بسم الله الرحمن الرحیم

علوم شناختی

جلسه ۲ (ب)

واکنش در برابر رفتارگرایی در روان‌شناسی

The Reaction Against Behaviorism in Psychology

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PART 1:
HISTORICL LANDMARKS

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Chapter 1:
The Prehistory of Cognitive Science

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Chapter 1.1:
The reaction against behaviorism in psychology

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گام‌هایی به‌سوی علوم شناختی

STEPS TOWARDS COGNITIVE SCIENCE

- چرخش **شناختی** در روان‌شناسی (از رفتارگرایی)
- توسعه‌ها در **نظریه‌ی محاسبه** و **نظریه‌ی اطلاعات**
- توسعه در **مدل‌های پردازش اطلاعات** از قابلیت‌ها و توانایی‌های شناختی

Steps towards cognitive science

- The cognitive turn in psychology (away from behaviorism)
- Developments in the theory of computation and theory of information
- Development of information-processing models of **cognitive** capacities and abilities

Basic principle of behaviorism

Rejection of mentalism:

1) appeal to thoughts and desires to explain **behavior**

2) use of introspection to study conscious mental experience

3) dependence upon verbal reports

Mentalism

"Psychology is the Science of Mental Life, both of its phenomena and their conditions. The phenomena are such things as we call feelings, desires, cognitions, reasonings, and the like."

William James, *Principles of Psychology* (1890: 1)

Method?

- According to James, psychology's job will be complete when it has "ascertained the empirical correlation of the various sorts of thought or feeling with definite conditions of the brain"
- Depends upon being able to identify and classify "the various sorts of thought or feeling"
- Dependence on introspection and verbal reports

Behaviorism

"The conscious aspect of behavior is undoubtedly most interesting. But we are unable to deal directly with this by the methods of observation and experiment."

"The ideal of most scientific men is to explain behavior in terms of matter and energy, so that the introduction of psychic implications is considered superfluous"

H. S. Jennings (*Behavior of the Lower Organisms, 1906: v and 329)*

Psychological behaviorism

- adopted by psychologists such as Watson (1878-1958), Skinner (1904-1990), and Pavlov (1849-1936)

- Features:
  - we can give a full account of human (and non-human) behavior in non-psychological terms
  - is driven by the methodological concern – problems of verifying claims about "inner" psychological states
  - focused on explanation of **behavior**
    - Explanatory tools that make reference only to behavior
    - E.g. conditioning theory

Classical/Pavlovian conditioning

- Depends upon an association between **stimulus** and **response**
- Certain stimulus-response pairings are inborn and reflexive
- Basic reflex responses are unconditionally elicited by certain types of stimuli [e.g. salivation on presentation of food]
- These basic responses can be elicited by other stimuli through conditioning

The mechanics

- ❑ **Unconditional stimulus** (US) – e.g. food
- ❑ **Conditional stimulus** (CS) – e.g. sound of a bell
- ❑ **Unconditioned response** (UR) – e.g. salivation

- Presenting the CS immediately before the US develops an association between the CS and the UR

- This conditional reflex is reinforced as the conditioning process continues

- It is extinguished once the US is no longer presented (after a certain period of time)

Interesting fact

- Pavlovian conditioning works even when the stimulus is noxious
- Pavlov conditioned dogs to salivate in response to a pin-prick
- These dogs developed a normal salivatory response and showed no aversion to the pin-prick (unlike unconditioned dogs)

