Analysis of information – think critically!

Site: INASP Moodle
Course: Questioning as we learn: An introduction to critical thinking (AQHEd-SL)
Book: Analysis of information – think critically!
Printed by: Veronika Schaeffler
Date: Friday, 23 November 2018, 2:29 PM

Table of contents

Introduction and learning outcomes

Facts and opinions
Why should we engage with facts and opinions?
Distinguishing facts and opinions

Causality
Correlation does not necessarily mean causality
Causality, correlation or simply coincidence?
Learn more about causality

Conditional statements
Identify conditional statements
Learn more about conditional statements

Fallacies
False cause
Irrelevant reasons
Ad hominem
Cherry–picking
Argument from ignorance
Deepen your understanding of fallacies

What have I learned?

References and further resources

Introduction and learning outcomes

Whenever we hear or read an argument, we should be alert to what the person who makes a claim wants to persuade us to accept or to do. This kind of alertness makes us less vulnerable to manipulation, and more reassured that what we accept has been filtered through our own best thinking. Our modern times are characterised by an abundance of information and we face the big challenge how to judge the quality of available information we deal with, as student, as responsible citizen, in any job or in our private life. Remember: critical thinking is reasoned and it involves making evaluative judgments about claims and arguments.

In this unit you will learn how to

- Distinguish between facts and opinions
- Recognise cause–effect relations
- Avoid mistaking correlations or simple coincidences for causality
- Understand what you can or cannot conclude from conditional statements
- Spot some of the more common fallacies

This unit provides the basic tools to avoid common pitfalls in reasoning. It includes several activities fo you to practise analysing statements and texts, and also encourages you to reflect on how your new knowledge and skills can help you to handle information like a critical thinker does.

Facts and opinions

An important aspect of handling critical information is to be able to distinguish between facts and opinions. While a fact is something that everyone knows and accepts, opinions are viewpoints that some people might not share – someone might convincingly argue against that opinion, and hold a radically different or opposite one. Opinions are not reliable unless supported by sound evidence (i.e. facts).

Comic from Crimes Against Hugh's Manatees by Hugh D. Crawford (1)

The following pages will help you to understand why it is important to distinguish between facts and opinions, and how you can do that.

Why should we engage with facts and opinions?

Exploratory activity

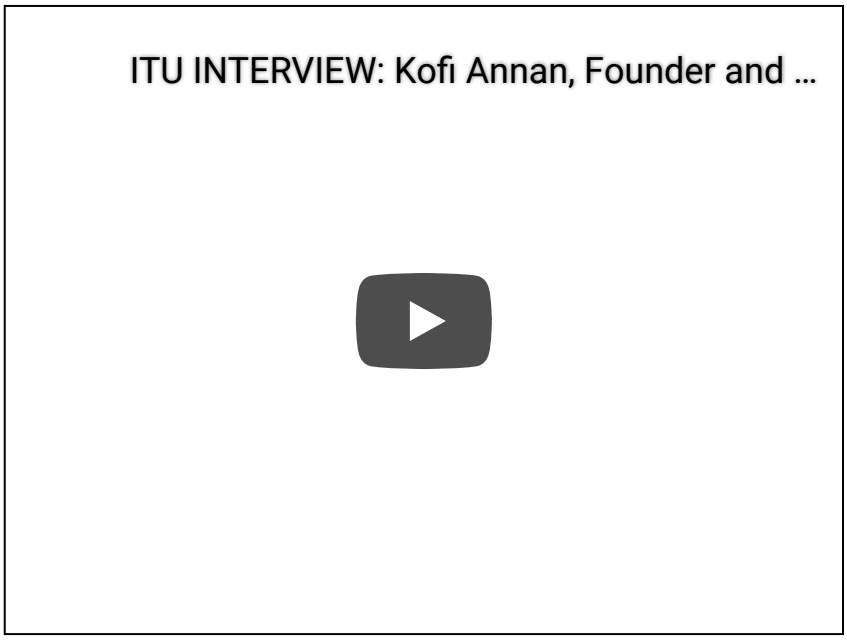
Watch this short video clip. It showcases the late 7th UN Secretary-General Kofi Annan in an interview about information exchange. Reflect on the messages Kofi Annan conveys and answer the following questions:

- What kind of information is Kofi Annan speaking about? Which of his remarks relate to facts and which to opinions?
- Why do you think Kofi Annan speaks about this topic in his role as a youth leadership activist? What does he say about why it is important to share information?
- Do you think there are good reasons why (young) people should engage with the evaluation of information and the exchange of opinions?

Note your thoughts down. Post your ideas in the discussion forum if you'd like to share them with your fellow students.

Interview with Kofi Annan about information exchange

Note: The video below is set to play for a part (approx. 2.5 min) of its full duration. Only this part is relevant to this activity.



Video 'ITU Interview: Kofi Annan, Founder and Chairman, Kofi Annan Foundation' (1)

Watch the video further on from 7.14 to 8.25 in order to hear Kofi Annan's answer to the last question we asked you above.

Distinguishing facts and opinions

As you are reading or listening to a speaker, you want to be able to tell whether you are offered a fact or an opinion. Let's begin with what facts and opinions have in common: both are statements. The first distinction between the two is that a fact is objective, while an opinion is subjective. A fact can be proved by direct experience – observation or testing – to be true or false, and it can be objectively verified. An opinion, on the other hand, expresses feelings, judgements, preferences and predictions which you can agree or disagree with. Opinions can be supported with facts or knowledgeable opinions.

Sometimes, in communication – whether written or oral – it can be difficult to tell fact from opinion because the two become entangled. Take, for instance, this statement:

The preferred scientific name of the tiger is 'panthera tigris', as you can see in the 'IUCN Red List of Threatened Species'.

