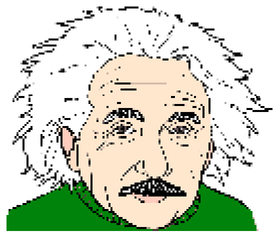


The Philosophy of Inquiry

Logical Argument

Logic is the study of arguments. It is used to analyze an argument or a piece of reasoning, and work out whether it is correct (valid) or not (invalid).

An argument is a conclusion with supporting statements (called premises). Logical arguments are constructed according to certain rules so as to minimize error.

The premises and conclusions of an argument are always statements or propositions (meanings or thoughts expressed by declarative sentences) as opposed to nonstatements (questions, commands, or exclamations).

Statements are either true or false. Nonstatements are neither true nor false. Non statements are never premises or conclusions.

Conclusions may be asserted (said to be true) or denied (said to be false). A conclusion is said to be affirmed when it has been asserted based upon some argument.

> The word “argument” is colloquially used to mean a disagreement, usually an unpleasant one. These equivocal meanings frequently lead to confusion.
>
> What may be a “good” argument in the formal sense is often a “bad” one in the colloquial sense.
>
> For instance, a desirable outcome in a disagreement within a family is usually NOT establishing that one individual is right and another wrong. Rather, the desirable outcome involves two components:
>
> - the parties in the disagreement come to understand each other’s desires, feelings, circumstances, etc.
> - the parties in the disagreement negotiate some mutually satisfactory accommodation.
>
> We need to distinguish between logical argument and what might be called personal argument. They are two distinctly different processes.
>
> - Logical argument has the purpose of providing support for statements.
> - Personal argument has the purpose of changing the nature of interpersonal relationships.
>
> The use of one type of argument during the other may not always be helpful.

Logical Argument: Inductive and Deductive Argument

There are two broad categories of argument:

- **Deductive Arguments** are arguments where the conclusion follows with **necessity** from the premises. A deductive argument is either valid (true) or invalid (false). If the supporting statements are true, the conclusion must be true.

  Example
  All students in this class are fine people.
  Jamal is in this class.
  Therefore
  Jamal is a fine person.

- **Inductive Argument** involves observation of a particular sample to derive general conclusions. Arguments in which the conclusion is derivable from the premises only with **probability** are called inductive arguments. If the supporting statements are true, the conclusion is probably true. Inductive arguments are not valid or invalid, but we can talk about whether they are better or worse than other arguments. We can also discuss how likely their premises are.

  Example
  These students are a random sample of members of that class.
  All these students are fine people.
  Therefore
  All students in that class are fine people.

  All inductive reasoning depends on the similarity of the sample and the population. The more the similarity between the sample and the population, the more dependable will be the inductive inference. However, if the sample is biased so as to be different from the population, then the inductive inference will be undependable.

  No inductive inference is completely accurate. Still, a good inductive inference provides a reason to believe that the conclusion is probably true.

Formal Deductive Argument

Look at the following two arguments:

All humans have hearts.
All lawyers are human.
Therefore
All lawyers have hearts.

All mammals are animals.
All cats are mammals.
Therefore
All cats are animals.

Each of these arguments is concerned about different things:

- The argument on the left has as its content Lawyers, Humans, and Hearts;
- The argument on the right has as its content Cats, Mammals, and Animals.

However, these two arguments have the same form (pattern, structure).

The pattern is

All B are C.
All A are B.
Therefore
All A are C.

This is one of many patterns (known as argument schemata) used in deductive argument. It was identified over 2,000 years ago and is referred to by logicians as *Barbara*.

A classical syllogism consists of three *statements* (two *premises* and a *conclusion*) and three *class terms* (the *major*, *minor* and *middle* terms). The minor and major terms must both be in the conclusion; the middle term must appear in each of the premises; and the major and minor terms must appear once in the premises.

In the lawyer example, the major term is “heart," the minor term is lawyer, and the middle term is “human.”

Syllogisms

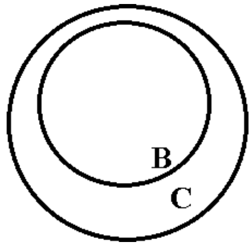
Venn diagrams allow one to make a quick test for the validity of a syllogism.

For example, we can diagram one of the Barbara arguments:

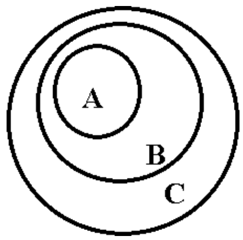
All mammals are animals.
All cats are mammals.
Therefore
All cats are animals.

We will use the letter A to represent the class term cats, B to represent mammals, and C to represent animals.

The first premise tells us that the set of mammals is totally contained in the set of animals, so we need to put a circle labeled B totally inside a circle labeled C.



The second premise tells us that the set of cats is totally contained in the set of mammals, so we put a circle labeled A totally inside the circle labeled B.



This demonstrates the conclusion that "All A are contained in C" or "All cats are animals."

The Chain Pattern of Deduction

The chain pattern of deduction involves using the conclusion of one argument as a premise for another.

Premise 1:	All B are C	All depression derives from superego attacks.
Premise 2:	All A are B	All suicide attempts result from depression.
Conclusion 1:	*All A are C*	*All suicide attempts derive from superego attacks.*
Premise 3:	No D are C	Pre-latency children do not experience superego attacks
Conclusion 2 :	*No D are A*	*Pre-latency children do not attempt suicide.*

Logical Operators

A logical operator joins two statements to form a new, more complex, statement.

The following are the logical operators:

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

Conditional

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

If P then Q

Example: “If I’m late, then I’m in trouble” makes the statement “I’m in trouble” conditional upon whether “I’m late.”

