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# National Program on Technology Enhanced Learning (NPTEL)

# Presents

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Course Title:

# Basic Cognitive Processes

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# Lecture 25: Attention - II

# Selective Attention

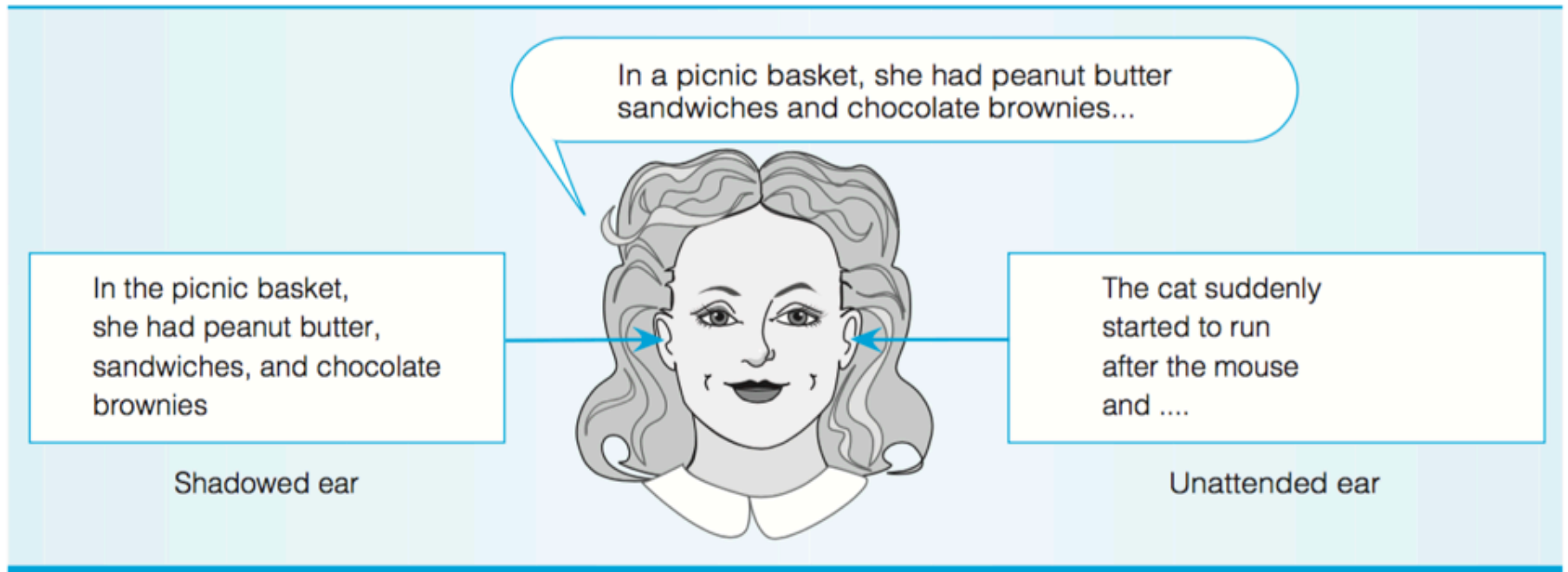
- it often happens in public gatherings like in parties or restaurants etc.; that some other ongoing conversations than the one you are currently involved in grabs our attention.
- Colin Cherry (1953) referred to this phenomenon as the **cocktail party effect**, i.e. the process of tracking one conversation in the face of the distractions from other conversations.
- Cherry observed that cocktail parties are often settings in which selective attention is salient.

**When you hear your name**

**in someone else's conversation**



- Cherry studied selective attention in a carefully controlled experimental setting; task known as **shadowing**.
- In shadowing, one listens to two different messages. Cherry presented a separate message to each ear; known as **dichotic presentation**; and asked the participants to repeat back only one of the messages as soon as possible after hearing it.
- Cherry's participants were quite successful in shadowing distinct messages in dichotic listening tasks, although such shadowing required a significant amount of concentration.



**Figure 4.8 Dichotic Presentation.**

In dichotic presentation, each ear is presented a separate message.

Image: Sternberg & Sternberg (2011) *Cognitive Psychology*. Wadsworth Publishing. 9<sup>th</sup> ed. ( p. 149).

