

Homeland Security, organizations, and perturbations

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Abstract

One of the problems with traditional computational models of reality is that information, *I*, is assumed to be mostly accessible for the asking, but theory and traditional models of organizations work very poorly and are ineffective (Werck & Quinn, 1999). In contrast, we offer a physics model of uncertainty for organizations which assumes that *I* is mostly inaccessible, and that organizations must be disturbed or attacked to gain *I*. We report on a study of this new model.

Introduction

Providing Homeland Security has become a significant problem not only because of recent events (collapse of the World Trade Centers, wars in Afghanistan and Iraq, and continued threats by Al Qaida), but also because the threats posed to our homeland are made by attackers who use asymmetric warfare techniques. Asymmetric warfare exploits the vulnerabilities of open societies such as democracies and the market-based economies defended by traditional militaries (NEC, 2004). In turn, asymmetric attackers are difficult to defend against because they rely on blending in with the social background, not presenting themselves as a state that can be attacked in a traditional manner, and with insurgents who melt back

into the social milieu from which they spring and control. This means that voluminous amounts of information are required to separate signals from noise, but that as a consequence biases may detract from analyses and must be, but often are not, considered.

Prior to the attacks on the WTC, despite evidence to the contrary (e.g., bombing of the USS Cole), scenarios of a possible attack were often discredited (9/11 Commission Report, 2004). The result, however, is leading to a major restructuring in intelligence analyses (U.S. Senate vote, October, 2004), military reorganizations into flatter, more self-organized structures (Harris, ICCRTS, 2004), and new screening and defensive techniques for air travel, ports of entry, and centers of commercial and government activity (Department of Homeland Security; see www.dhs.gov). However, many conflicting interpretations of the threat were evident between analysts in DOD, CIA, and State at the time of the WTC attack, and are likely to continue today; e.g., some critics charge that many of the changes address the last homeland attacks and not future ones (9/11 Commission Report); or editorials charge that despite many recommendations to slow the process, the rush to reorganize the intelligence structure and processes were politically motivated by the presidential election (Wall Street Journal, editorial, 10/7/04). These and other deeply conflicting interpretations spontaneously arise in open societies; but can AI systems enhance objective assessments while at the same time

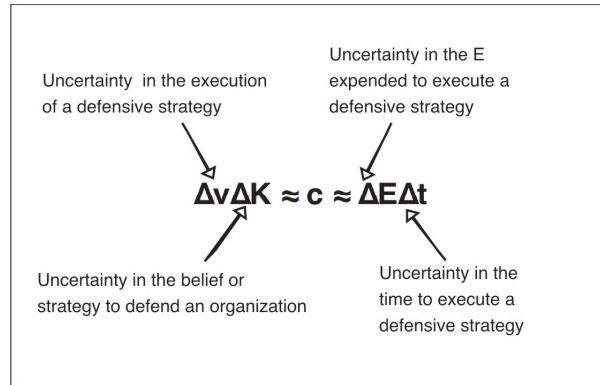
reducing personal biases? More importantly, should the biases be reduced or, instead, exploited?

To be more effective, however, we believe there are at least three fundamental limitations to a traditional rational approach to using AI for Homeland Security—these also apply to the problems with agent autonomy (see Tambe, in Pydnadath et al., 2001; Banks, 2002). One assumption in traditional rational theory assumes that information, *I*, is stable and mostly accessible, providing an easy status update across a Multi-Agent System (MAS) matrix (Lawless & Grayson, 2004a). This means that agents also have relatively complete updates of the status of their own states within the constraints imposed by their neighborhood. The second limitation is that static *I* can be used to predict dynamic behaviors, or worse, the assumption being that the choices of behaviors preferred or reported by agents are the same as behaviors objectively observed (Lawless et al., 2000b). The third limitation, reflecting social and cultural biases, is the assumption that values such as cooperation are more highly valued by society than competition (Lawless & Grayson, 2004b), an assumption that remains arbitrary and unproven (Nowak & Sigmund, 2004); in contrast, we recommend a value-less, more objective approach to this problem. Specifically, to work around these limitations, we have developed and applied the logic of mathematical physics of uncertainty to organizations with success (Lawless, Bergmann, & Feltovich, 2005).

In our model of the mathematical physics of uncertainty in organizations, we assume that reality is bistable with *I* that is mostly inaccessible. We have assumed, based on our model, that organizations reside in a lower energy, *E*, state (across at least two dimensions, psychological energy and economic energy or money), explaining why organizations attack each other as a matter of course to uncover *I* hidden not only to outsiders, but insiders as well; e.g., the coalition in Iraq attacked the Iraqi Army, shifting it into a higher *E* state (agitated) and watched as it huddled to determine its

counter-maneuver, but then it was re-attacked by the Coalition before the Iraqis could enact their own response, causing them to panic (Franks, 2004; Keegan, 2004); for example, Gen. Boykin (2004) has named this process “fighting for intelligence”. But this lack of *I* and uncertainty means that a measurement problem exists, created by dual interdependent uncertainties between strategy and execution and another between *E* expenditures for execution and the time it takes to execute a strategy (see the Figure below; Lawless & Grayson, 2004, AAAI Spring).

Figure 1. “Fighting for intelligence”.



We have confirmed this measurement problem in a field study between organizations using either consensus-seeking (CR) or majority rules (MR). We have found that MR organizations make quicker, more complex decisions that promote instrumental action and with fewer biases and greater learning of complex material; in contrast, we have found that CR groups make significantly slower and simpler decisions that promote individual values but without checking their biases, and that they have less incentive to reduce those biases. There is more internal conflict under MR, but wider acceptance of their decisions, and more external conflict with CR along with narrower ranges of acceptance of their decisions. Generally, instead of removing biases directly, but by

exploiting them, what we have discovered is that conflict under MR acts as forcing functions that serve to drive a random-like exploration of vast amounts of *I* that they self organize, and that feedback improves prior decisions by tuning or rejecting them, producing a limit cycle as the group evolves over time.

Acknowledgements: The author thanks J.A. Ballas, Information Technology Division, Naval Research Laboratory, Washington, DC, where most of this research was conducted with funds from the Office of Naval Research through an ASEE grant.

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