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In Search of a Combat Theory: The Tactical Utility of TMCI's Military Combat Theory

A Monograph
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ABSTRACT

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If the end objective of theory and doctrine is to generate combat power then TMCI's integrated approach of art AND science functions more usefully for the commander than does current U.S. tactical doctrine. TMCI's proposed model shows the commander the components and linkages of combat whereas current U.S. doctrine chiefly supplies a listing of imperatives with questionable utility. By grouping combat variables and analyzing their interaction TMCI both quantifies important combat intangibles and reduces the number of variables with which a commander must deal. Freed from the overwhelming immensity of combat unknowns, the commander is actually freer to practice his "art", and in a more informed way.

TMCI's <u>Military/ Combat: Theory, Practice, Modeling</u> has the big potential to change how we train commanders, design force structure and employ tactics within the U.S. Army.

SCHOOL OF ADVANCED MILITARY STUDIES

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To become both wise and courageous one must acquire a method, a method to be employed in learning as well as in applying what has been learned.1

INTRODUCTION
A New Combat Theory Proposed

Military combat is what military officers must learn, yet no comprehensive theory on combat exists in the West which has utility both in the classroom and in the field. Tactical analysis in the U.S. Army lacks a rigorous methodology and language, giving us imprecise procedures for the Commander's Estimate. Moreover, current techniques for generating combat power have proved inadequate. Combat power is a critical and potentially quantifiable component of the estimate that is left completely to a commander's "art".

With little fanfare to date, but with revolutionary implications, The Military Conflict Institute is developing a combat theory that offers both methodology and quantitative models for tactical studies and decision-making. The Institute's work breaks new ground in its attempt to synthesize the art and science of combat into an integral, holistic concept of war. It is an approach that should make the art of combat more calculable and the theoretical linkages between combat and other components of war better understood. If found tenable, this theory could significantly impact upon how we train, equip and employ tactical forces.

TCMI's Military Combat: Theory, Practice, Modeling, incomplete as of December 1989, is already conceptually significant and merits immediate discussion among combat professionals. This paper will 1) look at the art versus science development of combat theory for background; 2) compare TMCI's theory approach to U.S. doctrine in general terms; 3) give an overview of TMCI's combat theory; 4) discuss TMCI's theory relative to combat power; and 5) cite possible impact of TMCI's theory on the U.S. commander's decision/estimate process.

BACKGROUND
Art Versus Science

War as a topic has been dealt with at length by various philosophers and practitioners, including such greats as Sun Tzu, Jomini and Clausewitz. For the most part, these authors focused on the big picture of war and gave military combat only cursory attention as a subcomponent. Most saw military combat as a set of numerous variables too many to control and, therefore, to be dismissed to the realm of the commander's art. Clausewitz's profound influence on Western military thought seems to have directed our prejudices toward art and away from quantitative theory:

> Given the nature of the subject, we must remind ourselves that it is simply not possible to construct a model for the art of war that can serve as a scaffolding on which the commander can rely for support at any time...; talent and genius operate outside the rules, and theory conflicts with practice.2

Actually, Clausewitz argued for a more objective methodology in combat studies, but the limited science of his day precluded it. Even the "prescriptionist" Jomini yielded to the inevitability of commander's art at the tactical level.

The first attempt in the West to categorize the variables of combat into a science-based theory was by J.F.C. Fuller in post World War I England. He codified the seminal Principles of War in The Foundations of the Science of War, but he, too, was limited by state-of-the-art analytical techniques. Although, Fuller never quite formulated a scientific theory of combat, he held that:

> ...if we are disallowed a science of war, we can have no true history of war, only a 'terrible and impassioned drama'... We require not merely a chronology of past events, but means of analysing their tendencies- means of dissecting the corpse of war, so that we may understand its mysterious machinery. To deny a science of war and then to theorize on war as an art is pure military alchemy, a process of reasoning which for thousands of years has blinded the soldier to the realities of war, and will continue to blind him until he creates a science of war upon which to base his art.3

The Soviets take an "all science" tack toward combat theory, having taken Fuller's "science of war" to the extreme. They believe all variables can be reduced to formula, leaving little or no room for a commander's art. After Stalin's death, Soviet military science burgeoned into a disciplined field based strictly on the "laws and regularities of war as armed struggle".[4] Analyzing war in scientific terms fits the scientific materialism of Soviet political philosophy and has made for a more complete paradigm.

U.S. doctrine, or Airland Battle, on the other hand, has no encompassing combat theory which can be tested and used for objective tactical analysis. Combat decision is generated solely by the commander's "art" in manipulating set principles and conditions of war as he sees fit. Given the Western love affair with technology and science, it may seem odd our doctrine leans to military art, while the "backward"

Soviets rely on science.

The technological, scientific solution to U.S. military problems appears to stop at weapons and hardware development- perhaps, this is in reaction to the McNamara era. We use PERT charts and employ analytical techniques throughout American society, but quantitative analysis and professional military judgement have always been treated as near opposites within our military.

Current theories of combat, then, fall into either of two categories- philosophy/art or prescription/science. The real difference between the U.S. and the Soviets in the art versus science debate lies in the use of analytical techniques. "At the tactical and operational levels, [the Soviets] see themselves more as engineers, applying the fruits of scientific process".[5] Americans are the artists, perhaps more so now than ever, given the popular resurgence of operational art in the U.S.

Shortcomings of All Art, All Science

Either approach of "all art" or "all science" has inherent problems and limitations. The Soviets' strict science can engender rigid models of combat that allow for no unknowns to be resolved by the commander's art. Commanders need flexibility in the field to accommodate change that fixed numbers and static "norms" do not yield. Their inflexible combat model constructs, also, can place entire tactical combinations at risk if any underlying assumption proves incorrect.

Where the Soviets try to analyze all the variables in combat, the Americans are too selective in assigning variables to combat models. Most U.S. simulations focus on hardware effectiveness, disposition of the forces, and numbers. Our preoccupation with numbers stems from Lanchester's Laws, which have exerted undue influence over U.S. simulations and doctrine. Meanwhile, such "intangibles as quality of leadership, troop esprit, and level of effectiveness"[6] - or all the things a commander is supposed to mentally compute during the command decision/estimate process- are ignored by these selective models. Somehow we expect a commander to assign values to "intangibles" that we also claim, incorrectly, he cannot do in an analytical and objective manner.

Lack of a scientific method not only hinders efficiency, it degrades the validity of our base-line beliefs. Various models and assumptions of our "ground truth" have been too readily accepted "as truth without subjecting them adequately to comparisons with historical experience or common sense."[7] Despite his positing that "theory conflicts with practice",[8] Clausewitz believed history provides a necessary data base and laboratory for the military theorist.

"Historical examples clarify everything and also provide the best kind of proof in the empirical sciences."[9]

Combat theory should neither neglect history, nor misuse it. Clausewitz cautioned theoreticians against using specific examples that are the exception and not the rule. For this reason, the Soviets arrive at their "norms" by incorporating a large data base of military conflict. They use the "Great Patriotic War" for their primary data base, a base which has proved deep but too narrow. The U.S. military has no systematic cataloguing of combat experience for use in tactical analysis. We cite history only randomly and without strict methodology.

Synthesis of Art and Science

TMCI has created a third approach to combat theory, trying for a balance between art and science and reconciling our current problems with selective and inadequately grounded models. Using the advantage of modern tools of data collection and analysis, TMCI's theory proposes to fulfill Fuller's objective of identifying and modeling most variables of combat. "Norms" will be derived from an historical data base developed by Col. Trevor Dupuy's research group- the Historical Evaluation and Research Organization, HERO. This base will be not as deep but will be broader than that of the Soviets.[10] Above all else, the theory's established methodology should yield consistent and truer output.

By quantifying as many combat variables as possible to reduce the number of unknowns, TMCI's approach narrows the focus for the commander. He applies his art to a smaller number of variables and is not so overwhelmed by his job of processing data and making decisions. This is especially crucial in his mission of generating combat power which becomes a more quantifiable task. Important, too, is that TMCI's models give flexible parameters to the commander and do not constrain hi with "norms" set in concrete.

IN SEARCH OF A COMBAT THEORY
U.S. Tactical Doctrine

Any new quantitative theory of combat can anticipate a certain amount of institutional resistance, especially in an era of the art of war. At the same time, renewed interest in Clausewitz and the operational art have helped bring to light the glaring deficiencies in an "all art" and scientifically undisciplined approach. There is growing concern over the numerous unknown and untidy combat variables that can overwhelm a commander's art. But the fact remains, even if most of these variables were assiduously assigned values, there would be no model to plug them into. We have no theoretical framework for evaluating combat components.

U.S. tactical doctrine is seriously flawed in the sense that it is only a detailed listing of traditionally held "truths"; it has no foundation of theory derived by scientific method and capable of producing useful models. The nine principles of war, along with other lists of tenets, imperatives and operating systems, form the basis of our combat doctrine.[11] Such listings are long on description, but short on analysis. Maxims and principles help to organize and act as inputs for theory, but they do not constitute a theory of military combat.

FM 100-5 claims that these principles have stood the tests of analysis, experimentation and practice. "The principles of Airland Battle doctrine reflect past usages in the U.S. Army and the tested ideas of past and modern theorists of war."[12] But practice and the test of time are the only valid tests that have been used. Analysis and experimentation are virtually useless without a sound theoretical foundation to verify or deny hypothesis.

