CHAPTER 11

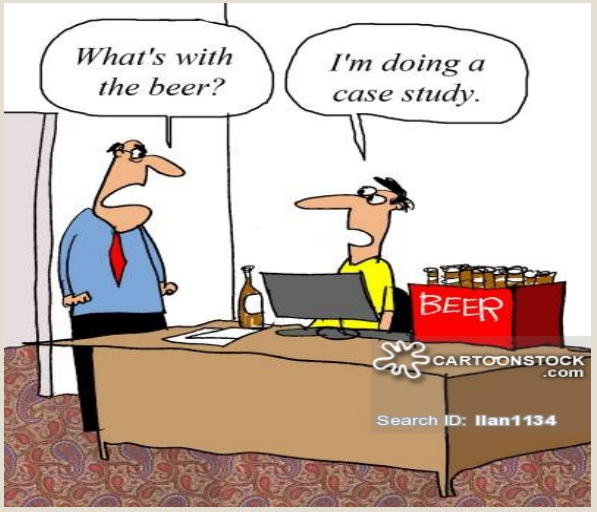
SINGLE-CASE, QUASI-EXPERIMENT, AND DEVELOPMENTAL RESEARCH

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

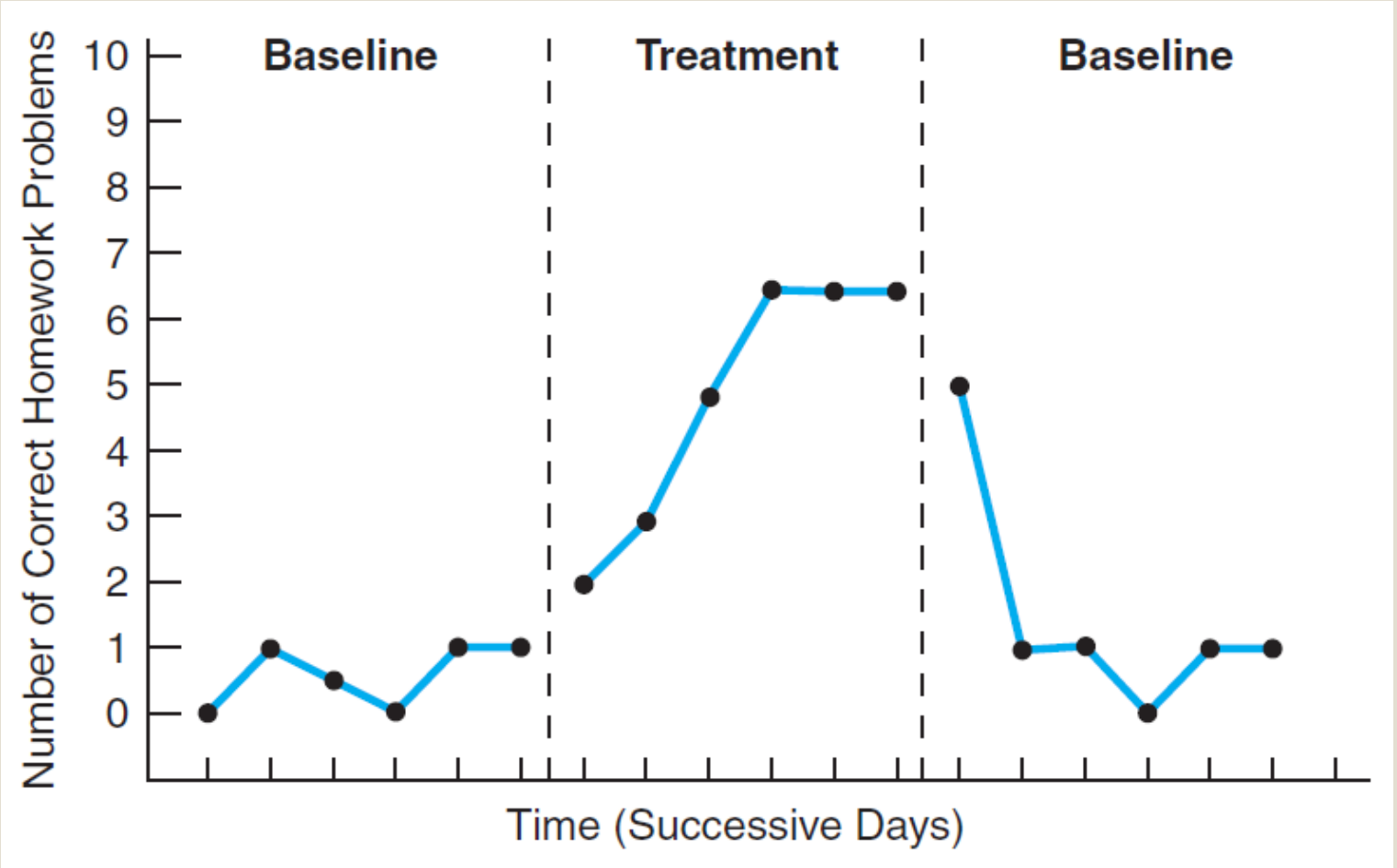
- **Single-case experimental designs**
  - a.k.a. single-subject designs
  - a.k.a. small N designs.
- Evaluates experimental manipulation on a single research participant
- *In **a single-case design**, the subject's behavior is measured over time during a **baseline** control period to treatment periods*
  - **Baseline**: Observed behavior before manipulation
- Two kinds of single-case designs:
  - **Reversal designs**
  - **Multiple baseline designs**