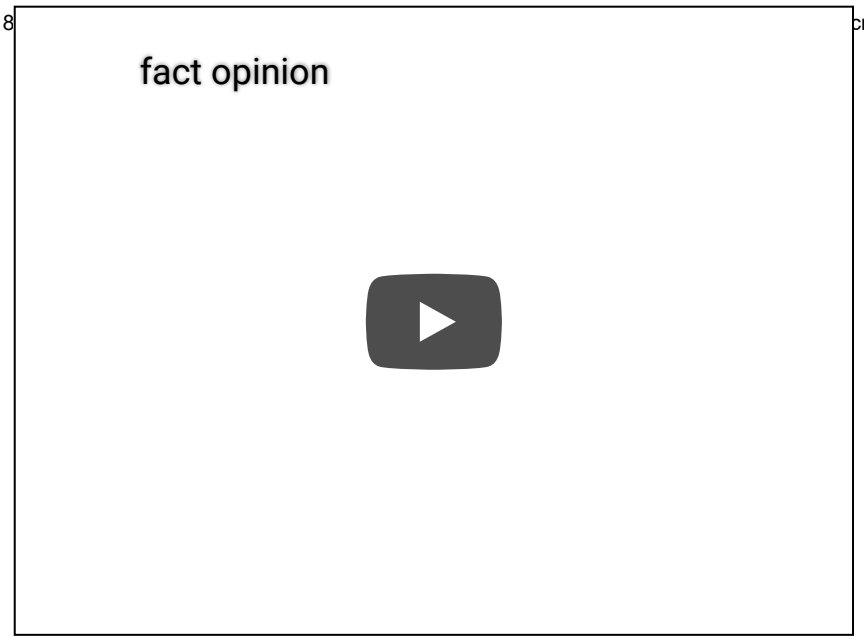
Is this a fact or an opinion? You can verify quite easily that the IUCN Red List (1) does indeed give 'panthera tigris' as the scientific name for tigers. Just go to the IUCN Red List and look that up (www.iucnredlist.org/details/15955/0). And the IUCN Red List also states that there are synonyms such as 'Felis tigris Linnaeus, 1758'. However, the term 'preferred' in the statement above makes us ponder: Who has decided that this is the preferred name? And which criteria have been used for this decision? Has the preference been inferred from the fact that the term 'panthera tigris' is more often mentioned in scientific literature than synonyms? Or because other taxonomic sources list 'panthera tigris' as the scientific name too?

So it seems it is rather an opinion than a fact that the preferred scientific name is 'panthera tigris', as the preference is based on underlying criteria which not all people may accept. Now, to make sure that we express no opinion here, but only verifiable facts, we can change the statement above as follows:

According to the IUCN Red List of Threatened Species', the scientific name of the tiger is 'panthera tigris'.

Optional activity

The following video can help you to understand the difference between facts and opinions better. So if you feel the difference is still not very clear to you, watch the video before completing the quiz below.



Video 'Fact opinion' (2)

Quiz

Read the statements about tigers below and decide whether they are facts or opinions. Think critically and try to apply what you have learned so far! And always try to state the reasons why you think the statement is a fact or an opinion. Don't worry if you don't get the answers right first time; we learn from our mistakes and you can repeat the quiz how often you like. Only a very experienced critical thinker would have no difficulties with answering the questions.

Question 1

According to the Biological Library BioLib (3), Felis tigris Linnaeus, 1758 and Panthera tygris are scientific synonyms of 'Panthera tigris (Linnaeus, 1758)'.

Is this statement a fact or an opinion?

- ○ Fact
- ○ Opinion

Check

Question 2

Tigers are territorial and generally solitary but social animals, often requiring large contiguous areas of habitat that support their prey requirements. (3)

Fact or opinion?

- Fact
- Opinion

Check

Question 3

In a blog by One Green Planet (4), we are told that many conservation experts have come to believe the following:

Given the continued decimation of tiger populations in the wild, the only way to ensure the species' long-term survival is to maintain and breed a stable population of captive tigers, with the hope of eventually releasing them back into the wild when conditions become more favourable.

Do the experts state a fact or express an opinion?

- Fact
- Opinion

Check

Question 4

Nelson Mandela describes in his book Long Walk to Freedom (5) that he and his fellow prisoners on Robben Island talked over and over again about whether or not there were tigers in Africa. Some of Mandela's fellow prisoners said that they have seen tigers in the jungles of Africa with their own eyes.

Do Mandela's fellow prisoners make a statement of fact or express an opinion?

Once you have done the quiz, try to answer the following questions:

- Was it easy or challenging to decide what is fact and what is opinion?
- How did you make up your mind? Were there any clues?
- Were all your answers rated as correct? Do you think it is always clear cut what is fact and what is opinion?
- Do you think facts can be false? Do you think opinions can be wrong?

Note your thoughts down. Post your ideas in the discussion forum if you'd like to share them with your fellow students.

Causality

By working through the following pages, you will learn about the cause–effect relationship and why correlation does not mean the same as causality. Start with the short activity below.


Reflective activity

In everyday life, arguments (i.e. disputes) often start because someone blames someone else for causing an undesired outcome. “If you hadn't done that, we would be fine now.” Or we blame something, an event, an incident: “If the alarm clock had gone off, I wouldn't have overslept”, “if it hadn't been for the traffic jam, I wouldn't have been fired for being late”, etc. Can you recall a situation like the above, when either you were blamed or you blamed someone or something for an unpleasant outcome? Was the unpleasant outcome actually caused by whoever or whatever was blamed? Or do you think the real cause was someone/something else?

Note your recollections down. Post your ideas in the discussion forum if you'd like to share them with your fellow students.

Correlation does not necessarily mean causality

To understand our past and present, and to foresee the future, philosophers and scientists since ancient times have been preoccupied by the issue of causality, i.e. the relationship between cause and effect.

Cause–effect relation – or causality – is the connection between two events occurring in such a way that one event (cause) leads to another (effect). For example, standing in the rain will cause you to get wet. Heavy rain over a long time causes flooding. Excessive deforestation causes soil erosion.

