

# Introduction of Expert System

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# Materials

1. Definition of expert
2. Expert vs Novices
3. Definition of Expert System
4. Domain
5. The relation with Artificial Intelligence
6. General concept of Expert System

# Definition of Expert

- **Expert:**

- A person with special knowledge or ability who performs skillfully

(<http://wordnet.princeton.edu/perl/webwn>)

- We'll talk about degrees or levels of expertise

- **Question:**

- How much expertise should a person possess before qualifying as an expert?

# Definition of Expert (2)

- **Expertise:**

- The extensive, task-specific knowledge acquired from training, reading, and experience
- It includes:
  - ❑ Facts about the problem area
  - ❑ Theories about the problem area
  - ❑ Fast rules and procedures regarding the general problem area
  - ❑ Rules (heuristic) of what to do in a given problem situation
  - ❑ Global strategies for solving these types of problems
  - ❑ Meta-knowledge (knowledge about knowledge)

## Definition of Expert (3)

- **Behavior of human expert:**
  1. Recognizing & formulating the problem
  2. Solving the problem quickly & properly
  3. Explaining the solution
  4. Learning from experience
  5. Restructuring knowledge
  6. Breaking rules
  7. Determining relevance
  8. Degrading gracefully

# Expert vs Novice

Expert	Novice
Have well-organized, highly interconnected units of knowledge	Have poorly organized, lossely interconnected, scattered units of Knowledge
Have automatized many sequences of steps within problem strategies	Show little or no automatization of any sequences of steps within problem strategies
Show highly efficient problem solving; when time constraints are imposed, solve problems more quickly than novices	Show relatively inefficient problem solving; solve problems less quickly than novices

## Expert vs Novice (2)

Expert	Novice
Accurately predict the difficulty of solving particular problems	Do not accurately predict the difficulty of solving particular problems
Carefully monitor own problem-solving strategies and processes	Show poor monitoring of own problem-solving strategies and processes
Show high accuracy in reaching appropriate solutions	Show much less accuracy in reaching appropriate solutions

# To be an Expert

“with enough training and motivation,  
everyone can become someone with an  
exceptional memory”  
(Chase & Ericsson)

# Definition of Expert System (1)

- **Prof. Edward Feigenbaum (Stanford University)**

An intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution

- **Jackson:**

An expert system is a computer program that represents and reasons with knowledge of some specialist subject with a view to solving problems or giving advice.

## Definition of Expert System (2)

- Puppe

Expert systems are programs for reconstructing expertise and reasoning capabilities of qualified specialists within limited domains.

- Rich & Knight

Expert systems solve problems that are normally solved by human experts

# Definition of Expert System (3)

- **Buchanan & Shortliffe**

An expert system is an AI program designed

- a) to provide expert-level solutions to complex problems
- b) to be understandable
- c) to be flexible enough to accommodate new knowledge easily

- **Darlington**

An expert system is a program that attempts to mimic human expertise by applying inference methods to a specific body of knowledge

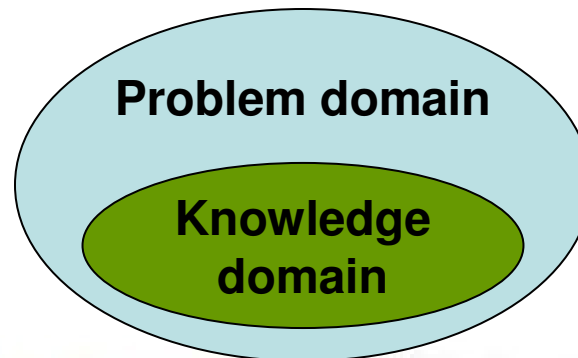
# Definition of Expert System (4)

