# Chapter 1

Cognitive Psychology: An Introduction

# Cognitive Science

- The scientific study of:
  - Thought
  - Language
  - The brain
  - The mind

# Memory

The mental process of acquiring and retaining information for later retrieval (Verb)

The mental storage system that enables these processes (Noun)

# Cognition

The collection of mental processes and activities used in perceiving, remembering, thinking, and understanding, as well as the act of using those processes.

# Thinking about Thinking

- Introspection
- Metacognition

- For next 3 questions, pay attention (as much as possible) to your internal thought processes…

## Thinking About Thinking
### Three examples:

- How many hands did Aristotle have?

- What is 723 divided by 6?

- Does a robin have wings?

# Intuitive Cognitive Analysis

Answer question

| | | | | |
|---|---|---|---|---|
| represent | sentence | words | letters | shapes |
| possibile | calculate | retrieve | | |
| decide | compare | reason | situation | motivation |
| respond | speak | word | phoneme | |

# Review

- Memory
- Cognition
- Thinking about Thinking
  - introspection
  - insight
  - metacognition
- Intuitive Cognitive Analysis

## Thinking About Thinking
## Three More examples:

- How many hands does Bon Jovi have?

- What is 623 divided by 6?

- Does a square have four sides?

# Intuitive Cognitive Analysis

- Your own perception of what it seems like your brain is doing combined with a logical analysis of what must be taking place.
- "Introspection" = first-person experience
- Task analysis = steps that must be occurring for task to be completed

# Intuitive Cognitive Analysis - Issues

- Some processes not available to conscious awareness - the Subconscious
- Reliability of first-person statements?
- Person-to-person variability?
- Only one way to complete a task?

# Summary of Cognitive Analysis
(Overview of topics in this course by chapter)

| Table 1-1 SUMMARY OF THE INTUITIVE COGNITIVE ANALYSIS | |
|---|---|
| **Processes** | **Topic and Chapter** |
| **Sensory and perceptual** | |
| Focus eyes on print | Visual perception, sensory memory: Chapter 3 |
| Encode and recognize printed material | Pattern recognition, reading: Chapters 3 and 10 |
| **Memory and retrieval** | |
| Look up and identify words in memory | Memory retrieval: Chapters 5–8 |
| Retrieve word meanings | |
| **Comprehension** | |
| Combine word meanings to yield sentence meaning | Semantic retrieval, comprehension: Chapter 7–10 |
| Evaluate sentence meaning, consider alternative meanings | Comprehension: Chapters 9 and 10 |
| **Judgment and decision** | |
| Retrieve answer to the question | Semantic retrieval: Chapters 8 and 9 |
| Determine reasonableness of question | Comprehension, conversation: Chapters 9 and 10 |
| Judge speaker's intent and knowledge | Decision making and reasoning: Chapter 11 |
| **Computational (Question 2)** | |
| Retrieve fact knowledge | Semantic retrieval: Chapter 7 |
| Retrieve knowledge of how to divide and execute procedure | Procedural knowledge: Chapters 6, 11, and 12 |

# Philosophical Considerations

- Mind = the entity that can process information and display intelligence
- Brain = the organ in your noggin
- Mind --> Brain?
- Brain --> Mind?
- Metaphysics : monism vs. dualism?  Soul? Afterlife?
- Assumption :  Mind = Brain = Mind

# Schools of Thought

- Philosophy
  - Aristotle and Tabula Rasa
  - Plato
- Psychology
  - Wilhelm Wundt and Introspection
  - Edward Titchener and Structuralism
  - Herman Ebbinghaus, the father of human memory research.
  - William James and Functionalism

## Plato : Phaedrus 370 BCE



Soc: Thamus replied: […] for this discovery of yours will create forgetfulness in the learners' souls, because they will not use their memories; they will trust to the external written characters and not remember of themselves. The specific which you have discovered is an aid not to memory, but to reminiscence, and you give your disciples not truth, but only the semblance of truth; **they will be hearers of many things and will have learned nothing;** they will appear to be omniscient and will generally know nothing; they will be tiresome company, having the show of wisdom without the reality.

