

## MicroChat: Elements of critical thinking

### Bias

(Kenneth Timmis and Lara Amorim)



Jess is the boy in the centre of the image whereas Kate is on the right and Cindy-Lou is at the bottom (image created by Fran Jebok; see also <https://www.theabsurdmicrobe.com/recurring-characters/>).

**Farmer Giles:** Oh, hello Jess, nice to see you this evening; it has been a lovely warm day!

**Jess,** looking a bit doubtful: Hello Farmer Giles. Yes, the weather is nice but the air is full of insects flying around and bombarding me – I hate insects!

**Farmer Giles,** a bit disapprovingly: Well, that is a pretty extreme declaration! But do you really? After all, insects are a really important group of organisms in food webs and, for example, provide food for the birds you like to watch so much. Just look at those beautiful swallows, sweeping and darting around, hunting for their favourite supper!

**Jess,** looking a tad guilty: Yes, they are wonderful to watch! Okay, I admit that insects are essential, but I hate them flying around the room when I am gaming, buzzing in my ear, and landing on my arm just as I am trying to avoid being killed by the worst monster in the game.

**Farmer Giles:** Hmmm. But, as you will learn in the fullness of time: life is like that. Many things have both positive and negative sides to them, and we cannot arrange it so that they only have the aspects we like.

I personally love most insects – well, at least those that don't eat my crops – because they visit the flowers of the plants I grow and pollinate them, so that they produce fruit and seeds I can harvest. For example, they are really important for the sunflowers you see growing in the field over there. That field will produce the sunflower oil your mum uses to cook, and especially to make her delicious almond cake. And although I don't have any almond trees, insects are even more important in the pollination of almond tree flowers and the production of almonds.



**Jess**, brightly: Oh: mum's almond cake is my favourite! Gosh, so it totally depends on insects?

**Farmer Giles**: Absolutely! And not only that; a major preoccupation of humanity, and especially farmers like me, is how to feed a growing world population with a shrinking amount of farmland. Options being actively explored are seaweed farming, the production of microbial food by fermentation, and.....guess what.....the production of insects as food! All these options, and others, are already practised at small scale but will need to be increased dramatically if we are to secure adequate nutrition for all people.

**Jess**: Oh, that is really interesting: one of the boys from another class was telling us that insect food is delicious and promised to let us try some next week.

**Farmer Giles**: You see – your opinion about insects is very *biased* – you only focus on the inconvenient aspects of insects, not their positive ones.

**Jess**, tritely: You are right, of course.....as usual. Sorry, I'll make an effort to like insects in future!

**Farmer Giles**: that's my boy – you are a good learner!

**Jess**, a little flushed with embarrassment: But what is bias really?

**Farmer Giles**: Ah: that is a good question! Bias is looking at an issue from just one side, rather than from all sides. This gives a distorted impression of reality. For example, if you pick from this tree a plum that looks nice, and pop it in your mouth, you may have an unpleasant surprise. Not only you like plums, but wasps do too, and when wasps eat plums they open up the plum flesh to microbes, which also like plums and when they eat them they start the rotting process. Looking at the plum from only one side gives you the false impression – a biased opinion – that it is healthy and tasty, whereas the reality is that it is rotting. In order to have an unbiased, realistic impression of the plum, it is necessary to be objective: to inspect it from all sides, and even to open it up to see if there are any grubs inside.

**Jess**: Oh yes, I bit into a rotten apple the other day – it was horrible!

**Farmer Giles:** Indeed! Of course, not all bias is bad. When you try almond cake made by the mum of one of your friends, you may think that it is not as good as your mum's. While this may be true (and probably is), it may simply be that it is a bit different and you are not used to it. We tend to prefer familiar things and are more suspicious of new ones; this is bias! But this is good and important for our sense of belonging: to a family, a group of friends, a team, a society, a nation, and so on.

**Jess:** Yes, I see what you mean. Our school football team has people from several countries and we are often visiting one another's houses where we are given different types of food. I don't really like some of them and some of my mates don't like the food my mum provides, which I find incredible!

**Farmer Giles:** Exactly, this is very natural. The same types of food have evolved important differences over time in different societies and these differences help create cultural identities.

Life's experiences inevitably confer biases that accumulate with age, for example a sting from a wasp in childhood can create a lifelong fear-hatred of wasps, the affection given by a family pet can create a love of animals, and so on. These are the natural biases that are an essential component of the identity-personality of every human, as varied as the range of experiences gained, and a major contributor to the diversity of human opinions and behaviour. This diversity of biases allows humans, through exchanges of varied opinions, debate and consultations, to evolve effective solutions to problems and discover new opportunities.

**Jess:** You are right! When we discuss strategy for football matches, we get some very original suggestions from boys from other countries.

**Farmer Giles:** There you go!

There are definitely good or positive biases, for example resulting from love, that influence our choices. For example, your mum may like garlic or spice in her food but, if she knows that you don't like them, she will avoid adding them when she cooks for the family; she deliberately biases her choice of ingredients.

