

The Princess Bride, Soccer Penalty Kicks, and Nuclear Proliferation

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- If 95% of students in my recitations complete them, *everyone* will receive a third of a letter grade increase in their section grade.

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- Evaluations should be available online.
- If 95% of students in my recitations complete them, *everyone* will receive a third of a letter grade increase in their section grade.
 - This amounts to a one in three chance of raising your class grade from a B+ to an A-, etc.
- Some people never show up to recitation, so if you are here, you basically need to do it.

End of Semester Calendar

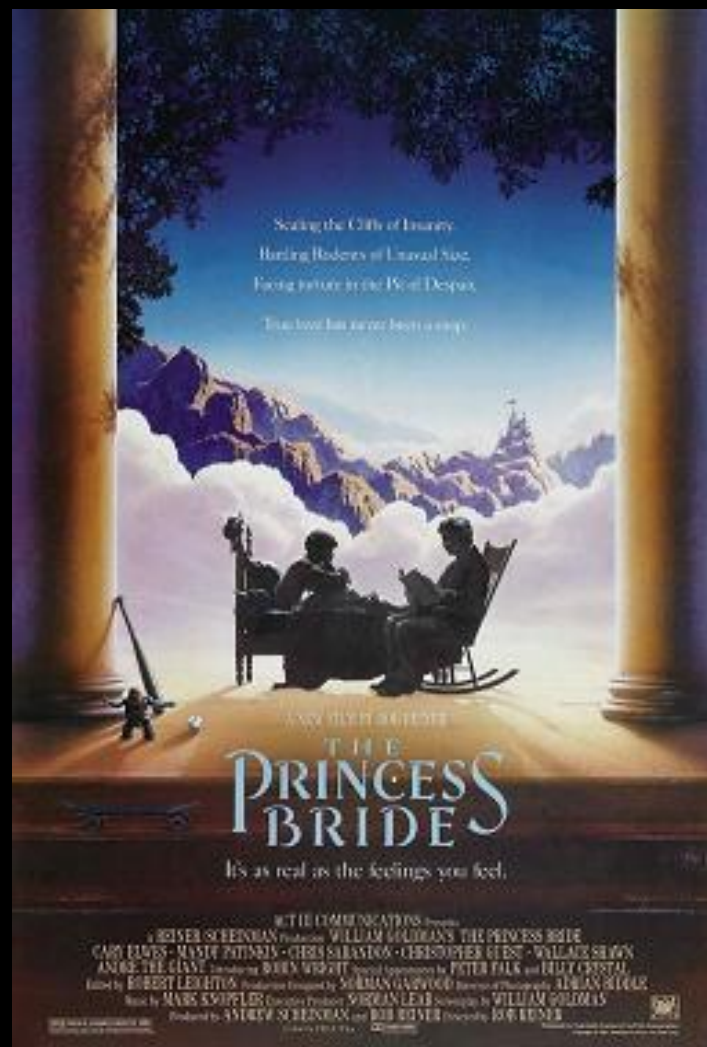
- Today: *The Princess Bride*, soccer penalty kicks, and Debs and Monteiro
- Next Week's Lectures: China, wrap up
- May 3, noon: Review session
- May 6, 8 pm: Review session
- May 7, 8:30 am: Final!

Guessing Games

1. *The Princess Bride*
2. Soccer penalty kicks
3. Nuclear proliferation

Guessing Games

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1987



Princess Buttercup



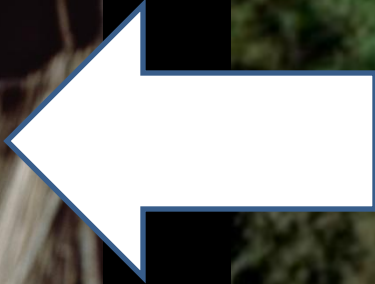
Princess Buttercup



Princess Buttercup



Vizzini



Vizzini





Dread Pirate Roberts



Dread Pirate Roberts



Inigo Montoya





Inigo Montoya





Inigo Montoya





Fezzik





Fezzik





Fezzik





Battle of Wits

Guessing Game!

