# DEALING WITH THE GROWTH OF KNOWLEDGE

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Fly in the constant angle to The same navigation heuristics the Moon applied to a Flame

ILLUSTRATION OF THE MOTIVATION Why do moths fly into flames?

#### (GRANDEUR) AIM PROPOSAL OF THE FOLLOWING RESEARCH PROGRAM

- Specify different **classes** of **incomplete** mental models. We are qualitatively better than a moth in that we are aware of our ignorance!
- **Evaluate** the quality of decision made on the incomplete mental model. When does light navigation heuristics work?
- Study the possibility and the effect of learning. If a moth is lucky, it may learn that the navigation may not always work and adjust the heuristics!
- Characterize such intuitive **heuristics** as the choice of "corporate mission". *Moon navigation is not bad, eh?*
- Propose new solution concepts and analyze them when possible.

The research program resembles that by Gigerenzer and his collaborators on simple heuristics. cf) Gigerenzer and Todd (1999) "Simple Heuristics that makes us Smart"

#### I stick to rational choice rather than simple heuristics.

### BACKGROUND

• We are not and cannot be omniscient.

- Q. Isn't lack of knowledge already formalized by expected utility (EU) theory? Ans. The lack of knowledge in this work refers to the situation in which uncertainty state variables are not necessarily clear for the decision maker.
  cf) EU theory depends heavily on **complete state space** assumption. This implies that when the state is known, there is no uncertainty left!
- Q. But (as Wittgenstein says) is there any way other than to shut up about what we do not know?
   Ans. We may at least imagine **potential** effects for different types of ignorance.

### BACKGROUND 2 -- QUOTES

#### • Savage (1972) "The Foundations of Statistics"

Making an extreme idealization, which has in principle guided the whole argument of this book thus far, a person has only one decision to make in his whole life. He must, namely, decide how to live, and this he might in principle do once and for all. Though many, like myself, have found the concept of overall decision stimulating, it is certainly highly unrealistic and in many contexts unwieldy. Any claim to realism made by this book -- or indeed by almost any theory of personal decision of which I know -- is predicated on the idea that some of the individual decision situations into which actual people tend to subdivide the single grand decision do recapitulate in microcosm the mechanism of the idealized grand decision.

Popper (1959) "The Logic of Scientific Discovery"

The old scientific ideal of episteme -- of absolutely certain, demonstrable knowledge -- has proved to be an idol. The demand for scientific objectivity makes it inevitable that every scientific statement must remain *tentative for ever*. It may indeed be corroborated, but every corroboration is relative to other statements which, again, are tentative. Only in our subjective experiences of conviction, in our subjective faith, can we be 'absolutely certain'.

# RELATED RESEARCH INTHE LITERATURE

- Formal Research --Savage (1972), Kreps (1988) "Notes on the Theory of Choice"
- Problem Structuring -- Keeney (1992) Value-Focused Thinking, Soft Systems Approach

## THE SETTING

 Assume the situation where the causal relationship between the controllable variables (actions) A, the uncontrollable variables X, and the obtained utility of consequences is deterministic.

#### $u: A \times X \to \Re$

- The decision maker can make the best response to the perceived state. (i.e. chance node comes before decision node)
   A very important application of such a situation involves the analysis of pure-strategy Nash equilibria in games.
- The decision maker however does not know the precise description above. She constructs a simplified mental model to represent the situation above.

# OBSERVATION FRAME AND THE MENTAL MODEL

 An observation frame (a generalization of an information structure) is a partial function P from the (the imaginary completely descriptive) state space of the world into the observation language.

$$P^i: A \times X \to A^i \times X^i$$

• Denote the mental model

$$u^i: A^i \times X^i \to \Re$$







### STRATEGIC LEVEL DECISION MAKING

How / When can we make strategic decisions without analyzing the details? (We do not want to solve a huge decision tree...)



## INSIGHTS

- Coming up with the **adequate** frame of strategic options and strategic information gathering may be an art.
- Nevertheless, strategic decision making without looking into the details is justified at least in one way.