# Two Types of Arguments: Deductive and Inductive

We previously introduced the basic ideas behind logic, arguments, statements, premises, and conclusions. We talked about the importance of putting arguments in standard form using the principle of charity. More recently, we discussed what it means to say that arguments must involve some sort of claim about an **inferential link,** and considered examples of passages that did NOT have this sort of link (such as reports, explanations, statements of belief, and so on). Today, we’ll be answering the following questions, which will further expand our understanding of how this inferential link works (and, in particular, of the two DIFFERENT TYPES of inferential claims that people can make):

1. What is the difference between a **deductive argument** and an **inductive argument**?
2. How can you determine whether an argument is deductive or inductive?
3. What are some common forms of deductive arguments? Can you explain why each type is deductive?
4. What are some common forms of inductive arguments? Can you explain why each type is inductive?

The basic idea of today’s lesson: in order to figure out whether an argument is a good one, we need to figure out what exactly the arguer (who might be us!) is actually trying to *do.* This will bring us to the distinction between deductive and inductive arguments, which will be an important one (and which will stay with us for the rest of the class).

## Defining Deduction and Induction

There are two fundamentally different types of arguments. In order to figure out how “good” an argument is, it is necessary to determine the type, since different types of arguments are evaluated in different ways.

A **deductive argument** is an argument that incorporates the inferential claim that it is *literally impossible* for the premises to be true and the conclusion to be false. Basic idea: in a good deductive argument, if you can convince the person of the truth of your premises, they MUST accept your conclusion with 100% certainty. Deductive arguments either work or do no work; there is no middle ground. Deductive reasoning plays a central role in areas such as mathematics and computer science (and philosophy!), but play a somewhat more limited role in other areas of life. (This isn’t to say that we don’t use deductive reasoning; it’s just that many of the most difficult/important parts of everyday reasoning are often going to be inductive).

An **inductive argument** is an argument in which it is only claimed that it is *unlikely* for the premises to be true and the conclusion false. Inductive arguments come in a variety of strengths and can (unlike deductive arguments) be weakened or strengthened by the addition of new premises (new evidence makes a difference). Basic idea: in a good inductive argument, you are aiming to show the person that *if* your premises are true and *if* you haven’t left anything important out, *then* your conclusion is likely to be true. Much of our reasoning in everyday life (including nearly all of science, history, etc.) involves inductive arguments.

Once you get the hang of the idea, you’ll find that many arguments are clearly inductive or clearly deductive. In unclear cases, use the **principle of charity**—represent the argument in whichever way it has the best chance of working. For example, here are two deductive arguments, which implicitly involve the claim that the conclusion *must* be true if the premises are true:

* All clown fish are Harry Potter fans. Nemo is a clown fish. So, Nemo is a Harry Potter fan. (GOOD form, deductively “valid”)
* All clown fish are Harry Potter fans. All sharks are Harry Potter fans. So, all clown fish are sharks. (BAD form, deductively “invalid”)

By contrast, here are two inductive arguments, which implicitly involve the claim that the conclusion is *probably* true if the premises are true:

* Most clown fish are Harry Potter fans. Nemo is a clown fish. So, Nemo is a Harry Potter fan. (GOOD form, inductively “strong”).
* A few clown fish are Harry Potter fans. Nemo is a clown fish. So, Nemo is a Harry Potter fan. (BAD form, inductively “weak”).

Notice the goodness or badness of the argument has NOTHING WHATSOEVER to do with whether the premises or true or false. (In all of these examples, the premises are clearly false). However, *if* the premises of a good argument are true, then we have good reason to believe the conclusion (this is why it’s worth caring whether or not an argument is good).

## How to Determine the Type of Argument: Some Rules of Thumb

Here are some “rules of thumb” for determining whether a given argument is deductive or inductive:

1. If you notice that it really is impossible for the premises to be true and the conclusion false, the argument is likely to be deductive. By contrast, if you notice that is very unlikely (but still possible) for the premises to be true and the conclusion false, then the argument is likely to be inductive.
2. If the context requires absolute certainty (e.g., mathematics), the argument is likely to be deductive. If absolute certainty seems unreasonable (e.g., making predictions about the weather, politics, sports scores, your love life, etc.), the argument is likely to be inductive.
3. Deductive arguments often contain words like *necessarily, certainly,* or *absolutely*. Inductive arguments often contain words like *probably, likely,* or *it is reasonable to believe that*. (This isn’t always reliable, since people often claim “certainty” about things for which they have only inductive support.)
4. Certain common types of arguments are normally deductive or normally inductive. We’ll talk more about these in the next section.