- **Efraim Turban**

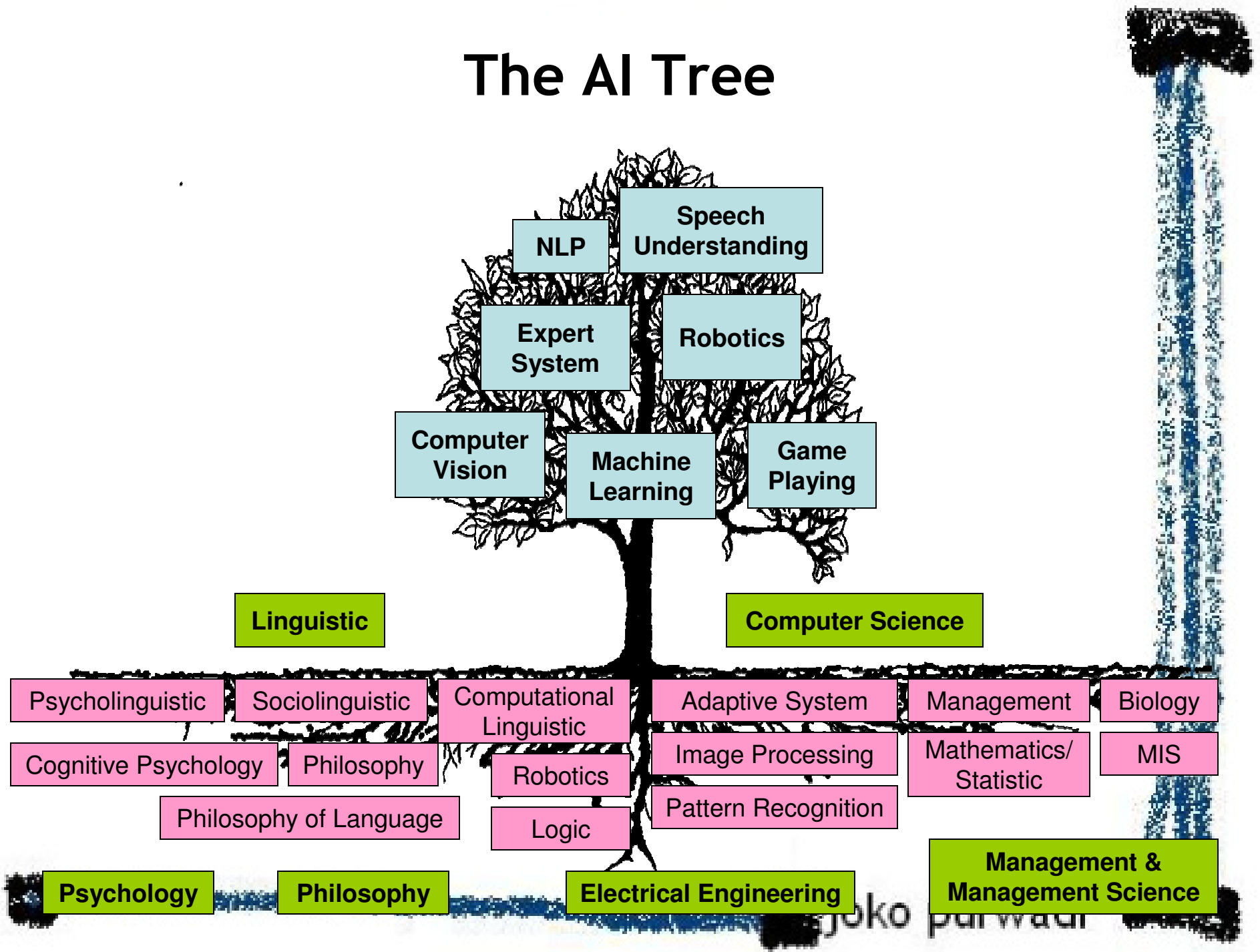
- An expert system is a system that employs human knowledge captured in a computer to solve problems that ordinarily require human expertise
- Well-designed systems imitate the reasoning process experts use to solve specific problems

# Domain

- **Problem domain**
  - The special problem area
  - Ex.: medicine, finance, science, engineering
- **Knowledge domain**
  - The expert's knowledge about solving specific problems
  - Example: in medical area
    - ✓ An ES designed to diagnose infectious diseases
    - ✓ Knowledge domain: certain symptoms, diseases, and the treatments