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

Biconditional

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

P if and only if Q

Example: “I eat pie if and only if I bake it” means that “I eat pie” is conditional upon “I bake pie” AND “I bake pie” is conditional upon “I eat pie.” In other words, I only bake pie if I’m going to eat it and I only eat pie if I have baked it.

The proposition *P if and only if Q* is true when both P and Q are true, or when both P and Q are false. It is false only when one of them is true and the other false.

Negation

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

Not P

Example: “I do not like squash” is the negation of “I like squash.”

The proposition *Not P* is true when P is false. It is false only when P is true. The truth or falsity of Q (or any other proposition) is irrelevant.

Conjunction

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

P and Q

Example: "I am late and you are late" is a combination that means both of us are late.

The proposition *P and Q* is true only when both P and Q are true. Otherwise, it is false.

Disjunction

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

P or Q

Example: "I am late or you are late" is a combination that means that one or both of us are late.

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

Non-syllogistic Arguments

There are formal deductive arguments that do not follow the syllogistic form (although two of them are called syllogisms). Four frequently appearing forms are as follows:

- Disjunctive Syllogism
- Hypothetical Syllogism
- Modus Ponendo Ponens
- Modus Tollendo Tollens

Disjunctive Syllogism

Uses the Disjunction Logical Operator (**or**) in its first premise and the Negation Operator (**not**) in its second premise. Its form is as follows:

• Either A or B	Either these injuries were accidental or inflicted.
• Not A	They were not accidental.
Therefore	*Therefore*
• B	They were inflicted

In the case where the first premise is not true (i.e., the first premise does not cover all possibilities), the informal fallacy of the *False Dilemma* occurs.

Hypothetical Syllogism

The Hypothetical Syllogism uses the Conditional Logical Operator (**if. . . then**) in its premises and conclusions. It has the following form:

If A, then B	If the factory closes, then more people will be unemployed.
If B, then C	If more people are unemployed, then more children will be maltreated.
Therefore	*Therefore*
If A, then C	If the factory closes, then more children will be maltreated.

Modus Ponendo Ponens

Modus Ponendo Ponens (the mood that affirms by affirming) uses the Conditional Logical Operator (**if. . . then**) in its first premise.

If A, then B	If Shel drinks four beers in an hour, Shel will be intoxicated.
A	Shel drank four beers in the past hour.
Therefore	*Therefore*
B	Shel is intoxicated.

Modus Tollendo Tollens

Modus Tollendo Tollens (the mood that denies by denying) uses the Conditional Logical Operator (**if. . . then**) in its first premise and the Negation Operator (**not**) in its second premise. Its form is as follows:

If A, then B	If Elwood is a good dad, he will go to the parent-teacher meeting.
Not B	Elwood did not go to the parent-teacher meeting.
Therefore	*Therefore*
Not A	Elwood is not a good dad.

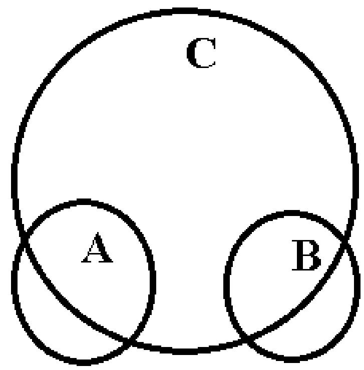
Fallacies

A **valid** argument is said to have **no formal mistakes** (it has the correct form). The demonstration of the validity of an argument if it gives only true conclusions from true premises.

An **invalid** argument contains **formal mistakes** (it is incorrect form). An invalid argument allows for a false conclusion from true premises.

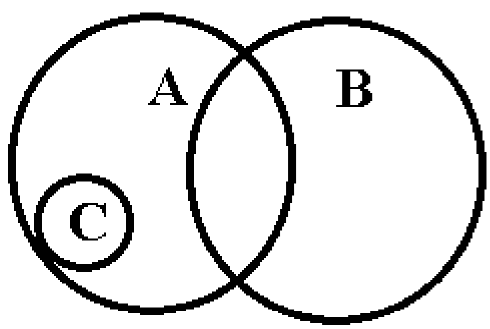
Here are two arguments, their formats, and their diagrams.

• Most major child neglect involves drug abuse.	Most A involves C
• Most major sexual abuse involves drug abuse.	Most B involves C
Therefore	*Therefore*
• Most major child neglect involves sexual abuse.	Most A involves B



It is possible for most neglect situations to involve drug abuse (A overlap C) and most sexual abuse situations to involve drug abuse (B overlap C) without there being any association between neglect (A) and sexual abuse (B)

• Some exhibitionists are rapists.	Some A are B
• All patients on this unit are exhibitionists.	All C are A
Therefore	*Therefore*
• Some patients on this unit are rapists.	Some A are C



It is possible for some exhibitionists to be rapists (A overlap B) and all patients to be exhibitionists (C contained in A) without any patients (C) being rapists (B).

A **sound argument** is patterned after a **valid form** and has only **true premises**.

An argument can be unsound for three different reasons.

- It may be patterned after an invalid form or involve misapplication of a valid form
- It may contain a false premise
- It may be irrelevant or circular.

Arguments patterned after an invalid schema are called **Formal Fallacies**.

The other two types of errors are called **Informal Fallacies.**

To reiterate, we can classify arguments as follows:

- **Sound Arguments** valid form with true premises
- **Unsound Arguments**
  - **Formally Fallacious** invalid form, misapplication of valid form
  - **Informally Fallacious** valid form with false premises, irrelevant, circular

Formal Fallacies

Some commonly occurring formal fallacies (invalid or misapplied valid arguments) include:

- Denying the Antecedent
- Affirming the Consequent
- Composition
- Division

Denying the Antecedent. This fallacy takes the form of:

- If A, then B — If Moni is a registered voter, then she is over 18.
- Not A — Moni is not a registered voter.
- Therefore — Therefore
- Not B — Moni is not over 18

The first premise is a complex conditional statement made up of an antecedent ("Moni is a registered voter") and a consequent ("She is over 18").

