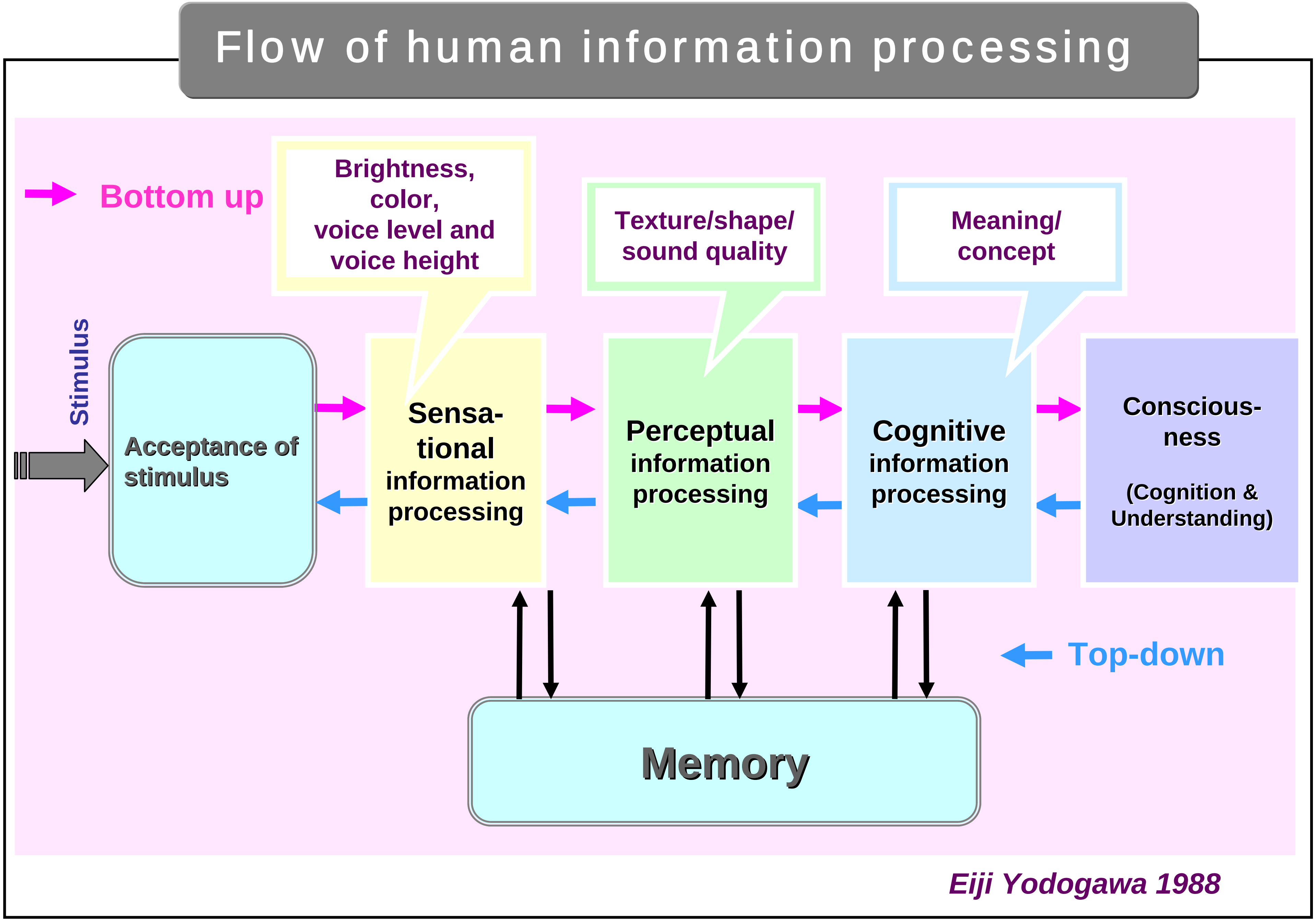
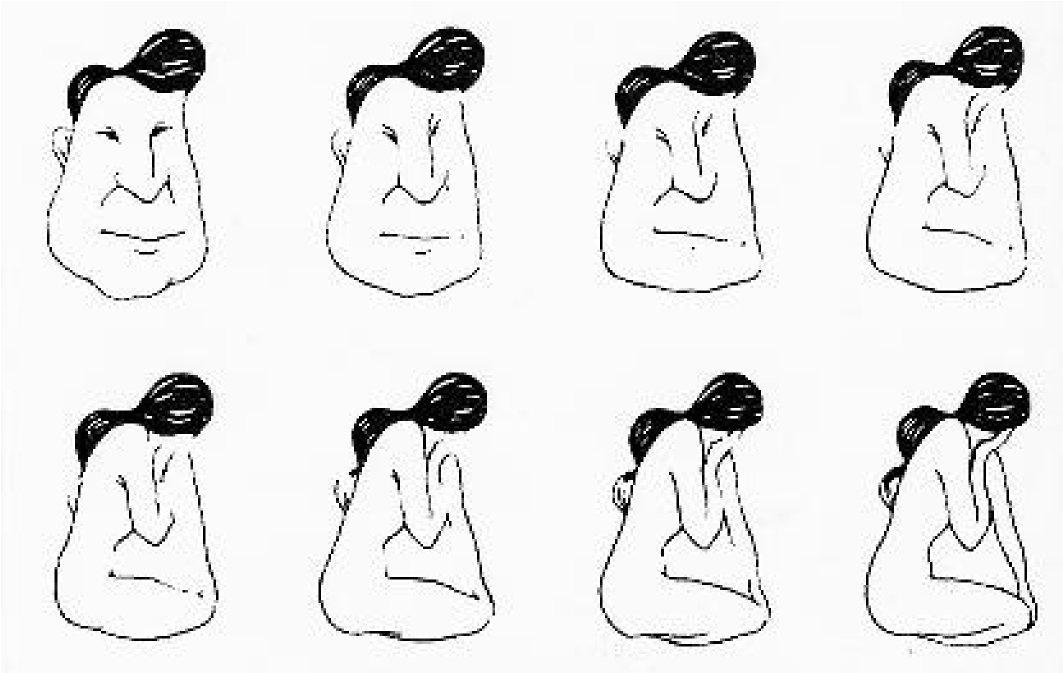

Flow of human information processing
Bottom up
Brightness, color, voice level and voice height
Texture/shape/ sound quality
Meaning/ concept
Stimulus
Acceptance of stimulus
Sensa- tional information processing
Perceptual information processing
Cognitive information processing
Conscious- ness
(Cognition & Understanding)
Top-down
Memory
Eiji Yodogawa 1988

