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"

Slide courtesy of Mike Shor, Vanderbilt University.

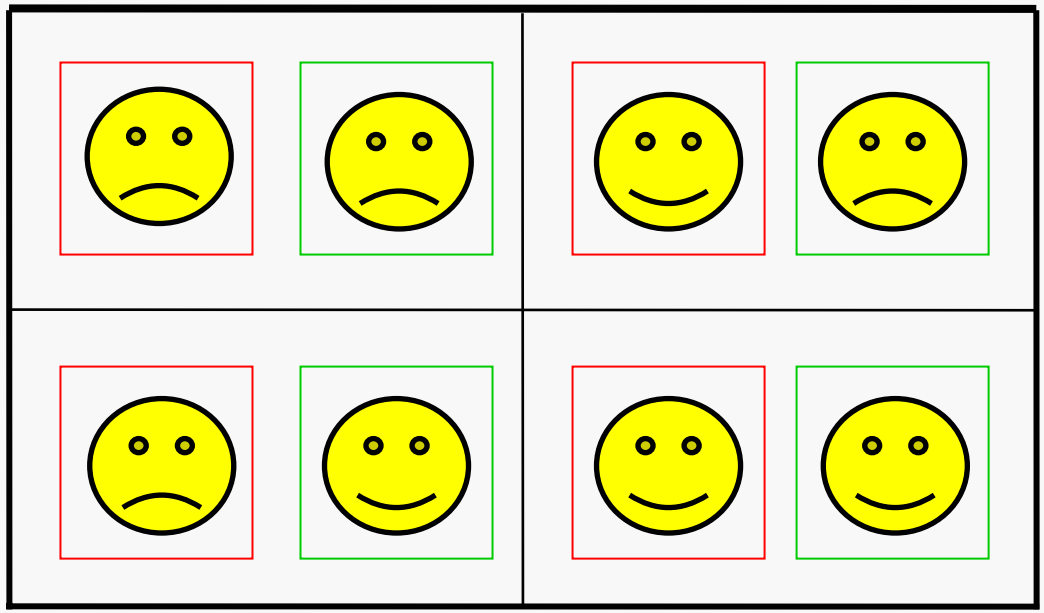
Surprise Attack

"There is a difference between a balance of terror in which <u>either</u> side can obliterate the other and one in which <u>both</u> sides can do it no matter who strikes first"

