Euromath 2012
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GAME THEORY

From Plato and Cortez to Neumann and Morgenstern

Plato ➜ Laches and Symposium

Soldier

Defense is successful

My Contribution is not essential
I risk my life

Defense fails

I should leave the battle

Cortez lands in Mexico(1518)

with a small force

They have to fight against numerous Aztecs

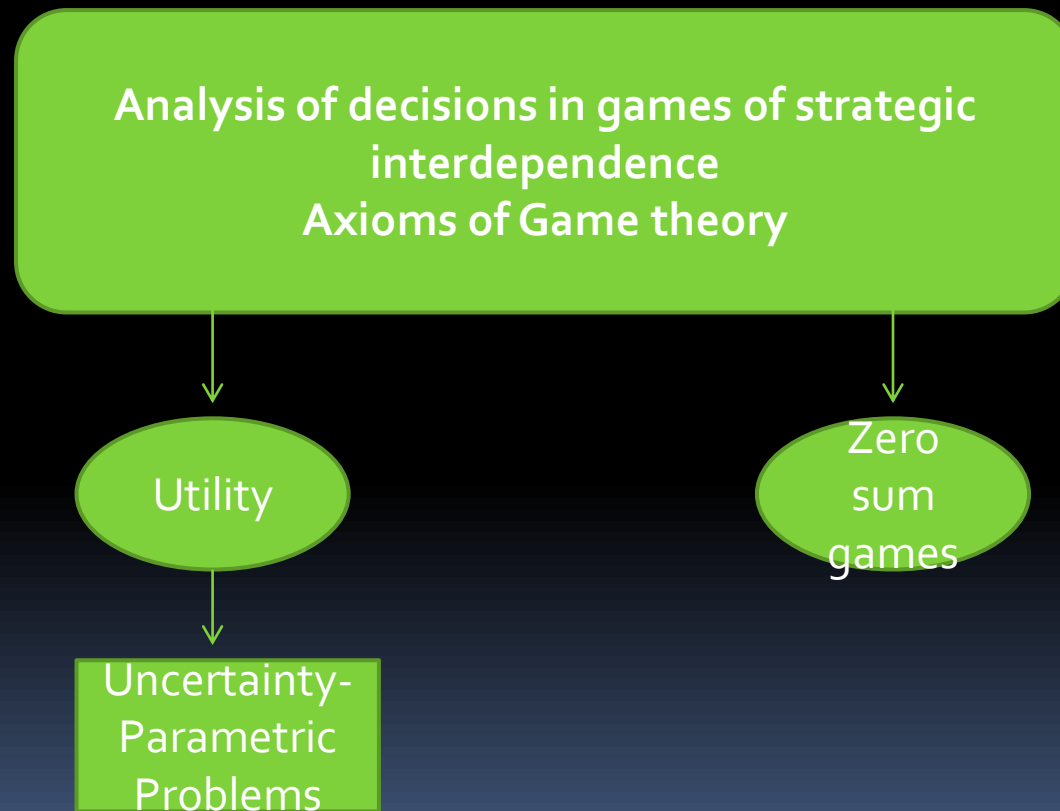He must ensure that his soldiers fight and win

He burns his ships

The Aztecs retreated and he had his victory bloodlessly !

Neumann and Morgenstern

Book: "Theory of Games and Economic Behaviour"

Analysis of decisions in games of strategic interdependence
Axioms of Game theory

Utility

Zero sum games

Uncertainty-Parametric Problems

Definition

Strategic interactions among economic agents

Game theory

Outcomes with respect to the preferences (utilities) of the agents

Strategy: a predetermined programme of play

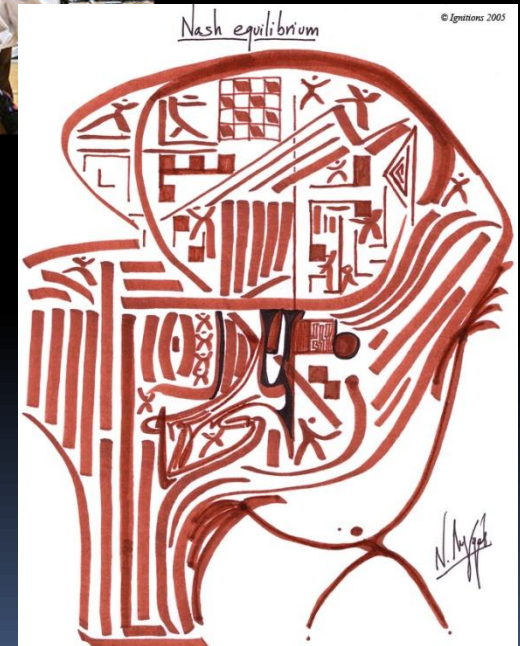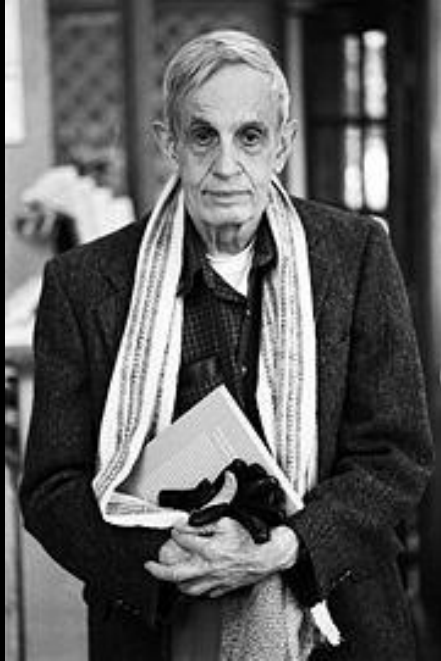# Characteristics of players-decision makers

rationality

- Intents to make decisions that will lead to the achievement of his goals

intelligence

- He knows the structure of the game
- He can assess the outcomes
- He knows that the other players are rational and intelligent(common knowledge)

