

Ethno-Political Conflict Simulator: Influencing Leaders and Followers

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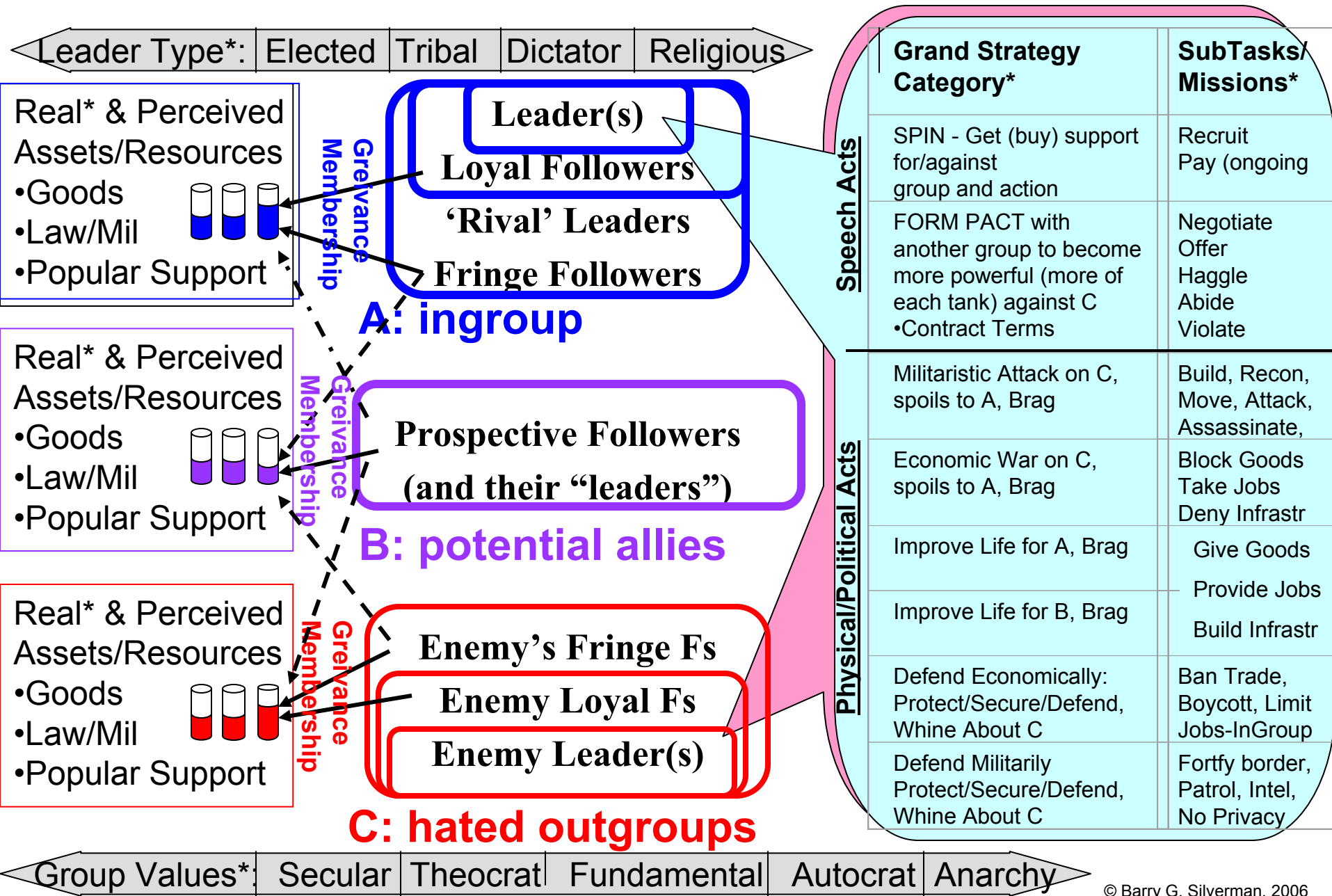
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Talk Outline

- **Ethno-Political Conflicts – Multi-Faction Game**
- Three Challenges:
 - I – Realistic Human Behavior Modeling (PMFserv)
 - II – Validation of FactionSim – Islamification Case
 - III - Simulation Intractability/Experimentation Dashboard
- Next Steps

Ethno-Political Conflict - Factions' Roles, Assets, Strategies



Athena's Prism as TableTop Game



ons

Source Selected
er B's Zealots in A



Flag

Selected Resource

Export
e Domestic Affairs
Development Project
c Asymmetric Attack
tional Investment
ate
Ops

Selected Resource


Biological WMD
it Cause
Ops
e Forces
a Support

Master Action List

ts
Aid
ry
Permission
ntional Military
atic
stic
mic
onventional Military


People

Leader A (Me)




Chat
Bio
Notes
Intel
Intercepts

Leader C




Chat
Bio
Notes
Intel
Intercepts

Leader B



Chat
Bio
Notes
Intel
Intercepts

Leader D



Chat
Bio
Notes
Intel
Intercepts

Scroll over highlights option
Single click opens pop-up or tab

Scroll over presents options
Single click shows wizard
Right click opens menu

Intercepts Intel Summits

Leader I

- Leader
- Leader
- Leader
- Leader

Place

World Map Territory A Territory B Territory C Territory D

Territory A

Flag


Properties

WMDs

Leader A: Chemical (1)
Leader A: Nuclear (2)

Borders

Border Forces



| Resources | Authority | Media | Economy | Populace | Diplomacy | Armed Forces | WMD Programs | Black Market | Zealots | Foreign Aid |
|--------------|-----------|----------|----------|----------|--------------|--------------|--------------|--------------|---------|-------------|
| | Leader A | Leader C | Leader B | Leader D | Unaffiliated | | | | | |
| Authority | 13 | 13 | 13 | 10 | 2 | 15 | | | 3 | 5 |
| Media | | 2 | 4 | 3 | 3 | | | | | 2 |
| Economy | | | | 5 | | | | | | |
| Populace | | | | 10 | | | | | | |
| Diplomacy | | | | | | | | | | |
| Armed Forces | 15 | | | | | | | | | |
| WMD Programs | | | | | | | | | | |
| Black Market | | | 3 | | | | | | | |
| Zealots | | | | | | | | | | |
| Foreign Aid | | | | | | | | | | |

Big Wig (2007)

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Cafe Games Limited is pleased to announce two sets of Classic Formula cars perfect for use with Racing Games like Formula De, and its first board game Hispaniola for 2005.

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PL Pro Ludo
Spielevertrieb

Pro Ludo is the German sister company to Cafe Games Limited. They primarily represent various US and French companies in the German Market. Well, in 2004 Pro Ludo gets into the publishing business itself, and they have chosen Cafe Games as its partner for all English language versions of their products. We would like to say Good Luck to our sister company in Germany, and may our partnership be long and successful.

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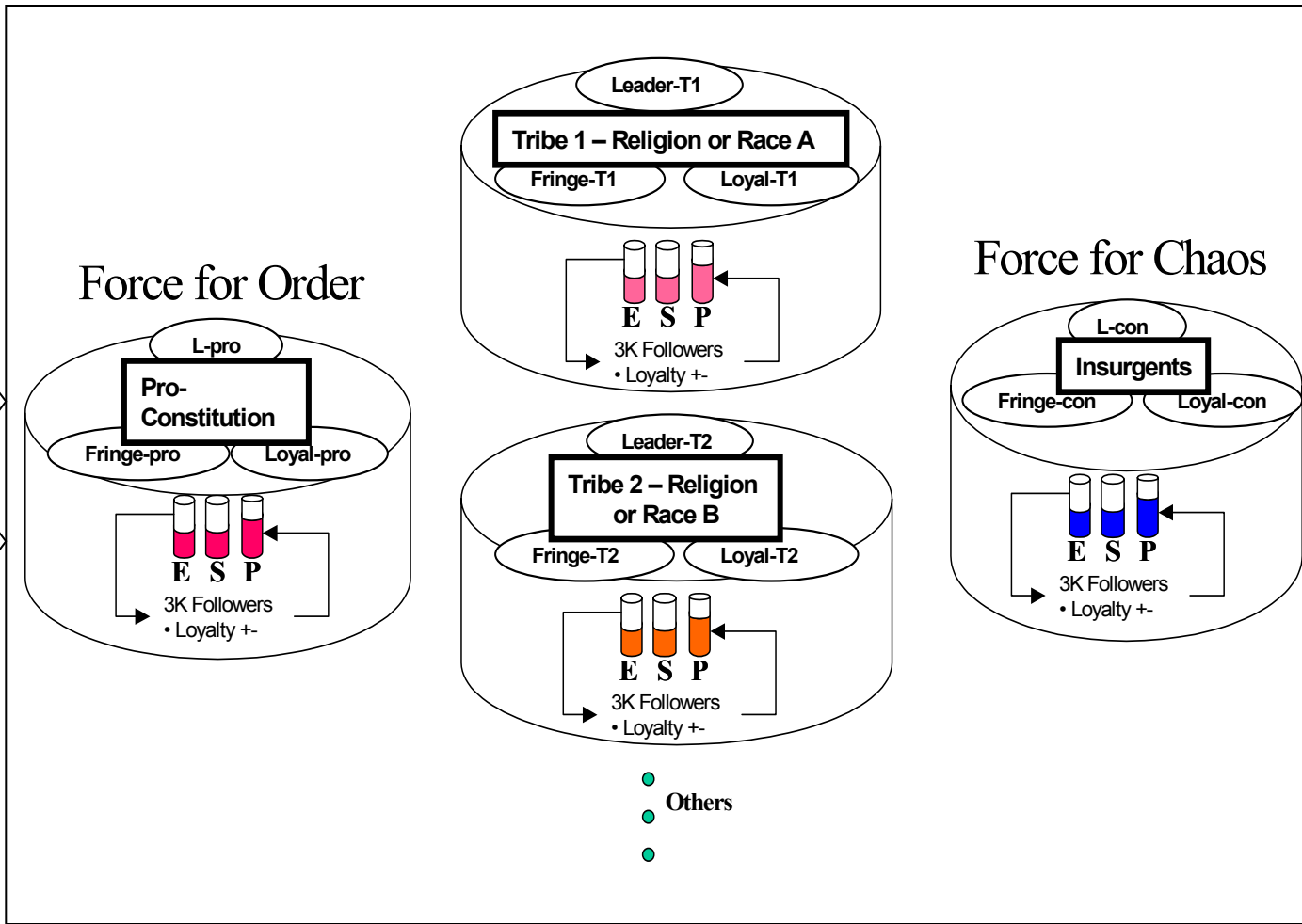
Turn your **GIFT CARD** into **THE PERFECT GIFT**

