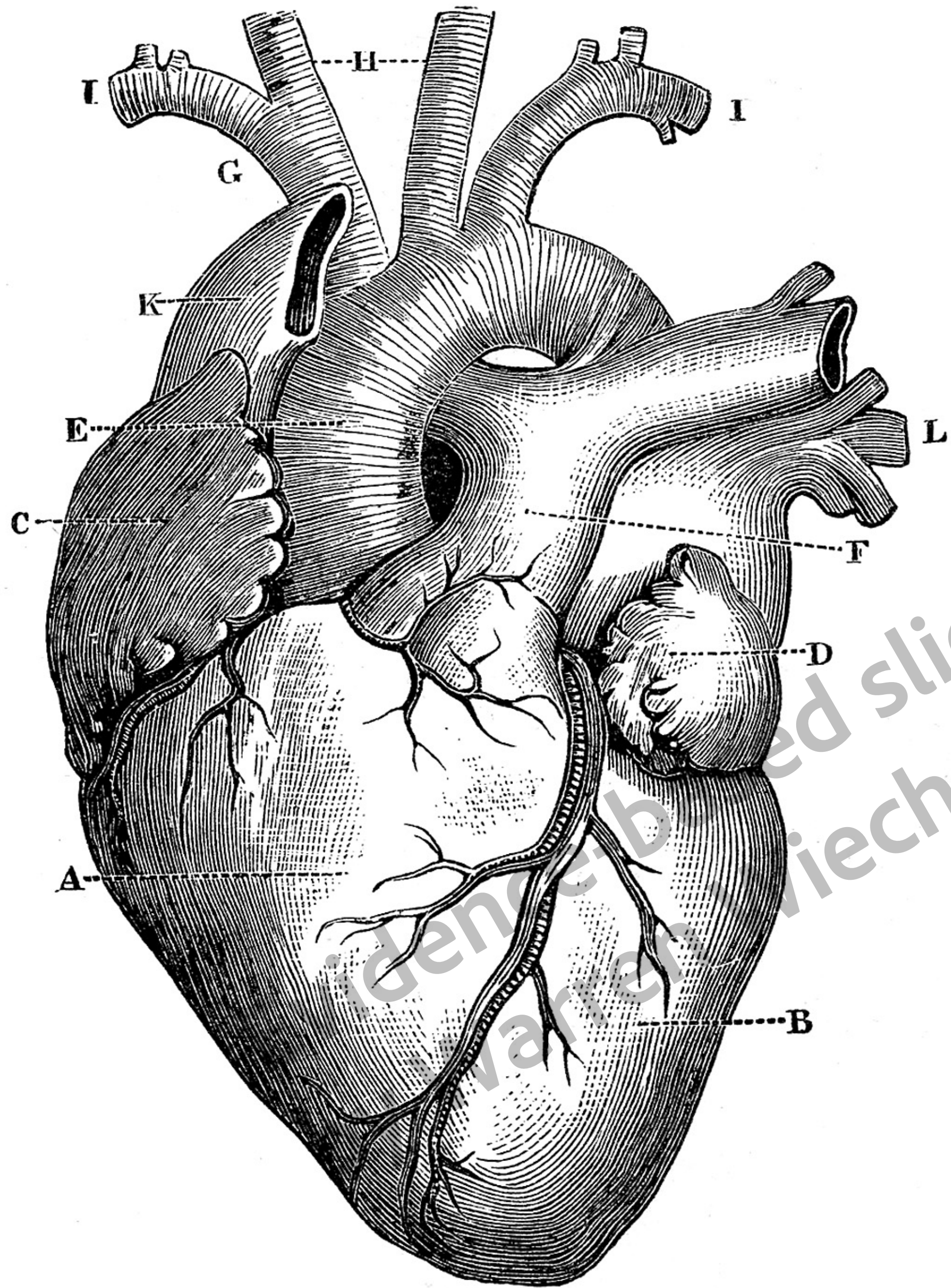


Fig. 37.



EVIDENCE-BASED

Slide Design

WARREN WIECHMANN, MD, MBA

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

As a clinician, it is my responsibility to
practice medicine informed by the
scientific evidence

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

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



What will you learn today?

Slide design matters.

Good design promotes more effective learning.

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

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

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

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



The Cognitive Theory of Multimedia Learning

Based on 3 assumptions:

