10th International Command and Control Research and Technology Symposium
The Future of C2

Title: Organizations, perturbations, and generating information

Track: Decision making and cognitive analysis

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Abstract:

LtGen Boykin (2004) recently proposed the novel use of combat troops in military raids for the express purpose of "fighting for intelligence." The first notice of this new approach to generating information was given earlier last year by Under Secretary of Defense Douglas Feith (2004): The main goal of the Afghanistan Campaign was the ability to execute attacks, but the first strikes also served to "produce intelligence that would allow the United States to understand and counter the enemy". From a traditional rational perspective of methodological individualism (i.e., game theory; in Nowak & Sigmund, 2004), this proposal does not make sense. Organizations are aggregations of individual members, an organization is what its members think that they are, and collecting data from the members of an organization is straight forward. From this perspective, attacking a group or organization should have no effect on generating information.

However, significant questions have arisen about the traditional view that an organization is what its members believe or state. It has been established that summing the beliefs of an organization's members produces a result that does not reflect or predict the behavior of an organization (Levine & Moreland, 1998); e.g., over the past two years, Delta Airlines had predicted and its managers have often stated in public that the price of oil would fall to $40 per bbl by 2005, the failure for oil prices to actually fall raising questions about Delta's ability to forecast but also leading to fresh concerns about bankruptcy for Delta (online.wsj.com). Further, internal observations can be inconsistent. In the rather common case of when two members of an organization equally disagree on an issue, as Nash (1950) observed from the perspective of bargaining theory, the sum is zero; consequently, the social value of the conflict is meaningless from the perspective of bargaining theory. But from our perspective, organizations are somehow different from aggregations.

The state of organizational theory today is considered to be very poor (Werck & Quinn, 1999). There are at least two major approaches to investigate organizations: methodological individualism and mathematical physics. In methodological individualism (e.g., game theory; in Nowak & Sigmund, 2004), in addition to the assumption given above that organizations are equal to the sum of the contributions from the individuals who comprise them, reality is supposedly stable and the information generated in it is more or less accessible (e.g., survey and interview data from preferences, opinions, interpretations, and justifications). But preferences (Kelley, 1992) and justifications (Shafir et al., 1993) have been found to be unrelated to the choices and decisions humans actually make. Interview questions can be written to solicit whatever opinion is desired (Eagly & Chaiken, 1993). Finally, methodological individualism arbitrarily assumes that cooperation has a greater social value than competition (Nowak & Sigmund, 2004). This arbitrary assumption has been coupled with the unsubstantiated claim that cooperation is paramount for the evolution and survival of the human species

(Axelrod, 1984; Hardin, 1968), that competition is toxic (Dennett, 2003), and that competition can be mentally and socially unhealthy (Whybrow, 2005).

Alternatively (Lawless & Grayson, 2004), the mathematical physics model of uncertainty in organizations is based on the assumption from Bohr that social reality is bistable—composed of interdependent actors and observers into multiple bidirectional or interdependent sources of information that are mostly inaccessible due to uncertainty, even to the organizations themselves. From this alternative perspective, well-defined problems are best solved with cooperation but the more proficient the teamwork in executing a solution, the less information that is generated relative to competition, producing the curious effect that independently of intentions, cooperation hides information from inside and outside observers (Lawless & Grayson, 2004). From this perspective, only competition can both produce information for observers among multiple, complex, hidden sources of information and drive the search among this information for the knowledge or beliefs that withstand all challenges (Lawless et al., 2000a). Thus, to uncover interdependent, uncertain information about an organization means that, in general, it must be purposively disturbed, an idea traceable to Lewin (1951). A common perturbation in economics is a hostile merger offer between competing organizations; another is a retail price cut (e.g., in January, Delta Airline capped its business fares at $499, angering other major airlines, but nonetheless increasing Delta's traffic and revenue); a familiar perturbation among citizen groups or committees is the conflict caused by incommensurable views, interpretations or beliefs. Thus, more than cooperative or command governments (e.g., dictators), competition serves the common good and social welfare by increasing information, generating knowledge, and consequently reducing corruption (Lawless et al., 2000b).