FactionSim Prototype (Leaders & Followers)

Tradeoff Resource Complexity of Athena (leaders only)

DIME
courses
of action
by MNC

**Faction &
Personality
Editor
(PMFserv
IDE)**

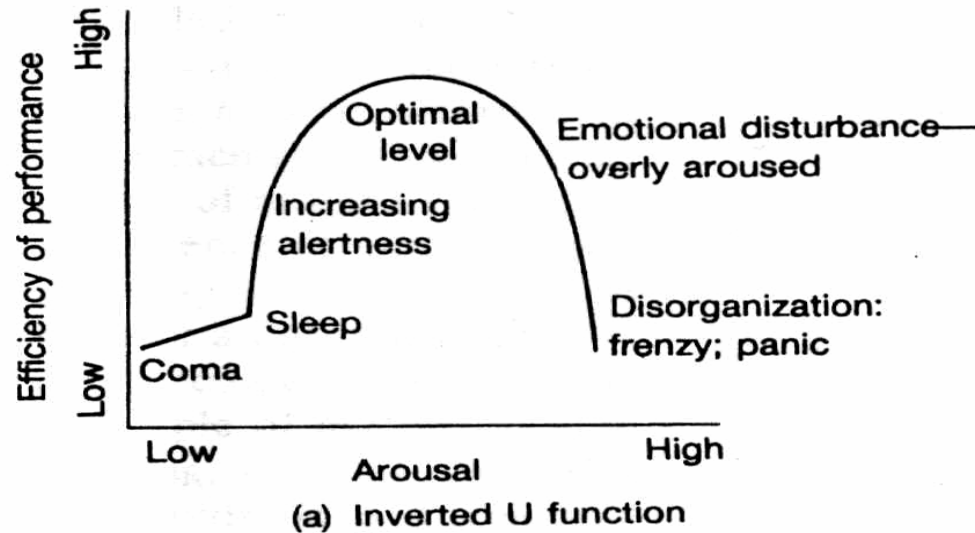


PMESII
effects
resulting
from
factional
runs

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- Three Challenges:
 - I – Realistic Human Behavior Modeling (PMFserv)
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500 PMFs - Theory Anthology



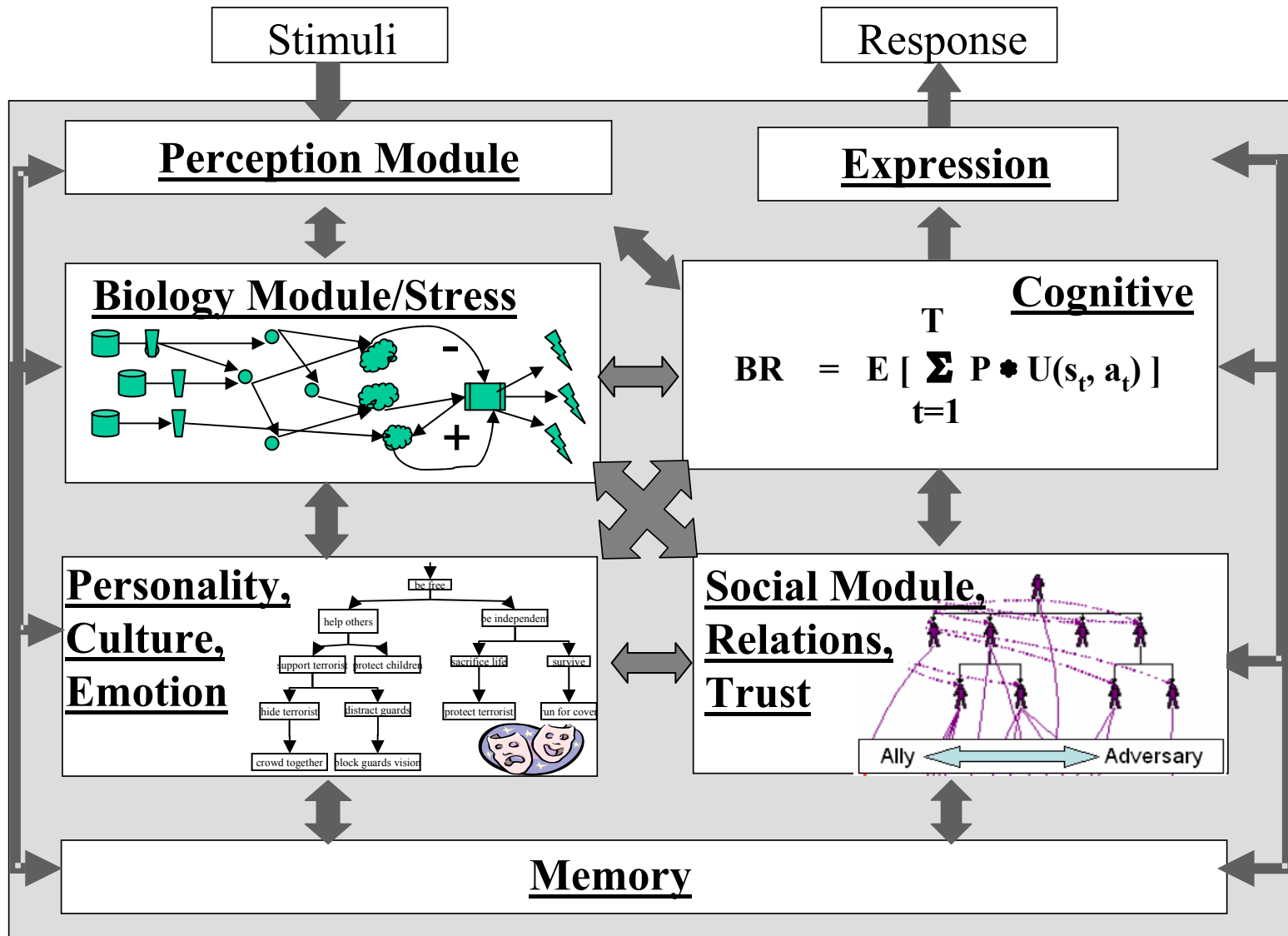
- Structured Abstracts
- Validity Scale and Ratings
- Common Mathematical Framework

