



**CENTRE FOR
INQUIRY
CANADA**

An Introduction to
Critical Thinking

by Doug Skeggs



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The **Centre for Inquiry Canada** is a national, volunteer-led educational charity involved in promoting reason, science, and freedom of inquiry.

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1) Introduction

About this Guide

The following is a very brief introduction to critical thinking concepts, compiled for the Centre for Inquiry Canada (CFIC) from various sources.

It is not comprehensive. Some of the concepts presented here have extensive levels of complexity developed over many centuries of philosophical exploration dating back to Aristotle and the ancient Greeks.

This introduction attempts to connect the principles of critical thinking with real-world information challenges.

At the CFIC, we believe these basic concepts of critical thinking should be taught to children, perhaps even as early as elementary school. Canada would be better prepared for the future if we equipped our children with the ability to think critically.

What is Critical Thinking?

Critical thinking is the rational, skeptical, unbiased evaluation of facts to form a judgment.

The defining words there are rational, skeptical and unbiased. The opposite of critical thinking would be to evaluate facts irrationally, gullibly and in a biased way.

Critical thinking is self-directed, self-disciplined, self-monitored, and self-corrective thinking.

The ability to think critically allows us to effectively manage, filter and interpret the information we receive.

Good critical thinkers can analyze and draw reasonable conclusions from a set of information, and discriminate between useful and less useful information to solve problems or make decisions.

Critical thinking is the search for what is true, as opposed to what we might want to be true, or what someone might want us to think is true.

Why is Critical Thinking Important?

Truth is important. We live in complex technological, social, and political societies where truth is often evasive. Critical thinking gives us the ability to believe as many true things and as few false things as possible. Critical thinking is a pathway to truth.

We live, like no other time in human history, in an age of information. People have better access to more information now than at any other time in the evolution of our species.

The problem is, not all information is good information. Not all information is fact-based. Not all information is true. Much of the information we are bombarded with by agenda-driven people and organizations and through social media computer algorithms, is incomplete information, misinformation, or purposeful disinformation specifically designed to nudge us in a judgment direction, often for commercial, social or political purposes.

Critical thinking is the search for what is true, as opposed to what we might want to be true, or what someone might want us to think is true.

Professor Julian Birkinshaw of the London Business School argued in a January, 2020 Forbes Magazine article that we live in a “post-truth” world today:

The post-truth era has emerged because of several long-cycle trends that affect how we make sense of the world around us. The phenomenon even has a name – agnotology, the study of culturally induced ignorance or doubt. And it comes in a variety of flavors, from the relatively benign (persuading people through ‘spin’ or selective use of facts) to the deliberately malicious (willful peddling of objectively incorrect information). The implications of agnotology, for business and for politics, are huge.

[Link](#) to the Forbes article.

The ability to critically evaluate information is a learnable skill that helps us better understand the world we live in, enriches our lives, and makes us better citizens.

Critical Thinking Tools

This guide looks at critical thinking by examining the following critical thinking tools.

- Skepticism (questioning evidence)
- Understanding Logic and Logical Argument
- Understanding Cause and Effect
- Recognizing Fallacies
- Recognizing and Understanding Biases
- Questioning Sources
- Understanding Delusion

2) Skepticism

Skepticism involves applying a questioning attitude or doubt towards ideas or “facts” that are asserted. It is basically choosing to not accept ideas or information at face value, especially when that information is extraordinary or important on a personal or societal level.

Skepticism is a topic of interest in philosophy. Philosophical skepticism comes in various forms. Radical forms of philosophical skepticism deny that knowledge or rational belief is possible. More moderate forms of philosophical skepticism claim only that nothing can be known with certainty, or that we can know little or nothing about non-empirical matters.

Scientific skepticism advocates for testing beliefs for reliability, by subjecting them to systematic investigation using the scientific method.

Informally skepticism can be applied to any topic.