Interesting fact

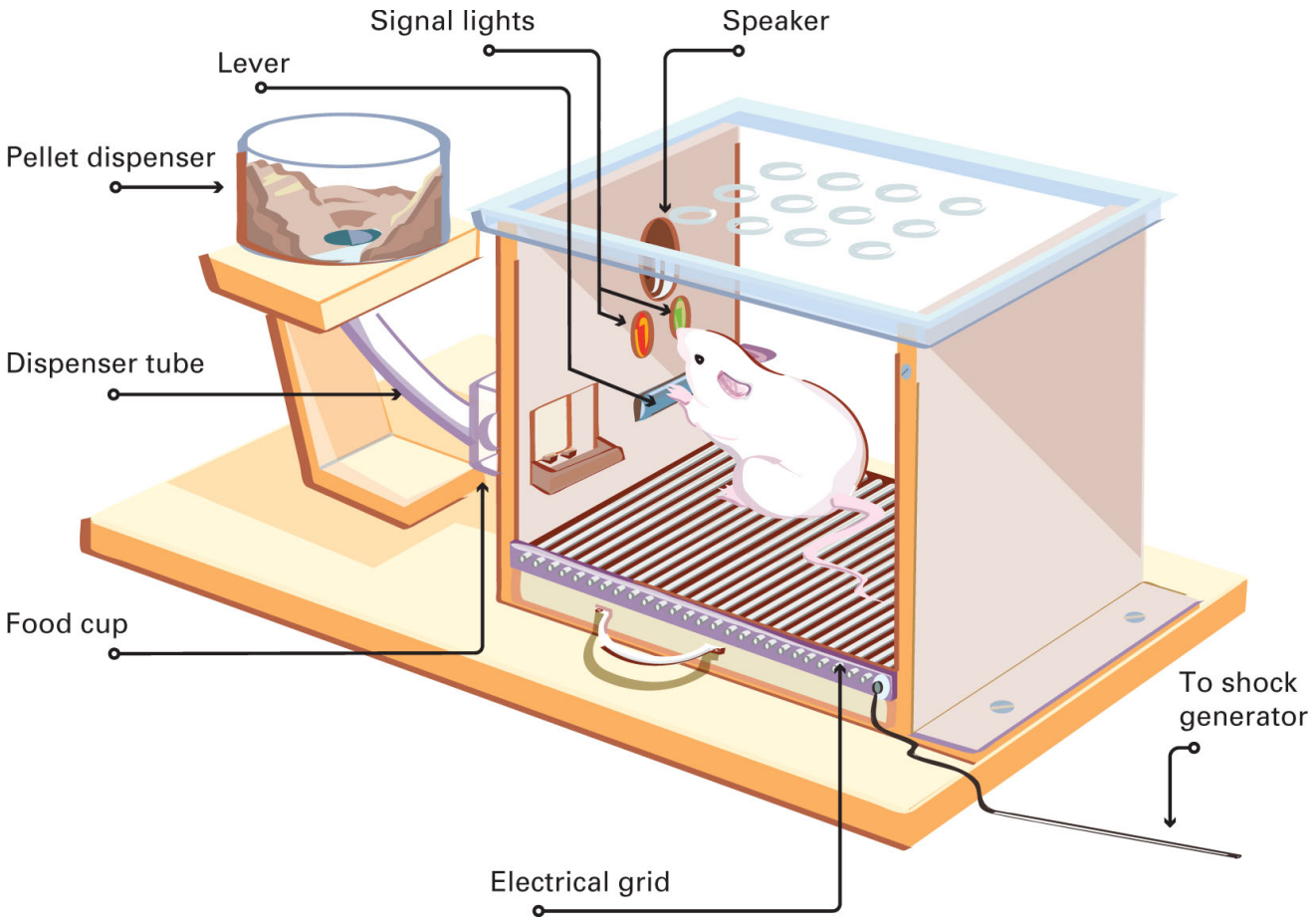
Omission schedules show that Pavlovian conditioned responses can persist despite their consequences

- Suppose a pigeon is conditioned to a flashing light as a CS signaling food delivery
- The pigeon will peck the light even if pecking the light brings about the non-delivery of food

Instrumental/operant conditioning

- Pavlovian/classical conditioning works via the US being presented immediately after the CS
- In instrumental/operant conditioning there is no CS
- Instead, the US is conditional upon performing a designated response – e.g. pressing a lever

Skinner box


Signal lights
Speaker
Lever
Pellet dispenser
Dispenser tube
Food cup
To shock generator
Electrical grid

Behaviorist goal (1)

A complete explanation of all behavior in terms of conditioned responses - e.g.

