Behavioral Influence Assessment (BIA) Method for Anticipating Behavior in Cyber Security Applications

Current Work and Potential Future Directions

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Organizational Cooperation in Cyber Defense: Current Environment

Little is known about the decision-making among organizations that face cyber threats:

- **Country-sponsored espionage, identity theft, and attacks on critical infrastructure**
- **Organized hacker communities**

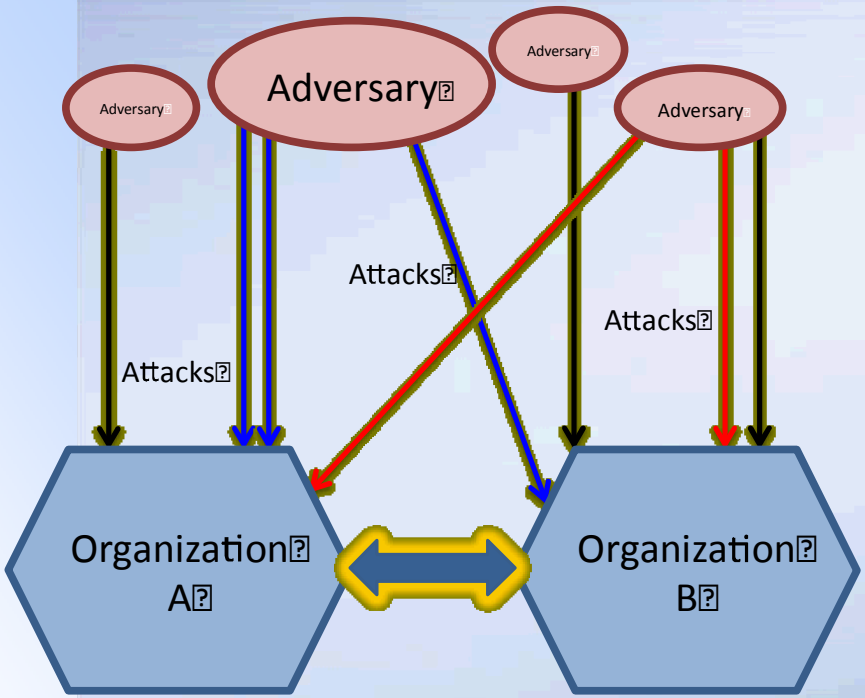
Focus of this effort:

- Develop a computational model for researching the psychological, social, and economic factors underlying decision-making in cyber defense
- Incorporate cultural, cognitive, and institutional constraints and conditions to simulate how cognition and environmental circumstances determine cyber defense strategies and behaviors
- Create a dynamic representation of the decision-making process that incorporates:
  1. individual cognition
  2. the effects of social interaction on individual cognition
  3. interactions between individuals

Current Effort:
Developing Models to Assess Adversary / Cyber Defender Interactions

How to Enhance Cyber Security Effectiveness?

- The **effectiveness of cyber defense might be enhanced** if information and resources were shared among organizations that face similar threats
  - Information about threats
  - Effective defense strategies
  - Personnel with particular expertise



- Motivations to cooperate:
  - Improve security without increasing resources
- Motivations not to cooperate:
  - Potential for embarrassment
  - Group inertia
  - Competitive strategy

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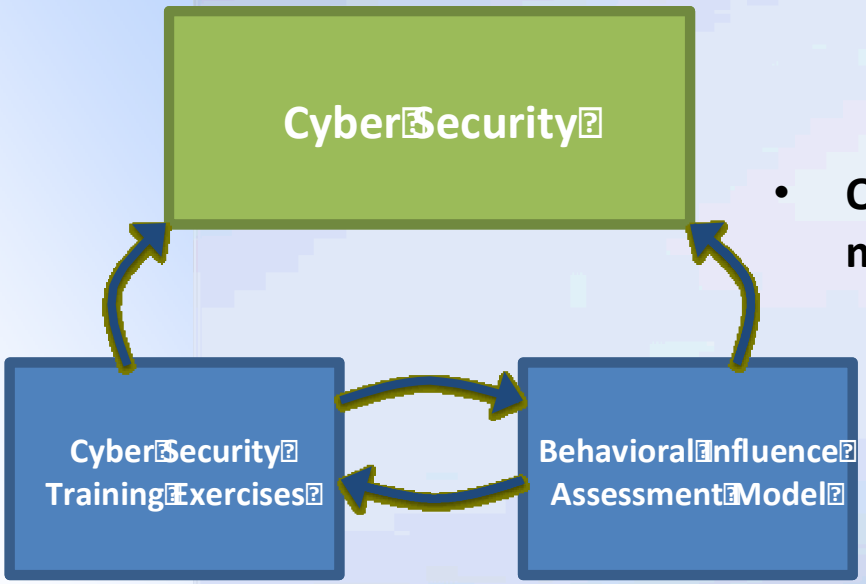
Organizational Cooperation in Cyber Defense: Potential Outcomes

