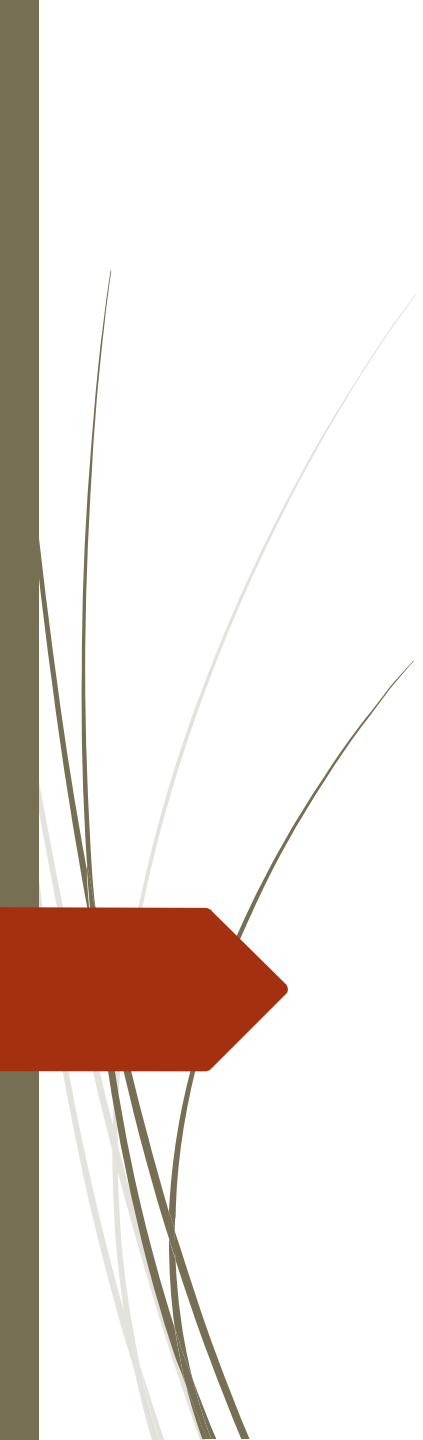




Attention



Aims of the Lecture

- To define attention.
- To discuss selective attention, divided attention and change blindness.
- To discuss Cherry's cocktail party phenomenon
- To discuss theories of attention – Early Selection vs Late Selection.
- To explore Automaticity.
- To examine the Stroop Effect.

Attention



Attention is a concentration of mental activity that allows you to take in a limited portion of the vast stream of information available from both your sensory world and your memory (Ward, 2004)

Attention

Divided attention



Is there a limit to the amount of processing that can be performed on incoming information at any one time?



Selective attention



How do we follow the one set of events that may be of interest from among many going on simultaneously and reject other events

Attention

- Started in the 1950s
- Attention in Perception
 - Look around – we experience an amazing richness of detail
 - But we do not notice the detail of the objects unless attention is directed to them
- Demonstration
 - Close your eyes
 - What colour tops/shirts etc. do your neighbours have on? My top? Carpet?

E.g, Change blindness

- https://www.youtube.com/watch?v=bh_9XFzbWV8
- Flicker Paradigm (Rensink et al., 1997)
- 'Change blindness' occurs both during intentional tasks in which
 - Observers actively search for changes. (Rensink et al 1997)
- During incidental tasks in which a change occurs unexpectedly. (Levin and Simons 1997; Simons and Levin 1998) – don't see the images in succession – **brief blank interval** – this interval makes it difficult for us to detect the change
- Observers sometimes fail to notice when the central actor in a simple motion picture is replaced by a different person wearing different clothing (Levin and Simons 1997).

Why is it difficult?

We usually process input from bottom up (from low features to higher features – this is optimised to continuous input - since usually our surroundings don't change immediately

- If we have changes in reality – usually due to motion
- So motion is an important feature for attention – when we see things move around us = attention is drawn to it.
- So the blank interval disrupts the continuous bottom up processing – so we don't detect this change/motion – thus NO CONTINUOUS MOTION CAN BE DETECTED
- So – in these examples we have to consciously search from point to point – so it becomes a top down process – because our bottom up processing doesn't work anymore.
- So what you have when you search for the difference - you experience explicit use of attention

Change blindness in everyday life...

