The Metaphysics of War

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Preface

Preface Head

This is another book about war. I spent a goodly number of years doing the research for and writing the monster **Physics of War** (POW). I say monster on two accounts. First, any book more than 1300 pages in length is monstrous large. Second, the work itself is monstrous in exaggeration. There is not much of a science of war (although quite a bit of science in war,) so calling that earlier work the **Physics of War** was an exaggeration that enough science was there to merit the name.

Which brings us to this slim volume. I call it the **Metaphysics of War**. In normal usage, metaphysics is "the branch of philosophy concerned with the first principles of things." (Concise Oxford English Dictionary, Tenth Edition) That is not quite how I mean it although there is a philosophical aspect to the content. The word *meta*, by itself, can mean "that which is more fundamental than." This is how I use the word. That is, I use metaphysics in this instance to mean "that which is more fundamental than physics."

What I am writing about here is some of what I learned about war during the period when I was working on POW that could not be described by physics, either due to unsuitability or immaturity. If we had a developed science of war, then much (?) of what is here could be explained in fullness. As it is, what is here is largely beyond scientific explanation although, in some case, it is not beyond analysis.

This does not mean that what is here is supernatural or beyond the normal. Far from such, it is eminently natural and even occasionally normal, to the extent that any human activity is normal (rather than normed!)

Much of what is here has been observed by others, but not arranged in the pattern here. These pieces are not original although the associations are, at least in part. Other pieces, to my knowledge, are original recognitions or analyses although there is a non-zero probability my scholarly research has not uncovered those who have gone before me. If this be the case, I apologize to those workers. My interest is to share with others to increase the understanding of the subject, not to impress them with my dementia.

Along these lines, some of what is here is almost fictional in form. Matters both ancient and contemporary, historical and pre-historical, are open to interpretation in the absence, almost always, of certainty. Thus, the development here is intended to be as coherent as possible even when that means filling in gaps with speculation. Do not forget, this is not science but a compendium of what cannot be explained for a lack of science.

Some may criticize that I am not a soldier and thus have no business writing a book of this type on war. Obviously I thought this book needed writing and no one had addressed this need. I am not at all sure that this book could have been written by a soldier who

is not also a scientist. Such are extremely rare. But I hope that such will pick up the gauntlet and produce the next generation product that will be the better for the soldier's temperament and experience.

Acknowledgments

A lot of folks, many of them soldiers, put time and effort into relationships with me that contributed to this work. I can't begin to list them all but those who have the greatest irrational association, I can embarrass by associating with this poor effort. In this group I list MAJ Larry Phillips (FA), Dr. J. P. Ballenger (also FA), and Donald Peterson, who have been constant friends and colleagues. I also include COL Art Lykke who held the Chair of Strategy at the Army War College when I was there and was my writing project advisor whose patience with my attempts to mathematify, if not scientificate, strategy were doubly difficult given his aversion to mathematics. I need also include BG John Scales, Ph.D., (IN) who was one of my roommates my junior and senior years of undergraduate school, and a staunch friend and colleague since, LTG Robert Moore, who was the first real general I worked with, and COL Herb Carr (AD), and LTC Mike Garrambone, who asked good questions, COL Griff Callahan (AD) who led by doing, and COL Don Summers (AD) and COL Joe Baer (CA), who showed me the integrity of the soldier. Finally, I have to acknowledge three historians, only one of whom I have met and argued with, Trevor Dupuy, Archer Jones, and Victor Davis Hanson, for offering up models, not just facts, and in one case, showing that historians can make models but they should leave the math to others. As always, I acknowledge the quiet support of my wife Carol, who has not yet killed me in my sleep, and my boss, Dr. Bill McCorkle, who provides an environment that fosters thought and effort.

AMRDEC *Bruce W. Fowler*.

Contents

1 What is War?

Searching for a Definition or Description

This is a difficult question.

I have two bases for asserting this, one observational, the other logical. In several years of studying war, I have found that very few of those who write about war offer any definition or concise description of what war is. We do not expect those who write of their experiences and reminiscences of war to do so, because the main subject of the book is a description of a war, or at least one person's microcosm of a part of a war or even wars. For our purposes in this chapter, such works may be dismissed as neither concise enough in their descriptions, nor broad enough in their scope of consideration. Such works are not to be demeaned however, for they most clearly show us the horrors and inequities of war at the micro level, even when such is not the intent of author or editor.

These works of anecdote are not the only works of war. In particular, most are concerned with history from the war (or anti-war) perspective, or works dealing with the theory and practice of the art of war. Occasionally one finds in the popular press a volume on the materiel of war that implies a criticality of technological advantage to warfare that is belied by historical evidence that such advantages occur only occasionally. These works are sometimes portrayed as part of the science of war in the mistaken association, as noted by the historian James Burke, that technology is often mistaken to be science.

The histories and the theoretical works are as bad as the anecdotal works. Few advance any definition of war. In fact, the military dictionaries, published either by enterprising book merchants or by the defense establishments of the various nation states, are equally silent. Apparently, we have a membership rite of colossal proportion here; if one has to ask for a definition of war, then one does not need to know the definition.[1] Presumably

[1] This is a variation on an old gag about prices on the menu at expensive restaurants. It is a rapidly waning piece of humor as the oncroaching ubiquity of fast food not only destroys the concept of dining but eliminates the presence of menus.

students of warfare are whispered the definition when they are inducted into the sacred order of soldiers and taught the secret recognition signal of the salute. We do not know, for this author is a physicist, not a soldier. Indeed, being a soldier and a physicist is considerably difficult, for the former must adhere to the strictest of external discipline while the latter must adhere to the strictest of internal discipline and few humans can do both without becoming explosive. Besides, if soldiery is a mystic and secret order like Masons or Skull and Bones, then revealing order secrets would be dishonorable (and thereby repellent, even anathematic, to soldiers,) and dishonest (and thereby equally repellent and heretical to physicists.)

There may also be argued a logical reason for no definition. The logical reason is that those who write books on war either direct their attention to an audience of soldiers and veterans who have their own personal definitions of war, or to those who are quite willing to imagine that they have a definition to associate with that group by reading such books. The warrior tradition is one that has ancient roots for our species and its nature dictates a special bonding among those who are warriors and engenders a yearning among those who are not. Thus, there is little need for war to be defined. To do so would actually be counterproductive, for the reader might find himself in violent disagreement and either reject the message of the author, or even worse, not buy the book. Even worse, the book could be panned by a critic, a conspicuous species of non-warrior.

This work however, is not the run of the mill book on war. The author is not a member of the secret society, but a physicist who has made his existence designing weapons and trying to understand the physics of war, an undertaking that would be impossible at either modern civilian universities, because of political correctness, or at modern defense universities, because of propaganda control. No, academia is PC all over.

Having been essentially forced to such ends, we now consult a standard, general purpose dictionary. [Pearsall Tremble 1996] This gives us:

Definition 1.1 *"armed hostilities between esp. nations; conflict".*

This definition is not without merit, but it lacks any satisfying overarching cohesion. While the form of many wars is indeed armed conflict between nations, war is not just any of these. For example, are radio broadcasts and propaganda leaflets arms? Is all hostility between nations war? Is all armed hostility war? When does a jurisdictional brawl between border constabularies become war? For that matter when do (e.g.,) bar fights

between two parties, each of whose populations happen to share a common nationality, become wars? Is all conflict war or is there some form of conflict that is not war? Finally, and perhaps most crucial to us in our contemporary circumstances, can war only be fought between nation states or are there other actors of war?

We are thus forced to continue our search.

Clausewitz and Keegan

Of writers of war, none holds such pride of place as Clausewitz.[2] Clausewitz clearly understands the need for a definition and in Section One of Chapter One of Book One of **On War**, [Clausewitz 1976] entitled "What is War?", he gives us a definition:[3]

Definition 1.2 *"War is thus an act of force to compel our enemy to do our will."*

This is much better! This definition tells us that war is not just the superficial violence noted and decried by so many but the use of force to achieve compulsion of the enemy. Violence is not the intent but the by product. This definition also speaks to both aim and purpose, namely, to bring the opponent, the enemy, to exhibit a behavior that we desire.

Sadly however, this is still not adequate. Is a parent disciplining a child for improper behavior war? Is a psychologist modifying the behavior of a patient war? Our inclination is that they are not.

Nonetheless, we have made more progress with these few words than we have in consulting a multitude of other texts. It is little wonder that soldiers accord Clausewitz a respect bordering on the mystic awe accorded a messiah.

If we delve further, we come upon the title of Section Twenty-four of Chapter One of Book One, that:

Definition 1.3 *"War is a continuation of policy by other means."*

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[2] It may be argued that this is a chauvanistic Western view, that Sun Tzu should be first. Sun Tzu however, does not define war, nor does Jomini.

[3] I am doing something here that I find rather distasteful in its mystcistic form. In reading and dealing with Clausewitz scholars and proponents, one encounters citations of Biblical prescription. Pieces of Clausewitz's writings are cited in the same manner as a preacher would admonish a congregation with a Bible verse by enunciating (e.g.,) "John 4:16". But I will keep it minimized lest I be accused of being a *Vom Kreig Thumper*.

This is also a useful statement. For one thing, it gives us a link between civil and military authority (that has so often been pictured as antithetical to military preference,) since policy is a province of both the civilian and military aspects of government. Before we launch on our discussion of this, however, it is first appropriate to discuss the concerns of another military writer who takes on this arduous task.

John Keegan is inarguably one of the most creative military writers of the Twentieth Century. His **Face of Battle** [Keegan 1976] established a valid place of consideration of the environment of the individual soldier in combat, a titanic accomplishment given the long tradition of memoirs. His **Fields of Battle** [Keegan 1995] clearly demonstrated to us, through the depth of misunderstanding of even such a dedicated Americophile as he, just how difficult the personal, cultural, social, and even political aspects of war are to comprehend by those who are not contemporary members of that culture, society, and polity.

In **A History of Warfare**, Keegan finds Clausewitz's definition inadequate for several reasons. [Keegan 1993] He first criticizes it for not making a distinction between a legal and a non-legal soldier. Then, based on Clausewitz's own conclusion that Cossacks in his own period do not "deserve the dignity of the title" soldier, and the failure of the Philhellenes to teach the *klepes* (half bandits, half freedom fighters) close order drill in the period following the Napoleonic wars, he says that:

> "It is at the cultural level that Clausewitz's answer to his question, 'What is War?', is defective. This is not altogether surprising. We all find it difficult to stand far enough outside our own culture to perceive how it makes us, as individuals, what we are."

In somewhat contemporary terms that we will come to in due course, Keegan says that Clausewitz's definition (actually section title but it is so useful as a definition that we will use it as such,) fails when dealing with Primitive War. Given the examples cited, and the interpretation of war as an activity between nation states, which is likely the view Clausewitz himself took, we cannot disagree with this conclusion. Nonetheless, we do find that Clausewitz's definition has more merit than Keegan (and Clausewitz) claim.

Before addressing this, let us consider that this section head is sometimes held to be a mistranslation. Indeed, Keegan alludes to this in his discussion. Another translation is given as: [Rohr 2004]

Definition 1.4 *"War is nothing but a continuation of political intercourse, with an admixture of other means."*

which is a translation of

> *"Der Kreig ist nichts als eine Fortsetzung der politischen Verkhers mit Einmischung ander Mittel."*

Clearly the authors and translators intend to elevate the nature of policy over that of political wranglings, but for our purposes in considering these two definitions, the distinction is not immediately relevant. If we take into account the basics of contemporary organizational theory from management science, we note immediately that either policy or politics are characteristics of organizations. This immediately answers one of our earlier derivative questions and addresses both Clausewitz's and Keegan's objections if we view war as the province not solely of nation states but rather of organizations.[4]

Enter the Organization

Let us consider: an organization is a group of people with a function. That function may be the production of a product, or the social improvement of the individuals, or their care and welfare. The organization generally has both rules and policies, the former establishing taboos and punishments, and the latter establishing goals and standards. The organization will have a personality, a manner in which it acts, which may evolve over time, and a culture, which may also evolve. In general, both of these will be distinct from the personalities and the cultures of the comprising individuals although they may share commonalities. While it is recognized that the organization must discipline or even eject any individual who deviates too greatly from organization culture, personality, policy, or rules, it is also recognized that if a substantial number of individuals deviate too greatly the organization will either cease or shift or split.

The organization is fundamental to humanity. It is something that actually predates humanity, as we shall discuss in a later chapter.

We may now address the criticisms. First, nation states are organizations and their rules (at least some of them), are called laws. Thus, within the context of the culture of a nation state, it is perfectly natural to consider whether war is legal and whether those who practice it act legally or not. I will argue that it is not our purpose at this point to discuss such legality, except that because such laws are constructs of organizations, an

[4] It is intriguing that Ferrill [Ferrill 1985, p. 9 ff.] has a section entitled "What is War?", but does not answer the question. War is associated with formation, which is an obvious form of organization. On the other hand, Dawson [Dawson 2001, p. 25.] does define warfare as "coalitional intraspecific agression" and thus includes the activities of ants.

inherent ephemerality and irrelevance must be considered. It suffices for our purposes to note that the issue of war legality is embedded in Clausewitz's definition/description[5] if we extend it to the modern consideration of an organization rather than just the nation state of the Napoleonic era.

Similarly, Clausewitz's own criticism is also mitigated. In the context of his day, the nation state (organization) in his view was Imperial Russia, which had soldiers in their army. The Cossacks, who were subjects of the Tsar, did not possess that organizational structure. Their organizational structure was essentially tribal in nature and that organization was sufficiently subordinate to Imperial Russia to provide certain military resources, of which Clausewitz is referring. We may mention in passing that this organizational subordination was itself the result of war. Certainly, the Cossack organizational (and individual) culture was significantly different from that of Imperial Russia and its ethnically Russian organizational members (subjects). We are thus left with a bit of a quandary of how we distinguish the practice of war from the difference between a soldier and a warrior. The Cossacks were clearly attempting to practice war. Given the second order nature of their membership in the warring organization and the rather distinct differences between Imperial Russian culture and Cossack culture, those attempts may have been halfhearted and ineffectual. It is not clear that whether they considered themselves soldiers or warriors, although Clausewitz clearly did not consider them the former. This opacity is further accentuated by the nature of steppe warfare which has a much more fluid character than Clausewitz was used to in Western European warfare. This difference is fairly well documented today and its swarming behavior has even been the subject of recent scientific study.[6] Resultingly, if we view war as an organizational activity, there are several rather good reasons why Clausewitz should view Cossacks as not being soldiers and possibly even as not practicing war.

Finally, we come to the failure of the Napoleonic veterans to teach Greeks how to fight Turks. Given the birth(?) of linear tactics in Greece, this may seem surprising. The answer is that these are mountain dwellers. Greece is highly mountainous. It has been observed [Hanson 2001, pp. 158-9.] that those who live in mountains develop warfare using projectile weapons and fortifications, those who live on plains (and steppes) de-

[5] We could make a great deal over the difference between a definition and a description. Other than identifying that a difference exists, we shall treat them as equivalent for our purposes. We shall be as happy with a comprhensive description as a comprehensive defintiion.

[6] As indicated the scientific side of things is pretty much covered in **Physics of War**. I will note that steppe warfare is much more like naval warfare than conventional Napoleonic warfare. Steppe dwellers are nomads. Specific pieces of ground are not generally valuable unless they control access to other ground. Fighting is seldom decisive or conclusive, and number relationships are highly Lanchestrian, so persistence is contraindicated so long as captors do not execute prisoners categorically.

velop highly mobile tactics - cavalry if suitable animals are available - and use projectile weapons, while those who live in rolling terrain - hills and valleys - tend to develop heavy infantry using swords and spears.[7] In this case, we have mountain dwellers, not the valley and hill dwellers of classic Hellenic civilization that the Byronic military experts were looking for. Their mode of warfare was to fight at fortifications, inflict a few casualties, and run away into the search vastness[8] of the mountains. Adopting line techniques ala the phalanx, which is essentially what their Napoleonic era mentors sought to give them, would have cursed them with disaster. Like the Cossacks, these mountain Greeks have a different organization whose culture of war is suited to that organization's environment.

It is a widely held notion, even model, among those who study organizations that organizations are comprised of individuals, processes, and culture, and that the most difficult thing to change is culture. The mistake that is commonly made in prescribing changes is to fail to recognize when individuals and processes, perceived by common wisdom to be easier to change, are indeed artifacts of culture. War seems to be one such process as we shall examine in a later chapter when we take up the idea of military revolutions.

Did Clausewitz intend for us to make this association of organization with war? Clearly there was some recognition of organizational mechanics in Clausewitz's period and given the inseparable relationship between the military and organization, he would certainly have been aware of it. While he does not dwell on the matter, other precedent and contemporary writers on war discussed military organization in detail. This is a matter for argument by scholars. We do not actually care whether Clausewitz induced the generality by observation of the behavior of nation states and regiments or a happenstance occurred that permitted us to deduce from organizational science. The bottom line is that if we may apply the concept that either policy or political intercourse is the unique province of an organization then we have at least the potentiality of applying Clausewitz's definition(s) in a rather broad sense.

This leads us to other testing questions. Can organizations other than nation states practice war? The immediate answer from this premise is yes. Herein we immediately grasp the contemporary concern over war between and with terrorist and non-governmental organizations. The extension to other means freely admits then of such concepts as economic war. The extension to other than governmental organizations places a broader scope to the actions of corporations, political organizations, and even social organiza-

[7] I will repeatedly return to this model of Hanson's, simply because of its fundamental relevance and importance.

[8] Its a search vastness because the Lines-of-Sight (LOS) are so short.

tions. In the sense that an individual may act as an organization of one, distinct to some degree from that individual, that individual as organization may practice war, although we see a fairly consistent view of governments today that such behavior is criminal and often unsane.

Reciprocity

Only moderate examination is needed to reveal a serious limitation of the definition. As much as the association of policy with organization extends the scope of what is war, it does not address a shortcoming ignored in both the original and new interpretations.

The basic and extended interpretations of Clausewitz's definition make clear that when a nation state (organization) applies "other means" to impose its will on another nation state (organization), war exists. Inspection reveals that this process is unidirectional. Particularly, it raises the question: if organization A makes war on organization B, what does this tell us about the actions of Organization B? Quite obviously, the definition tells us nothing, and this is the shortcoming of the definition.

To address this shortcoming, we introduce the Principle of Expectation of Opposition. Obviously, this principle is empirical in inspiration. Contemporary and historical observations show that two-sided warfare (at least among nation states), is the norm.

Simply put, we advance that once the organization that is the focus of the "other means" becomes aware of such, the usual decision is to oppose the imposition. Indeed, in most cases, the opposition is symmetric.

This now begs the question of what form that opposition takes, and how much awareness is required to trigger the response. We shall discuss these in greater detail in a later chapter we take up the matter of limitations on war.

We do postulate here however, that there are instances when the organization that is the target of imposition may choose not to acknowledge the existence of war, or to counter the imposition overtly. The most obvious example of this apparent contra-survival behavior may be found in the governments of nation states.

Clearly, if a government is being warred upon by a revolutionary organization (e.g.,) then it may choose to deny that the war exists and oppose the revolutionary organization with (e.g.,) police rather than military means. This behavior follows from the hierarchical structure of governments and the sovereignty that they wield so pridefully. In most

cases, governments will hold that only sovereign governments may make war and any war making by other than sovereign government organizations is rebellion or simple criminal activity. This is the environment of the traditional interpretation of Clausewitz's definition of war and reflects the zealousness with which governments protect their special status among organizations. As we have already indicated, this is a form of limitation, in particular of the class of legality, and we shall deal with this in more detail in a later chapter.

The question arises whether war can be one-sided or can war be fought against an organization incapable of opposition? These questions are at the heart of expectation of opposition. In effect, if an organization that is the target of "other means" chooses not to oppose while declining to accept the imposing organization's will, then war can be one-sided. Obviously, if the will (policy) is accepted, then the "other means" are not needed and there is no need for war. Use of the "other means" in this case ceases to be justified.

A more interesting situation occurs when the target organization is incapable of opposition. We argue in this case that the use of "other means" may be war if the target organization is aware of the situation and chooses not to accept the imposing organization's will. The fact that they are unable to oppose does not seem obviously and generally relevant.

Along this line, we do note that the opposition does not have to be symmetric, although it does need to be by "other means". A target organization may oppose an imposing organization's use of military warfare with economic warfare, for example. on the other hand, the use of police forces in a revolutionary situation is not "other means" since this is a normal and usual policy tool.

This leads us to another question and another assumption/restriction. Is extermination war? This has the interesting cognate question of whether members of different species can fight wars? If one's enemy surrenders, accepts the compulsion of one's will, does not war end? Under the usual definitions of these words, it should.

Starting and Stopping

How does war start and stop? The first is pretty well implicit in the definition. Once an organization decides to pursue policy by "other means" and once those means are used, war exists. If we require opposition, then we add the requirement of the use of opposing

means, not necessarily symmetric.

How or when does war stop? This is somewhat more complicated. If we have a requirement of expectation of opposition, this implies an opposing policy, which may be as simple as the conjugate of the imposing policy. That is, organization A may have some policy that it wishes to impose on organization B. If the opposing policy of organization B is that they will not adopt organization A's policy, then the opposing policy is conjugate to the imposing policy.

This does not have to be the case. Organization A may have an imposing policy that province C is rightly theirs. Organization B may have an imposing policy that province C is rightfully theirs (which is a conjugate policy) and province D, currently under the rule of organization A, is also rightfully organization B's. This total opposing policy is obviously not conjugate although it may become so once organization A asserts a policy that province D is also rightfully theirs as well.

In this context then, we may offer some circumstances when war would stop. The most obvious of these is when one of the two organizations accepts the other's policy. This implies a second, which is that neither accepts the other's policy, but they do agree to stop the war. That is, they agree to abandon the use of "other means".

From this we may infer other possible circumstances. What about the termination of the use of "other means" by only one organization? Is this cessation of war? Under the developed conditions of expectation of opposition, this should be such. Obviously, the acceptance of will is a trivial case here (surrender.) What is important is the situation where one organization simply decides to stop using "other means", nominally military, without an acceptance of will.

While this may be a cessation of war, it has a disturbing aspect. If organization B abandons the use of "other means", and organization A continues to use "other means", what is this condition? If it is not war, it has a disturbing moral and/or ethical quality that we sense has to be an elaboration rather than a fundamental matter.

This leads us to an elaboration of the expectation of opposition. We argue that opposition does not necessarily entail "other means", symmetric or otherwise. Rather, refusal to accept imposition of a policy seems sufficient to constitute opposition. This effectively permits war to be one-sided and this is disturbing.

If we return to our consideration of governments we see the nature of this disturbance. Recall that we have considered the matter of mutual recognition and sovereignty. Some

organizations, notably governments, and governments of nation states in particular, accord recognition of sovereignty only to those they define to be peers. Thus, we may have a non-state organization use "other means" to impose its will on a nation state organization. Assuming the nation state to decline to accept the imposing policy, which constitutes opposition, then war exists even though the nation state does not acknowledge such, making the war effectively one-sided. Further, such a war must persist until the imposing organization (the non-state in this example,) either prevails (its policy is adopted,) or ceases the use of "other means".

This has some important consequences. First, since war is "fought" between organizations, even if fought by individuals, does war cease when one of the organizations collapses? We have already elaborated opposition to be non-acceptance of policy (or will.) We now argue, somewhat sophistically, that if one of the organizations collapses, ceases to exist, the condition of contention (mutual opposition) by two organizations ceases to be satisfied and there is thus no war.

We are now in a position to consider the special case of extermination, which is a subject of some interest as we proceed. by extermination we mean that organization A has a policy that the members of organization B be killed. The question, rather obviously, is whether this is war?

Obviously, if organization A does not use "other means", then their actions are not war. More critically, if organization A uses "other means" and organization B exists and does not accept or accede to the policy, then war exists. The key here, however, is that once organization B accepts the policy, or collapses, then war ceases. The implication here is that efforts to exterminate a population may be war only so long as that population has an organization that opposes the policy of extermination. This further implies a distinction between imposing a policy and applying it. This distinction will not come as a surprise to students of organizational theory or practice.

The key point here is again organization. The intent is to impose will on the enemy organization. If the enemy organization collapses, then it no longer has a will of its own and while no will may be imposed upon it, the aim of war has to be considered, in general, to have been satisfied.

No Dogs Allowed

This mutual recognition is embodied in the nation state concept of sovereignty. Clause-

witz did not accord Cossacks soldierly status in part because their tribal/chiefdom organizations were not considered to be sovereign. Sovereignty is at once the means by which nation states recognize each others' legitimacy and keep other organizations from being legalistic practitioners of war (and hence Keegan's concerns.)

This also leads us into a very interesting middle ground. To all appearances, nation states have established a position for themselves that war can only be practiced by sovereign organizations. In modern organizational theory, organizations can establish their own sovereignty unless it is taken away by another organization or by collapse. We have already established that for war to exist both organizations involved must acknowledge that their enemy organization can make war. If a non-nation state makes war on a nation state, then sovereignty places the nation state in a quandary. Either it may ignore the war making or it can reciprocate.

If the former, then the nation state experiences the attrition of war without response and thereby weakens itself in the esteem of its organizational members - whether they be citizens, taxpayers, or subjects. It may, of course, stand upon its nation state right and deem the war making organization to be criminal, and if it can destroy or adequately suppress the war making organization, then the elaborate distinction of nation state as sole war making organization is preserved. Failing this destruction or adequate suppression, the nation state must either accept its pain and suffering or make war in return, the same dilemma we are dissecting.

If the nation state, whether by choice or by compulsion, makes reciprocal war upon its non-nation state foe, a state of war now exists. The elaborate dance of sovereignty aside, war now exists. Politically, the non-nation state now enjoys an advantage, for whether formally recognized as a war making organization or not, the fighting nation state has achieved a measure of nation state credibility. That honor is fraught with peril. Nation states counter criminals with police forces, whose mission is to preserve order; they fight war with military forces, whose mission, as we defined above, is the imposition of the nation state's will.

In the hierarchy of nation state priorities, survival is the highest, followed by others, of which preservation of good national order is one of those in the second rank. Thus, a war has the potential at any time to become actually the highest priority of the nation state. Further, police forces, being order bearers, are inherently one with the structure of law. Police forces are thus metered by their inherent lawfulness and indeed, so long as a modicum of order is maintained, further extension of orderliness is actually restrained. Military forces, on the other hand, answer to a higher law, a biological law transferred

to the organization, that of survival. While few wars start as survival matters, the very fact that they may become so is reflected in the nature of the military organization. As Clausewitz noted (and we have not yet discussed,) there is total war and there is limited war. To a first approximation, total war is survival war; limited war is war limited by laws and rules affordable in the absence of a perception of conflict for survival or imposed by external realities.

Primitive War

Clearly, the military forces are an organization within an organization. Even the Spartans' military that dominated Greek warfare for much of the classic period was distinguishable from the organization that made war.[9] In defining and describing what war is, it is useful to address the nature of primitive war.

Harry Holbert Turney-High [Turney-High 1949] introduced the idea of "true war" based on the basic tenets of Clausewitz and Fuller's Principles of War. In Turney-High's description, these were the criteria by which war, even and especially primitive war, could be distinguished from violent, war-like, but in his estimation, non-war activities. These have great utility but still merit analysis in terms of our recognition that war is an activity of organizations.

As presented by Turney-High [Turney-High 1949] these are:

1. "Tactical Operations;
2. Definite Command and Control;
3. Able to conduct a campaign;
4. Group motive beyond kinship; and
5. Adequate Supply."

Obviously, number one implies a body of knowledge of military activity as well as a definite force that can go to the field and conduct tactical activity. Such a force does not necessarily have to be a permanent organization, just based on this criterion. Number two is sufficient to establish that permanence because it implies a directive structure of determined leaders and obedient followers. Military action is not a result of either consensual or chaotic decision.

[9] Greek classic period warfare, while apparently more demographically diverse than during the Bronze Age, was still largely the province of an upper class who had sufficient material wealth to be armed.

Number three dictates that the military force (organization) be able to conduct a campaign. This further reinforces the structural nature of the war making force. A campaign is generally several battles whose intent is the implementation of some mission that directly supports the strategic objectives of the war. This criterion distinguishes fairly clearly between single battle-like activities, whose intent is either show-of-force political message or preservation of order police actions, and a comprehensive effort to impose will.

The significant question that arises here is why are these activities - the show of force or the police action - not war? Presumably both are extensions of policy or political interaction, in the first case with another nation state-like organization and in the second the maintenance of the rule of law or power. In both cases, the distinguishing characteristic would seem to be reciprocity.

Generally, show of force military activities serve the purpose of maintaining peaceful relationships between nation state organizations. In the American vernacular, they say "Don't tread on me." Now, clearly if they achieve that end, they cannot be considered war. If, on the other hand, they are the start of a two sided conflict of will imposition, they are war.

Maintenance of order is a similar situation, as we have discussed above.

Turney-High criterion number four is even more intriguing. While it clearly indicates that the organization must have determined that war is necessary, it restricts what that organization can be. In particular, that organization must be other than a kinship based organization. The organizations that Turney-High studied were in the main larger than what we might consider to be fundamental kinship organizations.

In the modern usage, we have a tendency to view kinship organizations as one or two parents raising one or more children, or the remains of such after the children have matured and distanced themselves from their parents, or the children once they have distanced themselves but before child rearing. This is the contemporary view of the nuclear family but in the concept of house as castle, actually more like a household. One reason for this in modern society is the almost complete prevalence of the practice of bride stealing, a topic that we shall discuss shortly.

In other than modern societies, the family was considered to be wider than this. It included several generations and thus not just parents and siblings, but grand parents, and grand siblings, and thereby uncles, aunts, and cousins. These families were (and

are) organizations, but in the past they had considerably more strength than they have today. In many cases, they exercised group determination with considerable force - controlling reproduction, for example - and engaged in violent or forceful activity to impose will.[10]

However, for most of the organizations that Turney-High studied, the family was not the largest, nor in those contexts, the organization that exercised sovereignty. As such then, he excluded war-like activities between kinship organizations as feuds rather than classifying them as wars. There seem to be two good reasons for making this distinction, and they are instructive. First, the larger organization tended to consider these activities as (at worst) criminal. That is, if they recognized the war-like activities between two kinship organizations, they treated them politically, not militarily. The actions of the larger organization were to re-establish good order and the participants in the war-like activities were subjected to criminal sanctions.[11] Second, and more significantly, the activities of the kinship organizations were suspended upon war activity of the larger organization. In other words, the larger organization had sovereignty, not the kinship group, and the kinship group either accepted this as a matter of course, or set itself up as a competitor to the larger organization.

It is interesting to contemplate the evolution of the hierarchy of organizations. We shall examine this in the later chapters. Nonetheless, we can anticipate that at some point in human development the kinship group may have been the largest or highest form of organization and thus makers of "true war".

Turney-High criterion number five is in its way the most telling. First of all, true war can only exist if there is a source of adequate supply, which clearly implies that there is a larger organization than the military force. That organization must have both the determination and the means to provide supply to the military force. This excludes purely military forces who supply themselves through loot and pillage and reinforces the group will aspect of the previous criterion. This supply must be substantial since it not only must sustain a complex military organization capable of performing tactical operations under a structure of discipline and direction, but it must do so for a protracted period of time.

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[10] We shall discuss the war characteristics of the evolutionary stages of governance organizations in a later chapter.

[11] Bearing in mind that such sanctions may be materially as well as physically punitive.

Why War?

No description/definition of war would seem complete without some consideration of the causes of war, the *casus belli*. If for the moment we step back from the legalistic aspects of this promulgated by nation states and the Augustinian aspects of ethics and/or morality, we are still left with concern for what conditions are necessary for war to begin.

Clearly, the Clausewitzian implication is that war occurs due to a political imbalance of sufficient magnitude. What is this magnitude? The answer must clearly be situational in two factors. To discuss these, Dehlbruck's [Delbruck 1985, pp. 108-109.] concept of annihilation and attrition wars is useful. First, dealing with annihilation, the political imbalance is such that the likelihood of defeat in war must be of acceptable risk. The assessment and analysis of this risk has many dimensions and is beyond the scope of this presentation except to note that most of these dimensions do not admit of rational assessment or rational analysis, or both.

Second, dealing with attrition, merely going to war at all incurs a substantial loss, both of members of the military force and of the resources that constitute their adequate supply. Once embarked upon, war cannot be simply abandoned, but endured until such time as either one side prevails or both sides collapse.

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2 The Invention of War

Having in the previous chapter developed a definition/description of war, and with the assistance of the study of primitive war found a set of at least preliminary conditions for "true war", we are now in a position to explore the subject of war in a more general context. In doing so, we recognize that our definition/description may need revision or elaboration as we discover situations that we may recognize as war but are beyond the scope of the definition/description.

In considering the developmental stages of war, we must recognize that we shall be dealing with a great deal of guesswork and hypothesis. Temporally, this period largely predates writing and thus history. We shall therefore again be dependent on the work of archaeologists, which we know suffers considerable limitation.

First, archaeological work is not heavily resourced. It has no immediate or compelling impact on either the nation state or the marketplace. The discoveries of archaeology do not raise great factories manufacturing clever toys for the masses, nor great instruments deemed central to the public defense. No, archaeology is science of a relatively pure form, a search for knowledge and understanding largely for its own sake and not for application. As such, it is dependent on the dedication of its practitioners and the kindness of wealth, either through idealism, idiosyncratic interest, or tax avoidance. Archaeology enjoys neither great monetary resources nor great numbers of practitioners.

Because there are so few archaeological resources, little of the planet has been studied (and much of it is being built over.) Few sites of ancient habitation (or even battle) have been found because: little area has been studied; ancient populations were sparse; and their largely organic dwellings (building materials) and possessions were highly ephemeral. Until man invented agriculture he did not have the slack labor resources to build elaborate edifices for the entombment of autarchs or the dismemberment of others.[12]

In addition to the scarcity of discovered information we must also cope with the human-

[12] I use slack here in the optimization sense of resources that may be applied to effort. Edifices has the meaning of both belief system and building.

ity of the practitioners of archaeology. Most of these practitioners are academics and those who administer the archaeological journals are overwhelmingly so. Thus, they not only suffer from human foibles, but are susceptible to the political maladies that infest the campuses. From our standpoint, the most critical of these is the anti-war sentiment that developed during the Twentieth Century. Intensifying it is the cult of commonality that seeks to promote diversity while ignoring differences among individuals and groups. This results in such tortured pronouncements as the inherent peacefulness of primitive man and the widespread (apparent) acceptance by many archaeologists that any form of violence is evidence of war.

I need caveat here that the latter assertion is based on my observation. I do not possess the knowledge or skills that define the professional characteristics of archaeologists. I do however, possess knowledge of war sufficient to distinguish among brawls, social and political duels, and battles. Broad pronouncements commonly occurring in anthropology and archaeology books and articles demonstrate that those who wrote these books and articles frequently cannot so distinguish.[Leakey Ardrey 1972] Attempts by archaeologists and anthropologists to define war are no more widespread than those of military writers.

What is Man?

In the preceding chapter we noted that some animals are said to practice war. The most common example of this is the ant. Within our definition of war however, we are moved to dismiss these assertions. Ants, while sentient, are not intelligent. So far as has been determined, they do not practice what we might consider to be politics or political interactions. Their policies are a matter of biological encoding in their DNA[13], and not a matter of group determination. Thus, while ants and other animals display violent group behavior, this cannot be considered to be war since it does not embody intelligent objective, but only instinctual.

In this context then, and until we observe war among other intelligent species, we must regard war as the province of man, because of his intelligence, among other things, and therefore our first task in discovering the invention of war is to follow the development of man as it impacts that invention.

What is man? At first glance, we may choose to characterize man by his social activities (which lead to cities, agriculture, and war), his brain/intelligence (sentience, while

[13] DeoxyriboNucleaic Acid

important, even crucial, is too common for this list,) and his opposable thumb. Erect carriage with differentiation of limbs for grasping and carrying distinct from those used for locomotion, and ovoviviparousness might be added to or substituted on this list.

These characteristics distinguish us from other animals to various degrees. Term placental birth with suckling clearly distinguishes us from the egg layers but not from the marsupials. What does this have to do with the nature of humanity and war? Simply, it relieves us of the constraints of egg protection. This constraint, whether we embraced it or ignored it, would have made vast changes in what man is and how war would look. Happily, we are not external egg layers, so we need spend no further effort considering intelligent external egg layers and their type of war.

Similarly, the opposable thumb and social activities also distinguish us from most of the mammals, at least in combination, but still lump us in with monkeys and apes. It takes the differentiation of limbs to distinguish us from the rest of the animals in existence today. All of our close relatives (as indicated by commonality of DNA,) monkeys and chimps and the like, do not walk erect with arms free to carry children or goods or weapons.

Speech and intelligence are more problematic, in combination if nowhere else. Research has shown that other animals have capability of oral (or body language) communication. Similarly, researchers have also shown that the monkeys and chimps can learn communication, but this begs the question of whether they can invent it.

In a like manner, intelligence is a quantitative rather than a strictly qualitative matter. Again, our relatives can do puzzles and figure out how to build *ad hoc* structures to acquire the food suspended from the ceiling. But they do not apply the results of those puzzles to the development of permanent physical or informational structures.

As regards speech and intelligence then, it is a matter of quantity and combination. What sets man apart from other animals (besides limb differentiation) is how much speech and intelligence he has and how he uses them together.

Obviously, speech without intelligence turns into simple signalling such as the songs of birds. Intelligence without speech seems equally doomed to mediocrity, if not failure. The situations of deaf-mutes, such as the exceptional Helen Keller, are fully indicative. Those who have an avenue of communication opened up to them (soon enough) manifest themselves as human and even with discrimination and prejudice are treated as such. Those who do not learn to communicate but remain trapped in a solitary universe

are reduced to simple animality with expectations of humanity only by those unable to distinguish appearance from capability.

With this list in hand, we are now in position to look at the rise of man. Before we embark on that journey however, this seems a good juncture to broach a model of human development. This model, made popular by Toffler,[Toffler 1980] is one of ages (or epochs) of activity.[14] In his discussions, Toffler makes use of three ages: Agricultural; Industrial; and Informational.

We shall not discuss these in detail here, deferring that discussion to later chapters as the ages fit more naturally into our presentation. Since Toffler does not discuss the so-called Hunter-Gatherer [Haviland 1997] Age very much, possibly because his interest is primarily at the other end of chronology, and it does fit into our presentation here, we introduce the concept and that age now.

Further, as we embark on this presentation, we again note that we are dependent on the work of anthropologists and archaeologists, with all the limitations we have noted previously.

Out of the Trees

Those who search the earth for the bits of stone and bone and wood (in some cases turned to stone) that are the remains of man and his activities prior not only to history but to what we glibly call civilization (dwelling in cities,) tell us that at some point many years ago the ancestors of modern man climbed down from trees and became ground dwellers. This started a long journey marked by the physical changes from a limb jumping animal to a ground walking animal and the mental and social changes from immediate object adaptation to tool making and keeping.

We add tool making/keeping to our list of man characteristics. This may be debated by those who observe other animals adapting available objects to do work, sometimes with modification. The use of a twig, once its leaves are stripped off, to extract insects from their nests is a classic example. Every case cited shares a common feature that differentiates that animal from man. Once the task at hand is completed, the tool is invariably discarded, often forgotten. The key appears to be not only construction of the tool but its retention as well. Of course, an animal whose limbs are not differentiated can scarcely be expected to retain tools if that compromises locomotion? Again we see

[14] In later works, Toffler is joined in authorship by his wife.

that the measure cannot just be the simple satisfaction of a check list but must include the synergy arising from the interactions of those criteria.

Man, or something like man - hominines[15] - have inhabited the Earth for quite a while. [Haviland 1997] The date in current textbooks places the start of this at about 4.4 MY[16] before now.[17] Obviously, for numbers this large, we can afford to be somewhat cavalier about the millennium we are currently in. When it gets critical we will switch to a more absolute numbering system.

The earliest incidence known of the hominines is *Ardipithicus Ramidus*, but since this appears to be a transitory species, our first concentration is on the genus *Australopithicus* (four species known as of this writing,) who emerged about 4 MYA.

The *Australopithecines* are noteworthy because they are truly bipedal. In terms of our earlier discussion, they have begun the process of limb differentiation. Of course, they have opposable thumbs; that characteristics appeared with the lemurs (or before?) They also have a social organization inherited from their ancestors.

The textbook explanation for the development of bipedalism is usually given as heat control. Having come down out of the trees and onto the ground, the hominines also moved out of the forests and groves onto the plains and savannas. This indicates either that they were driven out by the tree dwellers, which is rather at odds with the hominines being a more fit species/genus, the trees went away (decreased in density,) due to climatic changes (a view expressed in some texts,) or the hominines were so prolific that the forests would no longer support them all so some had to move onto the open plains where greater area was needed because of the lower food density.

One wonders about the trauma of all this. It is difficult to view the tree dwellers as driving out the ground dwellers. Their environments had diverged. But if the food source of both was tree fruit, then the tree dwellers would likely possess an advantage over the ground dwellers in gathering fruit and in escaping the countermeasures of the ground dwellers. As of yet, the ground dwellers were not yet tool makers (based on discovered, unrotted evidence,) so the obvious insight is that competition between tree and ground dweller over tree fruit would place a premium on organization of the ground dwellers? At any rate, it seems too much that the tree dwellers would have expelled the

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15 Hominines are distinguished from other animals by their bipedalism.

16 Million Years = 10^6 years. We shall use the acronyms MYA for million years ago, and KYA for thousand (kilo) years ago.

17 The dates given are drawn from several sources: [Bunch 1993]; [Campbell 1999]; [Grun 1963]; [Haviland 1997]; and [Mithen 1996]; which have greater or lesser overlap and agreement. Rather than specifically attribute common dates, we consolidate citations here.

ground dwellers and entirely reasonable that the ground dwellers would have to accept second place in fruit acquisition competition. Of course, they had other challenges and opportunities on the ground.

Similarly, even if we neglect the thinning of the forests and groves, it would not have taken a great increase in reproductive capacity to reach a point where there was simply not enough fruit available to sustain the numbers. We may fairly safely assume a protracted infant development time. Ground raised infants may have greater inherent survivability than tree raised, depending on how the predator threat is handled. Tree raised infants may fall from the trees and require concerted rescue but are less susceptible generally to predators. On the other hand, having been encouraged to develop greater community or group organization to acquire fruit, that encouragement is doubled by the need to protect infants from predators. Which is more vulnerable, ground or tree raised infants?

Regardless, because fruit is not a high energy foodstuff, and the ground dwellers are likely coming off second best in acquiring the available fruit, not too much fecundity is necessary, enhanced by even primitive group organization, or diminution of forest and grove density, for the ground dwellers to become food marginalized in this environment. If they do not do something, they will starve.

It seems unlikely at this point that any type of rational activity occurred to determine who stayed among the trees and who moved out. Perhaps it was a group activity where particularly ineffective groups chose to leave the trees just because they were looking for a better life, or perhaps it was a case of groups dividing with expulsion of the weaker or lower class members. I have seen no pronouncements, possibly because the anthropologists do not want to discuss violence, but more likely because there is no record, no evidence.[18] So, most simply, some of the *Australopithecines* moved out onto the plains.

Onto the Plains

At any rate, once out on the plains, heat control becomes a problem of increased magnitude. In the trees, one can avoid insolation by stepping into the shade or seek breezes by climbing the tree to get higher in the turbulent boundary layer where air flow can be smoother. This is not the case out on the plain where one gets heat both from ground conduction and direct radiation. To reduce heat absorption, one goes from four extremities in contact with the ground to two, and increases the ratio of surface area to volume

[18] If the trees just went away because of climate change, then the violence issue is a non-starter.

to increase air conduction and emission. Standing upright also helps.

We do not know whether the *Australopithecines* were combative or not, or if so to what degree, but regardless, we can be reasonably sure that they had not invented war. Until about 2.5 MYA, there is not much evidence that they were tool makers or hunters. Up to this point we are in more of a Scavenger-Gatherer Age than a Hunter-Gatherer. Also, the population density was very low, and appears to have stayed low by the *Australopithecines* being prey for large and pack carnivores of the time and region. Survival was too hard for wasting efforts fighting each other.

It seems worth digressing a bit at this point to discuss some mechanical details. When the *Australopithecines* came down out of the trees, they lost their large canine teeth and had already lost their claws. Nails are defensive, not offensive. The *Australopithecines* were poorly equipped with natural weapons to either fight carnivores or kill game. At the same time, vegetation is not a good source of energy. Admittedly fruit and nuts, plant reproductive organs, contain more energy to nourish the developing plant and thus offer more energy for diversion by *Australopithecines* (and Humans) to their own needs. Of course, these have to be digestible, which is not a universal condition, and they are often seasonal. A better energy source is animal flesh.

About 2.4 MYA, *Homo Habilis*, the first hominine to pass the "so-what" test to be labeled human, makes an appearance. As a result of the heat control made possible by bipedalism, and differentiation of limbs, and increased brain size and function, tool making, using, and keeping come into their own. Similarly, scavenging of remains (this gives us a whole new perspective on "road kill",) a common albeit paradoxical behavior of the *Australopithicines* begins to evolve through stealing of recent kill into full fledged hunting. Heat control also means energy control and that will only work if the energy source is controllable.

There are two aspects of this evolution that appear important to note. Having observed larger carnivores "robbing" smaller carnivores of their recent kill, and given tools and thence fairly directly hunting tools, it is not too great a leap from running from all carnivores to staring down the smaller ones (while still running from the larger,) to "robbing" the smaller of their recent kill. This does not happen over night, but we are talking most easily in megayears here, so change can be slow. Part of this change, this evolution from scavenger to hunter, is establishing a dynamic of confrontation. This confrontational behavior is an important step on the road to inventing war. The joint art of confronting that which is like us and that which is not is the precursor of politics and thereby of the strategic level of war.

The second aspect is the development of hunting itself. Hunting is the precursor, the developmental laboratory, of the tactical level of war, just as confrontation is a precursor of the strategic level of war. Basic column and line formations are common to hunting and war.

If one bands with others in a group for survival, and this is necessary to protect young from predators, starting when one competes with tree dwellers for fruit and then when one lives on the plains and runs first from all carnivores and then only from the large ones, then when one begins to hunt and confront some, eventually all(?), carnivores, one hunts at least in small groups, if practicable. Concentration is a survival shield that goes back at least to being hominines, if not sooner, and there seems no reason to discard it at this stage. (Having made this argument here, we shall shortly depart from it in elaboration.)

If one hunts in small groups, then one moves in a column as the group searches for game and as it approaches the game to minimize the chance of the game sensing the hunters. Once close however, or once the game has been alerted, the column quickly redeploys to line to maximize the killing (or chasing) resources of the group against the game. The transfer of this to war is so obvious that I shall not belabor it further.

