# Logical Fallacies and its Applications

Sung Benson

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# Fallacies

In logic and rhetoric, a **fallacy** is incorrect reasoning in argumentation resulting in a misconception. By accident or design, fallacies may exploit emotional triggers in the listener or interlocutor (e.g. appeal to emotion), or take advantage of social relationships between people (e.g. argument from authority). Fallacious arguments are often structured using rhetorical patterns that obscure the logical argument, making fallacies more difficult to diagnose. Also, the components of the fallacy may be spread out over separate arguments.

# Fallacies

# 1. Accident (fallacy)

The logical fallacy of **accident** (also called **destroying the exception** or **a dicto simpliciter ad dictum secundum quid**) is a deductive fallacy occurring in statistical syllogisms (an argument based on a generalization) when an exception to a rule of thumb is ignored. It is one of the thirteen fallacies originally identified by Aristotle. The fallacy occurs when one attempts to apply a general rule to an irrelevant situation.

For instance:

1. Cutting people with a knife is a crime.
2. Surgeons cut people with knives.
3. Surgeons are criminals.

It is easy to construct fallacious arguments by applying general statements to specific incidents that are obviously exceptions.

Generalizations that are weak generally have more exceptions (the number of exceptions to the generalization need not be a minority of cases) and vice versa.

This fallacy may occur when we confuse generalizations ("some") for categorical statements ("always and everywhere"). It may be encouraged when no qualifying words like "some", "many", "rarely" etc. are used to mark the generalization.

For example:

Germans are Nazis

The premise above could be used in an argument concluding that all Germans or current Germans should be held responsible for the actions of the Nazis. Qualifying the first term:

Some Germans are Nazis

This premise may make it more obvious it is making an (extremely weak) generalization and not a categorical rule.

Related inductive fallacies include: overwhelming exception, hasty generalization.

The opposing kind of dicto simpliciter fallacy is the converse accident.

# 2. Converse accident

The logical fallacy of **converse accident** (also called **reverse accident**, **destroying the exception** or **a dicto secundum quid ad dictum simpliciter**) is a deductive fallacy that can occur in a statistical syllogism when an exception to a generalization is wrongly called for.

For example:

If we allow people with glaucoma to use medical marijuana, then everyone should be allowed to use marijuana.

The inductive version of this fallacy is called hasty generalization.

This fallacy is similar to the slippery slope, where the opposition claims that if a restricted action under debate is allowed, such as allowing people with glaucoma to use medical marijuana, then the action will by stages become acceptable in general, such as eventually everyone being allowed to use marijuana. The two arguments imply there is no difference between the exception and the rule, and in fact fallacious slippery slope arguments often use the converse accident to the contrary as the basis for the argument. However, a key difference between the two is the point and position being argued. The above argument using converse accident is an argument for full legal use of marijuana given that glaucoma patients use it. The argument based on the slippery slope argues against medicinal use of marijuana because it will lead to full use.

# 3. Ignoratio elenchi

**Ignoratio elenchi** (also known as **irrelevant conclusion** or **irrelevant thesis**) is the informal fallacy of presenting an argument that may in itself be valid, but does not address the issue in question. "Ignoratio elenchi" can be roughly translated by ignorance of refutation, that is, ignorance of what a refutation could logically be; "elenchi" (genitive singular of the Latin elenchus) is from the Greek ἔλεγχος, meaning an argument of disproof or refutation. This is one of the fallacies identified by Aristotle in his Organon, and in a broader sense he asserted that all fallacies are a form of ignoratio elenchi.

## Example

The film Thank You for Smoking provides an excellent example of this fallacy in action:

Nick Naylor: OK, let's say that you're defending chocolate, and I'm defending vanilla. Now if I were to say to you: 'Vanilla is the best flavour ice-cream', you'd say...

Joey Naylor: No, chocolate is.

Nick Naylor: Exactly, but you can't win that argument... so, I'll ask you: so you think chocolate is the end all and be all of ice-cream, do you?

Joey Naylor: It's the best ice-cream, I wouldn't order any other.

Nick Naylor: Oh! So it's all chocolate for you is it?

Joey Naylor: Yes, chocolate is all I need.

Nick Naylor: Well, I need more than chocolate, and for that matter I need more than vanilla. I believe that we need freedom. And choice when it comes to our ice-cream, and that Joey Naylor, that is the defintion of liberty.

Joey Naylor: But that's not what we're talking about

Nick Naylor: Ah! But that's what I'm talking about.

Joey Naylor: ...but you didn't prove that vanilla was the best...

Nick Naylor: I didn't have to. I proved that you're wrong, and if you're wrong I'm right.

Joey Naylor: But you still didn't convince me

Nick Naylor: It's that I'm not after you. I'm after them.

**Other Examples**

- "Because HIV can be found in the human population, it should be found in other animals as well."
- "Because a certain car was recalled because of faulty brakes, then all other cars by the same car company must have faulty brakes too."

### Red herring

Similar in category, but with darker implications than ignoratio elenchi, a "red herring" is an answer, given in reply to a questioner, that goes beyond an innocent logical irrelevance. A red herring is a deliberate attempt to divert a process of enquiry by changing the subject.

For example:

"I think that we should make the academic requirements stricter for students. I recommend that you support this because we are in a budget crisis and we do not want our salaries affected."

Topic A is the proposal that academic requirements be raised. Topic B is the possible effects of a budget crisis on teacher salaries. Topic A is abandoned and the unrelated topic B is introduced.

A "red herring" is a debating tactic that seeks to divert an opponent. A digression can, similarly, be a verbal tactic of diversion, but has no place in a serious debate; and the diversion of digression may also be in play.

During a political campaign effort, U.S. President Harry Truman referred to accusations that his administrative policies leaked information to Communist Russia as a political red herring.

# 4. Affirming the consequent

**Affirming the consequent**, sometimes called **converse error**, is a formal fallacy, committed by reasoning in the form:

1. If P, then Q.
2. Q.
3. Therefore, P.

An argument of this form is invalid, i.e., the conclusion can be false even when statements 1 and 2 are true. Since P was never asserted as the only sufficient condition for Q, other factors could account for Q (while P was false).

The name affirming the consequent derives from the premise Q, which affirms the "then" clause of the conditional premise.

## Examples

One way to demonstrate the invalidity of this argument form is with a counterexample with true premises but an obviously false conclusion. For example:

If Bill Gates owns Fort Knox, then he is rich.
Bill Gates is rich.
Therefore, Bill Gates owns Fort Knox.

Owning Fort Knox is not the only way to be rich. There are any number of other ways to be rich.

Arguments of the same form can sometimes seem superficially convincing, as in the following example:

If I have the flu, then I have a sore throat.
I have a sore throat.
Therefore, I have the flu.

But having the flu is not the only cause of a sore throat since many illnesses cause sore throat, such as the common cold or strep throat.

The following is a more subtle version of the fallacy embedded into conversation.

A: All Republicans are against gun control.
B: That's not true. My uncle's against gun control and he's not a Republican.

B attempts to falsify A's conditional statement ("if Republican then against gun control") by providing evidence he believes would contradict its implication. However, B's example of his uncle does not contradict A's statement, which says nothing about non-Republicans. What would be needed to disprove A's assertion are examples of Republicans who support gun control. If this refutation is then followed by A asserting that all true Republicans are against gun control, it would be a case of No True Scotsman fallacy.

## Cases where affirming the consequent is valid

### Tautologies

If claims P and Q express the same proposition, then the argument would be trivially valid, as it would beg the question.

If P, then P.
P.
Therefore, P.

This is also the case for definitions. For example.

If a man is a bachelor, then he's an unmarried male
John is an unmarried male.
Therefore, John is a bachelor.

In everyday discourse, however, such cases are rare. The validity of such definitions is due to the fact that definitions can be expressed as an if and only if (see below). Clearly if the definition of "bachelor" is "an unmarried male", then the propositional statement: "A is a bachelor" if and only if "A is an unmarried male", must be true. In normal speech it is awkward to use the phrase "if and only if", so we substitute the valid but less complete "if", giving the conventional form which is similar to the form of the formal fallacy.

## If and only if

The reason the conclusion of an argument that affirms the consequent does not follow is the lack of a **unique** cause for **Q**. However, if it is explicitly stated that the consequent could only have one cause (known as an "if and only if" statement or biconditional), the argument becomes valid. For example:

If he's not inside, then he's outside.
He's outside.
Therefore, he's not inside.

The above argument may be valid, but only if the claim "if he's outside, then he's not inside" follows from the first premise. More to the point, the validity of the argument stems not from affirming the consequent, but affirming the antecedent.

## Use of the fallacy in science

Although affirming the consequent is an invalid inference, it is defended in some contexts as a type of abductive reasoning, sometimes under the name "inference to the best explanation". That is, in some cases, reasoners argue that the antecedent is the best explanation, given the truth of the consequent. For example, someone considering the results of a scientific experiment may reason in the following way:

Theory P predicts that we will observe Q.
Experimental observation shows Q.
Therefore theory P is true.

For example,

Einstein's General Relativity predicts that Mercury's orbit will shift in space, due to warping of space-time caused by the Sun's mass.
Mercury's orbit has been observed to shift spatially.
Therefore General Relativity is true.

However, such reasoning is still affirming the consequent and logically invalid (e.g., Let P = geocentrism and Q = sunrise and sunset). The strength of such reasoning as an inductive inference depends on the likelihood of alternative hypotheses, which shows that such reasoning is based on additional premises, not merely on affirming the consequent.

# 5. Denying the antecedent

**Denying the antecedent**, sometimes also called **inverse error**, is a formal fallacy, committed by reasoning in the form:

If P, then Q.
Not P.
Therefore, not Q.

Arguments of this form are invalid. Informally, this means that arguments of this form do not give good reason to establish their conclusions, even if their premises are true.

The name denying the antecedent derives from the premise "not P", which denies the "if" clause of the conditional premise.

One way to demonstrate the invalidity of this argument form is with a counterexample with true premises but an obviously false conclusion. For example:

If Queen Elizabeth is an American citizen, then she is a human being.
Queen Elizabeth is not an American citizen.
Therefore, Queen Elizabeth is not a human being.

That argument is obviously bad, but arguments of the same form can sometimes seem superficially convincing, as in the following example imagined by Alan Turing in the article "Computing Machinery and Intelligence":

If each man had a definite set of rules of conduct by which he regulated his life he would be no better than a machine. But there are no such rules, so men cannot be machines.

However, men could still be machines that do not follow a definite set of rules. Thus this argument (as Turing intends) is invalid.

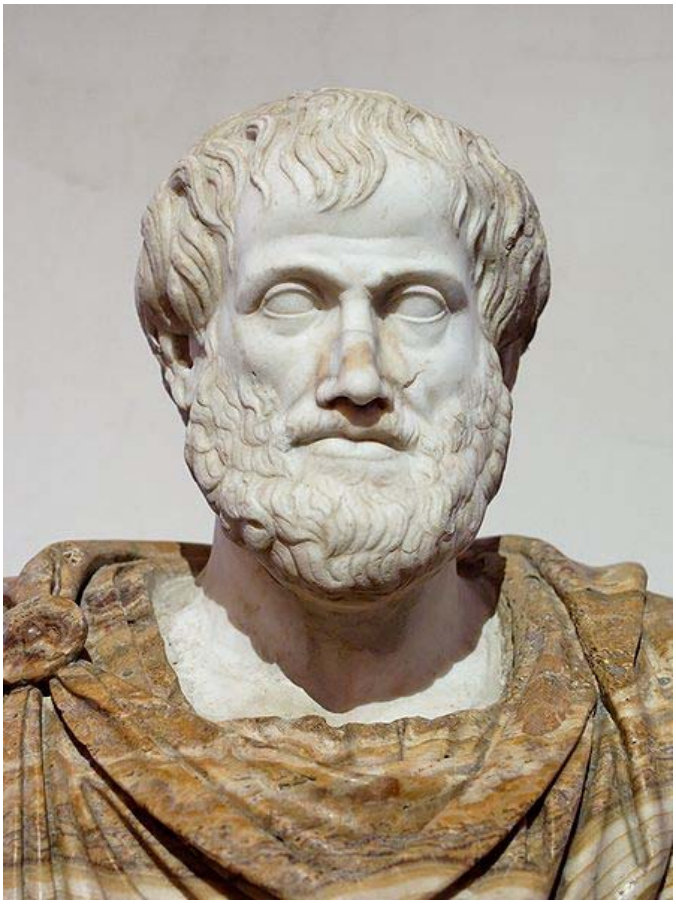
It is possible that an argument that denies the antecedent could be valid, if the argument instantiates some other valid form. For example, if the claims P and Q express the same proposition, then the argument would be trivially valid, as it would beg the question. In everyday discourse, however, such cases are rare, typically only occurring when the "if-then" premise is actually an "if and only if" claim (i.e., a biconditional). For example:

If I am President of the United States, then I can veto Congress.
I am not President.

Therefore, I cannot veto Congress.

The above argument is not valid, but would be if the first premise ended thus: "...and if I can veto Congress, then I am the U.S. President" (as is in fact true). More to the point, the validity of the new argument stems not from denying the antecedent, but denying the consequent.

# 6. Begging the question



Bust of Aristotle, whose Prior Analytics contained an early discussion of this fallacy

**Begging the question** (or **petitio principii**, "assuming the initial point") is a type of logical fallacy in which the proposition to be proven is assumed implicitly or explicitly in the premise. The first known definition in the West is by the Greek philosopher Aristotle around 350 BCE, in his book Prior Analytics, where he classified it as a material fallacy. Begging the question is related to the circular argument, circulus in probando (Latin, "circle in proving") or circular reasoning, though these are considered absolutely different by Aristotle.

## History

The term was translated into English from the Latin in the 16th century. The Latin version, Petitio Principii (petitio: petition, request; principii, genitive of principium: beginning, basis, premise of an argument), literally means "a request for the beginning or premise." That is, the premise depends on the truth of the very matter in question.

The Latin phrase comes from the Greek en archei aiteisthai in Aristotle's Prior Analytics II xvi:

Begging or assuming the point at issue consists (to take the expression in its widest sense) [of] failing to demonstrate the required proposition. But there are several other ways in which this may happen; for example, if the argument has not taken syllogistic form at all, he may argue from premises which are less known or equally unknown, or he may establish the antecedent by means of its consequents; for demonstration proceeds from what is more certain and is prior. Now begging the question is none of these. [...] If, however, the relation of B to C is such that they are identical, or that they are clearly convertible, or that one applies to the other, then he is begging the point at issue.... [B]egging the question is proving what is not self-evident by means of itself...either because predicates which are identical belong to the same subject, or because the same predicate belongs to subjects which are identical.

Thomas Fowler's Deductive Logic (1887) argues that the Latin origin is more properly Petitio Quæsiti, which is literally "begging the question".

## Definition

The fallacy of petitio principii, or "begging the question", is committed "when a proposition which requires proof is assumed without proof." More specifically, petitio principii refers to arguing for a conclusion that has already been assumed in the premise, in effect "begging" any listener to "question" the basis of the logic. The fallacy may be committed in various ways.

When the fallacy of begging the question is committed in a single step, it is sometimes called a hysteron proteron, as in the statement "Opium induces sleep because it has a soporific quality". Such fallacies may not be immediately obvious in English because the English language has many synonyms; one way to beg the question is to make a statement first in concrete terms, then in abstract ones, or vice-versa. Another is to "bring forth a proposition expressed in words of Saxon origin, and give as a reason for it the very same proposition stated in words of Norman origin", as in this example: "To allow every man an unbounded freedom of speech must always be, on the whole, advantageous to the State, for it is highly conducive to the interests of the community that each individual should enjoy a liberty perfectly unlimited of expressing his sentiments."

When the fallacy of begging the question is committed in more than one step, it is sometimes referred to as circulus in probando or reasoning in a circle but incorrectly so, if we look at the definition Aristotle gave in Prior Analytics.

"Begging the question" can also refer to making an argument in which the premise "is different from the conclusion ... but is controversial or questionable for the same reasons that typically might lead someone to question the conclusion."

.... seldom is anyone going to simply place the conclusion word-for-word into the premises .... Rather, an arguer might use phraseology that conceals the fact that the conclusion is masquerading as a premise. The conclusion is rephrased to look different and is then placed in the premises.
—Paul Herrick,

- Person 1: Bob is annoyed right now.
- Person 2: How do you know?
- Person 1: Well, because he is really angry.

## Related fallacies

In informal situations, the term begging the question is often used in place of circular argument. In the formal context however, begging the question holds a different meaning. In its shortest form, circular reasoning is the basing of two conclusions by means of which there is demonstrated a reversed premise of the first argument. Begging the question does not require any such reversal.

Begging the question is similar to the fallacy of many questions: a fallacy of technique that results from presenting evidence in support of a conclusion that is less likely to be accepted, rather than merely asserting the conclusion. A specific form of this is reducing an assertion to an instance of a more general assertion which is no more known to be true than the more specific assertion:

- All intentional acts of killing human beings are morally wrong.
- The death penalty is an intentional act of killing a human being.
- Therefore the death penalty is wrong.

If the first premise is accepted as an axiom within some moral system or code, this reasoning is a cogent argument against the death penalty. If not, it is in fact a weaker argument than a mere assertion that the death penalty is wrong, since the first premise is stronger than the conclusion.

## Modern usage

Some English speakers assume "beg the question" means "raise the question" and use it so: for example, "this year's deficit is half a trillion dollars, which begs the question: how

are we ever going to balance the budget?" Some usage commentators deem such usage incorrect.

# 7. Non sequitur (logic)

**Non sequitur** (Latin for "it does not follow"), in formal logic, is an argument in which its conclusion does not follow from its premises. In a non sequitur, the conclusion can be either true or false, but the argument is fallacious because there is a disconnection between the premise and the conclusion. All formal fallacies are special cases of non sequitur. The term has special applicability in law, having a formal legal definition. Many types of known non sequitur argument forms have been classified into many different types of logical fallacies.