www.seas.upenn.edu/~barryg/PMFset.zip

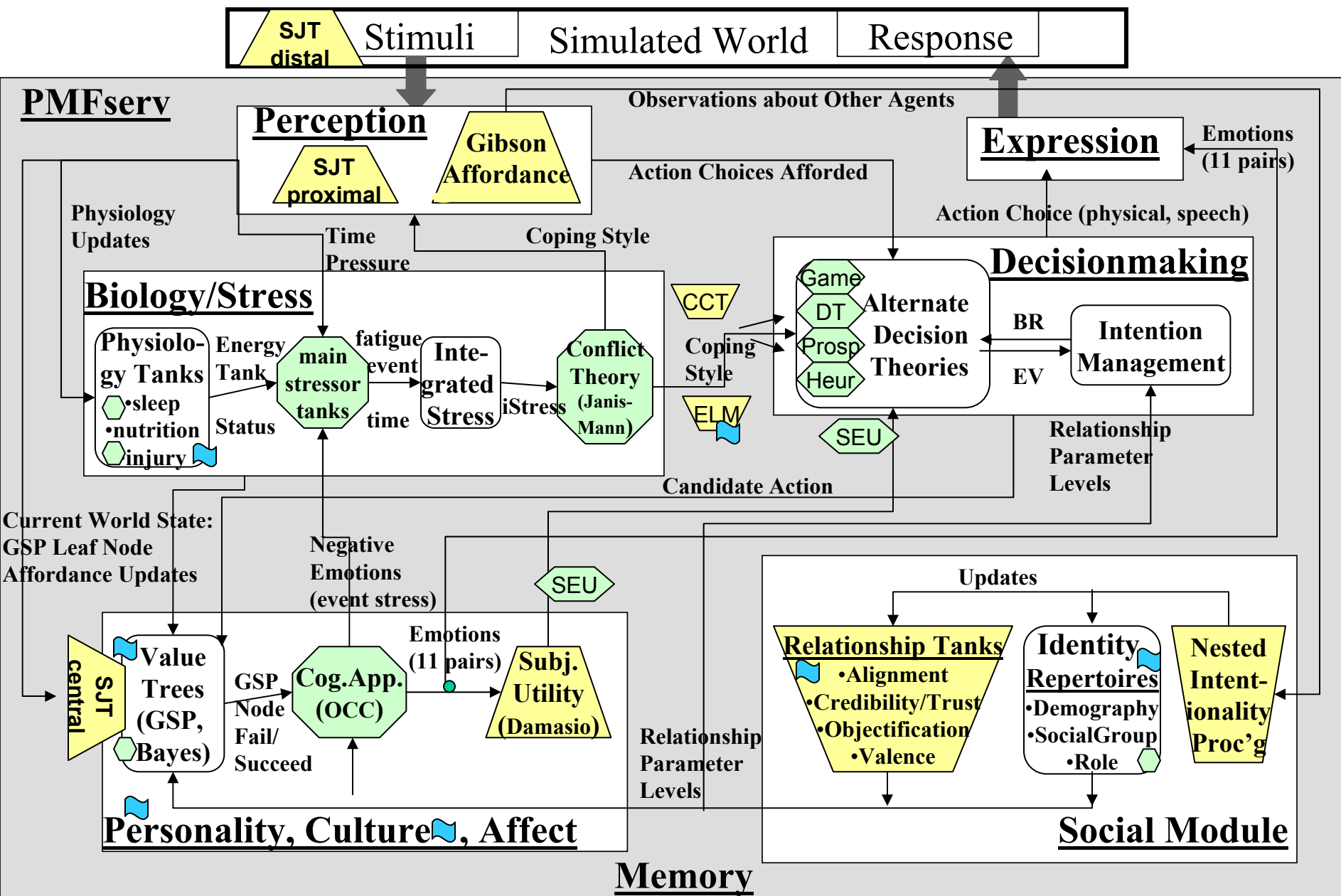
www.seas.upenn.edu/~barryg/PMF_Addendum1.doc

PMFserv's Unified Architecture for Cognition

(Breaking Stovepipes Between Sub-Fields, Synthesizing Best-of-Breed Models)



www.seas.upenn.edu/~barryg/HBMR



LEGEND:

- Green hexagon: Implements Literature
- Yellow trapezoid: Interprets Literature
- White box: New PMF
- Blue wavy icon: Validated Profiling Instrument Available (Hermann, Eidelson, Hofstede/House, NfC)

BR -- Best Response
CCT – Cognitive Continuum Theory(Hammond)
DT – Decision Theory (Keeney, Raiffa)
ELM – Elaboration Likelihood Model (Petty)
EV -- Expected Value
Game-Game Theory (von Neumann, Nash)

GSP – Goals, Standards, Preferences
Heur – Heuristics, Rules, Biases (Simon, Klein, Slovic)
OCC – Ortony, Clore, Collins
Prosp –Prospect Theory(Kahneman & Tversky)
SEU – Subjective Expected Utility(Edwards, Wright)
SJT – Social Judgement Theory(Brunswik, Hammond)

PMFs Visual Metaphor (common math of hydraulics)

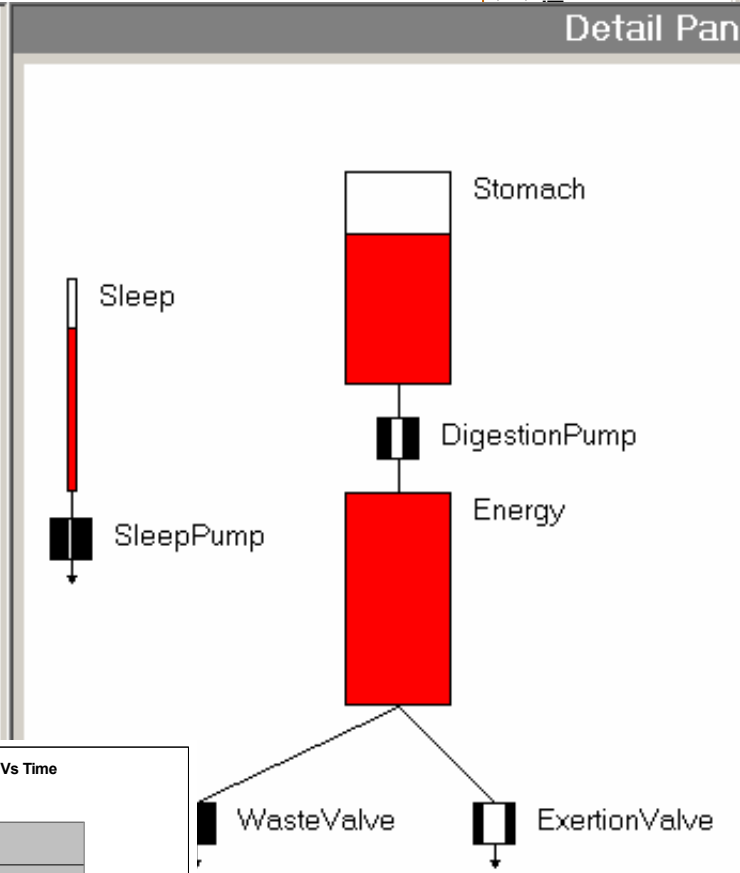
Agents

- Programmer
 - Programmer Tree
 - Stress
 - Physiology
 - Relationships
 - State

Coffee Battle

Agents

- Programmer
 - Programmer Tree
 - Stress
 - Physiology
 - Relationships
 - State
 - Action Bindings
 - Perceptual Types
 - Decision
 - Emotions
 - Perception
- Programmer 2
 - Programmer Tree
 - Stress
 - Physiology
 - Relationships
 - State
 - Action Bindings
 - Perceptual Types



Event Stress Override

Effective Fatigue Override

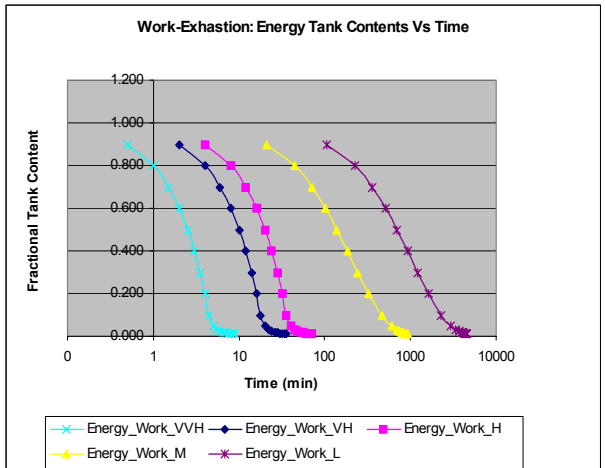
Time Pressure Override

Integrated Stress Override

Coping Style

- Panic
- Defensive Avoidance
- Vigilant
- Unconflicted Change
- Unconflicted Adherence

0.90
0.70
0.40
0.10



PMFserv Incorporates Personality, Cultural Values, Utility (common math framework – subjective expected utility)

Coffee Battle

Agents

- Programmer
 - Programmer Tree
 - Stress
 - Physiology
 - Relationships
 - State
 - Action Bindings
 - Perceptual Types
 - Decision
 - Emotions
 - Perception
- Programmer 2
 - Programmer Tree
 - Stress
 - Physiology
 - Relationships
 - State
 - Action Bindings
 - Perceptual Types
 - Decision
 - Emotions
 - Perception

Objects

- Coffee
- State
- Action Bindings

Detail Panel - Programmer 2's Emotions

Goal Emotions: Fortunes of Self

Distress Joy
Fear Hope

Preference Emotions

Disliking Liking

Goal Emotions: Fortunes of Others

Resentment Pity
Gloating Happiness

Standard Emotions: Attributions

Shame Pride
Reproach Admiration
Anger Gratitude
Remorse Gratification

Active Events

| Id | Action | Result | Target Id |
|--------------|------------|-----------------|--------------|
| Programmer | Drink | Coffee Consumed | Coffee |
| Programmer 2 | Get Refill | Get Refill | Coffee |
| Programmer | Drink | Coffee Consumed | Coffee |
| Programmer 2 | Perceive | Perceive | Programmer |
| Programmer 2 | Perceive | Perceive | Programmer 2 |
| Programmer 2 | Perceive | Perceive | Coffee |

Goals

- 0.55 --- Fun
- 0.15 --- Health
- 0.50 --- Get Sleep
- 0.20 --- Stay Hydrated
- 0.30 --- Wealth
- 0.50 --- Be Productive
- 0.50 --- Seek Opportunities
- Standards
 - 0.40 --- Good Behavior
 - 0.30 --- Help Others
 - 0.40 --- Respect Others
 - 0.30 --- Share
 - 0.60 --- Snobbery
 - 0.25 --- Buy Possessions of Quality
 - 0.25 --- Drink Beverages of Quality
 - 0.25 --- Eat Food of Quality
 - 0.25 --- Enjoy Quality Entertainment
- Preferences
 - 0.34 --- People
 - 0.10 --- Coworkers
 - 0.40 --- Friends
 - 0.50 --- Spouse
 - 0.33 --- Place