Differentiation of limbs also raises another point that we have to explore. While our ancestors were still tree dwellers or ground dwellers using the four point system, they had an excess of stability. The tripod is the most stable of structures with three points of contact. Our ancestors, with four point of contact systems, enjoyed an excess of stability. They could locomote by always having three points of contact, alternately moving a limb out and into contact. Further, limited combined locomotion and carrying could be effected. This same stability would have been present in the trees as on the ground.

The disadvantage with this, from our perspective, is how to carry something and still preserve stability? It is tempting to hypothesize that this need to carry, to make more productive use of the limbs, is a reason to move down to the ground and to develop limb differentiation. If so, its documentation of study is beyond the level of my researches.

Anyway, having moved from the trees to the ground, and from the forest to the plains, thermodynamics takes over and our ancestors went from three point stability to two point instability, from leaping and swinging to walking. In this process, the old three point stability was given up. In its place is a system that is not stable at all.

This transformation, as we know, was neither easy nor immediate. Not only did the shapes of bones and muscles have to change, but their connectivity as well. The whole architecture of skeleton and musculature had to change for erect stance and two legged walking to work.

In this process, our ancestors had to get new programming so they could walk both consciously and unconsciously. They had to become programmed not to fall down, and when they did fall down, to do so in a reasonably safe fashion.

This change in the programming, the so-called "wet ware", of our ancestors also had other effects on them. The obvious one is that it changed the nature of the Fight-or-Flight response. If you can run, then the advantages of flight are increased; on the other hand, if you have two spare limbs instead of part of one, and can hang onto something all the time, then the advantages of fight are increased. By differentiation of limbs, our ancestors, who could now run and carry/grasp full time with two limbs, now have a whole new Fight-or-Flight landscape[19] that may not have changed greatly in the mean but definitely greatly in extent. Flight now spans everything from walk away to panic running; fight now means considerable mobility and two fighting limbs as opposed to an almost static defense and one fighting limb.

The new two point contact system is more complicated than the old three/four point system, making greater demands on the individual. The process of developing this was undoubtedly a long one for the pace of extreme biological changes is slow. We get some idea of the enormity of this change when we watch infants progress from crawling to actual walking. We get some idea of the difficulty of walking when we compare the developmental time of primates to that of human infants, noting that a considerable amount of that difference is spent by the human in becoming proficient in the skill of walking.

Not only is the two point stance not statically stable, but walking is almost unstable dynamically. In fact, taking a single step is less stable than walking a mile. This phenomena is not unusual. Almost all ground animals have a method of movement that has some periodicity that makes the movement more stable over distance.

But walking is somewhat analogous to an engine in the sense that once an engine is started, it is relatively easy to keep running because it has a periodic stability. The hard thing with engines is getting them to start and stop. The way we get an engine to start is

[19] Yes, this is a double entendre. I mean landscape both in the sense of Chaos Theory and in the sense of purview of real estate.

by some impulsive action, as using an electric motor to turn it, and fool the engine into "thinking" it is already running. Usually, we stop an engine by starving it.

While the impulsive action works to start a human walking, we have to stop walking by damping the periodic behavior. If we just go from walking to standing we usually fall down. The problem is one of control, and this is the point that we have been building to. Just as the added scope of Fight-or-Flight requires more thinking capacity (or capability) when you can walk/run/carry, the starting and stopping of walking requires more thinking capacity/capability as well.

If you go to the textbooks and read up on the thermodynamics of the two point stance, you see that this is associated with brain development. The implication is that by having to go to the two point stance, which is the result of moving out of the forest, which is due in part to reproductive efficiency, which is due to coming down from the trees, our ancestors were fortuitously set on the road to intelligence. Sadly, that's the wrong impression to take. For the two point stance to work, our ancestors had to develop the wetware to develop the processing to walk and to cope with the changed environment as reflected by how Fight-or-Flight worked. What is fortuitous is that the approach that resulted in our ancestors worked and others didn't.

One crucial area of that wetware development that resulted from walking and influenced, for example, the Fight-or-Flight decisions, was our ancestors' approach to risk. Risk is a strange thing. In general, one wants to take the right amount of risk. If one takes too little risk, then the result is always inadequate. If one takes too much risk, the result is almost always inadequate. The trick with risk is to take the right amount so that if loss occurs it is not too destructive, but if gain occurs, it is worthwhile. Attempts by Operations Researchers to be quantitative aside, risk taking is often subjective and depends on the world view. In our ancestors' case, their world view shifted to being more risk accepting when they started walking. This inclination to take greater risks in an environment of persistence is a critical factor leading to the invention of war. If our ancestors had not made the transition from three/four point to two point stance, from leaping to walking, with the accompanying mental faculty to start and stop walking, and to deal with the extended scope of Fight-or-Flight, which gave them an expanded scope of dealing with risk, then war would not look the same as we see it.

It also seems reasonable at this point to deal with our earlier mention of reproductive efficiency by putting this in the context of the social group of our ancestors. Based on both archaeological findings and modern observations of primates, we are presented a model where the social group consisted of about 25-50 members. Again, based on risk,

this seems a reasonable estimate. Below this size the group would not have enough members to do multiple things. Above this size the group would be too large to support itself.

It is tempting to postulate a cyclic model where the social group increases in size until it becomes too large to support itself and then splits into two groups of approximately half the size of the original. One may even do some quantitative population modeling of this that is relatively insightful in terms of the balances of individual life span and time between group fissions.

We shall refrain from that delightful diversion and content ourselves with simple speculations like whether the demographics of these groups of plains walkers were different from those of groups of limb swingers?

Enter Man, Stage Left

Limb differentiation began about 4 MYA with the *Australopithecines*. As indicated, this was a long, tedious undertaking, but by about 2.4 - 2.5 MYA it is essentially complete as *Homo Habilis* makes a brief appearance on the world stage. *Habilis* has not only made the physical and mental transition to limb differentiation, but has begun to explore the possibilities of this transition. Tools, in the form of worked pebbles, have made their appearance and the diet has changed to include much more meat.

Again, we are at the mercy of Archaeology. We have no assurance that tool making did not occur earlier, but unless the tools were made of stone, or of other materials that happened to ossify, it is highly unlikely they would have survived to the present and await discovery.

The evidence that is available is fairly clear however. *Homo Habilis*, with limb differentiation, is now a more dynamic creature. With the ability to walk efficiently, mobility shapes life. The increased intellectual capacity needed for (at least starting) walking has also been directed towards providing capabilities denied by nature. These additional capabilities afforded by tools are, in moderation, transportable because of limb differentiation. The combination of mobility, tool making and keeping/transport, and the enhanced faculties of risk management put *Homo Habilis* more often in contact with hunting carnivores and small game. The frustrating role of fruit, berry, and nut gatherer is diminished as scavenging and then hunting is developed.

This has at least two major effects: one social; the other biological. The biological effect

is an acceleration of brain/mental development. Current views are that the fats present in meat are directly responsible for the increase in brain size and function as man evolved. The social effect was to increase the division of the social group. While the group was still preponderantly gatherers, the prime differentials were age and the maternal role of females. Now, with the advent of hunting, the social group is further divided. In effect, the Principle of Concentration comes into play.[20]

So valuable is the use of tools, and so profligate their use, by about 1.9 MYA there is evidence of industrial production of tools. This indicates several things:

First, it indicates that the tools are probably not very durable and wear out quickly with use. But it also indicates that tool making has become not only internalized as part of the wetware, but has probably been socially accommodated with application of the Principle of Concentration.

For industry to work, the manufacturing process must be broken down into component operations and skills applied to these operations optimized in assignment. In other words, folks tend to do those jobs they can do best. Another step has been taken on the road to civilization, and to war.

But also crucial to industry is a means of distribution. It does little good to produce great quantities of goods - in this case, stone tools - if they cannot be distributed. At this stage in human development, animal domestication has not occurred, so the only method of transportation and thereby distribution, is by human. This raises serious questions. Does the social group spend some time each year at the industry site producing enough tools for a year and carry them with them, or do they spend all of the year there and other groups trade with them? The records I could find were silent on this.

The great leap of tool industry was apparently the swan song of *Habilis*. By about 1.8 MYA, *Homo Erectus* has come on the scene. This new species of man has some physical improvements, but pretty clearly shows that the direction of improvement is going to be along mental lines. By about 1.5 MYA, *Erectus* has figured out how to use fire, if not necessarily how to make it. We also have evidence of cannibalism.

Do we have a war situation here? What happened to *Habilis*? Does cannibalism indicate military activity? The cautious answer is probably no, we do not yet have true war. While full transition from Scavenging/Gathering to Hunting/Gathering apparently takes place with *Erectus*, there is scant evidence that either species is far enough along to

[20] For a discussion of the Principle of Concentration, see the Physics of War (POW).

invent war. But we may be beginning to have brawls and fights that go beyond fisticuffs. With the invention of tools, and in particular stone tools, what had previously been nasty wrestling, eye gouging, ear biting fights could now become deadly earnest.

We do not know how dense man was on the ground, nor how frequently two groups encountered each other. Clearly as time progressed, these probabilities of encounter increased and may have been contributing reasons for migration. At some point in human development, consciousness of identity would develop enough to give rise to the basic idea of Us-Them that is necessary for competition, conflict, and war. Were these meetings of groups peaceful trading affairs or bloody fights? Before we embrace either view, we have to recall that at this point in human development our ancestors do not appear to have speech.

Prior to the invention of tools, and given low enough densities, we may imagine that most group meetings did not result in fights, but either stare down contests or outright flight on one or both sides. Fights, if they did occur, were probably indecisive brawls. With the invention of tools, the situation is somewhat improved, but not much. We shall discuss the nature of weapons subsequently, but simply put, hand tools are poor weapons whether used to kill game or other humans.

How then do we explain the presence of cannibalism? In an environment moving from scavenging to inefficient hand tool hunting, it is still hard to get enough food. If a stranger wanders by, given a developed sense of Us-Them, and food is short, the stranger is just another animal, especially in absence of speech. If a hunter is killed in the hunt, don't let the meat go to waste.

What happened to *Habilis*? Did *Erectus* kill *Habilis* off? This is more interesting. While genocide is at best marginally war, it is decidedly warlike because it requires organizational objective and persistence, and usually violence.

Is It War Yet?

Genocide is commonly considered to mean the extermination of some large group, often what we rather inaccurately call a race. (While the concept has outlived its scientific usefulness, it is still used by lawyers and politicians.) The word has its origins in Latin and may be translated somewhat literally as "clan killing", a clan being taken to be a collection of (extended) families and thus similar to the Roman *gens*.

For our immediate consideration of whether one species of human extinguishes another,

this is a mixed term. The taxonomic use of the word *genus* is not too far from this use of clan here. In fact, both words, genus and genocide, arise from the same Latin root *gens*. Given that commonality, we depart from it when we consider the use of the term genocide. A *genus* refers to one or more species, while genocide is usually applied to a group that doesn't even have a taxonomic distinction. Genocide of a species, such as we are considering here, or of a subspecies, as we shall be considering later, is an extreme use of the term in both senses.

We have presented that war is an extension of policy by other means. War is practiced by organizations. We have already discussed that humans form organizations, an activity passed down to them from non-human (pre-hominine) ancestors.

We might characterize the basic policy of such organizations as survival. Survival is the bedrock reason for the primitive organization even if the organization's behavior and activities evolve into other dimensions. In the sense that survival may span a space of situations ranging from snatching imminent death from the jaws of predators to good health and physical and mental well-being, even many of these evolved alternate dimensions take on a survival related complexion. In fact, what demonstrates the fundamental survival policy of the organization is the immediate abandonment of these other dimensions when the predators are present.

As we have already discussed, if *Habilis* and *Erectus* are to survive on the plains, they must do so as an organization, not as a collection of individuals. If that organization perceives that another, similar organization's actions threaten the first organization's survival, then the first organization may adopt a policy of enmity towards the second. Then other activities failing, war may result if the first organization uses compulsive means (usually violence) to impose its will on the second organization, and the second organization responds in kind.

We have also discussed that the density of humans on the ground is fairly low. It has to be because at this stage of technology, hunting is still more a matter of scavenging the remains of large animals and of killing small animals directly. The gathering part of the food activity is still a large part just because hunting has not yet come into its full efficiency. Thus, our small organizations, these Hunter/Scavenger-Gatherer bands, have a fairly large area of operations, because they need a large area to sustain themselves, and they operate in a fairly compact locality to protect themselves. In other words, while they need a big area to live on, they only use a relatively small part of it at any one time.

The immediate import of all this is that one band may pass through another band's

territory and the two bands never see each other, but be aware of each other's presence by the depletion of food resources, or the garbage left behind.

The question we now need to address is what happens next? This is not at all clear. We have very little idea of the nature of social interaction between these bands. Current theory is that they did not have speech yet, and this is commonly taken to indicate an absence of language. While there is a lot of evidence for the development of non-speech languages, such as the Amerindian hand signal language, we won't argue with the experts.

Given the absence of language, can we presume that this also means a lack of communication? Maybe or probably are the best answers we can come up with. Some experts argue of primitive trade, especially of young people to balance out the bands' breeding demographics. In my simple mind the question I would like to see/hear answered is whether our ancestors have learned about the genetic catastrophe of inbreeding and propagated that knowledge enough to have a rational reason to interact with others? In other words, have we figured out incest at this point?

Happily, it appears that we don't actually need to answer this question for our needs here. Let's assume that when two bands meet, they respond with a simple collective Fight-or-Flight. Taking a leaf from the work of those who research Complexity,[Jensen 1998] let us assume that the band has some sort of organization that collectively decides to either run away or attack or defend (somehow this one seems a lot more likely?)

Now let us consider the nature of the band. We've already discussed that these generally have a size of 25-50 folks. Given that any given group of (modern) folks in any fairly broad locality tend to have the same size of comfort zone, we can probably assume fairly safely that when these two bands of early humans meet, they're going to have about the same natural density of folks. Thus, even if they can't count, they can discern whether the band across from them is bigger, smaller, or about the same. Thus, they have some reasonable basis to make a run away decision.

Also, somewhere around 10-20% of the band are the hunters (scavengers) who have some skill and experience in using hunting tools on animals. Of course, tools are not all that differentiated yet, and are all pretty much hand tools. At least we think they're hand tools but since we would probably haft them on wood using bark or sinew, survivability of the entire tool becomes problematic. Anyway, let us say they only have hand tools, but let us also recognize that these tools may be sharper than modern steel alloy razor blades. This is important.

The usual thinking on this is that the hunters would form the attacking body while everyone else in the band formed a defensive perimeter if the band decided to attack. Alternately everyone would form a defensive perimeter with the hunters as a flying force if they decided to defend, and the hunters would form a rear guard if they decided to run away. Regardless, the hunters are the armed force. Lets pursue that for a moment.

If the two hunter sub-bands meet, then the combat is going to get close up - the weapons are all hand tools, remember - and sanguine - because those hand tools are sharp - so the combat is going to be mean and nasty. Now recall that the hunting group is at most 20% - five people in a small band - and this is a generous estimate. Lets say that the hunters are good enough that they can each feed six people. In that case, a band of 25 people can afford the loss of one hunter without massive impact, but they can't lose two without a big impact.

Further, when they do lose two (or more) hunters, it isn't a simple case of performing a RIF (Reduction In Force) and turning out five folks from the band to starve. Its more likely a case of everyone going on limited rations, some of the children and aged dying quickly, and a balance being restored. But if the band is close to the minimum number to start with, the loss of 20% of its folks may be catastrophic and it collapses. Or if it spreads the hunger over the whole band, it collapses because it can't perform. Or it loses too many skills to be effective? Regardless, it appears that combat at this time is going to be pretty nasty and that would seem to cause a polarization of these interactions between bands.

Before we get there, lets consider an alternative. There is evidence that *Erectus* (and *Neandertalensis*) practiced cannibalism. The usual argument is that they do this when food is short and on wandering strangers. How about when they lose a fight with another band and know they're not going to be able to feed everyone?

Anyway, the polarization is based on this nastiness of combat. If the two bands do clash, and the clash preferentially occurs among the hunters, and given that once it starts it isn't going to turn off easily, then what we have is very different from a simple quarrel. What we have is a situation where once a fight occurs, its going to have a very strong effect.

From this, we can project that we might expect *Habilis* and *Erectus* bands to be fight averse, just because of this high risk, but if such a fight does occur, the result is likely to be the collapse of one or both of the bands. (And that collapse may be the source of the wandering strangers?)

We can project that the greater the differences between the two bands, the more likely a fight is to occur. In other words, given the physical differences between *Habilis* and *Erectus*, fights between an *Habilis* band and an *Erectus* band are more likely to occur than fights between two *Habilis* or two *Erectus* bands.

Now, if we give *Erectus* a slightly better efficiency than *Habilis*, either in birth rate/infant survival, or in the likelihood of (non-) collapse of a band after combat, then it doesn't take a policy on *Erectus*' bands part to eradicate *Habilis*. Even if the probability of an *Erectus* band's collapse after losing two hunters is (e.g.) 49% versus (e.g.,) 51% for an *Habilis* band, after a fairly short period of time, there will be no more *Habilis* bands. I won't belabor the mathematical modeling of this, but leave it that *Erectus* doesn't need to go out of his way to destroy *Habilis*, *Erectus* just needs to be a bit better at survival.

Oh!, and by the same argument, we don't yet have war here yet. At least, we don't have true war yet because we don't have the capability to have a campaign, or even a battle that isn't always attritional in form. We may have fights between bands, when they can't avoid it, but it isn't war yet.

The First Change of Man

The archaeologists have found very little evidence that *Erectus* eradicated *Habilis*, no compelling collection of massacre sites. Of course, given the probabilities that we have previously discussed, absence of such sites is not definitive. Further, as we've just developed, we're not talking big sites here. All we need is a few, two or three fatalities per side, either on the field or off, for the band to collapse after a fight. Nonetheless, our assessment, arrogant as it may be, is that *Erectus* did not practice genocide on *Habilis*. The official textbook answer of the anthropologists seems to be that *Habilis* just wasted away as a species by virtue of *Erectus*' greater abilities. In other words, *Habilis* couldn't compete with *Erectus* for resources and died a miserable species death of starvation.

This seems a bit hard to swallow, even now. Yes, if the two types of bands did fight, then it is plausible for *Habilis* to get edged out If *Erectus* is a little bit better at fighting than *Habilis*, and predominantly collapses *Habilis* bands to be preyed upon and starve, then it is easy to see that *Habilis* would have gone away. If both types of bands were fight averse, because they understood the risks, and risk understanding is part of erectness and limb differentiation, then if *Erectus* is a better hunter than *Habilis*, *Habilis* will wither away. But even this isn't necessary.

The textbook theory is that *Erectus* started as a mutation of *Habilis*. If this is the case, then the early *Erectus* individuals would still be interfertile with *Habilis*. While Darwinism has a tenet that independent species are not interfertile, if a new species arises from another, the two have to initially be interfertile. But we do have to assume that the mutation is dominant genetically.

If that's the case, and the mutation is more survivable, then females of both the original and mutation "species" will want to mate with males of the mutation "species" because that will make the survival of their offspring more likely. Thus, as proto-*Erectus* is developing, and is surviving because its a better survivor than basic *Habilis*, then because it is better at surviving, proto-*Erectus* males are more likely to get mates than *Habilis* males, and if the mutation is genetically dominant, more proto-*Erectus* babies are being born each generation. Thus, over time, natural selection replaces *Habilis* with proto-*Erectus* (and thence *Erectus*) without the need for genocide. And the only nastiness of this type of conflict is frustrated *Habilis* males, not widespread starvation.

Bottom line appears to be that it isn't war yet.

Having made the transition from *Habilis* to *Erectus*, at about the same time the use of fire appears (about 1.5 MYA.) What is called archaic *Homo Sapiens* makes an appearance at about 1 MYA, but *Erectus* is still around and stays around till about 400 KYA. On the surface this would seem to indicate that there's no genocide going on, or archaic *Sapiens* is totally inept as a fighter!

At this point I need to talk about a matter of confusion. That confusion has to do with *Neandertalensis* and *Sapiens*. I mentioned that archaic *Homo Sapiens* made an appearance at about 1 MYA. The confusion seems to be whether *Neandertalensis* is a precursor to modern *Sapiens* or a parallel track. Some of the expert narratives refer to *Neandertalensis* as *Homo Sapiens Neandertalensis* and "modern" man as *Homo Sapiens Sapiens*, which would indicate the possibility that *Sapiens* (modern man) evolved from *Neandertalensis*. Other narratives indicate that they both evolved from *Erectus* at about the same time but at different places and it took about a half MY for them to build up enough numbers to run into each other. For our purposes of looking at the development or invention of war, its not at all clear to me whether it matters very much.

Enter the Spear

By about 300 KYA, *Neandertalensis* has established himself/herself in Spain, indicat-

ing that Europe has been entered. What is highly critical, but not mentioned often in the learned narratives is that by this time, based on remains that have been found, the wooden spear has been developed. Since the wisdom is that *Erectus* faded away about 400 KYA, this leaves the planet to *Neandertalensis* and *Sapiens*.

We also have the rather helpful information that not only tool making but fire making (or at least using) has preceded the spear. Why is this useful? Well, it tells us quite a bit about usage.

We know meat became a major part of the human diet about 1 MYA. This had to start as scavenging and grow into small animal hunting. We have already discussed how risky it is for man to confront large animals with hand choppers and blades. Of course, we have evidence of massive kills of large animals effected by driving herds off cliffs, often using fire, but we have to acknowledge that such windfalls are not going to be common. Not every human band is going to have their own private cliff that animals will willingly queue up to be driven over every month or so.

Now scavenged meat is going to be old and even partly predigested. In fact, its likely to be at least partly rotted. As a result, germs and suchlike aside, the complex proteins and fats have already been partly broken down. As a result, our ancestors started out on diets that were easier to digest than we would expect.[21]

Anyway, along comes the use of fire and the construction of stone tools. Fire is an entropic wonder. It takes stored chemical energy and converts it into heat and you get waste products like smoke. Smoke is nice because smoked meat lasts longer before it rots to the point of danger. One can hypothesize, given the fine line between well aged meat and rotten meat, between easy to digest and makes you sick unto death, that smoking of meat was accidentally discovered but led to the invention of cooking on the good old human formula that if a little is good, a lot must be better. This formula is the basis of much of the fast food industry today, so it is probably a human wisdom that has a genetic existence.

At the same time, tool making was developing. It would take a long time for the accidental juxtapositions of the separate components of "flint and steel" sparking, fire starting from high surface area soft organic matter, ... to evolve into deliberate fire technology. Nonetheless, the evidence indicates that while fire making may have been the rocket science of the day, human bands were acquiring the technology. That’s not to say that other

[21] This brings a whole new viewpoint to the German philosophical phrase "That which does not kill us makes us stronger."

techniques, like fire drills or bows, or even some fire container couldn't have evolved, but those things would have been organic and have themselves rotted away by now. And the learned narratives I sampled didn't talk at all about this.

The actual dynamics is not directly relevant to our goal, what is important is that man had fire making and cooking before the spear.

Why is the spear important? The answer is simple. It revolutionized hunting.

Up to this point, hunting implements appear to have been hand tools. There were a variety of things including the ancient equivalent of razor blades and hand axes, even some evidence of stone blades set into animal bones to make the ancient equivalent of a serrated edge knife. But there doesn't seem to be much evidence for hafted tools. Even if there were hafted axes, and we would expect that the idea of a true spear would start as a stabbing spear, a hafted point, an ancient *assegai*, this doesn't change things very much. Of course, we don't know about the tools that were organic in composition that rotted away before modern archaeologists got on the spot, but we'll try to allow for that.

Let us assume we have these simple tools and are going hunting. What and how do we hunt? Well, its very hard to sneak up on small animals, and almost impossible to sneak up close enough to smite them with a hand axe. No, if we're going to hunt small animals, we're going to do it by sneaking up on them and throwing a hunting rock at them, inflicting disruption or bone breaking. Oh, and by the way, there's some evidence in the learned narratives that man had figured out basic aerodynamics enough to make throwing stones.[22]

You don't throw little stones at medium to large animals. You can get pretty close to a large animal before they spook, but then what are you going to do? Charge them and try to hack them into chops with a hand axe and razor blades before they stomp you into the mud or run away? No, you don't hunt large animals with hand weapons.

If you don't hunt large animals, then you don't have hunting parties either. You may have a group of people who go off every day and hunt, but they don't stay together. No, they disperse so that they don't get in each others' way and spook each others' game. You may hunt small animals, varmints as we sometimes call them in Alabama, in pairs, partly for safety and partly to have the better part of a full circle of vision (about 240 degrees out of 360,) but you don't hunt in big groups and you sectorize to keep from wandering into each others' areas. But having a buddy is helpful in close terrain because

[22] Ardrey [Ardrey 1976, p. 120.] suggests these are evidence of bolas based on an argument by Mary Leakey based on wastage against them being thrown tools.

that extra pair of eyes tends to about double the daily take.

Of course, if you're in deep snow or swamp and run across a large animal mired in the snow or mud, then go ahead and chop them into burgers, but like the cliff, this is happenstance, not regularity.

Now, along comes the spear. Suddenly the whole nature of hunting changes. Now you have a tool that allows a hunter to transmit considerable force, as much or more than you can with a hand axe, depending on geometry, at a distance. The hunter no longer has to get right up next to the animal and have physical contact while imparting momentum. Now the hunter can stand off and impart damage. And if the animal lunges at you, you have a stand-off to either leap back or even impose the spear as a buffer.

Now, for the first time, man has a hunting tool that can be used against medium and large animals with regularity and reduction of risk. The face of hunting is changed. Now, if one hunts medium sized animals, pairing still works using, for example, hammer and anvil tactics. Against large animals however, the strategy is quite different.

Why hunt large animals? Well preferentially, large animals have more meat. If large animals are present in good numbers, it may be easier to hunt large animals, and thus large animal hunting may be more efficient. We have argued that the human bands consisted of 25-50 members and 10-20% of this population were hunters. Thus, for a large band, we have at most ten hunters. If they hunt in pairs, they may kill five medium sized animals a day, say 50-100 kilograms each. If they hunt together, they may kill one large sized animal per day, say 500-1000 kilograms. Thus, in this fictional example, if the probability of kill per day is the same, hunting large sized animals is twice as efficient as hunting medium sized animals.

But what are these probabilities? One can argue that medium sized animals are, in general, faster than humans, and are fairly easily spooked. Thus, we can argue that hunting medium sized animals is riskier than hunting large sized animals who are slower and less likely to be spooked. Of course, we also have to consider the population density of these animals. We generally expect medium sized animals to outnumber large animals, but this is not necessarily the case.

Based on the learned narratives, it appears that hunting large animals was more efficient and effective, and humans tended to hunt large animals when they could. Thus, the hunting sub-band was motivated and the differentiation of the human band intensified. This intensification follows lines already outlined. The value of upper body strength in spear

usage drives hunting to be a male activity. Because of human programming to species survival, hunters now became more desirable as mates. Further, since teamwork is required for effective hunting, the bonding of the hunters carries over into band politics, making them an interest group. The Principle of Concentration is hard at work.

With this development, the tactical basis of war is largely established. Column and line operations develop naturally in hunting large animals (or small herds of medium animals) that carry over into war. Team cooperation must exist in large animal hunting as well as in war. But one crucial thing is still lacking. While silence is a virtue in most tactical operations of hunting and war, speech is needed for effective and efficient Command and Control, and at this point, man is still incapable of speech..

Does this mean we don't have war yet? The answer is that we are getting closer. With the advent of the spear, much of the risk innate to earlier fighting is mitigated. Since a spear may be cast as well as thrust, and spear throwing has a role in hunting as an alternative to throwing hunting stones at small animals,[23] the way is now open for ambushes that open with spear throwing to effect surprise, spear thrusting to effect casualties, and disengagement to control risk. Brawls between bands over things like hunting range, whether planned ambushes or meeting engagements, have just gotten a lot less pyrrhic.

Bearing in mind that strategy is not well developed since speech is still absent, it seems unlikely that the higher functionality of war is yet possible. The advent of more efficient hunting techniques strengthens the capacity of the band to supply and support military activity. With fire and smoking, some reserves of food may be established, and with more efficient hunting and concentration in the hunting team, greater concentration of tool manufacturing is now possible. More and more of Turney-High's list is becoming possible.

Team hunting also has another effect. Because the team must act together to be effective, a new form of concentration now has a premium. Now the mental activity to permit an individual to participate as part of a short term intensely busy group is important. This concentration not only leads to cooperative effectiveness in the hunting team, but greater control of individuality as well.

This type of behavior is difficult to confirm. The remains that archaeologists find do not

[23] The naturalness of this is demonstrated in how early human Hunter-Gatherer differentiation is manifest in modern sexual differences. When women, gatherers classically, hunt for a suit, they visit many stores and then select the optimal suit from all they have seen, the modern equivalent of looking at all the berries before selecting which ones to pick. Men, hunters classically, visit stores serially until they find a suit that fits their requirements and they buy it, the modern equivalent of killing what comes along.

permit us ready measures of intelligence or the complexity of the mind.[Mithen 1996] If one uses brain volume as an indication, then *Neandertalensis* was more intelligent than modern man because he had a bigger skull and thus bigger skull capacity. But we do know that brain size is not all. Large animals have larger brains than human, but do not seem to be as intelligent. Thus, the mental capacity of humans has to be estimated by other means.

Modern archaeology makes use of other forms of evidence than just bones and direct objective evidence. Biochemical investigations have indicated that the switch to a meat diet was a major factor in the development of intelligence, largely because of those fats that we try so hard to avoid today. Other theories having to do with the development of the wetware, and in particular the software side of the wetware, hint that increasing complexity of cooperation and competition (ala evolution) are at the root of development of intelligence and mental capabilities and architecture.

Speech

Finally, after the spear has been around for about 200 KY, we have evidence of speech capacity. The oldest evidence, from about 80 KYA, is found in a *Neandertalensis* burial. The skeletal remains included an intact Hyoid bone. Interestingly then, we may infer that reverential treatment, such as burial, predated speech or developed along with it. This is not the earliest burial found, but it is the earliest evidence of a Hyoid bone, which is necessary for speech.

Just as with the spear, things seem to take off with the development of speech. Of course, the wetware had to pretty well be there for language to develop. After all, we're not just talking about a means of making better sounds. We're talking about language and language development requires some abstract thinking as well as cooperative capability. Thus just having a larynx and the other organic firmware didn't generate language and communication. Communication skills were already there and were extended by speech and language.

Anyway, by about 40 KYA, we have the first evidence of constructed domiciles, huts built using mammoth bones as structural members. If nothing else, this demonstrates the great efficiency of large animal hunting by spear armed teams if the band has the leisure to stay in place long enough to use big bones as posts and beams. By about 35 KYA, *Neandertalensis* has disappeared from the scene, leaving *Sapiens* as the only human around and once again raising the genocide question. By 15 KYA, we have the

first evidence of social hierarchy, although we can suspect that hierarchy had to start a lot earlier, and by about 10 KYA, we have evidence of deliberate trade. It seems pretty clear that language had to have a major impact. Of course, this isn't the only impact, but we'll defer that discussion till later.

With speech and the necessary wetware to develop and use language, the stage is now set for war. The tactical basis of war was laid with the development of the spear and its aftermaths, the development of team hunting, discipline, greater efficiency and effectiveness, etc. With language and speech, knowledge ceases to be only sensory and intuitional, information comes into existence in both positive and negative forms. Lying ceases to be simply bragging gestures and takes on new meaning, as does political activity. Band dynamics is no longer just done and doing, but promise to do as well.

Interactions between bands now expand as well. Before, chance meetings between different bands of humans were largely a matter of an extended form of Fight-or-Flight. Now, once both groups can use speech and language, a third alternative is possible and from this alternative flow others, including peaceful trade, or fighting, or even gene pool exchanges.

Did *Sapiens* kill off *Neandertalensis*? Is there genocide? Part of the answer to this turns on whether *Sapiens* was a mutation of *Neandertalensis*, or both were mutations of *Erectus*. If the latter, it is much more likely that they were not interfertile. There is some evidence from a few (?) sites, mostly in the Mideast, of co-occupation by *Erectus*, *Neandertalensis* and *Sapiens*. Those learned pundits who support a disappearance along the lines of *Habilis* point to these sites as evidence that beneficial mutations triumph naturally without need for sinister explanations. Others dismiss these sites and often embrace the idea that *Sapiens* killed off *Neandertalensis*.[Ardrey 1976]

One of the by-products of the development of language is that it altered the nature of individuality. As a result of being locked in our own skulls for so long without being able to share knowledgeable information, humans developed a very strong sense of me-ness. Lacking speech, this me-ness tends to be reflected most in differentiating behaviors. With the advent of speech and language, this individuality, this feeling of center of the universe, gives rise to politics and religion and a host of other things. Thus, with speech and language, we not only have an inducement for bands to communicate with each other to resolve what would otherwise be Fight-or-Flight situations, and if the former, likely cripplingly self-destructive to one or both sides, but to make conscious decisions to fight as well. As Clausewitz would say, with language, we now have a band will and, as Darwin would say, we have to be prepared to impose that will on others or cease

to survive. Language thus gives us the basis of "Us or Them", and extends personal individuality to an organizational individuality, which makes possible concepts such as politics and religion.

Clearly, given the substantial physical differences, especially with the skulls and thus facial features, between *Sapiens* and *Neandertalensis*, a sense of Them/Us exaggerated over two groups of purely either type seems possible. But does this lead to conflict and combat?

We have already argued that war does not yet exist, largely because all of the pieces of persistence don't exist yet. We have also argued, based on war having a reciprocal characteristic, that genocide cannot be war. But is the eradication of *Neandertalensis* genocide?

Some pundits say yes. One of the most popular of human origins writers, Richard Ardrey, flatly says so. Others are not so positive. We have to recognize that while both sides had language, they were not a common language, and it seems unlikely that all of the *Sapiens* bands agreed to do in the *Neandertalensis*. Coordination is thus too far fetched.

With our modern knowledge of Complexity, [Bak 1996] we can posit that the *Sapiens* bands exhibited what we might loosely call Self Organized Criticality and independently decided to do in the local *Neandertalensis* band. We can even posit that there were exceptions to this and this explains the sites in the Mid East. But again, it doesn't appear that we have to. We have evidence that *Sapiens* ranged further north during the glaciation than did *Neandertalensis*.[24]

This wider range argues for *Sapiens* being a better hunter than *Neandertalensis* and since the preference would be for team over individual hunting, that *Sapiens* was therefore better at teamwork than *Neandertalensis*. Thus, we would get the effect of genocide without either the intent or the act.[25]

As we indicated before in our discussions of the passing of *Habilis*, it didn't have to happen by genocide. If *Neandertalensis* and *Sapiens* were interfertile, then we can postulate

[24] This appears to be why no *Neandertalensis* remains have been found in the New World.

[25] This is admittedly a concept easily posited mathematically, but difficult in words. Basically, hunting is an example of what is sometimes called the encounter problem (see POW.) In substance, the probability that a hunter will encounter and kill a (e.g.) deer depends on the number of deer in a given area. If a *Sapiens* hunter has a greater probability of encountering and killing a deer (for a given population of deer,) than a *Neandertalensis* hunter, then *Sapiens* will get most of the deer killed, in effect depleting the deer population and starving out the *Neandertalensis*.

a scenario similar to that of *Habilis* and *Erectus*. If they were not, then we can postulate that if they cooperated in bands, and *Neandertalensis* was less effective as a hunter, now a elite social subset, then social mating predilections and hunting attrition would account for *Neandertalensis* disappearance. In other words, *Neandertalensis-Sapiens* matings would produce no zygotes and the risk level in hunting would preferentially place *Neandertalensis* hunters at greater risk and thus attrition.

If they did not cooperate in bands, then *Sapiens* hunters would be more effective and deprive *Neandertalensis* of food. If fighting between *Neandertalensis* and *Sapiens* occurred, possibly over territorial competition, then *Neandertalensis* would be less efficient in the pseudo-hunting that this fighting was. We do not have to postulate either deliberate or innate genocide to explain the passing of *Neandertalensis*. All we need is a slight advantage at the new skills of team hunting.

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3 The First Civilizations

In the preceding chapter, we started watching for evidence of war about 4.5 MYA, when the ancestors of *Homo Sapiens* came down out of the trees and became ground dwellers. That story paused at about 15 KYA when all of the pieces needed for war were in place. Actually, the pieces were all in place by sometime after 80 KYA when the first evidence of a Hyoid bone indicates the likely capability of speech. Thus, sometime after that date, we have all of the pieces: organization; tactics and strategy, and probably doctrine; discipline; differentiation of activity; probably politics[26]; command and control; supply; and standoff weapons. It seems unlikely, given that bands of humans would encounter each other occasionally and having common disagreements, that these bands would not engage in simple combat a stage or so above a common brawl but still several stages shy of the campaign capabilities necessary to satisfy Turney-High's standards of True War.[Turney-High 1949]

Of course, sometime before this, *Neandertalensis* passed, leaving *Sapiens* the sole member of genus *Homo* on the planet. When confronted with the question of whether *Sapiens* killed off *Neandertalensis*, we have no good answer, but can offer up other scenarios to account for *Neandertalensis*' passing other than direct conflict with *Sapiens*. As with most activities above the quantum level, if an end state can be reached by more than one process, then it is reached by a combination of most if not all. Thus, we must acknowledge that even though *Sapiens*, as a subspecies, could not have been organized enough to collectively decide to eradicate *Neandertalensis*, again as a subspecies or subsubspecies (depending on authority), at least some bands of *Sapiens* must have developed their fighting and warmaking skills by using them against bands of *Neandertalensis*. It also seems highly unlikely that, having inherited the planet, *Sapiens* settled down to a Rousseauian idyl of peace and tranquility.

No, with the acquisition of speech and thereby language and communication, to say nothing of command and control, we may expect that wily *Sapiens* did then exactly

[26] I say probably. In my humble opinion, politics predates language, developing from the social stratification present in our ancestors' bands, as evidenced by such behavior in Ape and Chimpanzee bands today.

what he does now when he needs help in dealing with others. He looked for allies or even friends. The period after speech acquisition was likely one where, lying having come into its own, diplomacy and intrigue were invented, and organization beyond the band came to be. With this organization, and the obvious benefits that become possible because of the Principle of Concentration, the knife edge of combat became dulled. War became less a matter of either frustrating stand-off or catastrophic collapse of one or both bands, and more a potential for actual gain. If every band of 25 (e.g.,) members has 5 hunters but can survive on the efforts of 4, then it only takes the federation of 5 bands to give a slack of 5 hunters that may be used to conduct military expeditions.

The Forge of Ice

About 24 KYA, when *Sapiens* had just gotten "control" of the planet, the planet entered another of its periodic Ice Ages.[Mithen 1996] Actually, this was just a cold phase of a pattern of fairly long cold phases interrupted with short warm phases and a higher frequency pattern of "micro" cold and hot subphases laid on top of that pattern. This period of cold continued till about 13 KYA, with a warming period that stretched from about 13 KYA to 12 KYA. In other words, it took about a thousand years for the planet to warm up. One of the noteworthy things about this period is that as soon as the warming was "complete", it cooled off again, from about 12 KYA to 10 KYA.

The effect of this rapid, in geological if not human terms, warming and cooling cycle was quite dramatic.[Lemke 2004] In the Great Lakes region of North America, a spruce forest grew up during the brief warm period in the region of Two Creeks. This forest was killed off by the returning cold by 11.85 KYA. Since then however, and except for short periods of cooling, the climate has been relatively warm, although a short or little ice age is credited with, among other things, driving the Vikings out of North America.

These cooling periods are not trifles. Today a scientific debate rages between the pundits of global warming, which is variously credited with causing run-away greenhouse effect or staving off the eminent ice age, and the pundits of global cooling who see the first signs of a new glacation. Either extreme would have marked, if not catastrophic, effect on our civilization, forcing us to accept general collapse and destruction of 90% of the current population of the planet, to say nothing of most of the infrastructure, or to undertake planetary engineering seriously with all of the risks that entails.

Our control of climate is not the subject of our interest here. Our interest is the meta-physical nature of war. So we turn back to this.

Somewhere between about 40 KYA and 35 KYA, *Neandertalensis* went away, by whatever means, but we suspect that it included enough direct and violent conflict between *Neandertalensis* and *Sapiens* bands for the arts of war to be improved by practice. We stop short however, of accusing *Sapiens* of genocide. We doubt seriously that social organization had advanced enough for a consensus among *Sapiens*, as a species or subspecies, to do in *Neandertalensis* as a species or subspecies. This means that *Sapiens* had about 10 KY of nice climate to merrily do the Hunter-Gatherer thing before his universe changed. We also know that the previous cold phase had ended about 59 KYA, so for *Sapiens* this cold weather was a new experience.

Of course, *Sapiens* adapted, after all, we're here today. But that adaptation was not trivial. With large amounts of the planet's water being tied up in the glacial ice sheets, the climate of the planet changed. Places that were lush became deserts. Deserts now became fertile. And in the north, forest was replaced with tundra. The first of these changes caused loss of food, forcing migration, and thereby greater competition for space. Again the skills of war are developed as newly arrived bands compete with old bands for food space.

Of course, the changes in the north gave rise to larger populations of large animals so that humans could find enough food in the far north to survive, so long as they could also find shelter and warmth. Man adapted, and apparently did quite well, penetrating into Siberia for the first time.[Gobei 1999] Despite the cold, *Sapiens* survived and thrived during this glacation.

Then the glacation ended.

Once again, *Sapiens* is faced with another new experience. Remember, its been 11 KY since the glacation set in. Man doesn't have written language (that we know of) and thus can't go check the Boy Scout or Special Forces manual on how to survive in a warm period. Nor does it seem likely that verbal myth is strong enough to store that kind of information. With something like four generations per century, that means at least 440 generations since the glacation, and that seems entirely too many to preserve such detailed information.

Just as it did when the glacation began, the climate changes when the glacation ends, but the effects are not completely symmetric. The reason for this is basic chemistry. The rule of thumb we want to invoke here is the one that the rate of chemical reactions doubles for every increase of ten degrees Kelvin. This rule of thumb is just that, a rule of thumb and therefore quite approximate, and it is only considered to be valid (or was

when I learned it as a young undergraduate) around "room temperature". Since room temperature means something different to different peoples depending on where they live and how energy rich they are, we can consider this rule to be approximately valid over most of the temperature range of liquid water. Thus we can apply the rule regardless of whether we are modern humans living in temperate or tropical environments, or Upper Paleolithic humans living wherever.

Incidentally, a Kelvin degree is the same as a Celsius (or as I learned it, centigrade) degree and equal to about 1.8 Fahrenheit degrees, so we can readily see regardless of whether we use the Celsius or Fahrenheit system, a change in temperature of ten degrees is something substantial. In fact, its substantial for the very reasons that we brought the matter up.

A ten degree Kelvin temperature change in our environment - say positive, an increase - is going to change how we live. We probably change how we dress, peeling off a layer of clothes or changing from long sleeve shirts to short sleeve shirts. In just the right range, it sends us to the thermostat to switch from heating to cooling in our houses.

Now while chemistry runs on the laws of physics, and biology tends to run pretty much on the laws of chemistry, the fact that we increased the temperature and thereby the reaction rates doesn't mean that we doubled the rate of life, but we have increased it. Biological systems as a rule are homeostatic, meaning that they tend to be self regulating. That's why when the temperature goes up we tend to take clothes off or turn the air conditioning up. We're trying to get rid of the extra heat generated by those faster chemical reactions.

The problem is that the efficiency of heat transfer depends on the temperature difference between an object (the biological system) and its external environment. The higher the temperature of the object over the environment, the faster and more heat that can be transferred. When the temperature of the two are equal, heat transfer stops, and when the environment gets to be a higher temperature than the object, then heat gets transferred from environment to object. The latter is how cooking works.

If we put this into the human context, then when the glacation ends and warming begins, everything starts living a bit faster. And the rate of living gets faster the warmer it gets. Because the biological systems are homeostatic, this eventually turns into system changes. Animals and plants that are optimized for a given temperature range tend to thrive in that temperature range and to not work well in ranges above or below the optimal. In a complex ecological system, this means that when the climate changes, the

local biological system changes as well, but with a lag.

One of the characteristics of this lag is that the old system tends to hang around longer than the climate. When the climate cools off, the warm climate plants and animals slow down but they don't just go poof and get replaced with cold climate plants and animals. In general terms, the cold climate plants have to out compete the (slowed) warm climate plants for ground, so that the cold climate herbivores move in and the warm climate herbivores move out and the carnivores follow the herbivores.

In our immediate case, we're interested in a warming cycle. In this case, the plants and animals can't immediately escape an effect of the higher temperatures, the increased rate of chemical reactions, and thus they live a bit faster. As a result, their numbers tend to increase and that is part of our story.

At the end of the glacation, when the warm cycle began, there was a period when there was a population explosion of plants and animals before the warm climate plants and animals moved north and changed the ecology. Thus, before the great herbivores, the elephant ancestors and the like, died off, there was a period when their numbers increased. In fact, it isn't clear that they died off completely in the short warm period before the short cold period.

In that brief period, the availability of food generally increased greatly, and *Sapiens* flourished. Of course, in a few years, say five or ten generations, everything moved north, and the forests came back and the big herbivores were reduced in number. And then the cold came back, for about the same period as the warm, and everything seesawed again until the second warming, which stayed around for a while.

The picture I want to paint here is a pattern of first accidental riches, a time of plenty, followed by a time of hardship, and a repeat of the pattern. This was a period of great challenge to *Sapiens* and since we have survived, obviously a period of great adaptation and invention. It is a period when the social organization of the hunting group was tested and forged, first by questions of its relevance in the face of great plenty and then by the need to respond to changing animal population, diminished food availability and overpopulation and greater interband competition and conflict over food space. It is during this period that civilization and culture began.

The New World

Before we proceed with our discussion of civilization's beginning, one of the topics I

need to discuss is the population of the New World, the Americas. As we have noted, hominines did not develop in the New World. There are New World monkeys, but they never made the transition to the ground or developed bipedalism. Thus, the New World developed without the benefit of man.

During the glacations, with much of the planet's free water tied up in glaciers, the Bering Sea between Alaska and Siberia disappears. So also does much of the Sea of Japan and the Sea of Cortez. Thus, the idea of the land bridge between Old World and New, between Siberia and Alaska develops. And because Columbus arrives in the New World and finds other *Sapiens* in the area, man had to have crossed the bridge. The only real question is when?

To date, no evidence of *Neandertalensis* has been found in the New World. Caveating this with our by-now usual consideration of probabilities, this indicates that genus *homo* did not cross to the New World until after the disappearance of *Neandertalensis*. There is also evidence that *Neandertalensis* did not penetrate far enough north to have achieved the trip. So the transit of the land bridge had to occur during the last glacation.

