PHIL309P
Methods in Philosophy, Politics and Economics

Eric Pacuit
University of Maryland

The Guessing Game

Guess a number between 1 & 100.
The closest to 2/3 of the average wins.

app.pacuit.io/games/avg

The Guessing Game, again

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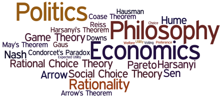

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What number should you guess?

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What number should you guess? 100

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What number should you guess? ~~100~~, ~~99~~, . . . , ~~67~~, . . . , 2, 1

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What number should you guess? ~~100~~, ~~99~~, . . . , ~~67~~, . . . , ~~2~~, (1)

Traveler's Dilemma

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4. The person that wrote the smaller number will receive that amount plus $2 (as a reward), and the person that wrote the larger number will receive the smaller number minus $2 (as a punishment).

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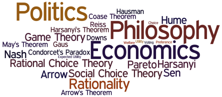

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Suppose that you are randomly paired with another person from class. What number would you write down?

app.pacuit.io/games/td

From Decisions to Games

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"*[T]he* fundamental insight of game theory [is] that a rational player must take into account that the players reason about each other in deciding how to play."

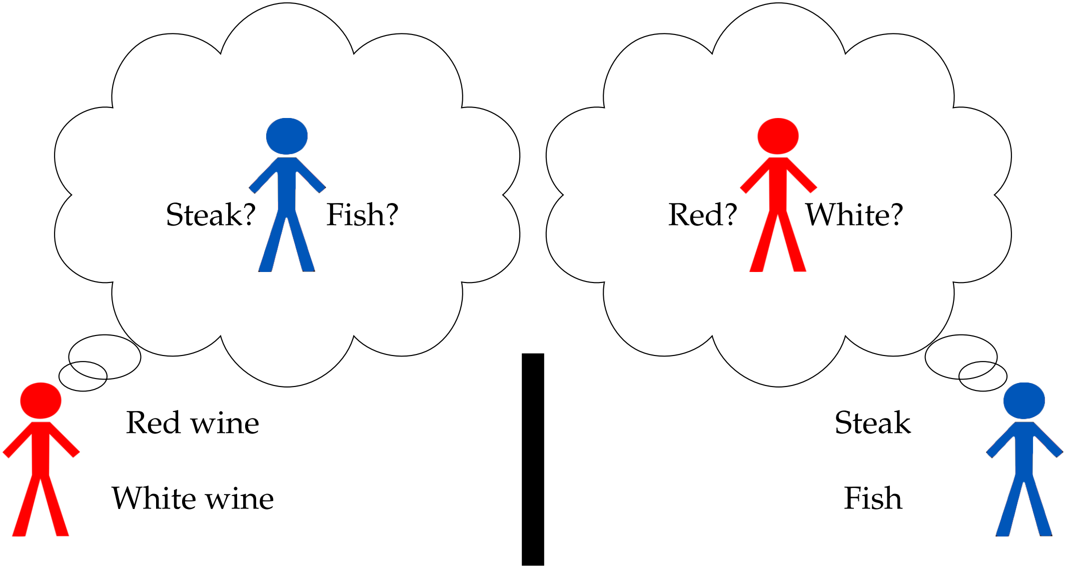
R. Aumann and J. Dreze. *Rational Expectations in Games*. American Economic Review, 98, pp. 72-86, 2008.

