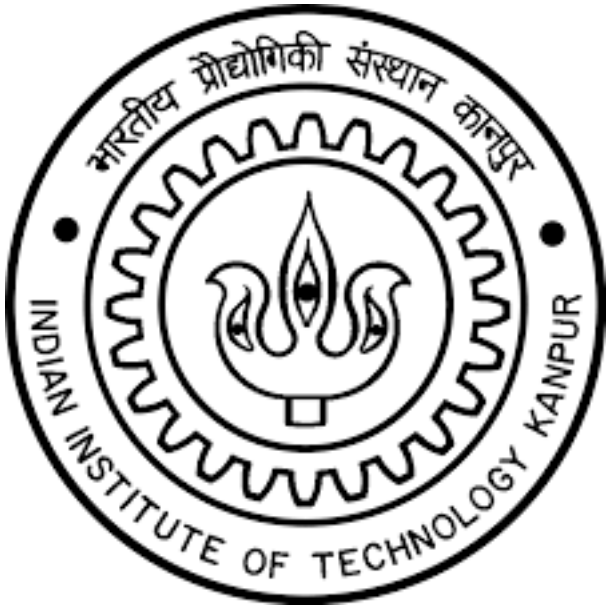

Indian Institute of Technology
Kanpur

In Collaboration
with

National Program on Technology Enhanced Learning (NPTEL)

Presents

Course Title:

Basic Cognitive Processes

By: Dr. Ark Verma,
Assistant Professor of Psychology,
Department of Humanities & Social Sciences,
IIT Kanpur

Lecture 29: Memory - I

Memory

"Has it ever struck you…that life is all memory, except for the one present moment that goes by so quickly you hardly catch it going? It's really all memory except for each passing moment." – Tennessee Williams

- What is Memory?
  - memory is the processes involved in retaining, retrieving, & using information about stimuli, images, events, ideas, & skills after the original information is no longer present.

- An interestig case of Clive Wearing:

This feeling is made poignantly clear by Wearing's diary, which contains hundreds of entries like "I have woken up for the first time" and "I am alive" (● Figure 5.1). But Wearing has no memory of ever writing anything except for the sentence he has just written. When questioned about previous entries, Wearing acknowledges that they are in his handwriting, but because he has no memory of writing them, he denies that they are his. It is no wonder that he is confused, and not surprising that he describes his life as being "like death." His loss of memory has robbed him of his ability to participate in life in any meaningful way, and he needs to be constantly cared for by others.

Excerpt from: Goldstein (2010). Cognitive Psychology: Connecting Mind, research & Everyday Experience. *Wadsworth Publishing*. 3rd Ed. (p.117).

- Let us try and structure memory:
  - Present (this moment, the moment just passed)
  - Past (that moment, that one)
  - Long Past (those moments that passed sometime back)

- Ok..make it simple:
  - Sensory + Short - term + Long - term Memory!!!

