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"Operationalizing C2 Agility"

THE ROLE OF NARRATIVE KNOWLEDGE IN OPERATIONAL ART: A PARADIGM SHIFT FOR INFORMATION TECHNOLOGY DEVELOPERS

PRIMARY TOPIC: Topic 3 – Data, Information, and Knowledge

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For decades, the development of supporting systems, displays, collaboration tools, and decision aids for military command and control has been dominated by logical positivism, the belief that all knowledge must conform to the principles of rigorous logic and empirical verification. The unquestioning acceptance of this view by information technology (IT) developers has blinded them to other forms of reasoning – particularly those forms of reasoning used to develop understanding of complex social situations. While this view has served the purposes of military command and control (C2) in a world dominated by physics, it is incompatible with the needs of military commanders operating in socially complex environments such as counterinsurgency and stabilization. By contrast, this paper highlights the distinct nature of narrative reasoning and knowledge and outlines its role in the commander's practice of operational art. Rather than constructing situation understanding in terms of an elusive "universal truth," narrative reasoning enables the commander to appreciate battlespace actions and events from multiple stakeholder perspectives. By supporting the narrative reasoning capabilities of a military organization, a commander is better able to achieve greater insight and effectiveness while avoiding unintended consequences of his initiatives and actions. Within this context, the paper calls for a paradigm shift within the IT community, one that leads to the development of a new class of support systems that assist military organizations in this essential form of reasoning and knowledge management.

Introduction

Mindsets are difficult to change. Once emplaced, they act in a subconscious manner to direct our thinking and actions. They become accepted without question, they represent the natural order of things, and they blind us to alternative approaches or strategies. In the end, they limit our progress and stifle our creativity. In the world of research and development, mindsets are commonly referred to as paradigms. Paradigms shape our research agendas and dictate what is, and is not, an acceptable developmental approach. Guided by the self-imposed constraints of the community, researchers will conform to the old paradigm in order to obtain funding and publication opportunities. However, every so often, a new way of thinking about a problem will emerge within the community. Viewing a familiar problem from a new perspective will enable a few researchers to advance their understanding beyond the limits of the old thinking. Eventually, the new paradigm will gain acceptance by the broader community. This process, defined by Thomas Kuhn as a "paradigm shift," has been demonstrated across many fields of study throughout the history of science.[1] One paradigm that has long influenced the design information technology has been the concept of scientific reasoning and knowledge. While this paradigm has usefully contributed to advancements in technology, it has become an obstacle for applying this technology in socially complex situations. In order to achieve progress in this area, it is time for the community to step back and question this paradigm in terms of first-order principles. [*Note: A word of caution is offered to the reader. This paper addresses the precise definition of scientific reasoning and knowledge as it shapes our development of information analysis tools and applications. The arguments should not be interpreted as broad criticism of scientific investigations as they are carried out by the military's research and development community.*]

In this paper, I argue that s a paradigm shift is needed in order to achieve greater effectiveness and agility in the field of military C2. Specifically, this paper argues that the support of military C2 with advanced information technology (IT) has for too long been constrained by the tenets of logical positivism –the belief that knowledge and understanding must always conform to rigorous logic, empirical testing, and the concept of a single universal truth. By contrast, I assert that narrative knowledge—a form of understanding that is unique and irreducible—occupies a central role in military C2. Consequently, future progress depends upon embracing this distinct form of epistemology in the design and development of future C2 systems, displays, collaboration tools, and decision support tools.

I begin this discussion by introducing the basic concept of narrative reasoning and knowledge as it was originally defined by Jerome Bruner.[2] Next, I examine the related concepts of operational art and operational science in order to show the relevance of narrative knowledge to military C2. This discussion is followed by a historical review of how the evolution of IT support to military C2 has been unquestioningly shaped by the paradigm of logical positivism. Finally, I illustrate how narrative reasoning reflects a necessary and useful form of analysis in the types of military operations we engage in today. Taken together, these arguments suggest the need for a new class of C2 systems, displays, collaboration tools, and decision aids that enable the military commander to visualize, reason about, and communicate his understanding of the battlespace in narrative terms.

What Is Narrative Knowledge?