A major and unreliable source of our doctrine comes from simulated combat scenarios out of The National Training Center. By raising questions or by confirming very specific variables, such as the impact of new technology or thought, simulation is valuable in training and in testing doctrine. The results of simulations, however. do not provide a suitable data base for theory, since key elements, such as "fear", are missing. The only valid basis for doctrine and its foundational theory is real combat experience.

Theory as a Black Box

If U.S. doctrine lacks a framing combat theory, just what is a theory and how should it work? TMCI sees "theory" as "an attempt to describe and explain why reality works the way it does".[13] Theory does not mean "mere hypothesis, speculation, (or) conjecture"[14] as commonly perceived, nor should it connote a non-functioning, static set of concepts.

Ideally, a successful theory functions like the proverbial "black box". Input of problems/questions and givens is worked upon by a process in the box to produce an output of solutions/answers. The "Principles of War" as outlined in FM 100-5 is a form of output, but without the explanation of process.[15] When Clausewitz said, "It is the task of theory, then, to study the nature of ends and means",[16] he understood the importance of learning process as well as achieving output.

Tactical combat commanders need a forecasting tool rather than a descriptive enumeration of the principles of war. As such, they need not only to know answers, but how to derive them, if they are to respond flexibly to the conditions of combat. TMCI emphasizes the importance of "process" in its definition of a "theory of military combat":

> ...a systematic description and explanation that provides or enables communicable understanding of how groups of people fight each other, and why they succeed or fail- win, 'lose or draw'- in a battle arena. Such a theory must describe and explain the processes and operations of battle (what goes on), whatever the numbers of people or nature and number of weapons that each side uses or has in reserve. It cannot be just a list of causes.[17]

Still, the black box needs data before "process" can begin, and combat provides endless opportunity for listings. The large number of variables in combat led Clausewitz to develop the concepts of "friction and chance" and reject the possibility of formulating a scientific theory of combat in his time. The complex and dynamic nature of armed conflict is reflected in the some two thousand combat variables that since have been identified.[18]

J.F.C. Fuller

TMCI uses an approach pioneered by Fuller that clusters and hierarchically orders variables of combat. Fuller believed the key to any combat theory lies in the decomposition of the whole into sets of manageable categories of activities and elements with their associated attributes. From a set of variables and lists, Fuller formed three categories of control, resistance and pressure. These he then amassed into a single law- the Law of Economy of Force. Fuller used concepts on the nature of man, the "Law of the Conservation of Military Energy", the nature of warfare, and the nature of the moral domain on which to base his groupings.[19]

To produce output, listings and groupings undergo "process" in the black box as they interact with each other [Fig. 6-2, 6-3]. Describing this interaction among groupings and showing their interrelatedness is basic to the combat theory of both Fuller and TMCI. Although the U.S. adopted Fuller's Principles of War, we failed to capture the interactive essence of his work. We settled for a listing, instead of using his principles to develop a dynamic system for understanding combat. The Soviets, on the other hand, made good use of Fuller's approach, as did the Germans.

Fuller's theory was seriously hampered by the lack of tools to identify and manipulate the many variables of combat in a comprehensive quantitative analysis. He could not adequately model the complex interaction among groups of combat variables. He developed, instead, an intuitive and non-verifiable construct in which the modeling is too simplistic and the theory mostly descriptive.

Taking cues from Fuller's work, TMCI accomplishes what Fuller could not. Where Fuller was a man working alone, TMCI's theory is a collaborative effort of leading theoreticians. TMCI has access to a broader

Figure 6-2
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CLUSTERS & HIERARCHIES OF
VARIOUS PROPOSED TERMS FOR COMBAT PRINCIPLES

CONTROL OF OWN FORCE:

- Objective
- Unity of Command/Coordination
- Span of control
- Simplicity
- Cohesion/Morale
- Protection
- Information (on one's own force state and disposition)

DEALING WITH OPPONENT:

- Security/Warning,
- Surprise/Readiness, Deception
- Initiative (to maintain Offensive)
- Reconnaissance
- Superior Execution/Superior Force/Flexibility/Creativity
- Unpredictability/Establishing Conditions for Surprise
- Timeliness
- Intelligence (on enemy forces state and disposition)
- Initiative (relating to opponent)/Offensive

OPTIMAL EXPENDITURE OF RESOURCES:

- Economy of Force
- Maneuver [/obstacles?]
- Concentration/Mass vs. Dispersion
- Sustainment/Logistics
- Reserves (maintain; when to commit; when to commit everything to achieve desired results)
- Reconnaissance ["Maskirovka"] [? = camouflage. Should be "Razvedka"? or is "Maskirovka" a set of activities of cover, concealment and detection to detect enemy reconnaissance and surveillance activities?]
- Offensive/Defensive

ALLOCATION ISSUES:

- Between Offense, Defense, Reserves
- Maneuver (for timely concentration at decisive place; disperse as appropriate).
- Sustainment/Support

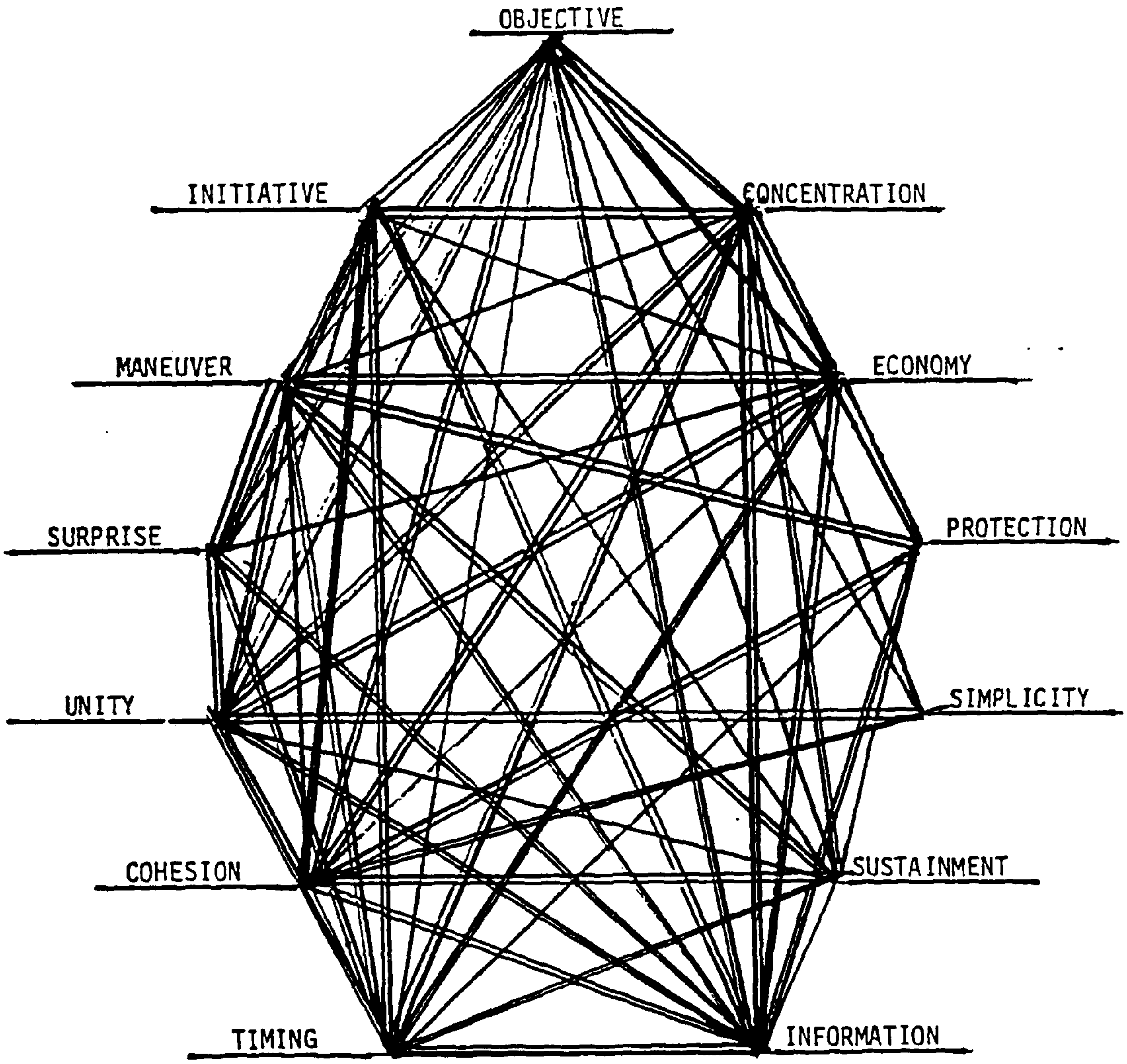
CHARACTERISTICS AND TRAITS OF PLANS, ACTIVITY:

- Simplicity
- Timeliness
- (Decisiveness)

Figure 6-3

INTERRELATED PRINCIPLES OF COMBAT

The lines drawn show specific, easily describable relations between the short term for the principles involved; the point of the figure is to show the interrelatedness of <u>all</u> of the principles of combat/war:



depth of data and better quantitative methods. Its models of combat, as a consequence, should attain a high degree of resolution for use in tactical problems. TMCI may have created the "black box" we need in both combat studies and the field.

TMCI'S COMBAT MODEL
Structure

TMCI's new theory is built upon inductive logic, in a vein similar to Fuller's approach. This is a fundamental departure from the deductive nature of today's U.S. doctrine which derives specific tenets and factors of combat from accepted base-line principles. In contrast, TMCI orders the specific variables of combat into more generalized and interrelated groups. They then model the interaction of these groups in an attempt to reflect the activity and nature of combat.