It is important to remember that none of these rules are 100% foolproof, and that it’s often best to use them in combination. However, they provide a good starting point.

## Common Types of Deductive Arguments

1. In an **argument from mathematics,** the conclusion can be derived from the premises using only mathematical reasoning (such as arithmetic or geometry).
   1. Ex: Since Joe Mauer hit over .300 in 2008, it follows that he got at least one hit for every four official at-bats.
   2. Ex: We know that . Let’s also assume that and that . We can conclude that .
2. In an **argument from definition,** the conclusion can be derived from the premises using only knowledge of definitions.
   1. Ex: The sin of hubris is ubiquitous in the United States. Therefore, there are many proud people living in this country.
   2. Ex: Sally is a bachelorette. So, Sally isn’t married.
3. A **syllogism** is a two-premise type of deductive argument. **Categorical syllogisms** have premises and conclusions that all involve claims about “some”, “all”, or “no” members of a category.
   1. Ex: All pigs are sentient. No sentient creatures should be eaten. So, no pigs should be eaten.
   2. Ex: All bats are mammals. Some bats fly. So, some mammals fly.
4. **Hypothetical syllogisms** have premises or conclusions that ALL involve conditional (“if-then”) statements.
   1. If a siren sounds, you should seek shelter. This follows from that facts that if a siren sounds, a tornado has been spotted and if a tornado has been spotted, you should seek shelter.
5. **Disjunctive syllogisms** have the form: “Either X or Y is true. But X is false. So, Y.” (*Disjunction* means “OR”)
   1. Jones is either an insomniac or a vampire. But Jones isn’t an insomniac. So, he must be a vampire.

## Common Types of Inductive Arguments

1. **Predictions** have premises involving the past or present, and conclusions involving the future. Arguments of this sort are common in science and everyday life.
   1. Ex: Because the sun came up the last 1,000,000 days in a row, it will most likely come up tomorrow, as well.
2. **Generalizations** draw conclusions about large groups (or **populations**) based on premises concerning smaller subgroups (or **samples**).
   1. Ex: 9 out of 10 consumers who were surveyed preferred Colgate toothpaste. Therefore, around 90% of all consumers prefer Colgate toothpaste.
3. **Causal inferences** draw conclusions about causes or effects based on premises that don’t (directly) concern causal matters.
   1. Ex: Since the incidence of lung cancer is much higher among smokers than nonsmokers, it’s safe to conclude that smoking causes lung cancer.
4. **Arguments from analogy** have premises concerning the similarities between 2+ more objects and conclude that they must be similar in some other way as well.
   1. Ex: Since both Britain and Russia were great powers who failed to win wars in Afghanistan, it is likely that that U.S. will fail to win the war in Afghanistan as well. (Implicit premise: The U.S. is a great power like Russia or Britain.)
5. **Arguments from authority** conclude that something is true because a presumed authority claimed that it was.
   1. Ex: My astronomy textbook says the sun is around 93 million miles from the earth; we can conclude that is probably correct.
6. **Arguments from signs** conclude that something holds because of a sign left by an intelligent being.
   1. Ex: Every map I’ve ever seen shows Minneapolis as being north of Chicago. So, your claim that Minneapolis is south of Chicago is just plain crazy.
7. **Arguments to the best explanation** conclude that a hypothesis is true because it is the best explanation for a known fact.
   1. Ex: Shelley missed class today. The best explanation for Shelley missing class is that she is sick. So, she probably really is sick.