In his 1991 paper, *The Narrative Construction of Reality*, Bruner asserts that knowledge is essentially constructed through social discourse within a particular community or cultural domain. He further notes that not all domains are organized by logical principles or associative connections, particularly those that have to do with man's knowledge of himself, his social world, and his culture. Yet, since the Age of Enlightenment in 18th century Europe, western society has focused on a particular form of knowledge that has become known as scientific knowledge. Bruner writes, *"…most of our knowledge about human knowledge-getting and reality-constructing is drawn from studies of how people come to know the natural or physical world rather than the human or symbolic world. For many historical reasons, including the practical power inherent in the use of logic, mathematics, and empirical science, we have concentrated on the child's growth as 'little scientist,' 'little logician,' 'little mathematician.' These are typically Enlightenment-inspired studies. It is curious how little effort has gone into discovering how humans come to construct the social world and the things that transpire therein."* [3] As constituent members of both western society and the mathematical/logical sciences, IT developers have largely remained oblivious and unappreciative of other forms of reasoning and knowledge. This is not a statement of criticism, but rather an acknowledgement that individuals are strongly influenced by the mindsets of their governing communities and cultures.

Bruner's contribution to our understanding of narrative knowledge is marked by his outline of ten basic principles that distinguish this form of reasoning and knowledge from scientific knowledge. Briefly, these principles can be summarized as follows:

1. *Narrative Diachronicity*: A narrative is an account of events occurring over time, a mental model that assigns meaning to these events within an irreducible chronological framework. It is irreducible in the sense that it cannot be further decomposed into a set of universal meanings –*i.e.*, it is an atomistic element of understanding.
2. *Particularity*: A narrative is referenced to a particular happening. Narratives typically exist within a larger generic story, but their meaning is referenced to a specific set of events and/or outcomes.
3. *Intentional State Entailment*: A narrative describes how a specific set of events is relevant to the intentional states of the involved actors, their beliefs, desires, theories, values, and so forth. A narrative implies freedom of action inasmuch as the set of events constituted only one of many possible courses of action.
4. *Hermeneutic Composability*: Individual narratives and whole stories shape each other's' meaning. This contextual dependency runs contrary to scientific knowledge inasmuch as there is no single "universal truth" that can be logically derived from a narrative.
5. *Canonicity and Breach*: Normative or conventional scripts for everyday life are not narratives –*i.e.*, they are accounts not worth telling. For a sequence of events to become a narrative, the events must violate (deviate from or breach) some normative or legitimate script. They inform us about the unexpected or deviant.
6. *Referentiality*: Because narratives are not referenced to a "universal truth," they give rise to a different reference point, often to that of a specific stakeholder or actor. Thus, narratives are not judged according to their verifiability, but rather to their verisimilitude or credibility with respect to a specific point of view.
7. *Genericness*: There exist certain kinds or recognizable narrative genres. However, genres must be understood in terms of both ontology (a particular set of domain concepts or language) and epistemology (a particular way of knowing or constructing reality). Unlike in scientific knowledge, a narrative genre is not treated as a universal property of the set of events. Rather, a genre is the motif or theme imposed by a stakeholder perspective in the sensemaking of the set of events –*i.e.*, the narrative is told through a particular lens of beliefs, desires, theories, values, and so forth.
8. *Normativeness*: Narratives are normative in the sense that they describe a violation of an accepted script or outcome. However, narrative reasoning, unlike scientific reasoning, does not presume that the violation has to be judged or rectified in a specific manner. Rather, narrative reasoning allows for different viewpoints to have equal legitimacy or relevance –particularly when the narrative is used to anticipate future events.
9. *Context Sensitivity and Negotiability*: Narratives are not interpreted in a vacuum, but rather their meaning and implications are understood in the context of a specific set of stakeholder/actor intentions and background knowledge. This contextual sensitivity gives rise to the role of narratives in social discourse: they both invite and enable negotiation of meaning. Whereas scientific reasoning moves individuals toward a focused form of problem solving, narrative reasoning supports a more open form of problem framing.
10. *Narrative Accrual*: Scientific knowledge accumulates particular empirical findings around a central hypothesis, employing the rigors of both logic and empirical

verification. While narrative accrual does not occur in a strict scientific sense, narratives do accumulate to eventually create a specific culture, a history, or a tradition. This more informal connection of narratives serves to construct our understanding of everyday life.

We can see from this brief introduction, that narrative knowledge and narrative reasoning play an important role in military operations –particularly when those operations involve the interaction of different cultures and societies. The contest of political will, military/economic power, and psychological influence always occurs in the context of actors and stakeholders with different world views. Unless the military commander can understand the battlespace from these different perspectives, he is likely to be neither effective nor efficient in the employment of his available resources. Even worse, his actions are likely to produce unintended consequences that might even reverse any perceived operational progress.

The Role of Narrative versus Scientific Knowledge in Military C2

The term "*command and control*" embodies two distinct processes by which a military commander applies kinetic force and other means in order to achieve a set of desired end states. This distinction has been variously described in military doctrine[4] and other writings[5] in terms such as

- Operational art versus operational science,
- Establishment of intent and scope versus the detailed planning and execution of actions,
- Problem framing versus problem solving.