To construct a model, TMCI takes identified variables of combat and groups them into categories of activities, elements, and attributes. These three groupings are further classified into "combat significant entities": Elements and their attributes are grouped together into "combat entities", while activities are aggregated into eight "primary combat functions".

The combat entities and functions are then arranged into a "time-fixed, two-sided construct". This construct gives feedback that relates combat outcomes to missions and objectives for both sides, creating a static snapshot of combat. To replicate the dynamic nature of combat, a time continuum can be approximated with multiple overlays of this construct.

The resultant model resembles a "black box" with input, process and output functions. Inputs are initial combat conditions. Process is the black box itself which is fixed and acted upon by the interacting elements and activities of combat inside it to produce "change". Output is this computed "change" in terms of relative combat power. The box should be able to tell us "victor and vanquished" within given constraints.

Elements and associated attributes are fixed, quantifiable variables at the start of combat which act as inputs to the box. They represent the initial conditions and contextual constraints that a commander must work within, and upon which he can exert little, if any, influence. In a specific situation, these variables become "givens" to a combat situation and are quantifiable at any given time if the model is constructed with enough data. Inputs to a combat situation include: scenario, physical environment, manpower, materiel, organization and structure of forces and operations concepts.

All combat activity, which occurs inside the box, is accounted for by the following primary functions and their counter-activities in the eight functional domains (see Appendix A): command and control, communications, information and intelligence, movement and maneuver, psychological warfare, fire, protection and cover, and logistic support.

These eight domains are further classified into three major subheadings: "active combat"- psychological warfare, movement and maneuver, and fire; "C^3I"- command and control, communications, and information and intelligence; and "logistics"- administration and other logistic support.[20]

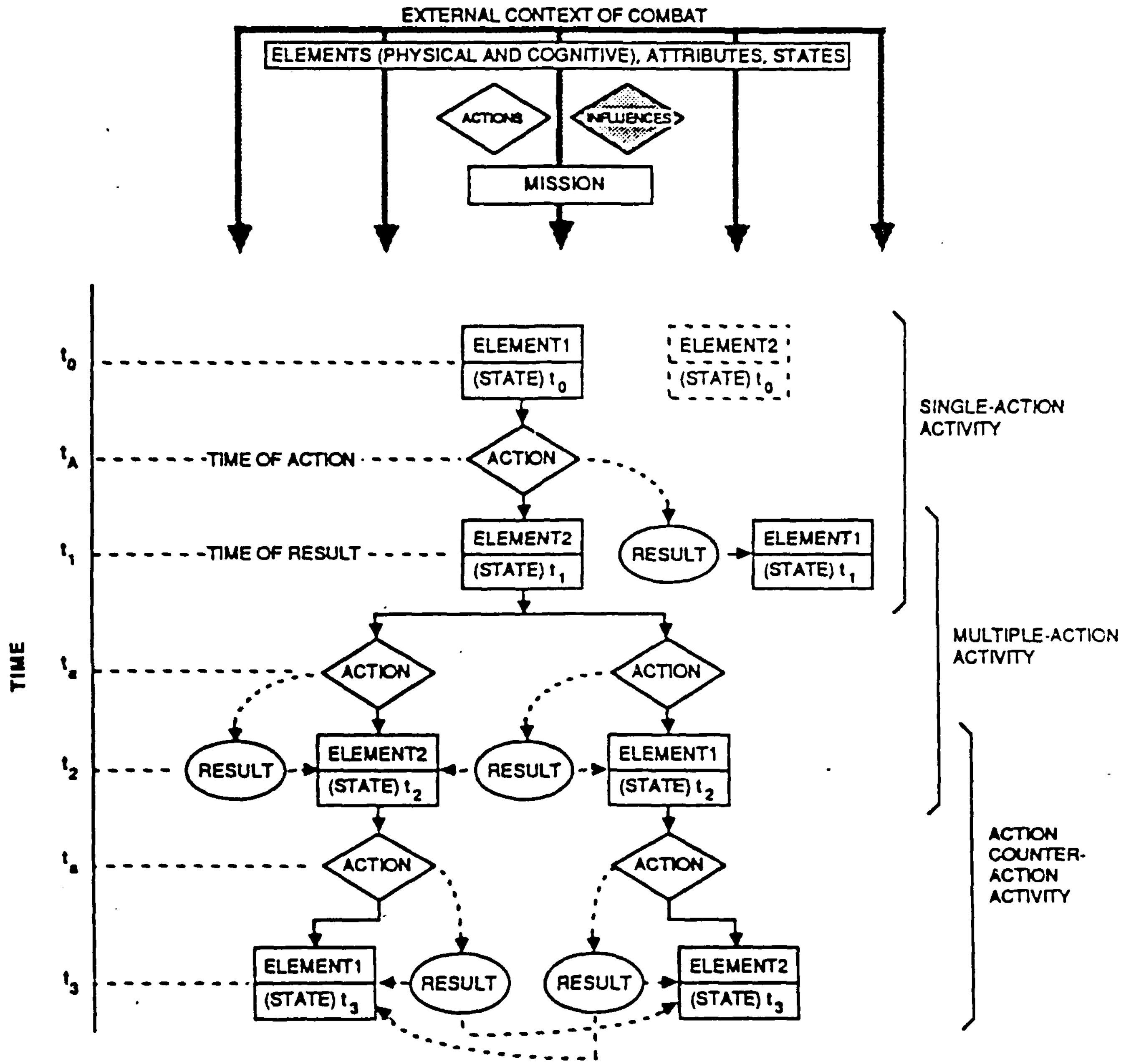
Model Dynamics

Combat elements, attributes and activities are interactive in TMCI's model (see Appendix B). Actions operate on elements to effect a change of state, or a change of attributes. This element-action-element dynamic represents activity in combat, as illustrated in Figure 9-1. TMCI postulates that combat structure is a "circumscribed activity system".[21]

In their model, the three functional groups of active combat (which includes tactics), C^3I and logistics interlock with each other. The degree of their interrelatedness varies with time and circumstances during combat as they effect changes of attributes. Their interaction is depicted in a one-sided time-fixed cross-section of combat in Figure 9-4.

Figure 9-1

BASIC RELATIONSHIPS (MICROSTRUCTURE) OF ELEMENTS, ACTIONS, RESULTS

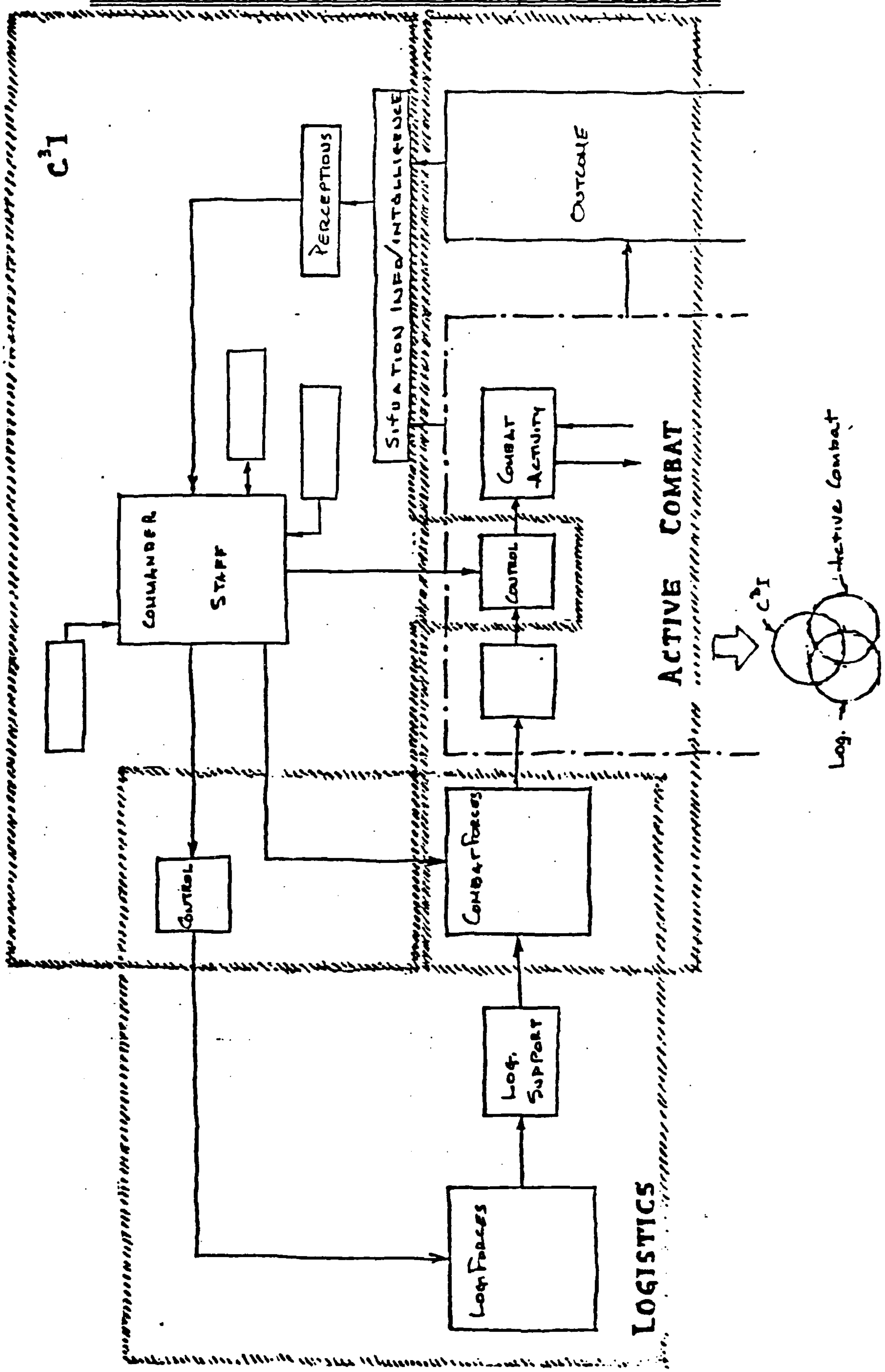


LEGEND

ELEMENT (STATE)	SINGLE OR AGGREGATE ELEMENT WITH A PARTICULAR STATE CHARACTERIZED BY ELEMENTS ATTRIBUTES, SPATIAL POSITION AND TIME
ACTION	ACT PERFORMED BY AN ELEMENT ON ONE OR MORE ELEMENTS, INCLUDING ITSELF
RESULT	RESULT OF AN ACTION WHICH EFFECTS A CHANGE OF STATE OF THE ELEMENT

Figure 9-4

INTERRELATIONSHIPS OF ACTIVE COMBAT, C^3I & LOGISTICS



Interconnected loops represent the varying "weights" assigned by the commander to each group.