The second premise negates (denies) the antecedent ("Moni is not a registered voter").

The conclusion does not follow. Moni could be over 18, but never registered to vote.

This argument can be falsified by pointing out the counterexample (i.e., not all persons over 18 are registered voters.)

Affirming the Consequent. This fallacy takes the form of:

- If A, then B — If Rush is on the radio, a liar is on the radio.
- B — A liar is on the radio.

Therefore — Therefore

- A — Rush is on the radio.

The first premise is a complex conditional statement made up of an antecedent ("Rush is on the radio") and a consequent ("A liar is on the radio").

The second premise restates (affirms) the consequent ("A liar is on the radio").

The conclusion does not follow. Another liar could be on the radio.

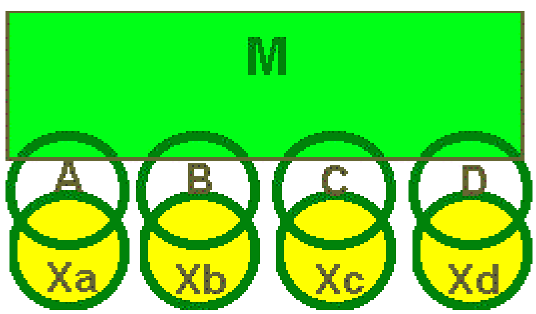
As previously, one may combat this argument through counter example (i.e., listing some other liars on the radio).

Composition. This fallacy takes the form of:

• A is part of M	Brent, the social worker, is a member of the multidisciplinary team
• B is part of M	Bonamy, the attorney, is a member of the multidisciplinary team
• C is part of M	Barbara, the pediatrician, is a member of the multidisciplinary team
• D is part of M	Boris, the child psychologist, is a member of the multidisciplinary team
• A, B, C, and D each have quality X	Brent, Bonamy, Barbara, and Boris each do their respective jobs well.
• *Therefore*	*Therefore*
• M has quality X	The multidisciplinary team does its job well.

This fallacy is committed when it is argued that a property which is present or absent in every part must be present in the whole. However, this is not necessarily the case. In the example, each individual may be very good at his or her own job, but be unable to work with the others

The argument also involves a semantic fallacy in that the jobs that each team member is good at are not the same job! Similarly, the job of the multidisciplinary team is different from each member's job and is not just the sum total of each member's job. If we had replaced the premise "Brent, Bonamy, Barbara, and Boris are good at their respective jobs" with "Brent performs well as a social worker; Bonamy performs well as an attorney; etc.", the fallacy might have been more apparent. This situation is diagrammed as follows.



Each A has a quality Xa; each B has a quality Xb; each C has a quality Xc; and each D has a quality Xd. However, Xa, Xb, Xc, or Xd do not have to relate to the aspect of A, B, C, or D that has to do with M.

This argument is contradicted by collecting evidence as to the truth or falsity of the conclusion. Using the multidisciplinary team example, one might point out that the members had been unable to reach a conclusion on a single referral due to a continuing intra-team power struggle.

Division. This is sort of the inverse of the fallacy of composition,

• M has quality X	The Burns-Allen couple are fun to have around).
• A is part of M	George is part of the Burns-Allen couple.
• B is part of M	Gracie is part of the Burns-Allen couple
Therefore	Therefore
• A and B each have quality X	George is fun to have around; Gracie is fun to have around.

This fallacy is committed when it is argued that a property which is present or absent in the whole must be present in all parts. As with composition, this is not necessarily the case. George may talk too much if he is alone and Gracie may be too bossy if she is alone. However, together, Gracie restrains George's loquacity and gives Gracie an object for her bossiness so that they constitute a delightful couple.

As with the fallacy of composition, this argument is contradicted by collecting evidence as to the truth or falsity of the conclusion.

Informal Fallacies

Informal Fallacies are unsound argument forms that may all be committed without making any formal errors. Hence, they are informal fallacies. They may be organized into five broad categories

- ***Appeal to Authority*** - These arguments take advantage of the fact that most of us are taught to respect authority. They all involve appeals to modesty in the face of some alleged authority.
- ***Irrelevant Appeals*** - This group of fallacies occurs when the conclusion that is supposedly established by a set of premises is irrelevant to the point at issue.
- ***Confusion*** - This set of fallacies involves presenting an argument in such a confused or ambiguous fashion that it is not clear what it means or what it is supposed to prove.
- ***Faulty Classification*** - This set of fallacies all involve errors associated with the formation of classes, sets, groups, or other aggregations.
- ***Begging the Question*** - This set of informal fallacies all involve assuming the truth of a question rather than proving it.

Appeals to Authority (Pseudoauthority)

The traditional Latin name for this class of fallacies is *argumentum ad verecundam*. This literally means “argument to modesty.” They take advantage of the fact that most of us are taught very early in life to yield to authority. Some common examples of the fallacy of Pseudoauthority include:

Irrelevant Authority. When a reputable authority in one area is presented as an authority in an entirely different area where he or she has no special expertise.

For example:

> Nobel Prize winner William Shockley has said that intelligence is an hereditary characteristic. Therefore, it has been argued that any racial differences in performance on intelligence tests must be due to genetic deficiencies.

The problem with this argument is that expertise in one area (semiconductor research) does not imply expertise in another (assessment of cognitive functioning, genetics). In the case of Shockley, his opinion on the nature of "intelligence" carries no more weight than any other non-expert's opinion.

Aphorism. When one uses some aphorism, cliché, maxim or proverb in the absence of a legitimate argument. This is basically a way of avoiding seeking actual evidence in favor of a prejudice "supported" by an aphorism that may not always be true.

