LOGIC IN PRACTICE

A First Guide for Both Formal and Informal Reasoning

Douglass McFerran

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AUTHOR'S NOTE

This workbook was designed to go with an online course I teach in the Los Angeles Community College system labeled "Logic in Practice." The class is intended to meet a typical general education requirement in California colleges and universities (apart from the UC system, which calls for a course that combines both logic and composition). The same type of course is offered under a variety of labels, often with the term "critical thinking" included. Sometimes it is also intended to provide a first introduction to what is called symbolic logic with an emphasis on what are called derivations.

This present book includes some material of mine published twenty years ago in *Thinking Clearly: Formal and Informal Logic for a New Age* as well as material from my more recent third edition of *Symbolic Logic: A Conceptual Approach*. Most of it, however, was developed over the years as I continued to rethink how best to present basic information about both formal and informal logic in as accessible a form as possible.

With some exceptions I keep to the terminology familiar in most textbooks, but a major difference is in the use of a postfix literal notation (PLN) as a teaching language for symbolic logic. The transition to a more conventional notation has usually been very easy, but the initial advantage of PLN had been in the computer programs it made possible (disks were included in the initial editions of the books mentioned above). Even though these are no longer available, a postfix literal notation is still useful in offering a simplified look at the mathematical structure inherent in formal logic (something which underscores its limitations as a representation of our actual thought processes).

A key point driving my presentation is that learning to read and then write effectively is a skill that is declining in contemporary culture in large part because of the emphasis on shortened expressions (the world of sound bites and Twitter). Understanding a carefully reasoned case requires learning to read differently, and constructing a carefully reasoned case requires learning to write differently. Developing techniques to make both happen more readily is part of the job I have set myself. It remains a work in progress, of course, and for that reason I want to acknowledge the contribution of my students in their questions and comments. I hope they learn from me, but definitely I learn from them.

Douglass McFerran
November, 2015

INTRODUCTION: WHAT SHOULD YOU EXPECT OF LOGIC?

As we get started, here is a first puzzle for you to think about. Imagine we have two characters whom we'll just call Cat and Mouse.

Here is Cat:  *and here is Mouse:* 

Let's listen in on one of their conversations.

Cat: Give me a good argument against eating you for lunch.
Mouse: It would make you a cannibal.
Cat: How is that?
Mouse: Since all cats have whiskers and I have whiskers, I must be a cat.
Cat: Too bad, and I was so hungry.

This obviously is a silly argument since you know quite well that many animals besides cats have whiskers. But what about an argument like this:

All Republicans are conservatives, and Senator Snort is a conservative, so he must be a Republican.

It too is an example of what we call a fallacy, a mistake not in the information but in what we do with it as we attempt to convince someone about why we are right in what we say. It even has a technical name (the undistributed middle) which we will talk more about later. It is also the type of mistake we can slip into easily because on the surface it seems so plausible (unlike what Mouse says to prove he really is a cat) in that we might tend to think that only Republicans are conservatives.

Back in ancient Athens, where citizens had the right to sue each other and have their cases judged by a jury of fellow citizens, a skill in presentation could make the difference between life and death, wealth and impoverishment. The reason was that each individual had to be his own lawyer and it was not the role of a judge to explain to a jury what counted as good or sufficient evidence to make a ruling one way or the other. This encouraged instructors to appear who offered to teach youngsters how to present a case, often enough with the object of making a weak case seem like a better one. Obviously this could become very abusive, and often enough the early teachers, usually from outside the city, came to be seen in the same bad light as many attorneys today in the way they could manipulate a jury's responses.

Plato and Aristotle were among the Greeks who saw the need to develop a more systematic study of what would set good reasoning and bad reasoning apart. Aristotle in particular worked with the idea of using letters to represent the terms or words we use in making a case. In particular he looked at the arrangement of ideas as we saw them in two examples above. With letters, we might see both taking this form: All A is an example of B, and C is also an example of B, so C must also be an example of A (or A -> B, C -> B, so C -> A).

The pattern does look somewhat like the one we might have when we would say (and this is Aristotle's classic example):

All men are mortal and Socrates is a man, so Socrates is mortal (or A -> B and C -> A, so C -> B).

The difference is that in this last example we have done something to set up groups so that automatically anything in group C also has to be in group B. The examples we started with just said that thing groups A and C had something in common, but that was all we could say for sure.

Here, since we are looking at patterns (forms) and not really the information provided, we are working with what can be called formal logic. Symbolizing things with letters makes it easier to do this.

Aristotle was not just concerned with formal patterns. He was the first to attempt a general catalog of the ways essentially irrelevant or misleading evidence could be presented in a case. These are what today we call informal fallacies to contrast them with the pattern mistakes we were just looking at. This sets up a distinction between deductive (formal) and inductive (informal) argumentation that still determines how most logic textbooks are organized. Aristotle's influence on both carried through the Latin-speaking Middle Ages, and still in use today are the Latin phrases that described both correct and incorrect ways of setting up an argument.

I will let Mouse offer an example of what in the Middle Ages was called *ad ignorantiam* (an appeal to someone's lack of knowledge).

Mouse: I can prove you should let me go.
Cat: How is that?
Mouse: Can you prove that you shouldn't?
Cat: Well, I'm not really very good at logic.
Mouse: See, since you can't prove that you shouldn't, it only follows that you should.
Cat: I guess you're right, but since I'm admittedly not good at logic I suppose I'll just have to eat you anyway.

Not the kind of case you would find in real life? Well, think of the times a persistent salesman keeps asking for a reason not to buy his product, or a prosecuting attorney attempts to win a conviction by getting the jury to think the defendant has to prove his innocence. These are ancient tactics of persuasion, and (except in my whimsical example with Cat and Mouse) they succeed altogether too often.

In the world of the Greeks civilization meant replacing physical force and intimidation with words, but in the market or the court there was still a sense of combat. It was now verbal rather than physical, and as

less scrupulous teachers assured anxious parents, in order to protect their wealth their children needed to learn the tricks of the trade. However, as Plato and Aristotle saw it, civilization also required a certain level of honesty and fair play. The point of learning the difference between acceptable and unacceptable argumentation was to develop a respect for the truth.

What they thought then is certainly relevant today, when what I tend to call the guerrilla war of words has escalated in intensity. Logic should not be about "winning" an argument, and for that reason a course such as this makes seeing the difference between good and bad reasoning a primary goal.

Before going on, I encourage you to go to the next page and write out your first answers to a set of questions about what to expect. At the end of the course I will repeat them and you can see whether you would answer them the same way.

WRITE YOUR ANSWERS TO THE FOLLOWING QUESTIONS.

What skills do you expect to develop as a result of this class?

Do you think a course in critical reasoning is really going to make any difference in your life? Do explain.

Do you think that your own more important choices or decisions in the past have been based more on reason or on emotion? Try to explain.

When it comes to controversial issues, do you think most people look at the evidence for one side or another objectively? What about yourself?

Do you think a logic course alone will help you be more rational in your choices or decisions? Explain.

Now, to build on the last question, just what do you think it would mean to be more rational?

Now that you have had a chance to think about it, let me make a few points connected with what you may reasonably expect from a course of this kind.

Way back in the Middle Ages, teenagers interested in any career that involved literacy were expected to become skilled at grammar (meaning, they could read and write and speak Latin, which in Europe was the only common language for educated individuals), logic (meaning, they could work with formal patterns of reasoning, such as the syllogism, and recognize those general errors in reasoning that we call fallacies), and rhetoric (meaning, they could express themselves effectively). Those same expectations continue with some of our general education requirements in college, although now we expect a proficiency in English instead of Latin and we use the terms "critical reasoning" or "critical thinking" to express the goals of a basic logic course.

Can critical reasoning be taught apart from specific course material? Experts tend to think not, and they argue that this is because what it means, for instance, to think like a scientist depends already on knowing a certain amount about science while thinking like an historian depends on knowing something about history. Even being able to think critically in everyday life situations calls for a considerable amount of background knowledge about how our political and economic systems work. It is not, then, just a matter of what we call common sense, especially when the classes offered in behavioral science point out how commonsensical expectations about individuals and groups can be wrong.

Here's one example: suppose we have a group of students in one city who are asked to conduct a survey but are not being paid for it, while a group of students in another city are asked to conduct the same survey but in fact are paid for it. Now the survey itself is not what matters, but the experiment is really about how the students rate the value of the survey. Who do you think are more likely to think the survey was a good one, the volunteers or the students who get paid?

The answer, which may surprise you, is that it is the volunteers. They have already invested something of themselves in conducting the survey, so they have a greater need to believe in it. The students who got paid have nothing to lose by being more "objective" in their ratings. The point made by psychologists is that we have a need to reduce what is called cognitive dissonance -- the clash between ideas that we already hold and those that are presented to us. Smokers, for instance, are much less ready to believe the reports about the dangers of smoking than are nonsmokers. Converts who are sent out to do missionary work with individuals unlikely to accept what they have to offer are in fact more rather than less committed to their new belief system than are converts not asked to put themselves on the line in this way (the explanation offered for the growth of traditions such as the Mormons or the Jehovah's Witnesses, which do expect this kind of missionary activity).

This is not quite the same thing as saying that we can never get past our prejudices, but it does suggest that without realizing it we are more likely to pay attention only to the good points about something we favor but concentrate on the bad points about something we oppose. It's not as simple as saying that "my mind is made up, do not confuse me with facts," but there is some truth to this saying in that "facts" may be the things we already believe while "opinions" are the things someone else believes. Seeing the difference between what really should be considered a fact and what is just an opinion is part of what this course is about, but even if discussing opinions as such there is a question about how well founded they are. This is what we will be looking at as we go on.

1. GETTING STARTED

Most likely you are taking this course because it is a GE graduation or transfer requirement. It is described as a course in critical reasoning or critical thinking, which means you are expected to improve your skills in reading argumentative material (things that are meant to convince you about the truth of something through a reasoned appeal) as well as in presenting reasoned cases of your own.

Okay, what does it mean to say you are being presented with a reasoned appeal? To use the terms that are basic to this course, you are being offered an argument, meaning a set of statements in which one or more are the reasons you should accept the writer or speaker's conclusion.

Caution: there is a difference between saying two people are having an argument (meaning that they are expressing disagreement) and saying that something expressed is itself an argument.

You should take a logic course. *No, this is not yet an argument, because there is no reason given for why you should do this.*

You should take a logic course because it will improve your skill at expressing yourself effectively. *Yes, this is an argument. The idea that logic will improve your skill at expressing yourself effectively is called a premise, and the idea that you should take a logic course is called the conclusion.*

Already you might note that words used in one way in ordinary conversation might well have a different meaning in this course. "Argument" is one, and "conclusion" is another. In conversation we talk about a conclusion as what comes at the end, but in logic it is what we mean to prove, and this could be expressed at the beginning or the middle or the end of an argument. In the example above it came at the beginning.

Particularly important is the term "valid." In conversation it typically means something is true or important or acceptable ("you have a valid point" or "you will need a valid passport"). In logic it has a very technical meaning: a valid argument in one in which it would not be possible for a conclusion to be false if its premises are true.

This leads to some rather strange points:

Today is Wednesday, so today is Wednesday. *This is presented as an argument, and it would have to be valid, even if rather pointless, since the conclusion could not be wrong if the premise is correct.*

Today is Tuesday and today is not Tuesday, so there are eight days in the week. *Since the premises taken together cannot both be true and we say every argument has to be either valid or invalid, we have to call this valid; an unavoidably false premise means it cannot be called invalid (true premises and a false conclusion).*

As you go through the course we will explain more about how we classify arguments or reasoning. One of the goals of the course is to develop an ability to recognize when a piece of reasoning is deductively

valid (what sometimes I will call a "perfect case") and when it is inductively strong. To do this you will need to develop an ability to spot some very common mistakes in reasoning, formal fallacies (when an argument is not really deductively valid but might seem to be) and informal fallacies (when an argument is not really inductively strong but might seem to be).

Another way of describing what the course is about is to suggest it is a way for you to survive the guerrilla war of words. You are constantly targeted as a consumer or as a voter, and this is why so much of the emphasis of the course will be on advertising and on political rhetoric. Just as in a guerrilla war, when it is not so easy to tell the difference between a combatant and a civilian, things are not always what they seem in the cases you are presented. Some situations will be easy enough: you can see that my telling you that a particular product will be beneficial for you because Joe Celebrity endorses it is not really a very good reason to buy it. But what about my leaning on you to buy my product because I can answer any objection you have to buying it (a favorite sales trick)? If you cannot prove something wrong, does that mean it must be true (the answer, by the way, is "no")?

At the beginning of the course I do want to emphasize how we use certain terms so that, as I've noted above, the meaning is rather different from their use in ordinary conversation. These are the words we will be most concerned with: *argument, premises, conclusions, (deductively) valid, (inductively) strong, fallacious.*

THE TYPES OF ARGUMENTS

Normally we classify all arguments into one of two types: deductive and inductive. Deductive arguments are those meant to work because of their pattern alone so that if the premises are true the conclusion could not be false. All other arguments are considered to be inductive (or just non-deductive), and these are meant to work because of the actual information in the premises so that if the premises are true the conclusion is not likely to be false. The difference is between certainty (we can be sure the conclusion is correct) and probability (we can bet on the conclusion being correct).

> *Anyone who studied would have passed, but Jack did not pass. It follows he did not study.* Here the argument is supposed to work on the basis of its pattern alone. Leaving Jack out of the group that passed automatically excludes him from the group of those who studied. We cannot imagine a scenario (a counterexample) that has Jack passing with the original information. This is an example of a deductive argument (regardless of whether the premises actually are true).
>
> *We know that Jack did not pass, so he must not have studied.* We could keep the information that he did not pass but imagine a counterexample in which he did study but became very confused during the test. This is an example of a non-deductive or inductive argument, since it depends solely on the acceptability of the evidence. Since we can easily imagine other factors changing the situation we would most likely want to regard it as inductively weak.

We now go one step further. A deductive argument with the right form (as in the first example) is considered to be valid, regardless of the truth of the premises. When the premises are in fact true and the argument is valid, then we call it sound.

