PSYC 441
Cognitive Psychology II

Session – Practice Effects on Attention

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Session Overview

- Practice leads to dexterity and we gain a lot of savings when we are performing a task in which we have become so proficient in delivering. In this section, we look at the effects of practice and how it affects our attentional capacity.

Session Objectives

- At the end of the session, the student will be able to

- Explain the effects of practice on attentional processes
- Explain the development of automatic processes
- Explain controlled and automatic processes
- Explain divided attention

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Session Outline

The key topics to be covered in the session are as follows:

- Topic One: Practice Effects on Attention
- Topic Two: Interference between Controlled and Automatic Tasks
- Topic Three: Development of Automatic Processes
- Topic Four: Feature Integration Theory
- Topic Five: Divided Attention

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Reading List

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Topic One

PRACTICE EFFECTS ON ATTENTION

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Practice Effects and Attention

Practice Effects and Attention

- Many of our daily routine schedules as well as complex behaviours such a driving a car, riding a bicycle, typing require our attention when we are first learning them.

- With time and practice over a long period, these tasks can become relatively **automatic** and might not require much of our conscious effort.

- Research supports the idea that practice on difficult tasks can lead to significant improvements in performance.

- A very simple experiment was conducted by Underwood (1974). He examined subjects' performance in a digit-detection task performed at the same time as a shadowing task.

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♦ One of the tasks was to shadow a message presented in the attended ear.

♦ The second task was to respond whenever a digit was presented in either the attended or the unattended ear.

Results

♦ Naïve (unpracticed) subjects were able to detect only 8% of the digits presented in the unattended ear.

♦ Interestingly, one of the subjects, Moray *(known for his earlier work in selective attention)* detected nearly 70% of the digits in the unattended channel. (Practice effects)

► Let's look in detail at –

Automatic and Controlled processes.

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Controlled and Automatic Process

Controlled and Automatic Processes

♦ Tasks that require conscious attention are referred to as **controlled processing tasks** and tasks that do not require attention are called **automatic tasks**.

♦ The two tasks are distinct types of tasks that reflect the operation of qualitatively different processes.

♦ **Controlled processing tasks** involve processes that are slow, limited by the available capacity that requires conscious attention.

♦ Whereas **automatic tasks** may require little if any capacity at all.

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Controlled and Automatic Process

The following criteria have been offered as the definition of automaticity (Eysenck, 1995).

- Automatic processes are fast

- Automatic processes do not require attention

- Automatic processes are unavoidable - that is, they always occur when an appropriate stimulus is presented

- There is no conscious awareness of automatic processes (processing does not reach the level of awareness)

Diagnostic Criteria for Controlled Versus Automatic Processes

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Automatic Processes	Controlled Processes
The process occurs without intention, without a conscious decision.	The process occurs only with intention, with a deliberate decision.
The mental process is not open to conscious awareness or introspection.	The process is open to awareness and introspection.
The process consumes few if any conscious resource; that is, it consumes little if any conscious attention.	The process uses conscious resources; that is, it drains the pool of conscious attentional capacity.
The process operates very rapidly, usually within 1 sec. *(fast/rapid).*	The process is slow, taking more than a second or two for completion *(slow).*
Processing takes place on easy tasks that use highly familiar items (e.g., scanning a list of names to see if your name is included.	Used on difficult tasks or on tasks that use unfamiliar items. (e.g., scanning the same list for names that are unfamiliar).
Automatic processing is **parallel** – two or more items can be handled at the same time.	Controlled processing is **serial**. We handle one item at a time.

Topic Two

INTERFERENCE BETWEEN CONTROLLED AND AUTOMATIC PROCESSING

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Controlled and Automatic Tasks

Interference between Controlled and Automatic Tasks

– Practice is thought to decrease the amount of mental effort required to perform a task (e.g., a novice driver compared with a professional driver).

– Practice appears to lead to the development of automatic processes, because practice frees capacity limitations that characterize attention.

– Let us look at a **Stroop Task** - a simple task that illustrates the effects of practice and automaticity.

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The Stroop Task

- John Ridley Stroop (1935) developed a task that demonstrates the effects of automatic and controlled processes in a single task.

- Stroop presented subjects with a series of color words (red, blue, green, brown, purple) printed in conflicting colors (the word red, for example, might be printed in green).

- Participants were asked to name as quickly as possible, **the ink color** of each item in the series.

- Participants stumbled through these lists, finding it difficult not to read the word formed by the letters.

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BLUE   **GREEN**   **YELLOW**

PINK   **RED**   **ORANGE**

GREY   **BLACK**   **PURPLE**

TAN   **WHITE**   **BROWN**

Stimuli from Stroop (1935) task. Try naming the colors of the ink that the words are printed in.