For example, I may oppose setting up a committee to seek community input by saying "An elephant is a mouse designed by a committee." I imply that a committee would be inefficient without providing any evidence that such is the case. This is best refuted by evidence to the contrary. In this case, you could point out that one of the masterpieces of English literature was created by a committee - the King James translation of the Bible.

Apriorism. An *a priori* fallacy occurs when it is argued prior to any investigation that certain events must or must not occur according to some theory or point of view.

For example:

> Psychoanalytic theorists argued that clinical depression was not possible for pre-adolescent children. This was because psychoanalytic theory required that clinical depression result from a failure in correspondence between the real self and the ideal self. Since a stable self-representation was not supposed to develop until adolescence, children could not demonstrate the full clinical syndrome of depression.

A statement does not have to be true simply because a theory says it is. In fact, pre-adolescent children have been found to experience the full clinical syndrome of depression.

Irrelevant Appeals

This class of fallacies was identified over two thousand years ago by Aristotle. The traditional name for then is *ignoratio elenchi* (literally, “ignorant refutations”). These fallacies all involve the use of premises that are irrelevant to the conclusion. The following are a small sample of irrelevant appeals:

Appeal to Pity. The Appeal to Pity (*argumentum ad misericordium*) is committed when one tries to persuade someone to a point of view by arousing feelings of pity.

For example:

"If I get a C in this course, I'll be thrown out of the program." The implied conclusion is that I should be given a grade higher than C.

Before we go further, I'd like to note that an appeal to pity is not always irrelevant. However, the burden rests upon the individual making the argument to demonstrate relevance. Specifically, he or she must show why compassion is the appropriate criterion for making the particular decision

In this instance, the burden was not met. The issue was not the bad consequences to the student, but the fact that the student engaged in the behavior that brought on those consequences and is now trying to evade responsibility for his or her own acts.

Further, compassion is a two-edged sword. If we ought to have compassion for the student, we similarly ought to have compassion for his or her future clients who would be receiving services from an inadequately trained social worker

Appeal to Ignorance. (*argumentum ad ignorantiam* - This is an argument that illegitimately attempts to shift the burden of proof from the person making the argument to the person hearing the argument. Basically, it is argued that the absence of evidence against a point of view must be counted as evidence for it

Elwood said,	"All homosexuals were originally recruited by child molesters."
Jake asked,	"Really? I find that very hard to believe.”
Elwood replied,	"Can you prove that I'm wrong?"

Elwood is attempting to place Jake on the defensive. The appeal to ignorance is, in fact, a form of intimidation. Elwood is trying to force Jake to the conclusion that a same sex orientation is the result of child molestation simply because Jake cannot immediately disprove the assertion.

However, in logical argument, the burden of proof is on the individual making the assertion, not the listener.

Abusing the Person. (*argumentum ad hominem*)- This fallacy involves shifting the attention from the issue and onto the person who is making the argument.

These personal attacks come in many forms. Abuse is the simplest. Others include *bad se*ed (the descendants of a "bad" person are not to be trusted), *bad connections* (people who associate with "bad" people are not to be trusted), *genetic fallacy* (if a person's motives for supporting a position are "improper", then the position is a bad one) and *poisoning the well* (making an accusation where replying to the accusation serves to create an illusion that the accusation is true).

Here are two examples:

- "You talk too much."
  This is poisoning the well. If you argue that you do not talk too much, you are talking and have proven the point. If you hold silent, you have conceded the point that you talk too much.
- "The reason why you disagree with your boss is that she is a woman and your arguments with her are derived from your turbulent relationship with your mother.
  This is the genetic fallacy. The speaker attempts to prove the argument false by attacking its source – its genesis. The intrusion of psychoanalytic formulations into popular culture has tended to make the genetic fallacy popular. While it may be true that a person's motives can weaken the ***person's*** *credibility, they are still irrelevant to the credibility of the* ***argument****. Whether or not you get along with your mom, the boss can still be wrong.*

Appeals to Confusion

This set of fallacies involves presenting an argument in such a confused or ambiguous fashion that it is not clear what the argument means or what it is supposed to prove. Some frequently occurring appeals to confusion are:

Equivocation. This fallacy occurs when the double meaning of a term is played upon in a misleading fashion. The perpetrator of this fallacy shifts the meaning of a key word over the course of an argument.

For example, " The editors of this newspaper have a duty to publish such news as it is in the public interest to have published. There can be no doubt about the public interest in the identity of the woman who alleged that she was sexually assaulted at the estate of a wealthy oil executive. Therefore, the editors of this paper would have failed in their duty if they had refrained from publishing the woman's name."

The twist here is in the meaning of the term "public interest." "Public interest" means "public welfare" in the first sentence, while it means "what many people are interested in" in the second sentence.

Exceptions To The Rule. This fallacy is based upon the aphorism "The exception proves the rule." It is committed when an individual claims that some rule or generalization has been established because of the existence of an exception or exceptions. The aphorism is fatuous. An exception does **not** prove a rule. It **disproves** a rule.

For example,

Elwood: "Republicans are all narrow-minded, hardhearted jerks."
Edith Anne: "My brother-in-law is a Republican and he is generous and broad-minded."
Elwood: "Well, he's the exception that proves the rule."

No, he is the exception that **disproves** the rule. **All** Republicans are **not** narrow-minded, hardhearted jerks. Of course, whether **most** Republicans are narrow-minded, hardhearted jerks is still open for discussion.

Answering Questions With Questions. When a legitimate question is answered with another question, the fallacy of confusing by answering a question with a question has been committed.

For example,

Michael: "What data supports the notion that your program is actually helping clients?"

George: " What makes you think that everything can be reduced to grids and graphs? Don't you recognize that our clients are unique human beings with unique problems?"