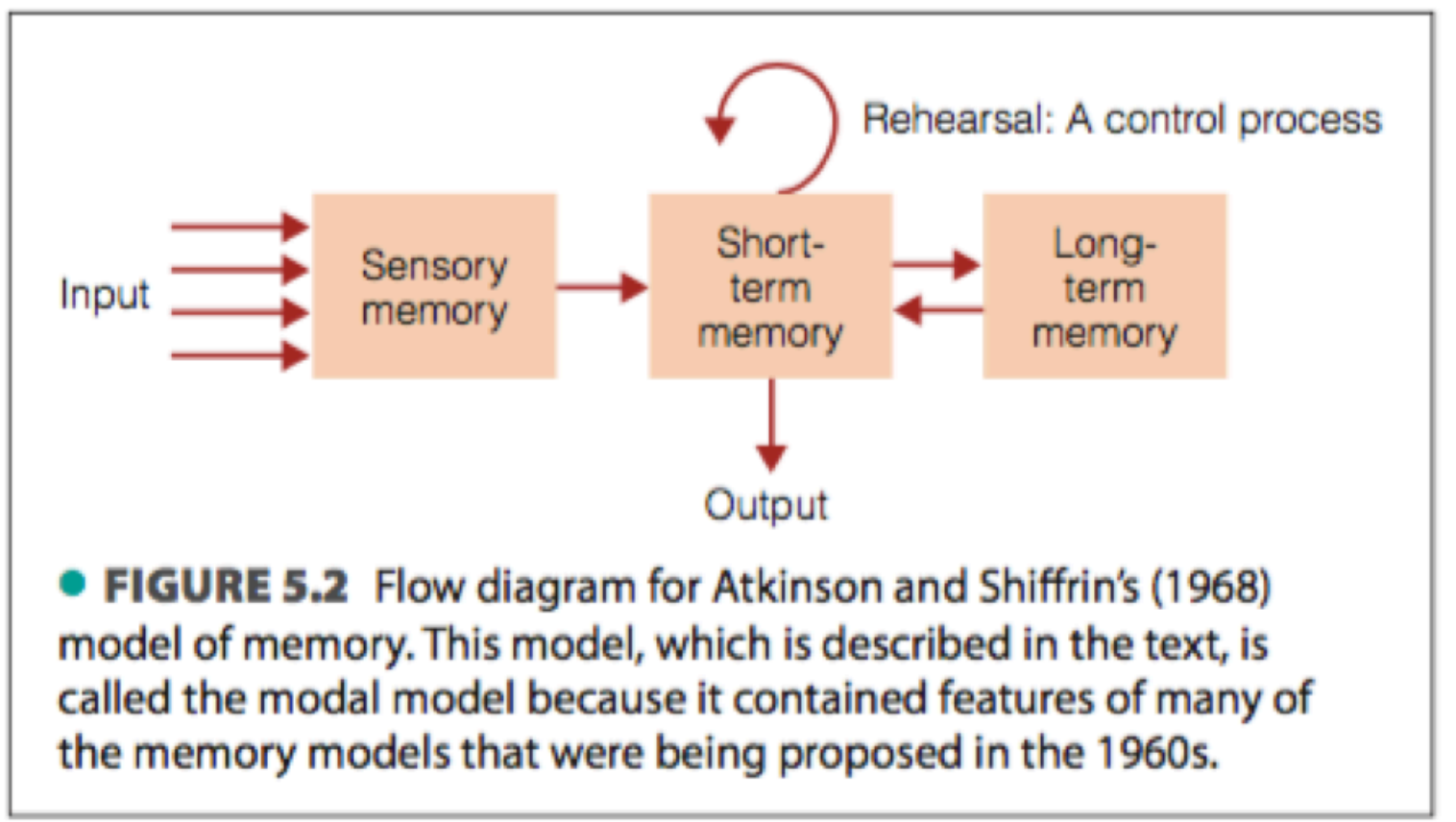

FIGURE 5.2 Flow diagram for Atkinson and Shiffrin's (1968) model of memory. This model, which is described in the text, is called the modal model because it contained features of many of the memory models that were being proposed in the 1960s.

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing*. (p. 118)

- Richard Atkinson & Richard Shiffrin (1968) proposed one of the earliest models in memory, called the **modal model of memory** because it included many of the features of memory models of the 1960s.

- This model became extremely influential and shaped research on memory for years.

- The stages in the model are called the **structural features.** They are:
  - ***sensory memory*** an initial stage that holds all incoming information for seconds or fractions of seconds.
  - ***short - term memory*** holds 5-7 items for about 15 - 30 seconds.
  - ***long - term memory*** can hold a large amount of information of information for years or decades.

- Atkinson & Shiffrin also described the memory system as including **control processes**, which are active processes that can be controlled by the person and may differ from one task to another. e.g. **rehearsal -** repeating a stimulus over and over, as one might repeat a telephone number in order to hold it in one's mind after looking it up in the phone book.

- let's see how it works…
  - if Rachel has to look up a pizzeria over internet to order Pizza.
  - when she first looks at the screen, all of the information that enters her eyes is registered in the **sensory memory**; she uses the control process of **selective attention** to focus on a number, so the number enter's **short term memory**.
  - She knows she might need the number again, so she decides that in addition to storing the number in her phone, she is going to memorise the number. the process she uses to memorise or store the number is called **encoding**.
  - a few days later, she wants to order Pizza again, so she **retrieves** the number again from long term memory.