We know that *Sapiens* lived further north than *Neandertalensis*, and thus the opportunity exists for transiting the land bridge. One problem that is presented by this is the North American ice sheets. The glacation that lowered the sea level and thereby made the land bridge (as we think of it) also covered the far north of North America in a pair of ice sheets, the Laurentide stretching from the east side of the Rockies to the Atlantic, and the Cordilleran stretching from the west side of the Rockies to the Pacific.[Adovasio 2002]

The problem here is rather the equivalent of how some carpet (or Putt-Putt, as we called it in my youth) golf holes are laid out, requiring a rather careful control of the golf ball's velocity to permit it to pass two obstacles that were staggered in time. In our case, the Bering Sea was the first obstacle, and it had to be crossed during a cold period. The second obstacle was the two ice sheets, the Laurentide and the Cordilleran. They had to not go too far up the mountainsides. If the weather was warm, the Bering was full of water and there was no crossing from Asia to North America; if the weather was cold, the Bering Sea water was tied up in glaciers, the land bridge was present, and Lo!, passage from Asia to North America could proceed. If the weather was too cold, then the ice sheets blocked the passage down through modern day Alaska and Canada. So, like Goldilocks, the temperature had to be just right, cold enough for the Bering Sea water to be locked up in glaciers, but not so cold that the glaciers went too far up the Rockies.

Of course, the migrants didn't have any God's eye view of all this. They didn't have a satellite with an imaging sensor to look down and they could finally say, "Oh!, the land bridge is formed, Move Out!" No, they were migrating for some other reason and just happened to have the right timing to happen on the land bridge and then happen on the rift between the two ice sheets. From a probabilistic viewpoint, this is interesting since we have three conditional events here. We can speculate that lots of folks wandered up to the Bering Sea when it was a sea and bounced back; some fewer wandered up when the land bridge was in place but never got across the land bridge; even fewer wandered across the land bridge and bounced off the closed ice sheet gap; and finally, a very few wandered all the way across the land bridge and down the rift into Central North America.

Unfortunately, we can't know much about most of these folks, since any artifacts they may have left behind are now at the bottom of the Bering Sea. It is interesting to speculate if any could have gotten across the land bridge and not found the rift and settled there, at least until the warming, but that's not what we are about here.

I should comment that this scenario of land bridge - rift is the classical one, and there is another that we need to explore. To do so, we need to visit a bit more technology history.

Based on European archaeology, [Gardiner 2001] about 18 KYA, there appeared the implements of fishing and sea hunting: harpoon tips and fish hooks. The earliest remains of boats date to about 11 KYA, which gives us an interesting set of dates, which we shall explore.

The second theory that I mentioned is that the migrants from Asia to North America didn't come across the "center" of the land bridge, but along the southern shore where they would have supported themselves by fishing rather than land hunting. The idea is that this shore would have been considerably warmer since it was in contact with liquid water.

If this shoreline migration theory is valid, then the problem of getting past the two ice sheets is moot since the shore line stretched all the way south past Tierra del Fuego.

The interesting speculation here has to do with boats. What does one do with harpoons without boats? The answer is that one uses them to hunt sea mammals, like walrus, that come up on the shore to be hunted but can retreat into the water. But this is a seasonal activity and one may ask whether early boats, made of hide and wood (ala coracles,) just didn't last to be found? If so, then we can see migrants merrily paddling along

the shore, fishing and sea hunting, all the way across the Pacific and down the North American coast.

Sounds unlikely doesn't it? Well, consider two alternatives. First, this is an era of hunting big animals in groups as a matter of efficiency. The same applies to large sea animals. For a sizable number of people to get across the shore route, there has to be a goodly amount of food. Second, if we have to wait for the 11 KYA date for boats, then if the migrants didn't come without boats, and recall that's an European and not an Asian date, they could only have crossed during that short cold spell between 12 KYA and 10 KYA!

Which is right? Maybe both are. We don't really care at this point. What we care about is that at some point after *Homo Sapiens* became lord of the planet, he and she crossed over from the Old World into the New World, and there they found a virgin environment. There were no hominines present! This boundary condition is what is significant for our consideration. By the time this migration occurred, the livable parts of the Old World were settled to some extent. The Hunter-Gatherer bands ran into each other with some frequency and either worked out a social or organizational arrangement or engaged in conflict, developing the art and skills of the primitive warfare that was forming. This was not the case in the New World. The country was wide open and such encounters were considerably less probable. As a result, the development of warfare and social organization in general took a different form in the New World, characterized by a time delay while the land filled up and by the absence of ice age conditions.

Oh yes, why are we using European dates? Because the few data we have on very early New World humans indicates that they might have been predominantly European in origin.

What's a Civilization?

Civilization is another of those words that don't define easily. The anthropologists tend to describe it in terms of characteristics that the state of civilization is associated with. These associations include a reasonably complex organizational structure with some form of hierarchy, usually governmental in nature, and concentrated in cities.[Haviland 1997] Anthropologists usually identify the city-states of Egypt, Mesopotamia, India, China, and sometimes, the Americas as the first civilizations, but I'm going to differ with that here.

One thing that we need to distinguish up front is the difference between civilization and culture. Culture is a set of rules, standards, practices, even outlooks that are shared by the members of an organization. The sharing of these components is fundamental to any successful organization since their purpose and evolution come from the survival and evolution of the organization. These shared rules, etc. have had survival value and have thus become part of the structure of the organization. They guide and direct the operation of the organization.

As such, they tend to have considerable social inertia. It is widely recognized by organizational scientists and practitioners that organizational culture is exceedingly hard to change. Indeed, new members of the organization are not generally accepted as full members until such time as they have adopted or adapted to these components to an acceptable degree.

Thus, while culture and civilization are clearly related, there are significant differences. Culture is more fundamental, since it is part of any organization. The clear implication of civilization is that it is most commonly associated with organizations that are structured and directive.

But what about the city part? Clearly the organizational structure of the "modern" *Homo Sapiens* Hunter-Gatherer band has become socially structured to a degree, first with the distinction between hunters and gatherers, and then with the specialization of the hunter element to use spears to hunt large animals in a group - the hunting sub-band. Add to this an age differentiation of child-junior adult-senior adult, with hunters having to be not only male but junior adult, and the Hunter-Gatherer band has considerable social structure. We might argue that the governance of the band is democratic but given the family-like structure of the band, this seems highly unlikely. No, we are left with the distinctions that the Hunter-Gatherer band is either not large enough or that it is not city dwelling to exclude it from civilization. In fact, as we shall see, these two are quite closely related.

We have already established that the technology of hunting had been steadily improving and that the general situation was actually improved somewhat by the glacation forcing or permitting a switch to the group hunting of large animals over the solitary or pair hunting of small to medium animals. This was beneficial not only in terms of more efficiently providing the higher density of calories present in meat, but over two different time scales enhancing intelligence and the organizational skills of the hunting group.[Ardrey 1976]

At some point, our close ancestors got good enough at this that they didn't have to move around as much. Whether by virtue of climate changes increasing the availability of food, or by increases in materiel and/or organizational technology, this situation has manifested itself time and again. Further, it has also set in motion forces that offer significant challenge, which in many cases, is not successfully met and results in social collapse.

Because they could acquire adequate food either without moving around or with less frequent moves, the Hunter-Gatherers succumbed to a subtle trap, that of becoming sedentary. Pundits and authorities wax eloquent on the joys of the wandering Hunter-Gatherer life style and bemoan the transition to a sedentary, agricultural life style, which they attribute to the relative superiorities of that latter life style. Sadly, neither are these superiorities so one sided, nor does the sedentary life style result from agriculture. Possibly, as we shall outline, agriculture arises, at least in part, from the sedentary life style.

The First Civilizations

As we have indicated, time and again, the Hunter-Gatherers have gotten productive and efficient enough, probably in the hunting aspect (based on calorie density) to have plopped down and stayed in place. Because they have not had to move (as often, if at all,) they either take up residence in naturally protective ground such as caves or overhangs, or they build more lasting shelters. This is demonstrated time and again in settlements like Abu Hureyra, [Mithen 1996] which actually has two occupation periods, one Hunter-Gatherer and the other agricultural, the site near kibbutz Sha'ar Hagolan, [Ardrey 1976] Monte Verde in Chile (?), and Poverty Point in Louisiana. The dates of these early settlements span a considerable number of years from the end of the glacation to the actual development of agriculture.

It seems likely that these were not original. Given the development of fishing gear 18 KYA, [Gardiner 2001] it seems likely that permanent or semi-permanent settlements would soon arise where there were adequate sources of fish, if not other sea animals. Unhappily, this will likely have to remain speculative since the end of the glacation assured that these sea-side settlements would have been inundated. Nonetheless, ancient lake and riverside settlements have been noted. Possibly, the idea grew up on the water's edge and spread inland?

Nonetheless, having stopped moving frequently, the deadly trap has been sprung, and that trap is property. Hunter-Gatherer bands don't, can't have much property, only what

they can carry. They can't afford to not have some food but they also can't afford to have much water either. Their possessions have to be limited to what they can carry on their persons because they don't have pack animals (yet), and the junior adult women also have to carry their children - which is why they tended to nurse children until they were old enough to walk with the band on their own. No, all the Hunter-Gatherers had in the way of possessions was absolute necessities.

All this changes when you don't move around. Now you can build a dwelling that will last rather than shelter in a fold of the ground or under some hastily thrown together lean-to. Of course, because the materials at hand are different and sturdier, new and better tools are needed, so man's natural fascination takes off and these new tools, and other artefacts, are built, and kept! Obviously, if the first settlements were for fishing, then the elaborate instrumentality of fishing, nets and lines and poles and the like have to come into existence. Also, if you're going to set up housekeeping and have space and time, containers proliferate for water and food and gear.

Happily, because your elite hunting group is efficient and productive enough to acquire adequate food without moving around, you now have several surpluses of time. First, and foremost, because you aren't moving all the time, that time spent moving is partly saved. The part that isn't saved is the time it takes to get food back to the settlement. In addition, any time spent building shelters is saved once the "permanent" shelters have been built. Further, because the technology of containers has begun in earnest, gathering has become more efficient and thus less time consuming.

Thus, there is slack time and that time can be spent on a variety of things like industry - the production of more property, social activities, government, and religion. Oh yes, and please don't forget war.

In addition to slack time and property, one of the characteristics of these settlements is that they tend to get larger. Because they're efficient and have slack time, they can apply more people resources to small animal hunting and gathering to accommodate population increases that would have normally caused the band to split. Further, other folks wander by, see the settlement and the life style and want to join in. And so long as the animal population doesn't become depleted, this growth can continue.

This growth, especially those coming in from other bands, forces changes in the organizational structure. No longer can the old methods of band governance be used, either because of culture mixing or just total numbers. The Principle of Concentration drives the organization to greater and greater hierarchy.

Of course, at some point this depletion of the animal population is exactly what happens, probably gradually. As a result, the settlement population uses more resources to gather more food or hunt small animals, or even conduct experiments with plant (or animal) cultivation. In some cases, they may be successful, but in a lot of cases they aren't and the settlement collapses. If this depletion happens quickly, in a generation or less, then the organization may survive, but if the settlement is able to exist longer, its ability to return to the mobile lifestyle, which folks are largely averse to because they don't want to give up their property, is compromised by changes in culture that reflected the new sedentary lifestyle.

What about war? Well, the same slack resources that let industry and government and religion develop also can be applied to increasingly singular fighting capabilities. The most capable of the hunter group, who are not necessarily the best hunters, may spend more and more time being fighters. In this way we may speculate that the warrior tradition begins.

Now the advantage that the settlement has over wandering bands is that they have these more specialized fighters and because they are more productive, they can afford risk of loss. The settlement fighters can afford to try to be decisive. They also have the advantage that with superior logistics they are better able to persist and to carry the fight to the enemy. Additionally, encounters are still pretty rare. Thus, the vaunted strength of the sedentary lifestyle.

Difficulty arises when food runs short. The settlement hunters have to cover more ground hunting food and thus encounter wandering bands more who perceive their territory as being trespassed and poached. Thus more encounters and more fights. Also, the obverse applies; if the settlers still have food, and the wanderers don't, then the settlement becomes an attractant.

The bottom line, fighting and conflict being the dynamic it is, and this points to the formulation of that dynamic, organizations evolve. The settlers develop new fighting skills to successfully defend against the wanderers, who in turn develop new skills, and so on. At some point, the skills mismatch enough for the wanderers to overwhelm the settlers.

There are other reasons that fighting is maturing towards war. Because the settlers have developed new organizational skills to accommodate greater population numbers and diversity, they can apply these skills to dealing with wanderers. So long as survival (i.e., food) issues do not arise, those that do arise can more likely be addressed. Because the

settlers are sedentary, they not only need goods not available in the immediate area, but can serve as an integrating center for the disparate needs of different wandering bands. Thus, there is considerable inducement for trade. Also, the perils of inbreeding probably having been identified, the equivalent of a trade of matable juniors should be a natural consequence.

This sounds all hunky dory, but one has to consider that not only must order be kept in this trading environment, but when peaceful relations fail, they fail much more spectacularly than when wandering bands couldn't afford decisive combat and could literally run away. As a result, military action, fighting, had to become more like war. With the adoption of the sedentary life style, flight became a much more drastic option than before and the balance between fight and flight shifted much more solidly towards fight. At the same time, because that fight situation was less likely but much more important, an evolution to more decisive effect became necessary.

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4 Transition: from Ice to Civilization

If one examines texts on Anthropology [Haviland 1997] or Ancient History, then one finds little coverage of the period between the end of the cold phases of the glaciation and the founding of the first great cities in Egypt, Mesopotamia, India, China, and the New World. This period between the Old Stone Age (Paleolithic) and the New Stone Age (Neolithic,) sometimes called the Middle Stone Age (Mesolithic,) seems to have little representation.

As we indicated in the preceding chapter, sometime before the end of the cold phase of the glaciation that shaped *Homo Sapiens* Hunter-Gatherer bands began to adopt a sedentary life style and build settlements that we argue were the actual first civilizations. Some of these settlements, especially those on the sea shore, have been inundated by rising water and are not available to be found. Others, located in sites yet unfound, may come to light some day. Enough have been found to indicate that the transition from Hunting and Gathering to Farming and Herding was neither instantaneous (in geological or evolutionary terms) nor simple.

Sedentary First

There appear to be two principal theories advanced for the transition to agriculture: crippling shortage of food ;[Pfeiffer 1977] and the ambitions of a luxury loving elite. [Mithen 1996] Both of these individually have some apparent problems.

While the end of the cold phase did cause considerable changes in the environment, in many cases causing migrations or radical adaptations to different foodstuffs and food acquisition, there does not seem to be extensive evidence of human die-offs. Instead, there is significant evidence of Hunter-Gatherer settlement, indicating not a shortage of food, but a plenitude of food.

Some of these early "cities" were occupied for extended periods of time. While there

is evidence of malnutrition, this could not have been the case over the entire period of occupation. It seems inevitable however, that eventually this surplus would have to become depleted. Agriculture could then begin to develop to stave off the need to abandon the sedentary life style, at least temporarily. As noted by Ardrey, [Ardrey 1976] gathering or primitive agriculture is not alone enough to feed a population. A certain technical level of agriculture is required to permit the widespread abandonment of hunting.

The Hunter-Gatherer life style has to be property averse, if luxury adoring because of that aversion. Accumulation of property can only become possible if there is a transition to a sedentary life style. The acquisition of property, of luxury, has to be a strong force for preserving the sedentary life style, thus providing a further rationale to stave off the collapse of that life style with agriculture. This commitment to property however, has to be widespread rather than solely concentrated in an elite. Otherwise, once food shortage became critical, there would be little to prevent the non-elite from voting with their feet and moving on. Property acquisition had to be part of a general culture change, not the province of a class or subculture.

Timing Problems

There is a problem with this model. Simply put, that problem is the New World, the Americas. Why does the transition to agriculture start so early in Eurasia and so late in the Americas?

As we have observed, Hunter-Gatherers are, have to be, property averse. This means that they carry their technology around with them. Hunter-Gatherer bands arriving in the New World would have the same basic technology as their counterparts who stayed in the Old World (allowing for a very slow diffusion of technology [Rogers 1995]). Thus, despite the fact that they would arrive in the New World without detailed knowledge of sources of raw materials, the scope of those raw materials is so extensive that one cannot blame the tardiness of the New World on some collapse in the standard of living due to loss of technology.[27]

If we accept for the moment a model of Hunter-Gatherers who do well enough to settle down, then become over-extended or under-resourced, and have to invent or adopt new forms of food acquisition, then we may address this question and expand the scope of the theory in the process.

[27] Collapse due to inadequate diversity of the gene pool is another matter that is beyond our discussion here.

As we have introduced in the previous chapter, once people have become sedentary the desire for property fosters the trading of goods. This trading requires that either these goods come to the settlement on the backs of other people, or be brought to the settlement on the backs of its residents. Thus, whether the trade is of the "push" or "pull"[28] form, or even a mixed form, people have to travel and since language has been invented, and indeed, is of central importance in trade, information is transported. Since these people are still close to the survival edge, we may expect that an application of Maslow's Hierarchy [Drucker 1974] would assure that some of that information, possibly part of the actual trading stock, is information on successful and failed new food acquisition efforts.

Further, when the settlement gets into troubles, some of the people will leave, readopting the Hunter-Gatherer lifestyle, and wander off looking for new territory. They also convey information, this time more of the negative variety of what does not work, or what caused the failure. This would not always be food acquisition failure. If could be failures in governance, or other social activity, or war. Being centers of both trade and enhanced food acquisition, the settlements will attract conflict.

Regardless, information is being diffused. This diffusion of information seems adequate to largely support the different timings of Old and New World in adoption of agriculture. Recall that the model is one of plenty followed by want and desperate (?) experimentation. The information derived from that experimentation would be spread via the vectors[29] of trade and abandonment.

Now, why is the Old World different from the New? The answer seems simple. The rate at which information moves depends on the density of the information network. (And the rate at which information is lost, at least in one form of loss, depends on the inverse of the density of the network!) In the days before Samuel Morse, Alexander Bell, or Leonard Kleinrock, this information network density meant population density. Thus, the late start in the New World was in part due to the low population density that assured both a slow transfer or transport of information and a frequent outright loss of information.

Cast out of Eden

Pfeiffer [Pfeiffer 1977] presents a rather dismal picture of the transition from the wan-

[28] I use push and pull in the military logistics sense.
[29] Vector is used here in the disease or diffusion sense.

dering Hunter-Gatherer life style to the sedentary agricultural life style. The world was Eden until the apple of agriculture was eaten and mankind was cast out.

He blames the transition on a slow but steady increase in population. Eventually, this increase in population brought on a catastrophic food shortage when the natural ecosystem was unable to feed parasitic man. This situation was retrieved only by the greater efficiency of agriculture.

Other authors discount the food shortage and blame the transition on property addition on the part of the ruling hierarchy.[Mithen 1996] (Interestingly, the food shortage pundits discount the property addiction theorists by claiming that the hierarchy was too impotent to effect such a transition!) Regardless, the picture presented of agricultural life is dismal and oppressive compared to the communal simplicity of Hunter-Gatherer life.

As already outlined, there are several problems with both of these theories. In fact, at the most fundamental level, it is difficult to reconcile these theories with basic human nature.

Not everyone enjoys a wandering life style characterized by constant exposure to the elements, the loss of fellows as a result of anything more than minor misadventure or disease, a complete lack of organizational risk management, and an enforced aversion to property. Not everyone enjoys the communal Hunter-Gatherer life style that seems to be the basis of the common Christian vision of Heaven. Most people want to have the semblance of risk control, are easily addicted to property, and want a balance between individual and communal activities.

The Hunter-Gatherer life style is far from the idyllic romp portrayed by its advocates, few of whom adopt that life style for even a short period of time, much less permanently. The Hunter-Gatherer must be property averse because all property has to be carried, Power or social influence is, in part, getting other people to either carry your property or more than their share of the community (band) property. The Hunter-Gatherer life style is property averse and that life is punctuated all too often by hard choices of what to leave behind.

Pundits of the Hunter-Gatherer lifestyle point out how little time is spent in gathering food and how much slack time is available for communal or group activities. In a property averse society, talking is about the only other activity that is possible.

The Drive to Civilization?

One of the blessings and curses of intelligence is causality, the almost innate, highly fundamental view that every effect must have a cause. The frustration of effect without obviously observable cause is surely the generator of mysticism. From this comes religion, which assigns deity the role of unobserved cause, and science, which is no less mystical in searching out the previously unobvious cause. In both cases, attempts to explain the environment, the seen universe, is inherent to limb diversity, a meat diet, and competition.

With the transition to a sedentary life style, great changes came into play. Many of these changes were shaped by causality, and that causality could act because of the increased slack time and individuality of the sedentary life style.

With less concern for food, and an organizational population both larger and more diverse, attention shifted up the hierarchy. One key area of concentration would have been the governance of the organization. In the familial Hunter-Gatherer band, governance was integrated with kinship. Such a basis ceases to be sound once the organization includes several bands, or even a band plus odds and sods of folks.[30]

We must recognize that this was not a new problem. Bands had been running into each other for a long time, and as the general population increased, these encounters would have become more frequent. So long as the only matter of common interest was food territory, the equivalent of barnyard pecking order, of perceived might, was sufficient. Of course, when it failed, conflict would result, and since the spear had come into common use, the combat associated with that combat might be decisive - but it could also still be conclusive[31], despite the stand-off advantages afforded by the spear.

Further, we can clearly consider this type of thing to be a simple form of warfare since survival of the band-organization would be a basic policy. But by that token, we must see survival policy as a two edged sword. While everyone in the band can throw rocks or wield a hand chopper or knife, such do not stand up well to a spear wielding hunter. Survival of the band is not just a matter of securing food. It is also a matter of the critical skills and abilities of the band surviving. Junior adults must have successors for when they become senior adults. Junior adult females are just as necessary to band survival as junior adult males.

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[30] This may not be the case when new bands form by division. Kinship ties may be somehow preserved.

[31] I use conclusive here in the Lanchestrian sense. See POW for technical details. The simple details are effective destruction of both combat forces.

The problem with this *might is right* form of governance is that it is basically limited to win-lose and lose-lose outcomes. As such it is stable only in an environment where there is some cohesive element to counter this inherently destructive instability. In the band, this cohesion is provided by the familial ties of the organizational members. These do not exist once we deal with an extra-band situation.

To gain access to win-win situations, such as trade or cross band mating (for genetic diversity,) one has to advance to some other form of governance. It is not our immediate task to consider those forms of governance. It is our task to note that such had to be developed before or with the establishment of the settlements. We may comment that these forms have a naturally political composition since, as we have noted, politics probably preceded speech.

It is sufficient to infer that prior to the end of the long cold phase (of *Homo Sapiens*) some form of cross-band governance had developed that transcended the kinship relationship fundamental to the band. This does not mean that kinship relationships were not a major factor in the governance, or did not cause it major problems. It simply means that the conditions of millions of years of governance had been transcended.

With the move to settlements, elaboration and evolution of this governance became necessary. Instead of only having to provide order during brief periods of interaction, the settlement now had to provide order essentially continuously. It seems likely that this had to increase the degree of central authority of the instrumentality. Routine disturbances are not the province of a citizens' assembly. The rules for dealing with the disturbances may be such, but the Principle of Concentration and the love of causality naturally push towards the idea of both police and judiciary functionalities to implement the rules.

Settlement makes changes in life style, and not all of these changes are happily accepted. Skill sets that were organizationally important to the band-organization may be less important to the settlement-organization, with loss of prestige and social standing. Changes to a trans-kinship/band governance may also be a source of alienation. Accordingly, one may expect that fraternities or proto-guilds may spring up to fulfill needs to sustain the loss or transition to the future. Such fraternities (sororities) are both necessitated and made possible by the life style of sedentaryness.

In calling these fraternities, I do not imply the necessity of members wearing special regalia (e.g., hats or aprons,) or the use of secret handshakes, ritually organized meetings, or code word greeting, recognition, or departures, although such may have evolved. I

do imply that these fraternities served a purpose for their members and were thus either exclusive to protect that purpose, or failed and passed away. As such, a degree of secrecy was a natural consequence to this. The formality would range from a step beyond a coffee *klatsch* to something shy of a true chartered order.

While our imaginations may run wild with this, it seems reasonable that we may identify four potential groups that would form such fraternities. The first of these would be those who participated most actively in the instrumentality of governance. Politics, as we all know, is not done in public. Political mandates and political decision may be expressed in public, but their constitution occurs in private surroundings with small groups of people. Even if the governance of a settlement is democratic or representative, plans cannot be made, nor deals struck, in public assembly of either citizens or council. Thus, politicians, literally those who make policy - how the rules are interpreted and applied, will form fraternities.

Second, the mystics will join together. While we may expect a certain commonality, on a regional basis at least, of mystical or religious activity, what may matter most may be the differences rather than the similarities. With a trans-band organization, these differences now magnify over what had been present in the single band that only occasionally was exposed to the heresy of the next band's shaman. Thus we may expect mystical fraternities of proto-priests to develop to either further one set of interpretations or, more importantly, to enforce a common interpretation of doctrine.

Third, we may expect that the traders will form fraternities. While they may be competing with each other, fraternities provide a means of protecting themselves as a group from the difficulties associated with being the new guys. With successful trading and the increased accumulation of wealth, traders find themselves doubly distanced from the rest of the community. Thus fraternities would serve as a means of exchanging information on management-labor relations (a new thing!), and of dealing in a unified manner with government. Further, risk could be shared by cooperative ventures.

Lastly, it seems likely that the hunters formed fraternities. With the advent of settlement, based initially on a plenitude of food and progressively on an increasingly effective agriculture, hunters find that their central role in band dynamics is marginalized. Agriculture, after all, is not the sole province of a junior adult male hunter. The transition to trans-band population establishes a sizable contingent of such disaffected. Thus we expect hunters to form fraternities to counter their initial marginalization and despite periods of de-marginalization, to continue as such. These periods would occur when food became scarce and the attention of the organization moved down Maslow's Hierar-

chy. Similarly, since military action would centrally devolve on these same folks, their social role as warriors would frequently recur.

It is tempting to postulate other organizations of (e.g.,) farmers, herders, or manufacturers of goods and gear, all new or expanded distinctions. This goes beyond our purpose of identifying the two dimensional evolution of organization in the period following the adoption of settlement: broader governance; and non-band fraternity. The roots of state and empire, of religion, aristocracy, class, and army, would seem to be in the innate nature of humanity.

The Crystallization of War

It seems evident that by the end of the cold phases, somewhere in the range of 12-10 KYA, all of the basic pieces have been put in place to constitute basic, if not true, war. The basic physiologies, psychologies, and technologies are in place. Limb differentiated, erudite, intelligent man has evolved with suitable stand off weapons of spear and *atl atl*, soon to be joined with bow and arrow. Organization has evolved beyond the strict kinship basis of the Hunter-Gatherer band, and the bonds of clan and tribe have only imperfectly formed. Organizational policy above the survival of the family level has evolved. Settlement is at least occasionally, if not predominantly, an alternative to ceaseless wandering. The accompanying, initial surpluses and slack labor make combat less risky because of decreased importance of hunters to the organization. Additionally, but perhaps not central to this, the hunter fraternities are maintaining team bonding and possibly even fostering aspects of the warrior spirit.

In **The Art of War in the Western World**, Archer Jones [Jones 1987] expounds his Force to Space Ratio (FSR) Theory of warfare. While Jones applies this theory earliest to literate Agricultural Age warfare, it seems more generally applicable and we shall thus use (or misuse) it. Most simply put, Jones classifies warfare in four basic states[32] as either raiding or persisting, and either combat or logistic. The relative efficacy of any of the four states of warfare is related to the amount of combat capability in the contested area (thus Force to Space) and thereby to the Principle of Concentration in a Lanchestrian sense.

[32] To be accurate, Jones calls these strategies. I find myself in the somewhat embarassing situation of not having defined strategy, tactics, or operations, at least partly because these terms have a temporal evolution. For our purposes here, and since both strategy and tactics arise from Greek roots of language and meaning, I will make the analogy that, to an admittedly limited extent, strategy bears a relationship to tactics analogous to that of *logos* to *praxis*.

For our initial purposes, we shall be primarily concerned with the states themselves rather than the efficacy. In general, raiding activities by an enemy are best countered by establishing such a high FSR as to prevent or prohibit movement of the raiding force. Failing this, offense against the raiding force's base of operation (home base), if vulnerable, is effective.[33] If the base is vulnerable, and an adequate FSR cannot be established, raiding is effective over persisting. A similar relationship applies with the other dimension. If one enjoys a favorable FSR over a persisting enemy, then a persisting combat strategy will be effective, if you can bring him to battle (and chance doesn't intervene.) If you don't enjoy a favorable FSR, or are having problems bringing him to battle, a logistic strategy is better.

Back to Cases

With this in context, we can fairly confidently expect that up to the invention of the spear, almost all proto-warfare was logistic raiding, primarily because of the inordinate risks associated with combat and the difficulties of sustaining any persisting activity. When the band has five hunters and will collapse into starvation with the death or incapacitation of two, combat is risky. When the available weapons are hand choppers, knives, and maybe hafted axes, the risk of mutual destruction[34] becomes too great. Thus, we expect that early warfare may have been largely limited to raiding to obtain needed raw materials (for weapons and tools) or breeding stock (bride stealing!)

With the advent of the spear, this situation changes somewhat. Skill and teamwork become somewhat more important in both hunting and war. Given a preference for hunting as large an animal as possible (to maximize the food acquired per day,) efficiently delivering momentum to target (maximizing trauma) in concert with fellows, a combination of individual and group skill, is desirable.

Similarly, if one engages in raiding (or counter-raiding) combat, the same tactics are effective in the accidental or deliberate combat between the equivalent of two raiding parties. The spear itself provides a stand off (of a meter or so,) not afforded by hand choppers, knives, or axes. Skill permits both offense and defense to be interwoven. Further, teamwork permits two on one engagements. Thus, risk is reduced and decisiveness is enhanced. As a result, we may expect that raiding combat with the spear will increase in representation although we expect persisting warfare to still be too risky and

[33] Thus the invasion of Afganistan in the wake of the Al'Quaida attack of 11 Spetember 2001.

[34] And we thought that Mutually Assured Destruction - MAD - was a new thing invented in the Nuclear Age.

unsupportable.

The Hunting Connection

Now we consider a succession of impacts on war, not always necessarily in the same order because of local conditions and the diffusion of technology.

We tend to have the popular vision of Ice Age (Pleistocene) man wandering about on the snow and ice slaying giant animals, most looking like elephants in fur coats. A more accurate picture seems more like there were people in the boundary between the forests and the ice sheet who were hunting big animals, largely because the environment tended to favor big animals. There were few animals on the ice sheet because there wasn't much for them to eat, and thus even fewer people. Indeed, the problem of existence on the tundra is often not so much food (because of the big animal tendency,) but fuel for fire (warmth) and shelter.

Anyway, this hunting of big animals, while the most efficient in terms of food acquisition, was not possible everywhere. Some locations, especially those that were forested, couldn't support animals of that size. Thus, there were places, even during the cold phases, where the animal population topped out with medium or even small animals. Thus, hunting techniques, and thereby, warfare techniques, depended on the animal demographics, which in turn depended on terrain.

The upshot of this is that the hunting of different size animals had different teamwork requirements. As indicated, large animals were hunted by the group as a whole since usually a large amount of trauma had to be delivered. If the animal had critical vulnerable spots, these were usually small. Medium animals, on the other hand, could not be engaged by a large number of hunters as the hunters would get in each others' way. Finally, small animals, as we have previously indicated, are best hunted by pairs of hunters; the pairing being for observational rather than engagement purposes.

We may also make some other generalizations.[35] The larger the animal, the less mobile it is. Thus, neglecting the differences between herd and solitary animals, the larger the animal being hunted, the less elaborate the engagement technique needs to be. For large animals, the hunting group need only close with the animal and hack away, taking care only to maintain its cohesiveness while avoiding individual injury. In military terms, this type of hunting is purely attritional.

[35] These will be very general. For instance, I largely consider only herbivores.

Medium animals may either stand and resist, or run away, unlike the large animals, and the latter demands that the assault on the animal preclude an escape. Further, since the medium sized animal requires less trauma to kill, and has greater impulsive counterattack capability, hunters of medium sized animals are naturally lead to adoption of missile weaponry.

Finally, these trends are carried even further with small animals. Their primary reaction to assault is to run away. In addition, they are difficult to see and to close with. Thus, hunting technique not only shifts to being primarily observational, but to a premium on stealth and missile weaponry.

As a result, we see a diversity of hunting tactics and technology that largely depends on the size of the animal being primarily hunted, and whether that animal is a herd or a solitary animal. So long as the hunters are wandering, we expect that their hunting weaponry will be dominated by a single type of weaponry and any secondary weaponry will be light in weight and small in volume. If this carries over into their combat with other humans, we may expect large animal hunter-warriors to slug it out with each other, medium animal hunters to either conduct ambushes or long range duels, and small animal hunters to ambush, skirmish, or be reduced to deadly face to face engagements. Further, since the teamwork requirements increase with animal size, we expect small animal hunter engagements to be very fluid while large animal hunter engagements to be the most cohesive.

Cohesion Lost

Of course, only the hunters of large animals had this high degree of cohesion. With the end of the cold phases, and the retreat of large animal habitat (to say nothing of hunting to extinction,) even those few who hunted large animals decreased in number. As a result, the team cohesion of hunter groups declined in the warm phases. We may project from this that the same occurred in the tactical arena as well.

As hunters universally became primarily hunters of medium and small sized animals, not only did the food acquisition become more difficult, but the social status of the hunter now rested more on the abilities of the individual than the group. Of course, for those who never had a chance to hunt the large animals, this was always the situation, but with the warm phases, it became more universal.

Similarly, with settlement, and the advent of more diverse, cross band populations, the

role of the hunter alternated between being critical and marginalized. As already indicated, we expect hunters to form fraternities to help maintain their social status and perfect their art. We know that by this time hierarchy had crept into human society, and with the shift from group to individual performance following the shift from large to smaller animal hunting, we expect this individuality to be reflected in the hunting fraternity.

Since the members of these fraternities would be called on to conduct any combat that would be needed, we may expect this individuality to be reflected in the fighter behavior as well. We may thus be witnessing the development of the warrior ethos.

Settlement and Agriculture

As already indicated, settlement changed the social relationship of the hunter-fighter. Since food had to be initially plentiful, the importance of the hunter as food acquirer decreased and the hunter became socially marginalized. However, the same abundance permitted an increase in population, which necessitated an instrumentality of order, which lead to a trans-band governance, which in turn lead to a need for someone who would provide that order, which was a role for the hunters. We may also expect an increased role as trade protectors.

Clearly the settlements, with their riches, would be targets of raids and possibly even brigandage. The advent of the latter is unclear. Obviously, if one has a settlement surrounded by wandering Hunter-Gatherer bands, property robbing is highly unlikely given the one is propertied, while the others are property averse (if desiring.) The attraction of bride stealing seems more plausible.

On the other hand, adjacent settlements might be competing for resources, and from this we may project some form of warfare between them.

With agriculture developing, first as a desperate measure, and then as an increasingly viable alternative to increasingly ineffective hunting as a food source, we see the role of the hunter increasingly eroded. Agriculture, unlike hunting, is not primarily the province of the junior adult male. As large scale farming techniques develop that place a premium on upper body strength (e.g., draft animal plowing, and scything,) the role of the junior adult male as farmer is increased, but initially with first gardening, and then small scale farming, this is not the case.

Initial settlement has started a pattern of superfluity/criticality of the hunter that is rein-

forced by repetition into a sort of "Danny Deever" formula. As agriculture develops, the marginalization of the hunter increases, but the role of the warrior is increased. With the periodic food shortages, conflict over food resources intensifies, and when settlements actually collapse, their remnant populations may be forced to become anti-settlement to survive (unless some other settlement will admit them.)

Increasingly effective agriculture, while possibly shifting up the hierarchy, still maintains a competition over resources, including water sources, particularly desirable ground, and even trade. As a result, the need for fighters is steadily increasing although we may expect the same cyclic phenomena of either marginality or criticality. By the time agriculture has matured enough to almost assure food supplies (except for acts of angry deities,) the hunter-fighter has made the transition to warrior-hunter with the latter revered not so much as a critical part of survival as an exotic, adventurous, or even elite activity.

Success at last?

One of the consequences of the information diffusion component of the theory is that once the cycle of success, experimentation, failure reaches a certain point where experimentation leads to enough delay of failure, the nature of the information content changes. Alternately, at some point there is enough information on how to do/not do agriculture that the collapse of the settlement is delayed for a substantial period of time. When this happens, the communication changes.

Now, when a settlement can support itself with local food long enough, and has developed an adequate social structure of governance, defense, etc., the communication, the information transfer, largely loses its negative component. Suddenly, the information coming out of an area to neighbors is no longer a mixture of small successes and small failures. Instead, it is a stream of what works, and over a short period of time (in geological and evolutionary scale,) it dries up entirely because, as we said, Maslow's Hierarchy applies and once something ceases to be critical on the hierarchy, consideration ratchets up a notch.

Now, we may postulate that once this level is reached, the mode changes. Settlements that are now self supporting can grow a bit, but more important, they can export their success to form stronger social associations and begin to optimize what they do.

It has to be noted that this success is partly the result of increased population density.

The more people there are, the more ideas and thus the more experimentation. The more experimentation, the more information, and the more people, the faster that information moves. In this sense then, the transition to agriculture is made possible by increased population, which results from the sedentary life style, rather than being forced by it.

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5 The Organization Evolves

The period from the emergence of man to his invention of written language is one that is inherently undocumented. Our understanding of it derives from the remains of man's physical and biological artifacts of the period, discovered by happenstance and guile, and interpreted without input from the actors themselves. This understanding is not large, indeed considerably smaller than our understanding of our own existence, which is itself highly limited. But what we do know gives us some insight into the evolution of war from the earliest times up to the invention of (the concept of) army.

Our means of examining this is the inferred development of the structure of what we might call the evolved fundamental human organization. The path of this evolution is used to infer and imply some aspects of the development of war. Anthropologists [Haviland 1997, p. 605ff.] offer a political taxonomy of organizations. This taxonomy is considerably based on the analysis of legacy organizations since the development of anthropology as a scientific discipline. Accordingly, we have a bit of a leap in assuming that the temporal procession is captured by the spatial distribution of fundamental human organizations, and that there is no organizational "missing link" in the chain.

This taxonomy varies somewhat depending on source, but for our purposes we shall make do with a four state taxonomy of band, tribe, chiefdom, and state. This very statement abundantly indicates that we will have some semantic twisting and straining to go through in this process.

The term band, as used by anthropologists to refer to political organizations, seems to be somewhat different from our previous usage of the term. The primary difference seems to be the size of the organization. Our use to this point has been primarily in the context of the Hunter-Gatherer Age and indicated the basic organizational component comprised of 25-50 humans. The band as a component of this anthropological taxonomy of political organizations is a larger group consisting of a few hundred humans. Thus the taxonomic band is two to several Hunter-Gatherer bands in size.

The operational anthropological definition of a taxonomic band is "a small group of

politically independent, though related households." Households have residential definition that implies a certain cohesion and even sedentaryness, but can easily be extended to correlate with our use of the term band heretofore.

We must also note that the anthropological use of the term political is also somewhat different from ours. As we have stated previously, all organizations develop policy, even if it is unwritten, so in that sense, all organizations may be considered to be political. Modern usage of the term has lost some of its connection with the policy development process, and has come to be largely associated with the larger process and activity of governance. Thus, the term political has come to refer somewhat ambiguously to the process of developing laws and policies of governance and how they are applied. Ambiguously, the term also applies to organizations, somewhat independent of the governance organization itself, whose members are bound in social, cultural, and policy doctrine. The anthropological use of the term appears to be essentially the common use.

Thus, we may see that the anthropological band being politically independent means that it is a sovereign organization while households are not.

We must recognize that organizationally this use of the term is somewhat of a misnomer. These extensions or evolutions of the fundamental human organization are not just governance organizations. Just as the Hunter-Gatherer band is a umbrella organization that includes aspects of direction (governance) and protection (governance, military and police, religion, etc.), the components of this taxonomy are umbrella organizations as well. Because this taxonomy infers an evolutionary or developmental progression, there is a progression of development of separate organizations and differential sovereignty.

Organizational Structure

Before embarking on a discussion of the evolution of the fundamental human organization, it is useful to examine how organizations are structured. Basically, there are two structures that are used in organizations. one of these structural forms is functional; the other is mission.

In simple terms, the distinction here is between what people know and do with that knowledge (functional) and what is to be achieved (mission.) Sometimes these will also be referred to as process and product oriented. This equivalence is not exact and there are technical differences. As management theories ebb and flow, one or the other of these two pairs of forms will be espoused as the better way of looking at/doing things

In general, functional organization is used when the development and/or maintenance of knowledge and skills is more difficult than construction of product. Mission organization is used when the opposite situation occurs.

In practice, it is sometimes hard to distinguish between the two, Further, the distinction is often made subjectively, or on bases such as effectiveness versus efficiency. Nonetheless, the two aspects are still basic to organizational structure. Many organizations however, are suborganized in a mixed manner.

For example, educational organizations are mission oriented at the lowest level of classroom or instructional laboratory, but at the next level up are usually functionally organized along discipline lines. At the same time, the administrative component of the organization is mission oriented but if large enough may be functionally organized.

Similarly, religious organizations are mission organized at the level of churches, synagogs, and mosques, but may be functionally organized at higher levels.

The distinction becomes more obscure when we consider the military. Military organizations are primarily functionally organized along branch lines of infantry, armor, artillery, etc. Many levels also embody functional components for support, administration, and management. The strong mission orientation of military organizations tends somewhat to obscure this structure.

Evolution of the Human Organization

The anthropological taxonomy that we will now considered is largely due to the researches and analyses of Service [Service 1962] and Fried.[Fried 1967] The combined model, which is useful in the generalizing sense of most models in investigating the underlying development and evolution of warfare is somewhat out of favor in the community of its origin. The model has been criticized by contemporary anthropologists because of its very generality in favor of a particularist approach.[Haas 1998] One of the fundamental difficulties of scientific disciplines dealing with human society is dealing with the instantaneous impacts of social fads and fashions. Notably, anthropologists, sociologists, and psychologists have always struggled with their aspects of the observer effect.

While this particularist view has several obvious merits, not least its inherent connection with actual data, one does wonder how generalization and theory can arise in the absence of aggregation efforts?**Reference needed here**

The Service model posits four stages of organizational evolution: band; tribe; chiefdom; and state. This model is very concerned with the development and application of policy aspects of the organizations. This tends to make it useful for our purposes of examining warfare. The Fried model, on the other hand, is somewhat more concerned with transitions between organizational states. It classifies organizations as egalitarian, ranked, or stratified. These qualifiers depend on the nature of social status and resource access.

It is perhaps important that we recall something we already know from organizational theory, that there is considerable variation between/among organizations. For example, Sears and Walmart are both multi-azimuth merchandisers but organizationally and culturally they are considerably different. The same is true of these Service-Fried organizations as well, and when we describe their characteristics we are speaking in generalization just as when we say that a battalion comprises three companies. The statement hides enormous differences and even some absolute exceptions while being useful and constructive.

Within this context, we may generally associate the band with egalitarianism, the tribe with rank, and the chiefdom and state with stratification. We recognize this association to be approximate for a variety of reasons including exceptions, temporal emergence, and organizational differentiation.[Pfeiffer 1977] For example, many democracies, such as the United States of America, aver that their citizens are all equal, indicating an egalitarian nature. However, the Grand Marshal of the local Independence Day Parade is more likely to be selected from the inhabitants of Nob Hill than the inhabitants of the Other Side of the Tracks. Similarly, Political Electees have different privileges than Political Appointees, who have different privileges than civil or military service personnel, who have different privileges than other citizens. Equality, rank, and stratification may exist in multiple dimensions.

The Service-Fried models are evolutionized in complexity and thereby, inferentially, in time. Recognizing that there are legacy organizations today (or recently) that are not states and seem unlikely to evolve into states,[36] we take this evolutionary assumption as indicative of progression of the human organization. We recognize while assuming this that the new, higher organizational form destroys and/or absorbs the older, lower organization.

We also offer our usual warning that the insights into the earlier forms are based on legacy organizations whose behavior may have evolved significantly from initiation to

[36] This evolutionary progress is somewhat problematic in some cases, as we shall discuss subsequently.

observation. Additionally, many of these organizations are located in marginal locations.

Band

The band, in the Service-Fried taxonomy, is somewhat larger than the Hunter-Gatherer band we have considered previously, numbering no more than a few hundred, and more modally as about a hundred. Otherwise, it is considerably similar. Because of its size and subsistence nature, it may fragment during the year to exploit a wider area while sill enjoying some benefits of concentration. As a rule, bands are Hunter-Gatherer in lifestyle.

Despite their larger size compared to the basic Hunter-Gatherer band we have previously concentrated on, these bands still seem to make decisions informally and by consensus. As such, these bands lack a code of established law, although they may have a formal "trial" process in the form of a jury of the whole. Management and administration of the band is effected informally by "natural" leaders. Some hereditary tradition may occur in the wake of an exceptional leader, but it is unclear how persisting these may be. In general, these bands are egalitarian, lacking formal rank or stratification.

During periods of war, which generally do not pass Turney-High's test of True War, [Turney-High 1949] band forces are led by a consensually agreed war leader, who will commonly hold office only for the duration of the conflict. Under conditions of a persisting threat the war leader's tenure may become indefinite. This has been suggested as a mechanism for transition to a higher organizational form. Since it is difficult to find a condition where another band could offer such a persisting threat, but easy for a higher organizational form to do so, diffusion cannot be discounted as a component or alternative.[Rogers 1995]

The nature of band war is similarly informal, very much a matter of "pick up and go" with few preparations. As previously discussed, ambush and raiding are the main forms of engagement with persisting combat rare and likely accidental'

When concentrated these big bands may be more robust because of their larger size. If they have to periodically disperse however, they may still be loss averse during these period of dispersion, especially for hunter-warriors. This may indicate that military action is preferentially undertaken during the periods of concentration. By the same token, captives are likely to be avoided, except possibly for bride stealing or child adoption, because of the inability to deal with unsocializable, unproductive associates. The egal-

itarian nature of the organization also militates against incorporation. Slavery is thus probably uncommon.