The fallacy of answering a question with a question is similar to shifting the burden of proof by Appeal to Ignorance. However, while the Appeal to Ignorance involves answering the question "What evidence is there for your position?" with "What evidence is there against it?", answering questions with questions involves a refusal to address the question at all and an attempt to shift the discussion away from the issue raised by the question.

Often this means that the individual has some very good reasons for not wanting to answer the question.

Faulty Classification

This set of fallacies all involve errors associated with the formation of classes, sets, groups, or other aggregations. In most cases they involve looking at irrelevant similarities or differences and developing conclusions from them. All of these fallacies, to some degree, involve oversimplification.

Some treatments of fallacies include Composition and Division in this category. They are appropriately placed here, but also can be placed in category of formal fallacies which is what I have done.

Continuum. This fallacy is committed when it is argued that, because of a continuum of differences between two extremes, there is no "real" difference.

For example:

Since there is no abrupt and obvious boundary between appropriate and abusive child discipline behaviors, one might argue that there are no "real" differences between the extremes of appropriate and abusive discipline.

This fallacy relies upon attending to one characteristic while ignoring the importance of the magnitude of the characteristic. One may refute such arguments by pointing out the obvious differences in the extremes (e.g., there is a difference between a child who is beaten to death and a child who receives one swat on the bottom for running out in the street). One ought also to concede that there is a "gray area". If we do not, we run the risk of committing a *False Dilemma* fallacy (discussed at the bottom of this page).

Golden Mean. This fallacy is committed when it is argued that the mean or middle view between two extremes must be right simply because it is the mean or middle view. This plays upon a cultural bias that tends to view "extremism" as being somehow dangerous.

Of course, it is sometimes appropriate to choose the middle ground. It is more conducive to survival to eat moderately than to starve on the one hand or gorge oneself on the other. However, this is not because there is some inherent virtue associated with the middle. Whether the middle is appropriate depends upon the circumstances. Obviously the middle position is not appropriate when we drive an automobile or we would drive down the middle of the street rather than drive down the right side to avoid extremism.

Here's another example:

Moe: Gays and Lesbians are dangerous and should not be permitted to work in occupations that bring them in contact with children.

Larry: Gays and Lesbians are no more dangerous than straight folks. Our sexual orientation should be no bar to working with children.

Curly: Let's not be extremist about this. The middle way is the best way. Here is what we will do. Gays and Lesbians will be able to work with children under close supervision. We'll let parents know which staff are gay or Lesbian so that they may choose whether to have their children be in their classes.

The "middle position" is still extremely problematic. Since there is no evidence of danger to children being associated with sexual orientation of teachers, the middle position still involves unnecessary and oppressive invasion of privacy.

False Dilemma. The False Dilemma fallacy is committed when it is argued that only one of a restricted number of arguments is true where they do not represent all legitimate arguments and/or the arguments are not mutually exclusive. The argument may be presented as a disjunctive syllogism:

> “Moni is depressed. There are basically two choices: She can undergo long-term psychotherapy or she can commit suicide. I think we can agree that psychotherapy is the preferred alternative.”

In the first place, most instances of depression are not associated with suicide attempts, so the disjunction (long-term osychotherapy or suicide) is not true. In the second, long-term psychotherapy is not the only appropriate response to a depression problem. There are other alternatives, many of which are superior to long-term psychotherapy.

Begging the Question

This set of informal fallacies involves assuming the truth of a question rather than proving it. The traditional name is *petitio principii* .

Alleged Certainty. This fallacy occurs when a claim in question is qualified by a phrase (e.g., "everybody knows") that tends to persuade without proving that the claim is beyond doubt.

For example:

> "Everybody knows that if you simply treat the symptom without treating the underlying disorder of psychic structure, you will just get symptom substitution."

Still, even if "everybody knows", it does not follow that what "everybody knows" is true. In fact, Freud reported symptom substitution only in cases of hypnotherapy. The evidence from the empirical clinical practice literature is that symptom substitution is a comparatively rare phenomenon.

This fallacy is also the basis for much bigoted belief. It is best dealt with by examining and presenting the evidence. Probably the best response to "everybody knows…" and "You have to admit that…" are statements like "I don't know any such thing" and "I have to admit nothing of the kind." They focus attention on the evidence or lack thereof for the statement.

Question Begging Definitions. When one uses question-begging definitions, terms of a presumably factual, but questionable assertion are defined in such a way that the assertion cannot fail to be true.

For Example:

Phyllis:	All Christians believe that abortion is murder.
Philippa:	I am a Christian and I don't believe that abortion is murder. In fact, I believe it is wrong to force a woman to carry an unwanted fetus.
Phyllis:	You are not a Christian because all *real* Christians believe that abortion is murder.

Phyllis has defined "real" Christianity such that opposition to abortion is a defining feature of "Christianity." However, Phyllis has not supported the statement that "real" Christians (as contrasted with "unreal" Christians) oppose abortions beyond saying it is so. Since this is the conclusion to be proven, the argument has failed

Circular Reasoning. This fallacy involves using the conclusion you are trying to reach as a premise or presupposing the conclusion in a premise.

For example:

> " Unless we have an internal representation of a loved one (an object), then we cannot love that person. But, we do love. Therefore, these internal representations (objects) exist."

The first sentence of this argument contains an unproven assertion which is also the conclusion. Namely, it asserts that an internal representation of an individual is a prerequisite to loving that individual. However, the question at issue is whether such representations exist. The argument starts with the assumption that they do exist and proceeds on this basis to prove that they exist. Thus, we call them circular arguments.

Inductive Argument

Inductive arguments may be thought of as falling into two categories. The first category involves those arguments that are based in the assumption that the universe is consistent. This is, of course, one of the central assumptions of the Scientific Method.

Inductive arguments that do not assume consistency have premises that use statistical reasons to support conclusions.