Inductive arguments can be seen as strong (the conclusion is more likely to be true because of support provided by the premises) or as weak. When an inductively strong argument does have true premises, we call it cogent.

How strong does an argument have to be to be acceptable? A good rule to start with is that the more is at risk, the more likely you want the conclusion to be correct. For instance, in a civil case (the kind that occurs when one person sues another) a jury is asked to decide between two sides based simply on the preponderance of the evidence, and typically there can be a split decision among the jurors. However, in a criminal case there is obviously more at stake (it could be a person's freedom or possibly his life), and so the jury is asked to decide unanimously on the basis of there not being a reasonable doubt about their verdict. In everyday life, you would expect a stronger argument about where to transfer for the last two years of college than you would about what movie to see next weekend.

All arguments then can be classified as valid or invalid. If valid, they are sound or unsound. If invalid, they are strong or weak and then, depending on the premises, cogent or not cogent. *Note that a strong argument by definition cannot be valid, and a valid argument by definition cannot be strong.*

Some additional notes: an argument that misuses a form (what we will call a formal fallacy) may not be valid but then we need to look at it in terms of inductive strength. Also, an argument may be technically sound (valid with acceptable premises) but still not a "good" argument because of some informal fallacy (another kind of mistake in the reasoning but one not related to the pattern). Most typically this could be a problem of what we call begging the question, when the premises would be acceptable only if someone already accepted the conclusion as true. (We'll see more about this later on.)

In the first part of the course we are going to look more closely at the form taken by deductive arguments that involve complete statements with a premise expressed as a conditional relationship (one that can be restated with the phrases "if" or "only if").

Inductive arguments can be seen as involving reasoning based on the similarities of things or events (reasoning by analogy), reasoning based on inferences from a limited group to a much larger one (inductive generalizations and statistical arguments), reasoning about what is likely to take place in the future or have taken place in the past (think of explanations such as those a jury is called up to make in a trial), and especially reasoning that sets out to decide cause and effect relationships. We will be looking at all this in more detail in the second part of the course.

A final point to be considered is how strong is a claim (the type of statement that might become a conclusion in an argument). Saying that Jack will get a perfect score on his exam is a stronger claim than saying he will do well on it. A good working rule for evaluating arguments intended to prove such claims is that the stronger the claim, the better the evidence should be. For instance, knowing that Jack is a good student and is studying hard might be enough to justify saying he will do well on his exam, but we would need more evidence before we can say he will get a perfect score. We would have a much stronger case for this if we also knew the test was comparatively easy.

Go to the next page and do the review quiz.

DECIDE WHICH OF THE FOLLOWING SHORT PARAGRAPHS WOULD EXPRESS ARGUMENTS AND WHICH WOULD NOT. FOR THOSE THAT ARE ARGUMENTS, UNDERLINE THE CONCLUSION.

Examples: Lee is studying very hard so that she will pass her test. not an argument
Lee is studying very hard, so she will pass her test.

1. Lee studied because she wanted to pass.
2. Lee must have studied since we know she wanted to pass.
3. Lee has studied since the beginning of the semester.
4. Lee will probably do well on her test. She must do so in order to get a high grade in the course.
5. We can be sure that Lee will try to do well on her test. She does need to do well in order to get a high grade in the course.
6. Lee must have studied. She has done very well on her test.
7. Lee is studying. That's why she will do well on her test.
8. Lee studied, then she did well on her test.
9. Lee might do very well on her test if she studies hard.
10. Why can we be sure Lee will do well on her test? She is studying very hard.
11. Lee ought to study harder. She needs to pass the course.
12. Lee ought to pass. She has been studying harder.
13. Lee must have passed her test. She studied very hard.
14. Lee must pass her test. She is studying very hard in order to do so.
15. Lee does not need the credit for this course, but she will in it.

UNDERSTANDING THE STRUCTURE OF AN ARGUMENT

You are starting in with a course that deals with (1) what counts as an argument and (2) how we know when we have a good argument.

One problem right off is that several of the terms we use in a course of this kind (a course dealing with critical reasoning or with informal logic) have technical meanings that are not the same as ordinary conversational usage. The term "argument" is one of these. In conversation we talk about having an argument when we disagree. However, a textbook might define an argument as "a set of claims in which one or more of the claims, the premises, are put forward so as to offer reasons for another claim, the conclusion." There's nothing here about disagreement, but there is the idea that we have a special relationship between things we say.

Let's look at examples of what would count as an argument.

The prosecutor to the jury: Mrs. Jones killed her husband, because she alone had access to the poison from which he died.

A student to her friend: This must be a hard test because it is very long.

And here are examples of what would not count.

Someone writing about the murder: Mrs. Jones killed her husband because she wanted the money from his insurance.

Another student to his friend: That was a hard test because it was very long.

So what is the difference in the examples? Note that they all use the word "because," but in the first set we are offering reasons to accept the claims that it was Mrs. Jones who killed her husband and that the test is hard. In the second set the claims that Mrs. Jones killed her husband and that the test is hard are already assumed to be true and we are offering explanations (saying why Mrs. Jones killed her husband and why the test was hard). Getting a feel for this difference is often difficult for beginning students, but one way of looking at this is to restate each so that the emphasis would be on an intended conclusion.

Mrs. Jones alone had access to the poison from which he died, so she is the one who killed her husband. *yes, this is a good reason to believe she is guilty*

Mrs. Jones wanted the money from his insurance, so she is the one who killed her husband. *no, we might have her motive but this alone is not evidence that she is guilty*

This test is very long, so it must be hard. *someone has not yet taken the test and is predicting that being long will make it hard*

This test was very long, so it was hard. *someone has taken the test and is explaining what made it hard*

As we go on to the next section we will learn more about how to talk about premises and conclusions, but for now focus on getting a feel for the special relationship involved. Think of it this way: two individuals can be living together but not be married. Being married means there is something different about the relationship. In the same way, we are looking at a special relationship between ideas that works in this way: one is the reason offered to think the other is true. What we are saying can be a fact or an opinion, but the point is that the acceptability of one (the premise) is intended to support the acceptability of the other (the conclusion).

Here is another point to consider. Sometimes something can be read either just as an explanation or as an argument. One rule to follow is called the principle of charity: do not interpret something as an argument if it would be a very unreasonable one. (This idea also applies to thinking of what is not stated but might be implied; do not read too much into what someone might be saying.)

Alice failed the test because she did not study. *As an explanation it assumes we already know Alice failed and we are hearing why that happened. As an argument it would mean we are trying to prove that she failed just because we know she didn't study, but that is not enough evidence to go on.*

Supposing someone wants to make it clear in writing that this is meant as an argument (regardless of how weak it might be), she could do two things:

(1) insert a comma: Alice failed the test, because she did not study.

(2) use other ways to emphasize the conclusion: Alice must have failed the test, since we know she did not study.

Still another thing to consider is whether someone means to be taken literally (going just by what the words say). Something could be intended ironically (as a figure of speech in which it is the opposite that is meant to be understood).

The President is really doing a great job. We have never had so many men killed in war since Vietnam. *It should be clear enough that the speaker or writer does not approve of the President's actions.*

Do note that a problem in reading something that may have been said aloud is that a transcript cannot communicate anything about the tone of voice or the speaker's facial expressions or the setting that itself may suggest how something is to be understood.

I'm going to kill you this afternoon. *So, is there any difference in the wording between a would-be murderer's threat and the challenge of someone out to play basketball with a friend?*

So when should you recognize something as an argument? When you have something fairly short, look to see whether there are what we call inference indicators, words that often (but not always) suggest the relationship between two separate statements. Introducing premises (the reasons offered to prove something true) are words such as "because" (when it is not used just to offer an explanation) and "since" (when it is not used to say how long ago for something). Introducing conclusions (the things we are trying to prove) are words such as "therefore" and "so" (when it is not used to express intention).

A special caution comes in with the word "if" since most often it indicates a conditional relationship between two ideas.

> Jack will pass because he studies. *We think of this as containing two separate statements even though it is just one sentence. The statement that Jack studies is offered as evidence (the premise) for saying he will pass.*
>
> Jack will pass if he studies. *This should be read as a single statement expressing a relationship between studying and passing and not as an argument. Nothing is yet being proven.*
>
> Jack will pass if he studies, and he is studying, so he will pass. *This is still one sentence, but here are three statements contained in it, two premises and a conclusion.*

In a logic class we typically look at fairly short paragraphs to examine the structure of an argument, but in everyday situations it is seldom the case that everything is this easy to analyze. That is why we are going to talk more in the next section about what we need to do in order to extract the structure of an argument from a longer piece of writing.

Let's go back to Cat and Mouse. Think through each of the following conversations to see whether you find an argument being presented.

Cat: I don't want to hear any arguments from you.
Mouse: You won't, I promise. I do not want you mad at me.
Cat: Already you've broken your promise.

Cat: Don't give me any more arguments.
Mouse: I promise not to. The last time I did give you an argument because I wanted to see how smart you were.
Cat: And what did you learn?
Mouse: You were more clever than I thought.
Cat: And what made you finally realize that?
Mouse: I can't tell you without breaking my promise.
Cat: Ah, but you just did – again.

Mouse: I bet you can't offer me an argument.
Cat: Yes, I can.
Mouse: Prove it.
Cat: I mean, I really can. See, I just did so.
Mouse: No, that doesn't count.
Cat: What if we say I can, or otherwise I'm going to eat you right now.
Mouse: Okay, now you did offer me an argument.
Cat: And it was a good one, wasn't it?
Mouse: No, it wasn't.

To see what's going on, let's use some new terms. When we talk or write not everything is expressed. We expect the listener or reader to see connections without our always spelling them out. We can use the terms inference and implication to explain this. When something happens or someone says

something we often read more into what is going on. For instance, I ask you to lend me twenty dollars for a few days. Using the word "lend" (especially when a certain amount of time is stated) **implies** that I mean to pay you back. Supposing I do not do pay you back but act as though the money was a gift. I might now **infer** that you are dishonest.

Implications can be there without anyone noting them. They are themselves not what we call mental acts (something going on in our minds). An inference, however, is something that does happen in our minds and can be expressed in words, as when I might tell you that I think you are dishonest because you asked to borrow money from me but you act as though you have no intention of ever paying me back.

Looking at the three last dialogues between Cat and Mouse, we can see that each does contain an argument in some manner if, as Cat clearly wants to do, we mean to use our definition of an argument to someone's disadvantage

In the first, Mouse does not just explain why he makes his promise. Cat thinks that saying anything at all implies that Mouse is making a case for why he had to say what he did. It is a close call, but we might then regard this as an argument, and as such Mouse did break his promise. Ordinarily, though, we will treat answers to the question of why something happened just as explanations, not as arguments. As a rule, apply that principle of charity in reading or listening to something so that you did not look at something as an argument if in fact it would not be a reasonable one.

In the second, Mouse tries to avoid explaining how he reached the conclusion about Cat's cleverness, but since he is justifying his refusal he actually is presenting an argument despite himself. Cat has managed to trick him into breaking his promise.

In the third, Cat's unsupported claim that he can offer an argument is not itself an argument (what makes an argument is that there would be something said that does support a claim). However, when Cat threatens Mouse there is an argument of sorts, but Mouse is correct in saying it would not be an acceptable one because it is an appeal to force and not to reason.

THE IMPORTANCE OF PARAPHRASING HOW AN ARGUMENT IS EXPRESSED

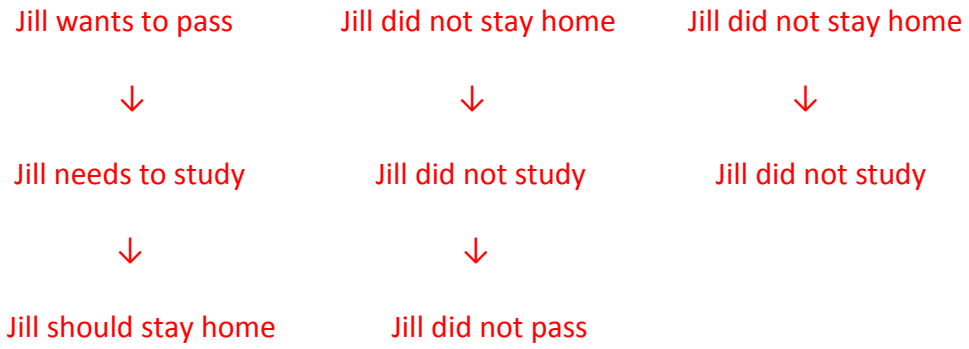
Throughout this course you will find that the skill in reading and writing we want to develop involves being able to substitute different ways of expressing an argument without actually changing the meaning of what was said originally.

Let's look at three sentences.

1. Jill needs to study because she wants to pass, and for that reason she should stay home.
2. Jill must not have studied because she did not say home, and so she probably did not pass.
3. Jill did not pass because she did not study, which must be what happened since she did not stay home.

Each has three ideas expressed, but they do not connect in the same way.

For each let's create what is called an argument diagram showing the logical movement of these ideas (not necessarily the order in which they are expressed).



The arrows point downwards to a conclusion. What is above the arrow is a premise for that conclusion. The first two are examples of what are called chain arguments in which the same statement can be the conclusion for one statement and the premise for another. In the third example we have only one statement that is a conclusion since in the first part of the sentence "because" is used to introduce an explanation for what is already given (not studying is used to explain the fact of not having passed).

We could reword each story in a number of ways without changing the logical relationships. Just as we are given the same information whether we say "Jack is Jill's brother" or "Jill is Jack's sister," it would not matter whether we said "Jill needs to study because she wants to pass" or "Jill wants to pass, therefore she needs to study." What would be different would be the following: "Jill did not stay home, she did not study, and she did not pass." This would only be a "Dear Diary" kind of sentence with one report following another and it just open to the imagination whether anything more is implied.

Most often we are looking at arguments that can be drawn out over a number of paragraphs with it up to the listener or reader to see what, if anything, is not being reported as a fact on its own but is meant to be accepted as true because of something else being said. A quick rule is to ask whether a particular statement is being presented as a known fact or as something that could be a matter of opinion. In the first sentence, that Jill should stay home obviously expresses an opinion; in the second it is given as a fact that she did not stay home and for that reason we can infer that she did not study (how reasonable an inference depends on an implied premise that Jill could have studied only when she did stay home).