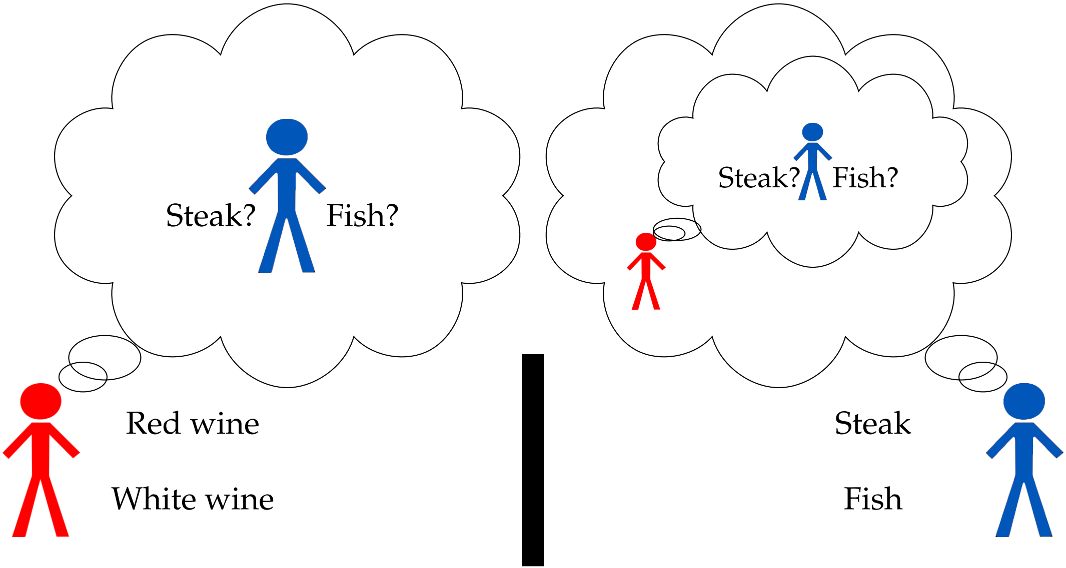
Red wine

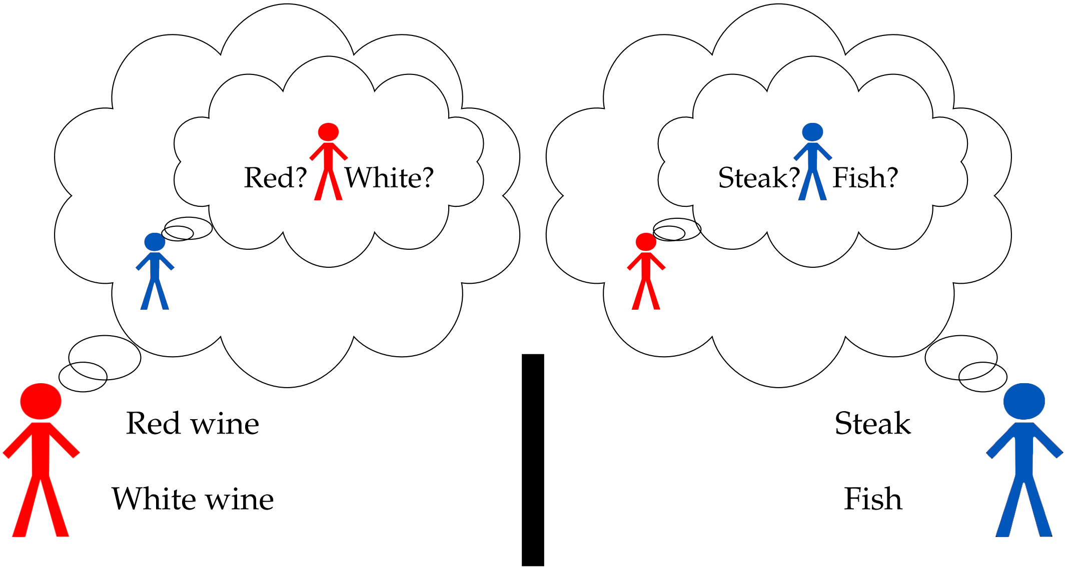
White wine

Steak

Fish


Steak?
Fish?
Red?
White?
Red wine
White wine
Steak
Fish


Steak?
Fish?
Steak?
Fish?
Red wine
White wine
Steak
Fish


Red? White?
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Red wine
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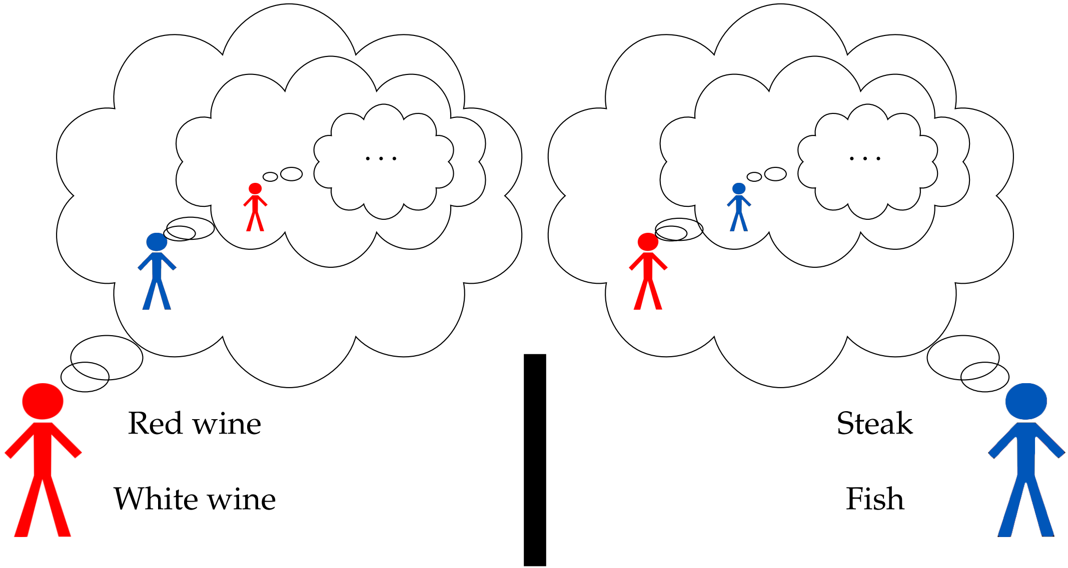
Fish



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From Decisions to Games

Commenting on the difference between Robinson Crusoe's maximization problem and the maximization problem faced by participants in a social economy, von Neumann and Morgenstern write:

"Every participant can determine the variables which describe his own actions but not those of the others. Nevertheless those "alien" variables cannot, from his point of view, be described by statistical assumptions.

