



U.S. Army Research, Development and Engineering Command

Light Models of Civilian Support in Blue-Red Operations



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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Influence the Population

Opposing forces in conflict

Combating forces
Blue-Red operation
Rebellion **Power struggle**
Guerrilla warfare **Counter insurgency**



*Able to influence**



Unable to influence

Unable to influence

Red

Neutral

Blue

Civilian Support

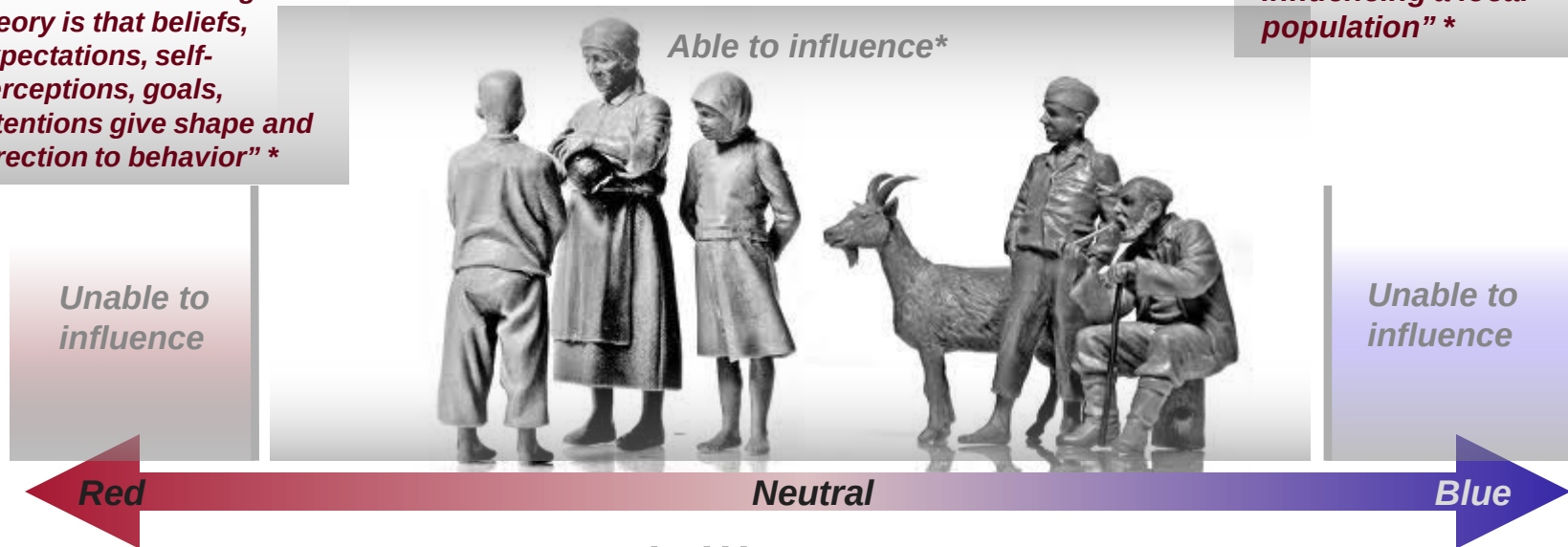
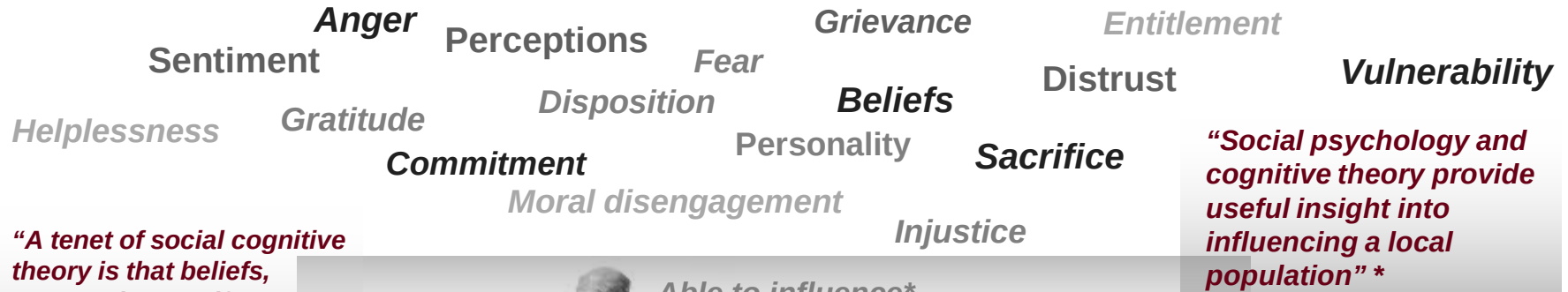
How is a population influenced to support one or the other force ???

