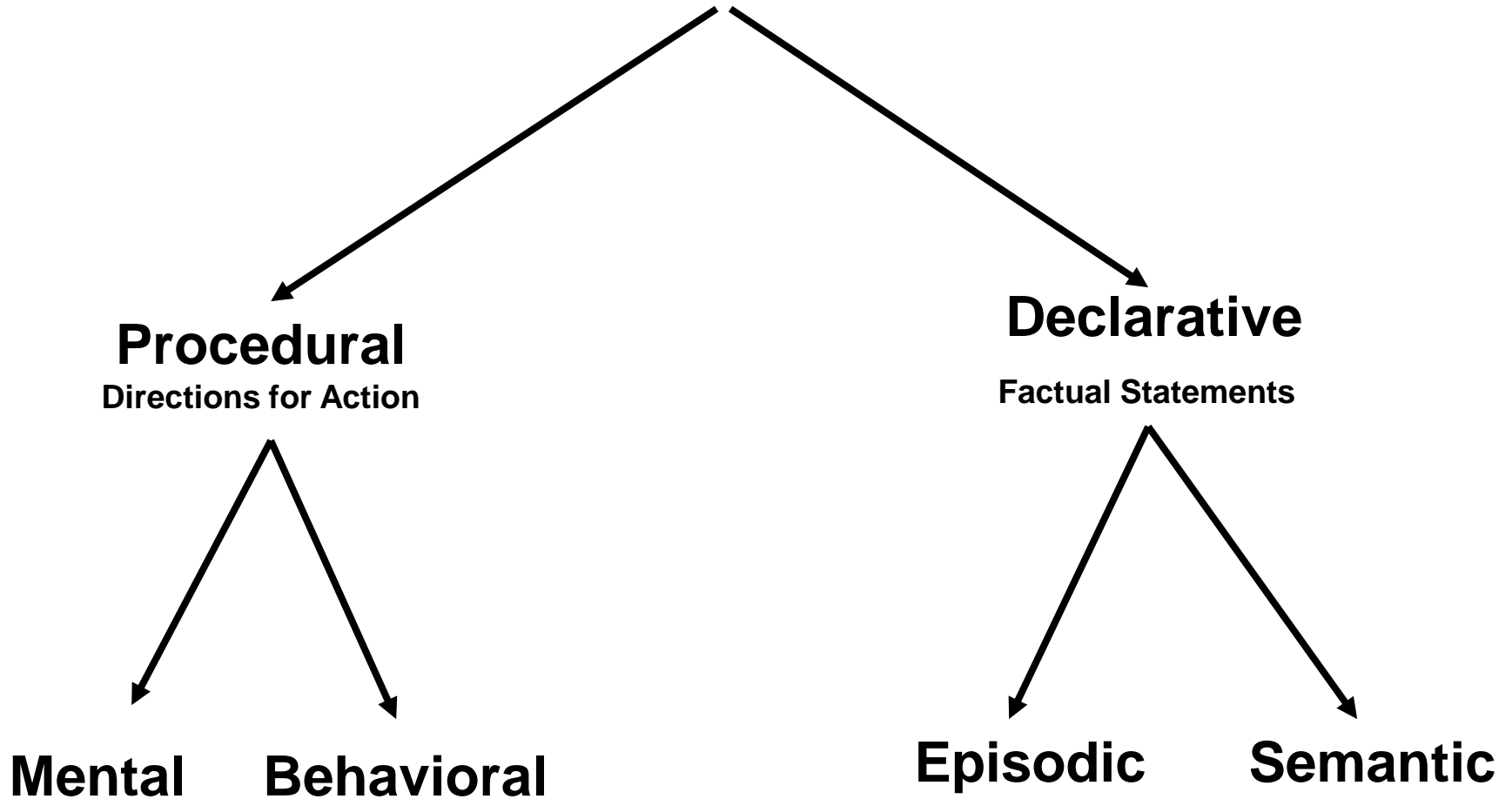


# Memory: Encoding Processes

## Lecture 18

# Taxonomy of Knowledge Stored in Memory



# Declarative Knowledge

- Factual Statements
  - About World, Past
- Sentence Format
  - Propositions
    - Subject - Verb – Object
- Types of Representations
  - Meaning-Based
    - Verbal Description
  - Perception-Based
    - Mental Image

A **bicycle** is a two-wheeled vehicle with seat and handles, propelled by pedaling.

