Applied Statistics for Public Policy Analysis

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Measurement

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Examples:

- The effectiveness of public officer is measured by having senior officers rate junior officers on various traits.
- Educational attainment may be measured by how well a student scores on standardized achievement tests.
- Good performance by a city bus driver might be measured by the driver's accident record and by his or her record of running on time.
- The success of a nonprofit agency's fund-raising drive might be measured by the amount of money raised.

Thought-Provoking Question!

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Does this indicate poor performance of district health department?

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- An operational definition is a statement that describes how a concept will be measured.
- An indicator is a variable, or set of observations, that results from applying the operational definition.

Examples of Operational Definition

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- Patients' satisfaction with the service of the Hospital is measured according to the response categories that patients check on a questionnaire item (high satisfaction, medium satisfaction, and low satisfaction).

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- One reason for using *multiple indicators* is that a concept may have more than one dimension.

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- Reliability, by contrast, refers to *how consistent the measure is with repeated applications*.
- A measure is reliable if, when applied to the repeated observations in similar settings, the outcomes are consistent.

How important is the Quality of Measurement??

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- Measurement is *straight-forward* when we can *directly observe the phenomenon*.
- Measurement becomes more challenging when you *cannot directly observe the concept of interest*.

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- Question:
- Is the CSS examinations a valid indicators of on-the-job performance of civil servants?