* McCormick 1994, NPS; Wendt 2005



Influence the Population

Social – Cognitive Constructs



Civilian Support

How is a population influenced to support one or the other force ???

* Bandura 1989, 1999



Social – Cognitive Constructs

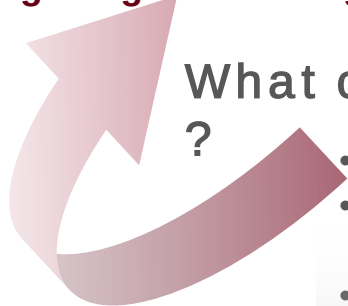
How do we model this ?

Anger Perceptions Fear Grievance Enmity
Sentiment Disposition Beliefs Distrust Vulnerability
Helplessness Gratitude Commitment Personality Sacrifice
Moral disengagement Injustice

Difficult to quantify
Lack of coherent underlying theoretical structure
Social scientists don't understand it well either

Why should we try ?

- Gaining popular support is crucial for effective operations *
- Educating forces in planning and conducting operations in populated areas
- Understanding the implications of force actions in gaining popular support
- Developing mitigation strategies for the effects of force actions



What could a simple model of civilian support offer ?

- *A bit of all of the above*
- *Make a sandbox for experimenting with different model representations (i.e., learn how to model social-cog concepts)*
- *A simple model is better than no model (i.e., typically large force-on-force simulations do not model civilians)*
- *Offer increased SA at low computational overhead*
- *Use the models that 'work' – embed them in larger simulations*

* FM3-24 2006; Galula 1964; Krieger 2007; Lynn 2005; . . .



Light Civilian Agent

A simple model is a 'light' model

- - - Simplified set of attributes and interactions

Light Civilian Agent

X pos

Y pos

State

Where am I ?

Am I alive ?

Fear of Blue

Fear of Red

Anger towards Blue

Anger towards Red

Violence threshold

Commitment (total)

Commitment (human loss)

Commitment (social disruption)



Select attributes offering insight to command-level decision makers

Utilize ideas/theories from social and political sciences – as a starting point

Psychological characteristics

Cognitive characteristics

Desires

Intentions

Physical characteristics

Beliefs

Each attribute increases computational complexity and size of parameter space

Degree of fear and anger towards combating forces *

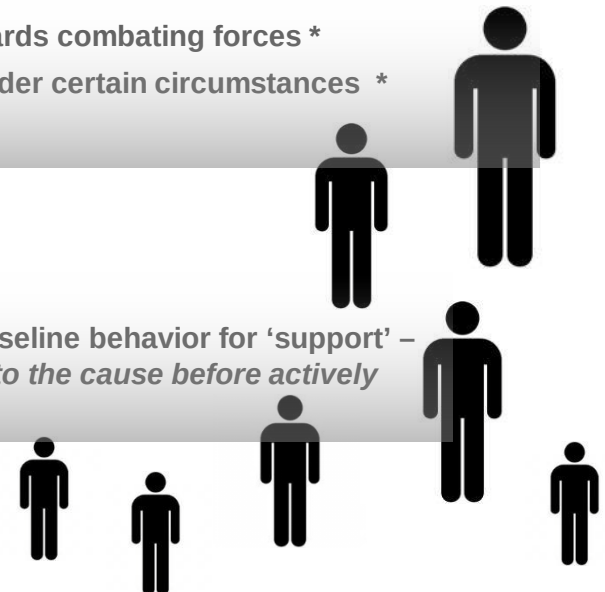
Propensity to use violence under certain circumstances *

Commitment "the act of binding yourself (intellectually or emotionally) to a course of action" **

Using commitment *** as a baseline behavior for 'support' – a civilian must be committed to the cause before actively contributing support ****