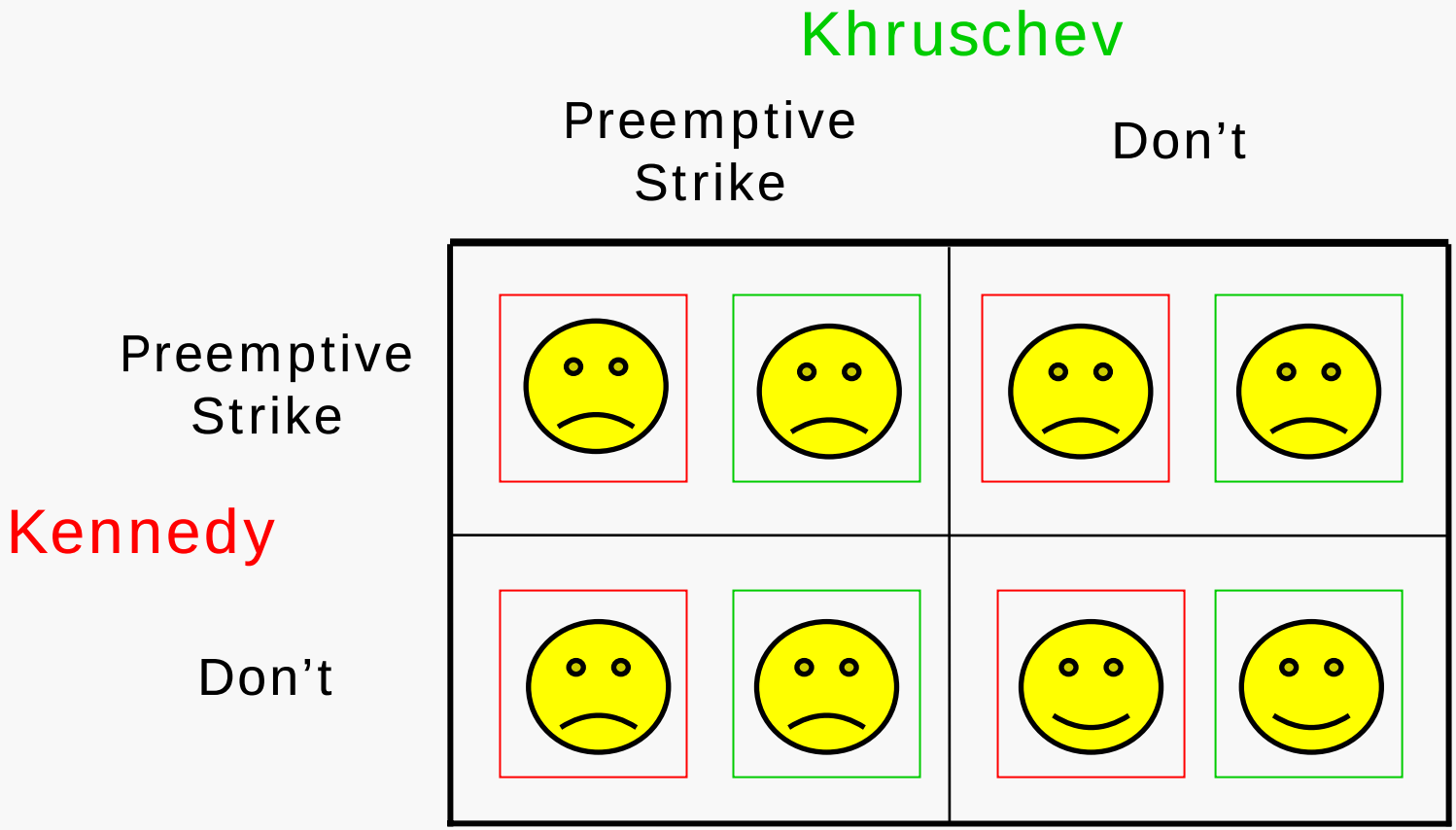
- Schelling, Thomas. *Strategy of Conflict*. Harvard University Press, 1960.

Old West Gunman Game

Steve McQueen

Clint Eastwood	Try to Kill	Don't
Try to Kill		
Don't		

Cold War Nuclear Game



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:

Dixit, Avinash K., and Susan Skeath. *Games of Strategy*. New York, NY: W. W. Norton & Company, 1999. ISBN: 0-393-97421-9.

How Might Kennedy Learn about Soviet Craziness?

1. (See page 457 in Dixit, Avinash K., and Susan Skeath. *Games of Strategy*. New York, NY: W. W. Norton & Company, 1999. ISBN: 0-393-97421-9.)

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

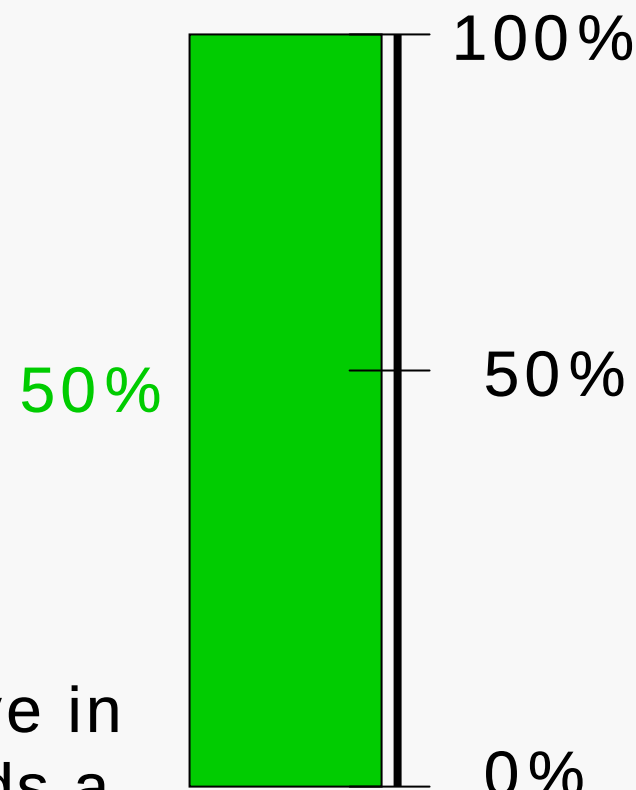
Example: Adverse Selection in Wars of Attrition

