# CP321 Data Visualization

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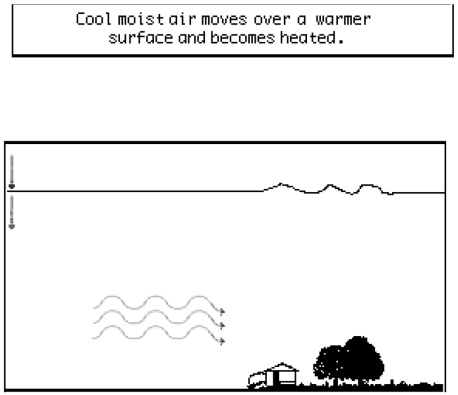
# Outline

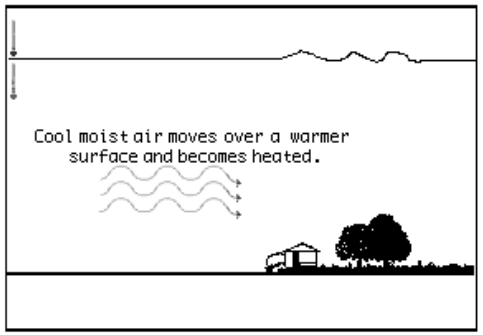
- Models for Information Visualization
  - Theoretical models
    - *Abstraction*
    - *Continuity*
    - Cognitive Load Theory and Multimedia Principles
  - *Descriptive models – Not yet*
  - Prescriptive models

- A Prescriptive model: ASSERT
  - A: Ask a Question
  - S: Search for Information
  - …

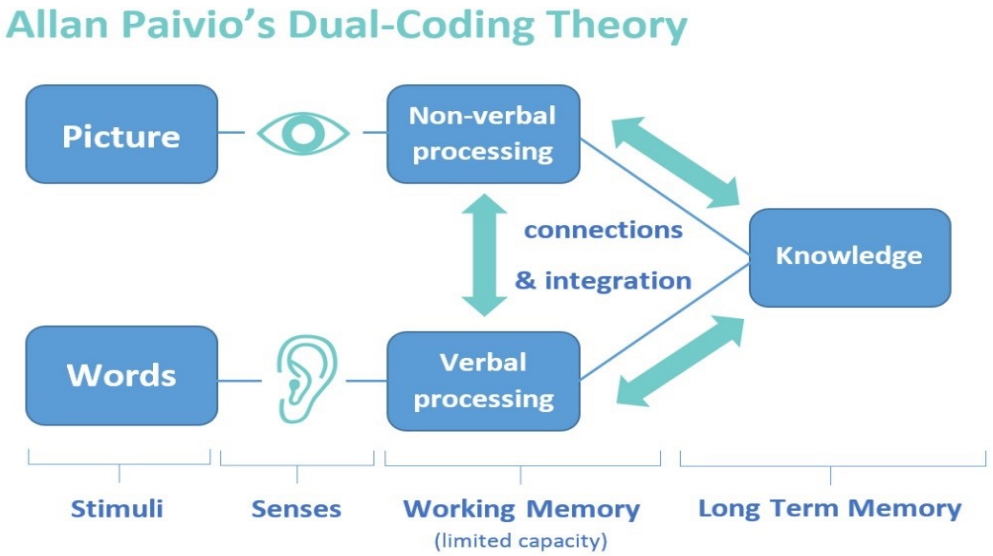
- Cognitive Load Theory (CLT)
  - CLT has emerged as one of the most important factors in understanding, learning, and overall attention
  - Memory is comprised of two primary structures — short term and long term
  - The aim of all instruction is to alter long-term memory, but information must first pass through short-term memory
  - Short-term memory can hold up to 7 ($\pm 2$) items (which will be lost within 20 seconds without rehearsal.
  - CLT in data visualization
    - present information in a comprehensible manner.
    - respect the limitations and make use of the affordances suggested by CLT about people' s ability to accept information