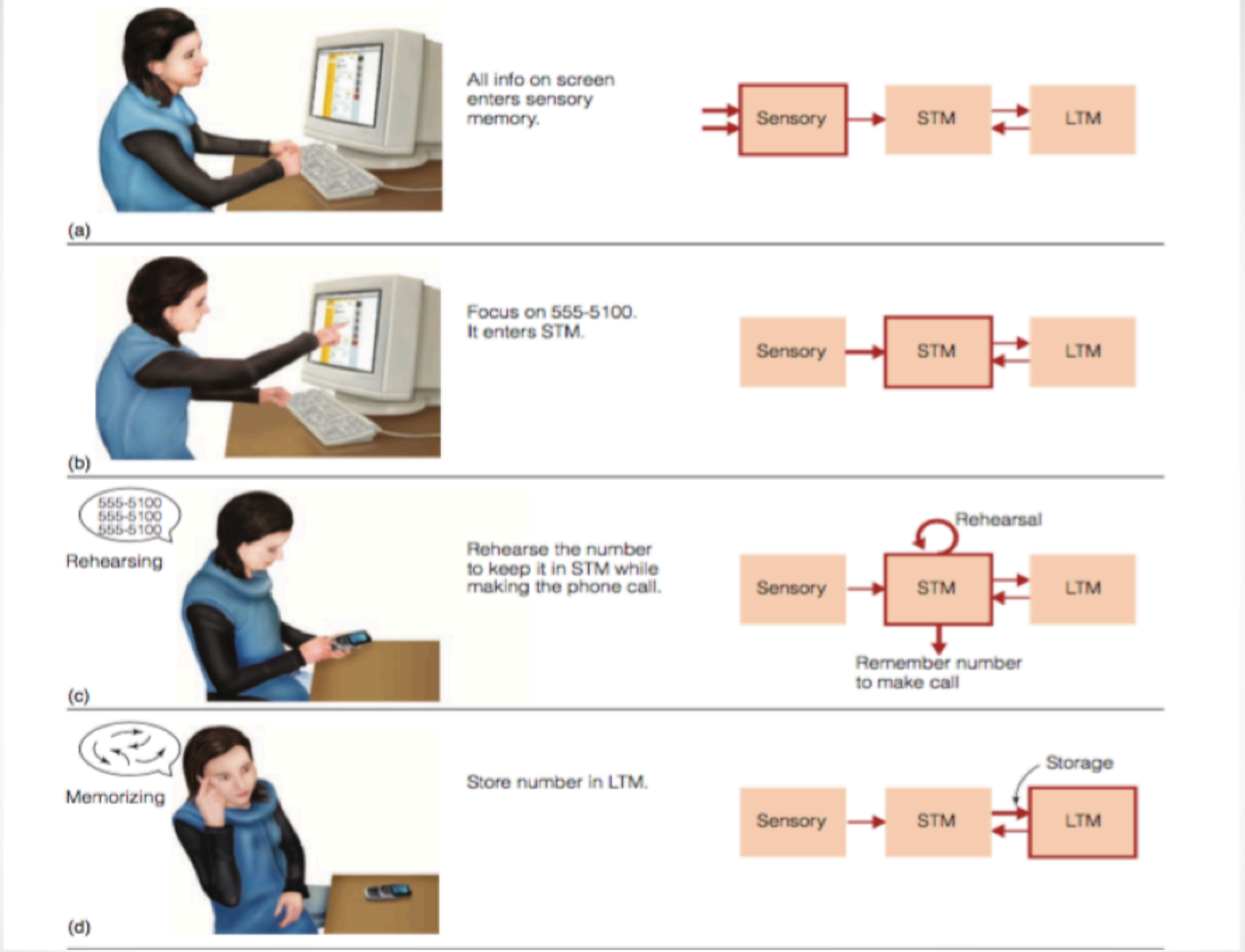

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing*. (p. 119)