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- **Two** basic findings emerge from studies using the Stroop task.

- **First**, facilitation occurs in the compatible condition. Subjects are faster and make fewer errors when the ink colors match the color words than in the control condition.

- **Second**, interference occurs in the incompatible condition. Subjects take longer to name the ink colors when they are incompatible with the color words than in the control condition.

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– The two findings can be interpreted in terms of the two processes, a

- **controlled process and**

- **automatic process**

Reason

♦ According to Stroop, the reason stems from the fact that adults have had so much practice with words, so that when confronted with items consisting of words, subjects could not help but read them, rather than mentioning the colors.

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Topic Three

DEVELOPMENT OF AUTOMATIC PROCESSES

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Development of Automaticity

Development of Automaticity *(automatization)*

♦ One influential researcher that investigated the development of automaticity is **Schneider and Shiffrin** (1977).

♦ They used a visual search task to study the factors that affect the **transition** from <u>controlled task to automatic task</u>.

☞ In this task, subjects are required to search for a specific target item or items among a series of briefly presented displays.

The experiment:-

– They used two types of **visual searches/ mapping** to explain the two processes:

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- The visual searches are:

  - **Varied Mapping**: An experimental procedure in which the response required for each stimulus varies from one trial to another (for example if an "**X**" is a target on one trial and demands a "**yes**" response, "**X**" might be a distractor on the next trial (and so demand a "**no**" response).

  - **Consistent Mapping:** An experimental procedure in which the response required to each stimulus is held constant across a block of trials.

    Thus, if a button-press is the appropriate response for seeing "**T**" viewed on the first trial, then this button-press will be the appropriate response whenever a "**T**" appears.

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Experiment on Varied and Consistent Mapping

	Varied Mapping	Consistent Mapping
Trial 1: Search for T among	V C H T G R Y	V C H T X R Y
Trial 2: Search for G among	P C H T G J Y	X D R Y G P B
Trial 3: Search for J among	V T G H Y J M	V F L J S M U

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Example

- Think about living in an Estate where all buildings are about same **(varied mapping).**

- If among the buildings, yours is the only storey building, then within a short time, location identification becomes automatic (**consistent mapping**).

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Implications

- Reaction time in the **consistent mapping** condition was the same regardless of the number of items in the display or the presentation time.

- Participants claim that the target appear to pop out and it did not require much effort.

- **In varied mapping** the reaction time was longer depending on the number of items in the set.

- According to Schneider and Shiffrin (1977) *automaticity of a task requires a consistent mapping.*

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Topic Four

FEATURE INTEGRATION THEORY

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Feature Integration Theory

Feature Integration Theory

♦ Here we are trying to understand the role attention and automaticity play in perception or vice versa.

Most of the things we have discussed involve the perception and recognition of familiar stimuli.

– ***What happens to our attention when we are in a new environment?***

♦ In other words, *how is our attention directed in a new environment?*

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Feature Integration Theory

♦ For example, if you enter a shop or a new place like an art gallery or jewellery shop, it is likely something will attract your attention that may draw you closer.

– *The big question is why?*

♦ Anne Treisman, inspired by the work of Schneider and Shiffrin, investigated this question, thereby developing what has come to be known as **Feature Integration Theory.**

– Her theory is that we normally perceive objects in two distinct stages.

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Feature Integration Theory

- **The First Stage** of perception occurs prior to the object being attended to. This occurs at the pre-attentive, automatic level called **preattentive proccessing.**

- At this stage **(first stage)** our sensory system registers (or selects) the features of objects such as colour or shape at the initial stage (physical properties). These features are registered early, automatically and in parallel manner.

