



Chapter 3

**Measurements,
Mistakes, and
Misunderstandings**

Thought Question 1:



Want to find out what people felt to be the *most important problem facing society today*.

Better to give a **fixed set of choices** from which they must choose or an **open-ended question** that allowed them to specify whatever they wished?

What would be the advantages and disadvantages of each approach?

Thought Question 2:



You and a friend are each doing a survey to see if there is a *relationship between height and happiness*.

Without discussing in advance, you both attempt to measure the height and happiness of the same 100 people.

More likely to agree on measurement of height or on measurement of happiness?

Explain, discussing how you would measure each characteristic.

Thought Question 3:

Newsletter distributed by politician to his constituents gave results of nationwide survey on Americans' attitudes about educational issues.

One question: *“Should your legislature adopt a policy to assist children in failing schools to opt out of that school and attend an alternative school—public, private, or parochial—of the parents’ choosing?”*

From wording of question, can you speculate on **what answer was desired?** Explain.

Thought Question 4:



At a swimming pool with a friend and become curious about the **width of the pool**.

Friend has 12-inch ruler, with which he sets about measuring the width. He reports that the **width is 15.771 feet**. (.771 ft = 9 ¼ inches)

Do you believe the pool is *exactly* that width? What is the problem?

Thought Question 5:



If you were to have your intelligence, or IQ, **measured twice** using a standard IQ test, do you think it would be **exactly the same both times**?

What factors might account for any changes?

3.1 Simple Measures Don't Exist



- Important to understand **how the information was collected and what was measured or asked.**
- Many **measurements are complex and difficult.**

3.2 It's All in the Wording

**Simple changes of words
can lead to big changes in answers.**

Example 1: How Fast Were They Going?

Students asked questions after shown film of car accident.

- About how fast were the cars going when they **contacted** each other?
Average response = 31.8 mph
- About how fast were the cars going when they **collided** with each other?
Average response = 40.8 mph

Example 2: Is Marijuana Easy to Buy But Hard to Get?

Source: Original Source 13 on CD

2003 Survey of Teens and Drug Use

Two versions of same question.

Half teens were asked about '*buying*' these items and the other half about '*obtaining*' them.

- Which is easiest for someone your age to **buy**: cigarettes, beer or marijuana?
- Which is easiest for someone your age to **obtain**: cigarettes, beer or marijuana?

Example 2: Is Marijuana Easy to Buy But Hard to Get?



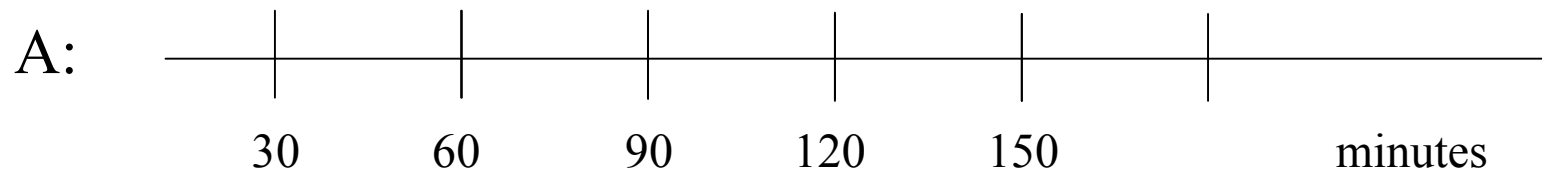
Results:

Response	“buy” version	“obtain” version
Cigarettes	35%	39%
Beer	18%	27%
Marijuana	34%	19%
The Same	4%	5%
Don’t know/no response	9%	10%

Note:

Beer is easier to ‘**obtain**’ than marijuana,
but marijuana is easier to ‘**buy**’ than beer.

How much TV do you watch each day?



A: 16.2% > 150 minutes

B: 34.1% > 2.5 hours

Pitfalls when asking questions ...



1. Deliberate bias
2. Unintentional bias
3. Desire to please
4. Asking the uninformed
5. Unnecessary complexity
6. Ordering of questions
7. Confidentiality and anonymity

Deliberate Bias



Questions can be deliberately worded to support a certain cause.

Example:

- Anti-abortion group's question: "*Do you agree that* abortion, the murder of innocent beings, should be outlawed?"
- Pro-choice group's question: "*Do you agree that* there are circumstances under which abortion should be legal, to protect the rights of the mother?"

Appropriate wording should not indicate a desired answer.

Unintentional Bias

Questions are worded such that the meaning is misinterpreted by many.

Example:

- **Do you use drugs?** --- need to specify if you mean prescription drugs, illegal drugs, etc.
- **What is the most important date in your life?** --- need to specify if you mean calendar date or social engagement.

The same word can have multiple meanings.

Desire to Please



Most respondents have a desire to please the person who is asking the question.

People tend to **understate responses about undesirable social habits**, and vice versa.

