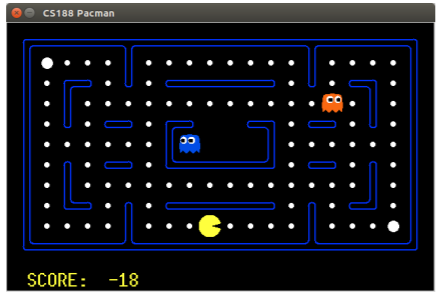
Complex Decision Making

Example 1: Pacman



One decision leads to another.

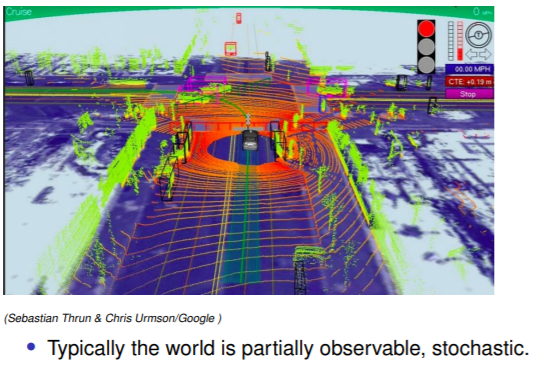
Each decision depends on the ones before and affects the ones after.

* These sequences of decisions are one of the reasons that decision making is difficult.
* It is hard enough to choose a decision when all the relevant information about a given world is available

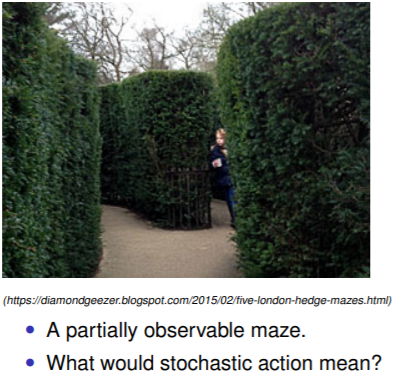
This is more complex in the real world because the world is not a fully observable deterministic process.

Factors that affect the Decision-Making Process

* Fully observable: You have all the information about a system like Pacman.
* Partially Observable: You only have some information and must make use of that information to decide.
* Deterministic World: This means there is only one consequence no matter the action you take.
* Stochastic: There are multiple possible consequences each linked to an action.
* Static World: Nothing changes except what the specific agent we are thinking about, does
* Dynamic World: The world changes with and without interference.
* Are there one or multiple agents in a world



The key point is that the car does not have a complete view of the world due to the range of its sensors, its “area of attention”.



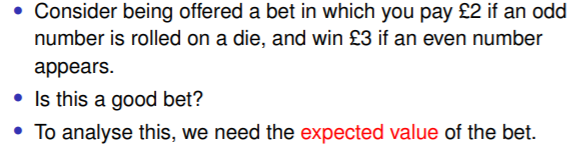
Stochastic action would mean that the robot may chose to go left but still have a probability of going right and vice-versa. This also includes not doing anything.

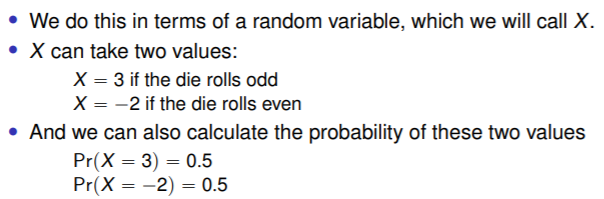
More examples:

If a robot is commanded to go 10 meters forward it may go 11 meters instead or 9 meters. There is a distribution over the result of the command due to a variety of issues such as wheel slippage or avoiding an obstacle causing the robot to deviate from its path etc. Robot may also go forward and to the left or forward and to the right. The same for backwards if the path is not blocked. As if the path is not blocked it is automatically a possible outcome in a stochastic world.

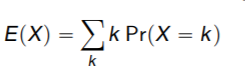
**Deciding what to do**

Start simple and make a single decision.



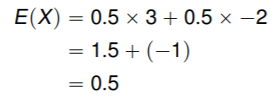


Expected value: The weighted sum of the values where the weights are the probabilities



Where the summation is over all the values of k for which P (X = k) != 0.

Plugging in the values from the previous slide the expected value is:



The expected value of X is £0.5 and we take this to be the value of the bet.

Is this a good bet?

Expected value of not taking the bet is £0 therefore it is.

0.5 is not the value you will get. For each bet you either win £3 or lose £2, £0.5 is simply the average you would earn if you took the bet multiple times