Rationality

Lecture 14

Eric Pacuit

Center for Logic and Philosophy of Science
Tilburg University
ai.stanford.edu/~epacuit
e.j.pacuit@uvt.nl

December 1, 2010
What should/will Ann (Bob) do?
What should/will Ann (Bob) do?
What should/will Ann (Bob) do?
Nozick: Symbolic Utility

“Yet the symbolic value of an act is not determined solely by *that* act.
Nozick: Symbolic Utility

“Yet the symbolic value of an act is not determined solely by *that* act. The act’s meaning can depend upon what other acts are available with what payoffs and what acts also are available to the other party or parties.
Nozick: Symbolic Utility

“Yet the symbolic value of an act is not determined solely by that act. The act’s meaning can depend upon what other acts are available with what payoffs and what acts also are available to the other party or parties. What the act symbolizes is something it symbolizes when done in that particular situation, in preference to those particular alternatives.
Nozick: Symbolic Utility

“Yet the symbolic value of an act is not determined solely by that act. The act’s meaning can depend upon what other acts are available with what payoffs and what acts also are available to the other party or parties. What the act symbolizes is something it symbolizes when done in that particular situation, in preference to those particular alternatives. If an act symbolizes “being a cooperative person,” it will have that meaning not simply because it has the two possible payoffs it does
“Yet the symbolic value of an act is not determined solely by *that* act. The act’s meaning can depend upon what other acts are available with what payoffs and what acts also are available to the other party or parties. What the act symbolizes is something it symbolizes when done in *that* particular situation, in preference to *those* particular alternatives. If an act symbolizes “being a cooperative person,” it will have that meaning not simply because it has the two possible payoffs it does but also because it occupies a particular position within the two-person matrix — that is, being a dominated action that (when joined with the other person’s dominated action) yield a higher payoff to each than does the combination of dominated actions.” (pg. 55)

What should/will Ann (Bob) do?
What should/will Ann (Bob) do?
What should/will Ann (Bob) do?
Prisoner’s Dilemma

<table>
<thead>
<tr>
<th></th>
<th>Bob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ann</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D</td>
</tr>
<tr>
<td>D</td>
<td>3,3</td>
</tr>
<tr>
<td>C</td>
<td>4,1</td>
</tr>
</tbody>
</table>

What should/will Ann (Bob) do?
What should/will Ann (Bob) do?
What should/will Ann (Bob) do?
What should/will Ann (Bob) do?
What should/will Ann (Bob) do?

Prisoner’s Dilemma

<table>
<thead>
<tr>
<th>Ann</th>
<th>Bob</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>D</strong></td>
<td><strong>C</strong></td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>3,3</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>4,1</td>
</tr>
</tbody>
</table>
What should/will Ann (Bob) do?

Prisoner’s Dilemma
“Game theorists think it just plain wrong to claim that the Prisoners’ Dilemma embodies the essence of the problem of human cooperation.
“Game theorists think it just plain wrong to claim that the Prisoners’ Dilemma embodies the essence of the problem of human cooperation. On the contrary, it represents a situation in which the dice are as loaded against the emergence of cooperation as they could possibly be. If the great game of life played by the hum species were the Prisoner’s Dilemma, we wouldn’t have evolved as social animals!
“Game theorists think it just plain wrong to claim that the Prisoners’ Dilemma embodies the essence of the problem of human cooperation. On the contrary, it represents a situation in which the dice are as loaded against the emergence of cooperation as they could possibly be. If the great game of life played by the human species were the Prisoner’s Dilemma, we wouldn’t have evolved as social animals! .... No paradox of rationality exists. Rational players don’t cooperate in the Prisoners’ Dilemma, because the conditions necessary for rational cooperation are absent in this game.”

Hi-Low

What should/will Ann (Bob) do?

\[
\{ \text{water, beer, sherry, whisky, wine} \} 
\]

\{water, beer, sherry, whisky, wine\}

**Task 1:** pick an option

\{water, beer, sherry, whisky, wine\}

Task 1: pick an option
Task 1: pick an option
Task 2: guess what your opponent picked

\{ \text{water}, \text{beer}, \text{sherry}, \text{whisky}, \text{wine} \}
\{\text{water}, \text{beer}, \text{sherry}, \text{whisky}, \text{wine}\}

Task 1: pick an option
Task 2: guess what your opponent picked
Task 3: try to coordinate with your (unknown) partner
Task 1: pick an option
Task 2: guess what your opponent picked
Task 3: try to coordinate with your (unknown) partner

\[
\{\text{water}, \text{beer}, \text{sherry}, \text{whisky}, \text{wine}\}
\]