Civilians committed to (supportive of) Red

Civilians committed to (supportive of) Blue



* Bennett 2008; Findley & Young 2006; Wheeler 2005; Boyle 2009

** <http://www.thefreedictionary.com/commitment>

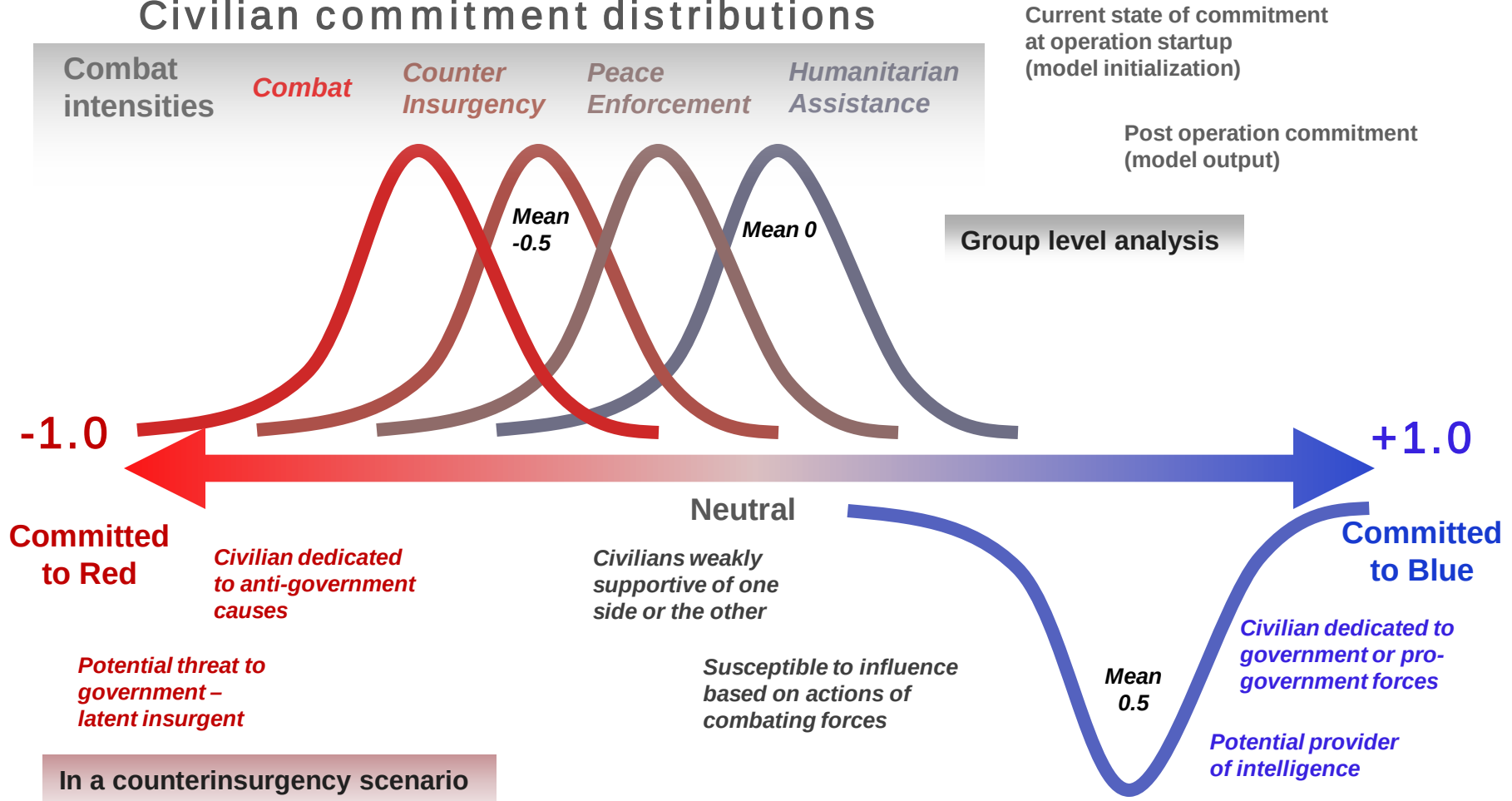
*** Findley & Young 2006

**** Baker 2006; Ford 2005; McGuire 2008; McNeil 2010; Sate, Kubo & Namatame 2011;



Commitment Continuum

Civilian commitment distributions





Calculating Commitment

Impact of direct action
on civilian attributes

*Simple representation of firing
within a populated area*

Fear of Blue

Fear of Red

Anger towards Blue

Anger towards Red

Violence threshold

*Control level of
fidelity during
exchange of fire*

Commitment (total)