However, not every connection between two events is a cause–effect relation. A correlation is simply a bidirectional relationship between two things. Moreover, some correlations between events or circumstances may be false, and to conclude anything from putting them together would be reckless. One of the funniest examples of such a rash conclusion is related in the anecdote of a farmer and his wife travelling on a train. A fellow passenger offers them an unfamiliar fruit they had never tasted before. Just as the husband bites into the fruit, the train enters a dark tunnel. Terrified by the effect of the fruit, he tells his wife, “Don’t you eat that fruit, Susie, it will make you go blind”. Coincidences are ‘by chance’ concurrences with no apparent causal connection.

Causality, correlation or simply coincidence?

Exploratory activity

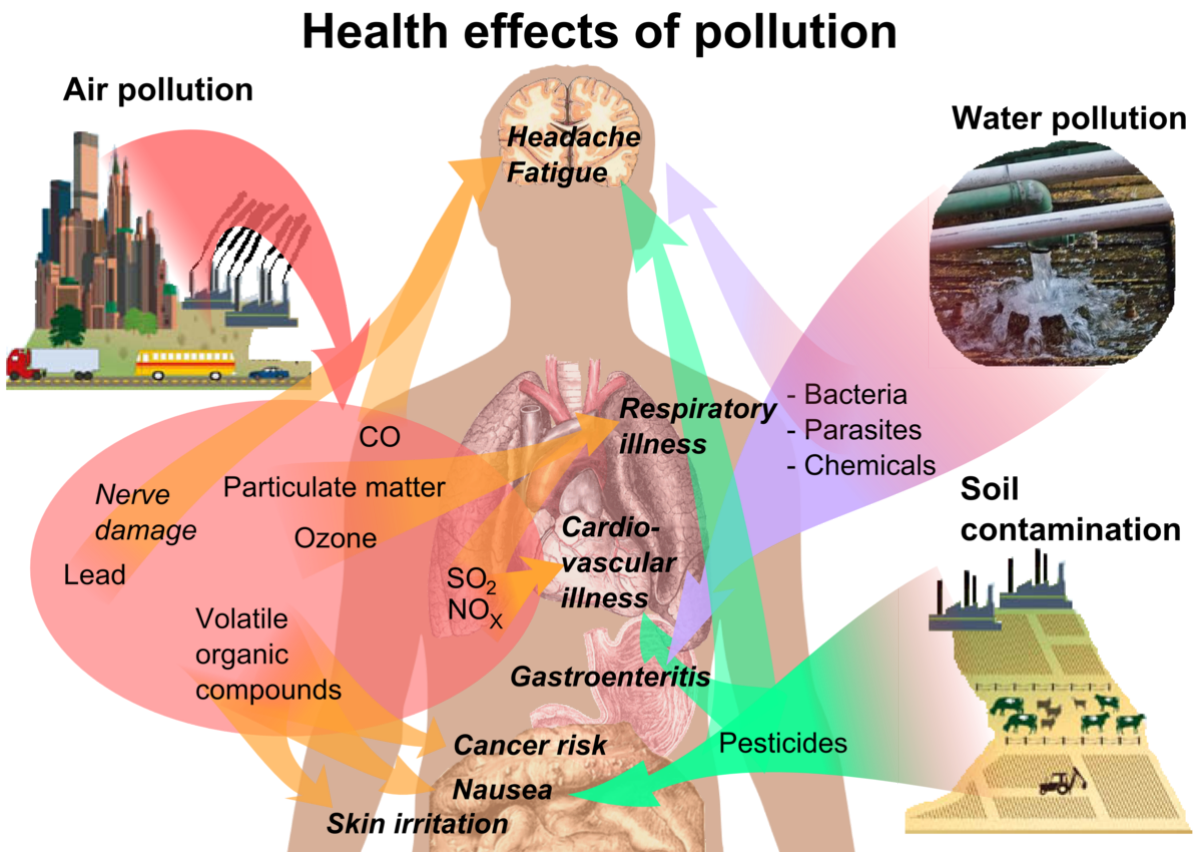
Look at the diagrams below and answer the following questions:

- What items do they depict?
- What kind of relationship do the items have? Are there any causal relationships?
- What happens with the other items if one item increases or decreases?

Make notes. Once you have thought through your answers for each diagram, you can reveal the comment below.

Diagram 1 – Health effects of air, water and soil pollution (1)

Please note that you only need to think through a couple of relationships; pick two or three items in this info-graphic that are related and answer the questions above.



Reveal Hide

The above diagram pictures cause–effect relations between air, water and soil pollution, and human health. Have you spotted a few relationships? For example, that air pollution through substances such as lead or carbon monoxide (CO) can cause headaches and fatigue. Water pollution through bacteria, parasites or chemicals can cause gastroenteritis (sickness that involves the stomach and small intestine).

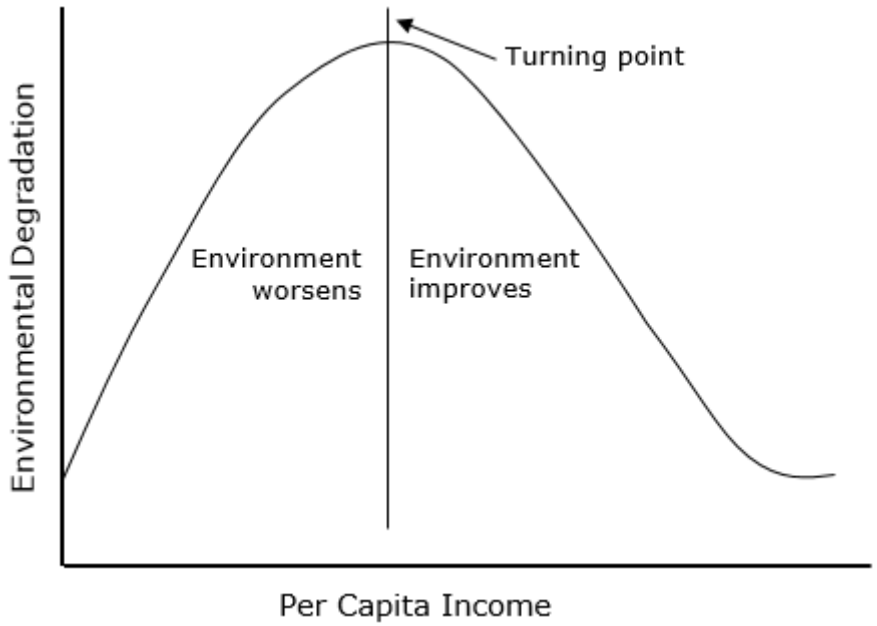
Research has proved relationships between environmental factors and diseases. But be careful and do not jump to premature conclusions in reality. Let's imagine the following scenario:
A community has a battery recycling plant and the factory increases the production of lead over the course of time. At the same time, doctors start to record an increase in patients suffering from headaches and fatigue. Researchers start to investigate possible causes for the increase. The diagram shows some potential causes. For example, the plant could cause pollution of the air with lead which can cause nerve damage in humans and result in symptoms such as headaches and fatigue. Then there could be a cause–effect relationship between the increase in lead production and the air pollution which causes the patients' suffering.