This aversion would give rise to some interesting impact on tactics and doctrine. Whoever controlled the "battlefield" would have to either leave enemy wounded in place, or kill them. Thus, we immediately raise the question of how survival critical is the combat? Moral and ethical considerations aside, enemy wounded left in place may recover and survive to fight another day. If the combat is survival critical, then killing wounded will assure those warriors will not be available for the next war. Further, if this is the case, then doctrine would dictate that "back cuts" be taken. As a result, recovery of wounded would become part of the tactical repertoire (economy of force) and the concept of the orderly withdrawal an important part of the military suborganization.

Some primitive organizations have been noted to permit recovery. It must be noted however that at least some of these organizations fight frequently and terminate the combat as soon as one casualty is inflicted.[Pfeiffer 1977] Despite the appearance, such behaviors can be hideously bloody, like civil wars, because they are indecisive.[Keeley 1996] We note however, that some of these instances are not war in that they are not extensions of "other means", but rather a shared policy of normal means to control population.

Regardless, it seems evident that post combat behavior, either execution or release of enemy wounded (or missing,) will be differentiated and both may be expected to exist, depending on circumstances, and possibly as mixed states. Further, both will give rise to forces that differentiate the military suborganization from the rest of the fundamental human organization.

Tribe

The tribe is the next stage of human organization evolution or development in the Service-Fried taxonomy. It is usually larger than a band but its size is still determined directly by subsistence. This increased size is made possible by the transition from Hunter-Gatherer foraging to agriculture, usually in the form of either horticulture or pastoralism. Greater food supply per area translates into more people within the same distance of communication. Nonetheless, the greater number of people necessitates some additional organizational structure.

Most obvious among these additions is some suborganization that preserves the kinship (lineage) relationship that largely characterized the band. Some organizational theo-

rists consider this suborganization natural, resulting from a primal need to maintain an "atomic" organizational level corresponding to the Hunter-Gatherer band, and higher levels forming by aggregation. Certainly, military organizations tend to follow this algorithm rather rigorously. [Kindsvatter 2003]

The other evidence of additional structure is the emergence of rank. These positions seem to be more administrative than directive. Experts consistently describe both bands and tribes as egalitarian, and tribes as ranked but not stratified. In this case, tribal organization is augmented by tribal officials who are primarily administrative in nature and whose reward would seem to be largely social in nature.

It is unclear if war leaders are included in these administrators or not, so this may vary among tribal organizations. Regardless, because of the largely administrative nature of such posts, war preparation is still sketchy. Further, if the polity is still egalitarian and consensual (at least to some degree amended by the greater size and possibly area occupied by the tribe,) then these war leaders-administrators may not be tactical commanders. Also, at this stage of organization we do not expect a strong differentiation of strategic and tactical military command. With the increased population we do expect a more developed military art and more competent warriors, partly due to internal competition.

We still expect engagements to be predominantly ambush and raid, but with less aversion to persistence because of the improved subsistence situation. The matter of captivity is uncertain. For example, LeBlanc [LeBlanc 2003] states that prisoners were executed. Subsistence and incorporation concerns still militate against captives, although the greater population makes some captivity-slavery more likely. Alternately the larger size, with familial suborganization tends to internalize bride taking and reduce external bride stealing.

Certainly we may observe that a horticultural organization may be more able to utilize captive labor than a pastoral organization. Additionally, we note that captive execution may be counter-decisive since it will polarize the warriors to either abandon the battlefield at the first reversal, or fight to the death.

As with bands, there is no formal law, but dispensation of justice may be delegated to the familial suborganizations.

Captive Taking

At this point, a more detailed analysis of captive taking becomes desirable. Obviously, captive taking consumes resources - captives must be fed, housed, and guarded - and contribute only if they can be persuaded to be cooperative. This is why bride stealing is normally excepted from other forms of captive taking.

Cooperation is obtained from stolen brides in two ways. First, women tend to be more sheltered than men in primitive organizations so they may be less likely to attempt escape. If they do escape, they are also less likely to be effective in that escape. Second, once a child has been produced, mother-child bonding occurs. Protection of children, which is directly related to species survival and thus arguably evolutionary in form, may be maximized by cooperation with captors. Resistance to captors would maintain alienation of the child from the father's organization. Similarly escape, which would be complicated by the child, would also cause alienation, regardless of whether successful, and probably regardless of whether kinship was matrilinear or patrilinear. Thus, only cooperation would have improved the child's survival position.

Nonetheless, the development of cooperation by stolen brides, albeit at least partly biological in origin, could have led to an acceptance of cooperation upon captivity as an alternative to death. As a result, we cannot categorically assume that all captives were resistive and thus necessarily unacceptable purely on subsistence grounds.

For a small organization operating at the boundary of subsistence, such as we have suggested for Hunter-Gatherer bands, then captives must be refused because even if the captive is cooperative there is insufficient resources, notably food, to accommodate one more person.

As the size of the organization increases, and assuming its food resources to increase at least proportionately, then a middle state may emerge where a cooperative captive may be accommodated but a resistive captive cannot. If the organization has a subsistence form that is Principle of Concentration in nature, that is, the food resources increase with the size of the population faster than linearly, then a state emerges where resistive captivity may be accommodated. Simply put, if some number of resistive captives may be compelled to work by a single guard and produce more food (and other resources) than they and their guard consume, then resistive captivity can not only be accommodated but produce an increase in resources. At this point an organization may go from being captive averse to captive seeking.

Let us now return to the captive averse organization. For a subsistence boundary organization, policy is very close to fight or flight. It seems likely that combat will occur when it is the lesser (assessed) risk choice and then when there is little alternative to the risk. As we have already indicated, combat presents considerable risk to the Hunter-Gatherer band of complete collapse of the band if the hunter-warrior components suffers moderate losses.

This has considerable import for captive taking. A wounded hunter-warrior is a drain on the band's resources but this drain is transient if the hunter-warrior can recover. Equivalently, a disabled or killed hunter-warrior is either a permanent resource drain or a permanent loss of resource gathering. Resultingly, there is an advantage to killing wounded hunter-warriors but also to neither killing nor taking captives who are not hunter-warriors.

As the size of the organization increases, the decisiveness of this decreases. Additionally, options increasingly accommodate persisting strategies. How does this impact captive taking?

Since the increase in organization size is usually associated with the change from foraging to agriculture, the option of flight manifestly decreases with the adoption of sedentaryness. As a result, combat takes on a much less alternative character, creating a need for a more robust diplomacy to provide other, compensating alternatives. If diplomacy develops, then we may expect captive taking to be accommodated to assist in obtaining diplomatic solutions for war termination or avoidance.

Alternately, if war is a necessity because flight is impossible because of sedentaryness, and resources are available to permit persisting combat, then one wants to have as competent a military as possible. One way to be the best is to kill captives. This signals to one's enemies that no quarter will be given and to one's warriors that no quarter should be expected. Enemies know that if they are wounded and their side does not control the field, they will die. Friendlies know that if they are wounded and their side does not control the field, they will die. Of course, this strategy is temporally metastable at best since it will eventually result in catastrophic losses or a rout, either of which has collapsing implication for both the overall organization and the military suborganization.

The Military View

What can we learn if we view this from the standpoint of military practice? Suppose

that military practice (doctrine) is not to take captives. We can see (at least) two components of this militarily. First an enemy killed is an enemy never faced again. For this to apply we should expect essentially continuous warfare and a constant enemy. Continuous warfare is Hobbesian, and a considerable part of what some recent studies propound. [Keeley 1996] [LeBlanc 2003] A constant enemy would seem to imply one of two things. Either one has a staunch competitor with an irresolvable point of contention, or all of one's neighbors are enemies, which is again Hobbesian.

The second reason to kill the wounded is pragmatism. A warrior who has fought well in combat, even as an enemy, is a member of the band of brothers. If he cannot recover and again take his place in the line, then he should not suffer. It is better that he die.

Of course, there are civil reasons why captives should not be taken, having to do with their burden on the organization, but even in the twilight of combat, civil desires are not always foremost in the military mind.

What is perhaps most disturbing here is the implication that the normal means of policy are not very effective. The military rationale for captive killing bespeaks a situation where differences between organizations are irreconcilable and warfare is continuous, and even possibly universal. Thus, we have something very like the Hobbesian model. In particular, we see an environment where diplomatic efforts, the mainstay of normal means of policy interaction between organizations, are nonexistent or ineffective.

As strange as the latter may seem, especially given the talkativeness of egalitarian organizations, [Pfeiffer 1977] this may actually be the case. In the Strange-Fried model, both bands and tribes are egalitarian, with leadership informal, and policy formulated and decision made by consensus. In such an environment, diplomacy would be difficult if not impossible, just because of its inability to negotiate effectively.

Thus, we see that the environment of Hobbes, of constant warfare, is imminently possible. Further, we see that in this environment of tribes (especially,) peace is an unstable state, because there are inadequate normal means to sustain it, and war is a stable state, because, again, there are inadequate normal means to end it.

This is a very harsh environment. It is not very conducive to progress. One also wonders how well warriors appreciate the prospect of being killed after the battle, especially when they consider that many wounds may prevent them from escaping but still be noncrippling. When and how does one cross the line to take captives?

It is interesting to speculate that the transition was originated by the warriors themselves.

One *gedanken* scenario is that a successful commander would introduce captive taking as a means of decisiveness. Captive killing has its greatest impact on family. It has the effect of adding an aspect of kinship conflict to the warfare, which with its quality of revenge, tend to perpetuate and degrade the warfare. Thus captive taking would offer a two-fold means for ending war. It would not only break the revenge cycle but captives would be mutable into hostages. Significantly, the tactical commander, especially if he was very successful, would be the most powerful, certainly the most authoritarian, leader in the organization. In effect, this envisions that diplomacy might be initiated by the military.

Certainly, as we have indicated, the agricultural organization, such as the tribe, would have resources to accommodate captives and could even benefit if individual worker productivity were high enough. But the impetus of providing a means of controlling (to some extent) warfare, and accommodating increasing social complexity, would tend to force further evolution of the fundament organization.

Chiefdoms

The evolutionary ratchet upward to chiefdoms has more changes than an increase in size. Increasing independence (or at least normal condition distance) from subsistence increases the size of the organization. However, one of the results of the differentiation of organization into a capstone organization and suborganizations (the situation with the tribe,) is rank. To a minimum, the natural leaders of the suborganizations tend to constitute a group for policy drafting, decision formulation, and even internal competition at a new top level, even in an egalitarian organization. It is a short, logical step from informality to some formality and this group is not a council-like organization within the umbrella organization.

In chiefdoms, the rank structure introduced in tribes now advances or evolves from administrative to directive. Rank is formalized, often along familial lines, into autarkic control. Further, resource stratification clearly emerges with differential allocation of resources. Whereas leadership in tribes may have maintained its position by distribution of resources, leadership in chiefdoms may accord position to subordinates in return for donation of resources. Depending on size, chiefdoms may be hierarchical with sub- and superchiefs. Law becomes more formalized with chiefs often serving as justice arbiters.

War becomes more complicated and shifts from being largely defensive/retributional to aggressive and even civil. Conquest appears as a means of growth. Chiefs deposed

through conquest or revolution/rebellion are normally executed, along with their families, to assure political legitimacy.

The hunter-warrior now shifts more fully to the warrior-hunter, or even to pure warrior. Captives are now sought to incorporate into the general population either directly or as slaves. As a result, war now takes on a less violent character.

Because of the personal concentration of control in the chief, the organization becomes much more rigid. Conquest is only possible by overthrowing the chief and executing him, all of his family, and all ranking candidates for the office.[37] Otherwise, the organization reconstitutes. This resiliency, which makes the chiefdom an enormously stable organization, explains why chiefdoms persist to this day and why states can (often) defeat chiefdoms only by what amounts to concerted extermination. It may also explain why states are such recent organizations.

States

States become possible because of effective distancing from subsistence. Limits to the diffusion of control result in the development of bureaucracies which differentiate by concentration. The directive nature of governance becomes effectual and limitations on behavior transcend familial vectors. Law becomes fully formalized, as does religion and the military.

Similarly, organizational membership becomes more formal so that members take on a property aspect of the organization. This carries over to war where captives are now regularly returned to their organizations after the end of the war. (Obviously, diplomacy has bloomed.) War now becomes formalized as well with trained if not standing militaries fighting each other.

The state is the norm today but increases in population and the complexity of society mean that it is not the end of the evolution of the human organization. In particular, we see the development of policy organizations of other forms such as commercial or social who, by virtue of having policy and being willing to go beyond its normal intercourse, may make war. Such organizations, as we have previously noted operate in a shadow relationship with states who tend to view war as a right of sovereignty and those non-states who make war as criminal. As a result, the warfare of these organizations is often

[37] This may not seem to be less violent warfare. It is however ofetn aftermath of war, and it is more focused, hence less violent overall.

quite different in form from the concentration derived bureaucratic war of states. Usually only if one of these organizations wants to become a state is state form warfare adopted.

Policy Evolution and War

One of the problems in the evolution of the human organization from band to state is the matter of who can make war. We have already introduced the basis of this consideration in our earlier discussions of sovereignty. Now we will explore some possibilities of the development of sovereignty.

Our previous discussion on the anthropological taxonomy has already elaborated the distinction between the fundamental human organization, which we called the Hunter-Gatherer band (about 25 people) and the taxonomic band, which is the evolutionary consolidation of several Hunter-Gatherer bands (approximately 100 people.) We may speculate that this increase in organizational complexity more likely arises from contact being maintained across several (little) band splittings than by actual coalition.

We have also discussed how war was extremely difficult, in not impossible, for the (little) band because of the band's catastrophic weakness to even minimal loss among its hunter-warrior segment. With the evolution to (big) band, this segment now becomes large enough that some simple war-like activities can be pursued, but the capacity for persisting combat is still lacking.

With the evolution to the tribe, the size of the organization increases. Some advance the opposite. That natural population due to agricultural sedentaryness manifested the development of the tribe. Regardless, the tribe is a more complex organization than the (big) band, and part of this complexity takes its form in suborganizations. These suborganizations typically seem to take the form of family groups (organization based on lineage - approximately corresponding to the little band,) clans (organization based on lineage from a common ancestor, usually comprised of several families - approximately corresponding to the big band,) and the fraternal organizations we have already alluded to. The latter may be cross family, clan organizations, adding at least one and probably several organizational cross dimensions to the tribal organizational structure. For example, fraternal organizations could be both occupational and religious so that an individual could be a member of occupation fraternity A and religious organization 3 (e.g.)

It seems certain, given the size of the tribe, that governance by consensus has become impractical. In its place has likely evolved some form of representative governance

based on the suborganizations. This is a natural progression and is still commonly used today. Leadership may reside with the caller of the meeting, or with a natural leader.

The difficulty that arises here is that this governance lacks a strong executive function. While the tribe has the resources to engage in something close to war, which can be persisting if trapped, the tribe lacks the structure to enforce policy. Thus, as we would expect, the shortcoming is organizational.

Because the tribe lacks the directive authority to enforce a single policy (in absence of consensus,) the increased organizational complexity can actually multiply the likelihood of war. In particular, the family and clan suborganizations, and the warrior fraternity, can decide to pursue "other means" of their own policy in opposition or ignorance of the (often weaker) tribal policy. As a result, an unstable situation of difference between policy expectation (for the tribe) and policy actuality (for the tribe and its suborganizations) may exist that results in an increased frequency of war. This instability arises naturally when members of a suborganization must resolve conflicts in loyalty between the suborganization and the organization.

The next step, the chiefdom, displays the characteristics of the executive organization. A rank structure is established. Leadership of the organization and the suborganizations is formalized and special responsibilities and privileges accrue to these leaders. In essence, the governance flow of the organization as a whole has moved from purely bottoms-up to a mixture of bottoms-up and top-down.

One reason for this, of course, is to put some degree of cohesion to policy. While the development of policy for the organization may be consensual among the suborganization heads, the conformity of the suborganization to that policy is expected and the enforcement is the responsibility of the head. At this stage, this enforcement is not yet punitive (in the large) but prescriptive. Policy breakers are ostracized socially or deprived of resources.

This order also carries over into war. The leeway of the suborganization to go off and pursue "other means" is restricted and to some extent focused against the executive in the form of rebellion or power struggle. Thus the movement to a directive executive actually puts the organization at greater risk internally in return for a reduction in external risk.

Just as the increase in societal complexity motivated the evolution of the (big) band to the tribe, an increase in social complexity seems to have motivated the evolution of the chiefdom into the state. This is marked, as is usual, by organizational formalization

and diversification. The formalization primarily occurs in the form of a permanent (or at least long term) hierarchical executive structure. To avoid dilution, this hierarchy is usually kept as trim as possible although societal inertia is still present (and often obvious.) To accommodate this concentration of functionality, supporting suborganizations (bureaucracies) with derived authority evolve. This complexity forces the adoption of punitive as well as coercive means to assure compliance.

Again, war follows this order. Turney-High's concept of total war [Turney-High 1949] now comes into its own by the directive executive control of resources and the replacement of the family (or its extended form) as a sovereign or semi-sovereign organization with the state, although the executive of the state may be a single family. The extent of top-down flow is further increased, giving rise to the dichotomy of normal wars and wars of rebellion as a concept.

In viewing this organizational evolution we cannot miss the role of sovereignty. The repeated process of formalization of structure and development of suborganization includes an aspect of the primacy of policy that leads to the concept of sovereignty in the state.

It is the nature of any organization to develop and use policy. This should not be at issue. As the organization develops, if it develops, it will become more formal and the nature of its policy will become more formal.

Some military theorists and historians advance that Clausewitzian war ("other means") is a recent development, essentially a feature of the centralized directive (punitive) state. Some hold that war was first Darwinian, then Hobbesian, then Clausewitzian. [Dawson 2001] The distinctions among these become rather natural in an organizational view. If war is the extension of policy by "other means", then the nature of war will be determined by (among other things) the nature of policy, which, in turn, depends on the nature of the organization. As we have advanced, the evolutionary stages of human organization (anthropological taxonomy) admit directly of what might be characterized as Darwinian, Hobbesian, and Clausewitzian warfare.

Evolution and Warfare

It would seem rather natural to seek some biological basis for warfare. After all, man is an animal and we would like, both scientifically and apologetically, to lay the blame for the existence of warfare on natural processes rather than on some perceived flaw in the

nature of humanity.

We have already mentioned the disparate views of primitive society advanced by Hobbes and Rosseau, of brute force violence and every man against another in the former case, and of idyllic peaceful coexistence in the latter. Now, we add to these considerations that of Darwin who advanced the concept of the survival of the fittest, that those species and individual members of those species survive and profit that are best able to survive. As a result, rather naturally, there is a tendency to view warfare as a contest of survival. From our perspective, as might be expected given the tenor of this work, such considerations often give too little consideration to the role of the human organization, treating it either anecdotally or parametrically. We must also recognize that this is not a simple matter. Darwinian evolutionary theory developed along geological as well as biological lines, so its focus on individual characteristics is natural. Today, of course, there are biologists who study animal organizations (and we might include social anthropologists among these.)

In general, organizations have both internal and external aspects. That is, they may be regarded as a system because they have internal processes and external processes. In a sense, these processes are built up from the individual level, but significantly, they are often different from the processes of the individual.

For example, organizations usually compete both internally and externally. The internal competition may be between individuals, either singly or as unorganized aggregates, between suborganizations, or between both. The external competition often exhibits the same structural form, plus the organization as a whole.

In considering this competition, it seems important to inject that the human organization exists for a reason, and that reason, at its most fundamental level, is survival. In a sense then, the human organization is Darwinian and cannot safely be ignored or slighted. As we have noted, the basic human organization precedes humanity. So far as we may project, the extended family or Hunter-Gatherer band was part of our ancestors' structure when they first moved out of the trees.

It is interesting to speculate that one of the reasons that the evolutionary discussions of man seem to neglect the organizational aspects is that there is a bit of a dichotomy between evolutionary theory and organizational actuality. The nature of this dichotomy is essentially the fundamental one between competition and cooperation. If animals survive by successfully competing and species advance or prosper by being more fit than those who decline and disappear by being less fit, then where does cooperation

come from?

The pragmatic answer is that there is a trade-off between cooperation and competition that frequently (and at least statistically) takes the form of enhancing survival. Of course, this two-sidedness is part of the basis for the Principle of Concentration.

It may be argued that this duality fundamentally arises from the duality of sex although one gets into a bit of a chicken-egg synergistic when considering how sexual differentiation occurs. However, since this differentiation precedes the development of man by a considerable margin, we may fairly safely neglect these questions.

Sexual reproduction is one of the most fundamental examples of the furtherance of competition through cooperation. If we took competition at its most fundamental then we should expect no reproduction to occur because individual competition would preclude it. Thus, the mere fact that two (opposite sex) individuals may produce offspring and even care for those offspring after gestation demonstrates how this trade-off operates.

It may be argued that the human organization is an extension of this type of behavior. In effect, the cooperation embodied in the human organization enhances the human ability to compete successfully. In this context, it is only a short step to organization developing characteristics and processes that transcend those of the individuals who constitute the organization.

The organization then, is a fundamental component of human competition and cooperation. At the most primitive level, it may be argued that the organization is an extension of biology, and this may indeed be the case when the organization is essentially fixed and determined by the nature of the animal. This is not however, the case with human organization. Human organization is not fixed. It responds to the social and cultural needs of its members. As we have advanced earlier, the human organization, like the human, has system-like characteristics and thus behaves and interacts as a system.

In this context, can we perceive anything about a biological side of war? Within the Clausewitzian definition we have advanced that war only exists as an activity of the organization. We must recall however, that this is a definition and remains valid only so long as it survives challenge.

In principle, it is possible to envision war as the "other means" of a single individual acting as an organization. Such a circumstance would not be inconsistent with what we might think of as Darwinian war where every human fights with every other human for survival. While we acknowledge this to be neither inconsistent nor inconceivable, we

do immediately note difficulties.

The most obvious difficulty is that man is a sexual animal. If this solitary warfare is Darwinian warfare, then how does reproduction occur? If every man and woman are fighting each other, then how does the cooperation necessary for reproduction occur?

Next, as we have previous noted, the human organization precedes man. Thus, we have difficulty reconciling the cooperative environment of the organization with this basic premise of evolutionary competition.

What we observe is that there are both individual and organizational components of competition and cooperation. Thus, we find that Darwinian warfare is more a matter of organizations fighting than of individuals fighting. This is not to say that individuals do not compete and fight, merely that, in the main, that fighting is not war.

Clearly we have difficulty observing Darwinian war. If Darwinian war is about survival, and includes the non-survival of both organization and members, this situation is essentially that of genocide, which we have already discussed. It may be recalled that we advanced that genocide ceased to be war once the policy was accepted or the organization collapsed. At this point we must acknowledge that if the organization is simple enough it may not collapse until only one member is left (and not necessarily then.)

Nonetheless, we must acknowledge that such organizational complexity is rather old. There is also the issue of whether there was sufficient technology for war when the human organization was this simple. It seems reasonable to advance that by the time language had developed, the human organization had become sufficiently complex that it would collapse before genocide could be effected. Thus, it seems in this view, especially lacking some physical evidence, that Darwinian war is a concept only.

This view may be too harsh. We have earlier advanced how risky war was to the Hunter-Gatherer band. If the band took about two hunter-warrior losses, some measure of starvation was virtually assured and completely destruction of the band was a strong possibility. This can be viewed as Darwinian war in that every band encounter offers the possibility of organizational destruction. It does not imply that every hand was raised against every other, but rather when two bands chose to fight there was a good chance one or both would not survive.

Hobbesian War - Rousseauian Peace

This is not necessarily the case with the Hobbes-Rousseau conditions of constant war and idyllic peace. We have already identified a scenario for the former.

For a simple organization lacking effective normal means of policy, such as diplomacy in particular, and in general the capacity for efficient decision making and action at the organizational level, it is easily possible for an organization, confronted with intense competition with other organizations, to be drawn into war. Once engaged in war however, it then becomes nearly impossible to disengage. The increase in people resources obtained in moving from band to tribe means that war is more feasible, even to the level of persisting warfare. The transition from foraging to agriculture not only increases the food resources (per area) but further frees up people - unemployed hunters - who can serve as "cannon fodder." Given an agricultural society with little law, or other formal procedures, a crowd hysteria rush-to-war is eminently possible, if not likely.

Now enmeshed in war however, and because the increase in size of military force has effectively reduced decisiveness while not yet being adequate to foster intensive military professionalism, a situation of attritional stalemate may result that is not easily resolved. Initial military exchanges, possibly now persisting combat because of the increased resources, could still not be fully capitalized on, even if they are successful, because resources would still not be adequate for a campaign, a full series of military engagements and/or operations to achieve an operational, even strategic, objective. In terms of Turney-High, [Turney-High 1949] war is still not true war.

In this situation, lacking early decisiveness, a situation of attritional raid and counter-raid, ambush and counter-ambush might develop. Having consumed their increased military margin in indecisive persisting combat engagements, regression to a raiding strategy is the only viable course in the absence of effective diplomacy.

It is this lack of effective diplomacy that appears telling. Just as the lack of effective checks and balances, and effective decision making and action in an informal egalitarian organization could lubricate the path to war, they could also impede or even prevent controlled termination of the war. In effect unable to negotiate in the absence of directive authority and concise decision making, only exhaustion would remain as a means of war termination.

This exhaustion would not likely occur quickly. As resources become depleted, the intensity of combat would alter. Because of the frustration of the attritional nature of

the war, we may expect to see engagements become much more intense and bloody, very much winner take all, but, at the same time, less frequent. This phenomenology is commonly found in so-called small wars, [Klare Kornbluh 1988] [Bell 1998] [Gallagher 1992] often misleadingly called low intensity combat. A more accurate characterization might be high intensity, low frequency, small scale combat, which is admittedly too complicated to say concisely. Nonetheless, we may expect considerable commonality between these types of wars although we must also recognize that this should not hide their differences from our consideration.

Of course, there is no inherent reason for an egalitarian organization to be impulsive. If anything egalitarian organizations can be quite conservative.[38] Further, even though the war may effectively be unendable, this very difficulty of ending a protracted, painful conflict is likely to induce an organizational aversion to war for a considerable period. Certainly, indications of warlike organizations becoming peaceful exist, [LeBlanc 2003] and we may infer the reverse from this.

Thus, we may see situations where even in the absence of effective diplomacy, war may be avoided, either by a conservative desire to preserve the *status quo* or an active aversion deriving from memory of recent war. In such cases, especially when resources are adequate, population not explosive, nor organizations too close to each other, peace may be the rule and persist for a considerable period. It is not inconceivable that under the proper circumstance a condition where Hobbesian and Rousseauian environments oscillate.

Back to the Box

By much the same mechanism, it is rather easy to see how a tribe might evolve into a chiefdom. A tribe, finding itself in the depths of despair, not necessarily war, may adopt or accept the direction of a leader. In such times, the decisiveness possible by an effective leader is attractive to the unsure and beset members of the organization, and his purposeful action is comforting, even when not effective.[39]

If the tribe is sufficiently complex that suborganizations have evolved and politics have developed among them, then this condition might arise among the group of the leaders of

[38] Consensual organizations are often, even notoriously, conservative and action averse. In fact, it is not uncommon for the actio, when finally taken, to be directed against the internal advocates of action rather than the external "threat."

[39] This, and discipline, are why military organizations try seriously to occupy their troops' time with frivolous tasks like the whitewashing of stones.

the suborganizations. Situations might develop where this group would take more power to itself, consulting individually with their suborganizations but increasingly avoiding or neglecting the organization as a whole. From this it is a relatively short step to the most politically powerful of the group exercising his power to establish greater permanence.

The organization having been drawn back from collapse, the directive leader could then have been retained, either through consensual acclaim and acceptance, or even through a *coup d'etat*.

Once a permanent directive (if not coercive or punitive) authority had been established, the diversification of that authority would follow rather naturally. As the authority stabilized itself, it would want to regularize itself. This most often leads to a hierarchical structure, and there is little reason not to expect such in this case.

As a result, one possibility is that the newly established chief will appoint subchiefs to administer the organization.

While chiefs generally do not have the coercive powers of heads of states, they still have considerable decision making power. As a result, chiefdoms may act more decisively than egalitarian tribes, and they may practice diplomacy. Thus, while they may more quickly go to war, because they may practice diplomacy, there is a vehicle for termination of the war other than by exhaustion (in the absence of decisiveness.)

Because of this increased capacity of dealing with war, it would appear that chiefdoms would also be able to be more acquisitive. Thus, we anticipate that chiefdoms can be larger than tribes.

Specifically, chiefdoms are often rather internal organizations. This may manifest in rebellion and other internal conflict between political segments of chiefs. This tends to have an impact on the nature of chiefdom warfare. In particular, it appears that chiefdoms practice captive-taking (and adoption) from the non-chief population but practice captive-killing on the chief population. This is a fairly obvious manifestation of politics and political influence on the military.

And Out Again

One of the things that is less obvious is the evolution of the chiefdom into the state. While we are obviously presented with the established fact of states, instances of recorded observed transitions are few. [Dawson 2001] We know that interactions between states

and chiefdoms are difficult. Chiefdoms tend to be very resilient. Many successful instances of states absorbing chiefdoms are more a matter of organizational, and even membership, destruction of the chiefdom.

As a result, we frequently observe coexistence, of a sort, between states and chiefdoms. The state is unable or unwilling to destroy the chiefdom, in the former case often because of a lack of military capacity, in the latter for social or political reasons. Classically, of course, states have exploited chiefdoms as buffers between themselves and other states or chiefdoms. Such usages are not without risk since the buffer chiefdom may become a valve for the higher bidder, or even the looter of the state. [Ferrill 1986] The latter usually develop into conquest only when the state organization collapses.

There is a tendency for chiefdoms to exist or develop internal to states, which of course tends to make the state ineffective. Warfare between these state encapsulated chiefdoms is often seen as a form of civil war of rebellion when it is actually a case of ineffective sovereignty.

Given all of this, how can we see an evolutionary path from chiefdom to state? The obvious question is what survival improvement does the state have over the chiefdom? The answer is that the state, which is characterized by the extension of rank into stratification, has a coercive component. This component is manifest in its bureaucracy.

This distinction seems crucial, and may account for the difficulty of evolving chiefdoms into states. Chiefdoms tend to establish rank along kinship lines. This is at once the basis of their strength and their weakness. Because of the family nature of the governance, there will be great cohesion in the face of external adversity, but this will also give fighting between chiefly families a revenge character that complicates termination, as noted by Turney-High. [Turney-High 1949]

The governance of states tends to be less familial in nature, although there is still familial character. This appears to be critical to the more directive nature of states. Fundamentally, states have less competition between authority families because of the combination of bureaucracy and fewer families. (In general, there is usually only one preeminent family, but several lesser but still ranked, even stratified, families for the first family to socialize and breed with.) As a result while states suffer periodic civil wars, they are usually not wars between families so much as wars in a family or between state and dissidents. As a result, states tend to be more external organizations than chiefdoms.

This and their adaptability of governance are probably key components in states' superi-

ority over chiefdoms. The relative abilities of states and chiefdoms to spawn and foster derivative or child organizations is unclear but may also contribute to the superiority of the state. The greater internal cohesion of the chiefdom (over the state) may prevent the development of derivative or child organizations, thus limiting the development and diversification of the chiefdom's society.

It is interesting to speculate about the evolution of the state. For a state to develop from a chiefdom, two essential changes must occur. These changes are the development of stratification and of the bureaucracy. For stratification to occur, the chiefal families would have to further differentiate, with one family becoming preeminent. Given observations that chiefdoms seem to be characterized by intense, violent competition among chiefs and their families (whence victorious chiefs execute defeated chiefs and their families,) and no permanence of place, emergence of preeminence would seem probable only when the chiefdom had been reduced to only one effective chiefal family. This could be the result of plague or warfare. Regardless, it seems a rather unlikely circumstance.

Second, the statish bureaucracy would have to develop. Bureaucracies, as opposed to staffs, tend to vest what loyalties they have in the state, sometimes identified with the dynasty. (This bureaucratic apathy or integrity, depending on viewpoint, is a means of state survival.) It is possible, of course, that the components of the bureaucracy could have developed through individual chiefal families.

Regardless, however, the development of the bureaucracy could not precede the emergence of the preeminent chiefal family although it could parallel it. Certainly it could not develop robustly in the chaotic and conflicting environment of competing chiefal family politics. Again, we have a somewhat unlikely circumstance in that it is dependent on an unlikely circumstance not only occurring but developing in a particular way.

As a result, it is interesting to speculate that the state and the chiefdom might be alternate rather than consecutive evolutionary forms. That is, rather than the state evolving from the chiefdom, perhaps the state and the chiefdom evolve from the tribe?

We have noted that evolutions from chiefdom to state are not frequently observed. Our examination of the changes necessary to obtain the organizational structure of the state have supported this rarity. However, if we examine the tribe in the same fashion we perceive quite a different situation.

The state bureaucracy has precursors in the tribe in the form of the tribe's suborganiza-

tions. One theory advanced by experts [Fried 1967] is that the heads of these suborganizations may evolve into chiefs. It also seems feasible for the suborganizations to evolve into components of the bureaucracy.

The theory for the development of the chiefdom is its higher directive and decisive capacity put into place initially by a strong leader during a period of severe organizational stress. The same theory would seem to apply to state formation.

In this speculation, the evolution of the tribe to the next organizational stage occurs due to the emergence of a strong leader (or leaders) in a circumstance when directive, decisive authority is necessary for organizational survival. Whether a chiefdom or a state emerges would seem to depend on several conditions. The crucial condition would seem to be how much authority reposes in the leader. How strong is he? Does he dominate the heads of the suborganizations or is he merely the strongest among them?

If the leader is dominant, then it is fairly easy to see how the suborganizations could develop into the bureaucracy. The second strata of authority would then flow down from the leader (first strata) e.g., as the families of the heads of the suborganizations, who are already dominated, or as the families of the leader's staff, or both. In this case, the end result is a state.

If the leader is not dominant, but only strongest, then compromise rather than direction must be operant. In this case, the leader may become the primary chief (at least for a while,) and the heads of the suborganizations become the secondary chiefs. The bureaucracy does not develop (probably,) because of the dilution of authority, and the end result is a chiefdom.

In this branching, we have considerable stability. Short of complete collapse of the organization, transformation from one to the other is difficult and improbable. Both chiefdom and state incorporate repair and stabilization components. Further, both have natural structures to accommodate growth (more than a tribe,) although more so for the state.

If behooves us to remind the reader one more time that this is speculation on our part. Anthropological theory seems to hold that state evolves from chiefdom evolves from tribe. The caveat is given because the author is not a professional anthropologist and the literature has not been exhaustively searched.

For our purposes in examining the nature of warfare, distinction between the evolutionary paths, whether accepted or speculative, is important only in the context of war. Both

states and chiefdoms practice war similarly with respect to captive taking. Heads of government/organization are eliminated, either through exile or killing, while military and general civil populace are either incorporated or returned. Both states and chiefdoms have the capacity for diplomacy, which has emerged as a prerequisite for Turney-High's true war. One of the most obvious differences is in the nature of the military. In a chiefdom, military force will tend to be localized with chiefs. In a state, military force will tend to be centralized. This partly accounts for states having little difficulty in conquering chiefdoms but great difficulty in incorporating them.

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6 The Invention of Armies

The First Great Cities

Somewhere about 6-5.5 KYA, another stage in human existence began. The experiment begun in the Hunter-Gatherer settlements had finally produced two mature sets of technologies, and these technologies were about to start massive changes. Of course, these technologies were mature primarily in terms of the scope of their application. Both could trace their roots back before the hominines.

The first of these technologies was agriculture (and husbandry.) The laboratories of the Hunter-Gatherer and pre-Agricultural Age[40] settlements had wrought mightily: flax was first domesticated about 10 KYA, about the end of the short cold phase; wheat, goats, sheep, and pumpkins were first domesticated by about 9 KYA; the dog and potatoes by about 8 KYA; by 7 KYA, chilies, sugarcane, the pig and the water buffalo, cattle and chickens, had first been domesticated; by 6 KYA, bread wheat, and citrus fruit; by 5 KYA, rice and the horse; and by 4 KYA, the horse had been bred enough to be ridden (in the Ukraine), and olives and maize had been domesticated. Material technology moved in parallel: adobe bricks by 10 KYA; beer invented by 8 KYA, and copper in limited use, primarily as a stone; fired pottery by 7 KYA; wine and cloth by 6 KYA; copper smelting and casting by 5 KYA; and gold, silver, and iron by 4 KYA. [Bunch Hellemans 1993]

The other technology was organizational. With the food shortage problem effectively solved, the problem of how to govern larger than band organizations had to be solved, and by 3500 BCE, a solution (probably, solutions,) had been developed. Perhaps developing from the fraternities, perhaps by other means, a hierarchical system (probably, systems,) of governance had been developed resting on the institutions of an aristocracy, a priesthood, and a military, all distanced in some degree from the farming and husbanding majority of the population.

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[40] One problem of discussion is when and what is the boundary betweeh Hunter-Gatherer and Agricultural Ages?

By this time, the villages that were the successors of the Hunter-Gatherer settlements had developed to the point where their populations probably numbered primarily in the range of 500-1,000. Some villages were larger, others smaller. The technological push for a different organization probably arose in the larger villages where there were just too many people for the chief executive to know all of their names.

At any rate, the world was ripe for the leap from villages and towns to cities: settlements as large or larger again than villages were larger than the original Hunter-Gatherer settlements; dependent on both surrounding agriculture and a constant influx of food (and people) from the adjacent area; and possessing a high level of social order. In other words, these cities met the qualifications for true civilization, [Haviland 1997] not just the proto-civilization of those Hunter-Gatherer settlements they developed from. The cities possessed great buildings, many dedicated to highly organized government and religion, and massive walls dedicated to defense, by the remains of which we have been led to knowledge of their existence.

The first cities were built in the lower valley of Mesopotamia by the Sumerians about 3500 BCE.[41] [Hawkes 1973] Egypt followed a couple of hundred years later. The cities of the Indus were first built after 3K BCE, of the Hittites and Crete about 1800 BCE. [Saggs 1989] These latter two had somewhat different geographic bases, which may have been contributory to their relatively rapid demise.

The Mesopotamian cities were built on the Euphrates and Tigris rivers, the Egyptian cities on the Nile, and the Indian cities on the Indus. Inadequate information is available to generalize on the Indus river cities, so we primarily focus our discussion on the Mesopotamian and Egyptian ones.

The common feature of these cities was access to a plentiful supply of moving water that could be applied to irrigation.[42] This broke the dependence on rainfall. In fact, given the paucity of rainfall in both the Egyptian and Mesopotamian regions today, people often express awe of these ancient accomplishments without recognizing that this was a significant factor in making these civilizations possible. If these river systems had been subject to substantial local rainfall patterns, which would have been effectively random, the existing level of technology would probably have been unable to cope with the demands of irrigation. As it was, the annual inundation of the Nile made significant differences in the art of irrigation and agriculture in Egypt compared to that in

[41] The lower valley had first been settled about 5K BCE, so we may speculate that the Sumerians may have brought organizational technology rather than agricultural. The Nile region was settled about the same time.
[42] The New World city of Caral in Peru, circa 2600-2000 BCE, was apparently also an irrigation city.

Mesopotamia.[43] It was this difference that apparently led to the invention of Armies.[44]

Army

Each year, the Nile floods, depositing new, wet silt on the lowlands along the river. Planting occurs once the flood has passed, and irrigation is only necessary to supplement this initial wetness. As a result of this behavior, the Nile does not itself silt up except in the turbulent boundary region of the delta where it flows into the Mediterranean.

This is not the case with the Tigris and Euphrates rivers.[45] They do silt up, and as a result, the rivers wander. Many of the ancient cities are far from the current courses of these rivers. But because the Euphrates and Tigris rivers do not flood like the Nile, much more extensive irrigation was needed to grow crops along these two rivers. Irrigation works must be more elaborate, and water discipline has to be more stringent. The need for this latter discipline led to the Sumerians' establishment of a governmental organization of portfolio or cabinet rank (Ministry in the British parlance, Department in the American,) responsible for administering water policy and practice. In Egypt, water management was essentially an "other duty as assigned" activity of a cabinet level Minister/Secretary, reflecting lesser importance.[46]

While it is not surprising that these first great cities, being fundamentally dependent on irrigation agriculture to keep them high on Maslow's Hierarchy, [Drucker 1974] would have "Water Departments" that really were senior elements of the governance, what is surprising is that the Sumerian military organization was essentially a mirror image of the Sumerian water management organization complete to titles of rank and organizational structure. [Hawkes 1973] I am unaware of any information that would indicate which organization came first and thus might be considered the progenitor of the other, but regardless of this we may draw some quite interesting comparisons.

It has long been held that one of the necessary characteristics of civilization is order, [Haviland 1997] which we may equate with a certain degree and extent of control, and incidentally, the association city-state. Clearly, given the large populations of first vil-

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[43] The Nile is apparently a "new" river, not coming into existence until the end of the last cold phase.

[44] This is admittedly subjective. What level of organization, of true warfare is necessary, for a military force to be an army? McNeill [McNeill 1982] might claim this distinction for the Assyrians and Hanson [Hanson 2003] for the Greeks.

[45] The Tigris and Euphrates do flood, but at the end of the growing season, not the beginning. Thus the Mesopotamian irrigation system exists in part to keep the rivers' flood from washing away the crops.

[46] The Egyptian chief executive, the Pharoah, did reserve the title and role of "flood bringer" to himself, however.

lages, and then, cities, the ability to maintain order, to control the behavior of the populace, is necessary. Given our arguments for the adoption of the sedentary life style as a desire for, among other things, property, we can immediately see how a desire to acquire and retain property would give rise to a desire for order and hence an acceptance of control. Further, we have the human propensity, as indicated by Maslow's Hierarchy, [Drucker 1974] to direct attention as high on the Hierarchy as possible, and thus to surrender to government or industry those necessary activities lower on the Hierarchy - until their practice awakens concerns at that level again.

Assuming the lower parts of the hierarchy have been relegated to organizations of government, religion, and the military, we may see that ensuring survival in the environment of the cities, and then the city-states, is largely a matter of control of resources, and thus of ground. Given that the Euphrates and the Tigris do not flood as the Nile does, control of the food supply, assuring its adequacy, is a matter of assuring that farmers make proper use of the irrigation system to assure maximum production. Thus, since humans operate on the theory that if a little is good, a lot is better, there is a need for the water police.

Similarly, the cities need to assure that there is a fairly constant influx of food from outside the city area. This means that those farmers have to be induced to bring their crops to our city and not another city. Thus, we may need to maintain an occupation of their territory, a control of their ground, as it were.

Further, since these are now our "rural" farmers, and part of our city-state, we have to make sure that other, envious or desperate city-states (or brigands) don't come raiding.

So we end up with two organizations with essentially identical structures because at root both have missions of controlling ground (and its processes or activities.)

Despite this rather elaborate argument, we have some other evidence that indicate the Sumerians may have invented Army. By the time cities are started, the agricultural and organizational technologies are pretty well developed. As a result, there is excess production to support a "leisure class", and the roles of government person, religious person, and military person have evolved. Increases in population have driven these government, religious, and military organizations to become hierarchical, and establish subclasses of junior and senior to assure continuance. We also find these three coming together hierarchically at the topmost level with the chief executive of government also often being the head of religion and head of military.

Infantry has been fairly well developed, and may have fractured into shock and missile specialities, but the individuality of the warrior has been, to this juncture, paramount. With the coming of the cities and the city-states, with their fundamental need to control surrounding ground to assure influx of supplemental food, the Principle of Concentration kicks in again and Empire is born. It does not take Rocket Science to recognize that, rebellions aside, only the perimeter needs to be defended while numbers derive from area. Thus, in principle, the bigger the area controlled, the more resources available, and the less military forces that are needed. Thus, Empire can be justified, not on loot and pillage, but on the Peace Dividend.

Of course, the problem with defending the periphery is that once the forces at the boundary are defeated, the way to the center is clear. As a result, and to counter rebellion, some non-peripheral forces are needed. So long as these can be kept small, the area:boundary relationship still works.

To be more economical, the military needs to be more efficient and the way to be more efficient is to apply the same techniques that have worked with government and religion. The answer is to establish greater order and tighter control.

No longer do we allow warriors to fight with whatever weapons they want to, and with whom they wish, and obey whomever. No longer do we let them wander around as they want, making decisions for themselves. Now, we clump together those with similar weapons, we control how those weapons are made, we separate unlike capabilities while clumping them, and we make warriors behave and move in an orderly manner. And we make them do what we tell them to.[47]

Thus, we get an Army. Special branches like supply and engineers get invented. Special equipment like armor and siege engines get invented. Light and heavy, shock and missile infantry are distinguished. Discipline is maintained. And suddenly, warriors aren't warriors anymore. Now they're soldiers.

The amazing thing with this Sumerian "invention" is how rapid and complete it is. In terms of archaeological time, one moment we have the local equivalent of a collection of hunting groups of warriors going out to fight, probably in a raiding fashion, and the next, a disciplined corps[48] of soldiers prepared to fight in a persisting fashion. In fact, this rapidness argues that the water organization came first.

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[47] This sounds easy. It is not! History shows us how these decay time and again, and are rediscovered time and again.

[48] I use the term corps here because the force is comprised of different types of infantry plus engineers and supply troops. In that sense, it is an all-arms or combined arms unit.

As indicated earlier, the lower Mesopotamian irrigation technology was already at least partly in place by the time the Sumerians showed up. For all we know, the Sumerians found that technology in place, appropriated it to their purposes and adapted it to their organizational skills. If this is the case, then finding that the new water instrumentality worked, and needing a means of fighting other city-states, which was a new thing, they adopted an organizational structure that they already knew worked.

Whatever the mechanism, the Sumerians now had a military instrument that could truly be called an Army. It was ordered and disciplined. Critically, from Turney-High's standpoint, and probably Jones' standpoint, this army could engage in True War. It definitely could adopt a persisting strategy, because it had to. To fight other city-states successfully, this army had to be able to meet opposing armies in combat and it had to be able to reduce fortified cities.

By about the time the Sumerians were inventing the army, both boats and wheeled wagons were around in Mesopotamia. The troops had the materiel to traverse the rivers and push adequate supplies, although they probably didn't use these vehicle yet for combat.[49] The resources of the city, food and weapons and the other needs of the army, were now available in the field as well as in depot.

The Nature of Civilization

These wonderful new organizations were (and are) not without their warts. As a lot of pundits have noted, the solutions to the food and order problems that made the cities possible aren't very good solutions. [Pfeiffer 1977] They don't keep food (or other resources) from running out, or order from collapsing, they just postpone it for a long enough period that people can get together in large numbers.

These weaknesses keep getting demonstrated by these ancient great civilizations. For example, the city-states of Mesopotamia keep fighting among themselves. The Sumerians, who "invented" cities and army and writing, didn't last very long. Because of the nature of the Mesopotamian irrigation, the dynamic was just not there for the Mesopotamian city-states to unite except under a (usually temporary or transient) conqueror.