- Minus the Dread Pirate Roberts' ability to cheat, this is a *guessing game*.
 - Roberts wants Vizzini to guess wrong.
 - Vizzini wants to guess correctly.

Guessing Game!

- Preferences over outcomes are diametrically opposed.
 - What one likes the other doesn't, and vice versa.
- Guessing games are prevalent in every day life...and international relations.

Power Shift

“Too Hot” for Proliferation

Bargaining!

“Too Cold”
for
Proliferation

Cost of Nukes



“Too Hot” for Proliferation

- The declining state prevents if the rising state builds.
- This deters the rising state from proliferating.

“Too Hot” for Proliferation

- The declining state prevents if the rising state builds.
- This deters the rising state from proliferating.
 - But only if the declining state can actually observe the rising state’s actions!

Covert Proliferation

Rising State

Declining State

Prevent

Peace

Build

Don't Build

Prevent	Build	Don't Build
Peace		

Guessing Games

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Simple Soccer Penalty Kicks

- The striker aims left or aims right.
- The goalie dives left or dives right.
- Assume the striker and goalie are superhuman. How should they play?

Penalty Kicks

Goalie

Striker

Kick Left

Kick Right

Dive Left

Dive Right

0, 0

1, -1

1, -1

0, 0

		Dive Left	Dive Right
Striker	Kick Left	0, 0	1, -1
	Kick Right	1, -1	0, 0

Penalty Kicks

Goalie

Striker

		Dive Left	Dive Right
Kick	Left	0, 0	1, -1
	Right	1, -1	0, 0

Penalty Kicks

Goalie

Striker

Kick Left

Kick Right

Dive Left

Dive Right

0, 0

1, -1

1, -1

0, 0




Penalty Kicks

Goalie

Striker

		Dive Left	Dive Right
Kick	Left	0, 0	1, -1
	Right	1, -1	0, 0



Penalty Kicks

Goalie

Striker

Kick Left

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0, 0

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Penalty Kicks

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Penalty Kicks

Goalie

Striker

Kick Left
Kick Right

Dive Left

Dive Right

0, 0

1, -1

1, -1

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Penalty Kicks

Goalie

Striker

		Dive Left	Dive Right
Kick	Left	0, 0	1, -1
	Right	1, -1	0, 0

Diagram illustrating the strategic interaction between a Striker and a Goalie during a Penalty Kick. The Striker chooses between Kick Left and Kick Right. The Goalie chooses between Dive Left and Dive Right. The payoffs (Striker, Goalie) are shown in the cells.

Arrows indicate the best response for each player:

- From (0, 0) to (1, -1) for the Striker (downward arrow).
- From (1, -1) to (0, 0) for the Striker (rightward arrow).
- From (1, -1) to (0, 0) for the Goalie (upward arrow).

Penalty Kicks

Goalie

Striker

		Dive Left	Dive Right
Kick Left	Kick Right	0, 0	1, -1
		1, -1	0, 0

Diagram illustrating the strategic form of the Penalty Kicks game. The Striker chooses between Kick Left and Kick Right. The Goalie chooses between Dive Left and Dive Right. The payoffs are shown in the cells, with the first number representing the Striker's payoff and the second number representing the Goalie's payoff.

Payoffs:

- (Kick Left, Dive Left): 0, 0
- (Kick Left, Dive Right): 1, -1
- (Kick Right, Dive Left): 1, -1
- (Kick Right, Dive Right): 0, 0

Arrows indicate best responses:

- From (0, 0) to (1, -1) (Striker's best response to Dive Left)
- From (1, -1) to (0, 0) (Goalie's best response to Kick Left)
- From (1, -1) to (0, 0) (Striker's best response to Dive Right)
- From (0, 0) to (1, -1) (Goalie's best response to Kick Right)

Penalty Kicks

Goalie

Striker

Kick Left

Kick Right

Dive Left

Dive Right

0, 0

1, -1

1, -1

0, 0



Guessing Games!

- Solution: act randomly.
 - Striker aims left half the time and right half of the time.
 - Goalie dives left half the time and right half the time.
- Neither player can be exploited under these conditions.