You can actually swap conversation partners

- <https://www.youtube.com/watch?v=FWSxSQsspiQ>

(Door study)

Finally – how attention may influence our perception

- https://www.youtube.com/watch?v=IGQmdoK_ZfY

(Monkey Business Illusion)

The invisible gorilla
is an example of
inattentional
blindness

- We miss things when we don't pay attention

- In the original study 50% didn't see the gorilla – despite the fact that when they measured exactly where people looked on the screen – majority of them spent average of 1 minute fixated on the gorilla – yet they still missed it!
- This shows that attention really impacts on perception
 - Bottom up would say of course we saw the gorilla – we must have perceived it – but no because we did not pay attention to it.

Models of attention

Attention allows us to focus on a particular stimulus while at the same time disregarding other stimuli

■ Key research questions

- How do people choose which stimuli from the environment to attend to and which to ignore?
 - Is it bottom up or top down? (sensory/data driven or previous experience/contextual cues)
- At which level is information processed when we decide to pay attention to a stimulus?
 - Physical characteristics (tonality, loudness, brightness)?
 - Not only physical characteristics but also meaning?
- What happens to the stimuli that are not attended?

Models of attention

Suppose you are at a Cocktail Party, with many conversations taking place around you.

- Selective Attention: you can't attend to all conversations at once
- Divisible Attention: you can converse while getting a drink at the same time
- Voluntary Attention Shift: you can consciously shift your attention from one conversation to another
- Involuntary Attention Shift: you suddenly hear your name being spoken by some people across the room

Models of attention

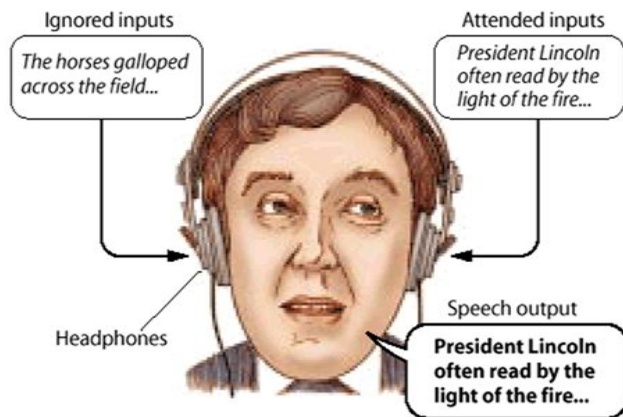
Cherry (1953) wanted to investigate the Cocktail Party phenomenon scientifically

- Dichotic listening paradigm (selective attention)
 - A different message is played to each ear
 - When voices had the same physical properties (same speaker), participants found it difficult to keep the two messages separate
 - So just using meaning only, is quite difficult



Models of attention

- ▶ How much information is retained from the unattended message?
- ▶ You want to control what the person is doing so – if you are asking them to just attend to the right ear – you don't know whether or not they are switching to the left ear
- ▶ To bind attention to one message - Shadowing task
 - ▶ A different message is played to each ear
 - ▶ Overtly repeat message played to one ear



- This is difficult since it requires strong focussing of attention on the attended input.
- Consequently, no attention on the ignored input.
- Ignored input – demanding – people often stutter through the speech output.

Models of attention

Was anything of the ignored remembered or recognised?

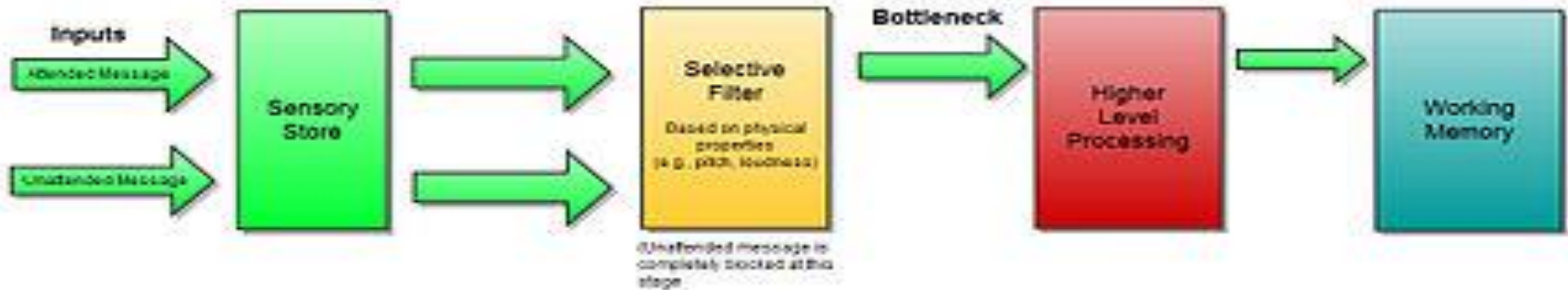
What happened to the ignored stimulus?