SINGLE CASE EXPERIMENTAL DESIGNS

- **Reversal design**: withdrawal of experimental treatment
- The objective of single-case experiments: determine that the manipulation of the IV 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)
  - *A more complicated reversal design: **ABAB design**, where treatment is applied again for the final treatment*
    - Example: Using praise as a treatment to measure the improvement of a child's school performance
  - a.k.a. *withdrawal design*, since the treatment is removed or withdrawn.

HYPOTHETICAL DATA FROM ABA REVERSAL DESIGN



SINGLE CASE EXPERIMENTAL DESIGNS

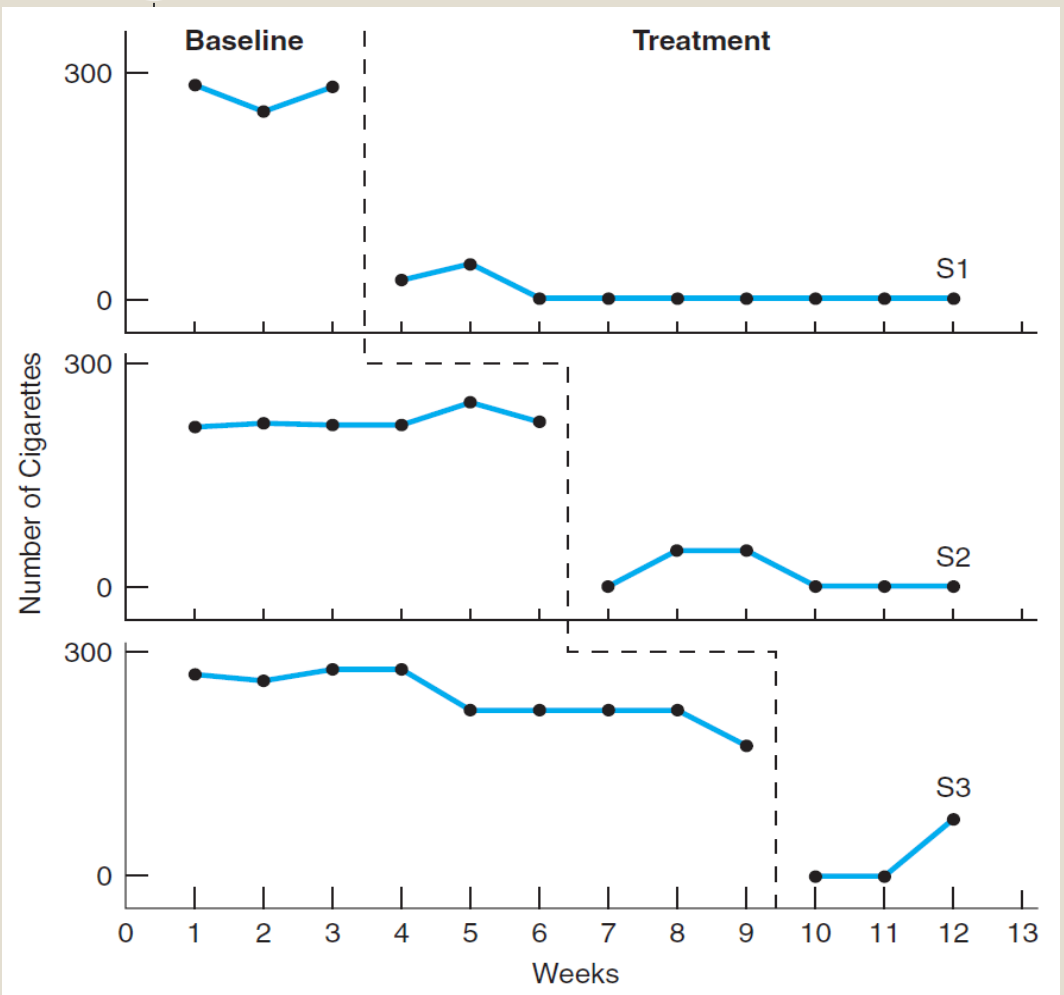
- **Multiple baseline design**
  - Introduce manipulation at different points of time
  - To demonstrate Observe change under multiple circumstances
  - Determine if manipulation is the cause of change
- *To demonstrate the effectiveness of the treatment, a change must be observed under multiple circumstances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

