Logic in Argumentative Writing

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This resource covers using logic within writing, including logical vocabulary, logical fallacies, and other types of logos-based reasoning.

This handout is designed to help writers develop and use logical arguments in writing. Through an introduction in some of the basic terms and operations of logic, the handout helps writers analyze the arguments of others and generate their own arguments. However, it is important to remember that logic is only one aspect of a successful argument. Non-logical arguments, statements that cannot be logically proven or disproved, are important in argumentative writing, such as appeals to emotions or values. Illogical arguments, on the other hand, are false and must be avoided.

Logic is a formal system of analysis that helps writers invent, demonstrate, and prove arguments. It works by testing propositions against one another to determine their accuracy. People often think they are using logic when they avoid emotion or make arguments based on their common sense, such as "Everyone should look out for their own self interests" or "People have the right to be free." However, unemotional or common sense statements are not always equivalent to logical statements. To be logical, a proposition must be tested within a logical sequence.

The most famous logical sequence, called the *syllogism*, was developed by the Greek philosopher Aristotle. His most famous syllogism is:
> Premise 1: All men are mortal.
> Premise 2: Socrates is a man.
> Conclusion: Therefore, Socrates is mortal.

In this sequence, premise 2 is tested against premise 1 to reach the logical conclusion. Within this system, if both premises are considered valid, there is no other logical conclusion than determining that Socrates is a mortal. This guide provides some vocabulary and strategies for determining logical conclusions.

Using Logic

Logical Vocabulary
Before using logic to reach conclusions, it is helpful to know some important vocabulary related to logic.
Premise: Proposition used as evidence in an argument.
Conclusion: Logical result of the relationship between the premises. Conclusions serve as the thesis of the argument.
Argument: The assertion of a conclusion based on logical premises.
Syllogism: The simplest sequence of logical premises and conclusions, devised by Aristotle.
Enthymeme: A shortened syllogism that omits the first premise, allowing the audience to fill it in. For example, "Socrates is mortal because he is a human" is an enthymeme, which leaves out the premise "All humans are mortal."
Induction: A process through which the premises provide some basis for the conclusion.
Deduction: A process through which the premises provide conclusive proof for the conclusion.

Reaching Logical Conclusions
Reaching logical conclusions depends on the proper analysis of premises. The goal of a syllogism is to arrange premises so that only one true conclusion is possible.
Example A:
Consider the following premises:
> Premise 1: Non-renewable resources do not exist in infinite supply.
> Premise 2: Coal is a non-renewable resource.
> From these two premises, only one logical conclusion is available:
> Conclusion: Coal does not exist in infinite supply.

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Example B:
Often logic requires several premises to reach a conclusion.
> Premise 1: All monkeys are primates.
> Premise 2: All primates are mammals.
> Premise 3: All mammals are vertebrate animals. Conclusions: Monkeys are vertebrate animals.

Example C:
Logic allows specific conclusions to be drawn from general premises. Consider the following premises:
> Premise 1: All squares are rectangles.
> Premise 2: Figure 1 is a square.
> Conclusion: Figure 1 is also a rectangle.

Example D:
Notice that logic requires decisive statements in order to work. Therefore, this syllogism is false:
> Premise 1: Some quadrilaterals are squares.
> Premise 2: Figure 1 is a quadrilateral.
> Conclusion: Figure 1 is a square.
> This syllogism is false because not enough information is provided to allow a verifiable conclusion. Figure 1 could just as likely be a rectangle, which is also a quadrilateral.

Example E:
Logic can also mislead when it is based on premises that an audience does not accept. For instance:
> Premise 1: People with red hair are not good at checkers.
> Premise 2: Bill has red hair.
> Conclusion: Bill is not good at checkers.
> Within the syllogism, the conclusion is logically valid. However, it is only true if an audience accepts Premise 1, which is very unlikely. This is an example of how logical statements can appear accurate while being completely false.