And at school, teachers provide instruction on the great religions and philosophies that aim to provide young people with ethical values and a moral compass, and on constitutions that establish principles, laws and rules for governance of states and organisations and the rights of the citizens of such states. These have the good intention to bias us, for example against actions that benefit us while disadvantaging others, in other words against selfishness.

**Jess:** So everyone has biases! But how then can some people talk about an unbiased opinion?

**Farmer Giles:** Excellent question! In reality, completely unbiased viewpoints are probably impossible, although some opinions are more balanced than others.

**Jess:** So if biases are not so bad, why do people say they are?

**Farmer Giles:** Well, the real problem is when individuals try to impose their own biases on others to spread and amplify biases in the population. Trying to influence - persuade others about something - is a normal aspect of human behaviour. But there are some forms of persuasion that are not based on good intentions, including some forms of advertising. For example, we know that tobacco, excess sugar, salt, etc., are bad for our health so encouraging their consumption by advertising is bad.

**Jess:** But I need high sugar drinks to win races at school!

**Farmer Giles:** You see: you have been convinced by advertisers and influencers that high sugar drinks will win races for you! But winning is all about training, dedication, mental attitude and personal talent, not high sugar drinks. Just think about it: if everyone drinks high sugar drinks in order to win, and there can only be one winner... But this is the power of advertising: to appeal to something you desire and convince you that the product being sold will deliver it. Always be suspicious of advertising because its primary purpose is to get you to part with your hard-earned money.

**Jess:** Hmm, I think you told me before not to buy high sugar drinks...

**Farmer Giles,** smiling: Hmm, I rather think I did!

But anyway, biasing you towards high sugar drinks is not the worst aspect of persuasion. Much worse is convincing large numbers of people to adopt a bias, creating collective bias and *groupthink*, which discourages people from thinking for themselves. Some biases that are propagated are intentionally bad for society and its good functioning, or against certain groups in society, or glorify attitudes and practices that are clearly wrong.

An example is glorifying evasion of payment of taxes that are needed to provide us with all manner of public services, like healthcare, education, safety, and road and rail networks. This encourages people to think that it is not only okay but actually clever not to pay taxes. Imagine if no-one paid taxes: there would be no public services like schools, garbage collection or police to respond to crime.

Biases prevent us from having a balanced view of things, so they are often the cause of wrong opinions, decisions and behaviour. Even worse, biases can be promoted and exploited by bad people to get good people to do things they shouldn't.

**Jess:** But why would someone try to persuade people to believe something that is wrong and harmful?

**Farmer Giles:** Quite simply, for personal profit: to gain power, money or anything else of value. A classical example is demonisation of innocent groups of people: for example a politician trying to gain votes by convincing one group of people that a different group represent danger and that they should be discriminated against in some way. This is the process of "*othering*", emphasising differences among people and arguing that the differences are bad in some way.

**Jess:** This sounds like *racism*!

**Farmer Giles:** Yes, othering includes racism, but also many other forms of discrimination. It directly attacks the reality that diversity is not only perfectly normal but indeed highly beneficial.

As a farmer, I am particularly appreciative of diversity because it is essential to good farming, from planting diverse crops, having diverse pollinating insects, diverse bushes in hedgerows that provide diverse homes and food for diverse birds, etc., etc. And yes, microbial diversity in soil, water, air and on plants, which keeps my crops healthy. For a farmer, when diversity drops, it means trouble.

**Jess:** Oh right - the other day we learned that diversity is important for our microbiomes.

**Farmer Giles:** Yes, it is extremely important to realise that diversity is an essential feature of the biosphere, providing resilience to environmental changes and challenges. Diversity is a real strength of humanity: for example, different types of people can offer different viewpoints that, collectively, are more useful than a single viewpoint in solving problems. Unfortunately, demonisation and discrimination propagated by selfish people for their own benefit have created biases that responsible for major problems facing the world today.

**Jess:** Wow! So my bias against insects because they land on my arm when I am gaming is part of a wider issue of bias in the world that causes so many problems!

**Farmer Giles:** Now that is a really profound conclusion: well done!

**Jess:** So what can I do?

**Farmer Giles:** Well, bias includes prejudice, distortion, favouritism, preference and one-sidedness, and is the opposite of objectivity, fairness and balance. It is a really important element of human psychology that makes us vulnerable to persuasion by people who want to control us for their own benefit. So the key thing for us all is not to blindly accept the opinions of others, or information we obtain, without first doing a reality check to make sure they are not biased, incomplete, distorted or misleading. To do this, we must take the time needed to consider such opinions and information critically and objectively, and not immediately take decisions or start actions based upon them, especially when people involved try to rush us. We need to maintain our ability to think clearly and independently and, where necessary, to disagree with things people say that we think are wrong.

**Jess:** But which information should be subjected to a reality check?

**Farmer Giles:** Good question! Although most information we receive has the possibility of being biased, some sources, like your mum, are more trustworthy than others. Learning which sources are trustworthy is an important part of growing up. That said, one major source of propagated bias is social media and the influencers who populate it. Influencers often try to make us dissatisfied with ourselves and to want to be like someone else, usually the influencer. But, although we should always try to do better and improve ourselves, we should never want to be someone else. For example, young males like yourself particularly need to be aware of the massive bias of *manosphere* propaganda.