- Mostly only physical properties (e.g., tonality, loudness) were noticed
- Virtually no noticing of
 - Meaning of the message
 - Change in language (English to German)
 - Change in gender (M to F)
 - Message in reverse speech

So – the unattended message seems to be filtered out very early in sensory processing, because virtually no 'higher-level' information is retained. (doesn't reach memory for higher processing of meaning)

Based on this research - Broadbent's (1958) Filter Model

Broadbent's Filter Model



- Inputs from the outside world: Attended message and unattended message
- All** info enters the sensory memory buffer store – no filtering
- The filter rejects the unattended message at an early stage of processing. The meaning of any of the messages is not taken into account at all by the filter.
- All semantic processing is carried out after the filter has selected the message to pay attention to.
- So whichever message(s) restricted by the bottle neck (i.e. not selective) is not understood.

Note: Broadbent's model is an early-selection model because selection (filter) occurs prior to the analysis of the meaning

Thus, selection must be made on the basis of the physical characteristics of the incoming information

But... how many people have heard their name mentioned in a conversation that they were not following?

“Cocktail party phenomenon”

The early-selection model cannot explain this phenomenon

There should be no processing of this information, that should be processed out before meaning

Based on this – Treisman came up with the Attenuator model.

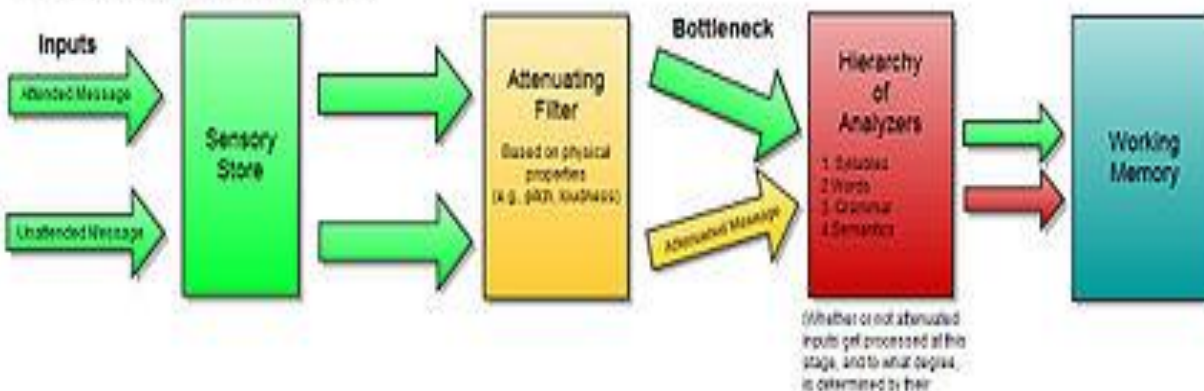
Different mechanism for filtering

- She agrees with Broadbent's early bottleneck filter. However, the difference is that Treisman's filter attenuates (weakens) rather than eliminates the unattended material.

Filter passes on unattended message in an attenuated (diminished) way

Passed to higher level processing – hierarchy of analysing the message...syllables, words, grammar and semantics (meaning)

Treisman's Attenuation Model



Again – the filter works on physical properties

Treisman Attenuation model

- Attenuated message always passed on
- Processed for meaning (higher processing) when it exceeds a certain threshold
- How is threshold determined?
 - Effected by context and priming and subjective importance (unattended message – processed on low level – but because our name has a higher salience – it has higher processing).
- So – unattended information can have no effect on behaviour. Behaviour is only affected by information we become aware of (by attended info).

