Chapter 1: Overview of Assessment and Psychometric Modeling

Bayesian Psychometric Models, Lecture 3

Chapter 1: Overview of Assessment and Psychometric Modeling

- Chapter provides overview of challenges of assessment
- Assessment as Evidentiary Reasoning
    - Purpose of assessment → Inferring traits of people based on their behaviors
    - Making predictions/conclusions about what is unknown from what is known
- Another way to summarize chapter: Logic underlying assessment

Toulmin Diagrams

Reasoning with Bayesian Statistics

- Bayesian statistics brings about probabilistic statements into logic of reasoning
    - Chances of being right/wrong about events
    - Quantification of uncertainty
- Models are the link between evidence and prediction
- Side note about comment on p. 11

    We adopt a philosophical position that asserts that our models are necessarily wrong, though hopefully useful. This sentiment, most closely associated with George Box (1976, 1979, Box & Draper, 1987), has been widely rein- forced throughout the statistical literature (e.g., Freedman, 1987; Gelman & Shalizi, 2013), as well as the literatures associated with different psychometric modeling paradigms (e.g., Edwards, 2013; MacCallum, 2003; McDonald, 2010; Preacher, 2006; Thissen, 2001).

Model-based Reasoning

Epistemic Probability

- Levy and Mislevy note they follow epistemic interpretation of probability
    - Siri says: Epistemic: relating to knowledge or to the degree of its validation
    - Other words: Probability represents beliefs (knowledge) about uncertainty
- Frequentist approach is based on long-run relative frequencies
    - Not entirely counter to epistemic probability

Evidence-Centered Design

- ECD: A way of understanding the argumentation behind the use of models
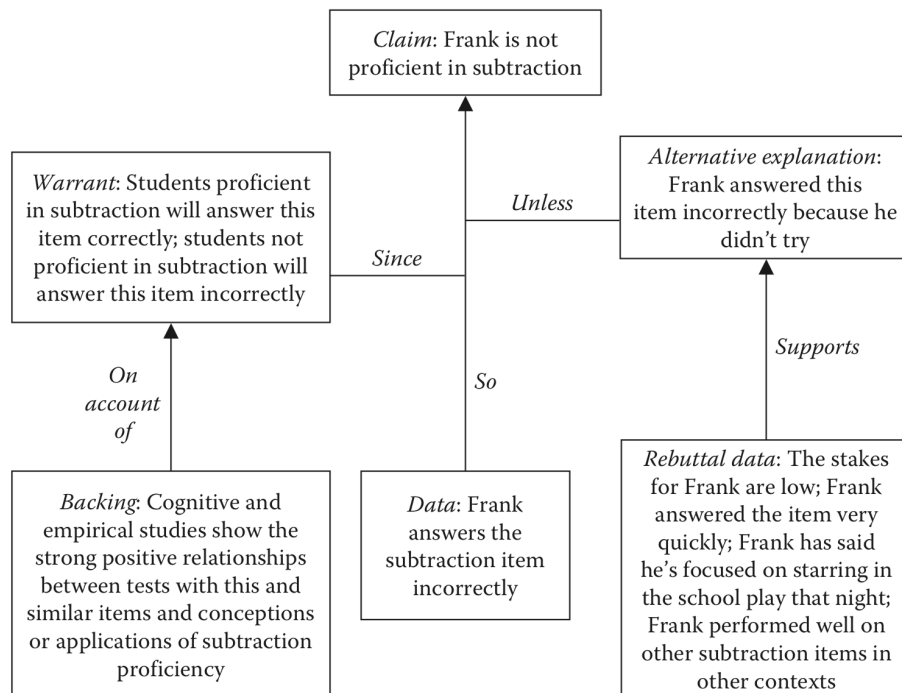
FIGURE 1.3
Example Toulmin diagram for the structure of the assessment argument. This example shows reasoning from Frank's incorrect response to a claim about his lack of proficiency.