Information integration

A girl and an old woman

Ambiguous Face

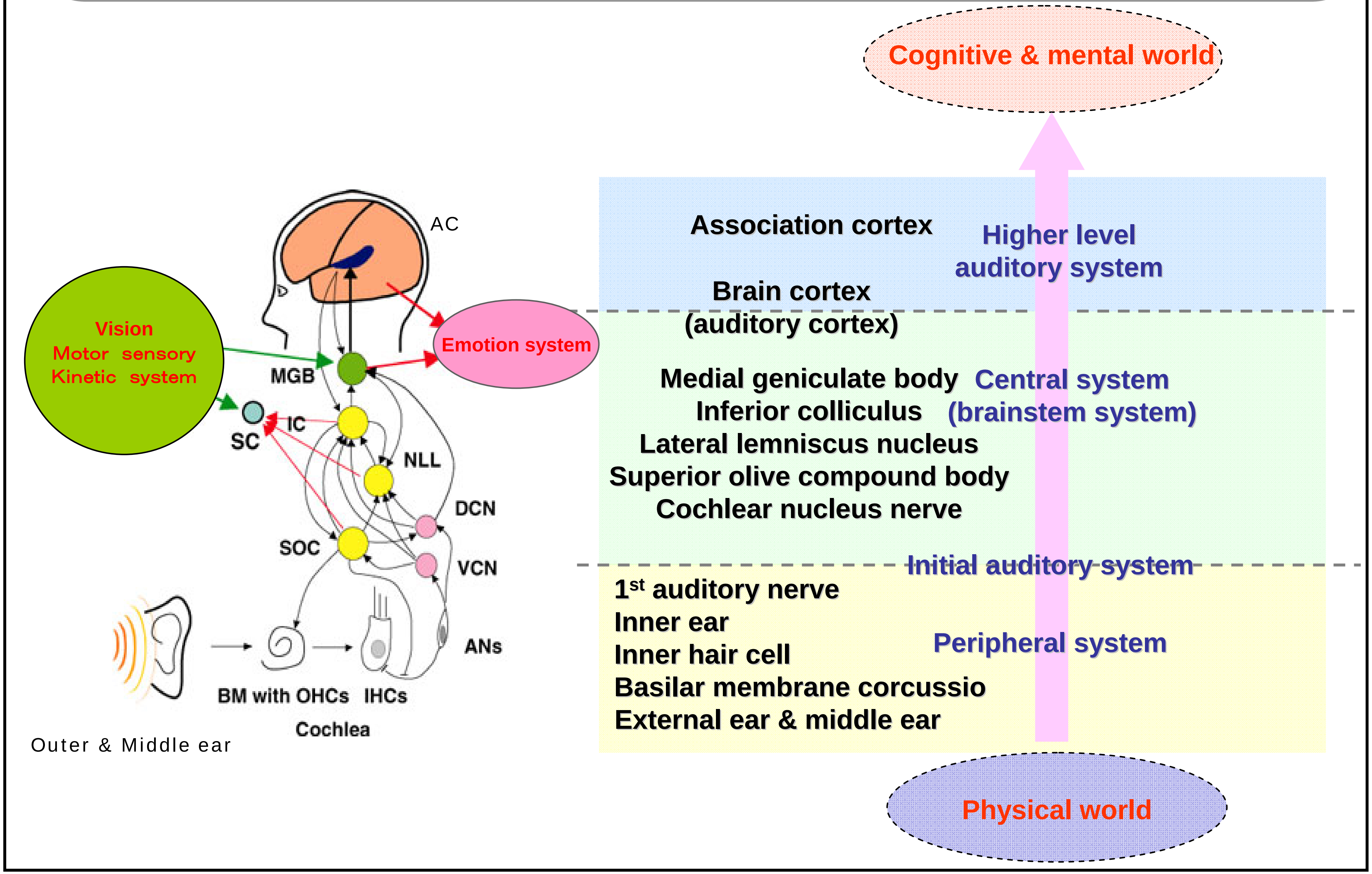
Information integration



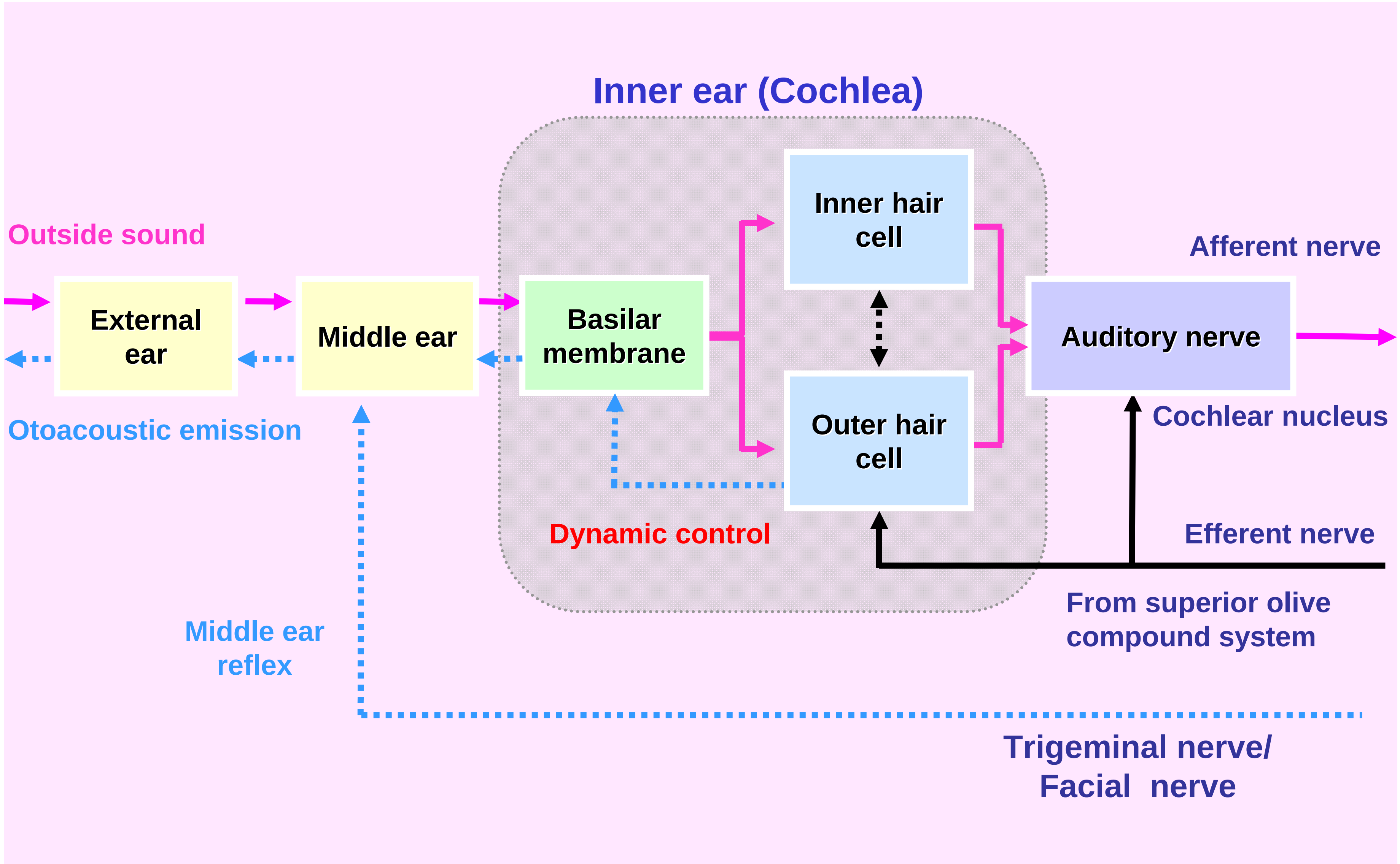
A man and a girl

Fisher1967

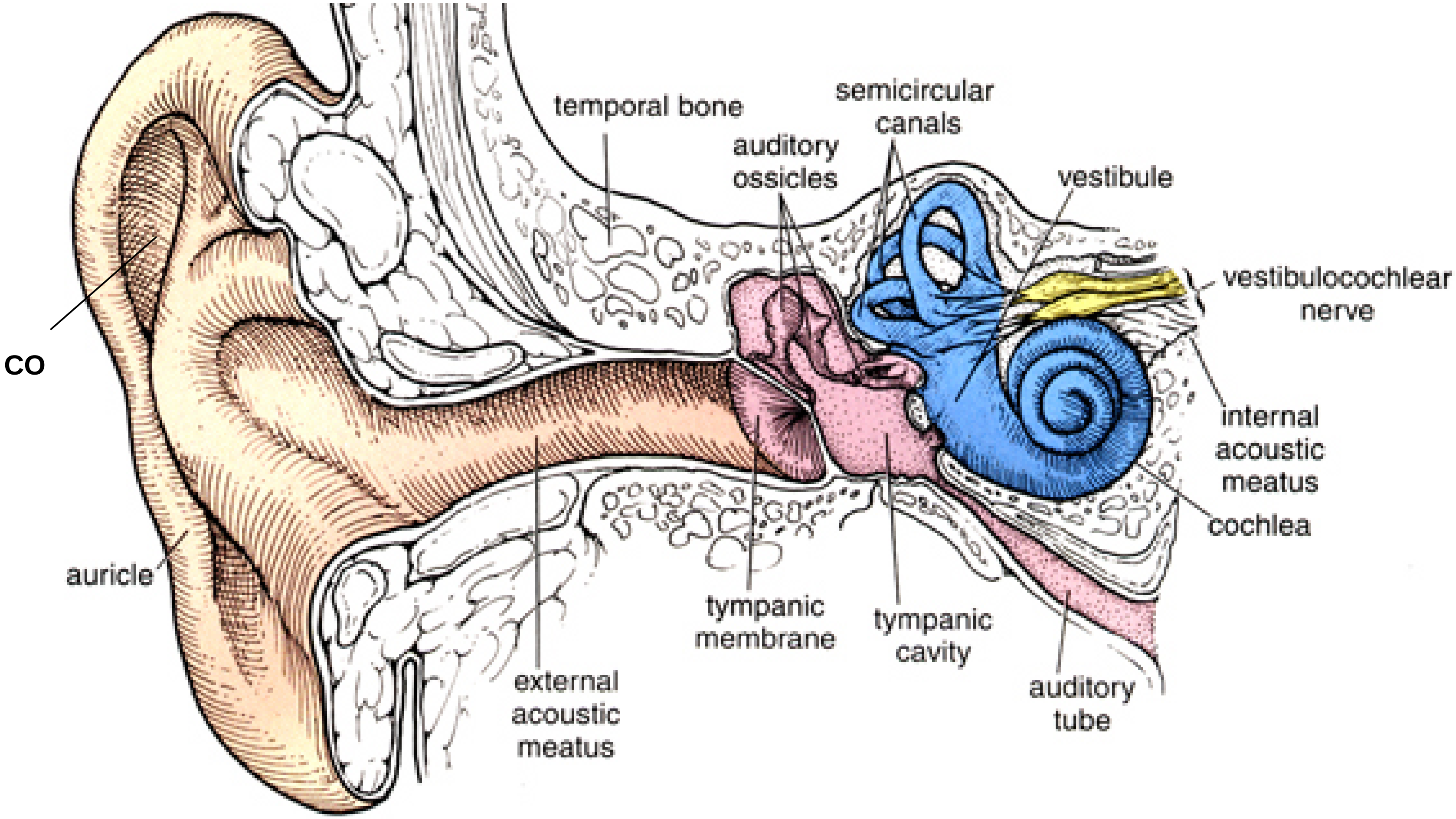
Initial and higher levels of auditory system