A **bicycle** looks like this:



Strand Theatre, Shelbyville IN

# Procedural Knowledge

- Directions for Goal-Directed Action
- “If-Then” Format (Productions)

- Goal - Condition – Action
- Production System

- Motor

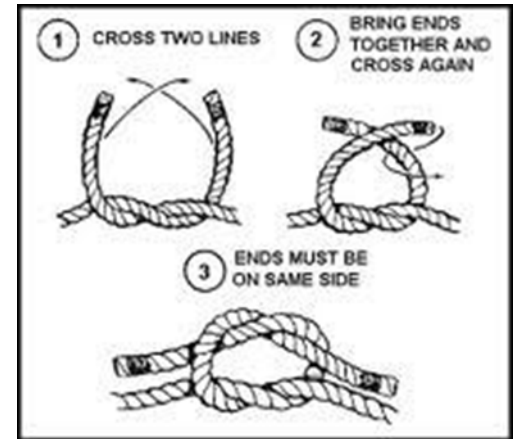
- Actions Take Form of Overt Behavior

- Alter Objective, Publicly Observable World

- Mental

- Actions Take Form of Mental Transformation

- Alter Internal, Private Mental Representations



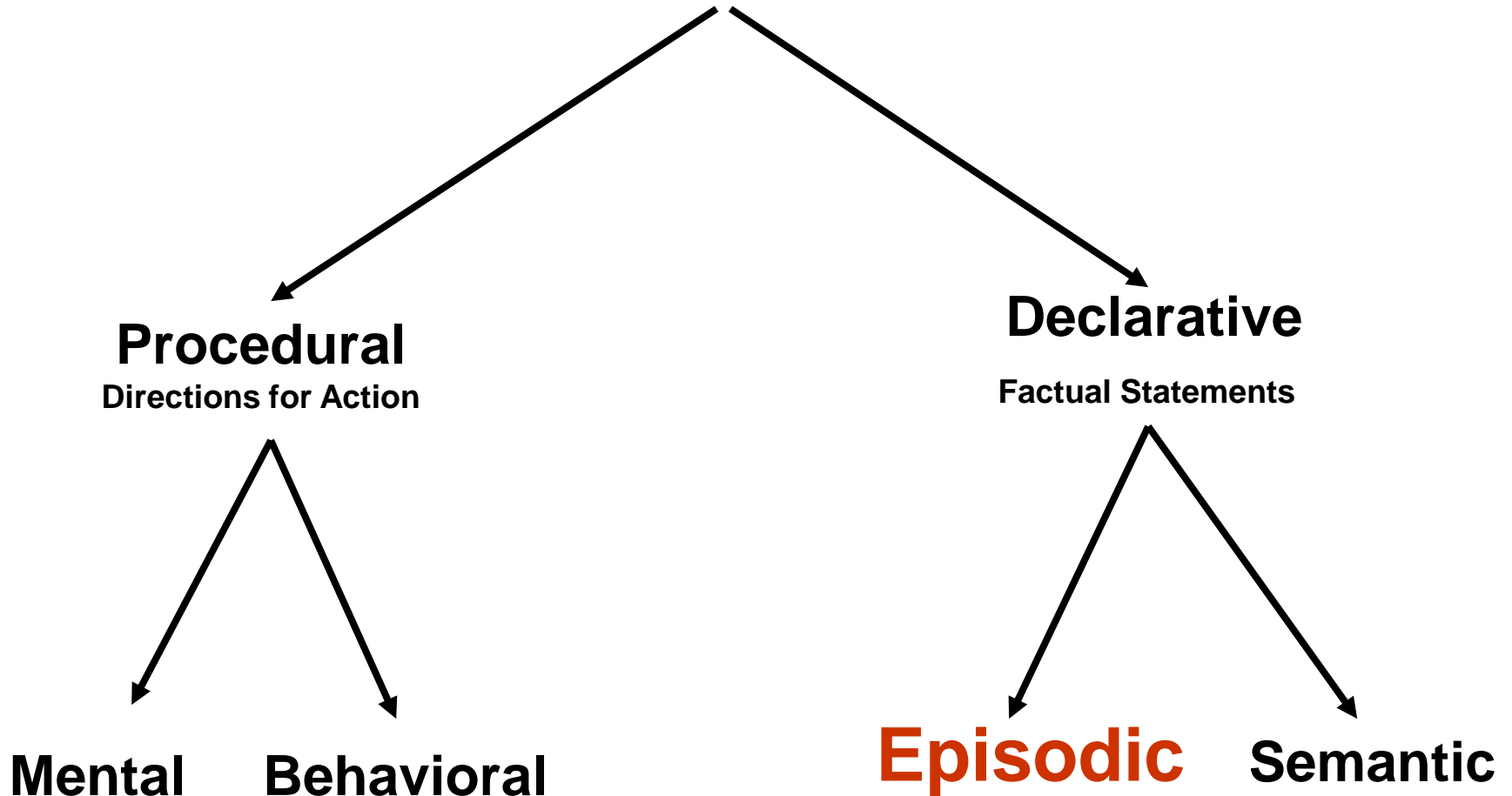
ScoutHelper

$$X + 6 = 38$$

# Types of Declarative Knowledge

- Episodic
  - Autobiographical Memory
  - Factual Knowledge About Personal Experiences
    - Spatio-Temporal Context
    - Self-Reference
- Semantic
  - Mental “Dictionary” or “Encyclopedia”
  - Abstract, Conceptual Knowledge about the World

# Taxonomy of Knowledge Stored in Memory



# Stage Analysis of Memory



- **Encoding:** Creating a Memory Trace
  - Perception Leaves Representation in Memory
- **Storage:** Retaining Trace in Memory
  - Latent, Available for Use
- **Retrieval:** Recovering Trace from Storage
  - Activating, Accessing Available Knowledge

# The Verbal-Learning Paradigm

- Study Phase (Encoding)
  - **Present List of Familiar Words**
    - Episodic, not Semantic Memory
    - Alternative Materials
      - Nonsense Syllables, Sentences, Paragraphs, Stories
