

## Experiment vs. Correlations

	<u>Correlations</u>	<u>Experiments</u>
• Measures two or more variables	X	X
• Determines relations between variables	X	X
• Has a hypothesis	X	X
• Manipulates a variable to establish cause and effect		X
• Observes naturally occurring variables	X	
	<ul style="list-style-type: none"> <li>• Do people who take vitamin C have fewer colds?</li> </ul>	<ul style="list-style-type: none"> <li>• Does taking vitamin C reduce the number of colds?</li> </ul>
	<ul style="list-style-type: none"> <li>• Do those who eat oat bran have lower cholesterol?</li> </ul>	<ul style="list-style-type: none"> <li>• Does eating oat bran reduce cholesterol levels?</li> </ul>

## Correlational Methods Reveal Relationships

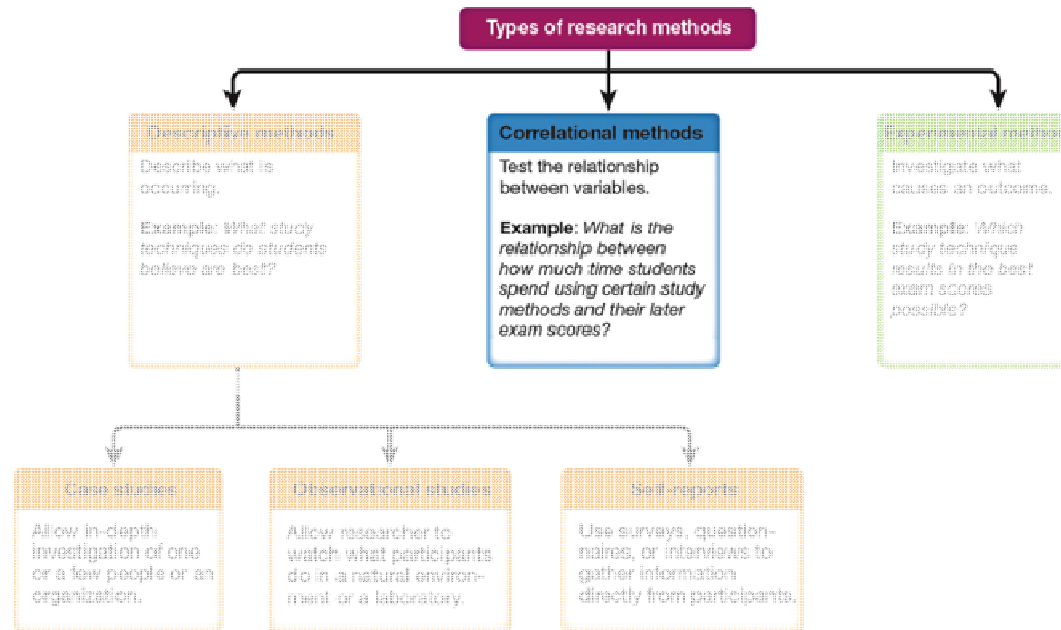


FIGURE 1.18

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A correlational study is a research strategy that allows the calculation of how strongly related two factors are to each other (page 34) without any attempt by the researcher to alter them or assign causation between them.

Unlike experiments that manipulate one or more variables (the independent variable), correlations do not manipulate any variables. Correlations only measure pre-existing variables.

