RESEARCH METHODS
Research Methods

• means of discovering truth
Research Methods

• means of discovering truth
• what is truth?
Research Methods

- means of discovering truth
- what is truth?

  - Riveda Sandhyavandanam ⇒ "The is only one truth [but] people often see it in different ways"
  - see also Ludwig Wittenstein (1889-1952) ⇒ *The metaphysics of space and motion and the wave structure of matter (WSM) gives absolute truth and meaning to language*
Research Methods

• means of discovering truth
• what is truth?
  – VALIDITY?
  – a conclusion based on a piece of research is valid when it corresponds to the actual or true state of the world
Validity

- a key (maybe THE key) criterion in the evaluation of any piece of research or test (measure)
- the appropriateness of **inferences** drawn from **data**
  - data = results of research study ➔ research validity
  - data = test scores ➔ test and measurement validity
Research Validity

- two philosophies, world views, or approaches to truth discovery
  - Donald Campbell and Donald Rubin
    - Shadish (2010; Campbell and Rubin: A primer and comparison of their approaches to causal inference in field settings. *Psychological Methods, 15*, 3-17)

- Campbell's causal model ⇒ methodologically and design driven
- Rubin's causal model ⇒ quantitatively and statistically driven
Research Validity

• can we recreate or recover truth statistically?
  – missing values and data imputation? [RMNET]
    – "we have no information as to why subjects’ fail to respond to items; to assume we do is total unwarranted ignorance" (Romie Littrell, 04/17/10)
  – meta-analysis?
  – control variables?
  – corrections for faking?
    – "once test users take a wrong course, there is no going back to the choice point" (Cronbach, 1990, p. 521)
Research Validity ⇒ re Campbell’s causal model [CCM]

• facets of research validity
  ▪ internal
  ▪ external
  ▪ statistical-conclusion
  ▪ construct

• threats to research validity

• controls
• **internal validity**—the validity of inferences about whether observed covariation between $A$ (presumed treatment) and $B$ (presumed outcome) reflects a causal relationship from $A$ to $B$, as those variables were manipulated or measured.

### Threats

- history
- maturation
- testing

### Controls?

- attrition or mortality
- selection
- regression
• history effects (events outside the lab)
  ▪ observed effect between IV and DV might be due to events occurring between the pretest and posttest when these events are not the treatment of research interest

• maturation effects
  ▪ source of error in a study related to the amount of time between measurements
• testing effects
  ▪ effects due to the number of times particular responses are measured
  ▪ resulting from familiarity with the measurement instrument

• attrition or mortality effects
  ▪ the dropping out of some participants before a study is completed, causing a threat to validity
• selection effects
  ▪ result from biases associated with the selection of, and assignment of research participants into groups

• regression effects
  ▪ tendency of participants with extreme scores on first measure to score closer to the mean on a second testing
  ▪ a statistical threat
• **internal validity**
  - extent to which we can infer that a relationship between two variables is causal or that absence of a relationship implies absence of cause
  - is the observed effect real or artifactual?
  - threats

• correction $\Rightarrow$ randomization
• **external validity**—the validity of inferences about whether the cause-effect relationship holds over variations in persons, settings, time, treatment variables, and measurement variables

<table>
<thead>
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<td>• population validity</td>
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<td>• ecological validity</td>
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<td>• temporal validity</td>
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• other participants
  ▪ interaction of selection and treatment
  ▪ population validity

• other settings
  ▪ interaction of setting and treatment
  ▪ ecological validity

• other times
  ▪ interaction of history and treatment
  ▪ temporal validity
• **external validity**
  - generalizability
• enhanced or increased $\Rightarrow$ random sampling for representativeness
• trade-offs between internal and external validity?
• **statistical conclusion validity**—the validity of inferences about the correlation (covariation) b/n treatment and outcome

- low statistical power
- violation of test assumptions
- poor test reliability
• low statistical power
  ▪ power analysis
    ▪ sample size ($n$)
    ▪ effect size (magnitude of effect)
    ▪ power (.80)
    ▪ alpha ($p$-value, .05)

• violations of statistical test assumptions

• poor reliability of measures

• address threats ⇒ adequate power, meet test assumptions, and use reliable measures
**construct validity**—the validity with which inferences can be made from the operations in a study to the theoretical constructs those operations are intended to represent.