- The participants were also able to notice physical, sensory changes in the unattended message - for example, when the message was changed to a tone or the voice changed from a male to female voice.
- However, they did not notice the semantic changes in the unattended message. They also failed to notice even when the unattended message shifted from English to German or was played backward.
- Conversely, about 1/3 of the people, when their name is presented during these situations shifted their attention to their name. Some researchers have noticed that those who hear their name in the unattended message have limited working memory capacity & are thus easily distracted (Conway, Cowan & Bunting, 2000).

- Three factors could help one to selectively attend the target speaker, if you are caught in a busy restaurant among many conversations:
  - distinctive sensory characteristics of the target's speech. e.g. high vs low pitch, pacing & rhythm.
  - sound intensity (loudness)
  - location of the sound source (Brungard & Simpson, 2000).

- **Theories of Selective Attention**

- The theories of selective attention can be grouped into **filter & bottleneck** theories.

- A filter blocks some of the information going through and thereby selects only a part of the total information to pass through the next stage.

- A bottleneck slows down information passing through.

- Two questions:
  - Whether there is a distinct filter for incoming information?
  - Where in the processing does filtering occur, Early or Late?

- **Broadbent's Model:** Acc. to one of the earliest theories of attention, we filter information right after we notice it at the sensory level (Broadbent, 1958).
- Multiple channels of sensory input reach an attentional filter; those channels can be distinguished by their characteristics like loudness, pitch, or accent.
- The filter permits only one channel of sensory information to proceed and reach the process of perception.
- We thereby assign meaning to our sensations.

- Other stimuli will be filtered out at the sensory level and may never reach the level of perception.
- Broadbent's theory was supported by Colin Cherry's findings that sensory information sometimes may be noticed by an unattended ear if it does not have to be processed elaborately (e.g. voice shifts to tone); but information requiring higher perceptual processes is not noticed if not attended to (e.g. English shifts to German).



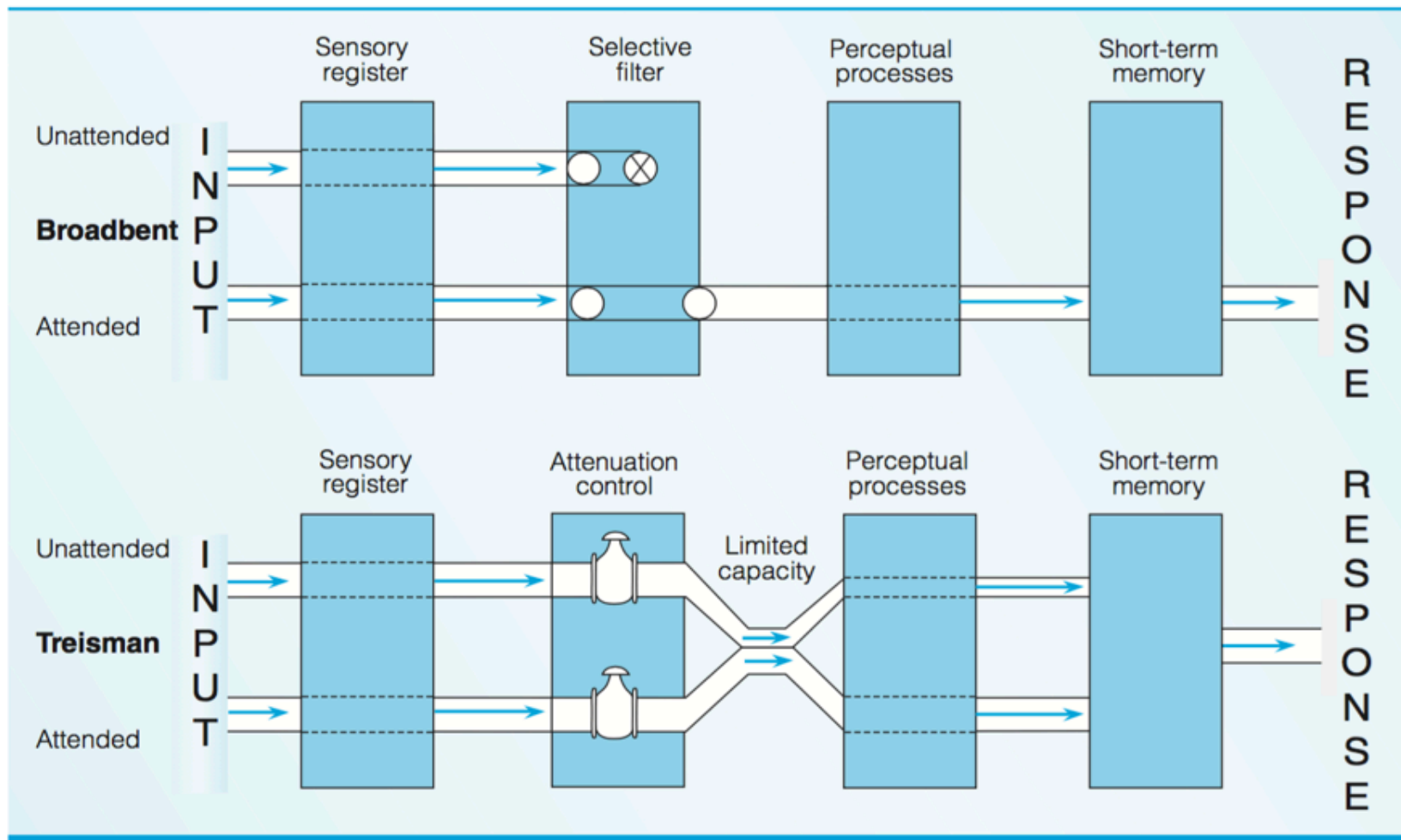
- **Selective Filter Model:** Moray found that even when participant's ignore most other high level aspects of an unattended message, they frequently still recognise their names in an unattended ear (Moray, 1959).
- He suggested that the reason for this effect is that messages that are of high importance to a person may anyways breakthrough the filter of selective attention; though other messages may not.
- To modify Broadbent's metaphor, one could say that, according to Moray, the selective filter blocks out most information at the sensory level; but some personally relevant information can still burst through.