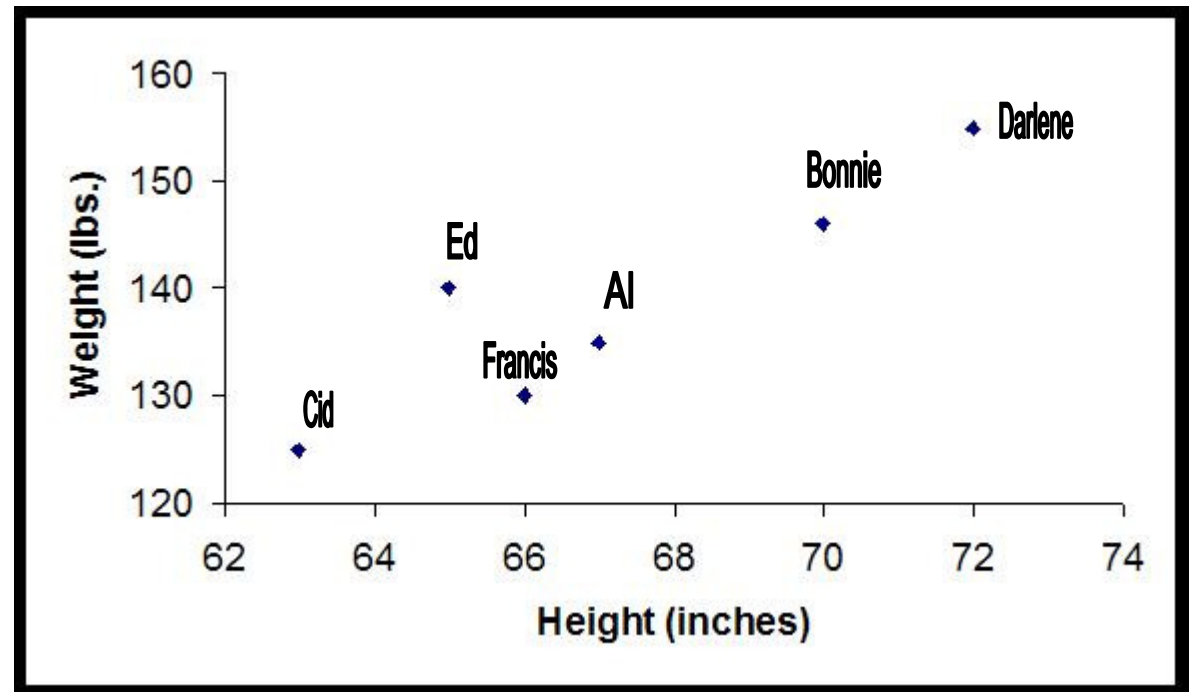
## Measuring a Correlation

Correlation: A correlation examines the relationship between two (or more) variables. A correlation occurs between a series of data (height and weight), not an individual such as Al, Bonnie, Cid, etc.

Correlations can be used to predict one variable from the other. It cannot show causation.

### The relationship between height and weight

	Height (inches)	Weight (lbs.)
Al	67	135
Bonnie	70	146
Cid	63	125
Darlene	72	155
Ed	65	140
Francis	66	130



## Correlation and the Correlation Coefficient

### Correlation coefficient:

A measure of the direction and strength of a correlation which is signified by the letter  $r$ .