More commonly, the terms are used in combination (hence the acronym C2) with little attempt to distinguish the unique nature and contribution of each component. This unfortunate blurring has been particularly prevalent within the military's IT community –a point that I will return to later in this paper. Nevertheless, in order to understand the respective roles of narrative and scientific knowledge within a military organization, I find it useful to build upon the distinctions listed above. Specifically, the terms "operational art" and "operational science" provide a useful framework for discussing these roles.

Operational Art

As defined in Joint military doctrine, operational art is "*the application of creative imagination by commanders and staffs—supported by their skill, knowledge, and experience—to design campaigns and major operations, and organize and employ military forces. Operational art integrates ends, ways, and means across levels of war. It is the thought process commanders use to visualize how best to efficiently and effectively employ military capabilities to accomplish their mission.*"[6] The application of operational art involves a comprehensive understanding of (1) the social elements, cultures, and political/psychological motivations comprising the commander's operational environment and (2) how these factors shape the interpretation of specific actions and events by different stakeholders and actors. The application of operational art emphasizes the mental process of problem framing inasmuch as knowledge of the operational environment is combined with mission objectives to determine which set of factors and relationships must be considered in framing the commander's operational design. Problem framing is an open type of analysis that considers input from a variety of perspectives and interpretations. The goal of problem framing is to identify "*the right things to do*" in order to achieve a desired set of end state conditions while avoiding unintended consequences. However, problem framing in a competitive environment also includes the anticipation of adversary and third-party behaviors such that the commander can maintain operational initiative and progress in a dynamic situation.

Operational Science

By contrast, operational science deals with the detailed planning, execution, and control of specific types of military operations once they are defined as part of the commander's overall campaign design and strategy. Typically, the military decision making process (MDMP) is more reflective of operational science. It methodically employs a variety of analytical techniques (*e.g.*, logistics models, synchronization matrix) and staff planning procedures (*e.g.*, mission templates, standard orders) in order to develop, evaluate, select, and execute the best course of action for achieving the desired effects and outcomes in a military operation. In some instances, the MDMP can be replaced by a more intuitive form of planning and decision making. In either case, however, the application of operational science deals primarily with problem solving. Problem solving takes a given problem framework (defined in this case by the Commander's intent and mission analysis) and seeks to find the most effective and efficient solution possible within the constraints of the military organization's available resources. In contrast to problem framing, problem solving is a closed type of analysis that focuses on applying a fixed set of models and staff procedures. As noted above, the process of problem solving can be highly intuitive in fast moving but recognizable situations. However, for both deliberate and intuitive forms of planning and execution, commanders retain the option of adjusting their actions in response to changing conditions within their operational environment. If sufficiently warranted, these adjustments can lead back to a new process of reframing the problem at hand. In this case, the nature of the commander's activity shifts from operational science back to operational art as new situational factors are considered.

The Role of Narrative versus Scientific Knowledge

An examination of military C2 from a knowledge management perspective suggests that this process involves the construction of a hierarchical, self-referent, and dynamic pyramid of knowledge. Construction of this pyramid involves contributions from a variety of organizational elements, including the commander, his intelligence system, and his operations staff. The pyramid is considered to be self-referent in the sense that each level of knowledge contributes to the meaning or interpretation of the others. The knowledge pyramid is dynamic in the sense that it is continuously being amended and revised to maintain overall coherency. Figure 1 depicts the basic structure and content of a typical knowledge pyramid. The pyramid of knowledge consists of four basic levels. Level 1 consists of a physical, geospatial, and temporal description of the battlespace objects, conditions, and events. Knowledge of these elements (when combined with additional expertise) provides the ontological building blocks for constructing Level 2 knowledge, a functional and structural understanding of the relevant political, military, economic, social, information, and infrastructure (PMESII) systems and their relationship to one another. Level 2 knowledge provides the basis for identifying the types of effects and outcomes visualized as part of Level 3. Level 3 knowledge consists of an intentional or operational understanding of the battlespace –*i.e.* a description of how each stakeholder intends to influence the battlespace. This level of knowledge includes a description of the desired end state conditions, perceived centers of gravity, lines-of-effort, phasing, progress metrics, etc. associated with each actor or stakeholder. This level of knowledge provides the basis for more detailed planning and execution decisions. Level 4 knowledge represents a projection of the first three levels forward in time to identify potential risks and opportunities that would impede or promote the operational progress of each stakeholder. This level of knowledge provides the basis for learning and adjustment decisions.