During combat, both sides are primarily engaged in fire and maneuver activities against each other's elements, with resulting attrition, suppression and neutralization. Movement functions may occur between the forces, as a result of combat actions.[22] Figure 9-3 illustrates this concept for a fixed cross-section of time.

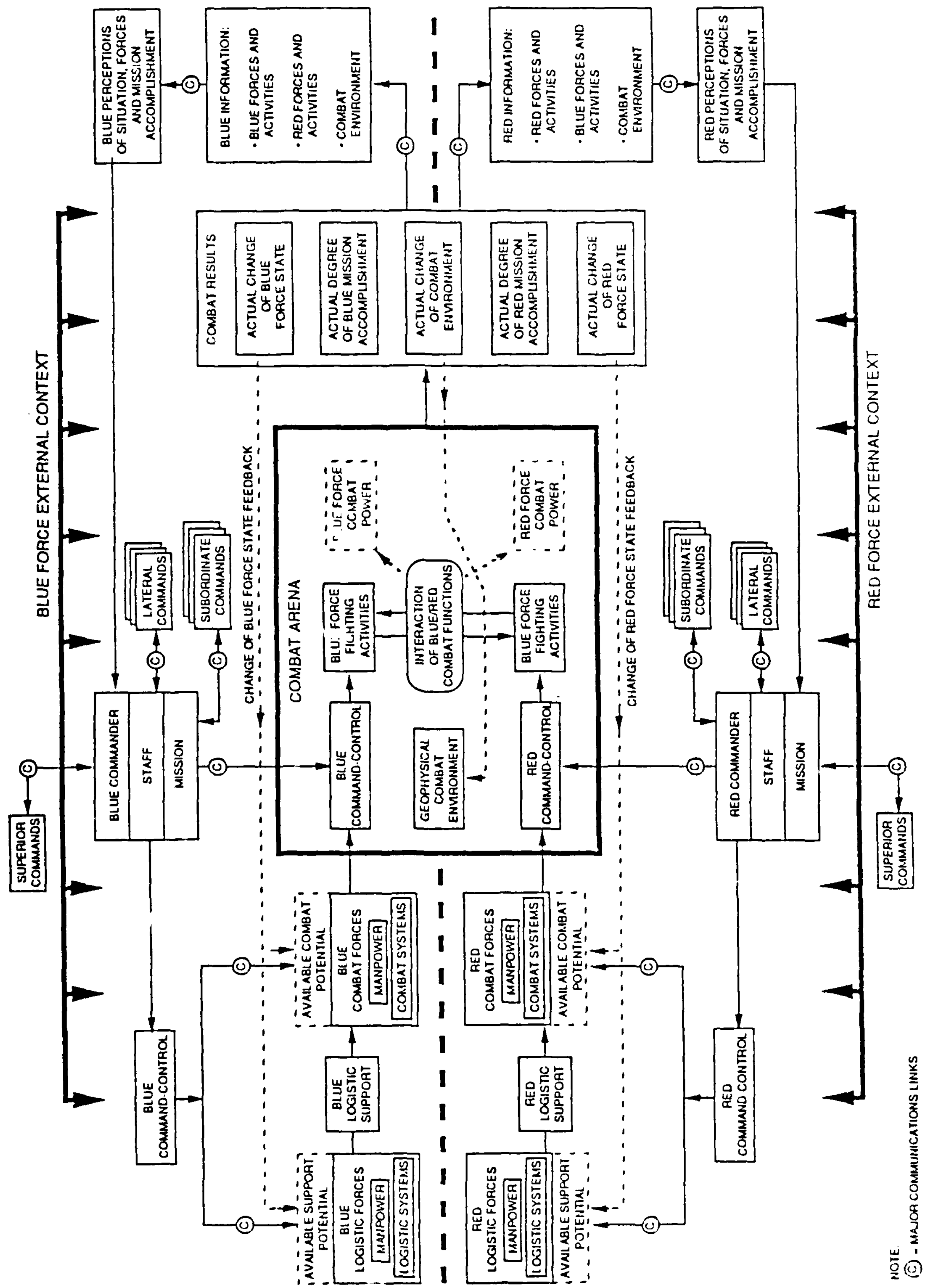
Despite the appearance of a symmetrical process in Figure 9-3, initial conditions and contextual constraints affect the opposing forces' behavior in combat. These constraints include: missions and objectives; strategy; posture; weapons and mixes of weapons, equipment; force levels and mixes of forces (organization); operations concepts; tactics; quality of personnel (morale, will, leadership, training, readiness, fatigue); and logistics.[23] The ability to accommodate asymmetries of the opposing forces' activities and behavior within their symmetrical combat dynamics shows the flexibility of TMCI's model.

Model's Utility

If a commander could isolate a "time frame" of combat, he would then be able to analyze the impact an activity has upon an element. Given enough data, a

Figure 9-3

GENERALIZED TIME-FIXED CROSS SECTION OF MILITARY COMBAT



complex analysis of many elements becomes possible.

Figure 9-2 represents a firefight scenario between two tank platoons. This model allows for a running narrative explanation as well as for an analysis of the combat in a fixed-time cross-section as outlined by "t= t1" in the example. The firefight model demonstrates specific tank on tank (element-action-element) engagements with the larger platoon on platoon fight. Analysis of any action at a specific point is possible.

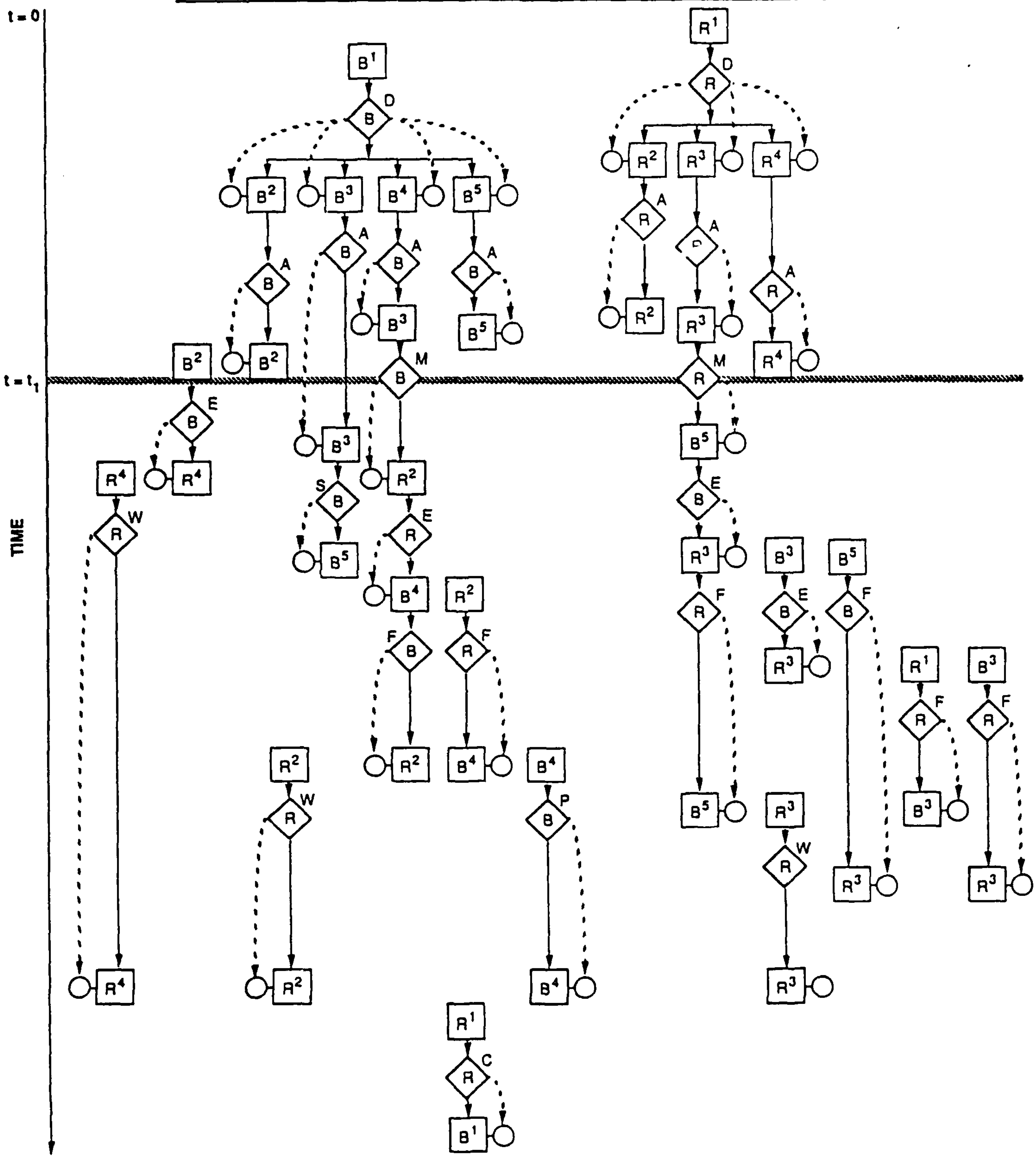
Developed from Figure 9-2, Figure 9-3 is a more generalized fixed-time cross-section of combat showing the process of combat. Figure 9-3 is an important model for TMCI'S theory in that it explains the "why" of happenings instead of being just a sequential description of events, as in Figure 9-2.