We shall call arguments that assume that the universe has some consistency *consistency arguments* and those that do not require this assumption *statistical arguments*.

To make the distinction between statistical and consistency arguments clearer, let us examine some examples of each.

Here is a *consistency* argument.

None of the 100 social workers we investigated has behaved unethically.
Therefore,
If we investigate another social worker, he or she will not have behaved unethically.

This argument is a form of induction by enumeration. Even though the first premise involves the collection of statistics, the argument is not a statistical argument. The reason is that the conclusion refers to an individual who was not one of the group of social workers in the premise. Thus, we must assume that the incidence of unethical behavior in the social workers not investigated is consistent with the incidence in the group surveyed. In other words, we must assume that the universe is a consistent place to be able to reach our conclusion. This places simple induction within the category of *consistency* arguments.

Here is a *statistical* argument.

Very few social workers in Ingham County behave unethically.
Jake is a social worker in Ingham County.
Therefore,
Jake does not behave unethically.

This is a statistical syllogism. The conclusion refers to an individual who is a member of the group discussed in the first premise. We do not need to make any additional assumptions (such as consistency) to conclude that it is unlikely that Jake behaves unethically.

We shall look at four types of inductive argument:

Statistical Syllogism

Statistical Generalization

Induction by Enumeration

Induction by Analogy

Statistical Syllogisms

The *statistical syllogism* involves making an inference about a member of a group using statistics about the group of individuals. For example, here is a *statistical syllogism* that belongs to the category of *statistical* inductive arguments.

99.44% of social workers employed by the state complain about filling out forms.
Elwood is a social worker employed by the state.
Therefore,
Elwood complains about filling out forms.

On statistical grounds, the conclusion is likely given the premises. In fact, we can accurately give the inductive probability as 99.44% without any recourse to an assumption of consistency.

The standard format for the *statistical syllogism* is -

p of A is B.
x is A.
Therefore,
x is B.

where p is a proportion and x is an element of A. The *statistical syllogism* usually takes the preceding form only when $p > 0.5$. When $p < 0.5$ it takes the following form -

p of A is B.
x is A.
Therefore,
x is not B.

When $p = 1$, an inductive syllogism becomes deductive.

All of A is B.
x is A.
Therefore,
x is B.

The premises in a *statistical syllogism* do not need to be numerically precise.

Most social workers employed by the state do not have an M.S.W.
Jake is a social worker employed by the state.
Therefore,
Jake does not have an M.S.W.

Since we are not making inferences about individuals outside the group in the first premise, this is also a statistical inductive argument. While we do not know the exact inductive probability, we know that it is greater than 0.5 and less than 1.0.

Statistical Generalization

Statistical generalization is a process distinct from the use of *statistical syllogism*. A *statistical syllogism* involves an inference from statistics about a group of individuals to a member of the group. *Statistical generalization* involves randomly selecting a sample of individuals from a larger group, collecting statistics on this smaller sample, and using these statistics to make inferences about the larger group.

Even though conclusions are being drawn about entities not included in the group being observed, this is still statistical induction. The reason is contained in the procedure for choosing the group to be observed. Since we are using a random sample, we can determine the inductive probability of our conclusion using mathematical procedures. We do not have to assume any natural consistency. Therefore, *statistical generalization* is a form of *statistical* rather than *consistency* induction.

Here is a *statistical generalization* with a fairly high inductive probability.

> About 26% of 1,000 social workers randomly selected from Michigan social service agencies are male.
> **Therefore**,
> Between 23% and 29% of social workers in Michigan social service agencies are male.

There are mathematical procedures for computing the inductive probability if a random sample has been used. In this instance, the inductive probability is about 95%.

Here is the general form of *statistical generalization* -

> p of n randomly selected A is B.
> **Therefore**,
> About p of all A is B.

The number n is the size of the sample. A is the group (population) from which the sample was drawn. p is the proportion of the sample that had characteristic B.

The validity of inferences made by *statistical generalization* is necessarily dependent upon the use of random sampling techniques. The effect of type of sample on conclusion validity will be extensively discussed in subsequent units of this course.

If the sample is random, two characteristics will affect inductive probability: the sample size (n) and the precision of the conclusion.

If we increase n, this strengthens the argument's premise in a relevant way which increases the argument's inductive probability.

If we weaken the conclusion, we will increase the argument's inductive probability. Notice that the conclusion in the example was "Between 23% and 29% of social workers in Michigan social service agencies are male". This is a weaker conclusion than "Exactly 26% of social workers in Michigan social service agencies are male".

It is very unlikely that a random sample would contain exactly the same proportion of Bs (males) as the population from which it was drawn. So, if we want our argument to have higher inductive probability, we must allow a margin of error in our conclusion. This is what the range of 23% to 29% signified. In mathematical statistics, this is called a confidence interval.

Induction by Enumeration

Another name for this category of induction is *inductive generalization*. An example of this type of argument is

> About 76% of the 54 clients who completed our program last year did so successfully.
> **Therefore**,
> About 76% of the clients who complete our program will do so successfully.

The form of this argument is

> p of n observed A are B.
> **Therefore**,
> About p of all A are B.

The number n is the number of elements of A that have been observed. p is the proportion of n that had characteristic B. In the example, p is 75%, n is 54, A is clients observed, and B is "successfully completed our program".

Induction by enumeration differs from *statistical generalization* in that it does not use a random sample in its premise. Since this is the case, *induction by enumeration* is a *consistency* argument. It depends upon the unstated assumption that the universe will be consistent with what has already been observed. In the case of the example, the assumption is that the overall successful completion rate will be the same as the rate for last year.

All else being equal, *induction by enumeration* arguments will have a lower inductive probability than *statistical generalization* arguments. The *induction by enumeration* arguments have the additional liability of not permitting the computation of an exact probability (which we can do for *statistical generalization*).

