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# Cognitive Load Theory: Implications for Instructional Design

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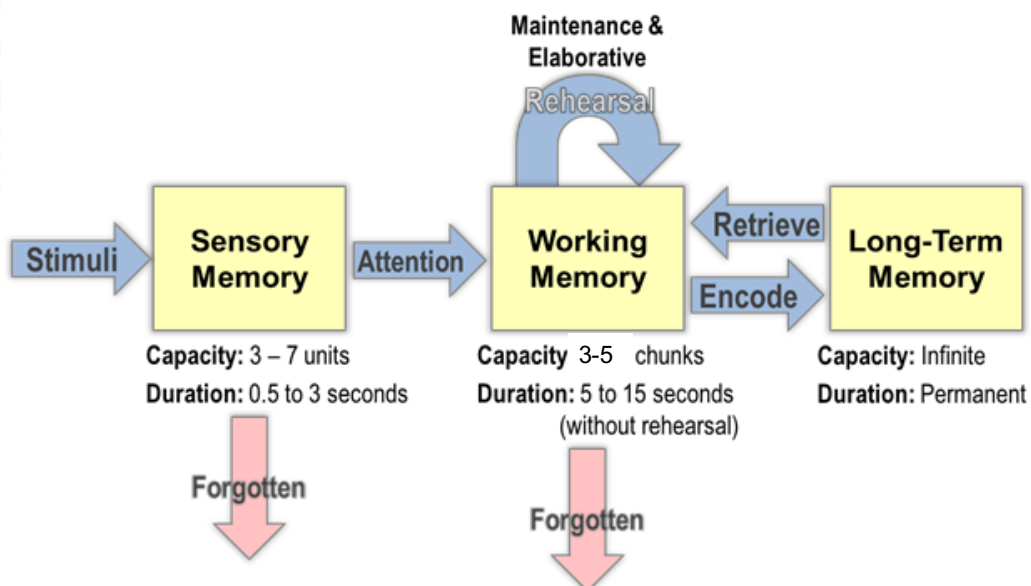
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1

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## Information Processing Model



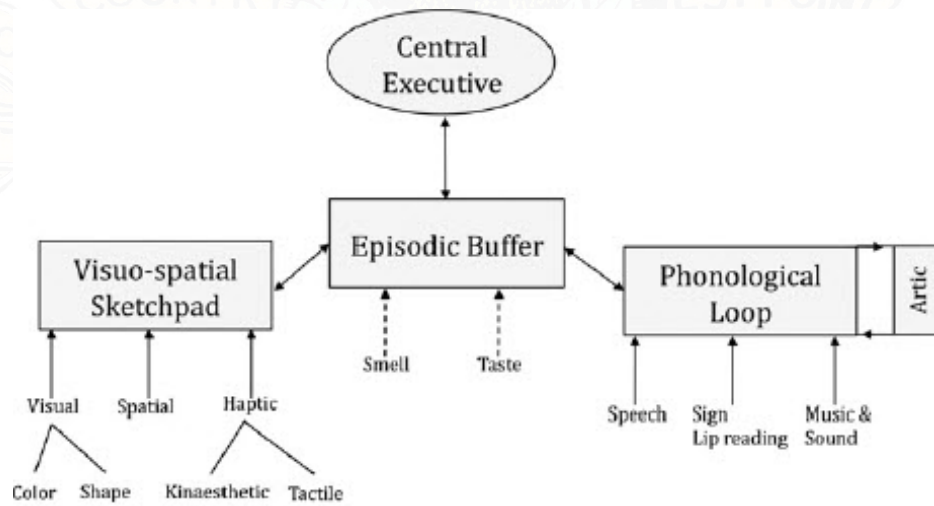
Axelrod, 1973

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2

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# Working Memory



**Fig. 8.** A revised model of working memory.

Baddeley, Allen, & Hitch, 2011

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## Schemas

- “A schema is a pre-existing assumption about the way the world is organized.” (Singer, 1968)
- Piagetian Schema Development:
  - Assimilation
  - Accommodation