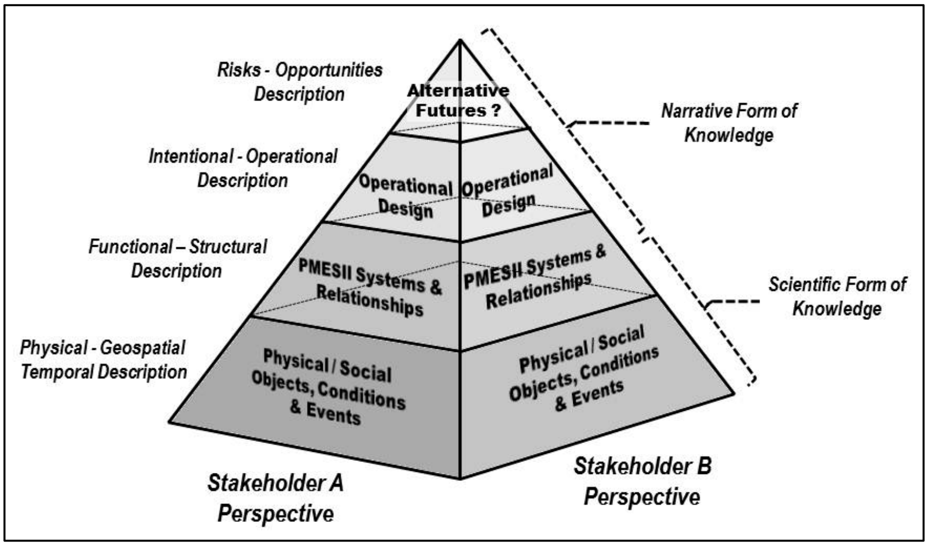

Figure 1 Pyramid of Operational Knowledge

As depicted in Figure 1, each facet of the pyramid illustrates that an understanding of the battlespace can be constructed from the perspective of a specific stakeholder –*e.g.*, coalition forces, adversary organization, tribe/clan, third-party country, etc. As a result, viewing the knowledge pyramid from each facet will reflect a different awareness and understanding of the battlespace objects, conditions, events, systems, and relationships. These differences arise from a variety of factors, including the cultural mindsets, the strategic goals, and the operational design of a specific stakeholder.

For a specific military unit (*e.g.*, Brigade Combat Team), a variety of organizational elements contribute to the construction and maintenance of the pyramid. The military unit's intelligence staff will typically be the primary contributor of knowledge regarding regional objects, conditions, and events. In some cases, this knowledge will be supplemented by operational patrols as they gather intelligence from specific missions. Reach-back intelligence agencies and other subject matter experts will assist in constructing the functional and structural knowledge of key PMESII systems. The unit's operational staff will typically be the primary contributor of knowledge regarding friendly resources and systems. The commander and his core command group will typically develop the unit's own operational design, with the intelligence staff (or red/blue team) contributing an understanding of the operational designs of other stakeholders. Finally, an assessment of projected risks and opportunities will typically emerge from relevant cross-staff working groups, ad hoc teams, and staff cells. Overall, the construction and dynamic maintenance of the knowledge pyramid will be a collaborative effort facilitated by the knowledge management practices and supporting IT of the military unit.

Importantly, the knowledge pyramid illustrated in Figure 1 reflects a combination of scientific and narrative knowledge. As depicted on the right side of the figure, Level 1 generally contains scientific knowledge –*i.e.*, an objective description of the physical and social objects, conditions, and events, together with relevant geospatial and temporal references. Level 2 represents a combination of scientific and narrative forms of knowledge. Each PMESII system will be objectively described in terms of its physical structure and functional relationships. These basic system descriptions will be complemented with narrative depictions of each system's purpose and relationship to important PMESII parameters. Level 3 knowledge is almost entirely narrative in nature as the operational design for each stakeholder links Levels 1 and 2 with the unique intentions, operational strategy, and progress metrics of that stakeholder. Level 4 projections of potential risks and opportunities are also narrative in nature.

Antenarratives: The Process of Constructing Story Narratives

In order to understand how an organization constructs and maintains the type of knowledge framework illustrated in Figure 1, it is useful to introduce the concept of the *antenarrative*. An antenarrative is a narrative fragment, an interpreted account of some experience that has not yet been integrated into a coherent theme or contextual framework of understanding. Hence, the prefix "ante" is used in a dual sense: it implies both (1) something that comes before the development of a complete narrative and (2) something that is still speculative or unconnected with other experiences.[7] Within any organization, constituent members will possess a variety of antenarratives that, when integrated and reconciled, can be used to reify (or construct) a larger interpretation of some facet of social life. Antenarratives are told from the perspective of the individual who might (1) possess access to certain information or experiences and (2) filter that information through a unique cultural lens or functional role. Antenarratives reflect disjointed fragments of living experience, whereas narrative stories provide a retrospective or sensemaking account of purpose/intent, actions/events, and outcomes/consequences.

