Game Theory Concepts

Strategic Interaction of Rational Agents

Agent: Autonomous, pro-active, acting entities

Interaction: The entire action profile determines the outcome

Strategic: Agents are aware of the game, its outcome and its utility

Rational: Agents aim for their most preferred outcome

Agents act knowing that others behave similarly: Quisque sibi Proximus....

In many standard example games the resulting solution is suboptimal according to Social Utility:

Prisoners dilemma, Tragedy of the Commons, ....
The impact of Rationality

The backward solution algorithm yields that this game has Value $1/0$. 
Mitigating the impact of Rationality by Cheap Talk

Red’s pledge: I swear that I will play \( \frac{1}{2}(M + L) \) whenever the game reaches C, yielding \( 2.5 / 2.5 \). If this pledge becomes part of the game playing then both players have a good reason to play M rather than L at A and B.
Changing the Rules

One of the great features in Mathematics is that one can always add or drop assumptions, and thus explore an unlimited realm of possible worlds.

Current Question:
What happens if we drop the assumption of Rationality?

What is the Alternative for Rationality? An Evil Agent??

How should we represent an Evil Agent? Model him after the best known prototype of Evil: the Devil??
How do we know the Devil?

- the fallen Angel
- Adam and Eve
- Job’s tribulations
- The temptation of Jesus
- Trader of Souls (Faust)
The lost battle
The outcome of the battle

Lucifer in Hell
Exploiting a weak opponent
Game Playing with God
Temptation of Christ

A deal not accepted
Faust and Mephistophiles

A deal accepted
How do we know the Devil?

- the fallen Angel
- Adam and Eve
- Job’s tribulations
- The temptation of Jesus
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The Devil may be Evil, but he is not Irrational! so he doesn’t solve our problem
Alternatives for rationality

- **Sadist / Masochistic player**
  - Same game form / adapted utility

- **Indifferent player**
  - Role played by Nature in game theory

- **Random player**
  - the same but now subject to probability

- **Unpredictable player**
  - Kolmogorov Random rather than probabilistically random

All these agents aim at optimizing something; they are Rational with respect to a Different Game
Yet another Alternative

Adriaans introduces a measure called **Facticity** for objects.

It measures the **code length** of the structural part in an optimal **two-part description** of the object.

Both regular and random objects have low **Facticity**.

A process yielding a sequence of objects is **Factive** if both the **Kolmogorov complexity** and the **Facticity** of the objects is increasing.

Rational players are not **Factive**; their behavior is predictable.

So our Irrational player could be a **Factive Player**?
Social Players

Game theory fails to represent **Dynamic formation and dissolving of Coalitions:**

“Let’s cooperate until we have eliminated Bob from the Game and then fight it out with the two of us...”

**Open problem:** Provide an description in terms of **Dynamic Epistemic Logic** of the scenario above, or in the **Cheap Talk Scenario** mentioned before.
Conclusion

Game Theory doesn’t provide a correct model of Real Life Game Playing; this has been confirmed by empirical research.

The dominant position of the Core Concept of Rationality is to blame

Alternatives for Rationality are hard to find

Being Evil is in most cases being Rational in some different Game

The Dynamic aspects of Social Interaction in game Playing requires to be modeled, possibly using Dynamic Epistemic Logic

ILLC is the right Institute for such a Project