



Mark Van Selst
San Jose State University

**Cozby & Bates: Methods in Behavioral
Research (11th)**

Chapter 5: Measurement Concepts

Summer 2012

Chapter 4 Review

- Causality
 - Temporal order
 - Covariation
 - Causal Path
- Conclusion Validity
- Confounding Variable
- Construct Validity
- Convergent Evidence
- Correlation
 - Coefficient
 - Predictor Variable
 - Outcome Variable
- Curvilinear Relationship
- Dependent Variable
- Experimental Control
- Experimental Method
- External Validity
- Field Experiment
- Independent Variable
- Internal Validity
- Mediating Variable
- Linear Relationship
 - Positive
 - negative
- Non-Experimental Method
 - Correlational design
- Operational Definition
- Participant (Subject) Variable
- Randomization
- Response Variable
- Situational Variable
- Third-variable problem

Graphing Laboratory (Recap)

- Use ruler
- Histograms vs. Bar-Graphs
- Zero Point on graph (labeled, even if by hand)
- Frequency Distributions
- Descriptive Statistics: Mean, Median, Mode, etc.
 - Significant Figures / How many decimal places?

Library Laboratory (Recap)

- Using PsycINFO
- “cited references”
- [abstract]
- Italics for *Journal name*, *Volume*, but not page numbers.
- Subsequent research follow-up
- Pursuing a tractable project for your own research

Variables

Variable: a general class or category of objects, events or situations.

- **Variables must be defined so they can be studied empirically (e.g., “I work better under pressure”)**

Classifications of Variables:

- **Situational Variables**
 - describe characteristics of a situation or environment
 - (word length, spatial density, credibility, etc.)
- **Response Variables**
 - responses or behaviors of individuals
 - (RT, proportion correct, aggression score, etc.)
- **Subject or Individual Difference Variables**
 - characteristics of the individuals
 - (gender, intelligence, personality traits)

Operational Definition

Defining the variable in terms of the operations or techniques the researcher uses to measure or manipulate it.

- Operational definition of a variable forces scientists to discuss abstract concepts in concrete terms
 - is the concept too vague to study?
 - is more reflective thought &/or background research required?
 - e.g., H_0 : frustration begets aggression
 - Measurement of operationally defined variables

Reliability

Error: includes both **Systematic Error** (included within reliability) and **Random Error** (which reduces reliability)

MEASURE = TRUE SCORE + systematic ERROR + random ERROR

True Score: the true score (increased % increases reliability)

Systematic error: other factors (increased % increases reliability)

Random error: coding error, inattention, ideosyncratic misperception of question, poor instrumentation [chance fluctuation in measurement] (higher % reduces reliability)