The process of constructing story narratives from a collection of antenarratives can be seen in both military intelligence and operational analysis. In both cases, different functional experts and information sources are brought together in collaborative communities of purpose (*i.e.*, working groups, chat rooms, wiki blogs, crowdsourcing) to build an integrated interpretation of some aspect of an operation. The process is both creative and dynamic. Antenarratives move throughout an organizational discussion until either they are incorporated into an accepted story narrative or they are discarded. Antenarratives can also be <u>re</u>assembled in the context of a different perspective to form a new story narrative, one that provides new insights, implications, or projected futures. In terms of the knowledge pyramid shown in Figure 1, the process of constructing story narratives is used to develop PMESII system descriptions (Level 2) and operational designs (Level 3) for both friendly and adversary/neutral stakeholders. Once developed, these story narratives are then used to project the risks and opportunities associated with alternative futures (Level 4).

Figure 2 provides an example illustration of how antenarratives might be collected and then fused into a meaningful story narrative: (1) An interview with Sunni tribal leaders conducted during a typical mission provides HUMINT insight regarding their goals and intentions within a particular region. (2) This information is combined with other collected intelligence to construct a tentative antenarrative regarding the goals and intentions of the Sunni tribal leaders. In this case, tribal leader goals and intentions are linked with both cultural and economic features of the province to establish a contextual understanding of how tribal behavior is motivated and shaped.(3) This antenarrative is then integrated with other intelligence-based antenarratives to build a story narrative that describes the role, strategy, actions, and influence of the Sunni tribal system. (4) Other story narratives are constructed by the military unit's operational and intelligence staffs, supported by reach-back analysis and sensor feeds –*e.g.*, a story narrative for the coalition military forces system and another story narrative for the local province's economic system. In each case, the story narrative is constructed from a set of antenarratives that are contributed by different elements of the staff and supporting agencies. (5) Eventually these narratives are integrated into a larger framework of understanding that describes how the goals, operational designs, chronology of actions, and effects and consequences of the Sunni tribal system are contextually related to the provincial economic system. System linkages are constructed by identifying objects and other features commonly referenced by both system narratives.

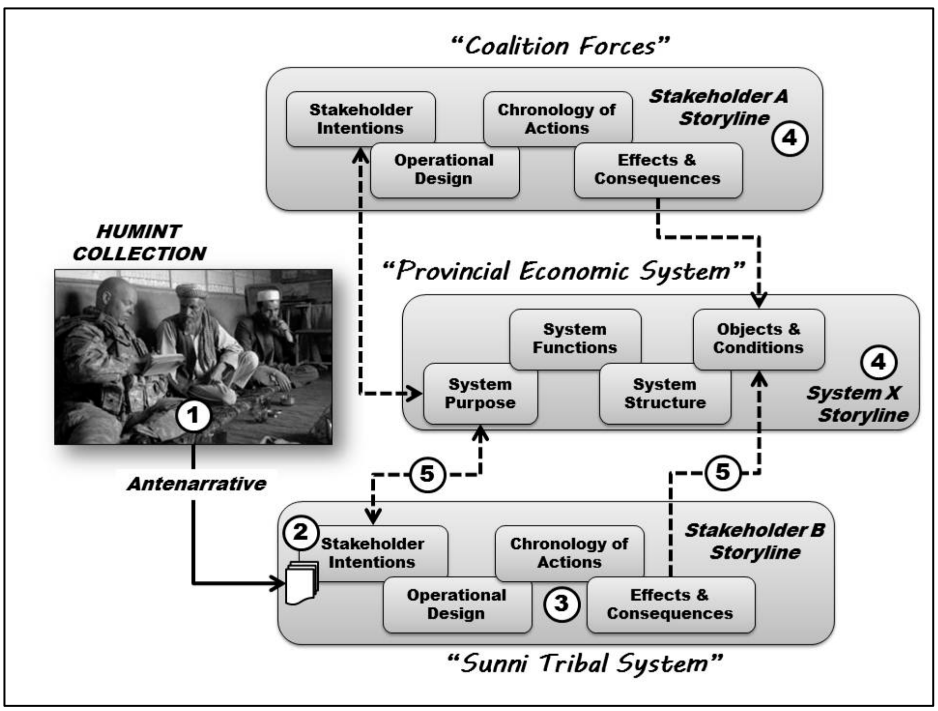

Figure 2 Illustration of How an Antenarrative Is Used to Construct a Larger Framework of Understanding

