VISUALIZING WAR
VISUAL TECHNOLOGIES
AND MILITARY CAMPAIGN PLANNING

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by

RICHARD D. PAZ, MAJ, USA
B.A., Philosophy, University of Washington, Seattle, Washington, 1987
MBA, Texas A&M University, College Station, Texas, 2001

Fort Leavenworth, Kansas
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ABSTRACT

VISUAL TECHNOLOGIES AND MILITARY CAMPAIGN PLANNING, by MAJ Richard Paz, 10 pages.

The School of Advanced Military Studies (SAMS) uses commercial off-the-shelf (COTS) software (Microsoft PowerPoint) as a medium for conveying military campaign plans. According to SAMS users, this visual method is limited in that it represents events, concepts and information in a singular fashion, i.e. it leads users and audiences to linear and sequential conceptions of battlespace and decision-making. The general problem of information conveyance has been the subject of previous research in the systems analysis, decision theory, and communications fields and presents itself as a critical field of study for military and business applications. What other visual technologies will enable users/planners to depict and communicate a plurality of ideas, concepts of simultaneity and concomitant event relationships?

We are trained to avoid being too clever in matters that are of no use – such as being able to produce an excellent theoretical criticism of one's enemies' dispositions, and then failing in practice to do quite so well against them. Instead we are taught that there is not a great deal of difference between the way we think and the way others think, and that it is impossible to calculate accurately events that are determined by chance. The practical measures we take are always based on the assumption that our enemies are not unintelligent.[1]

Spartan King Archidamus in a speech to his army prior to the Peloponnesian War

The purpose of this paper is to describe how collaborative technologies may aid military planners in campaign planning at the operational level of war. Planning military operations involves complex analysis, decision-making, communication, and assessments of how future environments may take shape. The School of Advanced Military Studies (SAMS) uses commercial off-the-shelf software (Microsoft PowerPoint) as a medium for conveying military campaign plans. However, this visual method is limited in that it represents events, concepts and information in a singular fashion, i.e. it leads users and audiences to linear and sequential conceptions of battlespace and decision-making. Analysis of problems of information sharing, decision-making, and information conveyance have been the subject of previous research in the systems analysis, decision theory, and communications fields and presents itself as a critical field of study for military and business applications.

This study focuses on planning at the operational level of war. Similarly, planning systems and to a lesser extent decision models discussed will be those designed for planning complex operations beyond the realm of the tactical engagement. This distinction is important because at the operational level of war humans, environments, and events act more like complex systems rather than apparent self-contained tactical situations more suitably solved by purely technical means. Though he did not formally define the operational realm, Clausewitz described the relationship and difference between tactics and strategy within that analysis; one can detect the emerging shape of operational art.

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[1] Thucydides, *History of the Peloponnesian War*, translated by Rex Warner, (London: Penguin Books, 1972), 85.

> If fighting consisted of a single act, no further subdivision would be needed. However, it consists of a greater or lesser number of single acts, each complete in itself, which…are called 'engagements'…This gives rise to the completely different activity of planning and executing these engagements themselves, and of coordinating each of them with the others in order to further the object of the war. One has been called tactics, and the other strategy.[2]

Operational action brings about multiple effects through time and various dimensions of warfare (through the range of military operations). Implications for military planners are that effects or consequences continually bear upon operational objectives and overall strategic success. It is imperative that we account for operational consequence in that failure to anticipate secondary effects may eventually lead to mission failure at the operational and strategic level. Dietrich Dörner, director of the Cognitive Anthropology Project of the Max Planck Institute in Berlin, stresses that people fail to solve complex problems because they do not pay enough attention to long term effects and because of the accrual of cognitive "bad habits" that lead to commissions of "small mistakes" that add up over time, resulting in unforeseen changes and sometimes disastrous outcomes.[3] Emphasis on consequence and effect are implied in our doctrinal notion of full spectrum operations, as the ambiguity of threats faced by our forces is high and the type of conflict varies with the type of threat and regional stability/instability. Given history, 'successful' human plans and achievements do not guarantee overall success and are as often subject to future disaster and chaos as any other course of action might suggest. Likewise, military planning, however great, may be doomed to failure, if the political and national security strategies are fundamentally flawed.[4]

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[2] Carl Von Clausewitz, *On War*, translated and edited by Michael Howard and Peter Paret (New York: Alfred A. Knopf, 1993), 146.

[3] Dietrich Dörner, *The Logic of Failure: Why Things Go Wrong and What We Can Do to Make Them Right*, (New York: Metropolitan Books, 1996), 2,7.

[4] Williamson Murray, "Innovation, Past and future," in *Military Innovation in the Interwar Period*, Williamson Murray and Allan R. Millet, eds. (Cambridge: Cambridge University Press, 1996). 305. See his footnote (#13) for the author's discussion of the low fault tolerance of politico-strategic judgment over the operational and tactical.

A prerequisite for any operational planning aid is that it promotes 'operational cognition' or employs a systematic approach to planning military operations.[5] From a joint doctrine perspective, the operational level of war links the "tactical employment of forces to strategic objectives."[6] At this level of war, the focus is on operational art. During the interwar period of the 1920s and 1930s, the Soviet military theorists developed the theoretical framework to first coherently define an intermediate level of warfare, between that of strategy/grand strategy and tactics, which became known as the operational level of warfare and the concept of *operational art*. Red Army general officer and theoretician, Aleksandr A. Svechin, described operational art in his seminal work, *Strategiia (Strategy)*.

> …operational art sets forth a whole series of tactical missions and a number of logistical requirements. Operational art also dictates the basic line of operation, depending on the material available, the time which may be allotted to the handling of different tactical missions, the forces which may be deployed for battle on a certain front, and finally on the nature of the operation itself.[7]

Battle command is a key Army doctrinal concept that describes leadership as an "element of combat power," that defines the art of command through a commander's ability to visualize, describe, and direct battlefield operations.[8] As such, visualizing and describing form the intellectual apparatus with which commanders set forth the vision of battlefield framework and direct the staff along a path to further analyze and recommend courses of action to meet strategic aims and mission accomplishment. The commander then directs units through the various battle operating systems to execute in accordance with his vision and intent.   Clausewitz elaborated on such leadership traits in his reflection on the concept of *coup d'oeil* or the ability to formulate a "quick recognition of truth that the mind would ordinarily miss or would perceive only after long

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[5] Shimon Naveh, *In Pursuit of Military Excellence*, (Portland: Frank Cass Publishers, 2000), xiii. Naveh's premise is that "since the French Revolution the phenomenon of war in general, and the domain of military operations in particular, have been characterized by the existence of material conditions; hence their study must comply with a systematic approach and their examination must be conducted in accordance with systemic criteria….Therefore, in those campaigns where a systematic approach was applied, in both planning and management of armed forces, the nature of warfare was marked by sound operational logic and its conduct can be defined as operational art."
[6] Department of Defense Joint Publication 3.0, *Doctrine for Joint Operations*, 10 September 2001, II-2.
[7] Aleksandr A. Svechin, *Strategy*, edited by Kent D. Lee, (Minneapolis: East View Publications, 1999). 69.
[8] Department of the Army Field Manual 3.0, *Operations*, 14 June 2001, 5-1 to 5-3.

study and reflection."[9]   However, Clausewitz understood that men who have all the necessary

attributes of "temperament combined with a strong and independent mind" are rare.[10]

In spite of the doctrinal intentions of battle command it describes only theoretically what

commanders should do, but does not guarantee a commander the requisite talent to accomplish

such singular feats of operational cognition.   The bottom line is that operational planning is

subject to many variables and interactions among many individuals of varying skills, cognitive

capacity, and leadership ability. Visualizing and describing operational plans as techniques also

have inherent weakness in that they may stifle operational art by regressing towards 'methodism'

or the particular way a commander wants to conduct operations, rather than promote dynamic

adaptation towards meeting operational goals and the strategic aim. Clausewitz acknowledged

that war is essentially a human affair subject to inconsistencies, passions, frictions, fog and

chance. In these situations where we are 'blinded' by lack of information, lack of experience, fog,

or friction, technology may be of assistance in attenuating chaos and uncertainty while keeping us

on the path of meeting our mission requirements.

