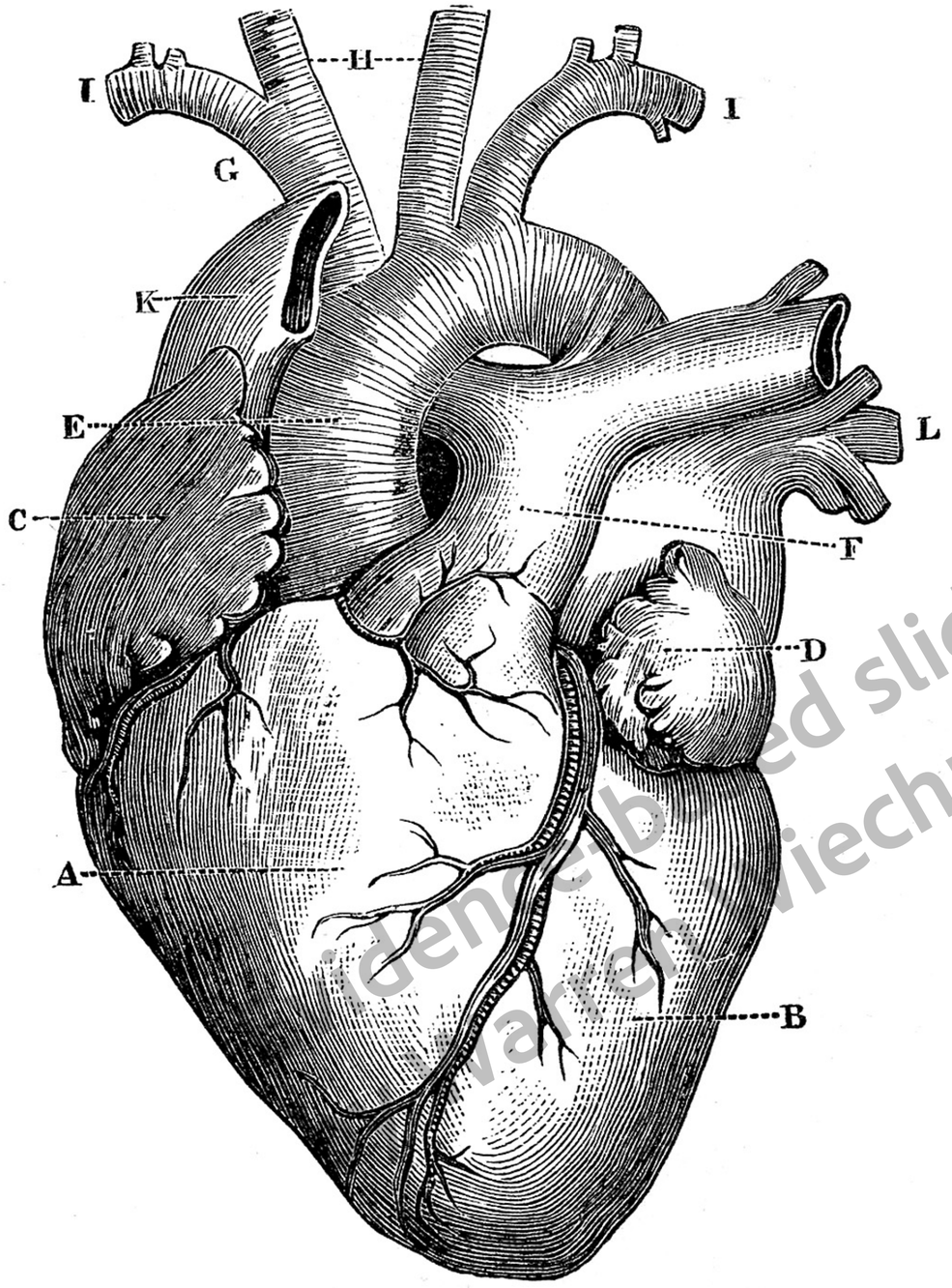
Fig. 37.



EVIDENCE-BASED

Slide Design

WARREN WIECHMANN, MD, MBA

The delivery of quality education should be driven by **evidence-based principles**

As an educator, it is my responsibility to teach informed by the **scientific evidence**

Learning Objectives

1. **Review** the core principles that inform evidence-based multimedia instruction
2. **Discuss** techniques to create effects in PowerPoint and Keynote that enhance your presentation
3. **Discuss** additional applications of these techniques in other educational settings
4. **Gather** resources that you can use to further improve your slides
5. **Identify** opportunities within your teaching content to apply multimedia principles

What will you learn today?

Slide design matters.