SINGLE CASE EXPERIMENTAL DESIGNS

- **Replications in single case designs**
  - Traditional single-case research presents results from each subject individually
  - A powerful alternative to more traditional research designs.
  - Useful for 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

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.



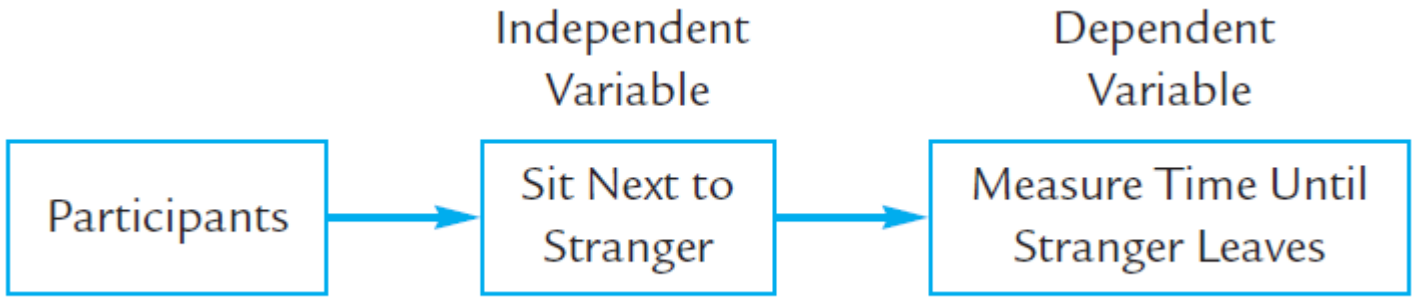
QUASI-EXPERIMENTAL DESIGNS

- **Quasi-experimental designs** address the need to study the effect of an IV in settings in which *the control features of true experimental designs cannot be achieved.*
  - IV 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