In summary, the preceding discussion provides a brief snapshot of the operational knowledge management challenges faced by a typical military unit. Proper construction and maintenance of the knowledge pyramid is required for effective C2. If any portion of this framework is missing, incongruent, or disconnected with the remainder of the framework, then the unit's sensemaking activities and operational decisions will suffer accordingly. Consistent with good knowledge management practices, construction and maintenance of the knowledge pyramid depends upon a balanced and well-integrated mix of expertise (*i.e.*, human capital management), information systems (*i.e.*, displays, collaboration tools, and decision aids), and organizational processes (*i.e.*, training, staff organization, knowledge management procedures). This mix of expertise, information systems, and organizational processes serve to develop and integrate relevant antenarratives into a coherent pyramid of operational knowledge and understanding. However, achieving this mix and integration has been problematic for a C2 research and development community. Over the past several decades, this community has focused exclusively on the management of scientific forms of knowledge while ignoring the need to support the management of narrative knowledge. This deficiency is epitomized by the IT community's embrace of logical positivism in its design of supporting technologies for military C2. To better understand this issue, I present a brief history of military IT design and discuss what I term the two worlds of battlespace description commonly present in military operations today.

Two Worlds of Battlespace Description

The military's interest in information technology has had a long history, extending from the use of telegraph systems during the Civil War, through the development of radar during World War II, through the development of the ENIAC general-purpose digital computer for solving complex ballistics problems, to today's world of tablet computers, cloud computing, and enterprise wikis. With each new generation technology, IT developers predicted "a revolution in military affairs," the notion that the technology would transform warfare practices and increase the effectiveness of our military forces. However, such has not been the case. As noted by Thomas McNaugher in 2007, "*…new information technology (IT) has sparked the imagination of defense intellectuals and policymakers for nearly three decades. In that time, it has also guided a sizable chunk of the U.S. Defense Department's experiments and investments in new technology. The related but ill-defined notion of a 'military transformation' even found its way into candidate George W. Bush's campaign rhetoric in 2000. And transforming the U.S. military became Donald Rumsfeld's chief goal when he was named Bush's secretary of defense after the election. Six years later, U.S. forces are mired in Iraq, fighting valiantly but without enough forces or the right weapons and operational concepts for the job. Rumsfeld is out of a job, and many pundits blame his vision of a small, high-tech fighting force for the problems U.S. troops now confront.*"[8] I would assert that much of this failure can be attributed to the IT community's preoccupation with logical positivism, the belief that a complex PMESII battlespace can be represented strictly in scientific knowledge terms.

In the early 1970s, Air Force Colonel John Boyd developed a simple model for air-to-air combat that became known as the OODA loop. In his later writings, Boyd broadened the application of this model (illustrated in Figure 3) to general warfare. As illustrated in Figure 3, the OODA loop consisted of a cycle of four interconnected knowledge management processes: *Observe-Orient-Decide-Act*. While each of these steps is important, it is the orientation step that provides the contextual interpretation needed for applying the right resources and actions at the right place at the right time. Within a well-ordered and defined combat environment such as air-to-air combat, orientation is a rather simple matter –often defined by the physics of the situation and a few rules of maneuver. During the Cold War period, traditional force-on-force combat was seen to follow a fairly well understood set of rules, thus leading to a relatively simple orientation task. However, with the rise of importance of counterinsurgency, stability, and reconstruction operations, orientation has become more problematic.