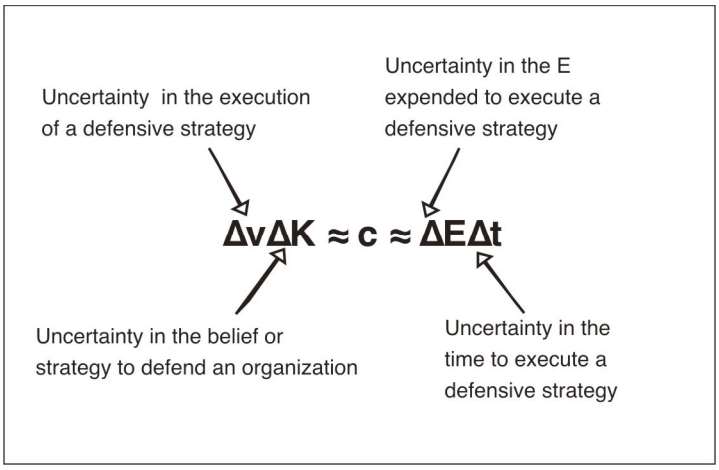
The novel use of perturbations by LtGen Boykin and Under Secretary Feith fits nicely at this point with our theory. Regardless of what its members believe or claim, attacking a group disturbs it, generating information about how the organization responds to threats, and reflecting its abilities to defend itself independently of its intentions or claims (e.g., in sports, it is common for claims made by opposing competitors preceding an event to be unrealistic and unreliable predictors of actual outcomes). As an example from recent combat operations, despite the claims by "Comical Ali" that Iraqi Forces were crushing the invading Americans, Iraqi forces were breaking apart. How? According to General Franks (2004), after observing that attacking an enemy such as the Iraq Defense Force forced them to huddle together to plan and coordinate their responses, re-attacks by the Coalition before the IDF response could be enacted produced panic (also see Keegan, 2004).

We applied these ideas to a study of how to improve METOC forecasts for strikes by the USMC MAGTF (i.e., meteorology and oceanographic planning for the Marine Air-Ground Task Force). In the second phase now occurring with Operation Iraqi Freedom today, the growing sophistication of military ground maneuvers, combat operations, weapons systems, and the continuing need for close air support and artillery have combined to increase the demand for METOC services by the MAGTF; e.g., transport, refueling and rearming operations are threatened by approaching storms; dust affects visibility; and water vapor affects thermal sights and laser guided munitions. In a series of field studies of METOC, we considered the effects of uncertainty on planning and executing forecasts for military strikes. Earlier, Klein and Miller (1999) had

suggested that planning occurs under time pressure and uncertainty. From the perspective of effects-based operations, Smith (2004) suggested that uncertainty exists with the execution of plans and the application of force.

We have combined these ideas into a double set of tradeoffs between uncertainties as shown in Figure 1 below (Lawless, Bergman & Feltovitch, 2005). In Figure 1, we let K represent knowledge, ΔK knowledge uncertainty (here ΔK equals Shannon's information, I), Δv knowledge implementation uncertainty such as the uncertainty in implementing a set of plans, ΔE uncertainty in the energy expended to implement a set of plans, and Δt the time uncertainty.

Figure 1. Defensive tradeoffs in interdependent uncertainties between military planning and execution, and between the management of energy and time in combat. Similar tradeoffs exist for offensive strategies.



Under the rapid response planning processes that occur during combat maneuvering, Figure 1 suggests that concentrating too much on plans comes at the expense of execution. Thus, a healthy tension must exist between self-organization processes such as distributed execution and command or central planning. As indicated in a New York Times article (nytimes.com, 3/15/05) describing a report released today by the FBI and Homeland security indicating that terrorists continue to test U.S. aviation for vulnerabilities, perturbations work for both sides in a conflict. Perturbations of enemy organizations is necessary to gain information about their strategy and their ability to execute but also their infrastructure, including the enemy's threshold responses to weather impacts, underscoring its intelligence value. But perturbations against social objects produces interdependencies in the information generated, known as the measurement problem which can best be understood as a series of tradeoffs in the meaning value of the information so acquired.

From the perspective of METOC and the left side of Figure 1, arriving at consensus decisions among forecasters takes an extended period of time to complete, can be adversely affected by pre-decision command influences, and, simultaneously, weakens the execution of plans; instead, during combat maneuvers, plans and coordination should be focused on the tasks at hand but also simplified as much as possible, constructed and

executed on the fly, and distributed but monitored centrally (e.g., weather impacts on Close Air Support do not have the same value to Unmanned Aircraft or on trafficability; that is, focusing assets to determine weather impacts on thresholds that affect the plan being executed will be more effective for the implementing units than working through or assimilating force-wide detailed forecasts). Moving from the right side of Figure 1, the vulnerability of small bandwidth precluding reach-back forecasts can be offset by investing in technology that reduces the time to produce a forecast (Gepp, 2003; e.g., new environmental visualization software has been found to reduce the time for a strike forecast by 40%; in Ballas, 2004). The two sides to Figure 1 can also be coupled: Focused plans that allow forces to adapt by exploiting weather opportunities can make execution easier and reduce the energy necessary to generate surprise.

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