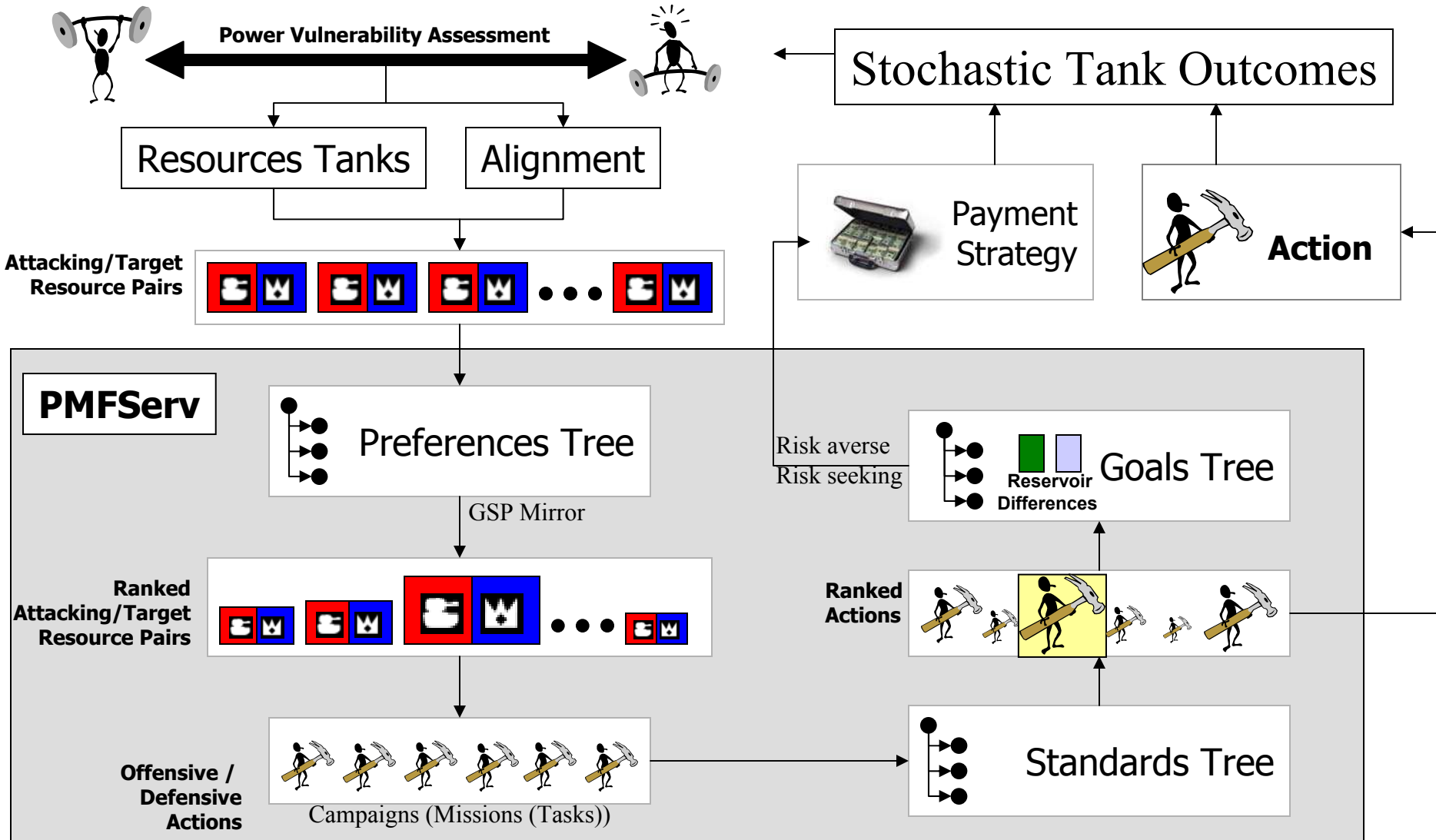
11 pairs of emotions
internally-derived utility

$$U = \sum_{\xi} I_{\xi}(s_k) / 11$$

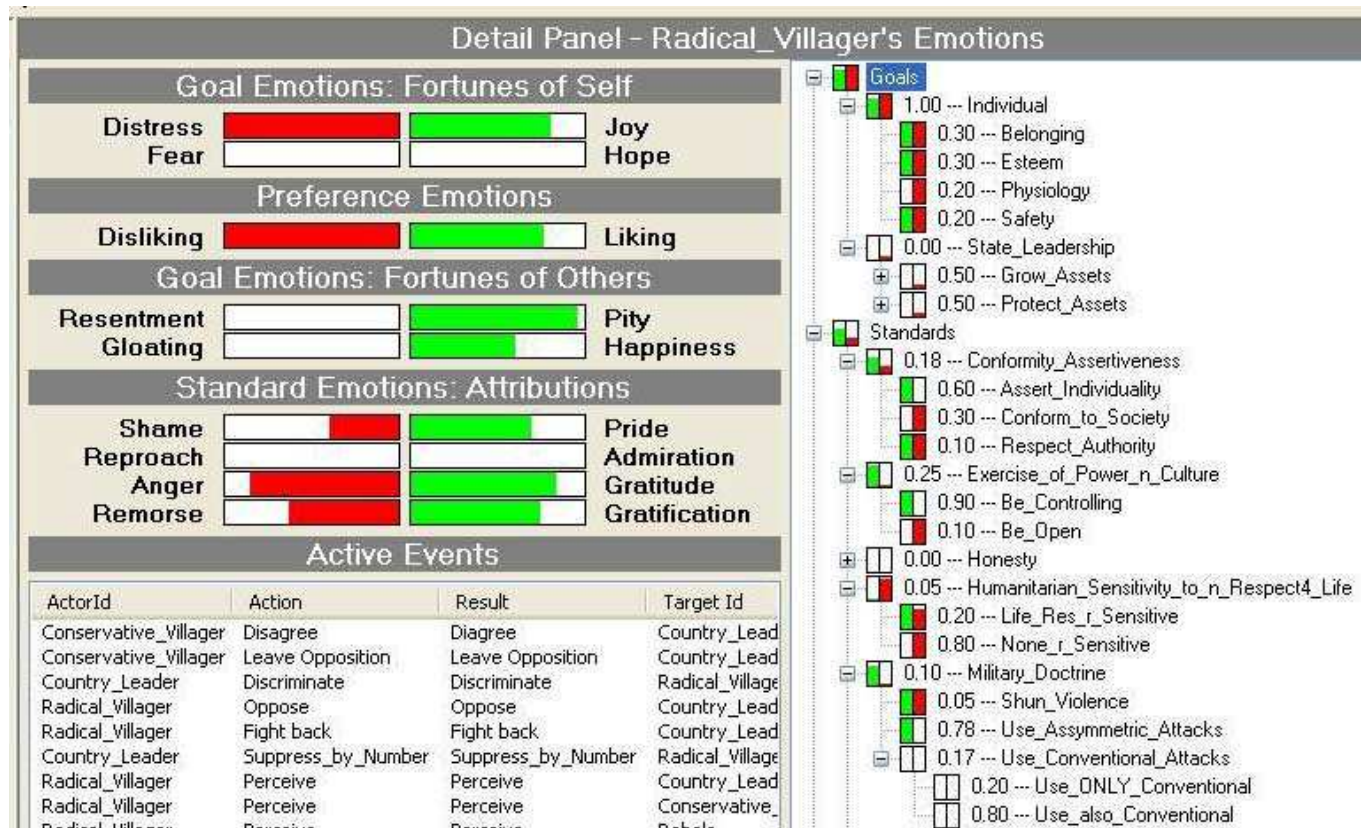
GSP Trees (Bayesian-weighted)

- Preferences - longer term hopes
- Standards - means acceptable in self and others
- Goals - short term needs and actions to reach Prefs

GSP Trees Drive Leaders To Manage Resource Tank “Prospects”



Value System (GSP Trees) and Emotions of Follower Archetypes



Loyal Member - Conservative Villager

- Parents/Older
- Live in rural region, farmers, laborers
- Long life in peace
- Family at stake

Fringe Member -- Radical Villager

- Grew up in village
- Sent away to Wahabbi School
- College degree, unemployed
- Returned home, teaching Koran

Follower Membership (Φ) “Game”

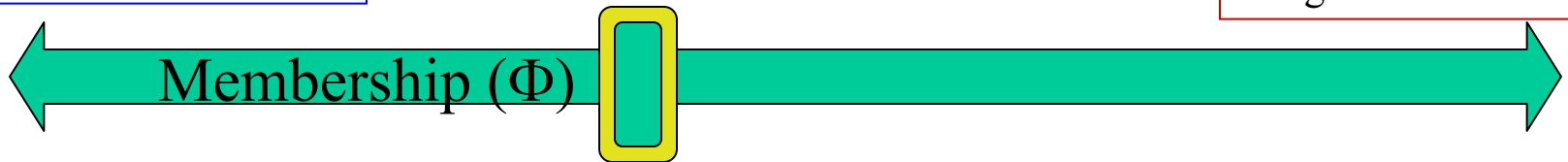
Faction A (Rule of Law)