All information is fully analysed for meaning (party – 10 conversations – you are aware of all conversations and brain processes all information for meaning)

Late-selection models

(Deutch & Deutch, 1963; Norman, 1968)

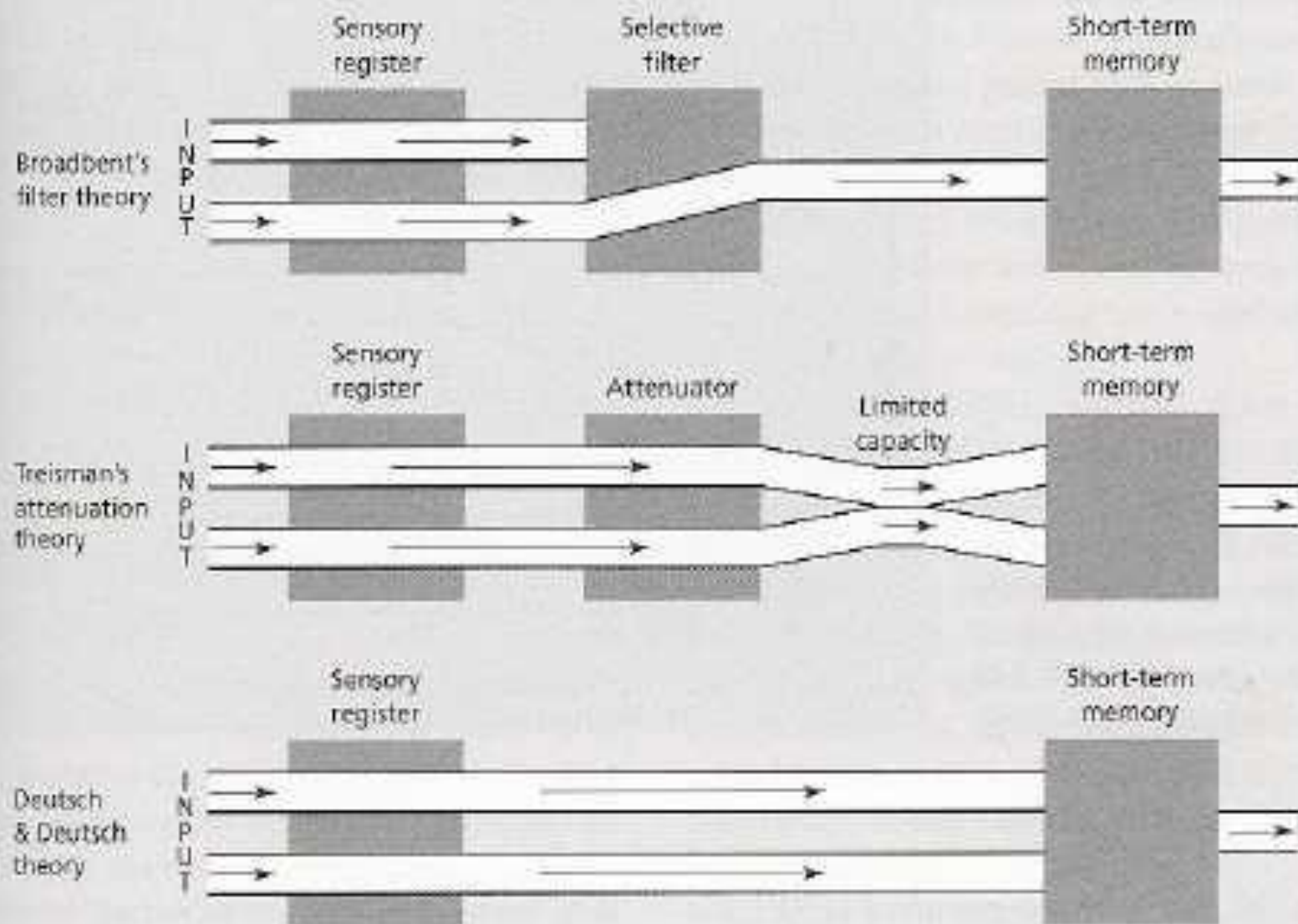
Only then, based on physical properties and meaning, selection by a filter takes place.

So we use meaning to guide our attention

Evaluation

- Ad: appealing because all information is processed, unlikely that important info is missed
- Disad: resource demanding (heavy-load)

FIGURE 5.2



A comparison of Broadbent's theory (top); Treisman's theory (middle); and Deutsch and Deutsch's theory (bottom).