In the next section we will work with examples that call on you to see the different roles a statement can be playing in a piece of argumentative writing, with a newspaper editorial being our model.

Cat has proposed a number of true/false questions for review. If you think that the item is false explain what is wrong with it briefly but carefully. Use examples when you can.

1. No one can offer an argument for something that everyone accepts as true. That's because any argument involves disagreement.

2. In examining any argument we should look for what is being proved to be at the end, since that is what we mean by a conclusion.

3. One requirement for an acceptable argument is that the premises are supported by the conclusion.

4. No statement can be both a premise and a conclusion.

5. Only deductively valid arguments can be considered acceptable cases.

6. An argument that is valid must have true premises.

7. A perfectly legitimate form of argumentation is to turn the tables on an opponent and have her prove you wrong.

8. There can be implied premises in an argument but no such thing as an implied conclusion, since otherwise we would not even know an argument was intended.

9. "If" is an example of an inference indicator. In the sentence "If logic is easy then it is fun" it indicates that what follows "if" is a premise while the part of the sentence following "then" is the conclusion.

10. The presence of the word "because" in a sentence tells us than an argument is intended and "because" will introduce a premise.

An argument is not really a collection of words but a connection of ideas. For rhetorical effect the same argument can be expressed with an emphasis on the premise or an emphasis on the conclusion. One way this can take place is by either repositioning the premise or conclusion or changing the inference indicators.

Rewrite the following arguments in two different ways as in the example below.

Logic is interesting because it is fun
Logic is fun because it is interesting.
Logic is interesting, so it is fun.

Since logic is not fun, it cannot really be interesting.

Logic is important, so it ought to be a required class.

Given that Jack did not study, we can be sure he will not pass.

Jill certainly must have studied since we know that she passed with honors.

2. BREAKING DOWN A CASE

Logic textbooks, including this one, typically stress shorter sentences or paragraphs in which premises and conclusions are expressed close together. In real-life situations the information in a premise might be expressed well before or well after the intended conclusion, and in between there can be a number of other things happening.

Let's look at the following example from an imagined editorial.

> This newspaper has seldom taken a stand on issues that involve personal moral standards, but we do see a clear reason for an exception with Mayor Jackson's proposal to terminate any city employee who openly supports plural marriage. This, of course, has been in keeping with Jackson's opposition to any unconventional lifestyle. The Supreme Court's ruling on same-sex marriage was a setback, and we cannot help but feel that what he is saying now is meant to echo his initial objection to expanding gay rights. As he said in a campaign speech, anything that weakened the notion of marriage as the union of one man and one woman would inevitably lead to the destruction of the family as a basic unit of society.
>
> Polygamy is obviously controversial, all the more so with the popularity of the television reality series *Sister Wives* featuring Kody Brown and his family. Jackson does cite the 1878 Supreme Court decision that upheld a conviction for polygamy to argue that plural marriage was not protected under the First Amendment. He conveniently ignores the more recent Utah Supreme Court ruling that eliminated the fear of prosecution that led the Browns to leave Utah for Nevada.
>
> The question we see is this: is it the business of any public official to decide what positions an employee of the city should be allowed to express on moral issues? We take the stand that the First Amendment takes precedence over even the best-intentioned efforts to support traditional values. Clearly there are going to be limits here, and we do recognize that Jackson as a political figure is within his rights to endorse what he sees as truth, justice, and the American way. However, when it is not a question of something clearly illegal, asking city employees to toe the party line even when speaking as private citizens is abusive.
>
> The City Council will rule on the mayor's proposal this coming Thursday. We hope that common sense as well as a respect for freedom of speech will prevail. Anything else is just not in keeping with the spirit of the American way.

Editorials differ from both news items and opinion pieces with an author clearly indicated. The represent a position taken by the editor or an editorial board and as such reflect a longstanding view that the press is not required to be neutral on controversial issues. The initial purpose of many newspapers and magazines was to act as vehicles for molding public opinion. An editorial, then, is not just meant to provide information in a completely neutral manner. It is argumentation, and working with editorials is one of the best exercises available to develop a skill in reading to see how ideas are meant to connect.

To do this well requires learning to see the role of any given statement in the total piece. Let's see some guidelines for doing this.

LOOK AT THE PURPOSE OF THE EDITORIAL

Generally an editorial will make a key point that expresses the stand of the newspaper. These points can be seen as fitting into one or another of the following:

Boo/hooray! The purpose of the editorial is to express approval or disapproval of a decision already made or an action already taken. ("Senator Snort should be ashamed of his stand on animal rights.")

Listen up! The purpose of the editorial is to call attention to a problem and ask for it to be resolved. ("There are mounting incidents of a misuse of animals in the name of medical research.")

Get with it! The purpose of the editorial is to recommend a particular decision, either for or against a definite course of action. ("Congress must pass SB 123 to limit the use of animals for experiments in cloning.")

LOOK AT THE ROLE OF INDIVIDUAL STATEMENTS IN THE EDITORIAL

In reading an editorial we have to understand where any particular thing that is said fits into the case being made:

Background. Typically an editorial will fill in information for the reader. This might be the history of a particular controversy, or it could be an incident that has attracted attention. It is here that the problem is stated, but we need to remember that if the issue is how to solve the problem then any explanation of why there is a problem may itself be just background, not strictly part of the case. ("Last year two thousand chimps in the name of science were slaughtered by Acme Pharmaceuticals.")

Rebuttal or counterargument. A case will be seen as stronger if objections to a proposed position can be answered. Often this is done even before the case itself is fully developed. ("We know that Senator Snort is an experienced legislator concerned with foreign policy, but that does not excuse his lack of interest in the plight of the creatures made to suffer in the labs of Acme Pharmaceuticals.")

Reasons or premises**.** These are the actual points made to support the stand taken. ("By requiring Federal approval before a primate can be killed, researchers will no longer be able to decide that an animal's suffering is immaterial.")

Inferences or conclusions. These are points that the editors want to convince the reader is true by citing other information. ("Senator Snort should withdraw his opposition to SB 123.")

SUPPLY IMPLIED PREMISES OR CONCLUSIONS

Most argumentation moves forward by finding points that a listener will accept and then building on these for the conclusion. Often enough what really should be considered are the things left unsaid but meant to be assumed. Because they are not presented openly, the listener is swept forward when possibly she ought to be holding back and demanding more information.

In reconstructing a case, a necessary step is to supply these implied premises or conclusions *as long as it appears that they are reasonably meant to be taken for granted*. We should always follow the principle of charity: do not have someone seeming to mean something which would be clearly unreasonable.

> Example 1: Alice will not pass her test. That is because she is not studying. *Clearly implied is the idea that study is a requirement for passing. Not reasonably implied would be the idea that study would definitely allow her to pass.*
>
> Example 2: We should vote to reelect Senator Snort, because he is committed to improving our relations with the countries in Asia. *Clearly implied is the idea that we should have someone in office who would work to improve these relations. Not reasonably implied would be the idea that relations would definitely be better if Snort were reelected.*

PARAPHRASE THE MAIN ARGUMENT IN A LOGLINE

In Hollywood a logline is the summary of a movie plot in one or two short sentences. Before a film ever gets made a proposed script is reviewed, and the logline is a crucial part of what is called its coverage. For instance, the logline for *Romeo and Juliet* might read "Teenagers from rival political families fall in love and unwittingly cause each other's death."

I've borrowed this Hollywood term to refer to a single sentence of no more than twenty-five words that expresses the heart of an argument--what someone means to prove (the conclusion) and the key reason offered as proof (the most important premise). For instance, let's say we are examining the argument put forward by the President in ordering the invasion of Iraq. His reasoning could be summed up this way: "The United States must invade Iraq and remove Saddam Hussein from power because his possession of weapons of mass destruction presents an unacceptable risk."

Loglines, then, are not excerpts from the actual argument. To develop a logline means that you do understand a writer or speaker's key point and you see how that person attempts to support it. You are then paraphrasing (putting in your own words) what you read or hear.

The formula I encourage you to use is this: either the conclusion followed by the word "because" and then the main premise or the main premise followed by the word “therefore” and then the conclusion. You are otherwise leaving out all that is background information as well as whatever other discussion is involved.

Your next task is to apply this to reading newspaper editorials, which for the most part are efforts to present the official stand of the newspaper on a particular issue. What you are trying to do is improve your reading skills so that you go beyond understanding individual sentences in order to see how the

ideas expressed fit together as a case (another word I use to mean the same thing as "argument"). Understanding the case can then lead you to evaluate how successful it is -- and perhaps ask other questions in order to see where the case does or does not work as well as the writer or speaker intended.

Applying these guidelines to the editorial imagined above, we might see it as a specific recommendation to the City Council to reject Mayor Jackson's proposal. This makes it a "get with it" editorial. The issue is the reasonableness of the proposal. There are elements of a counterargument in the reference to a nineteenth-century Supreme Court case as well as a suggested rebuttal. There are not really any additional points implied as premises or conclusions, so the job now is to look at the best way of summing up the key reason that the proposal should be rejected.

The danger to avoid here is using essentially rhetorical flourishes, like what we see in the final sentence, in favor of something more specific to the situation. The key point appears to be that the proposal goes against a citizen's right of free speech, even if the citizen would also be a city employee.

A good logline, then, might be either

The City Council should reject the mayor's proposal to terminate city employees speaking out in favor of plural marriage because it goes against their right to free speech.

or

City employees have a right to free speech, therefore the City Council should reject the mayor's proposal to terminate anyone speaking out in favor of plural marriage.

A SUGGESTED EXERCISE FOR CLASSROOM OR ONLINE USE

Cut out (or copy and paste in an online situation) a relatively short editorial from a major newspaper, then provide a logline that expresses the basic argument. Be careful not to cite a factual situation as a conclusion (for instance "there is a water shortage because we are failing to conserve our resources"). Unlike a prosecutor's case to a jury, ordinarily an editorial reports facts that are already accepted as such and then provides a response. Loglines are meant to express arguments, not explanations

How do editorials differ from other opinion pieces? A key difference is that many of the rhetorical devices we are likely to use in attempting to make a case are either absent or very subdued. Quotations or citations are not ordinarily used, and the personality of the anonymous author is not allowed to come through as would be expected of a well-known columnist. Also, as often as not, an opinion piece might not focus on a single issue or provide any clear recommendation. It could very well be the writer's reaction to a situation, possibly humorous or outraged, and the expectation is that it represents a more or less consistent view of how things should be from the author's viewpoint. A newspaper, appealing as it does to a general readership, will be considerably more restrained in its editorials. They may very well be controversial but they will appear far less exciting.

3. LOOKING FOR THE PERFECT CASE: DEDUCTIVE REASONING

Cat has some definite reactions to what Mouse means by a valid argument.

Mouse: Let's say that anything black is sweet.
Cat: Talking about me, of course. All right, let's say that's so.
Mouse: Let's also imagine that salt is black.
Cat: Okay.
Mouse: What follows?
Cat: Why, that salt is sweet.
Mouse: See, we've just proved the impossible.
Cat: So why bother with logic?

Mouse: Here's another one. Let's say some cats are lucky.
Cat: Obviously true.
Mouse: And some lucky individuals are rich, aren't they?
Cat: How could I deny that?
Mouse: So what else follows about cats?
Cat: Some of us are rich.
Mouse: Wrong, kitty. It may be true, but it doesn't follow.
Cat: I ask again, why bother with logic?

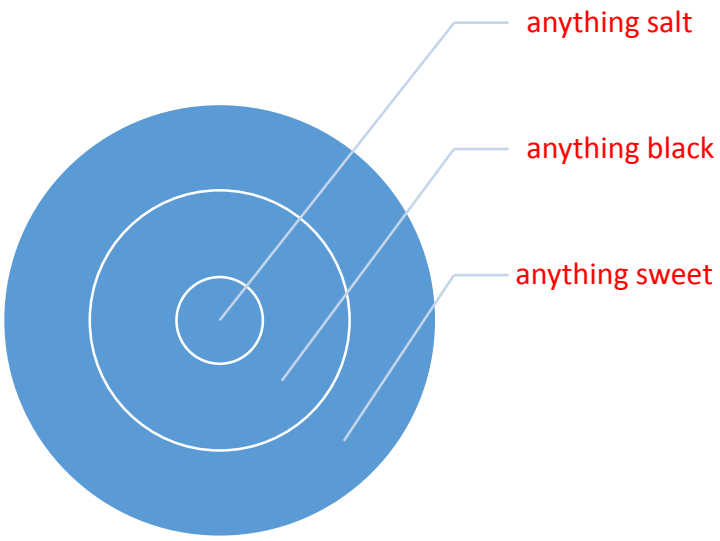
You might be tempted to say the same thing as Cat. So what really is going on?

Saying something follows in these examples is another way of saying that the case presented is deductively valid. That term "valid," remember does not mean that any particular statement is true. What is does mean is that, given that the premises in a certain pattern are true, we cannot really say that the conclusion is false. But let's see why Mouse can be so sure about himself in the first example.

Let's first restate the case he has made:

Salt is black. Anything black is sweet. Therefore, salt is sweet.

Now turn the page and see how we might diagram the relationships in terms of three concentric circles.



What we see is that while it is not really the case that anything black is sweet or that salt in fact is black it still follows from the pattern that salt would have to be classified as something sweet. That's really all we mean when we say an argument form is valid, although this can be put more abstractly as saying that it would be inconsistent to have true premises and a false conclusion (saying what we did about black things as sweet and salt as being black but then going on to deny that salt is sweet).

What Mouse does next to annoy Cat is offer a case in which everything might very well be true in itself but at the same time there is a possibility that the premises could be true and the conclusion could in fact be false.

Here is Mouse's case:

All cats are lucky. Some lucky individuals are rich. Therefore, some cats are rich.

How could we tell that it is invalid? Just imagine that while all cats are lucky for some reason only dogs get rich, so we find no rich cats at all.

Now if Mouse had changed things just a bit, there would have been no problem.

Some cats are lucky. Any lucky individual is rich. Therefore, some cats are rich.