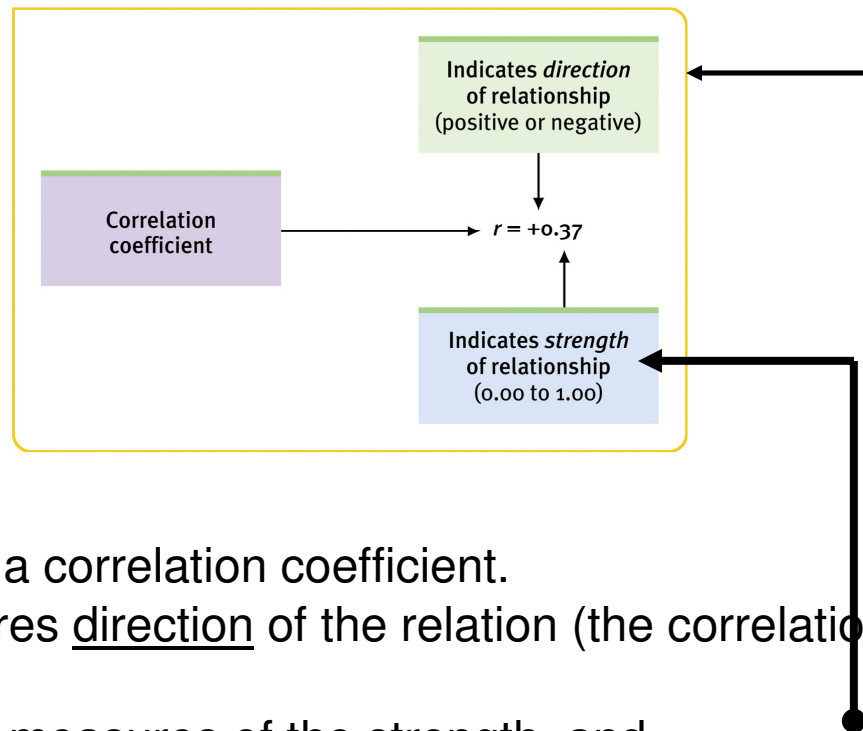


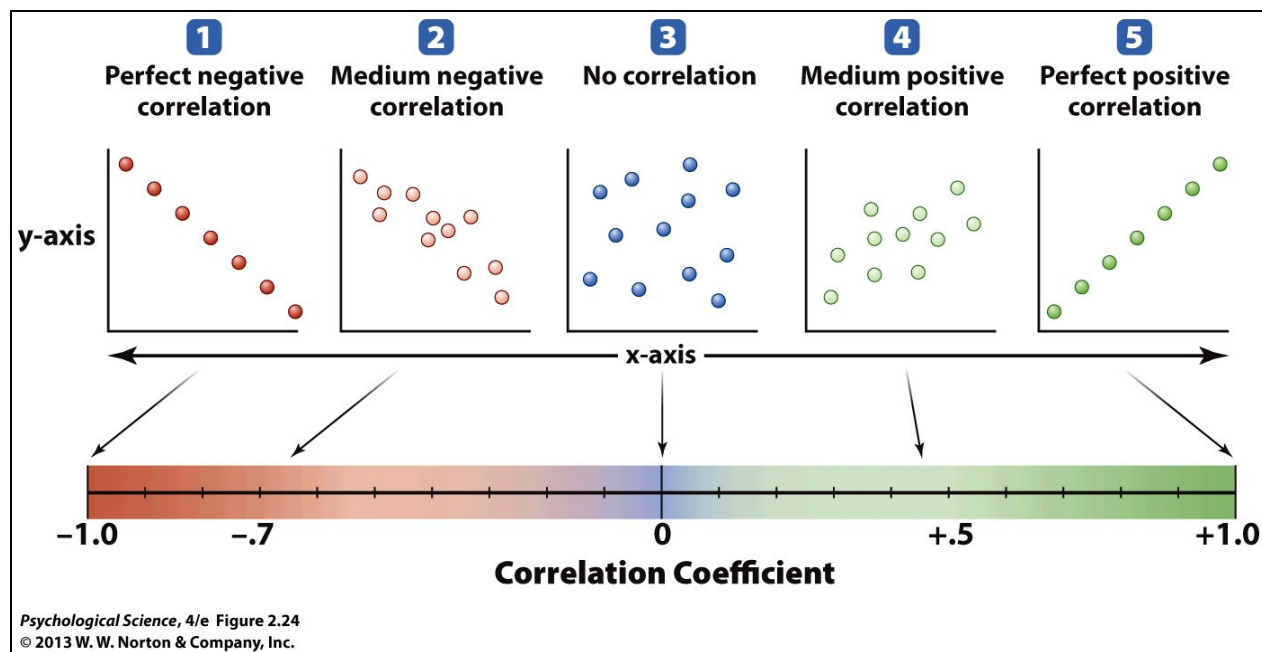
Image source: Psychology (????), Myers

There are two aspects of a correlation coefficient.

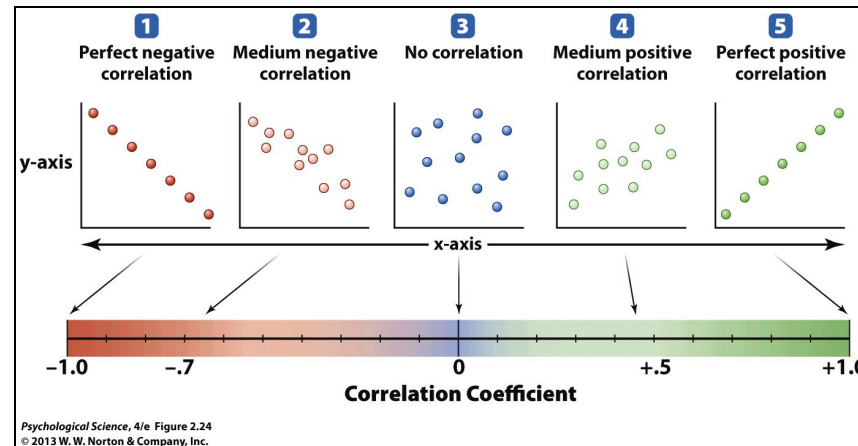
- The sign that measures direction of the relation (the correlation) between two variables.
- A numeric value that measures of the strength, and

## Correlation and the Correlation Coefficient

A correlation coefficient ranges from -1 to +1. The closer the correlation coefficient is to **+1** or **-1**, the stronger the relationship. Also see [section A.2 of the appendix](#))



## Correlations Coefficients: The Sign of the Relation



### A negative correlation

indicates that the variables act in the opposite direction. As one variable increases, the other tends to decrease.

- For example, trust in other people and cheating other people are negatively correlated.

### A zero correlation

indicates that there is no relation between the two variables.

- For example, there is no relation between a person's telephone number and their IQ score.

### A positive correlation

indicates that the variables act in the same direction. As one variable increases, the other tends to increase or as one variable decreases, the other decreases.

- For example, the most crowded areas of a city are the most impoverished.

