Stephen's Guide to the Logical Fallacies

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Introduction

(Original 1996 Introduction, will be replaced)

The point of an argument is to give reasons in support of some conclusion. An argument commits a fallacy when the reasons offered do not support the conclusion.

These pages describe the known logical fallacies. To browse, either go to the table of contents, follow the 'next' and 'previous' icons or try the pop-up navigation window.

See How To Use This Guide.

If you can think of more fallacies that you'd really like to see, please send me a note. For more information: please consult the references and resource pages. For educators: the entire website is available for easy download. Please see the bottom of the Table of Contents page. And as always, I hope you'll find the time to browse my home page. Thanks for the support!

In the long run, this site will become a complete discussion of logic. In my view, the reasons why the fallacies are, in fact, fallacies should be given. As a prelude to this, please take a look at The Categorical Converter (note that it needs to be supported with more informative pages, however, it may be of interest to people who already understand categorical inferences).

How To Use This Guide

Each fallacy is described in the following format:

> *Name*: this is the generally accepted name of the fallacy
> *Definition*: the fallacy is defined
> *Examples*: examples of the fallacy are given
> *Proof*: the steps needed to prove that the fallacy is committed

The fallacies are themselves grouped into categories of four to six fallacies each. This grouping is somewhat arbitrary and is for the sake of convenience only.

Learning About the Fallacies

The best way to learn about logical fallacies is simply to start at the first page and begin reading. After reading each page, click on the **next** button. In addition to the definitions of the fallacies themselves, you will be able to read background information, examples, and discussion of the various fallacies.

After you feel you have mastered the definition of a fallacy, test your knowledge by locating an example and submitting it to this site. All submissions are reviewed, and if your example is a good example, it will be added to the list of examples for that particular fallacy.

Finally, join in on the discussions. There is a discussion thread for each fallacy as well as more general discussion areas (if you don't like the selection, start your own discussion thread).

Using Your Knowledge

In your day-to-day life you will encounter many examples of fallacious reasoning. And it's fun - and sometimes even useful - to point to an argument and say, "A ha! That argument commits the fallacy of *false dilemma*."

It may be fun, but it is not very useful. Nor is it very enlightened.

The *names* of the fallacies are for identification purposes only. They are not supposed to be flung around like argumentative broadswords. It is not sufficient to state that an opponent has committed such-and-such a fallacy. And it is not very polite.

This Guide is intended to help you in your *own* thinking, not to help you demolish someone else's argument. When you are establishing your own ideas and beliefs, evaluate them in the light of the fallacies described here.

When evaluating the ideas and arguments proposed to you by others, keep in mind that you need to *prove* that the others' reasoning is fallacious. That is why there is a 'proof' section in the description of each fallacy. The 'proof' section is intended to give you a mechanism for showing that the reasoning is flawed. Apply the methodology described in the 'proof' section to the passage in question. Construct your own argument. Use *this argument* - not the name of the fallacy - to respond.

Logic and Truth

Finally - a point about logic and truth.

The idea of logic is *truth preservation*. What that means is that if you start with true beliefs, your reasoning will not lead you to false conclusions.

But logic does not *generate* true beliefs. There's no easy way to do that.

Most people use the *evidence of their senses* to generate true beliefs. They *see* that apples grow on trees, that some bananas are yellow, and so on.

For many other truths, we must rely on *faith*. That God exists, that right is better than wrong, that truth is a virtue: these are beliefs which cannot be confirmed by the senses, and reflect therefore a certain *world view*.

When it comes to conflicts between such basic precepts, logic fails. It is not possible to show that one world view is right and the other is wrong. If a person believes in God, for example, logic is unlikely to change that person's mind, for that belief is ultimately based on faith.

And remember - most people have non-logical reasons for believing the things they do. They may have political opinions because their parents had them, they may have on-the-job views because they're afraid of being fired, they may think a movie is good because all their friends do.

These too count as parts of a person's world view. There is no reason for *you* to hold these beliefs, because you are not subject to the same non-logical factors. But you should be aware that *mere reason* will not be enough to get them to change their minds.

So use reason with caution, and if you really want to persuade someone of something, remember that compassion, honesty and tact are as important as logic.

Enjoy the Guide.

Appeals to Motive in Place of Support

The fallacies in this section have in common the practise of appealing to emotions or other psychological factors. In this way, they do not provide reasons for belief.

The following fallacies are appeals to motive in place of support:

- Appeal to Force
- Appeal to Pity
- Appeal to Consequences
- Prejudicial Language
- Appeal to Popularity

Appeal to Force

(argumentum ad baculum)

Definition:

The reader is told that unpleasant consequences will follow if they do not agree with the author.

Examples:

i. You had better agree that the new company policy is the best bet if you expect to keep your job.
ii. NAFTA is wrong, and if you don't vote against NAFTA then we will vote you out of office.

Proof:

Identify the threat and the proposition and argue that the threat is unrelated to the truth or falsity of the proposition.

References:

Cedarblom and Paulsen: 151, Copi and Cohen: 103

Appeal to Pity

(argumentum ad misercordiam)

Definition:

The reader is told to agree to the proposition because of the pitiful state of the author.

Examples:

i. How can you say that's out? It was so close, and besides, I'm down ten games to two.
ii. We hope you'll accept our recommendations. We spent the last three months working extra time on it.

Proof:

Identify the proposition and the appeal to pity and argue that the pitiful state of the arguer has nothing to do with the truth of the proposition.

References:

Cedarblom and Paulsen: 151, Copi and Cohen: 103, Davis: 82

Appeal to Consequences

Definition:

The author points to the disagreeable consequences of holding a particular belief in order to show that this belief is false.

Example:

i. You can't agree that evolution is true, because if it were, then we would be no better than monkeys and apes.
ii. You must believe in God, for otherwise life would have no meaning. (Perhaps, but it is equally possible that since life has no meaning that God does not exist.)

Proof:

Identify the consequences to and argue that what we want to be the case does not affect what is in fact the case.

References:

Cedarblom and Paulsen: 100, Davis: 63

Prejudicial Language

Definition:

Loaded or emotive terms are used to attach value or moral goodness to believing the proposition.

Examples:

i. Right thinking Canadians will agree with me that we should have another free vote on capital punishment.
ii. A reasonable person would agree that our income statement is too low.
iii. Senator Turner claims that the new tax rate will reduce the deficit. (Here, the use of "claims" implies that what Turner says is false.)
iv. The proposal is likely to be resisted by the bureaucrats on Parliament Hill. (Compare this to: The proposal is likely to be rejected by officials on Parliament Hill.)

Proof:

Identify the prejudicial terms used (eg. "Right thinking Canadians" or "A reasonable person"). Show that disagreeing with the conclusion does not make a person "wrong thinking" or "unreasonable".

References:

Cedarblom and Paulsen: 153, Davis: 62

Appeal to Popularity

(argumentum ad populum)

Definition:

A proposition is held to be true because it is widely held to be true or is held to be true by some (usually upper crust) sector of the population. This fallacy is sometimes also called the "Appeal to Emotion" because emotional appeals often sway the population as a whole.

Examples:

i. If you were beautiful, you could live like this, so buy Buty-EZ and become beautiful. (Here, the appeal is to the "beautiful people".)
ii. Polls suggest that the Liberals will form a majority government, so you may as well vote for them.
iii. Everyone knows that the Earth is flat, so why do you persist in your outlandish claims?

References:

Copi and Cohen: 103, Davis: 62

Changing the Subject

The fallacies in this section change the subject by discussing the person making the argument instead of discussing reasons to believe or disbelieve the conclusion. While on some occasions it is useful to cite authorities, it is almost never appropriate to discuss the person instead of the argument.

The fallacies described in this section are:

- Attacking the Person
- Appeal to Authority
- Anonymous Authorities
- Style Over Substance

Attacking the Person

(argumentum ad hominem)

Definition:

The person presenting an argument is attacked instead of the argument itself. This takes many forms. For example, the person's character, nationality or religion may be attacked. Alternatively, it may be pointed out that a person stands to gain from a favourable outcome. Or, finally, a person may be attacked by association, or by the company he keeps.

There are three major forms of Attacking the Person:

1. ad hominem (abusive): instead of attacking an assertion, the argument attacks the person who made the assertion.
2. ad hominem (circumstantial): instead of attacking an assertion the author points to the relationship between the person making the assertion and the person's circumstances.
3. ad hominem (tu quoque): this form of attack on the person notes that a person does not practise what he preaches.

Examples:

i. You may argue that God doesn't exist, but you are just following a fad. (ad hominem abusive)
ii. We should discount what Premier Klein says about taxation because he won't be hurt by the increase. (ad hominem circumstantial)
iii. We should disregard Share B.C.'s argument because they are being funded by the logging industry. (ad hominem circumstantial)
iv. You say I shouldn't drink, but you haven't been sober for more than a year. (ad hominem tu quoque)

Proof:

Identify the attack and show that the character or circumstances of the person has nothing to do with the truth or falsity of the proposition being defended.

References:

Barker: 166, Cedarblom and Paulsen: 155, Copi and Cohen: 97, Davis: 80

Appeal to Authority

(argumentum ad verecundiam)

Definition:

While sometimes it may be appropriate to cite an authority to support a point, often it is not. In particular, an appeal to authority is inappropriate if:

i. the person is not qualified to have an expert opinion on the subject,
ii. experts in the field disagree on this issue.
iii. the authority was making a joke, drunk, or otherwise not being serious

A variation of the fallacious appeal to authority is hearsay. An argument from hearsay is an argument which depends on second or third hand sources.

Examples:

i. Noted psychologist Dr. Frasier Crane recommends that you buy the EZ-Rest Hot Tub.
ii. Economist John Kenneth Galbraith argues that a tight money policy s the best cure for a recession. (Although Galbraith is an expert, not all economists agree on this point.)
iii. We are headed for nuclear war. Last week Ronald Reagan remarked that we begin bombing Russia in five minutes. (Of course, he said it as a joke during a microphone test.)
iv. My friend heard on the news the other day that Canada will declare war on Serbia. (This is a case of hearsay; in fact, the reporter said that Canada would not declare war.)
v. The Ottawa Citizen reported that sales were up 5.9 percent this year. (This is hearsay; we are not n a position to check the Citizen's sources.)

Proof:

Show that either (i) the person cited is not an authority in the field, or that (ii) there is general disagreement among the experts in the field on this point.

References:

Cedarblom and Paulsen: 155, Copi and Cohen: 95, Davis: 69

Anonymous Authorities

Definition:

The authority in question is not named. This is a type of appeal to authority because when an authority is not named it is impossible to confirm that the authority is an expert. However the fallacy is so common it deserves special mention.

A variation on this fallacy is the appeal to rumour. Because the source of a rumour is typically not known, it is not possible to determine whether to believe the rumour. Very often false and harmful rumours are deliberately started in order to discredit an opponent.

Examples:

i. A government official said today that the new gun law will be proposed tomorrow.
ii. Experts agree that the best way to prevent nuclear war is to prepare for it.
iii. It is held that there are more than two million needless operations conducted every year.
iv. Rumour has it that the Prime Minster will declare another holiday in October.

Proof:

Argue that because we don't know the source of the information we have no way to evaluate the reliability of the information.

References:

Davis: 73

Style Over Substance

Definition:

The manner in which an argument (or arguer) is presented is taken to affect the likelihood that the conclusion is true.

Examples:

i. Nixon lost the presidential debate because of the sweat on his forehead.
ii. Trudeau knows how to move a crowd. He must be right.
iii. Why don't you take the advice of that nicely dressed young man?

Proof:

While it is true that the manner in which an argument is presented will affect whether people believe that its conclusion is true, nonetheless, the truth of the conclusion does not depend on the manner in which the argument is presented. In order to show that this fallacy is being committed, show that the style in this case does not affect the truth or falsity of the conclusion.

References:

Davis: 61

Inductive Fallacies

nductive Fallacies

Inductive reasoning consists of inferring from the properties of a sample to the properties of a population as a whole.

For example, suppose we have a barrel containing of 1,000 beans. Some of the beans are black and some of the beans are white. Suppose now we take a sample of 100 beans from the barrel and that 50 of them are white and 50 of them are black. Then we could infer inductively that half the beans in the barrel (that is, 500 of them) are black and half are white.

All inductive reasoning depends on the similarity of the sample and the population. The more similar the same is to the population as a whole, the more reliable will be the inductive inference. On the other hand, if the sample is relevantly dissimilar to the population, then the inductive inference will be unreliable.

No inductive inference is perfect. That means that any inductive inference can sometimes fail. Even though the premises are true, the conclusion might be false. Nonetheless, a good inductive inference gives us a reason to believe that the conclusion is probably true.

The following inductive fallacies are described in this section:

- Hasty Generalization
- Unrepresentative Sample
- False Analogy
- Slothful Induction
- Fallacy of Exclusion

Hasty Generalization

Definition:

The size of the sample is too small to support the conclusion.

Examples:

i. Fred, the Australian, stole my wallet. Thus, all Australians are thieves. (Of course, we shouldn't judge all Australians on the basis of one example.)
ii. I asked six of my friends what they thought of the new spending restraints and they agreed it is a good idea. The new restraints are therefore generally popular.

Proof:

Identify the size of the sample and the size of the population, then show that the sample size is too small. Note: a formal proof would require a mathematical calculation. This is the subject of probability theory. For now, you must rely on common sense.

References:

Barker: 189, Cedarblom and Paulsen: 372, Davis: 103

Unrepresentative Sample

Definition:

The sample used in an inductive inference is relevantly different from the population as a whole.

Examples:

i. To see how Canadians will vote in the next election we polled a hundred people in Calgary. This shows conclusively that the Reform Party will sweep the polls. (People in Calgary tend to be more conservative, and hence more likely to vote Reform, than people in the rest of the country.)
ii. The apples on the top of the box look good. The entire box of apples must be good. (Of course, the rotten apples are hidden beneath the surface.)