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

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

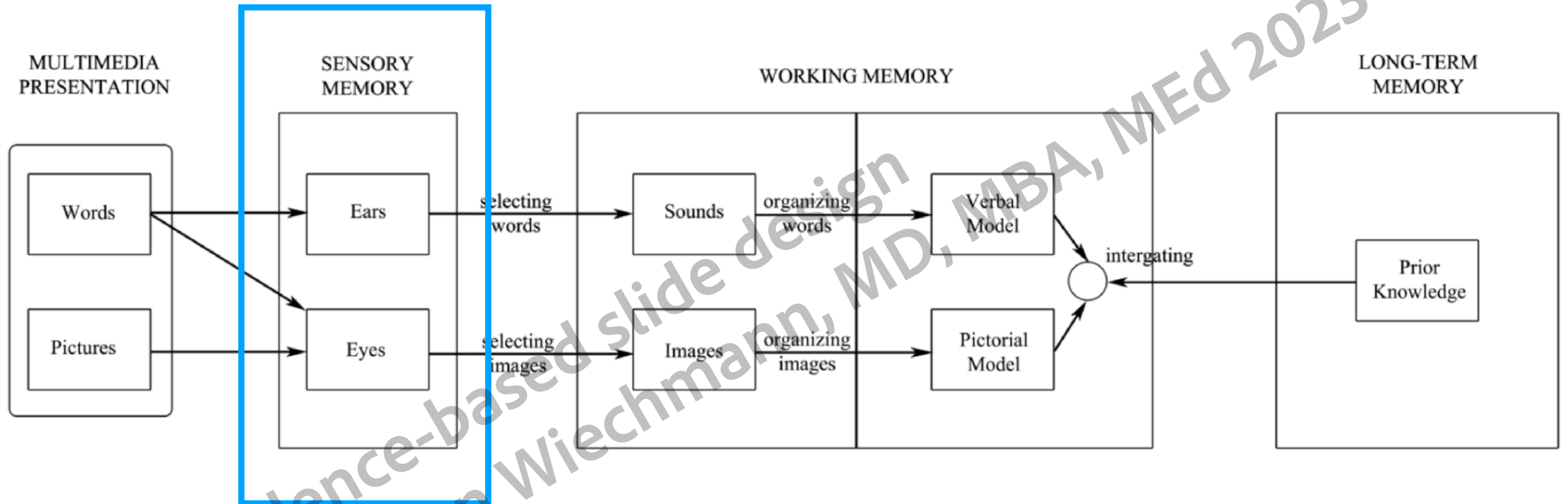
3

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

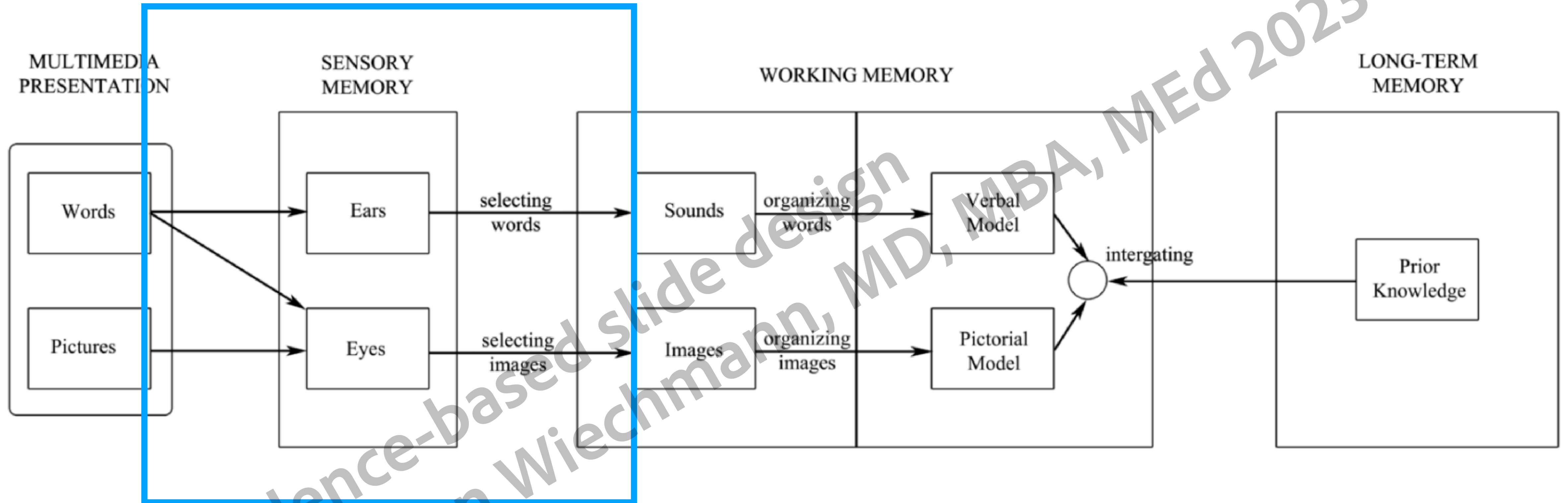
Breaking Down the Cognitive Theory of Multimedia Learning



