

Exercise 8.1

(1) This herbal remedy helps you heal faster. This morning I cut my finger. I took the herbal remedy straightaway and now, just a few hours later, my finger has almost stopped bleeding!

There is a causal claim – that the herbal remedy applied caused the finger to stop bleeding faster than it otherwise would have. The argument does not support the conclusion – it seems to be an example of the *post hoc* fallacy. Perhaps the finger would have stopped bleeding even without the remedy – there is no way to tell.

(2) In August this year we began a campaign to get the government to abandon the proposed desalination plant. Today the government has announced that the plant will not go ahead. Our campaign was successful.

There is a causal claim in this argument – that the campaign was causally responsible for the government abandoning the desalination plant. But the argument does not support the conclusion. The reasoning is *post hoc*: we did something and then something happened. So what we did was causally responsible for what happened. But perhaps the government's decision had nothing to do with the campaign.

(3) The last five times I've been to this restaurant the food has been excellent. This time, the food is only average. They must have a new chef.

The (implicit) causal claim is that the new chef is responsible for the decline in quality of the food. But there are many other possible explanations, including chance. That is, perhaps nothing at all has really changed at the restaurant. Even if that is case, you would expect some essentially random variation in the quality of the food each time you visit.

(4) A large scale study compared 250 schools across Australia, selected at random from a wide range of different socio-economic areas. It found that the schools which have the highest average student grades tend to be the smaller schools; the schools in the top 5% for student achievement are in the bottom 5% for size. Therefore, we should encourage smaller schools if we want to improve student performance.

The implicit causal conclusion from the data is that students do better *because* they are at a smaller school. Only if you thought that would it make sense to suggest that we should encourage smaller schools in order to improve student performance. The correlation between size and performance however might be explained in other ways. The most likely is that the effect is due to chance. Smaller schools mean a smaller sample of students. A smaller sample means above (and below) average results are more likely. (cf the 'kidney cancer' example)

(5) Signs posted around a university campus: "Improve your marks. Go to PASS. Students who attend more PASS sessions (Peer Assisted Study Sessions) get better marks."

The causal claim is that students get better marks because they attend PASS sessions. The premise is that there is a positive correlation between the number of PASS sessions a student attends and higher grades. But the premise does not support the conclusion: it does not follow from this alone that going to PASS can help to improve your marks. It may be that students who are academically higher achievers are more likely to go to PASS sessions than other students.

(6) During the three months before and the three months after a major earthquake in California, students at a college there happened to be keeping a record of their dreams. After experiencing the earthquake, half of the students reported dreaming about earthquakes. During the same six months, a group of college students in Ontario who had never experienced an earthquake also recorded their dreams. Almost none of the students in Ontario reported dreaming about earthquakes. So it is clear that experiencing an earthquake can cause people to dream about earthquakes.

Again, the premise states a correlation between experiencing earthquakes and experiencing them: amongst this group of students those who had experienced earthquakes were more likely to dream about them than those who had not experienced earthquakes. Although it is almost certainly true that experiencing an earthquake can cause you to dream about earthquakes, the stated correlation is not sufficient by itself to establish that the Californian students dreamed about earthquakes *because* they experienced them. Perhaps Californian students dream a lot about earthquakes whether they have experienced them or not. Knowing that earthquakes are common in California might be enough to cause dreams about them.

(7) Intelligent children are more likely to become vegetarians later in life, a study says. A Southampton University team found those who were vegetarian by 30 had recorded five IQ points more on average at the age of 10. The study of 8,179 was reported in the *British Medical Journal*. Twenty years after the IQ tests were carried out in 1970, 366 of the participants said they were vegetarian - although more than 100 reported eating either fish or chicken. Men who were vegetarian had an IQ score of 106, compared with 101 for non-vegetarians; while female vegetarians averaged 104, compared with 99 for non-vegetarians. (BBC news report, December 2006)

There is no causal claim here. The study simply reports a correlation; there is a positive correlation between childhood IQ scores and being a vegetarian later in life. Children with higher IQ scores are more likely to become vegetarians. No causal connection is mentioned or inferred in the report however. If someone did take this as showing that people become vegetarian because they are more intelligent (or vice versa!) that would not be supported by the evidence. A correlation alone is not sufficient for causation.

(8) Since the approximate number sense is essential for survival, it might be thought that all humans would have comparable abilities. In a 2008 paper, psychologists at John Hopkins University and the Kennedy Krieger Institute investigated whether or not this was the case among a group of 14-year-olds. The teenagers were shown varying numbers of yellow and blue dots together on a screen for 0.2 seconds and asked only whether there were more blue or yellow dots. The results astonished the researchers, since the scores showed an unexpectedly wide variation in performance. Some pupils could easily tell the difference between 9 blue dots and 10 yellow, but others had abilities comparable to those of infants – hardly even able to say if 5 yellow dots beat 3 blue. (From Alex Bellos, *Alex's Adventures in Numberland*)

There is no causal claim in this passage. It simply reports the fact that there is wide variation in school children's abilities to estimate the number of dots in a scene without counting them.

(9) An even more startling finding became apparent when the teenagers' dot-comparing scores were then compared to their maths scores in kindergarten. This study found a strong correlation between a talent at reckoning and success in formal maths. The better one's approximate number sense, the higher one's chance of getting good grades. This might have serious consequences for education. If a flair for estimation fosters mathematical aptitude, maybe maths classes should be less about time tables and more about honing skills at comparing sets of dots. (From Alex Bellos, *Alex's Adventures in Numberland*)

In this paragraph, we do find a causal claim: 'a flair for estimation fosters estimation' and a suggestion that we might therefore improve students' mathematical skills by trying to improve their ability to estimate without counting. The causal claim is perhaps only tentatively put forward here though: IF a flair for estimation fosters mathematical talent, then MAYBE

In any case, the correlation between estimation ability and grades in mathematics is not sufficient to establish the causal claim.

