

TESTING DETERRENCE

An Agent-Based Modeling Approach



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Report Documentation Page

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“A rational deterrent cannot be based on an irrational response.”

Richard Nixon

Critical national foreign policy has rested upon the assumption that deterrence, particularly nuclear deterrence, is a functioning process. This is a bold assumption.

Key assumptive issues include:

- Rationality
- War is always irrational, especially nuclear
- Chicken or non-myopic prisoner's dilemma games
- Cost/benefit is primary determinant issue



***“An appeaser is one who feeds a crocodile,
hoping it will eat him last.”***

Winston Churchill

APPROACH

Expected utility model using agent based methods is used to determine whether stable deterrence exists within existing theoretical structures.

Nuclear and non-nuclear deterrence is examined.

This presentation shows the base case deterrence model.



“However beautiful the strategy, you should occasionally look at the results.”

Winston Churchill

AGENT DEFINITION

Agents are defined as population groups occupying any particular region in the environment. Each agent has a national alignment. Each nation has the following properties:

- Power
- Nuclear Capability
- Counter-Strike Capability

Agents are resource maximizers



“Don't hit at all if it is honorably possible to avoid hitting; but never hit soft.”

Theodore Roosevelt

ENVIRONMENT DEFINITION

The environment is composed of individual resource areas. Each area has a resource value of 0, 1, 2, or 3.

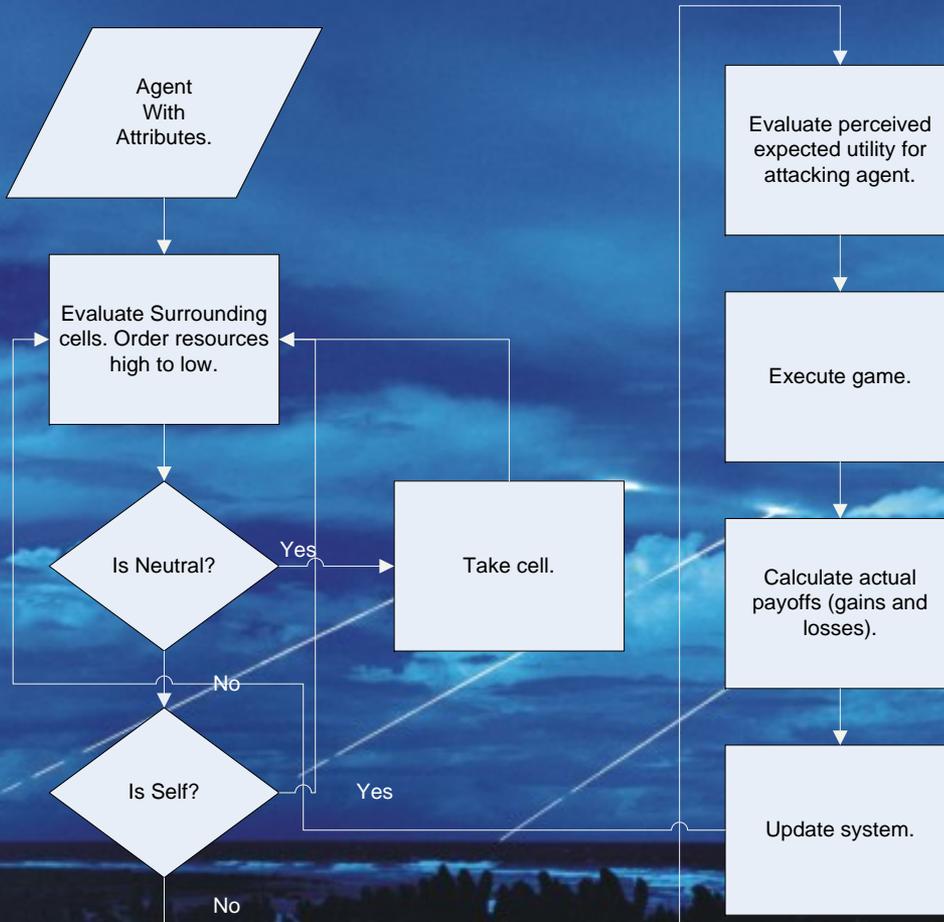
The value of the resources controlled by a nation, combined with its population, determines a nation's power.



“That was the era when we might have destroyed Russia completely and not even skinned our elbows doing it. ”

Curtis Lemay

AGENT BEHAVIOR DIAGRAM



“Nuclear war is such an emotional subject that many people see the weapons themselves as the common enemy of humanity.”

Herman Kahn

EXPECTED UTILITY FOR WAR, part 1

Political Position:



Each nation's political position falls within the above scale. .5 represents the median, status quo, position, while distance away from the median define risk aversion or acceptance (BDM). Distance between nations also figures into utility payoff calculations.



“Only strength can cooperate. Weakness can only beg.”

Dwight D. Eisenhower

EXPECTED UTILITY FOR WAR, part 2

Economic Position:



Each nation's economic position falls within the above scale, and is a percentage of the whole as defined by the sum of the conflicting dyad.



“The atom bomb was no ‘great decision.’ It was merely another powerful weapon in the arsenal of righteousness.”

Harry S. Truman

EXPECTED UTILITY FOR WAR, part 3

Scale of War: A global variable that controls the scale of conflict. Is deterrence more likely when the scale of war is greater?

WMD factor: A variable unique to each nation, set as:

- Positive where attacker is nuclear capable and defender is not
- 0 where neither nation is nuclear capable
- Negative where attacker is not nuclear capable and defender is, or attacker is but defender has counter-strike capacity.



“Domestic policy can only defeat us; foreign policy can kill us.”