- **Language** as a complex set of conditioned responses – words produced in response to particular objects or situations

- Analyzing a **sentence** as a chain of elements, each serving as a conditional stimulus for the succeeding element

Behaviorist goal (2)

Operationalization of psychological phenomena

Attention is not a mental act of focusing on part of the perceptual field, for example

Attention is simply the fact that an organism responds to a single stimulus when there are several stimuli present to which it would otherwise respond

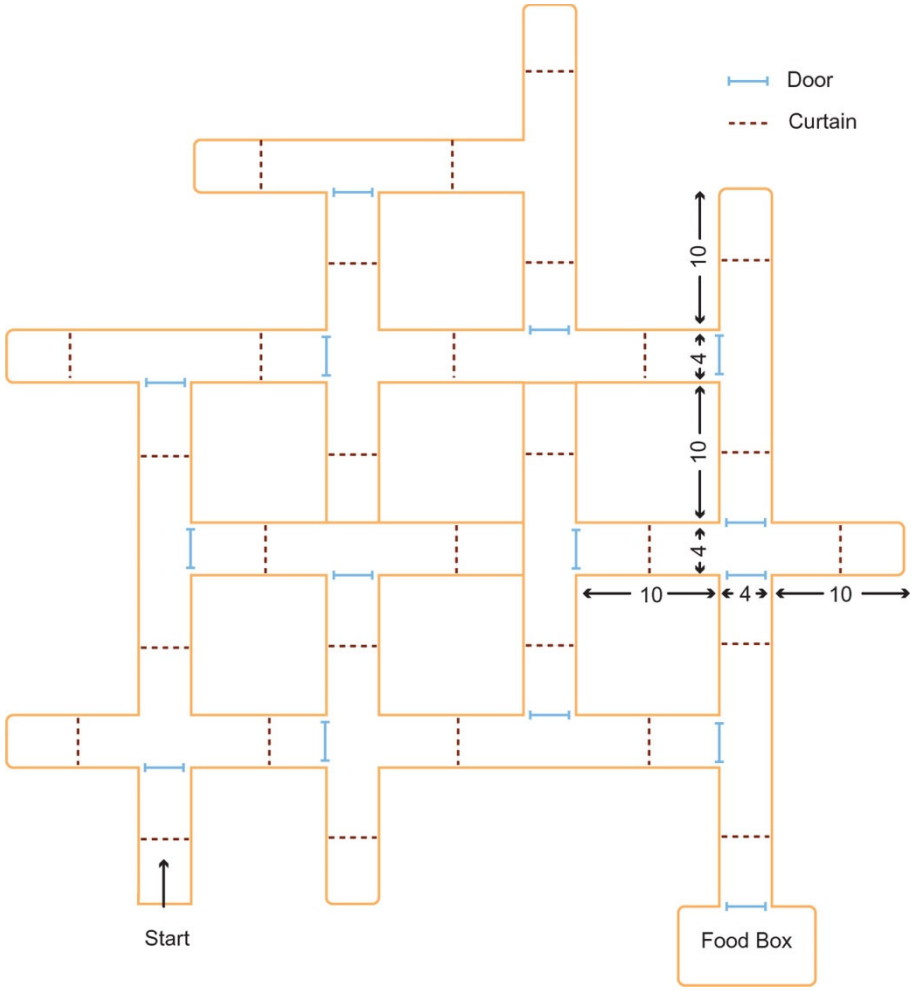
Problems for behaviorism

- Discovery that **learning** can take place without reinforcement and that it can involve pick up of information (latent learning experiments)