Good design promotes more effective learning.

style > substance

Evidence-based slide design
by Warren Wiechmann, MD, MBA, MEd 2023

style + substance

Evidence-based slide design
by Warren Wiechmann, MD, MBA, MEd 2023

Two foundational definitions

Multimedia Instruction = **words** + **pictures**

Printed text
Spoken text

Static images
Dynamic images

Multimedia Principle = people learn better from **words** + **pictures** than words alone

The Cognitive Theory of Multimedia Learning

Based on 3 assumptions:

1

Dual-channels assumption

Separate channels or pathways for processing visual (eyes) and auditory (ears) information

2

Limited capacity assumption

There is a processing capacity in each channel at one time

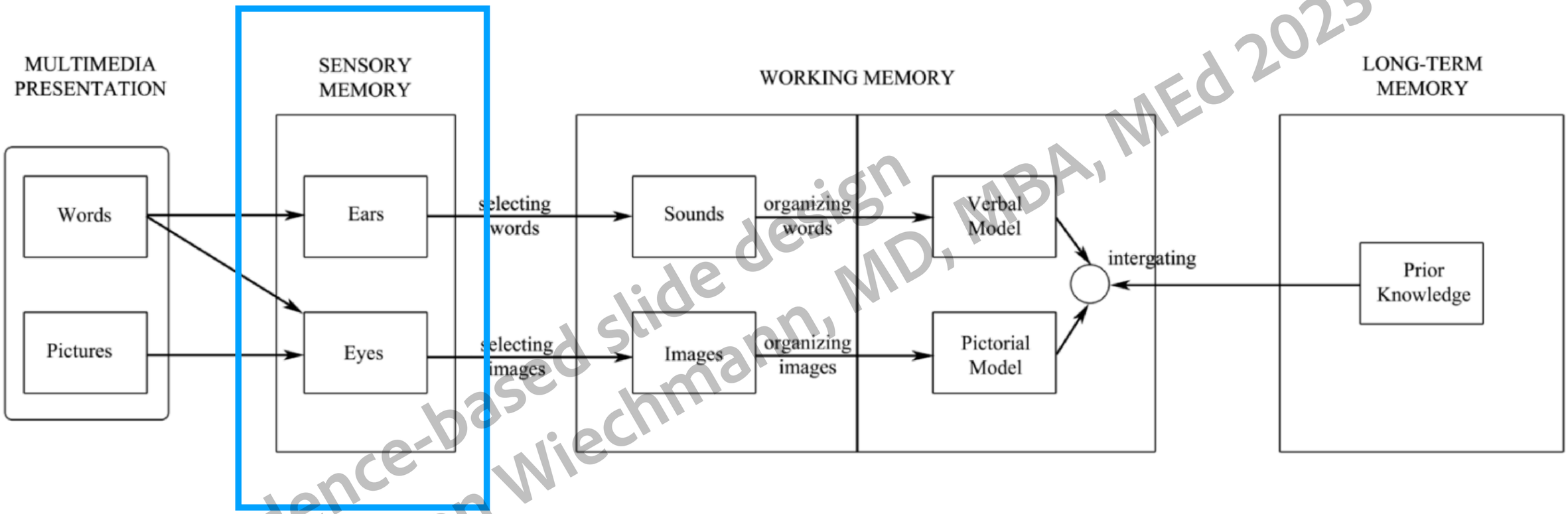
3

Active processing assumption

Active learning requires 4 steps:

- Attend to incoming information,
- Actively select relevant material,
- Organize that material into mental representations,
- Integrate selected material with existing knowledge