Figure 1: Deductive Reasoning: Data → Claim; Inductive Reasoning: Claim → Data

Representational form C
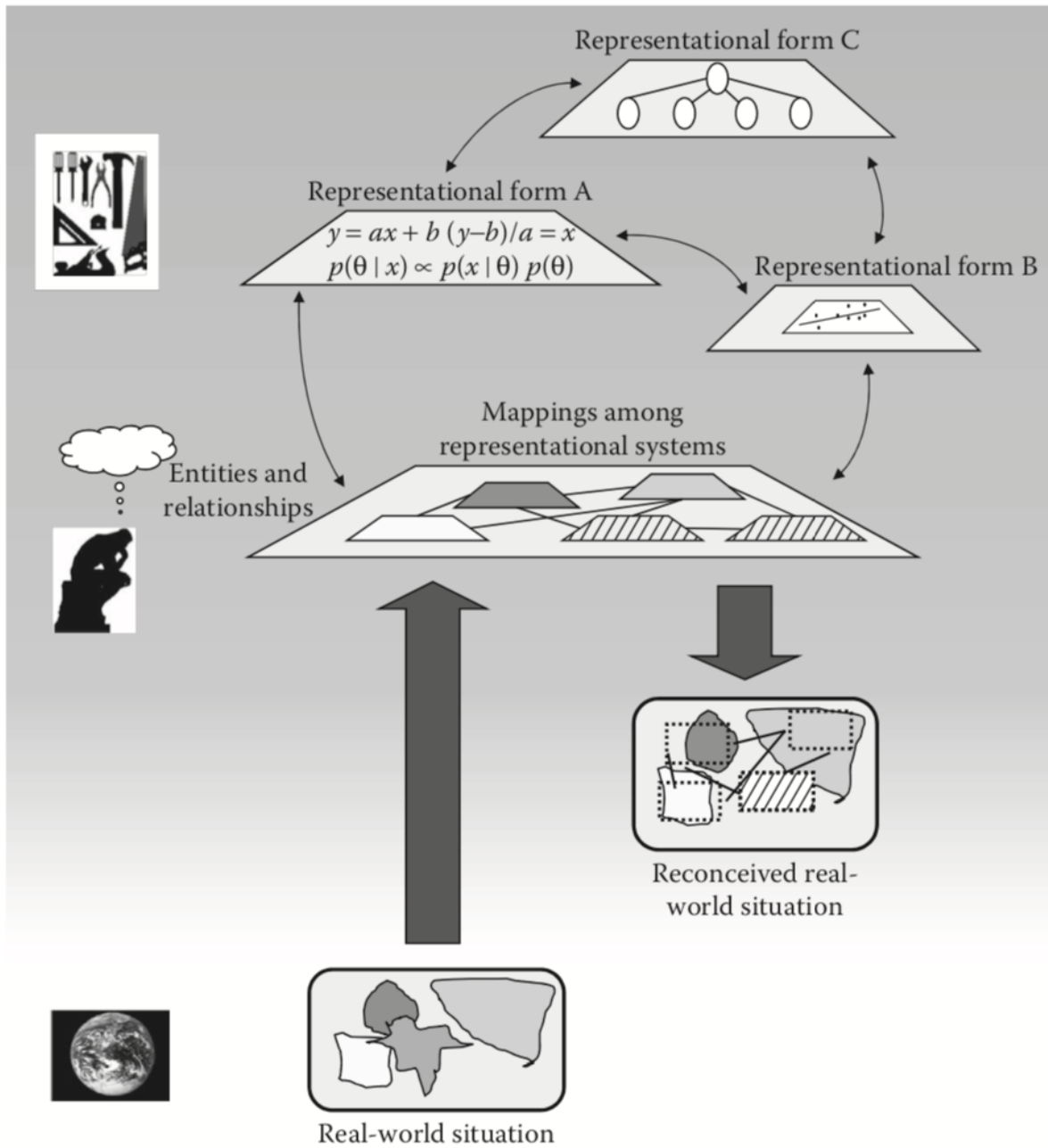
Representational form A

$$y = ax + b \ (y-b)/a = x$$
$$p(\theta \mid x) \propto p(x \mid \theta) \, p(\theta)$$

Representational form B

Entities and relationships

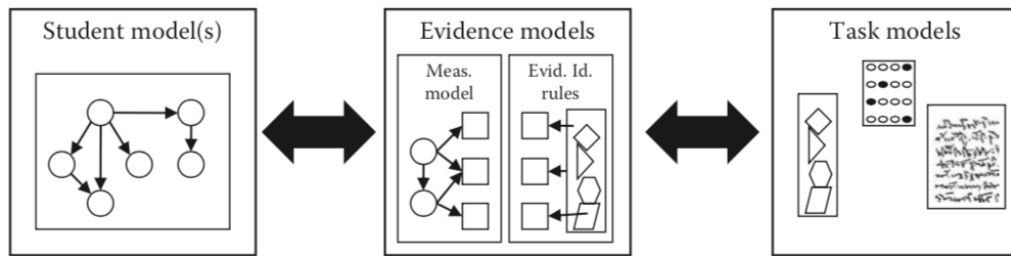Mappings among representational systems

Reconceived real-world situation

Real-world situation

Figure 2: Figure 1.4

Figure 3: Figure 1.6