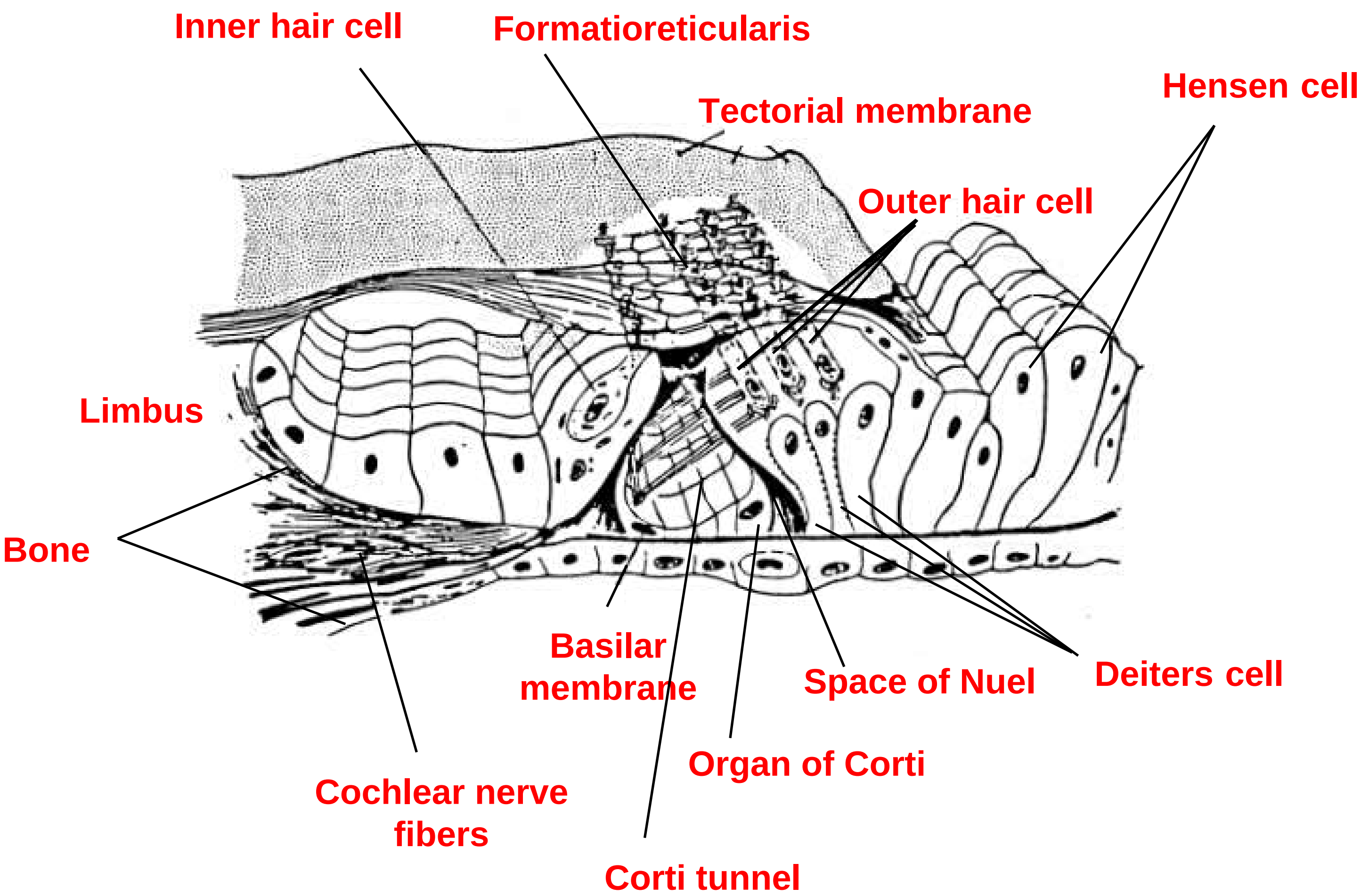
Block diagram of auditory nerve system



Structure of auditory nerve system



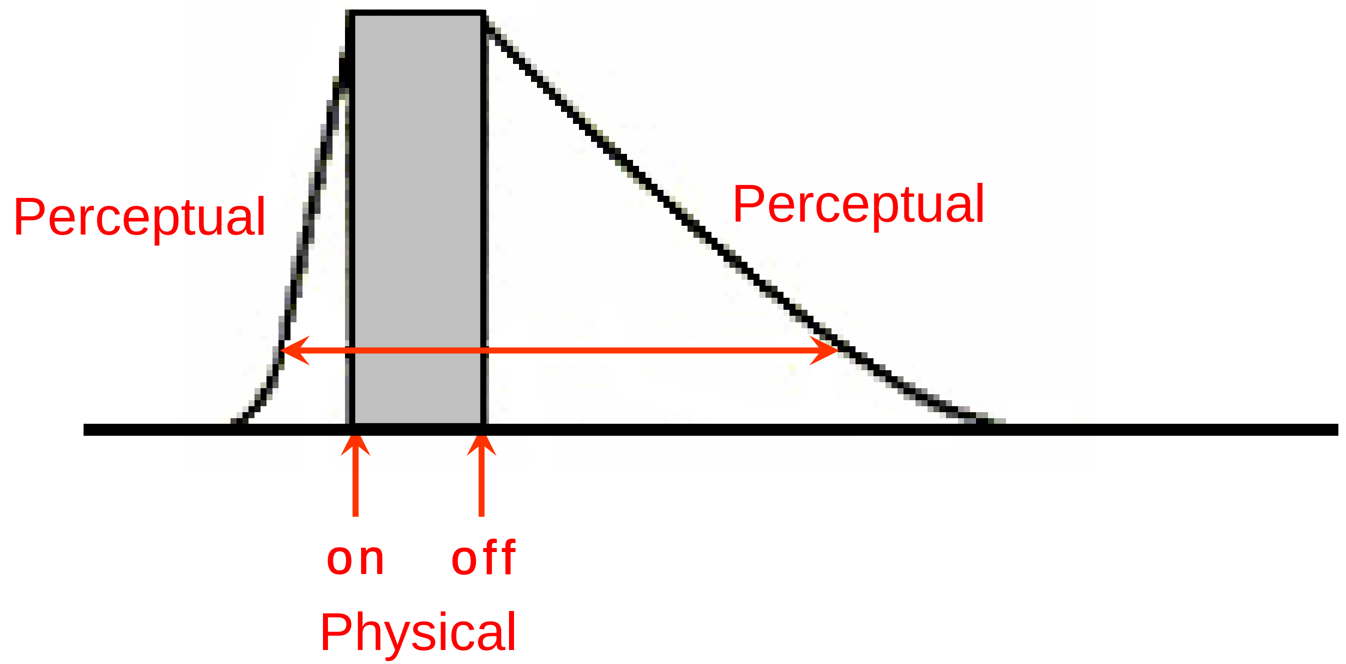
Cross section of Corti organ



Functions of acoustic peripheral system

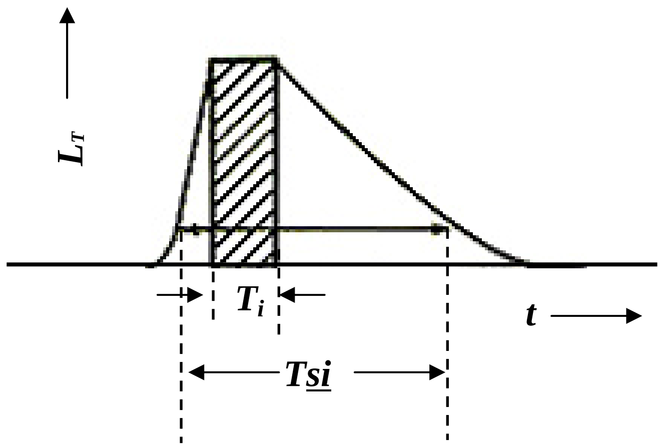
Part		Function
External ear		Band-pass filter
Middle ear		Impedance conversion
		Band-pass filter
		Automatic gain control
Inner ear	Basilar membrane vibration (motion)	Frequency conversion
		Adaptive Q-type band-pass filter
		Frequency masking
		Two tone interference (suppression)
		Combination tone generation
	Inner hair cell / Synapse connection	Half wave rectifier
		Saturation-type firing rate - sound pressure conversion
		Emphasis of rising
		Short-time adaptation
		Synchronous firing
1st acoustic nerve		Nerve excitation transmission path
Efferent nerve		Dynamic range control, etc.