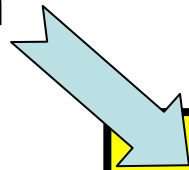


# The AI Tree



# Definition of AI

Expert  
System



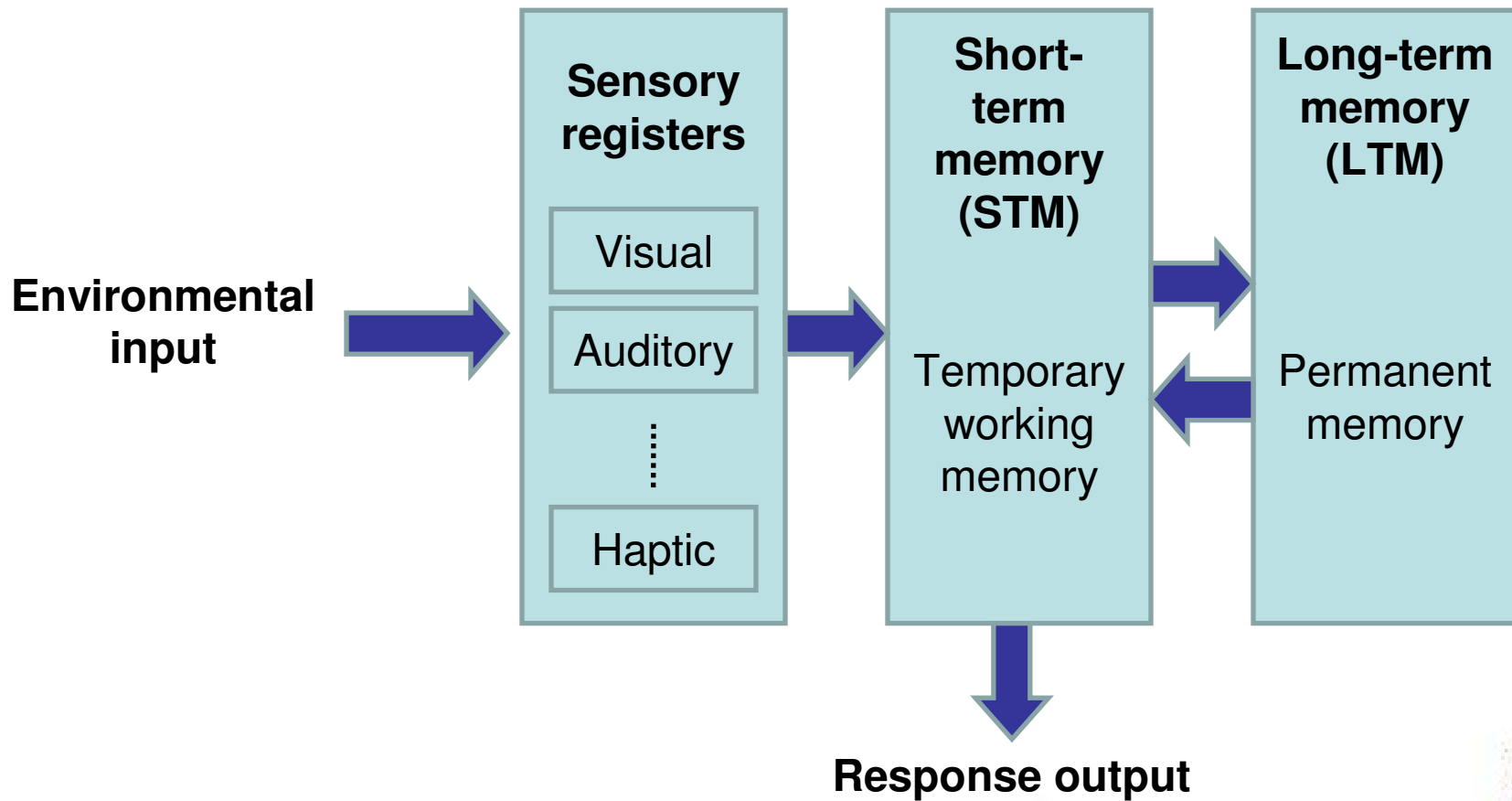
Thinking humanly	Thinking rationally
Acting humanly	Acting rationally