Now try to tell a story that would allow cats to be lucky but still not rich. This time we cannot do it, and we do have to say it is a valid pattern.

Another way of seeing this for yourself would be to draw two new diagrams. In the first make sure a circle with all the cats is inside the circle of everyone lucky, but then draw a circle for anyone rich but have them just overlap so that the circle with the cats remains outside the circle for everyone who is rich. This is not something you can do with the second example. Here the circle of cats and the circle of those who are lucky do overlap, but at the same time the circle of those who are lucky must fit entirely inside the circle of those who are rich. Inevitably some cats will have to be rich.

Cat, of course, is troubled by all this. Shouldn't a perfect case (the term I have used for a deductively valid argument) be a way of finding out what really is true or false?

The answer is that the conclusion in a valid argument simply makes us look at the picture and see that the information is already implicit in the premises combined the right way. If the information in the premises is not correct, we have no basis for saying that the conclusion has to be true, even though perhaps it is.

Yes, In a valid argument we really could have a false premise and a true conclusion:

Anything black is sweet. Sugar is black. Therefore, sugar is sweet.

But if in fact the premises are true, we know the conclusion has to be true as well. We then say the argument is not just valid but sound.

This explains why from the days of Aristotle on there has been an interest in deciding which patterns work and which don't. At the same time it points out the limitations of deductive arguments. They are useful only when we work with generalizations, but we are very well aware that aside from math things are not so black and white. Virtually all generalizations allow exceptions, after all. Except in a very limited situation I cannot really talk about all students and everyone who is ambitious and anyone who passes as we are doing so often with our examples, as when I ask what follows from saying all students are ambitious and anyone ambitious will pass.

Where deductive reasoning does play a role is when we have fixed rules. For instance, if it is a rule that you cannot get a grade in a class in which you are not enrolled, we can be sure that anyone not enrolled in a particular class will not get a grade for it (at least not legally).

Mathematics, of course, is about fixed rules, so deductive reasoning is how we set out to prove things in math. Think of the Pythagorean Theorem as an example. What made Greek geometry so exciting in the ancient world was how we could decide, even before doing any measurements, that any time we had a right triangle we could be positive that squaring the length of the longest side gave us the same number as adding up the squares of the two shorter ones. And that was only the beginning.

It is not surprising even as it is unfortunate that deductive reasoning became the gold standard for an acceptable argument. Our concern with it in this course is a way of acknowledging its historical importance, but I do not want to put too much emphasis on this area apart from alerting you to what can go wrong in attempting to make use of it.

LOOKING FOR PATTERNS

There are basically two key pattern types for a deductive argument. One, dating back to the Greeks, sets up sentences as syllogisms (from the Greek for saying things together) as in the example above that everything black is sweet and salt is black, so salt must be sweet. We also talk about this as categorical reasoning (we are setting up salt, things black, and things sweet as categories) or as predicate logic (being salt, sweet, or black are examples of what we can say or predicate about individual people or things).

The other pattern, much more characteristic of how things are done today, essentially builds on conditional relationships (statements expressing the idea that if one thing is true then another thing is true as well). An example would be saying that if logic is easy then it is fun, next saying that logic in fact

is easy, so logic must be fun. We call this a propositional logic since it works with complete statements (or propositions) rather than with what are just parts of a sentence (as in “salt is black,” when we look at being salt and being black separately).

Let’s take a first look at each of these. Later sections allow the opportunity for greater mastery as well as providing a start in what is called symbolic logic. Whether these are included in your course will be up to the instructor.

WORKING WITH SYLLOGISMS

The traditional syllogism comes down to us from Aristotle and was the standard for formal logic down to this century. To work with syllogisms in the way they were taught from Aristotle’s time on you will need to be able to do two things:

(1) Restate information in the simplest way possible in order to show whether you have--

- an A statement (universal positive), such as "All students are ambitious"
- an E statement (universal negative), such as "No students are lazy"
- an I statement (particular positive), such as "Some tests are easy"
- an O statement (particular negative), such as "Some students are not ready"

In doing this keep in mind the impact of the word "only" since it indicates a need to reverse the order of the terms in thinking through the statement. For instance, "Only fun things are easy" has to be rephrased as "All easy things are fun." Knowing that something is fun does not mean it is easy, but if we do have something easy it is in the class of things that are fun.

(2) Organize your statements in a standard form so that you have the middle (connecting) term as the first part of the top premise but the second part of the bottom premise, as in this example: We want to prove that "Some tests are hard" by showing the linkage between the idea that anything long is hard and the idea that some tests are long.

Anything long is hard. ("being long" is the middle term)
Some tests are long.
Therefore, some tests are hard.

There are several ways to recognize whether what you have is a valid form (meaning, one in which true premises could not give you a false conclusion).

(1) For an invalid form it is possible to set up a parallel example with different terms so that you definitely have true premises but there is an obviously false conclusion.

(2) For an invalid form you can imagine a counterexample -- a story in which the premises stay the same but the conclusion is the opposite, and you supply some explanation for how this is possible.

(3) You can run through the following checklist.

Rule 1: A syllogism works with only three terms used with exactly the same meaning throughout.

Example: "Anything light can be lifted up, but the sun is light, so the sun can be lifted up." We are not using "light" the same way (the fallacy of ambiguity).

Rule 2: Nothing follows from two negative premises.

Rule 3: Nothing follows from two particular premises.

Rule 4: Any negative premise calls for a negative conclusion.

Rule 5: Any particular premise calls for a particular conclusion.

Rule 6: The middle term must be distributed (meaning, it is used universally at least once in the premises).

Example: "All mathematicians are smart, and all geniuses are smart, so all mathematicians are geniuses." In both premises we talk only about some of those who are smart (the fallacy of an undistributed middle).

Rule 7: There cannot be a universal subject or predicate in a conclusion if the term was not used universally in the premises.

Example: "No woman has been president, but all presidents have lived in the White House, so no woman has lived in the White House."

We know the conclusion is wrong even though the premises are correct (if we don't count George Washington, who was president before the White House was built), so we know the pattern is invalid. To see why, we look at the way in which we move from the idea of being some of the people living in the White House (particular) to being none of the people living in the White House.

(There are still other techniques in use, especially what are called Venn diagrams, but learning to work with them correctly is not particularly easy and so for the beginning student may not be all that helpful.)

There is a special reason to think about statements using the vowels we find in the Latin words *affIrmo* (I say yes) and *nego* (I say no). We say something positive with A and I statements, something negative with E and O statements. But what is especially important is what happens when we negate a statement (say that it is false rather than true). What happens is that an A statement turns into an O one ("not all apples are green" gives us the same information as "some apples are not green") while an E statement turns into an I one ("it's not true that no apples are red" gives us the same information as "some apples are red). The same thing happens when we negate I and O statements to turn them into E and A statements. Another way of putting this is that we are working with contrapositives, essentially twin statements where one starts off as negative and the other as positive. The advantage of this is that seeing these relationships helps us to apply the seven rules above more efficiently.

While a number of mistakes can be made working with syllogisms, the most common involve mistaking two patterns, one of which is valid and the other not.

THE UDM FALLACY

A traditional syllogism works with three terms. For instance, let's say we are talking about artists, bakers, and cooks and trying to imagine all the things we could say about two of them at a time. Suppose we choose to say that (1) some cooks are bakers and (2) all bakers are artists. The term

or word in common is "baker" and there is something about the pattern that compels us to say that (3) some cooks are artists.

But what if we changed this so that we had (1) all bakers are cooks and (2) some cooks are artists. Would it follow (have to be true if the other statements are true) that (3) some bakers are artists? The answer is no. And the reason? This time the word in common (the middle term) does not talk about everyone in a group (it is not "distributed"), so it is quite possible to have every baker be a cook but none of them fitting into that little world of artistic cooks. To think so is an example of a mistake in reasoning or what we call a fallacy. In this case it has long been labeled the fallacy of an undistributed middle (let's say UDM for short), and it is the most common problem in trying to work with syllogisms.

Back in ancient Greece Aristotle provided an extensive analysis of syllogisms, much of which was repeated in the logic books of the Middle Ages with their complex analysis of how statements could be combined. All of this, however, could be reduced to two basic patterns. Using letters alone (as Aristotle himself did), we could say every A is B and every B is C, so every A is C. And we could say some A is B and every B is C, so some A is C.

Now this is not really enough to cover all our possibilities, especially if we start talking about non-A and non-B and non-C. However, there are a few things that do make this easier. Saying some A is B is just the same as saying that some B is A (but we cannot say that every A being B means that every B is A). Also, if we say that every A is B then it has to be the case that anything not B has to be a non-A. (If this seems confusing, put in the words we used before so that we are talking about artists and bakers and perhaps draw diagrams to show possible relationships.)

What often can complicate things is this word "only." There is a big difference between saying all acrobats are brave and only acrobats are brave. What we need to do is straighten out the pattern by having something like only A is B restated as anything B is A (having only acrobats be brave means that anyone brave is an acrobat, which is the same as saying that if someone is not an acrobat then that person is not brave).

The real question for us often enough is how we are to show someone else what's wrong if there is a mistake such as our UDM fallacy. Citing logic rules alone is not at all helpful. But what we can do is use the same pattern with common terms such as "animal," "cat," and "dog." For instance, earlier I presented the argument that all Republicans are conservatives and Senator Snort is a conservative, so Senator Snort must be a Republican. This is clearly an instance of our UDM fallacy since we certainly could have Democrats or Independents who are conservatives. We might show this by offering the example that all dogs are animals and Garfield (from the comic strip) is an animal, so Garfield must be a dog.

Now take a look at some arguments that Mouse offers for your consideration. See if you can tell which are valid and which not.

All cats are stupid, and some stupid animals are fat, so some cats are fat.

Some cats are lazy, and any lazy animal is fat, so some cats are fat.

All mice are smart, and any smart animal is nice, so all mice are nice.

No cats are smart, and all smart animals are nice, so no cats are nice.

It's wrong to say that no mice are fast, and anyone fast does not get eaten, so some mice do not get eaten.

It's false that all cats are fast, and anyone not fast goes hungry, so some cats go hungry.

Not all cats climb trees. No animal that climbs trees worries about dogs. So some cats do worry about dogs.

Not every mouse is brave, but mice that are brave can steal cheese. Some mice, then, cannot steal cheese.

Some logic problems are very tricky. Anything tricky will make a cat unhappy. Therefore, some logic problems will make a cat unhappy.

All logic problems are very tricky. Some things that are tricky will make a cat unhappy. Therefore, some logic problems make a cat unhappy.

AND FOR A SPECIAL CHALLENGE: Most mice are beautiful but cats are never beautiful. Anyone beautiful is happy, so there are no happy cats but there are happy mice.

WORKING WITH HYPOTHETICAL RELATIONSHIPS

Usually we are less likely to be presented syllogisms than we are when we arguments based on hypothetical situations. This happens when we work with statements expressing conditions of one sort or another. For instance, if I say that you will pass if you study and then that you do study, it follows that you will pass (meaning I can be sure of this as long as the hypothetical relationship I expressed with that word "if" really is true and it is also true that you do study).

Working with hypothetical or conditional relationships involves statements telling us that knowing one thing is true should be enough to know something else is true (for instance: if Jack studies he is going to pass) or that knowing one thing is a requirement for something else, so that if it does not happen then the expected result cannot happen (for instance: Jack will study only if he does not have a job).

To work more effectively, let's think of how these relationships could all be expressed in a standard form of "If X then Y" (or symbolically as "X -> Y"). We will select key words and use the first letters as our X and Y in the examples below.

X is a sufficient condition for Y. Careful, this is not the same as saying that X is a cause of Y, although that may be true. What we are saying is that once we know X is true, we can be sure that Y is true as well.

Jill will be cut from the team if she misses one more practice. If M then C. (M -> C)
Hard work ensures success. If H then S. (H -> S)
A lot of rain means that there is a danger of mudslides. If R then M. (R -> M)
High grades can be brought about by consistent study. If S then G. (S -> G)

A very important thing to note: the order in which we express each thought is not always the same as the logical order we are concerned with here. In the first and last examples above what we have in the X position (what we call the antecedent in the conditional) was heard after what we have in the Y position (what we call the consequent in the conditional).

Y is a necessary condition for X. What we are saying is that once we know Y is false we can be sure that X is false as well.

Alice will do well only if she studies hard. If W then S. (W -> S)
Logic has to be interesting in order to be fun. If F then I. (F -> I)
Perfect attendance is a requirement for a passing grade in this program. If G then A. (G -> A)

Something else to note is that as far as logical relationships are concerned, saying that X is a sufficient condition for Y and that Y is a necessary condition for X gives us the same standard form. For instance, "logic is fun if it is easy" and "logic is easy only if it is fun" are both expressed as if E then F (E -> F).

In order to have a valid argument with a conditional as one premise just one of two things can happen: (1) we can have another premise that puts the antecedent as true so that the conclusion will state that the consequent is true, or (2) we can have another premise that takes away the consequent as true (states it is false) so that the conclusion will state that the antecedent must be false also.

These are our two valid patterns, often identified with the Latin words for putting (*ponens*) and taking (*tollens*) and abbreviated as MP (for *modus ponens*) and MT (for *modus tollens*). If our conditional is seen in standard form, we put to the left or we take from the right.

If Alice studies then she will do well. She is studying. Therefore, she will do well. (MP)
If Alice studied then she would do well. She has not done well. Therefore, she must not have studied. (MT)

The most common mistakes in working with these patterns (what we call formal fallacies) are to deny the antecedent or to affirm the consequent.

If Alice studies then she will do well. She has done well, Therefore, she must have studied.

The error: affirming the consequent (there could be other reasons for her doing well).

If Alice studied then she would do well. She did not study. Therefore, she must not have done well.

The error: denying the antecedent (as above, there could be other things allowing her to do well)

What is the practical value of understanding these rules of MP and MT? The first is a reminder to avoid the very common fallacies of denying the antecedent and affirming the consequent (put to the left, take from the right--but not the other way around). The second is to see what might be needed for what we may call the perfect case--a deductively valid argument. For instance, we have the argument that Alice will pass because she is studying. By itself, just knowing that she studies will not guarantee her passing (we could imagine--come up with the counterexample of--an extremely difficult exam), but the closer we can come to closing the gap between the information given and the idea that in fact study would be enough (a sufficient condition) the stronger our case will be . If we also know the exam is very easy we do come closer.

