A Little Bit of Logic

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ARGUMENTS. Philosophy uses rational methods of inquiry to examine some fundamental concepts and presumptions that we hold regarding the world in which we live. The most common method of philosophical investigation is the use of argumentation. An argument can be defined as providing reasons or evidence in support of a claim; the reasons or evidence are called *premises*, and the claim being argued for is called the *conclusion*. Like a lawyer prosecuting a case, arguments are attempts at convincing people of a conclusion by the preponderance of evidence (or other reasons). Determining how well the premises actually support the conclusion is the job of evaluating the argument's *inferential strength*. The inferential strength of an argument is, essentially, how much support the premises provide the conclusion. There are a number of things to consider when evaluating the inferential strength of an argument.

EVALUATING ARGUMENTS. The purpose of an argument is to convince people of the truth (or reasonableness) of the conclusion *on the basis of* the reasons or evidence given. A good argument, then, is one that fulfills this purpose: *a good argument is one that gives reasons that make the conclusion reasonable to accept*. There are many things to consider when evaluating the inferential strength of an argument. We can summarize the important features of a good argument with two criteria. Any argument that fulfills *both* criteria is considered a *sound* (good) argument:

1. **The premises must be true or acceptable**:
   This first criterion should be obvious. Having an argument with false premises is like building a house on nothing but air: it just ain't going to stand up. If the premises of an argument are false, it doesn't matter how many there are, they can not provide support for any conclusion. Thus the premises must be true. However, this doesn't mean that they must be absolutely certain, rather the premises must be at least reasonably true. Although it is not always clear how to determine this it is advisable to use the standard of "reasonable doubt" used in jury deliberations: to be acceptable the premises must be *true beyond a reasonable doubt*.

2. **The premises must provide adequate support for the conclusion:**
   In addition to being true, the premises must also provide sufficient support for the conclusion to be acceptable. The amount of support the premises provide the conclusion is called the *inferential strength* of the argument. There are essentially two varieties of inferential strength: Deductive and Inductive.

   Deductive Arguments: The inferential strength of deductive arguments is referred to as *validity*. The term "validity" has a very specific meaning in philosophy. Validity represents the strongest type of support an argument can have: *A deductively valid argument is one in which the premises, if true, guarantee the conclusion to be true*. That is to say, the inferential strength of a deductively valid argument is so high that the conclusion must be true, if the premises are true. If the premises can not offer this absolute guarantee (even if the premises are true) then the argument is deductively invalid. Deductive validity is the strongest type of support because it is like a mathematical proof. The inferential strength of a deductive argument is derived from the form or structure of the argument, thus it is an all or nothing affair: if the argument follows a valid form, it is a valid argument, otherwise it is invalid.

   Inductive Arguments: The inferential strength of inductive arguments can never be as strong as deductive validity because inductive arguments can never guarantee the conclusion. The premises of an inductive argument can only provide probabilistic support for the conclusion. That is to say, the support inductive arguments can offer a conclusion is simply *a matter of degree*. So, the inferential strength of inductive arguments is measured on a sliding scale from weak to strong. We can define a weak inductive argument as one whose premises, if true, do not make the conclusion reasonable to accept. Whereas a strong inductive argument is one whose premises, if true, make it reasonable to accept the conclusion. Unlike a deductive argument, the strength of an inductive argument does not come from the form of the argument. Thus it is not easy to summarize what makes one inductive argument strong and another weak. Nevertheless, we can rely on a general rule of thumb: *the more support (the more evidence or reasons) there is in an inductive argument, the stronger the argument becomes*.

SOME SPECIFIC ARGUMENT TYPES. Below are a number of more specific types of arguments that we are likely to encounter in this class, as well as in more popular debates. The following descriptions are meant to familiarize the student with these types of arguments. A more detailed treatment of most of these argument types will be offered in class lectures and discussions.

1. **Deductively Valid Forms**: The validity of deductive arguments is derived from their logical form. Below are a handful of common deductively valid (and invalid) forms.

Name	*Logical Form*	*Example*
Modus Ponens	If P, then Q. P . Q	If it rains, then clouds are in the sky. It is raining. Therefore, clouds are in the sky.
Modus Tollens	If P, then Q. Not–Q Not-P	If it rains, then clouds are in the sky. Clouds are *not* in the sky. Therefore, it is not raining.
Disjunctive Syllogism	Either P or Q Not–P Q	Either it is a dog or a cat. It is not a dog. Therefore, it is a cat.
Dilemma	Either P or Q If P, then R If Q, then S Either R or S	Either David will go or Georgia will go. If David goes, Carla will be unhappy. If Georgia goes, Fred will be unhappy. Either Carla or Fred will be unhappy.