Dual-channels assumption

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

Breaking Down the Cognitive Theory of Multimedia Learning

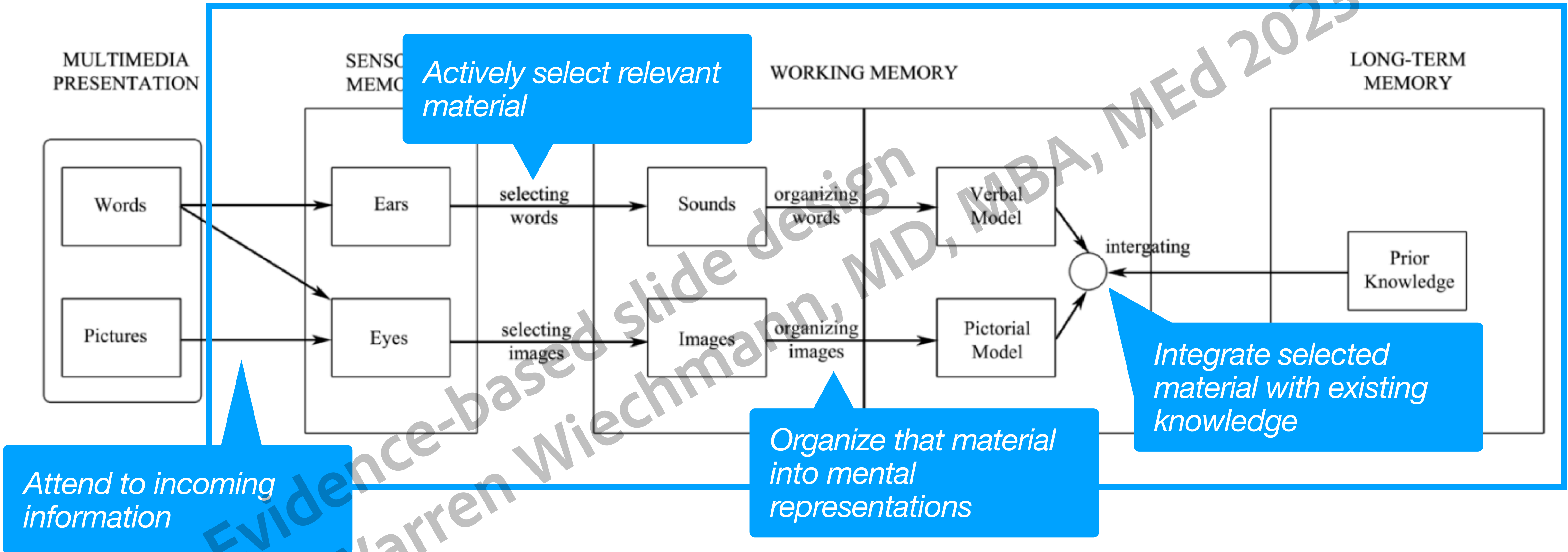


2

Limited capacity assumption

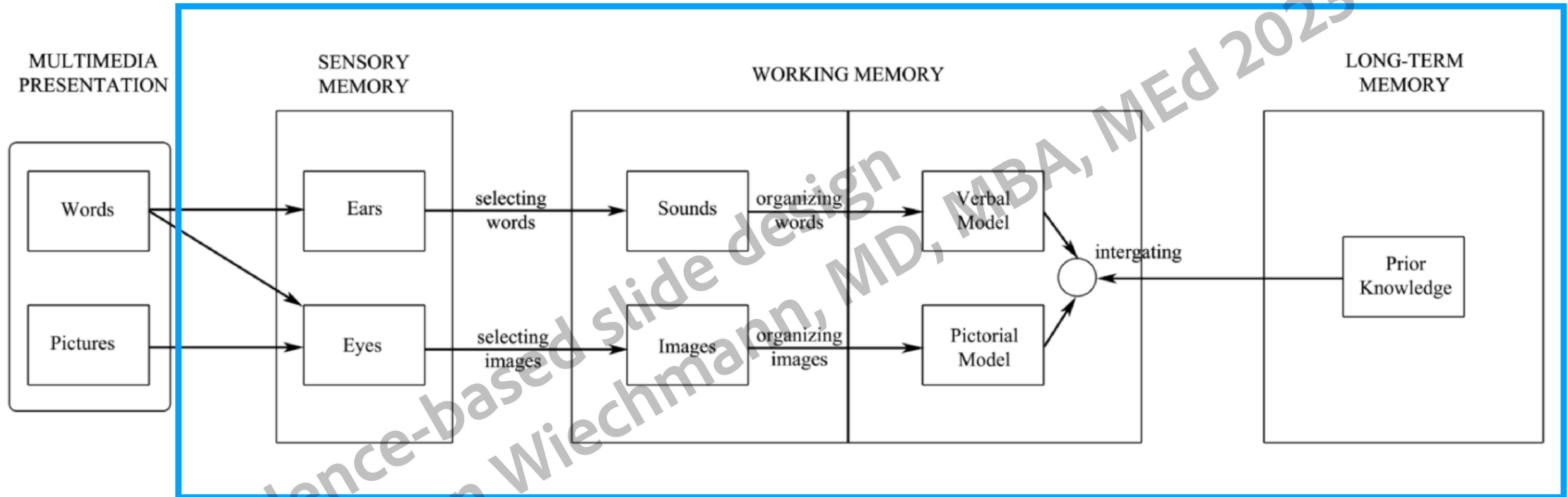
There is a processing capacity in each channel at one time

