Lecture 8 Game Plan

- Retaliation, escalation, and disarmament
- Brinkmanship
  - Angry Negotiation Game
- Games with hidden information
Commitment in “Dr. Strangelove”

- **Severity**
  Create fear in the mind of the enemy

- **Irreversibility**
  Must be irreversible

- **Irrationality**
  Not something a sane man would do

- **Practicality**
  Punishment shouldn’t be too harsh

- **Clarity**
  “Tell the world”
“There is a difference between a balance of terror in which either side can obliterate the other and one in which both sides can do it no matter who strikes first”

Old West Gunman Game

<table>
<thead>
<tr>
<th></th>
<th>Try to Kill</th>
<th>Don’t</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Steve McQueen</strong></td>
<td>![Sad Face]  ![Sad Face]</td>
<td>![Happy Face]  ![Sad Face]</td>
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<tr>
<td><strong>Clint Eastwood</strong></td>
<td>![Sad Face]  ![Happy Face]</td>
<td>![Happy Face]  ![Happy Face]</td>
</tr>
</tbody>
</table>

*Try to Kill*

*Don’t*
Cold War Nuclear Game

<table>
<thead>
<tr>
<th></th>
<th>Khruschev</th>
<th>Kennedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preemptive</td>
<td><img src="sad.png" alt="Face" /></td>
<td><img src="happy.png" alt="Face" /></td>
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<tr>
<td>Strike</td>
<td><img src="sad.png" alt="Face" /></td>
<td><img src="happy.png" alt="Face" /></td>
</tr>
<tr>
<td>Don’t</td>
<td><img src="sad.png" alt="Face" /></td>
<td><img src="happy.png" alt="Face" /></td>
</tr>
</tbody>
</table>

- Preemptive Strike: Khruschev and Kennedy both experience negative outcomes.
- Don’t: Both experience positive outcomes.
Retaliation and Escalation in Business

- Price wars
- Marketing battles
- Negotiations with organized labor
Disarmament

To escape from a game of mutual harm:

1. **stabilize**: remove your strategies that limit others’ ability or *incentive to retaliate*
   - unilateral OK though simultaneous preferred
   - “retaliate” = “hurt after being hurt yourself”

2. **de-escalate**: decrease your severity of harm *while* decreasing others’ severity of retaliation
   - must be simultaneous to maintain credible retaliation throughout disarmament process
Punishment Must Fit Crime

- For retaliation to be credible, you must have the ability *and incentive* to retaliate after being harmed

- USA could never credibly threaten to invade Japan over trade barriers
Brinkmanship

“... between one out of three and even ...”

- John F. Kennedy, estimating the likelihood that the Cuban Missile Crisis would lead to nuclear war, 1962
Chicken in Real Time

- Suppose you have ability to move first, but you are unsure whether your opponent will swerve
  - opponent is either “sane” or “crazy”
  - you are known to be “sane”

- What would you do?
Probabilistic Threats

- “Throw out steering wheel” has drawback that you crash when opponent is crazy
- Not doing anything also isn’t good, since then your opponent will then throw out its steering wheel
- A solution is to swerve with probability in between 0% and 100%
  - must be often enough to deter “sane”
  - how might you do this, credibly?
Gradual Escalation of Risk

- Calibrating the best probability of your own craziness requires a lot of knowledge:
  - must know probability other is crazy
  - must know how much *the sane type* wants to avoid crashing
- Without this knowledge, you can still “probe” the others’ limits through a gradual escalation of the risk
  - i.e. disable steering wheel a little at a time
Conditions for Successful Brinkmanship

For this graph, see Figure 13.5 in the course textbook:

How Might Kennedy Learn about Soviet Craziness?


2. Adverse selection among those who do not yield to a given threat
   - or, in other words, not yielding may be an effective *signal* of craziness
Example: Adverse Selection in Wars of Attrition

- For simplicity, suppose Kennedy believes that the Soviets are either Crazy (50%) or Sane (50%).

- Among the Sane, however, the likelihood of war needed to make them back down ranges all the way from 0% to 100% (all equally likely)
Kennedy’s Initial Belief

CRAZY – won’t give in even with 100% likelihood of war

SANE – will give in when $q$ exceeds a threshold (from 0% to 100%, equally likely)
Kennedy’s Belief After Threat $q = \frac{1}{2}$ Ignored

- **CRAZY** – none yield
- **SANE** – half of them yield

*not yielding* credibly signals higher chance of being crazy (as well as higher threshold if Sane)*
In-Class Game

Angry Negotiation Game
Angry Negotiation: Rules

- Union and Management in an all-or-nothing dispute (no compromise)
- Each round, both players decide whether to Yield or Not.
  - If either Yields, the game ends
  - Otherwise, someone gets Angry with probability 10%*(#rounds so far)
    - if someone gets Angry, the game ends
    - if not, we continue to next round
Angry Negotiation: Payoffs

- Angry leads to payoff of 0 for everyone

- If Union yields, it gets payoff $U$. If Management yields, it gets payoff $M$
  - $U,M$ each either 100, 200, or 400 with equal prob
  - if both yield at same time, both get this

- If Union yields and Management does not, Management gets $M+100$

- Vice versa, Union gets $U+100$ if ...
Get Angry!

You will play as pairs. (Choose a partner and find another pair to play against.)

We will provide your value (100, 200, or 400) and a die to roll to determine anger.

Record game progress on handout and give this to TA at end of game.
“Don’t Yield Immediately”

- Your opponent remarks before playing:
  
  “Even if you have the highest value for avoiding failure (400), the prospect of winning an extra 100 is worth the 10% risk of losing 400 in Round 1. So, no one should ever Yield in Round 1.”