- **Potential improvements to cyber defense capabilities**
  - May uncover leverage points and management alternatives that could improve cyber defense
    - Examples: resource allocation, allocation and recruitment of people with needed skills, bottlenecks
- **Potential improvements to cyber defense training program**
  - A model will be used to design collaborative challenges that could increase cooperative behavior
- **Opportunity for rigorous validation of a model of human behavior**
  - Using Tracer FIRE exercises as a source of validation data could help to improve accuracy of future models



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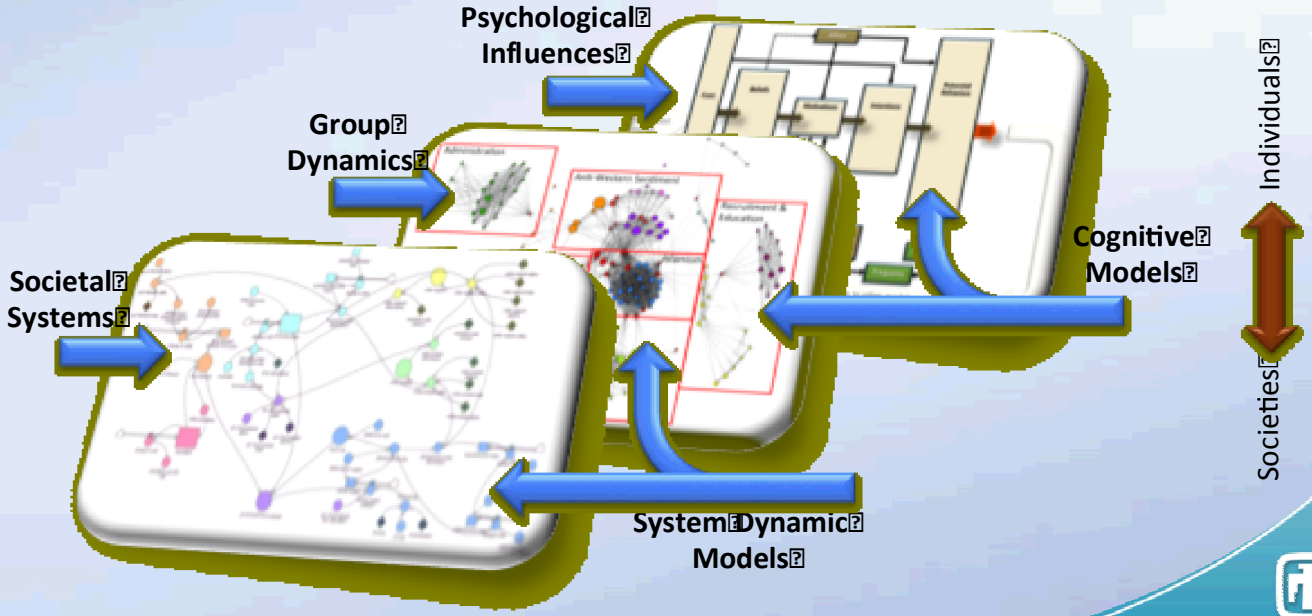
Behavioral Influence Assessment (BIA)

The system is founded on established psychological, social, cultural and economic models

- To understand the potential for cooperation in cyber defense, we are using a modified **Behavioral Influence Assessment (BIA)** method
  - Used to improve understanding of the human dimension in order to better anticipate behaviors in response to potential events
  - **Human behavior needs to be examined at multiple scales**
    - Theory domains: psychological, social, historical, anthropological
    - Computational domains: agent-based (cognitive) and system dynamics modeling



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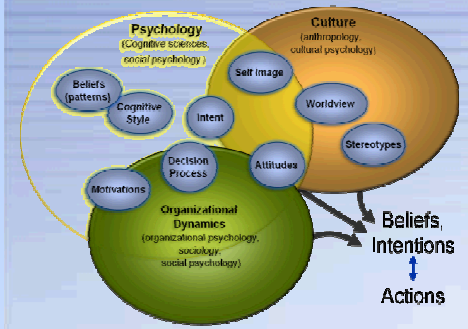
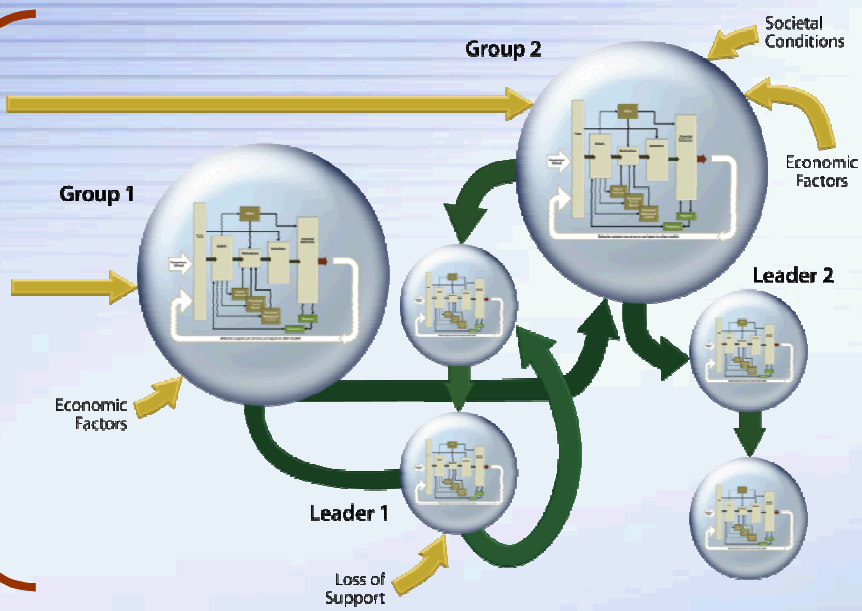
Behavioral Influence Assessment (BIA)