- **At the Second Stage**, attention allows us to "**glue**" the features we have registered together into a unified object referred to as **focused processing.**
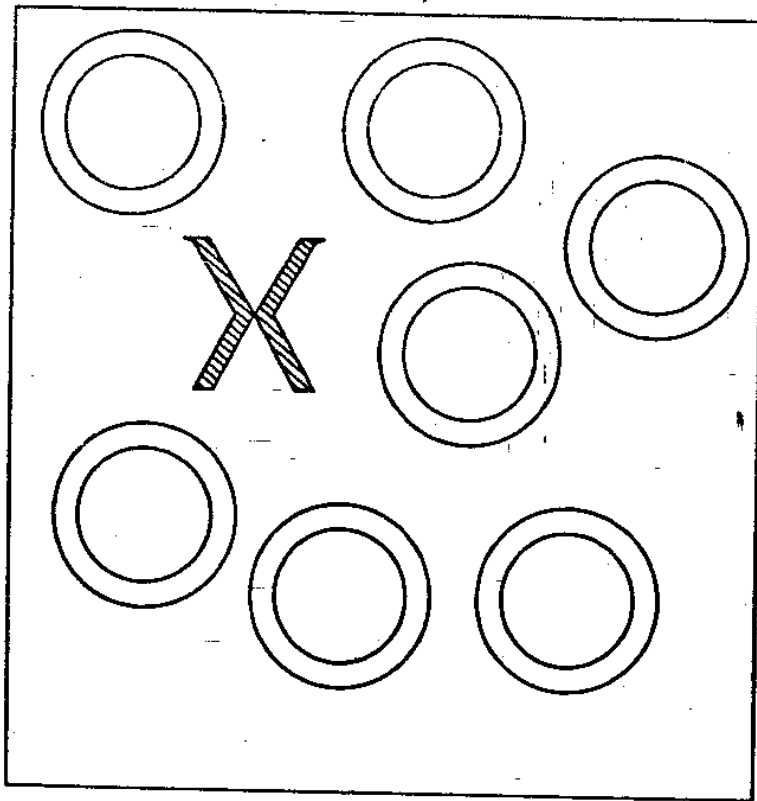
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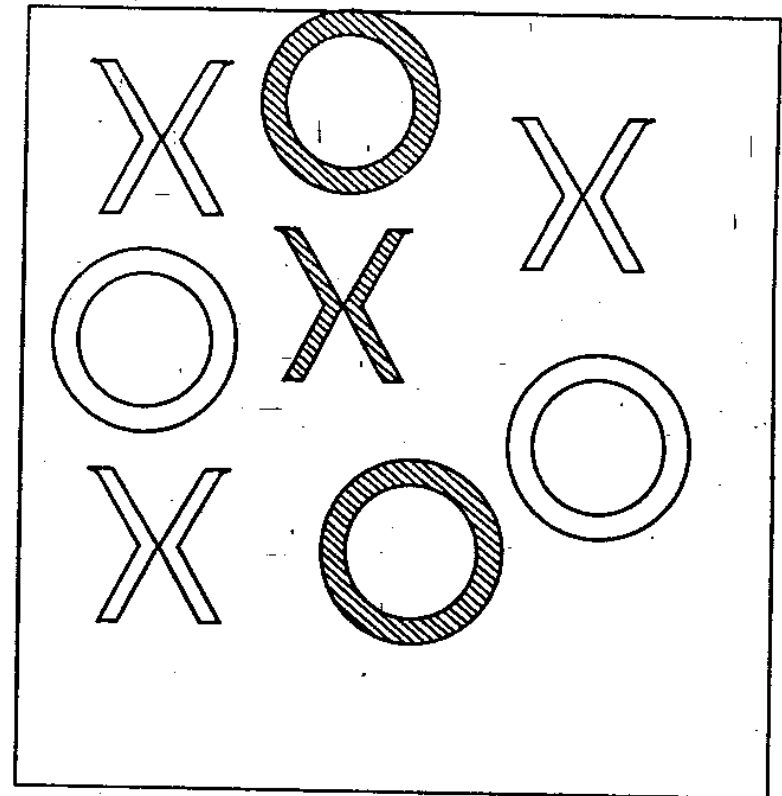
Figure A

Figure B

Slide 28

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- ***What about if the critical dimensions of the target object were unknown to the subject?***

  - Where the stimulus is unknown, then top-down processing cannot be used and the subject then resorts to bottom-up processing.

  - The visual search using **bottom-up processing** will then take longer than needed in top-down processing (if the subject knew about it already).

  - Pre-attentive processing (physical characteristics) is independent of whether it is bottom-up or top-down. The difference lies in the longer duration of search when using bottom up processing.

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- At the pre-attentive level we are attracted to the stimulus because of the **stimulus pop-out.**

- **Stimulus pop-out** is also consistent with stimulus familiarity. When you are familiar with something it pops out most of the time.

- When bottom-up processing is used to identify objects (especially with unfamiliar items), there could be **integration errors.**

- Treisman calls this *illusory conjunctions (errors made when combining elements into meaningful entities).*

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Focused Processing

- Focused processing occurs at the second stage – See Figure B.

- *Serial Processing occurs in this situation when the subject is searching for **X** (one after the other).*

- In order to detect the target **X,** the stimulus features must be processed and compared, one after the other (serial) – because the target and the non-targets share some features in common.

- In other words, **Focused searching** is influenced by the number of objects in the display and the distractors available.