      - Pictures, Scenes, Film/Video
      - Sounds, Smells, Tastes, etc.
- Retention Phase (Storage)
  - **Interval (Distraction)**
    - Long-Term or Secondary Memory
    - *Not* Short-Term, Primary, or Working Memory
- Test Phase (Retrieval)
  - **Remember Items of Word List**



# Example

- I'll read you a list of familiar words
- Listen to each one as I read it
- After I've finished, do "Serial Sevens" task
  - I'll give you a 3-digit number --
    - Subtract 7 from that number...
    - and then 7 from that result...
    - and then 7 from that result...
  - until you are told to stop.

Ready?

Go To the Next Slide

Listen to the List

When You Hear the Number,  
Begin Subtracting “7s”

Go to the Next Slide  
When I Instruct You to Do So

# Study List

Anger

Bread

Cold

Foot

Girl

King

Mountain

Needle

Rough

Slow

Spider

Thief

# Research Strategy for the Study of Memory

- Each List, and Each Word on the List, Represents an Episode of Experience
- Vary Conditions at Some Stage of Processing
  - Encoding
  - Storage
  - Retrieval
- Observe Effects on Subject's Ability to Remember the List Items

# The Encoding Phase of Memory Processing

- Assume that a Subject has Just Experienced an Event
- How Does a Mental Representation of that Event get Stored in Memory?