This wasn't the case in Egypt. The shallow depth of agriculture around the river meant that the centers of power were all on the river. So after a pre-historic period, the Egyptians were always united, usually in one government, but occasionally two. Well, I

[49] Some experts claim the wagons were fighting platforms. [Watkins 1989]

should say almost. That government wasn't stable although it was resilient.

Interestingly, the Egyptians were invaded at least three times. Two of these invasions were long term partial occupations by Asian peoples who had to be overthrown and expelled. The third invasion was by the Sea Peoples. Interspersed in these are two complete collapses of the governance that lasted for hundreds of years before the system could be re-established.

The invasion by the Sea Peoples was apparently repulsed, but the effort was so demanding that it set the Egyptians up for subsequent domination by Persians, Greeks, Romans.

The Indus river city-states were also relatively short lived, as compared to either the Egyptians or the combination of Mesopotamian empires. The reason for their demise is unclear, but given the Cretan fall from the disaster of a volcanic explosion and tidal wave, and the Hittites being ground down by too many military and cultural enemies, it seems likely that they succumbed to some shock or stress they could not continue to cope with. Apparently Mesopotamia and Egypt were enduring only because of their irrigation cultures, which are sometimes known as water monopolies.

Evidently the instability of civilization as a whole carries over to armies as well. The fall of Crete resulted in the Greek Heroic tradition of warfare, the numerous conquests in Mesopotamia were notable by the rotting of occupation society and army leading to successful revolts using successively less ordered forces, and the Hittites, who built their empire on a quite well ordered army, succumbed to the grinding of "quantity has a quality all its own". The Egyptians, perhaps lacking the irrigation model of the Sumerians, started out with a feudal system before evolving to a strong monarchial system with a central professional army. This army evidently suffered from corruption as it seems to be repeatedly reconstituted using foreign soldiers who were granted citizenship.[50]

This has to be due, at least in part, to the issues of army usage. Since no organization can sustain war for a long period above the warrior level, one is faced with what to do with an army between wars. If one uses it as a police force, then one has the dual problems of how to maintain order during wartime and how to remove the influences of long term policing, such as absence of decisiveness, stress, and graft. If one simply leaves the army in bases, it becomes alienated and the target of budgetary schemes.

[50] There are a couple of political reasons to restrict the profession of soldier to foreigners. It keeps the natives disarmed and disorganized and thus less likely to rebel. Further, the foreigners, having no friends or family locally, remain loyal to their paymaster.

Property

Evidently these early civilizations were quite aware that they had unstable situations, or else they were just fundamentally greedy. The idea of property, which had switched from something to be avoided to something that could be accumulated with the adoption of sedentaryness, had evidently developed along the lines of the hierarchical structures of government, religion, and military. Increasingly, not only were material goods considered to be property, but animals, land, crops, buildings, and even people.

Saggs relates that:

> "In course of time the attitude grew up amongst scribes in both Mesopotamia and Egypt that knowledge consisted not in practical activities incorporating observation and experiment but in the texts they copied and transmitted. This became a serious obstacle to scientific progress."[Saggs 1989]

Without drawing the obvious comparison to our present day, it would seem that these ancient civilizations adopted change only when necessary and were otherwise rather reactionarily conservative to the point of stultification.

Taken together, this intellectual conservatism and hierarchical structure of organization, the latter apparently necessary now as then for handling large organizations, combined in a highly authoritarian way. Little wonder then that people came to be possessions, either entailed to the land as serfs or directly to government, religious, or even military officials, who in turn were the property of either higher officials or the ruler. The ruler, in turn was either the property of a god or gods, (common in Mesopotamia,) or himself a god, (in Egypt.) In this context, the structure of religious orders and military organizations, even to this day, is obvious, and in both cases serving the same purposes of instant obedience to hierarchy and proper interpretation of doctrine.

Slavery also derives from this. While it seems possible for some captivity to exist during the Hunter-Gatherer age, slavery as we think of it could not have existed during that period because of property aversion. Captives had to either be quickly ransomed or otherwise returned to their band, adopted into the capturing band (possibly as gene pool diversification?,) or executed, as evidenced by (e.g.) *Neandertalensis*' cannibalism.

With the Agricultural Age, slavery became possible. It was largely an extension of common existence. The difference between slave and subject was initially probably mostly a matter of degree or extent of legal rights, although as time went on, the role of slaves came increasingly to be that of activities undesired or unsuited to subjects. In

many cases, this increased the difference between subject and slave's legal status.

Incidentally, the source of most of those slaves were the conquests of the new armies.

Soldier and Warrior

With the development of Army, we also have the development of soldier. The idea of soldier is considerably at odds with the idea of warrior. As we have discovered in this endeavor, definitions are at best difficult and often of questionable value. That is still the case here. The American Department of Defense does not defined either, [DoD 1987] and the standard dictionary definitions are that "a soldier is a member of an army", and "a warrior is one experienced or distinguished in fighting." [Pearsall Trumble 1996] While less than satisfactory, we may elaborate on these.

The soldier is a component (member) of the organization Army, which is itself a product of the thing we call Civilization, which can be directly related to the Principle of Concentration. Originally, as developed by the Sumerians, the purpose of Army was to secure the ground adjacent to a city so that the people inhabiting and farming that ground would continue to grow food and that food would be available for use by the city.

One of the key differences of Army was its degree of organization. Army was very much the creature of the city organization that directed and governed the large population and numerous processes of its populace. Because that governance had to develop as hierarchical because of the size of the population, the other suborganizations of the city tended to develop along similar lines. Additionally, the attraction of the idea of property was so strong that along the way the subordinate idea that everything and everyone should be property evolved.

Thus, Army is both hierarchical and formally directive, although originally this was probably no more pronounced than in other suborganizations of the city-organization. Nonetheless, the nature of civilization, permitting humans to group together in large numbers for activities above simple survival, was likely one of activity, not of thought. This is indicated by the quote from Saggs presented in the preceding section. It also explains why, when the classical Greeks invented philosophy, they distinguished between *praxis* and *logos*, largely because *logos* was a "new" thing that had been neglected (discouraged?) for so long.

In this environment, we see the soldier as a member of the suborganization Army, as one who performs the activities directed by the organization, including what clothing to

wear, what weapons to bear, how to use those weapons, and who and how to fight. Above all, those activities, including fighting, are done within the context of the organization, in an ordered manner. Over time, as the organizational structure borrowed from the "Water Department" proves itself effective in fighting, conquest, and administration, and contributory to the health of city and civilization, the hierarchical, directive nature of Army increases until today it has become the archetype of such.

In this, we see the difference and similarity between soldier and warrior. The soldier observes a discipline imposed from outside to be a productive member of a hierarchical, directive organization. Obedience and suspension of individuality is central to this, civilization at its essence. [Kindsvatter 2003]

The warrior is quite different, evolving from the marginalized role or niche of hunter of small to medium sized animals in the wake of sedentaryness and the end of cold phase. The warrior observes a discipline that is largely internal, one of personal excellence of skills and art. The warrior's productivity and contribution to the greater good arise from personal (or pair) activity, not directly from the (military) group. Since the effectiveness of warriors is linear, individuality is not at issue and often is adopted as the role model.

This is highly different from Army. The warrior decides whether or not to fight on an individual basis, shaped admittedly by the group, but still individual. A group of warriors fight until their social commitment to fight fails for enough individuals for all to cease, a collective of "fight or flight". A group of soldiers fight (ideally) until the commander decides to stop fighting. A warrior may be motivated by the organization to fight some enemy, but, other than by social forces, there is no assurance that the warrior will fight that enemy or only that enemy. A soldier will (ideally) only fight who the commander directs to be that enemy.

Killing and Individuality

The act of ending life has special significance for humans. This may derive from man's inherent preoccupation with causality. The cause of life is often considered to be a Mystery, and the inherent purpose of human organization is the preservation and improvement of life. Society has accorded special activity to both birth and death for thousands of years in thousands of societies and cultures. The issue of killing is central to every legal system and is fundamental to war in its distinction from murder. Many societies and cultures extend this speciality to taking not just human life, but any life at all.

In this context, much of early life taking was performed by the hunters of the band. We may observe that either this served to enhance the differentiation of hunters from the band as a whole, or it was advanced by hunters to enhance that differentiation, or both. We know that many primitive cultures/societies considered successful hunters to be in an undesirable mystical state that required religious activity to ameliorate. [Haviland 1997]

Hunters were the component of the organization that habitually dealt with the taking of life. When hunting became marginalized, this would naturally be transferred to warriors, although the mystical, religious aspects seem also to have been preserved and intensified. Nonetheless, the warrior was inured to killing, at least to some extent.

This is not necessarily the case with the soldier. Discipline is inherent to the directive hierarchical nature of army. Part of the reason for this discipline is to assure that soldiers kill when they are ordered to. To adequately consider this, we must give some attention to the matter of individuality.

Ardrey discusses the *Illusion of the Central Position*, which is the illusion of being the center of all things. [Ardrey 1965, pp. 143-145] [Ardrey 1976, p. 180 ff] He advances that this belief in the uniqueness of the individual is central to the existence of mysticism.[51] Certainly unless humans, as individuals, internalize the uniqueness of the one, the idea of causality is compromisingly flawed. In effect then, it is our human irrational belief in our own centrality to the universe that permits us to posit the relationship of cause and effect.

Regardless, this sense of individuality has to be suspended for civilization to work, and that suspension is never either absolute or complete. This sense of individuality is countered or contested by a sense of cooperation that gives rise to human collective activity that is moderated by what we call the Principle of Concentration. Discussion of the origin of these is beyond the scope of our work here, but it is sufficient to note that individuality and cooperation contend and result almost always in mixed states.

The environments of warriors and soldiers are both internal and external. The internal discipline of the warrior is influenced by his external environment, inducing him to fight or to not fight. The external discipline of the soldier is influenced by his internal sense of individuality and cooperation to either continue to obey his orders or to disobey them. Thus, both exist in mixed states. Sometimes the warrior cooperates and even obeys while sometimes the soldier does not cooperate and even disobeys.

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[51] Ardrey originally dismissed the illusion as of minor importance but eventually accorded it considerable, if still limited import. It is the latter assessment that we advance here.

When warfare is raiding and logistic, the cooperation level needed is generally much lower than in raiding combat or even in persisting warfare. Thus, in a raiding situation, the warrior may perform better than the soldier because FSR is low and the individuality of warriors does not interfere.[52] In a persisting situation, where FSR needs to be high, interference among fighters is detrimental and soldiers are preferable to warriors.

Obviously, one does not want to have two separate military forces to pursue raiding and persisting strategies, although history shows this to frequently be the case. What one would like is a hybrid of soldier and warrior who has the fighting skills of the warrior, at least in part, and the disciplined obedience of the soldier, at least when it is crucial. Then you have a soldier-warrior who can operate efficiently regardless of the FSR. Sadly, it seems that very few can handle both the internal and external disciplines of the warrior and soldier. Those who can seem to frequently form the elite "special" forces, but too often the mode seems to be that the military forces are organized along one model or the other, often leading to spectacular successes and failures when they encounter the opposite organizational structure in combat.

Violence and Discipline

Warriors are largely constrained by internal discipline, influenced by external events; soldiers are largely constrained by external discipline, influenced by internal events. Both warriors and soldiers have war as their reason for existence.[53] War, as we know sometimes requires the use of force, fighting, to impose will. Thus, warriors and soldiers are fighters.

With the warrior, fighting is a matter of individual skill and individual commitment. With the soldier, fighting is a matter of collective skill but again, individual commitment. Both may decide that they have killed enough and stop, or, more likely, do not want to fight because the risk of self-loss (death) is too high. Thus, the military issue with both is that they fight when they should and not fight when they should not. This control is fundamental to the reason for Army.

Army is the ideal of any government so long as it limits itself to being an extensor of policy. Unfortunately, as we have noted, army is frequently at the mercy of economics.

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[52] Force-to-Space Ratio [Jones 1987]

[53] Clausewitz [Clausewitz 1976] distinguishes between war and preparations for war. Both influence the reason for both soldiers and warriors. Regardless of the extent of peacefulness and the extent of trust in the organization's neighbors, some military force must be maintained in preparation for war because neither soldier nor warrior can be constituted immediately.

As such, the organization of an army will never be ideal nor absolute. Governments will opt for the cheaper alternative of warriors, who are driven by social concerns, over soldiers. This is a complex, mixed situation. Under certain conditions, which include the warriors actually maintaining their high internal discipline, greater fighting skill may be more beneficial than organizational obedience. Alternately, limitation of soldierly character also limits the intrusion of Army into politics proper. Of course, the opposites also hold true as well. Inadequate soldier-like character has led to the fall of government or nation on numerous occasions recorded by history.

As we have noted, violence is a side effect of war. It is almost a necessary side effect given the inherence of opposition as a component of war, although, as we shall discuss in later chapters, not always, nor necessarily. It may be argued that if the continuation of policy takes the military form of total war, then violence outside of combat will result. A logistic strategy involving the destruction of infrastructure or products may result in situations where the military force must use violence against civilians to effect its mission or protect itself.

Nonetheless, one may not argue that all violence, even during warfare, is instance of warfare. Discipline frequently lapses in military units, especially when under stress or distant from command. Soldiers who have experienced combat have tasted the love-hate dichotomy of life taking and may act warrior-like as a result, regardless of the overall soldier-like degree of the military force.

Violence by soldiers/warriors may be the result of contra-disciplinary activity. Combat is often, usually, violent, and both warriors and soldiers become habituated to it. As a result, violence becomes a modal response transcending war-making situations. Immediate observation or fleeting evidence may establish the difference between war and non-war violence, and permit the punishment of the former, but in may cases, time is on the side of commission. In the context of ancient events, discerning war violence from non-war violence is difficult if not often impossible. Certainly, however, one would err in equating all violence with war, even all collective violence.

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7 War and the Toffler Ages

At this point we change our focus somewhat. We have brought the progression of (possible) military revolutions up to the point of the lists offered by military theorists and historians. We had also earlier promised we would examine the nature of warfare in the context of the Tofflerian Ages. [Toffler 1980]

To be somewhat more accurate, Toffler is not so much concerned with ages, but with the turbulent boundary regions of intense change between these ages. He refers to these as waves, which he numbers rather than names. Our interest is largely in the warfare between the waves, so we will primarily dwell on them, and since they are inferred by the Tofflerian wave taxonomy, refer to them accordingly.

As described previously the Tofflerian taxonomy is essentially Agricultural, Industrial, and Information Ages. We rather arbitrarily added the Hunter-Gatherer Age to cover the rise of man and the transition into the Agricultural Age. We have already discussed the development of the material and organizational capabilities that lead to organizations with policy and the ability to extend that policy using military force.

Further, we have also discussed the evolution of war and its instrumentality. There is however a value to examining the nature of warfare in the context of the Tofflerian taxonomy and the accompanying analysis.

There are some difficulties with this taxonomy, largely relating to their boundaries, but all taxonomies suffer from fundamental limitations as aggregations. [Dunn Everitt 2004]

For example, it is very difficult to put a firm date on when an age begins and ends. The Agricultural Age probably began sometime after the end of the cold phase and the adoption of sedentaryness. Toffler [Toffler 1980] advances that the First Wave hit about 10 KYA. This is near the end of the short cold phase and when flax was domesticated. More specifically, was the beginning of the age when the first experiments in seed storage and planting began, or when they became successful enough to be adopted as a dominant social behavior over hunting, or even when there were more people engaged in sedentary agriculture and nomadic herding than in some variant of hunting and gathering?

There is probably no good answer to this. It is probably not that too much is unrecorded in the long centuries of pre-history, although this is surely a factor. No, it is much more a circumstance of not being able to draw a boundary.

This is part of the fundamental contradiction of any form of aggregation. The value of aggregation is consolidation but in doing so we have to give up specificity. As a result, we must accept some necessary fuzziness for the sake of generality that will permit us to appreciate the speciality as other than anecdote.

Agricultural Age

The Agricultural Age is commonly attributed the development of the fundamental organizations of society. As with many generalizations (and aggregations,) this is at once both accurate and inaccurate. Of course, understanding the differences is fundamental to realizing the value of the generalization.

Obviously the organizations of family and band developed prior to the Agricultural Age, during the Hunter-Gatherer Age. The flowering of organization however, obviously occurred during the Agricultural Age. A pattern of growth and division, which continues today, characterized the path of organization in this period. In particular the organizations of government, religion, and the military developed in size and distinction. Other organizations, responding to the increasing complexity of society, were born and grew, notably those of commerce and education.

Our purpose however is to examine the war aspects of this taxonomy. In doing so, we focus our attention on two types of wars that we may label as normal wars and wars of revolution. Obviously, these are related to wars between governments (organizations) and within governments (organizations), which in turn correspond to the interstate and intrastate wars cataloged by the Correlates of War project.[54] The nature of these wars is one of the primary insights that may be drawn from this model.

First of all, the Agricultural Age exhibits a bifurcation of culture. One of these is the nomadic herding culture. In a sense this is an extension of Hunter-Gatherer culture with animal herding largely replacing hunting. This type of culture tends to be terrain associated, primarily with terrains not productive enough to allow for sedentary existence.[55]

[54] "The Correlates of War project seeks to facilitate the collection, dissemination, and use of accurate and reliable quantitative data in international relations." (www.correlatesofwar.org) This project maintains a repository of war, as opposed to battle, data. Frequently however, with both, the devil is in the details.

[55] A special case are terrains that do not permit agriculture with a low level of technolog. An example of

As a result, this culture generally finds itself on the steppes and deserts where continual movement of the population is necessary to avoid overgrazing or starvation, and in mountain fastnesses ill suited to agriculture. In the latter case the nomadism may be seasonal and the culture is technically not nomadic since the population is often sedentary, but is still characterized by herding and some movement of the herds.[56]

The other branch of the bifurcation is sedentary agricultural culture. This culture represents a break with the movement of the Hunter-Gatherer, sustaining itself with farming and animal husbandry. The latter is non-nomadic although it may compete directly with nomadic herders on a selected geographic basis.

The property is the other major feature of Agricultural Age society that characterizes it from Hunter-Gatherer society. Where the Hunter-Gatherer had to be property averse, both the sedentary farmer and the nomadic herdsman can be (and are) property adopting. Obviously this is more the case with the sedentary farmer than the nomadic herdsman although with animal domestication even the latter may accumulate considerable property.

As the great organizations developed, largely in accord with the Principle of Concentration, the concept of property expanded as well. The need to distinguish (and adjudicate) among individuals' property and between individuals' and organization's property led to the development of law, just as the adjudication of organizations' property led to the development of diplomatic and military suborganizations and capacity.

The other contribution to this is what we might call the Principle of Control of Environment. This principle, like concentration, emerges as the size of the organization increases. It has two sides, that the individual wants to control his/her environment but concentrates on their Maslow Hierarchy level. Environmental matters that are at more fundamental (lower) levels, but not of immediate concern, may be entrusted to others.

This is the basis of government and indeed of any "service" organization.[57] If most of the individuals of a society have their interests focused on a relatively high level of Maslow's Hierarchy, then they will trust an organization to deal with necessities at a lower level. So long as the necessities are adequately cared for, and the individuals'

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such is the American prairie.

[56] Alternately, we may consider these mountain herders to be a third culture class, or even a composite of the other two.

[57] We have to distinguish somewhat the service suborganization, which is primarily a result of the Principle of Concentration, from the independent service organization, which is primarily a result of the Principle of Control of Environment. The distinction has a sizable difference of bottom-up versus top-down. For a contemporary consideration, see [Handy 1994].

attention stays at the higher level of the hierarchy, the organization is largely left alone to pursue its activities.

If however, the necessity is not or poorly cared for, the attention level of the individuals drops to that level of Maslow's Hierarchy. Alternately, some other external cause or even simple paranoia may cause the attention level to drop. Regardless of cause, the drop in attention level brings the organization's performance into direct attention and concern. This is the basis of rebellion.

In this context we may now examine the wars of the Agricultural Age. As we have already advanced, the great theme that followed the adoption of sedentaryness was property. As human organization developed, the concept of property was expanded from personal material possessions to animals and land to people. As indicated this expansion was paralleled by the development of law and directive administration. By the development of the state, about the same time as the development of the agricultural cities, people had become property.

This had several aspects. because the organization had become hierarchical, just because of human limitation and the necessities of command and control, this hierarchy extended to people as property. As indicated elsewhere in our discussion of the anthropological taxonomy of organizations, states are structured on rank and differential access to resources.

Thus, we finally have actual slavery, people owned by other people. Slavery is one of the ways that societies avoid resource costs on labor and productivity. To an extent however, it is also a matter of degree rather than kind. It is not uncommon in Agricultural Age societies for persons of lower rank to be owned by those of higher rank. This pattern proceeds up the hierarchy with the person of highest rank, the king or equivalent, either being the property of the gods, or himself a god. Regardless, the other members of the organization are the property of the king.

This is the space of Agricultural Age wars. The normal wars generally deal with property, either to take property (people, land, or both) from another government, or to redress how property is regulated. Wars of revolution, on the other hand, are anti-property in the sense of dealing with the regulation of property. More properly, we might say they increasingly dealt with who could own property and who was not property. Wars of revolution are not necessarily the same as civil wars. A war of revolution is a war over changes in the nature of the organization, while civil wars are concerned with who will exercise the governance of the organization.

This brings us some interesting considerations and even asymmetries. Wars of succession are basically civil wars. It is however possible for a war to be one type to one side and something else to the other. For example, the American Revolution is commonly portrayed as a war of revolution on the American side but a civil war (rebellion) on the British. The accuracy of this is unclear. A war over taxation is civil; a war over whether individuals will be subjects or citizens is revolution. The same ambiguity exists in the Second American Revolution, the American Civil War. A war over tariffs is, again, civil; a war over slavery is revolution, at least in the Agricultural Age when property is the characterization.

Industrial Age

The time of transition from Agricultural Age to Industrial Age is also ambiguous. It may be localized with some confidence by the nature of the age, this nature being characterized by the diversification of the human organization. Most obvious here is the separation of the commercial organization from the government organization and the development of manufacturing methods based on the Principles of Concentration and Control of Environment.

Any moderately detailed analysis of history reveals that the emergence of the Industrial Age was delayed,or even aborted, by the collapse of the Roman Empire and the necessity of feudalism to recover. Obviously, the emergence of the Industrial Age business organization was conditional on changes in the nature of the human organization.

The separation of the commercial organization was only possible because of fundamental change in the human organization. In particular, the nature of membership in the governance organization had to evolve from property to support for the commercial organization (and other non-governance organizations) to develop. This may be seen as the evolution from serf (or a variety of other names) to subject, and eventually to citizen. It may also be seen as the evolution of the nation in the sense that membership in the nation organization imparts a sense of identity to the member.

This is clearly not new. Prior to the collapse, there was the Roman Republic and Empire with "*civis Romanum sum*!" and its *latifundae*. What is new here is a social environment too complex and too expensive for the governance organization to control directly.

Toffler dates the Second Wave to the century 1650-1750 (technically this is a century and a year.) [Toffler 1980] In some ways, this is a highly interesting period. For instance,

it includes some enormous strides in physical science with the initial formulation of Newtonian Mechanics and Optics, and the calculus. It is the period of the perfection of the time piece and thereby the portability of astronomy. It is also the period of the rapid growth of free masonry.

The period is somewhat ambiguous from a policy standpoint. Obviously, it follows the English Civil War and the Restoration. We see thus a military organizational revolution in Cromwell's New Model Army, and the governance organization changes implicit in the empowerment of Parliament, regicide (execution of Charles I), and the replacement of James II with William of Orange.

The War of the Grand Alliance (1688-97 CE) [Dupuy Dupuy 1977] was effectively indecisive, its military results nullified to *status quo ante* territorially. Transformation of governance was hastened by numerous wars of succession in the first half of the eighteenth century. The growing importance of the commercial organization was evidenced by the Anglo-Dutch commercial wars. This was the period of fortresses and gunpowder revolutions.

But as to when the Industrial Age began, we have difficulties. Clearly a certain maturation of the commercial organizations and of manufacturing methodology is necessary, as is a certain state of evolution of governance. We fairly clearly see that the guilds of the Renaissance are contributory, and the block factory of Maudslay a first instance, [Burke 1978, pp. 146ff.] but we must put the boundary of the Industrial Age at the end of the eighteenth century and the beginning of the nineteenth.

There are many reasons to point to this period. Watt's development of the steam engine (patented 1769 CE) and Whitney's development of interchangeable parts (first contract 1798 CE) provided the technological basis for the factory.[58] From a governance standpoint, we have the American and French revolutions (1775-1783, and 1792-1800, respectively [Dupuy Dupuy 1977, pp. 708ff, and 678ff.]. Historians date the emergence of the modern era in this period. [Johnson 1991]

In the Industrial Age we see a change in the nature of warfare that seems to reflect these social changes. Normal wars are increasingly fought over commercial or ideological matters. That is, these wars are not just about property as they were in the Agricultural Age although property is still part of the warfare. Rather, these wars are fought over the rules of marketplaces or of governance, or, in some cases, both, in that the two are related

[58] It may be argued that factories may be powered by water. This is accurate so far as it goes. Critically, water power does not permit the proliferation of factories.

in the national sense. Penetration of marketplace by a nation's commercial organizations implies a role for that nation's government in the region of that marketplace, and *visa versa*.

The wars of revolution are similar. Agricultural Age wars of revolution were largely concerned with who in the rank structure would be property and could own property. Industrial Age wars of revolution are increasingly concerned with how the organization would be structured and how the director would be legitimized.

Finally, it bears comment that with the diversification of the human culture of organization, other forms of warfare emerged in the Industrial Age. These are often not the classical governance organization warfare and are thus less recognizable as warfare. Many of these are some form of economic warfare, evolving from the commercial organizations. Two examples immediately spring to mind: union strikes; and hostile corporate takeovers. The overt use of physical force and violence is not fundamental to these forms of war, but it often develops as a derivative. Additionally, these wars often occur on the boundaries of state legality, frequently resulting in their being labeled as criminal.

We now embark on the speculative part of the treatment, that of the Age of Information. Before starting that however, it needs be that we spend some attention on what information is.

What is Information?

We hear a great deal of discussion these days about information and its impact, but we hear very little about what information is. That's because information is such a fundamental topic in our lives that most people never get exposed to what information is. Like the weather, we talk a lot about it, and we experience it, but we don't understand it very well. One reason most people don't know much about information is because someone has told them that information is a highly technical matter and most people aren't very comfortable with things they think are technical.

Unfortunately, this is all mostly sham. The more accurate picture is that the technical part of information is the simpler, and, in many ways, the less important part of information. To see this, we need to back off a bit and come in from a different angle.

Let's start by talking about knowledge. Knowledge is something that everyone who is reading this has (or they wouldn't be reading!) Knowledge is what we have in our heads (because that where our brains are and we are pretty sure that's where knowledge re-

sides,) and its only in our heads. Knowledge is completely individualistic, or at least I think it is. The reason for thinking so is that while we each know what we know (although not in an instantaneous sense,) we can't compare what two people know directly. We can't connect a measuring instrument to our heads and measure our knowledge.

Now let's talk about data. Data is something that comes about from some form of observation (or operation) and it has at least one type of structure. The thing that makes observation (which includes sensation, obviously) into data is some form of encoding.

When we look at something or listen to something (a natural scene in this case,) we sense photons (light particles) or phonons (sound particles), and our brain tells us, by comparison with the knowledge stored there, that we are seeing (e.g.,) grass and trees or hearing birds and rain. This recognition makes these photons and phonons, which are a form of natural encoding, information.

Information can't be defined very well,[59] but it is a thing with two aspects. One of these aspects is data-like and the other is knowledge-like. The first can be counted , and the second, at least at this point in our scientific development, can't. It is not clear whether the anumeracity of the second aspect is fundamental or just a matter of current ignorance. Naturally, there is some dispute on this matter.

Before addressing this dual aspect thing a bit more clearly, let us spend a bit more attention span on data and its encoding. The encoding of photons and phonons is one of nature, deriving from the observable states of the particles. While this is very important in the physics of information, there are other encodings that are important to us as people.

In particular, one of these important encodings is letters and the sounds of language that correspond to the letters.[60] Numerals are another important encoding, in this case, of numbers. A third important encoding, derivative of these two, is the ASCII representation of these letters and numerals as assemblages of binary bits.

Now lets talk about communication a bit. Communication is usually defined as the transmission of information. Communication is either open or closed. A book is an example of open communication, one generates information from the knowledge in one's brain encoded as letters on a page, but one doesn't know who will read the book, or when, or even whether the reader will convert the information into knowledge in their brain.

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[59] For a discussion of a definition of information and some of its technical side, see POW and the references therein.

[60] For a discussion of this correspondence, see [Saggs 1989]

A conversation is an example of closed communication since a conversation is carried on (by at least) two people who give each other feedback that the information is being converted into knowledge "accurately". This is the indirect means by which we, sort of, get around not being able to measure or compare knowledge directly. In the same sense, tests in an educational context are a means of measuring how accurately we have converted information to knowledge.

In thinking about this duality, there are two similar analog models, although both are sensory. The first is a painting; the second is a gemstone.

A painting is comprised of pigment. Each little piece of pigment has a mass, a chemical composition, and spectral (color) characteristics. All of these can be counted in some fashion. As such, they are the data aspect of the painting, but they are not what is important about a painting. What is important about the painting is what we see in it, whether it is Elvis (on black velvet,) or Mona Lisa. This is the knowledge-like component or aspect.

A gemstone is similar. It is made of atoms and these atoms and their properties may be counted. Again, this is the data aspect. But what cannot be enumerated is the beauty of the gem. This is the knowledge-like aspect.

We can now get back to what we set out to do. We now know (or at least have been told,) that information has two components, one data-like, in that it can be counted, and the other knowledge-like. The horrible technical details that we may not want to talk about (like entropy and hit rates and gigabytes) are all part of the data-like aspect. The technology and the methodology of this may be complicated and because of that the province of specialists, but fundamentally information is really quite simple because at root all we are counting is letters or numerals or their binary bit representations.

What we don’t know how to count (or calculate) is the knowledge-like component of information. Some folks talk about ideons (particles of ideas) or memes (catch phrases that can be imitated) but it is not obvious that we know enough about the nature of knowledge to be able to quantify it, much less to establish its relevance or value. The best that we can do is to establish some sort of human (societal or cultural) context for the information.

This is not an easy thing to do. Consider that if I give you some information, say a page of letters that you recognize as words you know, but you can’t construct any more knowledge from the information than that, then that information may have no great value

to you. If, on the other hand, you recognize that the information is a stock tip (but not insider trading information,) and you take action on it and make a goodly sum of money, then that information has (had?) an obvious and even measurable value (at least in a monetary or marketplace sense.) If you had discounted the tip and not acted however, the information would not have had much value.

This illustrates another of our difficulties in dealing with information. We can measure its data-like character or aspect, but we cannot measure its knowledge-like aspect. Further, we do not even have a simple cause and effect relationship. Fundamentally, someone with knowledge (or their proxy) must generate information from that knowledge. That information must be communicated, transformed back into knowledge, and in conjunction with other knowledge precipitate a decision. At this point we have observable cause and effect and the potential for observation and quantification. Thus, the thing that we must be careful of in considering information is that it does not directly cause action - it does not have a directly quantifiable effect. It is only through the process of being converted back into knowledge and causing a decision to take action that quantifiable effect occurs. It goes without further elaboration that these processes are at least conditional, if not stochastic.

What may we gather from this about warfare? The most obvious thing is that Clausewitz [Clausewitz 1976] has already considered quite a lot about the nature of information and knowledge. He talks about the genius of the commander to compensate for missing or erroneous knowledge (due to absent or incorrectly transformed information.)This absent, erroneous, or erroneously transformed information is clearly a part of Clausewitz's friction.

This also tells us a great deal about what we may loosely call information warfare (while recognizing other specialized distinctions but wishing to preserve a form of generality.) Obviously, if I have information I need to communicate I do not want my enemy to have the knowledge embedded in that information. The necessity of mission precludes using subtleties or the like, so I must use an encoding that both I and my communicant can read (and hopefully understand,) but the enemy cannot. Thus, the need for cryptography and cryptology emerge.

This is defensive and thus there are other defensive things to counteract offensive ones. These offensive ones include disrupting the transfer of information and the introduction of false (inaccurate) information intended to generate inaction or false action through inaccurate transformational knowledge.

Again, however, the effects of these are conditional, if not stochastic. Even if invalid information can be imparted to the enemy, the enemy must transform the information to knowledge, and use that knowledge to make a decision that results in action beneficial to me and detrimental to him. This is not a new idea. It is at the base of Sun Tzu's theory of war. [Sun Tzu 1963] What makes it more obvious today is the pervasiveness of the instrumentality of information.

Nonetheless, obtaining the result is highly conditional and less than certain. In fact, excessive confidence in it may itself be an invitation to deception. This conditionality is the primary reason that information warfare has been largely hidden and why the more direct, forceful forms of warfare have been emphasized and necessary. These methods are aimed at corrupting or negating the effects of the action initiated by the decision made possible by the knowledge obtained from the information.[61]

Information Age

If anything the start of the Information Age is even more ambiguous than the start of the Agricultural and Industrial Ages because we are so close to it. The Information Age has either just begun, or is now beginning, or is about to begin, and we thus have no historical perspective to access. Toffler suggests that the third wave began in the decade 1955-65 when the number of white collar (knowledge or information) workers exceeded the number of blue collar (strength and skill) workers. [Toffler 1980] This interpretation however, is open to some discussion.

Obviously, the intent of the Industrial Age with commercial organization and manufacturing methods was to eliminate skill and strength from as many human activities as possible. Equally obviously, information technology was important to industry. The deployment of the telegraph (early-mid nineteenth century) parallels the deployment of the railroad from that date, demonstrating that inexpensive communication was equally crucial to industry as inexpensive transportation. The next elaboration of the information instrumentality came in the second half of that century with Bell's telephone and Hollerith's tabulator. [Burke 1978]

Nonetheless, the invention of the internet occurred essentially at the same time as the shift in the work force. The introduction of the first pervasive and pervading computer in the early 1980's is also supportive, although it does indicate that the formulation of

[61] One tends to think of the old nursery rhyme about horseshoe nails and battles at this point.

the principal characteristics of the age may still be forming.[62] At one moment it may seem evident that the Information Age is upon us, and the next that it has yet to gel. Some trends however may be noted.

First of all, human history (and prehistory) has been characterized by an elaboration of organization. The transition from the Hunter-Gatherer Age to the Agricultural Age witnessed the growth of the human organization from the band (or extended band) to the tribe, chiefdom, and state.[63] These split into governance organization, religious organization, and military organization, and thence commercial and academic organization spun off.[64] In the Industrial Age these latter organizations have matured, as have political parties (non-governing policy (?) organizations) and professional societies. In our consideration unions are commercial organizations, as are corporations and businesses, although each will probably take exception to the inclusion of the other.

We may expect the evolution of human organization to continue into the Information Age. Several types of new organizations are already evident although whether they are accurately new or just evolutions or developments of older organizations is not yet clear. We have already noted the development during the Industrial Age of political parties, which are policy agenda organizations deriving from the transformation of government. There are also organizations that have a policy agenda but not a direct goal of governance. Some of these clearly arise out of the professional and commercial organizations.

There are also organizations that are anti-societal in nature. These organizations, many of which arose out of the Industrial Age organizations, have purposes that are largely negative or retrograde. By and large, these organizations are opposed to some trend in society and are thus dedicated to reversing the trend or maintaining the *status quo*. Such organizations are not new, but the fundamental changes in the ecology of information is making them more practical.

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[62] The personal computer is one of the enigmas of the Information Age, at least thus far. Most pundits postulate that the center of the age must be the internet, considered to be a combination marketplace, communications center, and reference library, albeit all with warts nd pitfalls. The question that then arises is why does the personal computer persist in its present form, essentially unchanged since its introduction? It is clearly not ideally suited to be the individual's interface to the internet, but repeated attempts to introduce such devices over the past two decades have all been dismal failures. This is one of the strongest arguments that the Information Age has not yet arrived.

[63] It is now asserted that all of modern humanity descends from one path breaking extended band than left Africa and spread across Asia, leaving behind rear guards by band division that acted as barriers to further departures.

[64] The former apparently from governance and the latter from religious, in the main. Interestingly, prostitution may have spun off from the religious organization. The absence of a military organization spin off is also noteworthy. There is some argument that the professional societies may have their roots as military spin offs despite their largely academic and religious characteristics.

Finally, we mention the development of organizations that we might call "communities of interest". The term, which is used in the "discipline" of Knowledge Management, refers to a group of people who share a common information need and interest. We need to recall that Knowledge Management is really a misnomer in that it cannot actually manage knowledge in a positive sense (and the negative sense is rather nasty.) Rather, it seeks to manage or administer that specific information that may be directly transformed into specifically applicable knowledge.

In Knowledge Management usage, these communities of interest are usually sub-organizations with larger governance or commercial organizations that seek to capture and/or archive the information (that will transform into knowledge) that is crucial to the operation of the organization or the fulfillment of its mission. In this context then, these communities of interest are tools of the organization intended to maintain the organization's viability.

Our use of the term will be considerably more general than this. We shall take a community of interest to be an organization whose members share a common interest and thereby a common requirement for a particular type or scope of information. We distinguish these from educational organizations on the basis of formality and resources. Most of these communities of interest are highly informal, have minimal membership requirements, and often have no actual resources, depending on commercial organizations for such. (Chat rooms are a simple but extreme example of these.) Educational organizations, on the other hand, have exacting membership requirements and are highly commercialized.

Again, these types of organizations are not new. Indeed, they have direct ancestors in supper clubs of the period of the Second Wave. What sets these communities of interest apart is that they are creatures of the Internet. We expect these organizations to evolve. Thus, their current form is almost surely not their mature form. Indeed, we may expect that mature form may be a formal policy organization. Thus, these organizations reside naturally in the environment of informational war.

What is informational war? How is it different from information warfare such as netwar or cyberwar? The answer is that I don't know. Right now its just a tag for what Information War will evolve into.

What can we say about Information Age war? Based on what we have seen of war in previous ages, we may predict with relative certainty that we will still have normal wars and wars of revolution. The question then becomes one of what these wars will look like?

Our stumbling answer to this question is deferred to a later chapter when we have a bit more preparation.

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8 Technology and Tactics

Basic Definitions

This chapter treats with (some of) the relationship between technology and matters military, including, but not limited to war. As with many of our common conceptions, those concerning technology are fairly consistently incorrect, just like those concerning the military. Thus, it is with little wonder that we embark on the intersection of two poorly understood areas and find that intersection poorly understood.

To instigate this lack of understanding, we resort to reciting definitions in parallel from what amounts to a military dictionary and a civil dictionary. We present the latter definitions parenthetically. The sources are [DoD 1987] ([Pearsall Trumble 1996].)

Definition 8.1 *Tactics is "the employment of units in combat, or the ordered arrangement and maneuver of units in relation to each other and/or to the enemy in order to utilize their full potentialities." ("the art of disposing armed forces in order of battle and of carrying out manoeuvres in actual contact with an enemy.")*

The first thing we notice is the unnecessary "in order" in the second part of the military definition. The second thing is that this part of the military definition and the civil definition are essentially the same, and somewhat imply a degree of order on the battlefield that may be wanting outside classical set piece combat. The first part of the military definition has the merit of brevity and with the understanding that we shall be rather imprecise in what a"unit" is, the one we shall use.

In doing so, we acknowledge that some changes may be necessary as we proceed. Clearly, and somewhat cynically, we recognize that combat units can never be used to full potential, nor, if they could, would that be sufficient. It is very hard to reconcile this definition with certain activities, such as terrorism, which despite the political rhetoric of this period, is a tactic. In fact, the definition is rather reminiscent of what we might

consider to be Napoleonic combat. Nonetheless, some variation on "the employment of military units in combat" may be a reasonable first approximation.

Definition 8.2 *Strategy is "the art and science of developing and using political, economic, psychological, and military forces as necessary during peace and war, to afford the maximum support to policies, in order to increase the probabilities and favorable consequences of victory and to lessen the chances of defeat." ("the art of war, or the management of an army or armies in a campaign.")*

This is quite disappointing. While the tactics definitions clearly capture the *praxis* aspects of tactics that we have already alluded to, none of the strategy definitions quite capture the *logos* aspects that should be there.

We may note with approval that the concept of different types of force, other than strictly military, is advanced, although some experts distinguish the more general combination as grand strategy [Collins 1973] and reserve the simpler strategy just for the military component. We avoid this precision while acknowledging that there will be situations where such taxonomic precision (including mini- or micro-strategy and grand, mini, and micro-tactics) is necessary and warranted. In a like manner the idea of adjusting the (apparently) stochastic nature of war is noteworthy and inherently Clausewitzian, but falls short of the point. Combat and war have stochastic components that must be continuously (or at least continually) contested, but that contest is universal. It is not limited to what we might call the strategic level of war. Further, and here we specifically refer to the civil definition of strategy, there is more to the art of war than strategy, and campaign management is operational in nature, rather than strategic, given sufficient complexity of the military organization.

Ultimately and fundamentally, strategy is about planning. As previously indicated, strategy and tactics have a *logos-praxis* duality. Today we have largely reduced this duality to our words *logic* and *practical*. The duality is one of continuous or sequential alternation of thought (*logos*) and action (*praxis*). The relative quantities (intensity and duration) of the two depend on the nature of the activity. For example, in modern usage, a *practitioner* is often seen as one who does things (takes action.) The actuality may be quite different.

This duality characterizes any activity. In the military environment (in Clausewitzian terms, both war and preparations for war,) we have strategy amid tactics (and eventually intermediaries such as operational art.) Strategy is essentially thought-like in that it

fundamentally deals with planning military operations that translate the objective of war into actuality. Strategy is thus the transformation of the objective of imposing will into a plan (or plans) of military action (other means.) [65]

Tactics, on the other hand, is essentially action-like in that it deals with the actual transformation of the components of the plan into effort and result. Neither of these is pure. Strategy is not actionless, nor is tactics thoughtless (literally,) it is just that one is predominantly thought-like while the other is predominantly action-like.

The formulation of the plan, the product of the strategic activity, must be conditioned by knowledge of what is possible and impossible, hard and easy, in tactics. Similarly some thought is required to convert any mission description (order) into action and to respond to the tactical activities of the foe (just as the strategist must consider the same effect on a broader scope.)

The relationship between the tactical and strategic is another reason why military organization tends to be hierarchical. This is also why the developmental paths in open military organizations are primarily for tacticians to develop into strategists rather than the opposite.

The exact or detailed meanings of strategy and tactics are a matter of the complexity of the organizations involved and of the war at hand.[66] Wars that can (may) be concluded by a single battle may have simple strategy and tactics with little differentiation between the two. Similarly, simple, but effective, military organizations (such as the monoarmaic ones previously discussed,) may use simple strategy and tactics with little distinction. We should recall however, that strategy always has a political connection.

The evolution of this complexity is demonstrated in history. The terms *strategy* and *tactics* derive from Athenian organization during the Classical Greek period. At that time, the Athenian assembly annually elected the *strategoi* or generals. There were apparently no term limits on *strategoi*, and incumbents might be repeatedly re-elected although there seem to be many instances of removal by exile or execution. These *strategoi*, who responsibilities extended beyond military direction, did not actually command in combat. Combat command was effected by the ten *taxiarchoi* and their juniors. In many cases, the *strategoi* fought in the phalanx as hoplites, perhaps as part of the heroic

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[65] We will discuss Lykke's Theory of Ends, Ways, and Means that is the next step in elaborating this in a later chapter.)

[66] Once upon a time, I subscribed to the *Proceeding of the Naval Institute*. I recall reading an article on naval doctrine where a naval officer was quoted as saying "What I do is tactics, what my boss does is strategy."

tradition from the period of the Trojan War, perhaps as part of Athenian democracy. [Warry 1980]

Of course, the other city-states had their own (often similar) organizational structure and titles, but these are the ones that have come down to us. The use of these terms has evolved, partly evidenced by the introduction of the terms by military theoreticians. For example, the term *tactics* came into common use in Europe in the latter part of the Seventeenth Century, but the premier theoretician of the period, Montecuccoli, did not distinguish among strategy, operational warfare, and tactics. [Crevald 2002, p. 76.]

A distinction between strategy and tactics had to wait another century for Maizeroy. [Crevald 2002, p. 94.]

What this indicates is something that is inherently simple in terms of viewing war as the province of organizations. As time passes, human organizations have evolved from Hunter (Scavenger)-Gatherer bands to nation-states. The nature of war has evolved along with this and thereby the suborganizations that are military.[67] Thus, the view of the functionality of strategy and tactics will evolve as well.

This is evidenced in the historical literature. For example, Ferrell attributes "application of strategy and tactics by the beginning of Neolithic times", [Ferrill 1985, p. 20.] while Hanson states that "until the fifth century B. C. (BCE,) ancient armies usually collided together in rather simple fashion." [Hanson 2003, p. 232.]

The functions of strategy and tactics, of thinking (planning) how to impose will through the use of military force, tempered by the possible and fueled by the creative potential, and transforming that thinking into actuality through action of military force, are the actual foundations of war rather than the derivative violence so often associated with it. Over time however, as warfare has become more complex, these functions have also become more complex, requiring first specialization - the emergence of command and commanders - and the separation - generals and officers. So long as war, indeed competition itself, between organizations continues, and thereby must become increasingly more complex (except during periods of revolutionary simplification,) then these functions will become more complex. This is evidenced by the emergence in the last century of the concept of the operational level of war that represents another specialization and (eventually) separation of the functional implementation of thought and action.

Definition 8.3 *Doctrine is the "fundamental principles by which the military forces or*

[67] We shall discuss these evolutions in greater detail in due course.

elements thereof guide their actions in support of national objectives." ("what is taught; a body of instruction, or a principle of religious or political, etc. belief.")

The military definition is happily free of unnecessary "in order"s, but we find the interesting relationship of this definition with the second civil definition. The implication that military organizations may be contemporaneous with religious and political organizations is clear, and we would acknowledge such given our earlier recognition that all of these organizations reached their mature development during the Agricultural Age. More interesting however, is the implication that what the military consider to be fundamental may be in the nature of belief rather than scientific or logical in basis. For these reasons, we again adopt the first civil definition that doctrine is a body of instruction on how military matters are to be pursued.

The other term we need to consider is, of course, technology. Once again, the military dictionary offers us nothing, and the civil definition is:

Definition 8.4 *Technology is ("the study or use of the mechanical arts and applied sciences.)*

As we know, humans are technology animals. This comes directly from being intelligent, limb differentiated, and tool making. The "history" (in an evolutionary sense) of humanity is inextricable from the progress of technology. However, our interest in technology, and development of it, is quite punctuated, as demonstrated by the stultification of technical information in the early use of writing. [Saggs 1989] We must also take care to note that it is not so much technology itself as it is its interaction with society that is crucial.

