CHAPTER 11

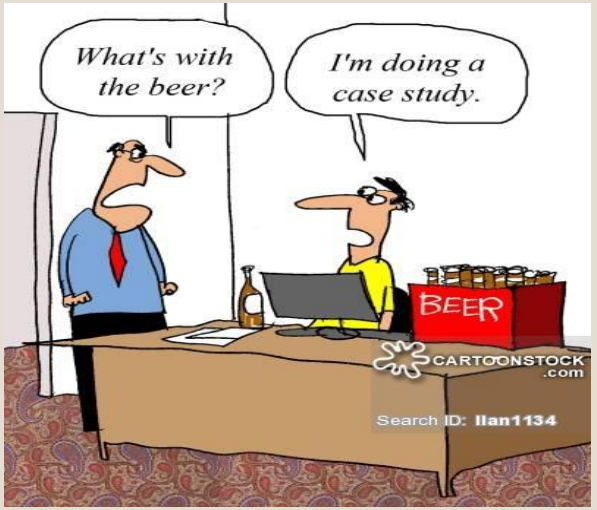
SINGLE-CASE, QUASI-EXPERIMENT, AND DEVELOPMENTAL RESEARCH

LEARNING OBJECTIVES

- single case experimental designs
- one-group posttest-only design
- one-group pretest-posttest design
  - the associated threats to internal validity:
    - history, maturation, testing, instrument decay, and regression toward the mean
- nonequivalent control group design and nonequivalent control group pretest-posttest design
- interrupted time series design vs. control series design
- cross-sectional, longitudinal, and sequential research designs
- Define cohort effect

SINGLE CASE EXPERIMENTAL DESIGNS

- **Single-case experimental designs** have traditionally been called single-subject designs;
  - an equivalent term you may see is *small N* designs.
- It evaluates the effect of experimental manipulation on a single research participant
- *In **a single-case design**, the subject's behavior is measured over time during a **baseline** control period to treatment periods*
  - **Baseline**: Observed behavior before manipulation
- In single-case designs there are
  - **Reversal designs**
  - **Multiple baseline designs**