OTHER PATTERNS WORTH NOTING

Apart from the key rules involving MP and MT there are other patterns to note. For instance, we have a pattern called the disjunctive syllogism and another called the hypothetical syllogism.

In a disjunctive syllogism we stress the idea that if at least one of two things can be true but one of those two is ruled out it follows that the other must be true.

Either Jack will study or he will not do well. Jack is not studying, so we can be sure he will not do well.
Do note that the first sentence means the same thing as saying "Unless Jack studies he will not do well."

Be careful not to make the mistake (a formal fallacy) of saying that because we know one thing is true the other must be false. Both alternatives could be true, as when Jack studies but for whatever reason still does not do well. All we are really saying, if we think about it, is that study is a necessary condition for doing well.

In a hypothetical syllogism we track a sequence of conditional statements.

If Alice studies she will pass her test. If she passes her test she will get a high grade in the class. Therefore, if she studies she will get a high grade in the class.

Yes, the term "syllogism" is ordinarily used here but these patterns should not be confused with those we met earlier.

Cat very much resented how Mouse worded his quiz on syllogisms, so he has offered his own suggestions for questions about working with conditionals. Again, decide which are valid.

If Mouse has a house, then he is lucky. Mouse does not have a house, so we know he is unlucky.

If Mouse has a house, then he is unlucky. Mouse is very unlucky, so we know he does not have a house.

Mouse has a house only if he is nice, which he is not. That means he does not have a house.

Either Mouse guesses the answer to my riddle or he will get eaten. He has not yet been eaten, so he must have guessed the answer to my riddle.

Either Mouse guesses the answer to my riddle or he will get eaten. He has guessed the answer to my riddle, so I suppose he will not get eaten.

If a cat is smart he will trick a dumb mouse. I can always trick Mouse, who is very dumb, so that proves how smart I am.

I would certainly eat Mouse if he is unlucky. Mouse would be lucky if he figured out the answers to any of these questions, but since he can't figure them out he is very unlucky and I am going to eat him.

3. A FIRST LOOK AT SYMBOLIC LOGIC

This chapter could well be seen as optional in a basic course about critical reasoning and argumentation. For those instructors who want to include it there is a basic introduction using PLN (Postfix Literal Notation) and then a transition to a more conventional notation.

Symbolic logic as we think of it today developed over the last two centuries, in part in search of a universal language that would be a means of ending international conflict, in part to provide a tool for expressing the foundations of mathematics and as such a way of determining what problems could be solved and which could not. Today its importance lies more in computer programming, something that became apparent with the recognition that having an electric current move or not move through a switch was like saying something was either true or false.

USING A POSTFIX LITERAL NOTATION FOR PROPOSITIONAL LOGIC

Let's imagine we wanted to play a game in which two players can control the color of a light by the way in which they push either a red or a blue button in front of them. What makes the game special is that there are four switches that determine what happens when they do this. The first switch will make the light turn red only if they both press a red button while another will make it turn blue only if they both press a blue button. We'll call the first A (for "and") since it needs both players to hit the red button in order for the light to be red while we'll call the second O (for "or") since it needs only one player to hit the red button for the light to stay red. It does not matter who pushes a button first.

A third button does depend on who pushes a button first. This time it will not matter what button either player pushes as long as the first player does not push a red button and the second follows with a blue button. If that happens then the light turns blue. We'll call this one C (for "condition") and unlike the last two it sets up some possible surprises. The light will be red whether both players push a red button or both players push a blue button, and it will be red if the first player pushes the blue button and the second pushes the red one.

The last switch has one purpose: if applied to the players it will act as though they push the opposite button, and if applied to their joint action it will similarly alter the color of the light to the opposite (for instance, if the first player chooses red and the second player chooses blue when the switch is set on C, the light will now be red rather than blue). We'll call this one N (for "negation").

We can represent different moves by using set letters to name the players (with just two we will use P and Q) and other set letters to name the switches. The first we will refer to as variables, the second as signals. In order to represent plays in the game we will combine the letters so that the signal follows what it applies to. It is as though in talking about arithmetic we were to have 2 3 + instead of 2 + 3. Why do this? The reason is to shorten the string of numerals and symbols needed when we are multiplying 4 by the sum of 2 and 3. We usually do this with parentheses, as when we write (2 + 3) x 4 while adding 2 to the product of 3 and 4 would have given 2 + (3 x 4). With our postfix notation that is no longer necessary. The first would be 2 3 + 4 x while the second would be 2 3 4 x + .

Now, to make the game more interesting, we also have the possibility of using switches over so that, say, instead of just asking what color the light will be when our players each choose blue, there is first a switch A and then a switch O and we are interested in the color when the results are combined through switch C. In our new notation the play is represented by PQAPQOC. To decide what color results we might set up the following chart:

P	Q		PQA	PQO	C
blue	blue		blue	blue	red

So what practical use could we make of all this? Well, instead of working with colors we will work with the ideas of true and false and use the variables to represent complete ideas. We will set up the code so that P is the idea that logic is easy and Q is the idea that logic is fun. PQA would say that logic is both easy and fun while PQO would say that logic is either easy or fun. PQAPQOC could be "translated" as "if logic is both easy and fun then it is either easy or fun." Well, duh! But that is just what we see here, although all we are seeing so far is that the conditional relationship holds when both ideas are given as false.

But what about other possibilities? Would it still hold true?

Let's set another chart, this time using "true" and "false" instead of "red" and "blue.

P (logic is easy)	Q (logic is fun)		PQA (logic is both easy and fun)	PQO (logic is either easy or fun)	PQAPQOC
true	true		true	true	true
true	false		false	true	true
false	true		false	true	true
false	false		false	false	true

What we see is that the statement about logic being either easy or fun if it is both easy and fun is a tautology (a statement that will always be true because of the logical relationships involved). What we use to show this is called a truth table.

Suppose though we exchange the position of the two statements being linked in the condition.

P (logic is easy)	Q (logic is fun)		PQO (logic is either easy or fun)	PQA (logic is both easy and fun)	PQOPQAC
true	true		true	true	true
true	false		true	false	false
false	true		true	false	false
false	false		false	false	true

What we now see is that it is possible for PQOPQAC to be false.

Why is this important? The reason is that the definition of a valid argument is that it is not even possible to imagine a situation in which the conclusion would be false when the premises are true. That matches up completely with the rule for deciding the truth value of a conditional statement (false only if the antecedent is true and the consequent is false). In fact, using PLN, we could rewrite the argument "if Jack studies he will pass, and he is studying, therefore he will pass" just as a conditional statement. Using P for "Jack studies" and Q for "Jack passes" we would have PQCPAQC. For our purposes now we need tol express the argument form so that the premises and the conclusion stand out more clearly. We will use a comma to separate premises and what is called the assertibility sign to indicate the conclusion:

PQC, P |- Q

P	Q		PQC	P	Q
true	true		true	true	true
true	false		false	true	false
false	true		true	false	true
false	false		true	false	false

What we are looking for is whether we have a so-called "bad line" in which the premises are true but the conclusion is false. That is not happening here, so we know the argument form is a valid one.

But what if the argument is "if Jack studies he will pass, but he doesn't study, therefore he won't pass"?

PQC, PN |- QN

P	Q		PQC	PN	QN
true	true		true	false	false
true	false		false	false	true
false	*true*		*true*	*true*	*false*
false	false		true	true	true

Now we do find one possibility for a bad line. This, of course, is an example of the fallacy that occurs with denying the antecedent just as the one before it is our familiar *modus ponens* or "put" rule.

For nearly a century using a truth table has been a standard way of deciding whether an argument form is valid. It is simple enough to use when we have just two variables, as in these examples, but increasing the number of variables doubles the number of lines needed (8 for three variables, 16 for four, and so on).

Note: One reason for PLN was to expedite this on a computer (the original program is available in my textbook Symbolic Logic: A Conceptual Approach*), but an alternate way of doing things is by working backwards to see whether a bad line can be created by setting up a supposed bad line and seeing whether all the variables can be fit into it without any inconsistency.*

DERIVATIONS

Just as in geometry, the idea in formal logic is not just that looking at all possibilities tells us only one result exists but that we can prove ahead of time that this must be so. Courses in symbolic logic differ greatly in showing how this can be done just as they differ in their notation, but a more or less standard approach is the use of what is called natural deduction based on establishing a limited set of rules that for propositional logic can be confirmed through a truth table. We will set up a small group of these as argument forms.

PQA |- P A elim (eliminating an A)
P, Q |- PQA A int (introducing an A)
PQO, PN |- Q O elim
P |- PQO O int
PQC, P |- Q C elim
PQC |- QNPNC and QNPNC |- PQC Contra (for contrapositive)
PQC |- PNQO and PNQO |- PQC CO subs (C and O substitution)
PQAN |- PNQNO and PNQNO |- PQAN A neg (negating an A)
PQON |- PNQNA and PNQNA |- PQON O neg (negating an O)
Note: the first five are called inference rules, the next four are substitution rules

Let's see just how these might be used to show that the following argument is deductively valid.

Jack will pass only if he studies, which he is not. He needs to pass in order to graduate. It follows that he will not graduate.

P: Jack studies Q: Jack passes R: Jack graduates

QPC, PN, RQC |- RN

1. QPC Ass (for assumed or given)
2. PN Ass
3. RQC Ass / show RN
4. PNQNC 1 Contra
5. QN 2,4 C elim
6. QNRNC 3 Contra
7. RN 5,6 C elim

What we have is a line by line movement, first setting up our premises or assumptions as well as what we intend to prove, then applying the rules (indicating the lines involved) until we arrive at the intended conclusion. This is a direct derivation (other techniques are indirect and conditional derivations).

PLN can also be used to work with predicate logic (again, see the full development in my textbook). For our purposes here it is enough to see the basic concepts involved, especially the goals of a truth table and a derivation.

CONVERTING TO A CONVENTIONAL NOTATION

PLN is primarily a teaching language. The transition to a notation more ordinarily in use (one that does not use letters to indicate logical relationships and is what we call "infix" rather than "postfix") is very simple and quick.

PQA would be P & Q
PQO would be P v Q
PQC would be P -> Q
PN would be ~P
PQCPAQC would be [(P ->Q) & P] -> Q

The rules would also have different names.

P & Q -> P Simp (simplification)
P |- Q P & Q Conj (conjunction)
P v Q , ~P |- Q DS (for disjunctive syllogism)
P |- P v Q Add (addition)
P -> Q, P |- Q MP (for Modus Ponens)
P -> Q, ~Q |- ~P MT (for Modus Tollens)
~(P & Q) = ~P v ~Q DM (for DeMorgan's Law)
~(P v Q) = ~P & ~Q DM

Otherwise, truth tables and derivations would be very much the same as presented here.

SUGGESTED EXERCISES

Look at these four arguments Cat presented a short while back. On the next page symbolize each in PLN or in conventional notation (set up separate codes for the variables), test for validity with a truth table, and present a derivation for those that are valid. (Hint: only two of these are in fact valid. See if you spot the formal fallacies in those that are not valid.)

If Mouse has a house, then he is lucky. Mouse does not have a house, so we know he is unlucky.

If Mouse has a house, then he is unlucky. Mouse is very unlucky, so we know he does not have a house.

Mouse has a house only if he is nice, which he is not. That means he does not have a house.

Either Mouse guessed the answer to my riddle or he will have been eaten. He has not yet been eaten, so he must have guessed the answer to my riddle.

YOUR ANSWERS

4. ARGUMENTS THAT ARE NOT DEDUCTIVE

Earlier we learned that we can see arguments either as intended to work solely because of their pattern so that we can be sure of the conclusion as long as we are sure about its premises or intended to work just because the information in the premises allows a more or less good bet that the conclusion is correct. In the last two chapters we have been looking at the first with our study of deductive arguments. Now we move on to what are usually termed inductive arguments.

Most of our everyday argumentation involves information and ideas that may make us reasonably sure about the truth of our conclusions but, for several very simple reasons, do not allow us to say we could not really be wrong, even if our premises are completely correct. One reason why is that deductive reasoning, as you will see, calls for premises that do not allow for exceptions. What we know, though, is that realistically we cannot always make such generalizations, and as often as not we are working with terms (for instance, "easy" or "fun" in the examples I will use about logic) that cannot be pinned down so as to have the same standard for everyone in what they mean.

At the same time understanding what would make for a perfect case (a deductively valid argument with true premises) does give us some way of judging what we need for an inductively strong argument. For instance, the closer we can come to saying that X is a sufficient condition for Y or that Y is a necessary condition for X, the more likely is it that we can make use of our "put and take" rules to reach an acceptable conclusion. Let's look at this example:

Jack will pass because he is studying.

By itself this is not enough for a deductively valid argument. To have a valid argument an implied premise (which may or may not be a safe assumption) would be "if Jack studies he will pass" or "anyone who studies will pass." An immediate counterexample for the original argument would be: Even though Jack is studying he will not pass because the test is very hard. If we have additional information that the test is not very hard, then we are moving closer to saying that study by itself is enough.

The more information we can bring in to block counterexamples the better the case.

Jack will pass because he is studying. *weak, since we are told nothing more about the test or about Jack's abilities*

Jack will pass because he is studying and he is taking an easy test. *moderately strong, but we still need to know more about Jack himself*

Jack will pass because he is studying for an easy test and he is good at the subject. *strong, but not a "perfect case" since we could still imagine how things could go wrong (the test is not graded fairly, for instance, or Jack gets ill and cannot finish)*

a key idea: when any remaining counterexample is itself invokes something not likely to take place, we usually can say we have a strong case; the question of how strong the case needs to be in order to be acceptable depends on the risk associated with being wrong (why we have a higher standard -- no

reasonable doubt -- for a criminal trial than we do for a civil one, which only calls for a preponderance of the evidence)

In developing a case for what someone should or should not do we can also make use of two basic conditional patterns that we will look at in more detail later on.