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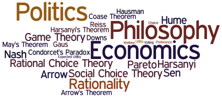

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"Every participant can determine the variables which describe his own actions but not those of the others. Nevertheless those "alien" variables cannot, from his point of view, be described by statistical assumptions. This is because the others are guided, just as he himself, by rational principles—whatever that may mean—and no *modus procedendi* can be correct which does not attempt to understand those principles and the interactions of the conflicting interests of all participants."

(vNM, pg. 11)

Game Situations

a group of *self-interested* agents (players) involved in some interdependent decision problem

Game Situations

Bob

F $\quad$ I

1 $\quad$ 0

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Game Situations

	Bob	
	F	*I*
	1	0
	0	3

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Game Situations

		Bob	
		F	I
Ann	F	3 1	0 0
	I	0 0	1 3

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		Bob	
		F	*I*
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Game Situations

Ann \ Bob	F	I
F	3,1	0,0
I	0,0	1,3

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pictured above: Battle of the Sexes (i.e., French, Italian)

Just Enough Game Theory

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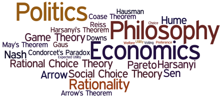

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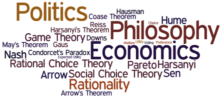

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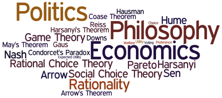

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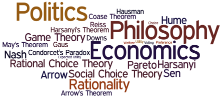

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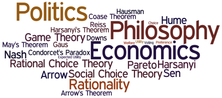

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*It does **not** specify the actions that the players **do take**.*

Rational Players

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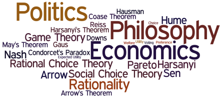

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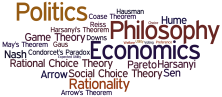

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- In decision theory, we treated these as stochastic/non-deterministic processes.
- However, in game theory, at least some of these processes are the actions taken by other players, which, in turn, are determined by the *internal reasoning* of those players.
- Furthermore, the reasoning processes of other players, themselves depend on their beliefs about the reasoning processes of all the other players (including us).

Simultaneous- and Sequential-move

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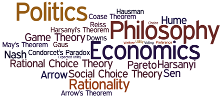

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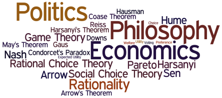

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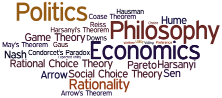

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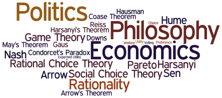

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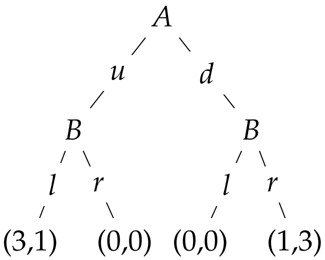
- In **Games of Imperfect Information** all players lack some knowledge about: each player's available actions, each player's preferences over outcomes, the structure of the game, or previous moves played (in sequential games). Examples: poker, buying/selling stocks, most real-world situations

Games

		B: l	*B*: r
A	u	3, 1	0, 0
A	d	0, 0	1, 3

Games

		B	
		l	r
A	u	3, 1	0, 0
	d	0, 0	1, 3



Games

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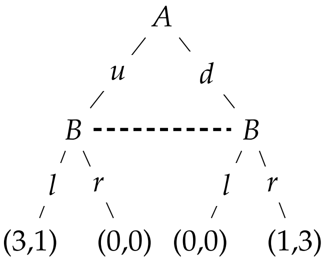

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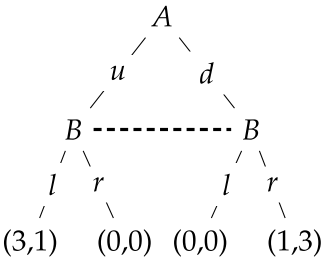

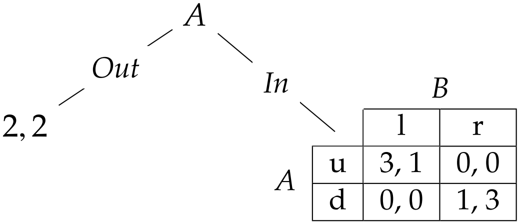

Solution Concept

A **solution concept** is a systematic description of the outcomes that may emerge in a family of games.

This is the starting point for most of game theory and includes many variants: Nash equilibrium, backwards induction, or iterated dominance of various kinds.

These are usually thought of as the embodiment of “rational behavior” in some way and used to analyze game situations.