Epistemology of CS

IBICT 2019

Epistemology

Epistemology

— It is the (philosophical) study of knowledge

— Includes topics such as

- k. generation
- k. structure
- Justification of k.
- Decision making
- A general introduction can be found in the [Stanford Wiki](#)

Why epistemology in innovation?

Epistemology and Innovation

— We study epistemology in innovation theory for two main reasons
   1. Knowing what k. generation process is assumed helps us understand where we operate ("the environment"), and thus how we can generate innovations
   2. At the same time, the environment leads us to a certain type of reasoning ("rationality") and therefore decision making process

— In this lecture, we present models that are considered surpassed, but still represent how most people think our k-making process works

Decision-making

Decision-making

Focus on...

— Type of decision-making process
— Difficulty of process
— Who can/can't use process
— Why use a process (over another)
— "Kritik" (i.e., boundaries and where it fails)

Why decision-making in business?

How does this connect to ICT?

Historical perspectives

Positivism

Objectivism

Determinism

Modernism

Romanticism

Rationalism

Positivism, Modernism, etc.

— All these words have been used to describe the world from Enlightenment to the ~1960s

— They share a common underlying assumption: there is a univocal "truth", and k. is an ensemble of fragments of this "truth"

— How these views differ is subtle, but if you are curious Wikipedia has *very* comprehensive articles on all of these words…

What we will present

— In this course, we illustrate four main views, called "certainty", "risk", "uncertainty", and "ambiguity"
— These are not "universal" words! They are what *we* chose to explain these concepts to you, but literature often changes the labels...
— Since they also have a certain lexical overload tied to them, we associate them to one reading that exemplifies that view

Certainty

"See? It just works."

Certainty

— In certainty, the world is assumed to be a given in which we cannot deviate

— Every action necessary resolves in a success or a failure, with no space for maneuver

— There is no real space for choice or alternative possibilities

— Knowledge is instantaneous, goals are clear, actions are pre-determined, consequences necessary

— No amount of repetition of experiments can alter results

Decision making in certainty

Given **preferences** → We formulate → Goals → Which lead to → Actions → That have necessary → Consequences
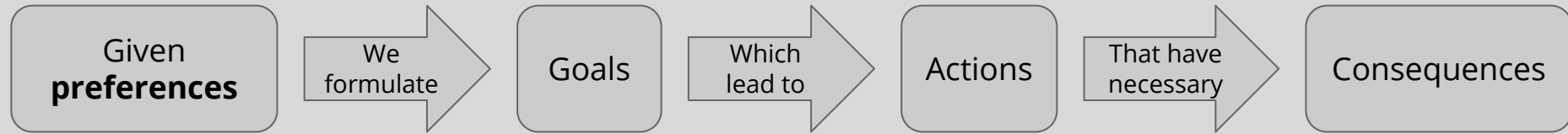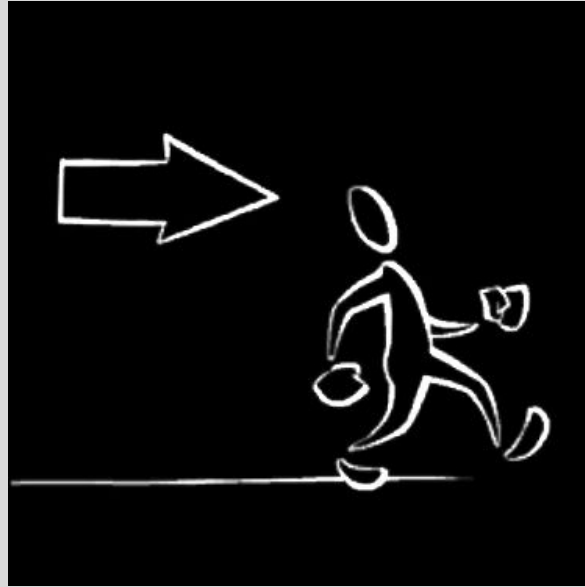
Some paths are straight forward.

Image and quote by Alexander Bruce, Antichamber (2013)
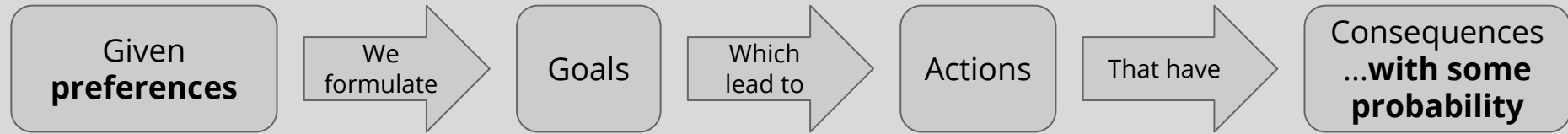
Risk

"60% of the times, it works every time."

Risk

— In risk, the world works like a casino

— The rules are clear from the get-go and, while we can be (un)lucky, no outcome is unforeseen

— Compared to certainty, the only difference is in the fact that outcomes are associated to a probability

— We can concoct strategies that allow us to handle risk when repeating experiments

— In this sense, the (conscious) risk-taker is already an entrepreneur

Decision making in risk

Given **preferences** → We formulate → Goals → Which lead to → Actions → That have → Consequences **...with some probability**

A choice may be as simple as going left or going right.

Uncertainty

"The truth is out there... It's up to you to find it."

Uncertainty

— In uncertainty we are still in a casino, but we don't know the probabilities (i.e., the rules of the game) so we have to search for them
— There still exists an objective, univocal truth, but we might still not be able to find it
— This is because search is associated with a cost, and we might not have enough resources
— This is the main epistemological view behind ICT!