# Human Information Processing

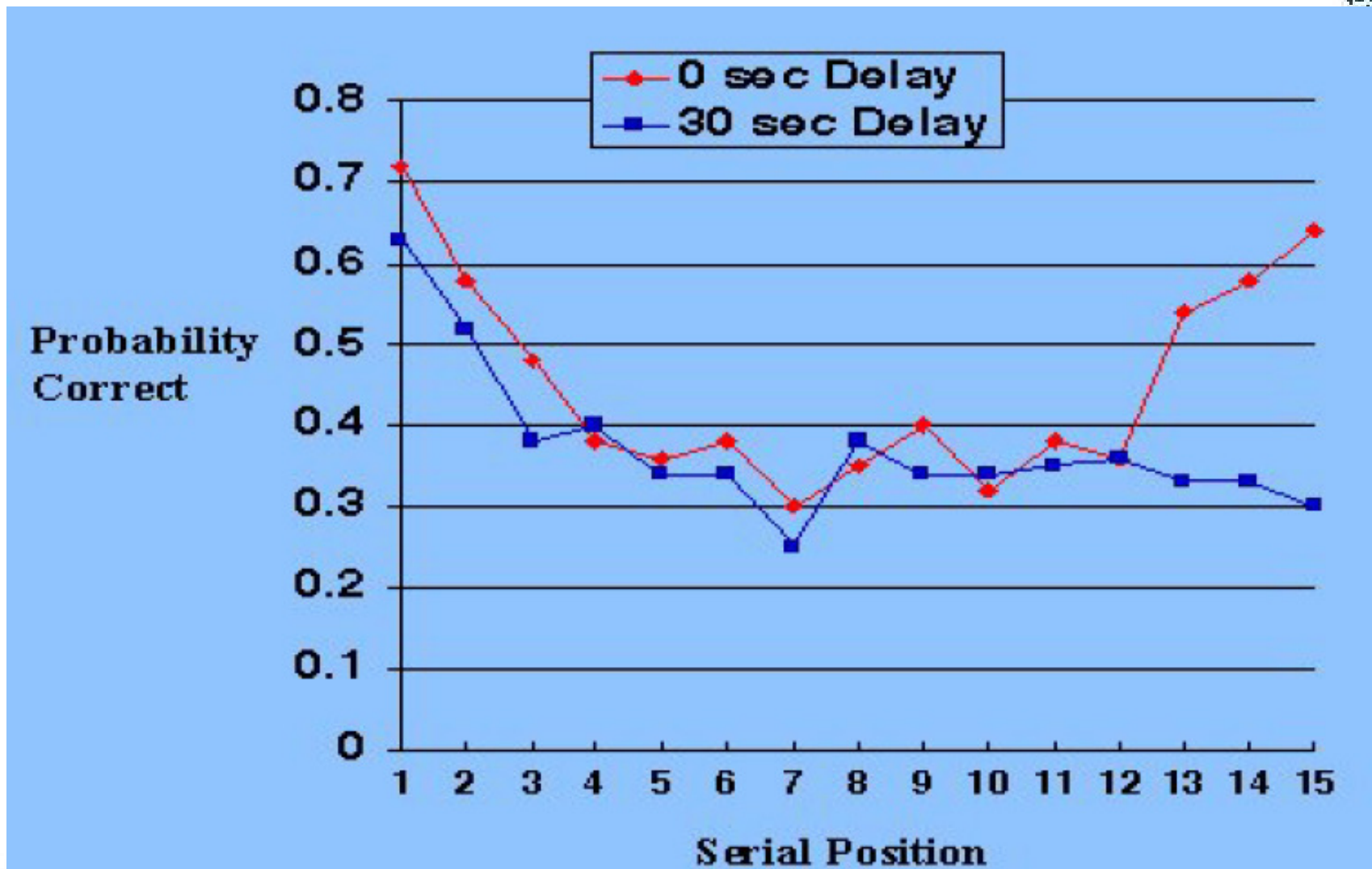
- Introducing 2 models of human information processing system:
  1. Atkinson-Shiffrin Model
  2. Adaptive Control of Thought Model