## Non sequitur in normal speech

The term is often used in everyday speech and reasoning to describe a statement in which premise and conclusion are totally unrelated but which is used as if they were. An example might be: "If I buy this cell phone, all people will love me." However, there is no direct relation between buying a cell phone and the love of all people. This kind of reasoning is often used in advertising to trigger an emotional purchase.

Two examples include:

- "If you do not buy this type of pet food, you are neglecting your dog." (Premise and conclusion are once again unrelated; this is also an example of an appeal to emotion.)
- "I hear the rain falling outside my window; therefore, the sun is not shining." (The conclusion is a non-sequitur because the sun can shine while it is raining.)

## Fallacy of the undistributed middle

The fallacy of the undistributed middle is a logical fallacy that is committed when the middle term in a categorical syllogism is not distributed. It is thus a syllogistic fallacy. More specifically it is also a form of non sequitur.

The fallacy of the undistributed middle takes the following form:

1. All Zs are Bs.
2. Y is a B.
3. Therefore, Y is a Z.

It may or may not be the case that "all Zs are Bs," but in either case it is irrelevant to the conclusion. What is relevant to the conclusion is whether it is true that "all Bs are Zs," which is ignored in the argument.

Note that if the terms were swapped around in the first co-premise or if the first premise was rewritten to "All Zs can only be Bs" then it would no longer be a fallacy, although it could still be unsound. This also holds for the following two logical fallacies which are similar in nature to the fallacy of the undistributed middle and also non sequiturs.

An example can be given as follows:

1. Men are human.
2. Mary is human.
3. Therefore, Mary is a man.

## Affirming the consequent

Any argument that takes the following form is a non sequitur

1. If A is true, then B is true.
2. B is true.
3. Therefore, A is true.

Even if the premises and conclusion are all true, the conclusion is not a necessary consequence of the premises. This sort of non sequitur is also called affirming the consequent.

An example of affirming the consequent would be:

1. If I am a human (A) then I am a mammal. (B)
2. I am a mammal. (B)
3. Therefore, I am a human. (A)

While the conclusion may be true, it does not follow from the premises: I could be another type of mammal without also being a human. The truth of the conclusion is independent of the truth of its premises - it is a 'non sequitur'.

Affirming the consequent is essentially the same as the fallacy of the undistributed middle, but using propositions rather than set membership.

## Denying the antecedent

Another common non sequitur is this:

1. If A is true, then B is true.
2. A is false.
3. Therefore, B is false.

While the conclusion can indeed be false, this cannot be linked to the premise since the statement is a non sequitur. This is called denying the antecedent.

## Affirming a disjunct

Affirming a disjunct is a fallacy when in the following form:

1. A is true or B is true.
2. B is true.
3. Therefore, A is not true.

The conclusion does not follow from the premises as it could be the case that A and B are both true. This fallacy stems from the stated definition of or in propositional logic to be inclusive.

An example of affirming a disjunct would be:

1. I am at home or I am in the city.
2. I am at home.
3. Therefore, I am not in the city.

While the conclusion may be true, it does not follow from the premises. For all the reader knows, the declarant of the statement very well could have her home in the city, in which case the premises would be true but the conclusion false. This argument is still a fallacy even if the conclusion is true.

## Denying a conjunct

Denying a conjunct is a fallacy when in the following form:

1. It is not the case that both A is true and B is true.
2. B is not true.
3. Therefore, A is true.

The conclusion does not follow from the premises as it could be the case that A and B are both false.

An example of denying a conjunct would be:

1. It is not the case that both I am at home and I am in the city.
2. I am not at home.
3. Therefore, I am in the city.

While the conclusion may be true, it does not follow from the premises. For all the reader knows, the declarant of the statement very well could neither be at home nor in the city, in which case the premises would be true but the conclusion false. This argument is still a fallacy even if the conclusion is true.

# 8. Straw man

A **straw man** argument is an informal fallacy based on misrepresentation of an opponent's position. To "attack a straw man" is to create the illusion of having refuted a proposition by substituting it with a superficially similar yet unequivalent proposition (the "straw man"), and refuting it, without ever having actually refuted the original position.

## Origin

The origins of the term are unclear; one common (folk) etymology given is that it originated with men who stood outside courthouses with a straw in their shoe in order to indicate their willingness to be a false witness, but it is unlikely that individuals would publicly declare their willingness to commit a crime outside a courthouse. Another more popular origin is a human figure made of straw, such as practice dummies used in military training. Such a dummy is supposed to represent the enemy, but it is considerably easier to attack because it neither moves, nor fights back.

In the UK, the adversary is sometimes called Aunt Sally, with reference to a traditional fairground game.

## Reasoning

The straw man fallacy occurs in the following pattern of argument:

1. **Person A has position X.**
2. **Person B disregards certain key points of X and instead presents the superficially similar position Y.** Thus, Y is a resulting distorted version of X and can be set up in several ways, including:
    1. Presenting a misrepresentation of the opponent's position and then refuting it, thus giving the appearance that the opponent's actual position has been refuted.
    2. Quoting an opponent's words out of context — i.e. choosing quotations that misrepresent the opponent's actual intentions.
    3. Presenting someone who defends a position poorly as the defender, then refuting that person's arguments — thus giving the appearance that every upholder of that position (and thus the position itself) has been defeated.
    4. Inventing a fictitious persona with actions or beliefs which are then criticized, implying that the person represents a group of whom the speaker is critical.
    5. Oversimplifying an opponent's argument, then attacking this oversimplified version.
3. **Person B attacks position Y, concluding that X is false/incorrect/flawed.**

This sort of "reasoning" is fallacious, because attacking a distorted version of a position fails to constitute an attack on the actual position.

## Example

Straw man arguments often arise in public debates such as a (hypothetical) prohibition debate:

Person A: We should liberalize the laws on beer.
Person B: No, any society with unrestricted access to intoxicants loses its work ethic and goes only for immediate gratification.

The proposal was to relax laws on beer. Person B has exaggerated this to a position harder to defend, i.e., "unrestricted access to intoxicants".

## Chapter- 2

# Verbal Fallacies

# 1. Equivocation

**Equivocation** is classified as both a formal and informal logical fallacy. It is the misleading use of a term with more than one meaning or sense (by glossing over which meaning is intended at a particular time). It generally occurs with polysemic words.

It is often confused with **amphibology** (amphiboly); however, equivocation is ambiguity arising from the misleading use of a word and amphiboly is ambiguity arising from the misleading use of punctuation or syntax.

### Examples

### Puns

This form of word play relies upon two different words that sound alike. However, their different senses become obvious only upon a moment's reflection. One example is the contrast between birth and death, and birth and berth, and told and toll'd in Thomas Hood's account of the death of Ben the sailor (which took place at the age of 40, contrasted with his age of zero at birth) in his humorous poem Faithless Sally Brown:

His death, which happen'd in his berth,
At forty-odd befell:
They went and told the sexton, and
The sexton toll'd the bell.

### Fallacious reasoning

Equivocation is the use in a syllogism (a logical chain of reasoning) of a term several times, but giving the term a different meaning each time. For example:

A feather is light.
What is light cannot be dark.
Therefore, a feather cannot be dark.

In this use of equivocation, the word "light" is first used as the opposite of "heavy", but then used as a synonym of "bright" (the fallacy usually becomes obvious as soon as one tries to translate this argument into another language). Because the "middle term" of this syllogism is not one term, but two separate ones masquerading as one (all feathers are indeed "not heavy", but it is not true that all feathers are "bright"), this type of equivocation is actually an example of the fallacy of four terms.

## Semantic shift

The fallacy of equivocation is often used with words that have a strong emotional content and many meanings. These meanings often coincide within proper context, but the fallacious arguer does a semantic shift, slowly changing the context by treating, as equivalent, distinct meanings of the term.

In English language, one equivocation is with the word "man", which can mean both "member of the species, Homo sapiens," and "male member of the species, Homo sapiens." The following sentence is a well-known equivocation:

"Do women need to worry about man-eating sharks?", in which "man-eating" is construed to mean a shark that devours only male human beings.

## Metaphor

A separate case of equivocation is metaphor:

All jackasses have long ears.
Carl is a jackass.
Therefore, Carl has long ears.

Here the equivocation is the metaphorical use of "jackass" to imply a stupid or obnoxious person instead of a male donkey.

## Switch-Referencing

This occurs where the referent of a word or expression in a second sentence is different from that in the immediately preceding sentence, especially where a change in referent has not been clearly identified.

The following fallacy is an example of amphiboly, and its success relies upon syntactical omissions that obscure an unparallel structure and that result in apparent ambiguity:

## "Better than nothing"

Margarine is better than nothing.
Nothing is better than butter.
Therefore, margarine is better than butter.

The fallacy is exposed when the omissions are supplied. Note that, in the first part of the second premise, the present-tense verb, "putting," has been changed to the infinitive, "to put."

[Putting] margarine [on bread] is better than [putting] nothing [on bread].
[However, there is] nothing [to put on bread that]is better than [putting] butter [on bread].

Then note how the meaning would change if the second premise were parallel to the rest of the syllogism:

[Putting] margarine [on bread] is better than [putting] nothing [on bread].
[Putting] nothing [on bread] is better than [putting] butter [on bread].

By supplying the parallel structure, the original conclusion becomes logical.

Therefore, [putting] margarine [on bread] is better than [putting] butter [on bread].

However, by exposing the unparallel structure in the original syllogism, the reader is now able to supply the logical conclusion:

Therefore, [putting] butter [on bread] is better than [putting] margarine [on bread].

### Politician's syllogism

A similar example is the Politician's syllogism, satirized on the television show Yes Minister:

Something must be done.
This is something.
Therefore, this must be done.

# 2. Fallacy of composition

A **fallacy of composition** arises when one infers that something is true of the whole from the fact that it is true of some part of the whole (or even of every proper part). For example: "This fragment of metal cannot be broken with a hammer, therefore the machine of which it is a part cannot be broken with a hammer." This is clearly fallacious, because many machines can be broken into their constituent parts without any of those parts being breakable.

This fallacy is often confused with the fallacy of hasty generalization, in which an unwarranted inference is made from a statement about a sample to a statement about the population from which it is drawn.

The fallacy of composition is the converse of the fallacy of division.

## Example

1. Atoms are not visible to the naked eye
2. Humans are made up of atoms
3. Therefore, humans are not visible to the naked eye.

## Application

In Keynesian macroeconomics, the "paradox of thrift" theory illustrates this fallacy: increasing saving (or "thrift") is obviously good for an individual, since it provides for retirement or a "rainy day," but if everyone saves more, Keynesian economists argue that it may cause a recession by reducing consumer demand.

Followers of Keynes would argue that the following syllogism is fallacious:

The thrift of any member of a group is beneficial to that member.
Therefore, the thrift of the group as a whole is beneficial to that group as a whole.

Other economists such as those in the Austrian school assert that Keynes's paradox of thrift does not represent a good explanation of how the economy works.

## Modo hoc fallacy

The modo hoc (or "just this") fallacy is the informal error of assessing meaning to an existent based on the constituent properties of its material makeup while omitting the matter's arrangement. For instance, metaphysical naturalism states that while matter and motion are all that comprise man, it cannot be assumed that the characteristics inherent in the elements and physical reactions that make up man ultimately and solely define man's meaning; for, a cow which is alive and well and a cow which has been chopped up into meat are the same matter but it is obvious that the arrangement of that matter clarifies those different situational meanings.

## Exceptions

Some properties are such that, if every part of a whole has the property, then the whole will, too. In such instances, the fallacy of composition does not apply. For example, if all parts of a chair are green, then it is acceptable to infer that the chair is green. Or if all parts of a table are wooden, it is acceptable to infer that the table is wooden. A property of all parts that can be ascribed to the whole is called an "expansive" property, according to Nelson Goodman. For a property to be expansive, it must be absolute (as opposed to relative) and structure-independent (as opposed to structure dependent), according to Frans H. van Eemeren.

The meanings of absolutes do not imply a comparison, whereas the meanings of relatives do. E.g., being green or wooden are absolutes, whereas fast or heavy or cheap are relatives. We know whether something is green or wooden without reference to other

things, whereas we do not know whether something is fast or heavy or cheap without implicitly comparing it to other things. Relative properties are never expansive. E.g., it does not follow that if all parts of a chair are cheap, then the chair is cheap.

Absolute properties shared by all constituent parts of a whole are expansive only if they are independent of the nature of the whole's structure or arrangement. That is, if it does not matter whether the whole is a summation or integration, an unordered collection or a cohesive whole, then the property is said to be independent. Consider the example, X is green. It does not matter whether X is a chair (an integration or coherent whole) or just a pile of twigs (a summation or unordered collection). Green is therefore an independent property. Now consider the example, X is rectangular. Rearrange a rectangular object—e.g., tear up the pages of a book—and it might not stay rectangular. Rectangularness is a structure dependent property and is therefore non-expansive.

# 3. Fallacy of division

A **fallacy of division** occurs when one reasons logically that something true of a thing must also be true of all or some of its parts.

An example:

1. A Boeing 747 can fly unaided across the ocean.
2. A Boeing 747 has jet engines.
3. Therefore, one of its jet engines can fly unaided across the ocean.

The converse of this fallacy is called fallacy of composition, which arises when one fallaciously attributes a property of some part of a thing to the thing as a whole.

Another example:

1. Functioning brains think.
2. Functioning brains are nothing but the neurons that they are composed of.
3. If functioning brains think, then the individual neurons in them think.
4. Individual neurons do not think.
5. Functioning brains do not think. (From 3 & 4)
6. Functioning brains think and functioning brains do not think. (From 1 & 5)

Since the premises entail a contradiction (6), at least one of the premises must be false. We may diagnose the problem as located in premise 3, which quite plausibly commits the fallacy of division.

An application: Famously and controversially, in the philosophy of the Greek Anaxagoras (at least as it is discussed by the Roman Atomist Lucretius), it was assumed that the atoms constituting a substance must themselves have the salient observed properties of that substance: so atoms of water would be wet, atoms of iron would be

hard, atoms of wool would be soft, etc. This doctrine is called homeomeria, and it plainly depends on the fallacy of division.

If a system as a whole has some property that none of its constituents has (or perhaps, it has it but not as a result of some constituent having that property), this is sometimes called an emergent property of the system.

# 4. Proof by intimidation

**Proof by intimidation** is a jocular term used mainly in mathematics to refer to a style of presenting a purported mathematical proof by giving an argument loaded with jargon and appeal to obscure results, so that the audience is simply obliged to accept it, lest they have to admit their ignorance and lack of understanding. The term is also used when the author is an authority in his field presenting his proof to people who respect a priori his insistence that the proof is valid or when the author claims that his statement is true because it is trivial or because he simply says so. Usage of this term is for the most part in good humour, though it also appears in serious criticism. More generally, "proof by intimidation" has also been used by critics of junk science to describe cases in which scientific evidence is thrown aside in favour of a litany of tragic individual cases presented to the public by articulate advocates who pose as experts in their field.

Gian-Carlo Rota claimed in a memoir that the expression "proof by intimidation" was coined by Mark Kac to describe a technique used by William Feller in his lectures.

# 5. Reification (fallacy)

**Reification** (also known as **hypostatisation**, **concretism**, or **the fallacy of misplaced concreteness**) is a fallacy of ambiguity, when an abstraction (abstract belief or hypothetical construct) is treated as if it were a concrete, real event, or physical entity. In other words, it is the error of treating as a "real thing" something which is not a real thing, but merely an idea. For example: if the phrase "holds another's affection", is taken literally, affection would be reified.

Note that reification is generally accepted in literature and other forms of discourse where reified abstractions are understood to be intended metaphorically, but the use of reification in logical arguments is usually regarded as a fallacy. For example, "Justice is blind; the blind cannot read printed laws; therefore, to print laws cannot serve justice." In rhetoric, it may be sometimes difficult to determine if reification was used correctly or incorrectly.

## Etymology

From Latin res thing + facere to make, reification can be 'translated' as thing-making; the turning of something abstract into a concrete thing or object.

## Theory

Reification often takes place when natural or social processes are misunderstood and/or simplified; for example when human creations are described as “facts of nature, results of cosmic laws, or manifestations of divine will”. Reification can also occur when a word with a normal usage is given an invalid usage, with mental constructs or concepts referred to as live beings. When human-like qualities are attributed as well, it is a special case of reification, known as pathetic fallacy (or anthropomorphic fallacy).

A reification circle is an outcome of the fallacy, occurring when a norm, first seen as artificial and forced, in time becomes so accepted that even its creators start to think of it as a natural law.

Willard Van Orman Quine suggests that reification exists potentially in all linguistic categorizations and naming objects, insofar as the recognition of the same object in different spatio-temporal contexts requires abstraction from time, change, interactions, and relations pertaining to the object. Already Heraclitus had observed "it was impossible to step in the same river twice", and this implies that identifying the river involves the imputation or attribution of a constancy which in physical reality does not exist.

Reification may derive from an inborn tendency to simplify experience by assuming constancy as much as possible.

## Difference between reification and hypostatisation

Sometimes a distinction is drawn between reification and hypostatization based on the kinds of abstractions involved. In reification they are usually philosophical or ideological, such as existence, good, and justice.

## Fallacy of misplaced concreteness

In the philosophy of Alfred North Whitehead, one commits the **fallacy of misplaced concreteness** when one mistakes an abstract belief, opinion or concept about the way things are for a physical or "concrete" reality.

There is an error; but it is merely the accidental error of mistaking the abstract for the concrete. It is an example of what I will call the ‘Fallacy of Misplaced Concreteness.’