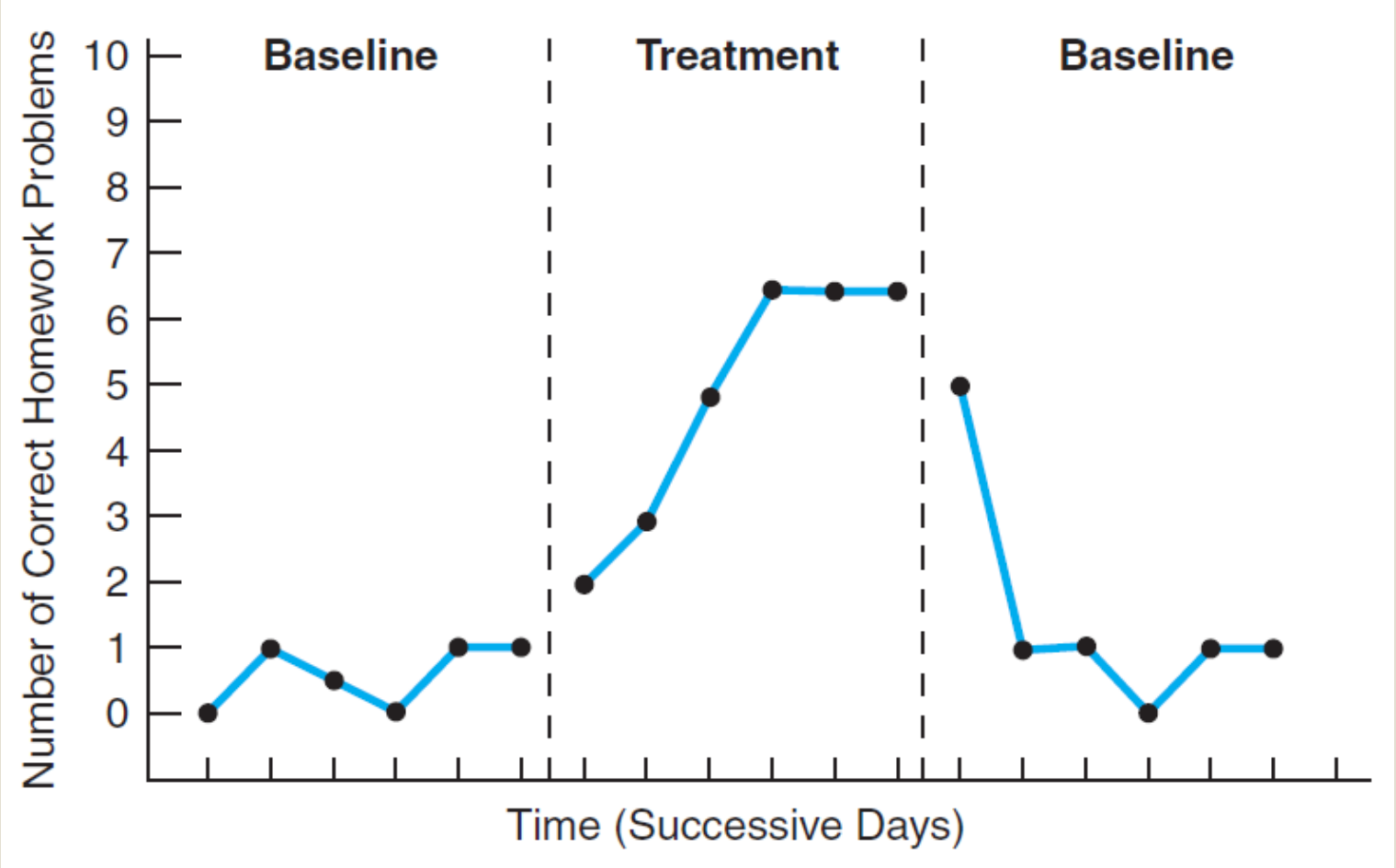
SINGLE CASE EXPERIMENTAL DESIGNS

- **Reversal design**: Is the withdrawal of experimental treatment
- The basic issue in single-case experiments is how to determine that the manipulation of the independent variable had an effect.
- *One method is to demonstrate the reversibility of the manipulation.*
- A simple **reversal design** takes the following form:
  - Baseline (A) → Treatment (B) → Baseline (A)
    - Example: The use of praise as a treatment to measure the improvement of a child's school performance
    - *A more complicated reversal design can be an **ABAB design**, where treatment is applied again for the final treatment*

SINGLE CASE EXPERIMENTAL DESIGNS

- **Reversal design**:
  - This design, called an ABA design, requires that behavior be observed during the baseline control (A) period, again during the treatment (B) period, and also during a second baseline (A) period after the experimental treatment has been removed.
  - (Sometimes this is called a *withdrawal design,* since the treatment is removed or withdrawn.
  - If there was an effect, one should see a change during treatment and a return to baseline after the treatment.
    - Assuming the nature of the treatment has no lasting effects