- Multiple Representation/ Multimedia
  - Different types of information representations are relatively independent to absorb
  - Multiple-channel learning Principles (Richard Mayer, 2005)
    1. *Multimedia principle:* People learn better from words and pictures than from words alone.
    2. *Split attention principle:* it is important to avoid formats that require learners to split their attention between, and mentally integrate, multiple sources of information

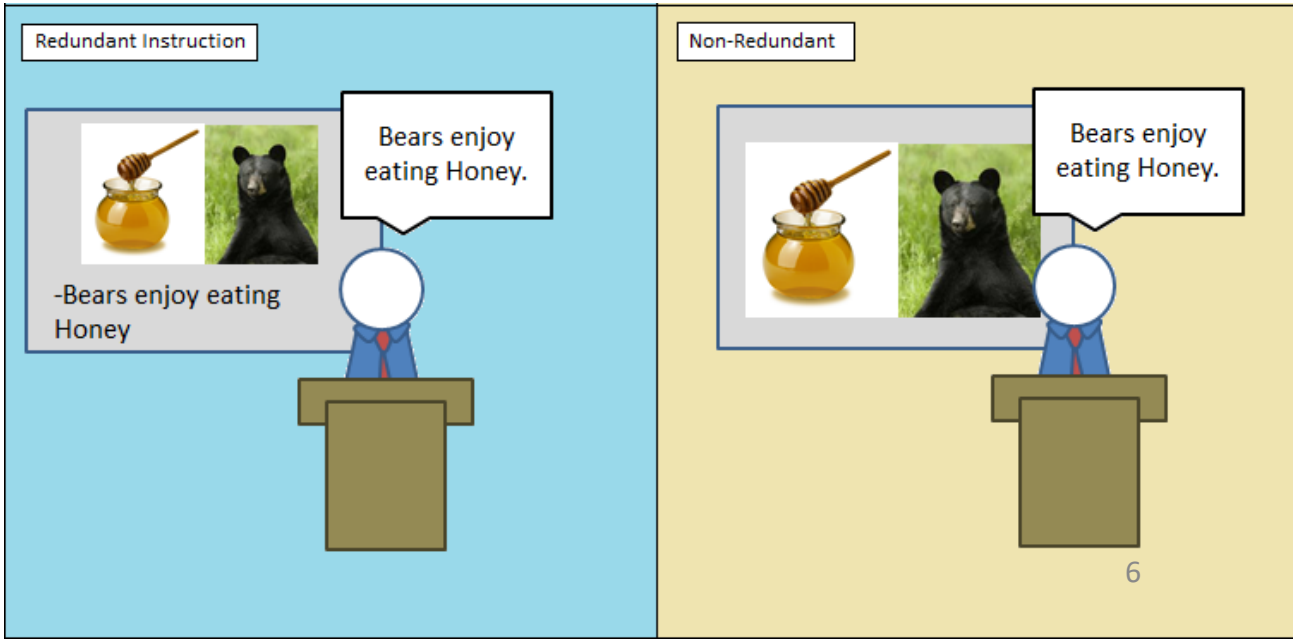


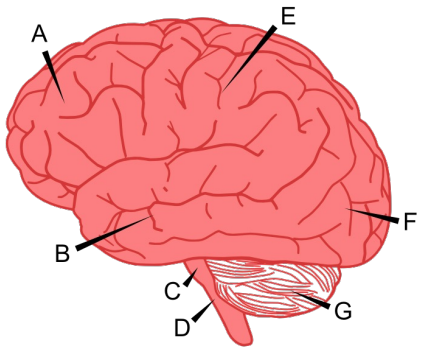
3. *Modality principle:* People learn better from graphics and narration(audio) than from graphics and text.



