Association Is Not Causation

Association is a pattern. Causation means one thing makes the other happen. A pattern can be coincidence or come from a lurking variable. Showing cause takes a designed experiment with random groups.

1 THE VOCABULARY
Words we use

Association a pattern between two quantities.
Correlation how strong the straight-line pattern is (r).
Causation one thing actually makes the other happen.
Lurking variable a hidden third quantity that affects both.
Coincidence a pattern that happened by chance.
Experiment a planned test with randomly assigned groups.

- Watch out for these.
- Saying a strong r proves cause.
- Forgetting to look for a hidden third quantity.
- Assuming which way the cause runs.
- Thinking association is never causation. Sometimes it is; you need evidence.

2 THE METHOD
Before you say cause

1. **COINCIDENCE?** could the pattern be chance?
2. **LURKING VARIABLE?** could something hidden drive both?
3. **BACKWARD?** could the second cause the first?
4. **A REAL REASON?** is there a clear way one makes the other happen?
5. **AN EXPERIMENT** random groups, change one thing: the way to be sure.

> **WHY AN EXPERIMENT WORKS**
> Putting people into groups at random spreads every lurking variable evenly between the groups. Then the only difference is the one thing you changed.

3 THREE STORIES
Just connected

Spelling Bee words and spider deaths	coincidence: no possible link
cars owned and years lived	lurking variable: money
ice cream sales and sunburns	lurking variable: hot, sunny weather
shoe size and reading score	lurking variable: age
hours of light and plant height	causation is reasonable, and an experiment can show it

> **A STRONG R**
> r = 0.95 shows a strong straight-line association. It does not show which causes which, or whether anything hidden is behind both.

> **SAY IT OUT LOUD**
> Association is not causation. A pattern is not a reason. Ask what else could be driving both.

Unit 10, Lesson 5 in one line: two quantities can be associated by coincidence or through a lurking variable, and only a randomized experiment can show that one causes the other.