# The Role of Rehearsal in Encoding Long-Term Memory

- Memory as a Product of Perception
- Traditional Associationism
  - Thorndike (1898)
    - Law of Exercise
      - Stimulus-Response Associations Strengthened by Use
  - Ebbinghaus (1885)
    - Law of Repetition
      - Retention a Function of Repetition

# Nonsense-Syllable Paradigm

Ebbinghaus (1885)



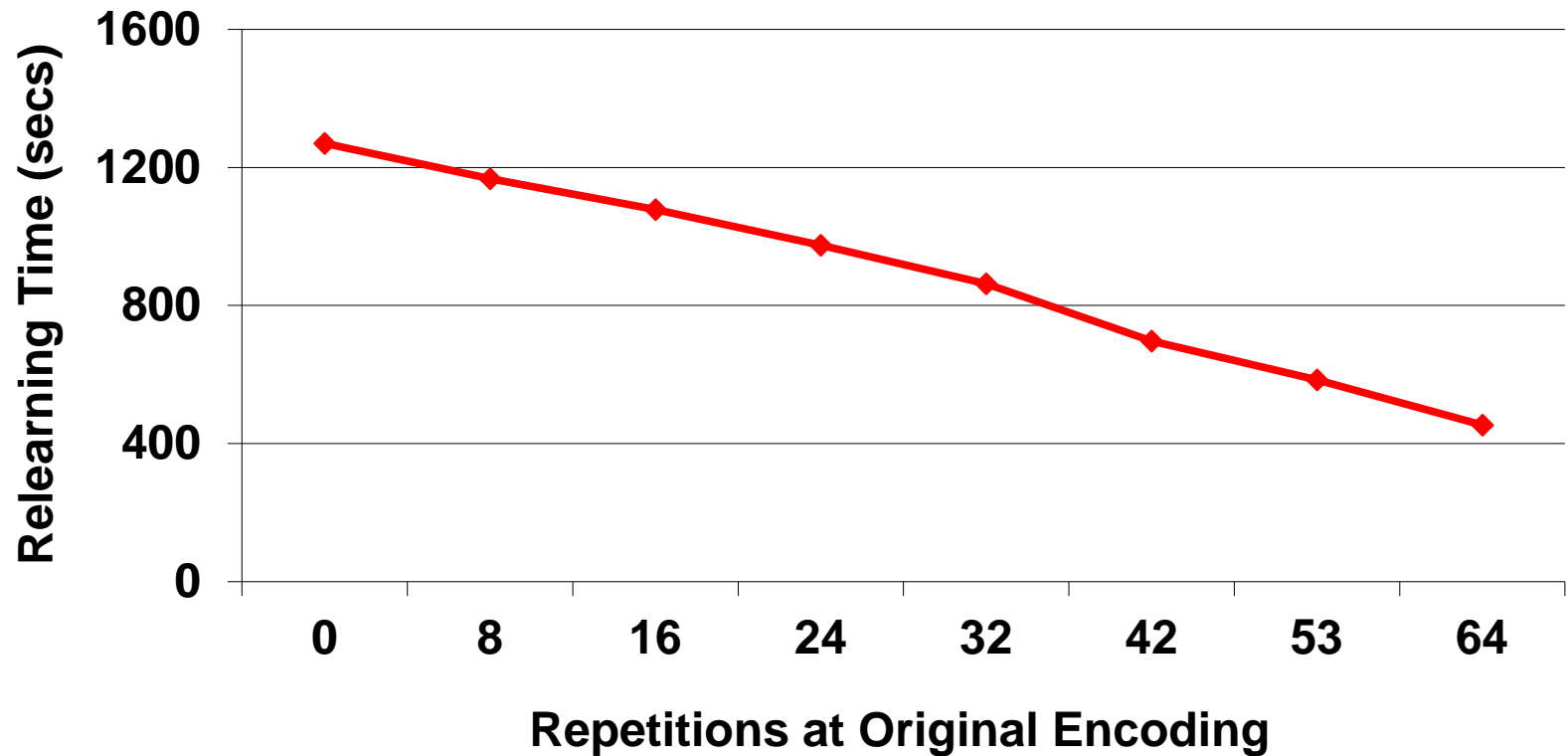
- Memorize List of Nonsense Syllables
  - Consonant-Vowel-Consonant (e.g., TUL)
  - Memorized in Strict Serial Order