Whitehead proposed the fallacy in a discussion of the relation of spatial and temporal location of objects. Whitehead rejects the notion that a concrete physical object in the universe can be ascribed a simple spatial or temporal extension, that is, without reference of its relations to other spatial or temporal extensions.

...among the primary elements of nature as apprehended in our immediate experience, there is no element whatever which possesses this character of simple location. ... [Instead,] I hold that by a process of constructive abstraction we can arrive at abstractions

which are the simply located bits of material, and at other abstractions which are the minds included in the scientific scheme. Accordingly, the real error is an example of what I have termed: The Fallacy of Misplaced Concreteness.

## Examples

### Nothingness

Another fallaciously reifying use of "nothing" is found in this joke: A man walks into a bar. The bartender asks him what he wants. "Nothing," he says. "So why did you come in here?" "Because nothing is better than a cold drink." The fallacy is manifested in the listener's interpretation of the man's answer, as, if the joke were successful, the listener is led to conflate the semantics of the two distinct but interrelated notions of emptiness and nothingness. If interpreted without this natural equivocation, the man's answer literally — if awkwardly, in the context of answering the question — means that he would prefer to drink nothing than to have a cold drink, instead of the commonly understood meaning, "There is no thing that is better than a cold drink".

### Legal and ethical

Regarding a state or a society as a conscious being ("This product is known to the state of California to cause cancer") or assuming government is a being with desires ("Government wants to help/harm you"). Both of these reifications are examples of the linguistic phenomenon metonymy.

The legal recognition of corporations as "individuals" may lead to fallacious assumptions. In reality, these are just organizations of capital and labor, but have been assigned the status of legal 'persons' which gives them entitlements and liabilities, such as the ability to own property or to be sued. It would be fallacious to attribute other personal qualities to corporations based on this status, e.g., "Acme Explosives is a warm-hearted company." Similar conflations are often intentionally deployed in advertising and public relations materials to distract from a corporation's actual behavior, that is, the behavior of its officers attributed to the fictional "person" of the corporation.

### Phrases

- "The universe will not allow the human race to die out by accident." (attributes intention to the universe)
- "Religion attempts to destroy our liberty and is therefore immoral." (attributes intention to religion)
- "Good and evil are forces ruling the universe." (attributes existence and agency to the abstract ideas of good and evil)
- "Evolution chooses the strong to survive." (attributes intention to evolution)
- "Information wants to be free" (attributes intention to information)

## Similar fallacies

Pathetic fallacy (also known as anthropomorphic fallacy or anthropomorphization) is a specific type of reification. Just as reification is the attribution of concrete characteristics to an abstract idea, a pathetic fallacy is when those characteristics are specifically human characteristics, thoughts, and feelings. Pathetic fallacy is also related to personification, which is a direct and explicit in the ascription of life and sentience to the thing in question, whereas the pathetic fallacy is much broader and more allusive.

The animistic fallacy involves attributing intention of a person to an event or situation. This is usually not reification because the "real" attributes are given to the perceived person involved, and not the event or situation. For example, "The train's conductor must have been impatient, so we missed the train." (animistic fallacy), compared to "The train was impatient." (reification).

Reification fallacy should not be confused with other fallacies of ambiguity:

- Accentus, where the ambiguity arises from the emphasis (accent) placed on a word or phrase
- Amphiboly, a verbal fallacy arising from ambiguity in the grammatical structure of a sentence
- Composition, when one assumes that a whole has a property solely because its various parts have that property
- Division, when one assumes that various parts have a property solely because the whole has that same property
- Equivocation, the misleading use of a word with more than one meaning

## As a rhetorical device

Reification is commonly found in rhetorical devices such as metaphor and personification. In those cases we are usually not dealing with a fallacy but with rhetorical applications of language. The distinction is that the fallacy occur during an argument that result in false conclusions. This distinction is often difficult to detect, particularly when the fallacious use is intentional.

## Chapter- 3

# Base Rate Fallacy, Naturalistic Fallacy and False Dilemma

# Base rate fallacy

The **base rate fallacy**, also called **base rate neglect**, is an error that occurs when the conditional probability of some hypothesis H given some evidence E is assessed without taking into account the "base rate" or "prior probability" of H and the total probability of evidence E.

### Example

In a city of 1 million inhabitants there are 100 known terrorists and 999,900 non-terrorists. The base rate probability of one random inhabitant of the city being a terrorist is thus 0.0001 and the base rate probability of a random inhabitant being a non-terrorist is 0.9999. In an attempt to catch the terrorists, the city installs a surveillance camera with automatic facial recognition software. If one of the known terrorists is seen by the camera, the system has a 99% probability of detecting the terrorist and ringing an alarm bell. If the camera sees a non-terrorist, it will only incorrectly trigger the alarm 1% of the time. So the failure rate of the camera is always 1%.

Suppose somebody triggers the alarm. What is the chance they are really a terrorist?

Someone making the base rate fallacy would incorrectly claim that the false-alarm rate must be 1 in 100, because the failure rate of the device is 1 in 100, so if the alarm rings, there's a 99% probability that the camera has detected a real terrorist. The fallacy arises from the assumption that the device-failure rate and the false-alarm rate are equal.

This assumption is incorrect, because if the camera sees a random sampling of the population—or even some less-random sample, like the people entering an airport—it is far more likely to see non-terrorists than terrorists. The higher frequency of non-terrorists increases the false-alarm rate.

Imagine that the city's entire population of one million people pass in front of the camera. About 99 of the 100 terrorists will trigger the alarm—and so will about 9,999 of the

999,900 non-terrorists. Therefore about 10,098 people will trigger the alarm, and only about 99 of them will be terrorists. So the probability that a person who triggers the alarm is actually a terrorist is only about 99 in 10,098, or 1/102.

The base rate fallacy is only fallacious in this example when there are a different number of non-terrorists than terrorists. In a city with a population of exactly 50% terrorists and 50% non-terrorists, the probability of misidentification from a camera system like the one described above will be the same as the failure rate of the device.

In many real-world situations, though, particularly problems like detecting criminals in a largely law-abiding population, the small proportion of targets in the large population make the base rate fallacy very applicable. Even a low false-positive rate will result in so many false alarms as to make such a system useless.

## Mathematical formalism

In the above example, where P(A|B) means the probability of A given B, the base rate fallacy is the incorrect assumption that:

$$P(\text{terrorist}|\text{bell}) \stackrel{?}{=} P(\text{bell}|\text{terrorist}) = 99\%$$

However, the correct expression uses Bayes' theorem to take into account the probabilities of both A and B, and is written as:

$$P(\text{terrorist}|\text{bell}) = \frac{P(\text{bell}|\text{terrorist})P(\text{terrorist})}{P(\text{bell})}$$
$$= 0.99(100/1000000)/[(0.99 \cdot 100 + 0.01 \cdot 999900)/1000000] = 1/102 \approx 0.98\%$$

Thus, in the example the probability is overestimated by more than 100 times, due to the failure to include the prior probability of one being a terrorist and the total probability of a bell ringing.

## Findings in psychology

In some experiments, students were asked to estimate the grade point averages (GPAs) of hypothetical students. When given relevant statistics about GPA distribution, students tended to ignore them if given descriptive information about the particular student, even if the new descriptive information was obviously of little or no relevance to school performance. This finding has been used to argue that interviews are an unnecessary part of the college admissions process because interviewers are unable to pick successful candidates better than basic statistics.

Psychologists Daniel Kahneman and Amos Tversky attempted to explain this finding in terms of the representativeness heuristic. Richard Nisbett has argued that some attributional biases like the fundamental attribution error are instances of the base rate

fallacy: people underutilize "consensus information" (the "base rate") about how others behaved in similar situations and instead prefer simpler dispositional attributions.

# Naturalistic fallacy

The **naturalistic fallacy** is often claimed to be a formal fallacy. It was described and named by British philosopher G. E. Moore in his 1903 book Principia Ethica. Moore stated that a naturalistic fallacy is committed whenever a philosopher attempts to prove a claim about ethics by appealing to a definition of the term "good" in terms of one or more natural properties (such as "pleasant", "more evolved", "desired", etc.). Arthur N. Prior defined it as

…the assumption that because some quality or combination of qualities invariably and necessarily accompanies the quality of goodness, or is invariably and necessarily accompanied by it, or both, this quality or combination of qualities is identical with goodness. If, for example, it is believed that whatever is pleasant is and must be good, or that whatever is good is and must be pleasant, or both, it is committing the naturalistic fallacy to infer from this that goodness and pleasantness are one and the same quality. The naturalistic fallacy is the assumption that because the words 'good' and, say, 'pleasant' necessarily describe the same objects, they must attribute the same quality to them.

The naturalistic fallacy is related to (and even confused with) the is-ought problem, which comes from Hume's Treatise. The term is sometimes used loosely to describe arguments that claim to draw ethical conclusions from natural facts. This view is in opposition to some forms of ethical naturalism.

Alternatively, the phrase "naturalistic fallacy" is used to refer to the claim that what is natural is inherently good or right, and that what is unnatural is bad or wrong. It is the converse of the moralistic fallacy, the notion that what is good or right is natural and inherent.

## Moore's discussion

PRINCIPIA ETHICA

BY

GEORGE EDWARD MOORE

FELLOW OF TRINITY COLLEGE, CAMBRIDGE

"Everything is what it is,
and not another thing"
BISHOP BUTLER

CAMBRIDGE
AT THE UNIVERSITY PRESS
1903

The title page of Principia Ethica

Moore's argument in Principia Ethica is (among other things) a defense of ethical non-naturalism; he argues that the term "good" (in the sense of intrinsic value) is indefinable, because it names a simple, non-natural property. It is, rather, "one of those innumerable objects of thought which are themselves incapable of definition, because they are the ultimate terms by reference to which whatever is capable of definition must be defined" (Principia Ethica § 10 ¶ 1). By contrast, many ethical philosophers have tried to prove some of their claims about ethics by appealing to an analysis of the meaning of the term "good"; they held, that is, that "good" can be defined in terms of one or more natural properties which we already understand (such as "pleasure", in the case of hedonists). Moore coined the term "naturalistic fallacy" to describe arguments of this form; he

explains (in § 12) that the fallacy involved is an instance of a more general type of fallacy, which he leaves unnamed, but which we might call the "definitional fallacy". The fallacy is committed whenever a statement to the effect that some object has a simple indefinable property is misunderstood as a definition that gives the meaning of the simple indefinable property:

That "pleased" does not mean "having the sensation of red", or anything else whatever, does not prevent us from understanding what it does mean. It is enough for us to know that "pleased" does mean "having the sensation of pleasure", and though pleasure is absolutely indefinable, though pleasure is pleasure and nothing else whatever, yet we feel no difficulty in saying that we are pleased. The reason is, of course, that when I say "I am pleased", I do not mean that "I" am the same thing as "having pleasure". And similarly no difficulty need be found in my saying that "pleasure is good" and yet not meaning that "pleasure" is the same thing as "good", that pleasure means good, and that good means pleasure. If I were to imagine that when I said "I am pleased", I meant that I was exactly the same thing as "pleased", I should not indeed call that a naturalistic fallacy, although it would be the same fallacy as I have called naturalistic with reference to Ethics.

– G. E. Moore, PE § 12

The point here is connected with Moore's understanding of properties and the terms that stand for them. Moore holds (§7) that properties are either complexes of simple properties, or else irreducibly simple. The meaning of terms that stand for complex properties can be given by using terms for their constituent properties in a definition; simple properties cannot be defined, because they are made up only of themselves and there are no simpler constituents to refer to. Besides "good" and "pleasure", Moore also offers colour terms as an example of indefinable terms; thus if one wants to understand the meaning of "yellow", one has to be shown examples of it. Yellow, then, may be understood as a quale; it will do no good to read the dictionary and learn that "yellow" names the colour of egg yolks and ripe lemons, or that "yellow" names the primary colour between green and orange on the spectrum, or that the perception of yellow is stimulated by electromagnetic radiation with a wavelength of between 570 and 590 nanometers. It is true that yellow is all these things, that "egg yolks are yellow" and "the colour perceived when the retina is stimulated by electromagnetic radiation with a wavelength of between 570 and 590 nanometers is yellow" are true statements. But the statements do not give the meaning of the term "yellow", and (Moore argues) to confuse them with a definition of "yellow" would be to commit the same fallacy that is committed when "Pleasure is good" is confused with a definition of "good".

Moore goes on to explain that he pays special attention to the fallacy as it occurs in ethics, and identifies that specific form of the fallacy as ‘naturalistic’, because (1) it is so commonly committed in ethics, and (2) because committing the fallacy in ethics involves confusing a natural object (such as survival or pleasure) with goodness, something that is (he argues) not a natural object. However, in spite of his rhetorical focus on the ‘naturalistic’ nature of the fallacy, Moore was not any more satisfied with theories that attempted to define goodness in terms of non-natural properties than he was with

naturalistic theories; indeed, the basis of his criticism of “Metaphysical Ethics” in Chapter IV of Principia Ethica is that theories which define 'good' in terms of supernatural or metaphysical properties rest on the very same fallacy as naturalistic theories (§69). The target of Moore's discussion of the "naturalistic fallacy" is reductionism at least as much as it is naturalism specifically, and the important lesson, for Moore, is that the meaning of the term "good" and the nature of the property goodness are irreducibly sui generis.

Moore advanced an argument for the indefinability of “good” (and demonstrating the “naturalistic fallacy”) which is known as the Open Question Argument.

## Other uses

### Appeal to nature

Some people use the phrase "naturalistic fallacy" or "appeal to nature" to characterize inferences of the form "This behaviour is natural; therefore, this behaviour is morally acceptable" or "This behaviour is unnatural; therefore, this behaviour is morally unacceptable." Such inferences are common in discussions of homosexuality and cloning. While such inferences may indeed be fallacious, Moore is not concerned with them. He is instead concerned with the semantic and metaphysical underpinnings of ethics. However, others hold that it may be reasonable to assert that the term "good" is merely an affirmation of approval and that, as such, good may be defined as "I approve."

Philosophers such as St. Thomas Aquinas held that the "good" was a process of actualization where the formal principle of a natural object fulfilled its final cause (purpose) such that a tree's purpose is to develop another tree or a bouncy ball's is to bounce. The formal principle to Aquinas was defined through Aristotle as "that which makes a thing what it is." Thus the source of potency to accomplish all natural object ends is through the formal cause of an object. For which Aquinas suggests a non-dualistic model for substance: Form and Matter. This argument still holds a lot of weight against the supposed "naturalistic fallacy." Aquinas held that what is good is what is natural in that God created all things and they were good. However, he argued from human reason rather than faith when he discussed the ontological significance. He suggested that the end (fulfillment of its purpose) is the good and there are various degrees of Good, such as the processes of development in a living being. Arguably, happiness is the ultimate end for all human beings and thus all morality is in reference to what actualizes this "happiness." But Aquinas argued that there was an objective principle, not relative, which accomplished self-actualization. A simple example is that drugs simulate happiness but are only "apparent/false" happiness while integrity, reason, and love all flow with nature and therefore permit actualization of the ultimate end: happiness.

### The is-ought problem

The term "naturalistic fallacy" is also sometimes used to describe the deduction of an "ought" from an "is" (the Is-ought problem), and has inspired the use of mutually

reinforcing terminology which describes the converse (deducing an "is" from an "ought") either as the "reverse naturalistic fallacy" or the "moralistic fallacy." An example of a naturalistic fallacy in this sense would be to conclude Social Darwinism from the theory of evolution by natural selection, and of the reverse naturalistic fallacy to argue that the immorality of survival of the fittest implies the theory of evolution is false. Moralists Jeremy Bentham and Immanuel Kant both indicated the is-ought problem in order to identify their theories of morality and law.

In using his categorical imperative Kant deduced that experience was necessary for their applications. But experience on its own or the imperative on its own could not possibly identify an act as being moral or immoral. We can have no certain knowledge of morality from them, being incapable of deducing how things ought to be from the fact that they happen to be arranged in a particular manner in experience.

Bentham, in discussing the relations of law and morality, found that when people discuss problems and issues they talk about how they wish it would be as opposed to how it actually is. This can be seen in discussions of natural law and positive law. Bentham criticized natural law theory because in his view it was a naturalistic fallacy, claiming that it described how things ought to be instead of how things are.

## Criticism

### Terminology

According to Bernard Williams , Moore's use of the phrase 'naturalistic fallacy' to describe this particular kind of meta-ethical thinking was a 'spectacular misnomer'; Williams contending that it is not properly either naturalistic or a fallacy. Far from clear is whether the thinkers Moore criticised, even supposing he were right in those criticisms, were committing an error of inference - the true meaning of 'fallacy' - rather than simply a metaphysical mistake, or a dubious redefiniton. Moreover, the mistake being made is not very closely related to what would ordinarily be considered either moral or metaphysical naturalism. Moore's arguments may rule out attempts to define 'goodness' in such obviously naturalistic terms as 'happiness', but no less do they preclude similar attempts to define the good in terms of God's will — in other words, divine command theory, not an ethic which could sensibly be described as naturalistic at all.

### Science and moral questions

Some scientists and philosophers reject the Naturalistic Fallacy, arguing that it is indeed possible to derive "ought" from "is", and even that it has already been done to some extent. Proponents of this view see morality as a budding science. This view is critical of Moore's "simple indefinable terms" (which amount to qualia), arguing instead that such terms actually can be broken down into constituents.

# False dilemma

The logical fallacy of **false dilemma** (also called **false dichotomy**, the **either-or fallacy**) involves a situation in which only two alternatives are considered, when in fact there are other options. Closely related are failing to consider a range of options and the tendency to think in extremes, called black-and-white thinking. Strictly speaking, the prefix "di" in "dilemma" means "two" and "lemma" meaning (in this context) "possibilites." When a list of more than two choices is offered, but there are other choices not mentioned, then the fallacy is called the **fallacy of false choice**, or the **fallacy of exhaustive hypotheses**.

