# RESEARCH VALIDITY

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# Research Methods

- means of discovering truth

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- what **is** truth?

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  - Riveda Sandhyavandanam $\Rightarrow$ "There is only one truth [but] people often see it in different ways"

  - see also Ludwig Wittenstein (1889-1952) $\Rightarrow$ *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 $\Rightarrow$ methodologically and design driven

- Rubin's causal model $\Rightarrow$ quantitatively and statistically driven

# Research Validity $\Rightarrow$ re Campbell's causal model [CCM]

- facets of research validity
  - internal
  - external
  - statistical-conclusion
  - construct
- threats to research validity
- controls

- internal validity $\Rightarrow$ the validity of inferences about whether observed covariation b/n $A$ (presumed treatment) and $B$ (presumed outcome) reflects a causal relationship from $A$ to $B$, as those variables were manipulated or measured

**Threats**

**Controls?**

| | |
|---|---|
| • history | • attrition or mortality |
| • maturation | • selection |
| • testing | • 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?

  - <u>threats</u>

- correction $\Rightarrow$ randomization

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

**Threats**

**Controls?**

- population validity
- ecological validity
- temporal validity

- 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 $\Rightarrow$ the validity of inferences about the correlation (covariation) b/n treatment and outcome

Threats

- low statistical power

- violation of test assumptions

- poor test reliability

Controls?

- 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 $\Rightarrow$ adequate power, meet test assumptions, and use reliable measures

- construct validity $\Rightarrow$ the validity with which inferences can be made from the operations in a study to the theoretical constructs those operations are intended to represent
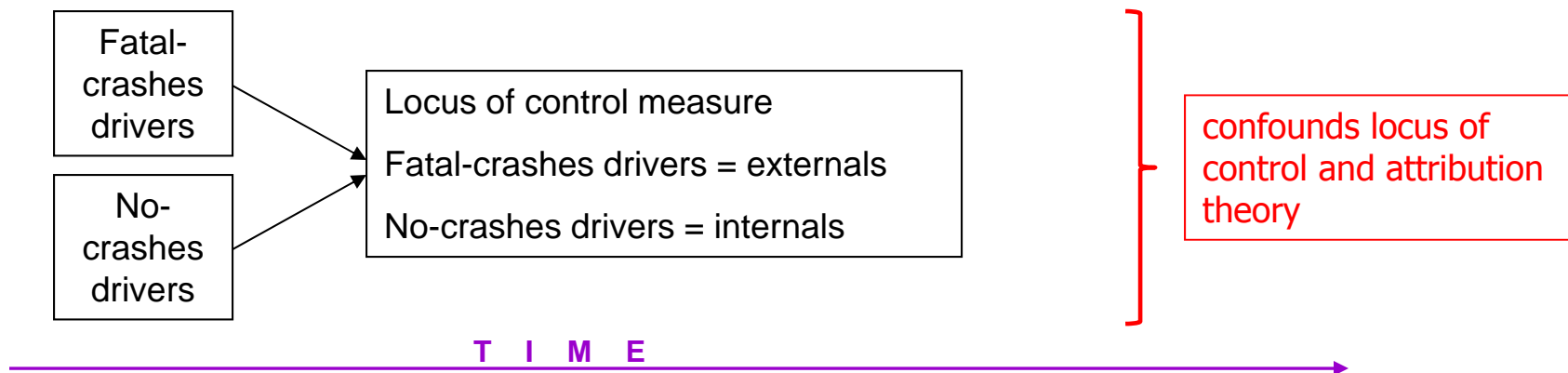
| Threats | Controls? |
|---------|-----------|

- loose connection between theory and study

- evaluation apprehension

- experimenter expectancies ("good-subject" response)

- ## construct validity
  - ■ use of appropriate theories, theoretical labels, or models to describe and explain phenomenon being studied