John F. Kennedy

EXPECTED UTILITY FOR WAR, part 4

Saliency: A country's preference for political vs. economic gains.

Decision Rule:

$$EU(\text{war}) = P * U(\text{winning}) + (1 - P) * U(\text{losing})$$

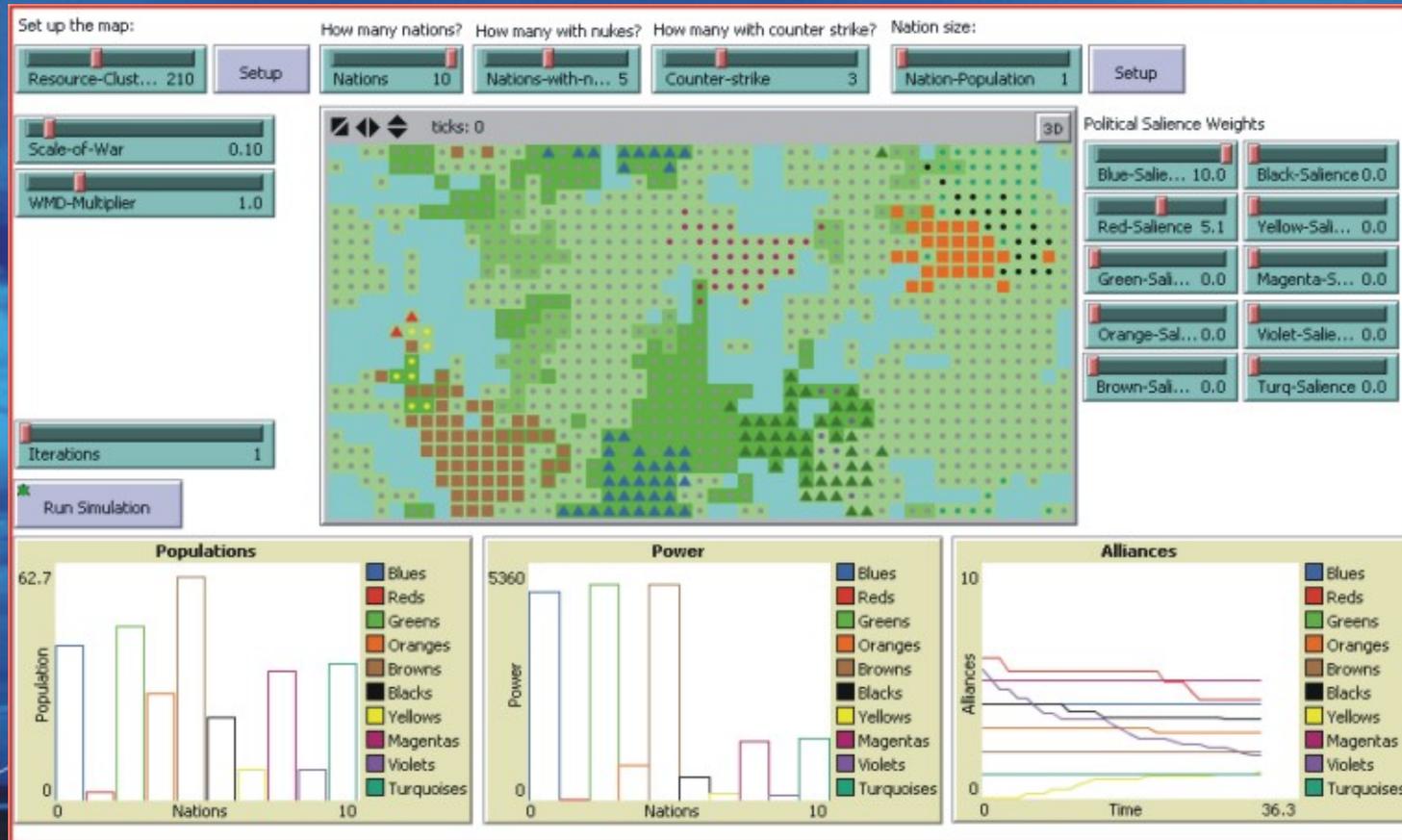
If Expected Utility for War > 1, conflict is initiated.



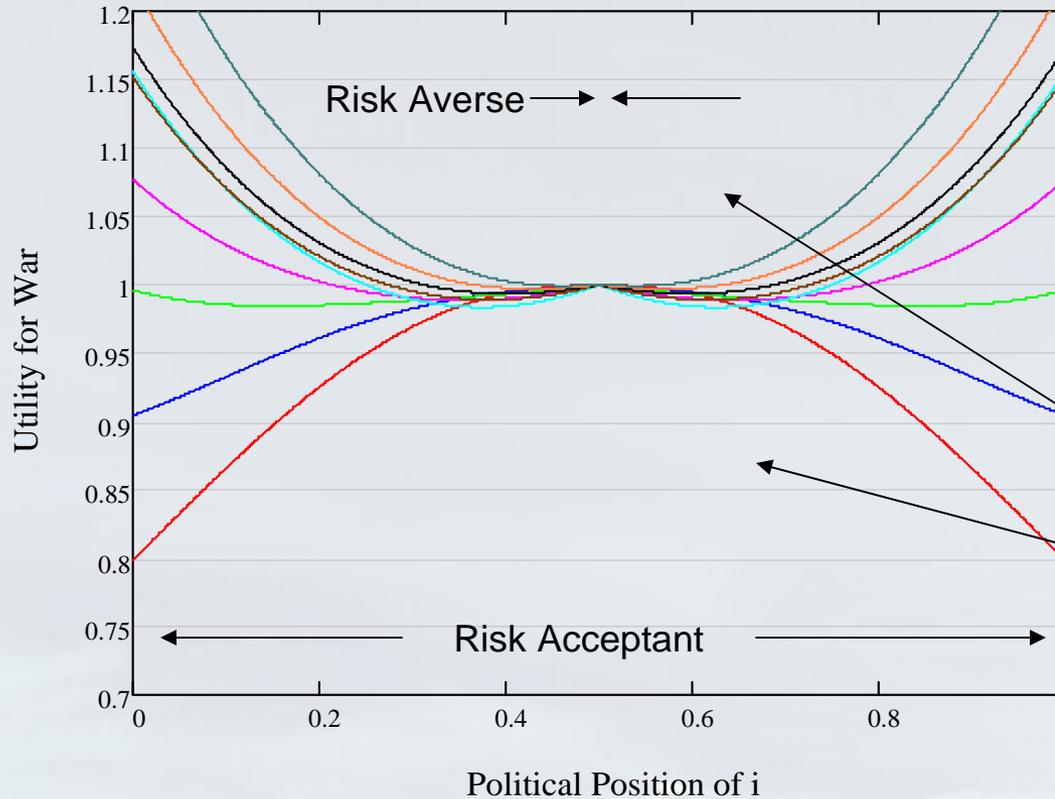
“If you live among wolves you have to act like a wolf.”