A commander should also be able to examine the behavior of combat over time. Figure 9-10 illustrates how time as a variable affects combat in TMCI's model. Figure 9-5, a simplified version of Figure 9-3, is represented as multiple time-fixed sections of combat in which activities impact and change elements of both sides in each frame. Over time, the results of combat become apparent, but TMCI's models make possible the analysis to determine the "critical time".

Few models and exercises today will allow for a constant updating along the timeline of both blue and red forces. If a commander understands the fixed and

Figure 9-2

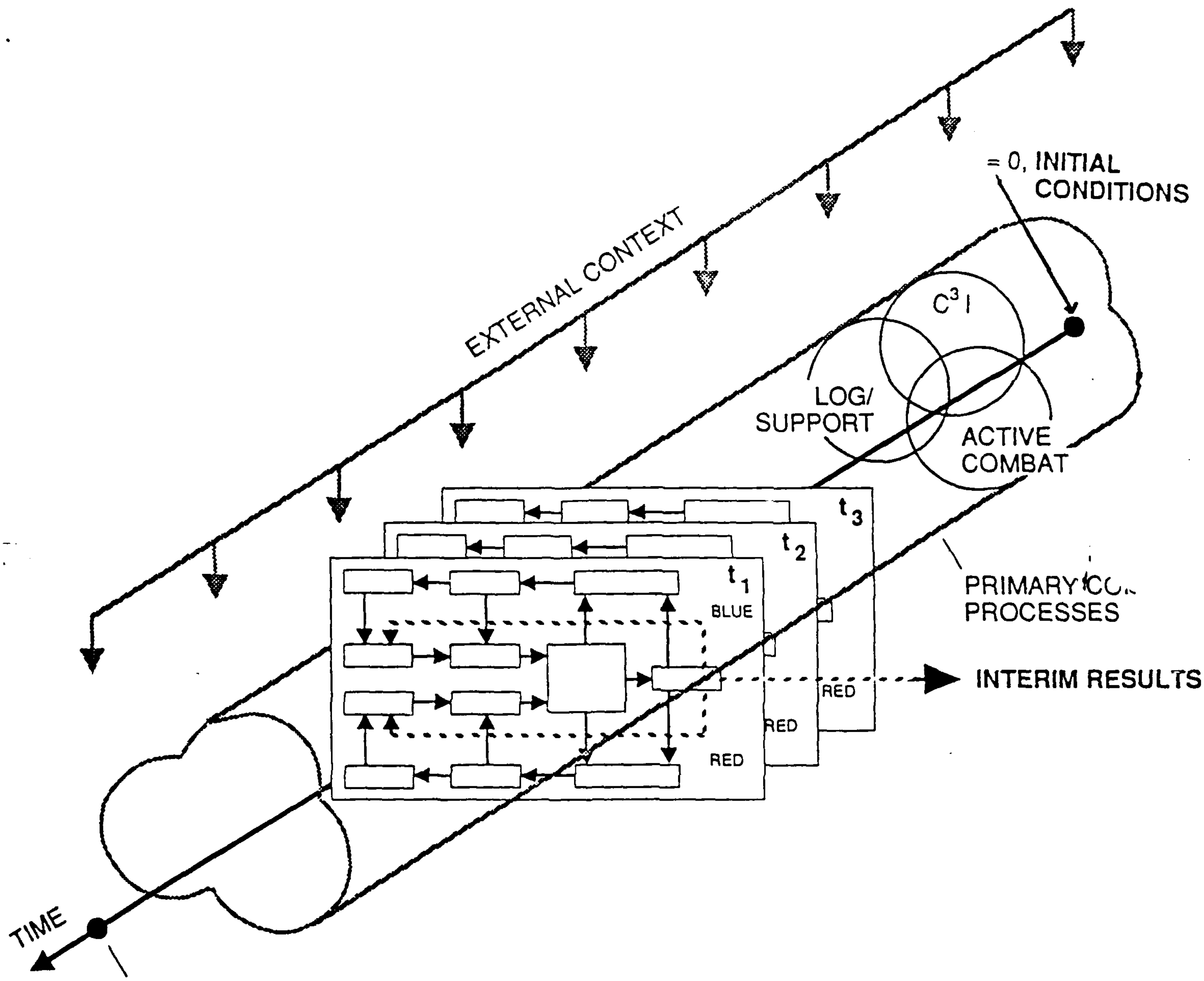
TIME HISTORY OF ADVANCE, FIREFIGHT, WITHDRAWAL, CAPITULATION



Element	D = Directive	S = Reinforce	B^1 = Blue Force Command Element
Action by Blue Force Element	A = Advance	W = Withdraw	B^2 to B^5 = Blue Force Elements
Action by Red Force Element	M = Maneuver	P = Pursue	R^1 = Red Force Command Element
Result	E = Engage	C = Capitulate	R^2 to R^4 = Red Force Elements
	F = Fire		

Figure 9-10

COMBAT STRUCTURE IN THE TIME CONTINUUM

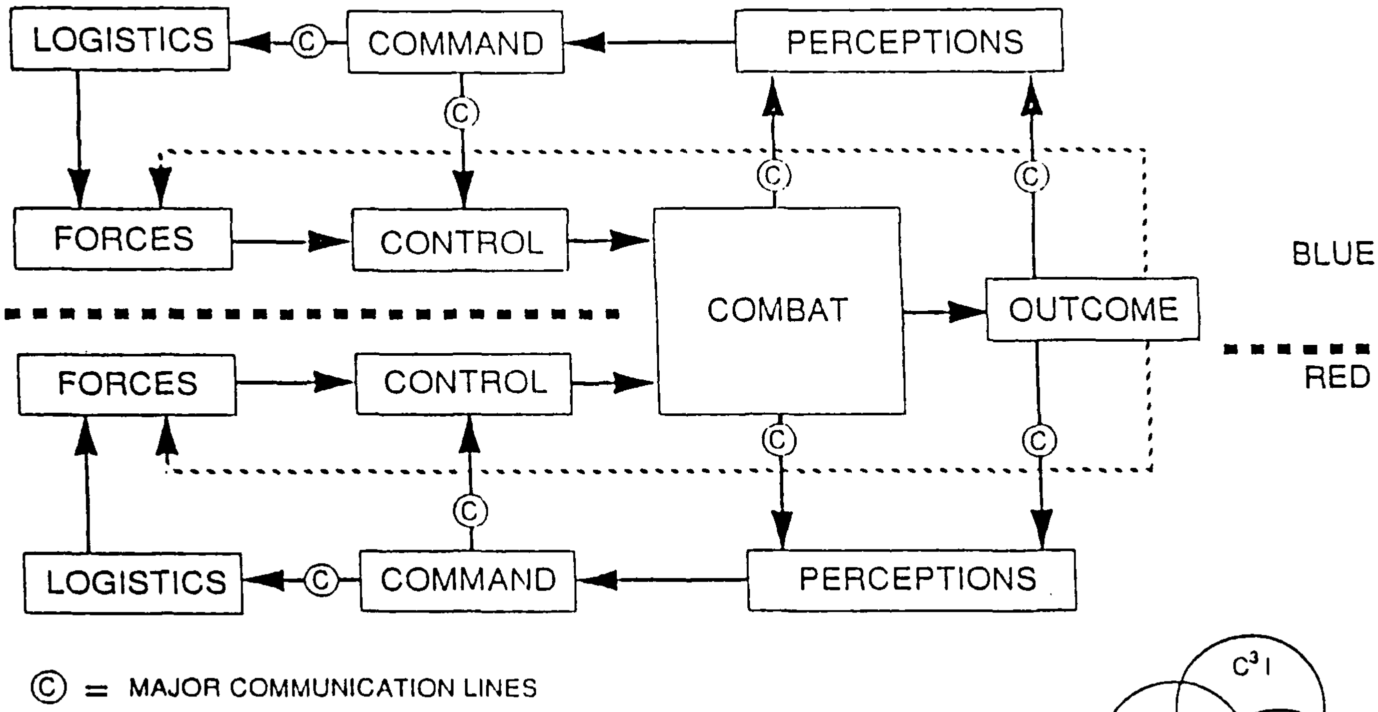


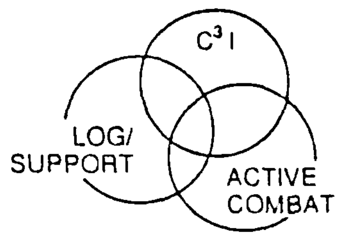
NOTE: C^3I combat and logistic support are not 'stove pipes', but their diameters will expand and contract over time.