> Alice should study because she wants to pass, and only someone who studies can pass. This can be seen as approximating what is called the MP pattern: if P then S, and P, so S
>
> Alice should not get a job since if she has a job she cannot study, and she needs to study. This can be seen as approximating what is called the MT pattern: if J then not S, but S, so not J

However, whenever we are discussing what should or should not be done we find that it might be possible to have strong cases that oppose each other. This is because we can shift our point of view (POV) in discussing such judgments. Imagine counterexamples for each of the arguments above:

Even though it's true that Alice should study because she wants to pass and study is necessary for passing, on the other hand Alice would have to give up her job.

Even though it's true that Alice should not get a job because she would not be able to study as she needs to do, on the other hand without a job she will not be able to pay for her expenses at school.

a key idea: in general it will be easier to make a case against doing something by pointing out a possible negative consequence; a case for doing something depends on there not being reasonable alternatives (making the thing in question both a necessary and a sufficient condition for a desired result)

SPECIAL TYPES OF INDUCTIVE REASONING

There are many types of arguments that by their nature would never be deductive: the most prominent examples are generalizations based on limited information, predictions based on past experience, and efforts to establish causal relationships. One way of linking them together is to compare them with what we expect in a syllogism, which relies on things being in fixed categories so that we can say, for instance, if anything A is also B and anything B is also C then we can be sure A is C also.

In the examples cited we are not talking about one thing being just the same as another (as when we say "all students are ambitious," which fits every student into the same category of individuals who are ambitious) but instead we are using the idea of similarity: A is enough like B so that if C is true of A it is likely to be true of B as well.

generalizations: on the basis of a sample we infer that an entire population has certain characteristics

predictions: we infer something about the future based on what we have already seen in the past

causal relationships: we infer that one thing is the actual cause of another largely on the basis of how we have seen similar connections

Pointing out similarities means we are dealing with analogical thinking. In general we are saying that the observed similarities outweigh possible differences. Later we will look more closely at how we work with analogical thinking in legal reasoning (how precedents are used to decide the way in which the law should apply to a particular situation) and in scientific reasoning (how past experience suggests hypotheses that can then be tested).

INFORMAL FALLACIES

If we understand well enough what a good case should be we can then see what goes wrong so that we have an example of a fallacy -- a mistake in reasoning. Earlier we looked at formal fallacies in connection with what we need for a deductively valid argument. Now we are going to look at informal fallacies -- other mistakes that are not based on the misuse of a formal pattern but on other problems in having relevant evidence for an intended conclusion.

PROBLEMS INVOLVING THE USE OF LANGUAGE

Again, think of what we need for a good case. Obviously the information in our premises should be correct, but a key difficulty is that often enough the words we use are vague or ambiguous so that we might not always be sure of what information counts in deciding whether a particular statement is true or not.

> Only important classes should be required for graduation. *important to whom or in what way?*
> Education should be a high priority for the next governor. *what really would this mean, since it could be seen just as a question of how funds are to be spent or it could be seen as a question of improving results?*
>
> We should not withdraw our troops until their mission is accomplished. *is it clear just what the mission is supposed to be and how success is determined?*

Definitely we need to avoid any use of language that closes off reasoned discussion because it loads the dice. Emotive language -- expressions that suggest how someone feels about something -- can be a special obstacle. As a thought experiment, decide how we should tell the difference between a patriot and an insurgent, a freedom fighter and a terrorist, then apply your standard to one or another historical individual (for instance, George Washington, Ho Chi Minh, or Osama Bin Laden). In the same way, think whether the bombing of Pearl Harbor that precipitated American involvement in the Second World War should be understood as a preemptive strike or as a sneak attack.

Let's look at still more examples, and think of how rational debate is affected.

> We cannot permit the continued slaughter of the unborn. *we are already forcing someone to accept that abortion is wrong in order to continue a discussion of whether it is wrong*

Military operations always involve collateral damage. *this masks the fact we are discussing civilian deaths and might well distract attention from the issue of whether civilian targets were deliberately intended*

Should we stay the course or cut and run? *this is putting a complex issue into black and white terms as well as using strongly emotive language*

We should allow an undocumented worker to get a driver's license.

We should not allow an illegal immigrant to get a driver's license. *how does the wording here change the tone of the argument?*

Making our language sufficiently clear and also sufficiently neutral is a formidable task. In legal documents and in scientific research we emphasize the need of operational definitions that spell out how a word is understood by citing something measurable. For instance, at the college level we typically see the term "full-time student" defined in terms of being enrolled for a certain number of semester units at an accredited institution. Not having any such definition leaves things wide open. For instance, how would you know when you have a case of "religious discrimination" or "sexual harassment"? (A classic example of how difficult a task we have is the Supreme Court's effort to define what counts as pornography; the justices finally settled on an obviously problematic appeal to community standards.)

PROBLEMS INVOLVING IRRELEVANT INFORMATION IN THE PREMISES

Anyone being asked to make an informed, rational choice should expect enough of the right kind of information. A great number of informal fallacies involve information (premises) that are not necessarily relevant to the conclusion but have the effect of shaping attitudes.

Arguments directed at the person rather than the issue **(**ad hominem arguments**):**

I'm again Senator Snort's bill on the environment. After all, here is a man who has been arrested twice for soliciting prostitutes.
we're being asked to oppose the bill not because of its merits but because of something about the person presenting it

However, attacking the person is not fallacious when the person's character or behavior in fact is the issue:

I'm against reelecting Senator Snort. After all, here is a man who has been arrested twice for soliciting prostitutes.
the senator's conduct is something that ought to be considered in voting for him

Appealing to an irrelevant authority:

We should vote for Senator Snort because he has an impressive list of celebrity endorsements.

This must be a great movie. It had the highest box office of all the films that came out last month.

However, an appeal to a relevant authority is exactly what we might want to hear:

We should support the measures to curb carbon dioxide emissions because of the findings of different scientific panels on what causes global warming.

We should not allow a prayer meeting during class because the Supreme Court has ruled this kind of activity violates the Constitution.

Emotional appeals of all sorts:

How can you let children starve? You must contribute to this UNESCO campaign.

You better vote for this bill. You will be very unpopular if you don't.

Turning the tables through an appeal to what someone does not know (*ad ignorantiam*):

Since you cannot prove the Bible wrong you should be going to church.

Since you cannot prove the Bible right I don't see why you should be going to church.
careful about this label: do not confuse this with, for instance, saying we should not make a certain decision because we do not know enough about its possible consequences

Turning the tables through an appeal to someone's own negative behavior:
How can you ask me not to cheat on my exams when you have been cheating on your taxes?

Distracting from the actual issue by setting up an easy target (the straw man fallacy):
We should be against any Equal Rights Amendment because women should not have to be drafted for military service.

Distracting from the actual issue by proposing hypothetical outcomes (the slippery slope fallacy):
If we allow the insurgents to win in Iraq we will have empowered them to destroy our interests in the Middle East, and then we can expect still more efforts to destroy Western civilization itself.

PROBLEMS INVOLVING HOW PREMISES ARE SET UP

Not only should the premises contain enough of the right kind of information, but they should not (1) call on someone to take for granted the very thing that has to be proved or (2) propose alternatives in an extreme way.

Begging the question:
We should oppose capital punishment because murder is wrong and capital punishment really is just another form of murder.
if the issue is whether capital punishment is wrong we cannot predetermine this by using a term such as "murder," which does not just refer to taking life but doing so wrongfully.

False alternatives:
Either we make college more affordable or we are condemning the poor to a life at just the subsistence level.
most controversial issues are fairly complex with a range of choices possible

Finally, we expect that when information is presented in order to make an informed decision we are not having something held back.
You should accept this credit card because it has a very low interest rate.
not mentioned in an ad except in the very fine print that most of us fail to read: this rate changes to something very high if there is even one late payment, and in addition there can be a substantial penalty that may even be more than the balance owed

UNDERSTANDING WHO HAS THE BURDEN OF PROOF

What we mean by this term "burden of proof" is who has to make the case. If I am the citizen asked to vote or the consumer asked to buy then I am not the one who has to defend my choice--or my silence. Being asked "Why won't you vote for Senator Snort?" or "What's wrong with this brand?" are examples of unfairly turning the tables. They are perhaps the most common tactics used by sales people, especially since the longer individuals are put on the spot the more likely they are just to go along with what they are being asked to do. Keep in mind you always have the right to say no (you don't have to vote at all, and you don't have to buy any particular product or service), and being unwilling to hurt someone's feelings or being afraid of seeming less smart or sophisticated can very well lead you to make unwise choices.

In a courtroom the concept of the burden of proof becomes especially important. In a criminal trial the prosecution must convince the jury beyond a reasonable doubt, but with what we understand by the presumption of innocence and the right not to incriminate oneself defendants are under no obligation to take the stand to make a case for their innocence. In a civil trial it is more a question of which side seems to be making the better case, and here a jury (or a judge, as in many civil trials) does expect to hear from both parties.

At the same time, be careful not to demand too much (one mistake students make in evaluating something like an editorial when they call it "unbalanced") . No one making a case for something has to list any of the points that could be raised on the other side, although anticipating them (presenting counterarguments) can be a helpful strategy. However, just answering objections is not itself presenting evidence. Saying you cannot prove me wrong does not mean I am right, but saying I can in fact prove you wrong also does not mean I am right.

Careful here: do not confuse this with the reasonable expectation that important evidence should not be suppressed. A prosecutor, for instance, does not need to present a defendant's alibi to the jury, but

before a trial the prosecution is expected to disclose any relevant information to the defendant's attorney. In the same way the President does not have to point out all the possible negative consequences of something he wants from Congress, but we would not want him to omit relevant information to which ordinarily members of the Congress would not have access.

REMEMBER, NOT EVERYTHING IS A FALLACY

Critical reasoning is a skill developed with practice. A quick way of explaining what we mean by critical reasoning is to say that we become used to thinking in terms of what else or what more we need to hear in order to make an informed and reasonable choice. Any discussion of informal fallacies is intended to cue us to think in terms of how easily we could be led to think we are being presented a good case when in fact there is just not enough of the right kind of evidence presented. Unfortunately, because of the way in which informal fallacies have come to be labeled in the textbooks, it is too easy to go the opposite direction and ignore what in fact might be an acceptable case. One textbook author, trying to curb this tendency, has talked about "look alike" situations: any appeal to authority or any attack on the person is seen as making a bad case when in fact the question has to be whether the information cited is really relevant to the conclusion. Unlike the discussion of formal logic, with its very fixed rules, here we need to understand just what it is we are being asked to accept. (In reading newspaper editorials, for instance, you would not ordinarily find informal fallacies, but you will have many "look-alike" situations.)

In this course you are being asked to pay special attention to what I'll call the guerrilla war of words. Political rhetoric and advertising in general are meant to lead you to develop certain attitudes or make specific choices which may not in fact be in your best interests as a voter or as a consumer. Survival involves a strategy of making sure

- you understand clearly what is being meant by a particular word or phrase
- you have a clear understanding of the issue (what it is that you are being asked to accept or reject)
- you know just what evidence you are being offered
- you can tell whether this is the right kind of evidence (you are able to assess its relevance)
- you can tell whether it is enough evidence (you are able to see whether there is more you ought to know for an informed decision)
- you have some way of assessing whether what you are being told is in fact true

In evaluating an argument try to avoid a "gotcha" outlook: either ignoring the principle of charity to have the presenter saying something not reasonably intended or claiming to have spotted a fallacy when really you have a "look alike" situation.

FINALLY, WEAK ARGUMENTS ARE NOT NECESSARILY FALLACIOUS

For an inductively strong argument we should have enough relevant evidence. By using the counterexample technique (keep the premises true but reverse the conclusion with an imagined explanation how this could be so) we can test just how strong an argument actually is. Fallacious

arguments are weak arguments because the evidence presented for a conclusion is either not relevant or clearly insufficient or in some other way is misleading, especially through an appeal to our emotions, so that the case looks better than it is. However, weak arguments are not necessarily fallacious: they may simply not provide enough relevant evidence. (A quick test: Is there something about the argument that makes the evidence seem stronger than it actually is? If so, yes, we most likely do have an example of one or another informal fallacy. It is not necessary and usually not that helpful to label the mistake; instead, point out how the premises in some way lead us away from the real issue.)

A SUGGESTED EXERCISE

Ads and commercials are intended to persuade you to buy a particular product or support a particular cause or candidate. Obviously there is considerable exaggeration, especially when this is done humorously. What should be a matter of concern is clearly distorted evidence likely to mislead anyone watching or listening (a typical example is the claim that a certain product contains a marvelous ingredient when in fact other products on the market contain the same ingredient even if not with the same trademarked name). Just as important would be suppressed evidence, especially in ads for a new prescription medicine that fail to indicate how more it would cost than a product already on the market.

Below describe an ad or a commercial that you have seen that would be an example of either distorted or suppressed evidence.

5. THE LOGIC OF EXPLANATIONS

When we started the course you saw that it was important to make a distinction between sentences such as these:

Jack will pass, because he is studying -- would be read as an argument with the fact that he is studying offered as the reason to believe he will pass

Jack passed because he studied -- would not be read as an argument (as though we were trying to prove he passed) but as an explanation of how it happened

Now we are going to look at what it takes to make the case that the explanation offered is the correct one. We might imagine something like the following:

Jack, who would never cheat, was taking a hard test in a subject that did not come easily for him. He did pass, so we can be reasonably sure he did so because he studied.

The next question is how we make this kind of case. A first answer comes from what we saw earlier in talking about non-deductive arguments when you saw this:

causal relationships: we infer that one thing is the actual cause of another largely on the basis of how we have seen similar connections

Based on familiar experiences, we could think of several likely reasons that Jack passed: he might have cheated, the test might have been very easy, he was just good at the subject, or he studied. If our information lets us rule out the first three, we can be fairly confident that the last is the correct reason (the cause we are looking for).