False dilemma can arise intentionally, when fallacy is used in an attempt to force a choice ("If you are not with us, you are against us.") But the fallacy can arise simply by accidental omission—possibly through a form of wishful thinking or ignorance—rather than by deliberate deception ("I thought we were friends, but all my friends were at my apartment last night and you weren't there.")

When two alternatives are presented, they are often, though not always, two extreme points on some spectrum of possibilities. This can lend credence to the larger argument by giving the impression that the options are mutually exclusive, even though they need not be. Furthermore, the options are typically presented as being collectively exhaustive, in which case the fallacy can be overcome, or at least weakened, by considering other possibilities, or perhaps by considering a whole spectrum of possibilities, as in fuzzy logic. In the community of philosophers and scholars, many believe that "unless a distinction can be made rigorous and precise it isn't really a distinction."

## Examples

### Morton's Fork

Very often a Morton's Fork, a choice between two equally unpleasant options, is a false dilemma. The phrase originates from an argument for taxing English nobles:

Either the nobles of this country appear wealthy, in which case they can be taxed for good; or they appear poor, in which case they are living frugally and must have immense savings, which can be taxed for good.

This is a false dilemma and a catch-22, because it fails to allow for the possibility that some members of the nobility may in fact lack liquid assets as well as the probability that those who appear poor also lack liquid assets.

### False choice

The presentation of a false choice often reflects a deliberate attempt to eliminate the middle ground on an issue. Eldridge Cleaver used such a quotation during his 1968 presidential campaign: "You're either part of the solution or part of the problem."

Another example would be the former president Bush stating that the world had a choice to make; "Either you are with us, or you are with the terrorists."

A common argument against noise pollution laws involves a false choice. It might be argued that in New York City noise should not be regulated, because if it were, the city would drastically change in a negative way. This argument involves assuming that, for example, a bar must be shut down for it to not cause disturbing levels of noise after midnight. This ignores the fact that the bar could simply lower its noise levels, and/or install more soundproof structural elements to keep the noise from excessively transmitting onto others' properties.

## Black and white thinking

A common form of the false dilemma is **black-and-white thinking**. Many people routinely engage in black-and-white thinking, an example of which is feeling boundless optimism when things are going well and suddenly switching to total despair at the first setback. Another example is someone who labels other people as all good or all bad.

## Falsum in uno, falsum in omnibus

This Latin phrase which, roughly translated, means "false in one thing, false in everything", and it is often used to label someone found to be wrong on one issue to also be wrong with regard to other issues. This is a logical fallacy because being found incompetent in one respect does not imply that one is incompetent in all other respects. This is an example of an ad hominem argument and a special case of the association fallacy.

## False opposites

This dichotomy occurs when two extremes or opposites are presented in an argument, when in reality only one of those choices presented is, in actuality, physically possible. This usually occurs when a physically possible opposite gains an opposite through the human desire to constantly have a balance (through the creation of false opposites).

## Chapter- 4

# Informal Fallacies

# 1. Appeal to ridicule

**Appeal to ridicule**, also called **appeal to mockery**, **the Horse Laugh**, or **reductio ad ridiculum** (Latin: "reduction to the ridiculous"), is a logical fallacy which presents the opponent's argument in a way that appears ridiculous, often to the extent of creating a straw man of the actual argument, rather than addressing the argument itself. For example:

- "If Einstein's theory of relativity is right, that would mean that when I drive my car it gets shorter and more massive the faster I go. That's crazy!" (This is, in fact, true, but the effect is so minuscule a human observer will not notice when it's observed on object without near-light speed.)
- "Evolution is ridiculous! If evolution were true, that would mean that all the apes wouldn't be here any more, since they all would have evolved into humans!" (This is not implied by the theory of evolution, thus the argument is false.)

This is a rhetorical tactic which mocks an opponent's argument, attempting to inspire an emotional reaction (making it a type of appeal to emotion) in the audience and to highlight the counter-intuitive aspects of that argument, making it appear foolish and contrary to common sense. This is typically done by demonstrating the argument's logic in an extremely absurd way or by presenting the argument in an overly simplified way, and often involves an appeal to consequences.

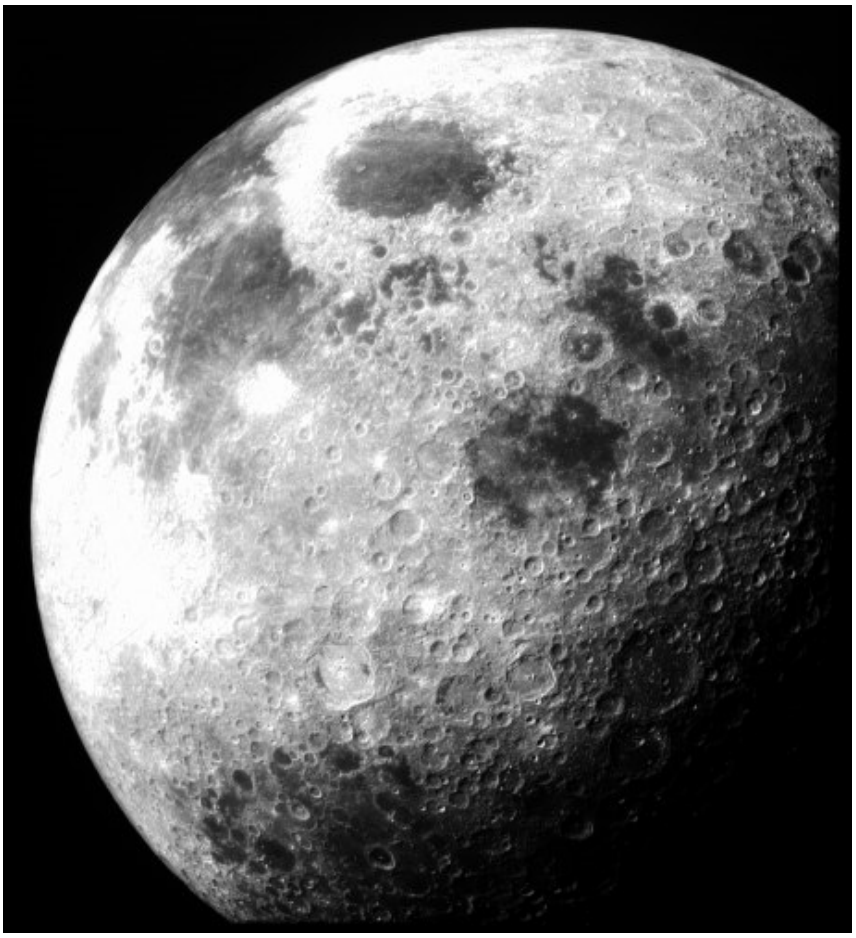
Appeal to Ridicule is often found in the form of challenging one's credentials or maturity;

- "Nobody believes in socialism after college! Grow up."

The argument is ridiculed on the basis that having a view commonly associated with youth is somehow invalid.

Although they appear very similar, this fallacy should not be confused with reductio ad absurdum, which is a valid type of logical argument.

# 2. Argument from ignorance



"You have no evidence that there is no teapot on the moon, so there is one" - an argument from ignorance

**Argument from ignorance**, also known as argumentum ad ignorantiam or appeal to ignorance, is an informal logical fallacy. It asserts that a proposition is necessarily true because it has not been proven false (or vice versa). This represents a type of false dichotomy in that it excludes a third option: there is insufficient investigation and the proposition has not yet been proven to be either true or false. In debates, appeals to ignorance are sometimes used to shift the burden of proof.

Carl Sagan famously criticized the practice by referring to it as "impatience with ambiguity", pointing out that "absence of evidence is not evidence of absence". This should not, however, be taken to mean that one can never possess evidence that something does not exist.

## Overview

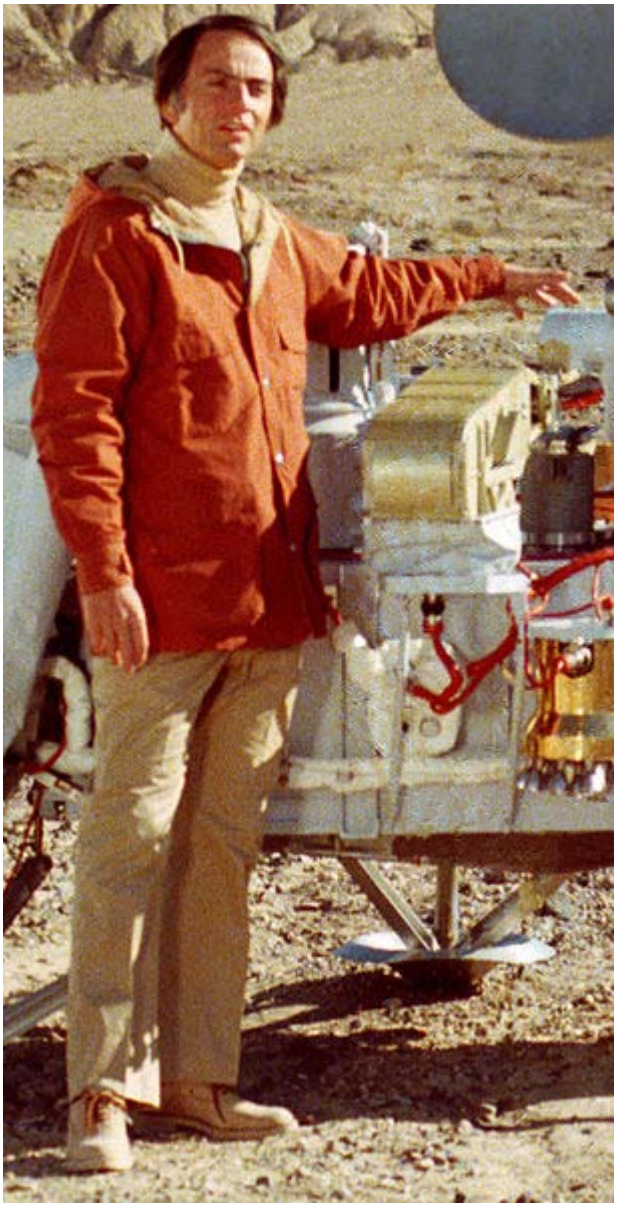
Arguments that appeal to ignorance rely merely on the fact that the veracity of the proposition is not known, or is undetected, to arrive at a definite conclusion. These arguments fail to appreciate that the limits of one's understanding or certainty do not change what is true. This fallacy can be very convincing and is considered by some to be a special case of a false dilemma or false dichotomy in that they both fail to consider perfectly valid alternatives. A false dilemma may take the form:

- If a proposition has not been disproven, then it cannot be considered false and must therefore be considered true.
- If a proposition has not been proven, then it cannot be considered true and must therefore be considered false.

Such arguments attempt to exploit the facts that (a) true things can never be disproven and (b) false things can never be proven. In other words, appeals to ignorance claim that the converse of these facts are also true (therein lies the fallacy).

To reiterate, these arguments ignore the fact, and difficulty, that some true things may never be proven, and some false things may never be disproved with absolute certainty.

This fallacy is sometimes confused, and or combined, with logically valid contrapositive arguments. Contrapositives rightly utilize the transposition rule of inference in classical logic to conclude that: To the extent that C implies E then Not-E must also imply Not-C. In other words, if a cause always leads to an effect, then absence of the expected effect is evidence of absence of the cause. For example, if the causal proposition that If it's raining outside then the streets will be wet is assumed, then it can be assumed that if the streets are not wet then it is not raining outside. The inference that it cannot be raining outside because the streets are not getting wet is exactly as true, or perhaps exactly as untrue, as the original proposition. The statements are logically equivalent.



Carl Sagan beside a Viking model

The phrase "absence of evidence is not evidence of absence" can be used as a shorthand rebuttal to the second form of the ignorance fallacy (i.e. P has never been absolutely proven and is therefore certainly false.). Most often it is directed at any conclusion derived from null results in an experiment or from the non-detection of something.

"**Appeal to ignorance** -- the claim that whatever has not been proved false must be true, and vice versa (e.g., there is no compelling evidence that UFOs are not visiting the Earth; therefore UFOs exist -- and there is intelligent life elsewhere in the Universe. Or: there may be seventy kazillion other worlds, but not one is known to have the moral advancement of the Earth, so we're still central to the Universe.) This impatience with

ambiguity can be criticized in the phrase: absence of evidence is not evidence of absence."

In this regard Irving Marmer Copi writes:

"In some circumstances it can be safely assumed that if a certain event had occurred, evidence of it could be discovered by qualified investigators. In such circumstances it is perfectly reasonable to take the absence of proof of its occurrence as positive proof of its non-occurrence." (Introduction to Logic, Copi, 1953, Page 95)

Therefore, absence of evidence that it rained (i.e. water is the evidence) may be considered as positive evidence that it did not rain. Again, in science, such inferences are always made to some limited (sometimes extremely high) degree of probability.

## Related terms

### Contraposition and Transposition

Contraposition is a logically valid rule of inference that allows the creation of a new proposition from the negation and reordering of an existing one. The method applies to any proposition of the type If A then B and says that negating all the variables and switching them back to front leads to a new proposition i.e. If Not-B then Not-A that is just as true as the original one and that the first implies the second and the second implies the first.

Transposition is exactly the same thing described in a different language.

### Absence of evidence

Absence of evidence is the absence, or lack of, any kind of evidence that may show, indicate, suggest, or be used to infer or deduce a fact.

### Evidence of absence

Evidence of absence is evidence of any kind that can be used to infer or deduce the non-existence or non-presence of something. For instance, if a doctor does not find any malignant cells in a patient this null result (finding nothing) is evidence of absence of cancer, even though the doctor has not actually detected anything per se. Such inductive reasoning is important to empiricism and science, but has well established limitations. The challenge thus becomes to try to identify when a researcher has received a null result (found nothing) because the thing does not exist (evidence of absence), and when one simply lacks proper means of detection (absence of evidence).

### Negative evidence

Negative evidence is sometimes used as an alternative to absence of evidence and is often meant to be synonymous with it. On the other hand, the term may also refer to evidence with a negative value, or null result equivalent to evidence of absence. It may even refer to positive evidence about something of an unpleasant nature.

### Null result

Null result is a term often used in the field of science to indicate evidence of absence. Keeping with the example above, a search for water on the ground may yield a null result (the ground is dry); therefore, it probably did not rain.

## Related arguments

### Argument from incredulity / Lack of imagination

Arguments from incredulity take the form:

1. P is too incredible (or I cannot imagine how P could possibly be true); therefore P must be false.
2. It is obvious that P (or I cannot imagine how P could possibly be false) therefore P must be true.

These arguments are similar to arguments from ignorance in that they too ignore and do not properly eliminate the possibility that something can be both incredible and still be true, or appear to be obvious and yet still be false.

### Argument from self-knowing (auto-epistemic)

Arguments from self-knowing take the form:

1. If P were true then I would know it; in fact I do not know it; therefore P cannot be true.
2. If P were false then I would know it; in fact I do not know it; therefore P cannot be false.

In practice these arguments are often fallacious and rely on the veracity of the supporting premise. For example the argument that If I had just sat on a wild porcupine then I would know it; in fact I do not know it; therefore I did not just sit on a wild porcupine is probably not a fallacy and depends entirely on the veracity of the leading proposition that supports it.

## Distinguishing absence of evidence from evidence of absence

Absence of Evidence is a condition in which no valid conclusion can be inferred from the mere absence of detection, normally due to doubt in the detection method. Evidence of absence is the successful variation: a conclusion that relies on specific knowledge in conjunction with negative detection to deduce the absence of something. An example of evidence of absence is checking your pockets for spare change and finding nothing but being confident that the search would have found it if it was there.

### Formal argument

By determining that a given experiment or method of detection is sensitive and reliable enough to detect the presence of X (when X is present) one can confidently exclude the possibility that X may be both undetected and present. This allows one to deduce that X cannot be present if a null result is received.

Thus there are only two possibilities, given a null result:

1. Nothing detected, and X is not present.
2. Nothing detected, but X is present (Option eliminated by careful research design).

To the extent that option 2 can be eliminated, one can deduce that if X is not detected then X is not present and therefore the null result is evidence of absence.

## Examples

### Absence of evidence

(These examples contain or represent missing information.)

- Statements that begin with "I can't prove it but…" are often referring to some kind absence of evidence.
- "There is no evidence of foul play here" is a direct reference to the absence of evidence.

### Negative results

- When the doctor says that the test results were negative, it is usually good news.
- Under "Termites" the inspector checked the box that read "no".
- The results of Michelson–Morley's experiment reported no shift at all in the interference pattern.

### Evidence of absence

(These examples contain definite evidence that can be used to show, indicate, suggest, infer or deduce the non-existence or non-presence of something.)

- A biopsy shows the absence of malignant cells.
- The null result found by Michelson–Morley's famous experiment represents "strong evidence" that the luminiferous aether was not present.
- One very carefully inspects the back seat of one's car and finds no tigers.
- The train schedule does not say that the train stops here at 3:00pm on a Sunday.

### Arguments from ignorance

(Draws a conclusion based on lack of knowledge or evidence without accounting for all possibilities)

- "I take the view that this lack (of enemy subversive activity in the west coast) is the most ominous sign in our whole situation. It convinces me more than perhaps any other factor that the sabotage we are to get, the Fifth Column activities are to get, are timed just like Pearl Harbor... I believe we are just being lulled into a false sense of security." - Then California's Attorney General Earl Warren (before a congressional hearing in San Francisco on 21 February 1942)

# 3. Circular cause and consequence

**Circular cause and consequence** is a logical fallacy where the consequence of the phenomenon is claimed to be its root cause. It is exemplified in the question, "Which came first, the chicken or the egg?"