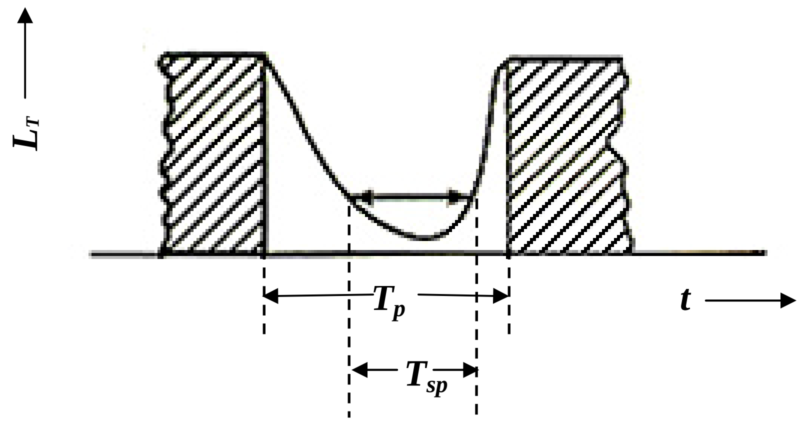
Masking



Physical and perceptual sound on-off (*Fastl*、*1981*)

Model of subjective time duration





Short sound with physical time duration T_i

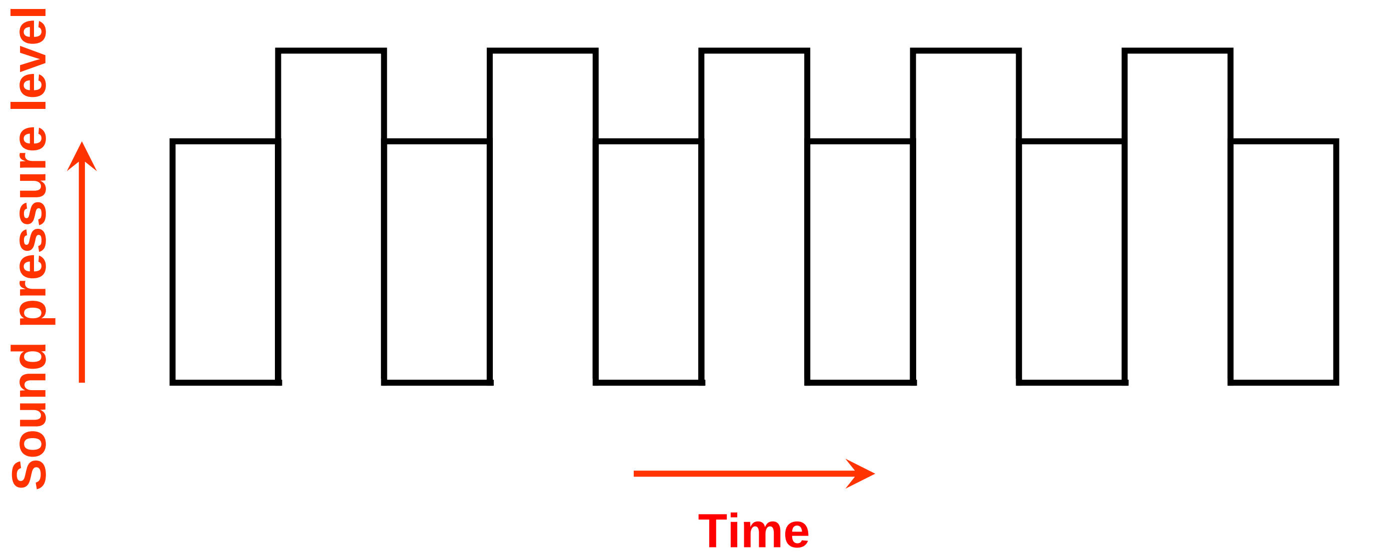
Subjective time duration
by the model is expressed by T_{si}

Sound sequence with physical blank length T_p

Subjective blank duration
by the model is expressed by T_{sp}

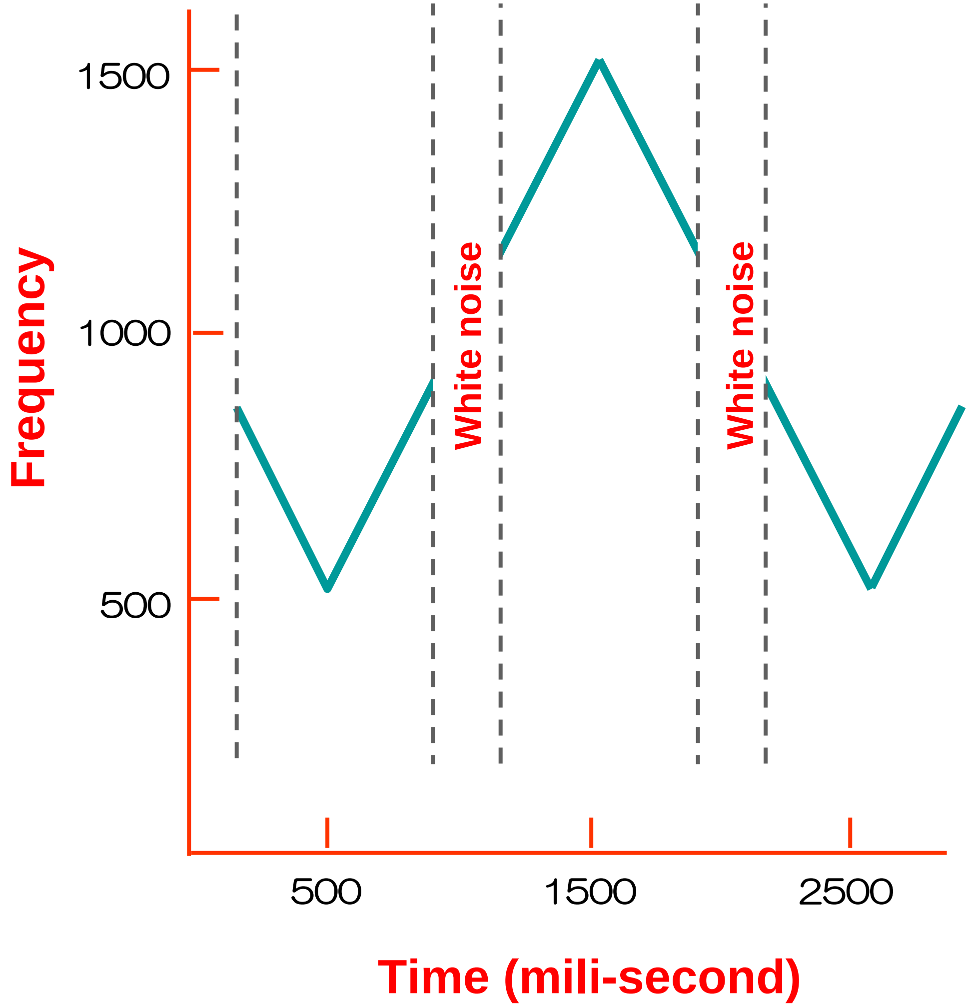
Fastl 1981

Illusion



Illusion by iterative presentation of loud and soft sounds
(Similar to the visual fence illusion)