Revolutions in Military Affairs

Another such demonstration, and one that illustrates the relationship of matters military to technology, is the idea of the Revolution in Military Affairs. This idea was originally developed by the Russians (Soviet Unionists) at their Frunze Academy and called the Military Technological Revolution. This term has largely been supplanted in the West for reasons that we shall indicate.

The basic idea of a Revolution in Military Affairs is that at punctuated intervals a change

in the structure of military organization, tactics, doctrine, and even materiel occurs that totally changes the nature of military practice. This change is such that those militaries who adopt the new structure enjoy a substantial advantage over any opponents who have not. Substantial in this case means that given reasonably close parity of forces (say within 3:1 or so,) the adopter will almost always defeat the non-adopter resoundingly and decisively in battle.

The adoption of the structure of a Revolution in Military Affairs (RMA) appears to follow a standard diffusion process, [Rogers 1995] given that the adopter is a complex organization, usually a nation/state, at least during most of recorded human history.[68] As might be expected, this usually translates into autarchies, such as oligarchies or dictatorships, adopting early and democracies adopting late. Of course, unless the oligarchs/dictator get directly involved as a proponent, the idea may never get adopted at all.

Various lists of Revolutions in Military Affairs exist. For example, Krepinevich [Krepinevich 1994] lists:

- the Infantry Revolution (circa Hundred Years' War 1337-1453 CE) which overturned the cavalry dominance, which may itself have been a revolution of the use of (among other things) the saddle and the stirrup, dating from circa the Battle of Adrianople (378 CE). The structure of this RMA appears to be a rediscovery of the principles of the Greek Phalanx with the addition of the Welsh longbow;
- this was followed by the Artillery Revolution (latter part of Hundred Years' War) whose structure was based on the technologies of gunpowder (chemistry and chemical engineering,) metallurgy, and so forth;
- the Fortress Revolution of the sixteenth century may be seen as a reaction to the previous RMA. Its structure was based on the development of techniques to make fortifications robust against artillery;
- this was followed by the Gunpowder Revolution (latter sixteenth century) whose structure was based on the improving technology of gunpowder to duplicate the artillery revolution with single soldier fire arms;
- the next RMA was the Napoleonic Revolution whose structure was based on the Corps system[69], the rediscovery of combined arms, the nation in arms, and various peripheral technologies;
- the Land Warfare Revolution followed in the wake of the Napoleonic Revolution (circa latter half of the nineteenth century). Its structure was based on the technolo-

[68] The nature of the process does not lend itself to simplistic analysis. [Goldman Eliason 2003] It is possible that the process is logistic rather than Gaussian. For example the adoption of Iron technology [Waldbaum 1978] is slightly better described numerically by a logistic rather than a Gaussian model. The number of data points is so small however, as to present no clear distinction.

[69] Napoleon is often given credit for this development although most of the groundwork for it had been developed during the pre- and early French Revolutionary period.

gies of steam locomotion and wired telegraphy. Advances in the state of gunpowder technologies (conoidal bullet and breech loading, primarily) caused the collapse of the tactics of the Napoleonic Revolution, which had a somewhat antagonistic effect;

- the next RMA was the Naval Revolution, the so-called Dreadnought revolution, which had a structure based on the technologies of large ship dynamics and single sized guns. This RMA was essentially still born because of its rapid adoption; and
- the Machine Revolution, which had a structure based on the internal combustion engine-vehicle, wireless communication, and practical aircraft.

Some pundits offer a Nuclear Revolution as an RMA but since a nuclear war has never been fought, there is substantial debate on whether this is a "true" RMA.

Historians have a somewhat different view of Revolutions in Military Affairs, giving us (e.g.,) a list of: [Knox Murray 2001]

- the English fourteenth-century RMA based on a combined arms doctrine made possible by the long bow;
- the French seventeenth-century RMA based on the development of the battalion which was made possible by improvements in gunpowder technologies of small and artillery arms, the bayonet, and what would become the Prussian/German concept of "corpse loyalty";
- the French Revolution RMA;
- the American Civil War RMA;
- the Prusso-German RMA, which built on the latter and added the General Staff;
- the battlefleet RMA;
- the three-dimensional warfare RMA (circa early twentieth-century); and
- the Blitzkrieg RMA.

Other lists exist, but these two serve our purpose of providing illustration for our discussion.

To delve into these, we must make a distinction between technology and manufacturing. As indicated, technology is "the use of mechanical arts or applied sciences" and represents as much a body of knowledge as a capacity of application. As such, there is an aspect of potentiality to technology. It does not directly determine what is made and used, but rather what may or may not be made. Manufacturing, on the other hand, is the determination of what is made and it incorporates two additional components: the application of resources to the capacity to produce product using one or more particular technologies; and the perceived and demonstrated utility of that product within the larger organizational context.

In this sense, we now have need to expand our definition of technology to encompass not only the technology of material things but also what we might describe as the technology of organizational things.

Technology of Organization

To talk about technology of organization, one has to consider the art and/or science of organization. In simple terms, how can an organization be structured and directed to execute some process and/or produce some product?

In a rather simple sense, we may consider an organization to be a machine, although we have to be rather careful how far we carry this analogy or model. After all, organizations are comprised of people and people do not consistently behave like the parts of a machine. Thus, and at best, we can consider an organization to be a machine whose parts frequently perform other than how we intended, often with surprising and even detrimental effect. However, if the machine has been properly cared for and is properly used, then some effect or product results.

In general, there are two people aspects. We need to consider the people in the organization both as individuals and in the collective or colligative sense of how they comprise the organization. Obviously, at the individual level, if the organization requires individuals to behave or perform in some manner they are unwilling to adopt (or continue, for whatever reason,) and if they cannot be coerced into this behavior or performance because of limits to the organization's powers of coercion, then any result dependent on that behavior/performance is infeasible. In this case, we may say that the organization lacks the technical means (technology) to effect the desired organizational behavior or performance at the individual level.

This lack of technology may not be a matter of inadequate progress. If the individuals are unwilling, and the organization lacks the power of coercion because of its structure, then the shortage may be corrected by structural changes in the organization. This is not always possible. For example, in a voluntary service organization, it is generally not possible for the organization to coerce members into assuming positions of responsibility. (I am not talking about overcoming displays of modesty or shyness on the part of competent individuals here.) This is partly because of external restrictions (e.g., laws of superior and sovereign or semi-sovereign organizations,) placed on such organizations, but primarily because of the inherent culture of the organization that arises in part from basic human nature. Since the organization is voluntary, coercion is almost impossible,

nominally limited to social and personality forms. More critically, if the members of a service organization do not wish to serve, then the organization has most likely ceased to be effective. Further, in such conditions, excessive use of personal persuasion in such instances is, in a sense, counterproductive since persuaded members render poor leadership and management, although this does hasten the demise of the organization, albeit to the frustration of other members.

It may be expected by the casual observer that coercion would be simple and inherent for a military organization. This is not always the case. It is easy to confuse discipline and degradation with coercion, but in the case of a healthy military organization, generally inaccurate.

Military organizations of even moderate organizational structure, those above the stage of warriors subject only to the simplest external discipline, degrade their new (or prospective) members to reduce their individuality and build identification and commitment to the organization. [Kindsvatter 2003] Discipline is necessary to assure the effective performance of the organization. For that matter, all organizations impose discipline on their members. What is usually different about military organizations is that like secret societies and nation states, one cannot stop being a member of the organization without its permission, and when one does try to sever membership without permission, penalty is exacted. In this sense, there is coercion.

The fundamental aspect of many activities of military organizations is timeliness. In time critical situations, debate and discussion would result in disaster. Thus, the need for discipline of an extraordinary degree.

Intense discipline is a hallmark of early Agricultural Age organizations: governments; religions; and the military. This generally follows from what we might call (somewhat loosely) unity of action or unity of purpose. Either the action must be effected in a unified way or the purpose must be uniform. The former tends to be the root of discipline in military organizations while the latter tends to be the root in religious organizations (doctrine and dogma,) and both the root in governments (laws and policies.) This dual aspect of governmental discipline probably explains the close relationship (and antagonism) of these three types of organizations.

Despite this discipline, there are still things that the organization cannot obtain from its members for cultural reasons. Organizations tend to have their own cultures, which may overlay other cultures its members belong to, and these cultures may be hard to change. Attempts to change organizational culture too rapidly can render an organization

ineffective or actually destroy it.

It may be recalled that anthropologists [Haviland 1997] define culture as a set of shared rules that contribute to the survival of the group. They also define a society, somewhat circularly, as a localized group of people who share a common cultural tradition. Within these definitions, mankind has been diverse organizationally since differentiation of task groups - hunters and gatherers - early in the Hunter-Gatherer Age. Thus, the situation of organizations having to cope with the aspects of their culture and other cultures is not a new one. Smaller, non-sovereign organizations have to cope with the culture deriving from larger organizations when they share membership, which is our primary interest here, but large, even sovereign organizations have to cope with their members having disparate culture because of differences in membership of smaller, even non-sovereign organizations. The classic example of the latter is political parties within a nation-state.

Nonetheless, the fact remains that for a considerable period of time, mankind's organizations have had to deal with the actuality that their members draw their culture inexclusively from that organization.

Because of their strong need for timeliness of action and a lesser but still reasonably tight need for adherence to doctrine, military organizations tend to be rather conservative and thus averse to instituting or adopting internal culture changes. To illustrate this, consider the question of desertion, dissolution of organizational membership without organizational permission. All military organizations suffer from this. Such dissolution or severance of membership is not acceptable in a tight control organization because of its effect of negation of that control. Desertion is, simply put, a form of indiscipline. In practical terms, the organization is reduced to inaction (or infectivity of action,) if the members can unilaterally decide to cease to be participants in the actions of the organization.

Addressing desertion is an enormous technical problem since it requires the organization to control, even suspend, the basic human characteristics of individual uniqueness and fight-or-flight of its members. Both of these are innate to humans, but while individuality can be submerged by degrading and team building, the problem of assuring that individuals will indeed go into combat and stay in combat, risking their lives, is larger. This is addressed by the same team building - soldiers tend to stay in combat because their society, their immediate unit expects it, and some form of coercion is applied, a sort of carrot and stick approach. In both cases, the motivation is fear, of either breaking faith with one's colleagues or fear of punishment, a point made abidingly clear by Fred-

erick of Prussia[70] although carefully concealed and minimized in today's environment of volunteer armies and political correctness.

This *Kadavergehorsham* (corpse loyalty) may seem extreme but it was probably typical of successful early armies. However, the problem is so large that it does not appear to have ever been completely solved. History shows us numerous failures when the transition from warrior group or civilian individual to army is attempted. History also shows us failures when armies rot into warrior bands or armed mobs. In both cases, the failure results from a mixture of cultural aversion to the necessary activity and managerial ineffectiveness. Both are organizational technology failures: in the first case due to a lack of a structural means of negating or evading the aversion; in the second case due to a structural failure of organizational dynamics that could not be negated or evaded.

In this vein, all organizations must be careful not to exceed the demands of their members, lest the organization fail. By the same token however, the canny organization is always looking to develop new organizational technology to permit it to do new or different things, or old things in new or different ways.

One example of this is the cultural change of self-determination. In the period of Frederick soldiers were not allowed to forage for food and could not fight except in rigid unit formations for fear (on the part of the organization,) that they would desert or mutiny. By the period of Napoleon the Fredeickian model of an aristocratic officer corps and a plebeian soldier corps had been replaced (initially only in the French army as a result of the revolution) with one of advancement based on excellence of performance. In this environment of self-determination, foraging had now become the rule and many units now fought outside formation.

It may be claimed that this cultural and organizational change was due to democracy, but this is difficult to accept. The French Republic was relatively short lived, quick replaced by an Empire with Napoleon at its head. This had no impact on this military practice. More telling however, is that no military organization can exist as a pure democracy - the indiscipline is too compromising. This was amply indicated in the American wars of the nineteenth century.

In the French (and eventually others') case however, the organizational technology of military self-determination allowed the military organization to fundamentally change its logistic and tactical activities.

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[70] Frederick is quoted as saying that he wanted his soldiers to fear their officers more than they feared death.

Back to RMAs

What does all of this have to do with RMAs? Well, the RMAs are all effective because of changes in organization, and those changes are due to advances in organizational technology.

In some cases, that organizational technology results directly from material technology but in many of these cases the material technology was first developed in the civil sector before it was adopted by the military. In general, only when the technology was only applicable to military purposes, or when the military was the dominant early adopter [Rogers 1995] of that technology in the society/culture was this not the case.

We have already described how the Napoleonic RMA was, at least in part, the result of organizational changes made possible by military self-determination, which was itself at least partly initiated by new, if transitory, cultural or social changes in the civil sector. The same appears to be the case with most, if not all, of the other RMA. The critical technology is organizational, making possible changes in military organization that result in profound effectiveness of action that overwhelm enemy forces still using the old organizational forms. In some cases, advances in material technology make the new organizational technology possible directly. More often however, the organizational technology change is made possible by internal or external cultural or social changes.

Between the Revolutions

J. F. C. Fuller, one of the fathers of British Mechanized Combined Arms, said (approximately) "there is nothing more alien to the mind of the military monk than change."[71] As we have seen indicated by Saggs, [Saggs 1989] Agricultural Age origin organizations such as governments, religions, armies, and learning centers tend to be conservative with change. As a result of this conservatism and an innate survival interest bordering on instinct, these organizations naturally have short episodes of profound, even revolutionary change, often associated with a sudden reduction in the organization's Maslow's Hierarchy level, interspersed with long periods of limited, evolutionary change.

In most cases, the adoption of new technology by military organizations is prompted by an organizational change. During peacetime, many such changes result from a reduction

[71] In the following discussion we need to be a bit careful. Any tight control organization, such as a religion, government, or army, will attract members that need the structure of such tight control because of an aversion to change or cogitation.

in organizational size for economic reasons. Occasionally such changes result from the redirection of force structure to accommodate a change in the organization's activities (mission in military terms.) During wartime, technology adoption is most often imitative although two other sources may be identified.

One of these is adoption of technology in response to disruption, even bankruptcy of doctrine. There is a military adage that "no plan survives contact with the enemy." A similar adage in this case could be "no (prewar) doctrine survives the second battle." When battlefield commanders are frantically inventing new tactics, technical experimentation does not appear very risky compared to defeat.

The other is adoption of big technologies. These big technologies are usually imposed by government rather than being voluntarily adopted by the military organization (although there are exceptions!) Nuclear weapons are the classic (albeit modern) example of this with senior military leaders (and their political supporters) decrying that such weapons are impossible. Such claims are interesting in that the argument is that the technology (applied science) will not function, not that the function will not be militarily effective.

There are significant reasons for this conservatism. We have already mentioned the necessary military characteristics of timeliness and orderliness. Technology is generally antithetical to both of these. Except for relatively minor technological changes to existing materiel, considerable changes in organizational structure and/or processes/activities are necessary to adopt technological changes. These changes can only be effected by a considerable period of organizational adaptation to the adoption.

We must keep in mind that organizational science for most of history, and to a great extent even today, was (is) an observational and not a predictive science. Even today, a finding of "will/will not work" can usually only be made historically and then only with exact replication of conditions. A more realistic finding is "may/may not work."

Timeliness and technology have two aspects. One derives from disorder. A disordered organization can seldom be timely. Further, technologies are never as easy, or as fast, to develop as claimed or expected. In fact, there is a viable argument that no managed technology was ever developed to schedule, either the schedule being extended or the level of development being lowered.

Nonetheless, technology cannot be safely ignored. Myths of RMAs and fear of defeat assure that military organizations carry on a love-hate relationship with technology.[72] In

[72] Man's ingrained, even genetic, penchant for technology is part of this, of course.

modern parlance, military organizations divide their attention between readiness (order and timeliness today) and modernization (order and timeliness tomorrow.)

Because this military organization is fundamentally concerned with timeliness and order, made possible by organizational technology, there is also a fundamental antagonism between tactics and material technology, with doctrine being the synthesis of tactical thesis and material technology antithesis. Only in the crucible of battle does the process collapse into true miscibility.[73]

Historically, tactics has almost always had the upper hand in this, given the slow pace of technological advance. With the pace of such advance increasing to overwhelm the responsiveness of tactics, we find desperate attempts to reduce the spectrum of material technological options to preserve an orderly synthetic process. However much such may be desirable in preserving readiness, such efforts run the almost assured risk of reducing modernization to a stochastic, possibly chaotic, draw.

The Once and Future RMA?

Such efforts may indeed be futile. If we accept either list of RMAs, a singular observation is presented. Even allowing for the telescopic effect of history, we may not escape the fact that time between RMAs appears to be decreasing. Modern military organizations' attentions are largely occupied by predictions of an Information RMA that is either eminent or on us already. If both of these are so, it seems likely that this RMA may be the last such.

What we have seen historically is the combination of several technologies adopted into a single organizational technology to bring about a major change in warfare. These combinations/adoptions have been punctuated in time. This punctuation results from the slow pace of material technology advance and thereby only occasional juxtaposition (or accumulation) of multiple technology advances, a slow paced change climate in both civil and military environments, and what might better be called organizational craft than science.

Increasingly this is not the case. The number of technological advances is increasing quite rapidly so combinations, juxtapositions or accumulations, are becoming so common that weeding efforts, previously discussed, are practiced. The civil, and increas-

[73] This is part of what Clausewitz is talking about when he distinguishes between War and Preparations for War.

ingly, military environments are change oriented. Further, organizational science is increasingly a meaningful, and not fanciful, term.

The result of this may be that we are moving from a discrete, punctuated RMAs to a continuum. At this point however, we may only speculate whether that continuum is one of multiple overlapping RMAs or a continuous (rather than discrete) RMA. From a standpoint of maintaining political and social stability, the latter is preferable to the former.

At the risk of offering either an erroneous prediction or a diversion, if not both, the next RMA-like adoption seems likely to be one of biology. At present the scope of this revolution is unclear and often the domain of science fiction writers. Nonetheless, the continued success of genetic modification and biological engineering demonstrate the potential that gives rise to this prediction.

Military Science

Clausewitz, who is as close as one comes to a systematic approach to the study of war, firmly states opposition to any "system" of war. Nonetheless, by the systematic approach in **On War**, Clausewitz establishes a systematic framework that exerts considerable influence on serious students of war continuously down to the present day.

This systemization does not obviously make what Clausewitz and those who have followed him strictly military scientists. Indeed, Clausewitz himself makes an excellent argument that war is primarily about art more than it is about science.

While we may argue that the efforts of Clausewitz and those who have followed him do in some way constitute a systematic body of knowledge/information, this body does not truly constitute a science even in a non-quantitative sense. Notably, Clausewitz repeatedly stated his opposition to mathematical adjuncts or components to the theory of war because he was concerned that such would be detrimental to the practice of war. Fundamentally, the activity of the soldier is dominated by *praxis*, and the *logos* of the soldier, while completely necessary, had to be conditioned on that fundamentality of practicality. The soldier does not have time to do computations in battle.

Additionally, the nature of war is so complex that no simple mathematical model can be comprehensive enough. Complementing this, and apparently in contrast to Jomini, [Jomini 1862] Clausewitz saw war as dominated by its human component.

In this view, we must see both the pervasiveness of science in Clausewitz's time, and the limitations of science and its tools. So long as science exists, it will suffer these limitations, in kind if not in degree. Today many of the components of war that Clausewitz cited as removing it from scientific consideration may be scientifically considered, at least approximately. Friction, which Clausewitz saw as fundamental to war and antithetical to scientific representation, can now be approximated as stochastic using a mathematical theory of probability far beyond what Clausewitz had access to.

Nonetheless, we must acknowledge that Clausewitz was right in that the practicing soldier cannot afford the luxury of science. In the heat of battle having to seek understanding in the context of a grand framework will not lead to success.[74] The soldier must take action to obtain effect. This may be supplemented by the technological products of science, but the soldier does not do science with these tools any more than a practicing physician does science with an x-ray machine.

From this, we further see that military science is not a simple thing. Like Caesar's Gaul, it may be divided into three parts. The first part is indeed the construction of a systematic body of knowledge on war. This discipline is rare, for the brave and acultural, asocial theoretician like Clausewitz rather than for the soldier as practitioner.

This first part of military science lacks a component of actually being scientific by the absence of experimentation. There is experimentation in war in the sense of acceptance of risk. This is a practical matter of trying to achieve effect, a use of artistic creativity. Indeed, Clausewitz recognized this when he distinguished the use of *kritik* in lieu of experimentation. This lack of experimentation is both fundamental and a limitation of war (which we discuss later.)

It has become fashionable to label military exercises as experiments. These are not experiments in the scientific sense but rather simulations. The matter is thus one of determining how well the simulation corresponds to reality rather than directly observing reality in a controlled manner.

The second part of military science is the application of science (traditionally physics,) to matters military. This part is inherently paradoxical. Knowledge of matters military is the province of the soldier. Knowledge of science is the province of the scientist and knowledge of technology is the province of the engineer. In general, soldiers are neither scientists nor engineers because being such is contra-survival. Similarly, scientists

[74] Clausewitz was not against a broad understanding, but he did claim its acquisition was an activity of peacetime, not wartime, and not part of any grand system. Such an understanding, gained through the study of history, could assist in avoiding failure.

and engineers are usually not soldiers because they are generally unwilling or unable to accept the external discipline in addition to their inherently internal discipline. Thus soldier-scientists and soldier-engineers are rare. As a result this second part of military science is directly dependent on collaboration, including communication, between soldiers and engineers and/or scientists. This is at once difficult because of the fundamental differences between these types of people and necessary to bring the benefits of science and technology to the military arts. Thus, the second part of military science incorporates a paradoxical conflict.

This character of paradox continues into the third part of military science. This part is the application of the scientific method to war. We must be careful in discussing this part to distinguish it from the previous two.

Both the first and third parts are essentially devoid of controlled experimentation. Thus both are limited to observation and subsequent analysis. The distinction lies in the first part being oriented to *kritik* and advancement of the basis of the military art. The third part, on the other hand, is oriented towards understanding of the nature of war and matters military. By its nature, this activity is contrary to Clausewitz in that it is scientific in nature and largely unconcerned with any shortcoming of holism. Its goal is discovery rather than effect.

Because of this and the scarcity of soldier-scientists, this third part of military science is most commonly not pursued by soldiers. The temperament differences that complicate the second part of military science are thus even greater in the third where the soldier is a necessary adjunct contributing to the observational nature of the endeavor, which is inherently antithetical to the soldierly nature and temperament. This adversity is one of the reasons that progress in this area is limited and despite scarcity, a considerable amount of this progress is due to the efforts of soldier-scientists.[75]

Form this, we see that the relationship between war and maters military, and science is largely indirect and through the vehicle of technology, which we have already discussed. While military science exists, it consistently enjoys an adversarial, or at least antipathetical relationship to science. We must keep in mind however, that this type of relationship is not uncommon with matters of *praxis*.

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[75] One is tempted to attribute some of this to an antipathy on the part of scientists to matters military. This cannot however, be the general case since dedication transcends political considerations.

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9 Decisiveness, Diversity, and Fragility

Several years ago my colleague and friend Don Peterson came up with what appeared to be an inherent weakness in the then-new concept of Information Age Warfare. Don was kind enough to share the perception with me and with some small contribution on my part this blossomed into "Induced Fragility in Information Age Warfare". [Fowler Peterson 1997] This article has enjoyed some degree of interest. That effort however, rekindled an interest in deficiency analysis, of which the currently fashionable gap analysis is a spin off, and led to the bulk of this chapter.

The Monoarmaic Force

The original combat force, as we have discussed in excruciating detail previously, was likely a hunting group or part of one. The members of this force probably fought in the same "formation" with the same "tactics and doctrine" as they used in hunting game.[76] This force's members would have been primarily armed with whatever the primary hunting weapon was: long spear (~2 m.); short spear (~1 m.) and *atlatl*; or bow and arrow; [77] augmented with additional hand weapons such as hand or hafted axes, clubs, and knives.

This progression mirrors a current in weapons development to increase the range of weaponry.

In all likelihood, the members of this force were, at least in terms of primary weapon, identically armed. Thus, what we might dub the monoarmaic force.[78] With other primary weapons being made available by technological and cultural advance, and the development of the warrior fraternities when the sedentary lifestyle was adopted, this

[76] I assume that in almost all cases, if sufficient large sized animals were present, they were hunted preferentially over medium (and thence, small) sized animals for reasons of efficiency.

[77] Is there a natural progression here of long spear to short spear and *atlatl* to arrow (shorter spear) and bow? I have never seen an anthropological exposition on this but it seems plausible if not demonstrable.

[78] From the Latin *arma* for weapon. In modern usage this has become the term arm referring to a branch or other part of the service or force. Of course, the services are armed services.

uniformity will likely totally or partially disappear until the army is invented by the Sumerians. The rationale for this is two-fold and synergistic. First, different weapons have different combat characteristics. For example, the long spear is a good thrusting weapon but may be so heavy that only one or two may be carried. Once the long spear has been thrown (if the warrior has only the one,) and with a fairly short effective range, the warrior is reduced to fighting with hand weapons at arms length. As noted earlier, this is a situation fraught with peril.

One may carry several short spears, and the *atlatl* gives these a greater effective range than that of the long spear. As a thrusting weapon however, the short spear is inferior to the long spear. This pattern extends linearly to the bow and arrow. The arrow has an even greater effective range than the short spear, but as a thrusting weapon it is quite inferior to the short spear, much less the long spear.

If one has two (or all three) of these weapons in their arsenal, then a force may be built using two primary weapons. That is, some members of the force will have (e.g.,) the long spear as a primary weapon while the other members have (e.g.,) the short spear and *atlatl* as a primary weapon. This force has both a long range "firepower" capability with the short spear and *atlatl*, and a short range "shock" capability with the long spear. Thus, the departure from monoarmaticity.

Symmetry in Combat

When these hunting group derived forces met in combat, we may also expect that (in most cases) both forces[79] would be identically armed, at least in terms of the primary weapon. Thus, we would have two forces, essentially identically armed, and assuming the same type of hunting practices, likely essentially identical in their tactics and doctrine. These two forces would fight each other in identical fashion, in a sense, mirror images of each other, and thus we might call this symmetric combat. [80]

We may immediately identify an exception to this. As Hanson [Hanson 2002] has noted, indigenous combat "style" tends to be shaped by the nature of terrain. It may be advanced, somewhat loosely, that this shaping is at least partly the result of this hunting-fighting relationship. At any rate, we may postulate that at the boundaries of hunting regions, where the hunting preference or predominance changed size (or perhaps even type,) of animal, hunting, and thus fighting, technique or style changed.

[79] I am assuming simple two-sidedness here for reasons that I hope are by now obvious given the period.
[80] This is not the same as symmetric warfare, but the ideas are similar.

To briefly address this in detail, consider that by large animals we mean elephants, rhinoceros, mammoth, and the like. Medium animals span sizes from moose and elk to deer and pig. Small animals are implied by what remains. What constitutes an effective means of hunting each animal depends on several factors, including size and fleetness. If we neglect trapping as a means and restrict ourselves to direct confrontation, then we may observe that large animals are usually best hunted with large spears and small animals are best hunted with bow and arrow (shorter spears.) Somewhat oversimplistically, the size of the weapon scales with the size of the game.

On the plains or steppe, animals have few hiding places and may have to travel long distances foraging. As a result, they may develop speed as a survival mode.[81] In such an environment, mobility and long range firepower will likely be necessary for hunting efficiency.

In mountainous terrain, cover is fairly common, and movement is difficult. In this environment, absence of motion, in the form of ambush hunting, and medium range firepower may be the efficient mode.

Finally, in rolling terrain with alternating forest and field, cover will essentially be binary. In this case, we may argue that the long spear with its combination of thrusting shock and short range firepower may be the right weapon to be used with an ambushing-stalking mode of hunting. From this, we see some indication, admittedly vague, of Hanson's categories.[82]

Even prior to the invention and development of the *atlatl*, much less the bow, we may expect geographic variation in the long spear. Obviously, the longer the spear, the more difficult it is to travel with and to deploy as a thrusting weapon. We thus expect size differences in the long spear depending on whether the predominant game is (e.g.,) mammoth or deer. [83]

On this basis, and continuing our projection of hunting technique into combat doctrine, we see some degree of asymmetric combat occurring across these hunting region boundaries. First with variation of long spears, and then with *atlatl* and then bow, these hunting

[81] They may also develop collectivism in the form of the herd.

[82] The reader is requested to take these conceptualizations as figurative. Experienced hunters or anthropologists can made valid arguments entirely counter to these. These arguments track fairly well with Hanson's model, but I have not developed here other factors, such as the competitive nature of combat, that anchor these arguments.

[83] Again, not having seen discussion in the anthropological literature, but one may postulate that the short spear developed from the long spear because of its utility as a thrusting weapon unter tight conditions. Thence, noting the reduced throwing range resulting from human arm mechanics, the *atlatl* was developed.

extension combat forces would have some exposure to different hunting techniques in the form of their extension doctrines, and thence asymmetric combat.

Over time, we may expect several things to result from this. First, we expect imitation to occur. By this we mean that if one doctrine proves itself to be more effective in combat than the other, then the losing force (assuming it survives,) will imitate the doctrine of the winning force.[84] Indeed the opposite also occurs. Sometimes the winning side may adopt part of the doctrine of the losing side. This imitation may be total or hybrid, and it may not be effective.

History gives us numerous examples of ineffective imitation. Some of these failures seem to occur because of inadequate analysis of the imitated doctrine. More commonly however, these failures result from inadequate technology. In some of these cases, the technological lack is material, but most commonly, doctrine imitation seems to fail because of inadequate organizational technology. Common instances of this form of failure include inability to induce the military leadership to abandon old doctrine, and inability to overcome some cultural aversion among the rank and file.

Imitation may also be hybrid in nature, and this leads us to the next response to asymmetric combat. Having observed that there are benefits to the proper form of asymmetric combat, and given the progression from hunter-warrior to warrior-hunter with adoption of sedentaryness (and agriculture) alternatives to monoarmaticity may be expected to emerge.

The forms of these alternatives would seem to depend, in large part, on the degree of control by the leadership, and its diligence. If control is tight, and the leadership is perceptive and diligent, then we may expect that the hybridization will occur by grouping primary weapon types and their associated doctrines. This is the route that leads to the discovery of the Principle of Concentration and thence to the Sumerians' invention of army. Of course, the success of this depends on many factors, not least the rigorous external discipline and team cohesion that manifests the difference between warrior and soldier.

For this reason, it seems unlikely that such a radical departure would be adopted so directly and rapidly. Rather, we may postulate that initially hybridization took the form of individual imitation. In an environment of consensual or collegial control, with limited or even weak leadership, we may expect a diffusion [Rogers 1995] process occurs where early adopters move to new weapons/doctrine (or even hybrid weapons/doctrine,)

[84] Although not commonly emphasized, doctrine has an organizational component.

but there would be no directed movement of adoption. Further, because this force would still be called upon to engage in symmetric combat, adoption would likely never be complete. However, it seems possible that failures of this form of hybrid force to defeat monoarmaic forces (or at least units,) would lead to discovery of the Principle of Concentration and then recognition of how units may be structured on the basis of primary weapons and doctrine.

The Diversity of Tactics

It seems likely that the basic rules of tactics were learned long before man progressed organizationally beyond the Hunter-Gatherer band. Early instances of the Principle of Concentration would derive from survival. The fragility of the band to small losses in the hunting-fighting combat group would drive home that most elemental of military precepts to not divide one's forces.

Similarly, the early predominance of raiding would have taught the value of the ambush, both offensively and defensively. This would have carried over as persisting combat emerged to the value of the flank attack.

While not wishing to improperly degrade the difficulty and complexity of the tactical art, this simplistic construct would seem to have been the essence of tactics in an environment of symmetric combat. Division of force is not to be done. Given combat is symmetric, then the best way to attack an enemy's flank is an ambush. Failing that, then one may try an off-side (or lateral) attack. Failing that, one abandons the flank attack completely and makes a frontal attack.

Doctrine of Catastrophe

We need to note that in a rational context, and we must ascribe a certain degree of rationality to our ancestors since we are here, attacking may be viewed as almost as bad as dividing the force. If force division has been figured out, then some inkling of the 3:1 rule [Davis 1995] must also have crept into the primitive military consciousness.

Anthropologists have observed strange military behavior in some (almost) contemporary cultures. While such must be suspect just because of their survival to modern times, they do have to be acknowledged. Some of these behaviors include posturing, chanting, and taunting prior to combat. One purpose of this behavior seems to be to prompt the

other side to attack. In cases where these behaviors do not prompt an attack, both sides become frustrated and the battle fizzles.

There is also clear evidence of the early recognition of any form of defensive terrain. [Keeley 1996] The use of favorable terrain augmented by some defensive works for bases of operations clearly show an appreciation of the value of the defensive. [Adavasio Page 2002]

The primitive commander clearly understood the risks of the attack and force division. We expect thus that the doctrine of successful organizations was predominantly ambush and negotiation. Frontal attacks and set piece battles were likely avoided and came about only once small losses to the hunting group (and the whole band) ceased to be inherently catastrophic.

Asymmetry and Hybridization

With asymmetric combat, and thereby hybridization of force, new opportunity is presented. If one has a unitwise hybrid force, then the force is already divided.[85] If the enemy is a non-hybridized (monoarmaic) force, then one has two options for assaying a flank attack: a symmetric frontal pinning attack followed by an asymmetric flank attack; or the reverse - an asymmetric frontal attack followed by a symmetric flank attack. While the choice would be a matter of combat judgment and thus in many cases a trivial decision, the fact remains that there is this increasing diversity of combat options with asymmetric combat

Diversity and Decisiveness

Decisiveness is the penultimate goal of combat. Ultimately, decisiveness in war is that we have imposed our will on the enemy and he has not only failed to impose his will on us, but he has accepted our will. Decisiveness in combat is generally not even this semantically clear cut.

In exploring decisiveness, we must first acknowledge that while attrition is related in some sense, mere attrition will not assure decisiveness. One may inflict grave losses on one's enemy and fail to be decisive. Similarly, one may be decisive and still incur great losses, perhaps too many to enjoy the fruits of decisiveness.

[85] This may have been one of the reasons why monoarmaticity persisted so long and unitwise hybridization took so long to occur.

One of the problems with hybridization is that while it combines two (or more) primary weapons/doctrines and may thus engage in approximately symmetric combat with monoarmaic forces of either weapon/doctrine, the hybrid force may not be sufficiently strong to defeat one or either of the monoarmaic forces.

Enter Fragility

Fragility is apparently inherent to combat. In a sense, it is a complement to decisiveness in the sense that decisiveness can be obtained if an opponent's fragility can be exploited enough.

We have already commented extensively on the fragility of the early hunter-fighter group to withstand casualties. One frequently hears today of the fragility of American forces to casualties, but this fragility is a matter of public opinion and thus political support. For the Hunter-Gatherer band, their fragility to casualties was a matter of survival. If they took too many casualties, more than about one out of the five person hunter-fighter force, then the band would starve as a result. [86]

Decisiveness becomes possible as a result of this fragility. If a force could ambush an enemy and inflict disabling injury, even death, on one or two of the enemy force, then the combat would have been decisive (assuming the ambushing force avoided casualties.) The enemy band would either have been consigned to starvation by insufficient surviving hunter capacity to feed the band, or they would be close enough to starvation that they would accept terms.

As the military art progressed, this complementary relationship between fragility and decisiveness developed and influenced the military art.

With adoption of the sedentary lifestyle, the fragility to casualties became less a knife-edge survival matter. Nonetheless, casualties have remained a combat issue except when arrogance triumphs over rationality and populations become culturally disposable. As casualties become acceptable, face to face combat, even set piece battle comes into its own. The response is some form of linear formation that has its fragility in flank and rear assault. This is the lesson of the Principle of Concentration.

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[86] The reader is referred to POW. A loss of one out of five left 80%, while the loss of two left 60%. Thus in terms of the Lanchester quadratic formalism of "combat capacity", one loss reduces the force to 64% of its original while two losses reduces to 36%! Interestingly, the (approximate) average of historical (i.e., recorded) battles' loss is about 30%, which lies exactly between that "magic" difference between one and two losses in the primitive hunter-fighter group.

The departure from monoarmaticity is similar. If two monoarmaic doctrines or styles clash, then one may overwhelm the other, but because the origin of these styles is often terrain based, extension beyond that terrain form may prove to be ineffective. A doctrine or style that works in the hills and dales may not work on the plains or in the mountains. If a force moves onto a new type of terrain and is beaten there by the locals with a different combat style, the defeated force runs a risk if they adopt their opponent's style of becoming fragile on their home terrain.

If they diversify their force to a multiarmaic force to accommodate both styles then they have a new fragility in dealing with a monoarmaic force of either type on its home terrain. In effect, multiarmaticity is a form of force division. It also illustrates that complexity is a form of fragility.

While reduction in casualty fragility due to sedentary lifestyle and decreased hunter criticality was contributory to the increase in pitched combat, the population increase/concentration of the sedentary lifestyle was another. Because of the greater population, and the (at least temporary) marginalization of the hunter, both greater concentration on the fighter role and skills, and larger forces become possible. As a result, the use of the ambush as a military tactic decreased.

Ambushes are creatures of surprise. Once surprise is exhausted, the ambush is either broken off or it turns into a meeting battle or engagement. It is absolutely crucial for an ambushing force that span of control be rigorous. One misaction is sufficient to turn an ambush into a disaster by compromising surprise.

It is also crucial in an ambush that the ambushing force have at least local superiority. The less the ambushed force is engaged, the sooner it recovers from surprise.

Once the forces at play get larger, both of these concerns militate against the ambush. Start from the perspective of a small force ambushing another small force (say 5 on 5!) Terrain is not likely to seriously divide the ambushed force and the ambushing force can be concentrated enough to be within spatial span of control.

If we now make the ambushed force larger, unless the terrain is such as to seriously disjoin the force, a small ambushing force cannot fully engage the ambushed force. As a result, surprise is more ephemeral and the ambushing force is susceptible to envelopment. If the ambushing force is increased in size, then spatial span of control is exceeded, coordination is complicated, and the risk of loss of surprise increases.

While we recognize that matters such as spatial span of control, coordination, and local

superiority depend on technology, for any given level of technology they are fixed and we are brought to the realization that once the scale of the forces exceeds the scales of span of control, coordination, and /or local superiority, a fragility of complexity emerges that, in this case, limits the use of ambush. Before sedentaryness, the ambush was a tactic that could be decisive in itself. With increased force size, it remains an important tactic, but will not be inherently or solely decisive.

This idea of complexity as the source of fragility seems to be fundamental. To see this, we need to spend some time worrying about states of result.

If we consider a one-on-one combat between two fighters, there are four possible states of result:

1. both fighters may survive the combat;
2. both fighters may be killed during the combat or succumb afterwards to wounds;
3. one fighter may be killed or succumb and the other survive; and
4. one fighter may survive and the other be killed or succumb.

Of these four, we may assess the first two to be non-decisive while the last two are decisive.

If we were quantitatively modeling combat, we should want to assign or determine likelihoods of each of these four states. For our qualitative modeling here, we are only going to worry about counting states, relying on Nature to assure that all states will have some existence given accessibility.

Under these conditions then, we may say that for a one-on-one combat there are two decisive states and two indecisive states. Thus 50% of the states are decisive.

Now let us proceed to the next least complicated situation. Consider a two-on-two combat. Assume that we may treat this as the combination of two independent one-on-one combats. Each combat has four states, so the two-on-two combat has sixteen states.

If we examine these states we discover that our thinking on decisiveness is still a bit cloudy. We want to define decisiveness in terms of war, but that is proving not to be so easy as we thought. For example, we have states in our double one-on-one combat where both fighters are killed in one combat and only one fighter is killed in the other. Is this state decisive or not? Put in other terms, will the "losing" side feel their will is bankrupt and they have to accept the will of the "winning" side? More directly, is the

"winning" side able to exert its will?

In considering this, let us bear in mind that we have not yet considered the additional complexity of the two-on-two combat where the survivors of the first one-on-one combats fight each other (when they are on opposite sides.) As soon as we go past the simple one-on-one combat (or at least rapidly thereafter!,) attritional measures of winning and losing, of decisiveness and indecisiveness, become secondary although may remain important. Clearly if the victory is pyrrhic, then it is not likely to be decisive. There is a clear aspect here that the "winning" side must be able to use force to continue the imposition of that side's will, and that force is not available if the side's number of fighters is too reduced.

As we extend the forces to larger sizes, the number of possible states of outcome increases geometrically in number. The number of these states that we may categorize as clearly producing decisive result decreases in proportion. Of course, not all of these states are equally likely, but the fact (or at least the proposition) remains that as the size of the forces grows, the likelihood of decisive combat outcome decreases.

Dimensions of Fragility

We must also not lose sight of the basic competitive nature of war. As we stated early on, there is a strong expectation of opposition in warfare.

As a result, each commander will do what can be done to not only seek decisiveness on his part, but to preclude or prevent decisiveness on his opponent's part. One form of this is to avoid excessive loss in battle. Another is to diversify the armaticity of the force.

Of course, this diversification is itself another source of fragility. The idea is somewhat like the Napoleonic model of combat where each component of artillery, cavalry, and infantry can defeat and be defeated by one of the other two components in a cyclic architecture. One therefore had the strength of using cavalry to defeat artillery (e.g.,) accompanied by the fragility that infantry could defeat (withstand) cavalry.

Of course, with the technological introduction of rifling and the conoidal bullet all this fell apart and the viable force because (essentially) monoarmaic again.

The strength gained from a multiarmaic (or multi-style) force is that it can successfully fight in several environments. The fragility gained is that in any given environment it is less capable than a monoarmaic (or mono-style) force specifically composed for that

environment. As the scope of combat has widened, the choice of monoarmaticity (or mono-stylicity) has ceased to be viable except for periods when technology has given an overwhelming advantage to one weapon and/or style of fighting.

As a result, the multiarmaic (or multi-stylistic) force always has the fragility that a given unit may be attacked by a unit of different composition that is inherently more effective. (There is also the state where a unit is attacked by a unit of different composition that is inherently less effective.) There is thus a situation akin to a type of polarized chess where a piece of a given type may take pieces of some types but not others. In effect, part of the management of combat is then the activity of attacking enemy units only with those that may overcome effectively but avoiding enemy attacks that would be effective.

In many cases, the path to decisiveness is using the inherent fragilities to be effective against one's enemy while avoiding or denying him effectiveness. This is not easy given the complexity of both inherent fragility and combat.

Offense versus Defense

Which is stronger, offense or defense? Clausewitz [Clausewitz 1976, p. 84.] tells us that "defense is a stronger form of fighting than attack." Other pundits offer other views, some of which reach the same conclusion as Clausewitz (although not necessarily agreeing with his argument,) while other disagree. At the risk of straying from our general approach, what may we discover about offense and defense?

Fragility

First of all, we intuit that defense should be less fragile than offense. This intuition derives from the relative simplicity of defense as compared to offense.

While both offer significant challenges in terms of planning, preparation, and implementation, and failure to effect any of these well increases the fragility, the greater complexity of effecting these for the offense tends to make it more fragile than the defense. it is easier to construct fortification (usually) than to travel across country. It is easier to plan the structure of these fortifications and their force components than it is to plan their destruction or, at least, compromise, even with advance intelligence. It is easier to fight effectively from the fortification than at or across them.

Still, in some ways the ultimate source of fragility must be the commander. Because

of the hierarchical structure of classic military organization, how well these things are effected depends a great deal on the commander. In particular, they will depend on the balance struck between rigorous discipline and individual creativity. In philosophical terms, this is a matter of the one and the many. [Stumpf 1966]

A military organization that is not disciplined and obedient enough is fragile. A military organization that is too disciplined and obedient is fragile. Similarly, as organization that accommodates too much individuality and creativity (or just individuality for that matter, but the creativity is particularly important here,) is fragile. An organization that does not accommodate enough individual creativity is fragile. The balance is not static, but dynamic and situational.

This balance devolves on the commander. The commander must establish this balance by understanding and leading both himself and his command, as well as contending with friction.

Decisiveness

It is easy to argue that defense is stronger than offense in terms of decisiveness. Any interaction between two forces, one in the offense, the other in the defense, gives rise to these basic states: indecisive; offensively decisive; and defensively decisive. By its nature, defense tends to be preservative of a condition while offense tends to seek the change of a condition. As such, an indecisive outcome tends to be more beneficial (or less damaging) to the objective of defense than it is to the objective of offense. If the three states are reasonably close to balance, or even if just the two decisive states are closely balanced, then defense is favored over offense.

If the states are not balanced, and, in particular if the offensive decisive state is likely, then offense is favored over defense, even with the advantage of the indecisive state. This imbalance may result from several conditions. Some technologies tend to favor offense over defense. Alternately, terrain and weather have definite effects on offense and defense. For example, as we discuss in the chapter on environment, defense usually requires some terrain boundary to anchor and protect flanks. For example, fog and rain tend to disrupt the cohesion of offensive units more than that of defensive units.

As with fragility however, much of decisiveness depends on the commander. In the absence of some factor of technology, terrain, weather, or the like, the source of imbalance in the decisive states is the difference between the commanders. Other factors aside,

the offensive side's commander has to be better than the defensive side's commander to make the offense stronger than defense.

The condition is however, itself a source of fragility. Recognizing that there is a significant advantage to the defensive in decisiveness terms, there is often a tendency to assign less capable commanders to inherently defensive missions while more capable commanders are assigned to inherently offensive missions. Alternately senior commanders tend to assign inherently offensive missions to their more capable junior commanders while assigning inherently defensive missions to their less capable junior commanders.

This is a source of fragility, especially if the defensive missions prove to be more crucial to the war. If both sides practice this innate asymmetry, then the strength of the defense is reduced and the strength of the offense is increased. The effect of this is to increase the chances of decisiveness at the micro level but not necessarily at the macro level.[87]

Force-to-Space

Finally, we come to consideration of defense versus offense in the context of Jones' Force-to-Space Ratio (FSR) theory. [Jones 1987] This theory is historical in character, which tends to assure that it is primarily shaped by war when force capabilities were balanced. Thus, it serves a valuable function of providiing a means of subtracting out the transient effects of the RMAs.

Since the defense must respond to the offense, we must consider separately whether the offense is pursuing a raiding or a persisting strategy. If a raiding strategy, which generally indicates a low FSR, then the defense can be effective only if the offense's freedom of movement can be denied, or if their base of operations can be eliminated. The latter method is offensive in nature so we will not consider it further here.