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# Types of Cognitive Load

- Intrinsic
    - Addition, subtraction, multiplication, division
    - Element interactivity
    - Manage it
  - Extraneous (Irrelevant)
    - Gamification, teamwork, online
    - Reduce it
  - Germane (Relevant)
    - Schema construction
    - Increase it
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5

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## Eight Principles of Cognitive Theory Applied to Multimedia Design

1. Multimedia principle
  - Deeper learning from pairing words and pictures
2. Contiguity principle
  - Deeper learning from presenting words and pictures simultaneously rather than sequentially

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## Eight Principles of Cognitive Theory Applied to Multimedia Design

### 3. Coherence principle

- Deeper learning when extraneous words, sounds, images are excluded

### 4. Modality principle

- Deeper learning when words are presented as narration rather than as on-screen text

Mayer, 2002

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7

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## Eight Principles of Cognitive Theory Applied to Multimedia Design

### 5. Redundancy principle

- Deeper learning when words are presented as narration rather than as both narration and on-screen text

### 6. Personalization principle

- Deeper learning when words are presented in conversational style rather than in formal style

Mayer, 2002

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8



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# Eight Principles of Cognitive Theory Applied to Multimedia Design

## 7. Interactivity principle

- Deeper learning when learners are allowed to control the presentation rate than when they are not

## 8. Signaling principle

- Deeper learning when key steps in the narration are signaled rather than non-signaled

Mayer, 2002

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# Instructional Gold Standard

- Worked examples
- Diversity of examples
- Decompose complex tasks and support

Kirschner, Sweller, & Clark, 2006

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## References

- Axelrod, R. (1973). Schema theory: An information processing model of perception and cognition. *American Political Science Review*, 67(04), 1248-1266.
- Baddeley, A. D., Allen, R. J., & Hitch, G. J. (2011). Binding in visual working memory: The role of the episodic buffer. *Neuropsychologia*, 49(6), 1393-1400.
- Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction*, 8(4), 293-332.
- Chi, M., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. Sternberg (Ed.), *Advances in the psychology of human intelligence* (pp. 7-75). Hillsdale, NJ: Erlbaum.
- Clark, R. C., Nguyen, F., & Sweller, J. (2006). *Efficiency in learning: Evidence-based guidelines to manage cognitive load*. San Francisco, CA: Pfeiffer.
- Cooper, E. (2009). Overloading on slides: Cognitive load theory and Microsoft's slide program PowerPoint. *AACE Journal*, 17(2), 127-135.
- Cowan, N. (2010). The magical mystery four: How is working memory capacity limited, and why? *Current Directions in Psychological Science*, 19(1), 51-57.
- Franklin, M. S., Smallwood, J., Zedelius, C. M., Broadway, J. M., & Schooler, J. W. (2015). Unaware yet reliant on attention: Experience sampling reveals that mind-wandering impedes implicit learning. *Psychonomic Bulletin & Review*, 23(1), 223-229.
- Kirschner, P. A. (2002). Cognitive load theory: Implications of cognitive load theory on the design of learning. *Learning and Instruction*, 12(1), 1-10.

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## References

- Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist*, 41(2), 75-86.
- Mayer, R. E. (2002). Cognitive theory and the design of multimedia instruction: An example of the two-way street between cognition and instruction. *New Directions in Teaching and Learning*, 89(), 55-71.
- Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, 63(2), 81-97.
- Paas, F., Renkl, A., & Sweller, J. (2004). Cognitive load theory: Instructional implications of the interaction between information structures and cognitive architecture. *Instructional Science*, 32(1), 1-8.
- Piaget, J. (1952). *The origins of intelligence in children*. New York, NY: International Universities Press.
- Shiffrin, R. M., & Schneider, W. (1977). Controlled and automatic human information processing: II. Perceptual learning, automatic attending, and a general theory. *Psychological Review*, 84(2), 127-190.
- Singer, J. E. (1968). Consistency as a stimulus process mechanism. In R. P. Abelson, E. Aronson, W. McGuire, T. Newcomb, M. Rosenberg, & P. Tennenbaum (Eds.), *Theories of cognitive consistency: A sourcebook*. Chicago, IL: Rand McNally.