

Nexus: An Interpretive Social Simulation of Corruption

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Interpretive Social Science to model Irregular Warfare

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- **Interpretive Social Science emphasizes the importance of the meaning of actions in context**
- **Interpretive Social Science is needed for irregular warfare**
 - Irregular Warfare analysis is concerned with social science concepts such as “legitimacy,” “will,” and public support for the actions of governments and insurgents
 - In most simulations, meaning is given, and interpretation assumed away
 - In information operations, the interpretation of actions is critical
- **In communications theory: The Narrative Paradigm (Fisher)**
 - People think based on Narratives, or stories with characters in roles, that have historical continuity
 - People think based on Narrative coherence, with the belief that persons behave consistently.
 - For example, if they believe Islamic extremist rhetoric, they believe Bush caused 9/11, despite evidence to the contrary
 - People think based on Narrative fidelity, looking to see if the explanations fit their identity and their values.
 - For example, they may have a historical consciousness and a national identity, in which they play a respectable role

Nexus uses the Narrative Paradigm to model Irregular Warfare

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- **Social group agents are cognitive, rather than reactive**
- **Agents interpret and reinterpret actions in context**
 - Of the actions that have happened before
 - Of ideological similarity to the actor
 - Of the network of support that agents have for each other
- **In light of new actions agents can**
 - Reassign blame for past actions
 - Change belief in the trustworthiness of other agents
 - Declare new support levels for other agents
- **Agents compute support levels with narrative-rational minds**
 - Narrative Coherence: They assign blame, belief in trustworthiness, and support so that the other agents have consistent behavior patterns.
 - Narrative Fidelity: They assign blame, belief in trustworthiness, and support as it supports their own identity and values.
- **Nexus is the only IW tool in which agents have a historical consciousness and reinterpret blame for actions**

Nexus: An Intelligent Agent Simulation of Irregular Warfare

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- **One agent per every relevant social group: whether groups overlap or contain each other does not matter.**
- **Each agent has a “group mind” (or you can say... it’s the leader’s mind...).**
 - This “group mind” fits in with SME statements of group opinion.
- **This group mind is a constraint satisfaction neural network, used to compute group support**
- **Constraint satisfaction neural networks simulate coherence**
 - **Duong, Deborah Vakas.** *A System of IAC Neural Networks as the Basis for Self-Organization in a Sociological Dynamical System Simulation.* Master’s Thesis, The University of Alabama at Birmingham, June 1991.
<http://www.scs.gmu.edu/~dduong/behavioralScience.pdf>.
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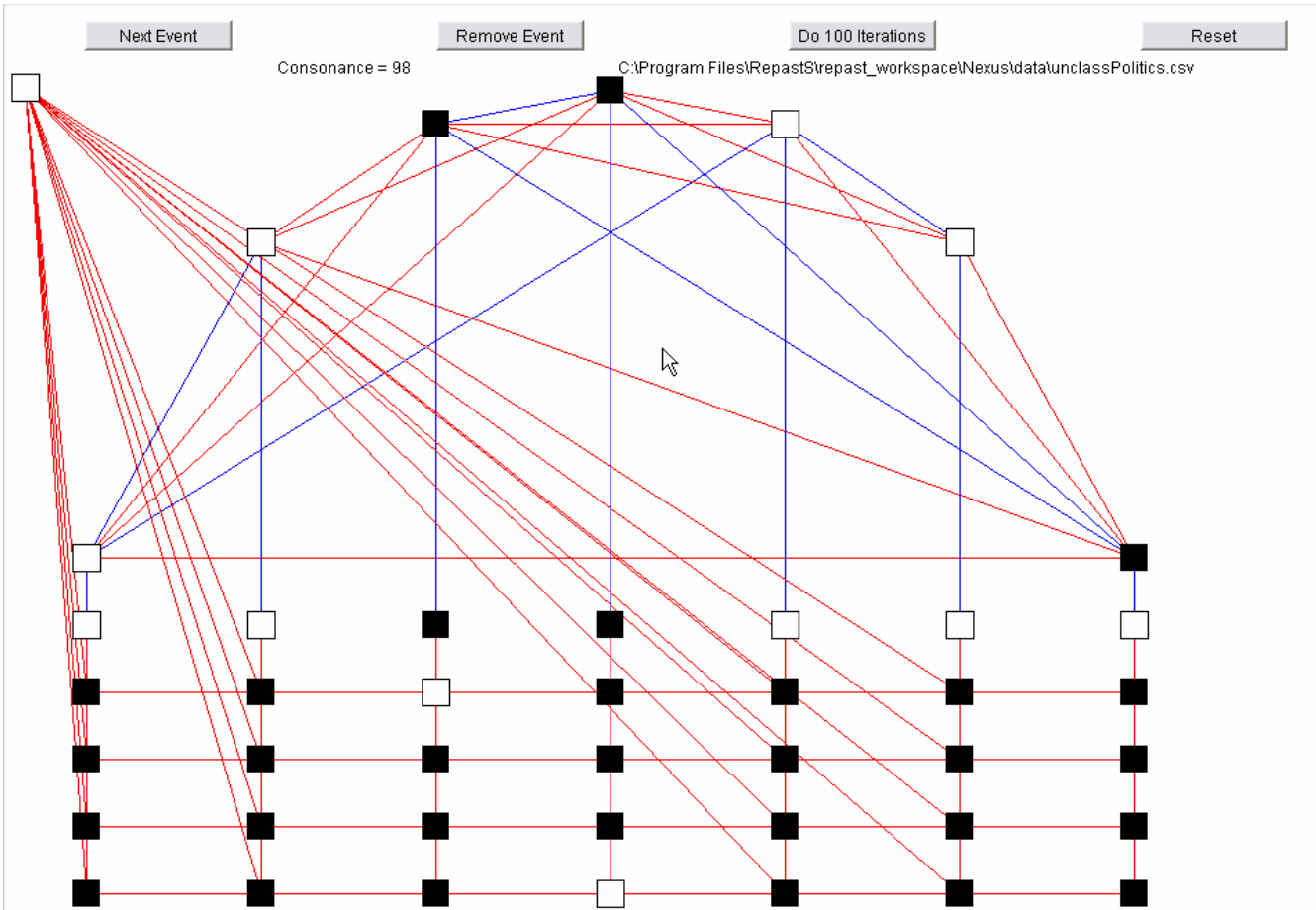