Applying skepticism in everyday life is something that everyone does without thinking about it. If your neighbour tells you she has a new pet dog. There is no reason to be skeptical about that claim. But if you neighbour then claims her new pet dog has a laptop computer and manages his own Instagram account, everyone would be naturally skeptical of this claim.

Question evidence
even if it seems to
originate from a
reliable source.

Leave room for doubt
in your thinking.

Using skepticism as a critical thinking tool simply involves intentionally applying that natural tendency to filter and question information to everything. Question evidence even if it seems to originate from a reliable source.

Remember there are no consequences if you question something and it later turns out to be true. There are consequences if you don't question something and later it turns out to be false.

Leave room for doubt in your thinking.

3) Understanding Logic and Logical Argument

Three Traditional Laws of Thought

The laws of thought are considered fundamental, self-evident rules for rational communication. These rules have a long tradition in the history of philosophy and logic. Generally, they are taken as laws that guide and underlie everyone's thinking. However, these classical ideas are still questioned and debated in modern times.

The history of the three traditional laws of thought begins with Plato, proceeds through Aristotle, and further evolves in the Middle Ages.

You do not need an academic understanding of the laws of thought to practice critical thinking. We include these here to reference the origins of our evolved understanding of critical thinking.

- The Law of Identity: Whatever is, is
- The Law of Non-Contradiction: Nothing can both be and not be
- The Law of the Excluded Middle: Everything must either be or not be

Beyond those classical laws of thought, there are three categories of logical reasoning (deduction, induction and abduction). Only deduction is considered a direct path to a "true" conclusion.

Deduction

Deduction is a conclusion drawn from the structure of an argument's premises.

The process of deducing or drawing a conclusion from a principle already known or assumed, or inference by reasoning from **general to specific**.

The conclusion of a deductive argument is certain. For example, all humans have a face, Jennifer is human, so Jennifer has a face.

Induction

Induction is a method of reasoning in which the premises are viewed as supplying some evidence, but not full assurance for the truth of the conclusion.

It is also described as a method where one's experiences and observations, including things learned from others, are synthesized to come up with a general truth.

The truth of the conclusion of an inductive argument is probable but not certain, based upon the evidence given.

There are three categories of logical reasoning. Only deduction is considered a direct path to a "true" conclusion.

Some sources describe induction as inference by reasoning from **specific to general**, although there are many inductive arguments that do not have that form.

For example, a group of primitive people live on the coast, on the east side of an impassible mountain range, where they notice that rivers flow east. They project that observation onto all rivers, and conclude that water always flows toward the rising sun. They take their specific observation and raise it to a general (therefore all) rule.

The structure of that argument would be:

- premise: rivers here flow east
- premise: all rivers flow east
- conclusion: rivers flow toward the rising sun

Abduction (apagoge)

Abduction is drawing a conclusion using a heuristic that is likely, but not inevitable, given some foreknowledge.

It is also described as a syllogism, of which the major premise is certain, and the minor only probable, so that the conclusion has only the probability of the minor.

Abduction is also sometimes referred to as argument by *reductio ad absurdum*, or a demonstration which does not prove a thing directly, but shows the absurdity or impossibility of denying it.

Heuristic processes are used to find the answers and solutions that are most likely to work or be correct. However, heuristics are not always right or the most accurate.

For example, police responding to an emergency use abduction or heuristic processes (sights, sounds, scattered evidence provided by people at the scene) to make decisions about how to approach a possibly dangerous situation. As they proceed further into the scene and gain further knowledge they update their approach.

This is sometimes referred to as a “fast and frugal” decision tree that can be quickly adjusted with new information.

Syllogism

A syllogism is an argument expressed or claimed to be expressible in the form of two propositions called the premises, containing a common or middle term, with a third proposition called the conclusion, resulting necessarily from the other two.

A syllogism is a kind of logical argument that applies deductive reasoning to arrive at a conclusion based on two or more propositions that are asserted or assumed to be true.