Attempting to explain how or why something happened is definitely our most common type of everyday argumentation. It is also what happens when a jury is deciding whether Mrs. Jones in fact is the one who killed her husband or whether a team of scientists is deciding on whether a particular new drug would be effective in treating a certain viral infection. The jury is asked whether his wife caused Mr. J's demise. The scientists are asked whether in various tests drug X has caused virus Y to disappear. In the first case we want to be sure beyond a reasonable doubt. In the second we want to be sure enough so that the benefits of using drug X outweigh its risks.

Critical reasoning is certainly involved in both. The jury has to think about alternative explanations for the circumstances in which Mr. J has been found deceased. The scientists have to make sure that the positive results of any trial of the drug were not due to other factors besides the drug itself (for instance, they have to rule out the possibility that the virus went away on its own). No one wants to make the mistake of the malodorous individual who claimed that garlic kept vampires away because he always wore garlic and had never yet been attacked by a vampire.

And it is here that we realize that what we mean by critical reasoning does depend on the kind of situation involved (why it is that experts have said critical reasoning cannot be taught as a specific skill). Formal logic is only of limited value, although the skills you develop there in thinking in terms of conditional relationships and recognizing the all too common fallacies involved might help you avoid some very simple mistakes.

Only someone who hated Mr. Jones would have killed him. The evidence establishes that Mrs. Jones had every reason to hate him because he was a thoroughly despicable character. Therefore, Mrs. Jones should be convicted of his murder.

Think of the pattern as killed - > hated: Mrs. J hated, so Mrs. J killed.
This the fallacy of affirming the consequent; if Mr. J is really that soap-opera horrible, there could be many who hated him and so have been his killer.

If drug X is effective then virus Y will disappear in two weeks. Virus Y has disappeared in two weeks. Therefore, drug X is effective.

Here we have effective -> disappear, virus Y disappears, so drug X is effective.
And we have the same fallacy. If the virus in question is the common cold, it will usually go away in two weeks no matter what someone takes.

So what does it take to do all of this right? Let's repeat: it depends on what we are talking about. Is it buying a product, voting for a candidate, deciding on a major career move? For each of these there is a body of background knowledge that has to be taken into consideration. Sometimes it is something an ordinary person should know, sometimes it is not.

Years back a particular gasoline (let's just call it Brand X) was advertised as superior because it contained a certain ingredient. The commercial depicted a former astronaut demonstrating a scene in which a number of cars equipped the same way and driven the same way set out on a course, but only the car with Brand X crossed the finish line while all the others, with gasoline that did not contain the ingredient in question, ran out of gas. The FTC yanked the ad quickly.
Why? All commercial gasolines contain the same ingredient, even if it has different trade names. The ordinary consumer would not know this, of course, so this was a monumental piece of deceptive advertising.

Jack is a CSUN student taking a logic course at Mission College to get a requirement out of the way. He has not done well in his midterm, so he is thinking of dropping. Jill, also a CSUN student, tells him not to, since this means he will have his GPA lowered. Good advice?
Jill's mistake: at a California state college it is not possible to drop a course after the first couple of weeks without extenuating circumstances as approved by a dean; at a community college a student can drop until close to the end of the semester with just a "W," which does not negatively affect a GPA. This is something Jack could be expected to know, so that he should understand why Jill's reasoning was off.

Explanations are about causes. But this is where things can get very difficult. Why?

What we mean when we say X causes Y is that knowing X happens means that Y happens as well. But, as so often in logic, we cannot make the mistake of working backwards. Knowing that Y happens when X happens is not the same as saying that X in fact is the cause of Y. For instance, let's imagine there is a very easy exam, and whenever that happens Jack, who has always studied very hard, does get a good grade. So is it the fact that he studied at all which causes Jack to get a good grade, or is the fact that it is an easy exam for which study is really not needed? Even if we have this happen all the time so that we are confident about the conditional relationship (study + easy test -> good grade), which is the factor that really matters? Or might it be that there is some rather unlikely thing at work, such as the decision by an overly kind instructor that Jack will always receive a good grade, regardless of how difficult the test or how well he studies.

We attempt to explain causes based on past information about similar situations. I attempt to explain why Jill is not interested in my class. I think of what other disinterested students have told me ("it's not relevant to my needs, " "it's too confusing," "I have too much going on in the rest of my life"). I try to think what else I know about Jill that would rule out all but one of these explanations. Maybe I do this well, and when I talk to Jill herself I find I'm on the right track. However, there can always be the reason I didn't think of because I had not run across it before. For instance, it might just be that Jill is disinterested because everything is really too easy for her and she is bored to tears.

SO WHAT COUNTS AS A CAUSE?

X makes Y happen. That is the basic idea of saying that X is Y's cause, but the problem is that X can be either a proximate or a remote cause (we think how closely linked are the events in time) and it can be either a direct or an indirect cause (we think how many things have to happen between X's action and the effect on Y). For both science and the law as well as in ordinary life, these distinctions do matter.

In the law we look for causal explanations in order to assign responsibility for an action. But how closely do we have to look at what someone does or fails to do when someone else gets hurt?

If X does cause Y, we can say for sure that if Y does not take place, then X did not happen first. (But watch for the kind of legal problem that comes up when someone tries to make something happen but does not succeed. A is still guilty of fraud if he tries to get money from B by deceptive means, even if he never really gets that money. We do not have "attempted fraud" or "attempted prostitution" in the same way as we have attempted murder). However, we need to watch out for what are called counterfactuals -- here, hypothetical descriptions of a situation meant to escape blame.

For instance: "If the teacher had not asked me those questions, I would have passed the test, but I didn't pass, so it was the teacher's fault that I failed." This makes it sound as though having asked these questions caused the student to fail. Or (based on the statement of a judge in a very controversial rape ruling) : "If she had not been wearing Levis, she would not have been raped, so it was her own fault that she was raped since she was wearing Levis." The working rule is this: if you act in a responsible manner, you are most likely not to blame if something goes wrong because of how another person handles the situation. As a teacher I am not normally responsible for your failure as long as I was fair in my testing (the student should know what to expect on a test, for instance). A woman is not to be held responsible for someone else's violent actions, even if she does dress "provocatively."

In the law there is an additional distinction between what a reasonable person could anticipate and a situation of strict liability. For many situations, the courts have decided that it is the public's interest to insist on strict liability, as when a manufacturer is at fault if the product fails and someone gets hurt as a result, even if the failure could not have been expected. One situation often coming up would go something like this: Jack's pit bull gets loose and attacks Jill; Jack is held at fault even if he had done all he thought reasonable to prevent the dog from getting loose. The concept is that owning a dangerous animal demands a higher degree of care, and a strict liability view tends to force this.

DO WE EXPERIENCE CAUSE AND EFFECT?

This is a philosopher's question, first raised by David Hume in the eighteenth century. We can experience a sequence of events, such as one billiard ball hitting another with the first stopping and the second starting to move (this is Hume's example). We infer that the first caused the second to move, but we are reaching this conclusion based simply on seeing what happened first and what happened next. And it is for this reason that much of our effort to get the right explanation for something is compromised. There can certainly be a correlation without there being a genuine cause-and-effect relationship. Let's imagine Bxtl the Martian trying to infer the reason for students in a spring class doing less well on their final than on their midterm. One thing he notes is that at the midterm (on a cool day in April) students typically wore sweaters or coats, but at the final (on a warm day in June) they did not, Ah, says Bxtl, the absence of sweaters or coats caused the performance to go down. What he might not pay any attention to is the fact that the midterm was a multiple-choice exam while the final was an essay exam.

We can talk, then, about the fallacy of false causality happening when a particular factor is cited as a cause for something happening when a more careful look at the facts might suggest far more likely possibilities. This also is the risk is going from talk about sufficient or necessary conditions to talk about sufficient or necessary causes.

LOGIC AND SCIENCE

In its most general terms, scientific reasoning is an effort to explain causal relationships: what makes something happen. Depending on the science, the purpose of the question might be to improve how we do things, whether it is medicine treating illness or chemistry developing a better type of paint. The purpose also can be just to understand ourselves and our universe, as when we ask about evolution or how our planet came into being.

In the last several hundred years the process for scientific discovery has relied primarily on the idea of proposing and testing a hypothesis -- what we call the experimental method. Earlier what was called science tended to rely on the idea that there was a general cosmic pattern that could be understood almost regardless of experimentation.

Aristotle, for instance, argued that a vacuum (a void, as he called it) could not exist since in a vacuum there would be no resistance to slow down a falling object, which meant that something dropped in a vacuum would have to be simultaneously at the top and at the bottom. The assumption, based on observation, was that air resistance was what made the difference in how something fell. Since the atomic theory suggested by other Greeks depended on there being such a thing as a void, it was supposedly proven to be impossible -- a classic example of what (again in Latin) is called a priori reasoning.

Galileo, who endorsed an atomic theory, tried to see what would actually happen when items of a different mass fell at the same time. What he learned (supposedly by dropping balls of a different weight from a tower) was that another factor was at work about which Aristotle had no idea at all. In your science classes you learn about this with the formula for the acceleration of a falling body: $s=at^2$

There are times when we are sufficiently sure of our ideas that we can rule something out as impossible a priori. For instance, if we have the rule that only a student enrolled in a class can receive a grade for it, we have enough evidence to say Alice did not get a grade in her logic class if we already know she had dropped it. This is deductive reasoning.

Suppose, though, we want to explain why Alice dropped the class and she is not around to tell us. Now we reason differently (inductively). Most likely we start by looking at what we already know from similar situations (we are going to reason from analogy). Past experience suggests a list of possibilities: the course was too difficult, she fell ill, she took a new job, there were family or relationship problems, and so on. If there were some way of ruling out all but one of these (for instance, it was actually an easy class, Alice seemed to be in good health, and she did not need to work), we would think we had the most likely answer in terms of family or relationship problems (we are reasoning to the best explanation). These possibilities are what we mean when we talk about hypotheses. If we can rule out all but one, we are likely to accept that we have the right answer, even though we understand there is still a chance of being wrong.

Scientific theories are simply more sophisticated versions of what we have been doing in attempting to explain Alice dropping a class. Think of the atomic theory or the theory of evolution in exactly the same way. We have statements about the facts we observe and we have statements that are an effort to explain why we observe. Theories first off are attempted explanations. Whether they are generally accepted depends on how well they fit the available evidence as well on how well they are open to evidence that could prove them wrong.

Here are some important terms:

A hypothesis is a trial explanation; to be good it must be something we can test so that we would know what would prove it wrong. In other words, it must be falsifiable, so an explanation that cannot be tested is not a scientific explanation.

One thing that will be distinctive about a scientific hypothesis is the effort to be very precise about the terms in use. There is an effort to make use of what we call operational definitions in which the meaning of a term is spelled out through how we might recognize that something has in fact happened that allows the term to be used. Think of the everyday sense of "student." Now think of how "student" will be defined operationally in order for individuals to get a theater discount (you are a student if you have a

school ID) or to go on their parents' insurance policy (you are a student if you can show you are enrolled in twelve semester units in an accredited institution).

A theory (such as the atomic theory or Darwin's theory of evolution) is a hypothesis that is acceptable because it does fit the evidence and so far has not been proven wrong.

A paradigm is a pattern of explanation that is generally accepted. For instance, an astrological explanation of human behavior falls outside the paradigm in use in psychology today. Paradigms do change, and this is because there are anomalies or things that do not fit.

A major fallacy is the self-sealing argument. The classic example is the argument proposed against the new approach to science in the nineteenth century. The finding of fossilized bones (the dinosaurs) indicated that the world must be millions of years older than what was being argued by those who looked to the Bible and reasoned that the world was only several thousand years old. The answer was that God could create the fossils to look old as a test of man's faith. Obviously, there is no way to prove this wrong.

Another example would be the reasoning that Mr. Jones, accused of murder, has family members who provide him an alibi, but since we can be sure he is guilty we can disregard their testimony as untrue. (Think of how this also fits what we understand with the fallacy of begging the question.)

LOGIC AND THE LAW

Let's imagine that as a professor I am able to excuse students from a particular exam depending on their reasons. Alice, the student body president, comes to me and asks to be excused because the final exam conflicts with an important meeting with administration scheduled for the same time. I excuse her readily. Not much later Bob comes along and tells me that unfortunately his family had arranged for everyone to travel to his sister's wedding on that date and could not change the reservations. Again I agree. But now Carla asks to be excused because she has a crucial job interview that could not be rescheduled. This time I refuse because Carla has been one of those students who puts me on the spot with her questions in class and I do not want to give her a break here. She protests that I am not being fair since I have already excused students in similar situations. Is she right?

I think most of you would say that she is. After all, I could not have excused anyone, or I could have set very rigid limits on what would count as an excuse. To be fair is to be consistent, so once I have allowed a certain kind of excuse I ought really make similar allowances without letting my personal feelings take over. This is the commonsense reasoning that provided the basis for the law in England and then in America, and essentially it says that a courtroom decision today should be in line with similar decisions.

What is characteristic of Anglo-American law is how these interpretations are expected to follow pre-existing patterns. Basically these patterns are established through past court rulings, some of which reach back to medieval England. We call these precedents, and the idea is that the more closely a new situation resembles an older one already ruled on, the more true it is that the ruling should be the same as before. In individual cases this may not always seem particularly fair, but the point is that the fairness of the system as a whole is supposed to depend on consistency.

This is clearly using analogical reasoning. The difficulty is that often enough a situation can be seen from different angles so that one side will argue that a particular precedent applies while the other argues that it does not. In the courtroom it is the presiding judge who rules on these points of law, but after the trial his decision can be appealed. The typical pattern at the state level is to have a trial court, then a certain number of courts of appeal in a state for different areas, then a state supreme court as the final arbiter at the state level. When it is a question of the laws of the United States, especially when the Constitution itself is being cited, we also have a Federal court system with its appeals courts and, finally, the Supreme Court. Understanding the law means knowing the key rulings from both state and federal appeals courts.

A guiding principle in the American legal system is called *stare decisis* -- stand by past decisions. This principle is so important that it has happened that the members of the Supreme Court have at times felt obliged to rule in a way they really did not like. A classic example was the question of flag burning. The Court had previously ruled that "symbolic speech" (in the case at hand it was a teenage student wearing a black armband as a protest against the Vietnam War) was protected by the First Amendment in the same way as actual speech. Despite their personal objections to the act of burning the American flag as a protest, the judges ruled that it too was protected. As a result, those who continue to see it as wrong have pushed in Congress (so far unsuccessfully) for an amendment to the Constitution that would specifically limit the First Amendment.

