History of Cognitive Psychology and its Relation to other Fields

Lesson I: Introduction module 02
Roots in philosophy
- Plato, Aristoteles, Descartes, Locke, ....

Experimental Psychology developed in the late 19th century out of ....
- Philosophy
- Physiology / Biology / Medicine

Structuralism

Functionalism

Gestalt psychology
The beginnings

- **Fechner (1860)**
  - “Elements of psychophysics”

- **Wundt (1879)**
  - First psychological laboratory in Leipzig

- **Ebbinghaus (1885)**
  - “Memory: A contribution to experimental psychology”

- **James (1890)**
  - “The principles of psychology”
Gustav Theodor Fechner: Elements of Psychophysics

- Relating the physical world to our experience of it
- The experienced intensity of a stimulus (e.g., brightness, loudness, weight, size) is proportional to the logarithm of its physical dimension

\[ E = k \times \log S \]
What are the elements of our thoughts?

Represents the start of experimental psychology (1876 in Leipzig, Germany)

Focus on physiological psychology, psychophysics, and higher mental processes

Preferred method: Introspection and systematic experimentation
Systematic introspection: Psychology as the study of experience from the point of view of the experiencing individual

Trained observers were to report their “pure” sensations

Structure of cognitive events was supposed to be analyzable similarly to chemistry - as the combination of different elements
Hermann Ebbinghaus: The mechanism of human memory

- First systematic study of human memory
- Quantification of forgetting and learning by studying nonsense syllables

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Equivalent of Wundt for American psychology

Functionalism: Focus on psychological processes and their function / relevance for human behavior

Philosophical approach in contrast to Wundt’s empirical approach
Watson (1913)
“Psychology as the behaviorist sees it”

- Discards introspection as method
- Rejection of mentalism - discards consciousness and other references to mental phenomena
- Emphasizes the functional relation between physical world and behavior
  STIMULUS -> RESPONSE
- The human mind as a “black box”
- Reliance on animal models
Skinner (1938)  
“The behavior of organisms”

- Strong voice of neo-behaviorism
- Focus on operant conditioning
- Agreement with Watson on the type of behaviorist psychology

- “The organism as the function between the stimulus and the response”
- Behaviorism ruled American experimental psychology for the first half of the century
Köhler (1917) “The mentality of apes”
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- "Sultan tries to reach the fruit with the smaller of the two sticks. Not succeeding, he tears at a piece of wire that projects from the netting of his cage, but that too is in vain... He suddenly picks up the little stick once more, goes up to the bars directly opposite the long stick, scratches it towards him with the ‘auxiliary,’ seizes it, and goes with it to the point opposite the objective (the fruit), which he secures."

- The solution of a problem requires not just the gradual accumulation of new facts, but the reorganization of existing facts into a new, coherent structure.
Tolman (1948) "Cognitive maps in rats and men"
- Re-introduction of mentalistic concepts
The cognitive revolution

- **Re-emergence of cognitive themes**
  - such as memory, attention, problem solving
  - The human as an “information processor”

- **Important works**
  - Shannon (1948) “Information theory”
  - Miller (1956) “The magical number 7 plus or minus 2”
  - Broadbent (1958) “Perception and communication”
  - Chomsky’s (1959) critique of Skinner’s (1957) book “Verbal behavior”
  - Neisser (1967) “Cognitive psychology”
Re-emergence of classical topics, such as ...
- Attention
- Memory
- Language
- Thinking
- Problem solving

Strict methodological principles
- Experimental method, factorial designs
- Processing speed: Reaction times
- Accuracy: Error rates
- Motor behavior
- Simulations and modeling
Understanding and growing interest in ...
- Localization of high-level brain function
- Neuro-surgery and pharmacology
- Functional organization of cell assemblies
- Modeling of neural processing

Refinement of neuropsychological methods
- Electroencephalography (EEG) to record brain activity in vivo
- Cortical stimulation during neuro-surgery
- In-vivo cell recordings of cortical neurons
The developing computer metaphor for cognitive processing ...

- Data storage vs. data processing
- Parallel vs. serial processing
- Representation formats
- Development of high-level programming languages (e.g., PROLOG, LISP)
- Computer simulations of thought (problem solving)
- Artificial intelligence

Nascent of information sciences ...

- Quantification and formalization of information
- Mathematical models of information processing