In a form, defined by Aristotle, from the combination of a general statement (the major premise) and a specific statement (the minor premise), a conclusion is deduced. For example, knowing that all men are mortal (major premise) and that Socrates is a man (minor premise), we may validly conclude that Socrates is mortal.

Abduction is sometimes referred to as a “fast and frugal” decision tree that can be quickly adjusted with new information.

Syllogistic arguments are usually represented in a three-line form:

- premise: All men are mortal
- premise: Socrates is a man
- conclusion: Therefore, Socrates is mortal

Valid Argument vs. Sound

In conversation, you may hear references to a sound argument and a valid argument. In logic, soundness and validity refer to different conditions of an argument.

Validity

An argument is valid if and only if it would be contradictory for the conclusion to be false if all of the premises are true. Validity doesn't require the truth of the premises, instead it merely necessitates that the conclusion follows from the premises without violating the correctness of the logical form. If the premises of a valid argument are proven true, then the argument is a sound argument.

This well-known example is a valid argument:

- All men are mortal
- Socrates is a man
- Therefore, Socrates is mortal

What makes this a valid argument is not that it has true premises and a true conclusion, but there is logical necessity in the conclusion, given the two premises. The premises lead to the conclusion.

The following has the same logical form but with false premises and a false conclusion. But this is still a valid argument.

- All cups are green
- Socrates is a cup
- Therefore, Socrates is green

We need to twist this syllogism one more time to produce an invalid argument.

- All men are immortal
- Socrates is a man
- Therefore, Socrates is mortal

Even though the conclusion may be true, this is not a valid argument because the conclusion contradicts the deductive logic of the premises, rather than deriving from it.

For an argument to be sound, it must be valid (the conclusion must follow from the premises) **and** its premises must be true.

Soundness

A sound argument is an argument that is valid, and its premises are true. As a consequence, the conclusion is true as well.

- All men are mortal
- Socrates is a man
- Therefore, Socrates is mortal

Because of the logical necessity of the conclusion, this argument is valid, and because the argument is valid and its premises are true, the argument is sound.

However, an argument can be valid without being sound. For example:

- All men live on Mars
- Socrates is a man
- Therefore, Socrates lives on Mars

This argument is valid because the conclusion logically follows from and does not contradict the premises. But the first premise is false so this is not a sound argument. For an argument to be sound, it must be valid and its premises must be true.

An Exercise Using the Kalam Cosmological Argument (KCA)

The Kalam Cosmological Argument is a modern form of the cosmological argument for the existence of god, named after the Kalam (medieval Islamic scholasticism) from which its key ideas originated.

It was popularized by William Lane Craig in his book, *The Kalam Cosmological Argument* (1979).

The form of the KCA defended by William Lane Craig states the following brief syllogism:

- Whatever begins to exist has a cause
- The universe began to exist
- Therefore, the universe has a cause

Craig's version of the KCA is valid in that the premises logically lead to the conclusion, and the reasoning goes from general to specific.

However, some critics of the KCA argue that the first premise may not be true, or is at least debatable. Another critique of the KCA is that the premises employ a false equivalence fallacy (comparing apples and oranges) – equating simple, observable cause and effect with something more complex and unobservable. For example, comparing a tsunami coming into existence caused by an undersea earthquake, with the universe coming into existence, something infinitely more complex and unobservable.

Based on the limits of our knowledge about the origin of the universe and absence of anything we can observe and point to as a cause, it is unreasonable to accept the KCA as a sound deductive argument.

Critiques directed at the Kalam Cosmological Argument dive deep into philosophical concepts and physical principles.

Much has been said and written about the KCA. Some of these critiques dive deep into philosophical and physical principles. For an example of this see Scott Clifton’s playful [critique of the KCA](#).

The KCA may prove to be valid and sound as we make new discoveries in cosmology. But by itself it is inconsequential.

The KCA in this simple form is not an effective tool in theist apologetics because it goes nowhere. It does nothing other than point to a gap in our knowledge about the origin of the universe.

