

## Transcript: Essential concepts in Critical Thinking

Hello everyone, welcome back. In this session I'd like to introduce a number of fundamental concepts in critical thinking. Thinking logically about these concepts will help us organise and evaluate information in a systematic way.

The most fundamental concept and the starting point for critical thinking is to understand what it is that we are talking about, In other words what do we actually know.

A **fact** is something which is demonstrably true. It is something that can be checked and verified, and confirmed to be true. For example, it is a fact that the sun rises every morning, in a direction that we call east in English, and it sets every evening in the direction called west. It is a fact that water flows downhill, and that plants grow towards sunlight. The starting point in analysing information is to understand what are the facts, that are relevant to the discussion.

An **assertion** is a statement that is held to be true, but which is not actually a fact because it is not, or cannot be, proved to be true. For example, you may assert that most people in this building like pizza, but you may not be able to actually prove that unless you actually ask every single person. It is often quite important to understand whether something is a fact, or an assertion. Assertions can be wrong, but facts by definition, are true.

Not too long ago, people believed that the Earth was the center of the Universe and the sun went around the Earth, and this was accepted as a fact. Actually that was an assertion, which was proved to be wrong when we discovered more information about the solar system and the universe that we live in.

Finally an **opinion** is weaker than an assertion, it is a statement of something that is believed to be true, but it is subjective and it is dependent on the point of view of the person who is making the judgement. As you know, different people may have different opinions on things, at the same time, and people can change their opinions, It is always important to understand when someone is expressing his or her opinion, instead of stating a fact that is demonstrably true.

So these are some of the fundamental building blocks for critical thinking. Try the following quiz, and see if you can distinguish facts, assertions and opinions.

OK, well done! The next concept is a very important, and sometimes the most misunderstood, concept for critical thinking. You may have heard people say “it’s just a theory”, or “that’s your theory”, in a dismissive way, as if a theory is just a guess or a supposition.

This is a misunderstanding of what a theory actually is.

A theory is an attempt at an explanation.

A theory is our best attempt to explain something in the natural world, based on our current knowledge and understanding. This is worth emphasising – a theory tries to explain what something is, or how something works, taking into account all the information that we currently know.

But we are always discovering new things, and understanding our world better and more fully. And this means therefore that a theory is not fixed and unchanging: on the contrary, a theory can continue to evolve and improve, as new information is discovered that may help make the explanation better than before.

Sometimes, there may be several different theories that try to explain a phenomenon in the natural world. This is often the case when we are dealing with complex phenomena, such as the global challenges that we are going to use as examples in this course, because the relevant information about these phenomena is incomplete, or unavailable. So, when we have several competing theories, how can we judge how good a theory is?

The value and usefulness of a theory is measured at the end of the day by only one thing: how well it corresponds with reality.

First of all, a valid theory must be supported by **evidence** - that is, it must be based on facts that we know about the natural world. If a theory does not agree with our current understanding of the world, then the explanation that it provides cannot possibly be correct.

For example, for much of human history in many different cultures, epilepsy was explained as an attack by an evil spirit or a demon, and that was the accepted theory for the explanation of epileptic fits. But we now know from advances in biology and medicine what happens in the brain during an epileptic fit, and we are able to control epilepsy with modern medicines. The old theory no longer fits with our understanding of the world, and therefore it has to be discarded.

Secondly, a valid theory must make predictions that can be tested against reality – that is, testable predictions which can be checked and shown to be true - verified, or falsified. A prediction based on the theory is called a hypothesis.

The ultimate real test of how good a theory is, lies in the hypotheses or predictions that it can make. A good theory will make testable predictions, that will consistently be shown to be correct. The more correct predictions that are made by a theory, the more credible it is, and the more likely it is that the explanation that it offers is the correct one.

By contrast, a theory that does not make any testable predictions, a theory that cannot be tested in this way, is no use at all since it does not really help us explain anything.

What do we do when the predictions from a theory turn out to be wrong? In that case, the theory is obviously incorrect in its present form, because the explanation that it is offering does not fit with the real world. Then we have two choices – the theory must either change and evolve so that it fits better with reality, or if this is not possible then the theory must be abandoned and a new theory, a new and better explanation, has to be found.

Here then is a diagram showing the relationship between theories and testable hypotheses, and the importance of evidence in supporting or disproving the theory and its predictions. You will learn more about evidence, and how to assess the credibility of evidence, from Celine next week. For the moment, this diagram shows how evidence can either support and verify the predictions from a theory, or lead to the change and evolution of the theory to better correspond to reality, or indeed lead to the rejection and abandonment of the theory, in favour of a new explanation.

We are often faced with different and competing explanations for things that happen to us, or around us – for example, different theories of why the global climate is changing, and is it man-made or not? It is important to understand the importance of evidence, and how we should use evidence to assess the credibility of different theories, instead of accepting them at face value. We will explore this further next week, but finally for today let me finish by introducing the concept of an argument.

An **argument** is a series of logical statements, which persuade you to follow in a reasoned way to a fair conclusion.

The conclusion should be supported by the reasons given in the argument, and it should be a logical deduction or inference that follows from the argument.

A valid argument is based on one or more premises or starting points, which may be relevant facts, observations, or assumptions. The argument then consists of logical statements based upon these premises, which together lead us to the conclusion.

Here's an example of a simple argument: we know that antibiotics are effective in killing bacteria, but they are not effective against viruses – that is our first premise. We also know that the common cold is caused by a viral infection, not a bacterial infection – that is our second premise. From these starting points, we can conclude therefore that antibiotics will not be effective in curing the common cold. Because we can be confident that both the premises are correct, and the logic that links them to the conclusion is correct, then the argument is a valid one.

In general terms, the validity of an argument depends both upon its premises, and the logical reasoning that builds upon these starting points. If any of the premises can be shown to be incorrect, or if the logical reasoning is faulty, then the argument is not valid and should be rejected.

The strength of an argument depends on the evidence that supports it. Evidence is the proof (facts, observations, or experimental results) that supports the premises and the logical reasoning that make up the argument.

A convincing argument will often be supported by several different lines of evidence – for example, observations of natural phenomena and results of experiments. On the other hand, an argument that is supported by little or no evidence, is not convincing.

In critical thinking, it is a valuable and essential skill to be able to put forward your own arguments in a persuasive and logical way, and to hear and take on board the arguments of others.