- Properties
- Salience (enter, exit)
- Demographics
- Alignments
- Event History
- Avg GSPs

Faction B (Moderates)

Faction C (Opposition)

- Properties
- Salience (enter, exit)
- Demographics
- Alignments
- Event History
- Avg GSPs



| <u>Observe/Orient</u> | <u>Decide</u> | <u>Act</u> |
|--|--|--|
| <p>Eidelson's <u>Dangerous Ideas Model</u></p> <ul style="list-style-type: none"> • Vulnerability • Injustice • Distrust • Helplessness • Superiority | <p><u>Loyalty, Voice, Exit Model</u></p> $\Delta\Phi_i = [U(\Phi_C) + \frac{COST_{TR}}{TR_{AC}}] - U(\Phi_A)$ $\Phi(r_{iA}) = \frac{Superiority_A \times GSPcongruence_{iA}}{VID_{Ai}}$ $TR_{A \rightarrow C} = Salience_{ExitA} \times Salience_{EnterC} \times GSPcongruence_{iC}$ | <p><u>Grievance Scale</u></p> <p>Sacrifice, Go on Attacks for A Support, Vote for Group A Join Authority Group A Agree with A Neutral (undecideds in Group B) Disagree, Vote against A Join Opposition Group C Oppose, Non-Violent Fight Rebel, Exit A</p> |
| <p>PMFserv for a Follower (perceptions, emotions, GSPs, utility, trust, relations, choice)</p> | | |

Gallery of Some Past PMFserv Agent Studies

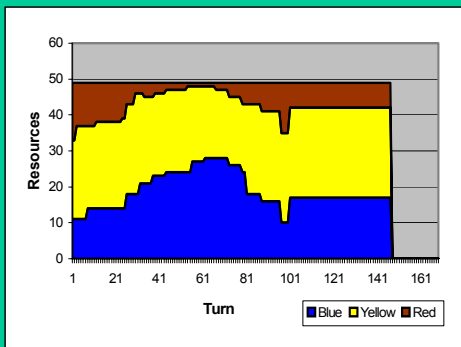
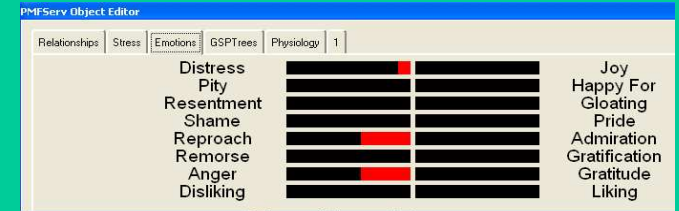


Asymmetric Plots (Culture/Emotions)

- **Recreate Black Hawk Down: Four types of Somalians**
 - Women/Kids, Civilian Males, Militia, Clan Leaders
- **Intifadah dynamics – cell leader, suicide-bomber, Mayor, populace reactions**
- **Grade B Movie - Al Qaeda & Iraqi Insurgency, SE Asia, Elsewhere**

Crowd Behavior Emergence (Bio-Affect-Values-Panic-Riot)

- **WTO Talks in Seattle -- Protesting/rioting crowds: Males (employed/unempl.), females, instigators**
- **Rioting/looting crowds at food distribution station (impact of cultural norms upon crowd behavior)**
- **Soccer Hooligans (Manchester United Supporters)**
- **Scale up to 1,000 agents in Sony OpenSteer**



Political Agents for RPGs

- **Nested intentionality, speech acts, reputation management**
- **World leaders in diplomatic strategy role playing games**
- **Hookup to social network models**
- **Group membership dynamics**

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FactionSim & PMFserv Validity Testing: Case Study

Leader Type*: Elected Tribal Dictator Religious

Real* & Perceived Assets/Resources

- Goods
- Law/Mil
- Popular Support



Grievance Membership

Leader(s)

Loyal Followers

'Rival' Leaders

Fringe Followers



Party Leader Model
Prime Minister
Buddhist Majority

A: Buddhist Party*

Real* & Perceived Assets/Resources

- Goods
- Law/Mil
- Popular Support



Grievance Membership

Prospective Followers
(and their "leaders")



Villagers

- Sultan
- Parents (Moderate)
- Unempl College Grad (Radicals)

B: Muslim*

Real* & Perceived Assets/Resources

- Goods
- Law/Mil
- Popular Support



Grievance Membership

Enemy's Fringe Fs

Enemy Loyal Fs

Enemy Leader(s)



Bersatu or BRN
Insurgents:

- Leader Model
- Follower GSPs
- Jemaah Islamiyah

C: eg, fundamentalist*

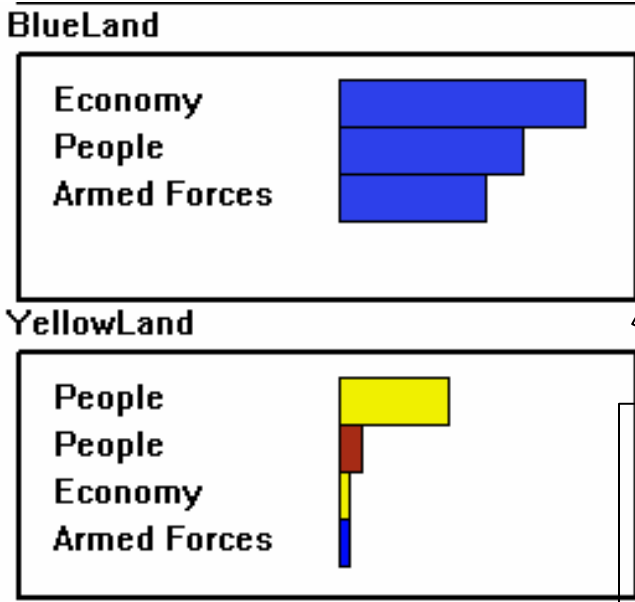
Group Values*: Secular Theocrat Fundamental Autocrat Anarchy

Start and End States For PMFserv Thick Agents And CV Villagers

LeaderSim Game

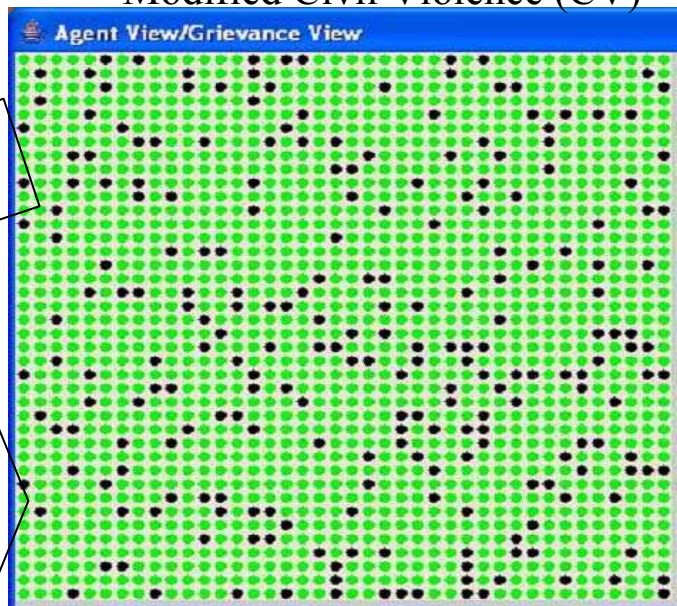
Modified Civil Violence (CV)