Proof:

Show how the sample is relevantly different from the population as a whole, then show that because the sample is different, the conclusion is probably different.

References:

Barker: 188, Cedarblom and Paulsen: 226, Davis: 106

False Analogy

Definition:

In an analogy, two objects (or events), A and B are shown to be similar. Then it is argued that since A has property P, so also B must have property P. An analogy fails when the two objects, A and B, are different in a way which affects whether they both have property P.

Examples:

i. Employees are like nails. Just as nails must be hit in the head in order to make them work, so must employees.
ii. Government is like business, so just as business must be sensitive primarily to the bottom line, so also must government. (But the objectives of government and business are completely different, so probably they will have to meet different criteria.)

Proof:

Identify the two objects or events being compared and the property which both are said to possess. Show that the two objects are different in a way which will affect whether they both have that property.

References:

Barker: 192, *Cedarblom and Paulsen: 257*, *Davis: 84*

Slothful Induction

Definition:

The proper conclusion of an inductive argument is denied despite the evidence to the contrary.

Examples:

i. Hugo has had twelve accidents n the last six months, yet he insists that it is just a coincidence and not his fault. (Inductively, the evidence is overwhelming that it is his fault. This example borrowed from Barker, p. 189)
ii. Poll after poll shows that the N.D.P will win fewer than ten seats in Parliament. Yet the party leader insists that the party is doing much better than the polls suggest. (The N.D.P. in fact got nine seats.)

Proof:

About all you can do in such a case is to point to the strength of the inference.

References:

Barker: 189

Fallacy of Exclusion

Definition:

Important evidence which would undermine an inductive argument is excluded from consideration. The requirement that all relevant information be included is called the "principle of total evidence".

Examples:

i. Jones is Albertan, and most Albertans vote Tory, so Jones will probably vote Tory. (The information left out is that Jones lives in Edmonton, and that most people in Edmonton vote Liberal or N.D.P.)
ii. The Leafs will probably win this game because they've won nine out of their last ten. (Eight of the Leafs' wins came over last place teams, and today they are playing the first place team.)

Proof:

Give the missing evidence and show that it changes the outcome of the inductive argument. Note that it is not sufficient simply to show that not all of the evidence was included; it must be shown that the missing evidence will change the conclusion.

References

Davis: 115

Fallacies Involving Statistical Syllogisms

A statistical generalization is a statement which is usually true, but not always true. Very often these are expressed using the word "most", as in "Most conservatives favour welfare cuts." Sometimes the word "generally" is used, as in "Conservatives generally favour welfare cuts." Or, sometimes, no specific word is used at all, as in: "Conservatives favour welfare cuts."

Fallacies involving statistical generalizations occur because the generalization is not always true. Thus, when an author treats a statistical generalization as though it were always true, the author commits a fallacy.

This section describes the following fallacies involving statistical syllogisms:

- Accident
- Converse Accident

Accident

Definition:

A general rule is applied when circumstances suggest that an exception to the rule should apply.

Examples:

i. The law says that you should not travel faster than 50 kph, thus even though your father could not breathe, you should not have travelled faster than 50 kph.
ii. It is good to return things you have borrowed. Therefore, you should return this automatic rifle from the madman you borrowed it from. (Adapted from Plato's Republic, Book I).

Proof:

Identify the generalization in question and show that it is not a universal generalization. Then show that the circumstances of this case suggest that the generalization ought not to apply.

References

Copi and Cohen: 100

Converse Accident

Definition:

An exception to a generalization is applied to cases where the generalization should apply.

Examples:

i. Because we allow terminally ill patients to use heroin, we should allow everyone to use heroin.
ii. Because you allowed Jill, who was hit by a truck, to hand in her assignment late, you should allow the entire class to hand in their assignments late.

Proof:

Identify the generalization in question and show how the special case was an exception to the generalization.

References:

Copi and Cohen: 100

Causal Fallacies

It is common for arguments to conclude that one thing causes another. But the relation between cause and effect is a complex one. It is easy to make a mistake.

In general, we say that a cause C is the cause of an effect E if and only if:

1. Generally, if C occurs, then E will occur, and
2. Generally, if C does not occur, then E will not occur ether.

We say "generally" because there are always exceptions. For example, we say that striking the match causes the match to light, because:

1. Generally, when the match is struck, it lights (except when the match is dunked in water), and
2. Generally, when the match is not struck, it does not light (except when it is lit with a blowtorch).

Many writers also require that a causal statement be supported with a natural law. For example, the statement that "striking the match causes it to light" is supported by the principle that "friction produces heat, and heat produces fire". The following are causal fallacies:

* Post Hoc (Because one thing follows another, it is held to cause the other)
* Joint Effect (A purpoted causeand effect are both the effects of a joint cause)
* Insignificant (The purported cause is insignificant compared to others)
* Wrong Direction (The direction between cause and effect is reversed)
* Complex Cause (The cause identified is only part of the entire cause)

Coincidental Correlation

(post hoc ergo propter hoc)

Definition:

The name in Latin means "after this therefore because of this". This describes the fallacy. An author commits the fallacy when it is assumed that because one thing follows another that the one thing was caused by the other.

Examples:

i. Immigration to Alberta from Ontario increased. Soon after, the welfare rolls increased. Therefore, the increased immigration caused the increased welfare rolls.
ii. I took EZ-No-Cold, and two days later, my cold disappeared.

Proof:

Show that the correlation is coincidental by showing that: (i) the effect would have occurred even if the cause did not occur, or (ii) that the effect was caused by something other than the suggested cause.

References

(Cedarblom and Paulsen: 237, Copi and Cohen: 101)

Joint Effect

Definition:

One thing is held to cause another when in fact both are the effect of a single underlying cause. This fallacy is often understood as a special case of post hoc ergo prompter hoc.

Examples:

i. We are experiencing high unemployment which s being caused by a low consumer demand. (In fact, both may be caused by high interest rates.)
ii. You have a fever and this is causing you to break out in spots. (In fact, both symptoms are caused by the measles.)

Proof:

Identify the two effects and show that they are caused by the same underlying cause. It is necessary to describe the underlying cause and prove that it causes each symptom.

References

(Cedarblom and Paulsen: 238)

Genuine But Insignificant Cause

Definition:

The object or event identified as the cause of an effect is a genuine cause, but insignificant when compared to the other causes of that event. Note that this fallacy does not apply when all other contributing causes are equally insignificant. Thus, it is not a fallacy to say that you helped cause defeat the Tory government because you voted Reform, for your vote had as much weight as any other vote, and hence is equally a part of the cause.

Examples:

i. Smoking is causing air pollution in Edmonton. (True, but the effect of smoking is insignificant compared to the effect of auto exhaust.)
ii. By leaving your oven on overnight you are contributing to global warming.

Proof:

Identify the much more significant cause.

References

(Cedarblom and Paulsen: 238)

Wrong Direction

Definition:

The relation between cause and effect is reversed.

Examples:

i. Cancer causes smoking.
ii. The increase in AIDS was caused by more sex education. (In fact, the increase in sex education was caused by the spread of AIDS.)

Proof:

Give a causal argument showing that the relation between cause and effect has been reversed.

References

(Cedarblom and Paulsen: 238)

Complex Cause

Definition:

The effect is caused by a number of objects or events, of which the cause identified is only a part. A variation of this is the feedback loop where the effect is itself a part of the cause.

Examples:

i. The accident was caused by the poor location of the bush. (True, but it wouldn't have occurred had the driver not been drunk and the pedestrian not been jaywalking.)
ii. The Challenger explosion was caused by the cold weather. (True, however, it would not have occurred had the O-rings been properly constructed.)
iii. People are in fear because of increased crime. (True, but this has lead people to break the law as a consequence of their fear, which increases crime even more.)

Proof:

Show that all of the causes, and not just the one mentioned, are required to produce the effect.

References:

Cedarblom and Paulsen: 238

Missing the Point

These fallacies have in common a general failure to prove that the conclusion is true.

The following fallacies are cases of missing the point:

* Begging the Question (The truth of the conclusion is assumed by the premises)
* Irrelevant Conclusion (An argument in defense of one conclusion proves another)
* Straw Man (The arguer attacks a weak version of an opponent's argument)

Begging the Question

(petitio principii)

Definition:

The truth of the conclusion is assumed by the premises. Often, the conclusion is simply restated in the premises in a slightly different form. In more difficult cases, the premise is a consequence of the conclusion.

Examples:

i. Since I'm not lying, it follows that I'm telling the truth.
ii. We know that God exists, since the Bible says God exists. What the Bible says must be true, since God wrote it and God never lies. (Here, we must agree that God exists in order to believe that God wrote the Bible.)

Proof:

Show that in order to believe that the premises are true we must already agree that the conclusion is true.

References:

Barker: 159, Cedarblom and Paulsen: 144, Copi and Cohen: 102, Davis: 33

Irrelevant Conclusion

(ignoratio elenchi)

Definition:

An argument which purports to prove one thing instead proves a different conclusion.

Examples:

i. You should support the new housing bill. We can't continue to see people living in the streets; we must have cheaper housing. (We may agree that housing s important even though we disagree with the housing bill.)

ii. I say we should support affirmative action. White males have run the country for 500 years. They run most of government and industry today. You can't deny that this sort of discrimination is intolerable. (The author has proven that there is discrimination, but not that affirmative action will end that discrimination.)

Proof:

Show that the conclusion proved by the author is not the conclusion that the author set out to prove.

References:

Copi and Cohen: 105

Straw Man

Definition:

The author attacks an argument which is different from, and usually weaker than, the opposition's best argument.

Examples:

i. People who opposed the Charlottetown Accord probably just wanted Quebec to separate. But we want Quebec to stay in Canada.
ii. We should have conscription. People don't want to enter the military because they find it an inconvenience. But they should realize that there are more important things than convenience.

Proof:

Show that the opposition's argument has been misrepresented by showing that the opposition has a stronger argument. Describe the stronger argument.

References:

Cedarblom and Paulsen: 138

Fallacies of Ambiguity

The fallacies in this section are all cases where a word or phrase is used unclearly. There are two ways in which this can occur.

1. The word or phrase may be ambiguous, in which case it has more than one distinct meaning.
2. The word or phrase may be vague, in which case it has no distinct meaning.

The following are fallacies of ambiguity:

* Equivocation (The same term is used in two different ways)
* Amphiboly (The structure of a sentence allows two different interpretations)
* Accent (An emphasis suggests a meaning different from what is actually said)

Equivocation

Definition:

The same word is used with two different meanings.

Examples:

i. Criminal actions are illegal, and all murder trials are criminal actions, thus all murder trials are illegal. (Here the term "criminal actions" is used with two different meanings. Example borrowed from Copi.)
ii. The sign said "fine for parking here", and since it was fine, I parked there.
iii. All child-murderers are inhuman, thus, no child-murderer is human. (From Barker, p. 164; this is called "illicit obversion")
iv. A plane is a carpenter's tool, and the Boeing 737 is a plane, hence the Boeing 737 is a carpenter's tool. (Example borrowed from Davis, p. 58)

Proof:

Identify the word which is used twice, then show that a definition which is appropriate for one use of the word would not be appropriate for the second use.

References

(Barker: 163, Cedarblom and Paulsen: 142, Copi and Cohen: 113, Davis: 58)

Amphiboly

Definition:

An amphiboly occurs when the construction of a sentence allows it to have two different meanings.

Examples:

i. Last night I shot a burglar in my pyjamas.
ii. The Oracle of Delphi told Croseus that if he pursued the war he would destroy a mighty kingdom. (What the Oracle did not mention was that the kingdom he destroyed would be his own. Adapted from Heroditus, *The Histories*.)
iii. Save soap and waste paper. (From Copi, p. 115)

Proof:

Identify the ambiguous phrase and show the two possible interpretations.

References:

(Copi and Cohen: 114)

Accent

Definition:

Emphasis is used to suggest a meaning different from the actual content of the proposition.

Examples:

i. It would be illegal to give away

Free Beer!

ii. The first mate, seeking revenge on the captain, wrote in his journal, "The Captain was sober today." (He suggests, by his emphasis, that the Captain is usually drunk. From Copi, p. 117)

References:

(Copi and Cohen: 115)

Category Errors

These fallacies occur because the author mistakenly assumes that the whole is nothing more than the sum of its parts. However, things joined together may have different properties as a whole than any of them do separately. The following fallacies are category errors:

* Composition (Because the parts have a property, the whole is said to have that property)

* Division (Because the whole has a property, the parts are said to have that property)

Composition

Definition

Because the parts of a whole have a certain property, it is argued that the whole has that property. That whole may be either an object composed of different parts, or it may be a collection or set of individual members.

Examples:

i. Each brick is three inches high, thus, the brick wall is three inches high.
ii. Because the brain is capable of consciousness, each neural cell in the brain must be capable of consciousness.

Proof:

Show that the properties in question are the properties of the parts, and not of the whole. If necessary, describe the parts to show that they could not have the properties of the whole.

References

Barker: 164, Copi and Cohen: 119

Division

Definition:

Because the whole has a certain property, it is argued that the parts have that property. The whole in question may be either a whole object or a collection or set of individual members.

Examples:

i. The brick wall is six feet tall. Thus, the bricks in the wall are six feet tall.
ii. Germany is a militant country. Thus, each German is militant.
iii. Conventional bombs did more damage in W.W. II than nuclear bombs. Thus, a conventional bomb is more dangerous than a nuclear bomb. (From Copi, p. 118)

Proof:

Show that the properties in question are the properties of the whole, and not of each part or member or the whole. If necessary, describe the parts to show that they could not have the properties of the whole.