### Examples

There are many real world examples of circular cause-and-effect (many of them constituting vicious cycles), in which the chicken-or-egg question helps identify the analytical problem:

- Expectation of economic downturn causes people to spend less, which reduces demand, causing economic downturn.
- Expectation of violence/war can make people more defensive/violent, the resulting tension/violence will cause more fear, also self-fulfilling prophecy.
- Without a treadmill test, it is not possible to ascertain the health of the heart, but taking such a test can cause the heart to fail.
- More jobs cause more consumption, which requires more production, and thus more jobs.
- Jobs are not readily available to people who have little to no experience in the field, yet workers cannot get experience without getting a job.

- An individual with no credit history has trouble getting credit, yet creditors are hesitant to give loans to people who have little to no credit history, which means more individuals with no credit history.
- An increase in production to feed a growing population leads only to a further increase in population.
- An actor cannot join the actor's union unless he has played a role in a union film, but a non-union actor cannot get a role in a union film because he isn't in the union.
- Software companies do not offer IPv6 content because of lack of support, yet Internet service providers do not offer IPv6 support because of lack of content.
- People will not buy players for a new media format without there being any recordings, yet recordings are not offered unless many people have the players.
- If somebody said they were a liar would they be telling the truth because if they were they wouldn't be a liar and if they were lying then they would be a truth teller which would be false because they have just lied.

This would only be a fallacy when saying "only A causes B, and only B causes A.". If the word "only" is removed then this would not be a fallacy. This might be understood as the "fallacy of begging the question".

## Contradictions

Circular cause and consequence is often confused with mutually contradictory statements, such as the famous "Catch-22", in which two mutually exclusive statements seem to send the reader back and forth in a cycle. Circular reasoning however is a problem of finding the 'root cause' (e.g. which came first) which is not the basis of the Catch-22 or any of the following examples of contradictions.

For example, Lewis Carroll in Through the Looking-Glass, where the White Queen states "Jam yesterday and jam tomorrow, but never jam today". Since every tomorrow becomes eventually today as the future turns into present, and past is gone forever, the result is that poor Alice will never have jam.

A real-life mutual contradiction is that one cannot get a job without experience, but one cannot get experience without a job. In this respect, the initial move to the job market can be very challenging. However, as with many possible examples, this isn't an absolute circular cause, since there are some jobs that require no experience, and people can get hired without experience for others in certain cases. In this way, a circular cause and consequence is usually short-circuited by extenuating circumstances.

Mutual contradiction is much akin to No true Scotsman fallacy, but where "No true Scotsman" fallacy assumes the premise wrong in an exception, the circular cause and consequence implies an impossible outcome in an exception. This implication makes circular cause and consequence similar to a Catch-22, where two mutually exclusive premises are required to reach the conclusion, hence the conclusion is impossible.

# 4. Continuum fallacy

The **continuum fallacy** (also called the **fallacy of the beard** , **line drawing fallacy**, **bald man fallacy**, **fallacy of the heap**, and the **sorites fallacy**) is an informal logical fallacy closely related to the sorites paradox, or paradox of the heap. The fallacy causes one to erroneously reject a vague claim simply because it is not as precise as one would like it to be. Vagueness alone does not necessarily imply invalidity.

The fallacy appears to demonstrate that two states or conditions cannot be considered distinct (or do not exist at all) because between them there exists a continuum of states. According to the fallacy, differences in quality cannot result from differences in quantity.

There are clearly reasonable and clearly unreasonable cases in which objects either belong or do not belong to a particular group of objects based on their properties. We are able to take them case by case and designate them as such even in the case of properties which may be vaguely defined. The existence of hard or controversial cases does not preclude our ability to designate members of particular kinds of groups.

## Relation with sorites paradox

Narrowly speaking, the sorites paradox refers to situations where there are many discrete states (classically between 1 and 1,000,000 grains of sand, hence 1,000,000 possible states), while the continuum fallacy refers to situations where there is (or appears to be) a continuum of states, such as temperature – is a room hot or cold? Whether any continua exist in the physical world is the classic question of atomism, and while Newtonian physics models the world as continuous, in modern quantum physics, notions of continuous length break down at the Planck length, and thus what appear to be continua may, at base, simply be very many discrete states.

For the purpose of the continuum fallacy, one assumes that there is in fact a continuum, though this is generally a minor distinction: in general, any argument against the sorites paradox can also be used against the continuum fallacy. One argument against the fallacy is based on the simple counterexample: there do exist bald people and people who aren't bald. Another argument is that for each degree of change in states, the degree of the condition changes slightly, and these "slightly"s build up to shift the state from one category to another. For example, perhaps the addition of a grain of rice causes the total group of rice to be "slightly more" of a heap, and enough "slightly"s will certify the group's heap status.

## Examples

### Fred can never be called bald

Fred can never be called bald. Fred isn't bald now, however if he loses one hair, that won't make him go from not bald to bald either. If he loses one more hair after that, then

this one loss, also does not make him go from not bald to bald. Therefore, no matter how much hair he loses, he can never be called bald.

### The heap

The fallacy can be described in the form of a conversation:

Q: Does one grain of wheat form a heap?
A: No.
Q: If we add one, do two grains of wheat form a heap?
A: No.
Q: If we add one, do three grains of wheat form a heap?
A: No.
...
Q: If we add one, do one hundred grains of wheat form a heap?
A: No.
Q: Therefore, no matter how many grains of wheat we add, we will never have a heap. Therefore, heaps don't exist!

### Others

Other uses of this fallacy seem to prove that:

- No man has a beard, no matter how long it is (or every post-pubescent male has a beard, no matter how cleanly shaven) because a beard can have varying lengths.
- A room is never either "hot" or "cold", because of the continuum of temperatures.

# 5. Correlation does not imply causation

"**Correlation does not imply causation**" is a phrase used in statistics to emphasize that correlation between two variables does not automatically imply that one causes the other (though correlation is necessary for linear causation, and can indicate possible causes or areas for further investigation... in other words, correlation can be a hint).

The opposite belief, correlation proves causation, is a logical fallacy by which two events that occur together are claimed to have a cause-and-effect relationship. The fallacy is also known as **cum hoc ergo propter hoc** (Latin for "with this, therefore because of this") and false cause. By contrast, the fallacy post hoc ergo propter hoc requires that one event occur before the other and so may be considered a type of cum hoc.

In a widely-studied example, numerous epidemiological studies showed that women who were taking combined hormone replacement therapy (HRT) also had a lower-than-average incidence of coronary heart disease (CHD), leading doctors to propose that HRT was protective against CHD. But randomized controlled trials showed that HRT caused a small but statistically significant increase in risk of CHD. Re-analysis of the data from

the epidemiological studies showed that women undertaking HRT were more likely to be from higher socio-economic groups (ABC1), with better than average diet and exercise regimes. The use of HRT and decreased incidence of coronary heart disease were coincident effects of a common cause (i.e., the benefits associated with a higher socioeconomic status), rather than cause and effect as had been supposed.

## Usage

In logic, the technical use of the word "implies" means "to be a sufficient circumstance". This is the meaning intended by statisticians when they say causation is not certain. Indeed, p implies q has the technical meaning of logical implication: if p then q symbolized as $p \rightarrow q$. That is "if circumstance p is true, then q necessarily follows." In this sense, is always correct to say "Correlation does not imply causation".

However, in casual use, the word "imply" loosely means suggests rather than requires. The idea that correlation and causation are connected is certainly true; where there is causation, there is likely to be correlation. Indeed, correlation is used when inferring causation; the important point is that such inferences are not always correct because there are other possibilities, as explained later here.

Edward Tufte, in a criticism of the brevity of Microsoft PowerPoint presentations, deprecates the use of "is" to relate correlation and causation (as in "Correlation is not causation"), citing its inaccuracy as incomplete. While it is not the case that correlation is causation, simply stating their nonequivalence omits information about their relationship. Tufte suggests that the shortest true statement that can be made about causality and correlation is one of the following:

- "Empirically observed covariation is a necessary but not sufficient condition for causality."
- "Correlation is not causation but it sure is a hint."

## General pattern

The cum hoc ergo propter hoc logical fallacy can be expressed as follows:

1. A occurs in correlation with B.
2. Therefore, A causes B.

In this type of logical fallacy, one makes a premature conclusion about causality after observing only a correlation between two or more factors. Generally, if one factor (A) is observed to only be correlated with another factor (B), it is sometimes taken for granted that A is causing B even when no evidence supports it. This is a logical fallacy because there are at least five possibilities:

1. A may be the cause of B.
2. B may be the cause of A.

3. some unknown third factor C may actually be the cause of both A and B.
4. there may be a combination of the above three relationships. For example, B may be the cause of A at the same time as A is the cause of B (contradicting that the only relationship between A and B is that A causes B). This describes a self-reinforcing system.
5. the "relationship" is a coincidence or so complex or indirect that it is more effectively called a coincidence (i.e. two events occurring at the same time that have no direct relationship to each other besides the fact that they are occurring at the same time). A larger sample size helps to reduce the chance of a coincidence, unless there is a systematic error in the experiment.

In other words, there can be no conclusion made regarding the existence or the direction of a cause and effect relationship only from the fact that A and B are correlated. Determining whether there is an actual cause and effect relationship requires further investigation, even when the relationship between A and B is statistically significant, a large effect size is observed, or a large part of the variance is explained.

## Examples

### B causes A (reverse causation)

The more firemen fighting a fire, the bigger the fire is going to be.
Therefore firemen cause fire.

The above example is simple and easy to understand. The strong correlation between the number of firemen at a scene and the size of the fire that is present does not imply that the firemen cause the fire. Firemen are sent according to the severity of the fire and if there is a large fire, a greater number of firemen are sent; therefore it is rather that fire causes firemen to arrive at the scene.

### A causes B and B causes A (bidirectional causation)

Increased pressure results in increased temperature.
Therefore pressure causes temperature.

The ideal gas law, PV = nRT, describes the direct relationship between pressure and temperature (along with other factors) to show that there is a direct correlation between the two properties. For a fixed volume, an increase in temperature will cause an increase in pressure; likewise, increased pressure will cause an increase in temperature. This demonstrates (4) in that the two are directly proportional to each other and not independent functions.

### Third factor C (the common-causal variable) causes both A and B

All these examples deal with a lurking variable, which is simply a hidden third variable that affects both clauses of the correlation; for example, the fact that it is summer in Example 3. A difficulty often also arises where the third factor, though fundamentally

different from A and B, is so closely related to A and/or B as to be confused with them or very difficult to scientifically disentangle from them (see Example 4).

Example 1
Sleeping with one's shoes on is strongly correlated with waking up with a headache.
Therefore, sleeping with one's shoes on causes headache.

The above example commits the correlation-implies-causation fallacy, as it prematurely concludes that sleeping with one's shoes on causes headache. A more plausible explanation is that both are caused by a third factor, in this case going to bed drunk, which thereby gives rise to a correlation.

Example 2
Young children who sleep with the light on are much more likely to develop myopia in later life.

The former is a recent scientific example that resulted from a study at the University of Pennsylvania Medical Center. Published in the May 13, 1999 issue of Nature, the study received much coverage at the time in the popular press. However, a later study at The Ohio State University did not find that infants sleeping with the light on caused the development of myopia. It did find a strong link between parental myopia and the development of child myopia, also noting that myopic parents were more likely to leave a light on in their children's bedroom. In this case, the cause of both conditions is parental myopia.

Example 3
As ice cream sales increase, the rate of drowning deaths increases sharply.
Therefore, ice cream causes drowning.

The aforementioned example fails to recognize the importance of time in relationship to ice cream sales. Ice cream is sold during the summer months at a much greater rate, and it is during the summer months that people are more likely to engage in activities involving water, such as swimming. The increased drowning deaths are simply caused by more exposure to water based activities, not ice cream.

Example 4

A hypothetical study shows a relationship between test anxiety scores and shyness scores, with a statistical r value (strength of correlation) of +.59. Therefore, it may be simply concluded that shyness, in some part, causally influences test anxiety. However, as encountered in many psychological studies, another variable, a "self-consciousness score," is discovered which has a sharper correlation (+.73) with shyness. This suggests a possible "third variable" problem, however, when three such closely related measures are found, it further suggests that each may have bidirectional tendencies, being a cluster of correlated values each influencing one another to some extent.

## Coincidence

With a decrease in the number of pirates, there has been an increase in global warming over the same period.
Therefore, global warming is caused by a lack of pirates.

The example above is used satirically by the parody religion Pastafarianism to illustrate the logical fallacy of assuming that correlation equals causation.

Since the 1950s, both the atmospheric $CO_2$ level and crime levels have increased sharply. Hence, atmospheric $CO_2$ causes crime.

The above example arguably makes the mistake of prematurely concluding a causal relationship where the relationship between the variables, if any, is so complex it may be labeled coincidental. The two events have no simple relationship to each other beside the fact that they are occurring at the same time. Another possible example is the somewhat jocular Mierscheid Law.

## Determining causation

David Hume argued that causality is based on experience, and experience similarly based on the assumption that the future models the past, which in turn can only be based on experience – leading to circular logic. In conclusion he asserted that causality is not based on actual reasoning: only correlation can actually be perceived.

Intuitively, causation seems to require not just a correlation, but a counterfactual dependence. Suppose that a student performed poorly on a test and guesses that the cause was his not studying. To prove this, one thinks of the counterfactual – the same student writing the same test under the same circumstances but having studied the night before. If one could rewind history, and change only one small thing (making the student study for the exam), then causation could be observed (by comparing version 1 to version 2). Because one cannot rewind history and replay events after making small controlled changes, causation can only be inferred, never exactly known. This is referred to as the Fundamental Problem of Causal Inference – it is impossible to directly observe causal effects.

A major goal of scientific experiments and statistical methods is to approximate as best as possible the counterfactual state of the world. For example, one could run an experiment on identical twins who were known to consistently get the same grades on their tests. One twin is sent to study for six hours while the other is sent to the amusement park. If their test scores suddenly diverged by a large degree, this would be strong evidence that studying (or going to the amusement park) had a causal effect on test scores. In this case, correlation between studying and test scores would almost certainly imply causation.

Well-designed experimental studies replace equality of individuals as in the previous example by equality of groups. This is achieved by randomization of the subjects to two or more groups. Although not a perfect system, the likeliness of being equal in all aspects

rises with the number of subjects placed randomly in the treatment/placebo groups. From the significance of the difference of the effect of the treatment vs. the placebo, one can conclude the likeliness of the treatment having a causal effect on the disease. This likeliness can be quantified in statistical terms by the P-value.

# 6. Fallacy of the single cause

The **fallacy of the single cause**, also known as **joint effect** or **causal oversimplification**, is a logical fallacy of causation that occurs when it is assumed that there is a single, simple cause of an outcome when in reality it may have been caused by a number of only jointly sufficient causes.

Often after a tragedy it is asked, "What was the cause of this?" Such language implies that there is one cause, when instead there were probably a large number of contributing factors. However, having produced a list of several contributing factors, it may be worthwhile to look for the strongest of the factors, or a single cause underlying several of them. A need for simplification may be perceived in order to make the explanation of the tragedy operational, so that responsible authorities can be seen to have taken action.

For instance, after a school shooting, editorialists debate whether it was caused by the shooter's parents, TV violence, stress on students, Hollywood or the accessibility of guns. In fact, many different causes — including some of those — may all have necessarily contributed. Similarly, the music industry might claim that peer-to-peer file sharing is the cause of a loss in profit whereas factors such as a growing videogame market and economic depression are also likely to be major factors.

Causal oversimplification is a specific kind of false dilemma where conjoint possibilities are ignored. In other words, the possible causes are assumed to be "A or B or C" when "A and B and C" or "A and B and not C" (etc.) are not taken into consideration.

The fallacy is alluded to (and refuted) in the 2001 film Ocean's Eleven:

**Tess**: You know what your problem is?
**Danny**: I only have one?

A notable scientific example of what can happen when this kind of fallacy is identified and resolved is the development in economics of the Coase theorem.

# 7. Fallacy of quoting out of context

The practice of **quoting out of context**, sometimes referred to as "**contextomy**" or "**quote mining**", is a logical fallacy and a type of false attribution in which a passage is removed from its surrounding matter in such a way as to distort its intended meaning.

Arguments based on this fallacy typically take two forms. As a straw man argument, which is frequently found in politics, it involves quoting an opponent out of context in order to misrepresent their position (typically to make it seem more simplistic or extreme) in order to make it easier to refute. As an appeal to authority, it involves quoting an authority on the subject out of context, in order to misrepresent that authority as supporting some position.

## Contextomy

Contextomy refers to the selective excerpting of words from their original linguistic context in a way that distorts the source's intended meaning, a practice commonly referred to as "quoting out of context". The problem here is not the removal of a quote from its original context (as all quotes are) per se, but to the quoter's decision to exclude from the excerpt certain nearby phrases or sentences (which become "context" by virtue of the exclusion) that serve to clarify the intentions behind the selected words. Comparing this practice to surgical excision, historian Milton Mayer coined the term "contextomy" to describe its use by Julius Streicher, editor of the infamous Nazi broadsheet Der Stürmer in Weimar-era Germany. To arouse anti-semitic sentiments among the weekly's working class Christian readership, Streicher regularly published truncated quotations from Talmudic texts that, in their shortened form, appear to advocate greed, slavery, and ritualistic murder. Although rarely employed to this malicious extreme, contextomy is a common method of misrepresentation in contemporary mass media, and studies have demonstrated that the effects of this misrepresentation can linger even after the audience is exposed to the original, in context, quote.