The analytical backbone of the Army's institutional planning methodology is the Military

Decision Making Process (MDMP). Field Manual 101-5, *Staff Organization and Operations*,

describes the MDMP as the Army's *single* [emphasis added] analytical process used to assist the

commander and staff in developing estimates and plans.[11] The 7-step MDMP process is depicted

in figure 1.   In its current formulation the MDMP has retained its vestigial characteristic as a

"commander's estimate" but has gained a reputation as a time consuming process that may be of

dubious value to a commander's and staff's ability to apply the operational art.

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[9] Clausewitz, 118.
[10] Ibid., 123.

Figure 1: The military decision-making process
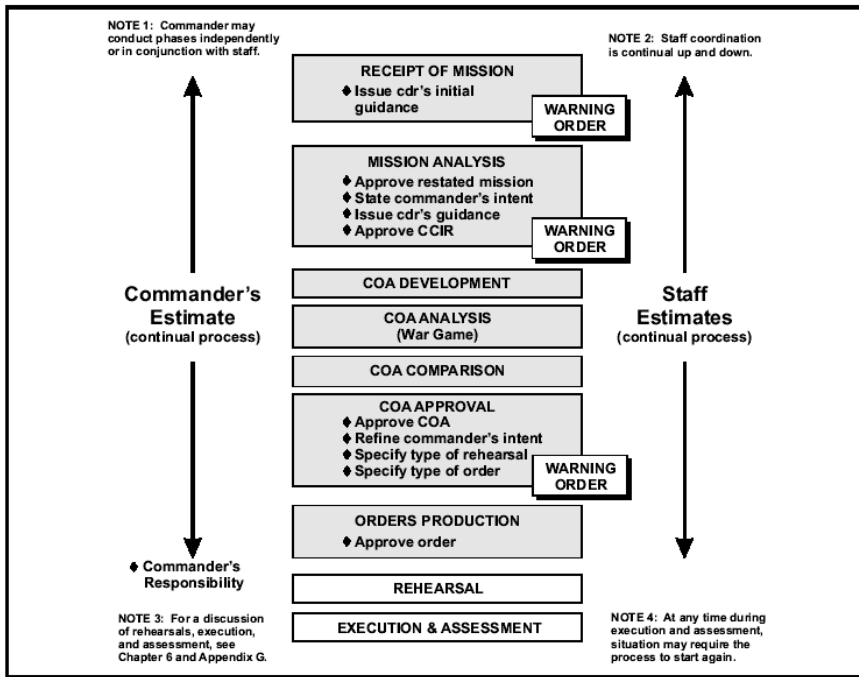
The MDMP traces its American lineage back to the Revolutionary War with the first documented

estimate prepared for General Washington by Major General von Steuben, who received his

training while serving on Frederick the Great's staff.[12]   U.S. staff structure and training stayed

essentially the same on through the Civil War period, but by the late 1890s a Fort Leavenworth

instructor, Captain Eben Swift, introduced a tactical orders course that adapted many Prussian

Army staff forms.[13] Swift's method was formally documented with the publishing of *Estimating*

Tactical Situations and Publishing Field Orders in 1909 and became official Army doctrine in

1910.[14]   By 1932 the Army established the five-paragraph commander's estimate within FM 101-

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[11] Department of the Army Field Manual 101-5, *Staff Organization and Operations*, 31 May 1997, pg. 5-1.

[12] Rex R. Michel's, "Historical Development of the Estimate of the Situation," Research Report 1577, (Fort Leavenworth: US Army Research Institute for the Behavioral and Social Sciences, October 1990), 3 as cited in Wilson A. Shoffner, *The Military Decision-Making Process: Time For a Change*, SAMS Monograph, (U.S. Army Command and General Staff College, 2000), 4. Shoffner states that the MDMP was 'originally known' as the "estimate of the situation." Schoffner cites James D. Hittle, *The Military Staff: Its History and Development*, (Westport, CT: Greenwood Press, 1975), 194 with regards to von Steuben's training with Frederick the Great.

[13] Hittle, 199 as cited in Shoffner, 5.

[14] Shoffner, 5.

5, *Staff Organization and Operations*.[15] In 1940, the estimate was modified to include mission, situation and courses of action, analysis, comparison, and decision and has remained in essentially the same general format since.[16] The estimate underwent dramatic change in the 1960s with its name officially becoming "the military decision-making process" but also in that the role of the staff was described doctrinally with the process formulated as a five-step method.[17] For a brief time, the process was described less rigidly and even presented as a "training aid" but it soon reverted back to its character as a deliberate estimation and planning process.[18]

The relationship between the Army's concept of battle command and use of the MDMP are consistent in that studies have shown that the main purpose of the MDMP (at the tactical level) is to "facilitate understanding and share images."[19] A study by the Rand Corporation in 1989 concluded that effective military information management systems must support how commanders process information.[20] A later study conducted at the National Training Center (NTC) confirmed that units are unable to develop adequate battle plans because of "poor staff cohesion and communication," compartmentalized staff planning, and commanders' inability to properly manage information.[21] Though these criticisms are focused at the tactical level, the MDMP's limitations may be due its flawed logical structure as analytical problem solving process.

The MDMP may be described as a form of rational expectation theory in which "individuals or groups evaluate the expected consequences of their decisions beforehand in terms

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[15] Ibid., 6.

[16] Rex R. Michel, 3 as cited in Shoffner, 6.

[17] Shoffner, 6. The five steps were, 1) statement of the problem; 2) collecting data; 3) developing possible solutions; 4) analyzing possible solutions; 5) selecting the best solution.

[18] Ibid., 7

[19] James P. Kahan, Robert Worley, and Cathleen Stasz, *Understanding Commander's Information Needs*, (Santa Monica, CA: The RAND Corporation Arroyo Center, June 1989), 20, as cited in John W. Charlton, *Digitized Chaos: Is Our Military Decision Making Process Ready for the Information Age?* (SAMS Monograph, U.S. Army Command and General Staff College, 1997), 13.

[20] Ibid., 14.