Late-selection models (Deutch & Deutch, 1963; Norman, 1968)

How can we
test whether
they are true?

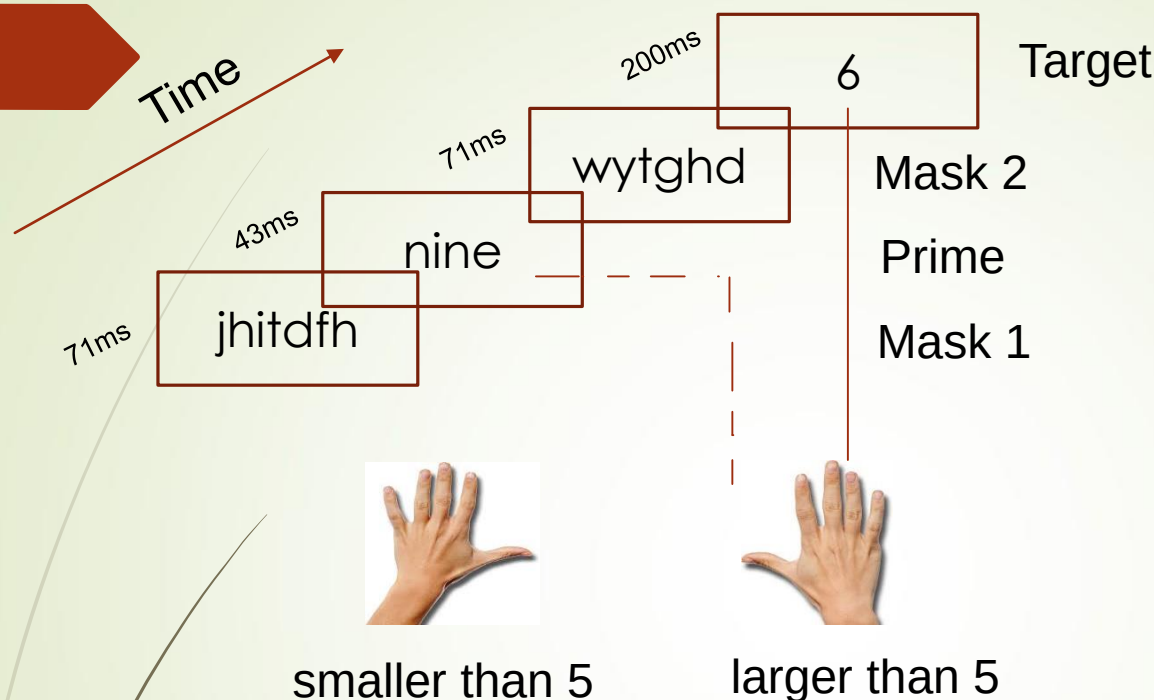
Key assumption: all
information is fully
processed

- If right- unattended and unaware information should have the power to influence behaviour

Subliminal
priming
(Dehaene,
et. al.,
1998)

Congruent Trial

Computer task



Shown target number = 6
Asked if it's larger than 5
press right hand or
smaller than 5 left hand

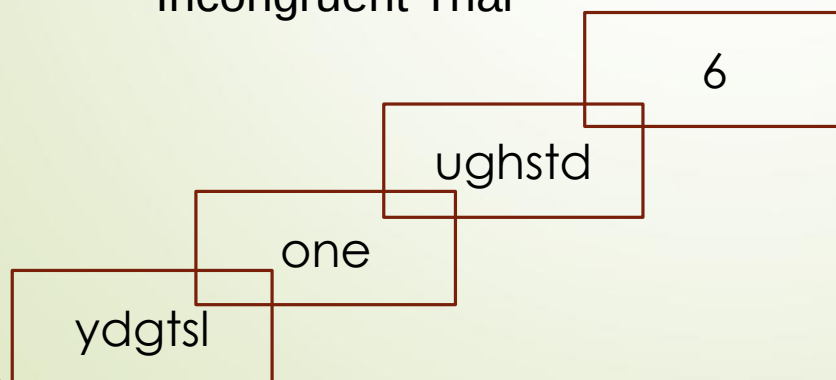
Sometime before the
target he showed another
number - 9 (prime)

(congruent – prime same
hand; incongruent different
hand)

Of course – the prime should
not be responded to... to
make sure this doesn't
happen =