Penalty Kicks

Goalie

Striker

		Dive Left	Dive Right
Striker	Kick Left	0, 0	.5, -.5
	Kick Right	1, -1	0, 0

Diagram illustrating the strategic form of the Penalty Kicks game. The Striker chooses between Kick Left and Kick Right. The Goalie chooses between Dive Left and Dive Right. The payoffs (Striker, Goalie) are shown in the cells.

Payoffs:

- (Kick Left, Dive Left): 0, 0
- (Kick Left, Dive Right): .5, -.5
- (Kick Right, Dive Left): 1, -1
- (Kick Right, Dive Right): 0, 0

Arrows indicate best responses:

- From (0, 0) to (1, -1) (Striker's best response to Dive Left)
- From (.5, -.5) to (0, 0) (Striker's best response to Dive Right)
- From (1, -1) to (0, 0) (Goalie's best response to Kick Right)
- From (.5, -.5) to (0, 0) (Goalie's best response to Kick Left)

The outcome (0, 0) is a Nash equilibrium.

Guessing Games!

- When players have cyclical preferences over these strategic outcomes, they act randomly.
 - The randomness isn't out of stupidity—it is meant to deliberately confuse the opponent.
- Exactly how they randomize depends on the numerical payoffs.

Guessing Games

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Prevent	Build	Don't Build
Peace		Status Quo

Covert Proliferation

Rising State

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	War Payoffs
	Status Quo

Covert Proliferation

Rising State

Build

Don't Build

Declining State

Prevent

War Payoffs
& Wasted
Costs

War
Payoffs

Peace

Status
Quo

Covert Proliferation

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Declining State

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War Payoffs
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Successful
Power
Shift

Status
Quo

Covert Proliferation

Rising State

Declining State

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Don't Build

War Payoffs
& Wasted
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War
Payoffs

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Status
Quo

Covert Proliferation

Rising State

Declining State

		Build	Don't Build
Prevent	Peace	Successful Power Shift	Status Quo
	War	War Payoffs & Wasted Costs	War Payoffs



Covert Proliferation

Rising State

Declining State

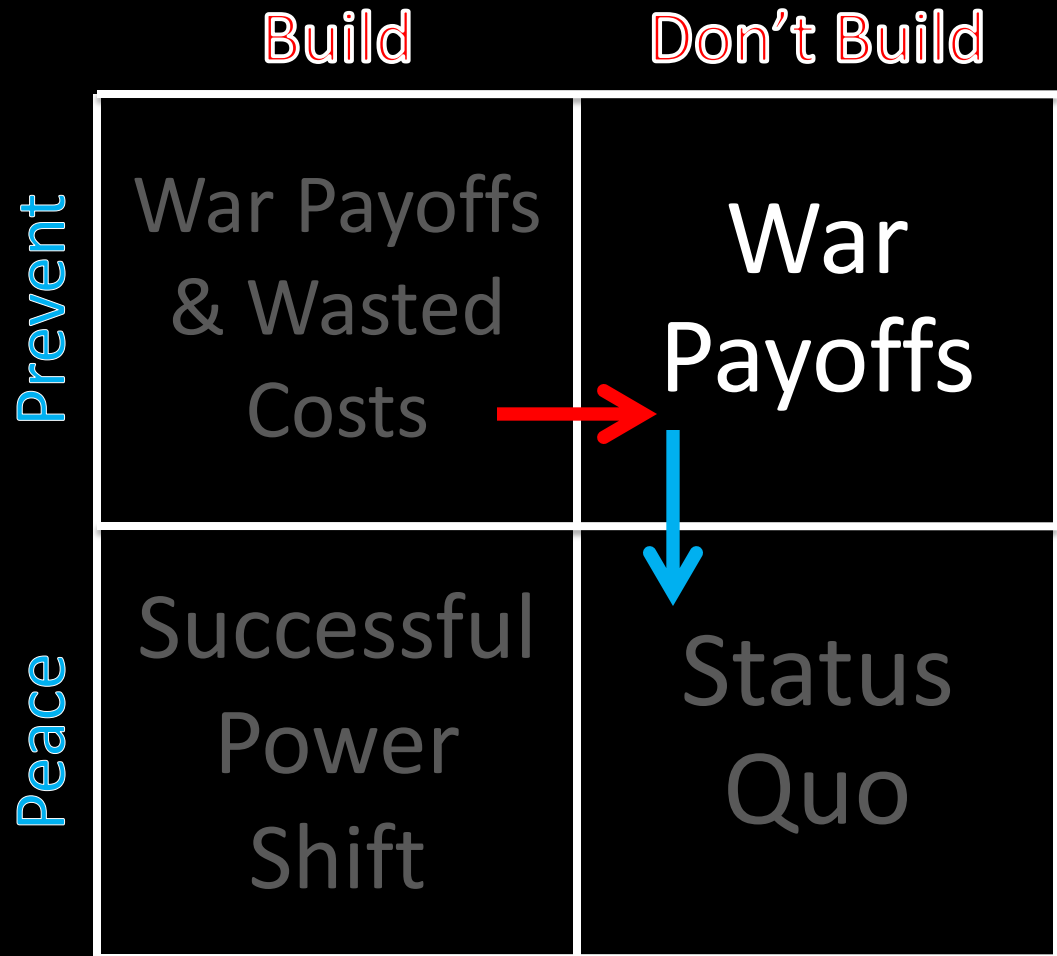
	Build	Don't Build
Prevent	War Payoffs & Wasted Costs	War Payoffs
Peace	Successful Power Shift	Status Quo