However, William Lane Craig takes the KCA to a new place and exposes his cognitive bias by appending a further set of premises and a conclusion to the KCA based upon his conceptual analysis of the properties of the “cause”.

Craig says if the universe has a cause, then an uncaused, personal creator of the universe exists who without the universe is beginningless, changeless, immaterial, timeless, spaceless and enormously powerful. Therefore, an uncaused, personal creator of the universe exists, who without the universe is beginningless, changeless, immaterial, timeless, spaceless and infinitely powerful.

A simplified version of Craig’s supplemental premises and conclusion is:

- If the universe has a cause
- The cause must be a god
- Therefore, god exists

This supplemental argument appears to be a product of wishful thinking rather than deductive logic. It also presents the logical fallacy of substituting cause with intent.

4) Cause and Effect

Understanding cause and effect is important in learning to think critically. Humans have used the observation and testing of cause and effect to answer very simple and extremely complex questions about reality.

Aristotle wrestled with the principles of cause and effect and categorized four types of causes – material, formal, efficient, and final. Philosophers over the centuries have expanded our understanding of cause and effect.

But in using cause and effect as an everyday critical thinking tool, it is important to recognize that there are very common pitfalls in the this-therefore-that approach to problem solving.

Cause vs. Correlation

The most common logical fallacy in recognizing cause and effect is confusing correlation with cause.

In statistics, the phrase “correlation does not imply causation” refers to the inability to legitimately deduce a cause-and-effect relationship between two variables solely on the basis of an observed correlation between them.

Aristotle wrestled with the principles of cause and effect and categorized four types of causes – material, formal, efficient, and final.

The idea that “correlation implies causation” is an example of a questionable-cause logical fallacy, in which two events occurring together are thought to have a cause-and-effect relationship. This fallacy is also known by the Latin phrase *cum hoc ergo propter hoc* (with this, therefore because of this).

As with any logical fallacy, identifying that the reasoning behind an argument is flawed does not necessarily imply that the conclusion is false. But a causal relationship would have to be established through the setting and testing of a causality hypothesis.

Cause vs. Intent

A second and very common fallacy when looking at cause and effect is confusing or substituting cause with intent. This involves failing to see cause and then assuming or assigning intent in its place. This confusion is the foundation of the god-of-the-gaps logical fallacy. An effect is observed and when a lack of knowledge fails to turn up a cause, intent is assumed and assigned, you fill in the gap in your knowledge with the intent of something unseen.

For example, an earthquake deep in the ocean can cause a tsunami. We know that but primitive people did not. It is not difficult to understand why a primitive and perhaps superstitious culture experiencing a devastating tsunami with no understanding of the cause might be inclined to substitute intent for cause — an angry god did it, with a purpose in mind.

The substitution of cause with intent is the product of an evolved cognitive mechanism in brain function called agency detection. This cognitive mechanism, the interpretation of anything we may sense or observe as having an intentional cause, is an important ability.

Imagine a member of some prehistoric, pre-human species of primate walking over the savanna who hears a rustling in the grass. The agency detection cognitive mechanism allows that pre-human to imagine the rustling in the grass might be a dangerous predator and not just the wind, which prompts an effort to seek safety, perhaps by climbing a tree. If the rustling in the grass was caused by the wind, there is no consequence in seeking safety up in a tree. But if it was caused by a dangerous predator, the agency detection cognitive mechanism has allowed this pre-human primate to survive in a dangerous world.

This conflating of cause and intent is also the underlying basis of arguments against the observed and tested truth of evolution. People seem more likely to substitute cause with intent when faced with observed complexity. It is common to hear the argument that life must be the result of design because it is so beautiful and so complex. Complexity is not synonymous with and does not imply design.

It is interesting to note that agency detection, when applied illogically (without reason or evidence) is also considered a cognitive bias.

The best answer when an effect is observed and cause is uncertain is – I don’t know.

A formal fallacy, deductive fallacy, and logical fallacy refer to an argument that is invalid because of a flaw in its logical structure.