Integration of Cognitive and System Models

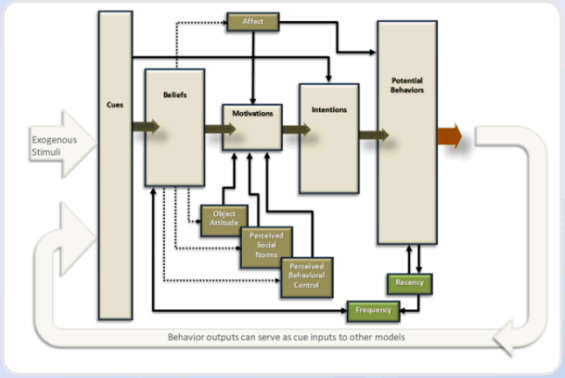
The system is addressing both individual and system-level decision making



System Level



Cognitive Level



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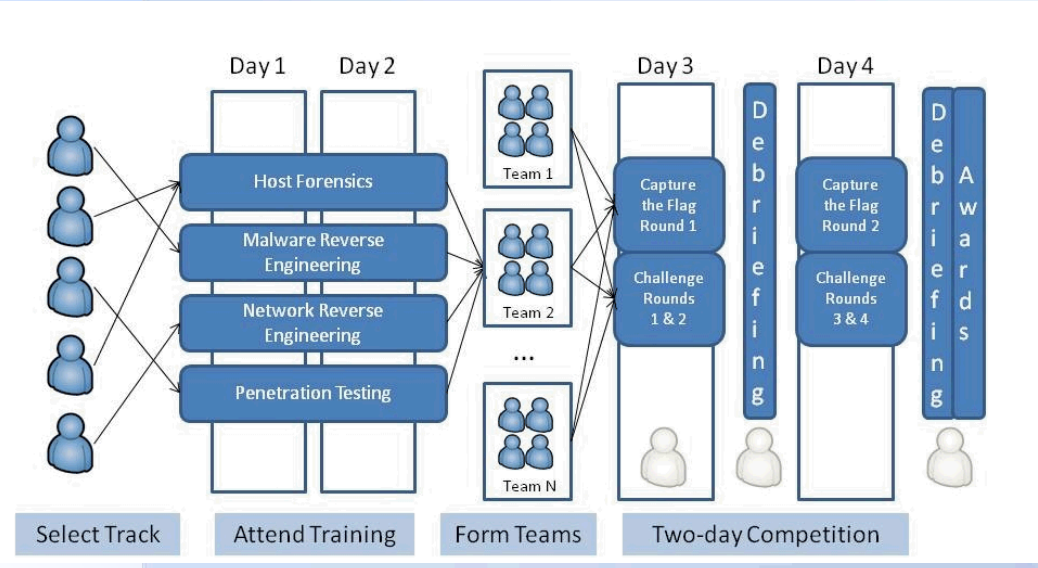
Tracer FIRE

- Will used data from Sandia's **Tracer FIRE exercises**
  - Training program for cyber defenders
    - Includes competitive cyber defense simulation exercises
    - Organizers are interested in using the training to improve cooperation between participants and organizations
- Tracer FIRE presents **opportunities for the Cyber BIA project**
  - Potential source of data on cognition, interactions, and scenario outcomes
  - Potential for model to improve exercises, and vice versa



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Potential Future Directions for BIA-related Cyber Research

- How **international relations**, treaties, etc. might affect the character of cyber threats
- **Insider threat**
- Understanding **cyber defenders** and leverage points that might make them more effective
  - Improving team performance in the cyber domain
- **Validating** models of human behavior in the cyber realm

Planned Research: Organizational Cooperation in Cyber Defense

- Phase 1: **Design collaborative challenges for Tracer FIRE**
  - A dynamic simulation model will be created and used to design a true multi-team collaborative challenge to be implemented at Tracer FIRE
    - The model will be conceptual, not strongly validated
    - The exercise will mimic a real life scenario, and will be designed to teach desired skills
- Phase 2: **Model Tracer FIRE exercises**
  - Data collected from Tracer FIRE exercises will create an opportunity for rigorous validation
  - Cooperative and competitive exercises may be compared
- Phase 3: **Model organizational cooperation**
  - Validation data from phase 2 will be scaled up where possible
  - The model will be used to locate leverage points and management alternatives to increase cyber effectiveness