Philosophical approach

• Renaissance associationists:
  – Hobbes, Locke, Berkeley, Hume, ...
  – How do sensations combine to form more complex thoughts?
• Never got beyond discussion
  – Wasn’t clear that the mind could be studied empirically
    • Illustrating the importance of assumptions

Introspectionist approach

• Late 1800s to 1920s
• Studied conscious mental events
  – Assumption: Mind can be studied empirically
  – Metaphor: Periodic table of the elements
• Method: Observe one’s own thoughts
  – After training
• Problems:
  – Observations could not be verified
  – Much of cognition is unconscious
    • Not cognitively penetrable

Behaviorist approach

• 1920s to 1950s
• What’s the behavior? How is it learned?
  – Assumptions:
  – Mind can’t be studied scientifically
  – Complex behavior emerges through learning
  – Social pendulum had swung toward nurture
• Main method was conditioning

Conditioning explains some complex behavior

But...

• Language was difficult to explain
• Colorless green ideas sleep furiously
  – Noam Chomsky (1957)
  – High agreement that it’s grammatical
    • Yet a novel stimulus
  – Evidence for mental representations of syntax
The computer

- Developed ~1955
- Did nothing without data and programs
  - Analog of mental representations
- With data and programs, could solve some problems like people did
  - Newell and Simon
  - Demonstration involved verbal protocols

Cognitive revolutionaries

Herbert Simon (Nobel laureate)
Allen Newell (Simon’s student)

Method

- Use behavior to make inferences about unobservable mechanisms
  - Difficult if not impossible
  - Rigor helps
- Any and all behavior
  - Verbal protocols
  - Response latencies
  - Accuracy
  - Self-report
  - Brain activity (EEG, fMRI, etc.)

---

So 760 times 93, uh
3 times 760
so 3 times 0 is 0, 3 times 6 is 18, uh
it was 760, so 3 times 7 is 21
plus carry 1 is 22, uh
so 3 times 760 is 22, 2 2 8 0, ok
that’s the first line, the second line is
I was multiplying by 93, I think, times 760
so 9 times 0 is 0, 9 times 6 is 54
[?] the 4, carry the 5, uh
9 times 7 is, um … 63
plus 4 is 67, so 6 7 4 0
plus … 2 2 8 0
0 plus 0 is 0, 8, uh
now I’ve lost the second number

760
x 93