cops

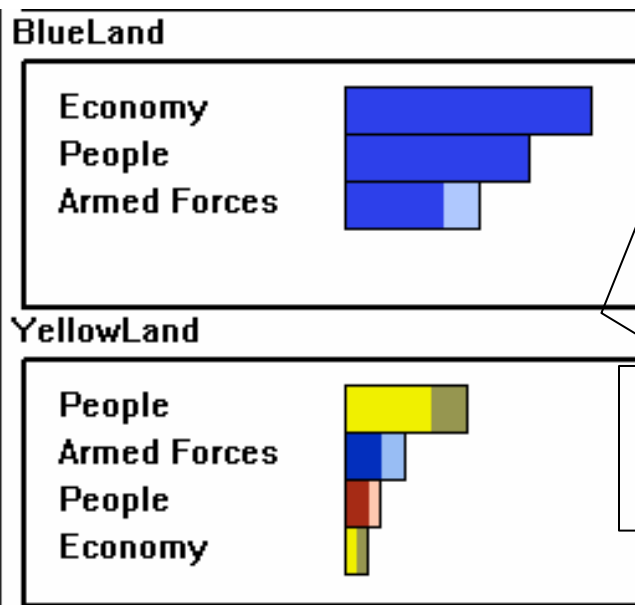


CV Agents' Grievance
•1,360 Neutrals

PMFserv Agents' Grievance
•80 Moderates
•80 Radicals

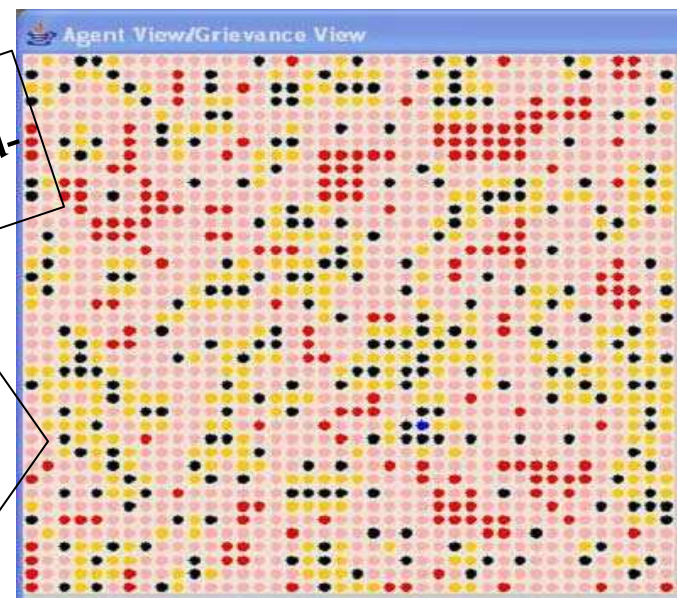


cops



CV Agents' Grievance
•503 Moderate, 530 Radical, 231 Rebel

PMFserv Agents' Grievance
•80 Moderates
•80 Radicals



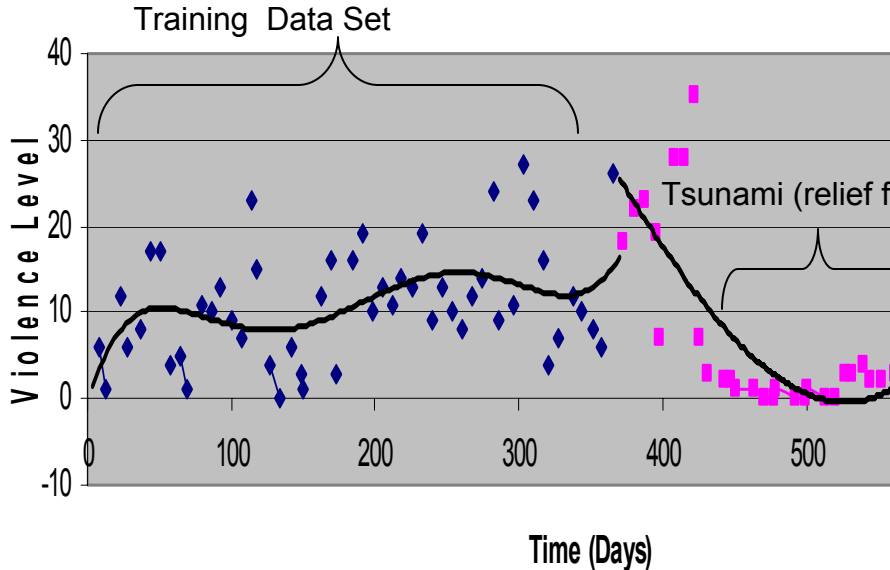
Evidence of Escalation of Violence

Transformation of society: people occupying higher grievance states increases.

Reject Independence of Means at 80% on Kendall Tau (Simulated Grievance vs. Actual Violence)

Actual Event Data

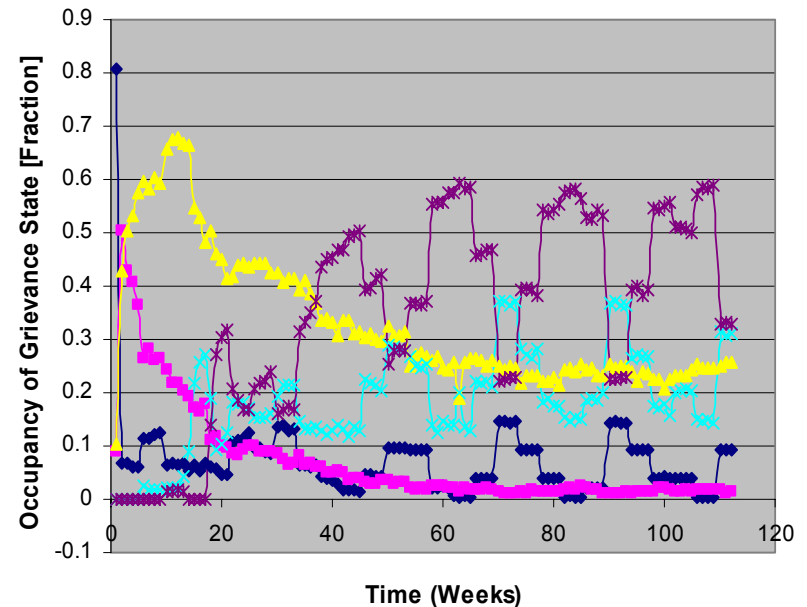
Level of Conflict in the CountryT wrt Time
(Initial Separation of Training & Test Sets)



◆ Level of Violence-Training Data ■ Level of Violence-Test Data — Poly. (Lev
 — Poly. (Level of Violence-Test Data) — Poly. (Level of Violence-Test Data)

Simulated Villager Feelings

Grievance State Occupancy Vs Time



◆ Mean Occupancy for GS0 ■ Mean Occupancy for GS1
▲ Mean Occupancy for GS2 × Mean Occupancy for GS3
✱ Mean Occupancy for GS4

Detail Panel - Villager's Emotions

Goal Emotions: Fortunes of Self



Preference Emotions



Goal Emotions: Fortunes of Others

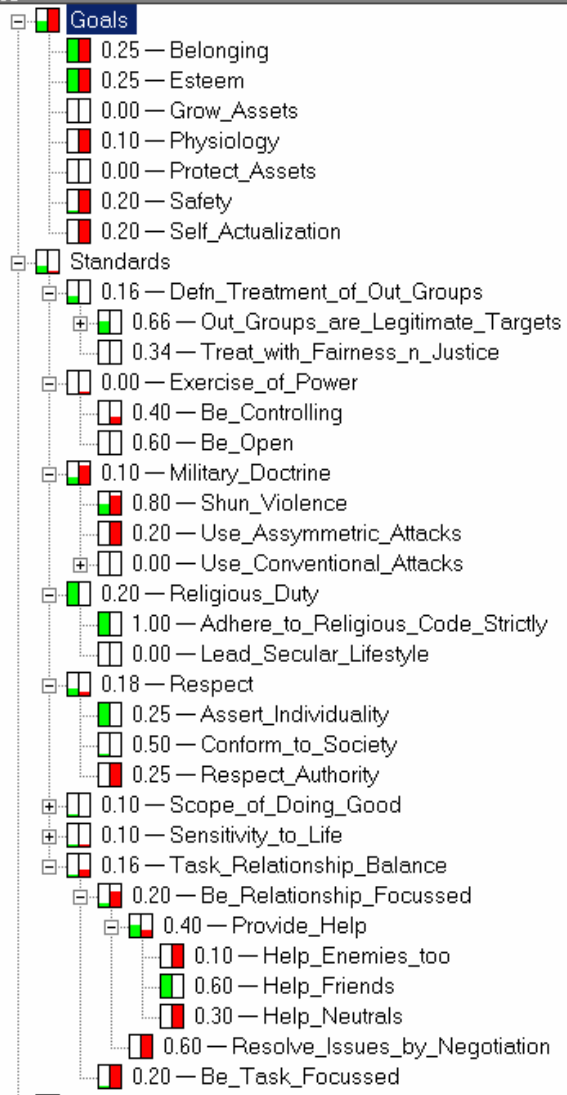


Standard Emotions: Attributions



Active Events

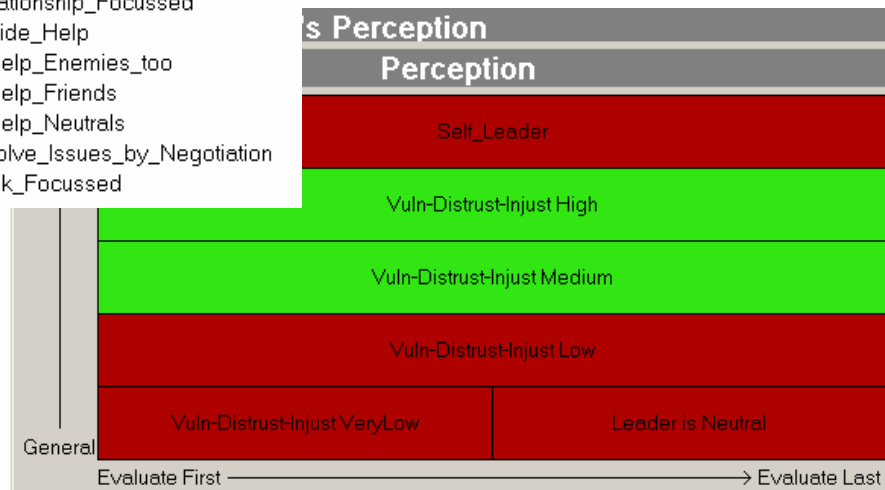
| ActorId | Action | Result | Target Id |
|----------|-----------------|-----------------|-----------|
| Leader | Suppress | Suppress | Villager |
| Leader | Discriminate | Discriminate | Villager |
| Villager | Join Opposition | Join Opposition | Leader |
| Villager | Fight back | Fight back | Leader |
| Leader | Suppress | Suppress | Villager |
| Villager | Disagree | Disagree | Leader |
| Leader | Suppress | Suppress | Villager |
| Leader | Suppress | Suppress | Villager |
| Leader | Suppress | Suppress | Villager |
| Leader | Suppress | Suppress | Villager |
| Villager | Perceive | Perceive | Villager |
| Villager | Perceive | Perceive | Leader |



