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Research Spotlight Forum

Social Sciences & Decision Making

DYNAMIC MULTI-SCALE ASSESSMENT TOOL FOR INTEGRATED COGNITIVE-BEHAVIORAL ACTIONS

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Michael Bernard, PhD

- Principal scientist and lead for the DYMATICA program within the Military Systems Analytics department at Sandia National Laboratories.
- Has degrees in applied experimental psychology and political science (emphasis in human-computer interaction, group dynamics, and group performance within systems).
- Research focus on modeling, assessing, and improving human decision-making
  - Work mainly involves the development of computational models of individuals, groups, and societies regarding how geopolitical, sociocultural, and economic factors dynamically interact with human decision-making.
- Work includes the:
  1. Study and modeling of human beliefs, attitudes, motivations, and behaviors
  2. Study and modeling of societal and group dynamics
  3. Study of human analytical performance by utilizing cognitive modeling techniques
- Michael has contributed in the submission of over 90 articles and numerous technical advance reports in the field of social psychology, human factors, and group decision-making.
- Keywords: DYMATICA, geopolitical modeling, sociocultural modeling

CURRENT WORK IN SOCIAL SCIENCES & DECISION MAKING

- DYMATICA is a computational approach to help decision makers better understand and anticipate likely responses and decision calculus of groups and individuals to geopolitical situations.
- DYMATICA assessments are designed to analyze geopolitical, psychosocial, economic, and military phenomenon subject to key physical constrains and conditions.