Validity and Reliability

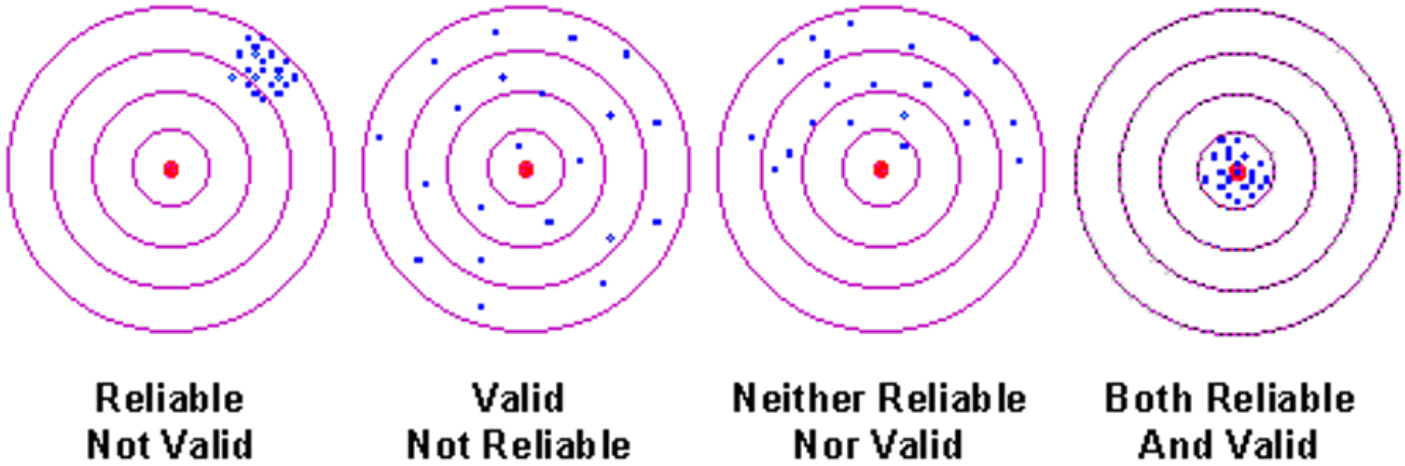

Figure: Validity and Reliability

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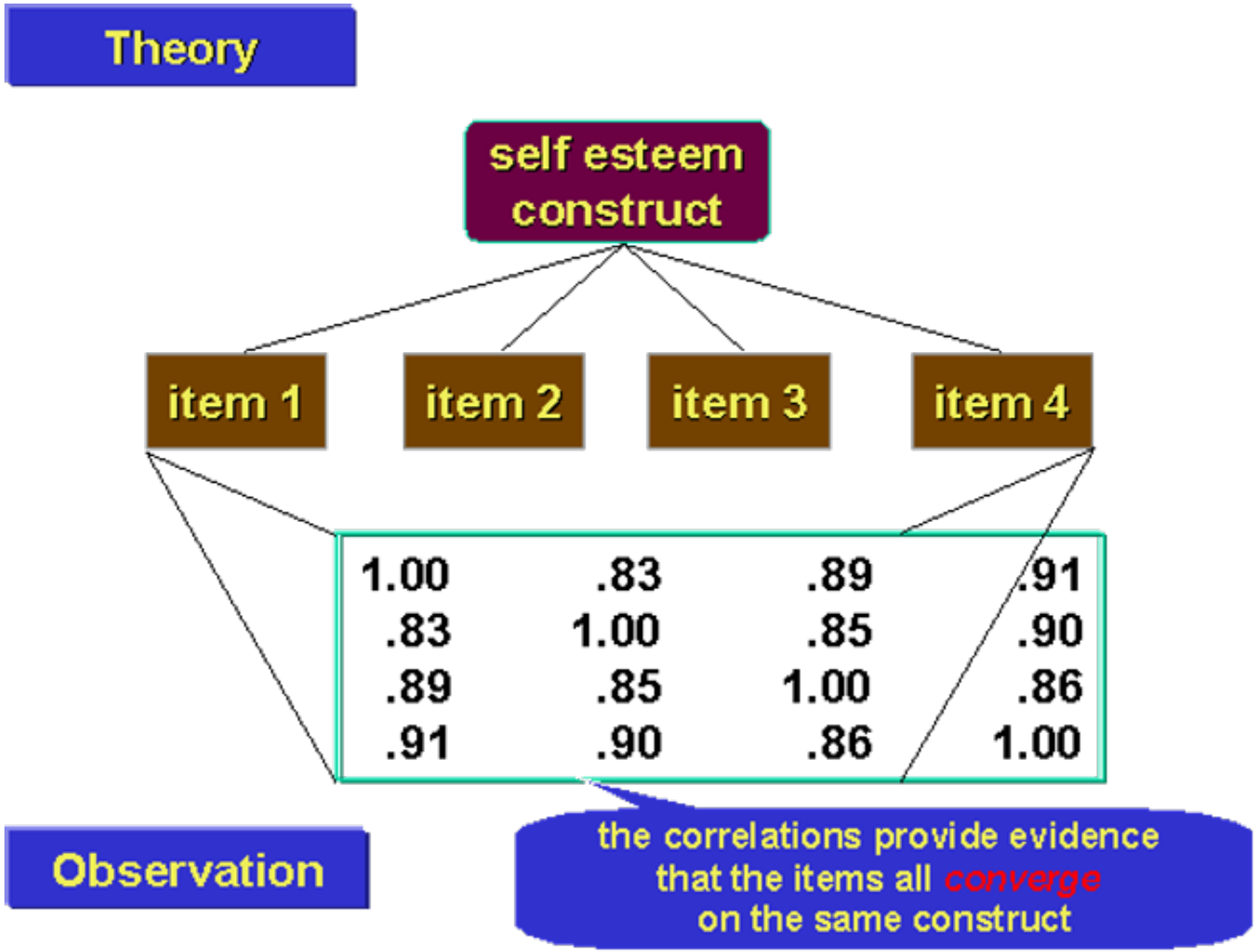
- Measures of constructs that theoretically should be related to each other are, in fact, observed to be related to each other.
    - E.g. you should be able to show a correspondence or convergence between similar constructs

Convergent Validity



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- Measures of constructs that theoretically **should not be related** to each other are, in fact, **observed to not be related** to each other.
  - e.g. you should be able to discriminate between dissimilar constructs

