**Week 3: Lecture 1 - Reasoning and Inference**

Aristotle wrote that human ***reason*** is a *faculty*, that is, an inherent mental capacity or power. However, we need to hear that description in context: what Aristotle actually wrote is that reason is a faculty *only*, and cautioned that this power – the faculty of reason – needs to be developed if we are to use it well. To use reason well, according to Aristotle, is to exercise it in a way that achieves happiness (the Supreme Good of the virtuous life), which for Aristotle is a life lived justly, ethically, thoughtfully, courageously, etc. (and by the way, that’s a pathetically abbreviated synopsis of Aristotle’s view on happiness, but conveys at least minimally the point that it’s not simply whatever pleases a person; happiness is fundamentally about expressing virtue).

The reason for bringing up Aristotle’s general description of reason is not to understand his richly complex philosophy (indeed, it would require several courses dedicated specifically to that task). Rather, the reason for bringing up his general description of *reason* is to remind us that this inherent faculty – this natural power that distinguishes us as a species – *needs to be cultivated*.

Let’s face it – our brains, which are far less understood than we might care to admit – have functions and capabilities that need training just like any other part of our body.

**Inferences**

Inference is a great example of this. Inference is technically an action – the act of inferring. That is, an inference is a conclusion reached on the basis of evidence and the application of logical thinking. Actually, it can be defined correctly in several ways – here’s another:

"An inference is an educated guess we make from evidence right in front of us while accessing our prior knowledge.” Or in short: “Prior knowledge + evidence = inference.” The following video ("What Is An Inference?) explicitly states that we infer all the time; it’s our brains at work. What the video also states - implicitly - is that our inferences do not always end up producing the correct conclusions.

**Video Transcript**

So, there are these things called inferences. Let's find out how to make learning targets. You should be walking away with two things: "I can define an inference" and "I can determine how to make one." But what exactly is an inference? You see, we make inferences every day; we just may not know it. We make an inference when we read a book, watch a movie, and when we interact with each other. It's just not always clear. Let's take these scenes as examples: a man hitting his head with a laptop. We might be able to infer that this man is very frustrated with his laptop. Or this scene, a bird chasing a man. The man is running away from the bird. We might be able to infer that the man is scared of the bird. A definition for an inference is an educated guess we make from evidence right in front of us while accessing our prior knowledge. Always remember, prior knowledge plus evidence always equals an inference. It's your turn. Pause this video and answer the question, "What can you infer from this scene?" Always remember, an inference is an educated guess we make from evidence right in front of us while accessing our prior knowledge.

Resource: <https://youtu.be/s_WH4pQMPJM>

**The Ladder of Inference**

Above all, inference is a *process*. A helpful way to understand the inference process is to imagine it as a ladder (there are several versions of the ladder of inference as well).

The process begins at the bottom rung, with the ‘**facts**’. This can also be identified as ‘reality’ or the ‘observable facts’. It’s the totality of our experience at any given moment. This might not be all there is, but it’s all we can observe in that context. In terms of argumentation, this is your ***evidence***.

**“My” facts** are a subset of *the* ‘facts’ that our belief systems and prior experience subconsciously ‘select’ for us. So, from reality (the facts in front of us), internal bias narrows our base of facts to a *selected* reality (“my” facts). This can also be understood as a ‘frame of reference.’

Our brains then **interpret**that subset of facts, assigning personal meaning to them. In other words, we begin to understand what we experience through our own lens. This implies subjectivity, because we each have our own lens through which we view the world – it cannot be any other way. There are degrees of overlap in *how* we interpret (e.g., cultures and ethnicities influence our lens, as do our professions, educational backgrounds and fields of knowledge, socio-economic attributes, and so on). But those attributes also create differences in our interpretations, as do all of the unique experiences and knowledge that we as individuals possess. In short, *our* identity plays a significant role in *our* interpretation of *our* facts.

We then make **assumptions** based upon our interpretation of the selection of facts. Um…I will assume you know what assumptions are. I prefer this definition: “A thing that is accepted as true or as certain to happen, without proof.” Note the two steps in that definition:

1. Something is observed or experienced (a fact, actually, ‘my’ fact). (*interpretation happens here*)
2. We accept that something as true, without proof.

Now that we have accepted as truth this fact that we have experienced and interpreted, we draw our **conclusions**.

Recall from the video when we observed the man running, and the bird flying behind him in the same direction. Based upon what we observed, we likely might conclude that the man is afraid of the bird.

Let’s analyze that example using the ladder of inference (and please note, there can be multiple correct analyses – this is but one):

**Facts (available evidence)**

* A video representation
* A man running
* A bird flying behind a man in the same direction

**My facts (what my brain selects for me)**

* The man is running quickly
* The bird is right behind him

**Interpretation (my lens for understanding my facts)**

* Some birds attack or scare people and this could cause a man to run away from one
* Some people are afraid of birds

**Assumption (my acceptance as truth without evidence)**

* The man is running away from the bird
* The bird is chasing or attacking the man

**Conclusion**

* The man is afraid of the bird

As previously mentioned, there are many reliable versions of the ladder of inference, and many ways of using them; this was just one way of using one of them for this example, and you are encouraged to research other versions.