References

(Barker: 164, Copi and Cohen: 117)

Fallacies of Distraction

Fallacies of Distraction

Each of these fallacies is characterized by the illegitimate use of a logical operator in order to distract the reader from the apparent falsity of a certain proposition. The following fallacies are fallacies of distraction:

* False Dilemma (misuse of the "or" operator)
* Argument From Ignorance (misuse of the "not" operator)
* Slippery Slope (misuse of the "if-then" operator)
* Complex Question (misuse of the "and" operator)

Logical Operators

Logical Operators

A logical operator joins two propositions to form a new, complex, proposition. (If you have not read about propositions, you should do so now. Follow the Next links until you return to this page.)

The truth value of the new proposition is determined by the truth values of the two propositions being joined and by the operator that joins them.

The following are the logical operators:

* Conjunction (and)
* Disjunction (or)
* Conditional (if-then)
* Negation (not)
* Biconditional (if-and-only-if)

Proposition

Definition:

A proposition is an assertion that something is the case. We use sentences to *express* propositions.

Examples:

i. The following sentences express the same proposition:
   - Il pleut.
   - Esta llooviendo.
   - It is raining.
   - Es regnet.
ii. The following sentences express the same proposition:
   - John loves Mary.
   - Mary is loved by John.

Discussion:

It makes sense to think of a proposition as being the *meaning* of a sentence. The meaning of a sentence has several components:

- *denotation*: the state of affairs in the world that the sentence holds to be the case.
- *connotation*: the feelings, ideas or emotions evoked in the reader by the sentence.
- *emphasis*: the relative importance the writer ascribes to different elements in the sentence.

For example, in the sentence "The fire raged down the hill" the denotation of the sentence is the assertion that there is a fire buring on a hill and moving down the hill. The connotation is that this is something to be feared (the word "rage" implies anger or danger). The emphasis in this sentence is the fire itself; had we written the same sentence "Down the hill raged the fire" the emphasis would be on the hill.

Philosophers argue a lot about meaning. Some say that the meaning is the denotation only, some say it is a combination of denotation and connotation only, while others (including myself) say it is all three.

Truth

A proposition can have the following *truth values*:

- true
- false

Philosophers argue a lot about what constitutes truth. For now, we'll keep it simple:

- "P" is true if and only if P.
- "P" is false if and only if not P.

For example:

- The proposition "Snow is white" is true if and only if snow is white.
- The proposition "Snow is white" is false if and only if snow is not white.

In other words, a proposition is true if it correctly describes the state of the world, and false if it incorrectly describes the state of the world. This is known as *Tarski's Theory of Truth*.

Conjunction

Any two propositions **P** and **Q** can be conjoined, producing the new, complex, proposition:

P and Q

The proposition **P and Q** is true if and only if both **P** and **Q** are true. It is false otherwise.

The truth table for **P and Q** is as follows:

P	Q	P and Q
T	T	T
T	F	F
F	T	F
F	F	F

If you have Java, try it out for yourself:

Set the truth values for the propositions **P** and **Q** by clicking on the appropriate button beside "P" and "Q" respectively. What is the truth value of **P and Q**? Find out by clicking on the "Compute" button.

P is: ○ T ○ F **Q** is: ○ T ○ F

Thus, **P and Q** is:

Truth Table

A truth table shows the resulting value when a logical operator is used to join two propositions, forming a new, complex proposition.

Suppose the two propositions being joined are **P** and **Q**. Each of these propositions will have two possible truth values: true, or false. This gives us four possible combinations. These are represented on a table, as follows:

P	Q	
T	T	
T	F	
F	T	
F	F	

In the space to the right, a complex proposition is displayed. Beneath the complex proposition are the truth values which result given the four possible truth values of **P** and **Q**. For example, here is the truth table for the complex proposition **P and Q**:

P	Q	P and Q
T	T	T
T	F	F
F	T	F
F	F	F

Notice that the complex proposition may be true or false depending on the different truth values of **P** and **Q**. Thus, if we know what the truth values of **P** and **Q** are, we know what the truth value of **P and Q** is.

Disjunction

Any two propositions **P** and **Q** can be disjoined, producing the new, complex, proposition:

P or Q

The proposition **P and Q** is true if and only if either **P** or **Q** are true. It is false only if both **P** and **Q** are false.

The truth table for **P or Q** is as follows:

P	Q	P or Q
T	T	T
T	F	T
F	T	T
F	F	F

If you have Java, try it out for yourself:

Set the truth values for the propositions **P** and **Q** by clicking on the appropriate button beside "P" and "Q" respectively. What is the truth value of **P or Q**? Find out by clicking on the "Compute" button.

P is: T F **Q** is: T F

Thus, **P or Q** is:

Conditional

Any two propositions **P** and **Q** can be joined by a conditional operator, producing the new, complex, proposition:

If P then Q

The proposition **If P then Q** is true if and only if either **P** is false or **Q** is true. It is false only when **P** is true and **Q** is false.

The truth table for **P or Q** is as follows:

P	Q	If P then Q
T	T	T
T	F	F
F	T	T
F	F	T

If you have Java, try it out for yourself:

Set the truth values for the propositions **P** and **Q** by clicking on the appropriate button beside "P" and "Q" respectively. What is the truth value of **If P then Q**? Find out by clicking on the "Compute" button.

P is: T F **Q** is: T F

Thus, **If P then Q** is: Reset

A special conditional occurs if we flip the **P** and **Q** around: we get **if Q then P**, which is the same as saying **P only if Q**.

Negation

Any proposition **P** can be converted into its negation with a negation operator, producing the new, complex, proposition:

Not P

The proposition **Not P** is true if and only if **P** is false. It is false only if **P** is true. The truth table for **Not P** is as follows:

P	Q	Not P
T	T	F
T	F	F
F	T	T
F	F	T

If you have Java, try it out for yourself:

Set the truth values for the propositions **P** and **Q** by clicking on the appropriate button beside "P" and "Q" respectively. What is the truth value of **Not P**? Find out by clicking on the "Compute" button.

P is: T F **Q** is: T F

Thus, **Not P** is: Reset

Notice that it does not matter whether **Q** is true or false. Every time, **Not P** is true if **P** is false, and false if **P** is true.

Biconditional

Any two propositions **P** and **Q** can be joined with the biconditional operator, producing the new, complex, proposition:

P if and only if Q

The proposition **P if and only if Q** is true if and only if both **P** and **Q** are true, or if both **P** and **Q** are false. It is false only when one of them is true and the other false. The truth table for **Not PQ** is as follows:

P	Q	P if and only if Q
T	T	T
T	F	F
F	T	F
F	F	T

If you have Java, try it out for yourself:

Set the truth values for the propositions **P** and **Q** by clicking on the appropriate button beside "P" and "Q" respectively. What is the truth value of **P id and only if Q**? Find out by clicking on the "Compute" button.

P is: T F **Q** is: T F

Thus, **P if and only if Q** is: Reset

The biconditional is a complex operator, built out of simpler operators. Think of it this way:

P if and only if Q is the same as:

(If P then Q) and (P only if Q). This is like saying:

(If P then Q) and (If Q then P).

The **if and only if** operator plays a special role in definitions. When we say **P if and only if q**, we are saying that P *says the same thing* as Q.

False Dilemma

Definition:

A limited number of options (usually two) is given, while in reality there are more options. A false dilemma is an illegitimate use of the "or" operator.

Putting issues or opinions into "black or white" terms is a common instance of this fallacy.

Examples:

i. Either you're for me or against me.
ii. America: love it or leave it.
iii. Either support Meech Lake or Quebec will separate.
iv. Every person is either wholly good or wholly evil.

Proof:

Identify the options given and show (with an example) that there is an additional option.

References

Cedarblom and Paulsen: 136

Argument from Ignorance

(argumentum ad ignorantiam)

Definition:

Arguments of this form assume that since something has not been proven false, it is therefore true. Conversely, such an argument may assume that since something has not been proven true, it is therefore false. (This is a special case of a false dilemma, since it assumes that all propositions must either be known to be true or known to be false.) As Davis writes, "Lack of proof is not proof." (p. 59)

Examples:

i. Since you cannot prove that ghosts do not exist, they must exist.
ii. Since scientists cannot prove that global warming will occur, it probably won't.
iii. Fred said that he is smarter than Jill, but he didn't prove it, so it must be false.

Proof:

Identify the proposition in question. Argue that it may be true even though we don't know whether it is or isn't.

References:

Copi and Cohen: 93, Davis: 59

Slippery Slope

Definition:

In order to show that a proposition P is unacceptable, a sequence of increasingly unacceptable events is shown to follow from P. A slippery slope is an illegitimate use of the "if-then" operator.

Examples:

i. If we pass laws against fully-automatic weapons, then it won't be long before we pass laws on all weapons, and then we will begin to restrict other rights, and finally we will end up living in a communist state. Thus, we should not ban fully-automatic weapons.
ii. You should never gamble. Once you start gambling you find it hard to stop. Soon you are spending all your money on gambling, and eventually you will turn to crime to support your earnings.
iii. If I make an exception for you then I have to make an exception for everyone.

Proof:

Identify the proposition P being refuted and identify the final event in the series of events. Then show that this final event need not occur as a consequence of P.

References:

Cedarblom and Paulsen: 137

Complex Question

Definition:

Two otherwise unrelated points are conjoined and treated as a single proposition. The reader is expected to accept or reject both together, when in reality one is acceptable while the other is not. A complex question is an illegitimate use of the "and" operator.

Examples:

i. You should support home education and the God-given right of parents to raise their children according to their own beliefs.
ii. Do you support freedom and the right to bear arms?
iii. Have you stopped using illegal sales practises? (This asks two questions: did you use illegal practises, and did you stop?)

Proof:

Identify the two propositions illegitimately conjoined and show that believing one does not mean that you have to believe the other.

References:

Cedarblom and Paulsen: 86, Copi and Cohen: 96

Non-Sequiter

The term non sequitur literally means "it does not follow". In this section we describe fallacies which occur as a consequence of invalid arguments. The following fallacies are non sequiturs:

* Affirming the Consequent

* Denying the Antecedent

* Inconsistency

Affirming the Consequent

Definition:

Any argument of the following form is invalid:
If A then B
B
Therefore, A

Examples:

i. If I am in Calgary, then I am in Alberta. I am in Alberta, thus, I am in Calgary. (Of course, even though the premises are true, I might be in Edmonton, Alberta.)
ii. If the mill were polluting the river then we would see an increase in fish deaths. And fish deaths have increased. Thus, the mill is polluting the river.

Proof:

Show that even though the premises are true, the conclusion could be false. In general, show that B might be a consequence of something other than A. For example, the fish deaths might be caused by pesticide run-off, and not the mill.

References

Barker: 69, Cedarblom and Paulsen: 24, Copi and Cohen: 241

Denying the Antecedent

Definition:

Any argument of the following form is invalid:
If A then B
Not A
Therefore, Not B

Examples:

i. if you get hit by a car when you are six then you will die young. But you were not hit by a car when you were six. Thus you will not die young. (Of course, you could be hit by a train at age seven, in which case you still die young.)
ii. If I am in Calgary then I am in Alberta. I am not in Calgary, thus, I am not in Alberta.

Proof:

Show that even though the premises are true, the conclusion may be false. In particular, show that the consequence B may occur even though A does not occur.

References

Barker: 69, Cedarblom and Paulsen: 26, Copi and Cohen: 241

Inconsistency

Definition:

The author asserts more than one proposition such that the propositions cannot all be true. In such a case, the propositions may be contradictories or they may be contraries.

Examples:

i. Montreal is about 200 km from Ottawa, while Toronto is 400 km from Ottawa. Toronto is closer to Ottawa than Montreal.
ii. John is taller than Jake, and Jake is taller than Fred, while Fred is taller than John.

Proof:

Assume that one of the statements is true, and then use it as a premise to show that one of the other statements is false.

References

Barker: 157

Syllogistic Fallacies

The fallacies in this section are all cases of invalid categorical syllogisms. Readers not familiar with categorical syllogisms should consult Stephen's Guide to Categorical Syllogisms.

The following are syllogistic fallacies:

* Fallacy of Four Terms: a syllogism has four terms
* Undistributed Middle: two separate categories are said to be connected because they share a common property
* Illicit Major: the predicate of the conclusion talks about all of something, but the premises only mention some cases of the term in the predicate
* Illicit Minor: the subject of the conclusion talks about all of something, but the premises only mention some cases of the term in the subject
* Fallacy of Exclusive Premises: a syllogism has two negative premises
* Fallacy of Drawing an Affirmative Conclusion From a Negative Premise: as the name implies
* Existential Fallacy: a particular conclusion is drawn from universal premises

Fallacy of the Four Terms

(quaternio terminorum)

Definition:

A standard form categorical syllogism contains four terms.

Examples:

i. All dogs are animals, and all cats are mammals, so all dogs are mammals.

   The four terms are: dogs, animals, cats and mammals.
   Note: In many cases, the fallacy of four terms is a special case of equivocation. While the same *word* is used, the word has different *meanings*, and hence the word is treated as two different terms. Consider the following example:

ii. Only man is born free, and no women are men, therefore, no women are born free.

   The four terms are: man (in the sense of 'humanity'), man (in the sense of 'male'), women and born free.

Proof:

Identify the four terms and where necessary state the meaning of each term.

References:

Copi and Cohen: 206

Categorical Form

Text

Terms

Undistributed Middle

Definition:

The middle term in the premises of a standard form categorical syllogism never refers to **all** of the members of the category it describes.

Examples:

i. All Russians were revolutionists, and all anarchists were revolutionist, therefore, all anarchists were Russians.

   The middle term is 'revolutionist'. While both Russians and anarchists share the common property of being revolutionist, they may be separate groups of revolutionists, and so we cannot conclude that anarchists are otherwise the same as Russians in any way. *Example from Copi and Cohen, 208.*

ii. All trespassers are shot, and someone was shot, therefore, someone was a trespasser.

   The middle term is 'shot'. While 'someone' and 'trespassers' may share the property of being shot, it doesn't follow that the someone in question was a trespasser; he may have been the victim of a mugging.

Proof:

Show how each of the two categories identified in the conclusion could be separate groups even though they share a common property.