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

confounds locus of control and attribution theory
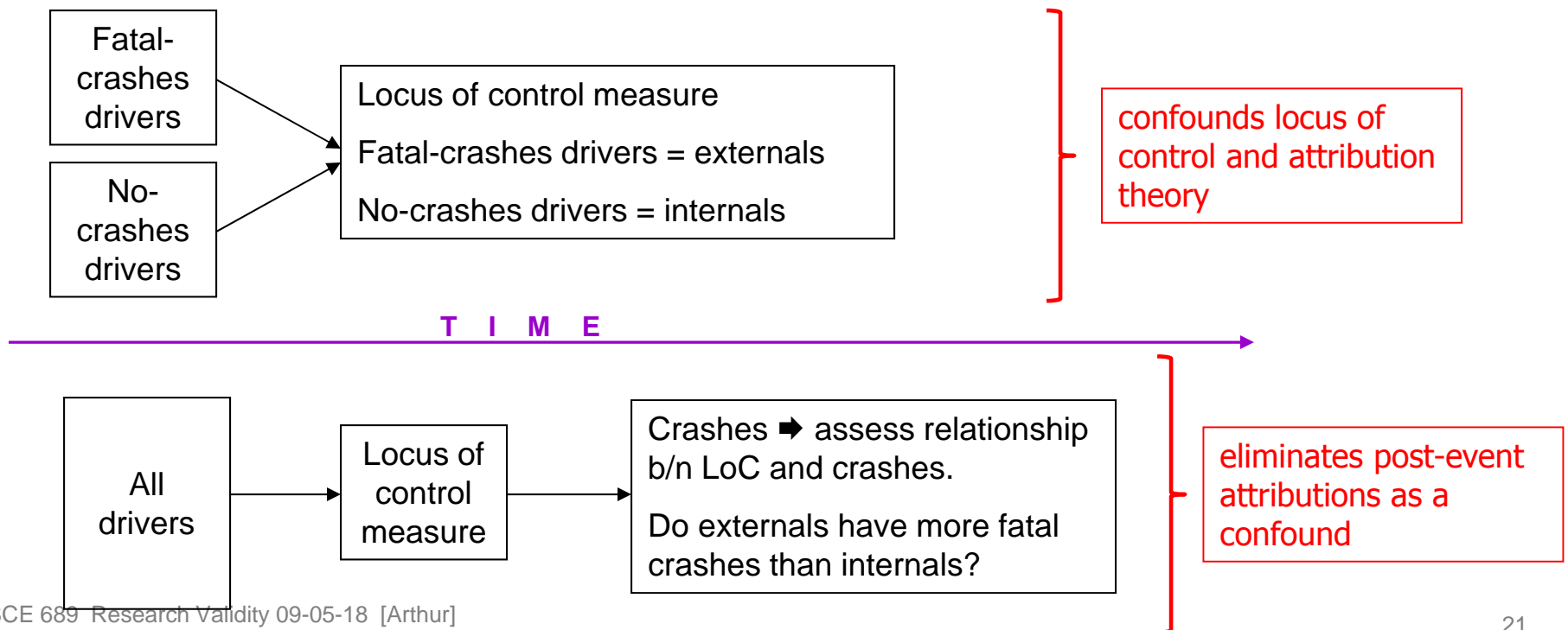
T  I  M  E

# • construct validity

## ▪ use of appropriate theories, theoretical labels, or models to describe and explain phenomenon being studied

| 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

confounds locus of control and attribution theory

**T I M E**

All drivers → Locus of control measure →

Crashes ➡ assess relationship b/n LoC and crashes.

Do externals have more fatal crashes than internals?

eliminates post-event attributions as a confound

- threats
  - loose connection between theory and study
  - changes in participants' behavior as a result of being studied
    - Hawthorne effect
    - "good subject" response
    - social desirability responding
    - evaluation apprehension
    - responses to experimenter expectancies, and experimenter effects

- control or minimize threats
  - double-blind procedures
  - single-blind procedures
  - deception