<table>
<thead>
<tr>
<th></th>
<th>pick</th>
<th>guess</th>
<th>coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>20</td>
<td>15</td>
<td>38</td>
</tr>
<tr>
<td>beer</td>
<td>13</td>
<td>26</td>
<td>11</td>
</tr>
<tr>
<td>sherry</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>whisky</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>wine</td>
<td>10</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>
Footballer Example

A and B are players in the same football team. A has the ball, but an opposing player is converging on him. He can pass the ball to B, who has a chance to shoot. There are two directions in which A can move the ball, left and right, and correspondingly, two directions in which B can run to intercept the pass. If both choose left there is a 10% chance that a goal will be scored. If they both choose right, there is a 11% change. Otherwise, the chance is zero. There is no time for communication; the two players must act simultaneously.

What should they do?

What should I do? (if the probability of Column choosing \( l \) is \( > \frac{10}{21} \) and if the probability of Column choosing \( r \) is \( > \frac{11}{21} \))
What should I do? (if the probability of Column choosing top is > 1.2 and if the probability of Column choosing bottom is > 11.2)

<table>
<thead>
<tr>
<th>Row</th>
<th>l</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>l</td>
<td>(10,10)</td>
<td>(0,0)</td>
</tr>
<tr>
<td>r</td>
<td>(0,0)</td>
<td>(11,11)</td>
</tr>
</tbody>
</table>
Row: What should I do?

<table>
<thead>
<tr>
<th></th>
<th>l</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row l</td>
<td>(10,10)</td>
<td>(0,0)</td>
</tr>
<tr>
<td>Row r</td>
<td>(0,0)</td>
<td>(11,11)</td>
</tr>
</tbody>
</table>
**Row**: What should I do? (\( r \) if the probability of Column choosing \( r \) is \( > \frac{10}{21} \) and \( l \) if the probability of Column choosing \( l \) is \( > \frac{11}{21} \))

<table>
<thead>
<tr>
<th></th>
<th>( l )</th>
<th>( r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( l )</td>
<td>((10,10))</td>
<td>((0,0))</td>
</tr>
<tr>
<td>( r )</td>
<td>((0,0))</td>
<td>((11,11))</td>
</tr>
</tbody>
</table>
Row: What should we do?

<table>
<thead>
<tr>
<th></th>
<th>l</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row l</td>
<td>(10,10)</td>
<td>(0,0)</td>
</tr>
<tr>
<td>Row r</td>
<td>(0,0)</td>
<td>(11,11)</td>
</tr>
</tbody>
</table>
Team Reasoning: escape from the infinite regress? why should this “mode of reasoning” be endorsed?

<table>
<thead>
<tr>
<th></th>
<th>Column</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Row</strong></td>
<td>l</td>
</tr>
<tr>
<td>l</td>
<td>(10,10)</td>
</tr>
<tr>
<td>r</td>
<td>(0,0)</td>
</tr>
</tbody>
</table>
“The basic intellectual premise, or working hypothesis, for rational players in this game seems to be the premise that some rule must be used if success is to exceed coincidence, and that the best rule to be found, whatever its rationalization, is consequently a rational rule.”

(Thomas Schelling)
Rationality in Interaction

What does it mean to be rational when the outcome of one’s action depends upon the actions of other people and everyone is trying to guess what the others will do?
Rationality in Interaction

What does it mean to be rational when the outcome of one’s action depends upon the actions of other people and everyone is trying to guess what the others will do?

*In social interaction, rationality has to be enriched with further assumptions about individuals’ mutual knowledge and beliefs, but these assumptions are not without consequence.*

C. Bicchieri. *Rationality and Game Theory*. Chapter 10 in [HR].
Example: Common Knowledge

Suppose there are two friends Ann and Bob are on a bus separated by a crowd.
Example: Common Knowledge

Suppose there are two friends Ann and Bob are on a bus separated by a crowd. Before the bus comes to the next stop a mutual friend from outside the bus yells “get off at the next stop to get a drink?”.
Example: Common Knowledge

Suppose there are two friends Ann and Bob are on a bus separated by a crowd. Before the bus comes to the next stop a mutual friend from outside the bus yells “get off at the next stop to get a drink?”.

Say Ann is standing near the front door and Bob near the back door.
Example: Common Knowledge

Suppose there are two friends Ann and Bob are on a bus separated by a crowd. Before the bus comes to the next stop a mutual friend from outside the bus yells “get off at the next stop to get a drink?”.