Discriminant Validity

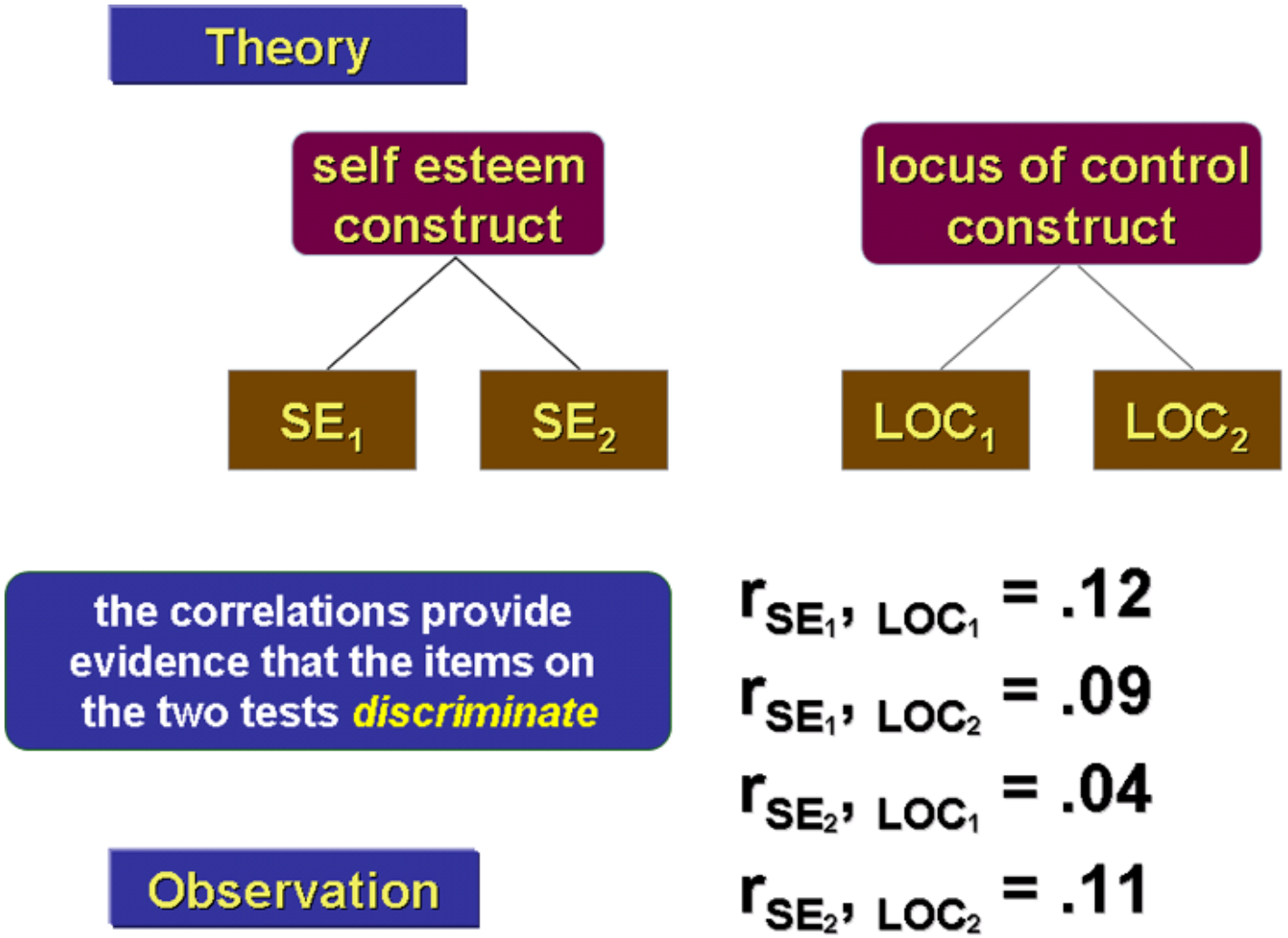

Figure: Discriminant Validity

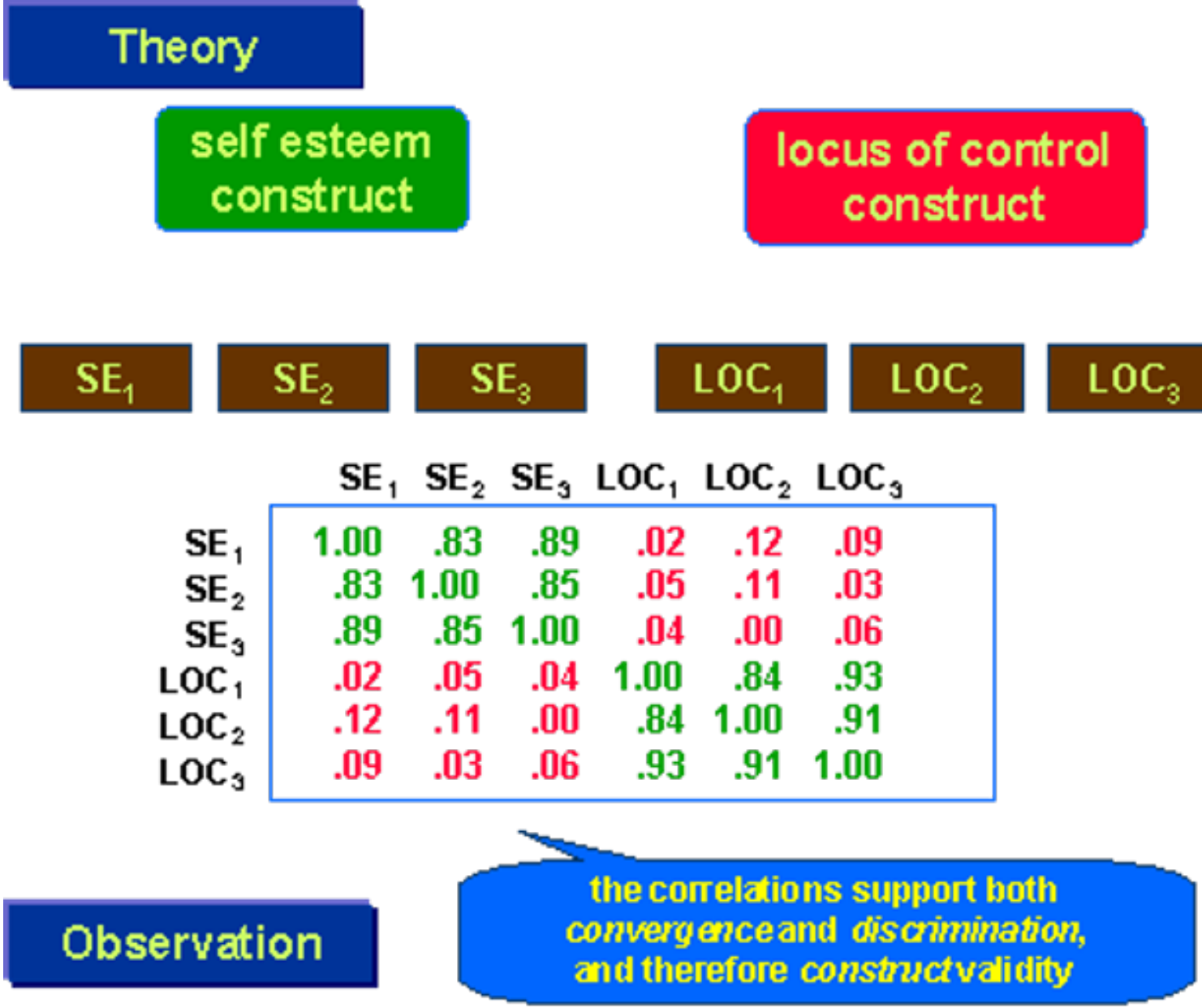

Figure: Construct Validity

Dealing with Errors in Measurement

- In reality, there is always some possibility that the number assigned does not reflect the true value for that case, i.e.:
  - Human Error e.g. 100 instead of 10
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- **How to overcome?**
  - Test-Retest Method
  - Cronbach's alpha or Kuder-Richardson Formula

What is Cronbach Alpha: https://statisticsbyjim.com/basics/cronbachs-alpha/

Testing Reliability: Cronbach's Alpha

- Cronbach's Alpha (α) is a measure of **internal consistency** — how closely related a set of items are as a group.
- Commonly used to test the reliability of scales and questionnaires.
- Values range from 0 to 1:
  - $\alpha \geq 0.7$: Acceptable
  - $\alpha \geq 0.8$: Good
  - $\alpha \geq 0.9$: Excellent

Formula

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} \sigma_i^2}{\sigma_T^2}\right)$$

- k = number of items
- σ_i^2 = variance of each item
- σ_T^2 = variance of the total score

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- **Ratio:** You can construct a meaningful fraction (or ratio) with a ratio variable.