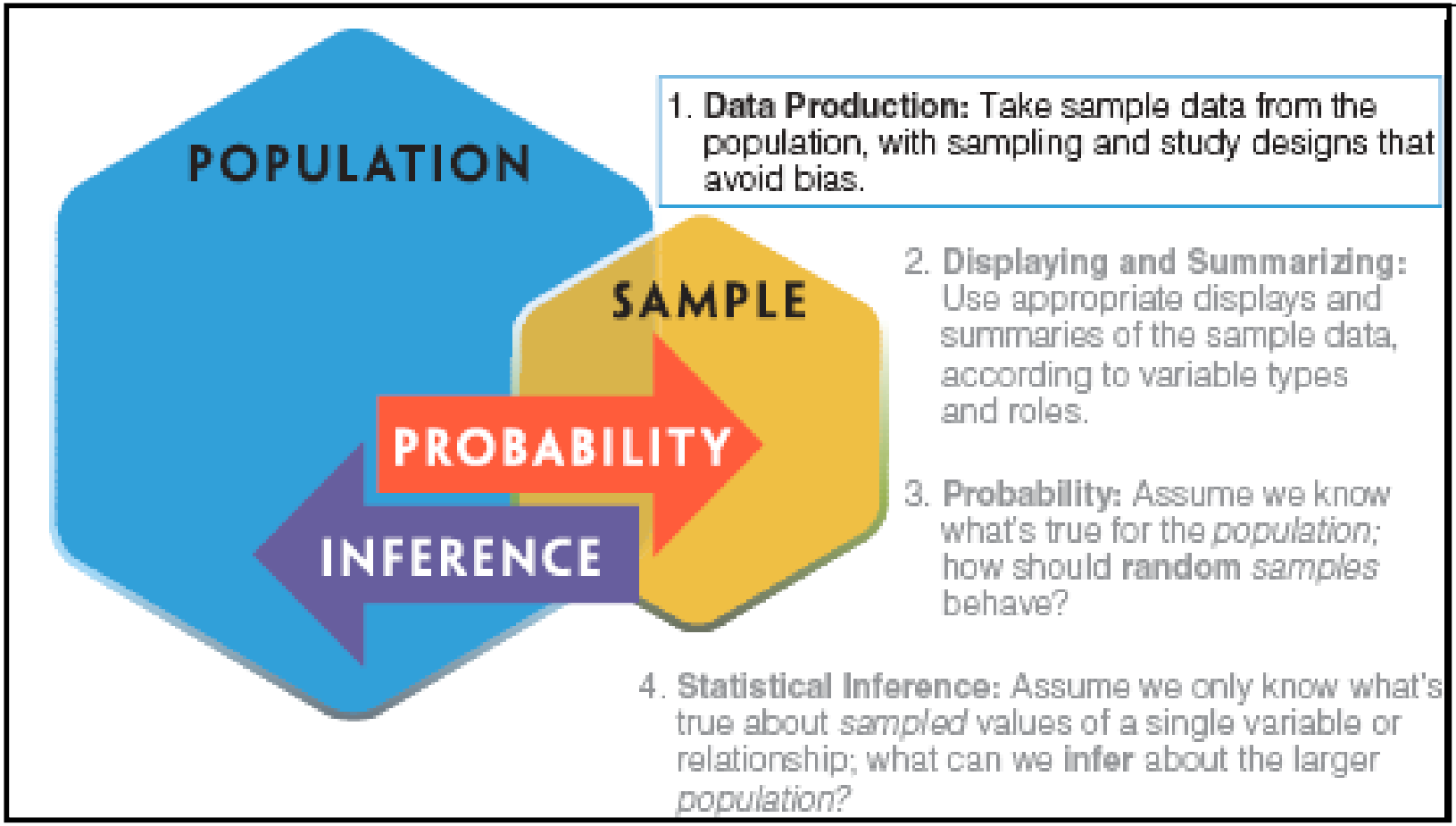
Lecture 2: Chapter 3, Section 2
Designing Studies
(Focus on Sample Surveys)

- Various Types of Study Design
- Issues in Design of Sample Survey Questions
- Issues for any Study Design

Four Processes of Statistics



The Data Production stage entails not only selecting a sample, but also designing a study to learn about the variables of interest for that sample.

Definitions

- **Observational study**: researchers record variables' values as they naturally occur (can be retrospective or prospective).
- **Sample survey:** observational study with self-reported values, often opinions
- **Experiment:** researchers manipulate explanatory variable, observe response
- **Anecdotal evidence:** personal accounts by one or a few individuals selected haphazardly or by convenience. *(To be avoided.)*

One Possible Study Design: Sample Surveys

- **Types of Study Design**
  - Experiment: researchers control explanatory variable
  - Observational study: values occur naturally
    - Special case: sample surveys (often self-reported).
- **Two steps in Data Production**
  - Obtain an unbiased sample.
  - Assess variables' values to obtain unbiased summary of sample.
    - Design survey questions to assess values without bias.

Example: *Formulating a Survey Question*

- **Background:** A popular 2005 movie sparked speculation: how common is it for a 40-year-old male to be a virgin?
- **Question:** Assuming you had a representative sample of 40-year-old males, what survey question would you ask to find out what proportion are virgins?

Students can jot down question & discuss after covering issues in survey question design.

