

Eronen (2024). Causal complexity and psychological measurement

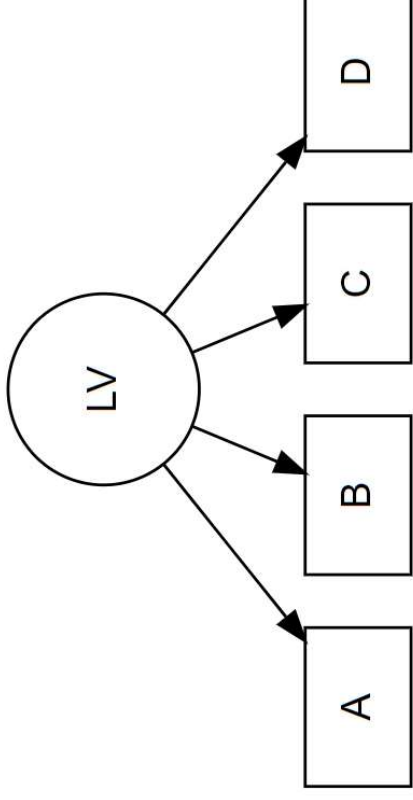
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Definitions for measurement

- Historically, discussions of measurement have revolved around the **representational theory of measurement**:
 - Relationships between empirical and numerical systems.
- Recently, **causality** gained more relevance:
 - The attribute or property that is being measured should *cause* the measurement outcome
- Mood -> survey

Psychometric measurement as causal models

In LVM observed variables are measurements of the latent variable with a degree of error. The attribute is causing the measurement outcomes.



- A test or measurement is valid if and only if it measures what it is intended to measure (Borsboom, 2005; Borsboom et al., 2004).

Minimal causal condition for measurement

- O is a valid measure of X *only if* there is a causal relationship from X to O .
- Necessary but not sufficient condition for measurement.
- The minimal causal condition is compatible with further requirements, such as proof that the attribute is in fact quantitative.

Conceptual ambiguity and causal complexity

- Most psychological concepts are not well-defined (e.g., psychological symptoms). This unclarity makes it harder to understand their causal structure.
- ‘Impaired concentration’ refers to three distinct phenomena that are causally different:
 - mental blanking;
 - intrusive thoughts;
 - drifting off topic.
- Each variable may be causally related to the observed variables in different ways.
- The minimal causal condition is not satisfied

Conceptual ambiguity and causal complexity

- A clearer conceptualization of psychological phenomena is hampered by causal complexity.
- The challenge is to distill relatively stable and causally well-behaved variables.
- The focus has been on applying statistical methods to empirical data, without much attention to how phenomena are conceptualized.
- Models based on *current* psychological concepts might oversimplify and misrepresent the causal structure.

Possible objections

- Factor analysis might be used to show that a symptom consists of one or several phenomena.
- But it is a poor guide to causal structure because different causal structures can explain the data equally well.
- Our current methods are not sufficient to determine how many variables there are and what is the cause of the measurements.

Implications for psychological measurement

- The minimal causal condition can justify that psychological measurement does not fulfill the requirements for genuine measurement.
- However, the results of psychological measurements are **often useful**:
 - Self-report measures of feelings are better predictors of decisions and actions than economic variables such as SES.
 - Intelligence scores can predict job performance or academic achievement.
- Psychological measurement can be informative and useful for specific purposes.

Hard vs. Soft measurement

A. **Hard measurement:** measurement as in the physical sciences, metrology, or the philosophy of measurement.

B. **Soft measurement:** data generation by human participants (human individuals putting numbers on things).

- Different from *hard* measurement, in *soft* measurement we don't know the causal structure and cannot assume a causal link between the attribute and the measurement outcome.

A new hope

- Psychological measurement is not *hard* measurement, but nevertheless measurement in a weaker sense.
- Soft measurement must be understood on its own terms as something distinct from hard measurement.
- Focus on the specific features of soft measurement, without trying to force psychological measurement into the mold of hard measurement.

Validity

- Psychological measurements can have a degree of validity for certain intended uses or interpretations.
- It does not mean validity in the causal sense.
- Intelligence test scores can be valid to predict academic achievement but might not justify the existence of an underlying latent variable.

Prediction without a causal link

- Prediction is possible purely based on (noncausal) correlations.
- Ambiguous concepts can be useful for prediction as long as they are correlated with the cause of what is being predicted.
- Emphasis on the qualitative aspects of measurement:
 - intended uses;
 - evidences;
 - conceptualization.

Conclusion

- Psychological measurement is fundamentally different from measurement in the physical sciences but can nevertheless be useful
- We should approach soft measurement not only with statistical tools but with conceptual and qualitative approaches.