Thinking Critically

Or how NOT to be fooled!

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You'll need to know:

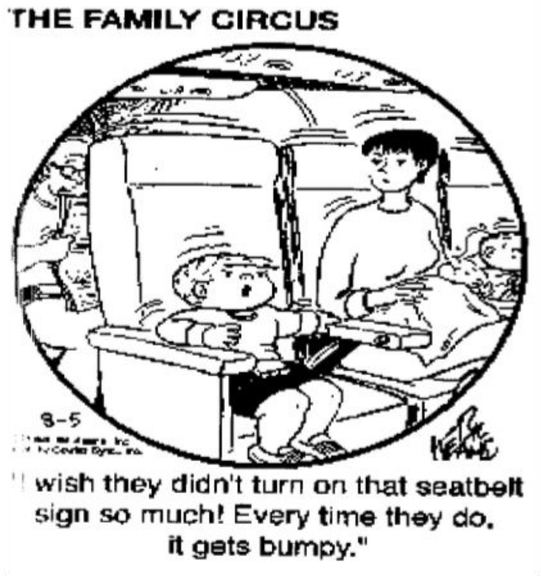
Inference

Looking at available evidence and using logic to draw a conclusion

But when can inference go wrong?

Correlation is not causation

Inferring events/data that happen at the same time or rate, (correlation) means one caused the other (causation.)



Fact!

Ice cream sales and drowning deaths rise and fall at a similar rate.

Conclusion

Ice cream causes drowning!

Nope, it an example that correlation is not causation!

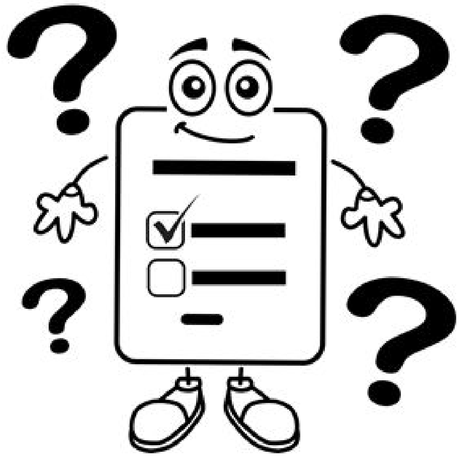
Ice cream sales increase in the warm summer months.

More people go to the pool or the beach in the summer months.

Causation! The cause of the correlation is warmer weather.

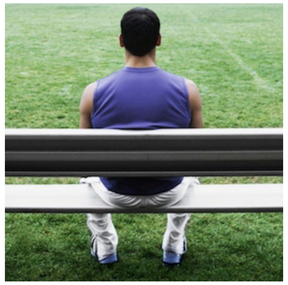
Experimenter bias

Inferring information is valid when the questions used to gather it were bias or leading



How do the following questions push an individual to answer in a way the experimenter wants?

Would you rather increase mandated testing of students or would you rather students fall further behind?



Should aggressive coaches be allowed to give more playing time to their favorite player and leave other distraught students sitting on the bench?

Which words or phrases show bias?

Would you rather increase mandated testing of students or would you rather students fall further behind?

Problems:

This is a false, either/or choice.

The choices are vague.
What is meant by "increase" and "further behind?"

Should aggressive coaches be allowed to give more playing time to their favorite player and leave other distraught students sitting on the bench?

Problems:

"Aggressive", "favorite", & "distraught" are loaded words.

No specific information or details is given.

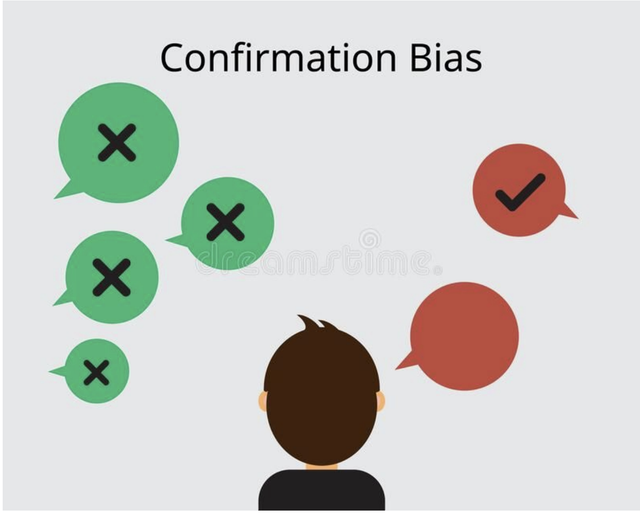
Are the students in kindergarten or high school?

Did the other student attend practices and work hard?

Is it a competitive league or a school team?