Breaking Down the Cognitive Theory of Multimedia Learning

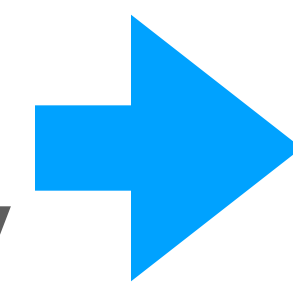


3 Active processing assumption

Breaking Down the Cognitive Theory of Multimedia Learning

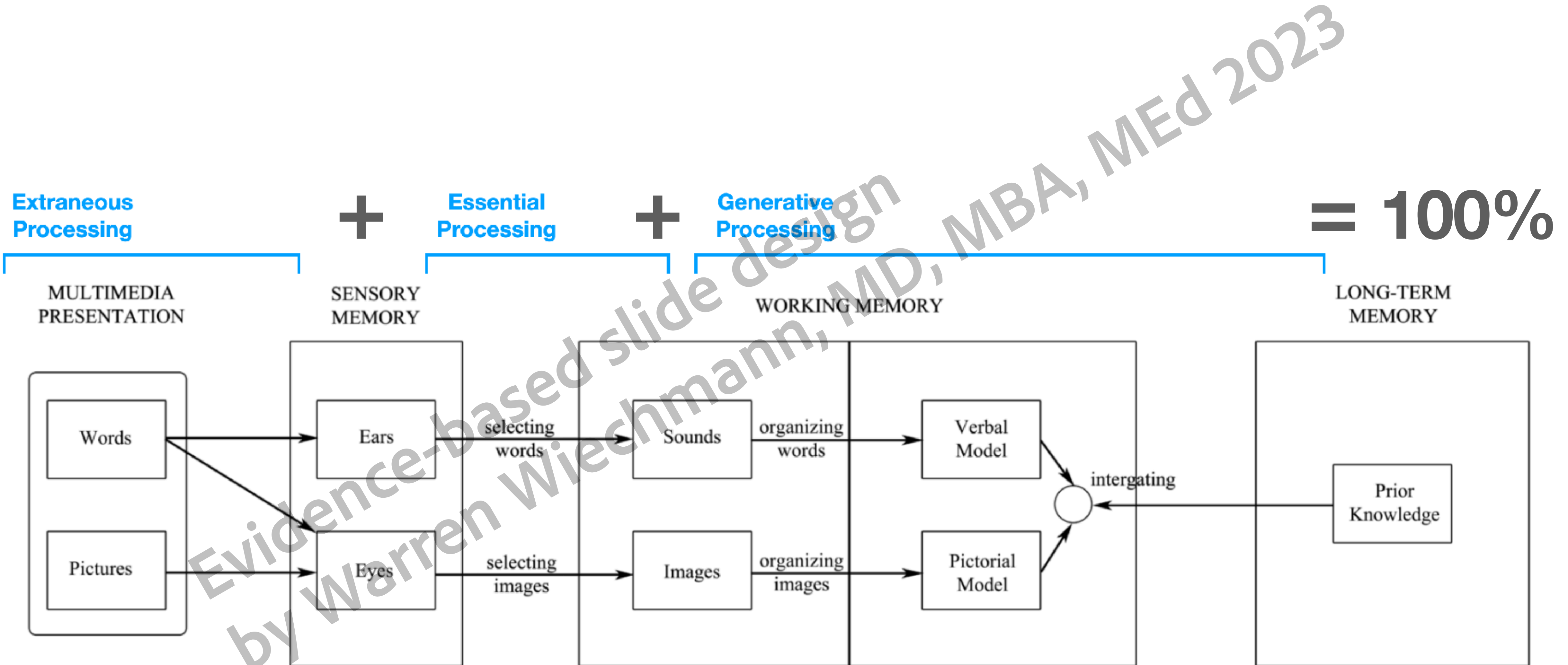


Learning requires processing
Processing has a fixed capacity



Learning is **disrupted** by
additional processing burdens

Breaking Down the Cognitive Theory of Multimedia Learning



Breaking Down the Cognitive Theory of Multimedia Learning

Bad design

Extraneous Processing

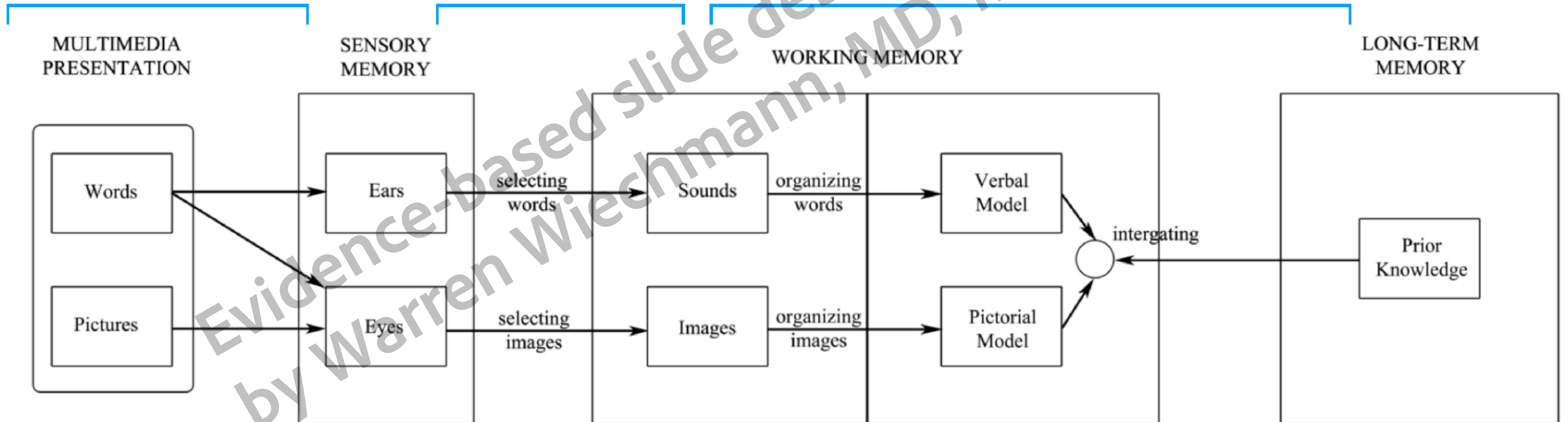
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Essential Processing

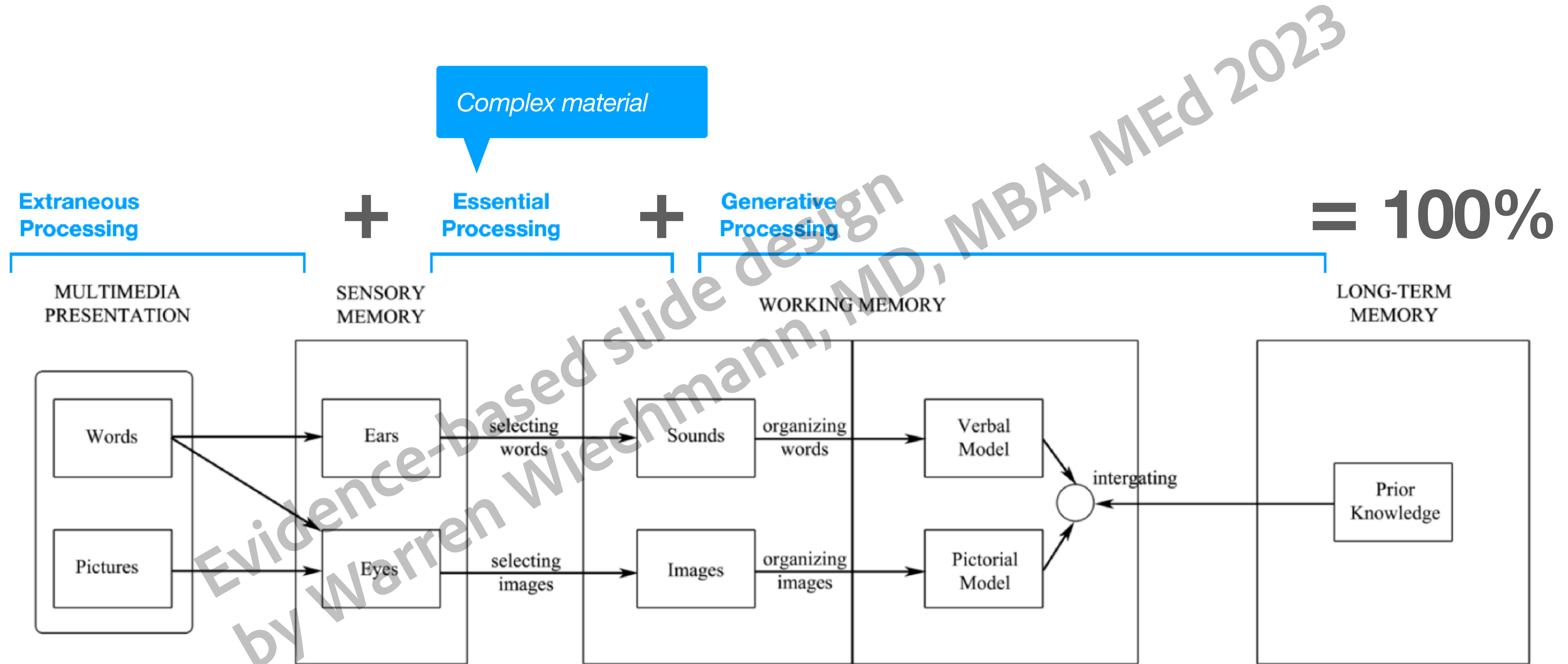
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Generative Processing