- interrelatedness of different facets or dimensions of research validity

  - statistical conclusion
  - internal
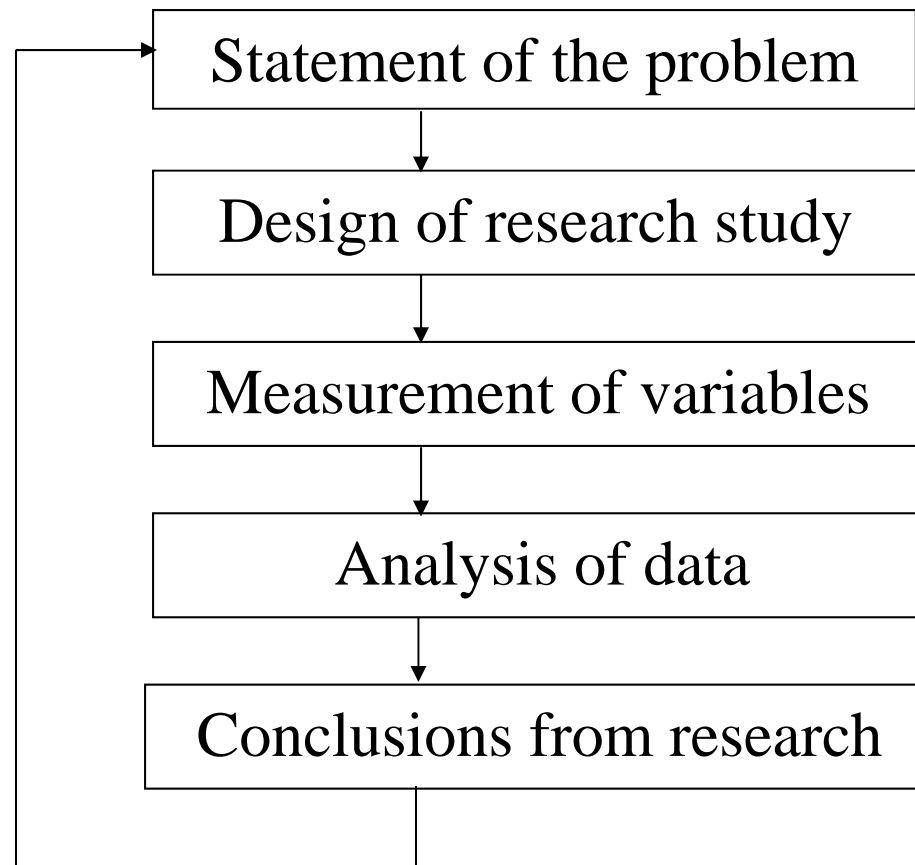  - external
  - construct

- good research design or study
  - free from threats
  - no alternative explanations
  - permits robust conclusions about relationships between study's variables
- if research is conceptualized 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