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<td>• evaluation apprehension</td>
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<td>• experimenter expectancies (&quot;good-subject&quot; response)</td>
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• **construct validity**
  - use of appropriate theories, theoretical labels, or models to describe and explain phenomenon being studied

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**Fatal driving crash involvement: Locus of control vs attribution theory**

- Fatal-crashes drivers
- No-crashes drivers

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**Fatal driving crash involvement: Locus of control vs attribution theory**

- **Fatal-crashes drivers**
- **No-crashes drivers**

- Locus of control measure
  - Fatal-crashes drivers = externals
  - No-crashes drivers = internals

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- **All drivers**
- Locus of control measure
- Crashes ▶ assess relationship b/n LoC and crashes.
  - Do externals have more fatal crashes than internals?
• **threats**
  • loose connection between theory and study
  • changes in participants' behavior as a result of being studied
    - "good subject" response
    - Hawthorne effect
    - social desirability
    - evaluation apprehension
    - responses to experimenter expectancies

• **control or minimize threats**
  • double-blind procedures
  • single-blind procedures
  • deception
• interrelatedness of different facets or dimensions of research validity

An noteworthy discussion during the presentation pertained to the BEST answer to the following item.

Which of the following dimensions of research validity would have to be demonstrated or established before one could meaningfully engage in a discussion of any of the other dimensions of research validity?

A. Construct validity
B. Internal validity
C. Statistical-conclusion validity
D. External

I put forward the proposition that C is the best answer, and still think so. However, as you may recall, Mindy and Saurabh [if my recollection is correct] expressed the alternate view that A may be/is the best answer.
• good research design or study
  – free from threats
  – no alternative explanations
  – permits robust conclusions about relationships between study’s variables

• conceptualized [i.e., research] as the "discovery of truth", it then becomes blatantly obvious that no single [primary] study will be sufficient to permit a claim of truth discovery
  – at best, it can only be claimed to be another datum in the cumulative body of knowledge that slowly moves us closer to the discovery of truth
Philosophies of Causal Inference \( \Rightarrow \)

Conditions of Causality

- contiguity
- temporal precedence
- constant conjunction

Constant conjunction stipulates that (A) if X is observed, then Y will occur; and conversely, (B) if Y is observed, then X must have been present in the past.

A number of noteworthy points pertaining to this arose from the presentation:

1. An effect can obviously have multiple causes.
2. This makes Stipulation B tenuous.
3. Which is ok and indeed reflects the elegance of the inference system since after all it entails a post-dictive paradigm and we know that post-dictive inferences are very susceptible to alternative explanations, as is the case here.
4. Thus, in summary, consistent with the predicates of predicitive and post-dictive paradigms, one would expect Stipulation A to permit stronger causal inferences than Stipulation B.
A rooster crows each dawn and observes that shortly after (30 minutes or so), the sun rises. After nine (9) months of this, the rooster concludes that he is responsible for making the sun rise. The farmer disagrees with this assertion and in an attempt to disprove this claim, asks the rooster to crow at 10:00 pm one evening.

By doing this, which condition of causality is the farmer trying to assess?
The Empirical Research Cycle

Research process - summarized as 5-step sequence

1. Statement of the problem
2. Design of research study
3. Measurement of variables
4. Analysis of data
5. Conclusions from research
Research Validity

- naturalness of the research setting
  - lab or field
  - "naturalness" or "artificiality" of the setting
  - field research typically employs a real-life setting, while lab research is more contrived and artificial
Research Validity

• degree of control
  – confounding and extraneous variables
  – manipulation—this is reflective of a high degree of control
  – research designs that permit manipulation are technically referred to as "experiments"
### Setting

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<th>Artificial</th>
<th>Natural</th>
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<tr>
<td><strong>High</strong></td>
<td>lab experiment</td>
<td>field experiment</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>quasi-experiment</td>
<td>correlational design</td>
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<td>survey research</td>
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- time ⇒ longitudinal and cross-sectional designs
- data collection protocols ⇒ observational designs?
- secondary research designs ⇒ meta-analysis
Experimental Designs

- random assignment and manipulation
  - pretest-posttest with a control group
  - solomon four-group
  - posttest only with a control group
    - within- and between-subjects designs
Quasi-Experimental designs

• self-selection groups
• pre-existing groups

- nonequivalent control group designs
  - delayed control group
  - mixed factorials
- designs without control groups
  - interrupted time series
  - repeated treatment
Correlational Designs

- predictive
- concurrent
- postdictive
Survey Research

• measurement and assessment of opinions, attitudes, and such, usually by means of questionnaires and sampling methods
Additional Design and Methods Issues

• time $\Rightarrow$ longitudinal and cross-sectional designs
• data collection protocols $\Rightarrow$ observational designs?
• secondary research designs $\Rightarrow$ meta-analysis
Additional Design and Methods Issues

• control techniques and strategies
  – random assignment to groups
  – matching
  – within-subject designs
    – order and carry-over effects
    – counter-balancing
  – manipulation checks
  – instrumentation of response
    – CMV
  – building nuisance variables into the study [moderators]
  – statistical control
  – experimenter effects and bias reduction
    – double-blind procedures
    – automation