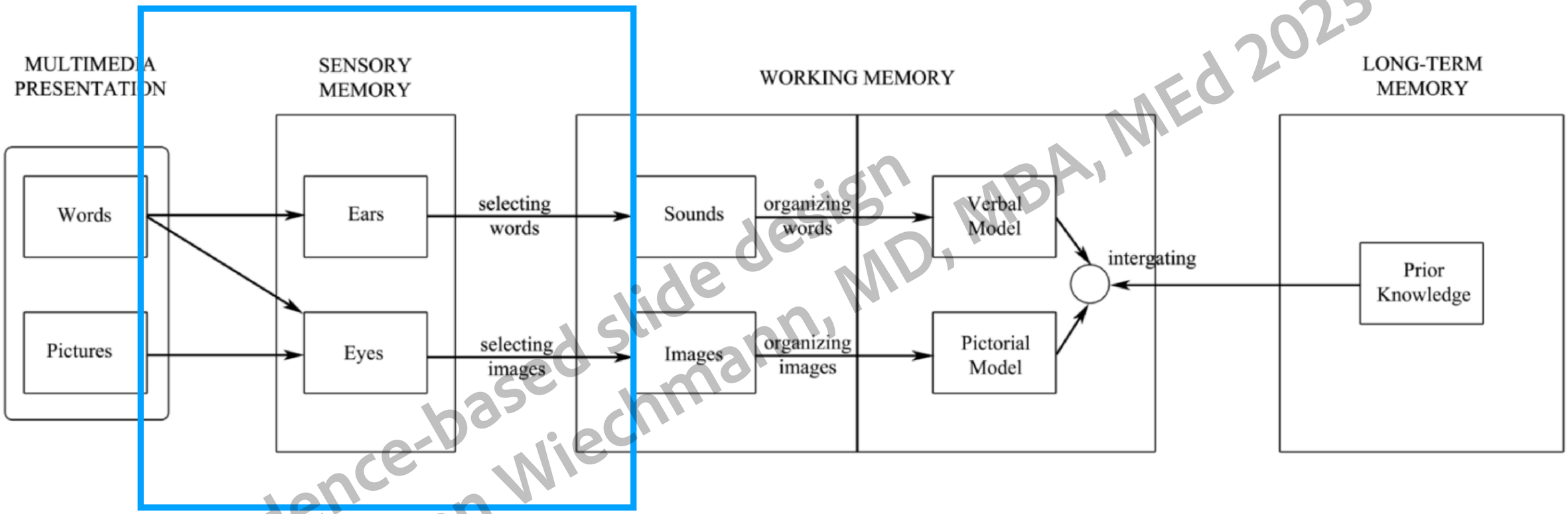
Breaking Down the Cognitive Theory of Multimedia Learning



1 Dual-channels assumption

Separate channels or pathways for processing visual (eyes) and auditory (ears) information

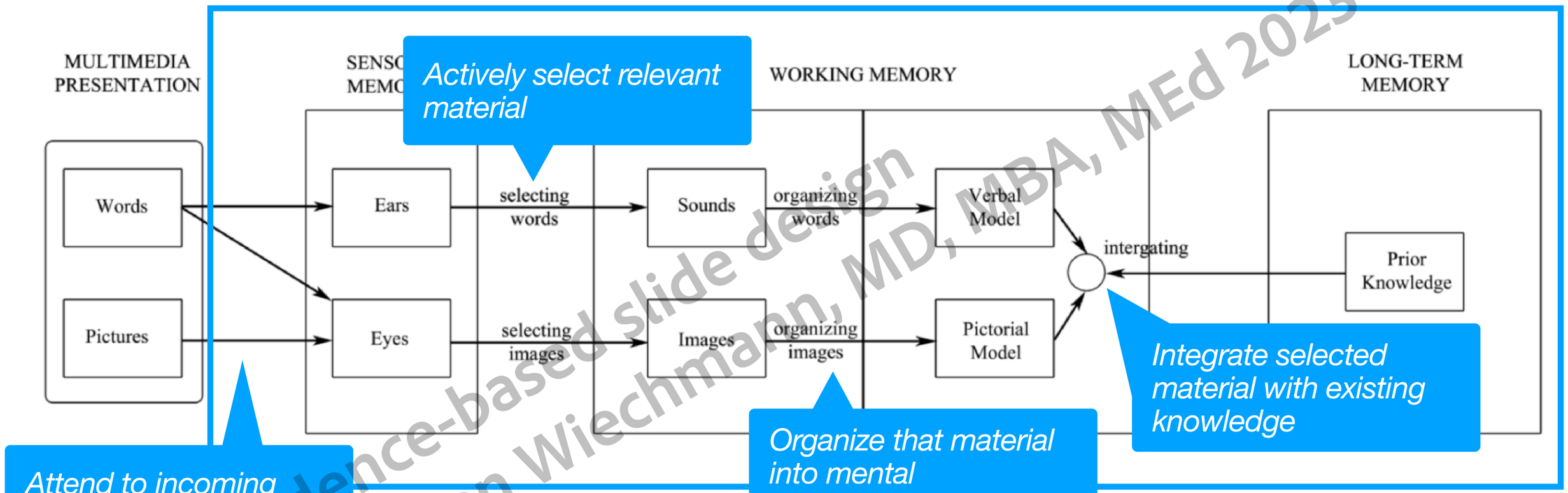
Breaking Down the Cognitive Theory of Multimedia Learning



