

MicroChat: Elements of critical thinking

Context can be really important

(Kenneth Timmis)



Cindy-Lou Ximena is the girl at the bottom of the image, whereas Jess is the boy in the centre and Kate is on the right (image created by Fran Jebok).

Farmer Giles: Mornin Ximena! You are looking a bit glum today; what's wrong?

Cindy-Lou: Oh, Farmer Giles: I came last in the swimming race at school yesterday, which is soooo disappointing. I did fantastically well last year and came first.

Farmer Giles: Well, that is indeed annoying; I do sympathise with your disappointment! Why don't we go over to the barn and see some newborn lambs: they are so cute and will definitely cheer you up.

Cindy-Lou, instantly brightening up: Oh, yes please, that would be lovely!

Five minutes later, in the barn:

Cindy-Lou: Just look at that little one lying in the hay: she has a black patch over her eye and is so gorgeous! Does she have a name?

Farmer Giles, eyes sparkling: Absolutely: she was born three days ago and is also my favorite! And no, she definitely needs a name: would you like to give her one?

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Cindy-Lou: Oh yes! I love Shaun the sheep (<https://www.shaunthesheep.com>). Could we call her Shauna?

Farmer Giles: Now that is a lovely name and suits her beautifully! Now: tell me more about your swimming disappointment. Have you been training regularly?

Cindy-Lou, a tad indignantly: Yes, of course! However, this year the race was over 50 metres, whereas last year it was over 25m, and I became very tired after the first length.

Farmer Giles, smiling with new understanding: Ahhh: so this time, the race was twice the distance of the race you won last year. This is probably the explanation. You need another year or so of hard training over 50 m to adjust your muscles and mind to the extra distance.

Cindy-Lou, stroking Shauna who nuzzles up to her: So you think I might be better next year and have a chance of winning?

Farmer Giles: Well, that all depends on a number of things. You are getting older, your body and mind are developing and changing, and you will probably spend more time on homework and other activities, all of which may affect your swimming training.

Cindy-Lou: What do you mean?

Farmer Giles: Well: children are constantly developing and changing; you will be a different person next year from the one you were last year. And this will affect all manner of things you do and want to do. I think I need to discuss the importance of *context* with you.

Let's start with a simple example. We humans consider ourselves to be the most successful beings on the planet, have evolved brains that enable us to develop creative, original and effective strategies to solve problems we face, and hands that enable us to make tools and other means of implementing solutions. Our bodies have evolved to support these key functions. We humans consider ourselves to be masters of all forms of life.

However, humans have evolved for life on land. Our wonderful respiratory system – especially our lungs – for acquiring the oxygen that we need to produce energy for everything we do, only works well when we have an adequate air supply. Under the water it does not work at all.

Cindy-Lou, looking up and stopping stroking Shauna, who shakes her head and bleats: But mum says I swim like a fish!

Farmer Giles: Well, she is a wonderful mum and encourages and supports you in all ways, so of course when you swim well she praises you.

But, although we may be able to swim, we are not *designed* for life in water. Water can in fact be a dangerous place for us: drowning is responsible for more than 300,000 deaths per year, and is the third highest cause of deaths due to unintentional injury (<https://www.who.int/news-room/fact-sheets/detail/drowning>). Many people like to eat fish. But if we die in water, the fish may eat us. So we need to be careful when swimming.

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Cindy-Lou, shivering, and returning to stroking Shauna: Ooohh, that does not bear thinking about!

Farmer Giles: No, not at all. However, this is a good example of what I wanted to discuss with you, namely the importance of context. In one context – life on land – humans are top dogs; in another context – life under water – other beings are much more successful. And we should keep in mind that more than 70% of the surface of the planet, which of course houses most of the biosphere, is water, most of it as sea. So: when we think about ourselves being the most successful animal, we are only talking about a small part of the biosphere – the land – and ignoring the water part which is two times larger.

Cindy-Lou: Ahh: this explains why oceans are the largest unexplored place on the planet (<https://manoa.hawaii.edu/exploringourfluidearth/standards-alignment/ocean-literacy-principles-olp/olp-7-ocean-largely-unexplored>): we can't explore them like places on land!

Farmer Giles: Exactly! Moreover, although humans are top dogs on land, we are only top dogs in the context of animals and plants: humans have less control over microbial life. In fact, microbes have always controlled us to some extent, one way or another.

Cindy-Lou: Really? How do they manage that?

Farmer Giles: Well, firstly, our gut microbes – the microbes in our intestines – determine how well we digest our food, provide us with important nutrients and generally affect our wellbeing, including our moods.