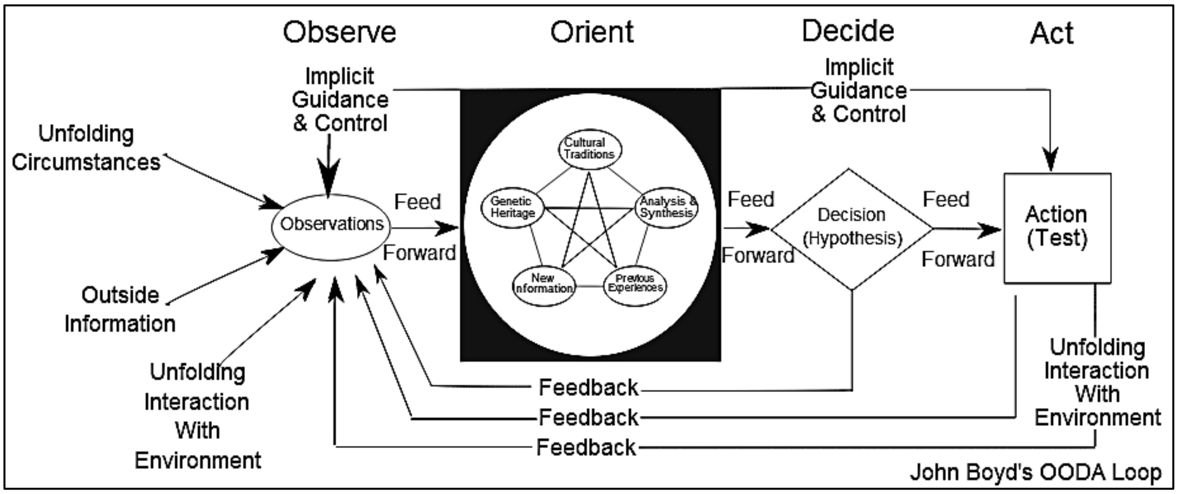

Figure 3 John Boyd's Original OODA Loop Model

Despite the utility of the OODA loop model for guiding its thinking, IT developers soon began to simplify this model in ways that ignored the potential complexity of the orientation step. Boyd's essential claim was that military victory depended upon executing this cycle faster than the adversary. Thus, early on, the military's IT community began to look for ways of reducing the time required for executing the OODA loop. Given its logical positivism bias, the IT community focused on reducing the time required for the observation step. At the same time, little or no attention was given to orientation because this step involves the complex filtering and interpretation of collected information through the lenses of culture, traditions, and genetic heritage. As stated by Boyd, "*Orientation is an interactive process of many sided implicit cross-referencing projections, empathies, correlations, and rejections…*" and "*We must be able to examine the world from a number of perspectives so that we can generate mental images or impressions that correspond to the world.*"[9] The practical effect of this emphasis or omission was that the OODA loop soon became shortened to *Observe-Decide-Act*. The role of IT was seen as reducing the "sensor-to-shooter" time by automating the delivery of sensor information directly to the weapons platform. For certain well-ordered and physically/geospatially defined military engagement problems, this simplification represented a reasonable approach to improving the combat effectiveness of military forces. However, this same simplification, when applied to more complex, political/social operations, creates an Achilles' heel in our military C2 systems.

In today's complex world of counterinsurgency, stability and reconstruction, peacekeeping, and humanitarian operations, observation and orientation activities are carried out in two primary ways. I find it useful to think about these processes as reflecting two epistemologically distinct worlds. Let's call them *World 1* (the world of scientific description) and *World 2* (the world of narrative description). World 1 is dominated by technical collection means and describes the battlespace in terms of geospatial imagery (GEOINT), signals intelligence (SIGINT), electronic warfare (EW), moving target indication (MTI) intelligence, topographic/terrain intelligence, and weather data. These systems can provide terabytes of real-time or near real-time descriptions of the physical battlespace, but with little or no PMESII context. While such information is useful for real-time targeting and engagement decisions for kinetic operations, it is less relevant to the commander's creative tasks of developing and focusing non-kinetic solutions across the political, social, economic, and informational dimensions of the operational environment. Epistemologically, World 1 descriptions of the battlespace are constrained to only what can be empirically observed and objectively defined. This quality enables the information to be collected, managed, and shared with decision makers in an automated fashion. Organization of World 1 information is typically organized in geospatial terms so that it can be integrated and displayed with reference to standard map coordinates. Beyond this, however, it lacks contextual meaning (*i.e.*, PMESII relevance) for its filtering and interpretation. Given this lack of operational meaning, amassing and displaying great quantities of World 1 scientific information can lead to a condition commonly known as information overload.

By contrast, World 2 is reflective of human intelligence (HUMINT) collection and analysis that focuses on the political, social, economic, and informational aspects of the battlespace. The world of HUMINT is dominated by antenarrative descriptions of social relationships, regional culture, political and economic motivation, sentiments, trust, and other abstract elements of the commander's operational environment. Because these descriptions are both subjective (*i.e.*, judgmental, perspective-driven) and non-empirical (*i.e.*, not subject to direct observation or objective sensing), they fall outside the realm of scientific information. Hence, this information must be organized and managed in more intuitive and manual ways –often in the narrative form of tactical spot reports, interview reports, and intelligence summaries. Over the past decade or so, management of this type of contextual knowledge has been hit or miss at a tactical or operational level. Intelligence reports and summaries become scattered across different email accounts, briefing folders, and desktop computers –thus making it difficult to retrieve or fuse these fragmented descriptions into a coherent framework of situation understanding. More recently, efforts to automate the management of HUMINT information have been limited to documenting it in the form of multimedia files and organizing these files in terms of geospatial map coordinates (*e.g.*, tools such as CHATS[10] and TIGR[11]). The nature of these multimedia files enables them to be manipulated as data objects; however, current tools do not provide any sort of analysis capability for their semantic or narrative content. Thus, while geospatial organization of these multimedia files provides some utility and efficiency to military units, the current generation of HUMINT management tools falls considerably short of supporting the synthesis of these reports (*i.e.*, antenarratives) into a coherent story narrative.