2 Limited capacity assumption

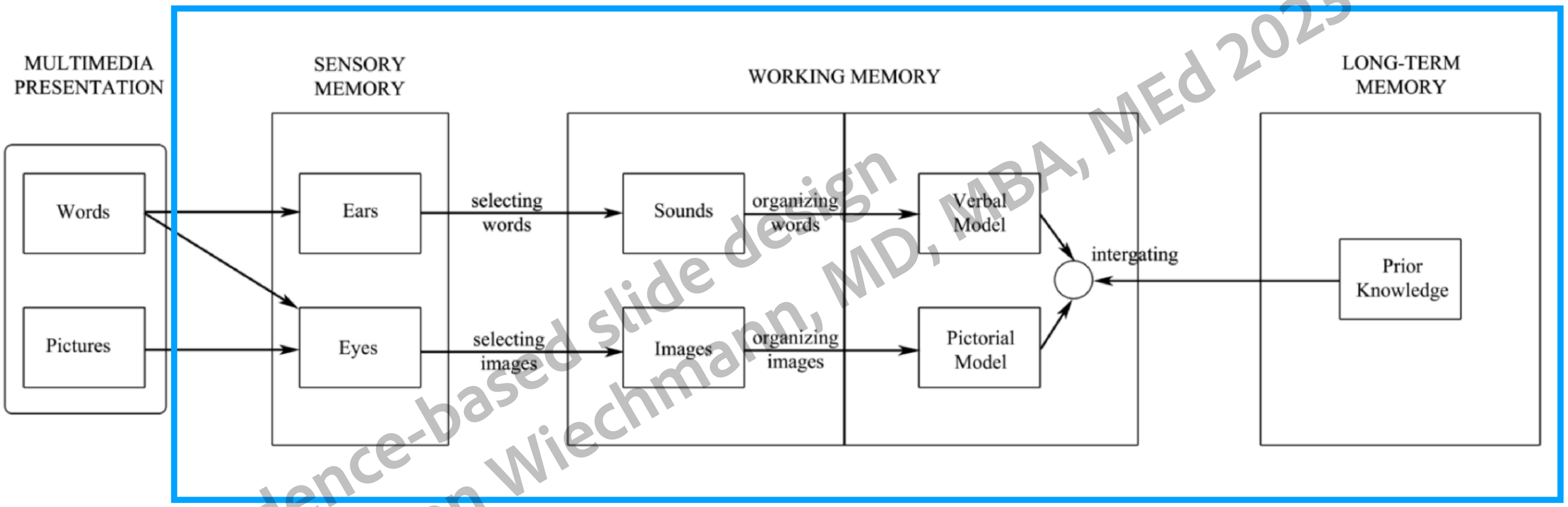
There is a processing capacity in each channel at one time

Breaking Down the Cognitive Theory of Multimedia Learning



3 Active processing assumption

Breaking Down the Cognitive Theory of Multimedia Learning



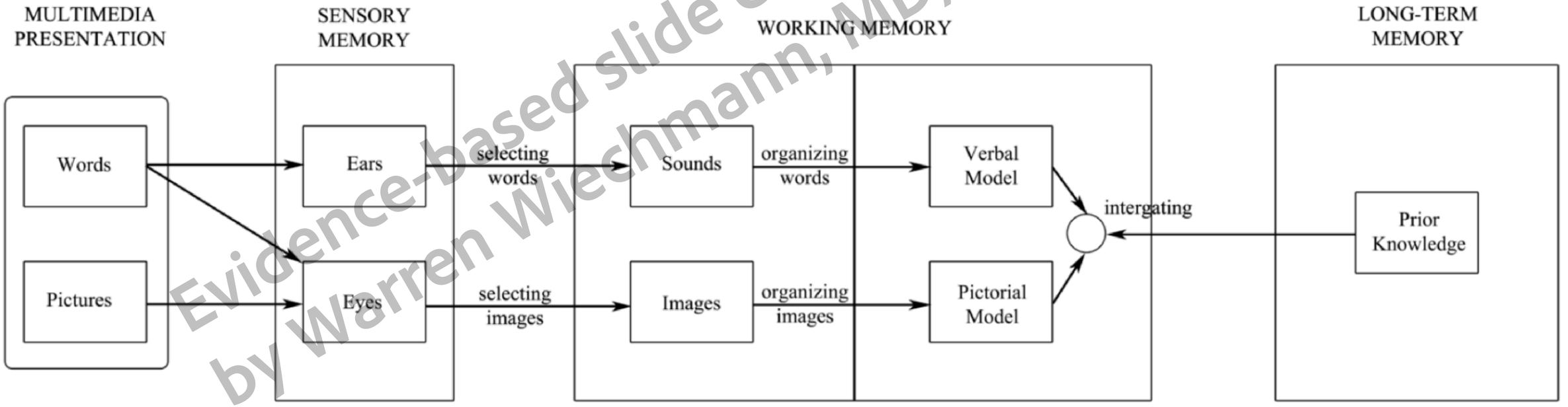
Learning requires processing
Processing has a fixed capacity