Example F:
> Logical conclusions also depend on which factors are recognized and ignored by the premises. Therefore, different premises could lead to very different conclusions about the same subject. For instance, these two syllogisms about the platypus reveal the limits of logic for handling ambiguous cases:
> Premise 1: All birds lay eggs.
> Premise 2: Platypuses lay eggs.
> Conclusion: Platypuses are birds.
> Premise 1: All mammals have fur.
> Premise 2: Platypuses have fur.
> Conclusion: Platypuses are mammals.
> Though logic is a very powerful argumentative tool and is far preferable to a disorganized argument, logic does have limitations. It must also be effectively developed from a syllogism into a written piece.

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Logical Fallacies

Fallacies are common errors in reasoning that will undermine the logic of your argument. Fallacies can be either illegitimate arguments or irrelevant points, and are often identified because they lack evidence that supports their claim. Avoid these common fallacies in your own arguments and watch for them in the arguments of others.

Slippery Slope: This is a conclusion based on the premise that if A happens, then eventually through a series of small steps, through B, C,..., X, Y, Z will happen, too, basically equating A and Z. So, if we don't want Z to occur, A must not be allowed to occur either. (You start at the top of a slope by with a solid claim, A. Then, you slip down a little with a claim that is not solidly linked to A, B. Soon, you slip farther down the slope, building momentum, crashing through conclusions that do not necessarily follow A, B, etc. until you reach the bottom, Z, which has little or nothing to do with where you started, A.)

> Example: If we ban Hummers because they are bad for the environment eventually the government will ban all cars, so we should not ban Hummers.

In this example, the author is equating banning Hummers with banning all cars, which is not the same thing.

Hasty Generalization: This is a conclusion based on insufficient or biased evidence. In other words, you are rushing to a conclusion before you have all the relevant facts.

> Example: Even though it's only the first day, I can tell this is going to be a boring course.

In this example, the author is basing his evaluation of the entire course on only the first day, which is notoriously boring and full of housekeeping tasks for most courses. To make a fair and reasonable evaluation the author must attend not one but several classes, and possibly even examine the textbook, talk to the professor, or talk to others who have previously finished the course in order to have sufficient evidence to base a conclusion on.

Post hoc ergo propter hoc (aka Post Hoc or False Cause): This is a conclusion that assumes that if 'A' occurred after 'B' then 'B' must have caused 'A.'

> Example: I drank bottled water and now I am sick, so the water must have made me sick.

In this example, the author assumes that if one event chronologically follows another the first event must have caused the second. But the illness could have been caused by the burrito the night before, a flu bug that had been working on the body for days, or a chemical spill across campus. There is no reason, without more evidence, to assume the water caused the person to be sick.

Genetic Fallacy: A conclusion is based on an argument that the origins of a person, idea, institute, or theory determine its character, nature, or worth.

> Example: The Volkswagen Beetle is an evil car because it was originally designed by Hitler's army.

In this example the author is equating the character of a car with the character of the people who built the car. However, the two are not inherently related.

Begging the Claim: The conclusion that the writer should prove is validated within the claim.

> Example: Filthy and polluting coal should be banned.

Arguing that coal pollutes the earth and thus should be banned would be logical. But the very conclusion that should be proved, that coal causes enough pollution to warrant banning its use, is already assumed in the claim by referring to it as "filthy and polluting."

Circular Argument (aka Begging the Question): This restates the argument rather than actually proving it.

> Example: George Bush is a good communicator because he speaks effectively.

In this example, the conclusion that Bush is a "good communicator" and the evidence used to prove it "he speaks effectively" are basically the same idea. Specific evidence such as using everyday language, breaking down complex problems, or illustrating his points with humorous stories would be needed to prove either half of the sentence.

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Either/or: This is a conclusion that oversimplifies the argument by reducing it to only two sides or choices.

  Example: We can either stop using cars or destroy the earth.

