# Argument Evaluation

We now know that every argument must have both premise(s) and a conclusion, which are defined by the fact that the arguer thinks there is an inferential link from premises to conclusions. Depending on how strong this inferential link is, we can classify the argument as one of two types. In deductive argument, the arguer claims the premises *prove* the truth of the conclusion. By contrast, in inductive arguments, the arguer claims the premises make conclusion probable. With this background, we can finally start talking about what it means for arguments to succeed or fail, or (more broadly) what it means to reason well or badly.

1. What two tests must every good argument pass?
2. What does it mean to say that a deductive argument is **valid** or that it is **sound**? What is the relationship between validity and soundness?
3. What does it mean to say that deductively valid arguments are “risk-free” or “truth-preserving”?
4. What does it mean to say that an inductive argument is **strong** or that it is **cogent**? What is the relationship between strength and cogency?

The concepts covered today can be tricky, at least partially because ordinary people tend use the words here (a “valid” or “sound” argument, a “true” conclusion”) in ways that don’t always match with what logicians mean. With this in mind, it’s crucially important that we pay attention to the precise *details* of these definitions, since understanding these definitions is a necessary first step for actually evaluating the success or failure of real-world arguments.

## How Can You Tell Whether an Argument is Good or Bad?

Any good argument (whether inductive and deductive) must pass two separate tests. Any argument that fails *either* test fails to be a good argument. Moreover, it’s important to note that *neither* test asks “Is the conclusion true?” or “Do you agree with conclusion?” This is because determining whether or not to believe the conclusion should something that we arrive at only after we analyze the argument. It shouldn’t be something that we start out by assuming.

**TEST 1: If we *assume* the premises are true, do they support the conclusion?** Since deductive/inductive arguments involve different sorts of claims about evidential support, this test requires different things of these different argument.

* For a deductive argument, the conclusion should follow *with necessity.* It shouldn’t even possible to tell a coherent *story* where the premises are all true, and the conclusion ends up being false. A deductive argument that meets this requirement is called a *valid* argument (it has “good form”) while a deductive argument that fails this test is called “invalid.”
* For an inductive argument, the conclusion should be at least *probable.* Unlike a deductive argument, the person can grant there is some chance that the evidence is what they say it is, but they still end up being wrong about the conclusion. An inductive argument that meets this requirement is called “strong” (since the premises, if true, provide “strong” reasons to believe the conclusion). An inductive argument that fails this test is called *weak.*
* This is the area of argument evaluation that logicians spend most of their time worrying about, since it doesn’t require determining whether particular premises are true or false (which is something that might require a great deal of content knowledge). Moreover, if an arguments fails this test, it is *irrelevant* whether the premises are true or false (test 2).

**TEST 2: Are the premises in fact true? Are they likely to be acceptable to the target audience?** If argument passes test 1 (i.e., the argument is either deductively valid or inductively strong), one can move to evaluating the premises. One should always aim to find premises that one’s opponents would find acceptable, since the whole point is to actually convince someone! It’s ineffective to use premises that “beg the question” in favor of the conclusion.

### Evaluating Deductive Arguments: Validity and Soundness

In a **valid** deductive argumentIF the premises are true, THEN it is *impossible* for the conclusion to be false. An **invalid** argument fails test 1. In this case, it doesn’t matter whether the premises (or even the conclusion) are true or false—it’s simply a bad argument.

* Ex: All chickens speak French. Some tigers are chickens. Therefore, some tigers speak French. (VALID but UNSOUND)
* Ex: All chickens speak French. All chickens are tigers. Therefore, all tigers speak French. (INVALID. All invalid arguments are unsound.)

A **sound** deductive argument is valid with all true premises. A valid but **unsound** argument fails test 2. All invalid arguments are unsound.

* Ex: Princess Zelda is either a video game character or a philosophy instructor at RCTC. Princess Zelda is not a philosophy instructor at RCTC. So, Princess Zelda a video game character. (VALID and SOUND—a “good” deductive argument.)

Valid arguments sometimes have false conclusions and invalid arguments sometimes have true conclusions. However, valid arguments (unlike invalid arguments) are completely “risk-free” or “truth-preserving”—one never risks starting from true premises and ending up with a false conclusion. Finally, a weird fact: If you look closely at the definition of validity, you’ll notice that any argument with premises that contradict one another is guaranteed to be valid (but unsound), no matter *what* the conclusion is.

