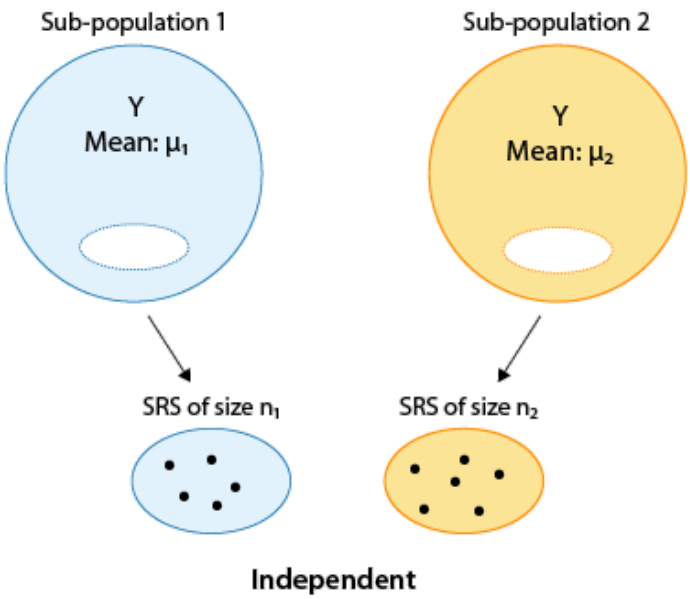
Case C→Q: Independent and Matched Samples

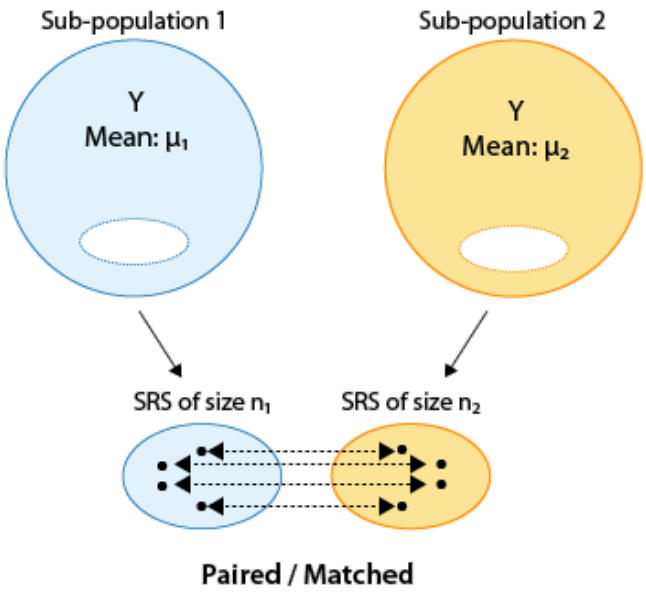
Learning Objective: Identify and distinguish among cases where use of calculations specific to independent samples, matched pairs, and ANOVA are appropriate.

Furthermore, within the sub-case of comparing two means (i.e., examining the relationship between X and Y, when X has only two categories) we will distinguish between two (sub-sub) cases. Here, the distinction is somewhat subtle, and has to do with how the samples from each of the two sub-populations we're comparing are chosen. In other words, what study design will be implemented. We have learned that many experiments, as well as observational studies, make a comparison between two groups (sub-populations) in order to see how responses differ for the two possible categorical values. In some cases, one group (sub-population 1) has one categorical value, and **another independent group** (sub-population 2) has the other value. Independent samples are then taken from each group for comparison.



Independent

In other cases, a matched pairs sample design may be used, where each observation in one sample is **matched/paired/linked** with an observation in the other sample. These are sometimes called "**dependent samples**."



Matching could be by person (if the same person is measured twice), or could actually be a pair of individuals who belong together in a relevant way (husband and wife, siblings). In this design, then, the same individual or a matched pair of individuals is used to make two measurements of the response—one for each of the two categorical values.

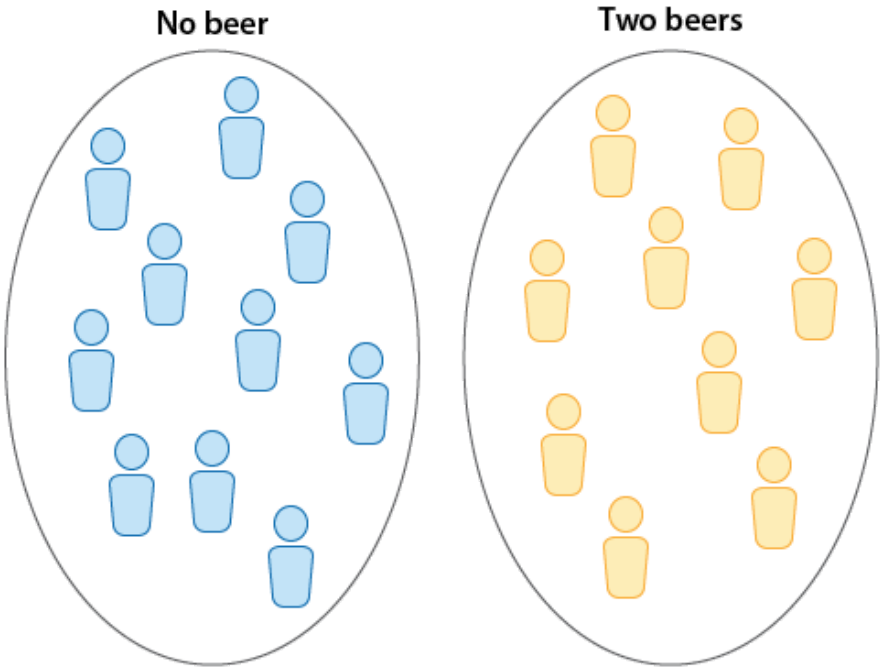
Comment

Note that in the first figure, where the samples are independent, the sample sizes of the two independent samples need not be the same (and thus we used n_1 and n_2 to indicate the two sample sizes). On the other hand, it is obvious from the design that in the matched pairs the sample sizes of the two samples must be the same (and thus we used n for both).