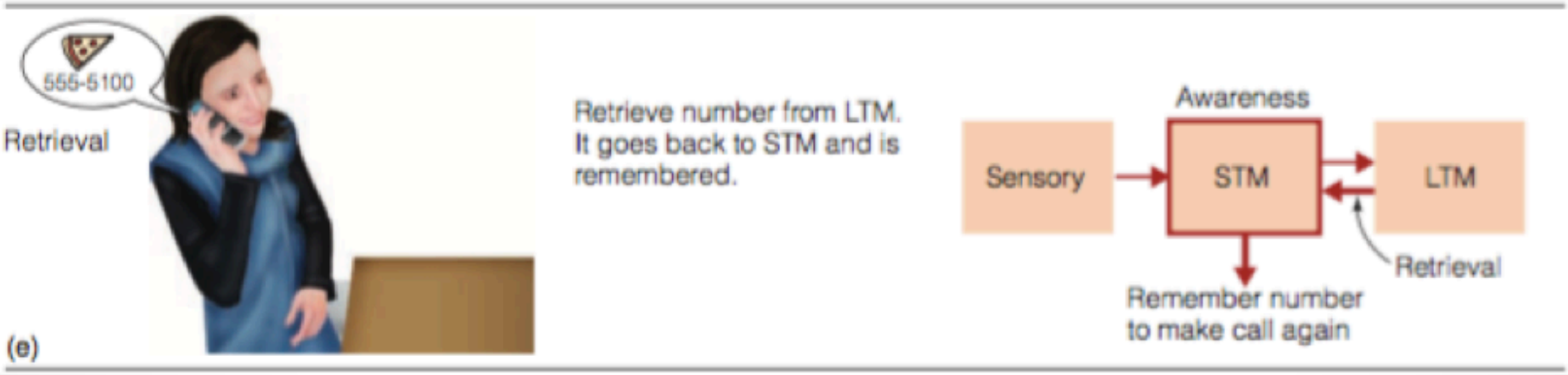

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing*. (p. 119)

Sensory Memory

- Sensory Memory is the retention, for brief periods of time, of the effects of sensory stimulation. e.g. the moving sparkler & the experience of seeing a film.