* Ex: God both really exists and really does not exist. So, pigs can fly. (VALID and UNSOUND—contradictory premises)

### Evaluating Inductive Arguments: Strength and Cogency

In a **strong** inductive argument ifthe premises are true, thenit is *improbable* for the conclusion to be false. A **weak** argument fails test 1.

* Ex: 99% of all chickens speak French. Foghorn Leghorn is a chicken. Therefore, Foghorn Leghorn speaks French. (STRONG but UNCOGENT, since the premises are false)
* Ex: A few chickens speak French. Foghorn Leghorn is a chicken. Therefore, Foghorn Leghorn speaks French. (WEAK. All weak arguments are uncogent, regardless of whether their premises are true or false.)

Remember that all inductive arguments are *risky*—there is always a chance the conclusion will be false, even if the argument is strong with all true premises (i.e. it is cogent). Inductive strength, unlike deductive validity, admits of degrees. There will always be *some* possibility the conclusion of a cogent is false, however remote.

In general, we can say that an inductive argument is **strong** if and only if:

1. The conclusion is likely to be true (>50%), SUPPOSING that the premises are true. Stronger arguments have higher probability.
2. The premises are *relevant* to the conclusion, in the sense that finding out the premises were true would *raise* the probability the conclusion was true.
3. The argument meets the **total evidence requirement**, which states that any known, significant evidence for the falsity of the conclusion must be considered. A strong argument shouldn’t leave out obviously relevant evidence.

A **cogent** inductiveargumentis strong with all true premises. A strong but **uncogent** argument fails test 2.

* It is almost always warmer in Miami, FL than in Fargo, MN in February. So, it will be probably be warmer in Miami than in Fargo his coming Feb. 11. (STRONG and COGENT—a “good” inductive argument).

## Seven Key Points to Remember

We’ve covered a lot of new terms here, which can be a bit difficult to keep track of. With that in mind, it’s worth restating what we’ve learned so far:

1. Depending on what the arguer is trying to do, every argument is either deductive (it is attempting to “prove” a conclusion) or inductive (it is attempting to provide “evidence” for a conclusion without proving it).
2. In a deductive argument, we demand that it be LITERALLY IMPOSSIBLE (you couldn’t even imagine it!) to have all true premises and end up with a false conclusion. An argument that meets this criteria is called “valid.”
3. Valid arguments might still have false conclusions, but only if they have false premises. A deductive, valid argument with true premises is called “sound.” **The only thing we can NEVER have is a valid argument with true premises and a false conclusion.**
4. Inductive arguments aren’t valid (or invalid) or sound (or unsound). These terms are not appropriate to apply to them, since the person making these arguments isn’t trying to prove anything. We use different terms to describe good/bad inductive arguments.
5. In inductive arguments, we just want to know whether the conclusion is *probably* true, given that the premises are true (withholding for the moment our judgement on whether the premises are true). If so, the argument is “strong.” And if we have a inductive, strong argument with true premises, we can say it is “cogent.”
6. While cogent inductive arguments and deductive sound arguments are both “good” arguments, there is a crucial difference. In a deductive, sound argument the conclusion CANNOT be wrong (this is why mathematicians, computer scientists, and logicians are so interested in studying deductive logic). By contrast, while the conclusion of a cogent argument represents something we “ought” to believe, we might end up being wrong as new evidence comes to light.
7. There is a huge amount of our everyday reasoning that is inductive, rather than deductive. When evaluating these arguments, make sure to use the appropriate concepts (strength, cogency). Don’t expect/demand deductive proof, or use the concepts appropriate to this (validity, soundness).