5) Logical Fallacy

Formal Fallacy

In philosophy, a formal fallacy, deductive fallacy, and logical fallacy refer to an argument that is invalid because of a flaw in its logical structure. The argument itself could have true premises, but still have a false conclusion.

So a formal fallacy is a fallacy where deduction goes wrong. This may not affect the truth of the conclusion, since validity and truth are separate in formal logic.

The term “*non sequitur*” (it does not follow) typically refers to those types of invalid arguments which do not constitute formal fallacies. In practice, “*non sequitur*” refers to an unnamed formal fallacy.

Informal Fallacy

An informal fallacy is a fallacy which may have a valid logical form and yet be unsound because one or more premises are false. Many types and forms of informal logical fallacies have been identified and are often heard referenced in conversation.

Wikipedia provides a list of logical fallacies [here](#).

Common Examples of Logical Fallacies

Slippery Slope: Asserting that a proposed, relatively small, first action will inevitably lead to a chain of related events resulting in a significant and negative event and, therefore, should not be permitted. (thin edge of the wedge, camel’s nose).

Special Pleading: The arguer attempts to cite something as an exemption to a generally accepted rule or principle without justifying the exemption (e.g. a defendant who murdered his parents asks for leniency because he is now an orphan).

Argument from Ignorance: Assuming that a claim is true because it has not been or cannot be proven false, or vice versa (appeal to ignorance, *argumentum ad ignorantiam*).

Argument from Incredulity: Appeal to common sense – “I cannot imagine how this could be true, therefore, it must be false.”

Ad Hominem: Attacking the arguer instead of the argument.

Poisoning the Well: A subtype of ad hominem presenting adverse information about a target person with the intention of discrediting everything that the target person says.

Appeal to Motive: Dismissing an idea by questioning the motives of its proposer.

Appeal to Authority: An assertion is deemed true because of the position or authority of the person asserting it (argument from authority, *argumentum ad verecundiam*).

Argumentum ad Populum: Appeal to widespread belief, bandwagon argument, appeal to the majority, appeal to the people. A proposition is claimed to be true or good solely because a majority or many people believe it. Widespread belief in something for which there is no evidence, is not evidence.

The bandwagon
Fallacy: Widespread
belief in something
for which there is
no evidence, is not
evidence.

Straw Man Fallacy: Misrepresenting an opponent’s argument by broadening or narrowing the scope of a premise and refuting a weaker version.

Appeal to Fear: An argument is made by increasing of fear and prejudice towards the opposing side.

Wishful Thinking: A belief is held based on what might be pleasing to imagine, rather than according to evidence or reason.

6) Cognitive Bias

Cognitive biases are systematic patterns of deviation from rationality in judgment. They are often studied in psychology and behavioral economics.

Cognitive biases may sometimes lead to perceptual distortion, inaccurate judgment, illogical interpretation, or what is broadly called irrationality. But biases can also help a person find commonalities and short cuts that simply make it easier to work through different situations in life.

Some cognitive biases, as a filtering process, can provide a desirable path to faster decisions, as illustrated in heuristics. Other cognitive biases are a “by-product” of human information processing limitations.

A continually evolving list of cognitive biases has been identified over the last six decades of research on human judgment and decision-making in cognitive science, social psychology, and behavioral economics.

Wikipedia provides a list of cognitive biases [here](#).

Using an understanding of cognitive bias as a critical thinking tool involves recognizing the many types of these biases and extracting those biases from the mix when analyzing a situation, an argument or a set of evidence.

Common Examples of Cognitive Bias

Agency Detection: The inclination to presume the purposeful intervention of a sentient or intelligent agent.

Confirmation Bias: The tendency to search for, interpret, focus on and remember information in a way that confirms one’s preconceptions.

Conservatism Bias: The reluctance to reasonably revise one’s belief when presented with new evidence.

Continued Influence Effect: The tendency to believe previously learned misinformation even after it has been corrected. Misinformation can still influence inferences one generates after a correction has occurred.