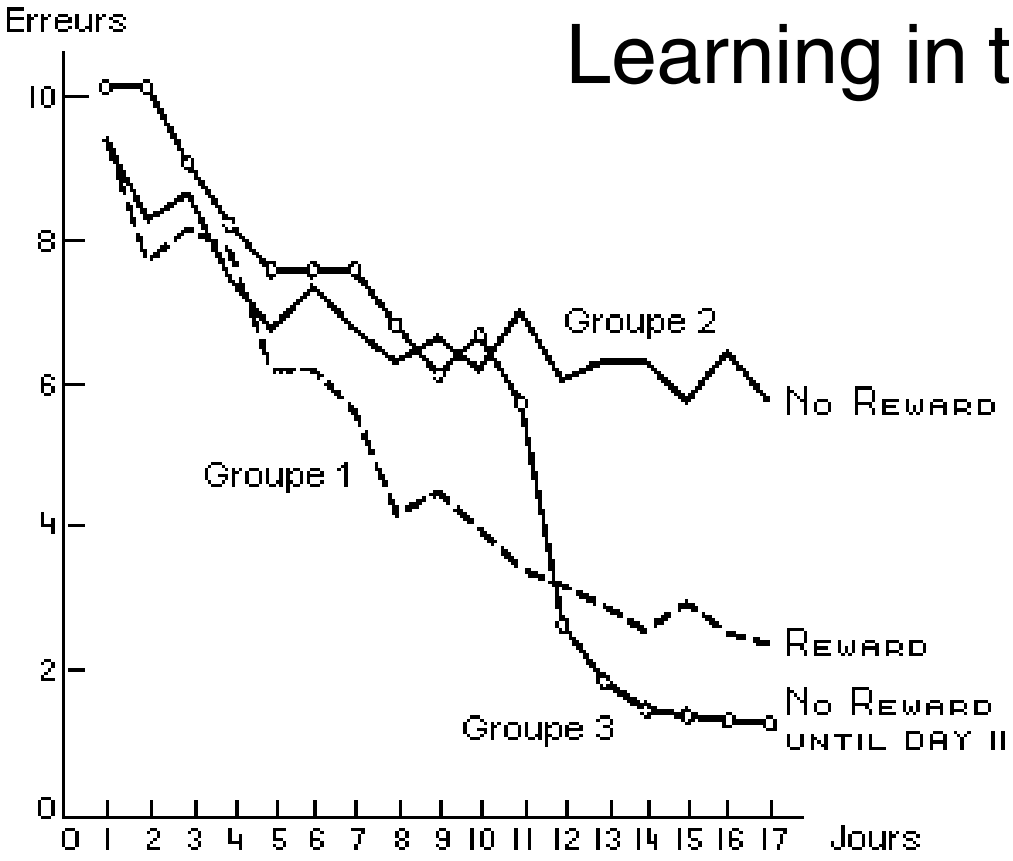
- Discovery that this **information** need not be information about bodily responses (place learning experiments)

- Objections to **behaviorist accounts of language**
(Chomsky's review of Skinner's book *Verbal Behavior)*