References:

Copi and Cohen: 207

Categorical Syllogisms

Illicit Major

Definition:

The predicate term of the conclusion refers to all members of that category, but the same term in the premises refers only to some members of that category.

Examples:

i. All Texans are Americans, and no Californians are Texans, therefore, no Californians are Americans.

   The predicate term in the conclusion is 'Americans'. The conclusion refers to **all** Americans (every American is not a Californian, according to the conclusion). But the premises refer only to some Americans (those that are Texans).

Proof:

Show that there may be other members of the predicate category not mentioned in the premises which are contrary to the conclusion.

For example, from (i) above, one might argue, "While it's true that all Texans are Americans, it is also true that Ronald Regan is American, but Ronald Regan is Californian, so it is not true that No Californians are Americans."

References:

Copi and Cohen: 207

Illicit Minor

Definition:

The subject term of the conclusion refers to all members of that category, but the same term in the premises refers only to some members of that category.

Examples:

i. All communists are subversives, and all communists are critics of capitalism, therefore, all critics of capitalism are subversives.

   The subject term in the conclusion is 'critics of capitalism'. The conclusion refers to all such critics. The premise that 'all communists are critics of capitalism' refers only to **some** critics of capitalism; there may be other critics who are not communists.

Proof:

Show that there may be other members of the subject category not mentioned in the premises which are contrary to the conclusion.

For example, from (i) above, one might argue, "While it's true that all communists are critics of capitalism, it is also true that Thomas Jefferson was a critic of capitalism, but Thomas Jefferson was not a subversive, so not all critics of capitalism are subversives."

References:

Copi and Cohen: 208

Exclusive Premises

Definition:

A standard form categorical syllogism has two negative premises (a negative premise is any premise of the form 'No S are P' or 'Some S is not P').

Examples:

i. No Manitobans are Americans, and no Americans are Canadians, therefore, no Manitobans are Canadians. In fact, since Manitoba is a province of Canada, all Manitobans are Canadians.

Proof:

Assume that the premises are true. Find an example which allows the premises to be true but which clearly contradicts the conclusion.

References:

Copi and Cohen: 209

Drawing an Affirmative Conclusion from a Negative Premise

Definition:

The conclusion of a standard form categorical syllogism is affirmative, but at least one of the premises is negative.

Examples:

i. All mice are animals, and some animals are not dangerous, therefore some mice are dangerous.
ii. No honest people steal, and all honest people pay taxes, so some people who steal pay pay taxes.

Proof:

Assume that the premises are true. Find an example which allows the premises to be true but which clearly contradicts the conclusion.

References:

Copi and Cohen: 210

Existential Fallacy

Definition:

A standard form categorical syllogism with two universal premises has a particular conclusion.

The idea is that some universal properties need not be instantiated. Itmay be true that 'all trespassers will be shot' even ifthere are no trespassers. It may be true that 'all brakelesstrains are dangerous' even though there are no brakelesstrains. That is the point of this fallacy.

Examples:

i. All mice are animals, and all animals are dangerous, so some mice are dangerous.
ii. No honest people steal, and all honest people pay taxes, so some honest people pay taxes.

Proof:

Assume that the premises are true, but that there are no instances of the category described. For example, in (i) above, assume there are no mice, and in (ii) above, assume there are no honest people. This shows that the conclusion is false.

References:

Copi and Cohen: 210

Fallacies of Explanation

An explanation is a form of reasoning which attempts to answer the question "why?" For example, it is with an explanation that we answer questions such as, "Why is the sky blue?"

A good explanation will be based on a scientific or empirical theory. The explanation of why the sky is blue will be given in terms of the composition of the sky and theories of reflection.

The following are fallacies of explanation:

* Subverted Support (The phenomenon being explained doesn't exist)
* Non-support (Evidence for the phenomenon being explained is biased)
* Untestability (The theory which explains cannot be tested)
* Limited Scope (The theory which explains can only explain one thing)
* Limited Depth (The theory which explains does not appeal to underlying causes)

Abduction

Subverted Support

Definition

An explanation is intended to explain who some phenomenon happens. The explanation is fallacious if the phenomenon does not actually happen of if there is no evidence that it does happen.

Examples

i. The reason why most bachelors are timid is that their mothers were domineering.
(This attempts to explain why most bachelors are timid. However, it is not the case that most bachelors are timid.)
ii. John went to the store because he wanted to see Maria.
(This is a fallacy if, in fact, John went to the library.)
iii. The reason why most people oppose the strike is that they are afraid of losing their jobs.
(This attempts to explain why workers oppose the strike. But suppose they just voted to continue the strike, Then in fact, they don't oppose the strike. [This sounds made up, but it actually happened.])

Proof

Identify the phenomenon which is being explained. Show that there is no reason to believe that the phenomenon has actually occurred.

References

Cedarblom and Paulsen: 158

Non-Support

Definition

An explanation is intended to explain who some phenomenon happens. In this case, there is evidence that the phenomenon occurred, but it is trumped up, biased or ad hoc evidence.

Examples

i. The reason why most bachelors are timid is that their mothers were domineering.
(This attempts to explain why most bachelors are timid. However, it is shown that the author bases his generalization on two bachelors he once knew, both of whom were timid.)

ii. The reason why I get four or better on my evaluations is that my students love me.
(This is a fallacy when evaluations which score four or less are discarded on the grounds that the students did not understand the question.)

iii. The reason why Alberta has the lowest tuition in Canada is that tuition hikes have lagged behind other provinces.
(Lower tuitions in three other provinces - Quebec, Newfoundland and Nova Scotia - were dismissed as "special cases" [again this is an actual example])

Proof

Identify the phenomenon which is being explained. Show that the evidence advanced to support the existence of the phenomenon was manipulated in some way.

References

Cedarblom and Paulsen: 160

Untestability

Definition

The theory advanced to explain why some phenomen occurs cannot be tested.

We test a theory by means of its predictions. For example, a theory may predict that light bends under certain conditions, or that a liquid will change colour if sprayed with acid, or that a psychotic person will respond badly to particular stimuli. If the predicted event fails to occur, then this is evidence against the theory.

A thoery cannot be tested when it makes no predictions. It is also untestable when it predicts events which would occur whether or not the theory were true.

Examples

i. Aircraft in the mid-Atlantic disappear because of the effect of the Bermuda Triangle, a force so subtle it cannot be measured on any instrument.
(The force of the Bermuda Triangle has no effect other than the occasional downing of aircraft. The only possible prediction is that more aircraft will be lost. But this is likely to happen whether or not the theory is true.)

ii. I won the lottery because my psychic aura made me win.
(The way to test this theory to try it again. But the person responds that her aura worked for that one case only. There is thus no way to determine whether the win was the result of an aura of of luck.)

iii. The reason why everything exists is that God created it.
(This may be true, but as an explanation it carries no weight at all, because there is no way to test the theory. No evidence in the world could possibly show that this theory is false, because any evidence would have to be created by God, according to the theory.)

iv. NyQuil makes you go to sleep because it has a dormative formula.
(When pressed, the manufacturers define a "dormative formula" as "something which makes you sleep". To test this theory, we would find something else which contains the domative formular and see if makes you go to sleep. But how do we find something else which contains the dormative formula? We look for things which make you go to sleep. But we could predict that things which make you sleep will make you sleep, no matter what the theory says. The theory is empty.)

Proof

Identify the theory. Show that it makes no predictions, or that the predictions it does make cannot ever be wrong, even if the theory is false.

References

Cedarblom and Paulsen: 161

Limited Scope

Definition

The theory doesn't explain anything other than the phenomenon it explains.

Examples

i. There was hostility toward hippies in the 1960s because of their parents' resentment toward children.
(This theory is flawed because it explains hostility toward hippes, and nothing else. A better theory would be to say there was hostility toward hippies because hippies are different, and people fear things which are different. This theory would explain not only hostility toward hippies, but also other forms of hostility.)

ii. People get schizophrenia because different parts of their brains split apart.
(Again, this theory explains schizophrenia - and nothing else.)

Proof

Identify the theory and the phenomenon it explains. Show that the theory does not explain anything else. Argue that theories which explain only one phenomenon are likely to be incomplete, at best.

References

Cedarblom and Paulsen: 163

Limited Depth

Definition

Theories explain phenomena by appealing to some underlying cause or phenomena. Theories which do not appeal to an underlying cause, and instead simply appeal to membership in a category, commit the fallacy of limited depth.

Examples

i. My cat likes tuna because she's a cat.
(This theory asserts only that cats like tuna, without explaining why cats like tuna. It thus does not explain why my cat likes tuna.)
ii. Ronald Reagan was militaristic because he was American.
(True, he was American, but what was it about being American that made him militaristic? What caused him to act in this way? The theory does not tell us, and hence, does not offer a good explanation.)
iii. You're just saying that because you belong to the union.
(This attempt at dismissal tries to explain your behaviour as frivolous. However, it fails because it is not an explanation at all. Suppose everyone in the union were to say that. Then what? We have to get deeper - we have to ask ***why*** *they would say that - before we can decide that what they are saying is frivolous.)*

Proof

Theories of this sort attempt to explain a phenomenon by showing that it is part of a category of similar phenomenon. Accept this, then press for an explanation of the wider category of phenomenon. Argue that a theory refers to a cause, not a classification.

References

Cedarblom and Paulsen: 164

Fallacies of Definition

In order to make our words or concepts clear, we use a definition. The purpose of a definition is to state exactly what a word means. A good definition should enable a reader to 'pick out' instances of the word or concept with no outside help.

For example, suppose we wanted to define the word "apple". If the definition is successful, then the reader should be able go out into the world and select every apple which exists, and only apples. If the reader misses some apples, or includes some other items (such as pears), or can't tell whether something is an apple or not, then the definition fails.

The following are fallacies of definition:

* Too Broad (The definition includes items which should not be included)
* Too Narrow (The definition does not include all the items which shouls be included)
* Failure to Elucidate (The definition is more difficult to understand than the word or concept being defined)
* Circular Definition (The definition includes the term being defined as a part of the definition)
* Conflicting Conditions (The definition is self-contradictory)

Too Broad

Definition

The definition includes items which should not be included.

Examples

i. An apple is something which is red and round.
(The planet Mars is red and round. So it is included in the definition. But obviously it is not an apple.)
ii. A figure is square if and only if it has four sides of equal length.
(Not only squares have four sides of equal length; trapezoids do as well.

Proof

Identify the term being defined. Identify the conditions in the definition. Find an item which meets the condition but is obviously not an instance of the term.

References

Cedarblom and Paulsen: 182

Too Narrow

Definition

The definition does not include items which should be included.

Examples

i. An apple is something which is red and round.
(Golden Delicious apples are apples, however, they are not red (they are yellow). Thus they are not included in the definition, however, they should be.)

ii. A book is pornographic if and only if it contains pictures of naked people.
(The books written by the Marquis de Sade do not contain pictures. However, they are widely regarded as pornographic. Thus, the definition is too narrow.

iii. Something is music if and only if it is played on a piano.
(A drum solo cannot be played on a piano, yet it is still considered music.)

Proof

Identify the term being defined. Identify the conditions in the definition. Find an item which is an instance of the term but does not meet the conditions.

References

Cedarblom and Paulsen: 182

Failure to Elucidate

Definition

The definition is harder to understand than the term being defined.

Examples

i. Someone is lascivious if and only if he is wanton.
(The term being defined is "lascivious". But the meaning of the term "wanton" is just as obscure as the term "lascivious". So this definition fails to elucidate.)

ii. An object is beautiful if and only if it is aesthetically successful.
(The term "aesthetically successful" is harder to understand than the term "beautiful".

Proof

Identify the term being defined. Identify the conditions in the definition. Show that the conditions are no more clearly defined than the term being defined.

References

Cedarblom and Paulsen: 184

Circular Definition

Definition

The definition includes the term being defined as a part of the definition.

(A circular definition is a special case of a Failure to Elucidate.)

Examples

i. An animal is human if and only if it has human parents.
(The term being defined is "human". But in order to find a human, we would need to find human parents. To find human parents we would already need to know what a human is.)
ii. A book is pornographic if and only if it contains pornography.
(We would need to know what pornography is in order to tell whether a book is pornographic.)

Proof

Identify the term being defined. Identify the conditions in the definition. Show that at least one term used in the conditions is the same as the term being defined.

References

Cedarblom and Paulsen: 184

Conflicting Conditions

Definition

The definition is self-contradictory.

Examples

i. A society is free if and only if liberty is maximized and people are required to take responsibility for their actions.
(Definitions of this sort are fairly common, especially on the internet. However, if a person is required to do something, then that person's liberty is not maximized.)
ii. People are eligible to apply for a learner's permit (to drive) if they have (a) no previous driving experience, (b) access to a vehicle, and (c) experience operating a motor vehicle.
(A person cannot have experience operating a motor vehicle if they have no previous driving experience.)

Proof

Identify the conditions in the definition. Show that they cannot all be true at the same time (in particular, assume that one of the conditions is true, then show from this that another of the conditions must be false).