Some authorities argue that we can increase the inductive probability of *induction by enumeration* through increasing the number of observations. This will be the case if there is no systematic bias in our observations. However, if there is bias, we may give the *appearance* of higher inductive probability to an argument that has a false conclusion.

For example, consider this argument -

> 78% of 50 Michiganians surveyed said they supported school vouchers.
> **Therefore**,
> About 78% of all of all Michiganians say they support school vouchers.

Now, consider this argument -

78% of 500 Michiganians surveyed said they supported school vouchers.
Therefore,
About 78% of all of all Michiganians say they support school vouchers.

The second argument appears to have a higher probability than the first since it is based upon a larger sample. However, it may be less true than the first if the 500 individuals were all attendees at a conference for private and parochial school administrators. So, more observations does not necessarily imply greater accuracy.

Another form of the *enumeration* argument is

All of n observed A are B.
Therefore,
All A are B.

This is the way that scientific laws are justified. Such laws fall into the category of contingent knowledge and require only one instance where an A is not B to invalidate them.

Another form of *induction by enumeration* is sometimes called *simple induction*:

p of n observed A are B.
Therefore,
If we observe one more A, it will be a B.

99% of 100 teenagers observed at the fine arts magnet school wear black.
Therefore,
If we observe one more teenager at the fine arts magnet school, he or she will be wearing black.

However, if we strengthen the conclusion statement (as in the following argument), the inductive probability of the argument becomes lower:

99% of 100 teenagers observed at the fine arts magnet school wear black.
Therefore,
99% of teenagers at the fine arts magnet school wear black.

Induction by Analogy

An example of this type of argument is

Pamina is a yoga instructor, a member of People for the Ethical Treatment of Animals, and a member of the Hogtown Granary Food Co-op.
Papagena is a yoga instructor, a member of People for the Ethical Treatment of Animals, and a member of the Hogtown Granary Food Co-op.
Papagena is a vegetarian.
Therefore,
Pamina is a vegetarian.

In such an argument we observe that entity x has many characteristics C_1, C_2, C_3, . . C_n in common with entity y. We further observe that y has characteristic D. Since x and y are analogous in so many other ways, we conclude that x has characteristic D as well. The form of this argument is

C_1x & C_2x & C_3x.
C_1y & C_2y & C_3y.
Dy.
Therefore,
Dx.

Where

C_1 = yoga instructor,
C_2 = member of People for the Ethical Treatment of Animals,
C_3 = member of the Hogtown Granary Food Co-op,
x = Pamina,
y = Papagena, and
D = vegetarian.

Since there is no statistical basis produced to connect the similarities in characteristics, the *induction by analogy argument* depends upon an assumption of consistency.

The inductive probability of *analogy* arguments depends upon the relevance of properties C_1, C_2, C_3 to property D. For the example argument, the properties are probably related to each other, so the inductive probability is fairly high.

However, consider this argument:

Papagena listens to National Public Radio, likes Vernor's ginger ale, and watches hockey.
Papageno listens to National Public Radio, likes Vernor's ginger ale, and watches hockey.
Papageno likes mystery novels.
Therefore,
Papagena likes mystery novels.

This is a little more concerning. It is not clear that listening to NPR, liking Vernor's, and watching hockey are relevant either separately or together to liking mystery novels. The premises of an argument must (among other things) be relevant to the conclusion if the conclusion is to be supported. Lack of demonstrated relevance will result in an argument with low inductive probability.

Induction by analogy collapses when two similar objects are different in a way that affects whether they both share the property under consideration. This leads to an inductive fallacy (discussed later) called *Questionable Analogy*. It might also be thought of as a form of the *Exclusion* fallacy in cases where information about the difference is available, but withheld.

Inductive Fallacies

All inductive reasoning depends upon one of two assumptions:

- *Consistency*: meaning that there is a consistency inherent in the situation under discussion that permits generalization from observed events to unobserved events.
- *Statistical Validity*: meaning that the samples discussed in the premises have been randomly drawn thus allowing for exact evaluation of the inductive probability of the argument.

One or the other of these assumptions are necessary for the development of an argument with high inductive probability. As with deductive arguments, the argument must also be in valid form, and the premises must be true and relevant to the conclusion.

Some common inductive fallacies include:

Fallacy of Exclusion

Questionable Analogy

Hasty Generalization

Unrepresentative Sample

Inductive inferences are probabilistic and, hence, not perfect. This means that even a well supported inductive inference may occasionally be false. Even when the premises are true, the conclusion might be false. This is one of the reasons why we tend to discuss the probability of inductive arguments rather than their validity.

Exclusion

This fallacy was mentioned when we discussed *induction by enumeration*. This was where the conclusion was that about 78% of all of all Michiganians say they support school vouchers. This was based upon a survey of 500 Michiganians. The information that was excluded was that the 500 individuals were all attendees at a conference for private and parochial school.

This fallacy occurs when information that would affect a conclusion is left out of the argument. The fallacious argument appears sound unless one knows that the information has been excluded.

Here is another example:

> Tim will probably receive an A in this course because he has received A's in every course he has taken so far.

This is a form of the *induction by enumeration* argument:

Tim has received A's in every course he has taken so far.
Therefore,
If he takes one more course, he will probably receive an A in that course.

All of n observed A are B.
Therefore,
If we observe one more A, it will be a B.

As it stands, this argument has pretty good inductive probability. The premise (Tim has received A's in every course he has taken so far.) is strong; the conclusion (If he takes one more course, he will probably receive an A in that course.) is fairly weak; and the premise is highly relevant to the conclusion.

The *exclusion* fallacy works by reducing the relevance of the premise to the conclusion, thereby reducing the inductive probability of the argument.