## Argument Evaluation Visualized

## Common Deductive Argument Types: Valid and Invalid

|  |  |  |
| --- | --- | --- |
| **Argument Type** | **Valid Examples** | **Invalid Examples** |
| Categorical Syllogisms | * All P are M. All S are M. So, all S are P. * All M are P. Some M are S. So, some S are P. * No P are M. Some M are S. So, some S are not P. * All P are M. Some M are not S. So, some S are not P. * Some M are P. All M are S. So, some S are P. | * All M are P. All M are S. So, all S are P. * Some M are P. Some S are M. So, some S are P. * No P are M. No S are M. So, no S are P. * All P are M. Some S are not M. So, some S are P. * Some P are not M. Some S are M. So, some S are P. |
| Mathematical Args. | * X is greater than 3. So, X is greater than 1. * X is a triangle. So, X has three sides. * . So, . | * X is greater than 3. So, X is less than 100. * X is a triangle. So, X’s sides are of equal length. * 2X = 6. So, X = 3. (X might also be -3) |
| Args from Definition | Jones is a bachelor. So, Jones is male. | Jones and Jenny are of different genders. So, Jones and Jenny are not equal. (**FALLACY: Equivocation**) |
| Propositional Logic | * If P, then Q. P. So, Q. (**Modus Ponens)** * If P, then Q. Not P. So, not Q. **(Modus Tollens)** * P or Q. Not P. So, not Q. **(Disjunctive Syllogism)** * If P then Q. If Q then R. So, if P then R. **(Hypothetical Syllogism)** * P is true. So, P or Q. **(Addition)** * P is true. Q is true. So, P and Q. **(Conjunction)** * P and Q are both true. So, P is true. **(Simplification)** | * If P, then Q. Q. So, P. **(FALLACY: Affirming the Consequent)** * If P, then Q. Not P. So, not Q. **(FALLACY: Denying the Antecedent)** * P or Q. Not P. So, not Q. **(Using the wrong definition of “or”)** * P is true.So, P and Q are both true. * P or Q. So, P is true. |

## Common Inductive Argument Forms: Strong and Weak

|  |  |  |
| --- | --- | --- |
| Argument Type | Strong | Weak |
| Analogical Argument | Case D is like cases A, B, and C in all sorts of relevant respects. A, B, and C all have property P. So, D likely has property P as well. | Case D is like case A in a few not very relevant respects. A has property P. So, D likely has property P as well. **(FALLACY: Weak Analogy)** |
| Prediction | Events of type X have occurred thousands of times. They have (almost) always been followed by events of type Y. An event of type X just happened. So, an event of type Y will probably happen soon. | In a few cases, events of type Y have followed events of type X. An event of type X just occurred. So, an event of type will probably happen soon. **(FALLACY: False Cause)** |
| Generalization | In a large, representative sample, around X% had property P. So, it is probably true that around X% of the whole population has property. | In a small or biased sample, around X% had property P. So, it is probably true that around X% of the whole population has property. **(FALLACY: Hasty Generalization)** |
| Causal Argument | In repeated, controlled experiments, changing the value of X has been found to change the value of Y. So, X is likely a cause of Y. | X often precedes Y. So, X causes Y. **(FALLACY: False Cause)** |
| Arg. to Possible/Best Explanation | Scientific theory T is the \*best\* explanation for phenomena P. So, T is likely to be true. | Scientific theory T is one \*possible\* explanation for phenomena P. So, T is likely to be true. **(Pseudoscience)** |
| Arg. From Authority | A well-qualified, unbiased authority says that P is true. So, P is probably true. | An unqualified or biased authority says that P is true. So, P is probably true. **(FALLACY: Unqualified Authority)** |
| Slippery Slope | It is highly probable that A will lead to B, and that B will lead to C. So, A will probably lead to C. | It is somewhat plausible that A will lead to B, that B will lead to C,….(lots of steps until we get to Z). So, it is likely that A will lead to Z. **(FALLACY: Slippery Slope)** |
| Bad People! | Person A has often been a jerk in the past. So, person A will continue to be a jerk in the future. | Person A is a jerk. Person A has given an argument that we should believe P for reasons R. So, we can safely ignore this argument (**FALLACY: Ad hominem).** |
| Hopes and Fears |  | People will accept me if believe P. So, P. **(FALLACY: Appeal to the People)**  I am afraid what will happen to me if don’t believe P. So, P. **(FALLACY: ­Appeal to Force)**  Someone I care about will be sad if I don’t believe P. So, P. **(FALLACY: Appeal to Pity)** |

## Sample Problem: Evaluating Arguments

Determine whether the following are arguments. If they are, determine whether they are inductive or deductive. If they are inductive, determine whether they are weak or strong; if they are deductive, determine whether they are valid or invalid. Finally, use your knowledge of the truth of the premises to determine whether the arguments are cogent (for inductive arguments) or sound (for deductive arguments).