[21] John Grossman, Battalion Level Command and Control at the National Training Center, (Santa Monica, CA: The RAND Corporation Arroyo Center, 1994), xii, as cited in Charlton, 15.

of personal preferences."[22] The MDMP focuses commanders and planners on optimizing

consequences rather than on developing adaptable plans that can be modified according to

changing environments. Theoretically, rational expectation decision theory assumes that decision

makers have perfect knowledge of the situation, of alternative choices, of consequences of choice,

and of the situation's decision rules.[23] Given that reality rarely conforms to such criteria and that

this decision-making model does not account for longer-term residual effects, it fares poorly in

complex and dynamic situations. Alternative decision theories include bounded/limited

expectation theory of which Recognition-Primed Decision (RPD) theory is an example. RPD

theory is based upon a satisficing methodology where decision-makers use heuristic pattern

recognition based upon personal experience, knowledge, and skills to determine satisfactory

alternatives rather than optimized outcomes.[24] This theory is similar to the intuitive concept of

coup d'oeil. Decision-making processes based upon RPD are tactics-oriented, relying heavily on

personal experience without consideration of long-term effects, since decision-making relies on *a

priori* pattern recognition.

Other criticisms of the MDMP are that it degrades staff performance with its unbalanced

emphasis on the decision-making process *per se* at the expense of developing adaptive plans,

contingencies, and follow-on actions critical to operational initiative and agility.   Another tension

related to the visualization process is that the commander and staff waste time developing the

vision of 'how to fight' rather than focusing on making critical decisions during mission

execution. [25] Studies comparing the MDMP with other decision theories and have concluded

that the MDMP is not an effective planning or decision-making method.[26] Critics claim that it

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[22] James G. March , *A Primer on Decision Making*, (New York: The Free Press, 1994), 2, as cited in
Charlton, 4.
[23] Paul E. Moody, Decision Making: Proven Methods for Better Decisions, (New York: McGraw Hill Book
Co., 1983), 4 as cited in Charlton, 5.
[24] Ibid., 6.
[25] Shoffner., 11.
[26] Charlton, 17-18.

has proven itself as a time consuming process not adequately suited to either tactical or operational planning.[27]

In consideration of the aforementioned studies and criticism of the MDMP, it would then appear problematic to recommend technologies that merely 'automate the process' or to translate its capability through the Army's wider digitization efforts. However, other analyses suggest that the MDMP might be "dramatically improved" and "compatible" with Army modernization if the MDMP were appropriately modified.[28] However, such efforts of overhauling the MDMP doctrine will invariable include recommendations for wider doctrinal, cultural, and educational changes within the Army.[29] Nonetheless, considering that battle command utilizes visualization and description technique and that MDMP should allow commanders and staffs to share common operational 'imagery,' how might collaborative technologies assist in these processes?   Can computer mediated communication assist in validating shared vision in complex environments while mitigating the pernicious effects of shortsighted planning and 'ballistic' decision-making methodologies?

In his book, *The Logic of Failure*, Dietrich Dörner concedes that computer technology used to simulate complex situations provides the ability to "observe and record the background of planning, decision-making, and evaluation processes that are usually hidden."[30] Dörner and his colleagues observed that participants who successfully managed complex situations displayed behaviors that fell into cybernetic-like [31] interaction (or patterns of system information feedback mechanisms that resulted in manageable and stable environments). In other words, successful participants learned how to regulate and maintain system stability over long durations of 'game time.' Dörner outlines steps in effective organization of complex actions as seen in Figure 2

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[27] Charlton, 13-19, Shoffner, 9-13, Wheeler, 17 and Alex, 76-78 with regards to the tactical decision-making process.
[28] Charlton, 34-48 passim,
[29] Michael F. Pappal, *Preparation of leaders to make Decisions in Peacekeeping Operations*, (SAMS Monograph, U.S. Army Command and General Staff College, 2002), 50-52.
[30] Dörner, 9-10.

below.[32] These simulation and evaluation techniques are very much in line with Army training

doctrine, with its emphasis on "live, virtual, and constructive" forms of training.[33] Since planning

and visualization processes are virtual and constructive in their "live" form, it would be

appropriate for the Army to aggressively invest in computer-aided planning technology research

and development.

Figure 1: Steps in the organization of complex action.
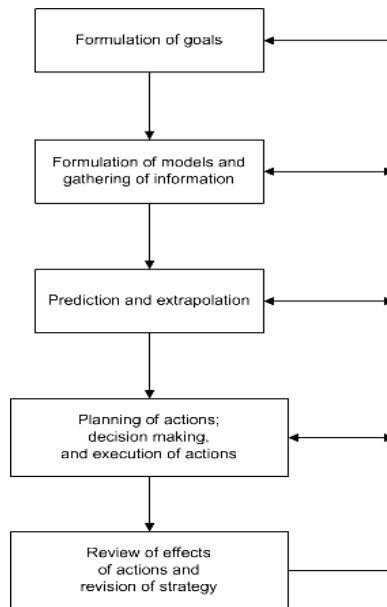
Another cybernetic based decision system is derived from the theoretical work of an Air

Force officer, Colonel John Boyd, called the Observe, Orient, Decide, Act (OODA) Cycle (See

Figure 3 below)[34]. The OODA Cycle or Loop as it is commonly referred to seeks to maximize

decision cycle speed (or your tempo in reacting to the environment) to outthink the enemy by

"getting inside" the enemy's "mind-space" or OODA loop through superior tempo. However, the
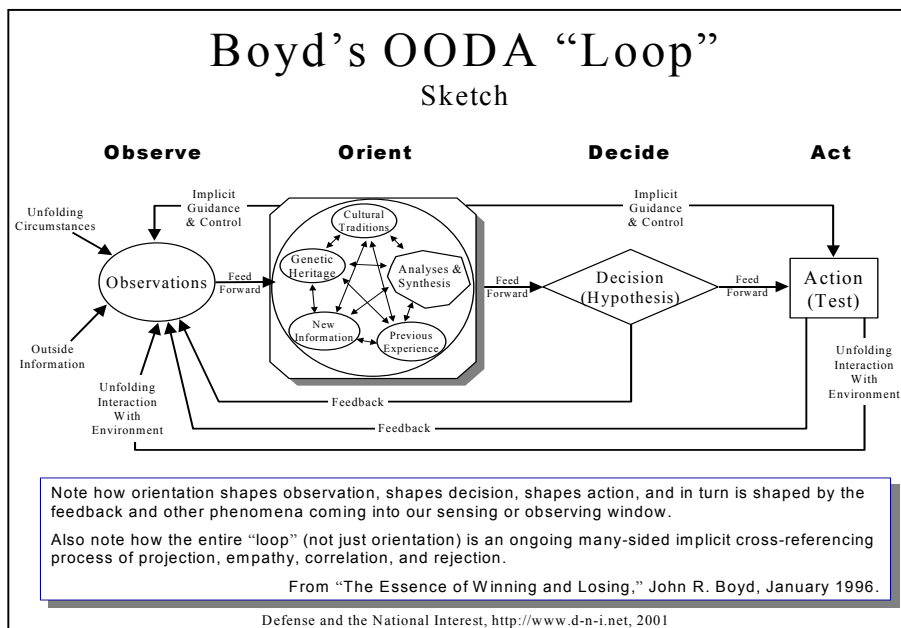
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[31] Ludwig von Bertalanffy, *General System Theory*, Revised edition (New York: George Braziller, Inc., 1968), 21-22.
[32] Dörner, 43.
[33] Department of the Army, FM 7-0, *Training the Force*, 22 October 2002, p. 4-14 to 4-15.
[34] "Boyd and Military Strategy," *Defense and the National Interest*, [Online] Available from http://www.d-n-i.net/second_level/boyd_military.htm, accessed 16 April 2003.

Figure 3: Observe, Orient, Decide, Act model

Boyd's OODA "Loop"
Sketch

Note how orientation shapes observation, shapes decision, shapes action, and in turn is shaped by the feedback and other phenomena coming into our sensing or observing window.