HYPOTHETICAL DATA FROM ABA REVERSAL DESIGN



SINGLE CASE EXPERIMENTAL DESIGNS

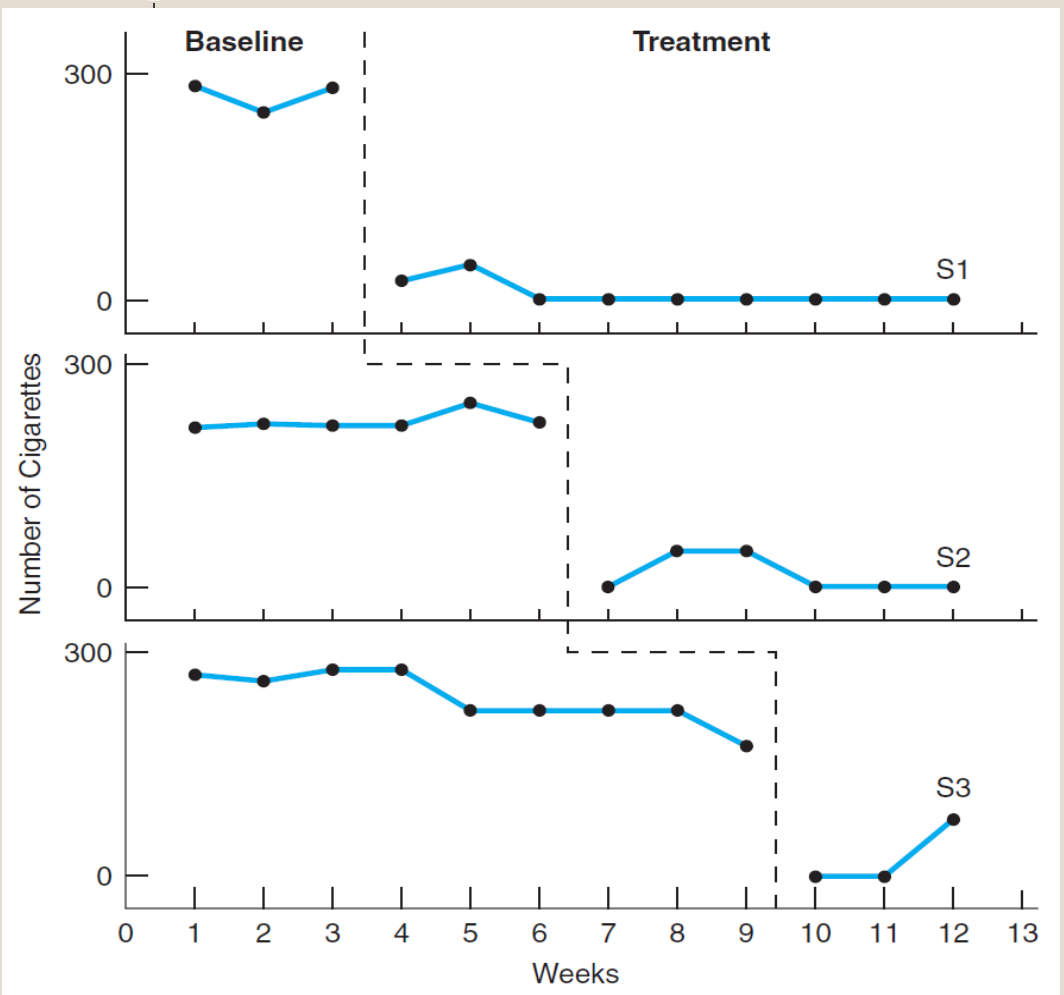
- **Multiple baseline design**
  - In a **multiple baseline design**, the effectiveness of the treatment is demonstrated when a behavior changes only after the manipulation is introduced.
  - *To demonstrate the effectiveness of the treatment, such a change must be observed under multiple circumstances to rule out the possibility that other events were responsible.*
    - Observe change under multiple circumstances
    - Introduce manipulation at different points of time
    - Determine if manipulation is the cause of change

SINGLE CASE EXPERIMENTAL DESIGNS

- **Replications in single case designs**
  - Single-case designs are useful for studying many research problems and should be considered a powerful alternative to more traditional research designs.
  - They can be especially valuable for someone who is applying some change technique in a natural environment
    - It is often used in schools to test new behavior modification techniques
  - Procedures used with a single subject can be replicated with others
  - Traditional single-case research presents results from each subject individually

HYPOTHETICAL DATA FROM A MULTIPLE BASELINE DESIGN ACROSS THREE SUBJECTS

- Here, one can see how three subjects were measured over 12 weeks for number of cigarettes at increasing lengths of time at baseline, and decreasing lengths of time for treatment.
- The last participant's effects seems to have the least effect.