## Contextomy in advertising

One of the most familiar examples of contextomy is the ubiquitous "review blurb" in advertising. The lure of media exposure associated with being "blurbed" by a major studio may encourage some critics to write positive reviews of mediocre movies. However, even when a review is negative overall, studios have few reservations about excerpting it in a way that misrepresents the critic's opinion. For example, the ad copy for New Line Cinema's 1995 thriller Se7en attributed to Owen Gleiberman, a critic for Entertainment Weekly, used the comment "a small masterpiece." Gleiberman actually gave Se7en a B− overall and only praised the opening credits so grandiosely: "The credit sequence, with its jumpy frames and near-subliminal flashes of psychoparaphernalia, is a small masterpiece of dementia." Similarly, United Artists contextomized critic Kenneth Turan's review of their flop Hoodlum, including just one word from it — "irresistible" — in the film's ad copy: "Even Laurence Fishburne's incendiary performance can't ignite Hoodlum, a would-be gangster epic that generates less heat than a nickel cigar. Fishburne's 'Bumpy' is fierce, magnetic, irresistible even… But even this actor can only do so much." As a result of these abuses, some critics now deliberately avoid colorful language in their reviews.

The European Union's Unfair Commercial Practices Directive prohibits contextomy, and targets companies who "falsely claim accreditation" for their products in ways that are

"not being true to the terms of the [original] endorsement". It will be enforced in the United Kingdom by the Office of Fair Trading, and carries a maximum penalty there of a £5,000 fine or two years imprisonment.

## Quote mining and the creation-evolution controversy

Scientists and their supporters used the term quote mining as early as the mid-1990s in newsgroup posts to describe quoting practices of certain creationists. It is used by members of the scientific community to describe a method employed by creationists to support their arguments, though it can be and often is used outside of the creation-evolution controversy. Complaints about the practice predate known use of the term: Theodosius Dobzhansky wrote in his famous 1973 essay "Nothing in Biology Makes Sense Except in the Light of Evolution" that

Their [Creationists'] favorite sport is stringing together quotations, carefully and sometimes expertly taken out of context, to show that nothing is really established or agreed upon among evolutionists. Some of my colleagues and myself have been amused and amazed to read ourselves quoted in a way showing that we are really antievolutionists under the skin.

The Institute for Creation Research (ICR) described the use of "[a]n evolutionist's quote mistakenly used out of context" to "negate the entirety of [an] article and creationist claims regarding the lack of transitional forms" as "a smoke screen".

Both Answers in Genesis (AiG) and Henry M. Morris (founder of ICR) have been accused of producing books of mined quotes. TalkOrigins Archive (TOA) states that "entire books of these quotes have been published" and lists prominent creationist Henry M. Morris' That Their Words May Be Used Against Them and The Revised Quote Book (published by Creation Science Foundation, now AiG, and available from the AiG website) as examples, in addition to a number of online creationist lists of quote-mines. Both AiG and ICR quote mine Stephen Jay Gould on intermediate forms.

## Stephen Jay Gould on intermediate forms

The fossil record with its abrupt transitions offers no support for gradual change. All paleontologists know that the fossil record contains precious little in the way of intermediate forms; transitions between major groups are characteristically abrupt

– Stephen Jay Gould

The full context shows that Gould only states this argument in order to reject it:

Although I reject this argument (for reasons discussed in ["The Episodic Nature of Evolutionary Change"]), let us grant the traditional escape and ask a different question.

Knowing that creationists are quoting him as if he were promoting this position, Gould responded with this scathing remark:

Since we proposed punctuated equilibria to explain trends, it is infuriating to be quoted again and again by creationists -- whether through design or stupidity, I do not know -- as admitting that the fossil record includes no transitional forms. The punctuations occur at the level of species; directional trends (on the staircase model) are rife at the higher level of transitions within major groups.

## "Absurd in the highest degree"

Since the mid-1990s, scientists and their supporters have used the term quote mining to describe versions of this practice as used by certain creationists in the creation-evolution controversy. An example found in debates over evolution is an out-of-context quotation of Charles Darwin in his Origin of Species:

To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree.

This sentence, sometimes truncated to the phrase "absurd in the highest degree", is often presented as part of an assertion that Darwin himself perceived his own theory of evolution as absurd. However, Darwin went on to explain that the apparent absurdity of the evolution of an eye is no bar to its occurrence.

The quote in context is

To suppose that the eye with all its inimitable contrivances for adjusting the focus to different distances, for admitting different amounts of light, and for the correction of spherical and chromatic aberration, could have been formed by natural selection, seems, I freely confess, absurd in the highest degree.

Yet reason tells me, that if numerous gradations from a perfect and complex eye to one very imperfect and simple, each grade being useful to its possessor, can be shown to exist; if further, the eye does vary ever so slightly, and the variations be inherited, which is certainly the case; and if any variation or modification in the organ be ever useful to an animal under changing conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, can hardly be considered real.

—Charles Darwin, Origin of Species

### Other out of context quotations

Besides the creation-evolution controversy, the fallacy of quoting out of context is also used in other areas. In some instances commentators have used the term quote mining, comparing the practice of others with creationist quote mining.

- **Entertainment:** with The Times reporting its frequent abuse by promoters with, for example, "I couldn't help feeling that, for all the energy, razzmatazz and technical wizardry, the audience had been shortchanged" being pared down to "having 'energy, razzmatazz and technical wizardry'".
- **Politics:** in the 2000 United States Republican primary campaign, George W. Bush's campaign screened advertising including a 'warning' from John McCain's "conservative hometown paper" that "It's time the rest of the nation learns about the McCain we know." The paper (The Arizona Republic), however went on to say "There is much there to admire. After all, we have supported McCain in his past runs for office."
- **Pseudohistory:** A book review in The New York Times recounts Lerone Bennett Jr.'s "distortion by omission" in citing a letter from Abraham Lincoln as evidence that he "did not openly oppose the anti-immigrant Know-Nothing Party" because, as Lincoln explained, "they are mostly my old political and personal friends", while omitting to mention that the remainder of the letter describes Lincoln's break with these former Whig Party associates of his, and his anticipation of "painful necessity of my taking an open stand against them."
- **Alternative Medicine:** Analysis of the evidence submitted by the British Homeopathic Association to the House Of Commons Evidence Check On Homeopathy contains many examples of quote mining, where the conclusions of scientific papers were selectively quoted to make them appear to support the efficacy of homeopathic treatment. For example, one paper's conclusion was reported as "There is some evidence that homeopathic treatments are more effective than placebo" without the immediately following caveat "however, the strength of this evidence is low because of the low methodological quality of the trials. Studies of high methodological quality were more likely to be negative than the lower quality studies."

# 8. Moving the goalposts

**Moving the goalposts**, also known as **raising the bar**, is an informal logically fallacious argument in which evidence presented in response to a specific claim is dismissed and some other (often greater) evidence is demanded. In other words, after an attempt has been made to score a goal, the goalposts are moved to exclude the attempt. This attempts to leave the impression that an argument had a fair hearing while actually reaching a preordained conclusion.

The phrase "moving the goalposts" may also refer to feature creep, in which the completion of a product like software is not acknowledged because an evolving list of

required features changes over time. Thus, the goal of "completing" the product for a client may never occur.

### Example

Bella Donna claims that Sybil Antwhisper, her room-mate, is not sharing the housework equitably. Sybil tells Bella to go away and itemize and record who does what household tasks. If Bella can show that she does more housework than Sybil, then Sybil will mend her ways. A week passes and Bella shows Sybil clear evidence that Sybil does not "pull her weight" around the house. Sybil (the advocate) responds: "That's all very well, but I have more work and study commitments than you do – you should do more housework than me... it's the total work of all kinds that matters, not just housework."

In this example the implied agreement between Bella and Sybil at the outset was that the amount of housework done by both parties should be about the same. When Sybil was confronted by the evidence however, she quickly and unilaterally "changed the terms of the debate". She did this because the evidence was against her version of events and she was about to lose the argument on the issue as originally defined. By "moving the goalposts" Sybil is seeking to change the terms of the dispute to avoid a defeat on the original issue in contention.

The term is often used in business to imply bad faith on the part of those setting goals for others to meet, by arbitrarily making additional demands just as the initial ones are about to be met.

Accusations of this form of abuse tend to occur when there are unstated assumptions that are obvious to one party but not to another. For example, killing all the fleas on a cat is very easy without the usually unstated condition that the cat remain alive and in good health.

# 9. Prosecutor's fallacy

The **prosecutor's fallacy** is a fallacy of statistical reasoning made in law where the context in which the accused has been brought to court is falsely assumed to be irrelevant to judging how confident to be in evidence against them with a statistical measure of doubt. If the defendant was selected from a large group because of the evidence under consideration, then this fact should be included in weighing how incriminating that evidence is. Not doing so is a base rate fallacy.

This fallacy usually results in assuming that the prior probability that a piece of evidence would implicate a randomly chosen member of the population is equal to the probability that it would implicate the defendant.

Typical occurrences of the fallacy are described below:

- One form of the fallacy results from misunderstanding conditional probability and neglecting the prior odds of a defendant being guilty before that evidence was introduced. When a prosecutor has collected some evidence (for instance a DNA match) and has an expert testify that the probability of finding this evidence if the accused were innocent is tiny, the fallacy occurs if it is concluded that the probability of the accused being innocent must be comparably tiny. The probability of innocence would only be the same small value if the prior odds of guilt were exactly 1:1. If the accused is otherwise totally unconnected to the case, and is only in the courtroom due to that DNA evidence then we should consider a much lower prior probability of guilt, such as the overall rate of offenders in the populace.

- The fallacy can arise from **multiple testing**, such as when evidence is compared against a large database. The size of the database elevates the likelihood of finding a match by pure chance alone; i.e., DNA evidence is soundest when a match is found after a single directed comparison because the existence of matches against a large database where the test sample is of poor quality (common for recovered evidence) is very likely by mere chance.

The terms "prosecutor's fallacy" and "defense attorney's fallacy" were originated by William C. Thompson and Edward Schumann in the 1987 article Interpretation of Statistical Evidence in Criminal Trials, subtitled The Prosecutor's Fallacy and the Defense Attorney's Fallacy.

## Examples of prosecutor's fallacies

1. **Conditional probability**:

Argument from rarity – Consider this case: a lottery winner is accused of cheating, based on the improbability of winning. At the trial, the prosecutor calculates the (very small) probability of winning the lottery without cheating and argues that this is the chance of innocence. The logical flaw: the prosecutor has failed to account for the low prior probability of winning in the first place.
Mistaking conditional probability for unconditional led to several wrongful convictions of British mothers, accused of murdering two of their children in infancy, where the primary evidence against them was the statistical improbability of two children dying accidentally in the same household (under "Meadow's law"). Though multiple accidental (SIDS) deaths are rare, so are multiple murders; with only the facts of the deaths as evidence, it is the ratio of these (prior) improbabilities that gives the correct "posterior probability" of murder.

2. **Multiple testing**. In another scenario, a crime-scene DNA sample is compared against a database of 20,000 men. A match is found, that man is accused and at his trial, it is testified that the probability that two DNA profiles match by chance is only 1 in 10,000. This does not mean the probability that the suspect is innocent is 1 in 10,000. Since 20,000 men were tested, there were 20,000 opportunities to find a match by chance.

Even if none of the men in the database left the crime-scene DNA, a match by chance to an innocent is more likely than not. The chance of getting at least one match among the records is:

$$1 - \left(1 - \frac{1}{10000}\right)^{20000} \approx 86\%$$

So, this evidence alone is an uncompelling data dredging result. If the culprit was in the database then he and one or more other men would probably be matched; in either case, it would be a fallacy to ignore the number of records searched when weighing the evidence. "Cold hits" like this on DNA databanks are now understood to require careful presentation as trial evidence.

## Mathematical analysis

Finding a person innocent or guilty can be viewed in mathematical terms as a form of binary classification. If E is the observed evidence, and I stands for "accused is innocent" then consider the conditional probabilities:

- P(E|I) is the probability that the "damning evidence" would be observed even when the accused is innocent (a "false positive").
- P(I|E) is the probability that the accused is innocent, despite the evidence E.

With forensic evidence, P(E|I) is tiny. The prosecutor wrongly concludes that P(I|E) is comparatively tiny. (The Lucia de Berk prosecution is accused of exactly this error, for example.) In fact, P(E|I) and P(I|E) are quite different; using Bayes' theorem:

$$P(I|E) = P(E|I) \cdot \frac{P(I)}{P(E)}$$

Where:

- P(I) is the probability of innocence independent of the test result (i.e. from all other evidence) and
- P(E) is the prior probability that the evidence would be observed (regardless of innocence):

$$P(E) = P(E|I) \cdot P(I) + P(E| \sim I) \cdot [1 - P(I)]$$

- P(E|~I) is the probability that the evidence would identify a guilty suspect (not give a false negative). This is usually close to 100%, slightly increasing the inference of innocence over a test without false negatives. That inequality is concisely expressed in terms of odds:

$$\mathrm{Odds}(I|E) \geq \mathrm{Odds}(I) \cdot P(E|I)$$

The prosecutor is claiming a negligible chance of innocence, given the evidence, implying Odds(I|E) -> P(I|E), or that:

$$\mathrm{P}(I|E) \approx P(E|I) \cdot \mathrm{Odds}(I)$$

A prosecutor conflating P(I|E) with P(E|I) makes a technical error whenever Odds(I) >> 1. This may be a harmless error if P(I|E) is still negligible, but it is especially misleading otherwise (mistaking low statistical significance for high confidence).

## Legal impact

In the courtroom, the prosecutor's fallacy typically happens by mistake, but deliberate use of the prosecutor's fallacy is prosecutorial misconduct and can subject the prosecutor to official reprimand, disbarment or criminal punishment.

In the adversarial system, lawyers are usually free to present statistical evidence as best suits their case; retrials are more commonly the result of the prosecutor's fallacy in expert witness testimony or in the judge's summation.

## Defense attorney's fallacy

Suppose there is a one-in-a-million chance of a match given that the accused is innocent. The prosecutor says this means there is only a one-in-a-million chance of innocence. But if everyone in a community of 10 million people is tested, one expects 10 matches even if all are innocent. The defense fallacy would be to reason, "10 matches were expected, so this evidence suggests a 90% chance that the accused is innocent, and has little relevance to the case." Thompson & Schumann wrote that the evidence should still be highly relevant because it "drastically narrows the group of people who are or could have been suspects, while failing to exclude the defendant" (page 171).

A version of this fallacy arose in the O. J. Simpson murder trial: crime scene blood matched Simpson's with characteristics shared by 1 in 400 people. The defense argued that a football stadium could be filled with Angelenos matching the sample, so the evidence was useless. Since there were fewer plausible suspects than the population of Los Angeles, that argument was a fallacy.

## The Sally Clark case

Sally Clark, a British woman who was accused in 1998 of having killed her first child at 11 weeks of age, then conceived another child and allegedly killed it at 8 weeks of age. The prosecution had expert witness Sir Roy Meadow testify that the probability of two children in the same family dying from SIDS is about 1 in 73 million. That was much less frequent than the actual rate measured in historical data - Meadow estimated if from single-SIDS death data, and the assumption that the probability of such deaths should be uncorrelated between infants.

Meadow acknowledged that 1-in-73 million is not an impossibility, but argued that such accidents would happen "once ever hundred years" and that, in a country of 15 million 2-child families, it is vastly more likely that the double-deaths are due to Münchausen syndrome by proxy than to such a rare accident. However, there is good reason to suppose that the likelihood of a death from SIDS in a family is significantly greater if a previous child has already died in these circumstances. (A genetic predisposition to SIDS is likely to invalidate that assumed statistical independence.) making some families more susceptible to SIDS and the error an outcome of the ecological fallacy. The likelihood of two SIDS deaths in the same family cannot be soundly estimated by squaring the likelihood of a single such death in all otherwise similar families.

1-in-73 million greatly underestimated the chance of two successive accidents, but, even if that assessment were accurate, the court seems to have missed the fact that the 1-in-73 million number meant nothing on its own. As an a priori probability, it should have been weighed against the a priori probabilities of the alternatives. Given that two deaths had occurred, one of two possible explanations must be true, and both of these are a priori extremely improbable:

1. Possibility A) Two successive deaths in the same family, both by SIDS.
2. Possibility B) Double homicide (the prosecution's case)

It's unclear that an estimate for the second possibility was ever proposed during the trial, or that the comparison of these two probabilities was understood to be the key estimate to make in the statistical analysis of the case.

Mrs. Clark was convicted in 1999, resulting in a press release by the Royal Statistical Society which pointed out the mistakes.

In 2002, Ray Hill (Mathematics professor at Salford) attempted to accurately compare the chances of these two possible explanations; he concluded that successive accidents are between 4.5 and 9 times more likely than are successive murders, so that the a priori odds of Clark's guilt were between 4.5 to 1 and 9 to 1 against.

A higher court later quashed Sally Clark's conviction, on other grounds, on 29 January 2003. However, Sally Clark never recovered from the court case and later died from alcohol poisoning.

## Chapter- 5

# Faulty Generalizations

# 1. False analogy

**False analogy** is an informal fallacy applying to inductive arguments. It is often mistakenly considered to be a formal fallacy, but it is not, because a false analogy consists of an error in the substance of an argument (the content of the analogy itself), not an error in the logical structure of the argument.

In an analogy, two systems are shown to have common sub-functions and/or properties and therefore additional corresponding sub-functions and/or properties are proposed and shown to exist. This is repeated for all sub-functions until the analogy ultimately fails.

More specifically the assumption of an analogy runs like this: if some system A has some function X and also some function Y, and some system B has a function X′ corresponding to A's function X, then the system B should also have a function Y′ that is analogous to A's function Y.

For instance, a popular analogy is between plumbing and electrical circuits. In plumbing there are sub-functions and properties such as valves and fluid flow rate. These functions and properties have corresponding analogs in electronics such as transistors and electrical current.

Another analogy concerns the gravitational force between two masses and the electrical force between two charges (both are governed by inverse square relations). One might be tempted to create a further analogy between plumbing and the gravitational force. It is difficult to say whether this would be a false analogy since the definition of a true analogy is equally difficult to define. The usefulness of any analogy must lie in the number of analogs it can establish between the functions and properties of two systems.