## Solved Problem: Deductive Versus Inductive

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| **Passage** | **Inductive, Deductive, or Not an Argument?** |
| Mario and Luigi are brothers. Therefore, they have at least one parent in common. | This is deductive, since the conclusion follows from the definitions of the word “brother” and “parents.” While we might need to do some work to determine whether the premise is true (“Are Mario and Luigi really brothers?”), once we’ve |
| Mario speaks with an Italian accent. Since Luigi was raised with Mario, Luigi probably speaks with one too. | Inductive. This is an argument by analogy. We infer from the fact that Mario and Luigi have certain similarities (they were raised together), they have other similarities (speaking with the same accent.) |
| Mario and Luigi went to plumbing school in the 1970s together. Mario got mostly Bs, while Luigi got mostly As. | This is not an argument at all. |
| All people with evil-sounding names are evil. “Wario” is an evil-sounding name. So, Wario is evil. | This is deductive, and looks something like a categorical argument (with the word “All”). Note that this doesn’t mean it is a *good* argument, since the premise that “All people with evil-sounding names are evil” is almost certainly false. |
| I’ve looked all over this castle, but I simply can’t find Princess Peach. So, the Princess must be in some other castle. | This is inductive, and looks like an argument to the best explanation. (We want an explanation for Peach’s absence; the best one we can think of is that she is another castle.) |
| The last 100 times I encountered a Koopa Troopa, it tried to bite me. So, the next Koopa Troopa I encounter will certainly try to bite me as well. | Inductive-prediction/generalization. While words like “certainly” sometimes signal deductive argumentation, we simply can’t use information about the past to predict the future with 100% certainty (as deductive argumentation requires). |
| I just saw a sign that said “This way to Bowser’s castle.” So, if we want to go to Bowser’s castle, we should go that way. | Inductive—argument from signs. Whenever you make an inference from “a sign says this” to “it’s true,” you are making an inductive leap (after all, maybe Bowser has been putting up fake signs, to mislead people about the location of his castle). |
| There are exactly 8 levels in *Super Mario Brothers.* I have beat 7 of them. So, if I beat one more, I will have finished the game. | Deductive—argument from mathematics. The conclusion here follows from “8 – 7.” Again, it’s important to note I might be wrong about my premises (e.g., maybe there are actually more than 8 levels). However, on the assumption that my premises are TRUE, my conclusion follows simply from the math. |
| If you like *Super Mario Brothers,* then you will also like *Sonic the Hedgehog.* | This isn’t an argument! It is a conditional statement, which claims that liking *Mario* is a sufficient condition for liking *Sonic.* (And that liking *Sonic* follows necessarily from liking *Mario.*) |
| If I continue playing video games for 30 more mins, I will beat the level. If I beat the level, I will be happy forever. So, if I continue playing video games for 30 more mins, I will be happy forever. | Deductive—hypothetical syllogism. (Again, note that the fact that this argument is deductive doesn’t necessarily mean the premises are true.) |
| The question box must contain a mushroom. This follows from the fact that it contains either a mushroom or a flower, and it doesn’t contain a flower. | Deductive-disjunctive syllogism. |
| Luigi couldn’t beat Bowser before he bought himself a Racoon Suit. After he bought a Racoon Suit, he beat Bowser with ease. So, the Racoon Suit must have been a cause of his beating Bowser. | Inductive—argument about causes and effects. Arguments about causes/effects are inherently uncertain, since there will *always* be other possibilities we haven’t accounted for. (E.g., maybe Luigi just got lucky this time, or his previous practice payed off, or he’d just had a cup of coffee, or whatever). |
| Toad told me that Princess Peach is thinking of becoming a race car driver, and that she’s sick of being a princess. Since Toad is one of Peach’s best friends, I think we can trust him. | Inductive—argument from authority. Every time we believe something on the basis that a person/group/book told us it was true, we are reasoning inductively. (This accounts for a huge chunk of our beliefs, obviously!). |

## Review Questions

1. Identify the conclusion of the following arguments, and then classify them as deductive or inductive.
   1. There's a good chance Kate will have to take off work for a funeral this week. I know that Anna and Kate were good friends and Vronsky just told me that Anna recently jumped in front of a train.
   2. Two things that are equal cannot be different. However, it is obvious that humans differ in terms of properties such as intelligence and physical strength. Therefore, humans are fundamentally unequal.
   3. There are no terrestrial (i.e. non-flying) mammals native to oceanic islands. We can conclude from this that the ancestors of the mammals on those islands must have come from nearby continents, since terrestrial mammals are precisely the animals that never could cross the ocean.
   4. If I am a master of inductive arguments, I can predict the future. I am a master of inductive arguments. So, I can predict the future.
   5. Nearly all of the basketball players I’ve met are taller than me. So, it’s probably the case that most of the ones I haven’t met are taller than me, as well.
   6. The sign on the door shows a picture of a man. So, that’s probably the door to the men’s restroom.
   7. Since a square is a type of rectangle, and all rectangles have four sides, we can conclude that squares have four sides.
   8. All of my friends said that Dr. Smith is a very difficult teacher. Therefore, I would probably struggle to get an A in her class.
2. Find a YouTube clip of a movie or TV character (such as Sherlock Holmes) using evidence to support conclusions (i.e., find an example of them “arguing”, even if there is no one they are arguing with.). Then, answer the following questions:
   1. Write down one (or more) of the arguments that the character seems to using in standard form (A warning: there are often many implicit premises).
   2. What specific type of argument is this? (Analogy, mathematical, causal, best explanation, etc.)?
   3. Is this argument inductive or deductive?