Dynamic Multi-Scale Assessment Tool for Integrated Cognitive-Behavioral Actions

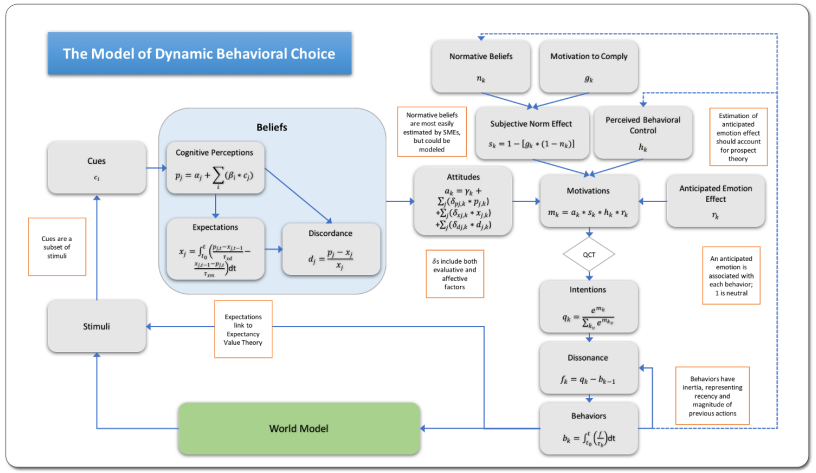
Informs High Consequence Decisions

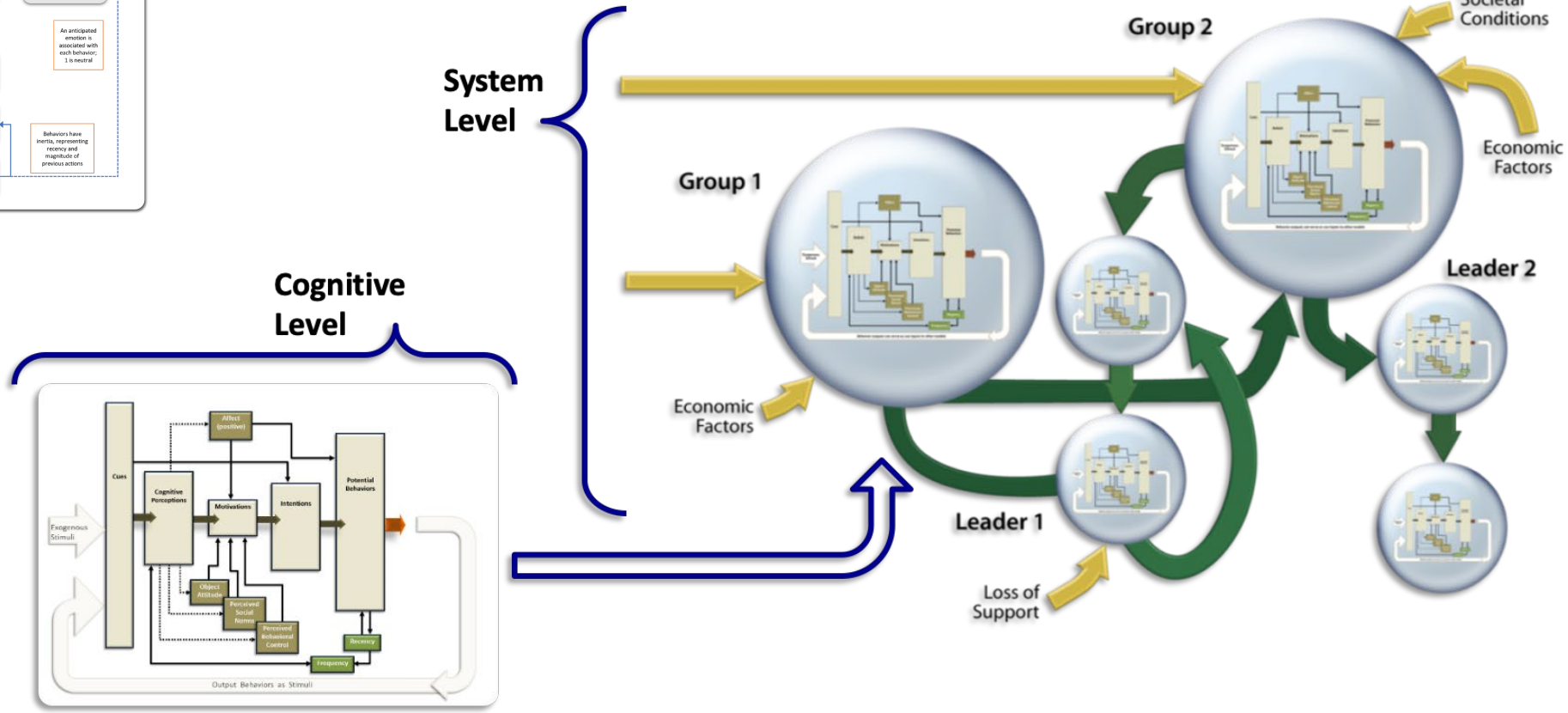
- Minimize the likelihood of decisions that lead to undesirable consequences by providing a more systematic analysis of group and individual decisions within state and non-state entities.

Impact

- Enable analysts to assess higher-order (cascading) influences and reactions to events, as well as determine the uncertainty that the event will produce the desired results over time

CURRENT WORK IN SOCIAL SCIENCES & DECISION MAKING





FUNDING SOURCES

- Since 2008, approximately 18 DYMATICA models have been developed representing a variety of topic domains and country regions from around the world, including countries from Africa, Asia, Europe, and South America.
- The assessment domain includes hybrid warfare activities—such as cyber messaging and deception; near-peer deterrence; state and non-state internal stability; migration; and propensity for aggressive behaviors.
- Funding partners include:
  - United States' Department of Defense
  - United Kingdom's Ministry of Defence
  - The intelligence community
  - Department of Energy
  - Federal Drug Administration
  - SNL through its internal Laboratory Directed Research and Development program

RESEARCH NEEDS

Existing Capability - Currently Can Address -	Ongoing R&D Areas & Developmental Goals
Modeling Domain ▪ The modeling, simulation, and assessment (MS&A) of governmental, political, and societal structures with well-defined governing entities ▪ The MS&A of select individuals up to multiple countries ▪ Assessment time horizons from days to ten or more years ▪ The MS&A of Western and non-Western (clan-based) societies - Very different dynamics and allegiance/decision-making structures - Groups that are highly dynamic, which overlap with societal structures - May have only nominal/local power and stability of government is questionable **Modeling Structure** ▪ Hybrid, system dynamics – cognitive, agent-based modeling structure ▪ Mathematical instantiation of broad-level psychosocial elements within the structure - Robust methods and structure based on scientific principles - Mathematical instantiations of detailed psychosocial elements	**Data Elicitation/Instantiation** ▪ Automatic/continuous data collection for psychosocial model development and parameterization **Confidence Management (Including V&V) Methodology** ▪ Quantitative corroboration of models with current data/information ▪ Long-term model-to-data comparisons ▪ Visualization & communication of psychosocial model interaction ▪ Expansion of UQ/SA methodology for psychosocial models **Theoretical Refinement** ▪ Tuning and/or expanding existing theories to better explain behaviors of interest