An example of a false analogy between energy and mass would be to assume that since $E=mc^2$, then energy and mass must be identical. Energy and mass are not identical, energy can travel at the speed of light while mass cannot. Analogies should never be mistaken for establishing an equivalence. Not recognizing the misapplication of analogy can be as potentially disastrous as not recognizing a misapplication of logic.

### Incorrectly classifying an analogy false

Very often people try to refute a correct analogy as a false analogy, often saying "Well, but that's different because", and refer to an existing property that the two things in the analogy indeed do not share. In cases like this, such a refutation is merely a "false charge of fallacy". But as analogies are comparing two different things there are always some properties that A and B do not share, so it is tempting to pull up one such difference to try to disqualify the analogy. For the purposes of the analogy, however, it is important to check if that difference is relevant for the analogy or not.

# 2. Hasty generalization

**Hasty generalization** is a logical fallacy of faulty generalization by reaching an inductive generalization based on insufficient evidence. It commonly involves basing a broad conclusion upon the statistics of a survey of a small group that fails to sufficiently represent the whole population. Its opposite fallacy is called slothful induction, or denying the logical conclusion of an inductive argument (i.e. "it was just a coincidence").

### Examples

Person A travels through Town X for the first time. He sees 10 people, all of them children. Person A returns to his town and reports that there are no adult residents in Town X.

Person A and Person B walk past a pawn shop. Person A remarks that a watch in a window display looks like the one his grandfather used to wear. On the basis of this remark, Person B concludes that:

Person A's grandfather pawned his watch; or
Person A's grandfather had expensive tastes in jewelry; or
Person A's grandfather was ostentatious; or
Person A's grandfather cannot tell the time any more.

Context is also relevant; in mathematics the Pólya conjecture is true for numbers less than 906,150,257, but fails for this number. Assuming something to be true for all numbers when it has been shown for over 906 million cases would not generally be considered hasty, but in mathematics a statement remains a conjecture until it is shown to be universally true.

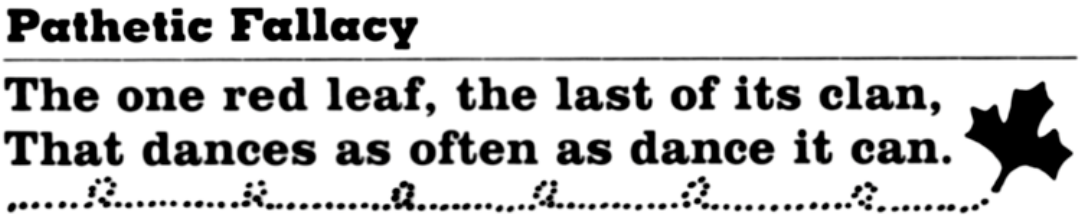
Hasty generalization is also the basis for racist beliefs and prejudices - a person will infer an attribute to be common to all members of a group based on knowledge of only a small sample size of that group. For example, the belief that a given person who is Jewish will be a greedy and nit-picky, the belief because a person is black, (s)he will be loud, poor, and criminal, or the belief that because a person is white, (s)he is lazy, overweight, arrogant, lack style, and have unearned or unwarranted wealth. This includes positive

racist ideologies as well, such as the belief that Asians are better off academically than other racial sectors.

### Alternative names

The fallacy is also known as: **fallacy of insufficient statistics**, **fallacy of insufficient sample**, **fallacy of the lonely fact**, **generalization from the particular**, **leaping to a conclusion**, **hasty induction**, **law of small numbers**, **unrepresentative sample**, and **secundum quid**.

# 3. Pathetic fallacy




A visual illustration of one of the most famous examples of the literary use of the pathetic fallacy, from Samuel Taylor Coleridge's poem Christabel, which was given by Ruskin as an example in his seminal essay Of the Pathetic Fallacy.

The **pathetic fallacy** or **anthropomorphic fallacy** is the treatment of inanimate objects as if they had human feelings, thought, or sensations. The pathetic fallacy is a special case of the fallacy of reification. The word 'pathetic' in this use is related to 'pathos' or 'empathy' (capability of feeling), and is not pejorative.

In the discussion of literature, the pathetic fallacy is similar to personification. Personification is direct and explicit in the ascription of life and sentience to the thing in question, whereas the pathetic fallacy is much broader and more allusive. "Personification" is a more obtrusive and formal use of human traits attributed to natural objects, according to M. H. Abrams.

### History

The term was coined by the critic John Ruskin (1819–1900) in his 1856 work Modern Painters, in which he wrote that the aim of the pathetic fallacy was “to signify any description of inanimate natural objects that ascribes to them human capabilities, sensations, and emotions." In the narrow sense intended by Ruskin, the pathetic fallacy is a scientific failing, since most of his defining paper concerns art, which he maintains ought to be its truthful representation of the world as it appears to our senses, not as it appears in our imaginative and fanciful reflections upon it. However, in the natural

sciences, a pathetic fallacy is a serious error in scientific reasoning if taken literally. M. H. Abrams in A Glossary of Literary Terms says that Ruskin's use of the term "pathetic fallacy" was derogatory.

## In legend

According to legend, when Xerxes was crossing the Hellespont in the midst of the first Greco-Persian War, he built two bridges that were quickly destroyed. Feeling personally offended, his paranoia led him to believe that the sea was consciously acting against him as though it were an enemy. As such Herodotus quotes him as saying "You salt and bitter stream, your master lays his punishment upon you for injuring him, who never injured you. Xerxes will cross you, with or without your permission." He subsequently threw chains into the river, gave it three hundred lashes and "branded it with red-hot irons".

## In literature

Literary critics after Ruskin have generally not followed him in regarding the pathetic fallacy as an artistic mistake, instead assuming that attribution of sentient, humanising traits to inanimate things is a centrally human way of understanding the world, and that it does have a useful and important role in art and literature. Indeed, to reject the use of pathetic fallacy would mean dismissing most Romantic poetry and many of Shakespeare's most memorable images. Literary critics find it useful to have a specific term for describing anthropomorphic tendencies in art and literature and so the phrase is currently used in a neutral sense. Josephine Miles in Pathetic Fallacy in the Nineteenth Century: A Study of a Changing Relation Between Object and Emotion, influenced by William Wordsworth's discussion of the practice, argues that "pathetic bestowal" is a neutral and therefore preferable label. However labeled, the practice occurs in any number of accomplished twentieth-century writers, including William Carlos Williams, Theodore Roethke, Mary Oliver, Eavan Boland, and John Ashbery.

It is a rhetorical figure and a form of personification. In the strictest sense, delivering this fallacy should be done to render analogy. Other reasons to deliver this fallacy are mnemonic.

## Examples

Ruskin quotes a stanza from Alfred, Lord Tennyson's Maud as an "exquisite" example of pathetic fallacy:

There has fallen a splendid tear
  From the passion-flower at the gate.
She is coming, my dove, my dear;
  She is coming, my life, my fate.
The red rose cries, "She is near, she is near;"
  And the white rose weeps, "She is late;"

The larkspur listens, "I hear, I hear;"
And the lily whispers, "I wait." (Part 1, XXII, 10)

In this poem the paradoxical events of flowers and animals talking are an explicit personification of non-human objects.

Other examples are:

- "The stars will awaken / Though the moon sleep a full hour later"—Percy Bysshe Shelley
- "The fruitful field / Laughs with abundance"—William Cowper
- "Nature must be gladsome when I was so happy"—Jane Eyre, by Charlotte Brontë

## Chapter- 6

# Red Herring Fallacies

# 1. Ad hominem

An **ad hominem** (Latin: "to the man"), also known as **argumentum ad hominem**, is an attempt to link the validity of a premise to a characteristic or belief of the person advocating the premise. The ad hominem is a classic logical fallacy, but it is not always fallacious. For in some instances, questions of personal conduct, character, motives, etc., are legitimate and relevant to the issue.

### Types of ad hominems

### Ad hominem abuse

Ad hominem abuse (also called personal abuse or personal attacks) usually involves insulting or belittling one's opponent in order to invalidate his or her argument, but can also involve pointing out factual but ostensible character flaws or actions which are irrelevant to the opponent's argument. This tactic is logically fallacious because insults and even true negative facts about the opponent's personal character have nothing to do with the logical merits of the opponent's arguments or assertions.

**Examples:**

- "You can't believe Jack when he says the proposed policy would help the economy. He doesn't even have a job."
- "Candidate Jane's proposal about zoning is ridiculous. She was caught cheating on her taxes in 2003."

### Ad hominem circumstantial

Ad hominem circumstantial points out that someone is in circumstances such that he is disposed to take a particular position. Ad hominem circumstantial constitutes an attack on the bias of a source. This is fallacious because a disposition to make a certain argument does not make the argument false; this overlaps with the genetic fallacy (an argument that a claim is incorrect due to its source).

Where the source taking a position seeks to convince us by a claim of authority, or personal observation, observation of their circumstances may reduce the evidentiary weight of the claims, sometimes to zero.

**Examples**:

Mandy Rice-Davies's famous testimony during the Profumo Affair, "Well, he would [say that], wouldn't he?", is an example of a valid circumstantial argument. Her point was that since a man in a prominent position, accused of an affair with a callgirl, would deny the claim whether it was true or false, his denial, in itself, carries little evidential weight against the claim of an affair. Note, however, that this argument is valid only insofar as it devalues the denial; it does not bolster the original claim. To construe evidentiary invalidation of the denial as evidentiary validation of the original claim is fallacious (on several different bases, including that of argumentum ad hominem); however likely the man in question would be to deny an affair that did in fact happen, he could only be more likely to deny an affair that never did.

## Ad hominem tu quoque

**Ad hominem tu quoque** (lit: "You too!") refers to a claim that the source making the argument has spoken or acted in a way inconsistent with the argument. In particular, if Source A criticizes the actions of Source B, a tu quoque response is that Source A has acted in the same way. This argument is fallacious because it does not disprove the argument; if the premise is true then Source A may be a hypocrite, but this does not make the statement less credible from a logical perspective. Indeed, Source A may be in a position to provide personal testimony to support the argument.

For example, a father may tell his son not to start smoking as he will regret it when he is older, and the son may point out that his father is or was a smoker. This does not alter the fact that his son may regret smoking when he is older, and the fact his father was a smoker means he can talk from a position of experience.

## Guilt by association

Guilt by association can sometimes also be a type of ad hominem fallacy, if the argument attacks a source because of the similarity between the views of someone making an argument and other proponents of the argument.

This form of the argument is as follows:

Source A makes claim B.
Group C also makes claim B.
Therefore, source A is a member of group C.

### Inverse ad hominem

An **inverse ad hominem** argument praises a source in order to add support for that source's argument or claim. A fallacious inverse ad hominem argument may go something like this:

"That man was smartly-dressed and charming, so I'll accept his argument that I should vote for him"

As with regular ad hominem arguments, not all cases of inverse ad hominem are fallacious. Consider the following:

"Elizabeth has never told a lie in her entire life, and she says she saw him take the bag. She must be telling the truth."

Here the arguer is not suggesting we accept Elizabeth's argument, but her testimony. Her being an honest person is relevant to the truth of the conclusion (that he took the bag), just as her having bad eyesight (a regular case of ad hominem) would give reason not to believe her. However, the last part of the argument is false even if the premise is true, since having never told a lie before does not mean she isn't now.

Appeal to authority is a type of inverse ad hominem argument.

### Common misconceptions

Gratuitous verbal abuse or "name-calling" itself is **not** an ad hominem or a logical fallacy.

# 2. Argumentum ad populum

In logic, an **argumentum ad populum** (Latin: "appeal to the people") is a fallacious argument that concludes a proposition to be true because many or all people believe it; it alleges: "If many believe so, it is so."

This type of argument is known by several names, including **appeal to the masses**, **appeal to belief**, **appeal to the majority**, **appeal to the people**, **argument by consensus**, **authority of the many**, and **bandwagon fallacy**, and in Latin by the names argumentum ad populum ("appeal to the people"), **argumentum ad numerum** ("appeal to the number"), and **consensus gentium** ("agreement of the clans"). It is also the basis of a number of social phenomena, including communal reinforcement and the bandwagon effect, the spreading of various religious beliefs, and of the Chinese proverb "three men make a tiger".

## Examples

This fallacy is sometimes committed while trying to convince a person that a widely popular thought is true.

- Nine out of ten of my constituents oppose the bill, therefore it is a bad idea.
- Nine out of ten of my fellow congressmen favor the bill, therefore it is a good idea.

It is sometimes committed when trying to convince a person that widely unpopular theories are false.

- It's silly for you to claim that Hitler would not have attacked the United States if they hadn't entered World War II. Everyone knows that he planned to conquer the world.

The fallacy is commonly found in arguments over ethics:

- Most people hold that infanticide is morally wrong. Therefore, infanticide is morally wrong.

The fallacy is also common in marketing:

- Brand X vacuum cleaners are the leading brand in America. You should buy Brand X vacuum cleaners.
- Watch Show X - the #1 watched show on television!

Other examples:

- Fifty million Elvis fans can't be wrong.
- All of my friends are doing it.
- In a court of law, the jury vote by majority, therefore they will always make the correct decision.
- Google gives more hits when this spelling is applied, therefore this has to be the correct spelling.
- Most analysts consider Enron Corporation a well-run company with excellent management, so its common stock is a good investment.
- Everyone jaywalks here and as long as I look carefully, nothing will happen.
- Find me anyone who shares your preposterous notion that the Earth orbits the Sun!
- 12 million people play World of Warcraft, so it must be the best video game ever.

## Explanation

The argumentum ad populum is a red herring and genetic fallacy. It appeals on probabilistic terms; given that 75% of a population answer A to a question where the

answer is unknown, the argument states that it is reasonable to assume that the answer is indeed A. In cases where the answer can be known but is not known by a questioned entity, the appeal to majority provides a possible answer with a relatively high probability of correctness.

There is the problem of determining just how many are needed to have a majority or consensus. Is 50 percent plus one person significant enough and why? Should the percentage be larger, such as 80 or 90 percent, and how does that make a real difference? Is there real consensus if there are one or even two people who have a different claim that is proven to be true?

It is logically fallacious because the mere fact that a belief is widely-held is not necessarily a guarantee that the belief is correct; if the belief of any individual can be wrong, then the belief held by multiple persons can also be wrong. The argument that because 75% of people polled think the answer is A implies that the answer is A, this argument fails, because if opinion did determine truth, then there be no way to deal with the discrepancy between the 75% of the sample population that believe the answer is A and 25% who are of the opinion that the answer is not A. However small the percentage of those polled is distributed among any remaining answers, this discrepancy by definition disproves any guarantee of the correctness of the majority. In addition, this would be true even if the answer given by those polled were unanimous, as the sample size may be insufficient, or some fact may be unknown to those polled that, if known, would result in a different distribution of answers.

This fallacy is similar in structure to certain other fallacies that involve a confusion between the justification of a belief and its widespread acceptance by a given group of people. When an argument uses the appeal to the beliefs of a group of supposed experts, it takes on the form of an appeal to authority; if the appeal is to the beliefs of a group of respected elders or the members of one's community over a long period of time, then it takes on the form of an appeal to tradition.

One who commits this fallacy may assume that individuals commonly analyze and edit their beliefs and behaviors.

The argumentum ad populum can be a valid argument in inductive logic; for example, a poll of a sizeable population may find that 90% prefer a certain brand of product over another. A cogent (strong) argument can then be made that the next person to be considered will also prefer that brand, and the poll is valid evidence of that claim. However, it is unsuitable as an argument for deductive reasoning as proof, for instance to say that the poll proves that the preferred brand is superior to the competition in its composition or that everyone prefers that brand to the other.

## Evidence

- One could claim that smoking is a healthy pastime, since millions of people do it. However, knowing the dangers of smoking, we instead say that smoking is not a healthy pastime despite the fact that millions do it.
- One could claim Brad Pitt is the best-looking man in the world, because he is regularly voted as such, although the sample he is part of (celebrities) is insufficient.
- One could claim that slavery is morally justified if the majority of people within society support it, or at least do not oppose it.

## Exceptions

Appeal to belief is valid only when the question is whether the belief exists. Appeal to popularity is therefore valid only when the questions are whether the belief is widespread and to what degree. I.e., ad populum only proves that a belief is popular, not that it is true. In some domains, however, it is popularity rather than other strengths that makes a choice the preferred one.

## Democracy

The "correctness" of electoral processes lies in the prior acceptance by the electorate that the outcome of an election shall be enacted no matter what it is.

"Most of the voting members at the last Rotary Club meeting thought that the Club should hold a fund-raiser in October. Therefore, the Club shall hold a fund-raiser in October."

Democracy is based on appeal to popularity. As a means of determining the truth of beliefs, it is fallacious. Democracy does not obviate this; it merely makes the fallacy irrelevant as correctness is defined by popularity in its case (possibly subject to constitutional restrictions).

Argumentum ad populum explains how some democracies (e.g. Nazi Germany, Fascist Italy) have fallen victim to the tyranny of the majority.

The following argument is an Appeal to consequences:

1. Most people of the country "A" may have wrong wills.
2. These wrong wills may have very bad consequences.
3. Therefore governing the country "A" based on the wills of most of its people is wrong.

Similarly fallacious is the following argument:

1. A human being may have wrong wills.

2. These wrong wills may have very bad consequences.
3. Therefore for human beings, having a free will is wrong.

In the statement 3, free will means the ability of a human being to act based on his/her right or wrong wills.

## Social convention

Matters of social convention, such as etiquette or polite manners, depend upon the wide acceptance of the convention. As such, argumentum ad populum is not fallacious when referring to the popular belief about what is polite or proper:

"Most people in Russia think that it is polite for men to kiss each other in greeting. Therefore, it is polite for men to kiss each other in greeting in Russia."