Some Common Invalid Forms: *The following common argument forms are not valid, but they are often confused with the valid forms above. Notice that they appear to be valid, but in fact, do not guarantee the conclusion.*

Affirming the Consequent	If P, then Q. Q . P	If it rains, then clouds are in the sky. There are clouds in the sky. Therefore, it is raining.
Denying the Antecedent	If P, then Q. Not-P Not-Q	If it rains, the clouds are in the sky. It is not raining. Therefore, there are no clouds in the sky.

2. **Reductio Arguments**: the latin name for this type of argument is *reductio ad absurdum*, which means "reduce to absurdity." These arguments are typically used to show that an opponents position is false because it leads to a contradiction or an absurdity. To do this one assumes that the opponents position is true, and then demonstrates how a contradiction or an absurdity follows from this assumption. For any view that leads to such a contradiction or absurdity we know (or are very confident) that the original view is wrong. One way to understand this argument is to think of it as a modified form of Modus Tollens. The assumption in question will be represented by A. The consequences of A will be represented by C.

Structure of Argument	*Example*
Assumption: A	Assume that it is raining.
If A, then C	If it is raining, then there should be clouds in the sky.
Not-C	However, there are not clouds in the sky.
Therefore, not-A	Therefore, it is not raining.

3. **Inductive Generalization**: perhaps the paradigm case of inductive arguments are inductive generalizations. These are arguments that draws a general conclusion on the basis of a few samples or examples. The following is an example of an **enumerative inductive generalization**.

> *I have seen hundreds of crows and each one was black.*
> *Therefore, it is probably the case that all crows are black.*

Notice the conclusion makes a general claim about all the crows on the basis of a few hundred examples of crows. That is, from a small sample of the general population of crows, the argument concludes that the entire population has similar properties. This argument does not guarantee the conclusion, but makes it more likely. This type of reasoning is often used in scientific research as well as opinion polls or surveys aimed at understanding the overall views of a large population. There are many considerations when evaluating inductive generalizations, but two stand out as extremely important. First, the sample (number of examples) should be large enough to support the conclusion. Generally speaking, the larger the sample used (say, thousands of crows rather than hundreds) the stronger the argument. Thus, a strong inductive generalization will avoid the fallacy of hasty generalization (see below). Second, the sample should be representative of the overall population. Inductive generalizations work only insofar as the sample actually represents the population at large. If, for example, I sampled everyone in my neighborhood, and it turned out everyone was planning on voting for Davis for the office of the President of the United States, it is unlikely we could make any worthwhile generalizations about the general opinion of the United States as a whole. Such a sample would be "biased" because it does not represent the wide variety of people, races, socio-economic classes, etc. that make up the general population of the US. Thus, the sample must be representative.

Statistical Inferences are another form of inductive generalizations: arguments that draw a conclusion about a specific individual or even on the basis of a general rule are called statistical inferences. The following is an example of a statistical inference.

> *79% of people who smoke contract lung cancer by the time they are fifty.*
> *Tom is forty-five years old and he is a smoker.*
> *Therefore, it is probable (79% chance) that Tom will contract lung cancer by the time he is fifty.*

The conclusion in this example is not guaranteed by the premises, but it gives a fairly strong argument for thinking that Tom will contract lung cancer. The logical strength of this argument depends largely on the accuracy and generality of the first premise. Since the generalization in the first premises says that 79% of people will contract lung cancer, the conclusion is given a 79% likelihood of being true. We can change the conclusion to represent this degree of support more obviously. The conclusion should read: "There is a 79% chance the Tom will contract lung cancer by the time he is fifty." There are at least two things to consider when evaluating the logical strength of statistical inferences. In addiction to the accuracy and likelihood of the generalization, the strength of a statistical inference depends on how well the individual or event fits the population that the generalization is about. For example, if the support for the generalization specified people who smoke at least a pack a day, but Tom only smokes half a pack a day, then the argument is weakened.

4. **Argument by Analogy**: A common but complicated type of argument is an argument by analogy. When using an analogy as support for a conclusion there is a claim that two things are alike in many respects and, therefore, they are probably alike in a further respect. Consider the following example.

> *Mary is very much like Charlotte; they both like the same music, they are both on the basketball team, and they have similar personalities. Charlotte likes motorcycle racing, therefore, it is likely that Mary also likes motorcycle racing.*

The argument suggests that Mary and Charlotte are alike (the analogy is between Mary and Charlotte) in many ways. The argument then concludes that, because of this similarity, there is some further similarity that they both share. In this example, the conclusion says that Mary probably likes motorcycles because she is similar to Charlotte who does like motorcycles. As you may notice, this argument does not guarantee the conclusion and so is best considered an inductive type of argument. The inferential strength of this arguments depends on the number of *relevant similarities* that Mary and Charlotte share. Generally speaking, we can say that the greater the similarity between Mary and Charlotte, the stronger the argument. However, since no analogy is perfect, the strength of the argument also depends on the number of *relevant dissimilarities*: the fewer the better. If it turns out that Charlotte and Mary don't share similar interests in other activities relevant to the conclusion, such as mountain biking, then the argument is weakened. Determining how strong an argument by analogy actually is often is a very difficulty task, and would require more space than we have here to explain. Nevertheless, it is clear that any evaluation of arguments by analogy requires the consideration of both the *relevant similarities* and *relevant dissimilarities* involved in the analogy. We can, therefore, tentatively define a strong argument by analogy as one that has *a large number of relevant similarities and a small number of relevant dissimilarities*.