Nikita Khrushchev

USER INTERFACE



Utility for War: Economic Difference & Political Position



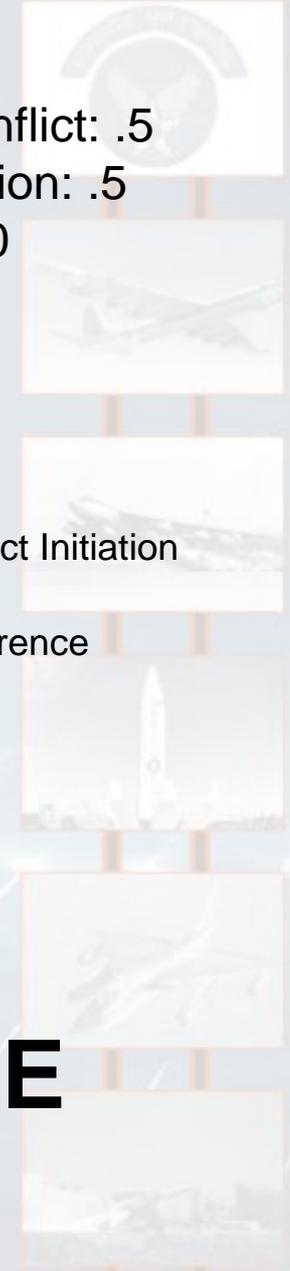
Severity of Conflict: .5
 j Political Position: .5
 WMD Factor: 0
 Saliense: 5

Region of Conflict Initiation

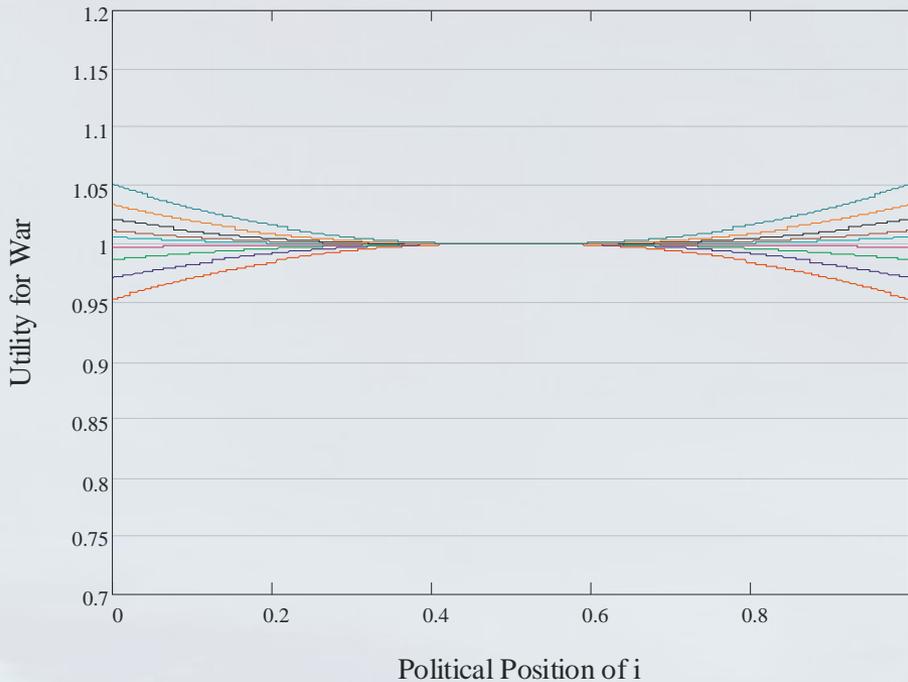
Region of Deterrence

- Share of Resources: .1 for i
- Share of Resources: .2 for i
- Share of Resources: .3 for i
- Share of Resources: .4 for i
- Share of Resources: .5 for i
- Share of Resources: .6 for i
- Share of Resources: .7 for i
- Share of Resources: .8 for i
- Share of Resources: .9 for i