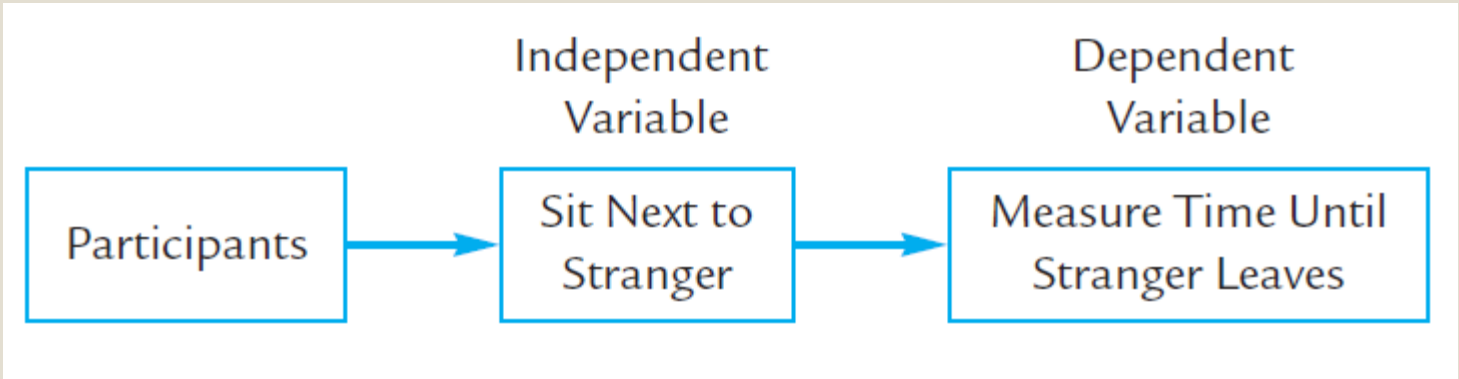
QUASI-EXPERIMENTAL DESIGNS

- **Quasi-experimental designs** address the need to study the effect of an independent variable in settings in which *the control features of true experimental designs cannot be achieved.*
  - Independent variable cannot be manipulated
  - *It does **not** use **random assignment***
  - Internal validity may be affected
- **Selection differences**: Are biases that occur when participants who form the two groups are chosen from existing natural groups

QUASI-EXPERIMENTAL DESIGNS

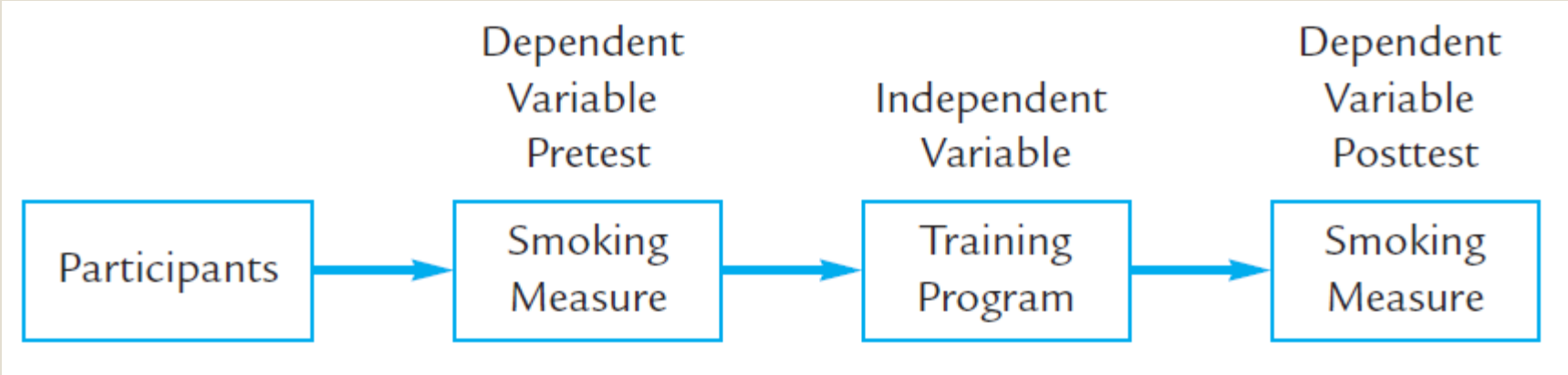
One-Group Posttest-Only Design

- This **one-group posttest-only design**—called a "one-shot case study" lacks a crucial element of a true experiment: a control or comparison group.
- The one-group posttest-only design with its missing comparison group has serious deficiencies in the context of designing an internally valid experiment that will allow us to draw causal inferences about the effect of an independent variable on a dependent variable.