Also note how the entire "loop" (not just orientation) is an ongoing many-sided implicit cross-referencing process of projection, empathy, correlation, and rejection.

From "The Essence of Winning and Losing," John R. Boyd, January 1996.

Defense and the National Interest, http://www.d-n-i.net, 2001

OODA loop, like the RPD method, is best suited to simple tactical situations and does not appear adequate for complex situations.[35]

Information systems development greatly expanded during the decade of the 1990s, but so did the proliferation of data and information sources available to users. The sheer volume of information has called its value into question. Rather, it is our 'attention' that has become the critical resource.[36] At the organizational level, Knowledge Management Systems (KMS) and Collaborative Information Systems (CIS) are still emerging technologies that have not fully penetrated the private sector and therefore the capabilities and benefits of such systems are not fully understood.[37] However, in its digitization efforts, the Army is seeking to quickly overcome this problem by 'corporate' transformation through the power of advanced information

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[35] Shoffner, 36. See also Carl A. Alex, *Process and Procedure: The Tactical Decision-Making Process and Decision Point Tactics,* MMAS Monograph, (U.S. Army Command and General Staff College, 2000), 21-22.

[36] Jay F. Nunnamaker, Jr., Nicholas C. Romano, and Robert O. Briggs, "A Framework for Collaboration and Knowledge Management," (*HICSS 34, 2001*), 1.

[37] Nunnamaker et al, 1.

technologies.[38]   The formal application of Decision Support System (DSS), a subset of KMS, and

Group Support System (GSS) or CIS technologies to operational art is not theoretically new but

remains an elusive concept to bring into a functional medium.[39]   Recent work within the U.S.

Army research community and private sector products reveal the current status in the

implementation of collaborative technologies in military planning and operations.

Howard Higley and Robert Harder tested GSS technology at Fort Leavenworth during the

Command General Staff College's (CGSC) "Prairie Warrior" exercise as part of the Army

Research Laboratory's project, "Collaborative Technology for the Warfighter."[40]   Though their

study did not set out to redefine the MDMP process itself, their findings demonstrate the inherent

difficulties with automating the MDMP.   The authors' main observations were that the GSS

enabled MDMP process created excessive information, most of which was not used, and that

changes to the MDMP GSS structures were not easily standardized and were subject to continual

changes.[41]   Similar to the aforementioned RAND studies, the researchers also found that the

overall operational 'picture' was difficult to develop and that automating the process did not

prevent the divergence of planning and decision processes. The staff's inability to gain a clear

'picture' of the operational environment or planning process was again noted. Some of these

problems, however, may have been the result of commanders and staff's subjective assessment of

what steps should be omitted or what should be done in order to meet mission analysis

requirements. Finally, student subjects used planning techniques they were most comfortable

with and used GSS only when required.[42]   However, in later study concerned with mapping

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[38] *United States Army White Paper: Concepts for the Objective Force*, (Washington DC: Department of the Army, 1999), 1.

[39] Tedd A. Wheeler, *Operational Art – Leveraging Information Technology*, (SAMS Monograph, U.S. Army Command and General Staff College, 2000). See the introduction for a discussion on information technology and automating aspects of the operational art i.e. systems *thinking* that Wheeler describes as Information Technology Leverage Points.
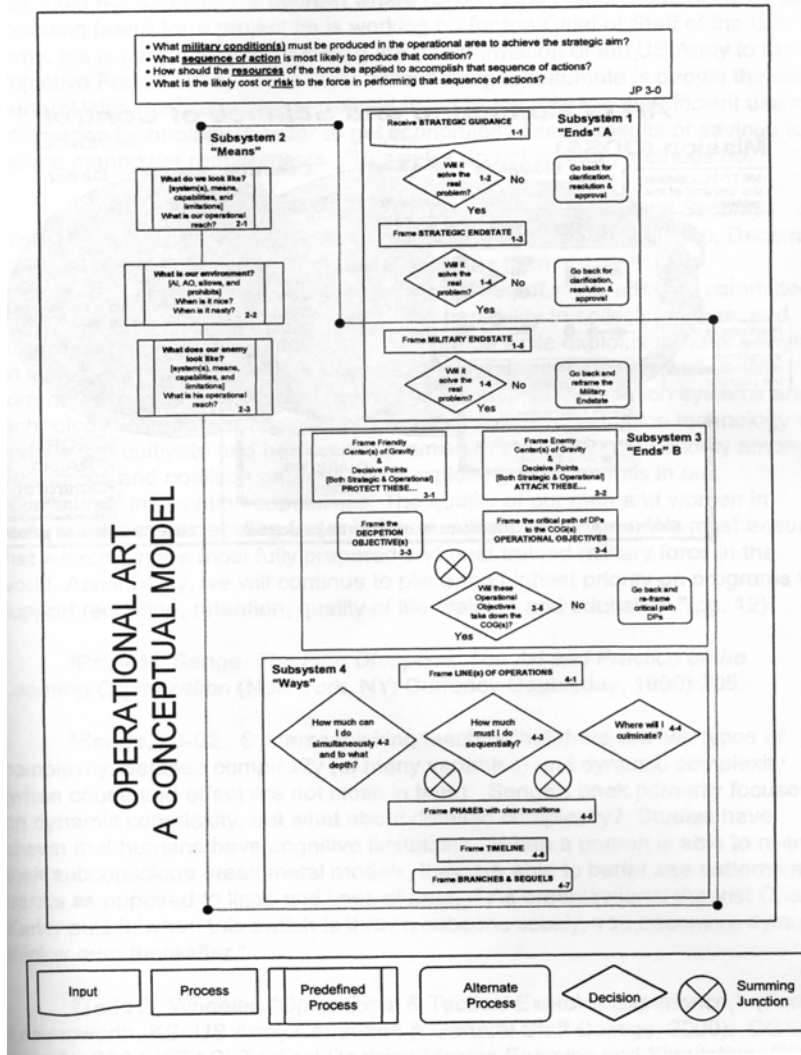
[40]Howard C. Higley and Robert J. Harder, "Tailoring an Electronic Meeting System to Military Planning and Operations, a Case Study," *Proceedings of the 36th Hawaii International Conference on System Sciences* (*HICSS 36*), January 2003, 1.

[41] Higley and Harder, 7.