Figure 9-5

TIME-FIXED CROSS SECTION OF COMBAT (SIMPLIFIED)

Artigiani - I don't understand this line. Why is it dotted? Why does it only touch forces directly? The forces it touches have already been changed in a combat/outcome anyway.





multiple time frame concepts in TMCI's model, he can begin identifying variables he might affect in the combat arena. He can use the dynamic of element-action-element to determine changes in attributes of the elements.

The concept of the three interlocking functional groups of active combat, C^3I and logistics helps to quantify the command- decision estimate process. Here lies the art of combat, the focal point for the commander. As the groups' interaction varies with time and circumstance, the commander can weight each accordingly, in his attempt to generate more combat power with fixed constraints. Up to this point, TMCI has attempted to quantify all variables with a scientific approach, but now yields to the realization of a commander's creative potential: his art.

COMBAT POWER

The promise TMCI holds for the tactical commander is the ability to generate combat power, which TMCI defines as:

> Results from synergistic mix of combatants in units with their weapons, equipment, supplies and support, when applied as force against opposing forces; varies over time and space, increased/decreased by internal/external environmental factors, entropic process of enemy induced attrition and neutralization, internal friction, loss of cohesion.24

Figure 9-3 demonstrates this synergistic process within the box, or "combat arena". The commander can task organize combat systems into a force which has measurable performance characteristics and capabilities that create a synergistic effect and total more than their sums. This combat potential, which Dupuy and others believe can be calculated, as well, has an index of combat power.

The commander must further refine combat potential into "Realizable Combat Potential", a more realistic measure that reflects "real life" contextual factors such as weather, terrain, exhaustion and other constraints in the combat arena.[25] Most constraints come under elements and attributes, which affect combat more through establishing the constraints and boundaries at the initiation of combat.

The dynamic components of combat are activities. Activities are the means to generate more combat power. As Figure 9-3 of the combat arena shows, the interaction of blue/red combat functions results in a change of attributes for the elements, i.e., a change in combat power. This is the duality of combat which determines the combat power of each side.

The relative nature of combat is a useful construct for the tactical commander. The latest conceptual model for TMCI's theory, Fig. 9-10, demonstrates the change in combat power over time. From this model a commander should learn that "process" is invariable and that the three functional groups are variables he controls during combat to generate combat power. An advantage to TMCI's theory is that it reduces the number of variables the commander has to deal with when generating combat power, once combat has begun.

A commander who structures a force before or during combat without benefit of theory, is doing so with an implicit understanding of the functional interrelatedness of the elements and activities. In fact, he is intuitively applying TMCI's theory. Study and use of this theory would reduce the degree of error or inefficiency in generating combat power.

OTHER CURRENT COMBAT MODELS

Wass de Czege

A model of combat that closely resembles TMCI's is that of Brigadier General Huba WASS de CZEGE in his Understanding and Developing Combat Power. His bottom line is the same as TMCI's: "The outcome of battle is determined by the relative combat power of the antagonists."[27] He places activities into four function groups of maneuver, firepower, protection, and leadership; he omits four of the eight that TMCI uses. These functions are relative to the opposing side, and "the object of combat actions and preparation prior to combat, then, is to affect the value of both sides of this equation".[28] The result is effect: firepower effect, maneuver effect and protection effect.

To achieve a higher resolution than four variables, General de Czege breaks down the four functions into subsets of 18, and then into 64 more specific variables with the potential of further levels.[29] His focus was the method of analysis as a process. As such, he did not develop a method for quantification or for qualitative comparison of his variables and functions. Wass de Czege intended his model to teach U.S. Army officers "how to think" and not "what to think".

Trevor Dupuy

A model that attempts to quantify and qualify all variables is the Quantified Judgment Model (QJM) of Trevor N. Dupuy. Dupuy is a major contributor to the TMCI, which gives a good indication of where TMCI's theory is headed. As a member of TMCI, the separation of his ideas and concepts from TMCI'S is difficult to establish, but the framework of TMCI's model is greater in scope than QJM's. His model focuses on combat power and not as much on the process.

Dupuy claims that inspiration for his combat model comes from the writings of Clausewitz who, according to Dupuy, expressed a Law of Number in Book Three's "Superiority of Numbers":

> If we thus strip the engagement of all the variables arising from its purpose and circumstances, and disregard the fighting value of the troops involved (which is a given quantity), we are left with the bare concept of

> the engagement, a shapeless battle in which the only distinguishing factor is the number of troops on either side.30

Clausewitz identifies external variables and quality of troops as quantifiable variables. He explains that:

> These numbers, therefore, will determine victory. It is, of course, evident from the mass of abstractions I have made to reach this point that superiority of numbers in a given engagement is only one of the factors that determines victory. Superior numbers ... may actually be contributing very little, depending on the circumstances.31

Clausewitz goes on to discuss many of the variables that contribute to strength and concludes: "To achieve strength at the decisive point depends on the strength of the army and on the skill with which this strength is employed."[32] Clausewitz repeatedly identifies quality of the troops and skill of the commander as the key variables to producing combat power.

Clausewitz did not assign specific values to this analysis or in any of his examples. Still, he did express himself in quantitative terms. Dupuy arrived at a formula he attributes to Clausewitz's influence: P= N x V x Q, where N = numbers of troops; V = variable circumstances affecting a force in battle; and Q = Quality of force (to include the commander).[33]

From this basic formula Dupuy derived that: Combat Power= Force Strength x Variable Factors x CEV.[34] CEV equals Combat Effectiveness Value, and is a "composite of factors representing the total effect of all of the variables that have not been identified and quantified explicitly in the computation of combat power."[35]

Dupuy claims to be able to give a quantitative value to these intangible variables- such as leadership, morale and training- by using a large historical data base. An extensive data base would allow him to devolve the CEV as the factor explaining the difference between theoretical and actual outcome.[36]

Dupuy's premise and methodology parallel much of the Soviets' work, but with a different data base. The Soviets use data from WWII, while Dupuy uses 362 engagements from throughout the twentieth century. His provides a broader, and as deep a data base.[37]

Dupuy also uses his historical base to test his QJM model, and has some impressive results. He "documents" the constant nature of the CEV over time. For example, the Germans had a CEV of about 1.20 with respect to the Western allies in both WWI and WWII. "In other words, 100 Germans in combat units were equivalent to about 120 British or American troops in combat units."[38] (The term "combat unit" represents force, and not number of troops).

Exceptional commanders can change the CEV value, but this infrequently occurs since systems, societies, and doctrine tend to be consistent. If Dupuy's model proves to be valid, the intangible variables of combat are quantifiable and TMCI's model has a higher degree of resolution. The implications for staffs and commanders are tremendous; they may substantially increase their abilities to generate combat power both before and during combat.

THE COMMANDER'S ESTIMATE
U.S. Method of Combat Generation

The principal difference between the U.S. and TMCI in their combat doctrinal assessment lies in their basic methodology of thought. Theory development is dependent on approach, for the method of construction will inherently affect results. TMCI uses an inductive approach to develop a comprehensive theory of combat, while the U.S. approach is deductive. TMCI's inductive method, of going from the specific to the general, involves decomposition, a la Fuller. TMCI identifies and then groups components of combat, eventually resulting in a combat model, (see Fig. 9-10).

The U.S. concept of combat power is derived from Airland Battle Doctrine and is given structure by the Commander's Decision/Estimation process. The U.S. approach is a deductive one. Descriptive lists of imperatives and functions derive from base-line principles:

> The nine principles of war... provide the timeless general guidance for the conduct of

> war at strategic, operational and tactical levels. They are the enduring bedrock of U.S. Army doctrine... The fundamental tenets of Airland Battle doctrine, (initiative, agility, depth and synchronization), describe the characteristics of successful operations... The imperatives listed below prescribe key operating requirements. These provide more specific guidance than the principles of war...39

"Tactics is the art by which corps and smaller unit commanders translate potential combat power into victorious battles and engagements."[40] As do the other models, FM 100-5 sees synchronization as the key to generating combat power. "Combat power is the ability to fight. It measures the effect created by combining maneuver, firepower, protection, and leadership in combat actions against an enemy in war."[41] FM 100-5 concedes quantitative measures of combat capability, but not of actual combat power. This is due to the "unquantifiable" nature of combat intangibles, such as the quality of troops and the ability of the commander.

Through its decompositional method of clustering, TMCI has reduced the number of variables that the commander has to consider in generating combat power. But U.S. doctrine has expanded the lists of variables for the commander to synchronize, because of its deductive construction. Moreover, since these variables are difficult to identify, understanding their interaction falls to the realm of "art". U.S. doctrine, as a result, relies heavily on a commander's intuition in arriving at the correct formula for combat power. "Recognitional decision-making",[42] as such, insures inconsistent and ineffficent results among commanders.

"Estimates", in FM 101 -5 Appendix E, lays out a "logical method of determining the most suitable course of action to accomplish a tactical mission."[43] A serious disconnect appears in the "Format for the commander's (operations officer's) estimate of the situation", however. The format, which considers intangibles such as leadership, morale and training, adequately estimates friendly forces power. But it fails in estimating enemy combat power since measurements reflect only number and size, as seen in "Enemy situation". This focus on numbers is a carry-over from Frederick William Lanchester and his "laws of war" that deal primarily with concentration.

Lanchester's Square Law

U.S. doctrine incorporates Lanchester's Square Law that says combat power equals a force's effectiveness times the square of its numerical size. Unfortunately, recent articles and evidence, (see works by Schneider, Dupuy, and Epstein) tend to invalidate many of the models and formulas derived from Lanchester. The failure of Lanchester's Square Law to stand up to historical validation should cause distress for the tactical commander, for much of his doctrine, force structure, and training rest upon it.