I&E in Uncertainty

— Uncertainty gives much more space for innovation and entrepreneurship

— Innovation can be found in the way we conduct searches, and in how we manage the unknowns

— The entrepreneur is the person able to create new search strategies, invest wisely his resources... and take responsibility for the consequences of the unknowns

Decision making in uncertainty
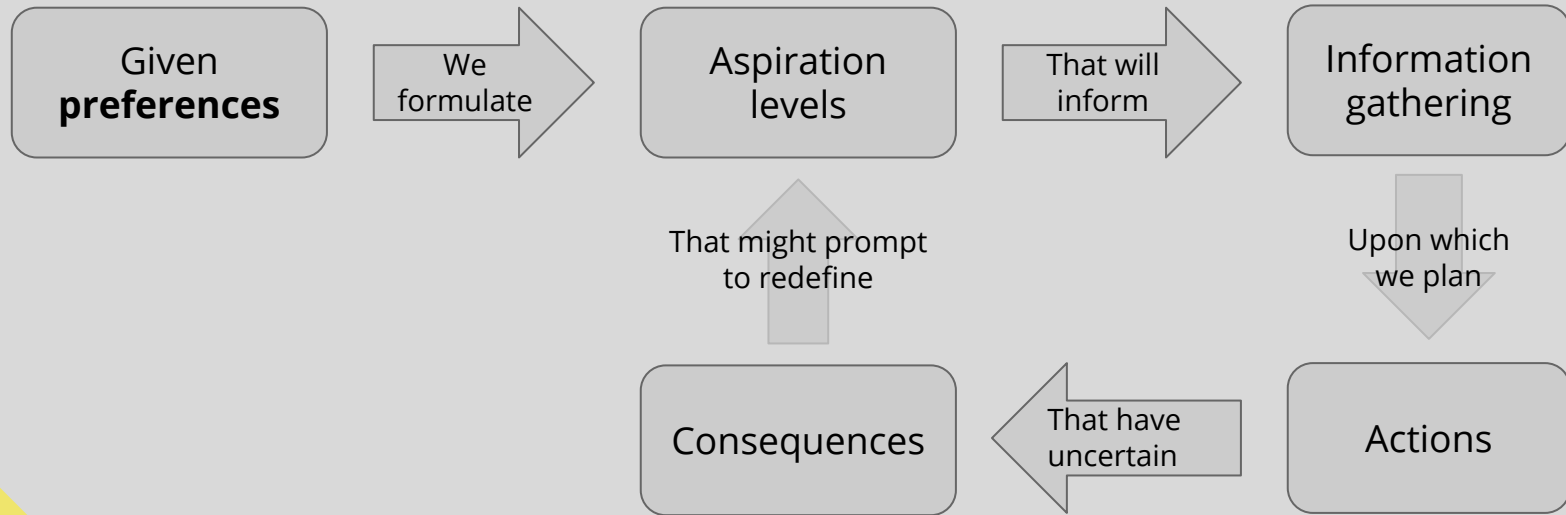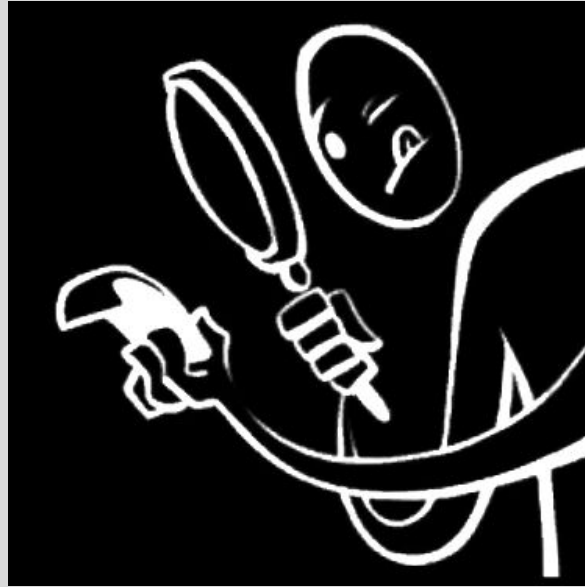
The solution to a problem may just require
a more thorough look at it.

Image and quote by Alexander Bruce, Antichamber (2013)

Examples

...in innovation

Examples

...in business

Examples

...in ICT

Key points

— Limited resources
  - Time
  - Money
  - CPU cycles
  - Cognitive capacity
— Convergence to optimality

Points of failure

Hasty Generalisation

assuming certainty

Risk → Reward

Risk Aversion

Uncertainty Intolerance

Different optimum definitions

Unknown unknowns

Contemporary Perspectives

— We present here only two perspectives on what we call "ambiguity"

— These views were proposed in the 1980s, but we will cover more of the so-called post-modern and contemporary world in the next lecture

Roulette

Roulette

— This is a complete worked example: we start from certainty and go all the way to strong ambiguity
— Look at the following slides to see how we incrementally alter the roulette to fit the presented models

Certainty

— Probabilities are always 1 or 0
— The knowledge that we have is the "true" knowledge
— Data are given

— How does this roulette work?

Roulette - Certainty

— All numbers and colors are replaced with the same number and color (e.g., all cells are a red 7)

Risk

— Probabilities are given and known a priori
— The knowledge that we have is true with a given probability
— Knowledge is a collection of data with given probabilities

— How does this roulette work?

Roulette - Risk

— Regular, run-of-the-mill roulette

Uncertainty

— Probabilities are not known a priori
— ... but they're out there, and can be searched
— Resources are limited, but once we acquire information, it is good forever

— How does this roulette work?

Roulette - Uncertainty

— The distribution of numbers and colours is unknown at the beginning
— When the ball stops the croupier shows the tile for the future rounds

What next?

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