Law of continuation/ Auditory induction

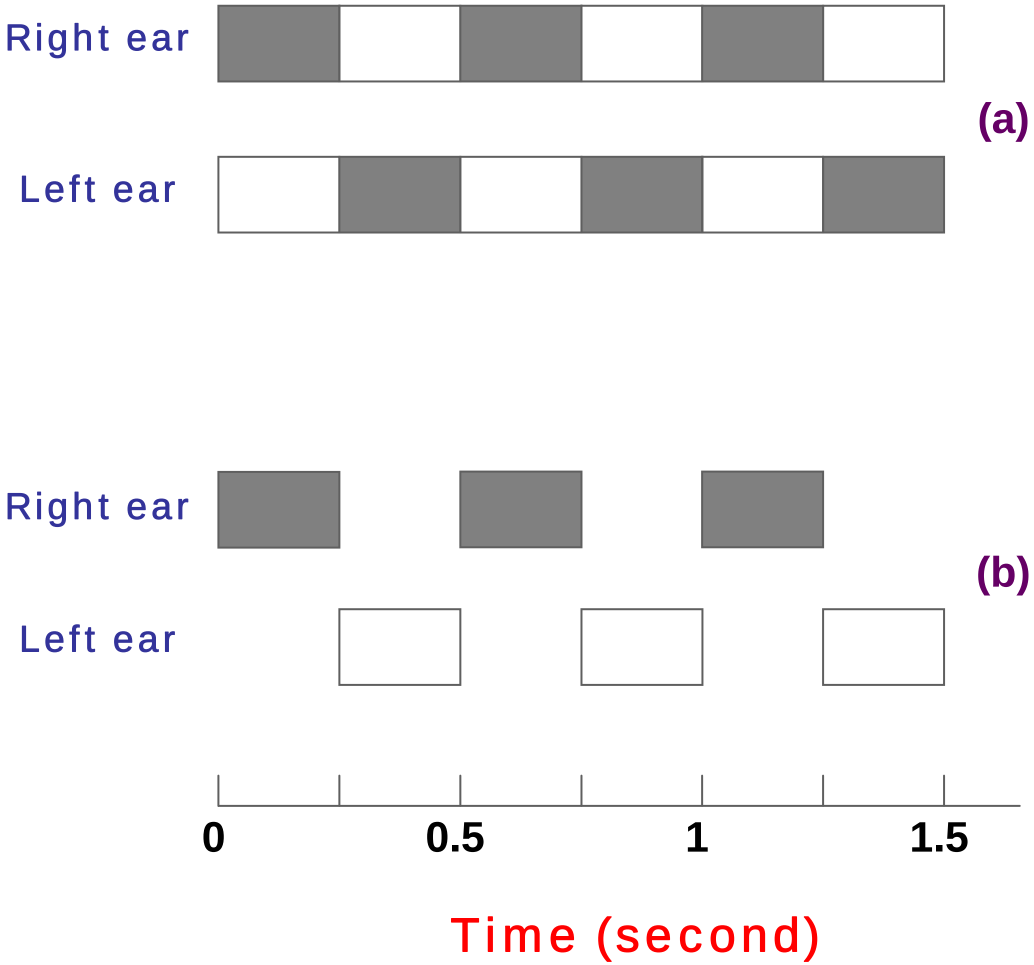


Phonetic restoration

Even if a pure tone with smoothly changing frequency is interrupted by white noise, the pure tone is continuously heard.

(*illusory continuity; Warren、1982*)

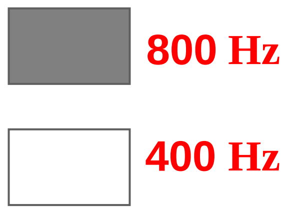
Scale illusion



(Octave illusion)

High sound is heard from the right ear and low sound is heard from the left ear like (b).

(*Deutsch*、*1983*)



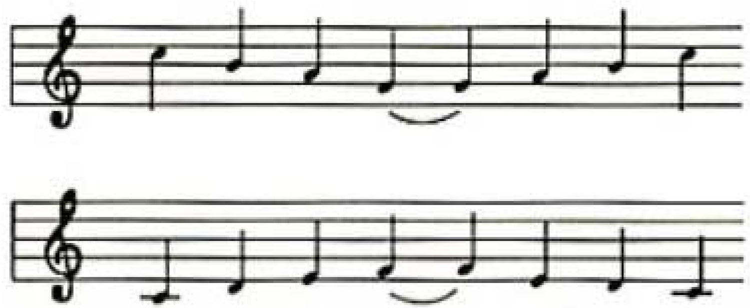
An example of a music making scale illusion

♪ = 240

(a)

Right

Left



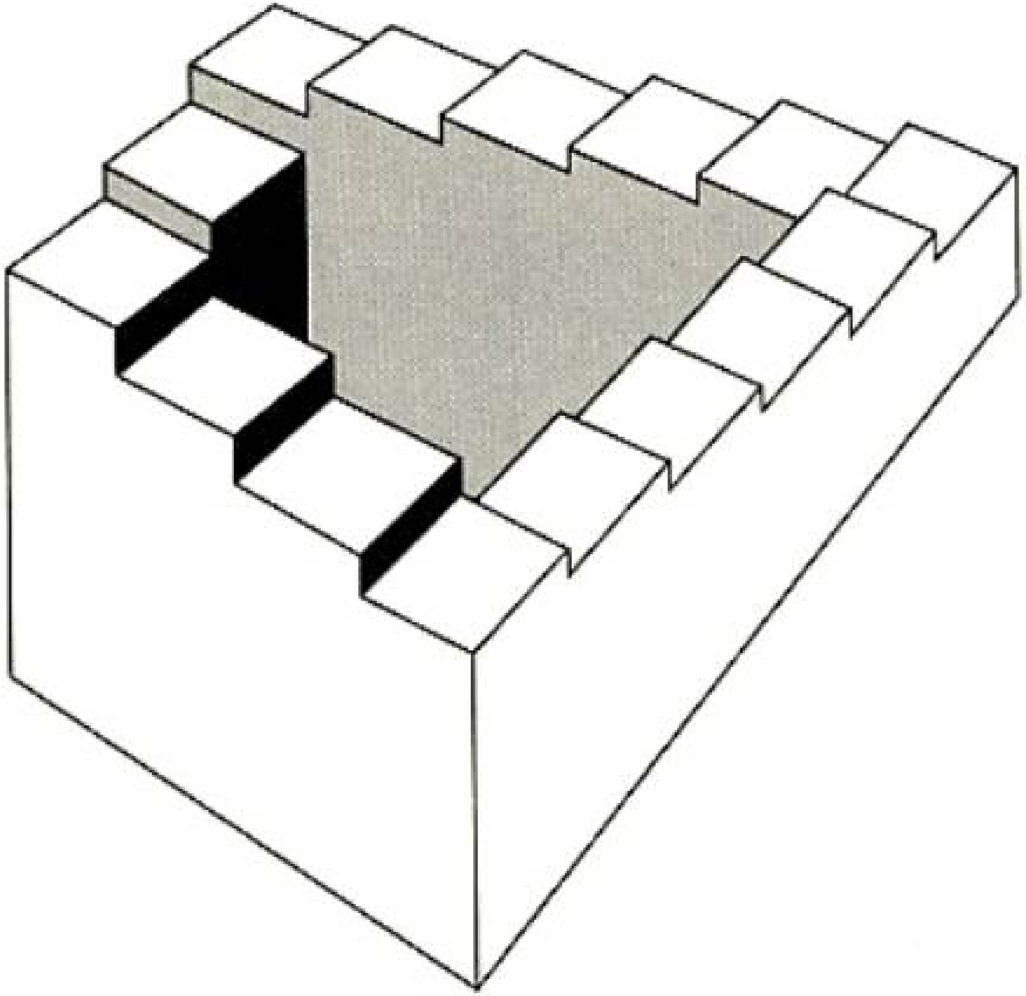
(b)

(*Deutsch、1983*)