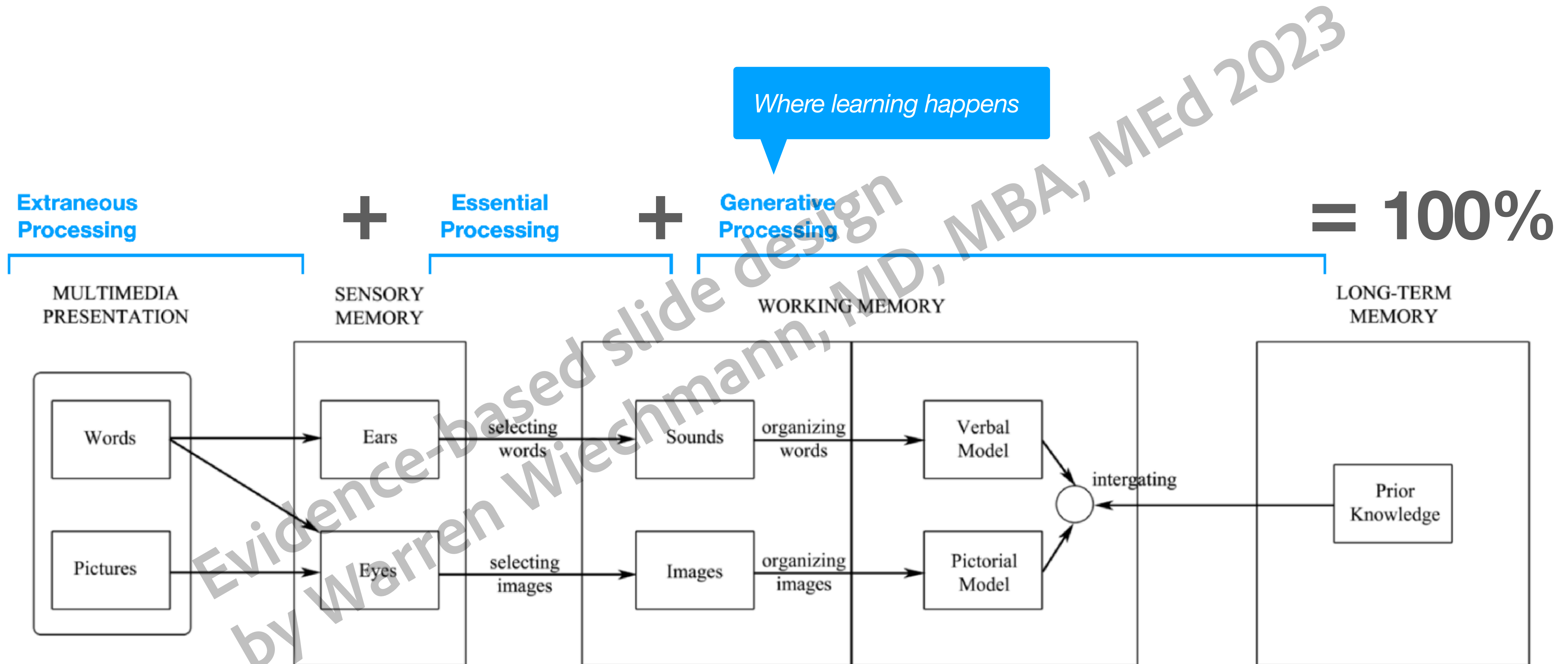
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Breaking Down the Cognitive Theory of Multimedia Learning



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

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by Warren Wiechmann, MD, MBA, MEd 2023

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



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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The Multimedia Principle

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

Median effect size of $d=1.35$

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by Warren Wiechmann, MD, MBA, MEd 2023

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 $d=0.70$

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The Signaling Principle

emphasis

color

font size

boxes

arrows

image overlays

icons

titles

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by Warren Wiechmann, MD, MBA, MEd 2023

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 $d=0.82$

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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 $d=1.31$

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The Coherence Principle

decrease extraneous processing by removing:

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

Median effect size of $d=0.86$

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The Redundancy Principle

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by Warren Wiechmann, MD, MBA, MEd 2023

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

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The Segmenting Principle

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

Median effect size of $d=0.67$

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The Generative Activity Principle

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

Median effect size of $d=0.71$

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The Generative Activity Principle