## Aristotle: De Memoria 350 BCE
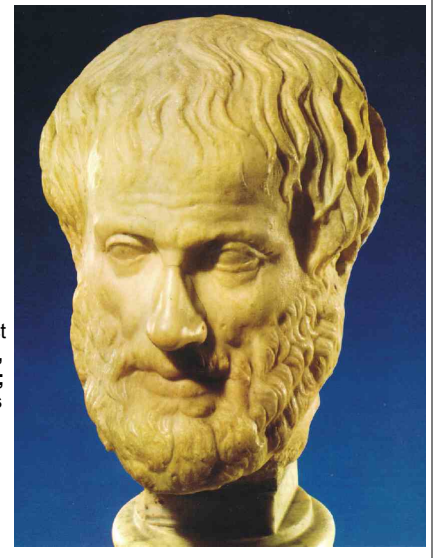
Memory is, therefore, neither Perception nor Conception, but a state or affection of one of these, conditioned by lapse of time. As already observed, there is no such thing as memory of the present while present, for the present is object only of perception, and the future, of expectation, but the object of memory is the past. **All memory, therefore, implies a time elapsed; consequently only those animals which perceive time remember, and the organ whereby they perceive time is also that whereby they remember.**

## Descartes : Principles of Philosophy (17th century)



**VII. That we cannot doubt of our existence while we doubt, and that this is the first knowledge we acquire when we philosophize in order.**While we thus reject all of which we can entertain the smallest doubt, and even imagine that it is false, we easily indeed suppose that there is neither God, nor sky, nor bodies, and that we ourselves even have neither hands nor feet, nor, finally, a body; but we cannot in the same way suppose that we are not while we doubt of the truth of these things; for there is a repugnance in conceiving that what thinks does not exist at the very time when it thinks. Accordingly, the knowledge, I think, therefore I am, is the first and most certain that occurs to one who philosophizes orderly.

# History of Cognitive Psychology
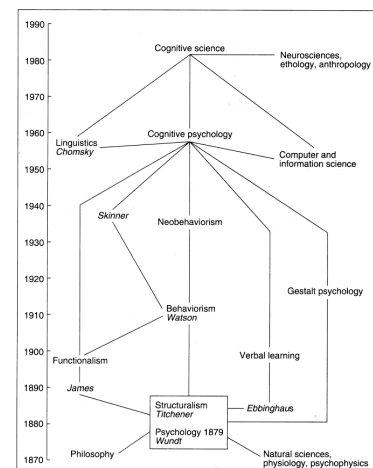
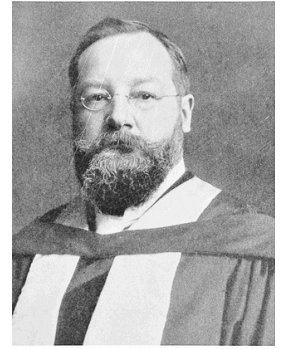# History of Cognitive Psychology

- Wilhelm Wundt
  - German physiologist
  - Established as own science
  - Introspection
  - Topics:
    - "conscious processes and immediate experience"

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# History of Cognitive Psychology

- Edward Titchner
  - 1st School of Thought
    - Structuralism
  - Methods
    - rigorously trained introspection
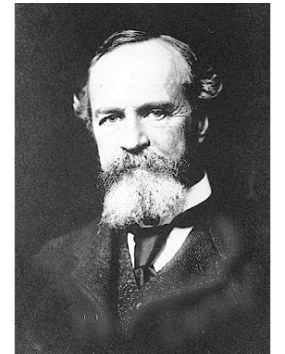
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# History of Cognitive Psychology

- Hermann von Ebbinghaus
  - Father of Memory Research
  - Savings Score

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# History of Cognitive Psychology

- William James
  - 2nd School of Thought
    - Functionalism

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# Behaviorism

- John Watson
  - Founder of Behaviorism
  - Observable Behaviors
  - No Mental Processes

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# Behaviorism

- John Watson, the founder of behaviorism
- A response to Wundt's introspection
- The scientific study of observable behavior only
- Since mental processes can't be seen, they have no place in psychology
- Behaviorism is "antimentalistic"

- Modern Evaluation?
  - methodological rigor was needed
  - antimentalism was an overreaction

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# Challenges to Behaviorism

- "The Misbehavior of Organisms"
- World War II
- Verbal learning
- Linguistics-- Chomsky versus Skinner
- The mind/computer analogy-- humans are information processors too
- Telecommunication analogies...