Nexus Simulation Loop

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- **All groups compute their support for all other groups**
 - Group A computes support for group B, with neural net, based on:
 - » the past actions of group B
 - » what other groups group B supports
 - » how close group A is in ideology to group B
 - The neural net takes into account not only the historical actions of a group but the action of their friends, and their friend's friends, etc., into a coherent picture that looks at higher order relations
 - » The enemy of my enemy is my friend: from Heider's balance theory
 - » Evidence of Cognitive Dissonance when triad rules are broken
- **All groups make public declarations of support.**
 - There is a hook for adding "believed support" if it differs from public declarations.
- **Groups modify their neural nets according to their new beliefs of public support.**
- **Groups act based on concept of operations (CONOPS)**
- **Groups re-compute support, etc.**

Each Agent Mind is a Boltzmann Machine Neural Network



The Boltzmann Machine

- **A Constraint Satisfaction Neural Network**

- Nodes may represent states of the world
- Links may represent how much evidence of one state supports evidence of the other state
- An Ising Spin model, similar to the Hopfield Network

- **Stochastic: Uses Simulated Annealing**

- Nodes are turned on randomly at first
- Each node computes its activation based on (activation of nodes linked to it X weight at synapse)
- Randomness dissipates slowly so that network can settle on more consonant states

- **Represents a Paradigm of consonant states**

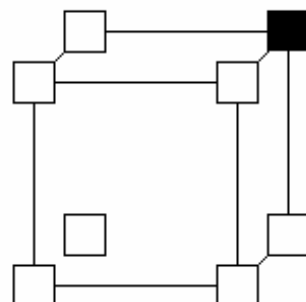
- Nodes compute activation over and over until all converge on a steady state
- Settled upon state represent an internally consistent set of evidence, and a consensus of the evidence on the state.
- Can represent a paradigm shift, a change in belief in who is responsible for the

group's problems

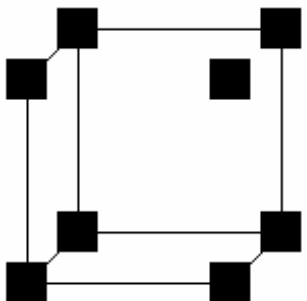
Example: The Necker Cube

Do 1 Iteration Do 20 Iterations

Reset Weights visible?