There have been a number of controversial Supreme Court decisions, perhaps the most bitterly opposed being the 1973 ruling that stated the government could not legally prevent a woman from getting an abortion in the first six months of pregnancy. A close look at the actual decision indicates the complexity of the reasoning. The majority of the justices ruled that the question of deciding just when a fetus should be considered a human being with a constitutionally protected right to life was made difficult because of the diversity of both scientific and theological views. Selecting the point when a fetus was able to survive outside the uterus (when it was viable, usually not before the end of the first two trimesters of pregnancy) did seem an acceptable compromise so that states were allowed to restrict abortion in the last three months of pregnancy, except when a woman's life or health were at risk. Otherwise, a woman had a right to solicit abortion in a medical setting, subject only to restrictions in the second trimester that might relate to her health.

The precedents cited for the right of the pregnant woman are particularly interesting. They reach back to the period immediately after the First World War when some state governments decided to foster "Americanism" by (1) restricting the teaching of foreign languages to younger children and (2) requiring compulsory attendance at public schools only. Both were ruled unconstitutional on the basis that the First Amendment protected the interests of the parents in deciding what their children should learn. These precedents in turn were used to overturn state laws that restricted marriage on racial lines, and then, in 1965, they were cited again in overturning a state law that prohibited the use of contraceptives. It was in this last decision that the concept of a right to privacy was spelled out. The parallel between a woman obtaining birth control from her doctor (something at that time clearly seen as immoral) and a woman asking to have her pregnancy terminated by her doctor was seen as close enough (especially since some techniques of contraception in fact are abortifacient in nature) for this idea of a right to privacy to apply here as well.

Given the importance of the principle of *stare decisis*, the Supreme Court has consistently overturned state laws that have attempted to prohibit abortions even before a fetus is viable. What is important

to recognize is that justices who have ruled this way have not themselves been in favor of abortion. As in the flag-burning case, what matters is consistency, especially in any effort to determine individual rights. This is why it seems unlikely that it ever would be enough to appoint individuals to the Supreme Court who personally wish abortion were illegal (those who might be considered social conservatives) since these same individuals are likely to be legal conservatives reluctant to overturn past rulings.

However, just what will or will not be allowed in the future because of a claim to a right to privacy is hardly predictable. The important thing to remember is that analogical reasoning depends on both the similarities between situations and the differences. It remains a human judgment to decide which matter more.

6. DEVELOPING A GOOD CASE

A key idea in the course is that the stronger the claim (what you are trying to prove in your conclusion) the better the evidence needed. For instance, you need much better evidence to prove that Alice will have a perfect score on her exam than if you were just trying to prove she would pass it. Another idea that is important is that the more is at stake in the argument, the higher the standard for what will count as an inductively strong case.

One useful technique is to think about what would be needed for what I call a perfect case (one that is deductively valid). Remember that in ordinary argumentation we cannot usually present deductively valid and sound arguments because typically they call for generalizations that would go beyond our evidence. However, by examining how close an actual argument might resemble one that is deductively valid we do have a way of measuring its inductive strength. We can do this by looking at the possible counterexamples -- hypothetical situations in which the premises remain true but the conclusion is false along with an explanation of how this could happen. In a valid argument there can be none at all. The more improbable the counterexample, the stronger the case.

Anyone who studies will pass, and Jack is studying, so Jack will pass.
Only someone who studies will pass, but Jill is not studying, so Jill will not pass.

These are two basic patterns for a valid argument, but the problem in real situations is justifying the generalization in the first premise.

Let's look at the arguments we might ordinarily use.

1. Jack is studying, therefore he will pass. *inductively weak, since we can easily imagine a good reason why he might not pass*

counterexample: Even though he is studying, it is a very hard test and so Jack will not pass.

1a. Jack is studying and it is an easy test, therefore he will pass. *this would be a moderately strong argument but we can still imagine a plausible exception*

counterexample: Even though he is studying for an easy test, Jack will not pass because the material is not something he understands.

1b. Jack is studying for an easy test on material he understands very well, therefore he will pass. *inductively strong, since without further evidence a counterexample appears to be an unlikely script for the events*

counterexample: Even though he is studying for an easy test on material that he understands well, Jack will not pass because he is going to become ill during the test.

note that in 1a and 1b we are closing the gap that would make study alone a sufficient condition for passing

2. Jill is not studying, therefore she will not pass. *inductively weak, since we can easily imagine a good reason that she might still pass*

counterexample: Jill is not studying but since she already knows the material we can be sure she will pass.

2a. Jill is not studying and this is unfamiliar material, therefore she will not pass. *this would be a moderately strong argument but we can still imagine a plausible exception*

counterexample: Even though she is not studying and this is unfamiliar material, the test questions are so easy that Jill will be able to guess the right answers and so will pass.

2b. Jill is not studying for a very difficult test on unfamiliar material, therefore she will not pass. *inductively strong, since now we have to imagine exceptions that, with no further evidence, would not be likely to be true*

counterexample: Even though Jill is not studying for a very difficult test on unfamiliar material, she will be able to cheat and so will manage to pass.

note that in 2a and 2b we are closing the gap that would make study a necessary condition for passing

The guide, then, is to keep thinking in terms of sufficient conditions (for a positive result) or necessary conditions (for a negative result).

When we turn to arguments about what we should do we can apply our guidelines in this way:

In presenting a case for a particular action, we need to come as close as we can to showing that the action is both a sufficient and a necessary condition for a desired result. In other words, doing what is recommended will guarantee the result and there are no alternatives.

> Jill needs to study if she wants to pass, and if she does study she will pass, so she ought to study.

In presenting a case against a particular action, we need to come as close as we can to showing that the action is a sufficient condition to an undesired result.

> Jack should not take the time to study, since he would have to give up his job to do so and therefore could not stay in school.

The second example in particular brings up the possibility of what we call POV (point of view) objections. In almost any ordinary situation we can imagine how, viewed from a different angle (or point of view), there is a risk of some kind. The closer we can come to saying there is no risk or downside, the stronger the case we are making. This also means that if we are making a case for a course of action, we need to be sure that we could, if we needed to, show why an alternative is less acceptable. This is something we do when we present a counterargument (a plausible objection) and then attempt to answer it.

One of your early assignments was to take an issue that had been presented as the basis for an editorial and analyze how the evidence available would allow the strongest possible case. You should return to that assignment and review your submission. Examine your logline, then ask about the implied or unspoken premise we might be expecting for the perfect case, then see how closely the evidence available allows you to come to such a case.

Let's suppose you were working with an editorial opposing the idea of undocumented workers (individuals from another country who are in the United States illegally) being allowed to obtain a driver's license.

Example:
logline: Undocumented workers should not be allowed to get California driver's licenses because this rewards illegal behavior.

implied premise: Any action that provides a service to a person not legally in the country is rewarding illegal behavior, and it is wrong to do this.

POV objection (the counterargument): On the other hand, only through a process of providing licenses can unsafe drivers be kept off the road, so this is a benefit to other citizens even more than it is a benefit to an undocumented worker.

Questions to be asked**:** What percentage of California drivers are in the country illegally? Does the manner in which driver's licenses are granted reduce unsafe driving? How many undocumented workers would actually apply for a driver's license? *note that many questions cannot readily be answered with any assurance, but the more actual evidence is available the better the support in the case*

EVIDENCE THAT COUNTS: A PROBLEM WITH WORDS

Many, perhaps most, problems involve disagreement on terms. One kind of mistake is rather extreme, as we might see from another conversation between Cat and Mouse.

Mouse: Kitty, you can't eat me if I'm not here.

Cat: Oh, but I am here, and I am very  *hungry.*
Mouse: Well, I'm looking for a cat, but what I see is fur and whiskers.
Cat: And claws and teeth. Don't ever forget those.
Mouse: But a cat's fur and whiskers and claws and teeth are not the cat itself. They're just fur and whiskers and claws and teeth. Show me the cat.
Cat: You mean something that's not just these?
Mouse: Exactly.
Cat: Meow!
Mouse: That won't do, since a cat's sound is still not a cat.
Cat: But there isn't anything else here.
Mouse: That is my point. See, you're not really here at all.
Cat: Well, at least we're even. You are not here, either.

Philosophers, following Gilbert Ryle, would characterize Mouse as engaging in a category mistake – a confusion that results from expecting something to be the same kind of thing as another that is actually in a different category. Ryle's own example was having someone shown all the buildings and students and activities of a college and having that person still ask to be shown the college also, as though it were something apart from the buildings and students and activities. Cat, of course, is not just his fur and whiskers, but neither is he something else without fur and whiskers.

Category mistakes are the basis for many informal fallacies, such as those in the following examples.

> *The Glendale Gazetteers won the national championship, so they proved they were the best players in the league. Joe Slow, who was a member of the team although he sat on the bench all year, has a right to say he was one of the best players in the league.*
>
> *Since only one out of ten individuals will get an "A" in this course, Betty has just a ten percent chance of getting an "A." Since she needs to keep her 4.0 average, she should probably drop the course.*
>
> *It's foolish to make a boat out of concrete, since concrete sinks in the water.*

Even asking someone to define their terms is not always a solution. One way past this is to ask for *stipulative definitions*, as when we agree to think of both the United States (a republic) and the United Kingdom (a monarchy) as democracies in that the individuals who actually make the laws are elected by their citizens. The operational definitions discussed in the section on scientific method are a special type of stipulative definition that involve establishing a specific measurable activity (as when psychologists define intelligence in terms of the results on a pencil-and-paper test).

EVIDENCE THAT COUNTS: EVALUATING TESTIMONY

We take much more on faith – on someone else's word – than we usually appreciate. Anything that is not our direct experience comes to us from what others have told us, and that includes such basic items as a date of birth, the history of our country, and the idea that the sun rose and set a century ago in just the same way as it does now.

Part of what we come to take on faith is what things we can safely take on faith. With education we learn to be skeptical about many things that earlier we would have believed without question. We also learn what we are expected to disbelieve as normal adults – the existence of a tooth fairy or Santa Claus or the Easter Bunny – just as we learn what things will come to be seen as a matter of personal conviction and ideally no one's concern but our own (such as our religious beliefs).

"Critical reasoning" as a phrase implies a willingness to challenge at least some claims proposed to us: the content of ads and commercials, the information or propaganda put out by organizations dedicated to particular causes, even the well-meaning advice of our friends and relatives. This is not at all the same as saying a logic student should be a skeptic on principle, as though nothing is ever really acceptable without proof. Instead, the task should be to recognize when additional evidence ought to be demanded and when such a demand is unnecessary.

In part this involves developing a workable distinction between facts and opinions. Ordinarily we think of facts as those things accepted as true without further challenge – the stuff of our physical experience, historical data, standard accounts of how nature works. Opinions are statement that are not acceptable at the same level, and these would include various interpretations of some things otherwise considered facts, almost all value judgments (the exceptions would be those crucial to carrying on a discussion, such as the importance of knowing the truth), and predictions that do not rely on strict scientific laws. Where this distinction often blurs is in the area of scientific theory – the explanations for what we observe – in that some theories (such as our understanding of atoms and molecules) appear incontrovertible, some are generally accepted in the scientific community but may be widely disputed elsewhere (as is the understanding of biological evolution), and some are strongly debated even among scientists (for instance, explanations of mental illness).

Some mistakes in reasoning come from thinking of the distinction as one that is between what is clearly "true" and what cannot be proved "true." What we should recognize is that our factual knowledge is constantly subject to revision (textbooks change, not just by adding new information but by eliminating or revising some of the supposed information of the past) and that opinions can be either pure speculation or extremely well supported inferences.

There are some guidelines we can use to measure the possible worth of any opinion (or theory) presented.

1. A radical inconsistency with what we observe creates a presumption of error. This is a guideline that we have to be careful with, however, since there is a considerable difference between any actual observation and its interpretation. For instance, we do not actually see the sun move around the earth, since what is visually apparent can be explained either by saying that the earth

stands still and the sun moves around us or by saying that we are turning and in fact moving around the sun.

2. Inconsistency with other beliefs we hold that appear well established also creates a presumption of error. Certainly we may be wrong about even some very basic beliefs, but ordinarily any effort to imagine how they could be wrong also affects how we would make any challenge to them. A key distinction between genuine science and a "crank" theory is the general acceptance of previous findings. Copernicus and Galileo, for example, did not reject the centuries of astronomical observations preceding them. Crank science, such as the theory that the earth is hollow, is oddly selective about what is to be kept and what is to be thrown out.

3. Appropriate training and experience in a particular field of study is seen as making a new approach worth considering. An MD with strong research credentials who suggests a novel approach to treating AIDS can hope for a serious hearing while a famous actor cannot. Knowing that someone is a recognized expert and endorses it may be only partial justification for accepting a particular belief, but asking someone to accept it solely on the word of a celebrity would be an example of a fallacious appeal to authority.

4. An opinion that cites no evidence apart from intuition, a supposed revelation, or highly improbable experiences does not usually merit serious consideration. It may happen, of course, that a person does "know" something but is unable to verbalize how he knows it, yet the burden of proof must still remain with anyone attempting to persuade us to agree. Some opinions, such as those dealing with what seems unknowable in itself, may make interesting speculations (playing "what if") but have to be regarded on a par with science fiction and not seen as serious candidates for scientific consideration.

WRITE YOUR ANSWERS TO THE FOLLOWING QUESTIONS.

What skills do you think you developed as a result of this class?

Do you think a course in critical reasoning has made any difference in your life? Do explain.

Do you think that your own more important choices or decisions in the past have been based more on reason or on emotion? Try to explain.

When it comes to controversial issues, do you think most people look at the evidence for one side or another objectively? What about yourself?

Do you think a logic course alone has helped you be more rational in your choices or decisions? Explain.

Now, to build on the last question, just what do you think it would mean to be more rational?

COMPARE YOUR ANSWERS NOW TO THOSE YOU WROTE AT THE BEGINNING OF THE COURSE.