## Examples of magnitude and direction of the relation:

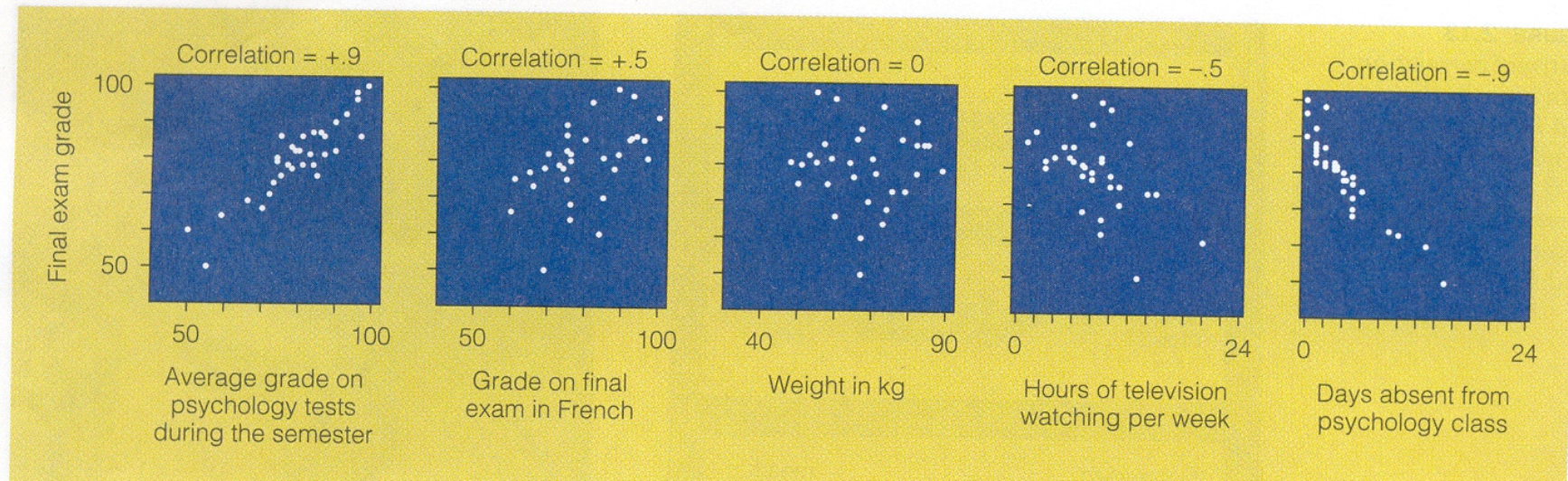
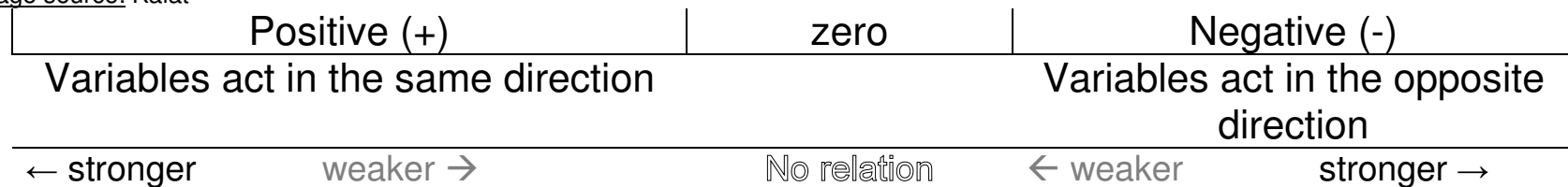


Image source: Kalat



## Correlations

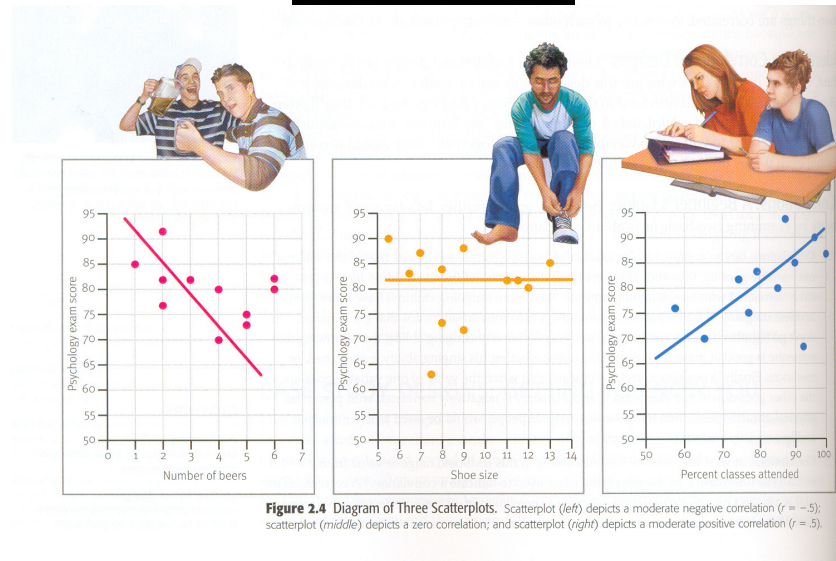


Image source: Psychology, Lilliefeld

### Examples of Correlations

- Is there an association between number of beers consumed and the psychology exam score?
- Is there a relationship between attendance and psychology exam score?
- Do people exhibit more aggressive behavior when it is hot?
- Does the score on the “pre-quiz” predict your final grade in the course?
- Is there a relationship between the number of books in a family’s home and the child’s school grades?
- Does CEO pay predict performance?