Mask before and after the
prime – makes the prime
invisible (prime =
subliminal)

Incongruent Trial



Congruent – response is faster- because the right response has been primed. Incongruent (other hand)– slower

If we do not process information that is subliminal – the prime shouldn't have an effect at all

Early selection models would say prime doesn't have an effect – same response times for congruent and incongruent

Late selection predict congruent faster than incongruent

Results

Quicker –
congruent
= priming
effect

He also varied
the notation –
word or number
(9 and nine)

The fact that the prime
affects behaviour irrespective
of notation shows

It is not
perceptual
priming

It's semantic
meaning has
been
processed

Models of attention

There is
evidence for
early selection
models

Information of
unattended
channel is not
really retained

There is
evidence for
late selection
models

Subliminal
stimuli are
processed for
their meaning

What model is correct?

- Maybe both
- Maybe sometimes selection is early, and sometimes late?
- But what determines whether selection is early or late?

Difficult tasks – focus resources

E.g., find a specific DVD among other DVDs – focus attention – search all DVDs

Require a lot of attentional resources

Selection is early to make resources available

- Focus on one task – ignore everything else

Easy tasks

E.g., find a specific DVD among books

Require a little of attentional resources

Selection is late since resources are available (can process other stimuli for meaning)

Summary

- Early selection model (Broadbent, 1958)
 - Unattended information is filtered out completely early in processing
 - Attenuator model
 - Unattended information is attenuated early in processing (not filtered out completely)
- Late selection models (Deutsch and Deutsch, 1963)
 - All information is processed for meaning, it is filtered out only late in processing
- Theory of perceptual load (Lavie, 1995)
 - Selection is early in difficult tasks, and late in easy tasks

Automaticity

Controlled Processing

- Limited capacity
- Requires attention
- Rather slow
- Effortful
- Is aware, conscious
- Flexible: can be used flexibly in changing circumstances

Automatic Processing

- Unlimited capacity
- Does not require attention
- Rather fast
- Effortless
- Outside of awareness
- Inflexible: cannot be easily changed to changing circumstances

Theories differ in the way in which they think about this dichotomy.

Some say processing is either controlled or automatic, while others regard it as a gradual transition between the two

Automaticity

➤ Controlled or Automatic?



Walking

Automatic



Controlled

Automaticity

- Controlled or Automatic?



Driving

Automatic

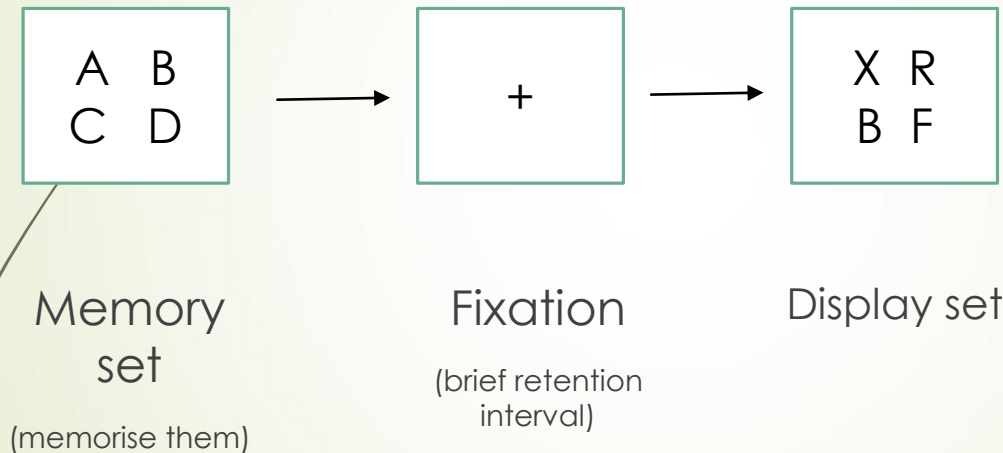


Driving lessons

Controlled

Automaticity

- Schneider & Shiffrin (1977)
 - First researchers to investigate automaticity



In this example – yes!