**DAJ - GEX - MUB - TEV - WOL**

- Associations by contiguity
  - Each CVC serves as stimulus for next one
  - Each CVC is a response to the previous one
- Vary number of repetitions
- Savings in Relearning after 24 hours

# Retention As a Function of Repetition

Ebbinghaus (1885)





# The Role of Rehearsal

Craik & Watkins (1975)

- Present List of Familiar Words
- Report Most Recent Word Meeting Criterion
  - Begin with Letter *P* – “Critical”
  - Ignore All Other Words – “Neutral”
- Vary Amount of Rehearsal Given to Each Word
- Then Test Recall of All Critical Words

# Study List

Craik & Watkins (1975)

**peas**

chair

**potato**

book

egg

cat

window

**punt**

radio

music

spiral

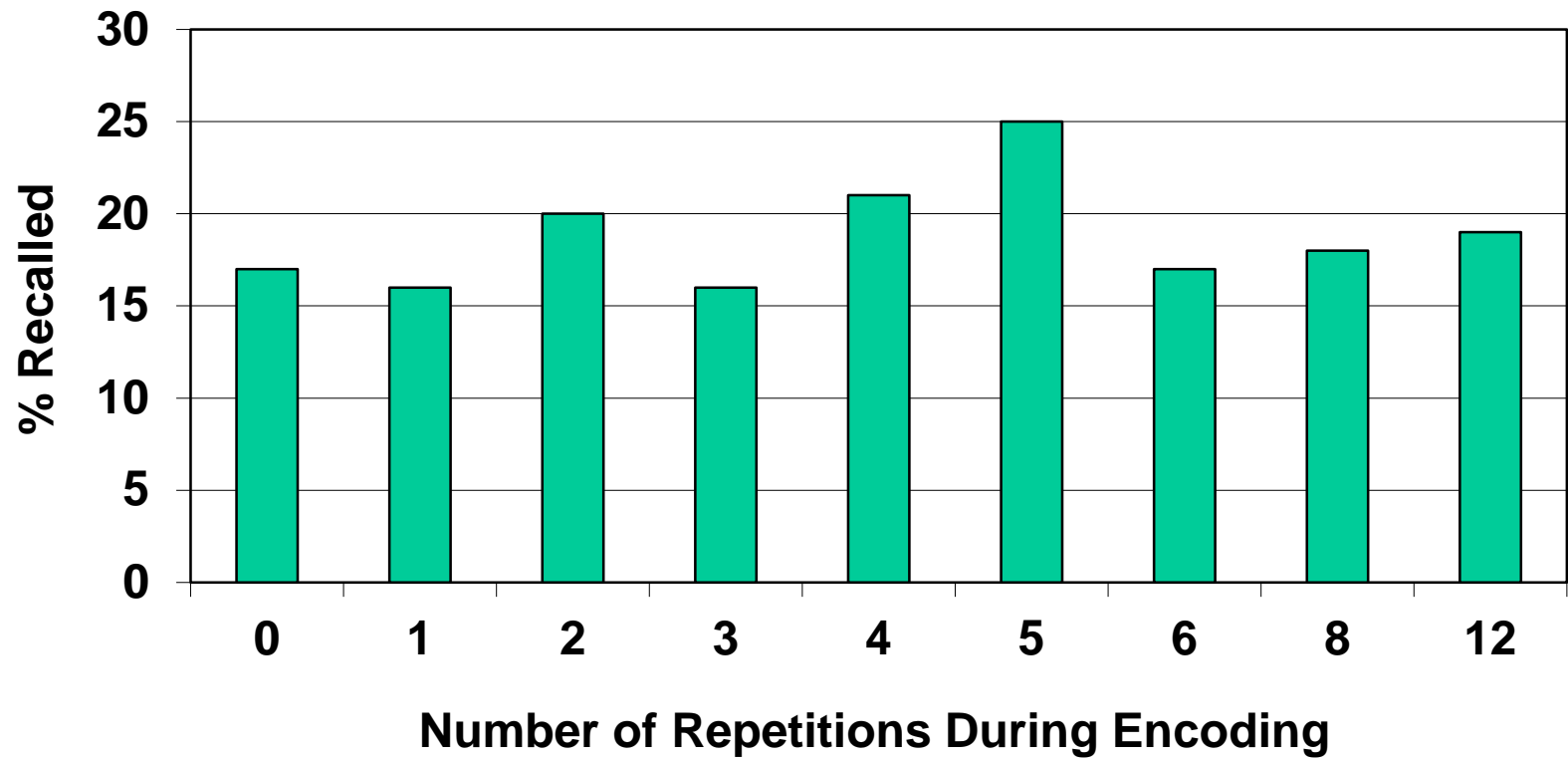
**position**

bell

**parking**

# Repetition and Recall

Craik & Watkins (1972, Exp. 1)



# Two Types of Rehearsal

- Maintenance Rehearsal
  - Rote rehearsal
  - Maintains representation in highly active state
  - Maintains representation in short-term (primary/working) memory
- Elaborative Rehearsal
  - Links representation to other knowledge
  - Encodes representation in long-term (secondary) memory

# “Depth of Processing” Paradigm

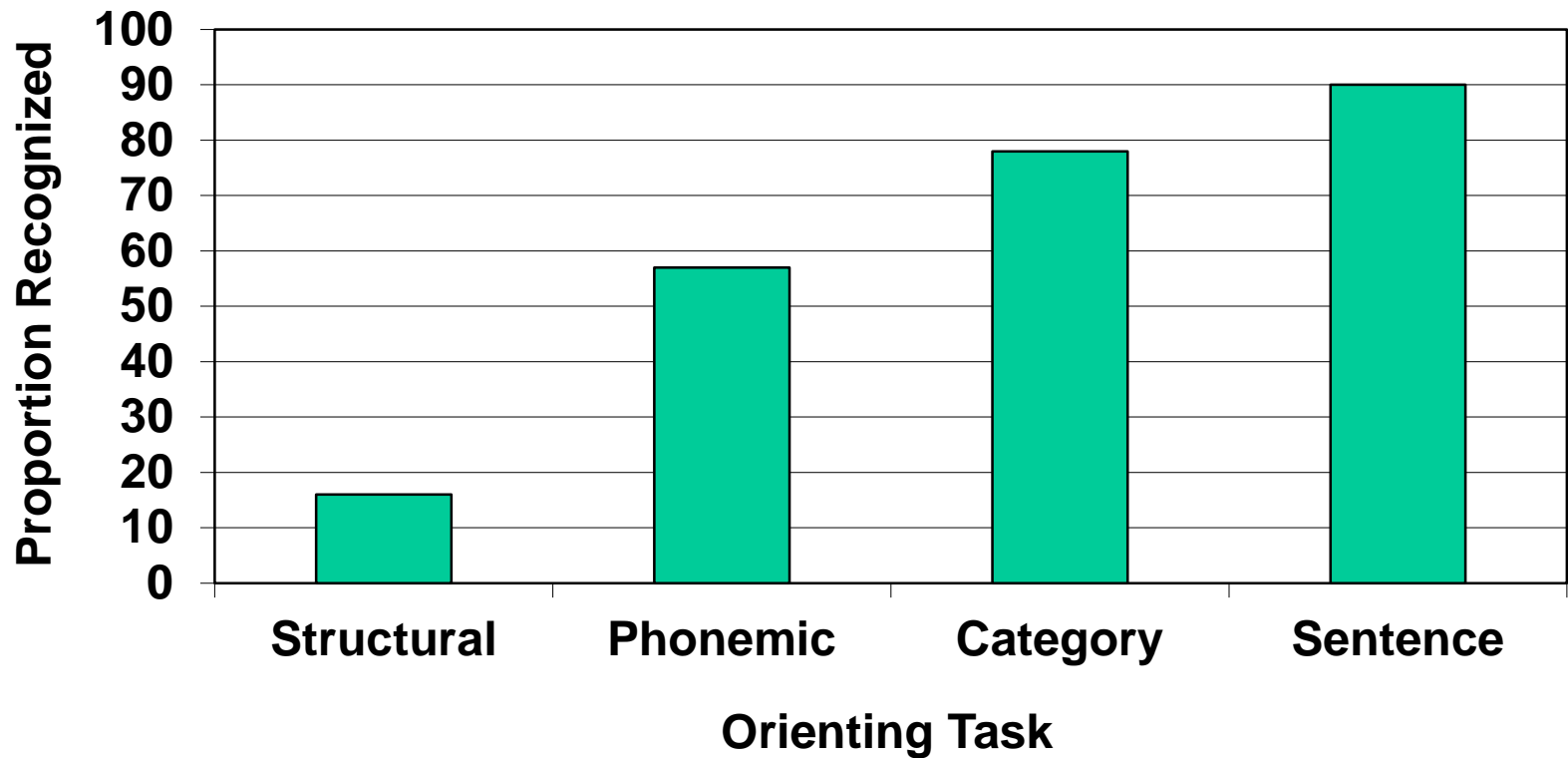
Craik & Lockhart (1972)

