



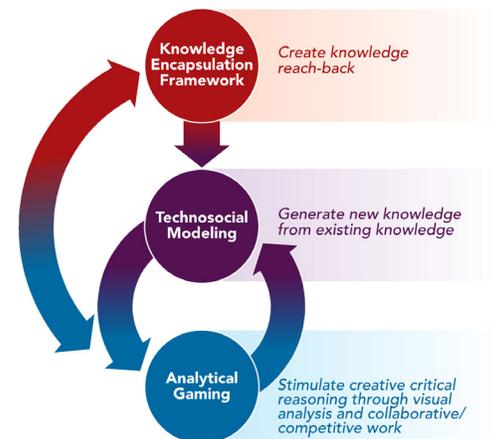
# Technosocial Predictive Analytics: Creating Decision Advantage through the Integration of Human and Physical Models

Events occur daily that challenge the security, health and sustainable growth of our nation, and often find us unprepared for the catastrophic outcomes. If we are to meet the challenges that emerge from these events, we must develop novel methods for proactive analysis that support a concerted decision-making effort by analyst and policymakers to protect our freedoms and way of life. Technosocial Predictive Analytics (TPA) addresses this need through the development of a software platform which creates decision advantage through the integration of human and physical models. TPA leverages knowledge management to support the achievement of evidence and subject matter expertise, and it harnesses analytic gaming to foster social intelligence through collaborative and competitive work.

## HUMAN JUDGMENT AND DECISION MAKING

The human brain provides a basic framework for memory and prediction in which decision making emerges as a process of pattern storage, recognition and projection rooted in our experience of the world and driven by perception and creativity. Qualities such as the ability to focus on what is perceived to be most important and the capacity to make quick decisions by insight and intuition make human judgment uniquely effective. However, the same qualities can also be responsible for fallacious reasoning when judgment is biased or is hindered by lack of knowledge/expertise. TPA helps analysts and policymakers provide better proactive analysis and response by enabling naturalistic decision making while countering adverse influences on human judgment through a combined set of capabilities that

- ▶ provide multidisciplinary knowledge reach-back to inform analysis and response during decision making
- ▶ supplement the expertise of the analyst and policymaker with simulated scenarios generated by computational models that integrate human and physical factors
- ▶ engage analysts and policymakers within a gaming environment that stimulates creative critical reasoning through visual analysis and collaborative/competitive work.