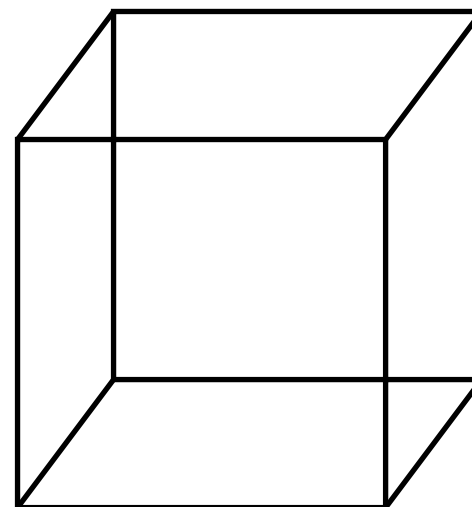


Goodness = 36



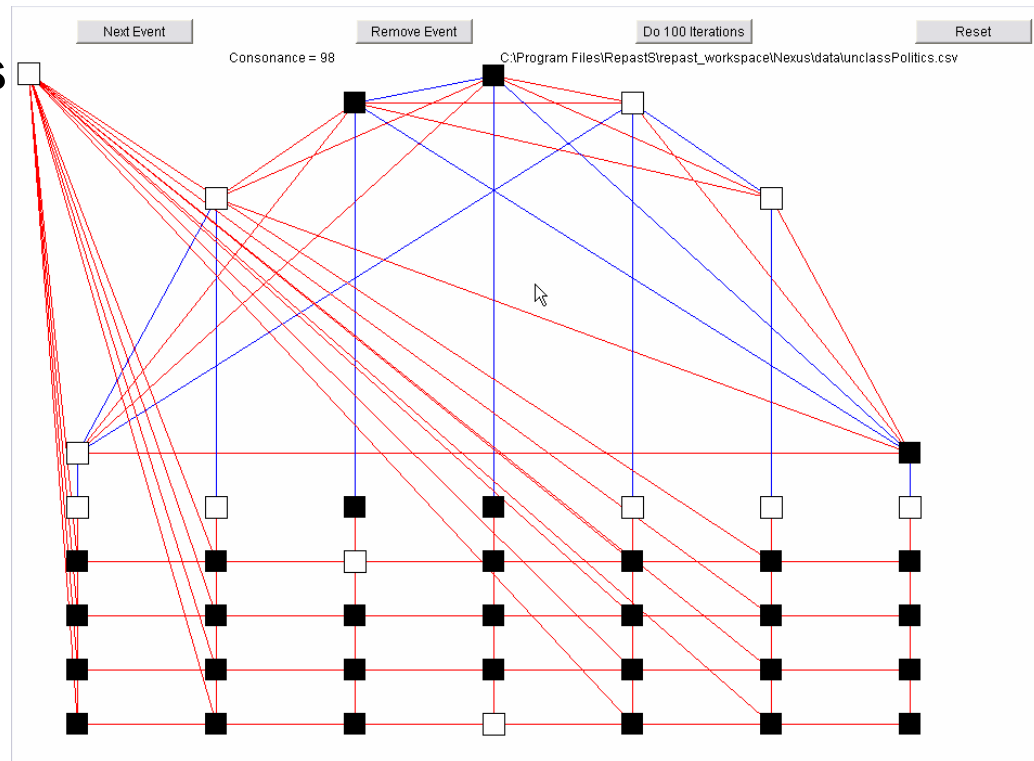
Simon, Dennis. "The Boltzmann Machine Necker Cube Example"

<http://www.cs.cf.ac.uk/Dave/JAVA/boltzman/Necker.html>



Architecture of Nexus' Neural Networks

- Columns are social groups
 - First Row: Support Nodes
 - Second Row: Trust Nodes
 - Remaining Rows: Blame Nodes for Salient Historical Events
 - One event per row
 - Ordered: bottom are future events
 - Evidence Node
 - Court-type “Proof” they’ve witnessed, before the minds spin
 - Ideology Node (not pictured)
 - Ideological similarity of groups
- (connects to the trust nodes)



Nexus Agents act according to the Narrative Paradigm

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• Agents seek a coherent picture of events

- Agents may reinterpret the blame for events in the past depending on present beliefs
- Agents choose alliances according to a coherent picture
- Coherence includes consonance with historical events, in an ongoing story
- Higher order vulnerabilities in support network may be brought to light
 - Useful in campaigns to strengthen or weaken support
- Works by way of cognitive dissonance theory, or the minimization of incoherent facts

• Nexus has lots of explanatory power for a variety of Irregular Warfare Scenarios

- For example, Insurgent-agents may incite Rodney King incidents, make videos of it and distribute it, planned by looking ahead to what actions would advantage them. They choose Rodney King because they see that to keep an alliance with population, government agents would be forced to prosecute police, separating police from government.
- Groups can represent countries and Gandhi type protests can represent actions that cause them to try to keep ideologically similar to their allies, so their allies will trust them.
 - Ghandi wouldn't work for Nazis, because the Nazis allies were outwardly brutal
- It could model why an ideology that is dissonant may become popular, for example, a Nazi insurgency succeeding in a civilized country. Humiliation by enemies after WW1 was so strong, and Germany wanted to preserve superior identity so much, that moral dissonance could be minimized.