4. *Redundancy principle*

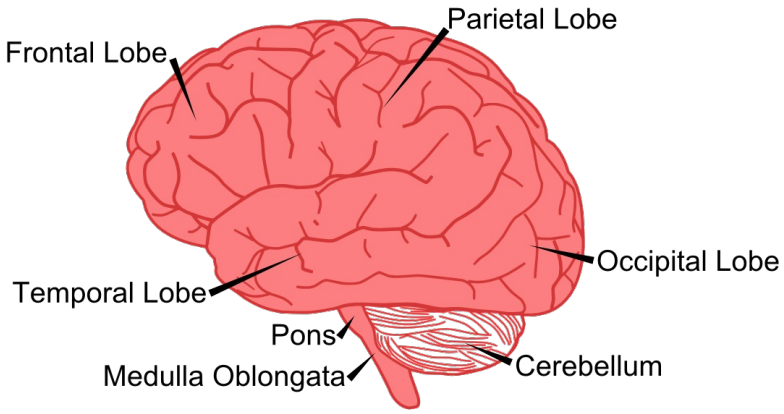



5. *Spatial Contiguity Principle:* People learn more deeply from a multimedia message when corresponding words and pictures are presented near rather than far from each other on the page or screen




A - Frontal Lobe
B - Temporal Lobe
C - Pons
D - Medulla Oblongata

E - Parietal Lobe
F - Occipital Lobe
G - Cerebellum




6. *Temporal contiguity principle:* People learn better when corresponding words and pictures are presented simultaneously rather than successively

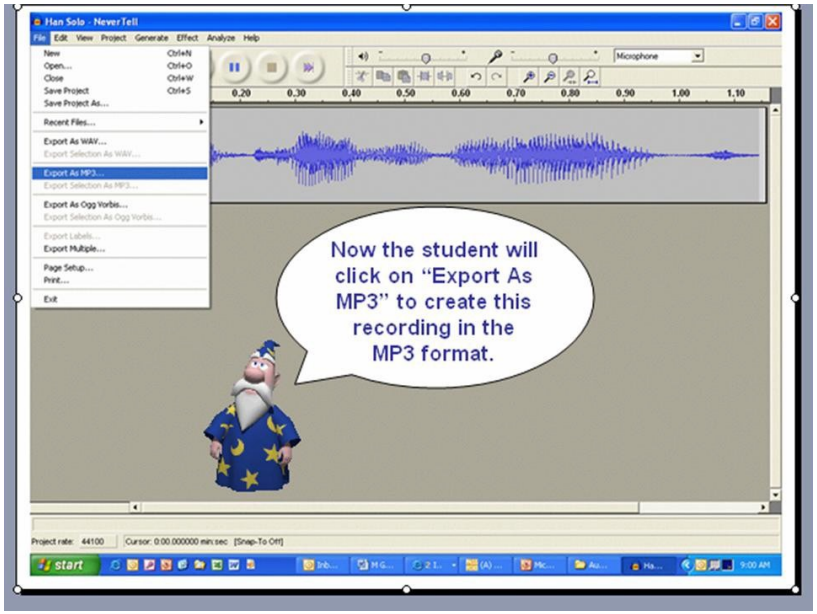
7. *Coherence Principle: People learn more deeply from a multimedia message when extraneous material is excluded than included.*

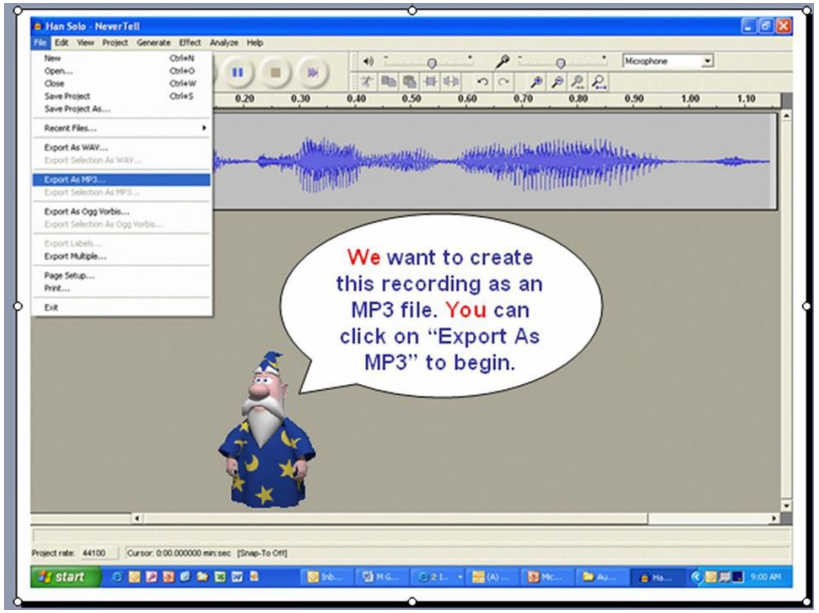
8. *Signaling Principle:* People learn more deeply from a multimedia message when cues are added that highlight the critical aspects of the presented information.

