Epistemology of CS/ICT

Notekeeper: Federico Gozzer

Lesson: 30/10

Disclaimer: We will see a lot of contents/terms. Integrate notes, slides, links with your own reasoning! At exam is rewarded self thinking.

1 Epistemology

1.1 What is Epistemology about?

- Something related to knowledge
- Acquiring knowledge/truth/facts
- A branch of philosophy
- Justifications/concept
- Philosophy of science! How we acquire/manage/verify/falsify knowledge! Is the lvl above all the procedures/theorems/...

1.2 Is Epistemology and abstract entity applied to anyone? Does exist only one Epistemology in the world? Does a farmer acquire knowledge the same way a computer scientist does or a doctor does? How are they affected?

- The environment is different
- The experience is different
- The perspection of the space around you is different

1.3 Does a designer and a developer (working in the same field) acquire knowledge the same way? The environment is the same, but do they acquire/use knowledge in the same way? what do they use?

- Relevant content (work of somebody else adapting it to my work)

- They acquire knowledge using previous experience patterns to develop code.
- But, there are different lvl of rigor/formality in gather and use knowledge on the job i have to do!

1.4 Why would i care about Epistemology when i talk about innovation?

- Find patterns for successful innovation!
- pattern that can help us find new innovation!
- patterns that can help us to find patterns!

2 Decision making

2.1 Why Epistemology in Decision making?

- Patterns we found can help us to take decisions!
- Decision = Choosing a certain path over a set of options. If you take a choice you can't have another of the same type.

2.2 Examples of Decision

- University to attempt
- Who to vote
- What to wear at the morning
- What to eat
- Hiring from a set of recruits

2.3 Focus on:

- Type of decision making:
  - Istant / Lot of time
  - Linear
  - Many opportunities / one opportunities
- Difficult? Can i/ Cannot i find an optimum? is a set of optima?
- Who can/ cannot use the decision process? If i take a very complex procedure, a complex algorithm, can you do it by hand?

- Why use a process over another? If you need to buy a small thing, you need a fast process to not bury much time
- "Kritik", Kant (German philosopher), is the search for the limit, where i cannot take a decision. Find special cases of decison making processes.

2.4 Why is decision making critical in business?

- I lose resources! Money, time, people, investors, network, technologies, market share.
- I want to gain!
- When we take a decision we take it for the future, we have an outlook in the future.
- legal aspects of the business

[Example of decision making informal, do a parallel in business]: What to wear in the morning?

If i wear always the same, is this a decision optimum? NO! You need to adapt the decision looking at pitfalls.

[Example of decision in business]: Protection of datas.

If you always use the same data protection protocol, it may no longer be effective at some time.

[Example of Change in decision making in business]: Apple.

From a computer based approach to a mobile based approach! They changed their name in 2011 from Apple computers to Apple!

They also changed their provider of processors in 2007 from IBM to Intel, even if IBM was much more effective.

Also they changed the CEO, Steve Jobs was fired by apple! Because he didn't agreed with some managing of some products, he was a big promoter of the PDA (personal digital assistant). He got hired back in few months, with a salary of 1 dollar/month.

Take decision lead you to success/failure/new opportunities/ ...

2.5 How does decision making connect with ICT?

Alan Turing is credited to be the guy who invented computer science, with Turing machine, used to model computation of functions. He also designed the Turing Test for artificial intelligence. The test took a person which could exchange messages with someone, if after a certain time, the person could not distinguish if the one who is writing is a computer or another person, if it is a computer, it is intelligent.

The test was about taking a decision! To decide if the computer is a person or not!

3 Historical Perspective

Figure 1: The Historical Prospectives

3.1 What do they have in common?

- Philosophical movements
- They have Rules! They have rigor!

  Objectivism - There is a truth out there it is objective! I can find it and no one can falsify it!

  Positivism - The science reign supreme, it can discover everything

  Determinism - Everything is predetermined

  Romanticism - The human mind can discover everything!

  Rationalism - Role of reason.

  Modernism - After the Industrial revolution, everything is new, everything is controllable like a production
- MAIN FEATURE: CERTAINTY

4 Certainty, Risk, Uncertainty and Ambiguity

4.1 Decision making in Certainty

4.2 Examples of certainties

- I will die/ I am alive
- Taxes (?)