# "Misbehavior" of organisms

# Verbal Learning

- Evidence of meaning in "nonsense" syllables
- Semantic Clustering of recall

# Linguistics

- Linguistics-- Chomsky versus Skinner
- "Skinnerism is the final philosophic statement of the puritanical protestant-ethic manipulators who dominated the world for 400 years up to Hiroshima" (Leary, 1977)

# Computers - Von Neumann Architecture

- The mind/computer analogy-- humans are information processors too
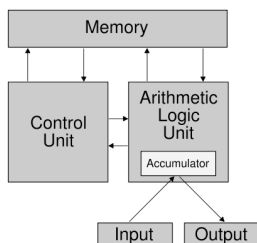


- Modular, sequential design with serial stages of processing

- Perhaps the brain is structured similarly and works the same way?

- Or do we have it backwards?

# Channel Capacity

- Limited Capacity
- Bandwidth

# Assumptions of Cognitive Psychology

- Mental processes exist!
- Mental processes can be studied scientifically (by using speed or accuracy as DV's).
- Human beings are active information processors.
- Humans are not necessarily special : it should be possible to deconstruct and reconstruct mental processes in other substrates (e.g. a computer)

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# Methods

- Time
- Accuracy

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# Reaction Time



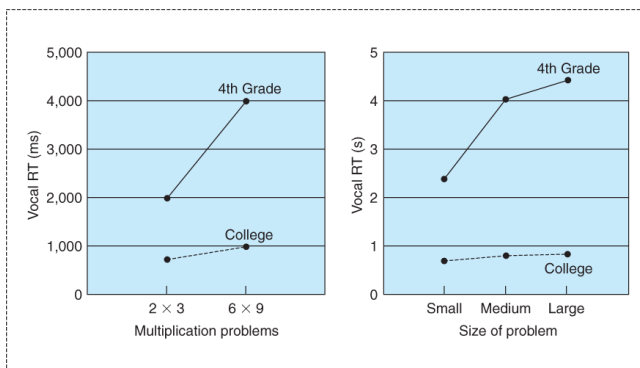**Figure 1-2**
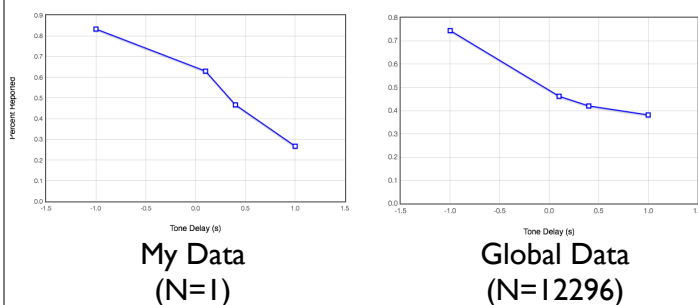Vocal response times (RTs) to multiplication problems.

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# CogLab: Partial Report

- "Perceptual Span" : how many items could be seen with a "brief exposure"
- Research suggested about 4.5
- George Sperling (1960)
  - "more than is seen than can be remembered"
  - Problem: report is to slow
  - Solution: partial report

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# CogLab: Partial Report
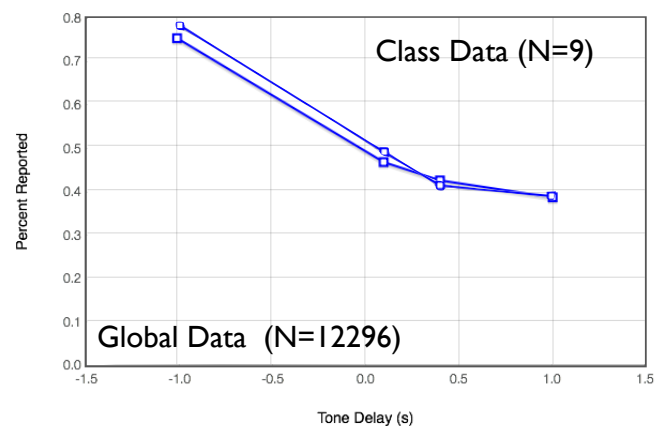


My Data
(N=1)

Global Data
(N=12296)

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# CogLab: Partial Report



Class Data (N=9)

Global Data (N=12296)

# CogLab: Partial Report

- Debriefing
  - Methods?
  - Predictions?
  - Robust? Limitations?