   e.g. headings, highlighting,

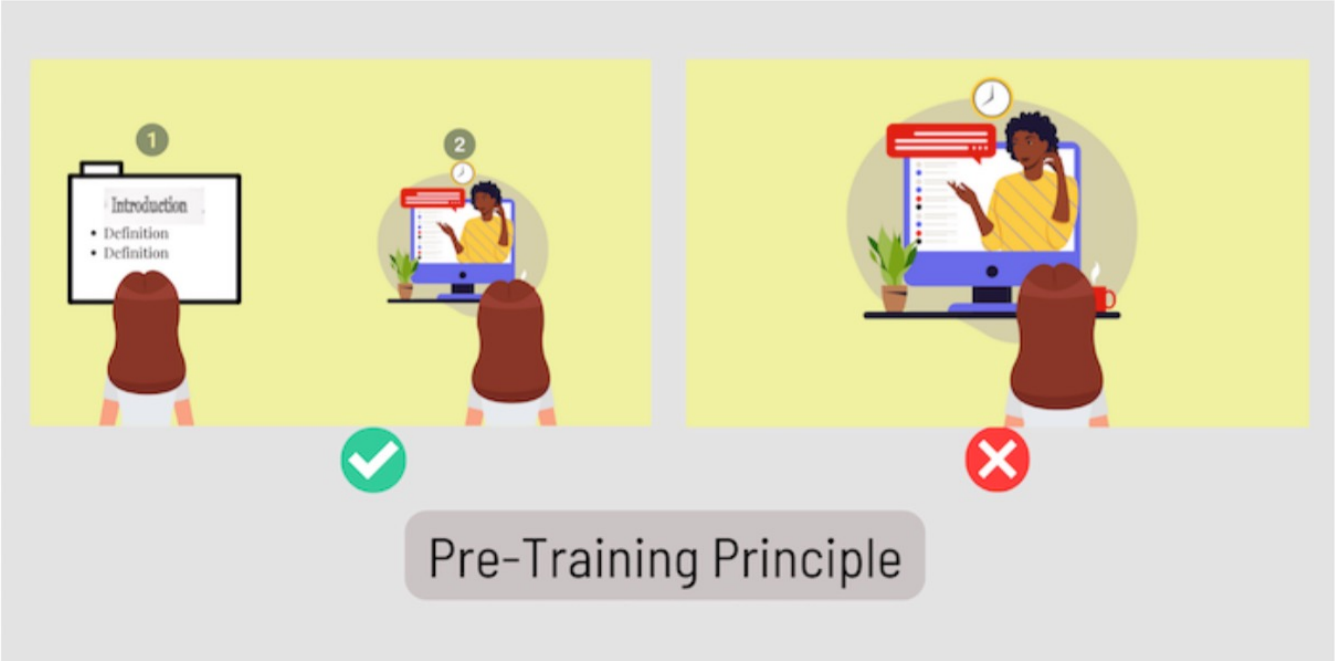
   emphasis…

9. *Personalization Principle:* People learn more deeply when the words in a multimedia presentation are in conversational style rather than formal style.