→ Learning is **disrupted** by additional processing burdens

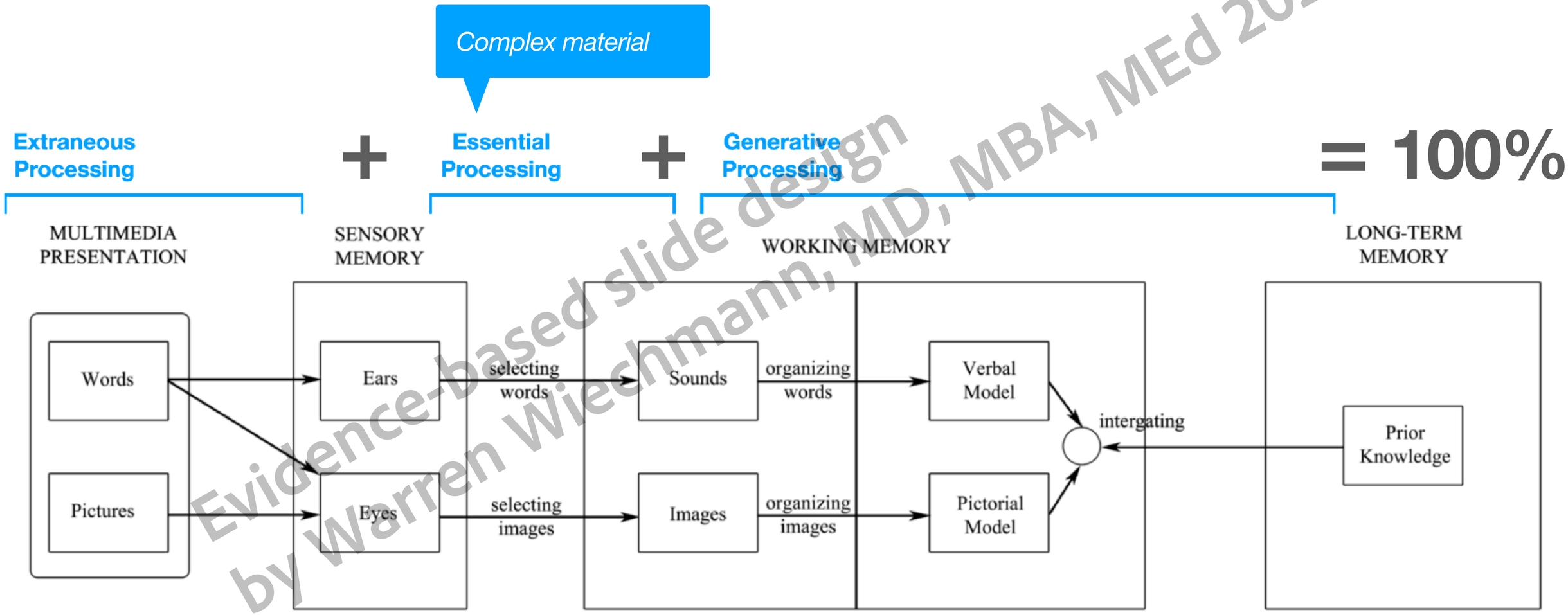
Breaking Down the Cognitive Theory of Multimedia Learning