Latent learning



Latent learning



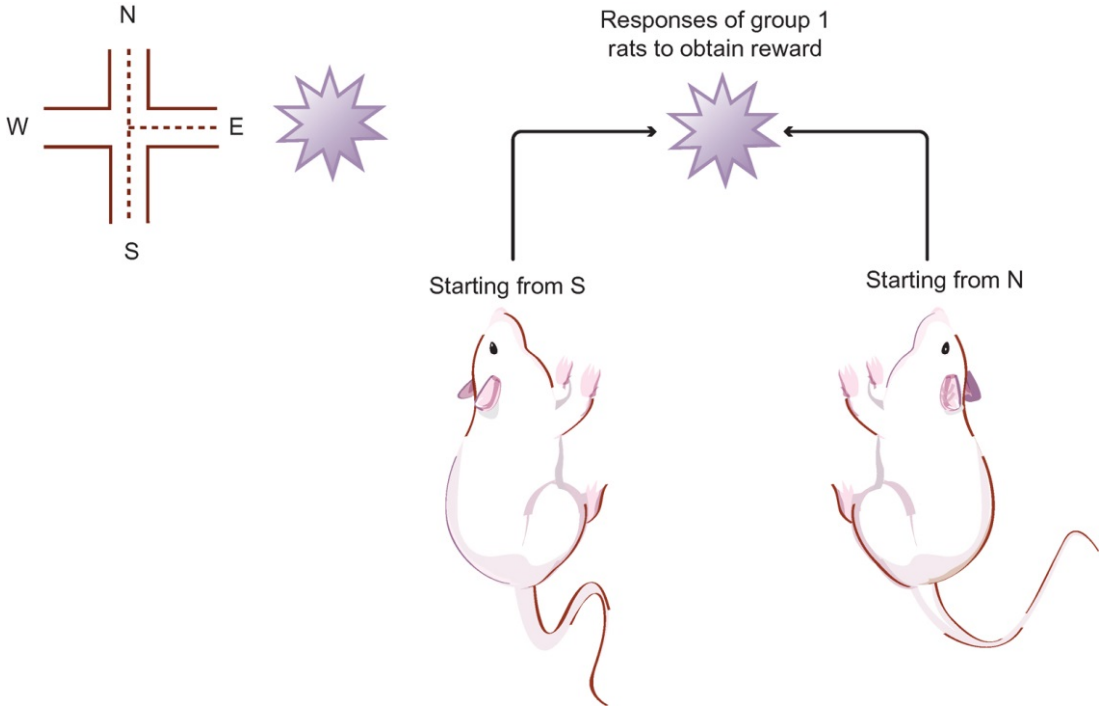
Learning in the absence of reward

Place learning

- Issue is whether **movement** is made possible by
  - Chained sequences of conditioned reflexes
  - Knowledge of spatial relations

- Tolman, Ritchie, and Kalish shows that the chained response theory is not always correct - cross maze experiments