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Declining State

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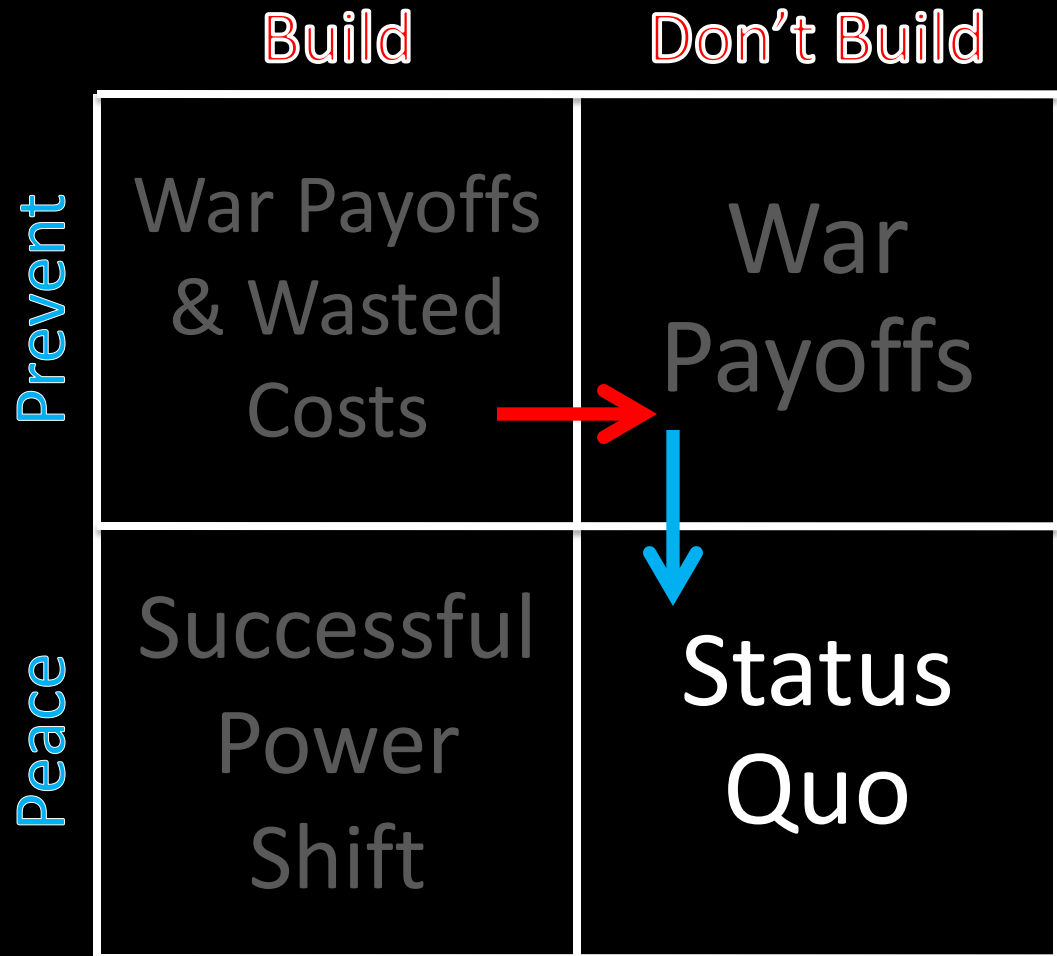