### Advantages of correlations:


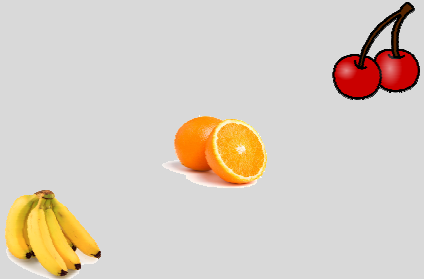

- Large amount of information can be gathered quickly.
- The method can be used in field as well as laboratory settings.
- It can assess the strength of a relationship and provides the basis for other predictions.
- It can rule out some factors that are relevant for prediction and identify others for study.

### Disadvantages of correlations:

- Difficult to establish cause-and-effect relationships.

## Correlations


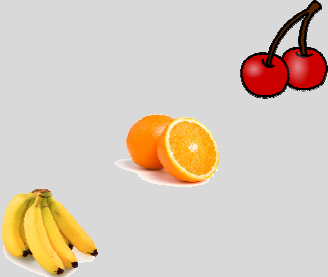
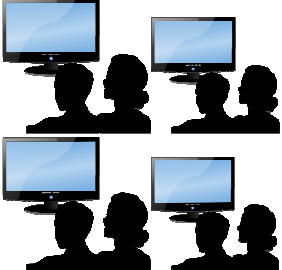

If we have a hypothesis that eating more fruit is associated with lower cholesterol. We measure how much fruit you eat and your cholesterol levels, we can find that these variables are associated with one another—people who eat more fruit have lower cholesterol levels.

		
We measure or observe how much fruit they eat, and measure and observe their cholesterol levels, and can find that those who eat more fruit have lower cholesterol levels than those who eat less fruit.		
Amount of fruit eaten		Level of cholesterol
	have	Lower cholesterol
	have	Higher cholesterol

However, because we have done a correlation (measuring the variables, we cannot know if eating fruit causes lower cholesterol levels.

## Correlations

We cannot determine cause and effect relationships with only a correlational study that measures/observes variables. In this case, a third variable could cause changes in both variables—the amount of fruit eating and cholesterol levels—such as lifestyle.

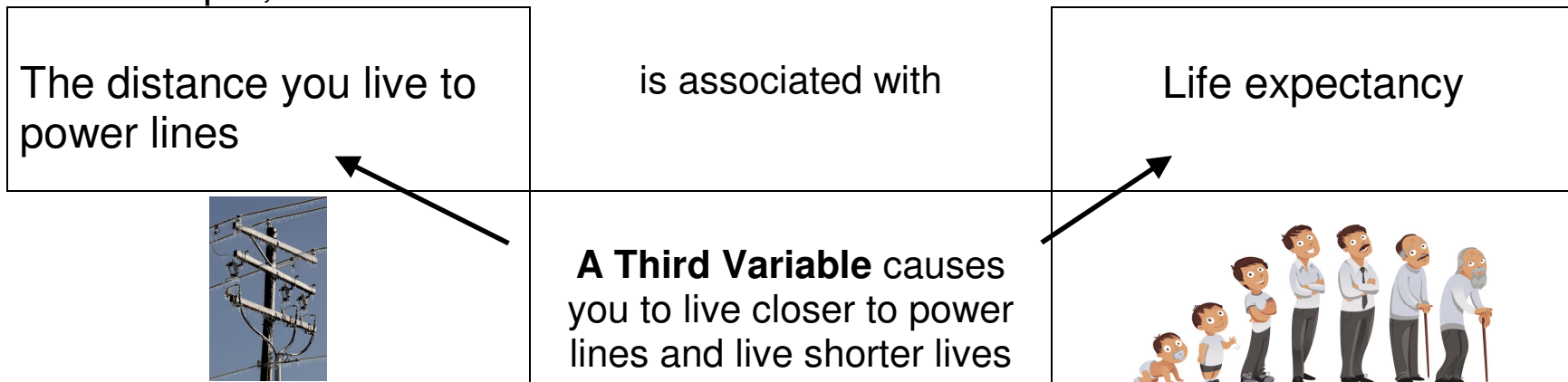
We measure or observe how much fruit they eat, and measure and observe their cholesterol levels, and can find that those who eat more fruit have lower cholesterol levels than those who eat less fruit.			
Amount of exercise	Amount of fruit eaten		Cholesterol level
		have	Lower cholesterol
		have	Higher cholesterol

## Limits of Correlations

Just because two variables are related, doesn't necessarily mean that there is a causal relation between them. There could be a third variable causing changes in both variables, and often referred to as the 3<sup>rd</sup> variable problem (see [page 25](#)).

Correlations by themselves can't determine causal relations. Correlations only tell you what variables are associated with each other.

For example,








- The shorter the distance you live to power lines, the shorter your life expectancy is.
- The farther away you live to power lines, the longer your life expectancy is.

Based on correlations alone, it cannot be concluded that the power lines cause people to live shorter lives. It is generally believed to be another factor that causes people who live under power lines to live shorter lives.