**Jess:** Oh yes, I have heard stuff from my sisters about the manosphere: it is scary!

**Farmer Giles:** Indeed! The other thing you need to be aware of is the power of images. People often pay more attention to images than the written or spoken word, so images are a powerful means of persuasion. It is really important to examine images critically to see if they convey an accurate and balanced representation.

**Jess:** Farmer Giles, you always give such good advice! But usually it involves microbes; do microbes have biases?

**Farmer Giles:** Ahh: smart question! Biases are generally considered to arise from the way our brains process and organise prior experiences, making them a natural part of our psychological makeup. Since microbes don't have brains, they cannot have the same type of psychological biases we have. However, many microbes prefer certain environmental niches characterised by specific conditions, such as those found in hot springs or cold environments, so might be considered to be metabolically biased.

A good example of metabolic bias in microbes is host and tissue specificity of pathogens and symbionts. For example, and to stay with the insects, termites are able to use wood as a food source only because they harbour in their guts special microbes that degrade wood to sugars, which the host termites use to grow. These symbiotic microbes are biased towards the termite gut as a home, and wood as a source of food. Most pathogens can only infect one or two animal species and, within a susceptible host, most can only infect one tissue, so-called tissue preference or tissue tropism. Examples include the flu virus, which infects our respiratory tract, and *E. coli*, which infects our gut.

**Jess:** So microbes are also biased!

**Farmer Giles:** Well, sort of, but this is metabolic bias that is hard wired in microbes to enable them to be as efficient as possible in obtaining the maximum benefit from available food. In contrast, bias in humans has an element of choice/volition: it is a characteristic that can be modified through discussion, like we are doing now.

**Jess:** Oh, okay!

**Farmer Giles:** Now although most microbiologists do not consider microbes to have biases, they are passionately against one type of human bias relating to microbes, namely so-called germophobia. This is the blanket demonisation of microbes only because a tiny fraction of them cause disease, when in reality the vast majority, including our own microbiomes, are highly beneficial. Humans need to appreciate microbes not demonise them!

**Jess:** Oh: I just love microbes, after all you have taught me about them!

**Farmer Giles:** That is good to hear; I see you are paying attention to the right influencer!

But to be more serious, someone estimated that adults make around 35,000 decisions per day. Of course, this number may be way off and, of course, many of these decisions will be automatic, like blinking when an insect comes close to our face, or drinking water when we become thirsty. But, still, it does give an impression of the large number of decisions we take that determine our

daily lives, some of which are not at all automatic and can be good or bad for us. Taking the right decisions means having reliable information and using it to make objective balanced decisions: *unbiased decisions*. So we really need to pay attention to bias in our daily lives.

**Jess:** 35,000 decisions a day: that is amazing!

**Farmer Giles:** Now young fella, I must take one of these 35,000 decisions, namely to go and do my last job of the evening. Foxes seem to be highly biased towards my chickens, not only because they are tasty, but also they are easy to catch, so I have to frustrate their bias and chase the chickens into their pens for the night.

**Jess:** Oh, can I come with you and see if there are any freshly laid eggs? If so, I can take them to mum and tell her all about the importance of insects for almond cake.....perhaps she might even take the hint and bake one for you and me!

### Suggestions for class discussions

- *Recognising bias in leaders and its impact.* Ask the class to identify impactful biases expressed by influential figures. Select 2-3 representative examples and have the class discuss them and analyse potential consequences for behaviour, decisions, influencing others, etc.
- *Recognising bias in self and its impact.* Ask everyone in the class to identify their own most important bias. Select 2-3 representative examples and have the class discuss them and analyse potential consequences for behaviour, decisions, influencing others.
- *Class debate: the art of persuasion.*
  - o Prior lesson: class discussion of issues or recent events influenced by bias, selection of one issue-event as a motion (e.g. *this house believes that high sugar drinks help win races*); ask for volunteers to present arguments in support and against the motion. The class votes to select a first and second speaker for and against the motion. Homework for all individuals is to prepare arguments in favour or against the proposition.
  - o Lesson: First speaker in favour of the proposition makes a 5 min case. Then the first speaker against the proposition makes a 5 min case. These are followed by the second speakers, after which the proposition is opened for general discussion by the entire class. Five min before the end of the lesson, the class votes on the motion.
- *Do I really want to be an influencer?*
  - o Prior lesson: Ask for volunteers prepared to play the role of an influencer. Select one randomly using short straws/coin toss. Have this volunteer prepare a short presentation of persuasion to buy a commercial product – real or imaginary.
  - o Lesson: the volunteer makes the presentation on the product and the reasons to buy-use it. This is followed by the volunteer being questioned by the class on the merits of the product and whether it really is something worth acquiring.

<https://thedecisionlab.com/reference-guide/psychology/bias>

<https://enviromicro-journals.onlinelibrary.wiley.com/doi/10.1111/1751-7915.70270>

<https://pmc.ncbi.nlm.nih.gov/articles/PMC6119549/>