(10) A study investigated the association between hyperactivity and how much sugary food there is in a child's diet. Here is a table showing the results.

| | | Greater than recommended sugary food in child's diet | |
|---------------|-----|--|----|
| | | Yes | No |
| Hyperactivity | Yes | 250 | 50 |
| | No | 50 | 10 |

Did this study find a correlation between sugar food in a child's diet and hyperactivity? If so, does that imply there is a causal link between the two? If not, what alternative explanations might there be of the correlation?

The study did **not** find a correlation between sugar intake and hyperactivity. **250/300** (=83%) of children with excess sugar consumption were hyperactive. **50/60** (83%) of children who did not have excess sugar consumption were hyperactive. So the children who had sugary food were **not** more likely than those who didn't to be hyperactive.

Studies shown that people often find **illusory correlations** between variables when presented with this kind of information. People pay attention only to the top left cell.

Lots (69%) of children ate sugary foods and were also hyperactive. But to establish correlation, you need to use *all* the cells. What percentage of children who ate sugary foods were hyperactive? What percentage of children who did *not* eat sugary foods who were also hyperactive?

This tendency to see correlations where none exist is another reason why people believe in spurious causal connections:

“Every time I’ve prayed for something, I got it”. (How many times did you get what you want *without* praying?)

“Every time I took echinacea when I had a cold I got better” (How many times did you get better *without* taking echinacea?)

Exercise 8.2

(1) Therapeutic Touch (TT) is an alternative medicine technique said to be used by over 40,000 nurses in North America alone. It is supported by major nursing organizations and gets favourable mention in the media. TT practitioners claim that an “energy field” unknown to science surrounds the human body and that practitioners can use their hands to detect and manipulate this field. (No physical touching of the body is involved, though.) In particular, they say that they can cure disease by “balancing” people’s fields, which are said to extend four to eight inches from the surface of the skin. Many people do in fact report feeling better after TT treatment.

Only one thing that might be called ‘evidence’ is given here: “Many people do in fact report feeling better after TT treatment.” But clearly that is not sufficient to establish that they got better because of the therapeutic touch. The talk of an ‘energy field unknown to science’ is a further cause for skepticism. Very unlikely claims require stronger evidence.

(2) A macrobiotic diet can be effective against cancer. Macrobiotics is a lifestyle and diet derived from Far Eastern ideas and promoted by many adherents. The diet is semi-vegetarian and low in fat. In recent years there have been many published accounts of people who say they have recovered from cancer because they ate a macrobiotic diet. There have also been several case reports. Attempts have been made to compare the outcomes of these cases to those of patients with comparable cases of cancer who did not follow a macrobiotic diet. These comparisons show that people on the macrobiotic diet often have better outcomes.

The fact that people *say* they recovered because of their diet is not good evidence that they really did get better because of their diet. People’s opinions about what caused what are not very reliable, especially when it comes to complex issues such as the relationship between diet and health. How could people really know what caused them to get better? How could they know they wouldn’t have got better if they had not been on the macrobiotic diet?

The second item of evidence is that there is an observed correlation between being on a macrobiotic diet and recovering from cancer. This is much better than relying on self-reports but it is still only a correlation. For all we know, the two groups might well have differed in lots of other relevant variables, not just on whether they were on the macrobiotic diet.

(3) Shark cartilage has been called to public attention by a CBS *60 Minutes* program focused on the theories of biochemist William I. Lane, Ph.D, author of *Sharks Don’t Get Cancer*, Narrator Mike Wallace began by calling attention to the book and stating that Lane says that sharks don’t get cancer. The program focused on a Cuban study of twenty nine “terminal” cancer patients who were given shark-cartilage preparations. Wallace visited the site of the experiment, filmed

several of the patients doing exercise, and said that most of the patients felt better several weeks after the treatment had begun. Two American cancer specialists then said that the results were intriguing. One, who was aligned with the health-food industry, said that three of the patients appeared to have improved. The other, who appeared to be solidly scientific, noted that evaluation was difficult because many of the X-ray films were of poor quality, but he thought that a few tumours had gotten smaller.

Firstly twenty-nine is a small sample. All the people in the sample were given shark cartilage: there was no control group of similarly sick people who were not given shark cartilage. Since there is no control group, we cannot tell whether these people would have felt better even if they had not got the shark cartilage. Also note that 'feeling better' is not quite the same thing as 'being better'. There might have been no change at all in the underlying progress of the patients' cancer. They might just have said they felt better to please the producers of the TV documentary. Or they might have felt better because they were getting lots of extra attention and perhaps feeling hopeful again.

The evidence obtained by actually looking at the tumours is more objective of course. But deciding whether tumours have grown or shrunk by looking at a fuzzy X-ray might be inaccurate. There is also a possibility of bias: if you expect or want to see the tumours shrinking, you might (even inadvertently) overestimate the effect. This would especially relevant for the cancer specialist who was 'aligned with the health-food industry' but not entirely absent from the other doctor either.

In a properly done experiment, the people looking at the X-rays would not know whether they were looking at X-rays from a patient who got the shark cartilage or an X-ray from a patient who did not. (That is, they would be 'blind' to whether the patient was in the control or treatment group). That way, their hopes and expectations cannot systematically bias the results.