QUASI-EXPERIMENTAL DESIGNS

- One-Group Pretest-Posttest Design
  - One way to obtain a comparison is to measure participants before the manipulation (a pretest) and again afterward (a posttest).
  - An index of change from the pretest to the posttest could then be computed.
  - Although this one-group pretest-posttest design sounds fine, there are some major problems with it.



QUASI-EXPERIMENTAL DESIGNS

- Threats to internal validity
  - **History effects**: Confounding event occurring at the *same time* as the experimental manipulation
    - History refers to any event that occurs between the first and second measurements but is not part of the manipulation. Any such event is confounded with the manipulation. However, history effects can be caused by virtually any confounding event that occurs at the same time as the experimental manipulation.

QUASI-EXPERIMENTAL DESIGNS

- Threats to internal validity (Cont.)
  - **Maturation effects**: Changes occurring systematically over time
    - People change over time. In a brief period they become bored, fatigued, perhaps wiser, and certainly hungrier; over a longer period, children become more coordinated and analytical. Any changes that occur systematically over time are called maturation effects.
  - **Testing effects**: Sensitization incurred in subjects on knowing one is being tested
    - *Testing becomes a problem if simply taking the pretest changes the participant's behavior—the problem of testing effects.*
      - Example: Blood pressure spikes when the nurse takes your vitals

QUASI-EXPERIMENTAL DESIGNS

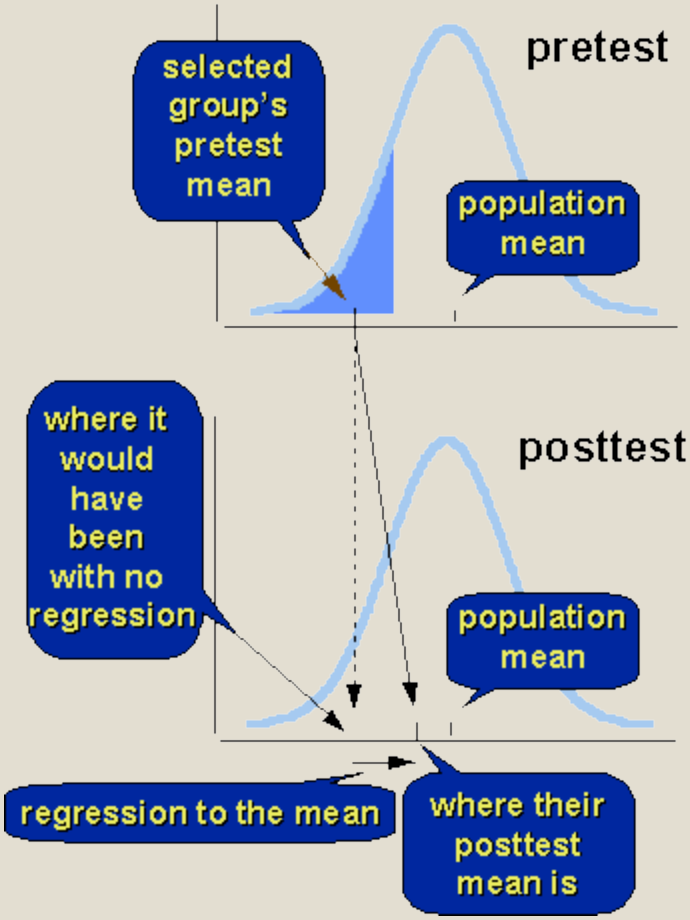
- **Instrument decay**: Changes in the basic characteristics of the measuring instrument over time
  - Sometimes, the basic characteristics of the measuring instrument change over time; this is called **instrument decay**.
  - Surveys, for example, may use outdated terminology or wording
- **Regression toward mean**
  - It is a statistical phenomenon that occurs whenever you have a **nonrandom** sample from a population and two measures that are imperfectly correlated.
  - It is likely to occur whenever participants are selected because they score extremely high or low on some variable.

QUASI-EXPERIMENTAL DESIGNS

- **Regression toward mean (Cont.)**
  - When they are tested again, their scores tend to change in the direction of the population mean.
  - Extremely high scores are likely to become lower (closer to the mean), and extremely low scores are likely to become higher (again, closer to the mean).