Denying freedom of movement, as we discuss in the chapter on environments, is more a matter of space than force *per se*. By this we mean that the effectiveness of defense is determined by the nature of space. If the terrain is restrictive and characterized by choke points and few avenues of movement, then all the defense needs to do to be effective is to control these points and/or avenues to pin down the offensive force and destroy it in detail. Of course, this requires a certain force size but given only a small amount of space must be controlled to effect this, these force requirements may be easily achieved.

[87] For example, a situation may emerge where defense is corrupted so much that a persisting strategy becomes impossible for both sides.

Resultingly, it is relatively easy in situations like these for defense to be stronger than offense.

However, if the terrain is open, the problem is much more complicated. Because a large amount of terrain must be controlled to "pin" the enemy, the defense is at a disadvantage in this type of terrain because of the large force size needed to control this large amount of terrain (and meet a minimum FSR to at least prevent breakthrough.) Further, since this type of terrain often favors rapid movement, this combines with the large force size to make mounting an effective defense quite complex. This complexity may result in such a loss of effectiveness for the defense, or such unsupportable requirements for forces, to render defense ineffective.

If the offense adopts a persisting strategy, which implies a large FSR, then the situation is somewhat more complex than when a raiding strategy is used. In this case, we must consider whether the offense is completing that persisting strategy with a combat or a logistic strategy.

In the latter case, that of a persisting logistic strategy, the defense may respond by adopting either a logistic persisting strategy or a raiding strategy. The former is most commonly implemented as what is called a "scorched earth" practice. The latter usually takes the form of raids on the edges of the offensive force. While observing that these raids are largely offensive in nature, which leads us to the distinction of strategic defensive, tactical offensive, [Summers 1989] we note that both of these responses are very space dependent.

For a barrier defense to be effective, regardless of whether the barrier is an obstruction or an impediment, it must stop the offense. An obstruction barrier, usually a fortification, must prevent the passage of the enemy either by denying use of avenue of movement or by presenting an unacceptable threat to the rear.

An impedimental barrier, which is what "scorched earth" usually is, impedes the passage to the point where the offensive force would become ineffective. If that force is dependent on forage (e.g.,) then "scorched earth" denies forage to the force crossing the barrier.

If the defense adopts a combat strategy, then the alternatives are to implement a raiding strategy, as in the logistic case but with the emphasis on combat missions rather than logistic, or to meet the offense head on in a pitched battle.

These options demonstrate the intimate relationship between defense and space. Two

of the three response strategies - raiding and "scorched earth" - are only effective if the distance for the offense to cover is long enough. In the first case, the raiding strategy, the distance must be great enough, given the offense's rate of travel, for successive raids to erode the offense's capability where the effort is broken off, or they can be defeated easily in battle, assuming a shift in strategy for the latter.

In the second case, "scorched earth", the distance to be traveled must be sufficient to deplete the key resources and render the offensive force ineffective.

The situation with a pitched battle is somewhat different. In this case, the space issue is not distance but closeness. Good defensive terrain is classically ground that allows flanks to be anchored and thus protected, at a distance that allows a good force-to-space ratio. It is also beneficial that the approach ground be difficult enough that the offense is prevented from concentrating.

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10 Government and Law

As we have indicated previously, organization precedes man. Since the development of *homo sapiens*, the types and forms of organizations have expanded enormously. Of these myriad types of organizations, none are more fundamental to man than government, followed closely by religious and military organizations.

It is tempting to speculate that this closeness occurs because the three types of organizations share a common evolution. To explore this, we start by noting that all three of these types of organizations share a common purpose, protection. At the risk of oversimplification, governments exist for the purpose of protecting their members from every day (natural) dangers while religious organizations exist for protection from extra-material dangers and military organizations exist for protection from other governments (sub-natural dangers.)

We may postulate that originally these three organizations were one in the consensual simplicity of the Hunter-Gatherer band. As the band evolved under the Principle of Concentration to greater specialization, as evidenced by such developments as structured burials and the spear, we may expect the emergence of religious specialists as we have already sketched the emergence of the hunter-fighter. With the adoption of sedentaryness, this concentration would intensify and the three organizational specialties would compel their separate emergence, perhaps first as the fraternities (sororities) we have already sketched.

There is a model of this evolutionary emergence, and as with many such models it gives us insight into the nature of war. Accordingly, we now take some time to review this model.

But where is the model?

Government

Government arises by the Principle of Concentration. As the size of the organization

increases, it becomes efficient to devote people to the provision of necessary services and the administration of the organization. Some of these services are critical decisions and actions.

In effect, government is inherent to organization. Simple organizations may elect to operate with a vision and purpose but without formal rules or order structure. Such organizations have a government that is purely *ad hoc* in nature, but is nonetheless a government. The basic Hunter-Gatherer band, as an organization, had a government although we do not know very much about what that government looked like or how it operated except as we may infer from anthropological investigations of currently or recently surviving Hunter-Gatherer bands. As we have already indicated, such inferences are questionable.

To provide these services efficiently, control of the services and their provision must be vested in that part of the organization - government - that provides them. In some cases, this control accrues naturally because the organization members do not want to perform these services for themselves. A common example of this in modern society is garbage disposal. In other cases however, the control accrues as an investment of trust on the part of the members of the organization.

As we have discussed already, this investment may be a necessary condition of membership in the organization. In other cases however, the trust may be subject to review, depending on the nature of the organization.

These trust investments are ideally those things that either cannot be done on a decentralized basis, or cannot be done efficiently enough.

By their nature, governments accrete power. Despite the basis of their existence being efficient provision of services, the control of those services, which are necessary to the organization or its members, provides the government with power over the organization and its members by denying or delaying those services. It is thus possible for government to use its power to discipline, coerce, or control the members of the organization.

Even the best of people cannot be categorically trusted to always make decisions or take actions that are in the long term best interest of the organization. The norm is often to make compromises that result in a short term gain, often with a personal as well as an organizational component.

Unfortunately, there are people who enjoy exercising power, if not control, over other people, and as such, these power desiring people are drawn to government specifically

to acquire this power. Equally, those who do not desire power often do desire to live their lives with minimum external effort. The combination leads to tyranny, oligarchy, and autarchy.

Law

If governance arises from the Principle of Concentration, then law arises from man's need for causality. At its most fundamental, man is inherently interested in the laws of the physical universe. Law of government however, is neither fundamental, nor pure.

In effect, government (or organizational) law is a compromise. Government desires to exercise its responsibilities without discussion, dissent, revolution, or rebellion. The members of the organization want government to exercise those responsibilities in the appointed manner and with righteous trust. Law is an extension of government in the sense that they are both formalizations of organization.

Law, by its nature, both limits and enables both government and governed. It defines what may not be done (or what may be done) and thereby encourages the opposite.

Complexity

Law and government both embody a complexity trade-off. To be effective, both government and the body of law must be large enough to do what needs to be done. In the case of government, it must be large enough to perform all of the services needed. In the case of law, it must cover all situations that arise.

The difficulty with both is that they have a tendency to grow. Services tend to increase in number and government must increase as well. Similarly, new situations arise and new laws must be put into play. At some point, the government becomes too large to be efficient because parts of it are operating at cross purposes, and the law becomes too large for even professionals to know it all.

When this happens, both law and government tend to shut down. Parts of the government that conflict with others may shut down. Laws that are not known well are ignored.

Love-Hate Relationships

In America there is a model, part mystical and part historic, that when war occurs, the citizens of the nation accept soldier status long enough to "win" the war and then revert back to being civilians again, leaving military affairs to a small professional corps. This model has its roots in the colonial origin of the nation, and is promulgated by both the civil and military sectors.

Those who served as citizen-soldiers are often, not always, ready to relate how the nation was saved despite the mindless hierarchical inflexibility of the career military. The professional military offer arguments of how, through professional diligence, they tamed irresponsible civilians in passable, albeit only temporarily, soldiers, and thanks to professional management and leadership, they were able to use these mediocre troops to achieve a marginal victory.

During the period of European rule, this model could be discounted easily because of the social division between the colonial (American) militia and the European professionals. With the days of colonial rebellion, the American Revolutionary War, this model first bloomed. In this war the impersistence and inconsistent military capabilities of the militias had to be supplemented with professional units.[88] At war's end a military coup was narrowly averted and the professional army reduced to virtual extinction until the establishment of the Federal government. Its insecurity and the on-going economic recession revitalized the professional military. Since then, the model of the small professional army struggling to continue its existence and fight small wars during periods of almost peace, rapidly expanding when a "real" war erupts, and then regressing back to its peace state have, arguably, been the mode. Pundits point to the Mexican-American War, the American Civil War (Second American Revolutionary War,) the Spanish-American War, and the two World Wars as evidence. Some leave off the Korean War as a police action (were the military actions of the North Korean and Chinese governments criminal or "other means"?), but others claim such omissions are political prevarications to deny nation state status. Certainly from the definition of war advanced here, this was a war, and the expectation of opposition was satisfied.

Somewhat more disturbing is the omission of the Vietnam War from the list. One rationale for this is legalistic, that it was not a war because war was never declared. This may mean that it was not a legal war, but that is not obviously a meaningful distinction. The

[88] Of course, this has a political as well as a military component. The professional units were needed to achieve recognition of sovereignty.

more important rationale is that the criterion of victory was not satisfied.

This rationale is also flawed. Obviously World War One was not won, just endured. It ended in an armistice, a settlement advantageous to the "Western Alliance" and penalties that are commonly claimed to lead directly to World War Two. The victory condition is thus revealed as more mythic than historic.

Critically, the Vietnam War is different in that the American military went through a complete cultural reassessment after the war. This reassessment was important in that it changed the American military at the structural and cultural levels. In this the Vietnam War deserves to be on this list of model wars since it may conclude the list.

Fundamentally, the change that the American military adopted, which was generated by debate and discussion that was both top-down and bottom-up, was to adopt the model of American professional athletics. The amateur component of the American military was eliminated, leaving only professional and semi-professional components - the regulars, and the national guard and reserves.

These terms are loaded with connotation so we need to examine these. According to our dictionary, [Pearsall 2002] a professional is one who is paid for pursuing his (her) hobby. This combination is important. The professional acts with the diligence and integrity expected and characteristic of a hobbyist and with an excellence that warrants payment. In this regard, an amateur may either be one who lacks sufficient excellence to warrant pay, or sufficient diligence or integrity. Obviously, one who lacks the hobby diligence or integrity cannot exhibit excellence, but one can possess knowledge (diligence) and standards (integrity) while lacking skill or aptitude (excellence.) Tragically, the term semi-professional gets caught in this ambiguity.

In the citizen-soldier model, the temporary soldier is generally taken to lack the pursuit of hobby diligence that is necessary. This is a self-fulfilling condition. The civilian is generally not interested in the military hobby and thus can never be more than an average soldier. Even when the civilians have a hobby interest in military matters, they do not have the opportunity to develop their skills to accompany knowledge.

The result of this elimination of the amateur soldier is a military that is (essentially) completely professional. In principle, it is a much more capable military. It may even be a much less expensive military since training and upkeep are just those of the professionals. Generally, the professional service is smaller than the amateur service.

The Service Triad

Much of this is politics and the political maneuvering that is characteristic of preparation for war (to use Clausewitz's term.) If we go beyond the politics for a moment we see in this activity a variant of a pattern seen time and again since the ancient invention of Army by the Sumerians, and probably older but not recorded.

This pattern is cyclic which means that we must break the cycle to conduct our discussion. We have already implied this with our previous discussion so we start with the service of the citizen-soldier. Since the citizen is a relatively recent reinvention of the eighteenth century, we must understand by this the part time soldier, the man (almost universally) who has some other daily activity but when the occasion for military action arises, leaves his normal occupation and serves the organization as a soldier.

Simply put, the organization goes through some period when its military suborganization is composed, in the main, of citizen-soldiers although the suborganization may be led by regulars or professionals. This is, in a phrase, the amateur army, or perhaps, even the *agricola* army.

At some point, the organization changes from an amateur army to a professional army, an army of regulars. There are several possible reasons for this change: the organization may grow in a manner that the amateur army becomes impractical because the citizens will no longer serve, or are no longer available to serve; the nature of warfare may change to require a continuously available military; or the organization may have an economic motivation arising from political or technological sources. The classic example of the latter was the adoption of the chariot by the Egyptians. [Brown et al 1998]

As we have already noted, the professional military is usually smaller in size than the amateur. This is often rationalized on the basis that while the full time professional is more expensive than the part time amateur, the professional is more effective. Thus either cost equivalence or even savings dictates a smaller force.

Generally, the form of the transformation is such that engagements between a professional force and an amateur force result, most of the time, in "victory" for the professional force. In Clausewitzian terms, the professionals generally handle the friction better. The basis of Clausewitz's Remarkable Trinity is an organization with a professional military.

At some point the organization undergoes another transformation, from a professional

military to a mercenary military. The reasons for these are varied but are generally similar to those for the transformation from amateur to professional, but intensified given the smaller numbers.

The mercenary military is characterized not just by the presence of an economic component but dominance by economics. This carries over into the policy side of the matter. Whereas the amateur and professional militaries are (usually) sub-organizations, the mercenary military is (usually) either a separate organization or the top (ruling) level of the organization. The mercenary military is thus more interested in maintenance of its existence than the support of the organization (except as it becomes the ruling or directing "class" of the organization.)

For the mercenary military to be successful it must be capable of consistently defeating a professional military. This necessary relationship completes most of what is necessary to form the cycle. The rest is the transformation from a mercenary military to an amateur military. This transformation is obviously predicated by the ability of the amateur military to decisively, if not consistently, defeat the mercenary military.

This ability seems to arise from one of two general causes. The first cause is the dominant economic nature of the mercenary military. Either the mercenary military becomes corrupt through greed or competition, if the military is independent, or, if the military is governing, the organization of governance itself becomes corrupt. In this case of corruption the empowerment of the citizen-soldier is either the disempowerment of the mercenary or righteous political indignation.

The second general case seems to be technological. In this case, the technological advance empowers the citizen-soldier, shifting the balance of quality versus quantity. Interestingly, this case also appears to short circuit the cycle, in some instances eliminating the mercenary stage.

We have described this cyclic process as localized within the organization. This localization is to a large degree illustrative, depending on the influence of other organizations. Since effective organizations (especially nation states) tend to compete militarily externally (with other organizations) rather than internally (within the organization,) military structure tends to a degree of consistency among such organizations. [Goldman Eliason 2003]

We must also note the duration of the phases of this cyclic process. History is illustrative in this matter rather than definitive since its nature is non-stationary. In general however,

we may expect each of these phases to be fairly long lasting in human terms. Since the primary change mechanisms are cultural, we may propose that, except for the occasional revolutionary technology, each phase has a duration that lasts several generations.

Further, we may also note that while transitions may be relatively abrupt, they do not have to be. Nor, do the military organizations have to be completely pure. Citizen-soldier forces may rely on hired wagons and teamsters for logistic support. Professional armies may enhance their strength with drafts, corvees, and the like. Mercenary armies may still have professional components to provide an organizational presence.

Just as each phase has a different military structure, it also has a different type of warfare, at least in a general sense. Warfare for the amateur army is often temporally localized to the period between planting and harvest, or between harvest and planting, depending on environmental circumstances. We must recall that this localization reflects the agricultural nature of mankind during much of history (and thus the agricola army.) Nonetheless it does show that citizen-soldier warfare has to be fitted in around the other things that the citizen must do.[89] For the same reason, citizen soldier warfare tends to be fairly local spatially and is much more suited to defending the homeland than conquest.

As the intensity of war spirals afield or over more of the year a natural evolution to a professional army occurs. This is often an expression of the Principle of Concentration where the citizen, nominally a farmer, contributes his labor-time not as a temporary soldier but as a more primary occupation to provide resources to support full time soldiers. In this we see the evolution of the concept and implementation of professionalism.

Because these soldiers are regulars, they have the skills to consistently defeat amateurs, largely through exploitation of mistakes, but by outwaiting them if necessary. War is no longer temporally constrained by citizen occupation, but it is by weather and thus tends to have a seasonal component. Because of this, war may take on an expeditionary nature and geographic expansion may result. Organizationally, this may result in stratification both in the occupational difference between soldier and non-soldier, and between old and new member of the political organization.

At some point, the stratification may become strained and the supply of professional soldiers depleted, or, at least, constrained. To meet requirements, a shift to mercenary forces may occur. Frequently, when this occurs, the nature of mercenary warfare causes a change in the political domain as well.

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[89] Recall the repeated problem with getting Spartans to the battlefiled whenever the Persians invaded CLassical Greece.

Up to this point both amateur and professional soldiers have been members of the (political) organization. The welfare of the organization and its members is a large part of the motivation of these soldiers. This is not the case with mercenaries. Their motivation is largely economic and personal, although some allegiance to their commercial military organization may exist.[90]

Because of this motivation, the members of the mercenary organization are often averse to wounding or death. This aversion limits tactical military action. Further, the mercenary organization cannot accept too many casualties without reducing income (while incurring expenses for medical treatment or pensions,) and losing employment. This limits operational military action.

As a result, mercenary warfare tends to be characterized more by maneuver than combat, and more by defensive than offensive operations. This is at the root of the closure of the cycle because of the fragility of the mercenary and his organization to the determination of the citizen-soldier.

References

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[Pearsall 2002] Pearsall, Judy, *editor*, **Concise Oxford English Dictionary**, Oxford University Press, Oxford, 2002.

[90] Mercenaries are professionals. We use the taxonomic distinction as we do for simplicity of communication.

11 Revolution and Refinement

Both of the lists of Revolutions in Military Affairs that we have considered do not identify any revolutions until well into recorded history. Knox and Murray's first RMA is the combined arms revolution of the fourteenth century; [Knox Murray 2001] Krepinevich's is the Infantry Revolution of the late fourteenth, early fifteenth century. [Krepinevich 1994] Given the end of the cold phase about 10 KYA ago ushered in sedentaryness and thereby warriorness, and the start of "real" cities about 3500 BCE (about 5.5 KYA,) we have a period of 5-9.5 KY without any RMA, followed by a period of about 0.5 KY with several.

Obviously, this period was not without military revolutions. Because of the dimness of history however, when it exists, it is difficult to determine exactly how military change occurred. In particular, we have some difficulty in telling when revolutions occurred. As a result, in this chapter, we shall not distinguish between actual revolutions and strong refinements in military practice.

The First Armies

One may argue both for and against the first armies being an RMA. Clearly they represented an organizational, cultural, social, and technological improvement over the hunting-fighting group of the Hunter-Gatherer band. Sedentaryness was a major cultural change from migration and with its increase in population of the organization, not only were cultural changes necessary but technological innovations were facilitated and necessary. These carried over to the military.

On the other hand, since these early village militaries were essentially the first warriors, they were the initiation of military affairs and as such, could not be a revolution.

Lest this discussion descend further into semantic machination, we keep the idea of major change in military affairs as embodied in the RMA and concentrate on the notion of major changes in military affairs.

Sometime around 3500 BCE, the Sumerians developed the Army out of the organizational concept of the "Water Department". This army initially had the purpose of controlling the land around the city, assuring that the farmers "sold" their crops in the city, and keeping other cities from encroaching on these domains. This force seems to have fairly quickly developed into a combined arms force of heavy and light infantry, battle wagons, and support troops. The heavy infantry, who seem to be professionals, were armed with spears and shields. The light infantry, who seem to be militia or irregulars, were armed with a hafted battle axe, a dagger, and either a spear or a shield. The battle wagons were predominantly four wheeled vehicles drawn by domesticated onagers rather than horses. [Hawkes 1973]

The heavy infantry was used in a phalanx-like manner, anticipating the developments of the Greeks. [Watkins 1989] It is unclear whether the Greek pushing tactic was employed so we content ourselves with considering this Sumerian Phalanx as being a tightly ordered force.

The light infantry probably served as scouts and shock troops. Given the wide use of helmets even at this early time, the effectiveness of the battle axe can probably be inferred to be considerable.

The battle wagons were apparently not very maneuverable and have been postulated to have been used as battle taxis. The expense of these vehicles and the demands of piloting them indicate that they were centralized assets with professional crews.

If the heavy infantry was operating in a phalanx-like style, then their rear and flanks would be vulnerable. About 2340 BCE, with the ascension of Sargon of Akkad, the heavy infantry went to a more open formation, which would have been better able to respond on its flanks. The throwing spear and composite bow were also adopted. The latter may indicate a further professionalization of the army.

The Egyptians did not initially have a standing army but with the firm establishment of pharaonic primacy the military capabilities of the nobles were reduced and then effectively eliminated[91]. The Egyptian force structure seems to have been entirely infantry divided between shield and spear carriers and archers using double-concave bows. The latter seem to have been predominantly professional mercenaries.

One of the interesting technological refinements during this period was the development of the bronze spear head. Originally, the spear head was tanged so that it could be

[91] Suppression of the Nomarchs is attributed to Sen-Worset III, circa 1900 BCE. [Hawkes 1973]

mounted in the spear pole by driving the tang into the wood. Of course, this weakens the wood. Over time, as the technology of bronze manufacture advanced, this gave way to a spear head with a socket which could be inserted over the spear pole end. [Watkins 1989] As a result, the strength of the wood was not compromised directly. What makes this progression so interesting is that is essentially the same as the evolution of the bayonet.

Two further observations are in order here. First, these armies are probably not very large. Sargon's professional cadre [Saggs 1989, p. 41.] was only about 5400 men. Part of the reason for both these first armies and their small size was the nature of bronze manufacturing. [McNeill 1982, p. 3.]

The development of bronze tools (and weapons) was an enormous improvement over stone (or pure copper, for that matter.) Nonetheless, the material components of bronze, copper and tin (or arsenic), are not commonly collocated,[92] so the manufacture of bronze was a process at the far end of a mining, refining, and transportation network. The descent of this is that we may fairly safely infer that bronze weaponry was expensive and thereby enjoyed limited production. This in turn infers that bronze armor and armament were in short supply but through proper maintenance had a long lifetime. Finally, we may infer from this that properly equipped soldiers were few in number, although slowly increasing over time.

This leads to the second point, the emergence of the professional warrior-soldier. The cost of bronze panoply indicates that it would not be intrusted willy nilly to every young recruit. This high cost would demand a proficiency of use that would neither be developed nor maintained by weekend drills. It follows then that the panoplied soldier was a kept man, either a professional or a mercenary.

Enter the Chariot

Somewhere about 1700 BCE, the nature of military affairs in the Mesopotamia-Egypt area underwent a major change with the adoption of the chariot as combat vehicle. This adoption is enabled by several technological advances.

The most fundamental of these appears to be the widespread adoption of the horse. As we noted earlier, the horse was first ridden in the Ukraine about 2000 BCE. [Bunch Hellemans 1993] It seems likely that horse breeding had been developed to the point where horses could

[92] This diversity may also apply to the material for tools, such as clay, and fuel for smelting and casting, as well.

be ridden for short periods of time but not for a long duration.[93] They had developed however to the point where they could be used for reasonable periods as draft animals.[94]

The second technology, or group of technologies, are those associated with the working of materials - primarily leather and wood - to construct the chariot. The most obvious of these was the ability to build a non-solid wheel that minimized weight while still being strong enough to support the vehicle in a rough terrain environment. In the same vein was the construction of the chariot body which often had a leather strap floor to conserve weight. The body had to be both sturdy and stable as well as provide some protection for the crew.

The less obvious material technology component was the chariot pole. This pole had to connect the chariot body, axle, and wheels to the horse in an efficient, effective way. This is not as trivial as it sounds, There is some indication that the pole cost as much or more than the rest of the chariot. [Drews 1993]

Another technology was the widespread development of capability to manufacture a bow more powerful than the simple bow. This generally means composite (Mesopotamia) or double concave (Egypt) bows rather than complex bows which are a recent invention. The disadvantage of these bows is that they commonly incorporate materials (sinew and glue) that are compromised in conditions of high humidity or immersion. Happily the desert environment friendly to the bow is also friendly to the chariot.[95]

The last technology was that of armor. Protection of the chariot crew was a concern. In this case the technology seems to be scale armor.

Fundamentally, the chariot became the dominant land arm because it was the most effective combat system on the battlefield. We recognize this from historical accounts. This means that it had to be highly effective against infantry while the infantry could not be as effective against it. It also had to have some degree of effectiveness against its own kind.

The effectiveness of the chariot was largely a matter of its mobility. Even lacking an effective horse collar that would permit the horse to pull without constricting its windpipe

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[93] This problem is not unique to pre-history. The American Army had this problem during the nineteenth century when it used the common practice of selecting cavalrymen based on their lack of height and weight.

[94] The physics of the draft versus carrying animal is simple. The carrying anomal has to bear the entire weight of the rider and his gear. The draft animal has to bear only the weight of harness but has to pull the conveyance. That pull is equal to the weight of the conveyance and contents times the coefficient of friction. The trade-off is then direct from a physics if not a physiological standpoint.

[95] This combination is what differentiates the chariot from the Sumerian war wagon - lighter bodywork and wheels, and better coupling of body and propulsion. The Sumerian bow was also considerably simpler.

(this is not a problem with oxen,) the chariot could move faster than an infantryman and considerably faster in bursts.

While there is some evidence that the chariot weapon was the thrown spear or javelin, the predominant weapon seems to have been the bow and arrow. Since throwing a javelin or firing a bow from a jouncing chariot is difficult, we may postulate that the chariot was most effective against a large, dense, unarmored target, and we may therefore postulate that the infantry of the period was described by those terms. Even if arrayed in a relatively loose formation, that formation would still have been dense. and large. Armor may have been largely a helmet and a hide or wicker shield that would not be much protection from an arrow at fairly long range. Real bronze armor was expensive and may thus have been reserved for chariot troops, giving them immunity to infantry archery.

Of course, the trick was to keep the range of chariot to target array in the right region - short enough to be effective but long enough that the infantry formation could not engage effectively. This would indicate that the chariots operated either by driving past the infantry formation in a racetrack fashion with those adjacent to the infantry firing into its bulk, or by coming to rest until the target closed enough for them to dash away.

The latter tactic would not be practicable against other chariots so the former could have been the style used. The descriptions of period battles [Watkins 1989] indicate a melee of two chariot forces charging past each other. Arrows were shot at enemy chariots as they rushed past. Of course, one can postulate that javelins - thrown spears - could also be used in this type of combat.

One has to wonder just how effective either of these types of combat would be. In engaging infantry, and if the chariot force were relatively invulnerable to infantry fire, then over time some attritional effect could have occurred. It is difficult to see how there could be any shock effect. The chariot on chariot interpenetrating charge is more problematic. It is considerably easier to hit a large stationary target than a small moving target. Neglecting crashes, one has to wonder just how effective chariots were against each other. In fact, if chariots were not so expensive, crashing might seem a better tactic for the stronger (more numerous) side.

This discussion is admittedly constructed. History relates that the chariot became the predominant land system. This could only have occurred if it exploited weaknesses in the other systems, notably the infantry.

Bronze to Iron

The same is true of the removal of the chariot from its role of primacy. The chariot could only be degraded if some other system exploited its weaknesses. This is commonly associated with the catastrophe that swept Eastern Mediterranean civilization between 1300 and 1200 BCE.

During this period, civilization in the lands of the Eastern Mediterranean - Egypt, Mesopotamia, Anatolia, Crete, Cyprus, and Greece - were dealt a severe blow. Mycenaean Greece was largely destroyed with many palaces destroyed, sacked, and/or burned, as were the cities on Cyprus. Many Mesopotamian cities were similarly hit, including Ugarit and Kadish. The Hittite Empire disappeared during this period. Cretan civilization was changed from an empire to a defensive homeland. Egypt avoided much of the destruction but entered a period of decline that left it ripe for a series of foreign conquests.

This catastrophe has been attributed to a number of things. Plague and famine are two such. Military action is a third. The destruction of the Mesopotamian and Anatolian cities along the coast have been attributed to a mysterious Sea Peoples' military actions. [Drews 1993] Egyptian history records a considerable war with the Libyans and these Sea Peoples. While Egypt triumphed, their place as superpower seems to have rapidly eroded in the aftermath.

Who and what the Sea Peoples were is not clear. The classical picture of them is a migrating people displaced by catastrophe. Drews argues this to be inconsistent with the destruction - migrating peoples will not be cutting edge warriors but refugees burdened with noncombatants. [Drews 1993] Regardless of whether the catastrophe was due to famine, or disease, or military action, or a combination, one of the results of this catastrophe was a major change in the nature of military affairs.

Principally, the chariot loses its predominance and begins to regress into again being a battle taxi and/or reconnaissance asset. Man on horseback cavalry emerges and begins to replace chariots, but does not take on a universally predominant role until the introduction of the stirrup. Infantry again becomes the arm of decision..

How did this come about? It certainly did not occur overnight. Indeed, the Assyrians, whose empire is commonly dated from about 1100 BCE and extended to about 600 BCE, are supposedly primarily a chariot army although they do have an extensive component of armored infantry armed with bows and protected by large shields. Indeed, the latter seem the model for the later Persian army that would repeatedly have its teeth broken by

Greek and Macedonian forces.

The Egyptian accounts of battle with the Sea People and Libyans indicate more widespread use of infantry than was their want to this time. Of course, if the Sea Peoples really were traveling about on ships, then they would likely not be carrying about lots of chariots and horses. Further, marine soldiers usually do not use armor by choice since it tends to assure that every man wounded and overboard is a kill, and they tend to use what are today considered to be melee or swarming tactics. (The use of formation in marine combat is attributed to the Romans in their Punic Wars.) If this were the case, the Egyptian chariots would not be as effective given the Sea Peoples' tactics of closing in on the chariots and not bunching up to present a large target.

If the chariot rose to primacy because of infantry's inability to cope with it as we projected earlier, then all that is necessary for it to fall is for infantry to find a way to cope. Because chariots are expensive it is not necessary to destroy them on the battlefield, All that is necessary is that they be rendered ineffective.

There are two obvious ways to achieve this. First, one may restrict the mobility of the chariots. This can be done by selecting the right terrain for battle. Chariots perform well on open terrain but poorly on closed terrain. Sadly this restriction is not always possible in the areas where chariots were commonly used.

An alternative way to restrict the mobility is indicated by Jones' Force to Space Theory. [Jones 1987] In terms of this theory, the chariot is a raiding system. Thus, it can be confronted by a persisting system, in this case, infantry. If one deploys more infantry on the battlefield and keeps them dispersed and moving, then the effectiveness of chariots is reduced by being unable to move about. This is close to the solution offered by Drews who also argues a lethality effectiveness on the part of the infantry. [Drews 1993]

The second way to render chariots ineffective is to reduce their force capacity. Chariots have force effectiveness against unarmored, densely packed infantry. This force capacity may be decreased by either armoring the infantry or by dispersing them. The latter is part of the first approach, the former compromises the chariots using conventional Bronze Age technology. This technology was the scale armor already mentioned in regard to the chariot crew.

This change from chariot dominance to infantry dominance occurred at the transition from the Bronze to the Iron Age. This period is characterized by two major advances in military manufacturing: the sword [Drews 1993] and mail armor. [Watkins 1989] The

latter, coupled with a shield, a helmet, and greaves vastly reduces the vulnerability of infantry to arrows. The former provides both a thrusting and a slashing capacity, not previously available to infantry in a single weapon.[96] The sword also requires more space to use, forcing infantry to a more open order.

There is also some indication of the wide spread adoption of either the thrown spear - javelin - or the bow. In combination, mail armor, sword, and projectile weapon are likely enough to reverse the effectiveness of the chariot over infantry by a combination of the two approaches or reducing its mobility and lethality.

The chariot did not disappear instantly but, except among the Assyrians, it would never again hold sway the way it had at the end of the Bronze Age. Increasingly, cavalry would move to the cheaper alternative of mounting two men on two horses, one to guide and the other to fire a bow. This is nothing more than the effect of the chariot with the chariot removed but indicates that horse breeding had advanced to the point where a rider could be borne long enough. Eventually this pairing would be broken with both riders being bow shooters (or lancers).

Nonetheless, whether chariot, man on horseback, or man on elephant, cavalry would be secondary to infantry for an extended period (except for brief periods.) This return would partly result from technology, partly from decay.

Infantry Evolves

The period from about 1200 BCE to 500 CE was characterized largely by the battlefield dominance of infantry. There were exceptions, largely on the steppes and the deserts where the horse nomads were developing, but by and large much of this period was one of infantry.

We have already discussed the possible means by which infantry was able to compromise the effectiveness of the chariot. Indeed, while the chariot remained in force structures it no longer held pride of first place. That place would be held by infantry whose only challenge would be the elephant.

As already indicated, [Drews 1993] the early years of the Iron Age were characterized by the collapse or retreat of the late Bronze Age governments. In this period robust, young political organizations emerged built on the rebirth of the common soldier-warrior. This

[96] The Egyptians had been using the sickle sword for some time. While technically a slashing weapon it was quite short, about half the length of the Naue sword.

rebirth may be fairly directly traced to the technology of iron.

As we have also previously discussed, the manufacture of bronze is a matter of mining two metal ores that are usually not located near each other, refining those ores, and bringing the two metals together for alloying and working. This is a complicated and expensive process that taxes a near subsistence agricultural economy cruelly and limits bronze to the higher ranks. It may also incidentally prevent improvement of the subsistence agriculture, further limiting expansion.

Iron is not like this. It is widely available and, compared to copper, easy to work with, although somewhat complex to alloy. Nonetheless, tempered iron is considerably "stronger" than bronze and considerably cheaper.

The effect of this reduction in manufacturing cost was what might be considered a consumer revolution. Certainly, the introduction of effective iron manufacture democratized metal. Where the bronze smith worked for the king or his noble bureaucracy, the iron smith became a pillar of the community. Instead of requiring a patron or considerable capital to go into the smith business, now only a modest investment was needed.

From this outpouring of iron manufactury came a change in the nature of the social organization and thence a series of profound changes in the military. The obvious materiel changes were iron weapons (including what might be considered true swords,) and iron armor. This panoply was not restricted to the ruling ranks but were available to members of what we might consider the middle class (if we use the term somewhat loosely.) With the introduction of iron, military forces once more became large. This increase in the size of military forces was abetted by the agricultural advantages of iron plows and other implements.

The organizational changes are first most obvious in the Assyrians, who survived the collapse of the Bronze Age largely unscathed and capitalized on the misfortunes of their neighbors. The period of Assyrian empire stretched from about 1000 BCE to about 612 BCE (when Ninevah fell.) [Wiseman 1989]

Notable about the Assyrians' army was ascribed rank, standardized units and equipment (to some extent already introduced by the Sumerians, [Hawkes 1973] [Saggs 1989] but evidently somewhat corrupted over the years,) and most democratic, promotion based on ability and not family. These refinements are why McNeill [McNeill 1982, pp. 13-14.] graces them with the name Army. The combat force structure was a mixture of chariots, horse cavalry armed with lances, and infantry. The latter seems to have been

largely comprised of paired archers and shield carriers.

The Assyrians were followed closely by the Greeks (circa 650 BCE to about 338 BCE Chaeronea) [Lazenby 1989] and the Macedonians (about 356 BCE to about 197 BCE). The Greeks are noted for armies of light infantry, light cavalry, and centrally, heavy infantry, the latter formed into the phalanx. The distinction between the Sumerian and Greek phalanxes is not clear because of the lack of information on the Sumerian phalanx. Certainly, the Greeks enjoyed iron technology, and their phalanx engagements were characterized by what we might call the "push of war".

The Greeks are credited with the invention of strategy and tactics [Hanson 2003] and they also developed a reasonable naval capability. As a result, they were able to stop two Persian (circa 500 BCE to about 333 BCE) invasions with army victories at Marathon (490 BCE) and Thermopylae (480 BCE), the latter cemented by the naval victory at Salamis and the army victory at Platea, both in 481 BCE.

The Persian force structure was almost the opposite of the Greeks', reflecting their different environment, no heavy infantry but considerable light cavalry and infantry. [Sekunda 1989] These were fairly ideal for their relatively open terrain (except for the mountain tribes/chiefdoms/ministates that were apparently largely successful in opposing them and plagued the Macedonians under Alexander.) These forces did not do so well in the intermediate terrain of Greece where they were generally bettered by the phalanx. This upset may be evidence of the weakness of a given force structure out of its environment although Hanson attributes it to the freer character of Greek citizen over Persian subject. [Hanson 2002]

The Greek structural model was extended by Philip of Macedon. [Devine 1989] He increased the length of the phalangite's *sarissa* (spear) from two to over three meters, converting the phalanx from an attrition (erosive) to an annihilation (destruction) weapon system, [Delbruck 1985, pp. 108-109.] and enhanced the light cavalry and infantry to form a more balanced combined arms force.

This force proved capable not only of defeating the Greeks at Chaeronea but of conquering the Persian empire, despite their force augmentation with Greek heavy infantry mercenaries. That force was, of course, commanded by Philip's son Alexander.

The Macedonians were followed by the Romans (circa 500 BCE to about 500 CE) who are notable for their ability to make significant organizational changes at least three times (Latin League pre-legion army, consular legion, Marian legion, and Augustian legion)

during this period, and the evolution from mercenary cavalry auxiliaries to a regular cavalry army (Augustian army) to a cavalry based army. [Connolly 1989] [Keppie 1989] [Dobson 1989] [Tomlin 1989]

Materially, the Romans initially combined missile and shock weapons: the *pilum*, a special javelin with a half length soft iron that was intended to penetrate and bend on impact making an enemy's shield inoperable; and the *gladius*, a short sword designed for hacking and stabbing. The Romans reinvented armor.

While the original Greek heavy infantry, probably based on Argive developments, had a panoply of helmet, back and breast plates, greaves, and a shield, the light infantry and cavalry generally had little or no body armor as such, perhaps a leather jerkin or the like, and perhaps a helmet. [Warry 1980] By the ascendancy of the Macedonians in 338 BCE with their victory at Chaeronea, the heavy infantry had been down armored to a linen body protector and up armed to a longer (~3 m) spear. The armor of the light infantry and cavalry had been slightly increased, reflecting their more balanced role in the Macedonian combined arms force.

This see-saw with armor is one of the patterns of military history.

The Roman's armor was initially the same as the Classical Greek's, [Gabriel Boose 1994, p. 293.] but evolved to a cylindrical shield (which could be used to form their impressive *testudio* formation) and a plate based corselet. Apparently the greaves were discarded.

The reason for this evolution, and the reason for the Romans' successes, was the legion, which as we have indicated evolved over time to meet the demands of military effectiveness and political expediency. Just as the *pilum* and *gladius* gave the Roman soldier both missile and shock weapons, the legion found a series of balances between order and freedom. This balance resulted in a rare military combination of efficiency and effectiveness, and notably, meant that the legion could not only adapt to battlefield conditions but disengage and withdraw. This was not possible with the phalanx and may be considered revolutionary. [Gabriel Boose 1994, p. 296.] This success was possible because of the inherent flexibility of the legion as a military organization, unlike the phalanx. Interestingly, both were re-engineered repeatedly, retaining the same name with different structures. Fundamentally however, the legion was a more robust organization than the phalanx.

The Romans also retained the light infantry and cavalry on the Greek model. The latter were often mercenaries or allied troops. The Romans early adopted a professional

service for the enlisted ranks, but the officer corps was largely drawn from the plebians on a political basis. This latter makes Roman success all the more impressive given their ability to win even under the command of political appointees and shine under the occasional gifted commander such as Gaius Julius Caesar.

This ability is amply demonstrated at the battle of Cynoscephalae (197 BCE) where the Roman legion retired the Macedonian phalanx. Admittedly, by this time the Macedonian phalanx had degenerated into a very specialized instrument. The spear had grown to a length of about 4 m, and armor now just a helmet and shield. [Gabriel Boose 1994, p. 327.]

Unfortunately, the phalanx was also now even less responsive and adaptable than the Classic Greek phalanx. As a result, it fell to the flanking capability of the Roman legion. In general the flexibility of the legion stood the Romans in good stead so long as they could use the flexibility. When they lost their mobility (Teutoburg Forrest 9 CE [Gabriel Boose 1994, pp. 397-428.]) or didn't have enough mobility (Carrhae 53 BCE [Gabriel Boose 1994, p. 330.] [Watkins 1989, pp. 156-7.]), they did not always perform well.

Cavalry Returns

Over time, the technology (and manufactory[97]) of horse breeding was worked out and horses that could be ridden for a long period, even in armor, emerged in number. In this environment the horse nomads of steppe, plain, and desert develop, in some cases even encroaching on farmland. In the open spaces, the lack of stability before the saddle and stirrup were developed is less important than the mobility.

Nonetheless, it is not obvious nor evidenced that the nomads developed the rideable horse. [McNeill 1982] A somewhat more supportable model would be its development in the agricultural state environment as a evolutionary improvement of a military and/or luxury commodity. The common use of both chariots and ridden horses for hunting and warfare, even after the transition from Bronze to Iron Age, would generate a market for faster, stronger, more robust horses that could be developed through artificial selection. As such, these improved horses could be acquired by nomads through trade, petty theft, or even raiding, then multiply and adapt to the open, nomadic environment. A similar

[97] The historian James Burke has noted (on television) a tendency to confuse technology as science and manufacturing as technology. The capability to breed a horse of particular characteristics is technology; the capability to produce many horses with those charateristics is manufacturing.

model can be proposed for the camel.

The return of cavalry is difficult to see as a revolution. It is simply too diffuse in time. Further, it may be seen more as a devolution of the Roman army in dealing with nomads than an evolution. Following the defeat in the Teutoburg Forest, Rome was increasingly beset by "barbarian" invasions and incursions, some direct and some derivative. Some of these invading/incurring peoples were horse nomads (like the Huns,) but others used infantry or dragoon forces. Nonetheless, the Roman army, traditionally weak in cavalry, adapted to this by increasing its proportion of cavalry and using elements and individuals of these peoples in the army. (The economic evolution of the Roman Empire had created a recruitment problem. [Ferrill 1986])

By 378 CE, with the battle of Adrianople (one of fifteen recorded,) [Gabriel Boose 1994, pp. 429-60.] the two arms (infantry and cavalry) seemed to be relatively balanced although the infantry had become unarmored while the cavalry had become armored, a reverse of earlier practice. The *pilum* and *gladius* had been replaced with a stabbing spear and a slashing sword, also a reversal. This reversal supposedly reflecting a shift in primacy from infantry to cavalry. Notably, the saddle had been invented/developed but not the stirrup, and reportedly only the Goths had the saddle.

The Goths, the other side in this battle were similarly comprised and equipped, although encumbered with the baggage of a migrating people. In the battle, the Romans made more errors than the Goths and were soundly defeated with great losses. In this we cannot avoid recalling the inherent politicization of the Roman officer corps and the Maslow's Hierarchy differences of the two sides.

The battle of Adrianople is noteworthy for what it was and was not. It was the first time a Roman army would be soundly defeated by encroaching "barbarians". In the aftermath of this battle, the "barbarianization" of the Roman army accelerated, possibly changing from diffusion to direct imitation.[98] It was not a phase change from infantry to cavalry, both forces in the battle being approximately balanced and similarly composed, but it did confirm the value of a more evenly balanced force.

Also notable in this process was the battle of Chalons, (451 CE [Ferrill 1986]) where the Huns were defeated, ending a devastating raiding campaign. Again, both forces were comprised of both infantry and cavalry. Indeed, both forces were coalitions with the Roman forces in the minority on their own side. Further, the Roman infantry, while still

[98] See [Goldman Eliason 2003] for a discussion of military diffusion and our earlier presentation for military imitation.

organized in the old soldierly form, fought in the "barbarian: warrior form because of lack of training and discipline order.

The impact of this battle is that it was the last Roman victory, at least in the West. By 500 CE, the Western Roman Empire had collapsed, replaced by "barbarian" states (some of which appear to have been chiefdoms,) who dueled with each other, the Eastern Roman Empire, and the rapidly developing Muslim military theocracy.

The forces of the Eastern Empire continued the shift to a cavalry focus, if not dominance, to contend more symmetrically with the light cavalry dominated Muslim forces. [Kennedy 2002] Nonetheless, a considerable infantry component was retained and effectively employed. It is this type of force buttressed by Western democratic individualism that is cited as turning the tide of Muslim expansionism in the West at the battle of Poitiers (732 CE).[99] [Hanson 2002] The story in the East is, of course, much different.

The final dominance of horse cavalry does not occur until later, after the "barbarian" states have evolved into what might be considered to be feudal states by the social-political evolution of the *precarium* into the *benefice* into the hereditary fief. In this process of formalization the vaunted democratic individualism was reduced into serfdom.

Do we have a revolution here? The answer is maybe. To expand this we need to go into a bit of analysis and exercise a bit of speculation.

The first question we have to address is what is the root of the shift from infantry to cavalry? The answer seems to be the development (by breeding) of the robust horse, which in turn led to the development of the horse nomad societies. The geo-environmental conditions of the Eurasian steppe [McNeill 1982, pp. 17-18.] then drive the rapid diffusion of this first piece of technology. This diffusion can be explained largely on the basis of the benefits of mobility and transportation with the military aspects evolving from the introduction of this new technological capacity to existing military practice.

Sometime in the third century CE, the saddle is invented, possibly out on the steppe. While the stirrup is still some years in the future, the advance of the saddle over the simple riding pad is significant. Estimates by contemporary soldiers who are also equestrians give the saddle 70-85% of the military benefit of stability of the saddle and stirrups. This means a considerable increase in the fighting capacity of the mounted soldier-warrior, and may explain some of the Goth's success at Adrianople, [Gabriel Boose 1994,

[99] Full stemming (?) took until 759 CE even with the innovative capabilities of Charles Martel's mobile forces. [Beeler 1971, p. 13.]

pp/ 429-60.] over and above Roman mistakes, since the Goths had saddles and the Romans did not.

This improvement offered by the saddle accelerates the shift in military demographic but after the fall of the Western Roman Empire, this trend is reversed by the combination of organization disruption and economic depression. [Beeler 1971] The successor top level organizations that geographically replace the Western Empire are less complex than the empire in terms of both governance and militaria. Simply put, the "barbarian" states fostered less trade, collected fewer taxes, provided fewer services, and were more warrior than soldier oriented. With the individual rather than the organization providing military equipment and less money in circulation, there are fewer horse warriors than before. Some horse warrior concentration may occur in mercenary and professional organizations distanced from the general populace. The bulk of the force is militia, citizen-warriors, however.

The directed solution to the economic problem, the hereditary fief, comes either after (early sixth century [McNeill 1982]) or upon (early eighth century [Gabriel Boose 1994]) the development of the fief. Coupled with the obvious desire of the fief holder to secure his position by disarming his (now) serfs, the move to cavalry as the dominant arm is now complete.

In effect, what one now has is a ruling class who are professional horse warriors, equipped with a big horse, saddle with stirrups, armor, sword, and lance. For a while in some places the bow and arrow was a requirement but this evidently soon faded away.

Since the *quid pro quo* of the fiefdom was military service, the fief holder and his few troops had to maintain a training regime. Money was still in short supply. normally the compensatory military service included full equippage and partial to total logistic support.