Illustrative Radicalization of a Villager

s Perception

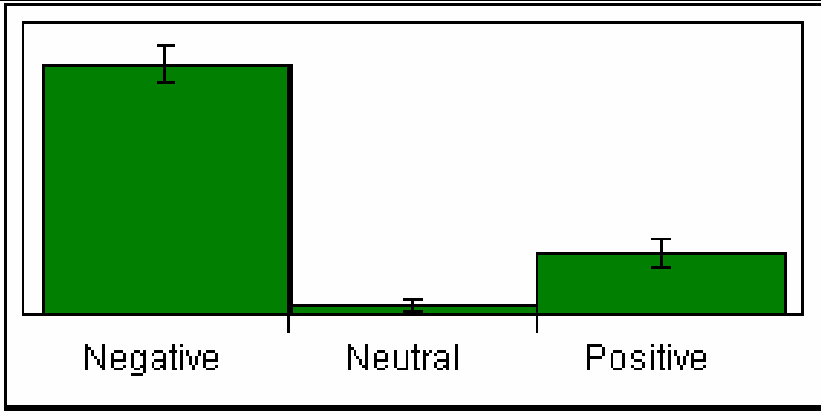
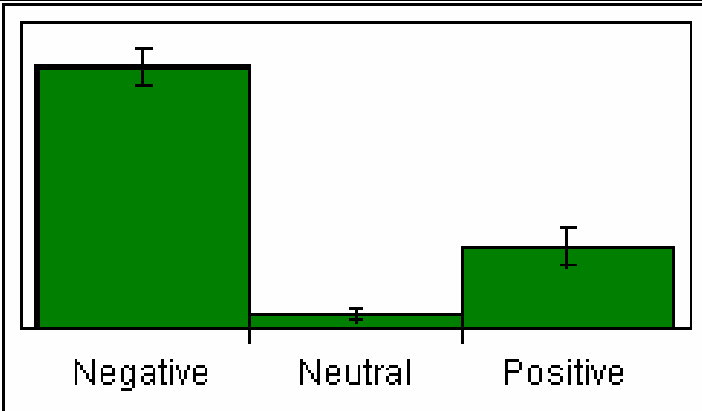
Perception



Villagers' View of Leader & His Impact on Vulnerability, Injustice, & Distrust

Correlation of Simulated Leader vs. Real Action Decisions

Comparison of distributions to see Mutual Entropy (M). Reject H0 & Accept H1 if $M < 0.1$

| | PMFserv-Simulated Prime Minister's Actions | | Real Leader's Chosen Actions | |
|------------------------------------|--|-------|--|--|
| <u>Distributions</u> |  | |  | |
| <u>Mutual Entropy Calculations</u> | Joint Entropy of <u>Sim & Real</u> | 1.396 | $H(\text{SIM}, \text{REAL}) = - \sum p(\text{sim}_i, \text{real}_j) \log p(\text{sim}_i, \text{real}_j)$ | |
| | Entropy of <u>Sim</u> | 0.681 | $H(\text{SIM}) = - \sum p(\text{sim}_i) \log p(\text{sim}_i)$ | |
| | Entropy of <u>Real</u> | 0.760 | $H(\text{REAL}) = - \sum p(\text{real}_j) \log p(\text{real}_j)$ | |
| | Mutual Entropy of <u>Sim & Real</u> | 0.045 | $M(\text{SIM} : \text{REAL}) = H(\text{SIM}) - H(\text{SIM} \text{REAL})$ | |

Legend of Leader Actions

Negative Actions:

Discriminate
 Suppress - Increase Number of Cops
 Suppress - Increase Violence of Cops

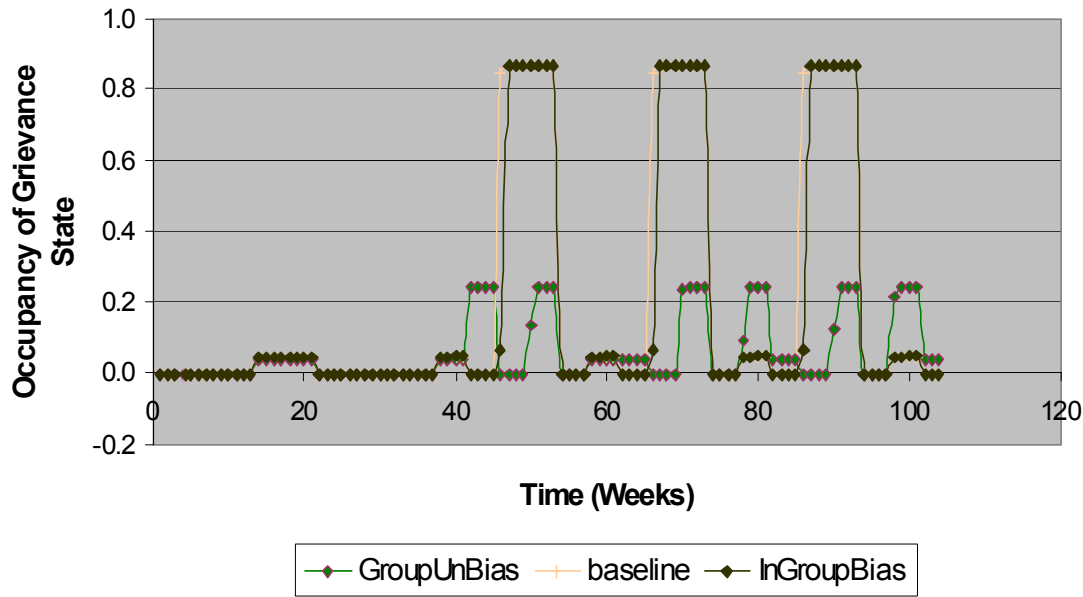
Neutral Actions:

Perceive (Observe Events)

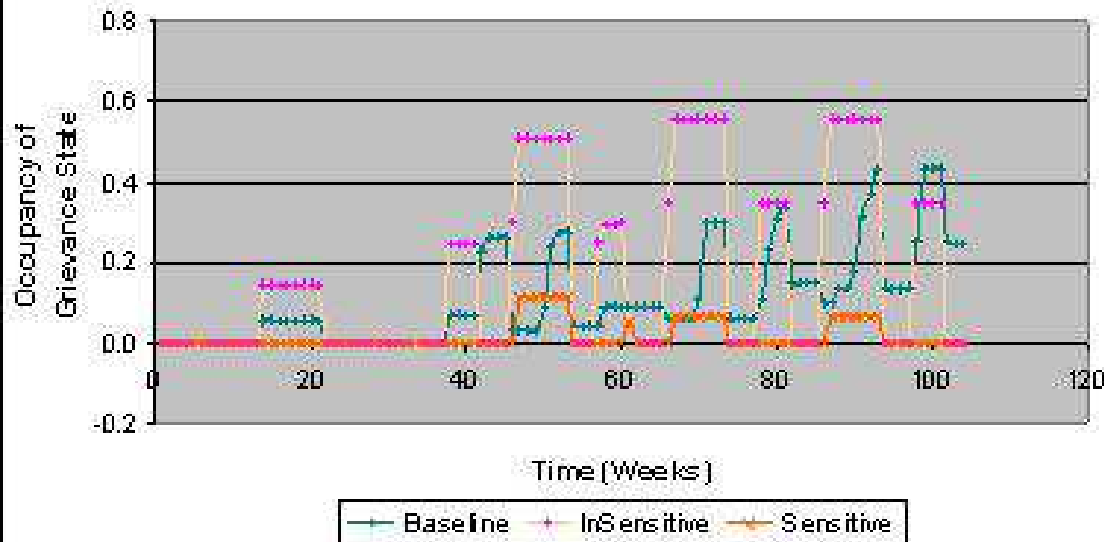
Positive Actions:

Give Culturally Sensitive Assistance
 Give Essential Assistance
 Reduce Suppress by Number
 Reduce Suppress by Violence