QUASI-EXPERIMENTAL DESIGNS

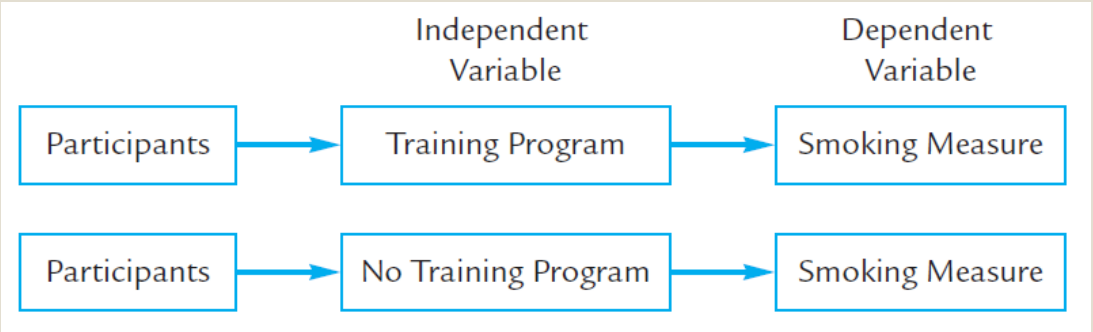
- **Regression toward mean**
  - If your sample consists of below-population-mean scorers, the regression to the mean will make it **appear** that they move ***up*** on the other measure.
  - But if your sample consists of high scorers, their mean will **appear** to move ***down*** relative to the population.
  - Because you picked a non-random sample that are imperfectly correlated, they will tend to move toward the mean naturally, whether they were exposed to your treatment or not.



QUASI-EXPERIMENTAL DESIGNS

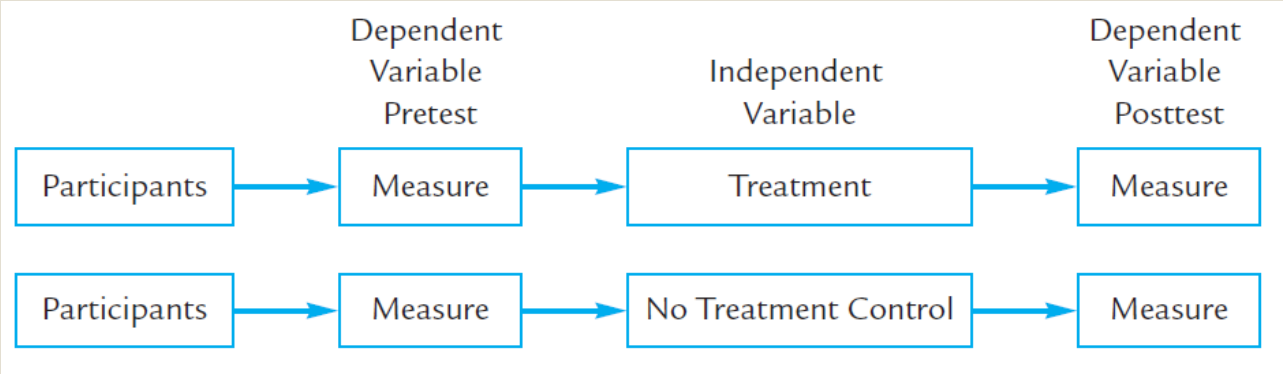
Nonequivalent Control Group Design

- This design employs a separate control group, but the participants in the two conditions are not equivalent.
- The differences become a confounding variable that provides an alternative explanation for the results.
- This problem, called **selection differences or selection bias,** usually occurs when participants who form the two groups in the experiment are chosen from existing natural groups.



