Outline of Johnson-Laird, P.N. (1999)

What do people rely on to make deductions? How do people yield valid conclusions that are true given true premises?

Use of logic in reasoning in real world:

- People seem to get by in real world despite poor laboratory performance
- General deductive competence vs. specialized inference modules (cheater detection)
- Rationality$_1$ and $_2$: Tacit competence for life's problems vs. conscious reasoning

Deduction as:

- Process based on factual knowledge
    - Chain of productions based on content of working memory (ACT, SOAR)
    - "Human thinking has nothing to do with logic. One inference calls to mind another."
    - Repetition leads to content-specific rule
    - Abstract deduction doesn't seem possible with productions
- Formal, syntactic process
    - Extract form from premises and use rules to derive conclusions
    - Connection and supposition dangerous computationally (p. 115)?
    - What do rules offer that productions cannot?
- Semantic process based on mental models
    - Representation of a possibility based on premise
    - Represent the truth but not what is false (e.g. – p. 117) – to reduce WM load compared to fully explicit models
        - Can lead to fallacy. E.g. – p. 129 – "only one of the premises is true"
    - Can deal with "most", "few", "some" quantifiers

Rules vs. Models

- Role of content:
  - Embedding logic in different contexts should not affect performance (if we use rules) or should affect performance (if models)
    - Wason selection task: numbers/letters vs. drinks/age
  - Believability increases chance of accepting invalid conclusions
- Connectives:
  - Rule-based system doesn't account for behavioral difference between "and" and "or" (p. 119)
    - Rule-based predicts 'and' > 'or' while people struggle more with 'or'.
- Development
  - Younger children tend to interpret conditionals as in a manner that reduced the number of models necessary (as conjunctions)
  - As age increases, we adopt more accurate strategies even if they require maintenance of more models.
- Difficulty/complexity
  - Should increase difficulty in model approach more drastically than in rule-based approach
  - p. 122-123 – spatial relations example
- Counterexamples
  - Models allow, but how do we come up with them?
  - Do rule-based systems allow them?