Waterfall

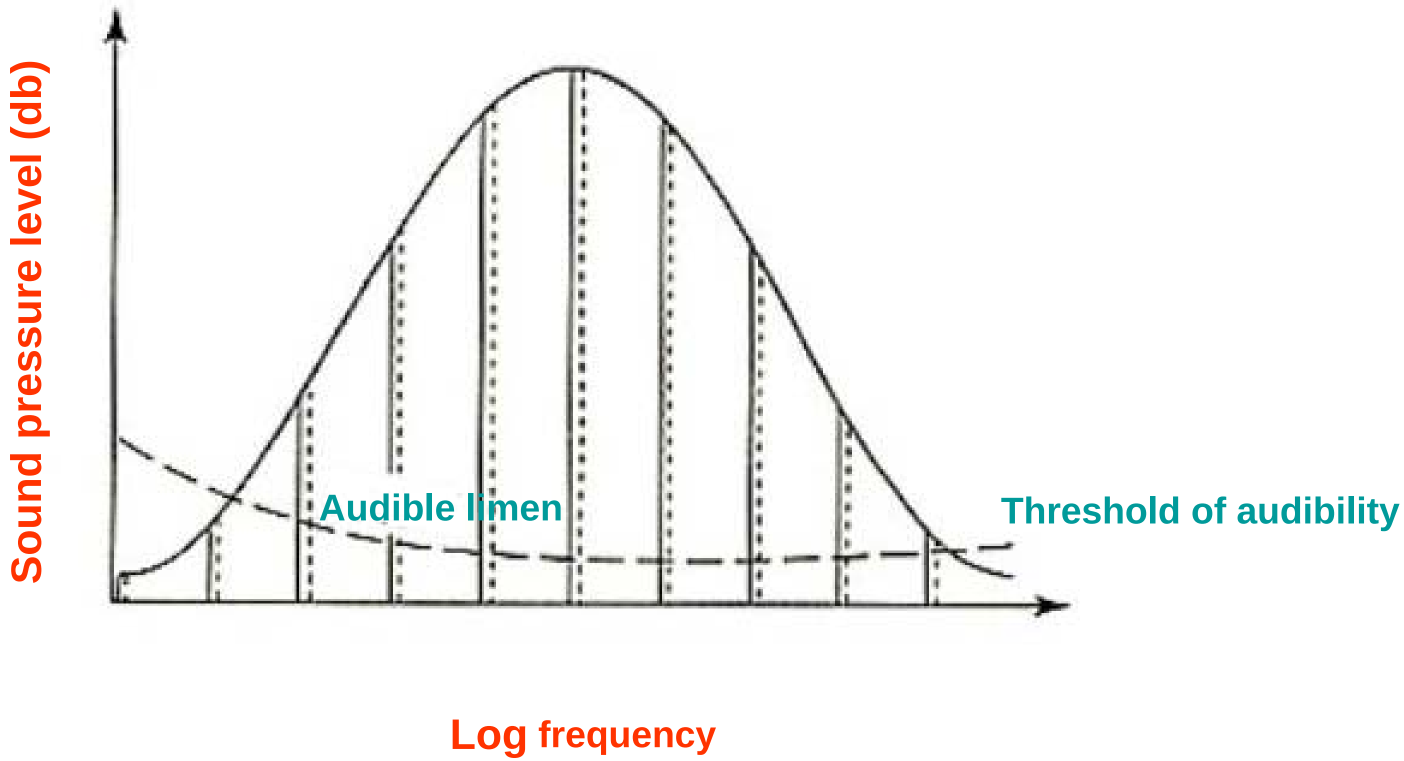
Escher 1961

Endless stairs



Spectral structure of tones in endless scale

Mechanism of pitch paradox, “endless scale”



Shepard 1983

Worked exercise

Suggest ideas for an interface which uses the properties of sound effectively.

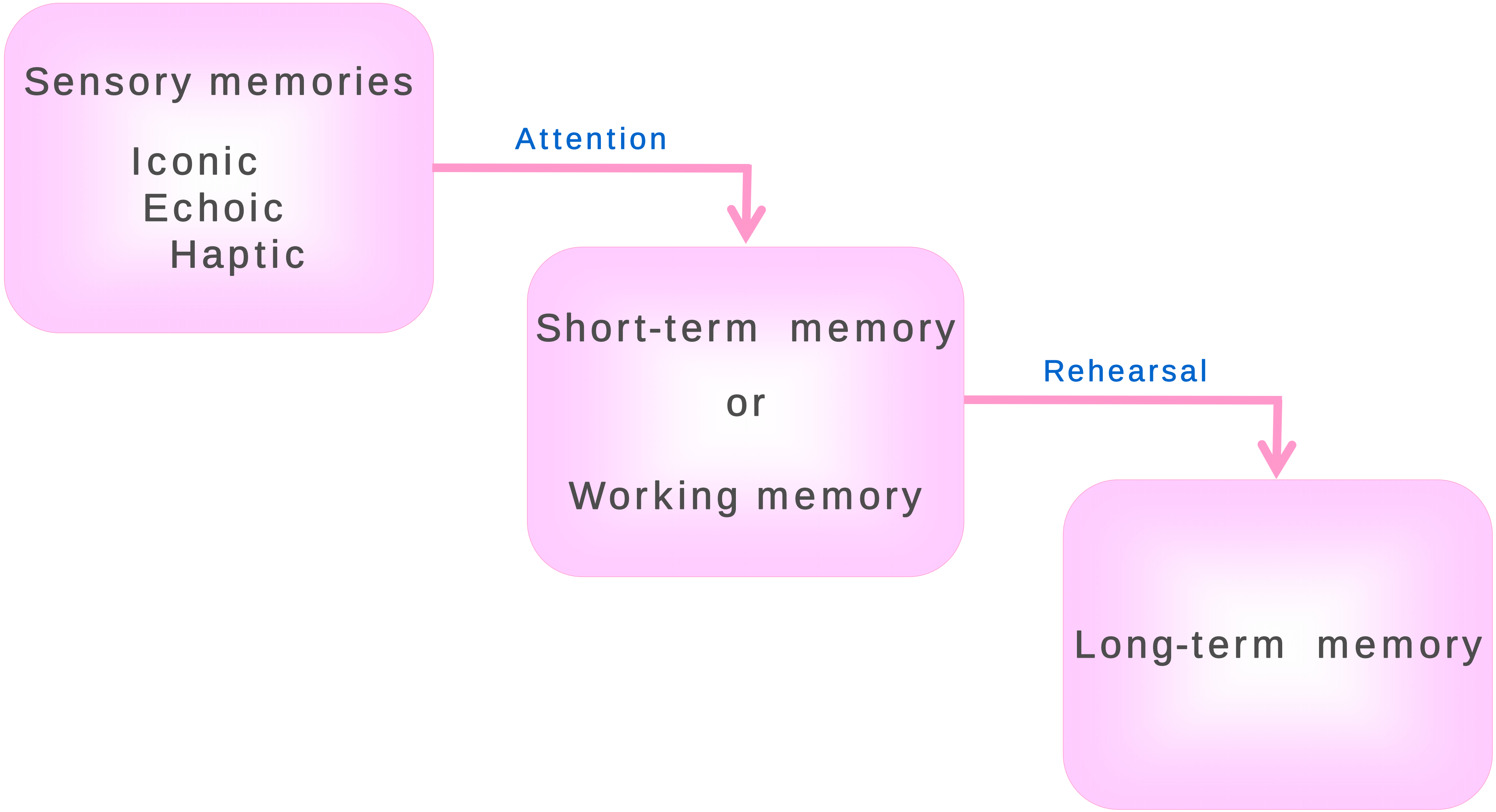
Answer

You might approach this exercise by considering how sound could be added to an application with which you are familiar. Use your imagination. This is also a good subject for a literature survey.

Speech sounds can obviously be used to convey information. This is useful not only for the visually impaired but also for any application where the user's attention has to be divided (for example, power plant control, flight control, etc.). Uses of non-speech sounds include the following:

- Attention – to attract the user's attention to a critical situation or to the end of a process, for example.
- Status information – continuous background sounds can be used to convey status information. For example, monitoring the progress ot a process (without the need for visual attention).
- Confirmation – a sound associated with an action to confirm that the action has been carried out. For example, associating a sound with deleting a file.
- Navigation – using changing sound to indicate where the user is in a system. For example, what about sound to support navigation in hypertext?