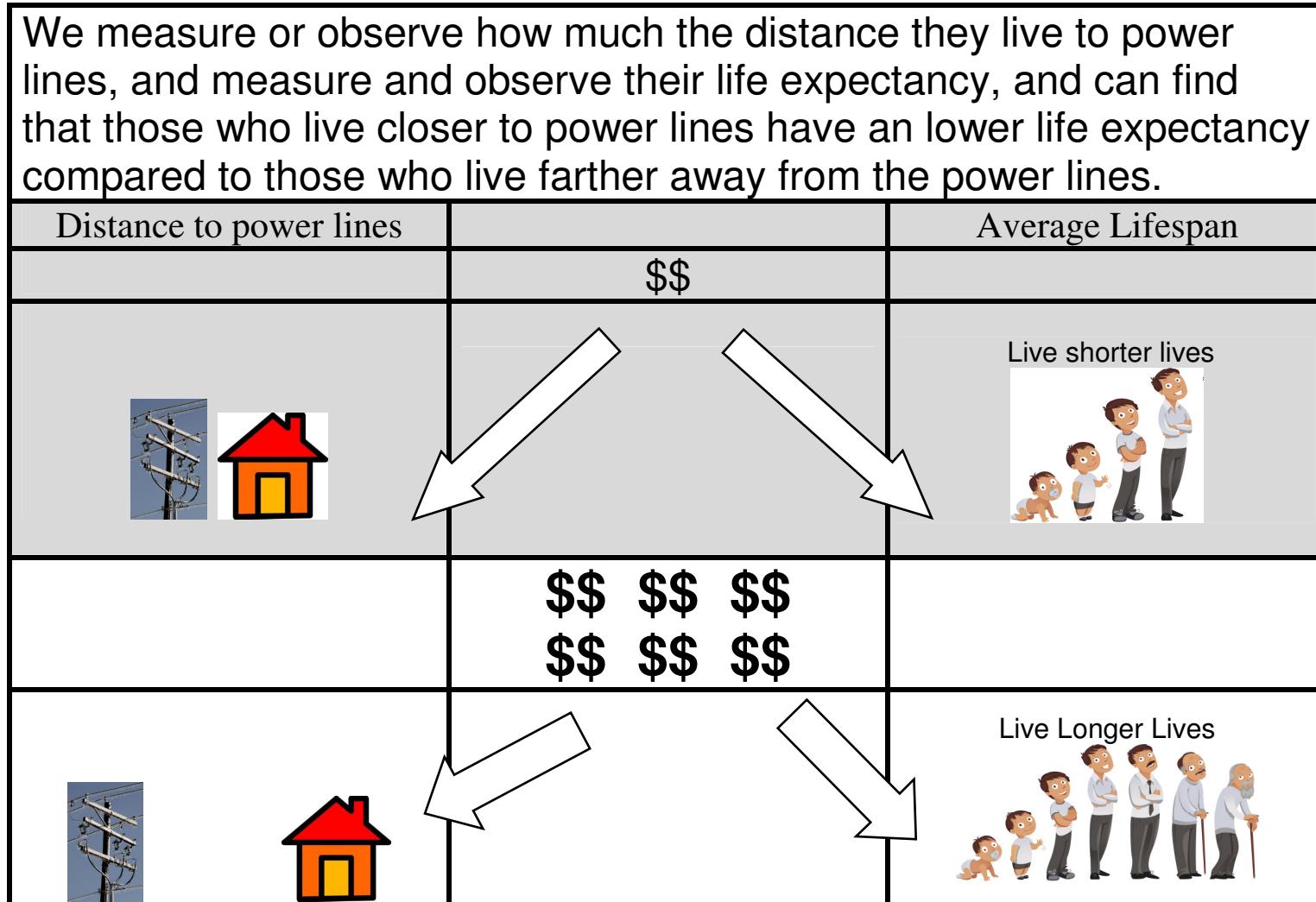
If you incorrectly believe in a causal relationship between life expectancy and power lines, you are unlikely to solve the problem.