In this example, the two choices are presented as the only options, yet the author ignores a range of choices in between such as developing cleaner technology, car sharing systems for necessities and emergencies, or better community planning to discourage daily driving.

Ad hominem: This is an attack on the character of a person rather than her/his opinions or arguments.

  Example: Green Peace's strategies aren't effective because they are all dirty, lazy hippies.

In this example, the author doesn't even name particular strategies Green Peace has suggested, much less evaluate those strategies on their merits. Instead, the author attacks the characters of the individuals in the group.

Ad populum: This is an emotional appeal that speaks to positive (such as patriotism, religion, democracy) or negative (such as terrorism or fascism) concepts rather than the real issue at hand.

  Example: If you were a true American you would support the rights of people to choose whatever vehicle they want.

In this example, the author equates being a "true American," a concept that people want to be associated with, particularly in a time of war, with allowing people to buy any vehicle they want even though there is no inherent connection between the two.

Red Herring: This is a diversionary tactic that avoids the key issues, often by avoiding opposing arguments rather than addressing them. (Imagine a big bin of white herrings. Now, imagine someone throws one red herring into the bin. Where does your attention automatically go?)

  Example: The level of mercury in seafood may be unsafe, but what will fishers do to support their families?

In this example, the author switches the discussion away from the safety of the food and talks instead about an economic issue, the livelihood of those catching fish. While one issue may affect the other it does not mean we should ignore possible safety issues because of possible economic consequences to a few individuals.

Straw Man (or Setting Up a Straw Man): This move oversimplifies an opponent's viewpoint and then attacks that hollow argument. (Setting up a weak, false "straw man" that can easily be knocked down.)

  Example: People who don't support the proposed state minimum wage increase hate the poor.

In this example, the author attributes the worst possible motive to an opponent's position. In reality, however, the opposition probably has more complex and sympathetic arguments to support their point. By not addressing those arguments, the author is not treating the opposition with respect or refuting their position.

Moral Equivalence: This fallacy compares minor misdeeds with major atrocities.

  Example: That parking attendant who gave me a ticket is as bad as Hitler.

In this example, the author is comparing the relatively harmless actions of a person doing their job with the horrific actions of Hitler. This comparison is unfair and inaccurate.

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Using Logic in Writing

Understanding how to create logical syllogisms does not automatically mean that writers understand how to use logic to build an argument. Crafting a logical sequence into a written argument can be a very difficult task. Don't assume that an audience will easily follow the logic that seems clear to you. When converting logical syllogisms into written arguments, remember to:

- lay out each premise clearly
- provide evidence for each premise
- draw a clear connection to the conclusion

Say a writer was crafting an editorial to argue against using taxpayer dollars for the construction of a new stadium in the town of Mill Creek. The author's logic may look like this:

Premise 1: Projects funded by taxpayer dollars should benefit a majority of the public.
Premise 2: The proposed stadium construction benefits very few members of the public.
Conclusion: Therefore, the stadium construction should not be funded by taxpayer dollars.

This is a logical conclusion, but without elaboration it may not persuade the writer's opposition, or even people on the fence. Therefore, the writer will want to expand her argument like this:

> Historically, Mill Creek has only funded public projects that benefit the population as a whole. Recent initiatives to build a light rail system and a new courthouse were approved because of their importance to the city. Last election, Mayor West reaffirmed this commitment in his inauguration speech by promising "I am determined to return public funds to the public." This is a sound commitment and a worthy pledge.

> However, the new initiative to construct a stadium for the local baseball team, the Bears, does not follow this commitment. While baseball is an enjoyable pastime, it does not receive enough public support to justify spending $210 million in public funds for an improved stadium. Attendance in the past five years has been declining, and last year only an average of 400 people attended each home game, meaning that less than 1% of the population attends the stadium. The Bears have a dismal record at 0-43 which generates little public interest in the team.