Confirmation bias

Believing or accepting only the information that supports the desired conclusion



Myra and Lily accused each other of cheating on the exam

Lily is your friend, and you believe she would never cheat.

Myra has to be the guilty one!

What evidence is available?

Myra struggled on past tests.

Myra scored better on this test.

Lily has a small piece of paper with notes but explained it was for studying on the bus.

Myra was seen studying before school.

Lily will be grounded and miss Saturday's party if she does poorly on the test.

You are using confirmation bias if you

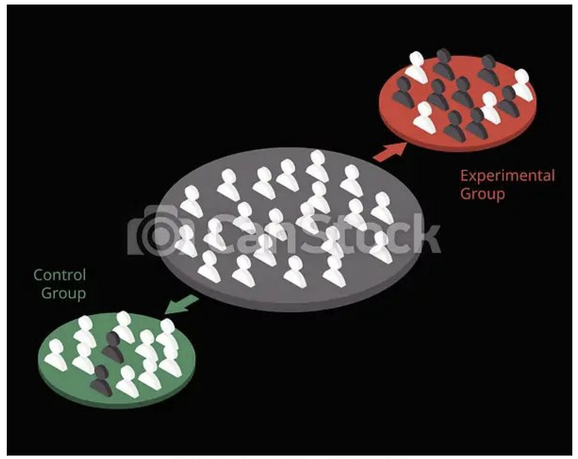
Only accept the information that

- supports Lily's innocence
- points to Myra's guilt

Ignore the information that

- supports Myra's innocence
- points to Lily's guilt

Lack of a Control Group



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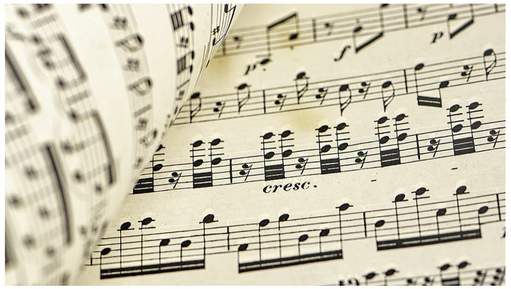
Inferring any change shows the actions taken worked even if there was no control group.

Control group: a group that does not experience the change. This demonstrates the improvement was due to the action rather than other factors

Mr. Gonzalez tries something new



History teacher, Mr. Gonzalez, read about the brain benefits of playing music at the start of class. During the unit, Westward Expansion, Mr. Gonzalez played classical music each hour.

The students scored 5% higher on the West test.

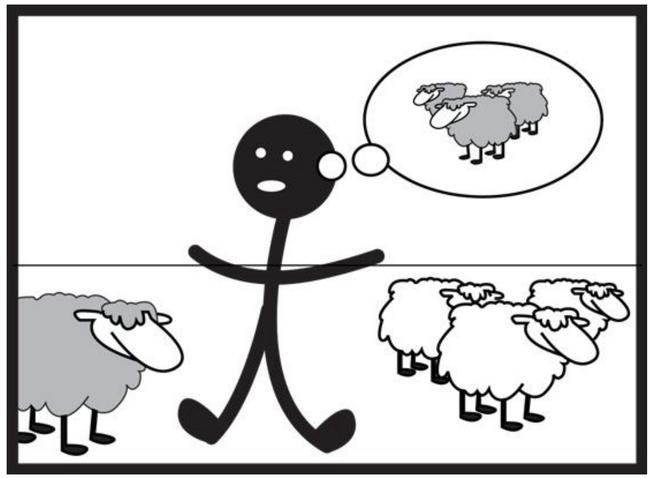
Mr. Gonzalez did not have a Control Group

Other factors could have contributed to the better grades.
- The unit or test may have been easier.
- Student may have studied more.
- Mr. Gonzalez may have unconsciously taught better because he thought grades would improve.

Using music in only some of his classes and comparing the scores would have provided a control group and more valid results..

Overgeneralization

Inferring conclusions made about a small group or sample will apply to all.



Principal Woolwine orders lunch for 500 students

Principal Woolwine decides the menu in the lunchroom needs updating. He sees three boys in the hall and asks their opinion. The students suggest breakfast burritos.

The next week, breakfast burritos are the main item on the menu.

Mr. Woolwine overgeneralized

Using three students in the hall is not a strong sampling.
- The sampling is too small.
- The three were probably friends and have similar tastes.

A survey of all students or a survey that takes a sample reflecting the makeup of the student body is necessary.

So can you spot the problem and not be fooled?

Random chance
Correlation is not causation
Experimenter bias
Confirmation bias
Lack of a control group
Overgeneralization

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