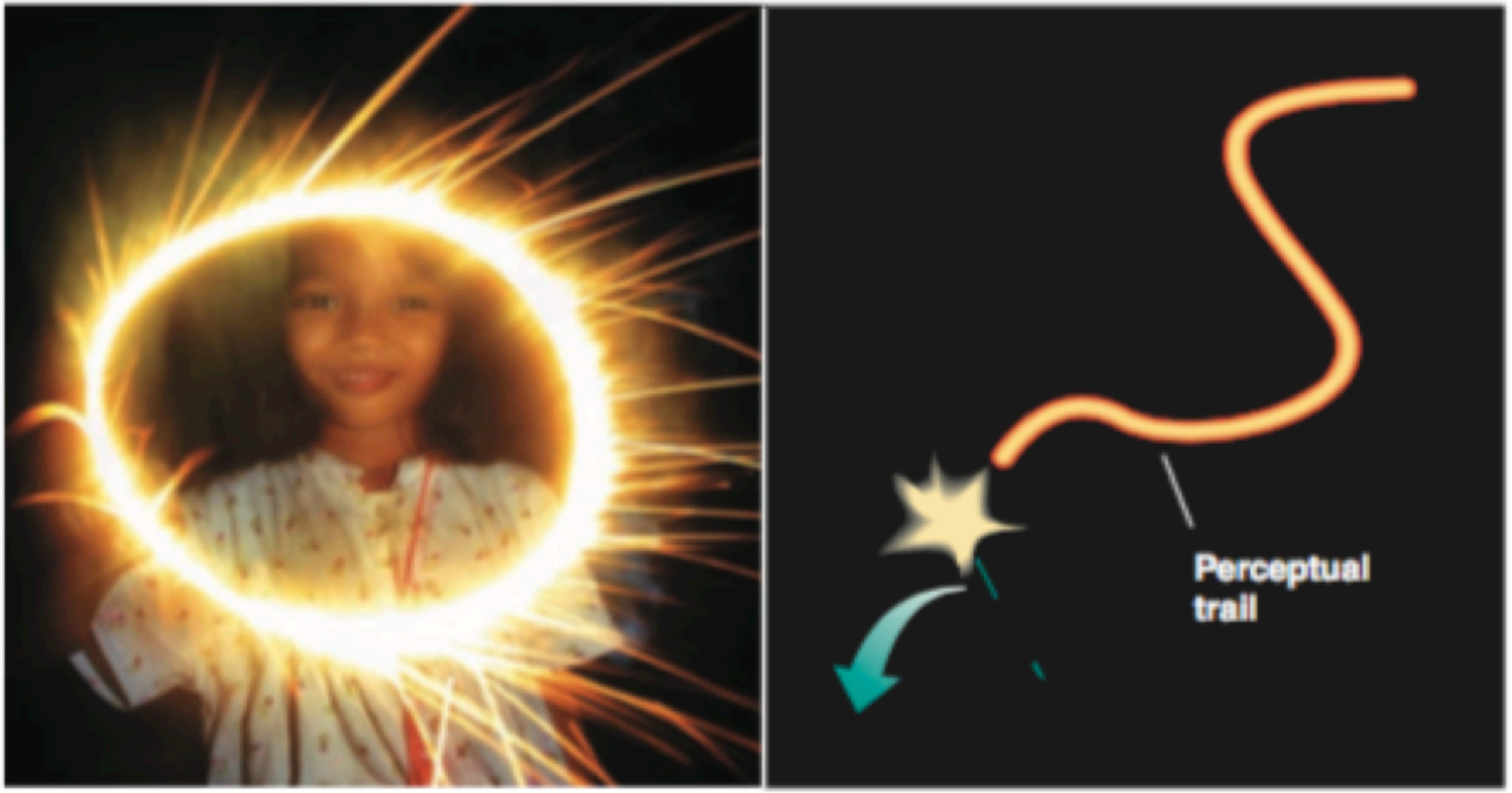

FIGURE 5.4 (a) A sparkler can cause a trail of light when it is moved rapidly. (b) This trail occurs because the perception of the light is briefly held in the mind.

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing.* (p. 120)

- as you swing the sparkler through the air, creating a trail of light; you would realise that there is actually no light along this trail. The lighted trail for the most part, is a creation of your own mind. this retention of the perception of light in your mind is called the **persistence of vision**.

- Similarly, once you are watching a movie in a darkened theatre, you may see actions moving smoothly across the screen; but what is actually projected is quite different.

- first, a single frame is positioned in the front of the projector lens, and when the projector's shutter opens, the image on the film frame flashes on the screen. the shutter then closes, so the film can move to the next frame & during the time the screen is dark.

- when the next frame has arrived in front of the lens, the shutter reopens, flashing the next image on to the screen. this process is repeated rapidly, around 24 times per second; so 24 images are flashed on the screen every second separated by a brief period of darkness.

- a person viewing the film does not see the dark intervals between the images because the persistence of vision fills in the darkness by retaining the image of the last frame.

- Sperling's Experiment!
    - George Sperling (1960) wondered *how much information* people can take in from briefly presented stimuli. He determined this in a famous experiment in which he flashed an array of letters, on the screen for 50ms and asked his participants to report as many of the letters as possible.
    - this part of the experiment used the **whole report method**; when participants were asked to report as many letters as possible from the whole matrix.
    - Given this task, participants were able to report an average of 4.5 letters out of the 12 letters.

- In the next version, Sperling devised the **partial report method**, i.e. he presented the matrix for 50 ms as before but sounded one of the following tones immediately after the matrix presentation, to indicate which row of letters the participants were to report:

- High Pitched: Top Row
- Medium Pitched: Middle Row
- Low Pitched: Bottom Row

- because the tones were presented after the letters were turned off, the participant's attention was directed not to the actual letters, which were no longer present but to whatever trace remind in the participant's mind after the letters were turned off.