- The greater the number of distractors, the longer detection will take.

- Decrease in Performance when a task requires "focused" attention is referred to as ***Visual Attention Disorder (VAD***). Such people do not have any problems with pre-attentive processing. The problem is their inability to discriminate because of distractors.

- Once in the second stage (i.e., focused attention), serial processing will occur which will involve a stimulus-by-stimulus search for the target item and that could be time consuming.

- *Example. Searching for your kid in a primary school could take along time since kids are about the same size at early age.*

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Divided Attention

Divided Attention Studies

- So far we have discussed what happens when we attend to one stimulus while ignoring a second one.

- We are now interested in a very different situation: attempting to do two things simultaneously.

    ♦ *Can we do two things at the same time?*

    ♦ *The answer is YES and NO. It depends on what we are doing.*

 For example,

- *From your lecture room, you walk to your hostel without thinking about the geographical position of the hall. You type and hold conversations. You read automatically!*

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- Let's look at the factors responsible *for allowing or not allowing* two tasks to be performed successfully.

- There are **three** important factors that determine our ability to multitask:

1. Task difficulty

- How well we can perform two tasks together depends on the level of **task difficulty**. We type and talk at the same time because both activities are so easy.

- Very few of us can read a complicated book while solving a difficult mental arithmetic (e.g., 55 x 13 / 13^2).

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2. How well practiced we are at the task

♦ The proverb "practice makes perfect" is very relevant to the study of divided attention. With practice, performance becomes automatic.

♦ A professional typist can type about 50 words per minute while engaged in conversation around.

3. The Similarity of the tasks

♦ Ordinarily, everyday activities that can be performed together reasonably well are those that are dissimilar.
For example, driving and listening to personal stereo; walking and talking or typing and reading.

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- Allport et al. (1972) asked subjects to learn a set of words while shadowing a spoken message.

- They found that the words could be learned when they were presented visually but not when they were presented as spoken words (auditory).

- You could see that our difficulty arise when we want to do two similar things at the same time.

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- **Let us try an experiment:**

- Rub your stomach with one hand while patting your head into the other hand. It is extremely difficult though with practice you can perform it better.

- **Let us try a second one.**

- Move two of your fingers in a circular fashion or clockwise. This is easy! Try moving one finger clockwise and the other anticlockwise. Almost impossible!

- ► *In summary we can have a rule of thumb:*

- Two dissimilar, highly practiced, and simple tasks can be performed well together.

- Two similar, novel, and complex tasks cannot. The obvious problem we face here is lack of coordination.

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- ***Why do we have these limitations on performance?***

- Norman and Bobrow (1975) suggest that the major factor that determines our ability to multitask is that our attentional resources are *limited (remember data limited and resource limited tasks).*

- Kahneman (1973) also argued that the amount of resources we give to a task is flexible but there may also be an **upper limit** to the amount of resources that are available.

- Kahneman argued that this upper limit and the amount and type of information we choose to attend to is determined by an **"allocation policy",** which is itself determined by several factors we discussed earlier on (evaluation demands, arousal, enduring dispositions, momentary intentions).

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Summary of Theoretical Explanations

- **Summary of Theoretical Explanations**

- There is general agreement on the major factors influencing performance on divided attention tasks.

- However, there is disagreement about the proper theoretical explanation.

- The first theory is the **Central Capacity Interference** favored by Norman and Bobrow (1975).

- The assumption is that there is some central capacity (attention) which possesses limited resources. Therefore the ability to perform two tasks together depends upon the demands placed on the resources by the two tasks.

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Summary of Theoretical Explanations

- Simply, performance will be poor if the two tasks require more resources than are available, whereas tasks can be performed successfully together if their combined demands for resources are less than the total resources of the central capacity.

- The <u>central capacity interference</u> theory can account for the effects of ***task difficulty*** *and* ***practice****,* however it's unable to explain ***task similarity****).*

- Another different theoretical position taken by Allport (1980) is known as the **Specific Mechanisms Theory.**

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Summary of Theoretical Explanations

♦ The assumption is that there are different processing mechanisms, and each has limited capacity.

♦ The implication of this is that similar tasks compete for the   same specific processing mechanisms, and this competition produces disruption of performance (e.g. two people using the same tool to work at the same time).

♦ On the other hand, dissimilar tasks make use of different mechanisms, and so will often not interfere with each other in any way.

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Sample Questions

1. Explain the following concepts: Preattentive processing, Focused processing, Consistent mapping, Varied mapping.

2. What limits our ability to perform more than one task?

3. According to Kahneman, what are the main factors that determine the amount of attention we give to a task?

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