

## ASSOCIATION AND CAUSATION

### 6.2.3

Considering all of the statistical tools available to measure the correlation between two variables it is very tempting to believe that a strong **association** between two variables is evidence of **causation**. The fact that two variables move together in a predictable manner does not show that one causes the other. Cause can usually only be shown using carefully controlled experiments, and usually not by just observing the relationship between variables.

### Example

A city is proposing a new bus route. A community activist who owns a residence along the route does some research which shows a strong association between the number of bus stops and the crime rate of a community. She presents her findings to the city council claiming, “Bus stops cause crime, so please vote no.” Another community activist who owns a business along the proposed bus route also does research and finds that bus stops are highly associated with the number of restaurants in a neighborhood. He presents his findings to the city council claiming, “Bus stops increase restaurants. Please vote yes.”

A city council member (who also teaches statistics) informs them that association is not the same as causation because of the many thousands of variables not included (lurking) in a study. The council member said, “Bus stops are generally an indication of large population centers so bus stops will be found along with other things associated with urban living. This does not mean that bus stops *cause* things found in cities.”

- a. List three desirable variables that are likely associated with bus stops but not necessarily caused by them.

Numbers of Museums, Theaters, Stadiums.

- b. List three undesirable variables that are likely associated with bus stops but not necessarily caused by them.

Quantity of litter, air pollution, noise.

## Problems

For each faux news headline, accept that the association is true and indicate a hidden or lurking variable that may be the actual cause of the relationship.

- a. “BOOKS IN THE HOME ASSOCIATED WITH HIGHER TEST SCORES”  
“Students buying truckloads of books before taking national exams.”
- b. “CHESS CLUB BOASTS HIGHEST IVY LEAGUE ADMISSION RATES”  
“Club president now flooded with membership applications.”
- c. “STUDENTS WHO LIVE OFF CAMPUS AT HIGHER RISK FOR AUTO ACCIDENTS”  
“State Police Warn: Play it safe, live on campus.”

## Answers

- a. A person who does a lot of reading would likely have a larger number of books in their home and higher test scores. So reading regularly is likely the cause. Just buying books does not cause higher test scores.
- b. Chess is game of strategy and an extracurricular activity. Those who play regularly may be more inclined to apply to Ivy League schools than non-chess players.
- c. Students who live off campus probably commute to school and may spend more time driving to and from school than students who live on campus. The additional hours on the road may be the cause of more accidents.