Cross maze (elevated maze) experiments



Cross maze (elevated maze) experiments

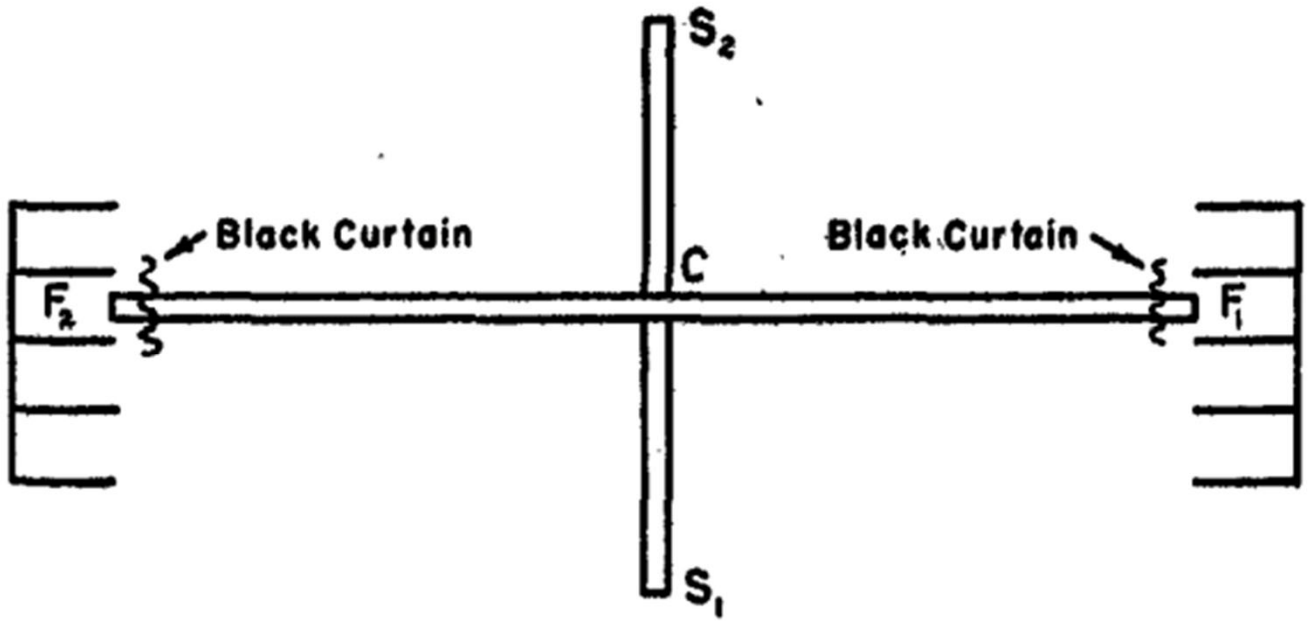
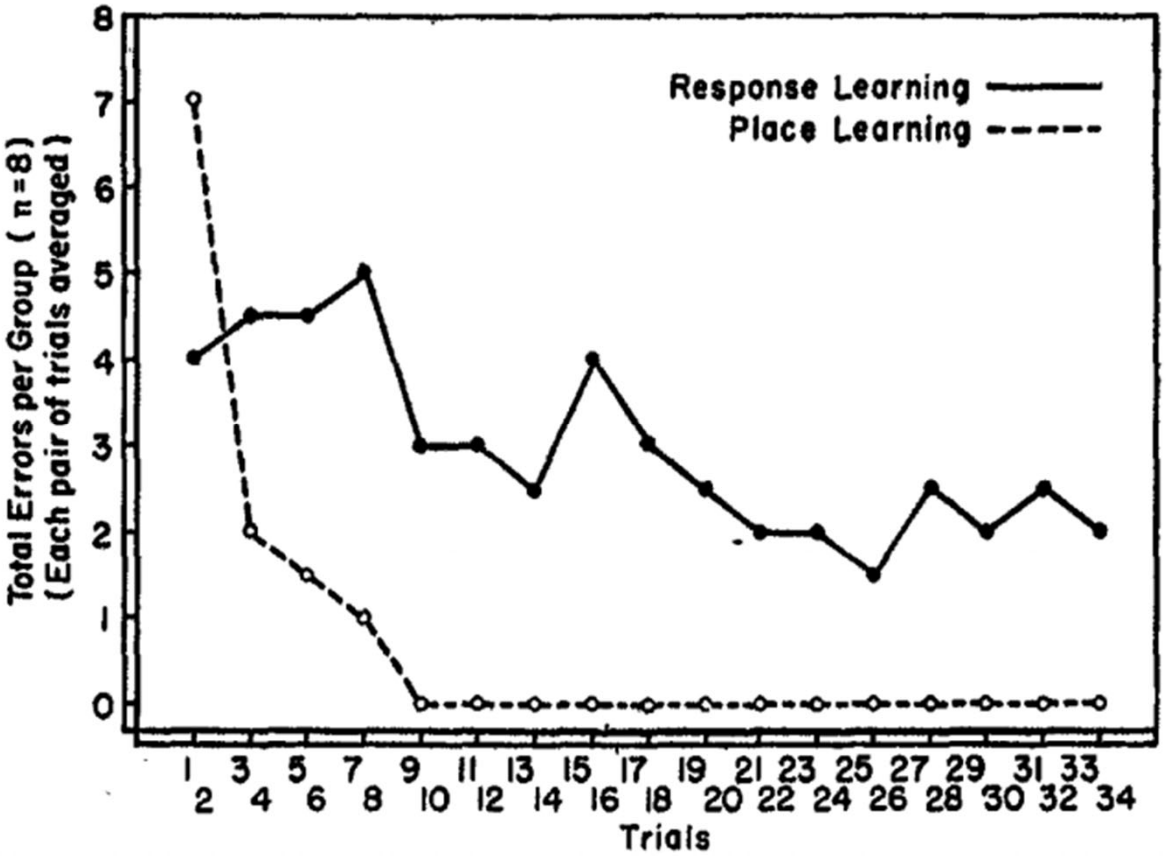


FIG. 1. Elevated maze. S_1 and S_2: starting points; F_1 and F_2: food boxes; C: center point.

From Tolman, E. C., Ritchie, B. F., & Kalish, D. (1946). Studies in spatial learning. II. Place learning versus response learning. *Journal of experimental psychology*, *36*(3), 221.

Cross maze (elevated maze) experiments

"Only three rats in the Response-Learning Group reached the criterion (10 successive errorless runs) while the rest developed consistent habits of going always to the same place. All of the rats in the Place-Learning Group reached the criterion within eight trials or less."