- summary
    - cause (X) must precede consequence (Y) in time; that is, X is manipulated and then Y is measured [temporal precedence and constant conjunction]
    - statistical covariation b/n X and Y must be present [contiguity]
    - alternative causes of Y must be controlled via random assignment to groups [experimental dsgn]
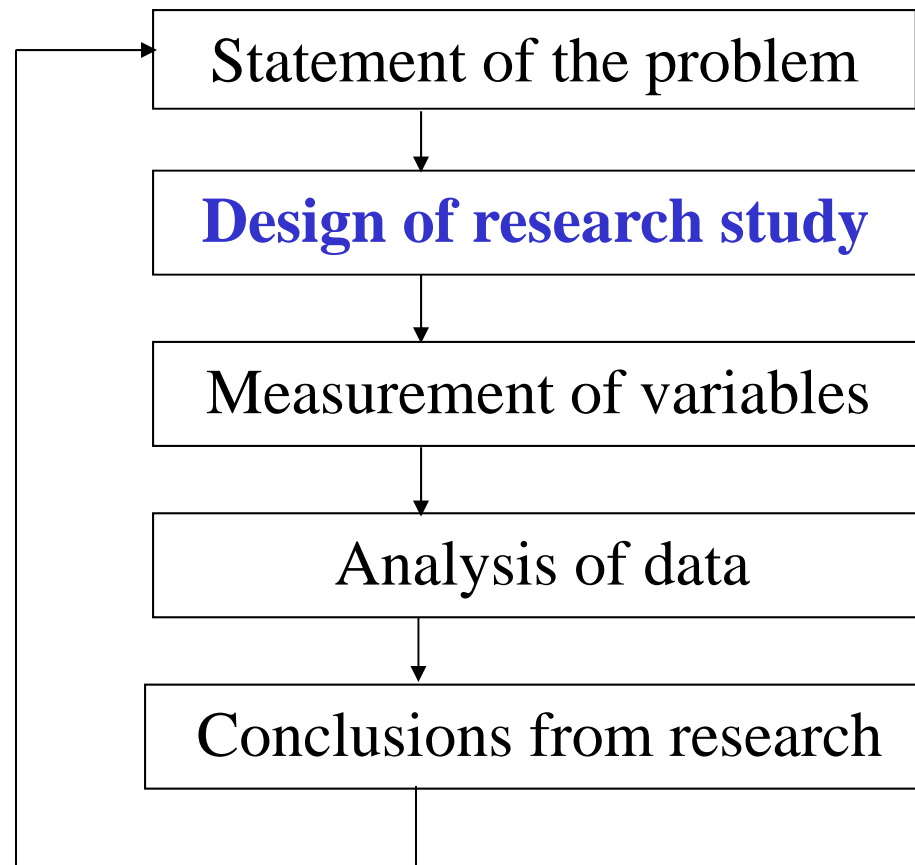
# The Empirical Research Cycle

Research process $\Rightarrow$ summarized as 5-step sequence

```
Statement of the problem
          ↓
Design of research study
          ↓
Measurement of variables
          ↓
Analysis of data
          ↓
Conclusions from research
```