Cindy-Lou, looking up from Shauna: Oh: were my gut microbes responsible for my bad mood today?

Farmer Giles: Well, I don't think microbiologists know this yet, but the topic of gut microbes and mood is a hot research topic right now. My guess is that a combination of the super effort you made in the race, the disappointment of losing, your uncertainty of the reason, and any changes you made in behaviour and eating as a result of the disappointment, may have influenced your gut microbes, which in turn may have influenced your mood today. But that is just wild speculation.

Cindy-Lou: Hmm.

Farmer Giles: Another obvious effect of microbes on our lives is the infections a few of them cause ([see the MicroRogues Gallery](#)), which can put us out of action for days. In fact, the most common infections we experience are respiratory infections – like colds and flu – infections exactly of our respiratory tract, our breathing apparatus.

Cindy-Lou: Oh yes, I had a cold last week.

Farmer Giles, smiling with more new understanding: Aha!! This is probably the reason you came last in the race! Although it is doubtful you would have won it, because the distance was relatively new to you, you may well have come in third or fourth if you had not had that cold beforehand, which will certainly have weakened you. This is also an example of context, in this case, a prior infection reducing your level of fitness.

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Cindy-Lou: Oh, I see. Farmer Giles.....was context important for the Covid pandemic?

Farmer Giles: Goodness me: you are so clever, which is why I suspect you will not become a swimming champion because you will spend a lot of time studying, rather than training for swimming races!

Yes, indeed, the Covid pandemic was definitely influenced by context. First of all, the virus was originally an animal pathogen which first needed to adapt to humans. It was probably helped by a change in context, namely increasing contacts between humans and wildlife, perhaps as a result of expansion of farmland into wilderness to feed the growing human population, and perhaps also an increasing taste for wild meat in some human populations.

Then: it spreads in aerosols, the clouds of tiny droplets we create when we sneeze or cough, but also when we shout, sing and even just talk. When we are close to someone, we breathe in the aerosols they produce. If that person has a respiratory infection, the aerosols produced contain the pathogen which can then infect us. The thing is: humans are social creatures: we love to chat with one another, just like you and I are doing now. In school you shout and scream when playing, and sing. And humans often get together in large numbers, in school, at parties, at pop concerts, in football stadiums, and so on. The closeness of people is another context that really helps the spread of the virus in aerosols in communities.

But what made Covid a pandemic – a global epidemic – was the massive extent of human travel, which ensured that the virus quickly spread all over the world.

Cindy-Lou: Oh, definitely! I am sure that the cold I had last week was caught from the person in the next seat on the plane, when we were returning from our holiday. She was coughing something terrible during the whole flight.

Farmer Giles: On the other hand, human bodies are well equipped with powerful defences that fend off most pathogens. However, the most powerful of these defences – adaptive immunity – works by recognition and attack of the pathogen, recognition through having seen it before as an infection or in a vaccine. However, the Covid virus was new to us, we had not seen it before, so could not recognise it and attack it. Our immune status is a super important context for infections.

Cindy-Lou: Oh yes: we are soon due for a vaccination at school!

Farmer Giles: The way we tried to control the pandemic was to change context in order to reduce virus transmission, by reducing human gatherings and instituting the wearing of masks to catch aerosols before they entered our lungs. We also developed vaccines to change the context of our immune systems so that they could recognise the virus. By introducing these and other barriers, we changed key elements of context, and so reduced infection rates. Just like the change in the distance of your swimming race was a change in context.

Cindy-Lou: Gosh – the Covid pandemic was never explained to me like this!

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Farmer Giles: Yes: vaccines create an amazing change of context. You will have had the measles-mumps-German measles vaccine, also called the MMR vaccine, when you were young to protect you against very nasty viral infections. The thing is: a vaccine can not only protect individuals who receive it but, because it can reduce transmission of the virus, it can also reduce the frequency of infection of non-vaccinated people. When enough people are vaccinated, something called *herd immunity* kicks in, which reduces the spread of the infection so much that people who are not vaccinated are unlikely to be infected.

Cindy-Lou: Oh yes, our teacher told us about herd immunity, but why is it so important?

Farmer Giles: It is important because some people have immunity problems and cannot be vaccinated or, if they can, the vaccine does not work so well and they cannot be protected. So it is *really* important for them that everyone else gets vaccinated.

And there is another reason: herd immunity can eradicate a disease so that it no longer circulates in the population. This was the case for measles in the USA which was essentially eradicated by the year 2000. Herd immunity represents a really important change of context for infectious diseases.

Cindy-Lou: But didn't I hear on the news recently that there are some measles cases there? How can that happen if the disease is eradicated?