- **Attenuation Model:** Treisman explored why some unattended messages pass through the filter by conducting some experiments.
- She had participants shadowing coherent messages, and at some point, switched the remainder of the message to the unattended ear.
- Participants picked up the first few words of the message they had been shadowing in the unattended ear (Treisman, 1960); so they somehow must have been somehow processing the content of the unattended message.

- Moreover, if the unattended message was identical to the amended one; all participants notice it. They noticed even if one of the messages was slightly out of temporal synchronisation with the other.
- Trainman also observed that some fluently bilingual participants noticed the identity of the messages if the unattended message was a translated version of the attended one.

- Her findings suggested that at least some information about unattended signals is being analysed.
- Treisman proposed a theory of selective attention that involves a later filtering mechanism.
- Instead of blocking stimuli out, the filter merely weakens the strength of the stimuli other than the target stimulus.
- So, when stimuli reach us, we analyse them at a low level for target properties like loudness & pitch; if the stimuli possess those target properties, we pass the signal on to the next stage; if they do not possess the target properties a weakened version is passed on to the next stage.

- In a next step, we perceptually analyse the meaning of the stimuli and their relevance to us, so that even a message from the unattended ear that is supposedly irrelevant can come into awareness and influence actions if it has some meaning for us.

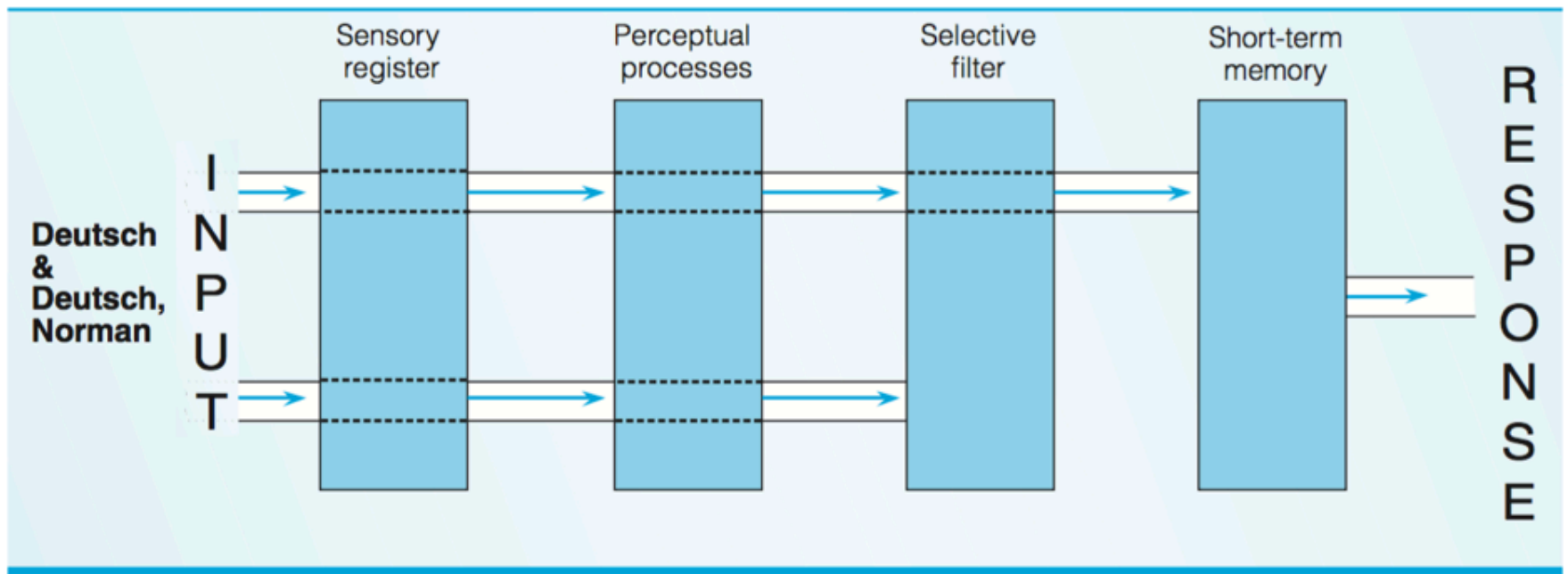


**Figure 4.9 Broadbent and Treisman's Models of Attention.**

Various mechanisms have been proposed suggesting a means by which incoming sensory information passes through the attentional system to reach high-level perceptual processes.

Image: Sternberg & Sternberg (2011) Cognitive Psychology. Wadsworth Publishing. 9<sup>th</sup> ed. ( p. 150).

- **Late - Filter Model:** Deutsch & Deutsch (1963) developed a model in which the location of the filter is even later.
- They suggested that stimuli are filtered out only after they have been analysed for both their physical properties and their meaning.
- This late filtering would allow people to recognise information entering the unattended ear. for e.g. they might recognise the sound of their own names or a translation of the attended version.