QUASI-EXPERIMENTAL DESIGNS

- **Nonequivalent Control Group Pretest-Posttest Design**
  - The nonequivalent control group posttest-only design can be greatly improved if a pretest is given.
  - When this is done a **nonequivalent control group pretest-posttest design** is one of the most useful quasi-experimental designs.
- This design provides a comparison condition to enable one to interpret results, or the effects of the experimental manipulation
- It helps design internally valid experiments



ADVANTAGES OF CONTROL GROUP

- **Propensity score matching**: Comparing groups over several variables in nonequivalent treatment
  - The nonequivalent control group designs lack random assignment to conditions and so the groups may in fact differ in important ways.
  - Advances in statistical methods have made it possible to simultaneously match individuals on multiple variables.
  - Instead of matching on just one variable such as health, the researcher can obtain measures of other variables thought to be important when comparing the groups.
  - The scores on these variables are combined to produce what is called a **Propensity Score**: a combined score of matching multiple variables in an individual .
  - Individuals in the treatment and control groups can then be matched on propensity scores—this process is called propensity score matching.

INTERRUPTED TIME SERIES DESIGN AND CONTROL SERIES DESIGN

- **Interrupted Time Series Design and Control Series Design**
  - A single comparison is really a one-group pretest-posttest design with all of that design's problems of internal validity:
    - chiefly confounding and third factor variables.
  - An alternative is to use an **interrupted time series design** where one *would examine something over an extended period of time, both before and after something else has been instituted.*
  - One-Way to improve the interrupted time series design is to find some kind of control group—**a control series design**.

INTERRUPTED TIME SERIES DESIGN AND CONTROL SERIES DESIGN

- **Interrupted time series design**
  - Examines the dependent variable over an extended period of time, before and after the IV is implemented
  - Interpretation problems (possible regression to the mean)
- **Control series design**
  - Improves interrupted time series design by finding an appropriate control group
  - Involves finding a similar population that did not receive a particular manipulation

DEVELOPMENTAL RESEARCH DESIGNS

- Developmental psychologists often study the ways that individuals change as a function of age.
  - In all cases, the major variable is age.
- There are two general methods for studying individuals of different ages: the **cross-sectional method** and the **longitudinal method**.
- The cross-sectional method shares similarities with the independent groups design whereas the longitudinal method is similar to the repeated measures design.

DEVELOPMENTAL RESEARCH DESIGNS

- **Cross-Sectional method**: *Persons of different ages are measured at the same point in time*
- **Longitudinal method**: *Same group of people are observed at different times as they age*
- **Sequential method**: *Combination of longitudinal and cross-sectional methods*

THREE DESIGNS FOR DEVELOPMENTAL RESEARCH

Cross-Sectional Method

	Year of Birth (cohort)	Time 1: 2010
Group 1:	1955	55 years old
Group 2:	1950	60 years old
Group 3:	1945	65 years old

Longitudinal Method

	Year of Birth (cohort)	Time 1: 2010	Time 2: 2015	Time 3: 2020
Group 1:	1955	55 years old →	60 years old →	65 years old

Sequential Method

	Year of Birth (cohort)	Time 1: 2010	Time 2: 2015	Time 3: 2020
Group 1:	1955	55 years old →	60 years old →	65 years old
Group 2:	1945	65 years old →	70 years old →	75 years old

DEVELOPMENTAL RESEARCH DESIGNS

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Longitudinal method	Cross-Sectional method
✓ Expensive ✓ Takes longer duration ✓ Can attribute change to development ✓ Variable can be assessed at a later time	✓ Relatively cheap ✓ Comparisons can be obtained quickly ✓ Inferring differences to developmental change is challenging ✓ One time measurement

COHORT EFFECT

- The cross-sectional method is much more common than the longitudinal method primarily because it is less expensive and immediately yields results.
- There are, however, some disadvantages to cross-sectional designs.
  - Most important, the researcher must infer that differences among age groups are due to the developmental variable of age.
- In a cross-sectional study, a difference among groups of different ages may reflect developmental age changes; however, the differences may result from **cohort effects**.

COHORT EFFECT

- The **Cohort Effect** is when a group of people are born at the same time, exposed to the same events, and influenced by the same demographic trends
  - Economic and political condition
  - Music and arts
  - Educational systems, and child-rearing practices
- Differences in cross-sectional study may arise due to cohort effects
- The results of Longitudinal studies may lose relevance.

LAB

- **Lab: Single-Case-Quasi-Developmental**

- Due before class next Tuesday
  - **Work on Research Proposals and Research Projects**
- Final Research Proposal Papers DUE Friday, Nov 13th