BASE CASE

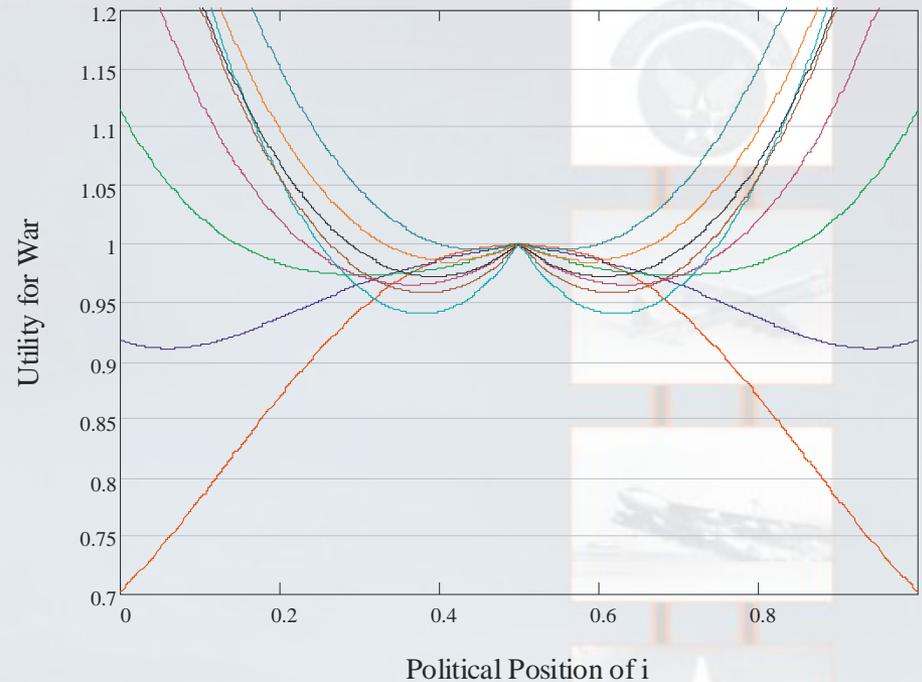


Utility for War: Economic Difference & Political Position



Severity of Conflict: .1

Utility for War: Economic Difference & Political Position



Severity of Conflict: .9

j Political Position: .5

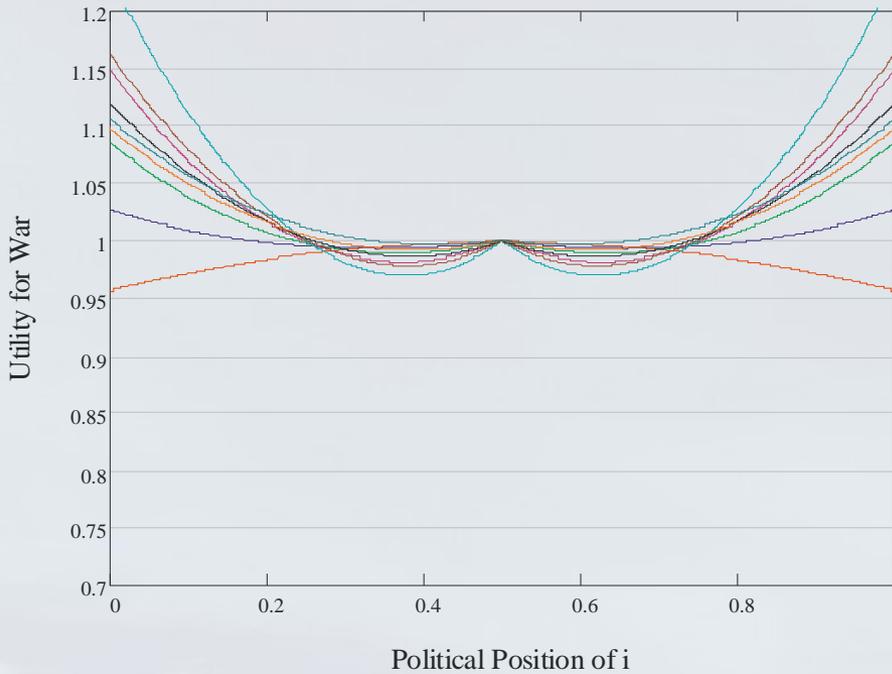
WMD Factor: 0

Salience: 5

- Share of Resources: .1 for i
- Share of Resources: .2 for i
- Share of Resources: .3 for i
- Share of Resources: .4 for i
- Share of Resources: .5 for i
- Share of Resources: .6 for i
- Share of Resources: .7 for i
- Share of Resources: .8 for i
- Share of Resources: .9 for i