From Tolman, E. C., Ritchie, B. F., & Kalish, D. (1946). Studies in spatial learning. II. Place learning versus response learning. *Journal of experimental psychology, 36*(3), 221.

Lashley and hierarchical processes

- Behaviorism relies on a series of linked responses (serial processing)

- But many of our activities use bottom-up and top-down processes (hierarchical processing)
  - e.g. tasks that require planning, prediction, or the use of goals

Lashley on serial order

- **Sequential organization** is key to human and animal behavior
  - ❑ Locomotion
  - ❑ Planned behaviors
  - ❑ Language

- Rejected idea that sequential organization is the result of associative chaining

Types of evidence

- Movement can occur even when sensory feedback is interrupted
- Some movement sequences are too quick for elements to be triggered by preceding elements
- Errors in behavior suggest high-level organization
- Context-sensitivity of behaviors
  - [e.g. /rajt/ in "The mill-wright on my right thinks it right that some conventional rite should symbolize the right of every man to write as he pleases"]

Basic motor plans

- Goal
- Selection of effector
- Trajectory of effector
- Muscle coordination
- Sensory feedback and fine-tuning

The big picture 1

Latent learning →
idea of information pick-up and storage

Place learning →
idea of information specifically about the environment (rather than the organism's own movements)

Language →
idea of hierarchical, rather than serial, organization [special case of Lashley's analysis of behavior]

The big picture 2

Cognitive science grew out of these basic ideas

- organisms pick up and process information about the environment [distal, rather than proximal]
- this information is organized hierarchically

Putting these ideas together was made much easier by two mathematical theories

  - the theory of information
  - the theory of computation

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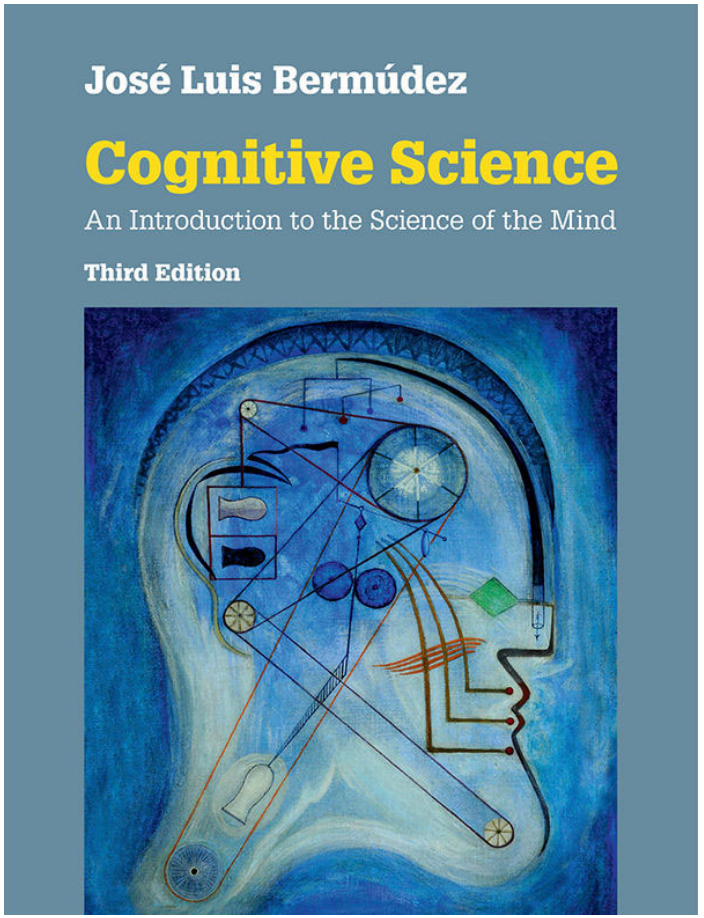