Declinism: The predisposition to view the past favourably (rosy retrospection) and the future negatively.

Dunning–Kruger Effect: The tendency for unskilled individuals to overestimate their ability and the tendency for experts to underestimate their ability.

Gambler’s Fallacy: The tendency to think that future probabilities are altered by past events, when in reality they are unchanged. The fallacy arises from an erroneous conceptualization of the law of large numbers. For example, “I’ve flipped heads with this coin five times consecutively, so the chance of tails coming out on the sixth flip is much greater than heads.”

Cognitive biases can lead to perceptual distortion, inaccurate judgment, illogical interpretation, and irrational conclusions.

Observer-Expectancy Effect: When a researcher expects a given result and therefore unconsciously manipulates an experiment or misinterprets data in order to find it.

Authority Bias: The tendency to attribute greater accuracy to the opinion of an authority figure (unrelated to its content) and be more influenced by that opinion.

7) Questioning Sources

As individuals, it is important to be informed and knowledgeable as a pathway to believing as many true things and as few false things as possible. But in seeking information, news and knowledge we need to be intensely critical of where that information comes from and skeptical of motives that may be attached to the information.

Basically, a critical thinker filters information by asking these two questions related to the source of the information:

- What is the source of this information, is the source credible?
- What are the possible motives of this source of information, is there an agenda attached to the information?

Much of the information we are bombarded with by agenda-driven people and organizations and through social media computer algorithms, is incomplete information, misinformation, or purposeful disinformation specifically designed to nudge us in a judgment direction, often for commercial, social or political purposes.

This is particularly true of information or “news” found on social media platforms, compounded by the function of computer algorithms on these platforms that analyze the information or points of view that you “like” or commonly view and then point you in the direction of similar information or sources of information.

For example, if you view a post, a group or a channel promoting an anti-vaccine point of view, on platforms such as FaceBook or YouTube, computer algorithms on those platforms will direct you to additional posts, groups or channels promoting a similar point of view. This is in effect, a computer generated, artificially imposed form of confirmation bias.

A recent study by the Pew Research Center on Journalism and Media found that those who rely on social media for news are less likely to get facts right about the coronavirus and politics and more likely to hear unproven claims. Link to Pew Research [study](#).

Important tactics in considering sources when seeking to be informed on any topic:

- actively seek information and news from reasonably objective sources (e.g. reputable news organizations, academic institutions, trusted organizations)
- be skeptical of information that comes to you unsolicited on social media platforms
- seek confirmation of information from several sources

A recent Pew Research study found that those who rely on social media for news are less likely to get the facts right.

8) Understanding Delusion

A delusion is a fixed belief that is not amenable to change in light of conflicting evidence. Another way of putting it is choosing to believe something when there is insufficient or no evidence to support that belief.

Most people live with some level of delusion. Simply remaining positive in a negative situation, convincing yourself that things will get better when a more critical analysis of the situation might provide evidence of a lost cause, is an example of mild (non-clinical) delusion.

One specific form of self-delusion is also considered a cognitive bias. The Dunning–Kruger effect is the tendency for unskilled individuals to overestimate their ability and for experts to underestimate their ability.

There is a more serious or clinical form of delusion associated with disorders such as schizophrenia and bipolar disorder.

Richard Dawkins chose to title his 2006 book *The God Delusion*, but many atheists avoid connecting god belief with delusion because of the possible negative association with delusional disorder, an identified mental disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM).

Understanding delusion as a critical thinking tool simply means recognizing that we are all capable of self-delusion, and making a conscious effort to avoid it. Believe things when the evidence supports that belief.

Conclusion:

This Introduction to Critical Thinking provides a very brief look at critical thinking concepts. It is not comprehensive. Each of the concepts presented here have extensive levels of complexity developed over many centuries of philosophical exploration dating back to Aristotle and the ancient Greeks.

What we have attempted to do here is connect the basic principles of critical thinking with real-world challenges in the hope that we can all find a clearer path to believing things that are true.

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