Example:

Estimate of prevalence of **cigarette smoking** based on surveys do not match those based on cigarette sales.

Asking the Uninformed



People do not like to admit they don't know what you are talking about.

Example:

“When the American Jewish Committee studied Americans’ attitudes toward various ethnic groups, almost 30% of the respondents had an opinion about the **fictional Wisians**, rating them in social standing above a half-dozen other real groups, including Mexicans, Vietnamese and African blacks.”

Source: Crossen (1994, p. 24)

Unnecessary Complexity

If questions are to be understood, they must be kept simple.

Examples:

- **Too confusing:** “Shouldn’t former drug dealers not be allowed to work in hospitals after they are released from prison?”
- **Asking more than one question at once:** “Do you support the president’s health care plan because it would ensure that all Americans receive health coverage?”

Ordering of Questions

The order in which questions are presented can change the results.

Example:

1. To what extent do you think teenagers today worry about peer pressure related to drinking alcohol?
2. Name the top five pressures you think face teenagers today.

Likely that respondents will name *peer pressure related to drinking alcohol* as one of the 5 choices.

Confidentiality and Anonymity



People answer differently based on degree to which they are anonymous.

- **Confidentiality:** researcher promises not to release identifying information about respondents.
- **Anonymity:** researcher doesn't know identity of respondents.

Surveys on issues like sexual behavior and income are hard to conduct accurately.

Case Study 3.1: *No Opinion of Your Own?* *Let Politics Decide*

Source: Morin, 10-16, April 1995, p. 36.

1995 Washington Post poll #1:

1000 randomly selected respondents added this question about the *non-existent* 1975 Public Affairs Act:
“Some people say the 1975 Public Affairs Act should be repealed. Do you agree or disagree that it should be repealed?”

- 43% of sample expressed an opinion – with 24% agreeing and 19% disagreeing.

Case Study 3.1: *No Opinion of Your Own?* *Let Politics Decide*

1995 Washington Post poll #2:

Two groups of 500 randomly selected respondents.

Group 1: “President Clinton (a **Democrat**) said that the 1975 Public Affairs Act should be repealed. Do you agree or disagree?”

Group 2: “The **Republicans** in Congress said that the 1975 Public Affairs Act should be repealed. Do you agree or disagree?”

- **Group 1: 36% of Democrat** respondents agreed, only **16% of Republican** respondents agreed.
- **Group 2: 36% of Republican** respondents agreed, only **19% of Democrat** respondents agreed

3.3 Open or Closed Questions: Should Choices Be Given?



- **Open question:** respondents allowed to answer in own words.
- **Closed question:** respondents given list of alternatives from which to choose answer. Often an ‘other’ choice is provided.

Problems with Closed Questions



Source: Schuman and Scott (22 May 1987).

“What is the most important problem facing country today?”

Open Question Results

Over half of the 171 respondents gave one of these four answers:

- Unemployment (17%)
- General economic problems (17%)
- Threat of nuclear war (12%)
- Foreign affairs (10%)

Closed Question Results

List of choices and percentage who chose them:

- The energy shortage (5.6%)
- The quality of public schools (32.0%)
- Legalized abortion (8.4%)
- Pollution (14.0%)

These four choices selected by only 2.4% of respondents in the open-question survey.

Problems with Open Questions

Source: Schuman and Scott (22 May 1987).

“Name one or two of the most important national or world event(s) or change(s) during the past 50 years.”

Open Question Results: most common choices

- World War II (14.1%)
- Exploration of space (6.9%)
- Assassination of John F. Kennedy (4.6%)
- The Vietnam War (10.1%)
- Don't know (10.6%); All other responses (53.7%)

Closed Question Results: given top 4 choices above + invention of computer

- World War II (22.9%)
- Exploration of space (15.8%)
- Assassination of JFK (11.6%)
- The Vietnam War (14.1%)
- Invention of Computer (29.9%)
- Don't know (0.3%)
- All other responses (5.4%)

Invention of computer only mentioned by 1.4% in open question survey. Wording of question led to focus on ‘events’ rather than ‘changes’.

3.4 Defining What is Being Measured



Example 3: Teenage Sex

Report 1: Teenage Sex on the Rise

“sexual activity among adolescents is on the rise. ... no indication that this trend is slowing down or reversing itself.” Source: Davis (CA) Enterprise, 19 Feb 1990, p. B-4.

Report 2: Teenage Sex on the Decline

“teenage boys are not living up to their reputations. ... seem to be having sex less often, with fewer girls and at a later age than teenagers did a decade ago.” Source: Davis (CA) Enterprise, 19 Feb 1990, p. A-9.

Example 3: Teenage Sex

Conflicting reports both reported in same newspaper on same day! **Key = *What* was measured?**

Report 1: Teenage Sex on the Rise

Measured sexual activity based on the **age** of first intercourse – 17.2 for females and 16.5 for males.