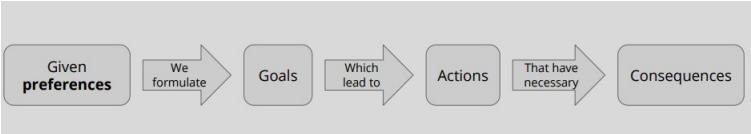

Figure 2: The Decision making in Certainty

- Mathematical rules for satisfiability problems
- Things we have observed a number of times!(excluding induction fallacy)
- Sun rises from the east
- fire burns

The process is instantaneous! No margin for error! Logic consequences!

4.3 Decision making in Risk

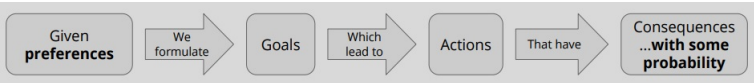

Figure 3: The Decision making in risk

If you go in a casino, you take some risks! I know that i take a risk but i know that even if the probabilities are done to make me lose, i have some probabilities to win! The probabilities(risk factors) are known! Once i know my limits the decision is immediate!

4.4 Decision making in Uncertainty

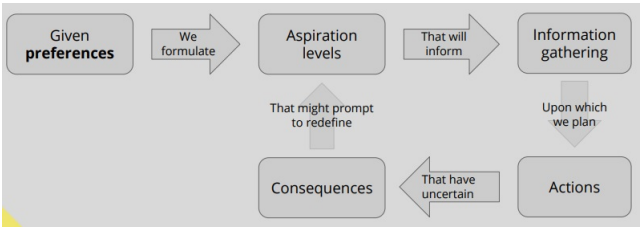

Figure 4: The Decision making in uncertainty

The truth is out there, is up to you to find it!

Risk is also not certain, what is stronger than risk? If you go on a stick exchange, you know the probabilities of winning and losing? NO! There are different lvls of unknown!

Try to analyze and find the logic between past of the stocks and the current state of the world, and try to build a model of probabilities! Is not an easy task! If something is easy, everybody can do it, if everybody can do it, no one can get money from it.

Try to reduce the uncertainty to a risk!!

What do you need to do it?

- Knowledge
- Algorithm
- Machine
- Time!

4.5 D & D Dungeon class check

The players throw dices every turn to find out what is the class(number of a D20) of the dungeon. Is uncertainty!

The players spend time (turns) to acquire knowledge(the number), reducing their uncertainty!

They just know if the throw of the D20 is a fail (not as high as the dungeon) or success (high enough for the dungeon), Having those 2 boundaries they can converge after some time(or a lot of time).

Uncertainty require complex decision making!

It is also called Procedural(the procedure is often a loop) decision making or bounded (by resources) decision making!

5 Examples

5.1 Examples in innovation

- Samsung S8: There were an S7, S6, ... That smartphone have been the fruit of iterations! Is the perfect Phone? no! otherwise won't exist an S9! is a local optimum after have spent a certain amount of resources.
- Price setting online: Collect datas to set the optimum price of sell/buy if a product!

5.2 Example in ICT

- Machine learning models: Start from a random guess and try to optimize it.

5.3 Examples for business

- Office procedures! Process burocracy to find the best procedure!

Key points:
- Limited Resources
- Convergence to optimality (the truth exist! just find it! epistemology is the search for truth)

6 Points of failure

- Hasty Generalization (Assuming that we are in certainty but we are not). Example: If i reinvest an amount of the income of my company supposing a certain growth, my company may broke.

  Example: 2008 crisis, subprime loans were considered certain, but the people fear made him not certain.

- Risk implies reward. Usually big risk implies big reward, and small risk have low reward. But if there is a reward it's still a risk! This should create risk aversion.

- Risk aversion. Be skeptical to risk! Be afraid of risks! Becomes a fallacy when i have limited resources.

- Uncertainty intolerance. Try to gather information when you have to take a decision! Rise the threshold of uncertainty tolerance!

- Different optimum definition.
  - ex. Nash equilibrium. (play selfishly)
  - ex. Pareto optimality. (more optimum acceptable)

- Law of big numbers. I risk to not converge.

- Unknown unknown. I need to reduce the unknown unknowns the more i can!

7 Roulette Similitude

7.1 Certainty

All the cells of the roulette are substituted with the same number and same color. Always win or always lose.

7.2 Risk

Classic roulette setting. Known probabilities.

7.3 Uncertainty

At the beginning, the roulette cells are covered, after every spin, i can see what it is. Gather information.