

1. **Super Bowl commercials.** When spending large amounts to purchase advertising time, companies want to know what audience they'll reach. In January 2007, a poll asked 1008 American adults whether they planned to watch the upcoming Super Bowl. Men and women were asked separately whether they were looking forward more to the football game or to watching the commercials. Among the men, 16% were planning to watch and were looking forward primarily to the commercials. Among women, 30% were looking forward primarily to the commercials.

Was this a stratified sample or a blocked experiment? Explain.

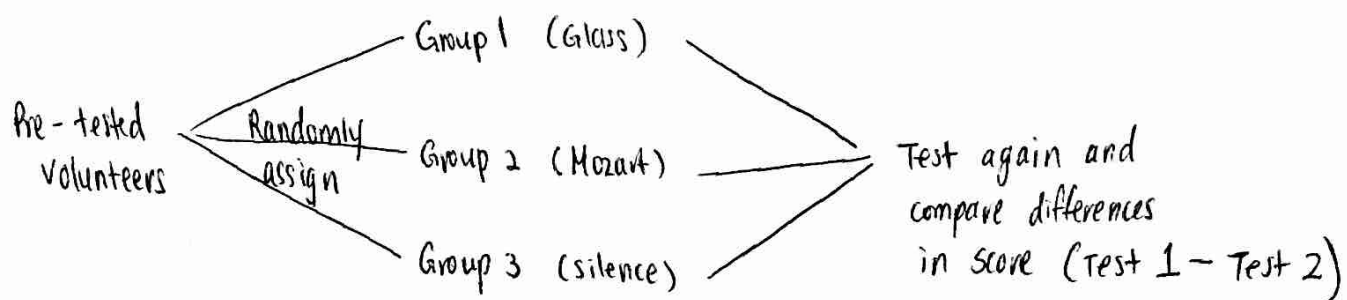
This is a stratified sample. No treatment was applied, so this is not an experiment.

2. Will listening to a Mozart piano sonata make you smarter? In a 1995 study published in the journal *Psychological Science*, Rauscher, Shaw, and Ky reported that when students were given a spatial reasoning section of a standard IQ test, those who listened to Mozart for 10 minutes improved their scores more than those who simply sat quietly.

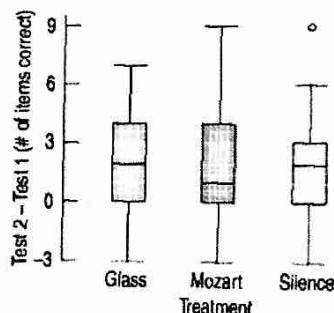
a) These researchers said the differences were statistically significant. Explain what that means in context.

The differences in spatial reasoning scores between the students listening to Mozart and the students sitting quiet were more than would have been expected from ordinary sampling variation.

b) Steele, Bass, and Crook tried to replicate the original study. In their study, also published in *Psychological Science* (1999), the subjects were 125 college students who participated in the experiment for course credit. Subjects first took the test. Then they were assigned to one of three groups: listening to a Mozart piano sonata, listening to music by Philip Glass, and sitting for 10 minutes in silence. Three days after the treatments, they were retested. Draw a diagram displaying the design of this experiment.



c) These boxplots show the differences in score before and after treatment for the three groups. Did the Mozart group show improvement?



The Mozart group seems to have the smallest median difference in spatial reasoning test score and thus the least improvement, but there does not appear to be a significant difference.

d) Do you think the results prove that listening to Mozart is beneficial? Explain.

No, the results do not prove that listening to Mozart is beneficial. If anything, there was generally less improvement. The difference does not seem significant compared with the usual variation one would expect between the three groups.

3. Read the following article about the connection between vitamin E and heart bypass surgery.

Vitamin E may have special health benefits

Large doses of vitamin E apparently can reduce harmful side effects of bypass surgery in heart patients. A study involving 28 bypass patients found that the 14 randomly-assigned patients who took vitamin E for two weeks before their operations had significantly better heart function after the procedure than the 14 randomly-assigned patients who took placebos.

The vitamins apparently prevent damage to the heart muscle by destroying the toxic chemicals, called free radicals, that form when blood is cut off during the surgery, said Dr. Terrance Yau of the University of Toronto.

a) Explain why this is an experiment and not an observational study.

This is an experiment b/c treatments (vitamin E, placebo) are imposed on subjects.

b) Identify the explanatory and response variables.

Explanatory: vitamin E treatment

Response: heart function

c) Identify the type of experimental design used in this study. Justify your answer.

Completely randomized design

Each subject is assigned to one of the two groups randomly.

d) In the second sentence above is the phrase, "...the 14 patients who took vitamin E for two weeks before their operations had significantly better heart function after the procedure ..." What is the statistical meaning of the word "significantly" in the context of this study?

Significantly means that the difference found in the heart function between subjects in the 2 treatments was large enough that it was unlikely to have arisen from chance variation.

e) This was a controlled experiment. Describe how it was controlled and explain the purpose of doing so.

Comparing subjects who were given vitamin E to others who were given a placebo (the controls) allowed the researchers to isolate the impact of vitamin E from any other variables.