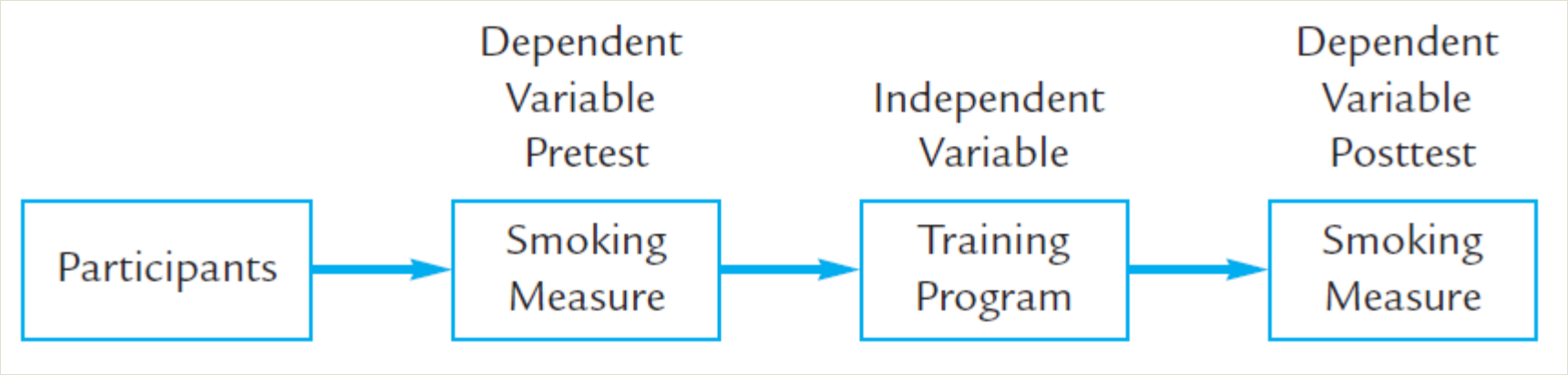
One-Group Posttest-Only Design

- a.k.a. "one-shot case study" lacks a crucial element of a true experiment: a control or comparison group.
- The one-group posttest-only design
  - missing comparison group
  - deficiencies with internal validity
  - Cannot draw conclusions on cause and effect of the IV and DV



QUASI-EXPERIMENTAL DESIGNS

- One-Group Pretest-Posttest Design
  - One way to obtain a comparison: measure participants before the manipulation (a pretest) and again afterward (a posttest).
  - Although this one-group pretest-posttest design sounds fine, there are some major problems with it.



QUASI-EXPERIMENTAL DESIGNS

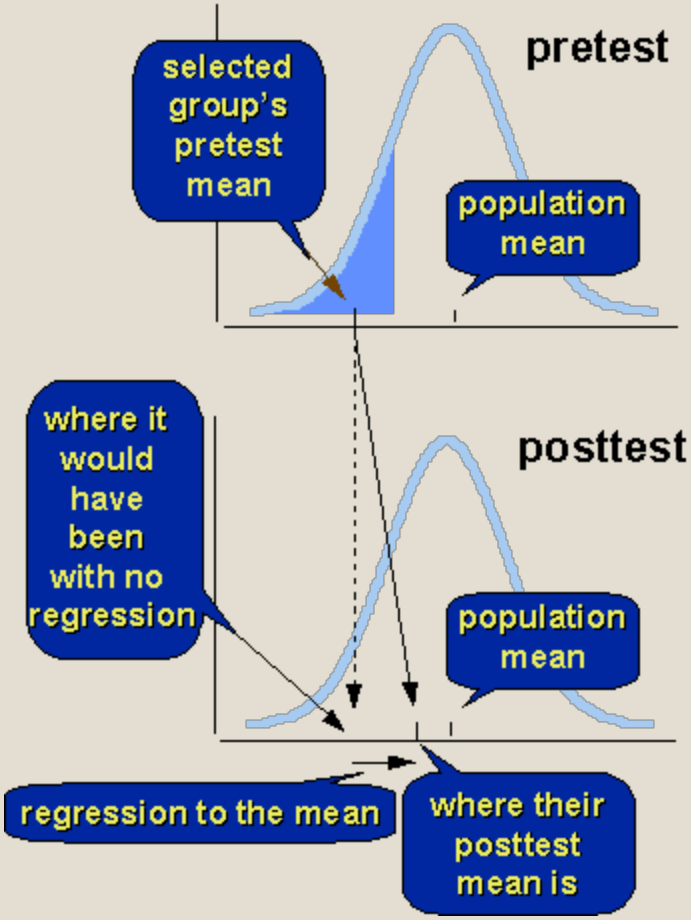
- Threats to internal validity
  - **History effects**: Confounding event occurring at the *same time* as the experimental manipulation
  - History refers to any event that occurs between the first and second measurements but is not part of the manipulation.
    - Any such event is confounded with the manipulation.
  - **Maturation effects**: Changes occurring systematically over time
    - People change over time.
      - they become bored, fatigued, wiser, hungrier; children become more coordinated and analytical.
  - **Testing effects**: Sensitization by subjects on knowing they are being tested
    - *Testing becomes a problem if 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
  - 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.
  - Can occur when participants are selected because they score extremely high or low on some variable.
  - 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

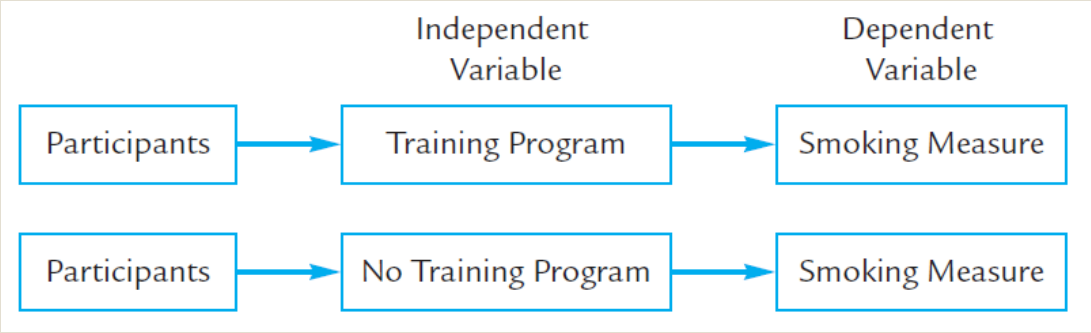
- **Regression toward mean**
  - If your sample consists of below-population-mean scorers, the regression to the mean will make it **appear** that they move ***up*** on the other measure.
  - But if your sample consists of high scorers, their mean will **appear** to move ***down*** relative to the population.
  - 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