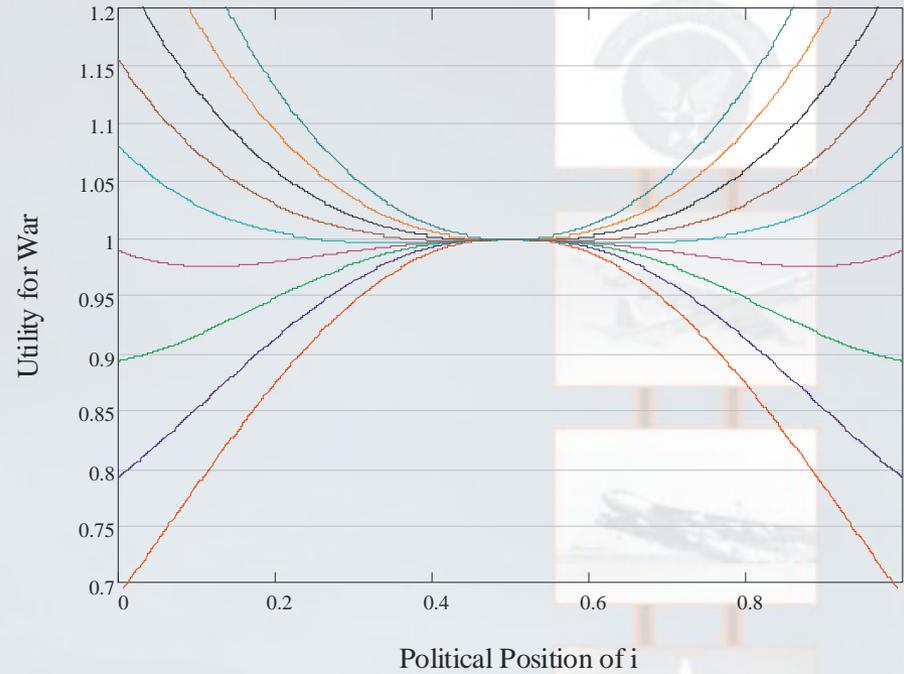
SEVERITY OF CONFLICT

Utility for War: Economic Difference & Political Position



Level of Salience: 1

Utility for War: Economic Difference & Political Position



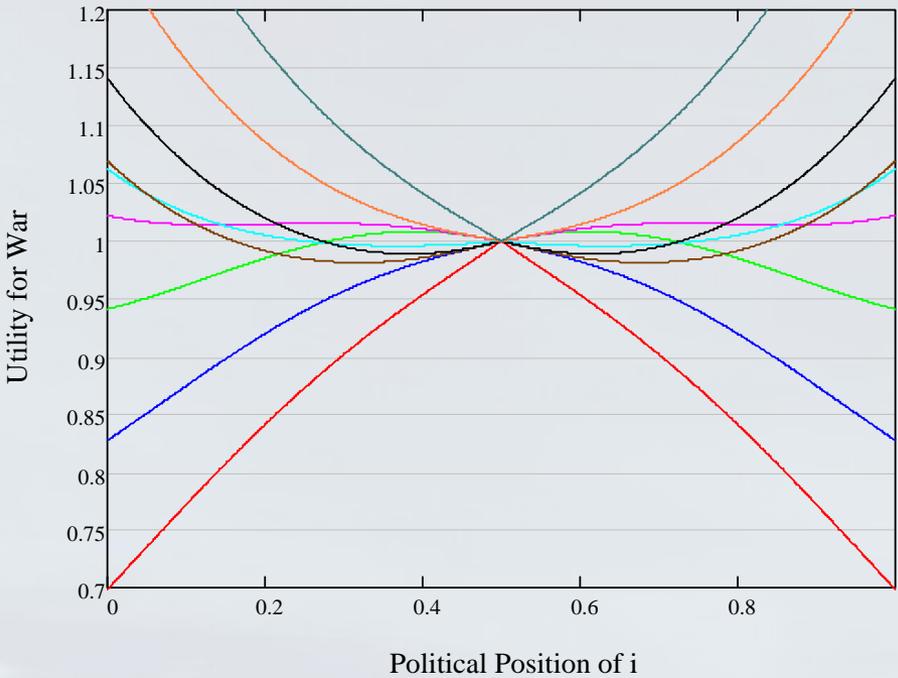
Level of Salience: 9

Severity of Conflict: .5
j Political Position: .5
WMD Factor: 0

- Share of Resources: .1 for i
- Share of Resources: .2 for i
- Share of Resources: .3 for i
- Share of Resources: .4 for i
- Share of Resources: .5 for i
- Share of Resources: .6 for i
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- Share of Resources: .9 for i