[42] Ibid., 7

MDMP structure to a GSS environment, student feedback indicated that such a collaborative

system would be beneficial in an operational environment.[43] Key lessons learned included that

GSS promoted the ability to view common information simultaneously, but that it was difficult to

maintain a standardized means of collaboration. The authors cited participants' lack of

familiarity with electronic mediums and some cultural impediments that caused student resistance

to collaborate electronically. Even with these findings, the authors were confident that the next

generation of GSS software, called *Cognito*, would address the "capabilities to provide needed

Figure 4: Wheeler's conceptual model of Operational Art

[43] Howard C. Higley and Robert J. Harder, "A Group Support System for Military Mission Analysis,"

and desired improvements…."[44]

In his analysis of the integration of information technology in the operational art, MAJ
Tedd A. Wheeler developed a conceptual model for the operational art, consisting of four
subsystems where information technology leverage points may be found (see Figure 4).[45]
Information technology (IT) leverage points are processes where information technology may be
employed to achieve economies of scale or "meaningful and lasting results."[46] Though the
information technology utility of this theoretical model is not obvious, it does render potential
"leverage points" that concept-mapping and other visual concepts diagramming programs could
use when combined with data resources such as the Universal Joint Task List (UJTL) and the
Army Universal Task List (AUTL). Concept mapping tools such Concept Map software from the
Institute for Human and Machine Cognition (IHMC) are used to "organize and represent
knowledge."[47]

Though concept maps were originally developed for the psychological study of children's
learning, the program has itself become a powerful learning and evaluation tool.[48]

> Concepts are defined as a perceived regularity in events or objects, or records of events
> and objects, designated by a label. Propositions are statements about some object or event
> in the universe, either naturally occurring or constructed. Propositions contain two or
> more concepts connected with other words to form a meaningful statement. Sometimes
> these are called semantic units, or units of meaning.[49]

Concept Map's hierarchical structure and cross-linking appear suitable to visualize and describe
concepts and tasks within a strategic, operational, and tactical framework (see Figure 5)[50];
however, the current version of the software program does not contain any cybernetic feedback

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(*HICSS 36*), January 2003, 10.
[44] Ibid., 10.
[45] Wheeler, Appendix I.
[46] Wheeler, 2. Wheeler's theoretical subsystems construct and 'leverage points' are based upon the systems
thinking and leverage concepts advocated by business author Peter M. Senge in his book, *The Fifth
Discipline*.
[47] Novak, Joseph D. "The Theory Underlying Concept Maps and How to Construct Them," *Institute for
Human and Machine Cognition (IHMC)* Web Site, [Online] Available at http://cmap.coginst.uwf.edu/info/,
13 April 2003.
[48] Ibid., 2.
[49] Ibid., 1.
[50] Ibid., 1.

structure. Programs such as Concept Map, if combined with data resources such as the UJTL and the AUTL, would provide the operational semantics required to define and organize strategic, operational, and tactical concepts, tasks and effects in an overarching conceptual framework.

Figure 5: Concept Map
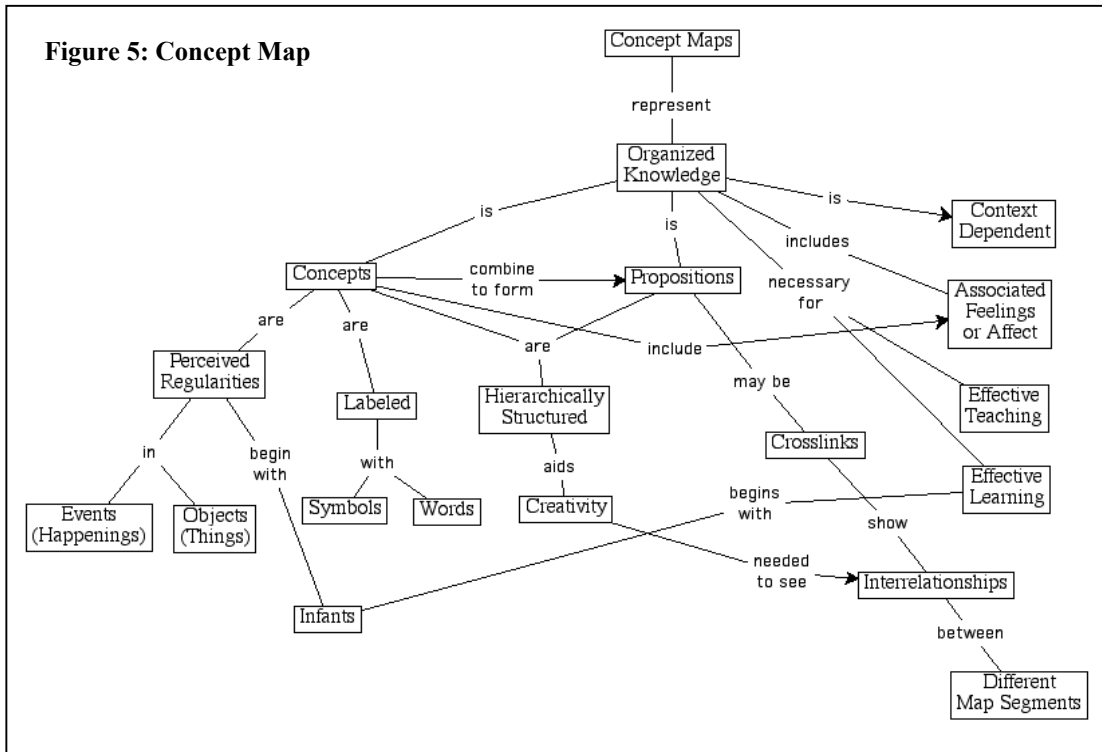
The UJTL serves as a common language and common reference system for joint force commanders, combat support agencies, operational planners, combat developers, and trainers to communicate mission requirements.[51] The UJTL, when augmented with the Service task lists, is a comprehensive integrated menu of functional tasks, conditions, measures, and criteria supporting all levels of the Department of Defense in executing the National Military Strategy.[52] The AUTL provides a "common, doctrinal foundation, and catalogue of the Army's tactical missions, operations, and collective tasks."[53]
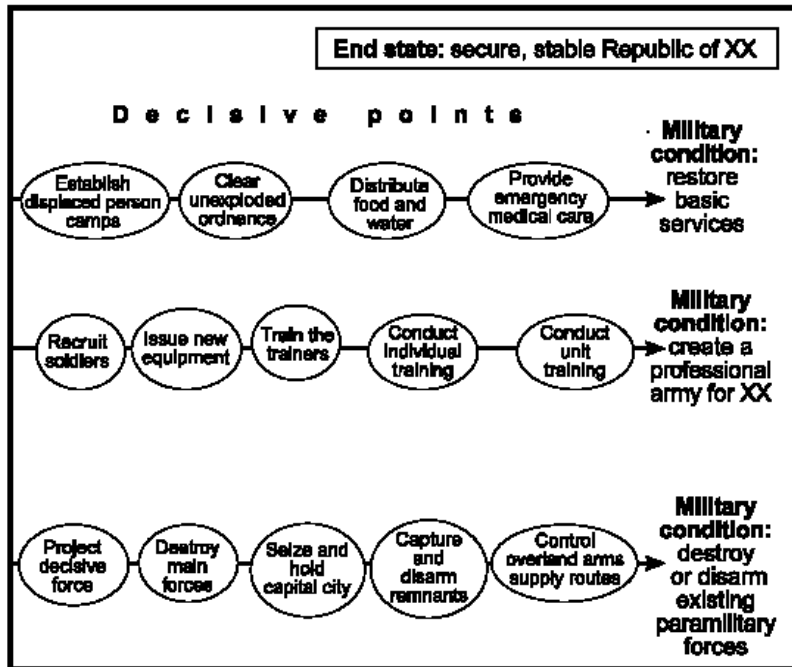
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[51]Department of Defense, Chairman of the Joint Chiefs of Staff Manual 3500.04B, *Universal Joint Task List (with Change 1),* 01 November 1999, pg. 1-3.
[52] Ibid., pg. 1-4
[53] Department of the Army, FM 7-15, *The Army Universal Task List,* Doctrinal Review and Approval Group (DRAG) edition, 18 July 2002, ix.