- 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

50%

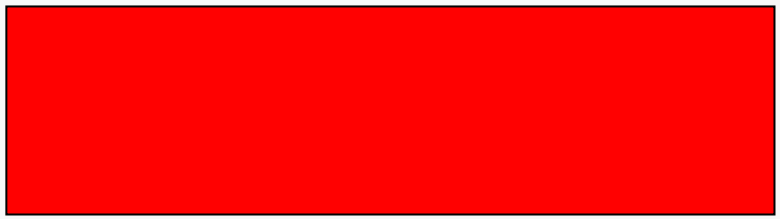
CRAZY – won't give in even with 100% likelihood of war



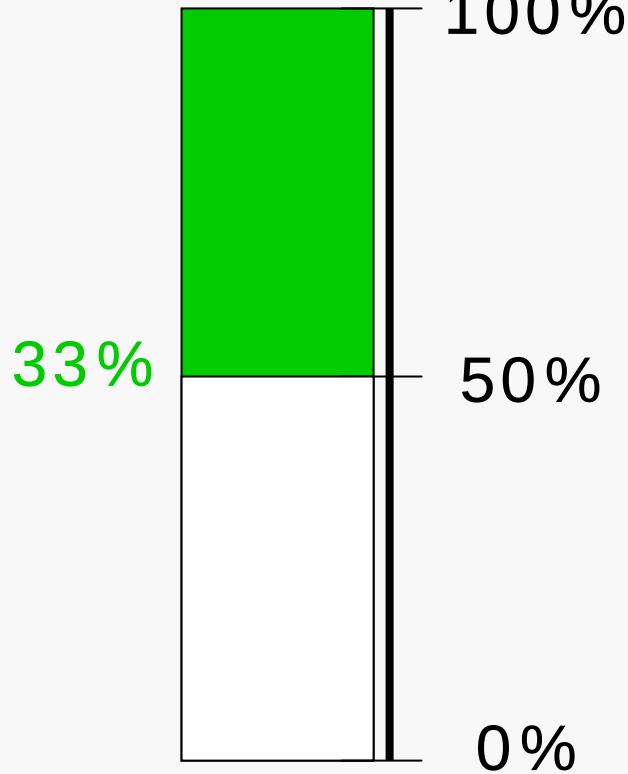
SANE – will give in when q exceeds a threshold (from 0% to 100%, equally likely)

Kennedy's Belief After Threat q = ½ Ignored

67%



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 w/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

Deception

“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: **$U*(K*10\%)*(1- p_K)$**
- **Benefit to waiting** until round K+1 is that other may yield now: **$100*p_K$**
  - p_K is probability that other yields in round K

Appendix: Round 1 Equilibrium Play

	Risk to Wait	Gain to Wait	Critical % Yielding	% Higher-Value Types
400-type	40	100	4/14 = 29%	0%
200-type	20	100	2/12 = 17%	33%
100-type	10	100	1/11 = 9%	67%

- 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

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

- 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

	Risk to Wait	Gain to Wait	Critical % Yielding	% Higher-Value Types
400-type	N/A	N/A	N/A	N/A
200-type	60	100	6/16 = 38%	0%
100-type	30	100	3/13 = 23%	34%

- 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

	Risk to Wait	Gain to Wait	Critical % Yielding	% Higher-Value Types
400-type	N/A	N/A	N/A	N/A
200-type	N/A	N/A	N/A	N/A
100-type	40	100	4/14 = 29%	0%

- 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…