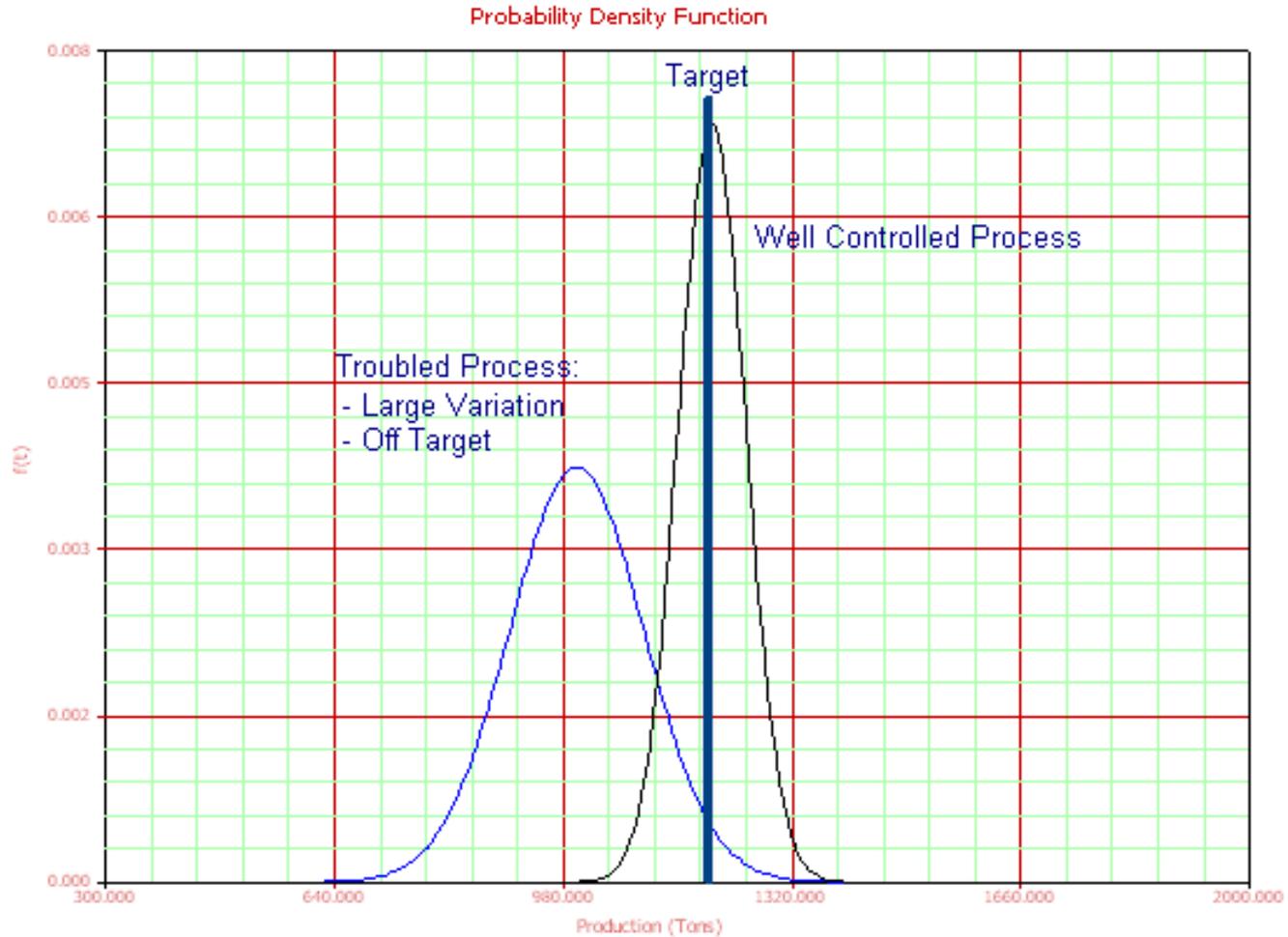
Forms of Reliability

Test-Retest Reliability: (subject to retesting effects)

- **The extent to which scores on the same measure, administered at two different times, correlate with each other.**
- Repeated measures
 - High correlation → the measures are reliable.
- If we are looking for relationships between variables, we want to have high reliability because we want to see the true relationship without it being hidden by noise.
- Trait Variable
 - Test-retest ok
- State Variable
 - Test-retest? (internal consistency may be better measure)

Reliability (and Validity)

ReliaSoft Weibull++ 7 - www.ReliaSoft.com



Folio1[Data 1: $\mu=1000.0000$, $C=100.0000$
Folio1[Data 2: $\mu=1200.0000$, $C=50.0000$

Forms of Reliability

Test-Retest

- The extent to which scores on the same measure, administered at two different times, correlate with each other.

Equivalent Forms Reliability:

- The extent to which scores on similar, but not identical, measures, administered at two different times, correlate with each other.

Internal Consistency: (e.g., Split-half, Odd-Even, item-total Reliability)

- The extent to which scores on the items of a scale correlate with each other.
- Usually assessed using coefficient alpha (Cronbach's alpha)

Inter-rater reliability:

- The extent to which the ratings of one or more judges correlate with each other.

Reliability versus Accuracy

- Just because a finding is consistent, does NOT mean that it is accurate (e.g., does your neighborhood gas station pump actually deliver 1.000 gallons for every gallon sold)

Validity

CONSTRUCT VALIDITY

- defined as the extent to which the operational definition of a variable actually reflects the true theoretical meaning of the variable. Whether the measured variable actually measures the conceptual variable it is designed to measure.
- Operational definitions are required by empirical research; Construct validity is the extent to which an operational definition reflects the underlying variable.
 - e.g., MEMORY SCORE, MEMORY GAME

Validity

Face Validity: (*appears adequate*) The extent to which the measured variable appears to be an adequate measure of the conceptual variable. The judgment of whether the empirical measure appears to measure the same thing as the “actual” construct.

Content Validity: (*concept covered*) the extent to which the measured variable appears to have adequately covered the full domain of the conceptual variable.

Convergent Validity: (*related to other as it should be*) the measure is related in predictable ways to other variables (e.g., REM sleep [physical measure] is often associated with self-reports of dreaming if you wake the subject).

Discriminant Validity: (*not related to other*) the measure should not be related to variables with which it should not be related.

Validity

Criterion Validity:

The extent to which a self-report measure correlates with a **behavioral** *measured variable*.

The ability of the *measure* (the predictor variable) to predict the *future behavior* (or event) called the criterion variable. (e.g., SATs, GREs and Scholastic Achievement).

- **Predictive Validity** (prediction) for the future
 - $r_{\text{self-report.behavior}}$
- **Concurrent Validity** (relationship) at the same time
 - $r_{\text{self-report.behavior}}$

REACTIVITY

- Reactivity is when awareness of measurement changes an individual's behavior
- Nonreactive (indirect) or unobtrusive measures may limit reactivity.

Measurement Scales

Nominal

- By name
- (categories: Male / Female, Dog / Cat, etc.)

Ordinal

- By order
- (place / rank: Michelin Stars)

Interval

- Meaningful intervals
- (equal interval scaling: Intelligence? Temperature °C)

Ratio

- Meaningful intervals with a “real” zero
- (i.e., computed ratios are meaningful: Reaction Time)

Chapter 5 Terminology

- Concurrent validity
- Construct validity
- Content validity
- Convergent validity
- Criterion-oriented validity
- Criterion variable
- Cronbach's alpha
- Discriminant validity
- Face validity
- Internal consistency
- Inter-rater reliability
- Interval scale
- Item-total correlation
- Measurement error
- Nominal scale
- Ordinal scale
- Pearson product-moment correlation coefficient
- Predictive validity
- Ratio scale
- Reactivity
- Reliability
- Split-half reliability
- Test-retest reliability
- True score



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