Commitment (human loss)

Commitment (social disruption)



Direct action
outcome counts



Use as input to agent
commitment attributes

Civilians killed by Red

Civilians killed by Blue

Total shots fired by Red

Total shots fired by Blue

IED detonations by Red

Indirect fire by Blue

Commitment (human loss)

Number of
civilians killed as % Of total *
civilians

Commitment (social disruption)

IED & IF counts translated into an
area of destruction value using size
of agent scan area in grid cells

+ Total
shots
fired **

Effectiveness

Probability of killing a target

Accuracy

Probability of avoiding
collateral damage

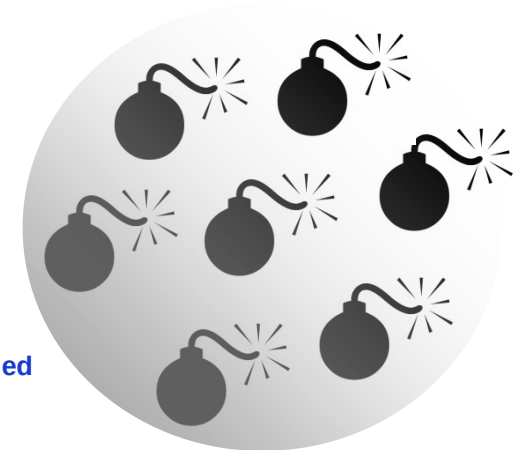
Parameters control firing
executed at individual agent level
where outcome is kill or miss

Example: Blue Effectiveness = 0.8

80% of the time when Blue fires at Red, Red is killed

Example: Red Accuracy = 0.6

40% of the time when Red fires at Blue, a civilian is killed by mistake



* If interval calculation, + /- response to human loss factor

** If interval calculation, + /- response to social disruption factor



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Calculating Fear and Anger

Impact of direct action
on civilian attributes

*Civilians characterized by a degree of
fear and anger at the combating forces*

Fear of Blue
Fear of Red
Anger towards Blue
Anger towards Red
Violence threshold

Commitment (total)

Commitment (human loss)

Commitment (social disruption)

Example: Fear of Blue = 0
Civilian is not afraid of Blue force

Example: Anger towards Red = 1.0
Civilian feels maximum amount of anger towards Red force

Example: Violence threshold = 0
Civilian has low threshold of violence, would
use violence under many circumstances

Example: Violence threshold = 1
Civilian has high threshold of violence, would be very
reluctant to use violence under any circumstance

* + response to fear factor
** + response to anger factor

Direct action
outcome counts

Red killed by Blue
Blue killed by Red
Civilians killed by Blue
Civilians killed by Red