> The population of Mill Creek is plagued by many problems that affect the majority of the public, including its decrepit high school and decaying water filtration system. Based on declining attendance and interest, a new Bears stadium is not one of those needs, so the project should not be publicly funded. Funding this project would violate the mayor's commitment to use public money for the public.

Notice that the piece uses each paragraph to focus on one premise of the syllogism (this is not a hard and fast rule, especially since complex arguments require far more than three premises and paragraphs to develop). Concrete evidence for both premises is provided. The conclusion is specifically stated as following from those premises.

Consider this example, where a writer wants to argue that the state minimum wage should be increased. The writer does not follow the guidelines above when making his argument.

> It is obvious to anyone thinking logically that minimum wage should be increased. The current minimum wage is an insult and is unfair to the people who receive it. The fact that the last proposed minimum wage increase was denied is proof that the government of this state is crooked and corrupt. The only way for them to prove otherwise is to raise minimum wage immediately.

The paragraph does not build a logical argument for several reasons. First, it assumes that anyone thinking logically will already agree with the author, which is clearly untrue. If that were the case, the minimum wage increase would have already occurred. Secondly, the argument does not follow a logical structure. There is no development of premises which lead to a conclusion. Thirdly, the author provides no evidence for the claims made.

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In order to develop a logical argument, the author first needs to determine the logic behind his own argument. It is likely that the writer did not consider this before writing, which demonstrates that arguments which could be logical are not automatically logical. They must be made logical by careful arrangement. The writer could choose several different logical approaches to defend this point, such as a syllogism like this:

> Premise 1: Minimum wage should match the cost of living in society.
> Premise 2: The current minimum wage does not match the cost of living in society.
> Conclusion: Therefore, minimum wage should be increased.

Once the syllogism has been determined, the author needs to elaborate each step in writing that provides evidence for the premises:

> The purpose of minimum wage is to ensure that workers can provide basic amenities to themselves and their families. A report in the Journal of Economic Studies indicated that workers cannot live above the poverty line when minimum wage is not proportionate with the cost of living. It is beneficial to society and individuals for a minimum wage to match living costs.
> Unfortunately, our state's minimum wage no longer reflects an increasing cost of living. When the minimum wage was last set at $5.85, the yearly salary of $12,168 guaranteed by this wage was already below the poverty line. Years later, after inflation has consistently raised the cost of living, workers earning minimum wage must struggle to support a family, often taking 2 or 3 jobs just to make ends meet. 35% of our state's poor population is made up of people with full time minimum wage jobs.
> In order to remedy this problem and support the workers of this state, minimum wage must be increased. A modest increase could help alleviate the burden placed on the many residents who work too hard for too little just to make ends meet.

This piece explicitly states each logical premise in order, allowing them to build to their conclusion. Evidence is provided for each premise, and the conclusion is closely related to the premises and evidence. Notice, however, that even though this argument is logical, it is not irrefutable. An opponent with a different perspective and logical premises could challenge this argument.

Does Logic Always Work?

Logic is a very effective tool for persuading an audience about the accuracy of an argument. However, people are not always persuaded by logic. Sometimes audiences are not persuaded because they have used values or emotions instead of logic to reach conclusions. But just as often, audiences have reached a different logical conclusion by using different premises. Therefore, arguments must often spend as much time convincing audiences of the legitimacy of the premises as the legitimacy of the conclusions. For instance, assume a writer was using the following logic to convince an audience to adopt a smaller government:

> Premise 1: The government that governs least, governs best.
> Premise 2: The government I am proposing does very little governing.
> Conclusion: Therefore, the government I am proposing is best.

Some members of the audience may be persuaded by this logic. However, other members of the audience may follow this logic instead:

> Premise 1: The government that governs best, governs most.
> Premise 2: The government proposed by the speaker does very little governing.
> Conclusion: Therefore, the government proposed by the speaker is bad.

Because they adhere to a different logical sequence, these members of the audience will not be persuaded to change their minds logically until they are persuaded to different values through other means besides logic.