Simulations such as the updated Concept Evaluation Model (CEM), FORCEM, and the Joint Exercise Support Simulation (JESS), all rely on Lanchester's Square Law.[44] The attrition and advance rates they suggest have little historical validity. As James Schneider states in <u>The Exponential Decay of Armies In Battle</u>: "The review of the empirical evidence ... strongly suggests that, insofar as land warfare is concerned, Lanchester's <u>square law</u> is not applicable."[45]

History is replete with examples of numerically inferior armies defeating more numerous opponents similarily equipped. Clausewitz, Fuller and Jomini all point to the commander's ability, quality of troops, morale and other intangibles as major contributors to combat power. Numbers are important, but are only part of the equation.

FM 101-5 defines "Relative combat power" as "maneuver units and supporting fires."[46] Additional factors are listed as secondary elements, but the emphasis on numbers and hardware remains. A standardized weighting of forces is not factored into the equation. The subsequent steps in the commander's decision process are all influenced by the estimated combat power. The course of actions and ultimate plan are predicated on enemy and friendly combat power.

In practice, some form of "weapons effectiveness indices", weighted unit values (WEI-WUV) and other shorthand indicators are used to compute combat power.[47] ST 100-9, The Command Estimate, does a better job of computing combat power than FM 101-5; it advocates the use of U.S. vs. Soviet Combat Unit Comparison Values tables based on a baseline (see Appendix C). The subjective values are often criticized as products of Delphi methodology.

Still, ST 100-9 encourages commanders to expand their weighting system and come up with their own systems for assigning values. This is not as ludicrous as it sounds, since a good system based on current intelligence and the lastest IPB should be able to work for any combat conditions. But there is still the problem of estimating combat power for a simulation or in a pre-war status. The only valid solution lies in using a broad-based historical analysis.

CHANGING PARADIGMS

TMCI was able to break away from traditional American military thought and restructure the way we look at combat because the Institute has taken a paradigm approach to developing its theory. Its members accept the need for institutional change.

A "paradigm" consists of a set group of people and their set of beliefs and actions which interact upon each other.[48] In a military paradigm, the community members are the practitioners of a military speciality having similar educations and professional experience. To achieve certain intrinsic goals they design and build elaborate equipment, develop esoteric vocabulary and hone professional skills.[49] This results in "professionalization", on the one hand, and to restriction of the military man's vision, on the other.

A paradigm has a built-in resistance to change, since it is a self-reinforcing system. But it is not a totally closed one. Fundamental change occurs when a sufficient number of anomalies shifts enough focus away from the belief structure and toward resolving them. Kuhn, author of The Structure of Scientific Revolutions, posits that change is normally revolutionary, not evolutionary, because of paradigms and their natural resistance to reordering.

An excellent example illustrating the need for institutional change can be seen in the field of combat power generation. This is an area experiencing substantial review and change. As it happens, we are heading toward Soviet solutions, as can be seen in St 100-9. The critical question begs to be asked: Can these new processes for combat power generation which are systematic and quantitative function appropriately in an existing military paradigm of intuitive practice?

Combat power generation may be a case where, because of our current deductive and compartmentalized approach to combat, we think we can isolate and "fix" subcomponents without substantially affecting the others. But our search for solutions and the making of decision matrixes require a comprehensive theory for ordering variables and testing concepts.

CRITIQUE
Not a Theory for All Levels

Despite its utility for generating combat power, TMCI's theory has some conceptual flaws that need clarification before the U.S. Army embraces it in its entirety. TMCI has tried to devolve a holistic concept of war from the roots of their combat theory. Instead, an overriding philosophy/theory of war should be conceptualized first. This would establish a framework to interlink the theories at various levels and against which to test their concepts. An architect designs and draws plans for the carpenters to follow, knowing that their unguided efforts would not build a Taj Mahal.

TMCI's theory of combat has problems of focus when its creators try to link it to a larger concept of war. War and combat cannot be modeled in the same manner for many reasons other than scale. The nature of combat requires detailed modeling of specific variables and principles. Too many non-specific and non-combat factors affect the bigger arena of war. TMCI's paradox leads to several definitions of "combat" and debate over which level of war to apply the term "combat".

TMCI's irresolution gives way to the consensus in Chapter Three that military combat "takes place at the tactical level in battle, engagements and duels".[50] Now focused at the tactical level, TMCI's model can impact upon combat by ordering the chaos of battle. "Combat is characterized by local chaos, but long-range order."[51] Order at the tactical level, in turn, impacts upon the operational and strategic levels which seek long-range order.

TMCI's model is valid primarily at the tactical level of war, since it chiefly addresses combat power generation. At the operational and strategic levels, force is not equal to combat power alone. Other factors come into play at the higher levels of war, principally, politics.

Politics are more than "boundary setting or external constraints", as TCMI implies. Politics fundamentally affect strategic and operational levels of war, and in a non-combat way. Political "ways" use diplomatic "means" to achieve certain ends, whereas military "ways" use lethal "means" for certain other ends. The incongruence of the ways and means between lower and higher levels of war invalidates TMCI's model for the operational and strategic levels. The same holds true at the opposite end of the spectrum, where politics are the dominating means in waging low intensity conflicts.

TMCI did not succeed in its stated goal "to develop a theory relevant to military conflict at all levels".[52] The Institute did create, however, a comprehensive combat theory and model for the tactical level which has great promise of improving our conduct of battle. But before we can employ it, we face a big, if surmountable, problem of creating a reliable data base. Especially in contingency operations, a thorough data base may not be available prior to hostilities. Our intelligence gathering systems would need to analyze enemy capabilities down to the brigade/regimental level and, as such, would require more assets.

CONCLUSION

> Theory will have fulfilled its main task when it is used to analyze the constituent elements of war, to distinguish precisely what at first sight seems fused, to explain in full the properties of the means employed and to show their probable effects, to define clearly the nature of the ends in view, and to illuminate all phases of warfare in a thorough critical inquiry.53

If its problems concerning focus and of achieving reliable data bases are addressed, TMCI's theory may illuminate much of what has been the fog of war, principally at the tactical level. It could function as an indispensable "black box" for the tactical commander, giving him a synergistic tool for improving the quality of his estimate. The commander would weight three interactive combat function groups at different intervals for a useable, more quantified picture of combat.

By identifying numerous variables, TMCI has reduced the number of combat unknowns with which the commander has to deal. This would let him process information and make decisions more efficiently, which is critical to either seizing or maintaining the initiative. Using new models, the commander could rationally structure the battlefield for force array and better allocate combat power. He would be able to maximize use of combat multipliers to generate more power.

Structured input and analysis should help a commander achieve Fuller's "Economy of Force" in his bid to win the battle.

TMCI theory might also be used to guide and evaluate training activites for staffs and commanders. With a better resolution potential than current Delphi solutions, TMCI's constructs could validate simulations and improve force design, weapons procurement and weapon systems employment.

TMCI's scientific methodology is not aimed at replacing or superseding a commander's "art". It aims to enhance his art through better science. A structured theoretical framework allows a commander to manipulate the "intangibles" of combat in a more informed way, potentially, for winning results.

We cannot carry on with our traditional approach to tactical combat, an approach which has lost too many first battles for us:

> U.S. Army officers often tend either to rely on intuition and experience to place values on factors contributing to the combat power of opposing sides, or they engage in a deceptively simple counting exercise in which they count things.54

"Bean counting", to some extent, is necessary when considering strategic and operational levels of war. At the tactical level, however, generating combat power is what counts. Lanchester's Square Law of War inadequately accounts for combat power. Generating techniques are finally being reviewed and changed within the U.S. Army, as shown in ST 100-9. But the challenge to existing methods, while probably overdue, only adds to the confusion unless it can be tied-in to a sound theoretical framework. Clearly, we need a unifying theory of combat to analyze new methods and to validate the old.

If we accept Kuhn's theory of institutional change, then, the military community may be prime for a new approach to combat theory. TMCI has just given us a comprehensive theory we should not only review, but should carefully scrutinize for tactical utility. It could prove to be a tremendous tool at the service of the combat commander, helping him collect and utilize his resources to best advantage. Certainly, it may be smarter and cheaper to develop methodology to maximize combat power than simply to acquire new hardware and weapons systems designed to generate same. This, alone, merits serious consideration in an increasingly cost-conscious Army.

Meanwhile, there will be the traditionalists who resist significant change, taking a stance of inertia and defending familiar ground. Some may be threatened by the specter of science invading their artform, fearing inspiration will go the way of engineering. "Hands-on" military practitioners may be put off by the theory's esoteric nature. Others will balk at the attempt to quantify the unquantifiable. In the words of Marshal Saxe: "no rules of conduct can be given to (war) which are reducible to absolute certainties".[55]

But our peacetime army simply should not be content with principles and simulation when so many problems go unresolved. It is time to overhaul our approach to combat theory and recognize the compatibility of science and art in theoretical and applied tactics.