Synthesis of World 1 scientific descriptions with World 2 narrative descriptions of the battlespace is currently left as a responsibility of the military analysts and decision maker. Because the analyst or decision maker must deal with two distinct forms of knowledge, this can be both time consuming and difficult. Except for associating the various descriptions in terms of geospatial coordinates, the analyst lacks effective IT tools for constructing the type of knowledge pyramid described earlier in this paper. At the heart of this problem is the inability of current IT applications to support the management, analysis, and fusion of narrative forms of knowledge.

A Radical Proposal

The IT community has recognized the need for tools that can assist military analysts and decision makers in constructing an understanding of the PMESII dimensions of the battlespace. Examples of these initiatives include (1) the building of human social cultural behavioral models,[12] (2) the proposed use of advanced analytic methods such as dynamic social network modeling[13] and Bayesian belief network modeling,[14] and (3) the employment of semantic web structuring technologies for organizing contextual information.[15] The problem of these various approaches is that they each represent extensions of the logical positivism paradigm. In their attempts to describe human political, social, economic, and cultural behavior in scientific terms (*i.e.*, it must be objective, logical, and empirically testable), these methods suffer from three limitations:

- They cannot for the richness of social relationships, regional culture, political and economic motivation, sentiments, trust, and other abstract elements of the commander's operational environment;
- They fail to appreciate the value of understanding situations from alternative perspectives;
- Their framing of operational situations runs counter to the way in which human beings naturally think about the world, especially in competitive and emergent situations.

In short, these tools have been developed to support the practice of operational science. By contrast, it is now time to develop a new generation of tools that can support the practice of operational art. Development of these tools will require the IT community to think in terms of paradigm shift. Rather than continuing to refine our knowledge management methods and tools through a series of incremental refinements, we must return to first-order principles and rethink our definition of knowledge. As argued by Bruner,[16] narrative knowledge and scientific knowledge represent two irreducible forms of knowing about the world. Therefore we cannot presume that methods and tools developed for one type of reasoning will serve us well for supporting a different form of reasoning altogether. If the proper way to think and reason about human social behavior is narrative in nature, then we should be developing methods and tools that conform to this form of reasoning. This, then, represents a paradigm shift for the military's IT community.

Evidence for making this shift is already appearing in literatures relevant to military operations –particularly those operations conducted within a complex political, social, cultural, and economic environment. Examples include

- Foreign and humanitarian policy evaluation[17]
- Organizational design and assessment[18]
- Managerial effectiveness[19]
- Information technology failure analysis[20]
- Terrorist movement analysis[21]

In particular, Karen Walker, a former counterterrorism analyst with the US Department of State and US Department of Homeland Security, has identified a range of tools that can be applied to situations such as found in Iraq and Afghanistan. These tools include such methods as narrative analysis, metaphor analysis, social movement analysis, visual rhetoric, ideological criticism, and others.[22]

Beyond these current methods of narrative analysis, I believe that it is possible to develop a reasoning calculus for collecting antenarratives and fusing them into meaningful story narratives. The calculus would be organized around the construction of knowledge pyramids such as illustrated earlier in Figure 1. It would also translate Bruner's ten principles of narrative knowledge (summarized earlier in this paper) into specific guidelines for creating antenarratives and then collaboratively combining these fragments of meaning into a coherent whole. As with traditional methods of narrative inquiry, the guidelines would focus on describing the meaning of these events and relationships to relevant stakeholders.[23] Whereas scientific methods of information analysis attempt to build a model of universal truth, narrative analysis serves to examine situations from alternative perspectives. This is viewed as particularly important in counterinsurgency, stability and reconstruction operations, and peacekeeping and humanitarian operations. As such, the reasoning calculus would direct support the commander's creative process of visualizing the manner in which both kinetic and non-kinetic initiatives serve to influence the hearts and minds of regional stakeholders.

Once tested and refined, the narrative calculus would then be instantiated in the form of a tool or application similar to TIGR. Such a tool or application would be used at both a tactical and operational level to build a running estimate of a regional situation and to support the commander's creative process of design. The tool would be made compatible with other forms of information (*e.g.*, GEOINT, SIGINT, multimedia files) such that these data objects could be appropriately linked with emerging story narratives. Through cloud computing, tactical analysts in the field would collaborate with staff analysts and reach-back analysts to place local knowledge within the context of regional narratives and established descriptions of different PMESII systems. In this manner, military commanders are better able to develop local initiatives that are compatible with national goals and strategy.

Undertaking a paradigm shift such as this will undoubtedly meet with resistance and criticism from those strongly wedded to the logical positivism approach. Their reluctance to embrace new ideas—particularly those that challenge fundamental concepts like the nature of knowledge—is understandable and not unlike what has been encountered in other fields of study such as economics.[24] Yet, if we are to make meaningful progress in this area, such a shift is necessary to free the creativity inherent within the US military. I believe it is a challenge worth accepting.

End Notes

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