**Figure 4.10** Deutsch & Deutsch's Late-Filter Model.

According to some cognitive psychologists, the attentional filtering mechanisms follow, rather than precede, preliminary perceptual processes.



- **A synthesis:**
  - Ulric Neisser synthesised the early filter and the late filter models and proposed that there are two processes governing selective attention:
    - **Pre attentive Processes:** These automatic processes are rapid & occur in parallel. They can be used to notice only physical sensory characteristics of the unattended message; but they do not discern meanings.
    - **Attentive, controlled processes:** These processes occur later. They are executed serially and consume time and attentional resources, such as working memory. They can be used to observe relationships among features; synthesise fragments into mental representation of an object.

- This two - step model could easily account for Cherry's, Moray's, & Treisman's data.
- Also, this model nicely incorporates aspects of Treisman's signal attenuation theory & her feature integration theory.
- Acc. to Treisman, discrete processes for feature detection & for feature integration occur during searches.

- **Neuroscience of selective attention**
  - Hillyard & colleagues (1973) conducted a ground - breaking study, exposing participants to two streams of tones; one in each ear.
  - Participants were asked to detect occasionally occurring target stimuli; when the target stimuli occurred in the attended ear, the first negative component of the ERP was larger than when the target occurred in the unattended ear.
    - The N1 wave is a negative wave appearing about 90ms after the onset of the target stimulus,
  - The researchers hypothesised that the N1 wave was a result of the enhancement of the target stimulus. At the same time there was a suppression of the other stimuli(distracters).

- This result is consistent with the filter theories of attention.
- Later studies (Woldorff et al., 1993) found an even earlier reaction to the target stimulus in the form of a positive wave that occurs about 20 - 50ms after the onset of the target. This wave originates in the Heschl's gyro, located in the auditory cortex.
- Similar effects have also been found for visual attention.
  - If a target stimulus appears in an unattended region of the visual field, the occipital P1 is larger than when the target appears in an attended region (Van Voorhies & Hillyard, 1977).

# To Sum Up

# References

- Sternberg & Sternberg (2011). Cognitive Psychology. Wadsworth Publishing. 6<sup>th</sup> Ed.