Figure 9-7

EXTERNAL/INTERNAL CATEGORIZATION OF COMBAT FUNCTIONS

COMBAT FUNCTIONS:	ELEMENTS:	COUNTERMEASURES:
1. COMMAND & CONTROL	Command & Staff	Targetting Command Posts/ Elements; the Commander
2. COMMUNICATIONS	Signals	Electronic Warfare
3. INFORMATION & INTELLIGENCE (including Reconnaissance & Scouting)	Collection & Movement/ Acquisition, etc.	Counterintelligence, including Deception
4. MOVEMENT & MANEUVER	Combat Vehicles & Pioneer Equipment	Obstacles; Interdiction
5. PSYCHOLOGICAL WARFARE	Broadcasts, Leaflets, other actions.	Propaganda
6. FIRE (for attrition, suppression, neutralization	Weapons; Mines	Fortification & Body Armor
7. PROTECTION & COVER (including armor, fortification, concealment, etc.	Helmets, trenching tools; camouflage gear; light conditions; terrain use	Penetrating weapons systems; specialized observation gear (night scopes),
8. LOGISTIC SUPPORT	Personnel & Materiel, including medical, construction, Administration, Civil Affairs, etc.	Targetting; specially targeted force elements and firing equipment/ weapons.

Figure 8-1
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CATEGORIES OF COMBAT COMPONENTS DEFINED

FACTORS = ELEMENTS OF COMPOSITION, OR CIRCUMSTANCES CONTRIBUTING TO RESULTS; FACTS WHICH MUST BE TAKEN ACCOUNT OF, OR WHICH AFFECT THE COURSE OF EVENTS.

ELEMENTS:	**ATTRIBUTES:**	**ACTIVITIES:**	**OTHERS:**
BASIC OR CONSTITUENT PARTS OR INGREDIENTS; MEMBERS OR UNITS OF A STRUCTURE	INHERENT CHARACTERISTICS, QUALITIES OR PROPERTIES (Desirable, or not)	MOVEMENTS; STATE OR FACT OF BEING ACTIVE [See Chapter Ten]	[COMPLEXITIES, OR HIGHER LEVELS OF ABSTRACTION]
CONTEXT OF SITUATION: Manner in which a thing is situated in relation to its surroundings; location, position or condition with regard to circumstances; combination of circumstances at any given time; environment; stimuli that affect. [Set of attributes for one or more elements]	STATES & CONDITIONS: Values or modes of existence, without reference to causes; phases or stages. CHARACTERISTICS: Distinguishing traits, qualities or properties; revealing, distinguishing or typical of the individual character.	PROCESSES/PROCEDURES: Courses or series of actions, events (or their methods); steps taken or acts that are performed; sequences of operations or changes undergoing; progressive, producing.	PRINCIPLES: Fundamental, eventual truths, laws, rules; settled rules as basis for activities or operations. [See Chapter Six]
FORCES: (combatant units): Any group of people organized for some activity; any organized group of soldiers, sailors, etc. WEAPONS: Instruments or devices of any kind used for fighting. EQUIPMENT: Whatever a person or group or thing is provided with to assist in executing their functions. SUPPLIES & SERVICES: Provisions & assistance for military forces, other than materiel.	DESIDERATA: Something considered to be necessary or useful in people or equipment (Aggressiveness, durability, stamina, etc.) QUALITIES: [Degree & relative superiority or inferiority] Peculiar and essential character; inherent features; degree of excellence; distinguishing attributes--very subtle difference from 'characteristics']	OPERATIONS: Actions or movements planned and executed, done or carried out; military actions, maneuvers or missions, including their planning and execution; things requiring the practical application of principles or/and processes. SEQUENCE: Order of succession; continuity of progression.	FUNCTIONS: What a person, thing or unit is supposed to do or perform. Activities appropriate to a person, unit or thing. (A goal to be served, rather than an operation *per se*.) [See Chapter Nine]
= SUBSTANTIVE ITEMS ('Nouns')	= MODIFYING ASPECTS ('Adjectives/Adverbs')	= PREDICATIVES ('Verbs')	= RELATORS ('Particles')

THE FACTORS OF COMBAT. Assembled into a structural framework through use of component categories from Chapter Eight, the factors are re-stated here as:

ELEMENTS = All components classifiable as things, whether animate, natural or material (e.g. the commander, combat units, weapons systems, equipment, supplies; terrain, vegetation, etc.). All things, whether physical or cognitive in nature. Physical things, as elements, may be animate, natural or material (man-made) and exist as single entities (e.g., an individual, a rifle, a truck) and as aggregated entities (e.g., a battalion, a forest, a unit-of-fire ammunition load). Cognitive things are entities that derive from human intellect or exist in the human mind (e.g., strategy, political/economic/cultural influences, doctrine, motivation). These classify as elements only if they originate and subsist outside of, or external to, a particular animate (physical) element of reference or interest. (Cognitive things that singularly exist within, or internal to, an animate element are classified as attributes (characteristics) of that element, as discussed below.)

ATTRIBUTES = Aspects consisting of -

-- Physical Properties - Physical descriptors of an element (e.g., dimensions, weights, configurations).

-- Characteristics - Technical and behavioral properties of an element that relate to its military function and performance (e.g., reliability, sense of discipline, rate-of-fire, vulnerability).

-- Qualities - Degrees or measures of characteristic worth in the context of combat context (e.g., high vulnerability, 0.5 hit probability).

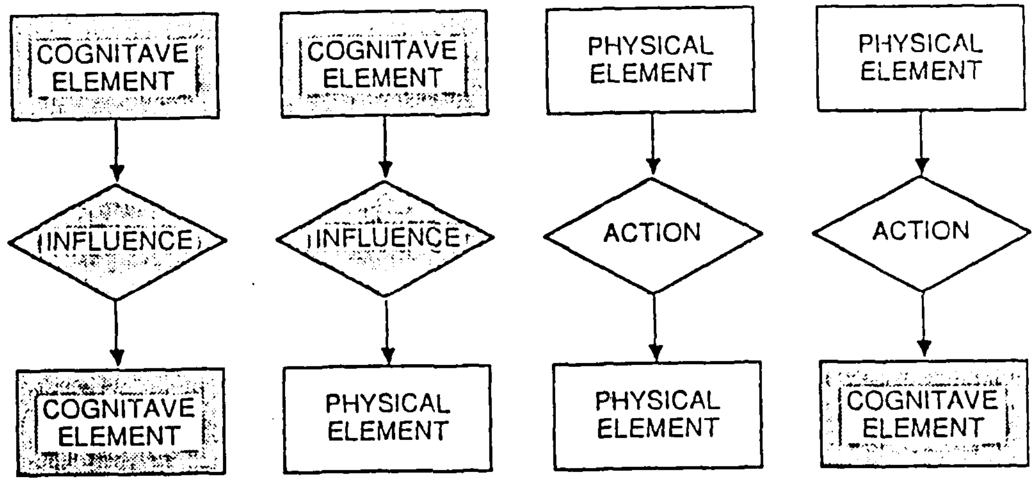
-- Posture - Time-dependent behavioral descriptors of element action and activity (e.g., aggressor, defender, retreating, firing).

The attributes of physical elements include all of the above four factors; those of cognitive elements consist only of characteristics and qualities.

ACTIONS = All the acts performed by a single or aggregated element to either change its own state (discussed below) or to change the state of other elements (e.g., moving, firing, communicating). For cognitive elements, "action" more appropriately translates into "influence". A cognitive element influences an animate physical element or another cognitive element to effect changes in state (attributes) of the element influenced.

ACTIVITIES = Triads consisting of elements acting on physical elements (element-action-element) or cognitive elements influencing other cognitive elements or physical elements. Thus, activities can either be classified as cognitive or physical depending on the category of the initiating element.

STATE = Condition of existence of a single or aggregated element expressed as a function of time, spatial position and commensurate attributes. Combat action is not a component of state, but actions operate on elements to effect changes of state.



COMBAT STRUCTURE. Our development starts with a treatment of combat at the micro-level. The discussion treats combat as a circumscribed activity system, recognizing that in certain circumstances or contexts in "real world" applications, parts of the system described can at times be present in diminished form, while other parts take on exaggerated importance.

[For example:

Endnotes

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3. J.F.C. Fuller, The Foundations of the Science of War, (London, 1928), p. 21.

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5. "In Pursuit of the Essence of War", Army, (Jan. 1984), p. 24.

6. Ibid., p. 20.

7. Ibid., p. 19.

8. Clausewitz, p. 140.
9. Ibid., p. 170.

10. Trevor N. Dupuy, Understanding War: History and a Theory of Conflict, (New York, 1987).

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14. Ibid., p. 1-4.

15. Ibid., p. 3-1.

16. Clausewitz, p. 142.

17. TMCI, p. 3-1.

18. Ibid., p. 9-1.

19. Fuller, p. 16.

20. TMCI., p. 9-18.

21. Ibid., p. 9-3.

22. Ibid., p. 9-22.

23. Ibid., p. 9-24.

24. Ibid., p. xiv.

25. Ibid., p. 9-7.

27. de Czege., p. 14.

28. Ibid., p. 14.

29. Ibid., p. 16.

30. Clausewitz, p. 194.

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32. Ibid., p. 195.

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37. Trevor N. Dupuy, "Can We Rely Upon Computer Combat Simulation?", Armed Forces Journal International, (Aug., 1987), p. 60.

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45. James J. Schneider, The Exponential Decay of Armies in Battle, (Fort Leavenworth, 1984), p. 17.

46. FM 100-5, p. 11.

47. "In Pursuit of the Essence of War"., p. 20.

48. Thomas S. Kuhn, _The Structure of Scientific Revolutions_, (Chicago, 1970), p. 176.

49. Ibid., p. 64.

50. TMCI, p. 3-3.

51. Ibid., p. 3-8.

52. Ibid., p. 2-8.

53. Clausewitz, p. 141.

54. de Czege, p. 5.

55. Fuller, p. 24.

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