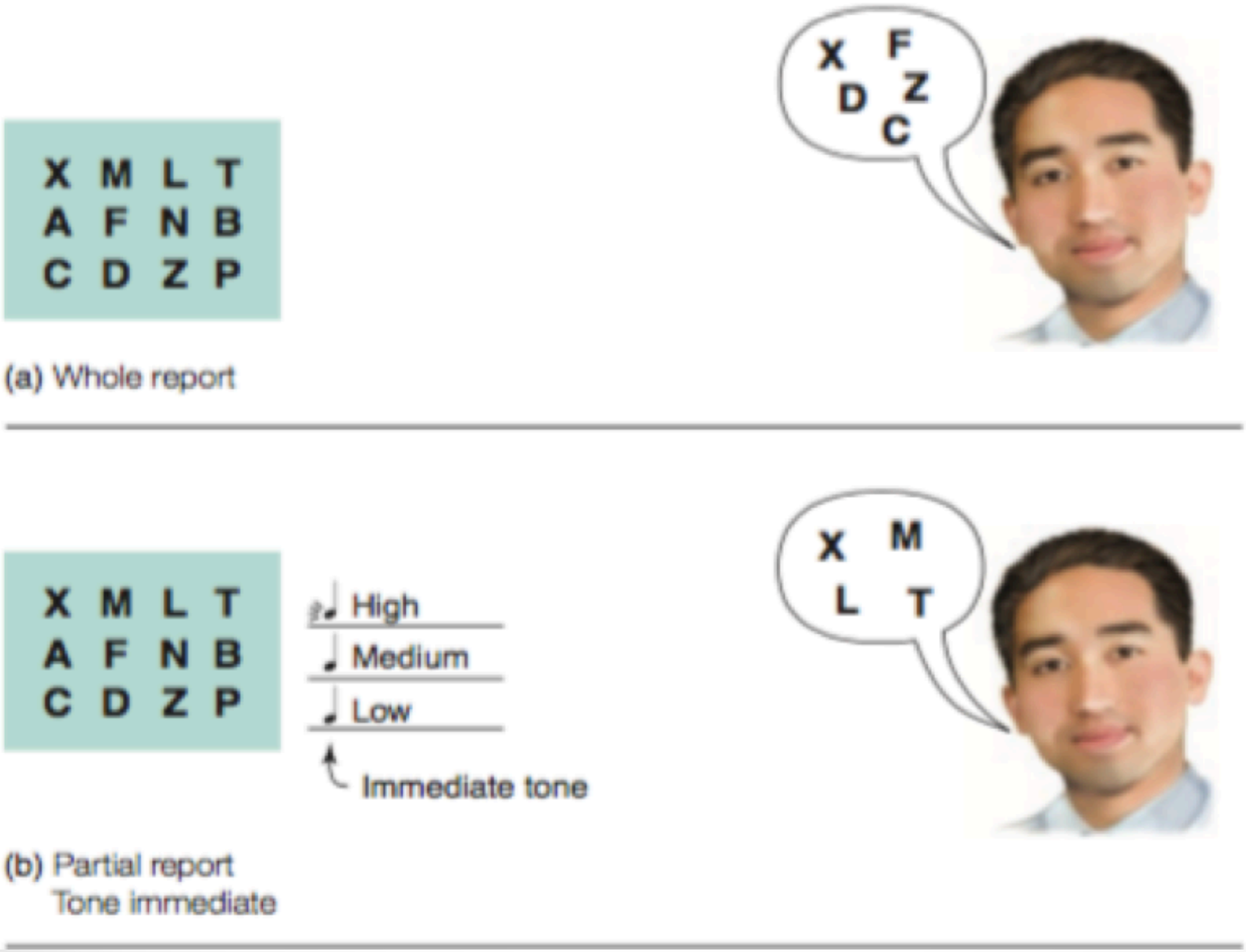

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing.* (Fig. 5.5, p. 120)

- When the cue tones directed participants to focus their attention on one of the rows, they correctly reported an average of 3.3 of 4 letters in that row.

- Sperling concluded that the correct description of what was happening was that immediately after the display was presented, participants saw an average of 82% of letters in the whole display, but were not able to report all of these letters because they rapidly faded as the initial letters were being reported.

- Sperling then did an additional experiment to determine the time course of this fading.

- For this, Sperling devised a **delayed partial report method** in which the presentation of tones was delayed for a fraction of a second after the letters were extinguished.

- The result of the delayed partial report method wa that when the cue tones were delayed for 1 second after the flash, participants were able to report only slightly more than 1 letter in a row, the equivalent of about 4 letters for all three rows - the same number of letters they reported using the whole report method.