## THE TPA SOFTWARE PLATFORM

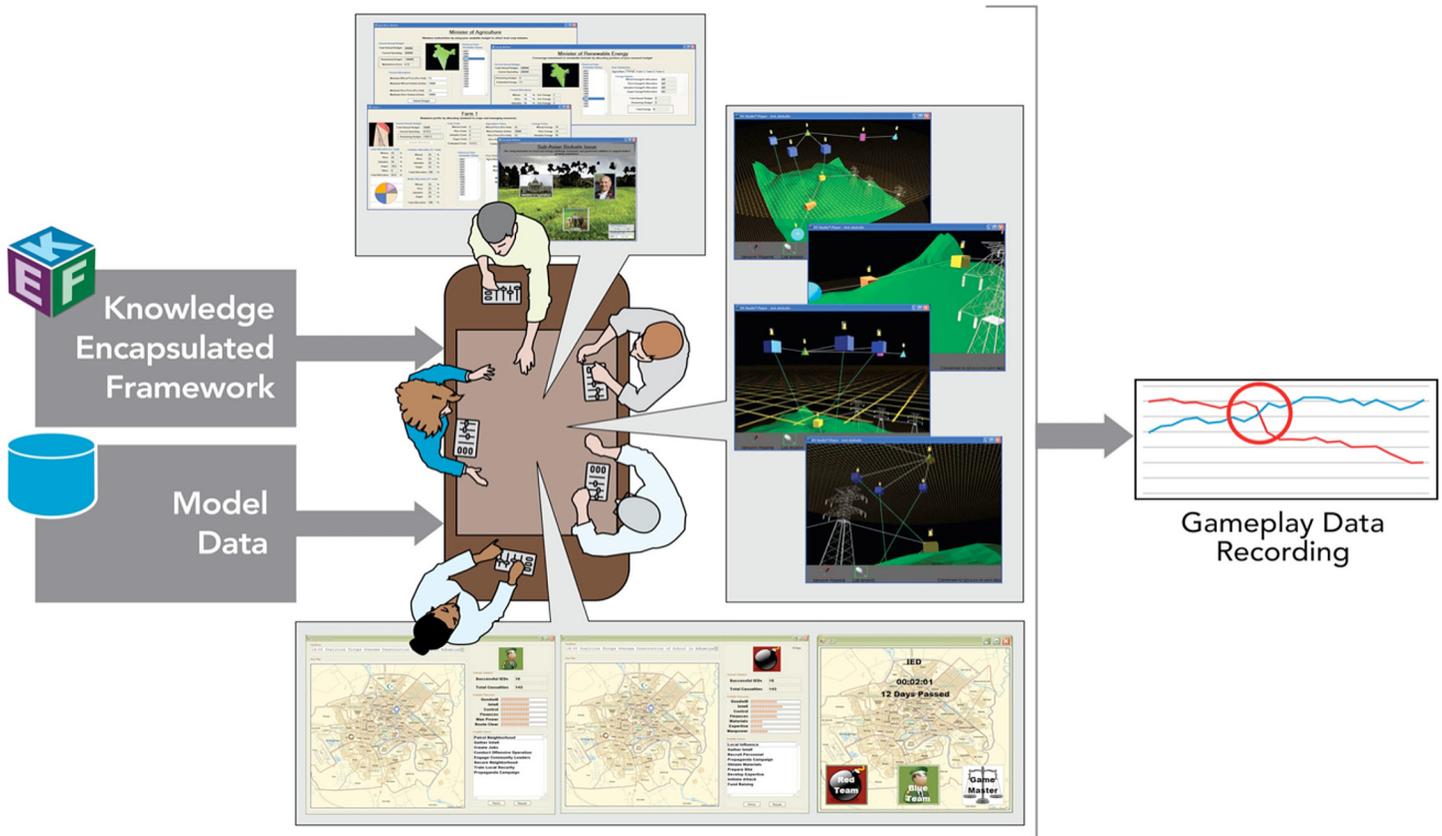
The integration of computational models that capture insights from both the natural and social sciences is paramount to understanding the complex web of factors that bear on the security, health and sustainable growth of our nation. These integrated models need constant updating with relevant knowledge so that our assessment can be always informed by ongoing change to achieve maximum fidelity. They also have to be

made understandable and accessible to end users who may not have sufficient background in the relevant mathematical, natural and social sciences to interpret and manipulate the direct model outputs. Finally, it is critical to articulate the use of these integrated models and their associated knowledge management processes within a workflow that increases the reliability of human reasoning by stimulating creativity and overcoming cognitive biases and limitations on human judgment.

These are the objectives we have been pursuing in the development of the TPA Software Platform (TPASP) at the Pacific Northwest National Laboratory.

TPASP offers a collaborative visual analytic interface with user-friendly access to integrated models in the areas of security, energy and the environment that are informed by knowledge management processes. TPASP promotes model integration through innovative algorithms that enable the combination

of diverse modeling paradigms such as probabilistic evidentiary reasoning and system dynamics. Integrated modeling is informed by a Knowledge Encapsulation Framework that facilitates the distillation and vetting of relevant knowledge from heterogeneous data streams, including social media. The TPASP collaborative working environment enables analysts and policymakers to stress-test the validity of their analysis and policy plans using techniques such as role-playing and serious gaming.



## ABOUT PNNL

Pacific Northwest National Laboratory is a Department of Energy Office of Science national laboratory where interdisciplinary teams advance science and technology and deliver solutions to America's most intractable problems in energy, national security and the environment. PNNL employs 4,250 staff, has a \$918 million annual budget, and has been managed by Ohio-based Battelle since the lab's inception in 1965.

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