# The Empirical Research Cycle

Research process $\Rightarrow$ summarized as 5-step sequence

Statement of the problem

**Design of research study**

Measurement of variables

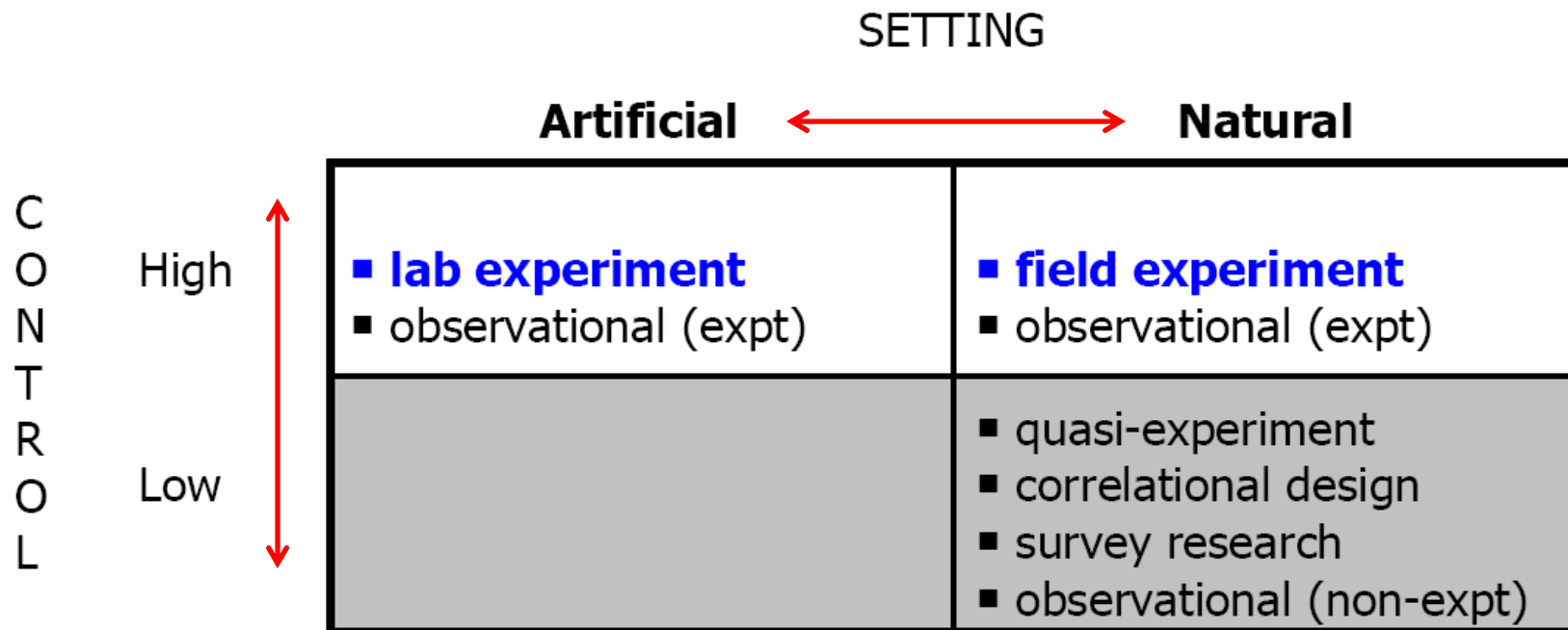Analysis of data

Conclusions from research

# Research Design

- 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 Design

- **degree of control**
  - confounding and extraneous variables
  - manipulation $\Rightarrow$ this is reflective of a high degree of control
  - research designs that permit manipulation are technically referred to as "experiments"

SETTING

| | Artificial ←——→ Natural | |
|---|---|---|
| | **Artificial** | **Natural** |
| **High** | ■ **lab experiment**<br>■ observational (expt) | ■ **field experiment**<br>■ observational (expt) |
| **Low** | | ■ quasi-experiment<br>■ correlational design<br>■ survey research<br>■ observational (non-expt) |

C O N T R O L

# Experimental Designs

- **experiment**
  - a research method in which the investigator manipulates a variable under carefully controlled conditions and observes whether changes occur in a second variable
  - experiments are used in order to detect *cause-and-effect* relationships

- **conditions that make a <u>true</u> experiment**
  - <u>**manipulation**</u> of independent variables
  - <u>**random assignment**</u> into experimental conditions (experimental & control conditions)