References

Cedarblom and Paulsen: 186

The Categorical Converter

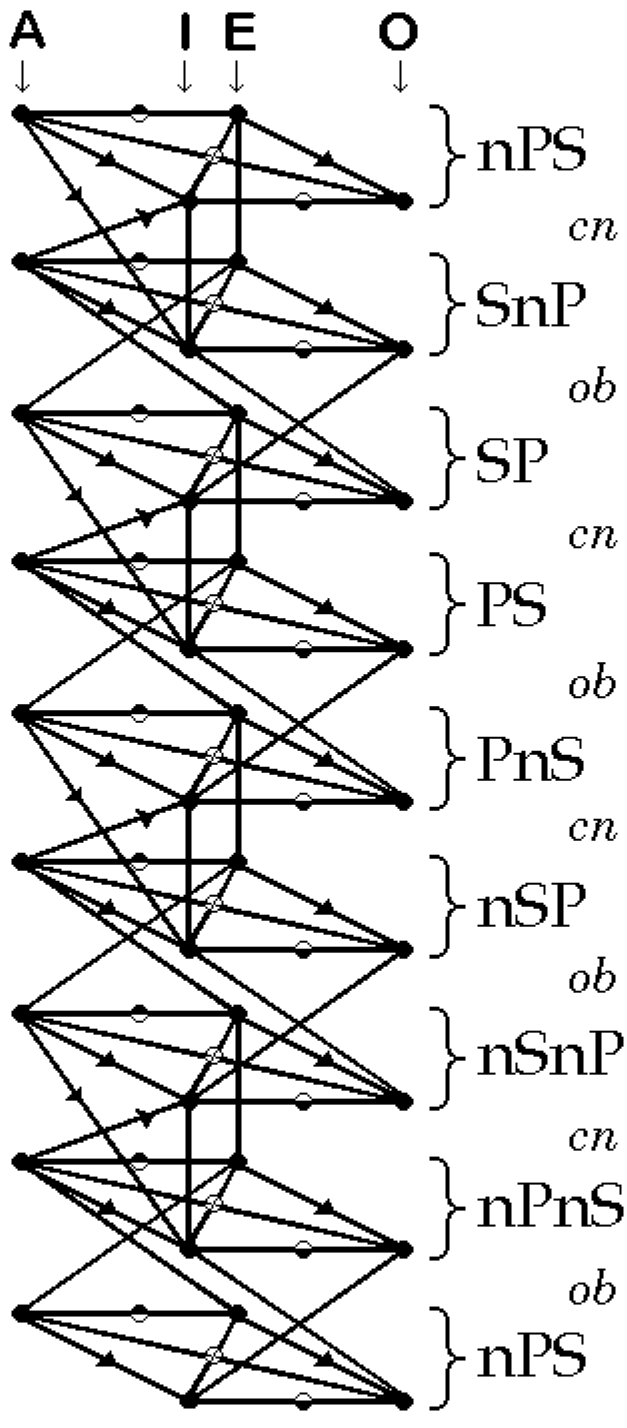
The Categorial Converter is a visual representation of all possible logical relationships between individual categorical propositions. It may be used to test the validity of an inference from one proposition to another.

In other words, the Categorical Converter represents all possible inferences using the rules of:

* Contradiction
* Contrary
* Subcontrary
* Subalternation
* Superalternation
* Obversion
* Conversion
* Transposition

From here, you may view the Categorical Converter. You may also learn how to use it, and finally, learn how it was constructed.

Viewing the Categorical Converter



Black dots (●) are propositions. On the diagram, locate the premise and conclusion of your inference.

You have three types of tokens: **T** (true), **F** (false), and **U** (undetermined).

If the premise is true, place a true (**T**) token on the dot which represents the premise. If it is false, place a false (**F**) token on the dot.

Any path (— may join the premise and the conclusion. Move the token from the premise to the conclusion, following the paths, exchanging it according to the following rules:

- **U** is never exchanged.

- If you have a **T** token, then:

  a. If you cross a contradiction ( ) or contrary ( ) symbol, exchange the **T** token for an **F**.
  b. If you cross a subcontrary ( ) symbol, exchange the **T** token for a **U**.
  c. If you cross an arrow ( ) pointing against your direction of travel, exchange the **T** token for a **U**.

- If you have a **F** token, then:

  a. If you cross a contradiction ( ) or subcontrary ( ) symbol, exchange the **F** token for a **T**.
  b. If you cross a Contrary ( ) symbol, exchange the **F** token for a **U**.
  c. If you cross an arrow ( ) pointing toward your direction of travel, exchange the **F** token for a **U**.

- When moving from the premise to the conclusion, you must avoid exchanging your token for a **U** if at all possible.

The value of the token when it rests on the conclusion is the result of the inference.

From here, you may learn how to use the Categorical Converter or learn how it was constructed.

Using the Categorical Converter

The first step in using the Categorical Converter is to locate the premise and the conclusion. That is what the letters above and beside the images represent.

The letters at the top point to every proposition (●) straight below them. They indicate the four major types of categorical proposition:

A Universal Affirmative
(All S are P)
E Universal Negative
(No S are P)
I Particular Affirmative
(Some S are P)
O Particular Negative
(Some S are not P)

The **S** and **P** represent categories. For example, **S** may represent *Dogs* while **P** may represent *Mammals*.

For any category, we can imagine the opposite of that category. So, for example, if we can imagine *Dogs*, we can imagine *non-Dogs*. Where **S** stands for *Dogs*, **nS** stands for *non-Dogs*.

The **S** and the **P** need not appear in the same order every time. For example, we can have the sentence **All S are P** and we can also have the sentence **All P are S**.

The letters on the right side of the diagram indicate the order of the **S** and **P** in the diagram. Together with the letters at the top, we are given a complete description of every proposition (●) in the diagram.

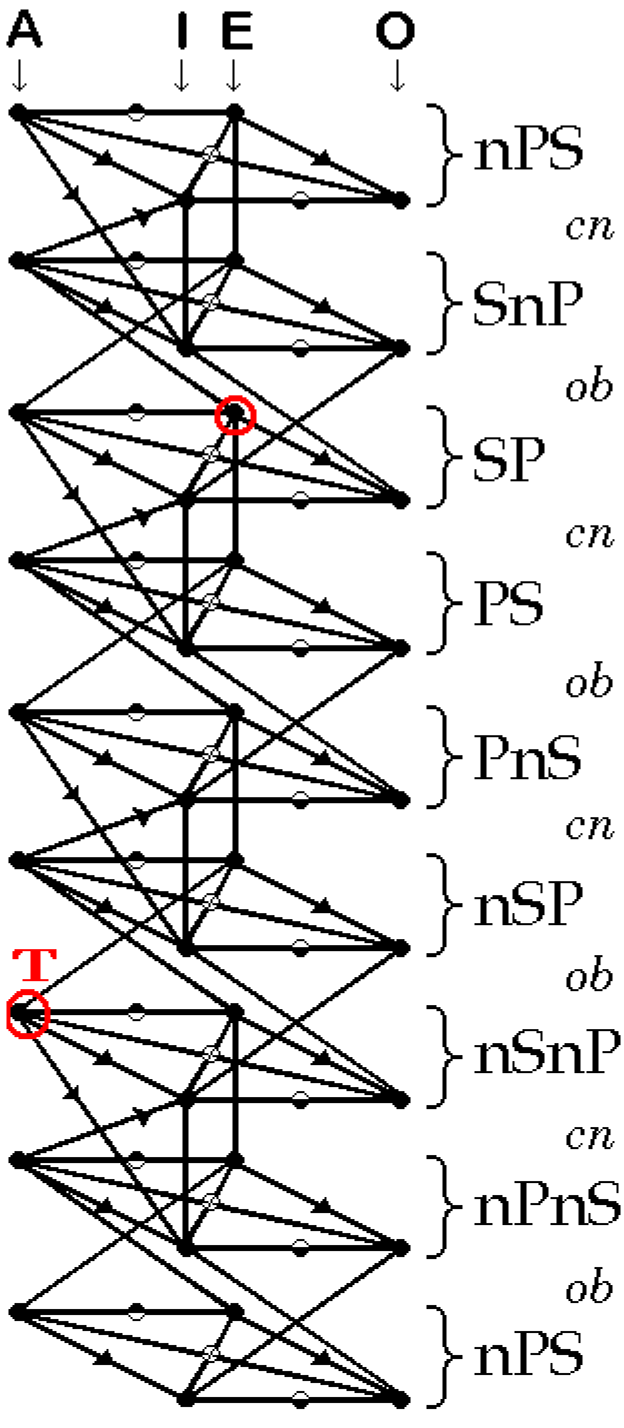
Thus, for example, the ●directly under the **A** and directly to the left of **SP** is:
All S are P.

Or, for example, the ●directly under the **O** and directly to the left of **nPnS** is:
All non-P are non-S.

Suppose now we had the following problem:

`Given that the proposition` **`All non-S are non-P`** `is true, what is the value of` **`No S is P`**`?`

We begin by locating the premise and conclusion (circled in red on the diagram to the right) and by placing a **T** token on the premise (the red **T** on the diagram - you may have to scroll down a bit to find it)

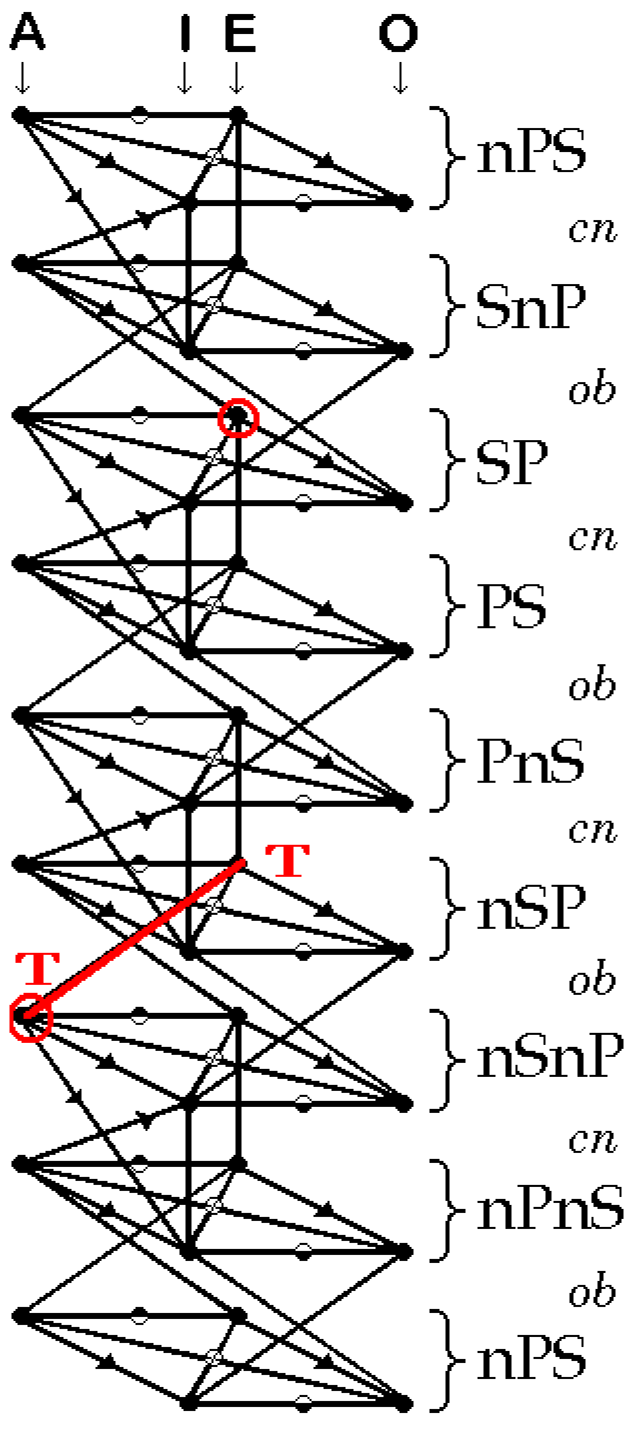


We begin to try to trace a path from the premise to the conclusion. Looking at the diagram, we can see it makes sense to try to move toward the conclusion. So we trace a path from the **nSnP** under the **A** column to the **nSP** under the **E** column.

Moving from **nSnP** to **mSP** follows the rule of **Obversion** (that's what the **ob** at the side stands for). Since we encounter no symbol along the path, the token remains **T** (true).

We might represent our inference thus far as:

```
"All non-S is non-P" is true, thus (by obversion) "No non-S is P" is true.
```

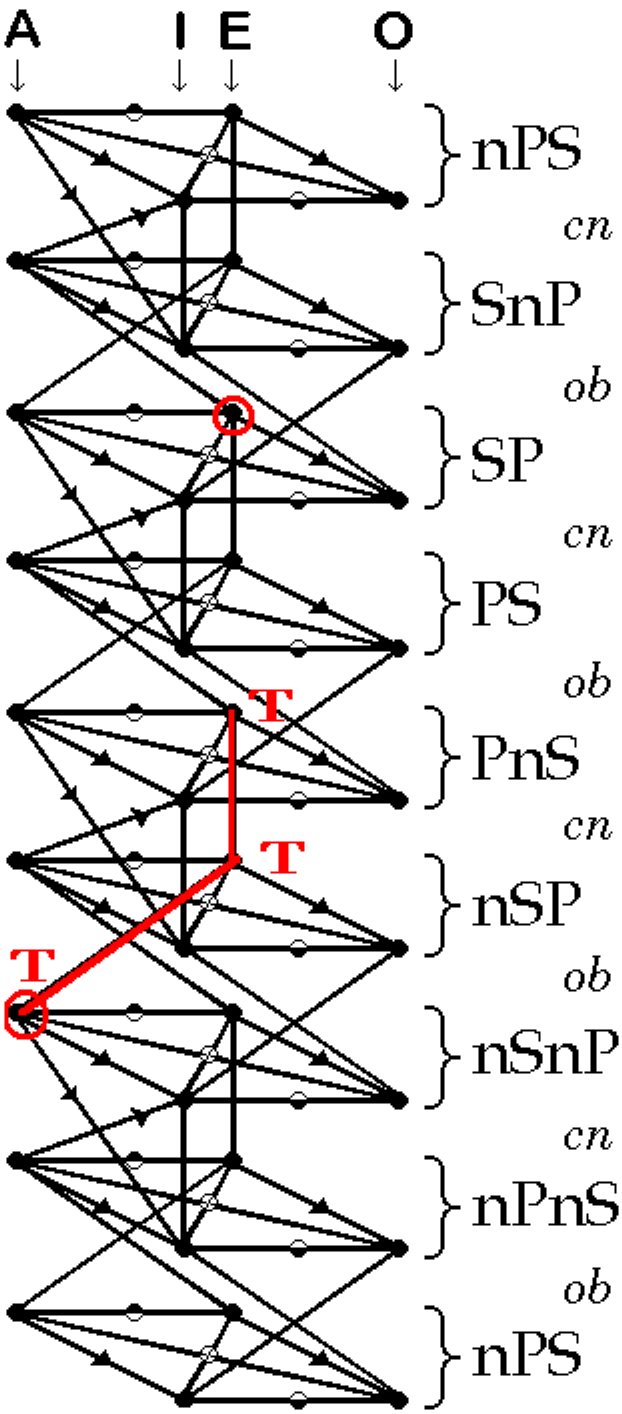


We continue by tracing our path along the **O** column from **nSP** to **PnS**.