Use as input to agent fear
and anger attributes

Fear of Blue/Red

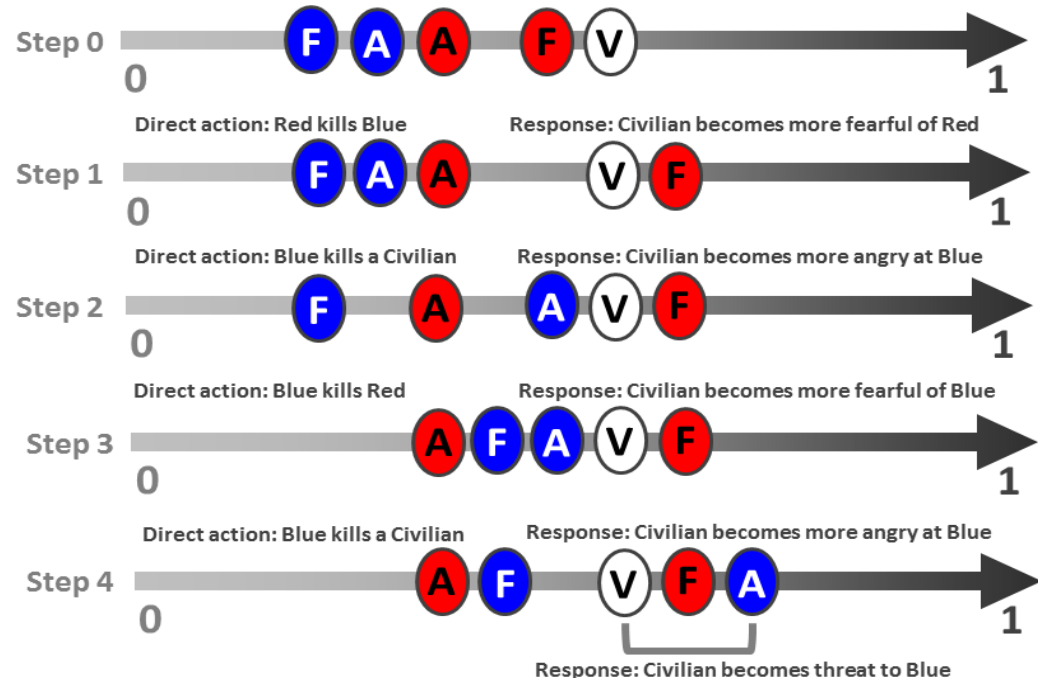
$$\text{Current level of fear} + \text{Fear factor} \times (1 - \text{Current fear})$$

Anger towards Blue/Red

$$\text{Current level of anger} + \text{Anger factor}^{**} \times (1 - \text{Current anger})$$

*Civilians willing to
engage in violence
against combating forces*

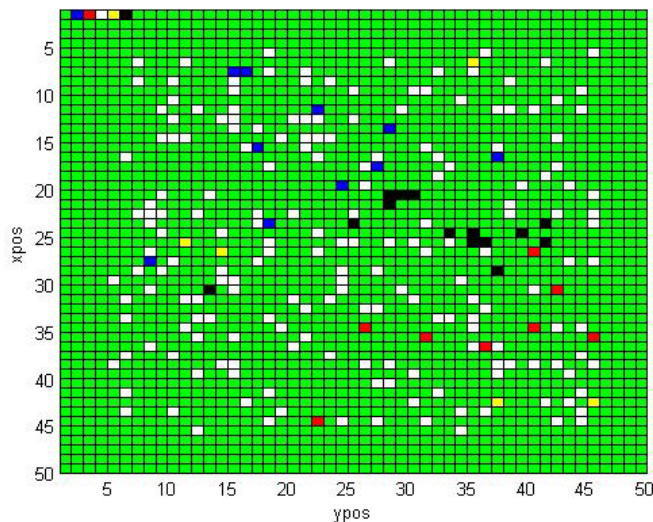
Initial state of Civilian fear, anger, and violence threshold attributes



Example Model Runs

Scenario 1A: NO indirect fire or IEDs

Blue Effectiveness = 0.8 **Red Effectiveness = 0.8**
Blue Accuracy = 0.8 **Red Accuracy = 0.8**

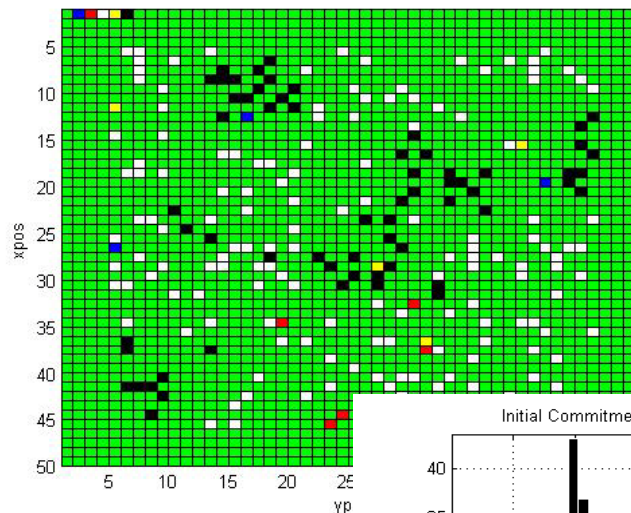


Red killed by Blue = 7
Blue killed by Red = 5
Shots fired by Blue = 7
Shots fired by Red = 5
Civilians killed by Blue = 1
Civilians killed by Red = 2
Initial commitment = 0.005
Final commitment = 0.013
Latent insurgents against Blue = 2
Latent insurgents against Red = 3