Sample Survey Design: Issues to Consider

- Open vs. closed questions
- Unbalanced response options
- Leading questions or planting ideas with questions
- Complicated questions
- Sensitive questions
- Hard-to-define concepts

Example: *Open vs. Closed Questions*

- **Background:** An exam may feature these…
- **Questions:**

1. What kind of question is this?
   (a) open (b) closed
2. What is an open question?

- **Responses:**

1. (Choose one) (a) open (b) closed
2. _____

Definitions

- An **open question** does not have a fixed set of response options.
- A **closed question** either provides or implies a fixed set of possible responses.

Example: *Overly Restrictive Options*

- **Background:** A neuroscientist asked survey respondents, "How often do you dream in color? Answer always/sometimes/never"
- **Question:** What is the most important improvement that should be made to this survey question?
- **Response:**

Example: *Unbalanced Response Options*

- **Background:** 91% of Americans surveyed rated their own health as good to excellent.
- **Questions:**
  - Is this result surprising to you?
  - If so, does it seem unexpectedly high or low?
- **Responses:**
  -
  -

Example: *Unbalanced Response Options*

- **Background:** 91% of Americans surveyed rated their own health as good to excellent. Options provided were

  Excellent / Very Good / Good / Fair / Poor

- **Question:** Now is the result surprising?
- **Response:**

Practice: 3.14 p.44

Example: *Deliberate Bias*

- **Background:** The following question was posted on www.a-human-right.com: If my child or my spouse were assaulted, I would…(choose one)
  1. Run away and hope my kid or spouse can keep up
  2. Be a good witness so I can tell the cops what happened later
  3. Try to convince the attacker to stop through verbal persuasion
  4. Fight to stop the attack
- **Question:** Do we know what response the surveyor wants us to choose?
- **Response:**

Deliberate Bias

If it's clear what response the surveyor wants, then the results are not useful from a statistical standpoint.

Example: *Complicated Question*

- **Background:** A telephone surveyor asked a homemaker to agree or disagree with this:

  "I don't go out of my way to purchase low-fat foods unless they're also low in calories."

- **Question:** How can this survey question be improved?
- **Response:**

Example: *A Controversial Question*

- **Background:** Anonymous PA Youth Survey given to 6th-12th public school students asked:

  How old were you when you first…

  - got suspended from school
  - got arrested
  - carried a handgun…etc.

  Choose: never have / 10 or younger / 11 / 12 / …/17

- **Questions:**
  - Why did parents object?
  - Why was the question worded this way?
- **Responses:**
  -
  -

Example: *Keyboards for Sense of Anonymity*

- **Background:** A stats computer tutor was piloted in a class where students consented to be identified by name. Still, one student filled in the text boxes with obscenities.
- **Question:** Why did the student write inappropriately in the computer lab, and not on his hard-copy homeworks or exams?
- **Response:**

A Closer Look: *This tendency is used to researchers' advantage when seeking responses to sensitive questions.*

Example: *Hard-to-Define Concepts*

- **Background:** A survey found 19% of Americans believe money can buy happiness.
  - R. Frost: "Happiness makes up in height for what it lacks in length."
  - A. Camus: "But what is happiness except the simple harmony between a man and the life he leads?"
- **Questions:**
  - By Frost's definition, can money buy happiness?
  - By Camus's definition, can money buy happiness?
  - What definition of happiness were respondents using?
- **Responses:**
  - Frost:
  - Camus:
  - Respondents:

Example: *Formulating a Survey Question*

- **Background:** Earlier we asked, "Assuming you had a representative sample of 40-year-old males, what survey question would you ask to find out what proportion are virgins?"
- **Question:** Are you satisfied with the phrasing of your question; if not, how would you rephrase it?
- **Response:** Consider
  - *Open or closed?*
  - *If closed, what response options are provided?*
  - *Is question designed to elicit honest responses?*
  - *Is the concept well-defined?*

Issues to Consider for Any Study Design

- Sample size
- Errors in Study's Conclusions

Example: *Sample Size and Study Design*

- **Background:** Researchers want to know if stronger sunscreens cause more time in sun. They could test this with an observational study or an experiment.
- **Question:** Which is better, using 10 students or 100 students?
- **Response:** It depends…
  - If study is flawed (poorly designed experiment or observational study)

    →
  - If study is well-designed

    →

Example: *Two Types of Error*

- **Background:** A study tested effectiveness of radar guns to identify speeders, concluding the guns do work properly or they don't.
- **Question:** What are the two possible errors in the study's conclusions, and the potential harmful consequences of each?
- **Response:**
  1. conclude guns _____ (consequence: _____)
  2. conclude guns _____ (consequence: _____ or _____)

Example: *Sample Size and Error*

- **Background:** A study tested effectiveness of radar guns to identify speeders.
- **Question:** Which error is more likely to be made if only a small sample of guns is tested?
- **Response:**

Example: *Errors in Home Drug Testing*

- **Background:** A study discussed limitations and risks in the use of home drug testing kits.
- **Question:** What are the two possible errors in a drug test's conclusions, and the potential harmful consequences of each?
- **Response:**
  - False positive due to
    →
  - False negative due to
    or
    →

Lecture Summary *(Sample Surveys)*

- Open vs closed questions
- Unbalanced response options
- Leading questions
- Complicated questions
- Sensitive questions
- Hard-to-define concepts
- Issues for any study design
  - Sample size
  - Errors in study's conclusions