Figure 6: Logical Lines of Operation

The AUTL serves as the Army's single source lexicon for doctrine, combat, and training developers.[54]   Besides defining all Army tasks and functions within a joint doctrinal structure, the AUTL will impact training assessment in that it also delineates performance standards.   The AUTL not only defines each tactical task, but also defines measures of effectiveness for evaluating the task.[55]   Thus with the UJTL and AUTL it is possible to map concepts to tasks and track branches and sequels within a logical line of operation (see Figure 6). Logical lines of operation are a means of visualizing an operation by linking "multiple objectives and actions with a logic of purpose --- cause and effect."[56]

TheBrain Technologies Corporation offers another promising and feature-rich software technology that enables users to "integrate, visualize, and manage information."[57]   US Joint Forces Command Joint Experimentation Directorate (J9) used TheBrain Technologies software

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[54] Memorandum, ATZL-SWW, Subject: Staffing of FM 7-15, The Army Universal Task List (AUTL) (DRAG Edition), U.S. Army Combined Arms Center, Fort Leavenworth, Kansas, 22 July 2002.
[55] FM 7-15, ix.
[56] FM 3.0, pg. 5-9.

package called, TheBrainEKP, during a limited objective experiment (LOE) that tested

multinational collaboration and planning in a coalition scenario based in the Pacific area of

operations in the year 2015.[58] Two geographically dispersed planning teams were tasked with

developing courses of action in operational vignettes that lasted between 6 to 10 hours in length

over a two-week period.[59] J9 personnel gave favorable reviews to the software for its ability to

present relationships and information rather than mere data points. Users indicated that the

program is an effective collaboration tool that can reduce planning time and provide integrated

real-time information that shows decision relationships which enhances organizational and

situational awareness. The software, with appropriate simulation capability, is also viewed as a

potential tool to design and evaluate effects-based operations. [60]

With such programs already on the market, it is not difficult to foresee the development

of more powerful tools incorporating Wheeler's conceptual model with a

concept/object/cybernetic-mapping program (with embedded UJTL and AUTL data and graphic

terms and symbols as necessary) and the concept of logical lines evaluation. This future

technology might serve as a planning tool, allowing commanders and staff to visualize and

describe the operational framework in a systematic manner. Such a program would employ

visual object-oriented attributes and features. Concepts, tasks, or relationships could be reused or

reconfigured for more than one operation. Once operations commenced staff could easily

transition to real-time data and information tracking of the operational environment. Proposed

examples (screen captures) are shown in Appendix 1.

Advances in Information Technologies such as KMS and CIS continue to challenge

Army personnel and organizations to reap their intangible and tangible benefits. However, Army

planning and decision-making processes and the theory behind them must be understood and

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[57] "Information Plus Context Equals Knowledge," *Signal – AFCEA's International Journal*, February 2002.
[58] Ibid., 3.
[59] Ibid., 3.
[60] Ibid., 4.

changed to allow for adaptive, agile, and visionary command and planning in complex operational environments. Based upon multiple studies, the Army's Military Decision Making Process (MDMP) is a candidate for doctrinal change, but this event will likely be accompanied by changes in Army organizational culture. Integration of GSS technologies into planning is realistic, but not as a means of automating obsolete organizational processes. The army should continue to support research and development efforts to develop technologies to enhance our individual and collective ability to plan and conduct full spectrum operations.