Target: **TROUT**

- **Structural (Orthographic)**
  - Is the word printed in capital letters?
  - Does the word contain the letter “e”?
  - How many vertical lines are in the word?
- **Phonemic (Acoustic)**
  - Does the word rhyme with *weight*?
- **Semantic (Conceptual)**
  - Is the word a type of *fish*?
- **Sentence (Linguistic)**
  - Would the word fit the sentence:  
*He met a man in the \_\_\_\_\_?*

# The Depth of Processing Effect

Craik & Tulving (1975), Exp. 1



# The Elaboration Principle

Memory is a function of  
the degree to which an event  
is related to pre-existing knowledge.

# Two Modes of Processing at Encoding

- (Rote) Rehearsal
  - Recirculating/Refreshing items
  - Primary/Short-Term Memory
- Elaboration
  - Processing individual items
  - Secondary/Long-Term Memory

But elaboration is not the only process  
that occurs during encoding...

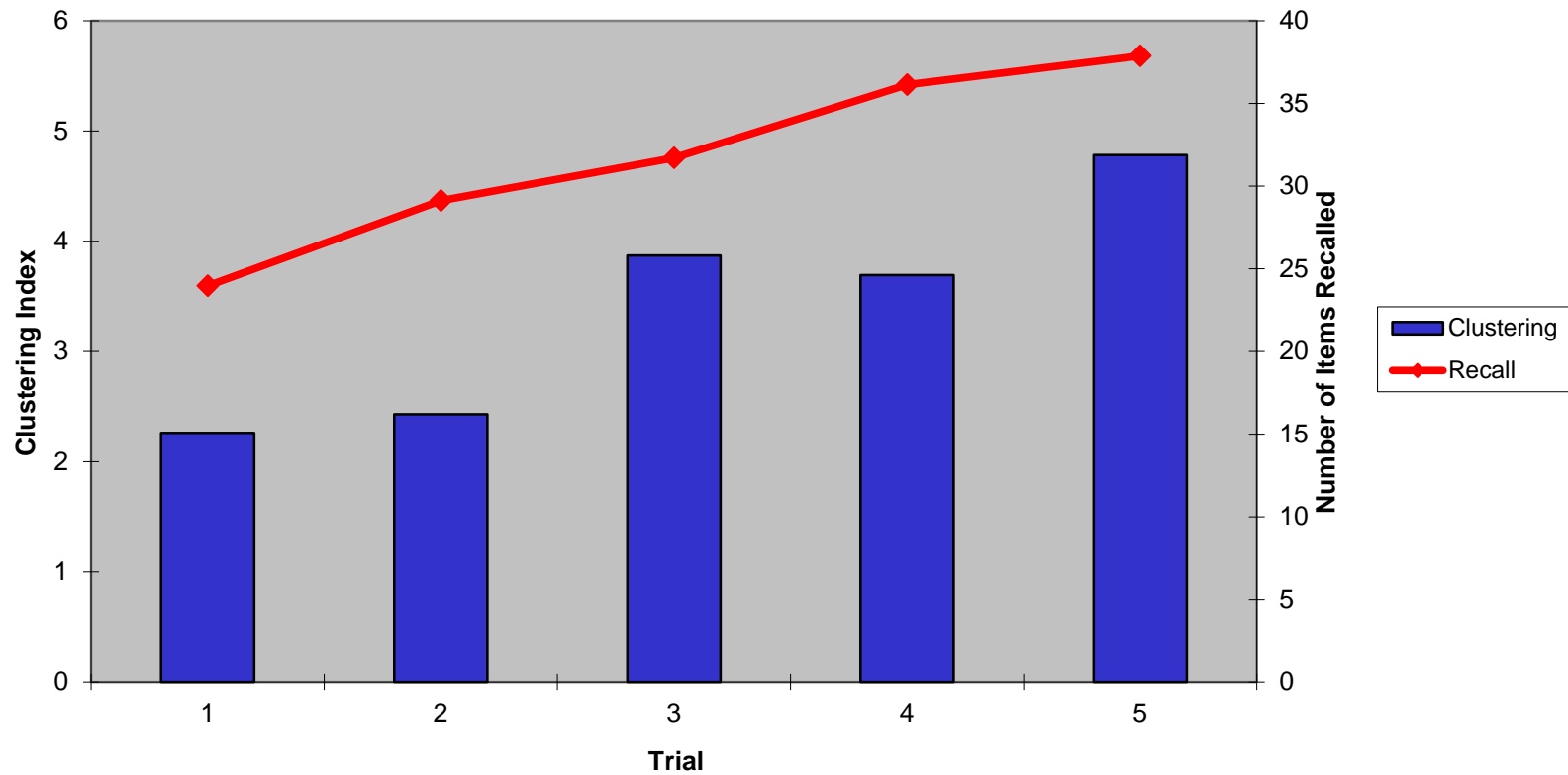


# A List of Category Exemplars Promoting Category Clustering

Foot	Elephant
Lion	Amber
Blouse	Mouth
Orange	Rat
Finger	Tie
Coat	Purple

# Category Clustering in Free Recall

Bousfield & Cohen (1953)



# A List of Associates

## Promoting Associative Clustering

Boy  
Black  
Table  
Long  
Eagle  
Flowers

Chair  
Short  
Girl  
White  
Blossom  
Bird

# A List of ‘Unrelated’ Words

## Promoting Subjective Organization

After Tulving (1962)

IRON

TABLE

DOG

PEPPER

BLUE

WINDOW

BOY

STARS

# The Organization Principle

Memory is a function of  
the extent to which  
individual events are related to each other.

# Organization and Elaboration Compared

- Elaboration
  - Item-Specific (Intra-Item) Processing
- Organization
  - Relational (Inter-Item) Processing
- Both reflect “Effort after meaning”
  - F.C.Bartlett (1932)
    - Make sense of what is happening
    - Relate what is new to what is already known

# Three Modes of Processing at Encoding

- Rote Rehearsal
  - Recirculating/Refreshing Items
  - Primary/Short-Term Memory
- Elaboration
  - Processing Individual Items
  - Secondary/Long-Term Memory
- Organization
  - Relating Items to Each Other
  - Secondary/Long-Term Memory