However, it could also be that the root cause is an increase in the population of the wider community. The factory receives more batteries to recycle which leads to higher lead production but there have been built more clinics and medical surgeries, and a higher number of people are visiting a doctor when they are unwell. The increase in recorded numbers of patients with headaches and fatigue is actually caused by more doctor visits and not linked to air pollution or any other pollution through the plant. The lead production and the recorded numbers of head ache and fatigue are correlated in the way that they have the same root cause – the economic development of the community – but they don't have a direct cause–effect relationship.

Of course, it could also be pure coincidence. For example, a new director started in the factory around the same time as the community clinic got new management. The plant director increases the lead production and the new clinic management demands more diligent recording of patient cases which results in an increase of recorded headaches and fatigue cases and probably not even an actual increase of patients with these symptoms.

Diagram 2 – Relation between environmental quality and per capita income (2)

Go back to the questions above and describe the relation which is depicted in the following diagram. Make notes and reveal our comments once done.



Reveal Hide

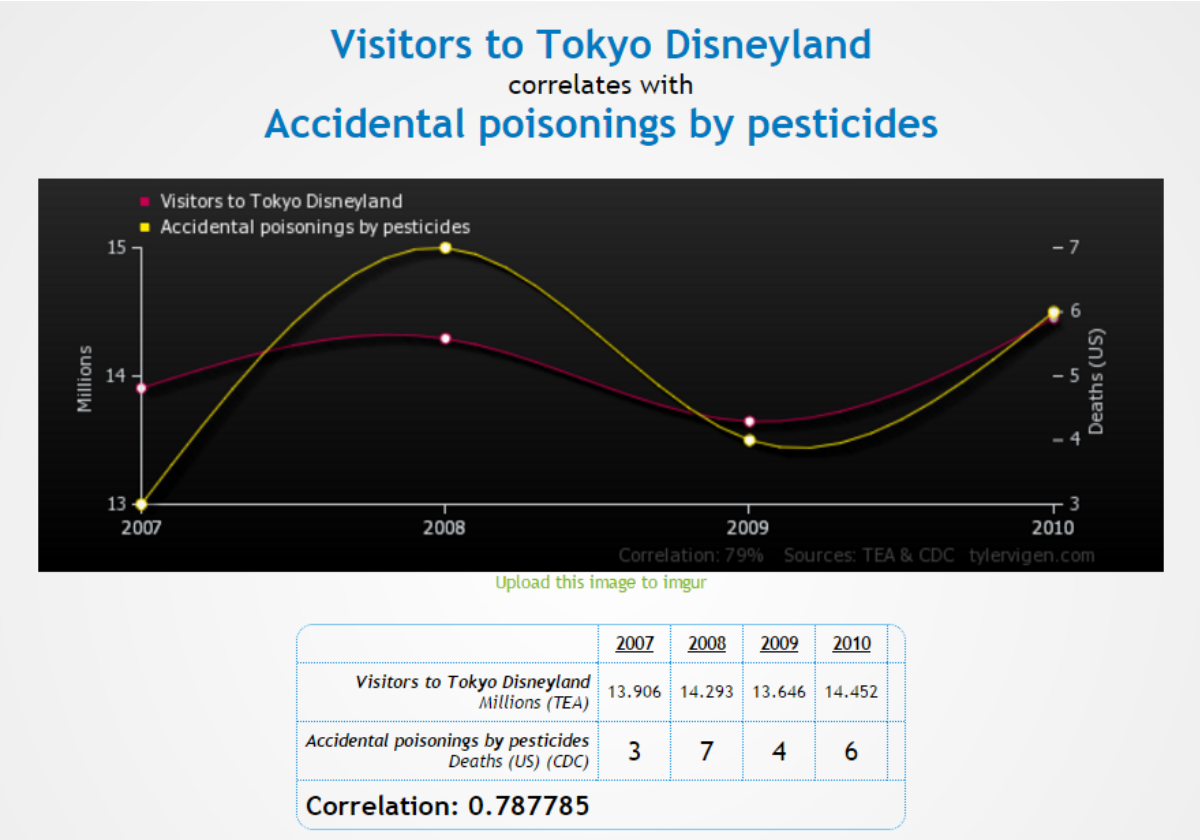
The diagram above shows a correlation between per capita income of a community and environmental quality. There is no information about how the environmental quality is defined and what type of relationship the two items have. Thus, we don't have any information that there could be a causal relationship.

Interestingly, there isn't a linear correlation between the two items; the quality initially worsens with the increase of income and then improves after a turning point.

Can you think of any reasons why this could happen? If so, you have just developed a theory which would need further exploration to prove or disprove your ideas.

Diagram 3 – Relation between accidental poisonings by pesticides in US and visitors to Tokyo Disneyland (3)

Go back to the questions above and describe the relation which is depicted in the following diagram. Make notes and reveal our comments once done.