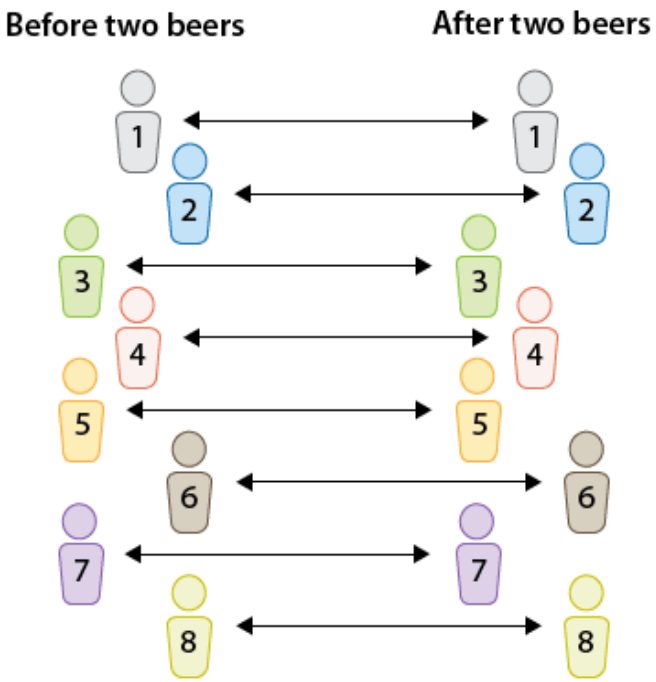
Example

The department of motor vehicles wants to check whether drivers are impaired after drinking two beers. Consider the following two designs:

1. The reaction times (measured in seconds) in an obstacle course are measured for a group of 10 drivers who had no beer. Two beers are given to each of a different group of 9 drivers, and their reaction times on the same obstacle course are measured. (In practice, this was done by selecting a random sample of 19 drivers and randomly assigning them to one of the two groups. The random assignment guarantees, at least in theory, that the two groups are independent).



2. The reaction times (measured in seconds) in an obstacle course are measured for 8 randomly selected drivers **before and then after** the consumption of two beers.



In the first design, we have two independent samples, and the second design is a matched-pairs design, since each individual was measured twice, once before and once after. The two figures highlight the main difference between the two designs. As we'll see, when we have two independent samples, the comparison of the reaction times is a comparison **between two groups**. In matched pairs, the comparison between the reaction times is done **for each individual.**

To summarize:

Inference Case C-Q

Start of transcript. Skip to the end.

We'll start our discussion of inference on relationships with case categorical-quantitative,

where the explanatory variable X is categorical and the

response variable Y is quantitative. We saw that inference on relationships in

this case amount to comparing population means. We distinguish between cases where

Video

Download video file

Transcripts

Download SubRip (.srt) file

Download Text (.txt) file

Did I Get This?

Each of the following three questions is an example of a situation in Case C→Q (categorical explanatory and a quantitative response), and therefore calls for comparing means of several (sub) populations. Your task is to decide which of the sub-cases of Case C→Q each of the examples represents.

Comment: You'll note that each of these examples is a variation on the same story, yet differs in the sub-case it represents. This was done on purpose to highlight the differences between the sub-cases.

Did I Get This

1/1 point (graded)

A publishing company wanted to examine whether typing speeds differ when using word processor A, word processor B, and word processor C. The company tested the three word processors on three groups of 25 randomly selected typists (each group used one of the three word processors) and

recorded the typing speed (in words per minute) for each typist. Which "case" does this study fall into?

- Comparing two means—independent samples
- Comparing two means—matched pairs
- Comparing more than two means—independent samples ✔

Answer
Correct:
In this situation, we are comparing the mean typing speed of three (more than two) word processors, and since each of the three samples was chosen randomly, they are independent.

Submit

Did I Get This

1/1 point (graded)

A publishing company wanted to test whether typing speeds differ when using word processor A or word processor B. A random sample of 25 typists was selected and the typing speed (in words per minute) was recorded for each typist when using word processor A and when using word processor B. (Which word processor is used first is determined for each typist by a coin flip). Which "case" does this study fall into?

- Comparing two means—independent samples
- Comparing two means—matched pairs ✔
- Comparing more than two means—independent samples

Answer
Correct:
Indeed, this example calls for comparing two means (the mean typing speeds of the two word processors), and since each typist is measured twice, this is an example of matched pairs.

Submit

Did I Get This

1/1 point (graded)

A publishing company wanted to test whether typing speeds differ when using word processor A or word processor B. The typing speeds (in words per minute) are recorded for a random sample of 25 typists using processor A, and for another (different) random sample of 25 typists using word processor B. Which "case" does this study fall into?

- (●) Comparing two means—independent samples ✔
- ( ) Comparing two means—matched pairs
- ( ) Comparing more than two means—independent samples

Answer

Correct:

Indeed, this example calls for comparing two means (the mean typing speeds using the two word processors), and since each of the two samples was chosen randomly, they are independent.

Submit