Variation of Occupancy of Grievance State 4
wrt In-Group Bias for the Leader

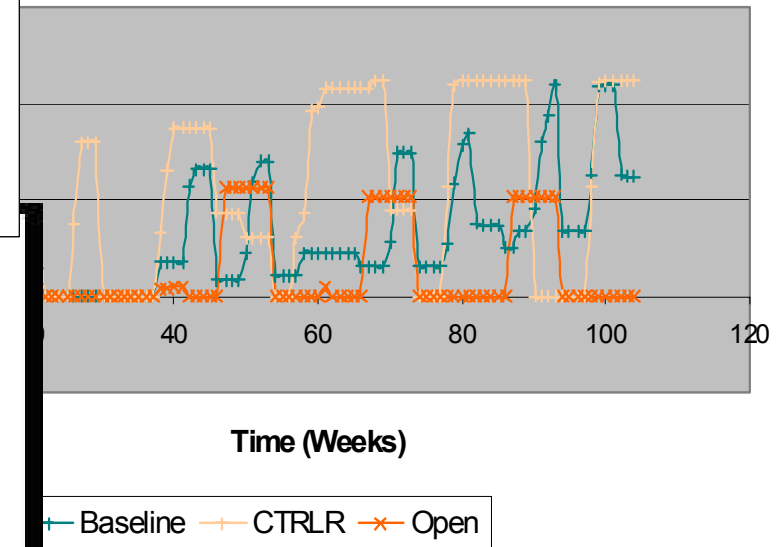


Variation of Occupancy of Grievance State 4
wrt the Leader's Sensitivity for Life

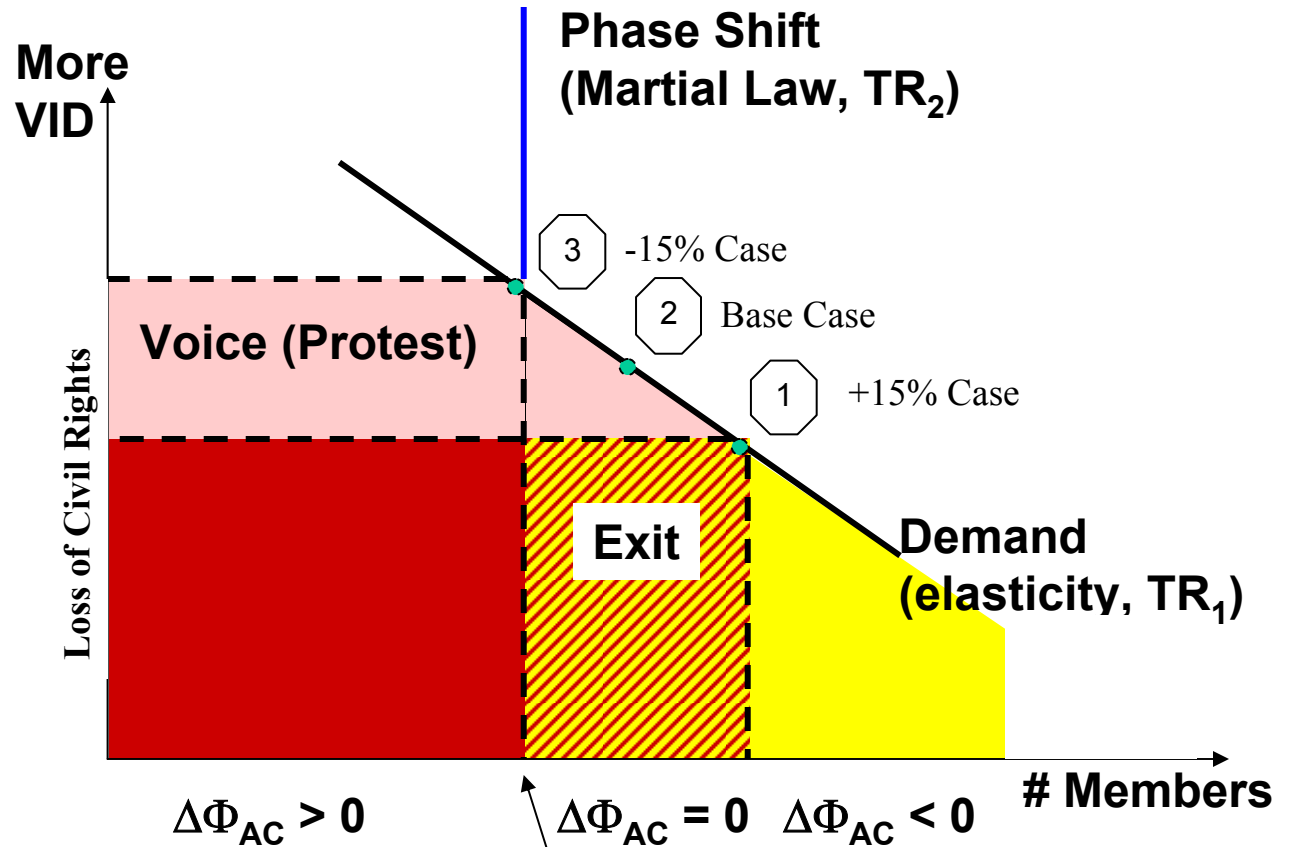


Sensitivity Analyses of Follower Outcomes vs. +/- 15% mean Leader Personality Standard

Variation of Occupancy of Grievance State 4
wrt Openness of the Leader



Surprise Result – Agent Macro-Behavior Seems to Confirm A.O. Hirshman (1970) – Model of Loyalty, Exit, and Voice



$$\Phi(r_{iA}) = \frac{\text{Superiority}_A \times \text{GSPcongruence}_{iA}}{\text{VID}_{Ai}}$$

$$\Delta\Phi_i = [U(\Phi_C) - \frac{\text{COST}_{TR}}{(1 + TR_{AC})}] - U(\Phi_A)$$

$$TR_{A \rightarrow C} = \text{Salience}_{\text{Exit}A} \times \text{Salience}_{\text{Enter}C} \times \text{GSPcongruence}_{iC}$$

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Summary

- **Human Behavior (PMFserv)** – Compose people archetypes. Open the agenda to research on parameters across many human behavior disciplines (biology/stress, values/personality/emotion, culture/groups, trust/reputation, decisions/gaming)
- **Effects Based Operations (GameWorld)** – Rapidly mockup realworld scenarios and play out how choices lead to alternative effects & ways to influence leaders/groups/followers (where does it fail?)
- **Campaign/Sensitivity Studies** – Find principled ways to explore the space of possible outcomes, to find robust states, and to understand the elasticities of behavior parameters as policy interventions and diffusions are attempted

Modeling and Simulation of Agents in Resource Strategy Games: Socio-Cultural Analysis Tools

Goal: Develop an experimentation dashboard for a world diplomacy simulator and personality emulator (stress, value systems, emotions, relationships)

Conflict Experimentation Dashboard

Preprocessor:

- Mockup World Conflict Scenarios
- Profile World Leaders
- Select Sampling Plan

SimLab Executor:

- Monte Carlo : Generate Samples
- Fill-in Latin Hypercube,
- Parameter Splits, Morris Walk

Postprocessor:

- Optimal Search - Robust Outcomes
- Study Leader Parameter Elasticities
- Generate Reports, Graphics

World Leaders: Personality/ Values Profiler (PMFserv)

Goal Emotions: Fortunes of Self

Distress Joy

Goal Emotions: Fortunes of Self

Distress Joy

Fear Hope

Preference Emotions

Disliking Liking

Goal Emotions: Fortunes of Others

Resentment Pity

Gloating Happiness

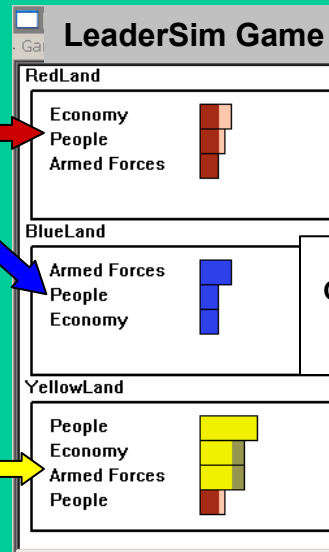
Standard Emotions: Attributions

Shame Pride

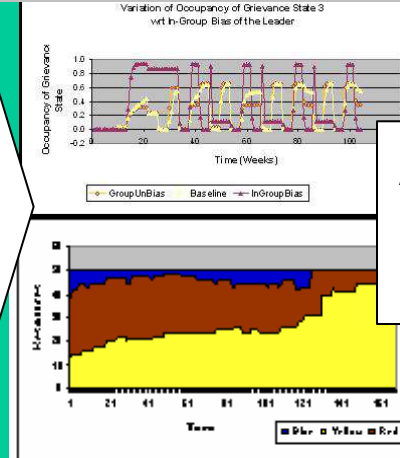
Reproach Admiration

Anger Gratitude

Remorse Gratification



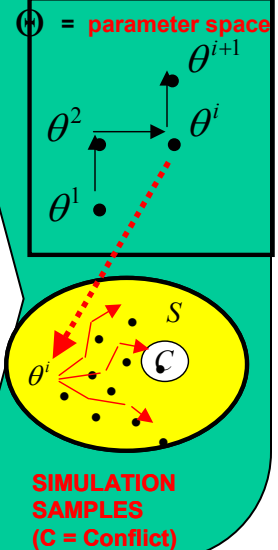
Sample Outcome of Conflict Scenario & Leader Personality Parameter Set



Run Game to Equilib. Point

Generate AllSamples, Log Results, Study Elasticities

MORRIS RANDOM WALK



Payoff to Air Force

- Find principled ways to explore the space of possible outcomes, to avoid conflict states, and to understand the elasticities of behavior parameters as interventions are attempted