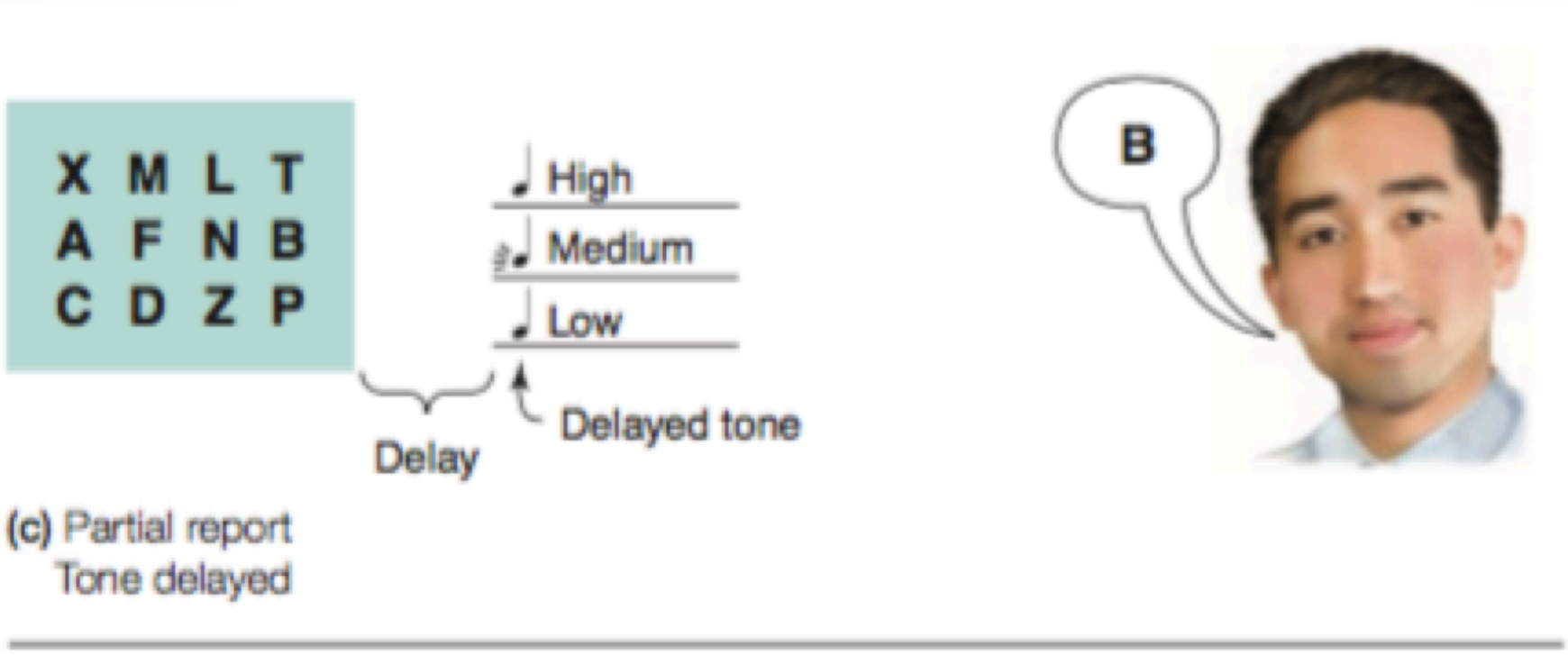

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing.* (Fig. 5.5, p. 120)