Bad design

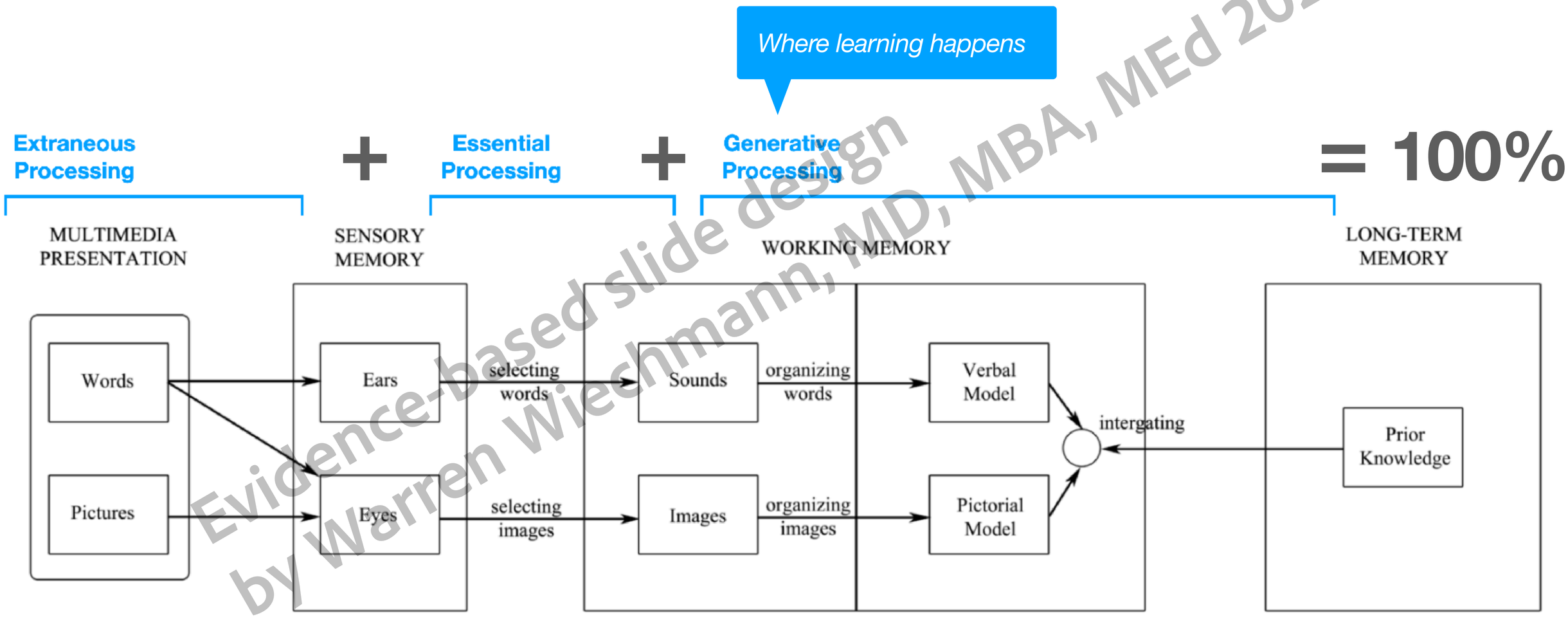
Extraneous Processing + **Essential Processing** + **Generative Processing** = 100%



Breaking Down the Cognitive Theory of Multimedia Learning



Breaking Down the Cognitive Theory of Multimedia Learning



The Cognitive Theory of Multimedia Learning helps to explain the Multimedia Principle

Additional principles to address these three areas of processing

Extraneous Processing

Signaling (pointing)
Spatial Contiguity
Temporal Contiguity
Coherence
Redundancy

Essential Processing

Segmenting
Pre-training
Modality

Generative Processing

Generative Activity
Personalization
Voice
Image
Embodiment
Immersion

Effect Size

Used to determine the **efficacy** of an intervention or educational practice relative to a comparison group or approach. Not only does the effect size indicate if an intervention would work, but it also predicts how much impact to expect in a range of scenario

p-value for education

Effect Size	Impact
d = +0.3	small
d = +0.4 - 0.6	moderate
d > +0.7	high

Range from -2 to +2, most are -0.5 to +1.75

https://www.illuminateed.com/blog/2017/06/effect-size-educational-research-use/

Evidence-based Slide Design Principles

Cognitive Theory of Multimedia Learning
Multimedia Principle
Signaling
Spatial Contiguity
Temporal Contiguity
Coherence
Redundancy
Segmenting
Generative Activity

The Multimedia Principle

people learn better
from **words** + **pictures**
than words alone

Median effect size of d=1.35

The Signaling Principle

learning improves when **cues highlight important information**

verbal (spoken or text)
visual (images)
live (pointing)

work by reducing extraneous processing by **directing attention** towards important details

Median effect size of d=0.70

The Signaling Principle

emphasis
color
font size
boxes
arrows
image overlays
icons
titles

The Spatial Contiguity Principle

a positive effect on learning when images and their corresponding words are **closer in proximity** to one another

Median effect size of d=0.82

The Temporal Contiguity Principle

a positive effect on learning when images and their corresponding words are **presented together** instead of consecutive order

Median effect size of d=1.31

The Coherence Principle

decrease extraneous processing by removing:

- interesting but irrelevant words
- unneeded words and symbols
- interesting but irrelevant music

Median effect size of d=0.86

The Redundancy Principle

learning is **not improved** when printed or on-screen text is added to a presentation that already contains images and spoken words

Median effect size of d=0.72

Wait…
Isn’t that every live lecture?