A model of the structure of memory



Design Focus

Cashing in

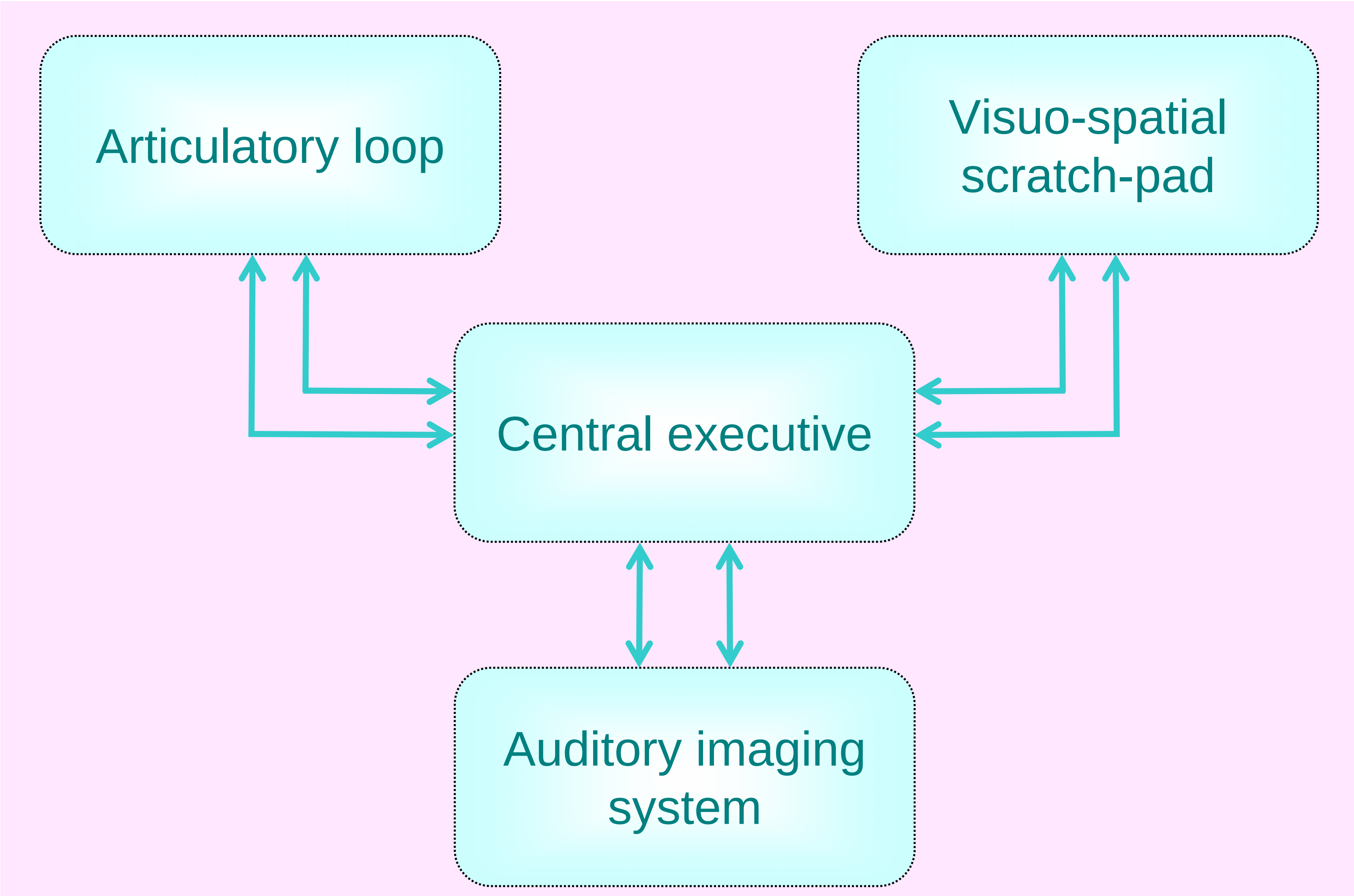
Closure gives you a nice 'done it' when we complete some part of a task. At this point our minds have a tendency to flush short-term memory in order to get on with the next job. Early automatic teller machines (ATMs) gave the customer money before returning their bank card. On receiving the money the customer would reach closure and hence often forget to take the card. Modern ATMs return the card first!

Can you remember?