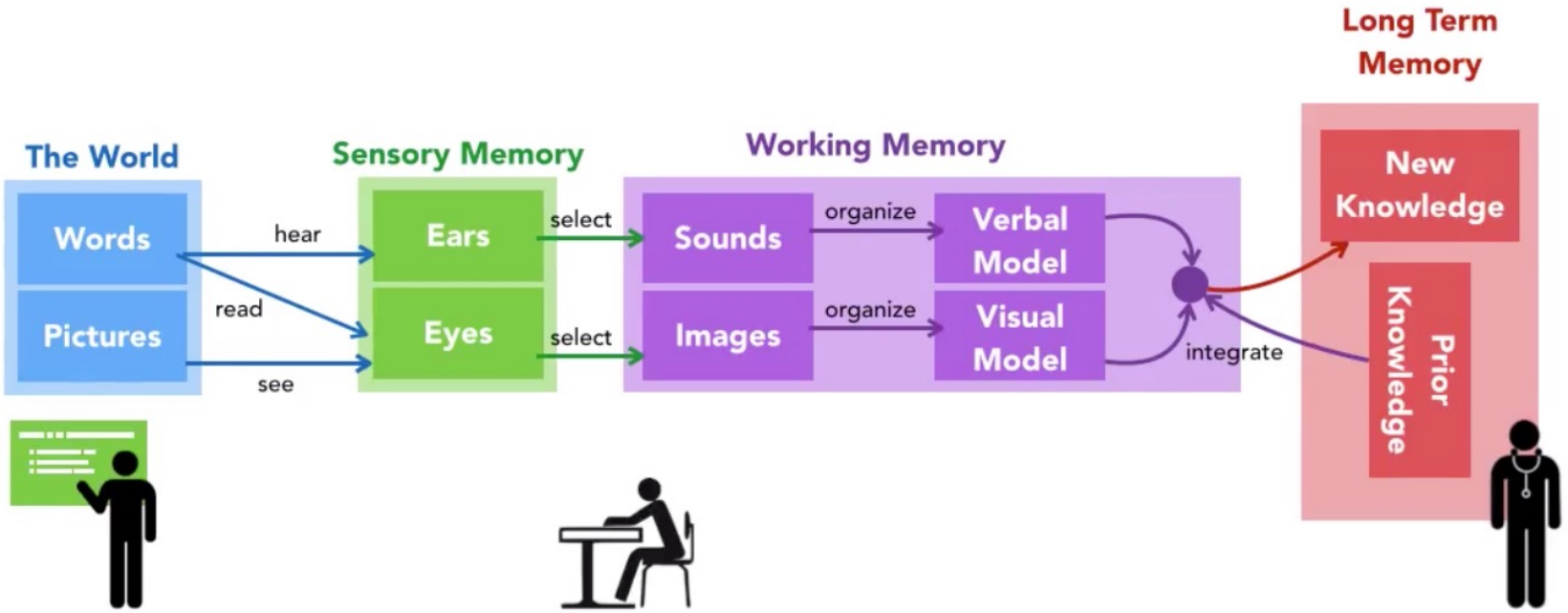


10. *Pre-training Principle:* People learn more deeply from a multimedia message when they know the names and characteristics of the main concepts



# Walk through Cognitive Model



# Models for Information Visualization

- *Theoretical models*
  - Abstraction
  - Continua
  - *Cognitive Load Theory and Multimedia Principles*

- *Descriptive models*

- *Prescriptive models*

# Prescriptive Models

- *Prescriptive models* seek to provide support in the creation, understanding, and evaluation of visualizations.
  - *Shneiderman's Visual Information-Seeking Mantra*
  - *Van Ham and Perer's Search and Expand*
  - *Chi's Data State Reference: analytical abstraction, visualization abstraction, and the view*
  - *Fry ' s Acquire, Parse, Filter, Mine, Represent, and Interact*
  - *The ASSERT model*

- The ASSERT model
  - Support the creation of visualizations that are accessible, insightful, educational, compelling
  - Includes the complete developmental life cycle of visualizations