Report 2: Teenage Sex on the Decline

Measure sexual activity in terms of **frequency** – boys said they had six sex partners, compared with seven a decade earlier; had sex an average of three times during previous month, compared with almost five times in earlier survey.

Example 4: The Unemployed

Bureau of Labor Statistics definition of *unemployed*:

“if they do not have a job, have actively looked for work in the prior 4 weeks, and are currently available for work.”

$$\text{Unemployment Rate} = \frac{\# \text{ meeting above definition}}{\# \text{ in the labor force}}$$

Note: *Discouraged Workers* are **not** included in official rate.

BLS definition of *discouraged worker*:

“not in labor force who want and are available for a job and who have looked for work sometime in the past 12 months (or since end of last job if held one within past 12 months), but who are *not* currently looking because they believe there are no jobs available or there are none for which they would qualify.”

Some Concepts Are Hard to Define Precisely



Example 4: Stress in Kids

News Story 13: *“How much stress is there in your life? Think of a scale between 0 and 10, where 0 means you usually have no stress at all and 10 means you usually have a very great deal of stress, which number would you pick to indicate how much stress there is in your life? (p. 40).”*

Results: *Low stress (0 to 3) = 29%*
Moderate stress (4 to 6) = 45%
High stress (7 to 10) = 26%

Example 4: Stress in Kids



News Story 15:

“To gauge their stress, the children were given a standard questionnaire that included questions like: *‘How often have you felt that you couldn’t control the important things in your life?’*”

- **No fixed definition** of stress.
- Important = **reader is informed about how** the researchers measured stress in any given study.

Measuring Attitudes and Emotions



How to measure self esteem or happiness?

Common Method: respondents read statements and determine extent to which they agree with statement.

Example for happiness:

“I generally feel optimistic when I get up in the morning.”

Indicate level of agreement from:

‘strongly disagree’ to ‘strongly agree’.

Case Study 3.2: *Questions in Advertising*



Example 6: Levi Strauss

Levi's 501 Report, a fall fashion survey conducted annually on 100 U.S. campuses ...

“90% of college students chose Levi's 501 jeans as being ‘in’ on campus.”

List of choices:

- Levi's 501 jeans
- 1960s-inspired clothing
- Overalls
- Decorated denim
- Long-sleeved, hooded T-shirts
- T-shirts with graphics
- Lycra/spandex clothing
- Patriotic-themed clothing
- Printed, pull-on beach pants
- Neon-colored clothing

Levi's 501 jeans were ONLY blue jeans on the list!

Case Study 3.2: *Questions in Advertising*



Example 7: Triumph Cigarettes

**“TRIUMPH BEATS MERIT – an amazing 60% said
Triumph tastes as good as or better than Merit.”**

There were actually three choices ...

- 36% preferred Triumph
- 40% preferred Merit
- 24% said the brands were equal

Ad is not false, but it is also true that 64% said
Merit tastes as good as or better than Triumph!

Which brand do you think wins?

3.5 Defining a Common Language



Categorical versus Measurement Variables

Categorical Variables: those you can place into a category. Categorical variables whose categories have a natural ordering are called *ordinal*, while categorical variables whose categories do not have a natural ordering are called *nominal*.

Measurement Variables: those for which we can record a numerical value and then order respondents according to those values -- also called *quantitative variables*. Sometimes we further distinguish between *interval* (can talk about differences but not ratios) versus *ratio* (has a meaningful zero).

Continuous versus Discrete Measurement Variables



Discrete Variables:

you can actually count the possible responses.

Key = ‘number of’

Example = Number of automobile accidents
on a stretch of highway.

Continuous Variables:

can be anything within a given range.

Key = ‘amount of’

Example = Age.

Validity, Reliability and Bias



Valid Measurement: actually measures what it claims to measure.

Example = IQ test not a valid measure of happiness.

Key = need to know exactly what was measured.

Reliable Measurement: will give you or anyone else approximately the same result time after time, when taken on the same object or individual.

Example = physical measurements with precise instrument.

Key = watch for degree of precision being reported.

Biased Measurement: systematically off the mark in the same direction.

Example = time on clock that's fast

Variability across Measurements



Variability: used when we talk about 2 or more measurements in relation to each other.

Measurement Error: amount by which each measurement differs from the true value.

Natural Variability: results from changes across time in the individual or system being measured.

The Importance of Natural Variability



Three Reasons Variability Occurs ...

1. **Measurement error:** measurements are imprecise.
2. **Natural variability across individuals** at any **given time**.
3. **Natural variability** in a characteristic of the **same individual across time**.

Heart of Modern Statistics:

Comparing natural variability to the variability induced by different treatments or group memberships.

- If there were **no variability** within two groups, it would be **easy to detect differences** between the two groups.
- The **more variability** there is within each group, the **more difficult it is to detect differences** between groups.