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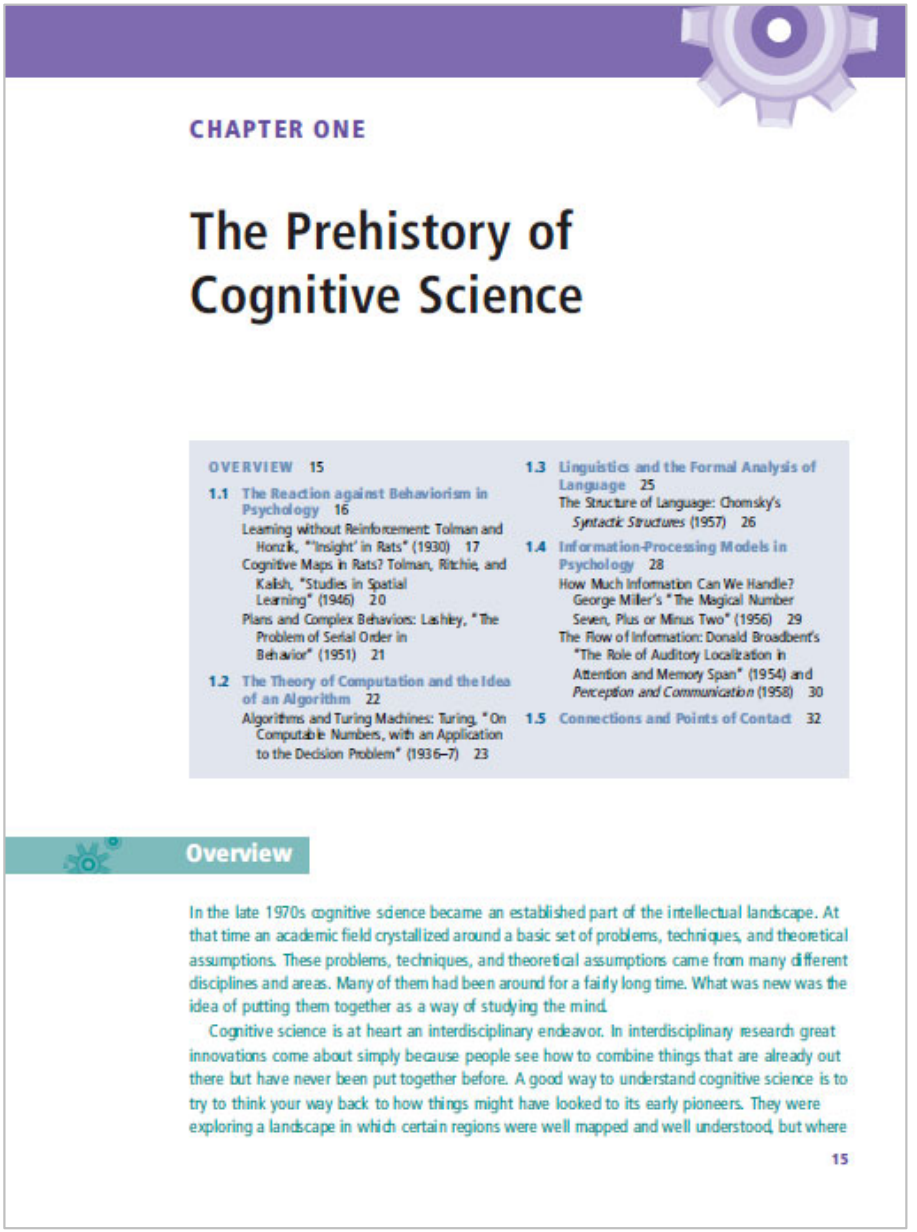

CHAPTER ONE

The Prehistory of Cognitive Science

Overview

In the late 1970s cognitive science became an established part of the intellectual landscape. At that time an academic field crystallized around a basic set of problems, techniques, and theoretical assumptions. These problems, techniques, and theoretical assumptions came from many different disciplines and areas. Many of them had been around for a fairly long time. What was new was the idea of putting them together as a way of studying the mind.

Cognitive science is at heart an interdisciplinary endeavor. In interdisciplinary research great innovations come about simply because people see how to combine things that are already out there but have never been put together before. A good way to understand cognitive science is to try to think your way back to how things might have looked to its early pioneers. They were exploring a landscape in which certain regions were well mapped and well understood, but where

15