# Information Processing Model

## Atkinson-Shiffrin Model (1968)



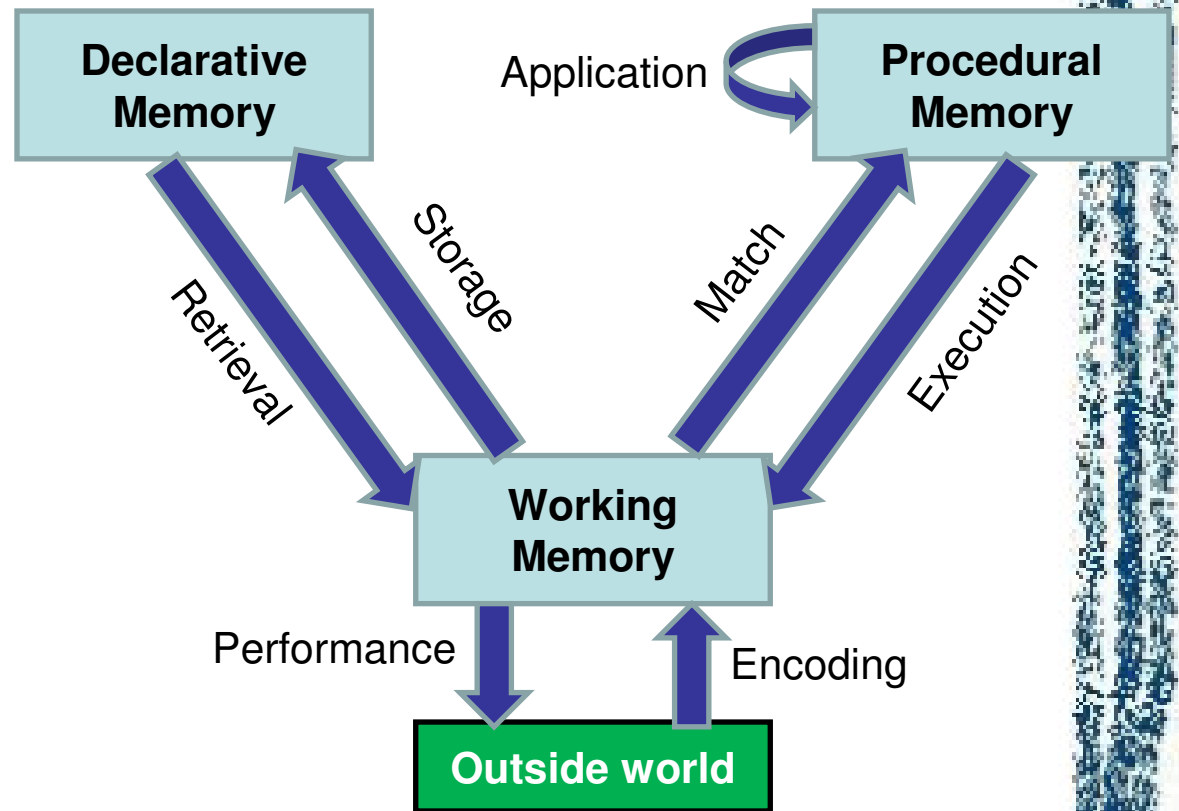
# Serial Position Effect



# Information Processing Model

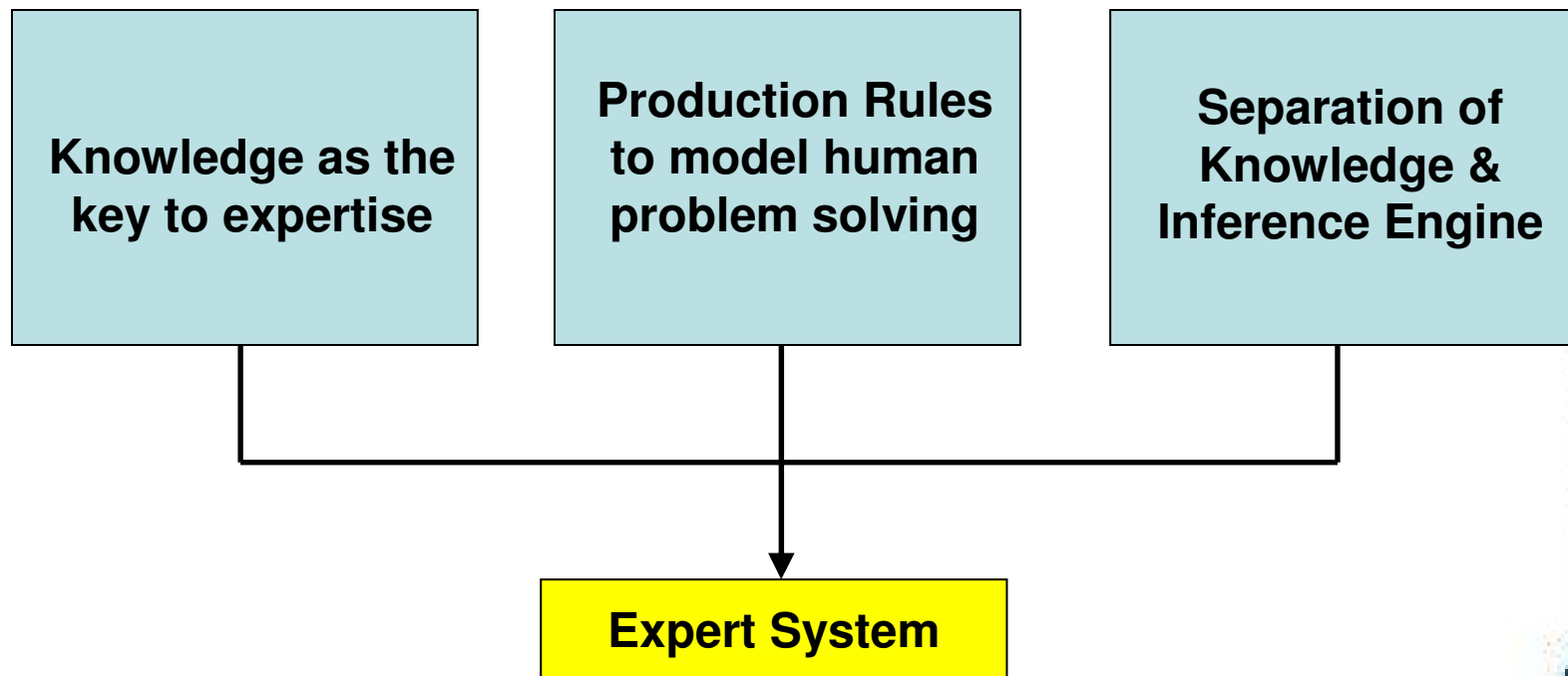