## Correlations

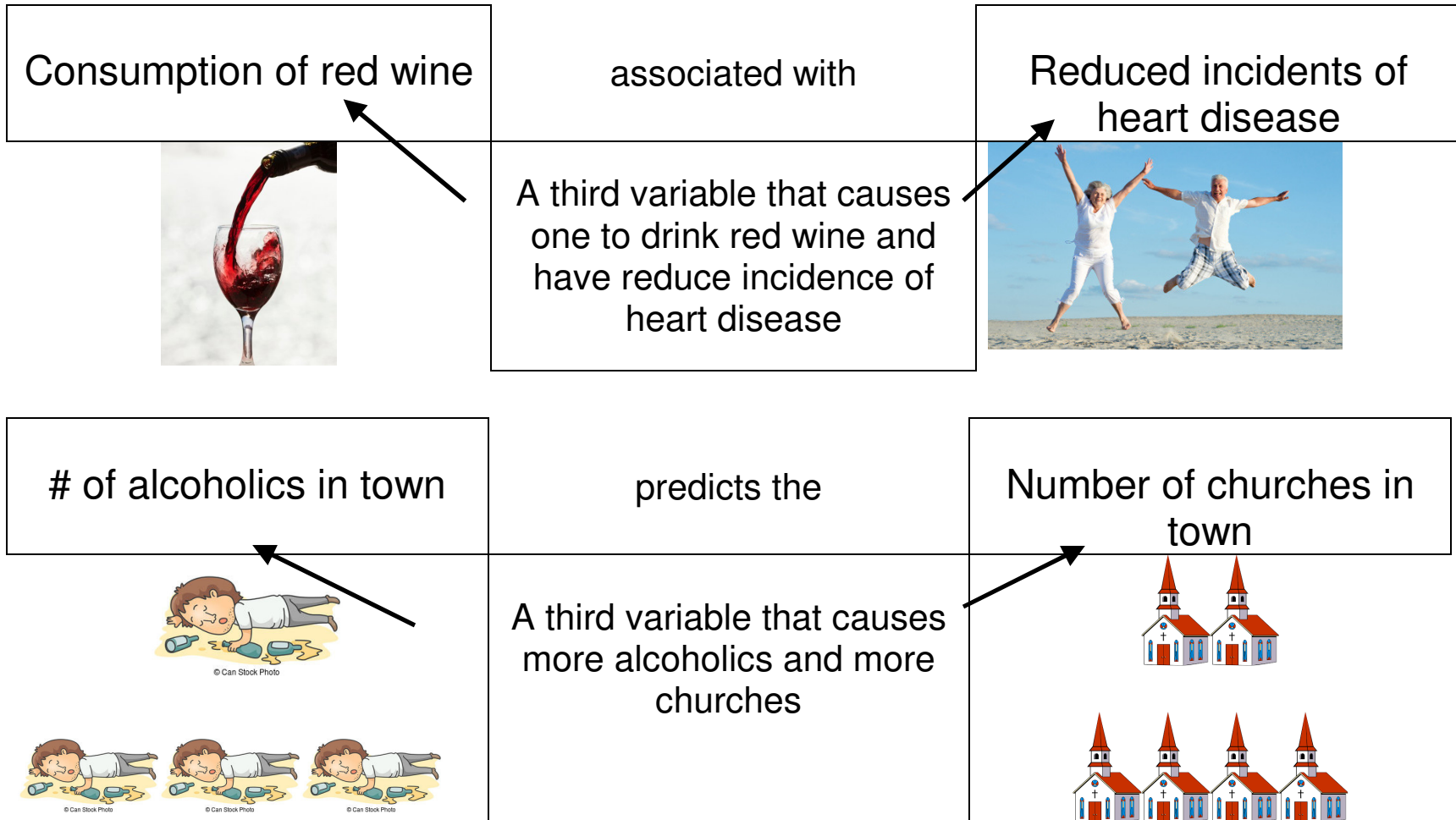
If we have a hypothesis that living closer to power lines is associated with living a shorter life.

		
<p>We measure or observe how much the distance they live to power lines, and measure and observe their life expectancy, and can find that those who live closer to power lines have an lower life expectancy compared to those who live farther away from the power lines.</p>		
Average Distance to Power Lines		Average Lifespan
	have	 Live shorter lives
	have	 Live Longer Lives

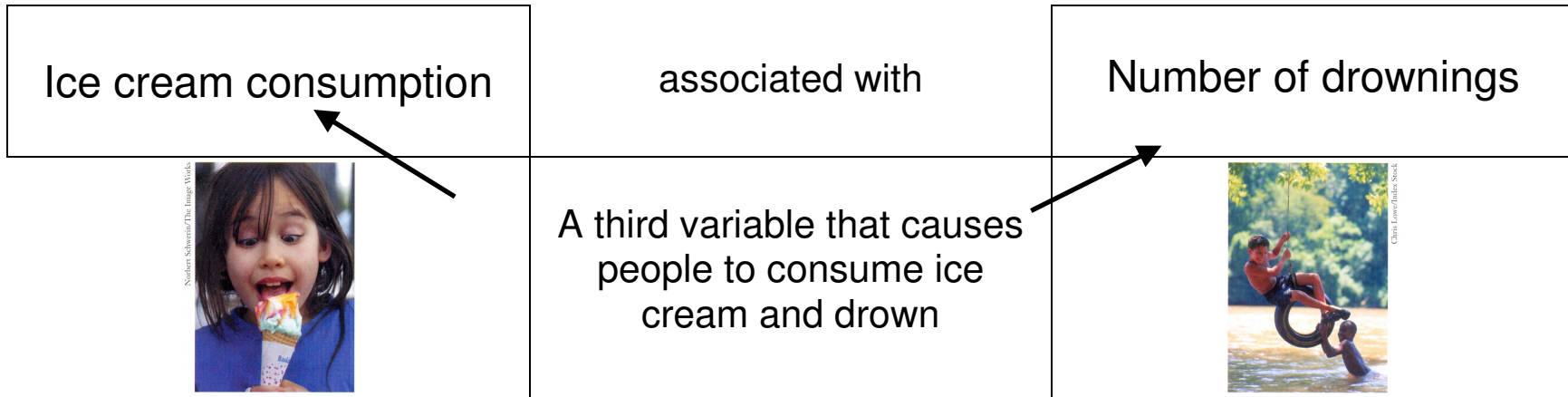
However, because we have done a correlation (measuring the variables, we cannot know if living closer to power lines causes you to live a shorter life.