Moving from **nSP** to **PnS** follows the rule of **Conversion** (that's what the **cn** at the side stands for). Since we encounter no symbol along the path, the token remains **T** (true).

We might represent our inference thus far as:

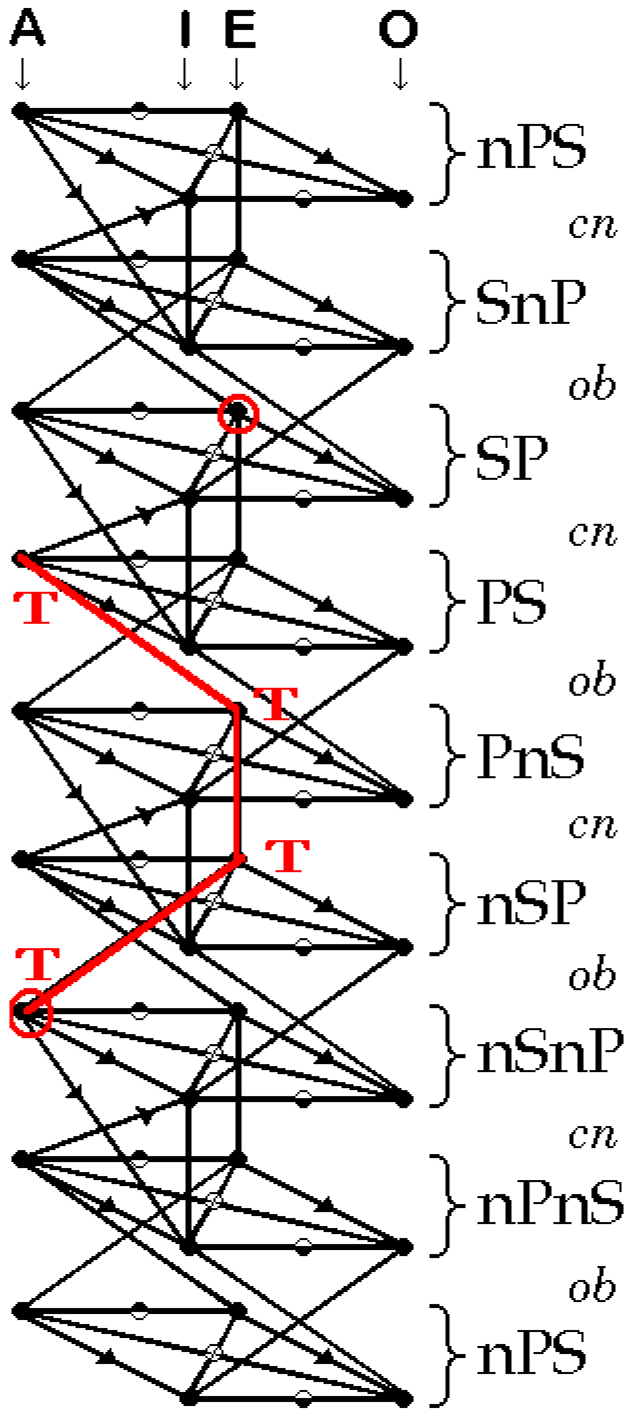
```
"All non-S is non-P" is true, thus (by obversion) "No non-S is P" is true,
thus (by conversion) "No non-P is non-S" is true.
```



We continue by tracing our path from the **PnS** under the **O** column to the **PS** under the **A** column. Moving from **PnS** to **PS** follows the rule of **Obversion**. Since we encounter no symbol along the path, the token remains **T** (true).

We might represent our inference thus far as:

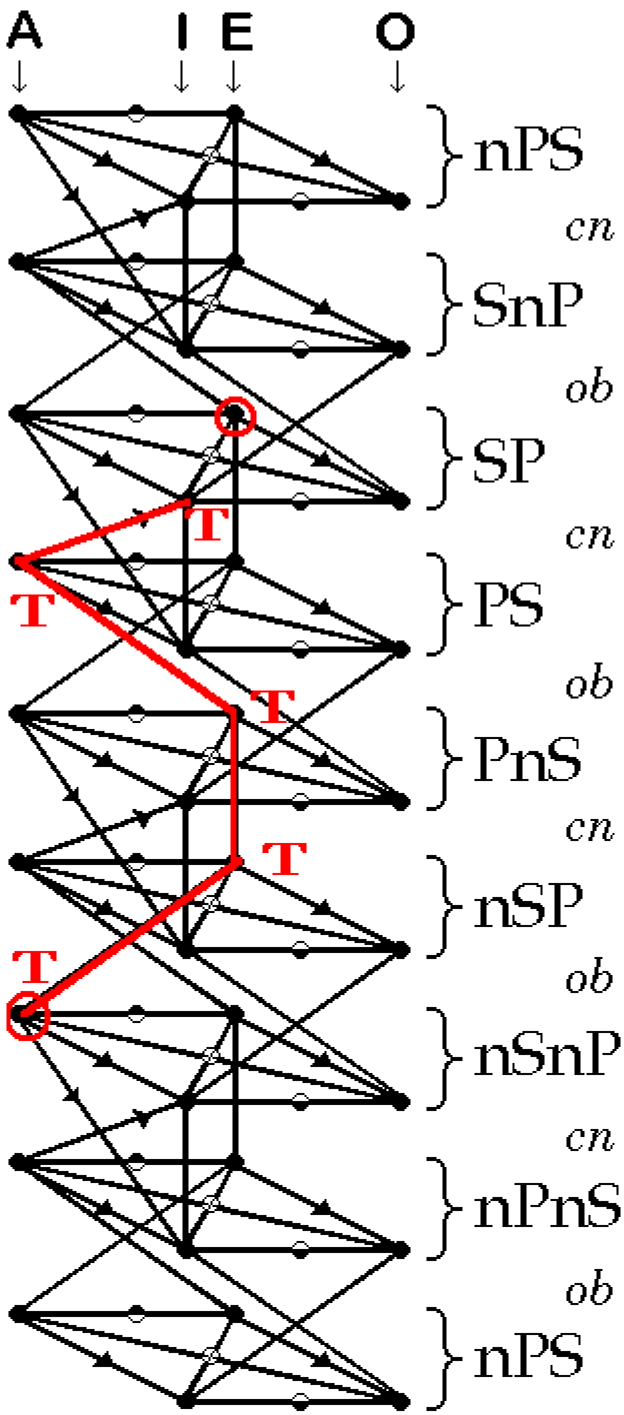
```
"All non-S is non-P" is true, thus (by obversion) "No non-S is P" is true,
thus (by conversion) "No non-P is non-S" is true, thus (by obversion) "All P
is S" is true.
```



We continue by tracing our path from the **PS** under the **A** column to the **SP** under the **I** column. Moving from **PS** to **SP** follows the rule of **Conversion**. Since we encounter no symbol along the path, the token remains **T** (true).

We might represent our inference thus far as:

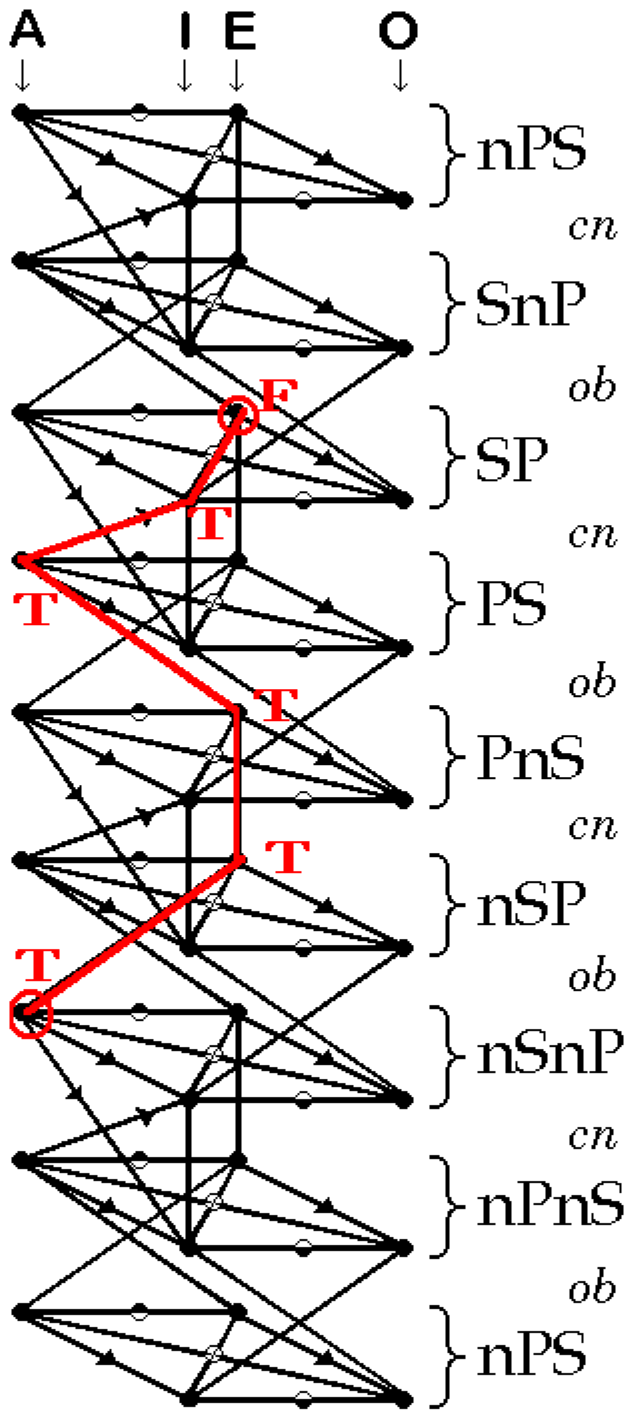
```
"All non-S is non-P" is true, thus (by obversion) "No non-S is P" is true,
thus (by conversion) "No non-P is non-S" is true, thus (by obversion) "All P
is S" is true, thus (by conversion) "Some S is P" is true.
```



We finish by tracing our path from the **SP** under the **I** column to the **SP** under the **E** column. Moving from **PS** to **SP** follows the rule of **Contradiction**. We encounter the symbol along the path, so the **T** token is exchanged for a **F** (false) token.

We represent our final inference as:

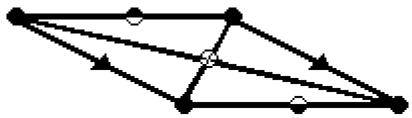
"All non-S is non-P" is true, thus (by obversion) "No non-S is P" is true, thus (by conversion) "No non-P is non-S" is true, thus (by obversion) "All P is S" is true, thus (by conversion) "Some S is P" is true, thus (by contradiction) "No S is P" is false.



This completes the description of how to use the Categorical Converter. If you wish, you may view the Converter again, or you may learn how the Converter is constructed.

Constructing the Categorical Converter

The first step in the construction of the Categorical Converter is to take a Square of Opposition and to angle it slightly (this allows us to construct the rest of the Converter as a three-dimensional object).



We place symbols on the Square to represent rules of inference as follows:

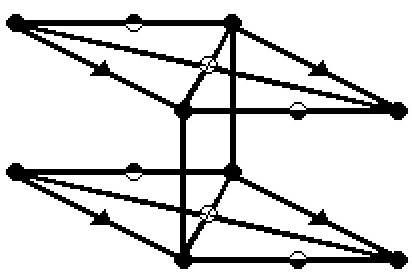
- **Contradiction**

- **Contrary**

- **Subcontrary**

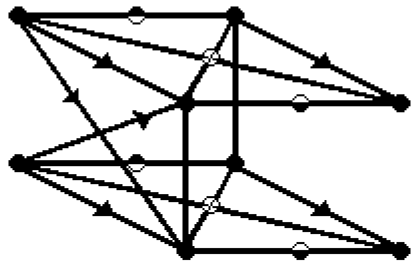
- **Subalternation**

We suppose that our Square of Opposition follows the standard **SP** model (so, for example, the proposition in the upper left corner is **All S are P**).



SP propositions are related by the rule of **Conversion** to **PS** propositions. Moreover, it is possible to construct a second Square for **PS** propositions.

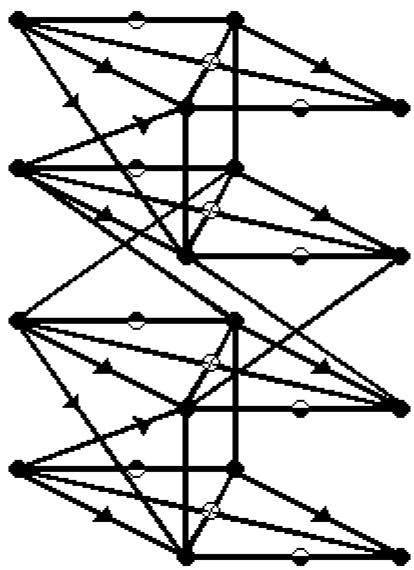
The image is constructed in two stages. First, we add the **PS** Square and draw lines to represent straightforward conversions among **I** and **O** propositions (diagram above).



Then we add the more complex conversions between **A** and **I** propositions (diagram above). Note that these are limited case conversions, being equivalent to the combination of a **Subalternation** and **Conversion**.

In addition to the rule of **Conversion**, propositions in the **SP** square are related to **SnP** Square by the rule of **Obversion**.

