Need for Community of Interest for Context in Applied Decision Making

Warfighter's Use of Context for Decision Making

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Abstract - **There is interest in building a community of interest for Context in Applied Decision Making. Warfighters have long exploited context in decision making. The mystery, therefore, is why the information technology (IT) community that supports warfighters provides so little IT that exploits context for decision making. One possible answer is the lack of a forum such as a community of interest that facilitates sharing (a) among those who do or might develop IT that exploits context for decision making and (b) with warfighters. This paper provides background information on warfighter's use of context and highlights an IT system that uses computer representations of context in order to facilitate establishing a community for Context in Applied Decision Making.**

Keywords – **ontology; context in decision making; warfighters; ICODES**

I. BACKGROUND

A community is needed for Context in Applied Decision Making because warfighters rely on context when processing data to create information and make decisions required for mission accomplishment. Further, for the last 20 years, warfighters and IT specialists have collaborated to create and evolve (a) at least one program of record (POR) IT system that processes data into information based on context and (b) several such applications for advanced concept technology demonstrations (ACTD) and other science and technology (S&T) efforts. Documents such as the 1998 presentation "Coping with Massive Amounts of Information: The Glare of War" produced and shared by Dr. Howard Marsh of the Office of Naval Research (ONR) are now impossible to locate. For the last 15 years, we should have been building on Dr. Marsh's insights. Instead, we continue to invest effort in replicating his research.

DoD needs the subject community of interest so DoD can shift from fragmented, individual successes that are rarely exploited in later efforts to an effective system in which (a) new successes build on earlier successes, (b) new successes avoid the problems of past failures, and (c) warfighters, who need IT tools that use context in processing data to produce information needed for good decisions, can readily share their needs, circumstances, and constraints with developers.

Because of reductions in DoD funding, there is a pressing need to not repeat mistakes made in earlier IT programs and to provide useful products as rapidly as possible. Indeed, simply making information on existing POR tools that exploit context in decision making easily available may be the most important short-term product of this community.

II. WARFIGHTERS' USE OF CONTEXT

People in general seem to be naturally inclined to focus their own contributions to current problems and to be unaware of and give proper credit to the intellectual and organizational accomplishments of past commanders and others. The more data and information that is generated and available, the harder it is to find relevant information. Napoleon is an example of an individual who was remarkably successful at creating a mobile capability to (a) assemble and move with him maps, files, and other information that provided him with context that he could (b) then use in processing incoming reports and other data to create the information he needed for battlefield successes. However, Napoleon's accomplishments in this area are also largely unknown. Anders Engberg-Pedersen writes in his dissertation "*The Empire of Chance. War, Literature, and the Epistemic Order of Modernity*" [1] that:

> Two wagons served the transportation of these maps, and later a lighter cabriolet was added due to its greater speed. Moreover, Napoleons own wagon was converted into a rolling office: drawers were installed for a small reference library where he would also store reports from Paris. When the drawers were full, superfluous material was cut into pieces and thrown out the window, which, according to Odeleben, could result in a veritable "paper rain." [2]. A central concern was thus to organize the cartographic material in a practical way in order to make it transportable and readily available.

Infantry in Battle [3], a book produced under the direction of George C. Marshall when he was a colonel leading the

Army's infantry school, is very clear on the value of understanding context when considering data and information. Chapter V, "Terrain," opens with the statement "Maneuvers that are possible and dispositions that are essential are indelibly written on the ground." That is, the terrain is a context for ground operations that, if understood, facilitates (a) predicting what enemy can and might do and (b) what our forces would benefit from doing and must do.

My favorite example of a warfighter using context is when US Marine Corps Captain Frank Izenour determined the start date of the major 1972 North Vietnamese offensive - now known as the Easter Offensive. In the course of working with Capt. Izenour from 1982-6, I learned the specifics from him directly. That he, in fact, made the prediction before the attack is documented in Marine Corps Colonel Gerald Turley's book, *The Easter Offensive* [4]. Early in that book, while Turley is recounting his early days with the Marine Advisory Unit in Vietnam, he states that Capt. Izenour was convinced the North Vietnamese would attack sooner rather than later.

How did Capt Izenour use context to predict what so many more experienced and senior officers missed? The most important element, as I learned from working with him, was that Capt. Izenour was a reader and a thoughtful officer. When he got data and information, he thought about them and searched for implications and logical conclusions. In early 1972, his assignment provided him access to a U.S. intelligence center in Saigon where he viewed large maps that used icons to represent the locations of North Vietnamese Army (NVA) units across and outside South Vietnam. These maps showed NVA units positioned the length of South Vietnam's boarders with its neighbors. The locations of these units, along with the resources required to deploy and support them in the field, produced information context that suggested to Capt. Izenour that the NVA was planning an attack across all of South Vietnam. The question was when, not if, a major country-wide attack would be launched.