# Ecological Validity

- Neisser's term for the degree to which our lab tasks resemble "real world" cognition.

- Also called External Validity.

# The Reductionist Approach
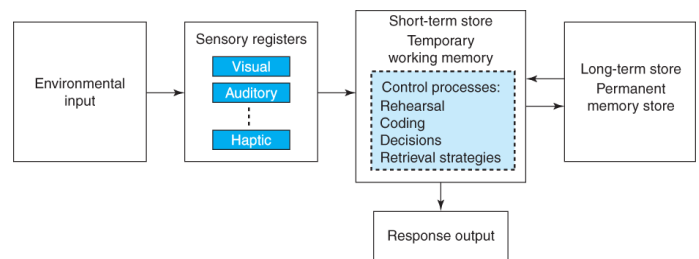
An attempt to understand complex events by breaking them down into their components.

# Information Processing and Cognitive Science
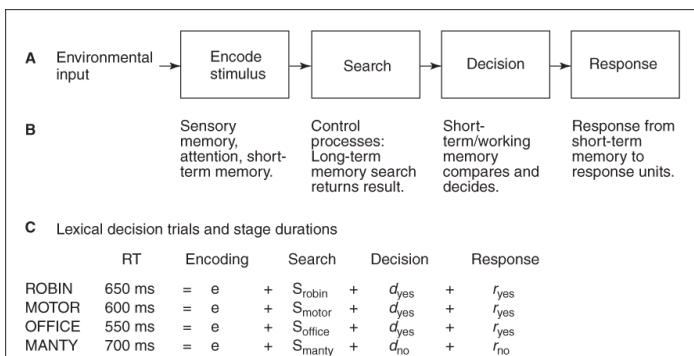
- Atkinson Shiffrin "Standard Model" aka "Standard Theory"

# Process Model (Sternberg)

- Lexical Decision Task



| | RT | Encoding | | Search | | Decision | | Response |
|---|---|---|---|---|---|---|---|---|
| ROBIN | 650 ms | = e | + | $S_{robin}$ | + | $d_{yes}$ | + | $r_{yes}$ |
| MOTOR | 600 ms | = e | + | $S_{motor}$ | + | $d_{yes}$ | + | $r_{yes}$ |
| OFFICE | 550 ms | = e | + | $S_{office}$ | + | $d_{yes}$ | + | $r_{yes}$ |
| MANTY | 700 ms | = e | + | $S_{manty}$ | + | $d_{no}$ | + | $r_{no}$ |

# Process Model

- Assumptions
  - Sequential Stages
  - Independent and Non-overlapping

- Challenges
  - Example: Typing (4 stages) - parallel processing
  - Context Effects (Priming)
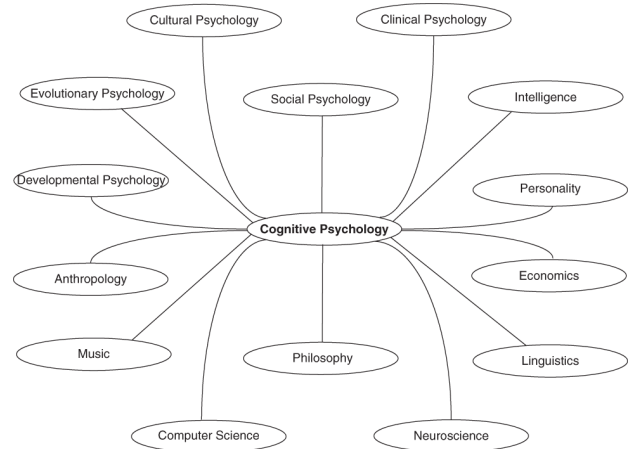    - faster to ID "MOTOR" 2nd time

# Ideas

- Parallel Processing
- Non-independence
- Bidirectional influence
- Hierarchy

# Cognitive Psychology

## Summary of Major Topics Covered in Chapter 1

- Thinking about thinking
- Memory and cognition defined
- History of Cognitive Psychology
- Cognitive psychology and information processing.

# Seven Themes of Cognition

- Attention
- Data-Driven vs. Conceptually Driven
- Representation
- Implicit vs. Explicit
- Metacognition
- Brain
- Embodiment