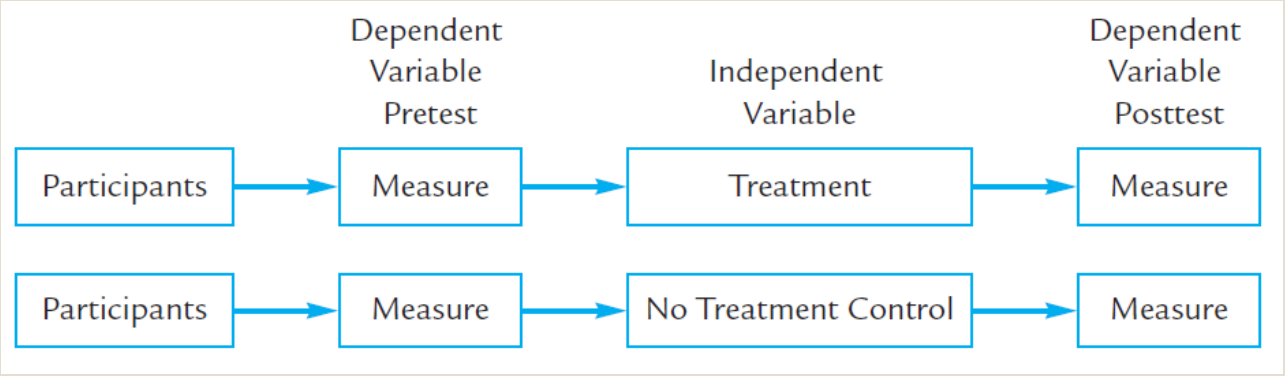
Nonequivalent Control Group Design

- Has separate control group, but participants in the two conditions are not equivalent.
  - Lacks random assignment
- 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**
  - A nonequivalent control group posttest-only design can be greatly improved if a pretest is given.
  - A **nonequivalent control group pretest-posttest design** can be one of the most useful quasi-experimental designs.
- Provides a comparison condition
- Helps design internally valid experiments



ADVANTAGES OF CONTROL GROUP

- **Propensity score matching**: Comparing groups over several variables in nonequivalent treatment
  - Nonequivalent control group designs lack random assignment
    - groups may in fact differ in important ways.
  - Advances in statistical methods have made it possible to 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 .
  - **Propensity score matching:** Individuals in the treatment and control groups are matched on propensity scores

INTERRUPTED TIME SERIES DESIGN

- **Interrupted Time Series Design** A **time series** is a continuous sequence of observations on a population, taken repeatedly (normally at equal intervals) over **time**.
  - A **time series** of a particular outcome of interest is used to establish an underlying trend, which is '**interrupted**' by an intervention at a known point in **time**.
    - An **interrupted time series design is** where one *would examine something over an extended period of time, both before and after the IV is implemented.*
    - Problems of internal validity: confounding and third factor variables
    - Interpretation problems (possible regression to the mean)

CONTROL SERIES DESIGN

- **A 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 three general methods for studying individuals of different ages:
  1. **cross-sectional method**
     - The cross-sectional method is similar to the **independent groups** design
  2. **longitudinal method**
     - The longitudinal method is similar to the **repeated measures** design.
  3. **Sequential method**
     - The sequential method is similar to a mixed model design (one-within, one-between)

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 longitudinal method
  - less expensive
  - immediately yields results
- Disadvantages to cross-sectional designs.
  - The researcher must infer that differences among age groups are due to the developmental variable of age.
- A difference among groups age groups may reflect developmental age changes
- However, 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
- Disadvantages to Longitudinal studies
  - May lose relevance.

LAB

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

- Due before class next Tuesday
  - **Work on Research Proposals and Research Projects**