Prompts to engage in active learning include:

summarizing, mapping, drawing, imaging, self-testing, self-explaining, or teaching

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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

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by Warren Wiechmann, MD, MBA, MEd 2023

Evidence-based Slide Design Principles

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

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

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by Warren Wiechmann, MD, MBA, MEd 2023



Slide design principles are useful for digital or traditional research posters

MAYO CLINIC

Differences in emergency department length of stay and throughput times between males and females: Preliminary results of the Sex Equity in Emergency Departments (SEED) study group

U.S. Kim, MD, MSc; Molly M. Jeffery, PhD, MPH; Venkatesh P. Belamkonda, MD, PhD

Mayo Clinic Graduate School of Biomedical Sciences, Mayo Clinic School of Medicine, and Mayo Clinic Medical Students Training Program, Department of Emergency Medicine, Department of Health Services Research, Mayo Clinic, Rochester, MN

Introduction

- Sex and gender disparities exist in healthcare and are addressed by the Centers for Medicare and Medicaid services.
- However, current knowledge of gender disparities in emergency departments is limited to analysis of individual chief complaints or diagnoses.

Purpose

- To determine whether there are sex-based differences in length of stay (LOS) and throughput for all comers to the Emergency Department.

Methods

- Retrospective study of all adults presenting to the ED (n=95,533) between 7/1/2015-7/31/2018.
- Data presented as n(%) or median (interquartile range), with all measures of time in minutes.
- Mixed-effects test used to compare means.

Results

- LOS was longer for females than males (230 vs. 222 min; p<0.0001).
- Men experienced shorter time to room, time to provider, time to disposition plan, and treatment time than women (for all comparisons p<0.0001).

Conclusions

- Females have longer throughput times and length of stay in their males within the same emergency department. This serves to spotlight an area of potential disparity where further investigation can be done to understand reasons why.

Female patients have longer ED lengths of stay than males

Take a picture to download the full paper

Program Number: 166

Table 1. Length of stay and throughput by sex

Variable	Male	Female
n	37,425 (48%)	34,128 (52%)
Length of stay	222 (147, 317)	230 (159, 326)
Time to room	8 (2, 50)	11 (4, 39)
Time to provider	24 (11, 63)	27 (12, 76)
Time to disposition plan	141 (88, 216)	157 (95, 227)
Treatment time	187 (120, 273)	195 (127, 279)

Figure 1. Definitions

Activity	Enter registration	Enter treatment room	See by provider	Disposition plan	Discharge or transfer
Length of stay					
Time to room					
Time to provider					
Time to disposition plan					
Treatment time					

KEY TAKEAWAYS

- Sex-specific differential diagnosis, testing, and treatments may account for some of the differences observed.
- Future studies should take into account the influence of sex-specific tests on differences in time.
- The differences in time to room and time to provider are more difficult to explain.
- Multivariate analysis adjusting for age, race, chief complaint, EMI, and insurance status should be developed to better control for differences observed.

Support

This research is made possible by Mayo Clinic Department of Emergency Medicine (Rochester, MN) and the Mayo Foundation.

Conflicts of interest were disclosed by the National Institute of General Medical Sciences (32,084,856-1) and Clinical Bed Translational Research (HL1700277), and thanks to the Mayo Clinic MSP for fostering an outstanding environment for physician-scientist training.

@cgknier
@mollyjeffery
@venkbellamkonda

Title

Authors

Intro

Main finding goes here, translated into plain english. Emphasize the important words.

Methods

- 1.
- 2.
- 3.
- 4.

Results

Discussion

More research is needed, but...