Say Ann is standing near the front door and Bob near the back door. When the bus comes to a stop, will they get off?
Example: Common Knowledge

Suppose there are two friends Ann and Bob are on a bus separated by a crowd. Before the bus comes to the next stop a mutual friend from outside the bus yells “get off at the next stop to get a drink?”.

Say Ann is standing near the front door and Bob near the back door. When the bus comes to a stop, will they get off?


“Common Knowledge” is informally described as what any fool would know, given a certain situation: It encompasses what is relevant, agreed upon, established by precedent, assumed, being attended to, salient, or in the conversational record.
“Common Knowledge” is informally described as what any fool would know, given a certain situation: It encompasses what is relevant, agreed upon, established by precedent, assumed, being attended to, salient, or in the conversational record.

*It is not Common Knowledge who “(formally) defined” Common Knowledge!*
The first formal definition of common knowledge?

<table>
<thead>
<tr>
<th>Authors</th>
<th>Title</th>
<th>Journal</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. Friedell</td>
<td><em>On the Structure of Shared Awareness</em></td>
<td>Behavioral Science</td>
<td>1969</td>
</tr>
<tr>
<td>R. Aumann</td>
<td><em>Agreeing to Disagree</em></td>
<td>Annals of Statistics</td>
<td>1976</td>
</tr>
</tbody>
</table>

Fixed-point definition:

\[
\gamma := i \text{ and } j \text{ know that } (\phi \text{ and } \gamma)
\]


The first formal definition of common knowledge?

The first rigorous analysis of common knowledge
The first formal definition of common knowledge?

The first rigorous analysis of common knowledge

**Fixed-point definition**: \( \gamma := i \text{ and } j \text{ know that } (\varphi \text{ and } \gamma) \)
The first formal definition of common knowledge?

The first rigorous analysis of common knowledge

Fixed-point definition: \( \gamma := i \text{ and } j \text{ know that } (\varphi \text{ and } \gamma) \)

**Shared situation**: There is a *shared situation* \( s \) such that (1) \( s \) entails \( \varphi \), (2) \( s \) entails everyone knows \( \varphi \), plus other conditions
http://plato.stanford.edu/entries/common-knowledge/.
Suppose you are told “Ann and Bob are going together,” and respond “sure, that’s common knowledge.” What you mean is not only that everyone knows this, but also that the announcement is pointless, occasions no surprise, reveals nothing new; in effect, that the situation after the announcement does not differ from that before.

...the event “Ann and Bob are going together” — call it $E$ — is common knowledge if and only if some event — call it $F$ — happened that entails $E$ and also entails all players’ knowing $F$ (like all players met Ann and Bob at an intimate party).

(Aumann, pg. 271, footnote 8)
Key Assumptions

CK1 The structure of the game, including players’ strategy sets and payoff functions, is common knowledge among the players.

CK2 The players are rational (i.e., they are expected utility maximizers) and this is common knowledge.
Common Knowledge of Rationality: Iterated Removal of Strictly Dominated Strategies

There is no prior such that $R$ is rational for Bob.
Common Knowledge of Rationality: Iterated Removal of Strictly Dominated Strategies

<table>
<thead>
<tr>
<th></th>
<th>Ann</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$U$</td>
</tr>
<tr>
<td>$L$</td>
<td>$1,2$</td>
</tr>
<tr>
<td>$R$</td>
<td>$0,1$</td>
</tr>
</tbody>
</table>

There is no prior such that $R$ is rational for Bob.
Common Knowledge of Rationality: Iterated Removal of Strictly Dominated Strategies

<table>
<thead>
<tr>
<th></th>
<th>Bob</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L</strong></td>
<td></td>
</tr>
<tr>
<td><strong>U</strong></td>
<td>1,2</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>0,1</td>
</tr>
</tbody>
</table>

If Ann knows this, then she does not consider $R$ a option for Bob.
Common Knowledge of Rationality: Iterated Removal of Strictly Dominated Strategies

<table>
<thead>
<tr>
<th></th>
<th>Ann</th>
<th>Bob</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>1,2</td>
<td>0,1</td>
</tr>
<tr>
<td></td>
<td>0,1</td>
<td>1,0</td>
</tr>
</tbody>
</table>

So, \( U \) is the only rational choice.
Common knowledge of rationality (players will not choose strictly dominated actions) leads to a process of iterated removal of strictly dominated strategies.
Common knowledge of rationality (players will not choose strictly dominated actions) leads to a process of iterated removal of strictly dominated strategies.