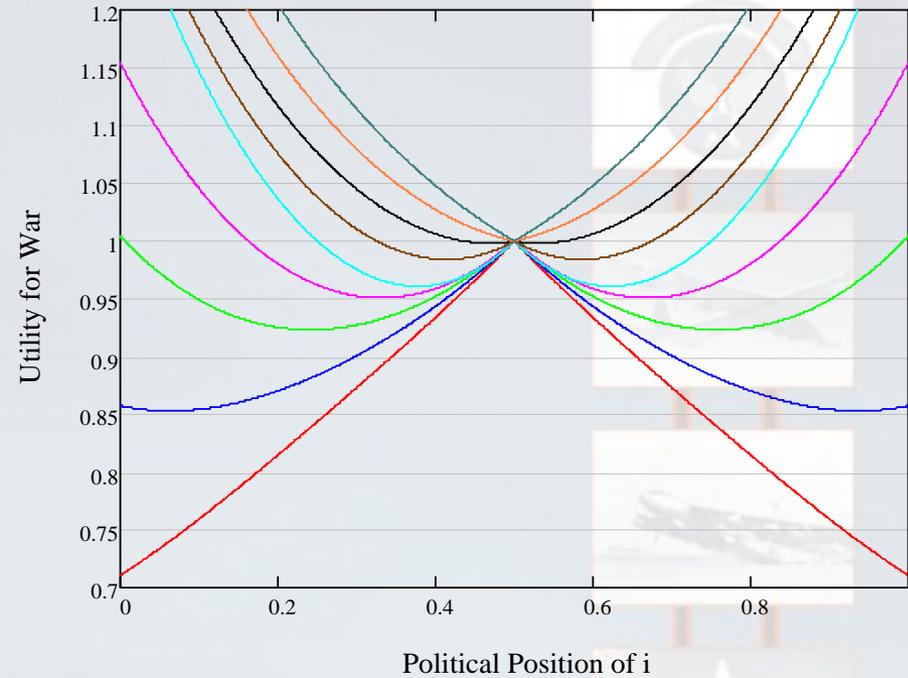
Level of Salience

Utility for War: Economic Difference & Political Position



WMD Factor: -0.5

Utility for War: Economic Difference & Political Position



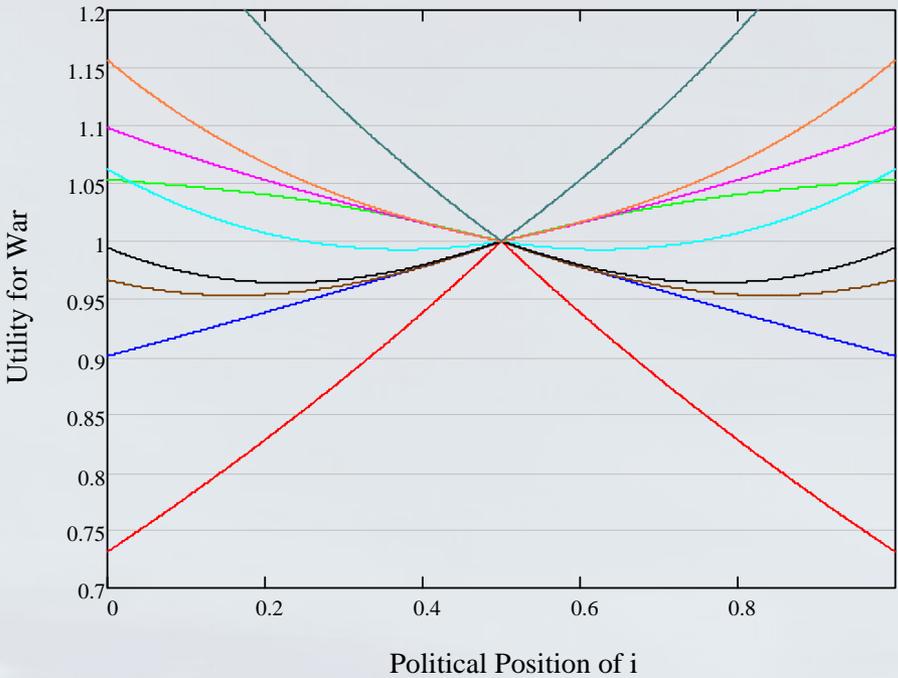
WMD Factor: .5

Severity of Conflict: .5
 j Political Position: .5
 Level of Saliency: 5

WMD Factor

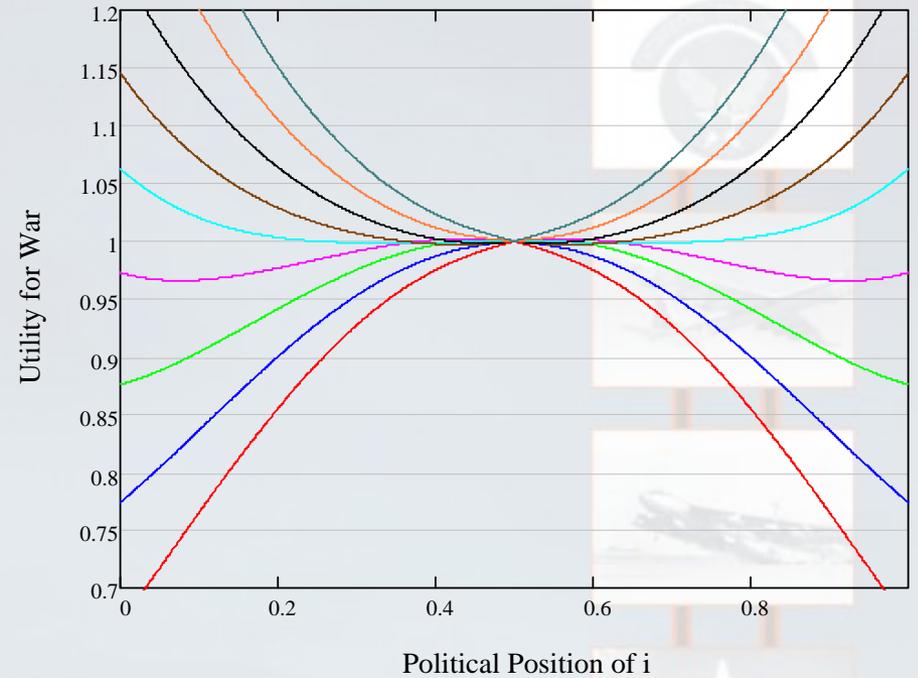
- Share of Resources: .1 for i
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- Share of Resources: .4 for i
- Share of Resources: .5 for i
- Share of Resources: .6 for i
- Share of Resources: .7 for i
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- Share of Resources: .9 for i

Utility for War: Economic Difference & Political Position



Level of Salience: 1

Utility for War: Economic Difference & Political Position



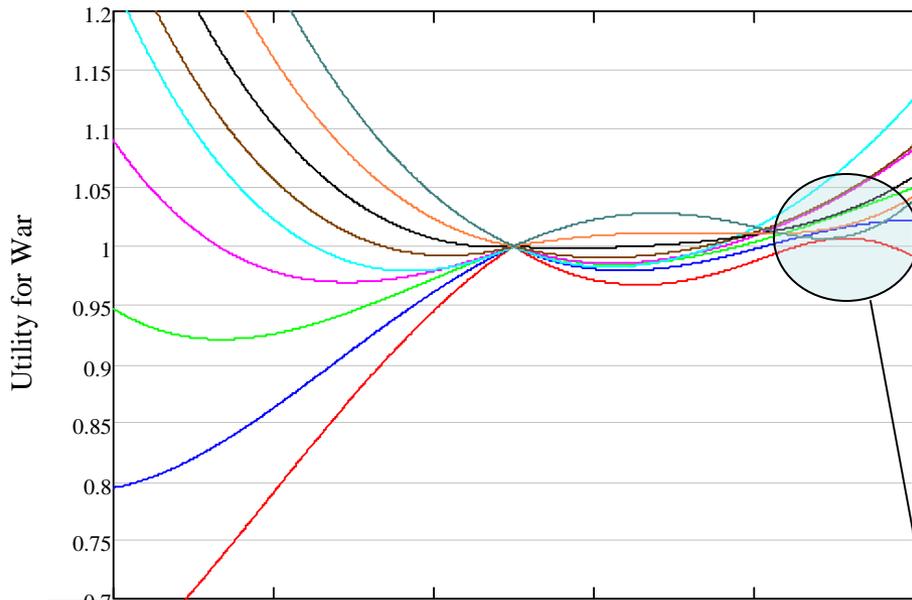
Level of Salience: 9

- Share of Resources: .1 for i
- Share of Resources: .2 for i
- Share of Resources: .3 for i
- Share of Resources: .4 for i
- Share of Resources: .5 for i
- Share of Resources: .6 for i
- Share of Resources: .7 for i
- Share of Resources: .8 for i
- Share of Resources: .9 for i

