# Philosophy

Why is Philosophy important?

* Throughout history we have taken inspiration from nature. For example, when looking at old paintings of flight, angels for example, often have wings.
* Because birds fly, and birds have wings, we should attempt to emulate this in order for us to attempt to fly.
* Modern airplanes take inspiration from birds, although airplane wings look very different from bird wings.

Feathers vs Wings

* Most birds have wings and feathers, however modern machines that fly have wings but not feathers.

## How does the Mind Work

If we can figure out how the mind works, we can emulate that on the machine.

Two schools of thought: Dualism and Monism

Dualism - We think of the mind as separate from the body

Monism - Body and mind are manifestations of a single substance

Body lies in the physical world i.e. it can be observed - size, weight, shape, colour, motion through space and time

Mind lie in private world – consciousness, and intentionality (including beliefs, desires, ideas)

If we shift from Dualist to Monist this means we can measure the brain / see how the brain works and emulate it. 🡪 no longer a private entity.

Can a Machine have a Mind?  
What is the relationship between the Mind and the ‘Brain’?

## Computational Theory of Mind

We know the brain is an organ with nerves / there are organizations with parts of the brain that are responsible for certain actions / properties.

Brain works by taking inputs that processes them as a computational engine and makes an output which is motor control.

Though this does not imply that the brain is a computer, as there are many different forms of computational engines.

We can try to recreate the brain on the computer (doing intelligent things that the brain does is theoretically feasible to recreate)

## David Marr’s Three Levels of Analysis

Method of analyzing what a computational system can do

Useful not just for a biological system but also existing computer programs.

Three levels:

* Computational Level: what does the system do, what problems does it solve and why does it do these things. (Highest Level)
* Algorithmic Level: How does the system do what it does, specifically, what representations does it use and what processes does it employ to build and manipulate the representations
* Implementational/Physical Level: how is the system physically realized (in the case of biological vision, what neural structures and neuronal activities implement the visual system) (Lowest Level)

For the example of flight

* Computational: Flight
* Algorithm: Flapping
* Implementation: Feathers

For more complicated social interaction

* Computational: Cooperation? Competition? Observational Learning?
* Algorithm: Reinforcement learning? Cost-benefit trade-off? Cognitive map?
* Implementation: Brain area, circuit, cell?

Computational / algorithm level is easier to transfer however implementation level is more difficult.

What do we know about the Brain?

### Architectures

In an experiment in by Hubel and Wiesel, they anesthetized a cat and put electrodes in the cat’s brain. They then showed the cat visual inputs, and as they changed the image showed to the cats, the measured the change in neuron outputs. We were able to find out there is a receptive field in the cells in the brain. i.e., each neuron is receptive to certain stimuli that the cat can see.

Inspired a lot of artificial neuron work. Fukushima, 1980 – tried to create a map of the cats brain / neural network and copy it onto a computer.

### Memory

Humans have very sophisticated forms of storing memory.

Procedural Memory - If we do something over and over, for example hitting a golf ball, we can recall this memory whenever we next try to hit a golf ball.

Priming Memory – Seeing a sketch and recalling it with high accuracy

Perceptual Memory – seeing a stimulus and recognizing that stimulus and understanding the context in which you saw it.

Semantic Memory – Recalling things without context (for example equations, which do not have specific entities)

Episodic-Autobiographical Memory - subjective memory of what you experienced in the past.

Episodic memory is easy to mimic on a machine learning platform however semantic memory is very difficult. Forms are not the same difficulty to transfer to machine.

Idea that the brain is modular is very important to understand when transferring it to machine learning.