Nexus is used for Analysis by the US Department of Defense

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- **US Office of the Secretary of Defense, Program Analysis and Evaluation, Simulation Analysis Center**
 - Created at the SAC for analysis of CONOPS in 2 classified scenarios
 - Will be used as part of the COMPOEX suite in the upcoming Africa Study
- **Marine Corps Combat Development Command**
 - Nexus was used in an analysis of unclassified scenario of a population's interpretation of an offer by the US to help during a natural disaster, and how it affects their support for their current government
 - Nexus will be one of the first simulations to go through the Marine Corps new Agent-Based Verification, Validation and Accreditation (VV&A) process.
- **Army TRADOC Analysis Center**
 - Nexus will be used in an analysis of Urban Cultural Geography in Stability Operations



UNCLASS Example: MCCDC Study

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- **Data from country Subject Matter Experts (SMEs)**
 - Ideological similarity estimations for ideological node input into trust nodes
 - Initial support levels between groups and for the government
 - 22 relevant historical events in evidence node input to blame nodes (for past events)
 - “Indirect or Direct” Data, SME predictions of group reactions as evidence node input to blame nodes (for future events)
- **Data elucidated by MCCDC through a technique that assigns a numerical value to SME vocabulary**
 - Popular support derived from vocabulary based on values from Affective Control Theory data (a combination of emotional valiance and power)
- **Study measured ten social group’s interpretations of US direct action vs. indirect action to help their country in a natural disaster, and how it affected their support for the government**
- **Groups were displaced persons, the urban poor, the urban middle class, old money, illicit organizations, the police, the army, the church, the government, and the insurgency**

MCCDC Study Results

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- **All groups except displaced persons were for the government and against the insurgents**
- **However, the structure of their support for each other combined with historical events made the government somewhat vulnerable.**
- **All groups except the old money and the displaced persons changed their attitudes slightly more towards the insurgency when the US helped (while still supporting the government).**
 - It did not matter very much which kind of help.
 - None of the groups, except for the urban middle class, had any different support levels for the government or the insurgents when direct and indirect action was compared.
 - Only the urban middle class liked the insurgents a little bit more when the US action was direct than when it was indirect.

The Africa Study: A study of Corruption

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- **Nexus will be used on the Office of the Secretary of Defense's 9 month classified study of a future scenario of conflict in Africa**
- **Corruption is one the most intractable blocks to development**
 - Aid organizations seriously debate whether aid does more harm than good
 - “Kleptocracy” contracts given according to favoritism, kickbacks uncontrolled
- **African Societies are based on a patron-client system**
 - Relations between elites (with access to resources) and common people traditionally based on mutual obligation
 - Distribution occurs through kinship and social networks, not merit
 - Distribution doesn't occur outside of these networks (including Aid)
 - Globalization weakens the patron-client ties
 - As ties between state and citizen become more impersonal, patron client ties become undependable
 - Obligations become ambiguous, suspicions of cheating the kin network arise as a side effect of hiding transactions from the foreigners that the Africans are cheating
 - Corruption depends on a strict ethical code among collaborators, arising from the patron-client relationship
 - Corruption is the result of social forces: Africans who participate are its strongest critics, but can't do anything about it. Its not a choice

Simulating Corruption with Nexus

- **Africans feel justified in exploiting the exploitative countries**
 - Dissonance exists between being forced to support countries because they are the only source of income, and upset feelings over exploitation of their resources
 - Dissonance is resolved by underhanded scamming of foreign contract grantors
- **Patron client relations are already expressed in a segmented social network to begin with, in which conflict with other groups (to protect own) is common**
- **Impersonalization of ties, caused by bureaucracy and globalization, further serve to make contracts between parties ambiguous and cause ambiguity of blame**
- **Uncertainty causes agents, when they look ahead, to further hoard wealth**
- **Rent-seeking behavior is implemented through economic model in COMPOEX.**

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