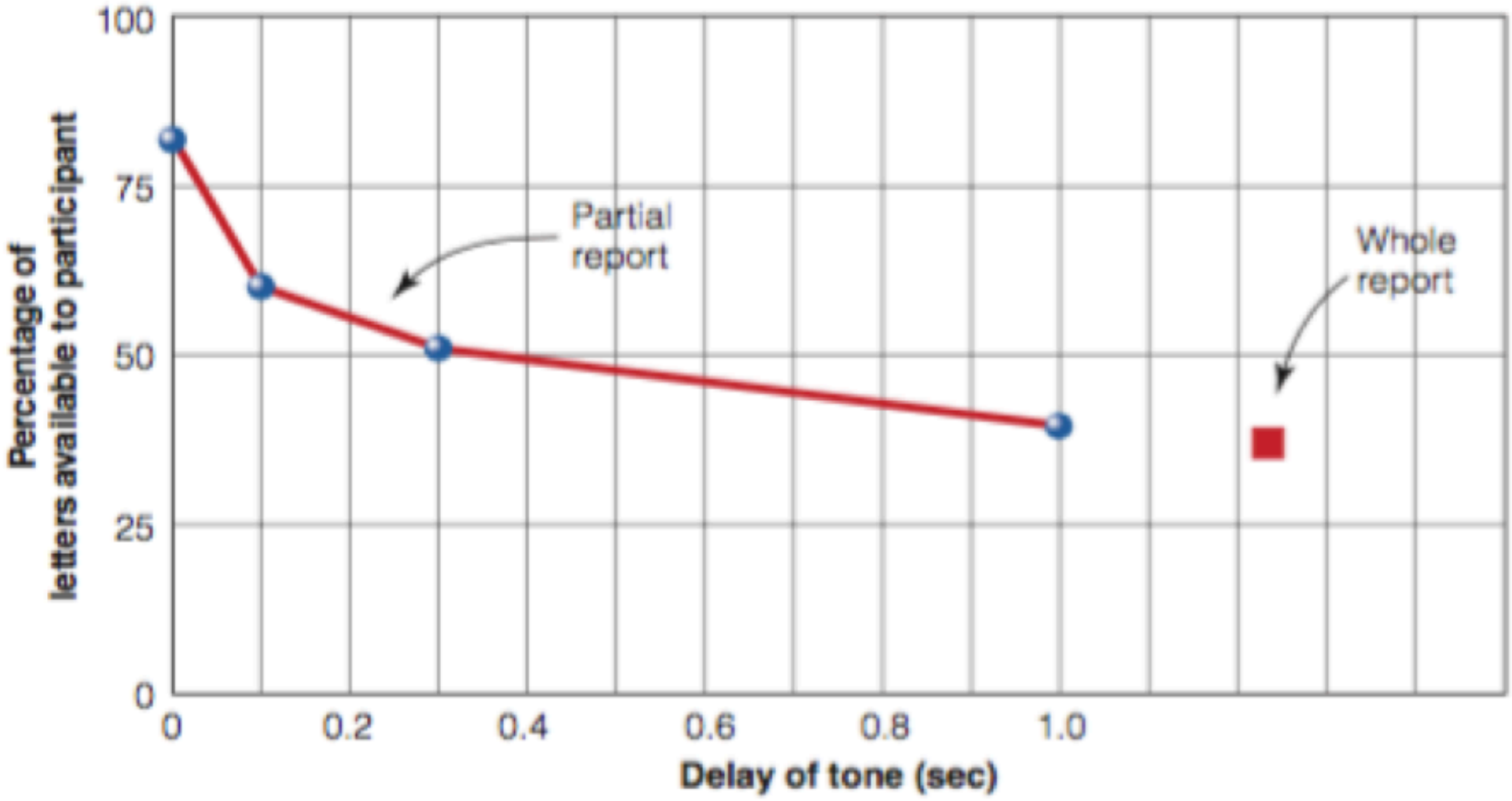

FIGURE 5.6 Results of Sperling's (1960) partial report experiments. The decrease in performance is due to the rapid decay of iconic memory (sensory memory in the modal model).

Image: Goldstein (2010). Cognitive Psychology: Connecting Mind, Research & Everyday Experience. *Wadsworth Publishing.* (Fig. 5.6, p. 122)

- Sperling concluded from these results that a short - lived sensory memory registers all or most of the information that hits our visual receptors, but that this information decays within less than a second.

- This brief sensory memory for visual stimuli is called the **iconic memory** and corresponds to the sensory memory stage of Atkinson & Shiffrin's model.

- Other research using auditory stimuli, has shown that sounds also persist in the mind. This persistence of sound, which is called **echoic memory**, lasts for a few seconds after presentation of the original stimulus (Darwin et al., 1972).

- The sensory memory can register huge amounts of information, but it retains this information for only seconds or fractions of a second.

- Many cognitive psychologists believe that the sensory store is important for :

  - collecting information to be processed
  - holding the information briefly while initial processing is going on &
  - filling in the blanks when the stimulation is intermittent.

- Sperling's experiment is important not only because it reveals the capacity of sensory memory (large) & its duration (brief), but also because it provides yet another demonstration of how clever experimentation can reveal extremely rapid cognitive processes that we are usually unaware of.

To Sum Up

References