	2007	2008	2009	2010
Visitors to Tokyo Disneyland *Millions (TEA)*	13.906	14.293	13.646	14.452
Accidental poisonings by pesticides *Deaths (US) (CDC)*	3	7	4	6

Correlation: 0.787785

Reveal Hide

This diagram has been produced by Tyler Vigen, a consultant and former PhD student at Harvard University in the United States. It is part of a series of such quite meaningless correlation diagrams, meant to show that it's possible to draw a graph showing statistical correlation between obviously unrelated items such as poisoning by pesticides in the US and visitors to Disneyland in Tokyo. Tyler wants to encourage people to think critically when looking at correlations and data. What other people present as correlation or even cause–effect may not be what it looks like.

Learn more about causality

Optional activity

Causality is a complex concept. The following video (duration approx. 11 min) can help you to understand it better and explains how to distinguish causality and correlation. We highly recommend watching this video if you want to learn more about causality and correlation.

Video 'Causality' (1)

Conditional statements

Claims can be conditional. This means that a statement's conclusion becomes true only if certain requirements are met. Conditional claims can be tricky. You may hastily draw the wrong conclusion if you don't pay close enough attention. The following pages will help you understand how you can interpret conditional statements correctly.

Let's take this example of a conditional statement:

If it rains, then Peter will watch TV.

In which cases has the speaker told the truth or predicted correctly what will happen? And in which cases has there been something wrong with the speaker's claim?

If it's raining indeed and Peter is watching TV, then the speaker has certainly said the truth.

If it's raining and Peter is not watching TV, then the speaker hasn't predicted the future correctly or given a wrong claim.

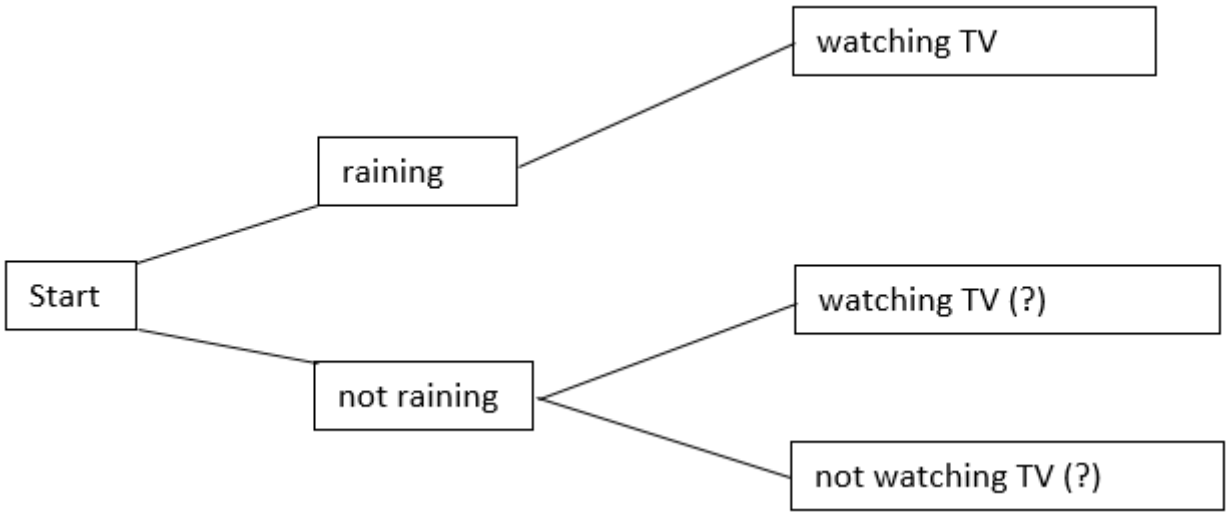
But what follows in terms of the statement's truth if it's not raining and Peter is watching TV or not? Both scenarios are in accordance with the statement. Actually, the speaker hasn't claimed anything for the situation where it's not raining. So Peter can watch TV or not, and the speaker wouldn't have lied.

This also means that if one believes the speaker, one can predict:

- When it's raining, Peter must watch TV. We can predict that without even checking on him.
- When Peter is not watching TV, it is not raining. So one doesn't need to look out of the window to check that.

However, you cannot predict anything when you see that it's not raining; Peter could be watching TV or not. And you cannot predict anything when you see that Peter is watching TV. It could be raining or not.

The tree diagram below may help you understand this - yet another graphic organizer for you to use. The diagram illustrates what the statement expresses – that 'watching TV' can go along with 'raining' or 'not raining', while 'not watching TV' is linked only to 'not raining'.



Tree diagram for the event 'watching TV', dependent on weather conditions

Identify conditional statements


Practical activity

Now read the next text about a research project in Tanzania which you can also download. The project team at Moshi University in Tanzania made some claims, expressed as conditional statements, before starting the project. The statements are predictions about what changes the project could make if it meets certain conditions. Find the conditional (if–then) statements in the first paragraph. Try to illustrate the if–then conditions in a diagram which depicts the conditions and shows what follows from the conditions.

Research access enables agricultural entrepreneurship

An INASP-funded project developed an approach to improving entrepreneurship and innovation in Tanzania to help women develop their business. The project, which took place in Tanzania between February and June 2016, was carried out by the Co-operative Entrepreneurship and Innovation Centre (CEIC) of the Institute of Continuing and Co-operative Education at Moshi Co-operative University. The project team at CEIC said that eradicating poverty represents an enormous global challenge which needs to be addressed to see sustainable global development. The team claimed that the project will contribute to reducing poverty, if it can help people get access to decent work. The team thought that if people have access to the latest knowledge and skills in their respective fields, they will be more likely to innovate and develop business and work. But often people don't know how to access relevant research literature. The university librarian stated that if the university students get training, they will be able to access electronic journals with the relevant research information.

Therefore, the project offered students at Moshi University training in how to access electronic journals. As a result of this training in electronic literature access, the students identified approaches already being used in Ghana and Nigeria that could be used to improve cassava production in Tanzania. Aurelia Isaack, a third-year undergraduate business economics student at Moshi Co-operative University and member of the project team, said: "We didn't know we could use the library password to login onto [online literature] – this is wonderful [that I know this now]. Now I can access a lot of journals to improve my research."