## Correlations that are not causal (3<sup>rd</sup> variable problem)







## Limits of Correlations

If there is a causal relation between the variables in a correlation, a correlation by themselves cannot tell you the direction of the causal relation (see [page 50](#)).

From the movie High Fidelity, John Cusack makes a personal observation that people who listen to pop music are depressed.

Observation:

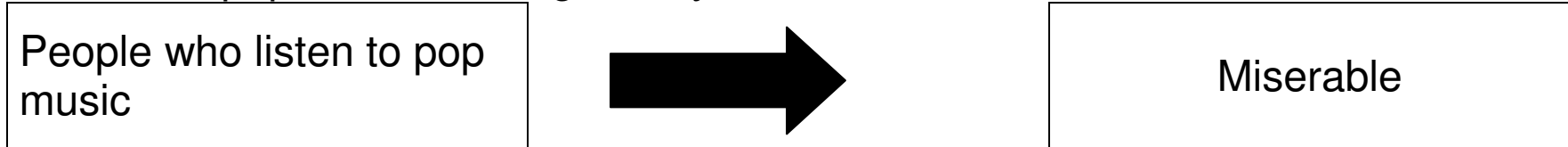
People who listen to pop  
music

are

Miserable

Assuming that there is a causal relationship,

- Is the pop music causing misery?



OR

- Is the misery causing people to listen to pop music



## Correlations

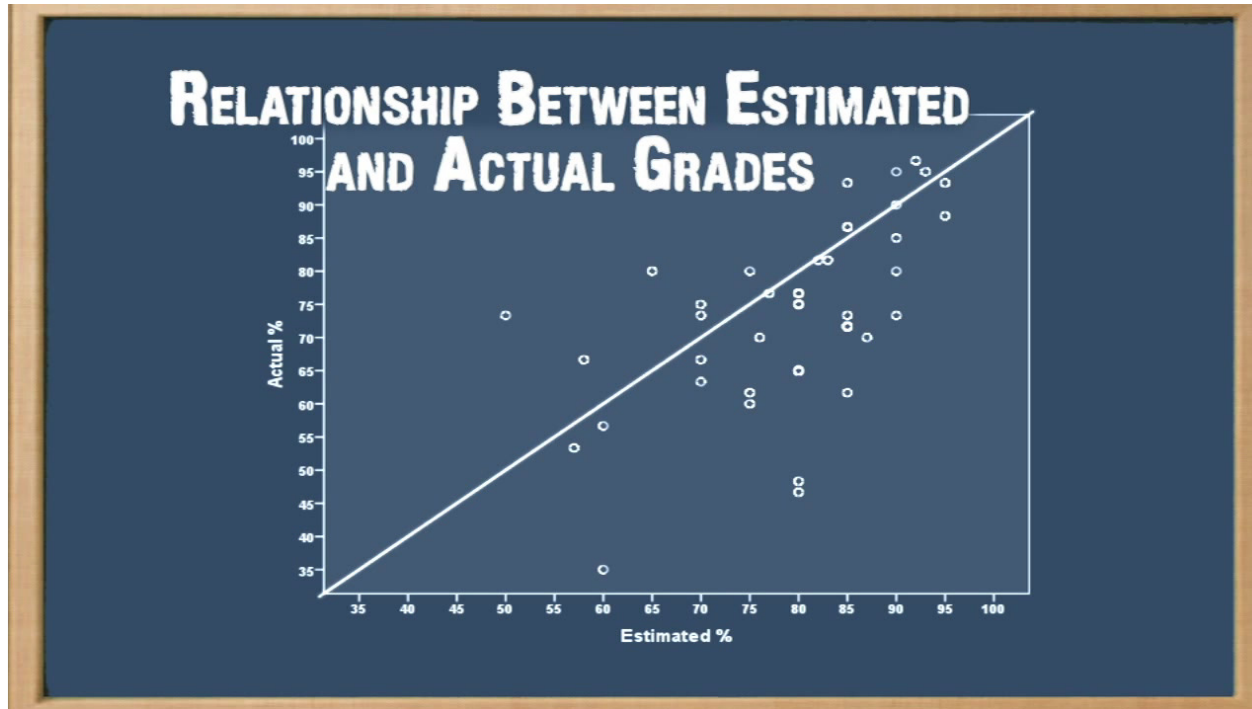


Image source: Belief that Make You Stupid, part 1