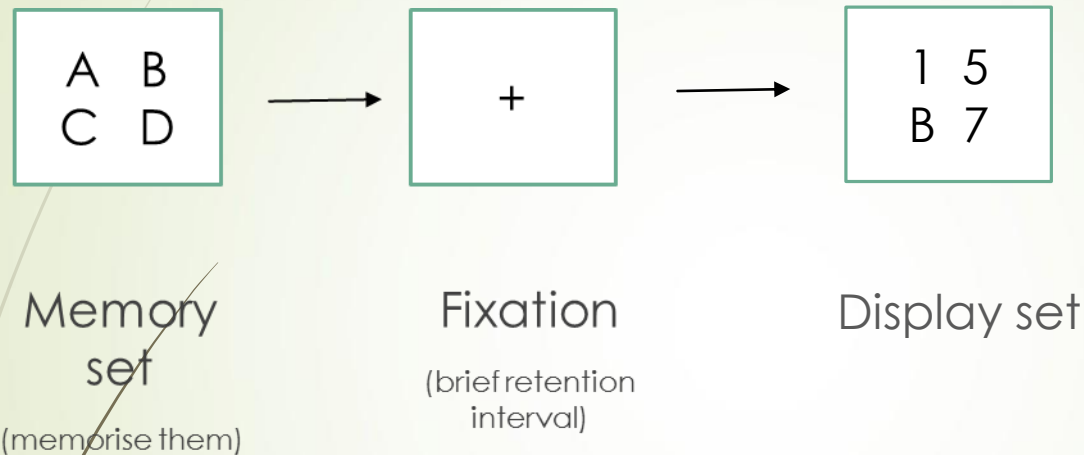
Task

Does the display set contain any stimulus from the memory set?

Automaticity

Schneider & Shiffrin (1977)

➤ Two conditions



Consistent mapping
Only letters in the memory set, only numbers as distractors in display set

Target detection due to automatic differentiation between letters and numbers



Varied mapping
Letters and numbers can be in both sets

Here, search requires a controlled comparison of each item of the display set with each item of the memory set (serially go through each set) – use memory and attention

Schneider & Shiffrin (1977) – predications and results

Predictions

- What happens when you increase set size?
 - Automatic – fast, effortless, pops out = response times should be independent of the set size
 - Controlled- through one letter/number after the other = response times should increase with the set size

Findings

Varied mapping/controlled =
Response times increase with set size increase

Consistent/automatic = flat rate – no increase

Automaticity

How does an activity become automatic?

- Practice
- But how?

Schneider & Shiffrin (1977)

Controlled and automatic processing is based on the same cognitive processes

Practice results in an increase in efficiency of these processes

Automaticity

Logan's (1988) instance theory of automaticity

Novice performance is limited by lack of knowledge and not lack of resources



With practice our knowledge-base changes and not the efficiency of some mechanisms



The more knowledge we have available to solve a task, the less attentional resources required (11x12. knowledge of 10x12=120, then use resources to come to 132 – combine memory and problem solving)

Automaticity



Tourists in UK – drive on different side of the road (and roundabouts)



Highway hypnosis - driving long roads – without any awareness (autopilot)

Application of this -
Causes dangers

Automaticity - summary

- Automatic processing is effortless, fast, and outside awareness (can't control it)
- Thus, automaticity greatly reduces demands on cognitive control and attention
 - Important for our everyday life – suppose you would need to explicitly attend to every action, like walking, driving, drinking/eating, writing...
 - So it's good for our system to automatize as many things as we can – so we have plenty of resources left
- The most profound disadvantage of automatic processes is their inflexibility
- Trade off – automaticity can be established by practice

STROOP

John Ridley Stroop



Task 1: name colour of patch

Why?

Reading is automatic

The colour of the ink and the word colour are incompatible

Controlled processes are required to override this interference caused by automaticity

Task 2: name colour of ink of the word

Red Green Blue

Finding: Naming colour of word ink is much slower than naming colour of patches – '*stroop interference*'

Support

Slow readers have less Stroop interference

Colour-words in second language: less Stroop interference

STROOP - summary

- Stroop interference
 - Demonstrates the power of automaticity
 - Demonstrates that we nevertheless can overcome such strong automatic tendencies
 - We actually can do the task, we just get slower
- Automatic responses can be overcome by
 - Executive functions: executive control processes (supervisory attentional system (Norman and Shallice, 1986))

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- Treisman, A. (1964). Verbal cues, language and meaning in selective attention. *American Journal of Psychology*, 77, 206-209.