Discuss one early-selection and one late-selection model of focused (selective) attention

Broadbent's early-selection filter theory states that our ability to process information is capacity-limited. Information from the senses passes 'in parallel' to a short-term store. This is a temporary 'buffer system' which holds information until it can be processed further and effectively extends the duration of the stimulus. The various types of information, such as two voices or more, are then passed, preserved in their original form, to a selective filter. This operates on the basis of the information's physical characteristics, selecting one source for further analysis and rejecting all others.

Information allowed through the filter reaches a limited-capacity channel. This corresponds to what we experience as happening now. The information allowed through the filter is analysed, in that it is recognised, possibly rehearsed, and then transferred to the muscles to produce an appropriate response.

Broadbent considered the short-term store to be capable of holding information for a period of time before it decayed. Therefore two simultaneous stimuli can be processed provided the processor can get back to the store before the information in it has disappeared. Consequently, attending to one thing does not necessarily mean that everything else is consequently lost. However, Broadbent maintained that processing two different pieces of information from two channels would always take longer, and be less efficient, than processing the same information from one channel. This is because switching attention between channels takes a substantial period of time.

The theory assumes that because the non-shadowed message is filtered out according to its physical characteristics, its meaning should not be subject to any sort of higher-level analysis. Moray (1959) demonstrated that when people are presented with their own name in an unattended message, they detect it on approximately one third of trials. This implies that analysis for meaning has taken place before selection occurred, and Broadbent's theory cannot account for these findings.

Other studies have also indicated that the meaning of the input to the non-attended ear is processed at least some of the time. Treisman (1964) discovered that if a French translation of the shadowed material was presented as non-shadowed material, some bilingual participants realised that the shadowed and non-shadowed material had the same meaning. Mackay (1973) presented the word 'bank' in a sentence, and participants subsequently had to recognise the sentence they had heard. Recognition was influenced by whether the word 'river' or 'money' had been presented to the non-attended ear.

Underwood (1974) found that participants trained at shadowing could detect two-thirds of the material presented to the non-attended ear. This throws doubt on Broadbent's claim that the non-shadowed message is always rejected at an early stage of processing. Also, when material used is sufficiently different, such as one being auditory and the other visual, memory for the non-shadowed message is good. This indicates that it must have been processed at a higher level than proposed by Broadbent (Allport *et al*., 1972).

Deutsch & Deutsch (1963) and Norman (1968, 1976) completely rejected Broadbent's claim that information is filtered out early on. According to the Deutsch–Norman late-selection filter model, filtering or selection only occurs after all inputs have been analysed at a high level, for example, after each word has been recognised by the memory system and analysed for meaning. The filter is placed nearer the response end of the processing system. Because processing will have already been undertaken on the information that's been presented, some information will have been established as pertinent and have

activated particular memory representations. When one memory representation is selected for further processing, attention becomes selective. The model implies that we perceive everything we encounter, but are only consciously aware of some of it (Hampson & Morris, 1996).

The Deutsch-Norman model can account for the processing of non-shadowed material, whereas Broadbent's theory cannot. If the Deutsch–Norman model is correct, then participants should be able to identify as many target words in the non-shadowed message as in the shadowed message, since both are allegedly completely analysed for meaning. Treisman & Geffen (1967), however, found that target words were much better detected in the shadowed message than the non-shadowed message. These findings assume that the shadowed and non-shadowed messages are equally important. Deutsch & Deutsch (1967) argued that this assumption was not met, because participants had to indicate when they heard a target word by tapping. This made the target words in the shadowed message more important than those in the non-shadowed message. When this problem was overcome by Treisman & Riley (1969) with an improved research design, performance was still better for the shadowed message.

The Deutsch-Norman model predicts that participants asked immediately afterwards should be able to repeat back the words presented to the non-shadowed ear. However, the non-shadowed message gets into short-term memory for only a brief period and is then forgotten very quickly. Norman (1969) found that participants could remember the last couple of words presented to the non-attended ear if tested immediately, but not after a short continuation of the shadowing task. This finding was replicated by Glucksburg & Cowan (1970).

Despite some support for the Deutsch–Norman model, Wilding (1982) believes that less is known about non-attended messages than it claims. However, more is known than can be explained by Broadbent's model. Many researchers question whether any single, general-purpose, limited-capacity central processor can, in principle, account for the complexities of selective attention (Norman & Bobrow, 1975; Neisser, 1976; Allport, 1980). Much of the relevant evidence comes from dual-task studies, which are more directly concerned with processing capacity.