The Redundancy Principle

There is a benefit of shorter text (signaling), but long blocks of text may be redundant

The Segmenting Principle

ensure that working memory (*essential processing*) is not overloaded by breaking up complex messages into small parts

Median effect size of d=0.67

The Generative Activity Principle

people learn better when they prompted to carry out activities that **promote active learning**

Median effect size of d=0.71

The Generative Activity Principle

Prompts to engage in active learning include:
summarizing, mapping, drawing, imaging, self-testing, self-explaining, or teaching

The Generative Activity Principle

Easy:
Add a slide with a multiple choice question

Easier:
Add a slide that asks them to summarize the previous few slides

Evidence-based Slide Design Principles

Cognitive Theory of Multimedia Learning
Multimedia Principle
Signaling
Spatial Contiguity
Temporal Contiguity
Coherence
Redundancy
Segmenting
Generative Activity

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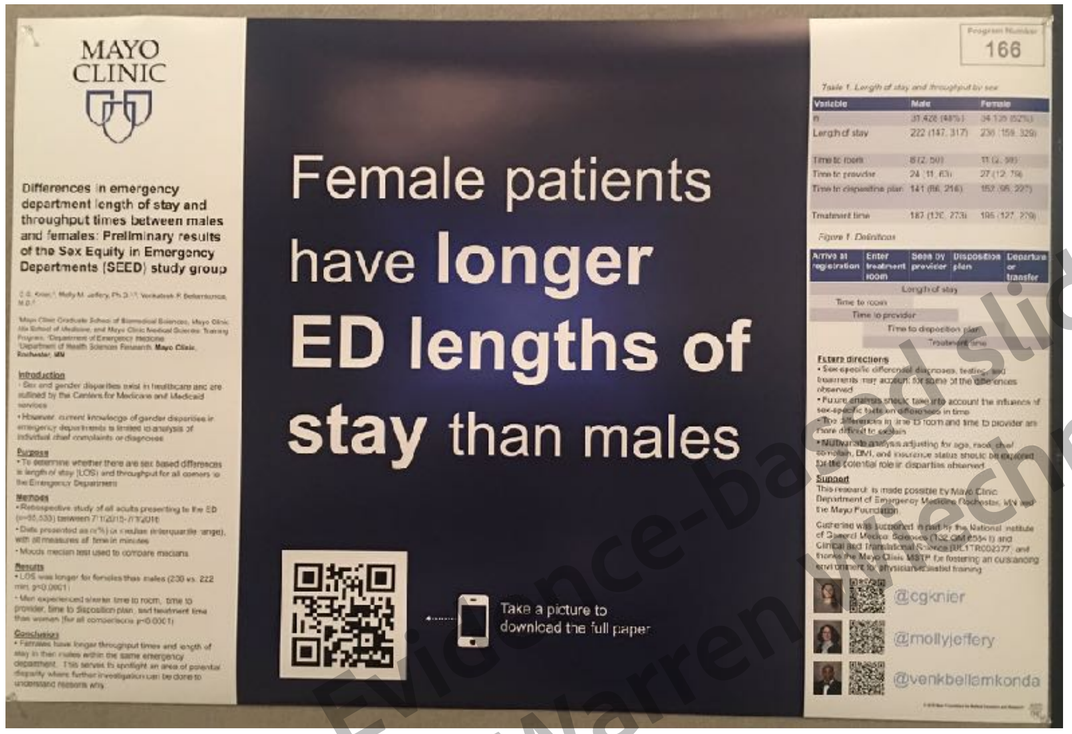
Slide design principles are useful for digital or traditional research posters



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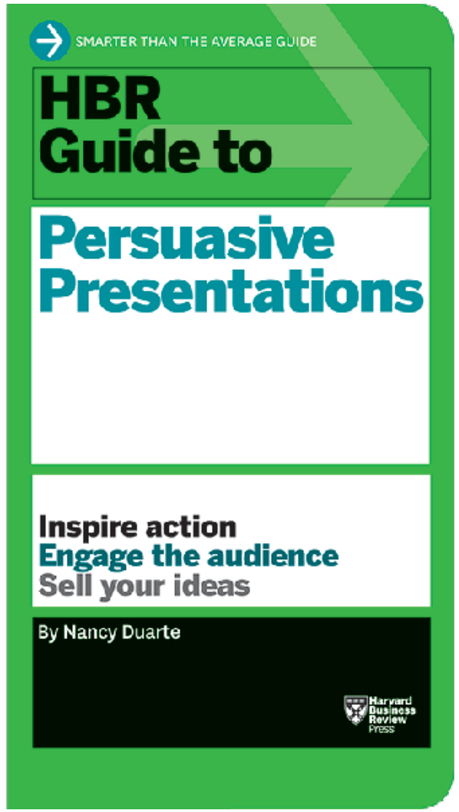