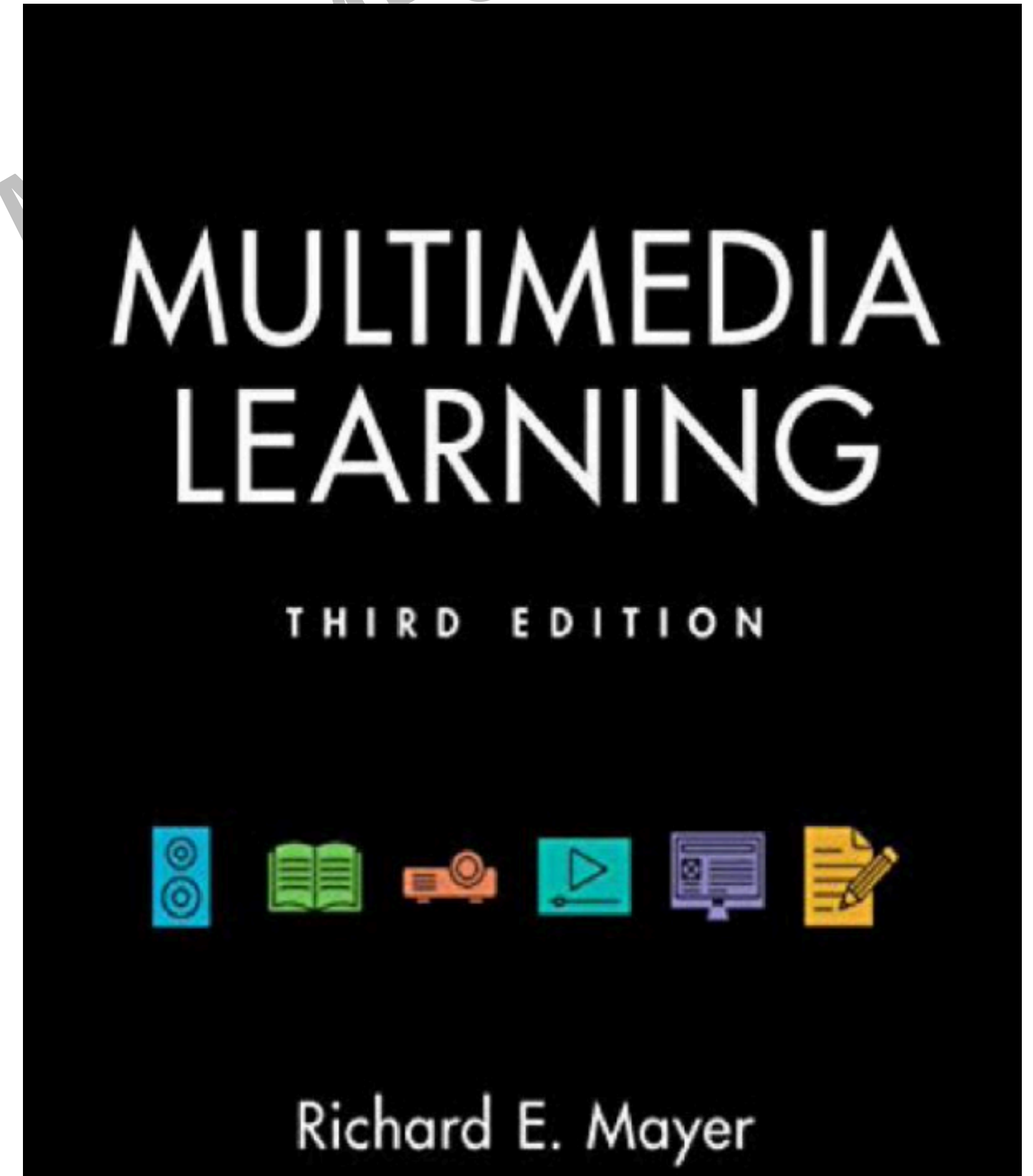
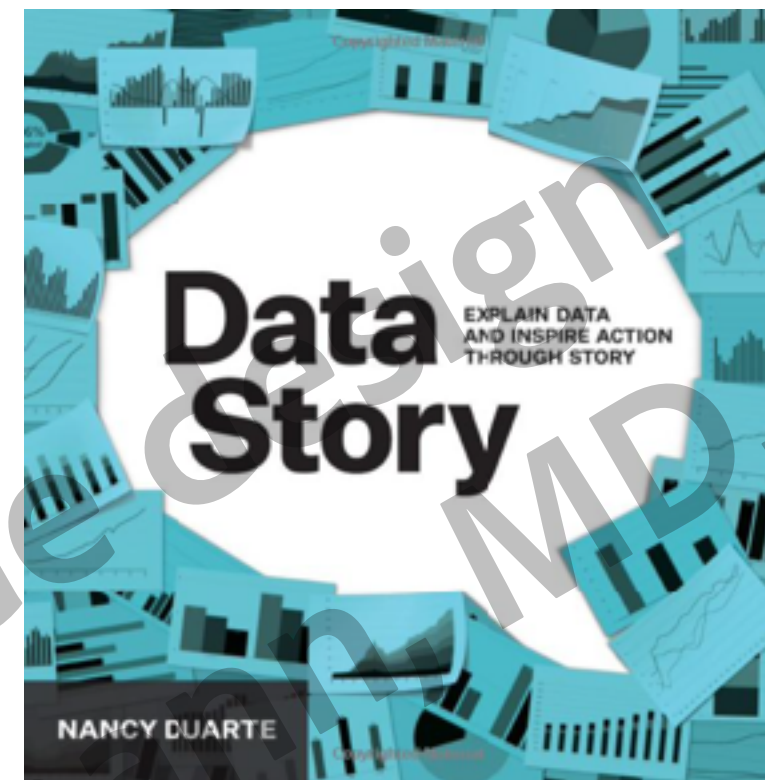
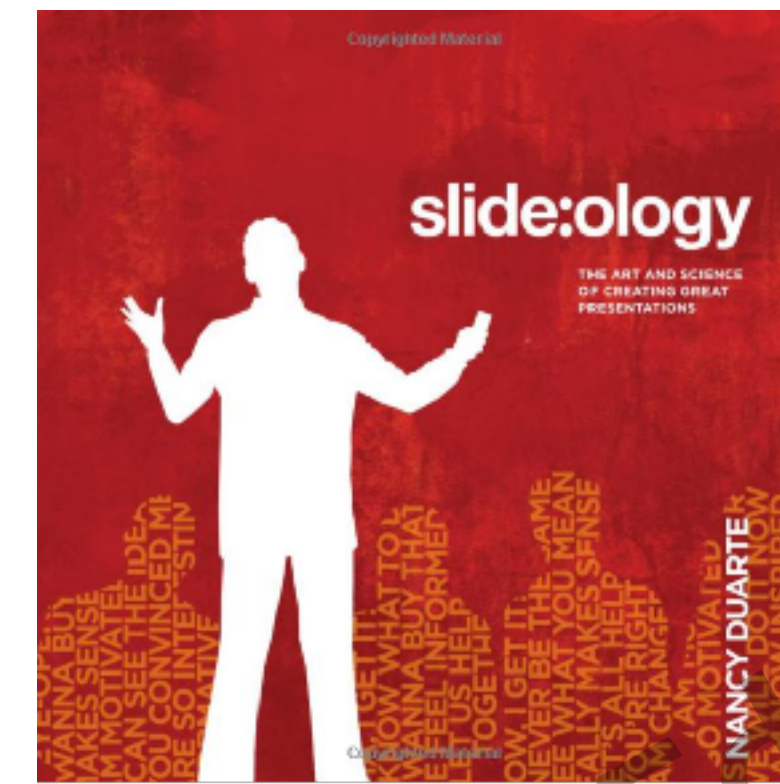
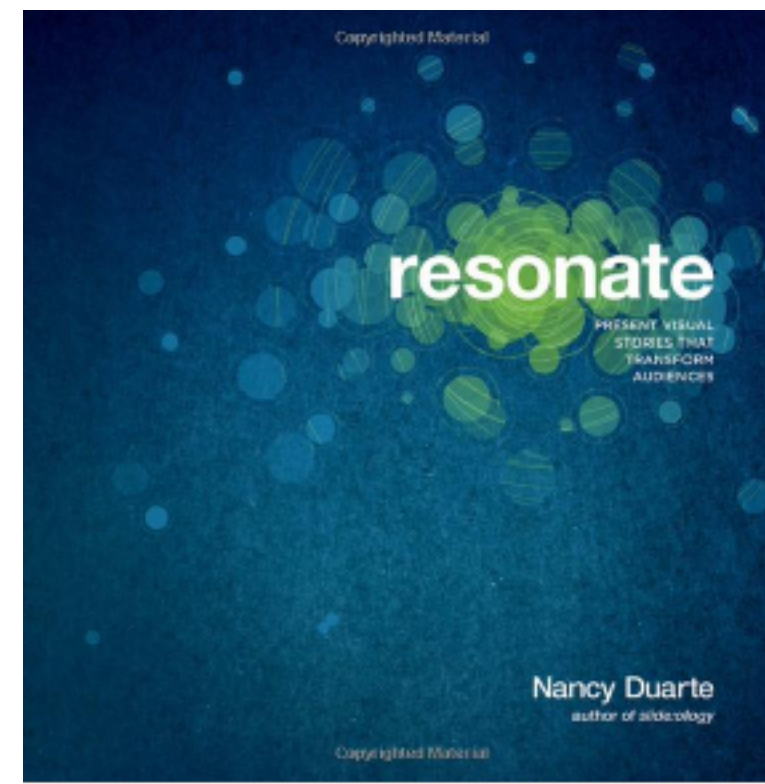
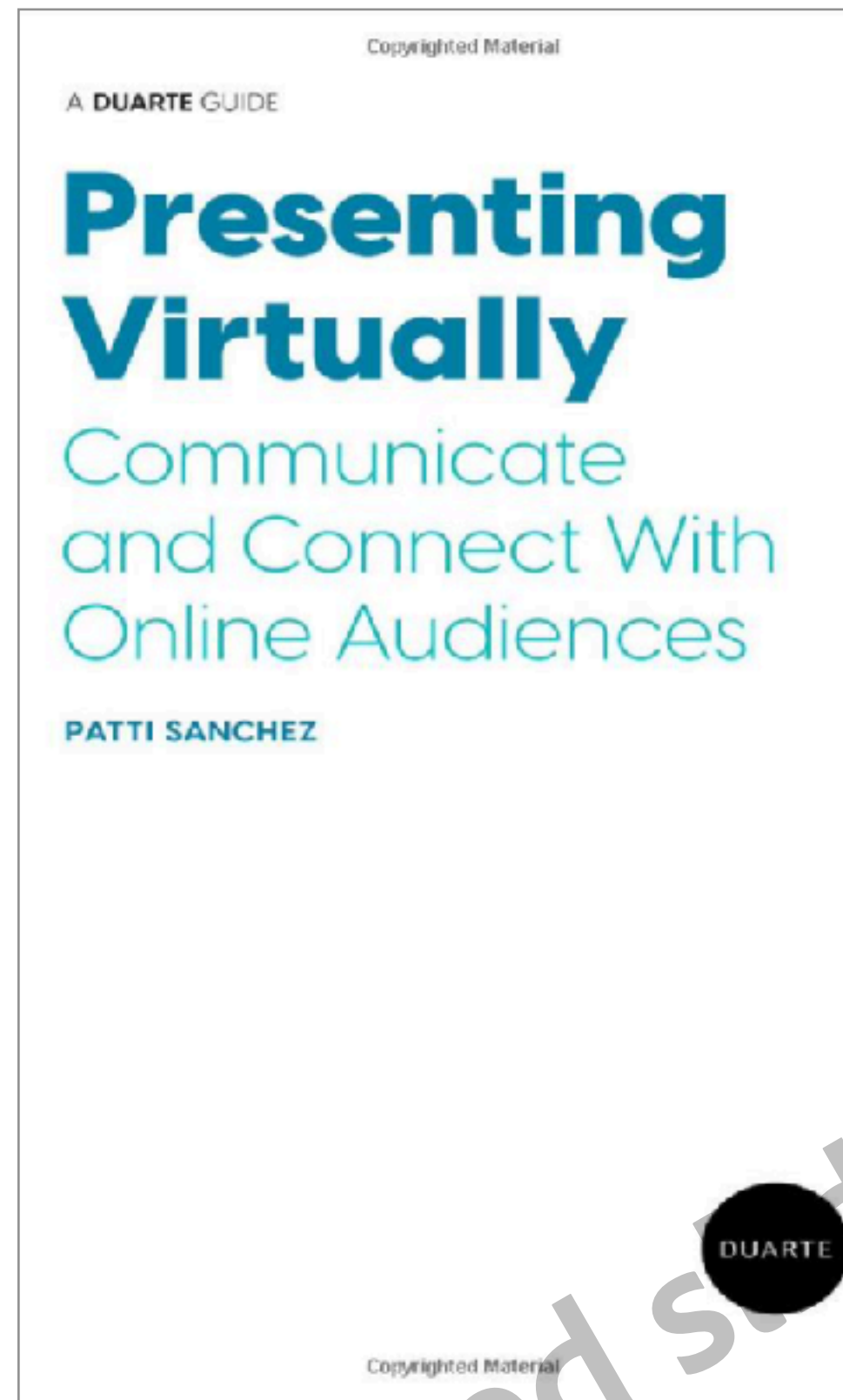
Extra Tables & Figures

Take a picture to download the full paper

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by Warren Wiechmann, MD, MBA, MEd 2023



Evidence-based software design (MD)

by Warren Wiechman

REC 2023

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