Social conventions can change, however, and sometimes very quickly. Thus, the fact that everyone in Russia this year thinks that it is polite to kiss can not be used as evidence that everyone always believed that, or that they should always believe it.

The philosophical question of moral relativism asks whether such arguments apply to statements of morals.

## Safety

Whether to follow a tenet decided by popularity rather than logical design may be a matter of safety or convenience:

"Nearly all Americans think that you should drive on the right side of the road. Therefore, you should drive on the right side of the road in the United States."

In this case, the choice of which side to drive on is basically arbitrary. However, to avoid head-on collisions, everyone on the road must agree on it. In many cases, what is safe to do depends on what others expect one will do, and thus on the "popularity" of that choice.

## Language

Linguistic descriptivists argue that correct grammar, spelling, and expressions are defined by the language's speakers, especially in languages which do not have a central governing body. According to this viewpoint, if an incorrect expression is commonly used, it becomes correct. In contrast, linguistic prescriptivists believe that incorrect expressions are incorrect regardless of how many people use them.

## Reversals

In some circumstances, a person may argue that the fact that the majority of a people believes X implies that X is false. This line of thought is closely related to the ad

hominem, appeal to emotion, poisoning the well, and guilt by association fallacies given that it invokes a person's contempt for the general populace or something about the general populace in order to persuade them that the majority is wrong about X. The ad populum reversal commits exactly the same logical flaw as the original fallacy given that the idea "X is true" is inherently separate from the idea that "Most people believe X".

For example, consider the arguments:

- "Most of your fellow Americans ignorantly think that the Earth is only 5000 years old and you're going to believe in God just like they do?"
- "Are you going to be a mindless conformist drone drinking milk and water like everyone else, or will you wake up and drink my product?"
- "Everyone likes The Beatles and that probably means that they didn't have nearly as much talent as <Y band>, which didn't sell out."
- "The German people today consists of the Auschwitz generation, with every person in power being guilty in some way. How on earth can we buy the generally held propaganda that the Soviet Union is imperialistic and totalitarian? Clearly, it must not be."
- "Most people still either hate gays or just barely tolerate their existence. How can you still buy their other line that claims that pederasty is wrong?"
- "Everyone loves <A actor>. <A actor> must be nowhere near as talented as the devoted and serious method actors that aren't so popular like <B actor>."

In general, the reversal usually goes: Most people believe A and B are both true. B is false. Thus, A is false. Chronological snobbery is the claim that if belief in both X and Y was popularly held in the past and if Y was recently proved to be untrue then X must also be untrue. That line of argument is based on a belief in historical progress and not—like the ad populum reversal is—on whether or not X and/or Y is currently popular.

# 3. Association fallacy

An **association fallacy** is an inductive informal fallacy of the type hasty generalization or red herring which asserts that qualities of one thing are inherently qualities of another, merely by an irrelevant association. The two types are sometimes referred to as **guilt by association** and **honor by association**. Association fallacies are a special case of red herring, and can be based on an appeal to emotion.

## Form

In notation of first-order logic, this type of fallacy can be expressed as $(\exists x \in S : \varphi(x)) \rightarrow (\forall x \in S : \varphi(x))$, meaning "if there exists any x in the set S so that a property φ is true for x, then for **all** x in S the property φ must be true."

**Premise** A is a B
**Premise** A is also a C

**Conclusion** Therefore, all Bs are Cs

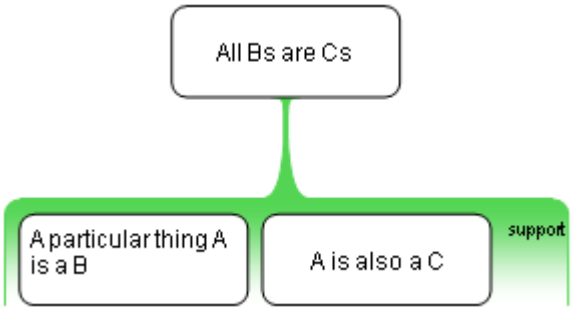



Fig. 1

The fallacy in the argument can be illustrated through the use of an Euler diagram:

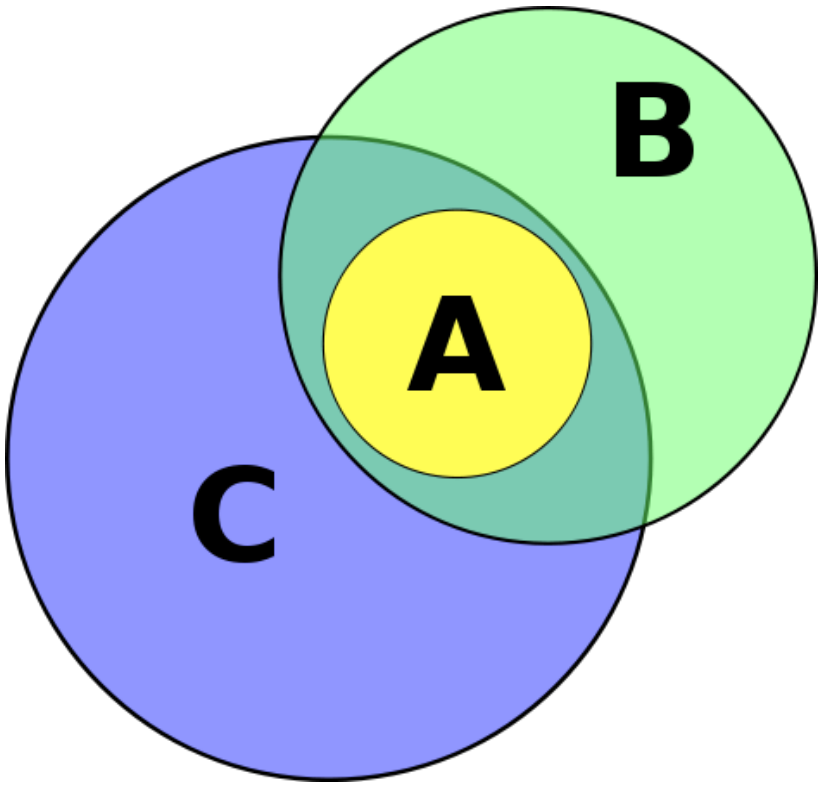



Fig. 2

"A" satisfies the requirement that it is part of both sets "B" and "C", but one can clearly see that it is possible that a part of set "B" is not part of set "C", refuting the conclusion that "all Bs are Cs".

## Guilt by association

### Examples

Some syllogistic examples of guilt by association are:

- John is a con artist. John has black hair. Therefore, all people with black hair are con artists.
- Jane is good at math. Jane is dyslexic. Therefore, all dyslexic people are good at math.
- All dogs have four legs; my cat has four legs. Therefore, my cat is a dog. (This argument is made by the wordplay-prone Sir Humphrey Appleby in the BBC sitcom Yes, Prime Minister).

### Guilt by association as an ad hominem fallacy

Guilt by association can sometimes also be a type of ad hominem fallacy, if the argument attacks a person because of the similarity between the views of someone making an argument and other proponents of the argument.

This form of the argument is as follows:

A makes claim P.
Bs also make claim P.
Therefore, A is a B.

Example I: Social justice is a philosophy shared by Nazis and Communists, therefore churches that teach social justice are equivalent to Marxists and Fascists.

Example II: George claims deportation is good immigration enforcement policy. therefore, George is a Zionist.

## Honor by association

The logical inverse of "guilt by association" is **honor by association**, where one claims that someone or something must be reputable because of the people or organizations that are related to it or otherwise support it. For example:

### Examples

- Citizens of Country X have won more Nobel Prizes/gold medals/literary awards than citizens of Country Y. Therefore, a citizen of Country X is superior to a citizen of Country Y.
- The entire advertising business heavily uses the principle of honor by association. For example, a beautiful woman says with an attractive voice that a certain

laundry detergent is good. Her attractiveness gives the laundry detergent good associations.

# 4. Argument from authority

**Appeal to authority** is a fallacy of defective induction, where it is argued that a statement is correct because the statement is made by a person or source that is commonly regarded as authoritative. The most general structure of this argument is:

1. Source A says that p is true.
2. Source A is authoritative.
3. Therefore, p is true.

This is a fallacy because the truth or falsity of the claim is not necessarily related to the personal qualities of the claimant, and because the premises can be true, and the conclusion false (an authoritative claim can turn out to be false). It is also known as **argumentum ad verecundiam** (Latin: argument to respect) or ipse dixit (Latin: he himself said it).

On the other hand, arguments from authority are an important part of informal logic. Since we cannot have expert knowledge of many subjects, we often rely on the judgments of those who do. There is no fallacy involved in simply arguing that the assertion made by an authority is true. The fallacy only arises when it is claimed or implied that the authority is infallible in principle and can hence be exempted from criticism.

## Origin of the expression

The Latin word verecundia means modesty or shyness, and argumentum ad vercundiam means literally 'argument towards modesty', though the phrase is normally rendered in English as Argument from Authority.

The expression was invented by John Locke, who explained the meaning of the term as follows: "When men are established in any kind of dignity, it is thought a breach of 'modesty' for others to derogate any way from it, and question the authority of men who are in possession of it."

## Forms

There are two basic forms of appeal to authority, based on the authority being trusted. The more relevant the expertise of an authority, the more compelling the argument. Nonetheless, authority is never absolute, so all appeals to authority which assert that the authority is necessarily infallible are fallacious.

The first form of the appeal to authority is when a source presenting a position on a subject mentions some authority who also holds that position, but who is not actually an authority in that area. For instance, the statement "Arthur C. Clarke released a report showing it is necessary to floss three times daily" should not convince many people of anything about flossing, as Clarke, a science fiction writer, was not a known expert on dental care. Much advertising relies on this logical fallacy in the form of endorsements and sponsorships. A sportsperson or actor, for example, is no more likely than average to have any special knowledge of watches or perfume, but their endorsement of a particular brand of watch or perfume is very valuable in advertising terms. Alternatively they may not be experts in the relevant part of the field (for example, an expert in litigation may not be an expert on trust law or commercial law even though they are indeed a civil lawyer). In some cases, the advertisers use an actor's well-known role to imply that the person has authority in an area; an actor who plays a doctor on television may appear in their white coat, and endorse a drug or health product.

The second form, citing a source who is actually an authority in the relevant field, carries more subjective, cognitive weight. A person who is recognized as an expert authority often has greater experience and knowledge of their field than the average person, so their opinion is more likely than average to be correct. In practical subjects such as car repair, an experienced mechanic who knows how to fix a certain car will be trusted to a greater degree than someone who is not an expert in car repair. There are many cases where one must rely on an expert, and cannot be reasonably expected to have the same experience, knowledge and skill that that person has. Many trust a surgeon without ever needing to know all the details about surgery themselves. Nevertheless, experts can still be mistaken, wilfully deceptive, subject to pressure from peers or employers, have a vested financial interest in the false statements, or have unusual views (or views that are widely criticized by other experts) within their field, and hence their expertise does not always guarantee that their arguments are valid.

In some cases, the appeal to authority plays on the Western culture's respect for credentials. For example, suppose a complex nutritional system and diet guide is endorsed or ghostwritten and credited to a qualified doctor. While a doctor does receive general training on nutrition and diet, they may not be an expert on nutrition and diet, a field for which an expert will often possess PhDs in nutrition and certification as a dietician. The same technique is used with the PhD degree; an advertiser may reinforce their claims about a product by appending an endorsement from John Doe, PhD, but without stating what area the PhD is in. If the product being endorsed is foot powder, and Dr. Doe studied podiatry, the endorsement carries some weight, but if he studied film criticism, he may have no more than average knowledge of the product and its merits.

In mathematics, the second form, especially when the appellant is himself the authority, is wryly referred to as "proof by tenure".

A related fallacy is appeal to accomplishment, in which Person A claims that Person B cannot criticize Person C, because Person B lacks the authority to criticize, as evidenced by an absence of accomplishments equivalent to those of Person C. It is a restated version

of the second form of argument from authority, though adding the assumption that accomplishments bring about authority (thereby begging the question).

## Appeal to authority as logical fallacy

A (fallacious) appeal to authority argument has the basic form:

1. A makes claim B;
2. there is something positive about A that (fallaciously) is used to imply that A has above-average or expert knowledge in the field, or has an above-average authority to determine the truth or rightness of such a matter
3. therefore claim B is true, or has its credibility unduly enhanced as a result of the proximity and association.

The first statement is called a 'factual claim' and is the pivot point of much debate. The last statement is referred to as an 'inferential claim' and represents the reasoning process. There are two types of inferential claim, explicit and implicit.

The converse, that (fallaciously) relies on something negative about the source and claims that therefore the conclusion is probably false, is called an ad hominem argument.

## Examples of appeals to authority

### Arguments

- Referring to the philosophical beliefs of Aristotle: "If Aristotle said it was so, it is so."
- Referring to the philosophical beliefs of Jesus, Muhammad, or any other religious figure: "If (religious figure) said it was so, it is so." Such an appeal may be based upon the belief that the speaker in question is holy and, by extension, inerrant. Alternately, the figure may be considered to be an expert on the given subject: "Buddha was a great moral teacher and he said that euthanasia is wrong, so it must be wrong."
- Referring to a sacred text: "If (the text) said it was so, it is so." Like in the previous example, such an appeal may be based upon the belief that the sacred text in question is inerrant. This argument may also present a false dilemma situation, where the text can be interpreted in multiple dissimilar ways.
- Referring to a famous text or work: "Democracy in America criticized American political party division, so we ought to promote bipartisanship."
- Quoting a well-known personage: "As Samuel Johnson said, patriotism is the last refuge of the scoundrel." Implying that, therefore, patriotism is always bad. (The term "patriot" was used at the time by radical followers of John Wilkes, whom the conservative Johnson opposed); or "There is no need to critically examine Plan A because [person's name] is in favour of it, and [person's name] is [experienced, knowledgeable, respected] in this field."

- Referring to what one is told by one's teacher and/or parent: "My teacher said so, therefore it must be so."
- Believing something because it is attributed to an honored profession, as in: "This **doctor** recommends (brand-name) aspirin" or "**Bankers** recommend that people have six months' wages in a savings account".
- Appealing to some reference or citation from a famous book or author without considering the actual truth of the citation. References in no way ensure, without any doubt, that the claim is true. References simply show where the information or claim possibly originated and to avoid plagiarism.
- Appeals to various well known opinion poll firms that are assumed to have collected the best data from a large enough sample, and that there were no leading questions.

### The nature of the fallacy

An appeal to authority cannot guarantee the truth of the conclusion, given the nature of truth and the Consensus theory of truth, because the fact that an authority says something does not necessarily make it so. The fact that, objectively, a proposition is in fact true or that it has good unrelated arguments supporting it will be what makes authorities believe it to be true. The fallacy comes in when the opposite situation occurs, with authority opinions leading to the belief itself. Thus, an appeal to authority confuses cause and effect.

As with all logical fallacies, the fact that an argument is an appeal to authority does not make its conclusion untrue (this line of thought is sometimes known as the logical fallacy fallacy) and does not make it unreasonable to believe the truth of the argument. It also must be noted that a rigorous concept of truth is a complex subject. In informal logic, the fact that a majority of experts in a given field believe X—for example, the fact that nearly all medical scientists think that HIV causes AIDS and reject AIDS denialism—makes it more reasonable for a person without knowledge in the field to believe X.

The bandwagon fallacy is very similar to the appeal to authority, given that it—with popular opinion being cited in support of an idea rather than popular opinion coming to believe an idea based on the idea's own inherent truth—confuses cause and effect in the same way. In normal conversation, these two fallacies frequently intermingle. For example, consider the statement: "Basically everyone, economic experts included, supports the financial bailout and so must I."

# 5. Poisoning the well

**Poisoning the well** (or attempting to **poison the well**) is a logical fallacy where adverse information about a target is pre-emptively presented to an audience, with the intention of discrediting or ridiculing everything that the target person is about to say. Poisoning the well can be a special case of argumentum ad hominem, and the term was first used with this sense by John Henry Newman in his work Apologia Pro Vita Sua.

The origin of the term lies in the ancient practice of pouring poison into sources of fresh water before an invading army in order to diminish the invading army's strength. In general usage, poisoning the well is the provision of any information that may produce a biased result. For example, if a woman tells her friend, "I think I might buy this beautiful dress", then asks how it looks, she has "poisoned the well", as her previous comment could affect her friend's response.

An even simpler example of poisoning the well is by tautology and definition, or circular reasoning. This is similar to equivocation, where the use of words communicate a confusing meaning (often called a subtle lie). For example, if one starts an argument with "Everything I say is correct, no matter what you say", the well is poisoned and nothing a person says (be it true or false) will matter by the initiator's definition. An example of this rhetorical strategy is attributed to Michel Foucault by John Searle, regarding philosopher Jacques Derrida: "Michel Foucault once characterized Derrida's prose style to me as "obscurantisme terroriste." The text is written so obscurely that you can't figure out exactly what the thesis is (hence "obscurantisme") and then when one criticizes it, the author says, "Vous m'avez mal compris; vous êtes idiot" [roughly, "You misunderstood me; you are an idiot"] (hence "terroriste")."

## Structure

A poisoned-well "argument" has the following form:

1. Unfavorable information (be it true or false) about person A (the target) is presented by another. ("Before you listen to my opponent, may I remind you that he has been in jail.")
2. Any claims person A then makes will be regarded as false, or taken less seriously.

A subcategory of this form is the application of an unfavorable attribute to any future opponents, in an attempt to discourage debate. ("That's my stance on funding the public education system, and anyone who disagrees with me hates children.") Any person who steps forward to dispute the claim will then apply the tag to him/herself in the process.

A poisoned-well "argument" can also be in this form:

1. Unfavorable definitions (be it true or false) which prevent disagreement (or enforce affirmative position)
2. Any claims without first agreeing with above definitions are automatically dismissed.