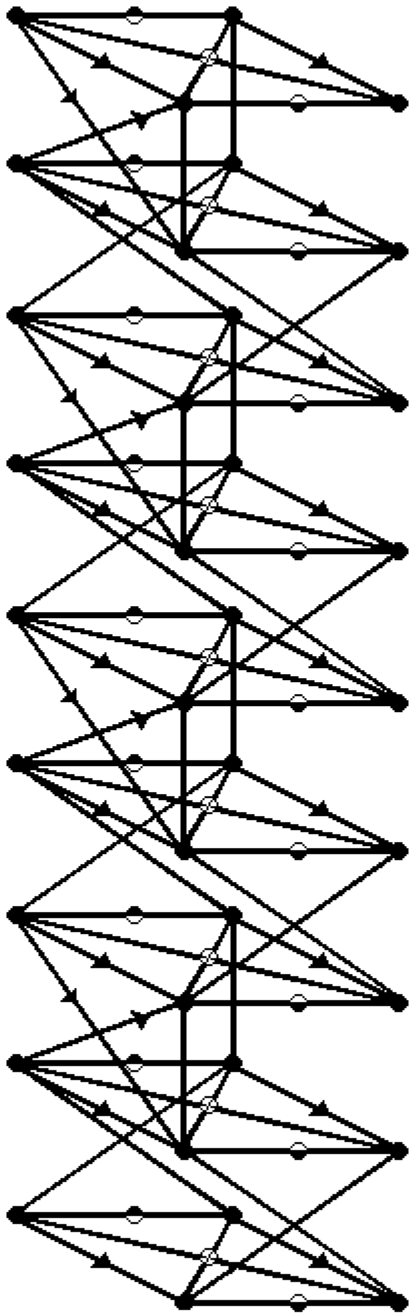
The **SnP** Square is constructed and lines are drawn from **A** to **E** propositions and from **I** to **O** propositions (see the diagram at right).



As it turns out, if we alternate between **Conversion** and **Obversion** layers, we can link all possible orderings of **S**, **P**, **nS** and **nP** Squares in eight layers.

A ninth Square is added at the bottom; this is exactly the same Square as the square at the top.

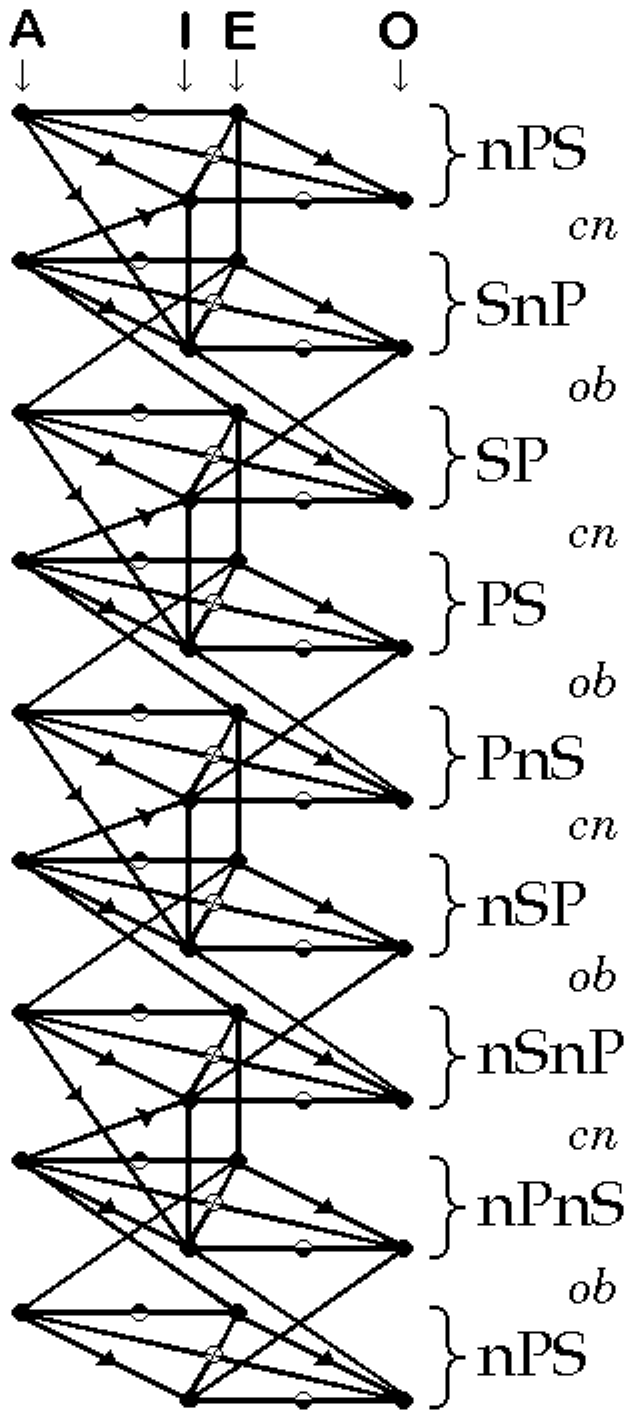
(You may wonder: what happened to the rule of **Transposition**. This rule turns out to be a combination of **Obversion** and **Conversion** rule.)



Finally, the columns and Squares are labled, as are the **Conversion** and **Obversion** inferences which transport you from Square to Square.

This ends the description of how the Converter is constructed. From here you may view the Converter or learn how to use it.

You might also be interested to learn why I constructed the Categorical Converter.


A
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cn
nPnS
ob
nPS

The Categorical Converter: Why I Constructed It

There are two major reasons why I constructed the Categorical Converter, one practical and one perverse.

The Practical Reason

In 1989 I was given the task of teaching first year logic students. In particular, I had to teach them the rules of contradiction, conversion, and the rest.

The rules as represented on the Square of Opposition were easy to teach; students to easily see which rule or sequence of rules would lead from premise to conclusion. However, once we got to obversion, conversion and transposition, it got a lot harder.

In particular, the following question perplexed both myself and my students: *how do we know which rules to try first?* It seemed like a matter of trial and error, and the logic texts were no help whatsoever.

I began by tracing the routes from **SP** to **PS** propositions. Once I realized that it *could* be done, constructing the remainder of the diagram was just work.

The rule for selecting which rule to start with which emerged was the following: *Begin by using obversion and conversion until the order of the **S** and **P** in the premise is the same as the conclusion. Then apply the Square of Opposition.*

Now why couldn't any of the dozens of logic texts I consulted say that? I ask you!

The Perverse Reason

Stripped of all words - including such suggestive words as **All**, **No**, **Some** and **non-**, the Categorical Converter is nothing more than an empty structure.

Or - as I picture it - it is a map without any place names.

When viewed that way, it is *entirely arbitrary* where we place our lines. For example, there is no line from **SP** under the **A** column to the **PS** under the **A** column. Why not?

The arrangement of the lines seems entirely arbitrary.

Even if we use **All**, **No**, **Some** and **non-**, the arrangement is arbitrary. There is no line between **All S are P** and **All P are S**. Viewed strictly as a structure or map, there is no reason why we shouldn't place a line there.

The reason why the lines are where they are, of course, is that inferences from one proposition to another should be *truth preserving*. But until we *introduce* truth into the system, the requirement of truth preservation cannot be used to dictate where we should place our lines.

In the Categorical Converter, however, truth is introduced by means of the **T** and **F** tokens. And indeed, it is not until we stipulate that **T** *stands* for **Truth** that we have introduced truth into the system.

But even *that* is not enough to tell us where to place the lines. Given *only* the structure and the truth tokens, there is *still* nothing which prevents me from drawing a line from **All S are P** to **All P are S**.

Such a system would be *different* from categorical reasoning as we know it, to be sure. But there is no a priori argument which may be given which states that it is *wrong*.

The only reason we use the structure we actually use is that the *world* resembles this structure. For example, in the world, even though it may be true that *All dogs are mammals*, there are counterexamples to the proposition that *All mammals are dogs*. But were the world constructed differently, there might not be any counterexamples. Our rules of inference would then be different.

So: my perverse reason is that this is one more way of showing that logic does not represent a priori necessary truth. Rather, logic follows from emprical observation. Logic works the way it does because the world works the way it does, and not the other way around.

This ends my explanation of why I created the categorical Converter. From here you may view the Converter, learn how to use it, or learn how to construct one.

Logic Resources

(Badly dated)

Logic resources exists scattered over the net. In this guide I have tried to sort them and list them. Obviously, no such list could ever be complete, so if you know of a site which I've missed, please send me some mail.

* Logical Fallacies - other sites which list and describe logical fallacies
* Branches of Logic - sites devoted to some particular branch of logic
* FAQs - newsgroup FAQs (Frequently Asked Questions) which discuss logic
* Logic Newsgroups
* Logic Software - programs which do logic for you
* Research - sites devoted to research in logic

Note: The 'Previous' button on all of these pages returns you to this page.

Logic Resources Sites

The following sites all have the same objective as *Stephen's Guide*: to list and describe logical fallacies.

- Argumentative Writing - a text for a basic logic course. Also includes discussion on categorical and propositional logic.
- Chris Holt Lounge - an discussion of the *ad hominen* (Attacking the Person) fallacy.
- Common Argument Fallacies - a very short list of fallacies from the Debate Forum of AOL.
- Common Fallacies in Reasoning - a short list of fallacies.
- Common Material Fallacies - a short list of fallacies from a course in logic called *Fundamentals in Argumentation*.
- Critical Thinking - a list and discussion of logical fallacies from a Biblical point of view.
- Fallacies - a short list of fallacies with examples and exercises.
- Fallacies - a fairly comprehensive list of fallacies with (very) short descriptions.
- Logic and Argument - a short list of fallacies for University of Victoria English students.
- Logical Fallacies: Bad Logic or Propaganda? - This site explores the use of fallacies in propaganda and provides some good examples.
- Nizkor Project - a list of fallacies presented by an anti-holocaust-denial group. Visit their site because it's the right thing to do.
- Propaganda and Politics - a good discussion of the use of fallacies in propaganda as applied to Rush Limbaugh.
- Valuable Memes - under construction, this site looks like the beginning of a discussion of a select set of fallacies.

Branches of Logic

Once you are past the basic, you come to see that logic has many branches and flavours. Much of this is documented on the web. This page points you to sites devoted to some particular branch or another.

- **Alternative Logic**
  This is a term I coined to capture the various New Age logics which have emerged in recent years, the paradigm of which is deBono's Lateral Thinking.
  - Logic On-Line - contains references to the G.O.S.N. and S.I.D.P.E. methodologies
- **Deontic Logic**
  This field of logic deals with permissions and obligations. It is typically used in the field of moral philosophy. Trying to teach it to computers is a bear. ;)
  - Deontic Logic - a one-line glossary entry
  - Deontic Logic - a short description
  - Deontic Logic Relativised to Bearers and Counterparties - a short paper
  - The Deontic Logic Group - just a title so far; pages under construction
  - Second International Workshop on Deontic Logic in Computer Science - outline only
  - Third International Workshop on Deontic Logic in Computer Science programme and call for papers
- **Description Logic**
  Description logics are languages tailored for expressing knowledge about concepts and concept hierarchies.
  - Description Logics at Intelligent Information Systems Laboratory, Department of Computer and Information Science, Linköping University
- **Epistemic Logic**
  Epistemic logic is the study of the relations between propositions describing states of knowledge and belief. For example, if I *know* that I am in France, does it follow that I ought to *believe* that I am in France?

  No references found - a few abstracts and book titles, but that's it

- **Fuzzy Logic**
  A lot of what is out there is imprecise. Many of the concepts and definitions that we employ are 'fuzzy'. This fact has lead to a branch of logic which takes fuzziness into account. The application of fuzzy logic theory concentrates mainly on two areas: system control and computer vision. Much of this list is taken from LogicaL at Globewide Network Academy.
  - Fuzzy Logic at the University of Missouri-Columbia
  - Quadralay's Fuzzy Logic Page at Quadralay Corporation.
  - Center for Intelligent Systems of Binghamton University.
  - Bart Kosko at the Signal and Image Processing Institute of the University of Southern California.
  - Lotfi Zadeh at the Computer Science and Engineering Division/ Berkeley Institute for Soft Computing (BISC) at the University of California at Berkeley.
  - Center for Fuzzy Logic, Robotics, and Intelligent Systems (CFL) at Texas A&M University
  - Fuzzy Logic Laboratorium at the Johannes Kepler University Linz.

    - Intelligent Fuzzy Systems Laboratory in the Department of Industrial Engineering at the University of Toronto.
    - Internet Fuzzy Logic Repository at the Institute for Telecommunication Sciences.
    - Fuzzy Repository at Østfold College.
- **Game Theory**
  Also known as *decision theory*, this branch of logic combines probability theory with the the value of certain outcomes.