- Is this correct?
- What would you say / do back?
“Don’t Ever Yield”

- Your opponent remarks before playing:
  
  “The way to play this game is to tell the other player that you will never Yield. That forces them to Yield (and Yield immediately) ... just so you know, I’m never going to Yield.”

- Is this correct?

- What would you say / do back?
What About Against Me?

- Suppose I am your opponent
  - someone who is known to know game theory inside and out
    - not necessarily an advantage!
- You are allowed to make either of these statements before the game
- I am not allowed to say anything either before or during play
(Perceived) Stupidity as Strategic Force

- If you say “I will never yield, so you must yield”, I will call your bluff
  - By not yielding, I prove that I don’t believe your threat that you will never yield. So the threat loses its teeth.

- If you say “It’s better for me not to yield in Round 1 (or Round 2!)”, I get worried
  - Perhaps you really believe this
  - I now have incentive to yield immediately
  - Conveying *mistaken beliefs* can be an effective strategy
Deception

“All warfare is based on deception”

- Sun Tzu, “The Art of War”, 500BC
“Apparent confusion is a product of good order, apparent cowardice of courage, apparent weakness of strength”

- Sun Tzu, “The Art of War”, 500BC
Summary

- Many games involve uncertainty about other players’ payoffs
- One can learn about others through their actions, in a “fooling-proof” way
  - it’s too costly for other sorts to try to fool you
- Brinkmanship is one sort of example
  - those who don’t give in are least afraid of disaster (or most wanting to “win”)

Next two lectures: More on the strategic impact of hidden information.
Online Game #8
(Takeover Bidding)

- Play Online Game #8 prior to midnight before next lecture.

- Note: We are not playing the games in their numerical order!!
Appendix: Yielding in Round 1

- Someone must *sometimes* yield in Round 1 (i.e. w/ positive probability)

- Suppose not, that the first time anyone ever yields is Round K>1

- But someone planning to yield in Round K would do better yielding in Round 1
  - for same reason, yielding must *sometimes* occur in every round until no one is left
Appendix: Yield This Round or Next?

- Union type yielding in round K must prefer that to waiting until round K+1.

- **Benefit to yielding** is you avoid risk of anger: $U \times (K \times 10\%) \times (1 - p_K)$

- **Benefit to waiting** until round K+1 is that other may yield now: $100 \times p_K$
  - $p_K$ is probability that other yields in round K
## Appendix: Round 1 Equilibrium Play

<table>
<thead>
<tr>
<th>Type</th>
<th>Risk to Wait</th>
<th>Gain to Wait</th>
<th>Critical % Yielding</th>
<th>% Higher-Value Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-type</td>
<td>40</td>
<td>100</td>
<td>4/14 = 29%</td>
<td>0%</td>
</tr>
<tr>
<td>200-type</td>
<td>20</td>
<td>100</td>
<td>2/12 = 17%</td>
<td>33%</td>
</tr>
<tr>
<td>100-type</td>
<td>10</td>
<td>100</td>
<td>1/11 = 9%</td>
<td>67%</td>
</tr>
</tbody>
</table>

- No 200- or 100-types yield
  - if so, all 400-types must also yield
  - but 33%+ yielding means 200- and 100-types should *not* yield

- All 400-types yield
  - since 29%<33%, only 29/33 of the 400-types yield
  - if all yielded, none of them would want to yield
Appendix: Round 2 Equilibrium Play

<table>
<thead>
<tr>
<th></th>
<th>Risk to Wait</th>
<th>Gain to Wait</th>
<th>Critical % Yielding</th>
<th>% Higher-Value Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-type</td>
<td>80</td>
<td>100</td>
<td>8/18 = 44%</td>
<td>0%</td>
</tr>
<tr>
<td>200-type</td>
<td>40</td>
<td>100</td>
<td>4/14 = 29%</td>
<td>6%</td>
</tr>
<tr>
<td>100-type</td>
<td>20</td>
<td>100</td>
<td>2/12 = 17%</td>
<td>53%</td>
</tr>
</tbody>
</table>

- No 100-types yield
  - if so, all 200-types must also yield
  - but 53%+ yielding means 100-types should not yield
- All 400-types yield (6% of remaining population)
- Only some 200-types yield
  - since 53% > 29%, 200-types would have incentive not to yield if they all yielded → only 23/47 of them yield
## Appendix: Round 3 Equilibrium Play

<table>
<thead>
<tr>
<th></th>
<th>Risk to Wait</th>
<th>Gain to Wait</th>
<th>Critical % Yielding</th>
<th>% Higher-Value Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-type</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>200-type</td>
<td>60</td>
<td>100</td>
<td>6/16 = 38%</td>
<td>0%</td>
</tr>
<tr>
<td>100-type</td>
<td>30</td>
<td>100</td>
<td>3/13 = 23%</td>
<td>34%</td>
</tr>
</tbody>
</table>

- All 200-types yield
  - since 34% < 38%, all 200-types must yield
- No 100-types yield
  - since 34% > 23%, no 100-types yield
## Appendix: Round 4 Equilibrium Play

<table>
<thead>
<tr>
<th></th>
<th>Risk to Wait</th>
<th>Gain to Wait</th>
<th>Critical % Yielding</th>
<th>% Higher-Value Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-type</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>200-type</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>100-type</td>
<td>40</td>
<td>100</td>
<td>4/14 = 29%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- 29% of remaining 100-types yield
  - any less and all would want to yield
  - any more and none would want to yield
- ... 5/15 = 33% of remaining 100-types yield in Round 5, etc...