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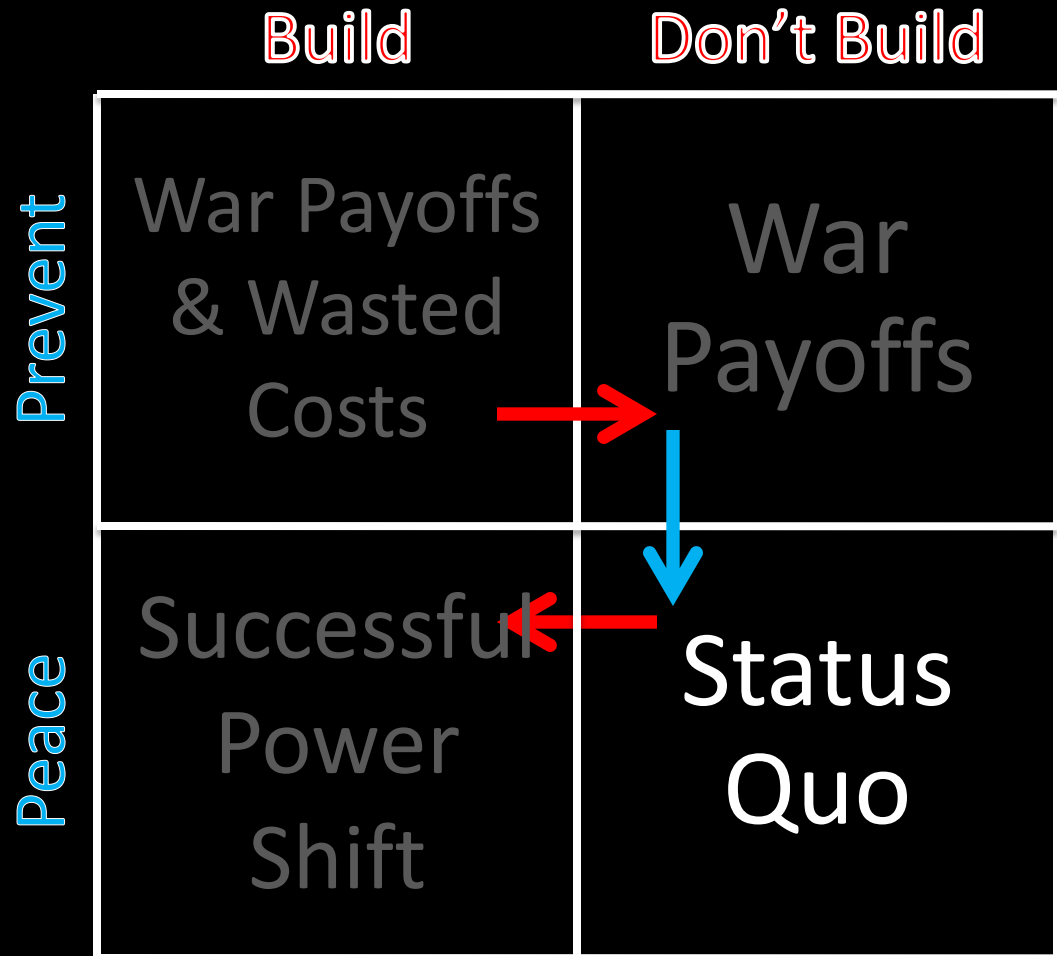