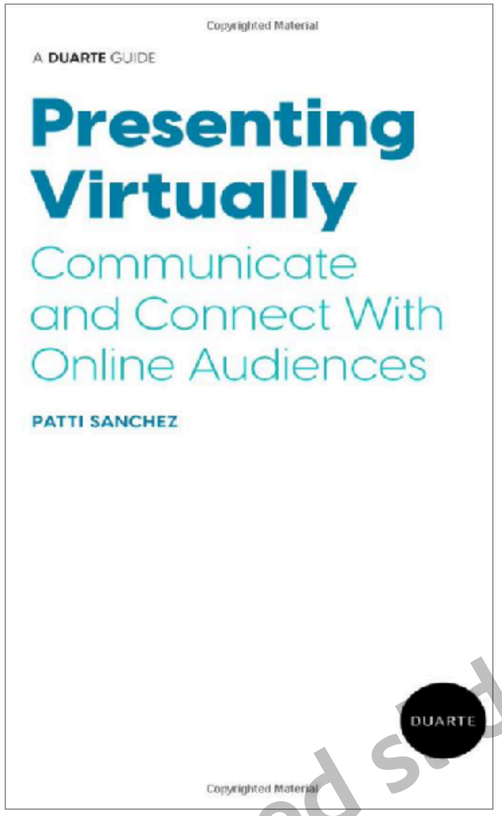

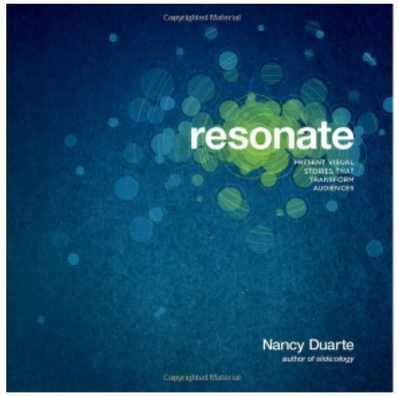

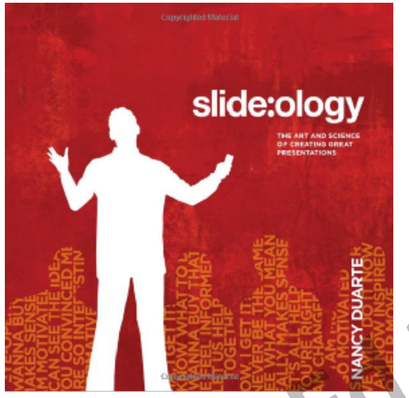

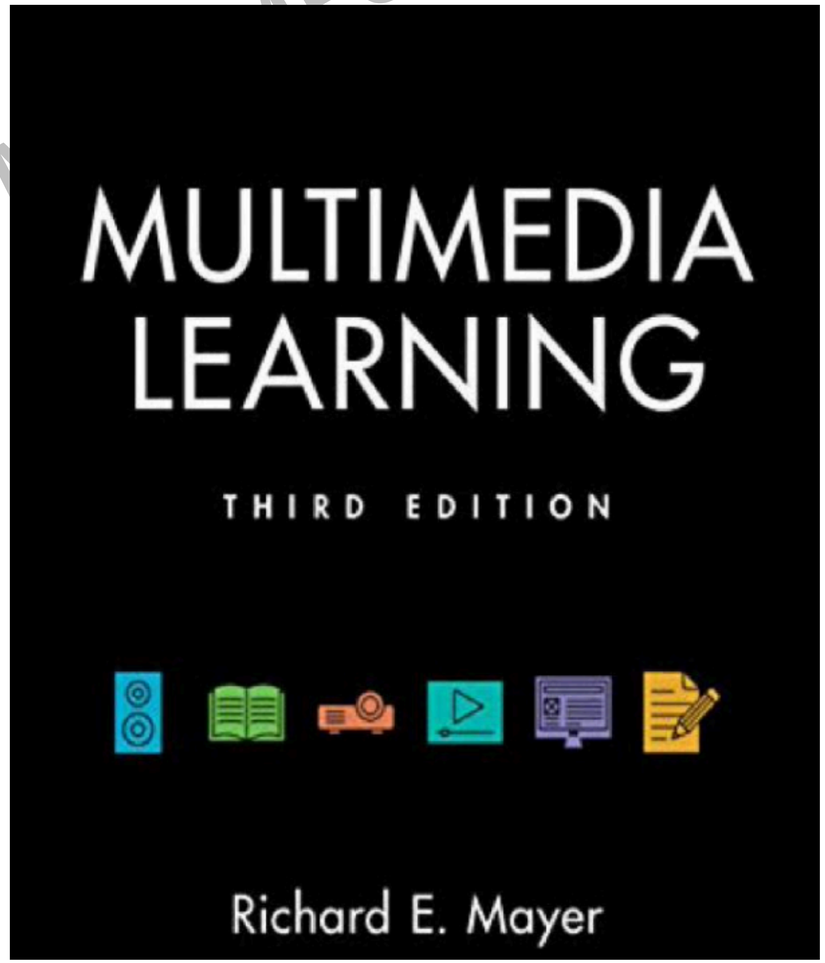

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