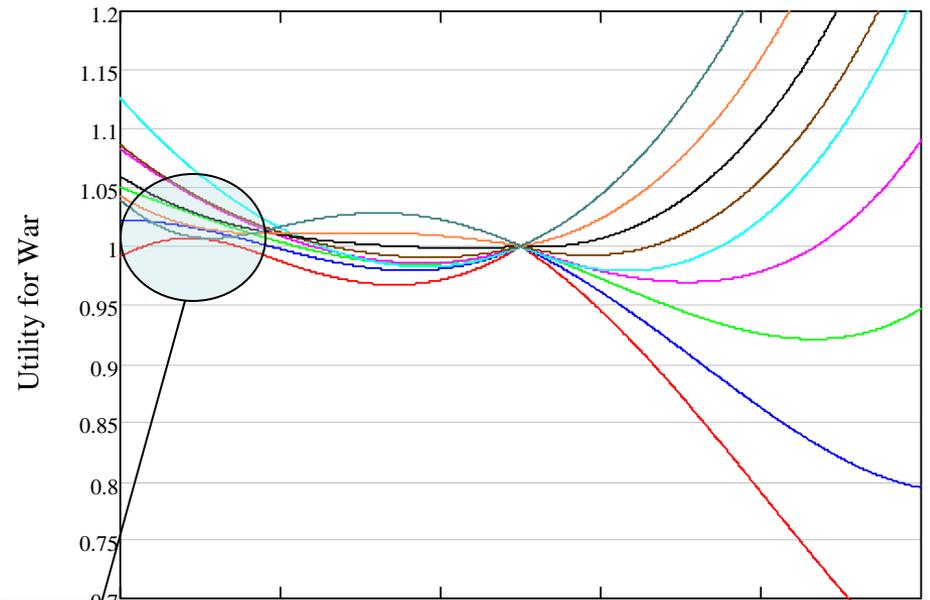
Severity of Conflict: .5
 j Political Position: .5
 WMD Factor: -0.5

WMD Factor & Salience

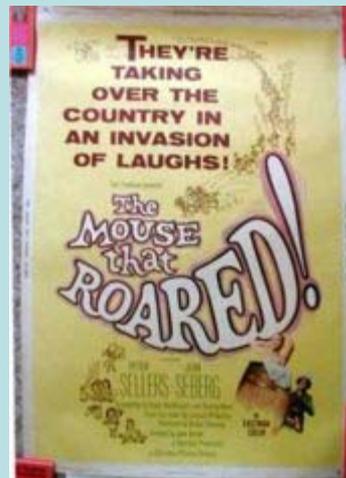
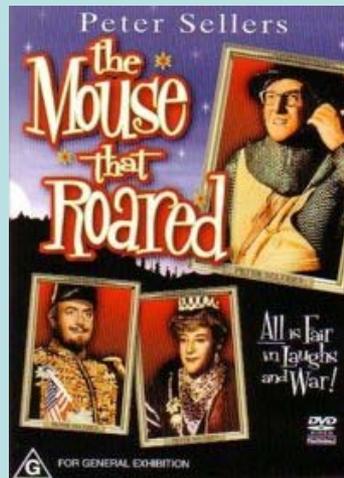
Utility for War: Economic Difference & Political Position



Utility for War: Economic Difference & Political Position



THE MOUSE THAT ROARED!



“There's no sense in being precise when you don't even know what you're talking about.”

John von Neumann

SUMMATION (because there can be no conclusion)

Regions of deterrence often exist, but under some conditions there is no deterrence at all.

WMD do not stop highly risk acceptant actors from initiating conflict.

Salience for political vs. economic interests plays a big role.

With increase in severity of conflict comes increase in potential gain.



“Goddammit, I'd piss on a spark plug if I thought it'd do any good!”

General Beringer from the film Wargames

USE IN WARGAMING

The problem with hypothetical scenarios:

- Where will they occur?
- Under what conditions?

Models like this can help answer that question.

Use real environment, resources, and forces to analyze situations and determine threats to stability.

Identified threats can be gamed for potential outcome determination.



“[Nuclear weapon] use under any circumstance would be nothing but a heinous crime against humanity. Therefore, any talk about winnable nuclear war is preposterous.”

N.D. Jayaprakash

THREE USE SCENARIOS

1. Preemptive Strike
2. Retaliatory Strike
3. National Survival

Options 1 & 2 are presumably escalatory and non winnable

Model demonstrates that conditions for initiation exist where attacker has nuclear disadvantage. Real-world example: Israel



“Wars teach us not to love our enemies, but to hate our allies.”

W. L. George

SURVIVAL SCENARIO

Conventional forces of risk accepting nation invade a nuclear power.

Must determine the necessary and sufficient condition for use of nuclear weapons to avert national destruction.

**Constrained optimization problem:
Maximize survival given that conventional forces cannot expel invader.**



“The statesman who yields to war fever must realize that once the signal is given, he is no longer the master of policy but the slave of unforeseeable and uncontrollable events.”