5. **Abductive Arguments**: Also known as "*inferences to the best explanation*," abductive arguments offer explanations for a given set of facts or events. Abductive arguments are a unique type of reasoning, neither deductive nor inductive. However, like inductive arguments, an abductive argument never guarantees its conclusion, rather it offers the "best" explanation for the event or facts in question. For example, a child's fever and red spots on his skin is best explained by measles. Puddles in the road, and water soaked leaves in the trees is best explained by a rain storm. As these examples illustrate, abductive reasoning is not about the probability of some event or fact being true, but about how best to account for these facts. There are many things to consider when evaluating abductive arguments, but the chief concern is how well the argument accounts for the facts compared to other plausible explanation. For abductive arguments there are no hard and fast rules for deciding between rival explanations, but there are a number of general considerations that should be kept in mind. First, the predictive success of the argument is important. If it can predict more events or events more accurately than alternative explanations then this suggests it is the better explanation. Second, the coherence that the argument has with already accepted accounts is important. If the argument is inconsistent with already accepted facts or explanations, then this suggests that the argument is not the "best" fit. Third, and closely associated to the second feature, is the simplicity of the argument. The simpler explanation is one that tends to have fewer *ad hoc* auxiliary hypothesis, or fewer additional commitments. And fourth, the best abductive argument is the one that provides greater fruitfulness. Fruitfulness is a rough measure of how expansive the explanation is, that is, how many new insights or discoveries it leads to when applied outside of the immediate domain of explanation.

FALLACIES. In addition to the two criteria mentioned above, good arguments must also be free from fallacious reasoning; that is, they must not commit any fallacies. A fallacy can be defined as *an error in reasoning, typically an error that leads one to accept a conclusion when it is not well supported*. In the study of fallacies hundreds have been identified, but for our purposes we need only be concerned with those that are most frequently encountered. What follows is something of a "Top Ten" list of common fallacies you should be familiar with.

1. **Hasty Generalization**: Also known as "jumping to conclusions," this fallacy occurs when the argument draws a conclusion from too little evidence. Consider the following example: "I went to one of those psychics and had my palm read. Boy, did that psychic get it wrong. They are all a bunch of phonies." The evidence amassed for this argument amounts to a single encounter with a psychic. This is not enough evidence to draw a conclusion about *all* psychics, so it commits the fallacy of hasty generalization. Drawing conclusions about a large group on the basis of evidence drawn from only one or a few members of that group is not very reliable. An inference from a sample of a group to the whole group is legitimate only if the sample is large enough and representative of the whole group. A hasty generalization ignores this requirement.

2. **False Dilemma**: An argument commits the fallacy of false dilemma when it presumes that two (or more) alternatives are the only options available when in fact they are not. This is a type of thinking that views everything as "black or white." For example, "You should vote for the Democratic presidential candidate because you don't want to vote for the Republican candidate." This argument is committed to the unstated assumption that the only options are either Democratic or Republican when there are any number of other options available, such as the candidate from the Reform Party, or the Libertarian Party, or even the Green Party. The premise doesn't obviously lead to the conclusion in this argument once this fallacious assumption is revealed.

3. **Appeal to Popularity**: One argumentative appeal that is extremely common is appealing to the popularity of an idea or item in order to convince someone that it is worthwhile. For example, to argue that you should jump off a bridge just because everyone else is doing it is an appeal to popularity. However, this is a fallacious argument because the reason given is irrelevant to the worthiness of an idea or item. The mere fact that some idea or item is popular does not mean that it is true or worthwhile. Independent means of determining the truth or value of an idea should be considered.

4. **Begging the Question**: Also called "circular reasoning" this fallacy occurs when the truth of the conclusion is assumed in the premises. For example, "God exists because the Bible says that God exists, and we can trust what the Bible says because it is the word of God." This is obviously fallacious: in order to justify the conclusion that God exists this argument relies on a premise that assumes that God exists. The argument assumes what it is trying to prove. This type of reasoning is obviously counterproductive if arguments are suppose to give us independent reasons or evidence to support their conclusion. It is like pulling yourself up by your own boot string: it just won't get you off the ground.