Farmer Giles: Unfortunately, yes. Because of travel, like your recent holiday, diseases can always be imported from other regions of the world that still have them. The problem is that, because a disease has been eradicated, there is less pressure on parents to have their children vaccinated – they think that there is no longer a risk. But when it is imported, the lower vaccination coverage means that it can spread better in the population – there is a change of context. This is what happened in the USA which currently has a measles outbreak in Texas and beyond because of low vaccination rates.

Cindy-Lou: I bet the parents regretted not having their kids vaccination!

Farmer Giles: Well, some of them will have, for sure! No parent likes to see a child suffer.

Another example from microbiology is the issue of *C. diff*: have you heard of it?

Cindy-Lou: Oh, yes: it is a horrid gut infection! My friend's grandmother had it when she was in hospital.

Farmer Giles: Exactly! So *C. diff* is a bacterium that lives normally in the gut of many people. Usually, it does not do us any harm, especially if we are healthy. However, if we are weakened, need to go to hospital, and especially if we are given an antibiotic, it can cause a nasty infection. Probably, it is the antibiotic treatment for something else which kills off a lot of microbes in the gut, microbes that keep *C. diff* under control, which allows it to multiply and make us feel unwell. The antibiotic changes the context.

Cindy-Lou: Well, I can see now that being aware of context seems to be really important.

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Farmer Giles: Absolutely! And, as I mentioned earlier, context will influence whether or not you will be successful in swimming in future, because a number of issues may influence your motivation to commit to the tough training that is necessary.

Cindy-Lou, pensively: Hmmmm...

Farmer Giles: So: when you see something on social media urging you to buy a product that will definitely improve your looks or other aspect of your life, just consider the context. This may be a product whose sale is going to make someone very rich, so that individual may just be telling you what you want to hear in order to persuade you and your friends to buy it.

These are just a few examples of how important context really is, and a factor that we all need to consider when assessing information in order to take a decision.

Cindy-Lou, looking a bit uncertain: Well, yes, I can appreciate that. The thing is: how do I recognise context and what do I do with it?

Farmer Giles: Ahhh: very good question. I think you will be a scientist when you grow up.

On one hand, context is everything related to a particular situation. On the other, and what we are discussing today, it is specifically those aspects that affect our consideration. I realise this is not easy to grasp, so let's take a concrete example. In the case of your swimming race, the broader context included the temperature of the water in the pool, the weather, what your teacher had for breakfast, and numerous other issues that you were unaware of, none of which was an important consideration. The *relevant context* included the change in race length from 25 m to 50 m, and the fact that you had recently had a cold, both of which you were aware of and could have taken into consideration when you were thinking about why you came last.

And of course the context of the change from 25 m to 50 m is central to your decision whether or not to try to be a winner next year, because it tells you that, in order to have a good chance of winning, you will need to train much harder than you do now.

Cindy-Lou, brightening up and reluctantly standing up and stepping away from Shauna: Oh, okay: understanding and taking into consideration the issue of context does not seem so hard; just being more aware and giving the situation a bit more thought, looking at it from all angles.

Farmer Giles: Yes, so next time your mum asks you to do something that Jess usually does, instead of being miffed and considering it to be unfair, think about the context and how it might have changed: that perhaps he needs to spend more time preparing for an upcoming exam, is not feeling well, or perhaps he has also been given something extra to do.

Cindy-Lou, looking a bit guilty: Oh, right....sometimes I do feel like that. Next time I'll try to see what is behind it and understand the situation better. Well, little Shauna: I must be off to swimming practice. *Farmer Giles:* I was never aware of the issue of context before. You really are a clever farmer, and such a good friend! Can I come back tomorrow and pet Shauna again?

Farmer Giles: Of course my dear – I really enjoy your company. Shauna already considers you to be her best friend!

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And remember: context change can occur naturally or by people's actions, both of which we saw with the example of the Covid pandemic. This means that in some instances, we react to a change in context; in other situations, we deliberately create a change context ourselves, in order to achieve something. You did this today by naming and cuddling Shauna: you changed the context of her first days of life and she now already considers you to be her best friend!

Suggestions for class discussions

- Think of examples of changes in context that influence events that personally affect you/decisions you take. Discuss why they affect the situation/the decision.
- Think of examples of changes in context that influence events that affect everyone, for example global warming, poverty, education, healthy seas, biodiversity, etc. Discuss why they affect the situation and the decisions that need to be made.
- Think of examples where you personally might change the context in order to achieve something, how this may play out and why.
- Think of examples where governments might change the context in order to achieve solutions to major problems, how this may play out and why.