Following the discovery of some relevant approaches in the literature, the group of students took their findings into the field. They identified two groups of female cassava producers in Makiba village (Arusha region) and Makuyuni village (Kilimanjaro region) to undergo training by university personnel to add value to their cassava crops by producing flour. Some 30 women in Makiba village and 27 women in Makuyuni village received training courses on entrepreneurship. The women benefited hugely from the training they received. "Before, we didn't have these seeds to plant cassava – this training helped us so much that we are surely going to harvest enough cassava to meet our food demands," explained Sauda, one of the women from the Makiba group. One group saw a 16% increase in the size of their group by the end of the project, so that more women got access to decent work. Moreover, each of the women is now required to give cassava seeds free of charge to five other women within a community of her choice every season, thereby increasing food production and further improving women's incomes. This made a tangible difference to the lives of the agricultural women, helping to improve their economic situations, secure their livelihoods and contribute to the socioeconomic well–being of their families and communities.

Source: Text adapted from INASP case study 'Research access enables agricultural entrepreneurship' (1).

Once done, you can compare with the sample answer below.

Reveal Hide

Have you found the following three if–then statements?

1. *The team claimed that the project can contribute to reducing poverty, if it helps people get access to decent work.*
2. *The team thought that if people have access to the latest knowledge and skills in their respective fields, they will be more likely to innovate and develop business.*

3. *The university librarian explained that if the students get training, they will be able to access electronic journals.*

You could have drawn a diagram like the one below. The diagram illustrates that there is a chain of conditions which leads to the goal of reducing poverty.

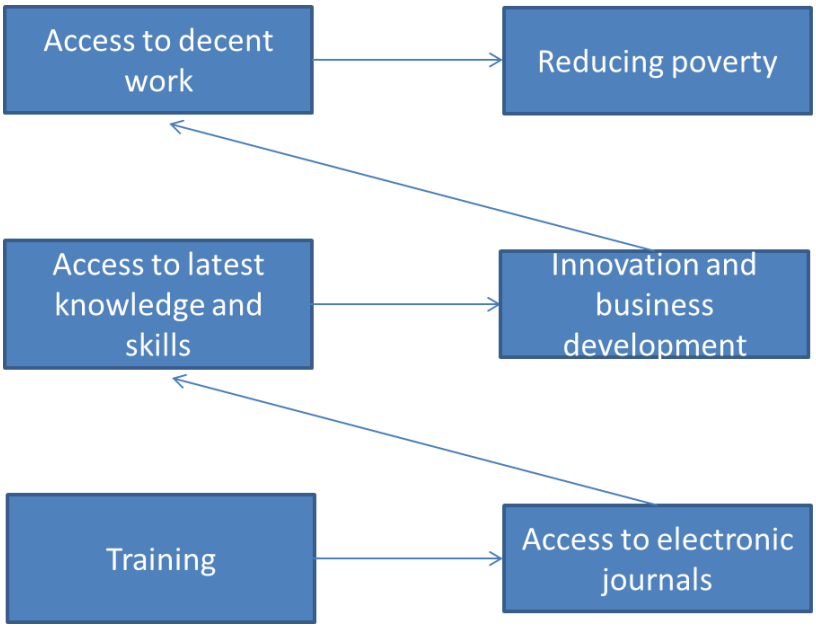


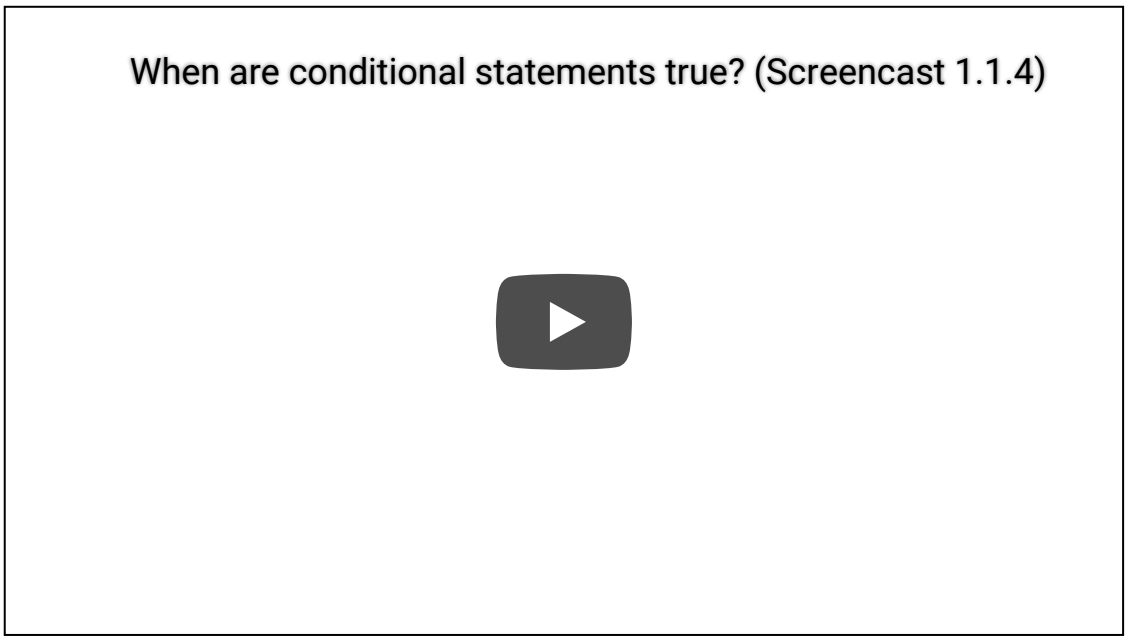
Diagram for the goal of contributing to the reduction of poverty, dependent on a chain of conditions

Can you find evidence in the text that some or all of the conditions have been met in the project and whether the promises or predictions of the project team were delivered as a result? For example, does the text describe that the students got training and if so, did they have access to electronic journals as a result? Then you may find the project successful indeed.

