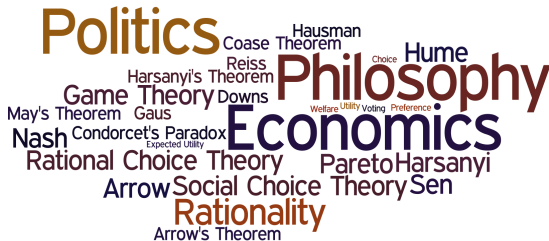


PHPE 400

Individual and Group Decision Making

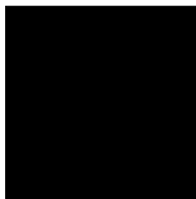
Eric Pacuit
University of Maryland
pacuit.org



Newcomb's Problem



A



B

Choice:

one-box: choose box *B*

two-box: choose box *A* and *B*

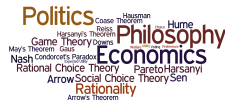


A very powerful being, who has been invariably accurate in his predictions about our behavior in the past, has already acted in the following way:

1. If he has predicted we will open just box B , he has put \$1,000,000 in box B .
2. If he has predicted we open both boxes, he has put nothing in box B .

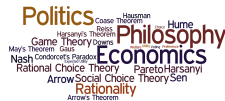
What should we do?

Newcomb's Paradox



		$pred_B$	$pred_AB$
you	B	1M	0
	AB	$1M+1T$	$1T$

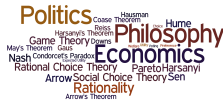
Newcomb's Paradox



		$pred_B$	$pred_AB$
you	B	1M	0
	AB	1M+1T	1T

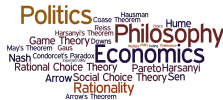
Principle of dominance: take both boxes.

Newcomb's Paradox



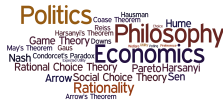
- ▶ $P(pred_B \mid B)$: The probability that the wizard predicted you would choose box B *given that you decided to choose box B .*
- ▶ $P(pred_AB \mid B)$: The probability that the wizard predicted you would choose both boxes *given that you decided to choose box B .*

Newcomb's Paradox



- ▶ $P(pred_B \mid B)$: The probability that the wizard predicted you would choose box B *given that you decided to choose box B .*
- ▶ $P(pred_AB \mid B)$: The probability that the wizard predicted you would choose both boxes *given that you decided to choose box B .*
- ▶ $P(pred_B \mid AB)$: The probability that the wizard predicted you would choose box B *given that you decided to choose both boxes.*
- ▶ $P(pred_AB \mid AB)$: The probability that the wizard predicted you would choose both boxes *given that you decided to choose both boxes.*

Newcomb's Paradox



- ✓ $P(pred_B \mid B)$: The probability that the wizard predicted you would choose box B *given that you decided to choose box B .*
- ✗ $P(pred_AB \mid B)$: The probability that the wizard predicted you would choose both boxes *given that you decided to choose box B .*
- ✗ $P(pred_B \mid AB)$: The probability that the wizard predicted you would choose box B *given that you decided to choose both boxes.*
- ✓ $P(pred_AB \mid AB)$: The probability that the wizard predicted you would choose both boxes *given that you decided to choose both boxes.*

Newcomb's Paradox

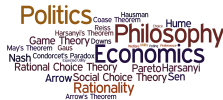


		$pred_B$	$pred_AB$
you	B	1M	0
	AB	1M+1T	1T

Expected utility maximization: take box B .

$$P(pred_B \mid B)1M + P(pred_AB \mid B)0 > P(pred_B \mid AB)(1M + 1T) + P(pred_AB \mid AB)1T$$

Newcomb's Paradox



What the Predictor did yesterday is *probabilistically dependent* on the choice today, but *causally independent* of today's choice.

Act-state independence: For all states s and actions X , $P(s) = P(s \mid X)$

J. Collins. *Newcomb's Problem*. International Encyclopedia of Social and Behavioral Sciences, 1999.

Game Theory

[illegible]

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The Guessing Game



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



The Guessing Game (Round 2)



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



The Guessing Game

Politics
Philosophy
Economics
Rationality
Arrow's Theorem
Arrow
Social Choice
Theory
Sen
Pareto
Harsanyi
Nash
Condorcet's Paradox
Gaus
May's Theorem
Harsanyi's Theorem
Coase Theorem
Hausman
Hume
Game Theory
Downs
Rational Choice Theory



Guess a number between 1 & 100.
The closest to $\frac{2}{3}$ of the average wins.

The Guessing Game

Politics
Coase
Hausman
Theorem
Hume
Philosophy
Game Theory
Harsanyi's Theorem
Downs
Economics
Nash
May's Theorem
Condorcet's Paradox
Gaus
Rational Choice Theory
Arrow
Social Choice
Pareto
Harsanyi
Theory
Sen
Rationality
Arrow's Theorem



Guess a number between 1 & 100.
The closest to $\frac{2}{3}$ of the average wins.

What number should you guess?



What number should you guess? 100

The Guessing Game



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

What number should you guess? ~~100~~, 99



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

The Guessing Game



Guess a number between 1 & 100.
The closest to $\frac{2}{3}$ of the average wins.

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

The Guessing Game



Guess a number between 1 & 100.
The closest to $\frac{2}{3}$ of the average wins.

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