Sir Winston Churchill

SURVIVAL SCENARIO CONTINUED

Necessary condition: military determination that successful expulsion of invading force is no longer possible.

Quantifiable in terms of military losses, position, and force ratios.

Stochastic element from position of field commander: nuclear release is a political decision.



“Kennedy said that if we had nuclear war we'd kill 300 million people in the first hour.

McNamara, who is a good businessman and likes to save, says it would be only 200 million.”

Norman Thomas

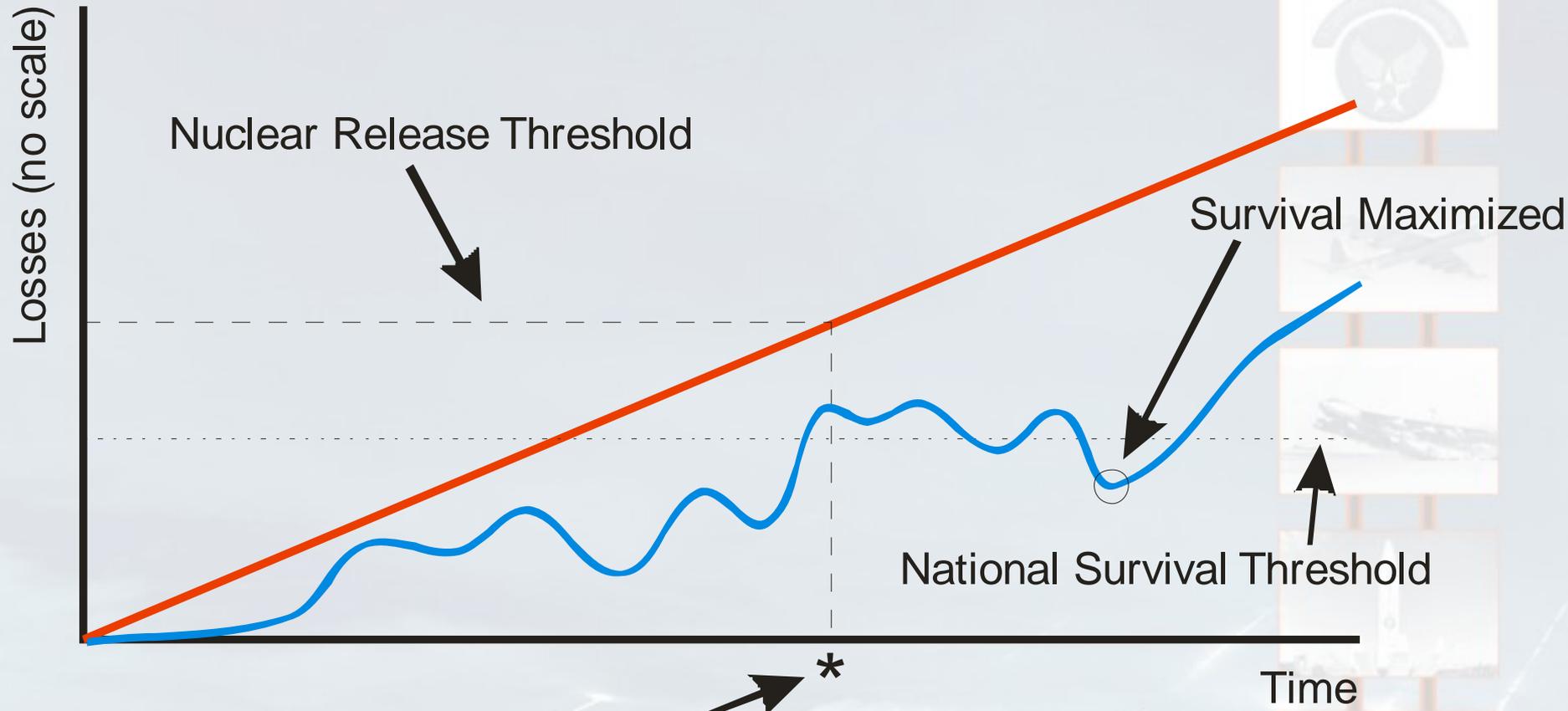
SURVIVAL SCENARIO CONTINUED

Sufficient condition: Survival is maximized

Quantifiable in terms of resources lost (cities, arable land, production) from use of nuclear weapons on home soil.

Stochastic element: strategic decision making, when is survival maximized and is it maximized enough that survival is still possible given that conventional war defeat inevitable.





Time after which nuclear release is authorized

Key

- Kinetic force losses due to combat operations
- Resource losses incurred from use of nuclear weapons on home territory

“In nuclear war all men are cremated equal.”

Dexter Gordon

SURVIVAL SCENARIO: Game Rules

**Set a randomized nuclear release threshold,
within a bounded set.**

**Determine a national survival scale using map
geography.**

**Set victory conditions that incorporate nuclear
release and its consequences.**



“Ours is a world of nuclear giants and ethical infants. We know more about war than we know about peace, more about killing than we know about living.”

Omar Bradley

SURVIVAL SCENARIO: Strategy Ramifications

Attacker must achieve geographic objectives quickly, while minimizing casualties inflicted.

Defender must hold territory while minimizing own losses. Once nuclear release threshold is crossed, defender must retake valuable geographic targets to maximize survival level.

Victory? There is no victory. To survive or not to survive. That is the question.



“War does not determine who is right — only who is left.”

Bertrand Russell



SURVIVAL SCENARIO

This scenario and several others will be examined in Millennium Wars: States of Conflict, Campaign Study No. 2 from Against the Odds Magazine and Modern Conflict Studies Group.

“I like a man who grins when he fights.”

Winston Churchill

THANK YOU!