Learn more about conditional statements

Optional activity

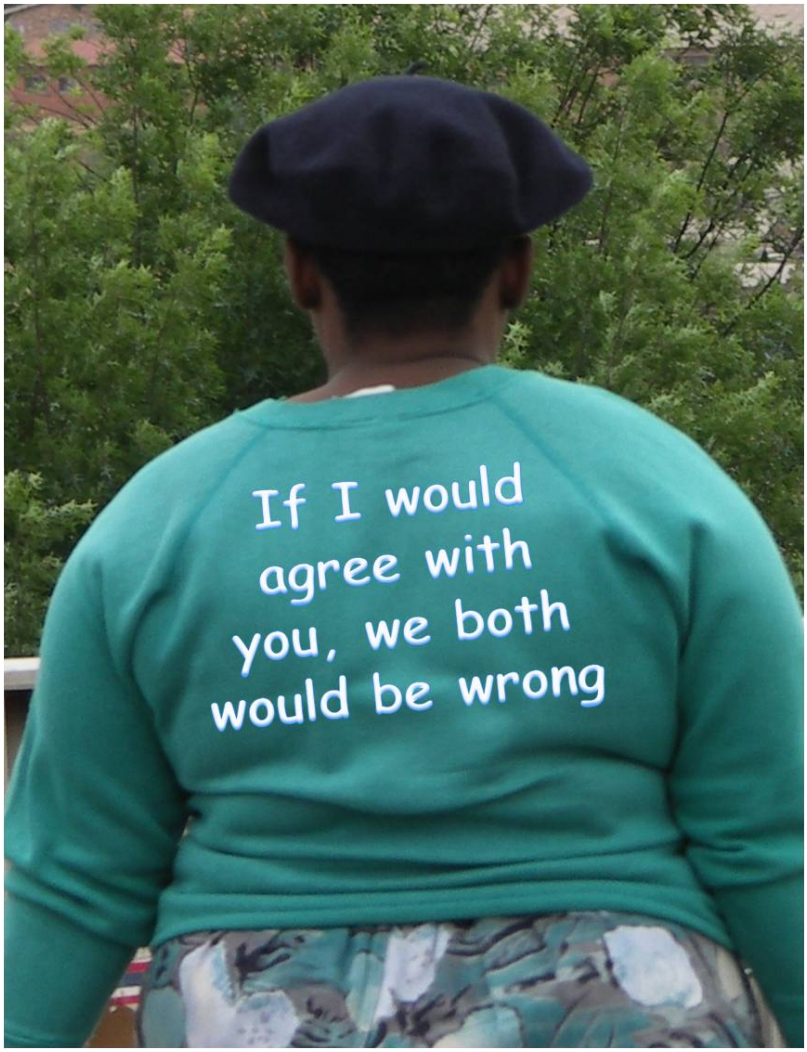
The following video (duration approx. 6 min) can help you understand what people mean when they make conditional promises. We highly recommend watchig the video if you want to learn more about conditional statements.



Video ' When are conditional statements true?' (1)

Fallacies

You have surely seen such T-shirts which have printed on them a statement or slogan. When you give the slogans more attention, you may see that they sometimes play with logic. We assume you wouldn't take such a conditional statement as in the picture below very serious. What is the flaw?



But also in more serious discussions, you will often encounter some flawed argumentation or reasoning. Flawed arguments which can trick you are also called fallacies. In Unit 3 you learned that arguments can be 'good' or 'bad', 'sound' or 'unsound', 'cogent' or 'uncogent'. We will discuss now some quite common cases how arguments and conditional statements can be constructed in a way which may fool you to believe the author or speaker made a good point. Being aware of these fallacies is also particularly relevant in research, as it can prevent research results being misinterpreted.

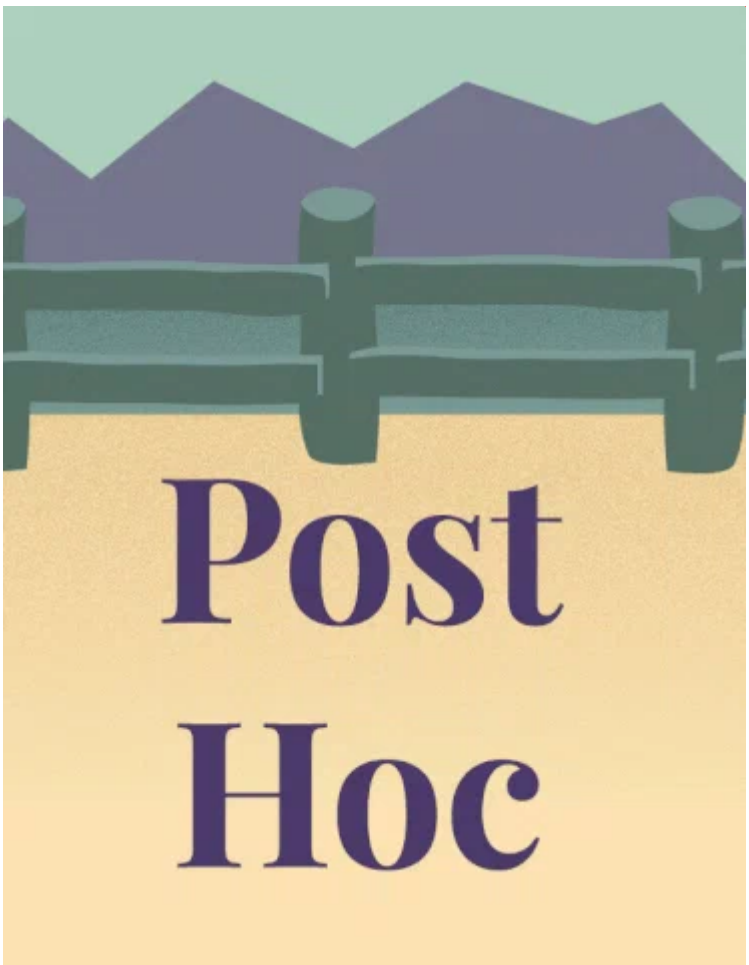
False cause

This fallacy relates to our discussion about causality above. People may try to convince you that because one event follows another closely in time, the first has caused the second to occur. Do you remember our example above about the battery recycling plant and the recorded cases of headache and fatigue? We had pointed out that there could be quite a diversity of causes for the correlation between the increase of lead production and recorded patient cases, or it could even be only a coincidence.