## Adaptive Control of Thought Model (Anderson)

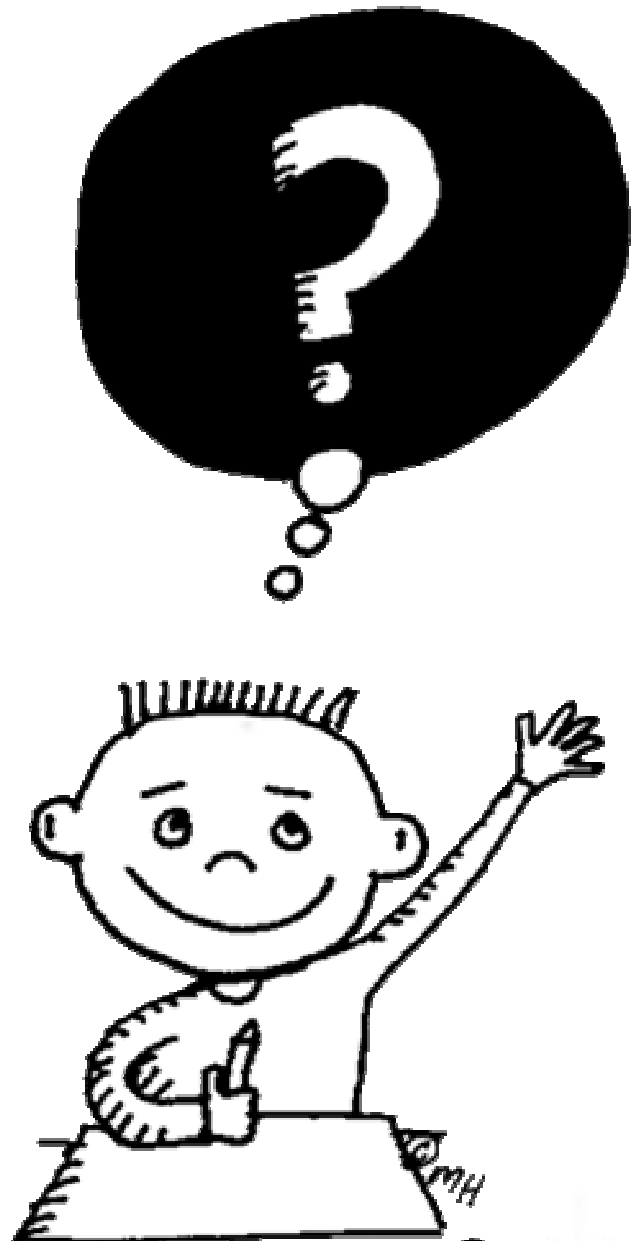
- **Declarative memory:**
  - Semantic network of interconnected concept
- **Procedural memory:**
  - The production rules
- **Working memory:**
  - Currently active information

