

References for this lecture:

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Ye. S. Venttsel, "Elements of Game Theory", Mir, 1980

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Game Theory: Theme and Variations

- Zero- vs. non-zero sum
- Two- vs. N-person games
- Finite vs. Infinite number of choices
- Games of perfect information
- Iterated vs. non-iterated games

Two-Person Zero Sum Games

- The notion of a "dominant" choice
- Tricks for reducing game matrices
- The "solution" of a zero-sum game

The "value" of a game
The minimax theorem

- "Pure" vs. "Mixed" Strategies
- Symmetric games

Non-Zero-Sum Games

- The notion of an "equilibrium" point
- The Prisoner's Dilemma and Axelrod's Tournament
- Psychological experiments with Prisoner's Dilemma-like Games
- Other considerations:
 - "noise" (error)
 - Populations/Geography
 - Evolution of strategies
- N-Person Games, and the notion of a "Solution Set"

ALL-DEFECT simply defects on every game.

```
(define (all-defect my-history other-guys-history)
  'DEFECT)
```

POOR-TRUSTING-FOOL cooperates on every game.

```
(define (poor-trusting-fool my-history other-guys-history)
  'COOPERATE)
```

UNFORGIVING cooperates up until the first defection of the other player; then it defects from that point onward.

```
(define (unforgiving my-history other-guys-history)
  (if (true-of-any?
      (lambda (other-guys-response)
        (eq? 'DEFECT other-guys-response))
      other-guys-history)
      'DEFECT
      'COOPERATE))
```

TIT-FOR-TAT cooperates on the very first game; after that it simply repeats the other player's move from the previous game (i.e. cooperating or defecting at game n if the other player did the same for game n-1).

```
(define (tit-for-tat my-history other-guys-history)
  (if (null? other-guys-history)
      'COOPERATE
      (most-recent-play other-guys-history)))
```

Game Theory in Cognitive Science

- The assumption of rationality
- Are strategies real?
- The game of chicken and the paradox of omniscience
- Finding the matrix

Von Neumann/Morgenstern principles for analyzing N-person games with coalitions

- Pareto Optimality

A solution set should contain only solutions that have "Pareto Optimality", meaning that there are no other solutions in which all the players simultaneously do better.

- Individual Rationality

Any solution that includes a coalition must be "individually rational": no player in the coalition should do better by simply going it alone.

- For any $S1$, $S2$ in a plausible solution set, it cannot be the case that $S1$ dominates $S2$. ($S1$ dominates $S2$ for an N-person game if there is a coalition of players that has the will and ability to adopt a new solution in which they-- i.e., the folks in the to-be-formed coalition -- all do better.)

- Every solution not in the solution set is dominated by some solution in the set.