    The History of Game Theory

- **Intensional Logic**
  Intensional (or indexical) logic is the study of assertions and other expressions whose meaning depends on an implicit context or index, such as time or spatial position.
    - Intensional Logic and Programming
    - ISLIP'96 The NinthInternational Symposium on Languages for Intensional Programming, May13-15, 1996 Arizona State University, Tempe, Arizona, USA
- **Many-Valued Logic**
  Most deductive logic assumes that a proposition is either *true* or *false*. Many-valued logic defines that assumption.
    - Many-valued Logics for Computer Science Applications of the of the Vienna Group for Multiple-valued Logics
- **Mathematical Logic**
  This is the study of the logical foundations of mathematics. A fascinating discipline, but you *really* must enjoy squiggles in your text to enjoy it. Much of this list is borrowed from Boris Piwinger's list.
    - Kurt Goedel Society Home Page
    - Mathematical Logic Group
    - Institut für mathematische Logik und Grundlagen der Mathematik
    - Lehrstuhl für Mathematische Logik
    - Institut für mathematische Logik und Grundlagenforschung
    - Mathematical Logic
    - Group in Logic at UC Berkeley
    - Logic at UCLA
    - Logic at UI Chicago
    - IU Logic Program
    - Mathematical Logic at Pennsylvania State University
    - Kenneth Kunen
    - Logic Group
    - Seminar on Mathematical Logic
    - Department of Mathematical Logic
    - Mathematical Logic
    - Logic seminar
    - Mathematical Logic Group
    - Mathematical Logic
    - Mathematicians online
    - MathSearch (search a collection of mathematical Web material)
    - Famous Mathematicians - Chronological Index
    - New Foundations Home Page

- The Beginnings of Set Theory
- Selected Logic Papers Other books by W.V. Quine avaiable from Harvard University Press
- Studies in Logic and the Foundations of Mathematics(book series by North-Holland)
- UMI (order papers...)
- Mathematical Logic Group at the University of Bonn
- Department of Mathematics (german)
- University of Bonn
- Luis Sanchis, Syracuse University

- **Medieval Logic**
  Brought to us by the leading lights of the twelth century, Medieval Logic is for the most part the study of universal forms.
  - Mediaeval Logic and Philosophy by Paul Vincent Spade
- **Modal Logic**
  Modal logic concerns the logic of possibility and necessity.
  - Jan O.M. Jaspars Home Page - links to some papers on modal logic
  - Modal Logic - a very short sketch and some references
  - Modal Logic - Examples - discussion of modal logic axiom systems and derived rules
  - Propositional Modal Logic - a short sketch and some diagrams
- **Paraconsistent Logic**
  Most forms of logic assume consistency, that is if *A* is true, then *Not A* must be false. Paraconsistent logic denies this basic assumption. This may sound like a denial of logic entirely, but given that many people hold inconsistent beliefs, it is an important area of study. Also, some forms of mathematical logic, such as intuitionisn, are variations on paraconsistent logic.
  - First World Congress on Paraconsistency First Announcement, Gent July 1997
- **Persian Logic**
  I know nothing about Persian logic, so I'm not even going to try a short sketch...
  - Association for Persian Logic, Language and Computing
- **Probability Theory**
  Probability theory is the study of the logic of statistical inferences.
  - Probability Theory: The Logic of Science
    This is a major work by E.T. Jaynes. All the links are to PostScript files.
- **Temporal Logic**
  Also known as *Tense Logic*, this branch of logic deals with temporal relations between propositons. A proposition which is true today may be false tomorrow; we need to understand what effect this has on the entailments of that proposition.
  - Some References for Temporal Logic - short list

Newsgroup FAQs

These newsgroup FAQs all discuss logic at least to some degree. Most are devoted to the particular topic of the newsgroup.

- alt.atheism FAQ: How to construct a logical argument
- talk.origins Welcome FAQ
- sci.sceptic FAQ contains a discussion of scientific method

I don't really enjoy the logic newsgroups because they tend to be twenty-first century versions of the "How many angels can dance on the head of a pin" debates. But many people enjoy them, so, a list:

- comp.object.logic
- sci.logic
- fa.philos-l
- fa.analytic.philosophy
- swnet.filosofi
- comp.ai.philosophy

Software

Research

This somewhat eclectic list focusses on research in logic. As a result, many of the topics listed will verge on the esoteric. If you are a novice in the field of logic you may want to save this material for later reading. But if you are a passionate logic devotee - enjoy!

- Indiana University Logic Group Papers
  A large list of papers on a wide range of topics
- Logic Goup Preprint Series
- The Nordic Journal of Philosophical Logic
- Notre Dame Journal of Formal Logic
- Visual Inference Laboratory
  This page lists several research projects in the area of visual inference (the use of diagrams and other visual tools for inference) at Indiana University. Links point to the participants' home pages and may or may not be useful.

References

The following list surveys major texts in logic and critical reasoning. Although not a complete guide (could there be sucha thing?) it should provide a good starting point. Although historical material is present, I have restricted selections to books published in this century.

- Barker, Stephen F. The Elements of Logic Fifth Edition.McGraw-Hill, 1989.

  Barker is one of the heavyweight thinkers in formal logic and his book reads like it. For the rest of us, that means: dense and unenlightening. The book covers categorical syllogisms, truth functions, quantification, fallacies, and inductive reasoning.

- Boolos, George., and Jeffrey, Richard. Computability and Logic. Second Edition. Cambridge University Press, 1980.

  A fascinating look at the overlap between computation and logic. Heavy going; it begins with Turing Machines, ponders undecidability, indefinability and incompleteness, and ends with Ramsey's theorems. People who like heavy symbolism will love this book. People who think it's all squiggles will hate it. Recommended.

- Bergmann, Merrie, James Moor, and Jack Nelson. The Logic Book. Second Edition. McGraw-Hill, 1990.

  This is ***the*** *introduction to formal logic. Covers syntax and semantics in propositional and predicate calculus. Introduces the concepts of completeness and decidability. The second edition was the first new edition in ten years, which speaks well for its stability. Recommended.*

- Cohen, Morris, and Nagel, Ernest. An Introduction to Logic. Harcourt, Brace and World, 1932, 1962.

  A traditional text, this book examines categorical syllogisms and touches on mathematical systems and probability. In other words, it's a (very) uneasy blend of classical logic and modern. Worth a look for its historical value.

- Copi, Irving M. and Cohen, Carl. Introduction to Logic. Eighth Edition. Macmillan, 1990.

  For many years, Copi was ***the*** *standard introductory text, and this edition continues the trend. Covers propositional logic, categorical syllogisms, and informal fallacies. A new edition appears every few years, which is hell on used book stores. Copi is the master of the circle-and-arrow argument diagrams (which never really worked, in my view). Better introductory texts have appeared in recent years.*

- Gianelli, A.P. **Meaningful Logic**. Bruce Publishing Company, 1962.

This is a classical logic text with numbered paragraphs and a focus on the universal and the particular. All this sounds bad but the author is an engaging and ernest writer. This book is useless to somebody who wants to learn logic, but a treasure to someone who knows and loves the discipline.

- Gilbart, Helen W. Reading With Confidence. Scott, Foresman and Company, 1988.

  This is the sort of stuff that is passing for 'critical thinking' in education these days. This very basic text begins by looking at 'controlling ideas', transitions, context, inference, bias and prejudice. It's a noble objective, but it's fuzzy and in some places just wrong. Not recommended.

- Haack, Susan. Philosophy of Logics. Cambridge University Press, 1978.

  This book is serious reading and should not be attempted without a good grounding in the field. Covers theories of truth, paradoxes, classical and non-classical logics, problems in modal logic (including relevance logic), and many-valued logic. Fascinating.

- Huff, Darrell. How to Lie With Statistics. W.W. Norton, 1954.

  I have the 38th printing, which should be an indication of this slim book's popularity. A classic in the field and a must read for anybody who reads newspapers or magazines. Although the examples are seriously dated, the material is not. For some reason, many of the tricks Huff discusses are not covered in more standard texts. Recommended.

- Hughes, G.H., and Cresswell, M.J. An Introduction to Modal Logic. Methuen and Co. Ltd., 1968.

  For many years the standard introduction to modal logic, this book is a must read for anyone seriously interested in advanced topics. Covers both propositional and predicate modal logic. It was my Bible in 1987. Recommended.

- Jason, Gary. Introduction to Logic. Jones and Bartlett, 1994.

  A standard introductory text, this book covers informal fallacies and propositional logic. Instead of describing categorical logic, it insteads treats the subject (more accurately, in my view) as a branch of set theory and the logic of properties and relations. Mill's Methods are relegated to an appendix; now that hurts! Jason uses squares and circles instead of the usual letters to stand for propositions in inference rules; this is a tactic which worked well in my own classes.

- Jager, Ronald. **Essays in Logic From Aristotle to Russell**. Prentice-Hall, 1963.

  Contains selections from Aristotle, John Stuart Mill, Lewis Carroll(!), John Dewey, Bertrand Russell, Henry Veatch and Gilbert Ryle. This makes it eclectic, to say the least, but interesting reading.

- Jeffrey, Richard. Formal Logic: Its Scope and Limits. McGraw-Hill, 1981, 1967.

  A beautiful book and an absolute must for any serious student of logic or computation. Can be used as an introductory text, but this use is not recommended. While it focuses entirely on deductive logic, its crisp definitions and theorems supplement a traditional (truth table) method of derivation along with truth trees. Jeffry is particularly strong on completeness and decidibility. Recommended.

- Johnson, R.H., and Blair, J.A. Logical Self-Defense. McGraw-Hill Ryerson, 1983, 1977.

  This book focuses almost entirely on informal fallacies and is intended for an audience that wants to read newspapers more critically. A noble objective but its limited scope means that a study of logic is better served by other texts.

- Kahane, Howard. Logic and Philosophy: A Modern Introduction. Wadsworth, 1990.

  A standard introductory text covering propositional and syllogistic logic, induction and fallacies. Part five is good: discussions of modal, deontic and epistemic logic along with an introduction to axiom systems.

- Kelly, David. **The Art of Reasoning**. W.W. Norton, 1988.

  A very nice blend of formal and informal argument forms. Covers definition, propositional and predicate logic, and inductive reasoning. Incorporates a number of effective graphical aids, especially in the discussion of definition (which precedes the discussion of propositions, a welcome change from what has become standard form of late). Recommended as a good first logic text.

- Mayfield, Marlys. Thinking for Yourself: Developing Critical Thinking Skills Through Writing. Wadsworth Publishing Company, 1987.

  *A **very** informal text which relies more on contemporary teaching strategies (such as 'discovery exercises' and memory maps). A strongly American political view of the world permeates this work. Not recommended.*

- Pospesel, Howard. Introduction to Logic: Propositional Logic. Second Edition. Prentice-Hall, 1984.

  An outstanding teaching book illustrated with contemporary (for 1984) cartoons and lively examples. Uses arrow to represent the conditional operator instead of the standard horseshoe. Recommended.

- Purtill, Richard L. **Logic for Philosophers**. Harper and Row, 1971.

The book is dedicated to Rudolf Carnap, an insignia which should alert the reader to expect staunch formalism throughout. Purtill doesn't disappoint. The book covers propositional, syllogistic, class, and modal logic.

- Putnam, Hilary. Philosophy of Logic. Harper, 1971.

  Heady, engaging, and Putnam at his expository best, this book is required reading for those interested in some of the issues beneath the surface of logic, and especially the realism-nominalism debate. Not for beginners.

- Quine, Willard Van Orman. Methods of Logic. Fourth Edition. Harvard University Press, 1950, 1959.

  An authoritative text. Quine focuses entirely on deductive forms: truth functional logic and quantification. Quine's unorthodox symbolism makes this book inappropriate for the novice. Essential for students for Quine's philosophy.

- Rescher, Nicholas. **Introduction to Logic.** St. Martin's Press, 1964.

  Rescher's book forms the foundation for Copi's ***Introduction to Logic*** *and hence covers syllogistic forms, informal fallacies, propositional logic and inductive logic. A useful text for the novice, but Copi is more up to date. Rescher himself is one of my favourite authors.*

- Salmon, Merrilee. Introduction to Logic and Critical Thinking. Harcourt Brace Jovanovich, 1984.

  Quickly covers deductive forms, but the bulk of the book is devoted to inductive argument, conditionals, confirmation of hypotheses, and arguments based on relations. Thus it has a lot of material not covered by other texts, but is not for the beginner.

- Salmon, Wesley. Logic. Third Edition. Prentice-Hall, 1983.

  Part of the widely popular (and vastly overpriced) Foundations of Philosophy Series, this slim volume covers basic deduction, induction, and some issues in logic and language. This is not a teaching text, as there are no exercises. Actually, it's hard to say why it was written, except perhaps to round out the series. Wesley Salmon is authoritative; this book is not.

- Schagrin, Morton L. **The Language of Logic: A Programmed Text.** Random House, 1968.

  This is a good idea which didn't really work.The reader works through a series of 'frames' and goes to different frames depending on how they answer questions. A lot like hypertext, only slower. The book should never have been printed in Helvetica.

- Sellars, Roy Wood. The Essentials of Logic. Revised Edition. The Riverside Press, 1925.

This transitional text resembles eighteenth century works but attempts to come to grips with the formal and mathematical nature of logic newly discovered in the late nineteenth and early twentieth centuries. For students of the history of logic only.

- Skyrms, Brian. Choice and Chance: An Introduction to Inductive Logic. Dickenson, 1966.

  A nice compact treatment of the major problems in inductive logic. Includes a lengthy (though dated) treatment of the traditional problem of induction along with and Goodman's new problem.

- Stephens, William N. **Hypotheses and Evidence.** Thomas Y.. Crowell, 1968.

  As the title indicates, this text focuses on induction, causality, hypotheses, theories and evidence. Unfortunately, it came out before a lot of the recent and important work in the area and so is of historical interest only.

- Thomason, Richmond. **Symbolic Logic: An Introduction.** Collier-Macmillan, 1970.

  *Required reading for any student of philosophy, mathematics or the harder sciences. Reads more easily than **The Logic Book** and provides a thorough introduction to the semantics, in addition to the syntax, of standard argument forms. Additionally, Thomason covers identity, set theory and mathematical induction. Not for the beginner.*

- Weston, Anthony. A Rulebook for Arguments. Hackett, 1987.

  This slim volume (93 pages) serves as an excellent introduction for novices. The text surveys commonly used argument forms: arguments by example, arguments by analogy, etc. and shows the reader how to use proper argument form in essays. Recommended.

- Yanal, Robert J. Basic Logic. West Publishing Company, 1988.

  Exactly as the title suggests. Uses a version of Copi's circle-and-arrow diagrams (but instead of using numbers, he uses phrases - a big improvement). Covers arguments, deductive logic and inductive logic. Ho hum.

Your logic book isn't on this list? And you want it to be? That's because I've never seen it. Send me a review copy and I'll add your treatise to the rest. No guarantee of a good review, though.

For Educators

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