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Rising State

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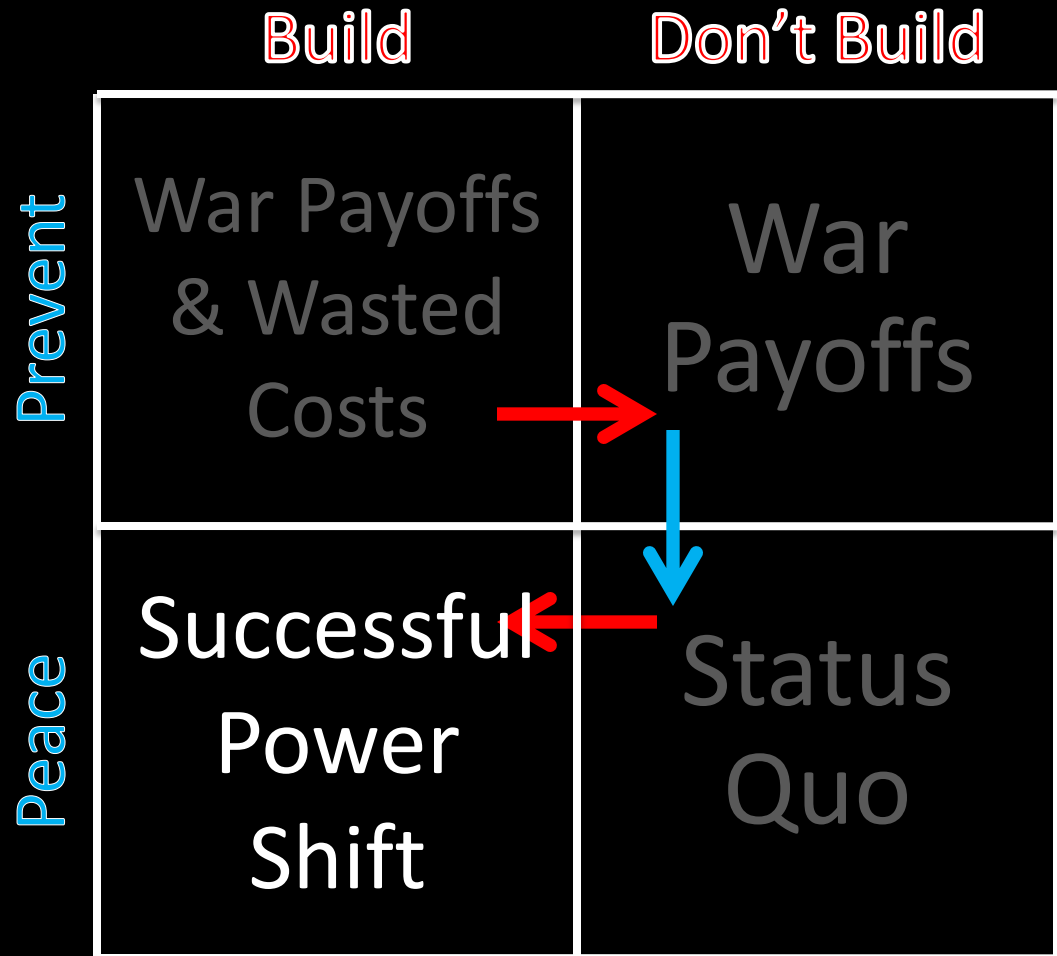


Covert Proliferation

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Guessing Games!

- This is a guessing game.
- Players act randomly and will each strategy with positive probability.
 - This implies that each outcome occurs with positive probability.

Covert Proliferation

Rising State

Don't Build

Declining State

Prevent

	War Payoffs

Covert Proliferation

Rising State

Don't Build

Declining State

Prevent

	Accidental Preventive War

What Are You Buying?

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- Do you accept that the U.S. could not adequately monitor Iraqi activity?

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 - It just looks silly after the fact!

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- Do you accept that the U.S. could not adequately monitor Iraqi activity?
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Not Quite the End

Parting Thoughts

- Festival days are a part of the college experience.
 - You won't remember what we covered in lecture this week ten years from now. You probably will remember today.

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Parting Thoughts

- Festival days are a part of the college experience. But...
 1. Stay hydrated.
 2. Know when to say no.
 3. Don't even think about getting into a car.
 4. Don't put yourself in situations you can't control.
 5. Sober friends are your best friends.

Thanks.