|  |  |
| --- | --- |
| Passage | Analysis |
| All penguins are birds. Some birds fly. So, some penguins fly. | This is deductive (a categorical syllogism). It is also invalid (the fact that the premises are true and the conclusion false is a dead giveaway for this). All invalid arguments are unsound. |
| I think penguins are really cute. By contrast, I firmly believe that ostriches are the scariest animals on earth. | This isn’t an argument. (Remember, saying what you “think” or “believe” isn’t an argument.) |
| Penguins’ bodies have been shaped by millions of years of evolution to be expert swimmers. Humans have not. So, it is likely that the average penguin can swim better than the average human. | This is inductive (it looks like a prediction). It is also strong with true premises. Because of this, it is cogent (and is a “good” argument”). |
| Penguins are expert swimmers. So, it likely that all birds are good swimmers. | This inductive (more specifically, it looks like a generalization). The premise is true, but the argument is weak. All weak arguments are uncogent. |
| Either penguins are mammals or penguins are fish. They are not mammals. Hence, they must be fish. | This is deductive (a disjunctive syllogism) and it is actually valid (it has a good “form”). However, since it has false premises, it is not sound. (Penguins are actually birds, not mammals or fish). |
| Both cats and penguins eat fish, and both are small and cute. Since cats make good pets, penguins would make good pets as well. | This is inductive (argument from analogy). Again, the premises are true, but the argument is weak (and thus, uncongent). |
| All penguins are birds. All penguins have wings. So, all birds have wings. | This is deductive (a type of categorical syllogism), but invalid (and uncogent). Importantly, it DOES NOT MATTER whether the premises or conclusion is true. The important thing is that the premises *could* be true without the conclusion being true. |
| In recent years, the ice around Antarctica has been melting at a higher rate than in years passed. As everyone knows, penguins live in Antarctica. From this, we can conclude that the melting of the ice has probably been caused by something the penguins did. | The is inductive (it is a causal argument), but it is weak (and uncogent). |
| It is likely that penguins and swans are more closely related to each other than either are to humans. After all, both swans and penguins have wings and lay eggs, while humans don’t. The best explanation for this is that swans and penguin are descended from a (egg-laying, wing-having) common ancestor. By contrast their common ancestor with humans must be more distant. | This is an inductive argument to the best explanation. It looks relatively strong, and cogent, but it could be improved with more evidence. It makes use of a scientific theory (in this case, the theory of evolution), plus various facts about the world (regarding penguins, swans, and humans) to defend a particular conclusion (regarding how closely related penguins and swans are, relative to how closely related they are to humans. |
| If penguins are mammals, then penguins are fish. Penguins are in fact mammals. However, as well as know, no fish are mammals. We can conclude that Wonder Woman is real. | This is a deductively valid argument, but a very strange one. The premises contradict one another, which means that there is NO POSSIBLE WAY they could all be true at the same time. This means that it *automatically* satisfies the definition of validity (impossible to have all true premises with a true conclusion). Since the premises can’t possibly all be true, however, the argument is not sound. |

## Review Questions

1. Classify the following arguments as deductive or inductive, and then evaluate them accordingly.
   1. It’s likely that the Vikings are a much better team than the Packers, since the Vikings won their first game and the Packers lost their first game.
   2. Duke University has won multiple national championships in basketball. Therefore, they would certainly beat the local high school if they were to play.
   3. Pigs are either fish or plants. If pigs are fish, then they have gills; if pigs are plants, then they have leaves. Pigs do not have gills. So, pigs are plants.
   4. If Elizabeth married Wickham, then she will not marry Darcy. But Elizabeth will marry Darcy. So, she will not marry Wickham.
2. Classify the following arguments as deductive or inductive, and then determine their validity and soundness, or strength and cogency.
   1. Since all daisies are flowers and all flowers are plants, we can conclude that all daisies are plants.
   2. Since all daisies are chipmunks and all chipmunks are mammals, we can conclude that all daisies are mammals.
   3. Since all daisies are flowers and some flowers are plants, we can conclude that all daisies are plants.
   4. Since all violets ever observed have had purple-ish color flowers, we can conclude that all violets have flowers of this color.
   5. Since all daisies ever observed have been chipmunks, we can conclude that all daisies are chipmunks.
   6. Since the daisies in my garden have yellow flowers, we can conclude that all daisies have yellow flowers.
   7. Since I have seen the daisies in my garden turn into chipmunks at night, we can conclude that all daisies are capable of transmuting into chipmunks.
   8. Since daises are both plants and mammals, and insofar as no plants are mammals, we can conclude that daisies do not exist.