resultant effect $\Rightarrow$ high levels of control over the who, what, when, where, and how, etc.
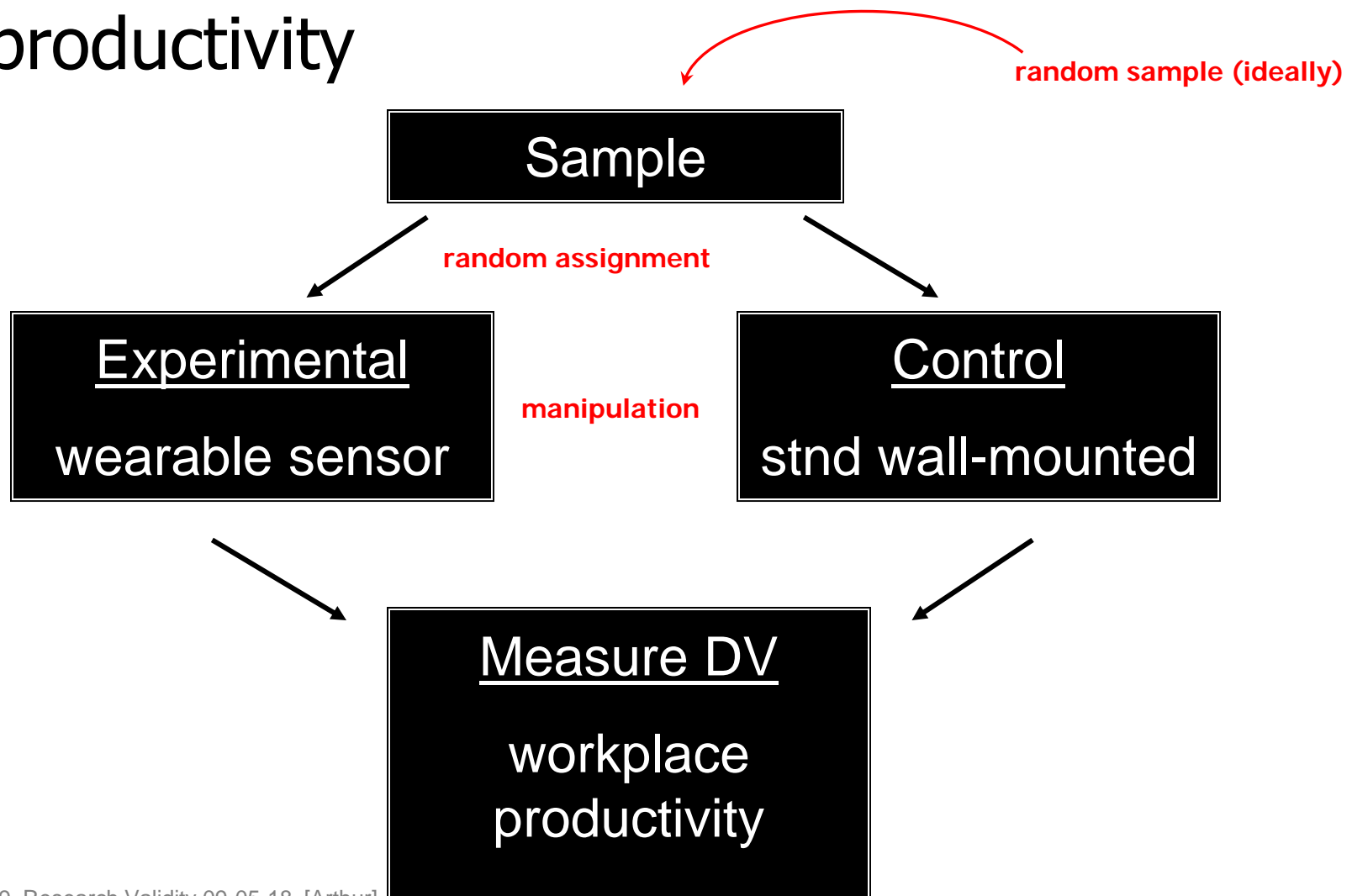
# Experimental Designs

- random assignment
- manipulation
- high levels of control over the who, what, when, where, and how, etc.

# Experimental Designs

- experimental and control groups
  - logic of the experimental approach
    - if the two groups are identical in all respects **[both known and unknown factors]** except for the variation created by the manipulation of independent variable, then any differences between the experimental and control groups on the dependent variable <u>**must be**</u> due to the manipulation of the independent variable

# Effect of sensory-integrated building micro-adjustments on workplace productivity



**random sample (ideally)**

Sample

**random assignment**

Experimental

wearable sensor

**manipulation**

Control

stnd wall-mounted

Measure DV

workplace productivity

- Quasi-Experimental designs
- Correlational Designs
- Survey Research

# 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
    - common method variance
  - building nuisance variables into the study [moderators]
  - statistical control
  - experimenter effects and bias reduction
    - double-blind procedures
    - automation

equivalency of conditions

QUESTIONS ?