So, without further evidence, the following argument is not strong enough to support the conclusion:

The battery recycling plant increased the production and at the same time the doctors started to record higher numbers of patients with headache and fatigue. That can't be a coincidence. Certainly, the pollution of the environment with lead had caused the increasing numbers of complaints about headache and fatigue.

A critical thinker should always look for enough evidence before concluding that one thing has caused another one.



GIF 'Post hoc' (1)

Irrelevant reasons

This fallacy is similar to the false cause fallacy in so far as there is a flaw in the causality and the premises don't sufficiently support the claim. But in the case of the irrelevant reasons fallacy the reason is unrelated to the conclusion. The argument would include premises which could certainly be true but don't support or falsify the conclusion since the premises and the conclusion aren't related.

You may encounter this kind of (non-) reasoning if someone wants to distract from an issue which is not convenient; for example, if someone wants to distract from the fact that there isn't enough evidence or that he/she doesn't know enough for supporting or falsifying a hypothesis.

Comic from Crimes Against Hugh's Manatees by Hugh D. Crawford (1)

You may also encounter this fallacy in advertisements to convince customers to buy a product based on reasons which aren't actually related to the product's quality.

Reflective activity

How strong would you rate the argumentation in the following sales pitch? Click on ‘reveal’ to see our comment.

All parents want the best for their children and keep them healthy. Our snack has been designed by our food experts specifically for children. Therefore, if you care for your children, buy our product.

Reveal Hide

When analysing the given argument, identify the premises and the conclusion first. One premise is that all parents want the best for their children and to keep them healthy. That may not be true for all parents, but most parents, who do indeed want the best for their children, would likely feel the advertisement is directed at them. The second premise is that the product has been designed by the manufacturer’s food experts. The sales pitch’s implicit conclusion is that all parents who care for their children’s health should buy the product since the product is healthy. For the conclusion to follow, it would be necessary that the food designers make sure that the product is indeed healthy. However, food design for a target group can include many aspects of producing food which appeals to a customer group and not necessarily to aspects related to health. Children’s products are very often designed rather to attract the children’s attention by being colourful and showing funny pictures as well as having a sweet taste which appeals to children. So the second premise about the food design is, on its own, not related to children’s health and is irrelevant. As you may expect from an advert, no strong argument in favour of buying the product is given to parents who want to keep their children healthy.

Ad hominem

This fallacy is also called ‘argument against the person’. This fallacy means attacking the person who supports a cause or holds a view rather than the cause or the idea itself.

One of the most infamous examples is the denunciation of the theory of relativity which was developed by physicist and Nobel Prize laureate Albert Einstein in the first half of the 20th century. Other physicists in Nazi Germany, who were supporters of the German dictator Adolf Hitler and his racially–motivated ideology against Jews and other population groups, rejected Einstein’s theory because of his Jewish family background. Philipp Lenard, physicist and Nobel Prize laureate himself, argued against Einstein’s work, as true discoveries in the natural sciences could only be achieved by the “Aryan race” and Einstein’s work could therefore only be “Jewish fraud” (1).

Cherry–picking

Cherry–picking is a quite common cause of misinterpretation of research results. Imagine a researcher has a hypothesis and runs a study to prove it. When analysing the study results, the researcher selects any evidence that supports the hypothesis and neglects all evidence that makes it more unlikely. Of course, the hypothesis would now seem much more likely than it actually is.

Cartoon by Luke Surl (1)

Argument from ignorance

This fallacy makes you belief that something cannot be true just because it hasn’t been proven, or that it must be true because no evidence has been found against it. As a critical thinker you should be open to different opinions as long as there is no clear evidence that speaks for or against a claim. For example, a doctor shouldn’t immediately brush away a patient’s complaint that their pain is caused through a side effect of a medicine he or she has taken, just because the doctor cannot find any side effects documented.

GIF 'Appeal to Ignorance' (1)

Deepen your understanding of fallacies

Optional activity

The following video (duration approx. 10 min) explains some common fallacies. Watch it, if you want to learn more about fallacies.

Video 'Fallacies' (1)

What have I learned?

Reflective activity

Reflect on your learning in this unit. Go over your notes from the first activity, and then answer the questions below:

- Would you now judge differently your decision to believe (or not) the claim you recalled in the introductory activity? Why (not)?
- How did you find the tasks in this unit: too easy, too challenging, or just right? Which was the most challenging one?
- What are the three most important things you now know and which you did not know at the beginning of this unit?
- How do you expect your new learning to impact how you read or hear information in the future?

Prepare questions or issues that you would like to clarify or discuss with your friends or in class with your tutor.

Note your thoughts down. Post your ideas in the discussion forum if you'd like to share them with your fellow students.

References and further resources

References by course pages

Facts and opinions

1. Comic from Crimes Against Hugh's Manatees by Hugh D. Crawford, http://crimesagainsthughsmanatees.tumblr.com/image/144077915117,licensed under CC BY-NC-ND 3.0, retrieved 16 March 2018

Why should we engage with facts and opinions?

1. Video 'Interview Kofi Annan, Founder and Chairman, Kofi Annan Foundation' by ITU (2013), licensed under Creative Commons Attribution license (reuse allowed). retrieved 26 January 2018

Distinguishing facts and opinions

1. IUCN Red list, accessible at www.iucnredlist.org.
2. Video 'Fact opinion' by Graney, J. (2012), licensed under Creative Commons Attribution license (reuse allowed), retrieved 26 January 2018

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