For example, let us imagine that some information has been excluded from this argument. Specifically, we have not been told that all the courses previously taken by Tim were "easy" courses, and the next course will be a "difficult" one. This excluded information would weaken the relevance of the premise to the conclusion and reduce the probability of the argument.

Tim has received A's in every "easy" course he has taken so far.
Therefore,
If he takes a "difficult" course, he will probably receive an A in that course.

This argument is falsified by producing the missing evidence and demonstrating that it changes the inductive probability of the argument. It is **not** sufficient just to assert that there *might* be excluded information. The information must be produced. Having done so, simply showing that some evidence was excluded is also insufficient. One must be show that the missing evidence affects the inductive probability of the argument.

Questionable Analogy

This fallacy involves a misuse of the *induction by analogy* argument. When we use analogical reasoning, we infer from an observed similarity of two objects on a set of observed properties that they are similar on another property that was not observed. However, this inference requires that the observed properties must be relevant to the unobserved property.

Here is the *questionable analogy* we looked at earlier.

Papagena listens to National Public Radio, likes Vernor's ginger ale, and watches hockey.
Papageno listens to National Public Radio, likes Vernor's ginger ale, and watches hockey.
Papageno likes mystery novels.
Therefore,
Papagena likes mystery novels.

It is not clear that the observed properties

- listening to NPR,
- liking Vernor's, and
- watching hockey

are relevant to liking mystery novels.

An analogy fails when two similar objects are different in a way that affects whether they both share the property under consideration.

Here is another example:

Government and business carry out many of the same tasks. So just as business must be sensitive primarily to the bottom line, government must do likewise.

This argument could be stated with greater specificity as follows:

Government receives money (taxes) from individuals and provides services.
Businesses receive money from individuals and provide services.
Businesses must be primarily sensitive to the bottom line (profit and cost).
Therefore,
Government must be primarily sensitive to the bottom line (profit and cost).

However, the objectives of government and business are different. The primary objective of a business is to show a profit. The primary objective of a government is to provide services to its citizens. Since the objectives are different, it is probable that they will not give the same weight to the bottom line.

(This example is derived from one found on Stephen Downes' on-line *Fallacy Page*.)

As mentioned previously, I believe that someone could make a good case that this is a special case of the *exclusion* fallacy applied to analogical reasoning. At any rate, this fallacy is uncovered by showing that the two objects under comparison are different in a way that will affect the conclusion of the argument.

Hasty Generalization

This fallacy involves misuse of the *statistical generalization* and *induction by enumeration* arguments. It is sometimes called the fallacy of *insufficient statistics*. This fallacy occurs when one reaches a conclusion before enough data have been collected to justify the conclusion. In other words, the sample size is too small to support the conclusion.

The following is a *statistical generalization* argument:

About 40% of 10 social workers randomly selected from Michigan social service agencies are male.
Therefore,
Between 30% and 50% social workers in Michigan social service agencies are male.

Compare this argument with the example given for *statistical generalization*.

There are some features of the new example that would appear to make it a more likely argument than the old one. The conclusion of the new argument (30% - 50%) is weaker than the conclusion of the old one (23% - 29%), which would raise the inductive probability of the new argument.

The sample proportion in the new argument (40%) is higher than the sample proportion in the old argument (26%), which would tend to strengthen the premise and raise the inductive probability of the argument.

However, the sample size in the new argument (10) is much, much lower than the sample size in the old argument (1000). This substantially weakens the premise in the new argument and lowers the inductive probability of the new argument. The old conclusion ("Between 23% and 29% of social workers in Michigan social service agencies are male.") had an inductive probability of about 95%. Because of the small sample size, we get an inductive probability of less than 50% for the conclusion of the new argument ("Between 30% and 50% of social workers in Michigan social service agencies are male.").

Here is an *induction by enumeration* example:

Two of the last three shoplifters referred were truant schoolchildren.
Fred was just referred for shoplifting.
It is very likely that Fred is a truant as well.

With a sample size of three, our inductive probability is going to be pretty low. It is not unreasonable for a sample this small to be atypical, especially when it is a non-random sample. This is the problem with anecdotal illustrations. They may be atypical.

This argument may be contradicted by noting that small samples are subject to large error when making inferences about population characteristics. This can be demonstrated mathematically by noting the effect of sample size on the standard error of the mean.

Unrepresentative Sample

This fallacy also involves misuse of the *statistical generalization* and *induction by enumeration* arguments. It is also called the fallacy of *biased statistics*. It occurs when one draws a conclusion based upon a sample that is known to be biased, or for which there is good reason to believe is biased. This essentially involves making inferences to a particular population from a sample drawn from a different population.

Here is the complete version of the *unrepresentative sample* fallacy we looked at earlier:

78% of 500 Michigan private and parochial school administrators surveyed said they supported school vouchers.
Therefore,
About 78% of all of all Michiganians say they support school vouchers.

The bias inherent in this argument is fairly obvious. The sample has been drawn from one Michigan subpopulation (private and parochial school administrators) to make inferences about the total population of Michigan. It is likely that the proportion of private and parochial school administrators favoring vouchers would be higher than the proportion found in the general population.

Another example of *biased statistics* was the notorious *Literary Digest* poll that predicted that Alf Landon would defeat Franklin D. Roosevelt in the 1936 presidential election. Roosevelt won by a landslide.

The sample for the survey was drawn from telephone directories and automobile registrations. During the Depression of the 1930s, many people did not have an automobile or a telephone. The sample was thus biased in favor of those better off individuals who had a telephone and/or automobile. These individuals were more likely to vote Republican than were less well off individuals.

This argument is falsified by showing how the sample is different from the population and demonstrating that it changes the probability of the conclusion. It is **NOT** sufficient simply to show that the sample is in some way different. One must be show that the difference is relevant.