What about weak dominance?
Weak Dominance

A

B
Weak Dominance

A

\begin{array}{|c|c|c|c|c|}
\hline
\bullet & \bullet & \bullet & \bullet & \bullet \\
\hline
\end{array}

B

\begin{array}{|c|c|c|c|c|}
\hline
\bullet & \bullet & \bullet & \bullet & \bullet \\
\hline
\end{array}
Weak Dominance
Suppose rationality incorporates weak dominance (i.e., admissibility or cautiousness).

1. Both Row and Column should use a full-support probability measure.
2. But if Row thinks that Column is rational, then should she not assign probability 1 to \( L \)?

The condition that the players incorporate admissibility into their rationality calculations seems to conflict with the condition that the players think the other players are rational (there is a tension between admissibility and strategic reasoning).

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>( U )</td>
<td>1,1</td>
<td>0,1</td>
</tr>
<tr>
<td>( D )</td>
<td>0,2</td>
<td>1,0</td>
</tr>
</tbody>
</table>
Iterated Admissibility

<table>
<thead>
<tr>
<th></th>
<th>$L$</th>
<th>$R$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U$</td>
<td>1,1</td>
<td>0,1</td>
</tr>
<tr>
<td>$D$</td>
<td>0,2</td>
<td>1,0</td>
</tr>
</tbody>
</table>

Suppose rationality incorporates *weak dominance* (i.e., *admissibility* or *cautiousness*).
Iterated Admissibility

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1,1</td>
<td>0,1</td>
</tr>
<tr>
<td>D</td>
<td>0,2</td>
<td>1,0</td>
</tr>
</tbody>
</table>

Suppose rationality incorporates *weak dominance* (i.e., *admissibility* or *cautiousness*).

1. Both Row and Column should use a *full-support* probability measure
2. But if Row thinks that Column is *rational* then should she not assign probability 1 to \( L \)?
Iterated Admissibility

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1,1</td>
<td>0,1</td>
</tr>
<tr>
<td>D</td>
<td>0,2</td>
<td>1,0</td>
</tr>
</tbody>
</table>

Suppose rationality incorporates *weak dominance* (i.e., *admissibility* or *cautiousness*).

1. Both Row and Column should use a *full-support* probability measure
2. But if Row thinks that Column is *rational* then should she not assign probability 1 to L?

*The condition that the players incorporate admissibility into their rationality calculations seems to conflict with the condition that the players think the other players are rational (there is a tension between admissibility and strategic reasoning)*
Iterated Removal of Weakly Dominated Strategies

```
  | L  | R  |
---|----|----|
T  | 1,1| 1,0|
B  | 1,0| 0,1|
```

Bob weakly dominates Ann.
Iterated Removal of Weakly Dominated Strategies

\begin{tabular}{cc|cc}
 & & L & R \\
\hline
T & 1,1 & 1,0 \\
B & 1,0 & 0,1 \\
\end{tabular}

$T$ weakly dominates $B$
Then $L$ strictly dominates $R$. 
Iterated Removal of Weakly Dominated Strategies

The IA set

```
|   | L  | R  |
|---|----|--
| T | 1,1| 1,0|
| B | 1,0| 0,1|
```
Iterated Removal of Weakly Dominated Strategies

But, now what is the reason for not playing B?
Backwards Induction

Invented by Zermelo, Backwards Induction is an iterative algorithm for “solving” and extensive game.
Eric Pacuit: Rationality (Lecture 14)

A

(2, 3)

(1, 0) (2, 3) (1, 5)

B

(4, 4)

(3, 1) (4, 4)
(2, 3)

(1, 0)  (2, 3)  (1, 5)

(4, 4)

(3, 1)  (4, 4)
Bl Puzzle

Eric Pacuit: Rationality (Lecture 14) 24/33
Bl Puzzle

\[
\begin{align*}
(A) & \quad R_1 \quad B \quad r \quad A \quad R_2 \\
& \quad D_1 \quad d \quad D_2
\end{align*}
\]

(2,1) \quad (1,6) \quad (7,5) \quad (6,6)
BI Puzzle

\[ \begin{align*}
A & \quad R1 \quad B \\
D1 & \quad (2,1) & \quad d & \quad (1,6) \\
& \quad r & \quad (7,5)
\end{align*} \]
Bl Puzzle

\[ A \quad R1 \quad B \quad r \quad (7,5) \]

\[ D1 \quad d \quad (2,1) \quad (1,6) \]
BL Puzzle

\[ A \xrightarrow{R1} (1,6) \]
\[ D1 \]
\[ (2,1) \]
Bl Puzzle

\[ A \rightarrow^{R1} (1,6) \]
\[ \downarrow^{D1} \]
\[ (2,1) \]
Bl Puzzle

A

D1

(2,1)
BI Puzzle

\[ \begin{align*}
A & \quad \xrightarrow{R1} \quad B \quad \xrightarrow{r} \quad A \quad \xrightarrow{R2} \quad (6,6) \\
D1 & \quad \downarrow \quad d \quad \downarrow \quad D2 \\
(2,1) & \quad (1,6) \quad (7,5)
\end{align*} \]
But what if...