APPENDIX I: Example Screen Views of Possible Future Operational Planning Software
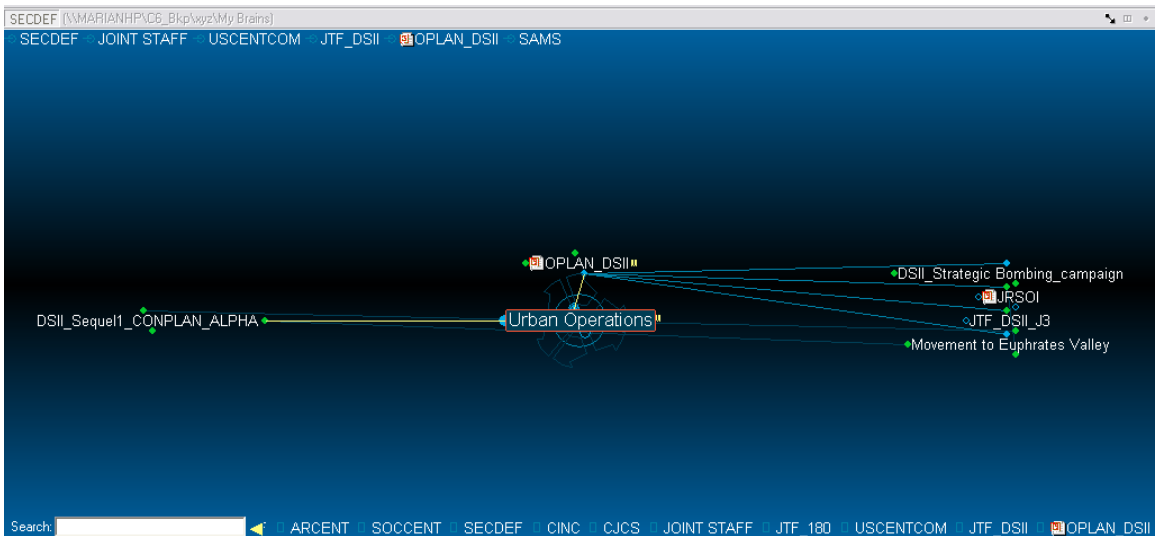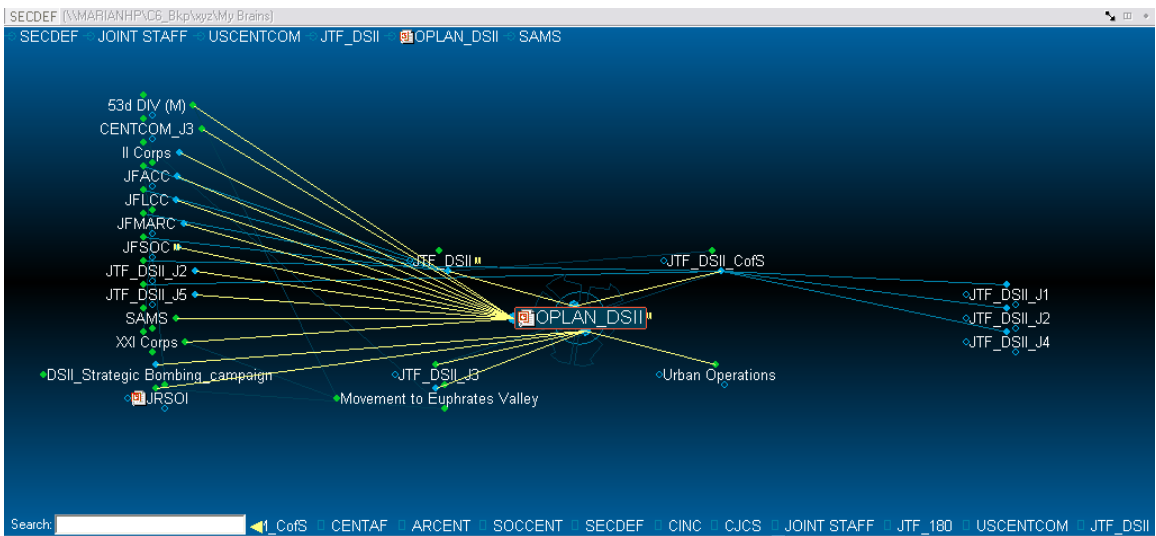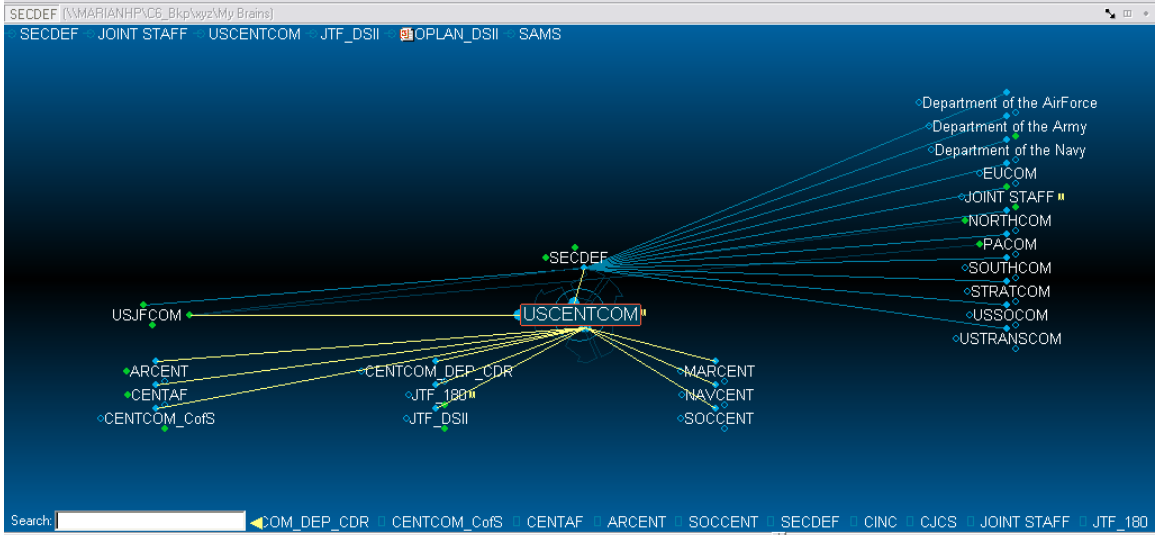
APPENDIX I: Example Screen Views of Possible Future Operational Planning Software
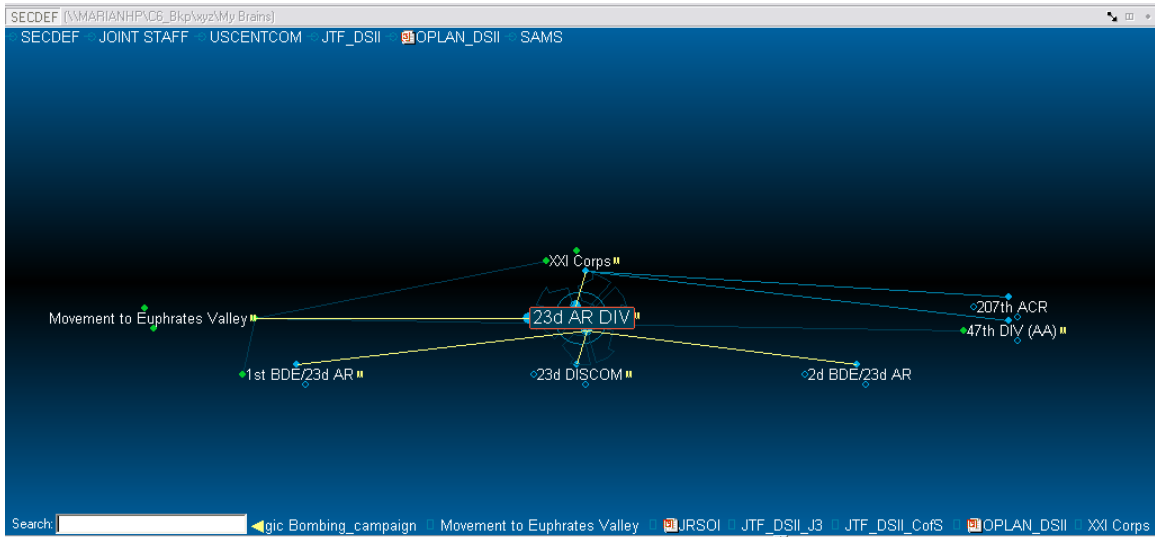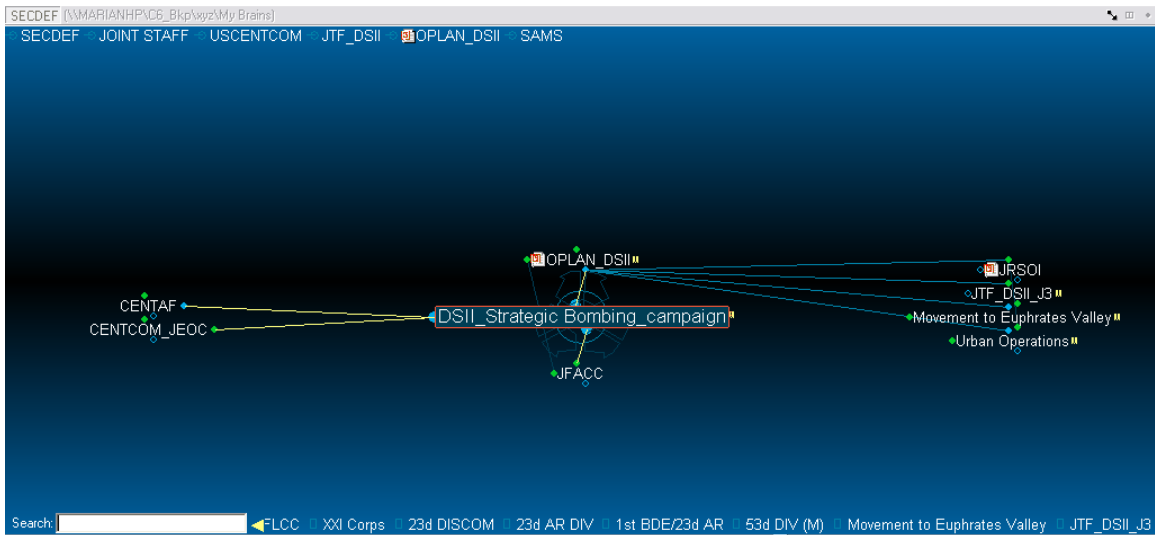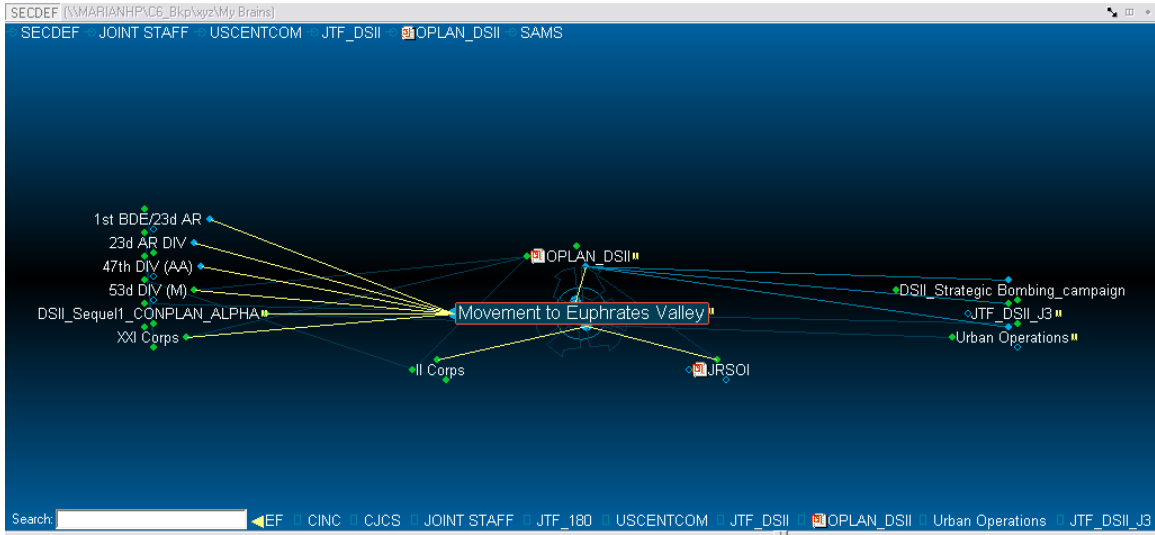
BIBLIOGRAPHY