Battlefield 50 x 50
Civilians = 200
Soldiers = 15 each
Model run = 100 steps

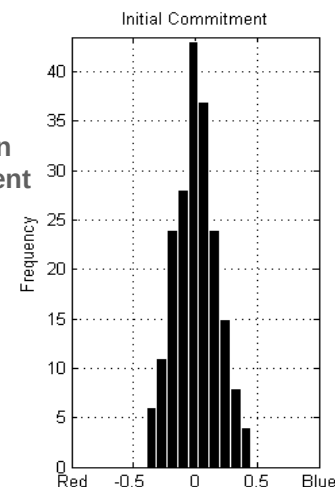
Scenario 1B: YES indirect fire and IEDs

Blue Effectiveness = 0.8 **Red Effectiveness = 0.8**
Blue Accuracy = 0.8 **Red Accuracy = 0.8**



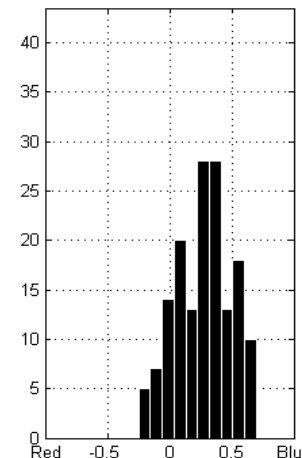
Red killed by Blue = 8
Blue killed by Red = 12
Shots fired by Blue = 4
Shots fired by Red = 4
Civilians killed by Blue = 15
Civilians killed by Red = 29
Blue indirect fire attempts = 2
Red IED detonation attempts = 3
Initial commitment = 0.005
Final commitment = 0.272

Initial Mean Commitment



Final Mean Commitment

Ending Commitment



Commitment shifted from neutral toward Blue force

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Example Model Runs

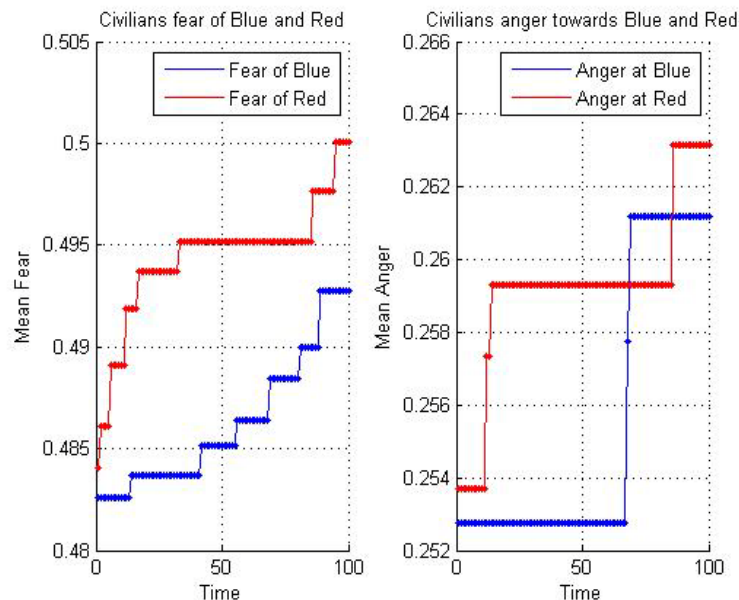
Scenario 2: NO indirect fire or IEDs

Blue Effectiveness = 0.8 Red Effectiveness = 0.8
Blue Accuracy = 0.8 Red Accuracy = 0.2

Initial commitment distribution = 0.25

Civilian commitment shifted slightly toward Blue at start of operation

Red killed by Blue = 6
Blue killed by Red = 8
Shots fired by Blue = 6
Shots fired by Red = 8
Civilians killed by Blue = 2
Civilians killed by Red = 4
Initial commitment = 0.25
Final commitment = 0.32