# 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
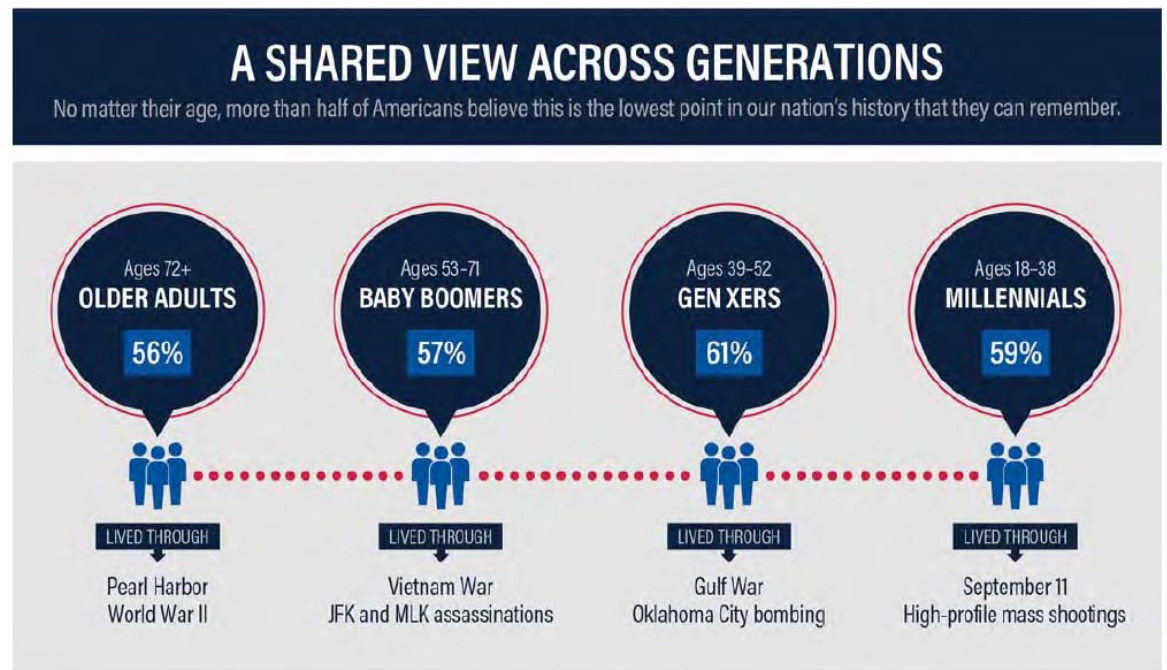    - repeated treatment

# Correlational Designs

- measurement of two of more variables and assessing relationship/association b/n them
  - predictive
  - concurrent
  - postdictive
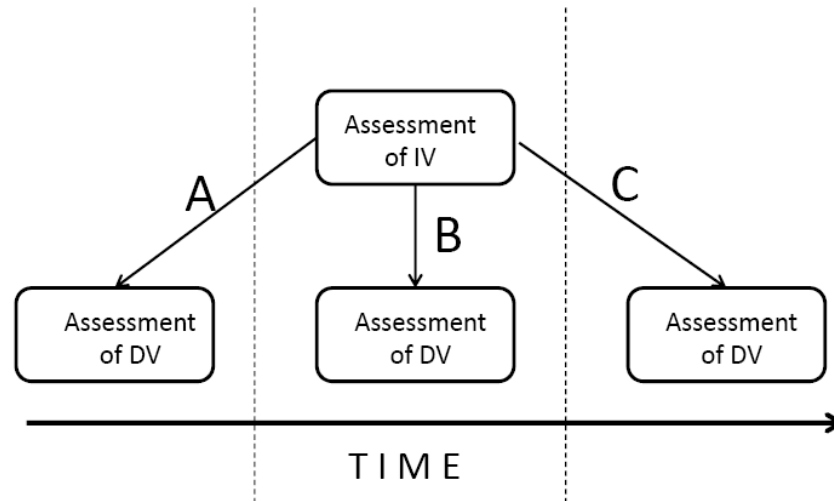
# Survey Research

- measurement and assessment of opinions, attitudes, and such, usually by means of questionnaires and sampling methods

**STRESS IN AMERICA™:**
**THE STATE OF OUR NATION**

### A SHARED VIEW ACROSS GENERATIONS

No matter their age, more than half of Americans believe this is the lowest point in our nation's history that they can remember.

| Ages 72+ OLDER ADULTS | Ages 53–71 BABY BOOMERS | Ages 39–52 GEN XERS | Ages 18–38 MILLENNIALS |
|---|---|---|---|
| 56% | 57% | 61% | 59% |

LIVED THROUGH
Pearl Harbor
World War II

LIVED THROUGH
Vietnam War
JFK and MLK assassinations

LIVED THROUGH
Gulf War
Oklahoma City bombing

LIVED THROUGH
September 11
High-profile mass shootings

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