Alex, Carl A., MAJ. *Process and Procedure: The Tactical Decision-Making Process and Decision Point Tactics*, Master of Military Art and Science (MMAS) Monograph, U.S. Army Command and General Staff College, 2000.

Bertalanffy, Ludwig von. *General System Theory*, Revised Edition. New York: George Braziller, Inc., 1968.

Briggs, Robert O., Jay F. Nunnamaker, Jr. and David Tobey, "The Technology Transition Model: A Key to Self-Sustaining and Growing Communities of GSS Users," *Proceedings of the 34th Hawaii International Conference on System Sciences (HICSS 34)*, 2001.

Briggs, Robert O., Gert-Jan de Vreede, Jay F. Nunnamaker, Jr. and David Tobey, " ThinkLets: Achieving Predictable, Repeatable Patterns of Group Interaction with Group Support Systems (GSS)," *HICCS 34*, 2001.

Clausewitz, Carl von. *On War*. Edited and translated by Michael Howard and Peter Paret. New York: Alfred A. Knopf, 1993.

Charlton, John W., MAJ. *Digitized Chaos: Is Our Military Decision Making Process Ready for the Information Age?* School of Advanced Military Studies (SAMS) Monograph, U.S. Army Command and General Staff College, 1997.

Department of the Army, Field Manual 3.0, *Operations*, 14 June 2001.

Department of the Army, Field Manual 6.0, *Command and Control (Final Draft)*, August 2002.

Department of the Army, Field Manual 7-0, *Training the Force*, 22 October 2002.

Department of the Army, Field Manual 7-15, *Army Universal Task List (DRAG Edition)*, 18 July 2002.

Department of the Army, Field Manual 101-5, *Staff Organization and Operations*, 31 May 1997.

Department of Defense, Chairman of the Joint Chiefs of Staff Manual 3500.04B, *Universal Joint Task List (with Change 1),* 01 November 1999.

Department of Defense, Joint Publication 3.0, *Doctrine for Joint Operations*, 10 September 2001.

Department of Defense, Joint Publication 5-00.1, *Joint Doctrine for Campaign Planning*, 25 January 2002.

Dörner, Dietrich, *The Logic of Failure: Why Things Go Wrong and What We Can Do to Make Them Right*. New York: Metropolitan Books, 1996.

Greer, James, "Operational Art of the Objective Force," *Military Review*, Sept-Oct 2002: 22-29.

Johnson, Phillip M., MAJ. *Visualization: Teaching the Art*, SAMS Monograph, U.S. Army Command and General Staff College, 2001.

Harder, Robert J. and Howard C. Higley, "Tailoring an Electronic Meeting System to Military Planning and Operations, a Case Study," *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS 36)*, January 2003.

_____. "A Group Support System for Military Mission Analysis," *HICSS 36*, January 2003.

Harder, Robert J., Alan E. Barrick, and Daniel Hocking, "Consequence Management Through an Innovative Use of Collaboration Tools," *HICSS 34*, 2001.

Hittle, James D. *The Military Staff, its History and Development*. Harrisburg, PA: The Stackpole Company, 1961.

Klein, Gary. *Sources of Power: How People Make Decisions*. Cambridge, MA: Massachusetts Institute of Technology, 1998.

_____. "Strategies for Decision Making," *Military Review*, May 1989

Kruse, John, Mark Adkins, and Robert O. Briggs, "Applying the Technology Transition Model to GSS Fielding," *HICSS 34*, 2001.

Murray, Williamson and Allan R. Millet, Eds. *Military Innovation in the Interwar Period*. Cambridge: Cambridge University Press, 1996.

Naveh, Shimon. *In Pursuit of Military Excellence, The Evolution of Operational Theory*. Portland: Frank Cass Publishers, 1997. Reprinted in 2000. Tel Aviv University: The Cummings Center For Russian and East European Studies.

Nunnamaker, Jay F. Jr., Nicholas C. Romano, and Robert O. Briggs, "A Framework for Collaboration and Knowledge Management," *HICSS 34*, 2001.

Pappal, Michael F., MAJ. *Preparation of leaders to make Decisions in Peacekeeping Operations*, SAMS Monograph, U.S. Army Command and General Staff College, 2002.

Shinseki, Eric K., GEN (CSA). *United States Army White Paper: Concepts for the Objective Force*. Washington DC: Department of the Army, 1999.

Schwarz, Roger M. The Skilled Facilitator: Practical Wisdom for Developing Effective Groups. San Francisco: Jossey-Bass Publishers, 1994.

Senge, Peter M. *The Fifth Discipline*. New York: Doubleday, 1990.

Shoffner, Wilson A., MAJ. *The Military Decision-Making Process: Time For a Chang,* SAMS Monograph, U.S. Army Command and General Staff College, 2000.

Svechin, Aleksandr A. *Strategiia (Strategy)*. Edited by Kent D. Lee. Minneapolis: East View Publications, 1999.

Thucydides, *History of the Peloponnesian War*. Translated by Rex Warner. London: Penguin Books, 1972.

Vandergriff, Donald. *The Path to Victory*. Novato, CA: Presidio Press, 2002.

Waldrop, Mitchell M., *Complexity: The Emerging Science at the Edge of Order and Chaos*. New York: Simon and Schuster, 1992.

Weatherall, Alan and Jay Nunamaker. *Getting Results with Electronic Meetings*. Southhampton, UK: Electronic Meeting Solutions, ltd., 2000.

Wheeler, Tedd A., MAJ. *Operational Art – Leveraging Information Technology*, SAMS Monograph, U.S. Army Command and General Staff College, 2000.

INTERNET SOURCES

Groupsystems Web Site, http://www.groupsystems.com,

"IHMC Concept Map Software," *Institute for Human and Machine Cognition Web Site*, http://cmap.coginst.uwf.edu/docs/, 13 April 2003

"Mind Mapping and Visual Concepts Diagramming," *Mastermind Explorer Web Site*, http://www.masternewmedia.com/issue22/mind_mapping.htm, 30 November 2002.

Novak, Joseph D. "The Theory Underlying Concept Maps and How to Construct Them," http://cmap.coginst.uwf.edu/info/, 13 April 2003.

TheBrain Technologies Web Site, http://www.thebrain.com,