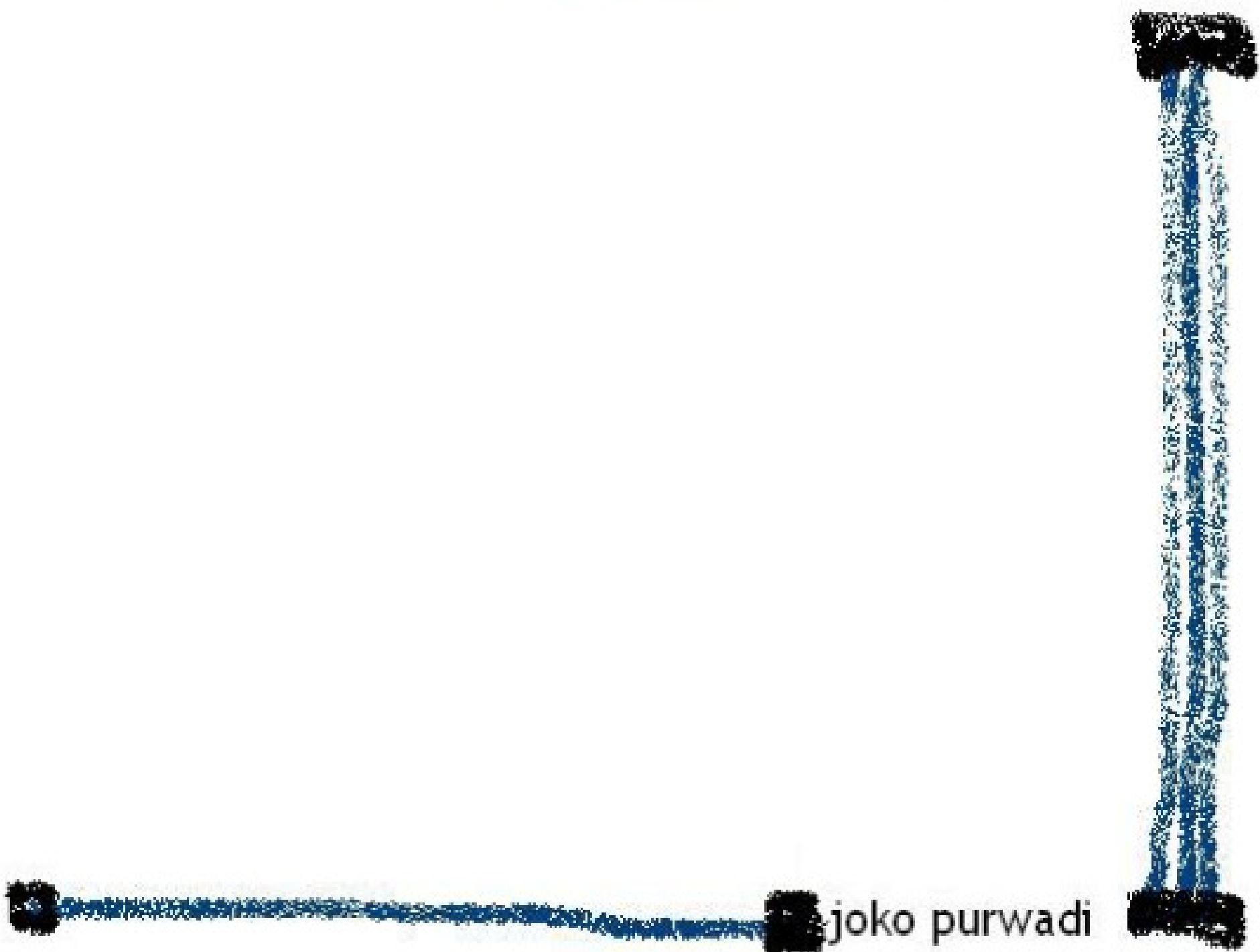


# General Concept of ES

- The modern ES is a convergence of 3 important factors:







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