HEC ATR ANU PTH ETR EET

THE CAT RAN UP THE TREE

A more detailed model of short-term memory

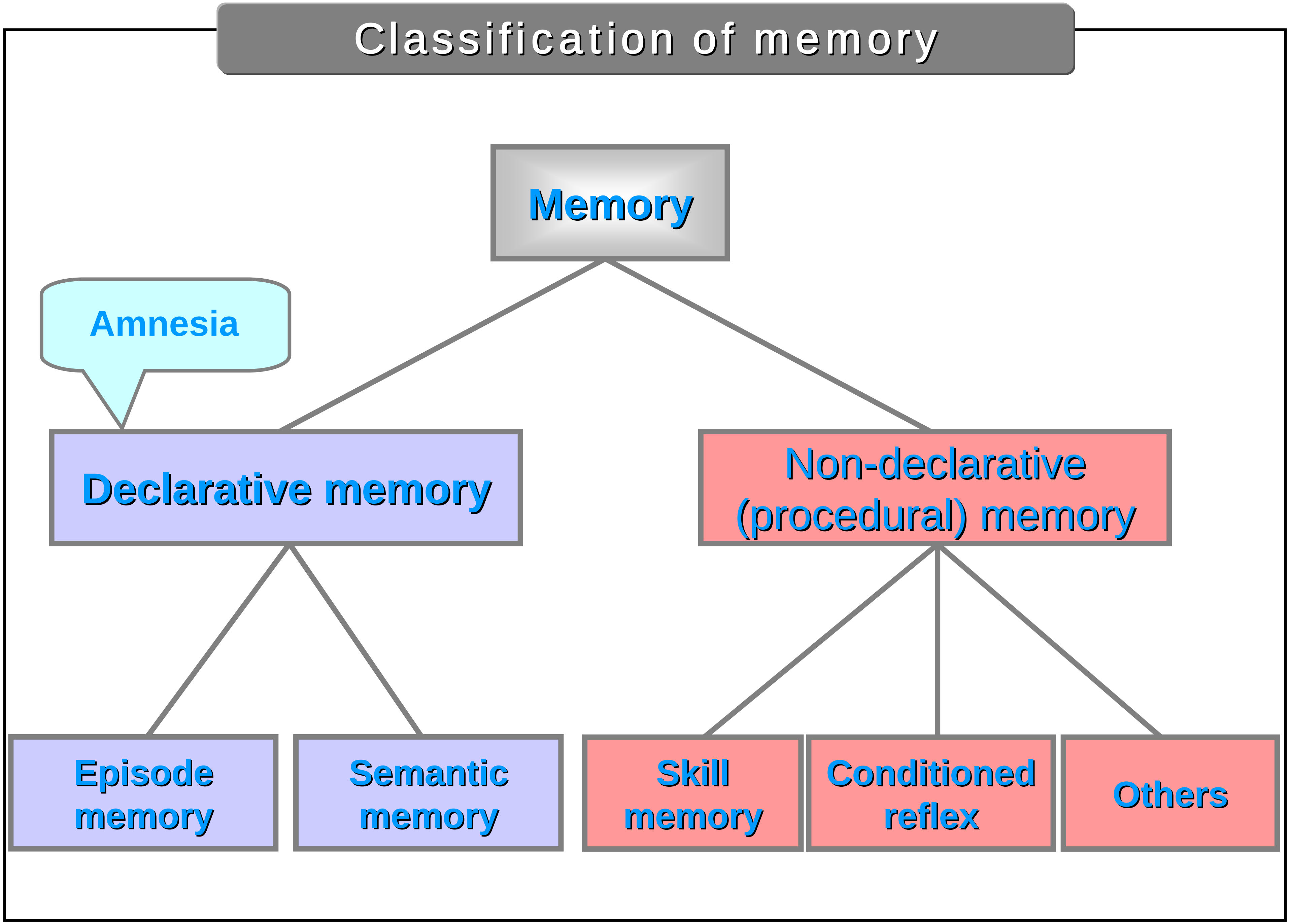


Improve your memory

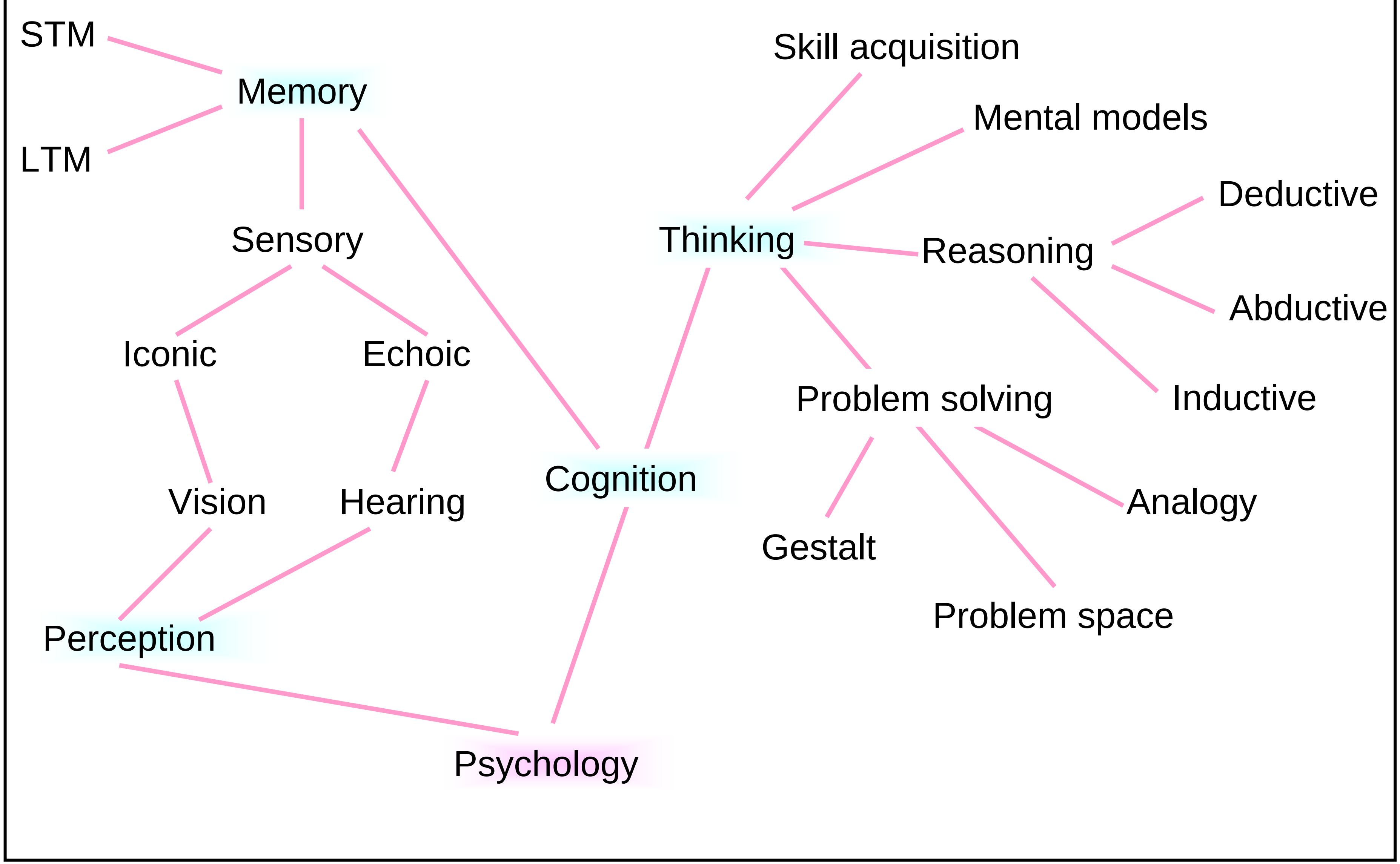
Many people can perform astonishing feats of memory: recalling the sequence of cards in a pack (or multiple packs – up to six have been reported), or recounting π to 1000 decimal places, for example. There are also adverts to 'Improve Your Memory' (usually leading to success, or wealth, or other such inducement), and so the question arises: can you improve your memory abilities? The answer is yes; this exercise shows you one technique.

Look at the list below of numbers and associated words:

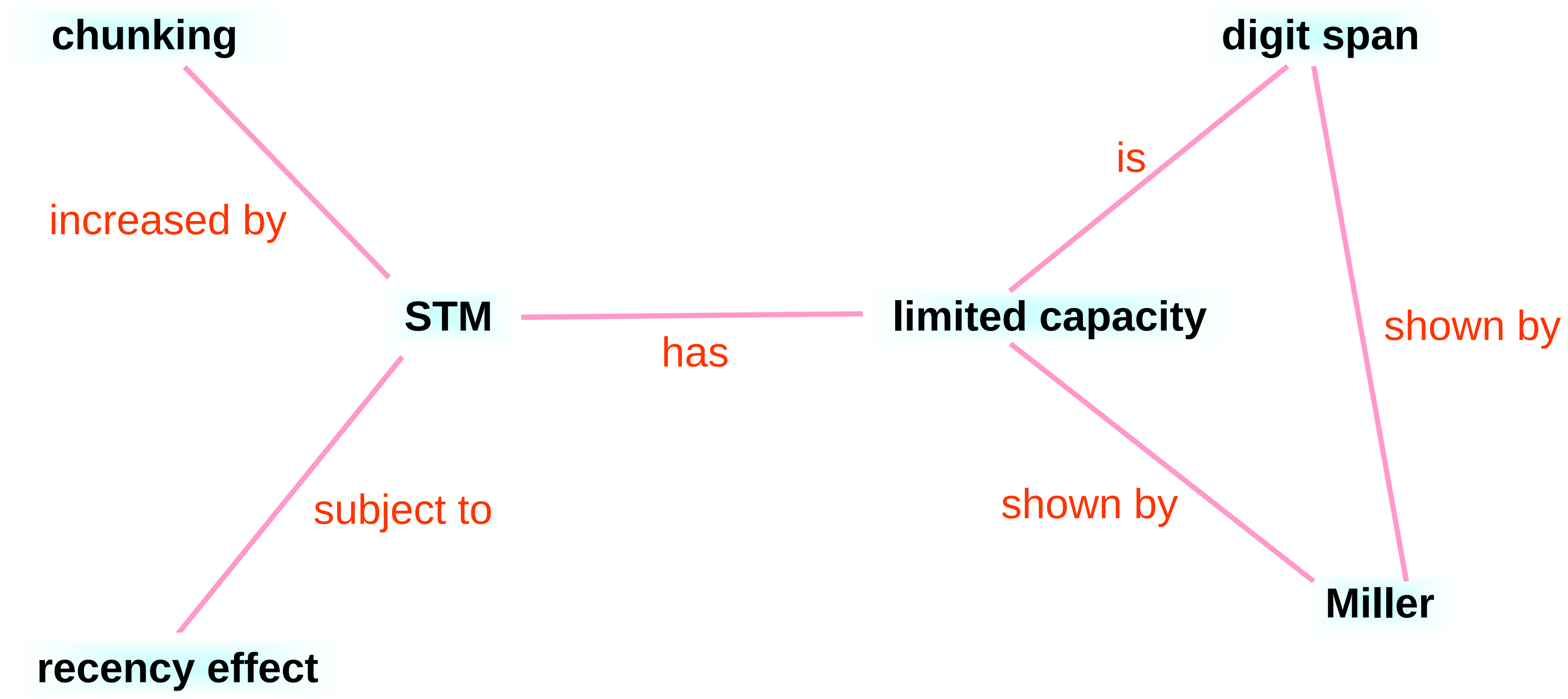
1	bun	6	sticks
2	shoe	7	heaven
3	tree	8	gate
4	door	9	wine
5	hive	10	hen


Classification of memory
Memory
Amnesia
Declarative memory
Non-declarative (procedural) memory
Episode memory
Semantic memory
Skill memory
Conditioned reflex
Others

Semantic network (Bottom-up view)



Semantic network (Top-down view)



Long-term memory may store information in a semantic network

A frame-based representation of knowledge

DOG	COLLIE
Fixed	**Fixed**
legs: 4	breed of: DOG
	type: sheepdog
Default	**Default**
diet: carnivorous	size: 65cm
sound: bark	
Variable	**Variable**
size:	colour:
colour:	

Representation of knowledge by script

A script for visiting the vet

Entry conditions: *dog ill*
vet open
owner has money

Result: *dog better*
owner poorer
vet richer

Props (objects): *examination table*
medicine
instruments

Roles: *vet examines*
diagnoses
treats
owner brings dog in
pays
takes dog out

Scenes: *arriving at reception*
waiting in room
examination
paying

Tracks: *dog needs medicine*
dog needs operation

Reasoning

- **Deductive reasoning: derives the logically necessary conclusion from the given premises**

  If it is Friday then she will go to work

  It is Friday

  Therefore she will go to work

- **Inductive reasoning: generalizes from cases we have seen to infer information about cases we have not seen.**

  If every elephant we have ever seen has a trunk, we infer that all elephants have trunks

- **Abductive reasoning: reasons from a fact to the action or state that caused it.**

  Suppose we know that Sam always drives too fast when she has been drinking. If we see Sam driving too fast we may infer that she has been drinking.

Wason's cards (Inductive reasoning)

4	E	7	K

Each card has a number on one side and a letter on the other. Which cards would you need to pick up to test the truth of the statement 'If a card has a vowel on one side it has an even number on the other'?