Are the players irrational?

What argument leads to the BI solution?
But what if...

- Are the players *irrational*?
- What argument leads to the BI solution?
Repeted Prisoner’s Dilemma

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
</tr>
<tr>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>
Repeated Prisoner’s Dilemma

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
</tr>
<tr>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>
Repeated Prisoner’s Dilemma

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
<th></th>
<th>C</th>
<th>D</th>
<th></th>
<th>C</th>
<th>D</th>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
<tr>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>

What about “tit-for-tat”?
Repeated Prisoner’s Dilemma

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
</tr>
<tr>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>

What about “tit-for-tat”?
Repeated Prisoner’s Dilemma

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
</tr>
<tr>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>

What about “tit-for-tat”?
Repeated Prisoner’s Dilemma

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
</tr>
<tr>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>

What about “tit-for-tat”?
Repeated Prisoner’s Dilemma

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
</tr>
<tr>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>

What about “tit-for-tat”?
Is anything missing in these models?
Formally, a game is described by its strategy sets and payoff functions.
Formally, a game is described by its strategy sets and payoff functions. But in real life, may other parameters are relevant; there is a lot more going on. Situations that substantively are vastly different may nevertheless correspond to precisely the same strategic game.
Formally, a game is described by its strategy sets and payoff functions. But in real life, may other parameters are relevant; there is a lot more going on. Situations that substantively are vastly different may nevertheless correspond to precisely the same strategic game. For example, in a parliamentary democracy with three parties, the winning coalitions are the same whether the parties hold a third of the seats, or, say, 49%, 39%, and 12% respectively.
Formally, a game is described by its strategy sets and payoff functions. But in real life, many other parameters are relevant; there is a lot more going on. Situations that substantively are vastly different may nevertheless correspond to precisely the same strategic game. For example, in a parliamentary democracy with three parties, the winning coalitions are the same whether the parties hold a third of the seats, or, say, 49%, 39%, and 12% respectively. But the political situations are quite different.
Formally, a game is described by its strategy sets and payoff functions. But in real life, may other parameters are relevant; there is a lot more going on. Situations that substantively are vastly different may nevertheless correspond to precisely the same strategic game. For example, in a parliamentary democracy with three parties, the winning coalitions are the same whether the parties hold a third of the seats, or, say, 49%, 39%, and 12% respectively. But the political situations are quite different. The difference lies in the attitudes of the players, in their expectations about each other, in custom, and in history, though the rules of the game do not distinguish between the two situations.

Two questions

▶ What should the players *do* in a game-theoretic situation and what should they expect? (Assuming everyone is *rational* and recognize each other’s rationality)

▶ What are the assumptions about rationality and the players’ knowledge/beliefs underlying the various solution concepts? *Why* would the agents’ follow a particular solution concept?
Writing a paper together

Intuitively, we solve these problems by working together. This is the question of collective agency.
Writing a paper together

Problem of Cooperation.

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,4</td>
</tr>
<tr>
<td>D</td>
<td>4,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>
Writing a paper together

Problem of Coordination.

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3,3</td>
<td>0,0</td>
</tr>
<tr>
<td>D</td>
<td>0,0</td>
<td>1,1</td>
</tr>
</tbody>
</table>
Writing a paper together

Intuitively, we solve these problem by working together. This is the question of collective agency.
Individual vs collective agency
Different contexts of agency

- Individual decision making and individual action against nature.
  - Ex: Gambling.

- Individual decision making in interaction.
  - Ex: Playing chess.

- Collective decision making.
  - Ex: Carrying the piano.

Eric Pacuit: Rationality (Lecture 14)
Different contexts of agency

- Individual decision making and individual action against nature.
  - Ex: Gambling.
Individual vs collective agency

Different contexts of agency

- Individual decision making and individual action against nature.

- Individual decision making in interaction.
  - Ex: Playing chess.
Different contexts of agency

- Individual decision making and individual action against nature.

- Individual decision making in interaction.

- Collective decision making.
  - Ex: Carrying the piano.
Different contexts of agency

- Individual decision making and individual action against nature.
- Individual decision making in interaction.
- Collective decision making.
Next: Social Choice Theory and Group Preferences