5. **Slippery Slope**: This fallacy is committed when an argument claims that once a certain action is taken another less desirable action will result, and this in turn will produce a further and worse situation, and so on until some extremely horrible state of affairs is reached. This fallacy occurs typically when an innocent first step is assumed to start an unstoppable chain of events that result in an ultimately disastrous conclusion. Consider the following example: 'If we create a national health care insurance program we are promoting socialized medicine that would lead to other types of socialized insurance programs, including socialized railroads, airlines. Eventually it would justify all sorts of socialistic measures including the foundations of our democratic government. Therefore, we should not create a national health care insurance program." The causal chain that links all these "inevitable" consequences is very weak because the argument assumes erroneously that the justifications we might use for a national health care program would also justify socializing railroads, airlines and ultimately our government structure. However, not all uses of slippery slope are fallacious. We often employ it when considering the consequences of some action. The fallacy is committed only when we accept without further argument that once the first step is taken the others are *inevitable*. In such extreme cases, this is improbable and so provides inadequate support for the conclusion.

6. **Ad hominem** ("Attacking the Person"): When an argument attacks the character or background of the person instead of the argument that person has given it commits the fallacy of attacking the person. Ideally an argument should be evaluated on the basis of the reasons and evidence given, not the person who offers the argument. Often this turns out to be a type of "name calling" or "character assassination." For example: "We should not pass the Equal Rights Amendment that is now before congress. It has been argued for by a collection of feminists who are little more than a small band of bra-less bubbleheads." This is a fallacy when the person's character or their background is *not relevant* to the truth of the conclusion. There are cases, however, when the character or background of the person giving the argument is relevant. For instance, in a court of law we can question the testimony of a witness by questioning their motives for giving the testimony as well as their trustworthiness. This would be a legitimate use concern. Ad hominem attacks are fallacies only because they attack the character of the person when that is *irrelevant* to the soundness of the person's argument. (Also consider the "Ad baculum" fallacy: an appeal to force. Believe what I say or I will hurt you! Is this relevant to the truth of the conclusion?)

7. **Composition & Division**: The fallacy of *composition* concerns inferences about the relation of a part to a whole. The fallacy of composition is committed when one falsely assumes that what is true of the parts is also true of the whole. For example, to claim that since atomic particles are lifeless does not mean that anything made out of atomic particles is also lifeless. Humans are made of atoms, but they are not lifeless. This type of reasoning is fallacious because the whole may have properties that its component parts do not possess. However, not all arguments from parts to wholes are fallacious ; some parts and wholes do share properties. The fallacy rests in *assuming* that what is true of the parts is necessarily true of the whole. It ignores the very real differences between parts and wholes.

   Division: The fallacy of division is the converse of the fallacy of composition. The fallacy of *division* is committed when the argument assumes that what is true of the whole must also be true of the parts. To claim that because people are alive and made of subatomic parts, therefore subatomic particles must also be alive is an example of division. It is fallacious for the same reason the composition is fallacious.

8. **Equivocation**: A certain fallacy that results from ambiguity in language is called equivocation. This fallacy occurs when a word or phrase used in an argument is used in two or more different senses, but the conclusion requires that we fail to distinguish these two senses. Consider the following argument: "General motors runs a large number of plants. Plants produce chlorophyll. Therefore, General Motors produces a large amount of chlorophyll." This is a fallacious argument because it rests on an equivocation of the term "plant." In other words, the argument uses a key term inconsistently. Of course, in everyday discourse and argumentation equivocation won't be so obvious, and often times will rely on subtle differences in meaning. Be wary of the meaning of key terms or concepts in arguments. Subtle changes in the use of a term could lead to an unreliable conclusion.

9. **Loaded Language**: This is a fallacy is not a specific logical mistake in arguments. Rather it points to the way that language can influence our judgment about a viewpoint or event without considering the evidence. Loaded language is emotionally charged language used to engender a positive or negative attitude about something without offering additional evidence or reasons for that judgment. It is also known as "slanting" or sometimes "poisoning the well." Politicians, for example, often appeal to terms such as "liberty," "patriotic," "Democratic," and so on to get you on their side because they are emotionally charged. Non-politicians do this to: people who think that abortion is wrong often identify themselves as "pro-life" because it sounds better than being "anti-abortion" or "anti-choice." Likewise, "pro-choice" sounds better than "pro-abortion." All this is just to say that one should be aware of the emotionally charged language that can be used in arguments, and which are often used to persuade without giving additional reasons.

10. **Straw Person**: The fallacy of straw person involves purposely misrepresenting or distorting another person's argument in order to make it appear much weaker (or simply ridiculous) and thus easier to refute: a person made of straw is much easier to knock down than a real person! Consider the way political candidates often represent the views of their opponents. There is not specific form of straw person, but a tip off that someone is constructing a straw person argument is that they tend to simplify arguments, or represent opponents as making wild inferences.