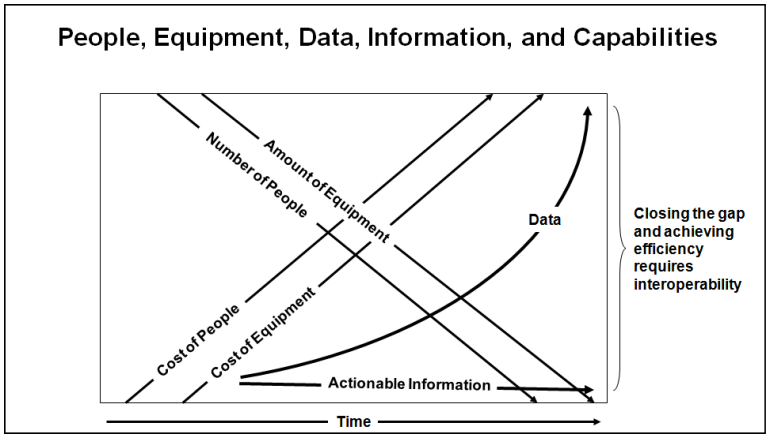
Capt. Izenour told me that opinions as to when the attack would come were varied. August and September 1972 were favored by many people with access to the intelligence. However, Capt. Izenour's information context included the monsoon seasons in South Vietnam. The monsoon comes to southern and northern South Vietnam at different times. The only period the southern and northern parts of the country were not having monsoons was in the three months of March through the end of May. Given that context, Capt. Izenour calculated the NVA would allow 30 days for the ground to dry and then launch an attack about April 1, 1972 across all of South Vietnam. In the actual event, he was off by only 24 hours. Unfortunately, because so few others shared his context and opinion, the Easter Offensive was a strategic surprise for the U.S. and significantly advanced the NVA's objective of gaining control of South Vietnam.

III. Operation Desert Shield and Storm: Data Overwhelms Context

In early 1991, the author of this paper was sent to Saudi Arabia to conduct a Marine Corps battlefield assessment of command and control in Operation Desert Storm. The author arrived shortly after the fighting ended and started interviewing participants in the war. To the author's surprise, those he interviewed who had served in the Vietnam War kept noting that fewer people and less equipment had been provided for tasks in Operation Desert Storm than the same tasks in the Vietnam War. Dr. Katherine McGrady, of the Center for Naval Analyses (CNA), had been detailed to support I Marine Expeditionary Force (I MEF) during Operation Desert Storm. When asked about the less equipment and fewer people in Desert Storm than in Vietnam, Dr. McGrady replied that the salaries of people and the cost of equipment were rising while manpower was being reduced and the new equipment being fielded was more capable than the equipment it replaced. The ongoing result was that senior leaders were counting on the fewer people being able to make better decisions so that better operational effects could be created with fewer pieces of better equipment.

Additionally, the war participants discussed the volume of data forced upon them. The G-2 (i.e., intelligence officer) stated that on the busiest days of the fighting, the intelligence section received so many reports that they stopped counting them at 6,000 a day, and they could not and did not even read all the 6000+ messages on those days.

This led the author to develop the following drawing depicting rising salaries and increasing cost of equipment with decreasing numbers of people and pieces of equipment as data volume increases at an ever-faster rate. The conclusion is that future IT after Operation Desert Storm would need the capability to process ever-increasing volumes of data into less but better focused information that commanders would need to make better decisions and produce better results with fewer pieces of equipment. If better IT was not produced, the cost of the people needed to process the available data would make DoD unaffordable.



IV. USE OF IT TO EXPLOIT CONTEXT

We now turn to successes in developing IT that exploits context warfighters use.

During Operations Desert Shield and Storm, U.S. forces deployed to Saudi Arabia by ship. The process and methods for planning ship loads was well developed by the start of Operation Desert Shield. Stripped to its essentials, planning a ship load is an exercise in determining where to place equipment of known dimensions using the context provided by a ship's plan (e.g., dimensions of a ship's storage areas and ramps). Given sufficient time, skilled load planners could develop good load plans manually.

However, Operations Desert Shield and Storm revealed that no-notice wars such as the Gulf War provide insufficient time for manually planning and adjusting ship load plans as the situation develops. The fog of war extended to the deployment of forces. Units found that the transport ships they had been told would carry their equipment and for which they had prepared load plans manually were replaced by other ships with little or no notice. The context or layout of the new ship could be learned easily, but often there was insufficient time to prepare a good load plan manually for the replacement ship.

After Operation Desert Storm, the Army's Military Traffic Management Command (MTMC), the command responsible for loading military equipment on ships, sought to develop IT support for agile load planning for ships. The objective was to extend the context from people-based activities to computer-based activities. These agile load planning inquiries were answered by the Collaborative Agent Design Research Center (CADRC) at the California Polytechnic State University (Cal Poly) at San Luis Obispo, California. For several years, Dr. Jens Pohl and his associates in CADRC had been experimenting with using ontologies to represent context and collaborative software agents to exploit the context provided by ontologies. When data on the equipment to be loaded on a ship was entered into the IT application, software agents would process the data based on the ontology(ies) and quickly develop an effective load plan [5].

The early experiments for MTMC matured into an application that was first fielded in 1997 under the name Integrated Computerized Deployment System (ICODES). In the intervening quarter century, ICODES has continually evolved with its latest version operating in a cloud environment.

ICODES' use of ontology and software agents has also been exploited in the Extending the Littoral Battlespace (ELB) Advanced Concept Technology Demonstration (ACTD), the Coalition Secure Management and Operations System (COSMOS) ACTD, and other efforts.

V. CONCLUSION

The role of context in applied decision making is well established and there is a rich body of literature on the subject. ICODES has demonstrated the efficiencies and increased effectiveness possible when context is exploited in IT systems used by warfighters. A forum such as a COI is needed that facilitates IT developers and others accessing literature and each other. From the perspective of a community on Context in Applied Decision Making, ICODES is important because its results include (a) significant reductions in the time to plan a ship load, (b) improved detection of potential hazardous materials violations, (c) significantly fewer senior ship load planners, (d) reductions in rental expenditures for piers and staging areas for loading military equipment onto ships and (e) effective use of applied ontologies and software agents. From the perspective of DoD, a community of interest is important because it would facilitate the exploitation of past successes and collaboration among ongoing and future efforts while contributing to better DoD efficiency.

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