So, is our conclusion **correct**?  Perhaps a better question is, “**How do we know if our conclusion is correct?”**Do we have enough information to conclude with certainty? Were our facts sufficient? Have we seen sufficient information? Did our internal bias and interpretive lens cause us to make faulty assumptions? Ahhh, this is critical inquiry at work!

What other information might there be that could change our conclusion? After all, we arrived at our conclusion through **inference**: “an educated guess we make from evidence right in front of us while accessing our prior knowledge.” Again, the short version: “Prior knowledge + evidence = inference.”

By now, you may have already thought of other possible “facts” that were *not* observable in the video frame but that would, if part of the story we experienced, change our conclusions!

With just that one additional fact, “our” facts, interpretation, assumptions, and conclusions would completely change!! And, the likelihood of that conclusion being correct might actually be greater.

**Week 3: Lecture 2 - Two Types of Inferences: Inductive and Deductive**

If inferences can produce faulty conclusions or lack certainty of truth, does that mean they are bad? The short answer: nope! As we learned, an inference is a process of drawing conclusions based on the evidence and our prior knowledge. Prior knowledge is an important source of information for drawing conclusions, isn’t it? And those conclusions can have a high degree of accuracy.

We do this all the time. If you park your car in a parking lot and discover later that you have a flat tire, and you observe a pile of nails nearby, you might infer that a nail caused the flat. It might not be true, but based upon the evidence, it seems like a likely conclusion.

There are two types of inferences: inductive inferences and deductive inferences. This is also commonly referred to as inductive and deductive reasoning.

***Inductive inferences*** begin with observations and, through a reasoning process (like the ladder of inference, for example), end in general conclusions. Take a simple example: the sunrise. The conclusion, “The sun rises every morning,” is an inductive inference - a general conclusion based upon the fact that the sun has risen every day up to now.

As you can already see, inductive inferences can be very useful and valid, but are not automatically certain. There is a chance, isn’t there, that the sun will not rise tomorrow?  That is, our inference can be faulty. “Case in point: the discovery that the earth revolves around the sun has disproved the ancient inference that the sun ‘rises.’ Essentially, inductive inferences move from specific examples to general, broad conclusions. They are also the heart of the scientific method.

Deductive reasoning is different. **Deductive inferences** move from a claim or hypothesis (premise), and draws specific conclusions. The classic example: All men are mortal (major premise); Socrates is a man (minor premise); Socrates is mortal (conclusion).

Notice in that example (which is a form of reasoning called a syllogism) that the conclusion is ‘contained’ in the premise, because Socrates is a man.

This means that, for deductive inference, if the premises are true, the conclusion must also be true. This is sometimes referred to as necessity. In an **inductive inference**, however, the conclusion might be true, but is not necessarily true.

Both forms of inference are important:

**Video Transcript**

Gentlemen Thinker: Philosophical concepts explained briefly in a posh English accent.

Deduction and Induction.

Generally speaking, there are two types of reasoning: deduction and induction.

Deduction, sometimes known as the top-down approach, takes premises and reduces them to conclusions. For example, "All men are mortal. Earl Grey is a man. Therefore, Earl Grey is mortal." This is an example of deductive reasoning. Note that we can be logically certain of the conclusion because, given the premises, the conclusion must be true.

Inductive reasoning, on the other hand, is sometimes called the bottom-up approach. It takes premises and draws probable conclusions based on what they provide evidence for. For instance, if every British person you have ever met has been polite, then the next British person you meet will likely be polite. Note that the conclusion of an inductive argument is not certain. It is possible that the next British person you meet will be a total cad.

Indeed, the moment you meet a rude Brit will be the moment when the evidence is greatest for assuming you won't. Much of science is based on inductive reasoning, despite the fact that its conclusions are uncertain. It is a fantastic guide to truth. If you note that a cannonball falls to Earth 99 times, you can be fairly but not completely certain that it will fall the 100th time.

One of the best ways to appreciate the contrast between deduction and induction is to recognize that deduction is complete. It is clear what makes a good deduction, namely that the premises entail the conclusion. But it isn't really clear what makes a good induction. The cannonball argument is clearly good induction, but all swans ever observed are white therefore, all swans are white is clearly a bad induction.

"[The Difference Between Deductive and Inductive ReasoningLinks to an external site.](https://danielmiessler.com/blog/the-difference-between-deductive-and-inductive-reasoning/)" provides an excellent summary, with examples, of the distinction between inductive and deductive inferences, and emphasizes a very important point: the real-world, every-day experiences (whether at work or at home or elsewhere) often require us to use inductive reasoning much more frequently.