Scenario 3: YES indirect fire and IEDs

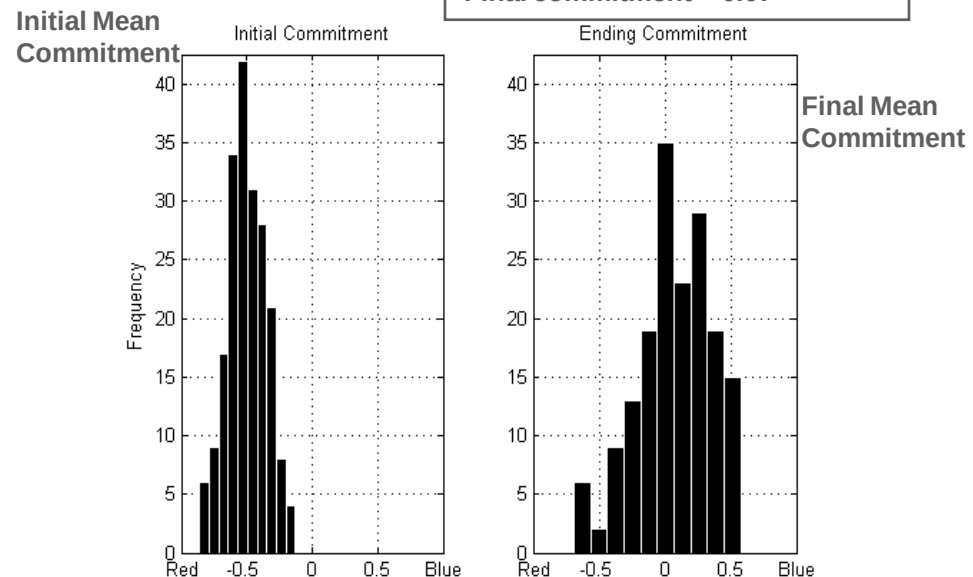
Blue Effectiveness = 0.8 Red Effectiveness = 0.2
Blue Accuracy = 0.8 Red Accuracy = 0.2

Initial commitment distribution = -0.5

Civilian commitment strongly supports Red force at start of operation

Commitment shifted from Red to nearly neutral

Red killed by Blue = 10
Blue killed by Red = 13
Shots fired by Blue = 10
Shots fired by Red = 6
Civilians killed by Blue = 1
Civilians killed by Red = 29
Blue indirect fire attempts = 0
Red IED detonation attempts = 3
Initial commitment = -0.5
Final commitment = 0.07





Example Multiple Model Runs

Repeat 25 model runs per scenario

Difference between Scenario 1A and 1B is the use of indirect fire and IEDs

Slight shift of commitment toward Blue

Little shift in commitment

Because high effectiveness and accuracy for Blue and Red and no indirect fire and IEDs – show almost equivalent low death counts

Although high effectiveness and accuracy, indirect fire and IEDs substantial increase in death counts especially civilians

Scenario			Initial Commitment	Ending Commitment	Blue Dead	Red Dead	Civilians Killed by Blue	Civilians Killed by Red
1A. No Indirect Fire or IEDs								
	Blue	Red						
Effective	0.8	0.8	0.005	0.019	4.80	4.48	0.60	1.04
Accuracy	0.8	0.8						
1B. Indirect Fire and IEDs								
	Blue	Red						
Effective	0.8	0.8	0.005	0.085	9.72	8.48	14.44	18.48
Accuracy	0.8	0.8						
2. No Indirect Fire or IEDs								
	Blue	Red						
Effective	0.8	0.8	0.256	0.309	5.44	5.44	0.64	3.12
Accuracy	0.8	0.2						
3. Indirect Fire and IEDs								
	Blue	Red						
Effective	0.8	0.2	-0.500	-0.384	7.52	10.12	12.64	23.40
Accuracy	0.8	0.2						

Low Red accuracy means higher collateral damage

Low Red effectiveness means poor targeting of Blue

Initial commitment slightly supportive of Blue force

Because of collateral damage caused by Red, slight shift to Blue

Initial commitment strongly supportive of Red
But because of greater civilians deaths by Red commitment begins to shift toward Blue

Lower Blue deaths because of low Red effectiveness

Higher death counts over all because of indirect fire and IEDs

Greater civilian deaths by Red because of low accuracy

No indirect fire or IEDs low death count in general

Greater civilian death count by Red because of low accuracy



Summary