Nash equilibrium

John Forbes Nash, Jr. (born June 13, 1928)
Princeton University in 1950:
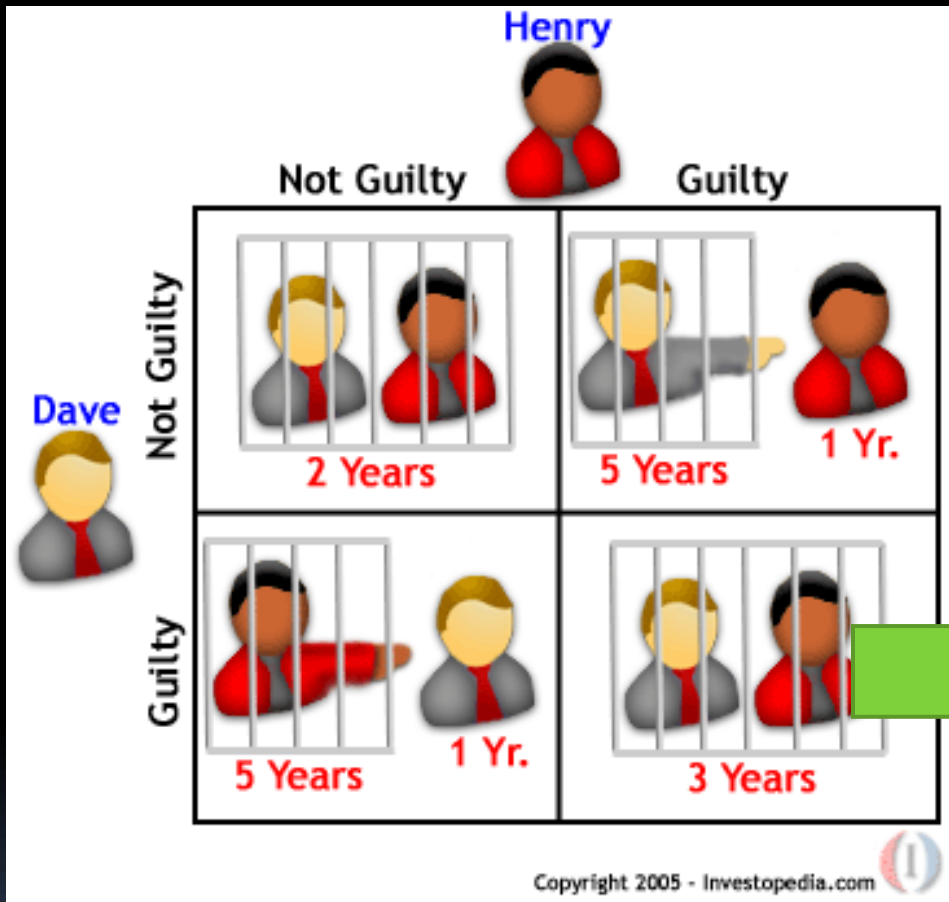**Equilibrium theory**

- When we say that a physical system is in equilibrium, we mean that it is in a *stable* state, one in which all the causal forces internal to the system balance each other out and so leave it 'at rest' until and unless it is perturbed by the intervention of some exogenous (that is, 'external') force.
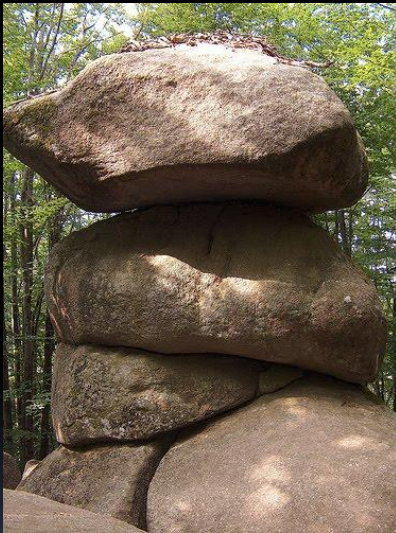
Every system in nature has at least a point of equilibrium!

The Prisoners Dilemma

Equilibrium

Game Theory & Biology

- An example: Hawk- Dove Game

	HAWK	DOVE
HAWK	½(V-C), ½(V-C)	V,0
DOVE	0,V	V/2, V/2

V = Resource for which conflict is initiated, C = Cost of injury / reduction of individual fitness

Game Theory & Biology

Hawk = Aggressive, will not retreat until injured or victorious

Dove = Will retreat if opponent has aggressive behavior

RESULTS / OBSERVATIONS:

1. Dove strategy is not evolutionary stable, because it can be invaded by the Hawk strategy

1. If V > C, then Hawk strategy is an evolutionary stable strategy

1. If V < C, then there is no evolutionary stable strategy if one only follows either Dove or Hawk strategy

Bibliography

- Avinash Dixit and Barry Nalebuff, "Game Theory." *The Concise Encyclopedia of Economics.* 2008. Library of Economics and Liberty. 21 March 2012. <http://econlib.org/library/Enc/GameTheory.html>.

- Kyrousis, Spuridakis,"Economic theory and algorithms".Patra, July 2007.

- Ross, Don, "Game Theory", *The Stanford Encyclopedia of Philosophy (Fall 2011 Edition)*, Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/fall2011/entries/game-theory/>.

THANK YOU FOR YOUR ATTENTION