The workers of the fief, the serfs who might rebel at any time, were, for this reason, essentially not armed. Adzes and hoes are not good weapons to confront an armored horse warrior.

It is also somewhat unfair to dwell too much on the adversarial relation here. There were good reasons for the local organization. Many areas were threatened by foreign expansionism. We have already mentioned the competition with militaristic Muslim evangelism. There were also incursions by horse nomads, sea raiders, and even marauding mercenary bands.

Money was not only in short supply, but may have been viewed as a solution that had already failed. As a result the drive for sustainment communities that could protect themselves and contribute to the state's existence was fairly natural. As a result, there was a balancing motivation for the worker to labor and contribute up to half of the fruits of his labor to the local organization and for the fief holder to trust the worker. Enlightened self-interest is not new.

Absence of an effective medium of resource exchange and efficient transportation meant that each local organization had to be highly self-sufficient. This was far from an ideal situation. Bulk goods could not be transported easily nor fast. Food, the major commodity, was not a good trade item because of wastage due to rot and overhead. However, some commodity or product of value was necessary to acquire survival necessities, such as the horses and armor for the fief holder and his cadre.

Also, because of the localization, military organization was necessarily simplistic, essentially militaristic. Local military organization was inherent to the social structure of the fief - one or a few on horseback leading a pick-up collection of farmers and a few craftsmen. This type of organization naturally gets led into primarily defensive thinking and action. (Witness the centrality of the castle.)

The situation at state level is at least as bad, if not worse. The fief holders cannot be away from their fiefs for very long, nor leave then unprotected. They are effectively forced to divide their local forces into those who stay home and those who go to war. There is little time for training, and doctrinal challenges are fundamental, in particular, concentration. How does one concentrate the professional cavalry and the irregular infantry? The army is not much more than a collection of intermixed (poorly) armed mobs.

This lack of organization is demonstrated by the structure of the First Crusade (1098-99 CE.) The crusader army was commanded by the Bishop of Le Puy, probably because only the Catholic Church could exercise even a modicum of control over the different military components of the "alliance". This difficulty is repeatedly displayed in later crusades, some of which were abysmal failures, where unity of command was fictional at best (which illustrates that government and military "official" prevarication is not new.)

This also demonstrates an aspect of the period that we have not considered - the church. It has been said that there were three types of people (in Europe) in this period: those who labored; those who fought; and those who prayed. [Montgomery 2000] In the period of the decline of the Roman Empire the Catholic Church had risen to become the

state religion of the Empire and thence transcended the replacement states.

The growing power of the church and its influence in military matters is illustrated by the Huns being dissuaded from sacking Rome in 452 CE (following their defeat at Chalons in 451 CE) by the intercession of Pope Leo. When the government organization of the Western Empire collapsed about 500 CE, the Catholic Church was the only major organization remaining. Its trans-state nature and on-going evangelistic growth provided a basis of stability for the redevelopment of civilization.

In addition to providing a common moral and morale message that facilitated this recovery by promising that suffering to rebuild would be rewarded after death, the church also provided a means of communication. Education and learning were largely concentrated in the church, whose maintenance of Latin in ritual and trans-Europe pervasiveness provided a network that linked the new nation states.

Recovery and the Return of Infantry

Given survival, over time the system outgrows itself. As the incursions are met and bested, as legalistic regularity is established, the conflicts move afield. As a result, the quality of the local militia may decline as they experience less survival stress to hone their military skills. Further, too much of the military service time may be consumed by just getting to the area of operations.

The first tends to evolve the fief away for a self-protection community and the fief holder from a governor-warrior to mostly a governor. The second militates for a force that can stay in the field longer. As a result, the fief shifts to bases of compensation in specie rather than service, and the state military to a more professional or mercenary composition.

This in turn means that the fiefdom must have some means of generating revenue.

Abhorrence of Money

It must be understood that the Middle Ages were a period of absence of professions. That is, we have some people, at least the fighters, the prayers, and some of the laborers who are pursuing their hobbies as occupations, at least part of the time, but in the main they are not getting paid for this because there isn't much money in circulation. Instead, the chief fighters have fiefs, essentially grants of land that they may use to draw their

survival from. The other fighters and the laborers operate as members of this survival organization, contributing their efforts to the organization in return for food, shelter, etc. What little money there is is used to buy the necessities the organization can't produce.

The church system is pretty much the same except that their disposable resources are devoted to supporting the needs of the prayers, who are also providing protection, in this case, from the wrath of God.

In this type of environment, competence is pretty easy to define. If the organization survives, then you are competent. If not, you (and your fellow members of the organization) weren't. The focus is almost entirely on the local level, largely because this organization has to be kept simple just to survive.

That doesn't mean that money wasn't around, just that it was in short supply and what money there was, was being spent on survival necessities such as fighters' equipment and prayers, both necessities of survival.

Once the local organizations had mover up Maslow's hierarchy however, this all changed. Increasingly the dominant scale was wider than the local organization and the fief system was not supporting the needs of the state. increasingly a level of complexity was needed that could not be satisfied by the original simplicity of the fief. Money was needed and that need required better transportation and commerce. As a result, competence began to be redefined.

One of the recurring themes of military history is the emergence of a dominating military system from outside the main stream. We have already seen this in history and in the nature of military revolutions. The latter are restrictive in how the system may be initiated and diffused.

We have seen how the Sumerians' invention of army by adapting water management was one such. The armor invention of the Iron Age led to the development of Sparta, which defined the shape of Greek warfare, which derailed Persian encroachment into Europe.

The challenge to the dominance of heavy cavalry actually arose in three different venues.

The first challenge arose in the forest cantons of Switzerland. The weapon was the halberd (later the pike) and the military organization was essentially a reinvention of the Macedonian phalanx with enough modification to provide a degree of flexibility to reduce flank vulnerability. Notably, this approach was initially proven at the battles of Mortgarten (1315 CE), Laupen (1339 CE), and Sempach (1386 CE.) [Gabriel Boose 1994,

pp. 611-642.]

The second challenge arose on the greensward of England. The weapons were the yew long bow, the clothyard arrow, and the impaling spike. The military organization was a combined arms force of professional (often mercenary) heavy cavalry and medium infantry armed with long bow and sword. The intensive practice necessary for basic competency with the long bow assured a disciplined force. The capabilities of this force were demonstrated at the battles of Crecy (1346 CE) and Agincourt (1415 CE.)

While the combined arms aspects of the English force had an abiding influence, the long bow did not. The personal discipline that made the English archer a good soldier also assured that the weapon could not be exported. Instead, the infantry that developed looked more like the phalanx of the Swiss pikemen than the line of the English archer, at least for a while.

This brings us to the third challenge. At the battle of Sudomer, heavy cavalry was defeated by a mixture of infantry and mobile artillery. This victory foreshadows the gunpowder revolution, bringing us back to where we started with military revolutions.

One frequently wonders at the evolution leading up to this revolution. Why the firearm? The answer is training. As we have noted, years of practice are needed to produce a long bow archer. Long training is also needed for a phalanx pikeman to assure commonality of movement and the mutual trust necessary for combat effectiveness. The firearm requires less training than either and the formation, being much looser than the phalanx, requires less coordination and trust.

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12 Environment

War, presuming it to be a readily observable state with definable boundaries, should be consistent regardless of the environment that the war is prosecuted in. This means that at its fundamental, even formal, level, war will be the same regardless of whether it is fought (e.g.,) on the land, at sea, or in the air or space. Regardless of environment, war is fought to force our will upon our enemy.

That will, of course, takes its form from the extension of the organization, as an extension of policy by other means. The form that will takes, and indeed the nature of the extension of policy, will depend on the characteristics of the environment. In this sense, warfare will take forms that depend on or reflect the environment of the war. It is in this sense then that war varies with environment.

Environment shapes warfare in two contexts, which are not independent. The first way, which is direct, is that the nature of the environment sets the conditions under which war may be prosecuted. The second, which is indirect, but is often the stronger, is that the environment has shaped and defined the culture of the occupants of the environment.

As we have previously indicated, culture is at least partly a set of shared rules of the members of an organization whose purpose is to assure or enhance the survival of those people and thereby, the organization. [Haviland 1997] The folks who dwell in an environment, by the nature of this definition, will be a culture (or subculture,) and have a set of rules that they observe for survival reasons. Thus, not only will the rules derive from the nature of the environment, but the rules will be followed from the standpoint of at least the lowest level of Maslow's Hierarchy. [Drucker 1974] As such, observance of these rules at this hierarchical level will be of the most fundamental nature, little different from instinct, and thus open to cognitive exploitation by a wily commander. [Clausewitz 1976] Regardless, the existence of this culture places boundaries on the nature of warfare in that environment.

Further, we also have the intersection of two suborganizations, or cultures here. First, we have the suborganization and culture of those who fight, whether warrior or soldier.

The differences between these two fighter types, and their combination in actuality, are influenced by environment. Secondly however, we have the suborganization and culture of the environment. Thus, we have the admixture of the environmental culture and the fighting culture.

To this point, we have not drawn this distinction, merely alluding to the existence and importance of other subcultures and suborganizations. As we consider different environments in greater detail however, we must now acknowledge distinction in greater depth. This depth is significant. In modern usage, stretching back to classical historical times, and presumably earlier, distinction has been drawn between those who fight upon the land, soldiers, and those who fight upon the sea, sailors. Indeed, so compelling is the latter environment, that sailor is commonly a term applied to those who make their lives upon the sea and not just those who both fight and live asea.[100]

This situation does not exist with respect to those who fly through the air and fight, commonly called airmen as opposed to aviators. Space is yet so new to military activity, and still so filled with political rhetoric to avoid its military use, that there is no term (in American English) for a space fighter, nor is there one, for example, for a fighter of economic warfare.

Ends, Ways, and Means

In considering the detailed impacts of environment on warfare, it is useful to employ a model (or models) that permit at least a taxonomic discussion and differentiation. We have already discussed Jones' Force to Space Ratio model. [Jones 1987] It is also useful to include Arthur Lykke's Ends, Ways, Means model in our toolkit.[101] [Lykke 1993]

In this model, one has ends that one wants to accomplish. These may be thought of as objectives or even missions. (Imposing one's will on the enemy is an end!) One has means, forces in the purely military context, that one may use to obtain ends. Finally, the means may be used in different ways to obtain the ends.

These must be balanced. If one has no end, then nothing one does with one's forces

[100] The term for a sea soldier, as opposed to a sea fighter, is a marine. These are notable since they are the product of the confluence of three, rather than two, subcultures.

[101] The Ends, Ways, Means model is amenable to mathematical representation, although mathematics is not part of this book. This representation was the subject of my writing project, essentially thesis, when I was a student at the Army War College. COL (Ret.) Lykke then held the Chair of Strategy and was my advisor. The fact that he abided a mathematic effort, the first at the Army War College, is testimony to his vision and greatness.

can have effect. Similarly, one may have inadequate means, or use them in ineffective ways. Because these must be balanced, Lykke's metaphor for the model is a three legged stool, which can only be stable, if sat upon, if the three legs - ends, ways, means - are balanced.[102]

Land

We start our discussion by considering the land environment. Man is a land animal, beginning his military activities on the land. In this regard, we may identify two basic environmental aspects of the land environment: terrain and weather.

Terrain tends to be the primary of these two. The nature of the land has a defining influence on primitive combat and thereby war. Indeed, it is an old adage that infantry (foot soldiers) must first fight and overcome the terrain before they can fight their enemy. Certainly, the progress of military science and art has been to overcome the constraint of environment on combat.

On land, weather tends to be secondary in the sense that it retards activity. Of course, this retardation may completely stop activity. Additionally, weather and military activity may combine to accentuate or intensify retardation. For example, spring rains often cause ground to soften, retarding motion. Military movement during such periods may be largely self-defeating, churning roads and paths that would be merely degraded under usual traffic conditions to quagmires under the high density of military operations.

Further, as we have indicated, the local culture of the occupants is important, perhaps crucial. In particular, the culture has developed rules of productive and unproductive behaviors and activities that are in the first case, expected, and in the second, restricted. For a primitive society, these will tend to define periods crucial for the production of food (or other essential products,) or when physical survival mandates particular behavior. These periods are militarily crucial because they constitute fragilities.

Survival being fundamental to these periods, military activity cannot be undertaken because either those who would serve as soldiers cannot because they must be occupied in the production of food (or other product,) or the force would be placed at excessive risk of loss to the vagaries of weather. By this exclusion however, a fragility arises making the locality/organization extremely susceptible to military activity. In the first case, with

[102] I once referred to this as a milking stool because, in my experience, only milking stools were three legged. COL Lykke took considerable exception to this and I have been careful, until now, not to mention milking stools and strategic models.

the would-be soldiers occupied in survival activities, military activity against them is doubly effective. Not only are the would-be soldiers not available to fight, but any killed or wounded in fighting cannot produce survival essential commodities, thus reducing or even compromising the survival capacity of the organization. In the second case, military activity during a period when such activity is "impossible" enjoys the element of surprise.

To see this impact of environment on the nature of warfare, we return once more to Hanson's model of combat variation with terrain: [Hanson 2001, pp. 158-9.]

> "the best infantrymen were rooted country folk and the product of a geography largely composed of valleys and lowlands situated between mountain ranges that favored intensive farming. In contrast, mountainous terrain is the haunt of herdsmen, who with slings, bows, and javelins master the arts of ambush and guarding routes of transit(..) On the other hand, steppes or uninterrupted plains favor nomadic and tribal horsemen, ensuring plentiful grazing lands and, more important, the room for vast cavalry sweeps that might outflank and envelop columns of foot soldiers(..)"

It is clear from this presentation that the key feature here is the tightness of the terrain, progressing from high frequency of variation - the mountains - to essentially zero frequency of variation - the plains. It is also clear that at least a factor here is how this variation constrains the battle space.

Mountains

In the mountains, level ground is rare and approximations to this tend to be used either for cultivation or transportation. Even then, land that can be cultivated is often small and rocky. Avenues of motion tend to be constrained to paths and passes, and these also frequently tend to be constrained. Further, summer tends to be short, and winter long, at least compared to lower elevations. This makes for a short growing season on small fields.

Because of this, farmers are inherently less productive. We may project that herding is often a more productive food production activity. Because food, even with the relative efficiency of herding, is in short supply, only a small population can be supported. As a result, we may also project that harvest time is a period of intense activity when crops are gathered and stored for the long winter, and either fodder is laid up for herd animals, or the animals are slaughtered, or both. This period then would be one when military activity would not be possible because of work load.

Herders tend to arm themselves with weapons to protect their herds from predators. Because the herd will occupy a large area, a premium is placed on projectile weapons that can deliver traumatic momentum at a distance: slings, bows, and thrown spears. As we have previously advanced, these will tend to be the weapons used in combat.

Combat styles tend to develop symmetrically, as we have previously advanced. We may take advantage of this in the analysis at hand. In considering combat in a mountainous environment (or any environment,) we may concentrate on symmetric combat.

We may consider that a decisive end is desired of any combat.[103] At the highest level, this end will be the imposition of will, but at a lower level, the end will likely be some objective that is perceived to contribute to imposition. Because food is at a premium in the mountainous environment, we may project that the disruption or compromise of the food supply is a subordinate end of this type.

The means that are available for military action are likely to be few in number because the population is restricted in size by the paucity of the food supply. The ways this force may be used can be described using Jones' Force to Space Ratio (FSR) Theory. The small size of the military would indicate a low FSR, which in turn would indicate that raiding would be more successful than persisting. The constraints of terrain further favor the defensive, making persisting military action undesirable.[104] Given that food is in short supply, we then also expect combat to be avoided in favor of taking action against logistics. Thus, we expect the favored way to be logistics raiding, which leads us to ambushes.

Steppes and Plains

A similar situation arises in very open terrain. These environments do not lend themselves to agriculture. In many cases, crops cannot be raised at all, or the land is sufficiently weak in ground water or nutrients that it becomes quickly wasted. In other cases, simple agriculture is not possible, requiring elaborate farming tools such as were necessary on the North American Plains. As a result, people can only subsist in these environments by herding. At this point the similarity falls apart because the terrain is open.

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[103] This is not strictly so. There are some combats one is willling to draw. We shall deal with the distinctions of strategy and tactics in a later chapter.

[104] In effect, where the terrain is very constrained, a small force can obtain a high FSR, thus making persisting action profitable. Because these constrained terrains are localized, the persisting force must be localized as well, leading to the defensive preference.

If the vegetation is sparse, then a given area of ground will support fewer animals. However, the openness of the terrain does not mean that the herders need to be sedentary like the mountain herders. Because the terrain is open, and regardless of the sparseness of the vegetation, a nomadic life style not only permits herding, but herding on a larger scale than in the mountains.

This herding however, is considerably different from herding in the mountain environment. In that environment, the fixedness of the herd food supply limits the consumption rate of the herd and thereby its size. Thus, mountain herders tend to harvest both young and old animals in the fall. Steppe and plains herders tend to harvest throughout the year, because they lack storage capacity, and tend to harvest animals less able to travel, the aged and weak.

If is difficult to predict from this the population size. Admittedly the herds may be larger, assuming the capability to protect them from predators (and raiders.) If they were larger, then there would be plenty of food to support a larger population.[105] Obviously, the development of the ridden horse (or similar animal) is crucial, which perhaps indicates a relationship of horse development in the Ukraine and the success of horse nomads in Eurasia.

Regardless, we still have a situation of low FSR, just because the space is so open and unbounded. Persisting military action is thus likely to be unprofitable. In classical military terms, the lack of boundaries means that there is no way to anchor flanks. As a result, regardless of what level we consider, flanks of formations can always be compromised. Thus, raiding will be the predominant form of military activity. We may expect some combat activity in the form of cavalry melee, but logistic raiding should remain the predominant form of military activity.

Because the terrain is open on the steppe and plains, the route of enemy forces is not known. This places less premium on the defensive, although one is led naturally to the concept of the staged raid. In this type of raid, a small part of the force is pushed far forward so that it will be seen and a counter-raiding force directed against it. The small part then withdraws into the rest of the force, effectively leading the counter-raiding force into an ambush.

[105] As during the cold phases, fuel may be a more crucial resource than food.

Valleys and Lowlands

Here we have a markedly different situation. The terrain situation is now intermediary between mountains and steppe, both of which exhibited herder culture and raiding military action. Now, however, we have an environment where frequently agriculture is possible and is often more productive than herding. This leads us to two fighting seasons: either in the summer between spring planting and fall harvest (assuming a single planting per year!); or in the winter between harvest and planting, adverse weather permitting; or both.

Further, because the population can be large, the terrain is frequently fairly open with boundaries, and there are substantial periods when military action may be taken, formations may develop and they can anchor their flanks on the terrain boundaries. As a result, infantry may develop along the lines described by Hanson.

Infantry, of course, is the original military type, growing out of sedentaryness following the end of the cold phase 10 KYA. In essence, infantry was the type that could develop. As time progresses however, as material and biological technological advances occurred, devices such as rams, catapults, and wagons, and domesticated animals such as oxen, mules, and horses developed. With such not only may infantry evolve but cavalry, artillery, and engineers may develop.

This applies to the steppes and plains as well. It seems highly likely that these places were inhabited before horses were domesticated. Therefore any military force that steppe herders would develop prior to the robust development of the riding horse would be an infantry force. Given human nature, there is also no doubt that at least some, if not all, steppe herding organizations would have developed military capability.

We have some historical insight into the transformation from walking to riding, at least for a single instance. We know when the Spanish introduced the horse into North America. At that time, any dwellers on the North American plains had to be walkers since indigenous horses appear to have been hunted to extinction prior to domestication. We also have reports of the development of horse culture on these plains by settlers, traders, and explorers, including Lewis and Clark.[106] From these we may see that horse nomad culture may develop very rapidly, in little more than the time for adequate numbers of horses to multiply. Of course, these horses were already bred to riding robustness.

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[106] As I write this there is considerable interest in the "Voyage of Discovery" of Lewis and Clark, including commemoration with coins and stamps.

In the valleys however, we have conditions where offense and defense are reasonably balanced. As we have noted, in the mountains the tightness of the terrain favors a static defense. On the steppes and plains the openness of the terrain militates against a static defense. The valleys, with intermediary tightness of terrain, have conditions where the defense is neither assured nor prevented. As a result, persisting military action is possible, and infantry optimized for persistence may develop.

Consolidation

The commonality of these three is flanks. Man, the human, has stereoscopic binocular vision. To moderate range, humans may judge distance and size quite accurately. This ability derives from our tree-dwelling ancestors who needed this ability to not crash into things while swinging from limb to limb, or misjudge distance to the next branch and fall through the foliage to the forest floor below.

This stereoscopic vision stood us in good stead as we developed. First it facilitated our role as scavengers, permitting us to snatch rotting remains with reduced risk. Then when we developed tools, it permitted us to make use of mechanics to throw stones or spears. Of course, if we could throw those objects at other animals, we could also throw them at other humans.

A consequence of this ability is that our vision is concentrated. The main concentration is in a "cone" of about one hundred and twenty degrees width. Thus, our primary vision extends out sixty degrees to each side. Our secondary vision extends considerably further, for many as far as one hundred and twenty degrees to each side, but almost all have vision out to ninety degrees. Of course, our heads, where our eyes are located, are fairly mobile, having considerable vertical and horizontal movement. but in a high risk combat situation, we don’t want to be having to turn our heads.

This architecture of vision means that we can’t see behind us like some animals can. Its a price we pay for that stereoscopic vision.

What does this have to do with combat environments? Well, because we can’t see behind us, or see very well to the sides, we tend to naturally fight in a line so that we can know that our sides, our flanks, are protected. This has enormous impact. It shapes the dynamics of basic combat organization and tactics. And its because of this dependence on the persons next to us that the flanking attack is such a fundamental of elementary warfare.

So we arrange our combatants in a line. But we only have a finite number of combatants, so at some point we run into a problem. The people at each end of the line don't have any one on one side of them. That means they are vulnerable and they are going to know it and worry about it. Of course, we could close the line into a circle or even a square and solve this problem, but now everyone isn't facing the same way and we can't move this closed formation.

In mountainous terrain there are lots of places where the terrain is tightly constricted or constrained. These places have special combat value since they allow a force to stretch across the constriction and have the end combatants shielded on their off sides. In essence, the line can be anchored to the terrain. Assuming the terrain to either side is impassible, and ideally the position is selected with this in mind, then flanking is impossible.

Furthermore, if the constriction is deep enough, then it also limits how many combatants can be sent against this line. As a result of the terrain, we have a situation where a defensive formation cannot be flanked and cannot be confronted with overwhelming numbers. This gives an enormous advantage to such defensive situations and thus they tend to shape the nature of warfare in that environment.

We must not forget however, that offense and defense are paired, and no matter how much the defense may be preferred in an environment, there must be some means of attacking. In mountainous terrain, this means is stealthy, the ambush. To be offensively successful, one must attack one's enemy when the enemy does not have the protection of terrain constrictions. Thus, warfare in mountainous terrain tends to be defensively persisting and offensively raiding (in Jones' terminology.)

Somewhat the opposite accrues in open, steppe or plains, terrain. Except for occasional water courses or suchlike, there are no constricted places to anchor flanks. Thus, steppe warfare is characterized by an absence of flank security. Set piece battles tend to be avoided since the force with the larger Force-to-Space ratio can just flow around the enemy's flanks. Battles tend to be meeting engagements where defense consists of either immediate or deferred counter-attack. In the first case, if the attacked force is larger, immediate counter attack (possibly leading to melee) is indicated. If the attacking force is larger, immediate withdrawal is indicated, hoping the attacker will pursue and become sufficiently drawn out to permit effective counter-attack.

An intermediary situation arises in terrain of hills and valleys. Anchoring opportunities exist, but in lesser density than in mountainous terrain. Frequently, only one flank may

be anchored. As a result, the situation is one where there is a closer balance between offense and defense. Persisting warfare becomes more feasible because of this balance.

Further, because of the lesser density of anchoring terrain, an advantage to size emerges. A larger attacking force can lap around or overwhelm a smaller defending force. A larger defending force can find more terrain that will anchor its flanks. Thus, there is an advantage to larger military, and thereby, political, organizations. In addition, because these organizations have larger logistic and communications (control) requirements just because of their size, a premium for organizations that can use and control more ground with fewer combatants emerges.

Technological Modifications

The introduction of weapons technology alters this somewhat from the development of formation during the long period of human powered weapons. The development of chemical powered weapons has a general impact of shifting the balance between shock and firepower towards the latter. This is sometimes used to explain the loss of decision and the increase in attrition over annihilation. [Delbruck 1985] [Weigley 1991] Such theories are partial and the effects of force size (which itself dilutes decisiveness,) and dispersion need also be considered.

Dispersion provides a wonderful example of the dynamics of war. The original trend to reduce dispersion (concentration) took its form in the phalanx (based on historical evidence.) This reached a peak with the Macedonian phalanx. The need to provide flank security led the Romans, traditionally shy on cavalry, to adopt different weapons and accordingly a more open formation[107] that coincidentally was more maneuverable and adaptable.

Another example occurred with the introduction of chemical powered weapons. Originally, guns were so inaccurate[108] and so difficult to load that fire and loading had to be orchestrated, which required the troops to be concentrated (range of voice limitation.)

With improvements in the accuracy of the weapons, lethality went up because of the large targets presented by the concentration. In parallel, the technology of loading advanced so that orchestration could be relaxed and the formation dispersed. This dispersion however, had to await the development of the socket bayonet, which permitted

[107] This open formation also had greater persistence. This persistence may have been the real reason for the adoption? The Romans were not shy about meatgrinder engagements.
[108] Actually, they still are. That's an inherent limitation of ballistics.

infantry to once more become monoarmaic with the elimination of the pike from the army. [Dupuy 1980]

Up until the American Civil War (1861-65 CE) dispersion took the form of reducing the depth of the battle line formation rather than an actual increase in man-to-man spacing. Fundamentally, the military gun was still quite inaccurate, about on a par with a bow and arrow or light crossbow (although for different reasons.) The reduction in depth of formation was a means of increasing firepower rather than of survival. Despite the large target sizes presented by these formations, they were largely immune at even moderate ranges.

As a result, battlefield practice used firepower as a shock weapon. Formations advanced within range and traded volleys until one formation collapsed, either from losses or from stress.

There were more accurate weapons, but they had much lower rates of fire, so they tended to be used primarily by skirmishers, sharpshooters, and snipers. The former, of course, were not viewed as decisive, and the latter two were often viewed as improper by elite, professional officer corps.

This all changed with the development of aerodynamic projectiles like the conoidal bullet[109] of Colonel Mine and cartridged projectiles. The first enormously decreased the drag on the bullet, thus slowing it less rapidly. As a result, the aerodynamic bullet went further in a given amount of time than its non-aerodynamic predecessor. Since the inaccuracy of a projectile is the ratio of the distance traveled by the projectile perpendicular to the aimed path to the distance traveled along the aimed path, this speed increase meant more accuracy was possible with existing guns by simply adopting the new bullet.

A second improvement was to put a well or depression in the base (tail) of the bullet. This allowed the bullets to be made a bit smaller than before. The reduction in size increased speed of loading since less force was needed to load the bullet down the length of the barrel from the muzzle.

Normally, we would expect this to increase the inaccuracy of the system since making the bullet smaller meant it could bounce around side-to-side in the barrel more, thus increasing its speed perpendicular to the aimed direction. Because of the depression however, this was not the case. The enormous heat and pressure of the propelling py-

[109] Previous bullets had been mostly spherical, hence the term "ball" that persists event today, or, rarely, cylindrical. The term conoidal is a misnomer. The bullet is actually cylindrical with an ogival nose and possibly a rounded back or tail.

rotechnic gas deformed the depression outward, against the inner wall of the barrel. The effect was not only to reduce the side-to-side bouncing, but to increase the effectiveness of the propelling gas. The result was to increase the overall speed of the bullet while decreasing its off-aim speed component. Combined with the aerodynamic shape of the bullet, this meant greater speed at range with less off-aim speed, which resulted in greater accuracy and momentum at range.

This could also be increased with rifling. Rifling had not often been used in military muzzle loaders. To realize the effect of rifling, the barrel must have spiral grooves, which adds to the manufacture cost, and the bullet must engage the grooves for spin to be imparted. The latter requires a tight fitting bullet, which slows loading and reduces firing rate. Thus, the economic interests of the governance organization and the timing interests of the military organization militate against rifled guns. With the introduction of the dimpled base bullet, this all changed. Now the military benefits of rifling could be obtained without a reduction in loading rate.

The overall result of all this was that there was an enormous increase in bullet accuracy and effective range about the middle of the nineteenth century. It is claimed that this was the main reason for the considerable casualties of the American Civil War. [**?**] This is not quite the case. If we look at the loss fractions (essentially percent losses) of the battles of this war, we find that overall these battles are less lossy than the norm.[110] A second look indicates that large battles, such as Gettysburg, are more bloody (lossy) than the norm and this bloodiness can be attributed, at least in part, to a devotion to Napoleonic formation even under these altered conditions.

Of course, the officer corps of both sides were comprised of legacy professionals, most of whom were schooled in Napoleonic tactics and doctrine[111] and politically connected amateurs who had little choice to adopting these tactics given their personal ignorance and social responsibility, the absence of texts on any more contemporary tactics, and the example of their professional colleagues. Still, the great losses of that war, which seem typical of civil wars, are the result of a combination of big loss big battles and many small battles and skirmishes. In many cases these small battles were of short duration, because of the lethality of the infantry weapon, but the sheer number of such battles enormously incremented the losses.

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[110] By norm, I mean in the larger historcal context, rather than in the statistical meaning of the term. In particular, if we look at battles from Marathon to Goose Green, we see the overall mean fractional loss to be geater than for the battles of the American Civil War.

[111] Which illustrates the constancy of the difficulty of balancing the "last war syndrome" with extracting lessons learned.

One of the peripheral impacts of this increase in accuracy was to destroy the balance of the Napoleonic combined arms triad. Basically, the range/rate-of-fire balance among infantry, cavalry, and artillery was broken.

Happily, in the same war, manufacturing capability to produce reliable compact pyro-mechanical igniters and exactingly precise thin wall metal cases was developed. This permitted the increase in bullet accuracy to be balanced.

This advance was, of course, fueled by on-going "colonial wars" against (e.g.,) Native Americans where a relaxation of formation and orchestration was important in reducing vulnerability to swarming tactics. [Porch 2001] [Arquilla Ronfeldt 2000] [Edwards 2000] Admittedly these lessons were hard learned in many instances.

Still, this deformationization and dispersion were at once driven by the lethality increases, and made possible by the increased ease of loading. These lethality increases derived first from the aerodynamic bullet, and then from multiple shot weapons.[112]

The cartridgeization of ammunition fundamentally made breech loading compactly and safely possible. This leads to the adoption of survivalist tactics since it is now possible for an infantryman to load and fire from a prone position. This, in turn, leads to greater dispersion, partly to reduce fratricide, partly to reduce the vulnerability of concentration.

The extension to magazine feeds in weapons further accentuated this by making automatic weapons possible. This would eventually revitalize the cavalry as well as make aerial weapons possible. The cartridge, of course, kept artillery viable by letting it shoot from afar, and contributed to the battleship revolution.

Despite this, the environment still intrudes, and occasionally rules. While the effective abandonment of formation and shock (except for shock through firepower or maneuver) has largely equalized the nature of combat in open and medium terrain (admittedly there is considerably more technology needed to do this than we have sketched!), it has not totally changed things in tight terrain.

In conditions of short visibility range (line-of-sight), long range accuracy is not necessarily important. Choke points that cannot easily be flanked may still be defended by a few against many. Admittedly, there is a new overhead flank with airplanes and helicopters, but in dense jungle, especially triple canopy, targets are hard to find, hard to kill if found, and landing zones for maneuvers on the rear are few and fragile. In mountains, restricted avenues of aerial access may be easily covered with minimum anti-air

[112] Incidentally, this gives rise to a recurring concern over the merits of marksmanship.

weaponry.

Still, this does illustrate how technology is coming to dominate warfare at an increasing rate.

Sea

The marine environment is quite different from the land environments. Indeed, we should equally admit to marine environments. Man is not native to the marine environment. Occupation of the marine environment is as new as civilization, the origin of boats in Europe being dated to about 10 KYA, when the cold phase ended. [Gardiner 2001, p. 11.]

In the land environment, survival does not require a container. A dwelling is desirable, but in much of the land environment it is not necessary. Even then, the dwelling is something to retreat to in adverse weather. Man however developed in the land environment and dwelling usage, while difficult to date, is surely no more than tens of kiloyears.

In the marine environment this is not the case. Except in the most benign of conditions, the human cannot occupy the marine environment for an extended period of time. If the water temperature is a few degrees too high or low, metabolism is disrupted. Man is poorly suited to defend himself against marine predators. Accordingly, man needs a container to exist in the marine environment, a boat or ship.

Even with such a container, occupation of the marine environment is difficult. Water, being some 700 times denser than air, is quite resistive, while having strong currents. Thus, movement with the current is almost effortless while movement contrary to the current requires considerable effort. As a result, movement on water tends to be similar to that in mountains, largely limited to paths, except that now the paths are anisotropic. The invention and development of the sail mitigates this but does not alleviate it, nor does the development of direct propulsion systems. A contrary current is still a counterforce to movement.

Because water is a dense liquid, weather has a more marked effect at sea than on land. Under conditions of good weather, movement on water may be easier than on land, but even moderately bad weather that is merely obstructive on land may halt movement into the weather and put the container at risk of being physically overturned or filled with precipitate water and sunk. The seaman thus develops a culture of weather consideration and forecasting comparable to that of the farmer during planting and harvesting seasons,

but effectively continuous and of sufficient temporal depth to permit return to shore. As a result, strong environmental rules develop that influence the marine culture and thereby, marine military action. While technology mitigates the effects of weather, it does not alleviate it.

The fundamental component of military force on land is the individual human. Organization then develops as an efficiency. Organization however, defines the fundamental component of military force in the marine environment to be the container, the boat or ship. Further, since the interaction of the container with current depends on the area of the container,[113] which for a given level of technology and mission is determined by the volume of the container, the Principle of Concentration operates directly through the container. Thus, as we see from history, and except for periods of propulsion means replacement, the trend is for marine containers to grow larger. The result of this is that the marine environment tends to be empty as compared to the land environment.

The water environment does not lend itself easily to fight in, but in a subtly different way it does lend itself to maneuver and movement more than the land. Land, air, and water are all resistive media, so motion is possible in them by pushing and pulling. Since the human body is largely water, it does not fall through water as it does through air, nor rest on its surface as it does land. The relationship is one of partial immersion, which is fortunate since humans have difficulty breathing water.

While most human bodies are less dense than water,[114] and thus float, movement in water is difficult. Further, one does not have to add much gear to the human body to make its effective density greater than that of water.

The answer to this is something to separate the human from the water by having an effective density considerably less than that of water. Experience with the solution soon reveals that a certain set of architectural criteria need to be satisfied to provide an answer that floats, can be moved relatively easily, and is abiding.

The latter two are fairly fundamental limitations of rafts, and the movement restriction one of early circular boats, [Gardiner 2001] although they do have uses. For example, some types of fishing are accomplished by being stationary in the fishing area so the only movement required is to and from that area, and this movement may be accomplished in an acceptable time in some cases. These cases seem exceptional. Indeed, the armies of Mesopotamia commonly used these simple boats to move troops, chariots, and other

[113] Analogous relationships exist for sail, paddlewheel, propellor, and nozzle area.
[114] There are some who have so little fat that they cannot float.

equipment across streams and rivers, but it is unclear whether the boats were pulled or pushed. [Hawkes 1973]

In general, boats, and their larger cousins, ships, have an architecture and geometry that is not individually optimal, but is clearly on a path to an optimality of the purpose or function of the vessel and the technology of the propulsion system. The water going vessel has naturally been led to a functional concentration.

While stationarity is possible in the water environment, it tends to have a markedly different form than on land. Marine stationarity tends to occur in protected harbors where the vessel is not at risk to the vagaries of weather.

Weather has a somewhat different influence than it has on land. Because the vessel is itself a form of shelter, and embodies some capacity to withstand the ravages of weather, the water vessel may continue to operate in (relatively) light adverse weather where land forces would have to take shelter and curtail or reduce their operations. Once the weather worsens beyond this level however, the vessel must seek shelter or risk catastrophic failure. This need to move to a protected harbor shapes operations on water. The differences between land and water operations offer fundamental challenges and opportunities for their joint activities.

Basically, we have an environment where movement may be easier and faster than on land because of the consistency of the terrain, but shelter has to be sought to avoid damaging weather. Coupled with the functional concentration of the vessels themselves, the nature of warfare at sea is determined.

On land, military operations often center on reducing the enemy's force structure or gaining control of terrain. This focus also accrues at sea, but the form is altered somewhat. Because of the concentration inherent to the sea vessel on the basis of its functionality and the level of technology, mostly propulsive, the sea force does not have the same organizational freedom as the land force.

Obviously, one may not post or send part of a vessel to a task. Further, the fragility of stationarity means that holding locations has a slightly different form. In fact, occupation takes on a form that depends on environment. Since harbors are important as safe havens during bad weather, control of harbors is important to a point of criticality.[115]

Indeed , it is at the boundary of land and sea that something of static control is important. Control of harbors as weather sanctuaries and stores depots, and of constrained seaways

[115] The impact on the nature of neutrality is obvious and shall not be belabored.

is central to sea warfare. The former constitute secure bases of operation (in Jones' terminology), while the latter provide the same means of area control that they do in mountainous warfare on land. Otherwise, sea warfare tends to resemble steppe warfare. Surprising an enemy force against the land sea boundary retards disengagement.

Away from the land-sea boundary, control tends to be more dynamic than static. Sea areas are not so much occupied as access is controlled. This is usually effected by mobile patrolling rather than static fortification, and this patrolling emanates from the controlled boundary.

How then is this different from raiding and counter-raiding on the steppe or desert with low Force-to-Space ratio? In some senses it is not, but the fundamental difference is the unit of concentration. Where land forces have essentially complete freedom of concentration, sea forces, as we have noted, have much less freedom because of the concentration unit of the ship.

As a result of this, defeat in detail is much more a concern in sea warfare. Consider that if one side has ships that are larger, faster, or stronger than the ships of the other side, even if the first side has fewer total ships, then the first side may have a disproportionate advantage, even with the reduced numbers. As a result, and so long as the numbers are not so disparate as all of the engagements may not be kept to one ship on one ship, the first side (as an extreme presented purely for illustration,) may completely destroy the enemy fleet and still have a large fraction of its fleet intact.

If we couple with this the uncertainty of combat, with the entire crew to be lost if the ship is sunk, or even the need to surrender to avoid this fate, we see an entirely different view of balance of forces at sea than we do on land.

War at Sea

Despite the emptiness of the sea environment, war does cause ships to assume formation. To a greater extent than on land (at least classically,) these formations are shaped by technology.

We have already discussed that the shape of the ship itself is largely driven by the response of technology (and thence, science,) to the nature of the environment. For a ship of war, this shape is further driven by the nature of war. For example, ships of war are usually more heavily armed and faster than the norm.

We have also noted the importance of land boundaries of the sea (and, of course, islands,) in providing safe bases and supply, and how the narrow land constrained passages between elements of sea are important. Despite this, we note that formations of sea ships (almost) never anchor their unprotected aspects against the land. They may seek to maintain interior lineage to the safe bases so they may retreat from their enemy to these bases, or exterior lineage so that they may trap their enemy between themselves and the shore bases, but they do not generally anchor themselves to the land.

The reason for this appears to be twofold. One reason is the inherent mobility that characterizes war at sea. The ship at rest, even often the slower ship, is the ship more at risk. The other reason is the additional risk of the boundary itself. Ships are designed to be sturdy in the sea environment but they are astonishingly fragile in the land environment.

Sea warships assume formation for the same reason as land warforces, to reduce their vulnerability. On land this normally means the flanks of the soldiers. In the sea environment, the formation depends on the weapon system.

For example, in the classical era, ships fought by two forms of action: by ramming; and by boarding. The former meant that ship formations in this period tended to be a line abreast so the vulnerable flanks could be protected.[116] The latter meant that the size of a warship's crew was large and included a sizable component of soldiers.

With the development of projectile weapons, this shifted. Ships no longer needed to physically touch each other to exert military force.[117] The application of the Principle of Concentration that standardized gun size on land [Knox Murray 2001] also operated in the sea environment and combined with environment and science/technology to develop the broadside ship. As a result, the combat formation shifted line (abreast) to column (line ahead). Of course, this formation protects the front (bow) and rear (stern) of the ships while exposing the sides of the ships to fire broadsides. The formation still protects the vulnerable flanks, but these are now front and rear, not sides.

In modern warfare, as on land, this all tends to fall apart. Modern sea environment forces include undersea (submarine) and oversea (air) ships. Vulnerable aspects are thus increased to include the tops and bottoms of ships. Further, weapons may be deployed in any direction without significant preferment. As a result, modern ship formations

[116] Ramming and human propulsion also drove ships to have a high length to width/depth ratio, so they would be fast, hence, have momentum. The trade-off between weight (mass) and speed is interesting, largely dominated by the human propulsion system. Warship technology direction is largely towards more banks of rowers to imcrease power and thence speed because of length restrictions of materials.

[117] Ramming has been repeatedly readopted during periods when the competition between penetration and protection swings to the latter.

tend to be two-dimensional (rather than one-dimensional) with the more important (and vulnerable) ships in the center of the formation. The formation is further augmented in the third dimension with skirmisher elements.

Air

The dynamic nature of war in the marine environment is accentuated in the air environment. There are several reasons for this but they are fundamentally a confluence of the constraints of environment and technology.

As in the sea environment, the unit of concentration of the air is a ship, and these ships must operate from safe bases at the boundary of the environment. Concerns about the security of bases and the need for ships to shelter in them during sufficiently adverse weather are the same in kind if not in degree.

The principal distinctions in the air environment are its airy composition and its extended dimensionality. The latter means that the aerial ship has more sides to be vulnerable. The former effectively means that there is no surface of repose as there is in the land or sea environment.

While it is possible to develop naturally "floating" air ships by encasing a gas of lesser density than air, thus producing the equivalent to the maritime ship, these air ships are weight limited and thus relatively neither strong nor fast. The norm for air ships are highly mobile vehicles that obtain their buoyancy from their motion.

As a result, aerial combat is very dynamic with opposing vessels either jockeying to obtain favorable geometry that will permit exploitation of vulnerability, or seeking to avoid such geometries. Combat between air warships tends to be a three dimensional melee. Combat between air transports and air warships tends to be a three dimensional swarming of the transports' formation. The formation, as always, is adopted to reduce edge vulnerability. The difference here however, is the dimensionality of the environment and the continuous movement through it.

Unlike the sea environment, there are usually no choke points for access to the air. Like the sea environment however, voyages are begun from safe bases, which like sea bases are geographically localized. Thus, since the air ships draw their buoyancy from their motion, air warfare tends to be a matter of symmetric swarming melee for spatial control and asymmetric raiding and counterraiding of the safe bases and supporting infrastructure.

Technology is as fundamental to enabling air activity as it is to sea. Indeed, a greater level of technology is necessary for the air. This accounts for some fundamental differences between the two. The technological difficulties of bounding air density are greater than of bounding water and air. Thus, the development of air ships occurred much later than of sea ships. The first boats are dated to about 10 KYA although *Homo Erectus* is ascribed capability to build rafts. The first warships occurred by the reign of Rameses III (1198-1166 BCE.) [Gardiner 2001, pp. 11, and 41.] While Leonardo da Vinci drew air ships (fifteenth century), early low density (lighter than air) airships first occurred in the eighteenth century, and the high mobility (heavier than air) airship in the twentieth century. [Burke 1978]

By the time of low density airships, projectile weapons had been developed so the ramming phase of air warfare was skipped. Further, the increased dimensionality of the air environment and the extreme ship mobility largely negated the value of macro-formation except for bomber formation during the Second World War that largely parallel sea formation against torpedo boats. However the fundamental nature of formation is ably demonstrated in the air micro-formation of pairing, apparently introduced early in the same war by Chennault in China.

The advance of technology presents similar challenges to the air ship that it does to the sea ship. Vulnerability to modern weapons is essentially three-dimensional. The response in the air however, seems to be more counter-capability than counter-force as it is in the sea environment, although such assessments are difficult under evolving conditions.

Jointness

No discussion of the effect of environment on war can ignore jointness, the mixing of the components of the diverse environments, since environment is the basis of jointness. We have already noted the greater degree of movement in the sea and air environments as well as the tethering in both environments to safe bases.

As a result, the opportunity for cumulative synergism exists. [Wylie 1967] Sea and/or air ships may transport land forces through their environment for raiding or persisting purposes with a rapidity that may achieve surprise. Alternately, they may raid directly with organic capability. Reciprocally, land forces may threaten or occupy sea or air safe bases, effectively extending control of those environments.

Space

The space environment is even more accentuated than the air environment. Man may not even live outside the vessel of the environment so operations in the space environment must dwell continually on maintaining human life or substituting mechanism for it. In addition, stationarity is even more difficult, often more costly of energy and resources than movement. Further, all changes in movement require the use of direct (physical) force and the expenditure of resources.

While war in the space environment is yet young, there are a few points that we may draw. Where aerial combat is characterized by a dynamic free-for-all, we may expect space combat, at least in near planet space, to be calculating and exact. Since motion is easy but change of motion is hard, we may expect such changes to be few and a source of surprise.

Because space is not hospitable to man, and survival depends on constantly renewed resources we expect few humans in space. AS a result, we further expect space to primarily be used for intelligence gathering. However, because of this, even a minimal effective combat presence in space may be decisive.

This situation may be expected to change with need and the advance of technology, but regardless we may expect space war, or at least, space combat, to be shaped and even determined by the space environment.

Cities

In a sense, the urban environment seems the opposite of space. One does not have to carry all of one's living environment around with one as one does in space. Air to breathe is usually not a problem in cities. Similarly, being stationary is not the problem in the city that it is in space, and moving about is a problem. In a sense, the city is the ultimate in closed (or tight) terrain with its admixture of two- and three-dimensional structure.

This special nature of the environment shapes the nature of urban warfare. There is a multiplicity of choke points, both in the two- and the three-dimensional components of the terrain. This multiplicity is one of the principal determining factors of war in cities.

The other factor is logistics. Unlike mountainous terrain, cities do not have a sustaining interior. From their initial development by the Sumerians, cities have been unable to

sustain themselves, needing influxes of food (massive), goods and materials, and people to continue.

In this latter regard, the urban environment is similar to space. Except for space and a contained subenvironment to live in, you have to carry around your resources in the city the same way you do in space.

You may be able to recruit soldiers in an urban environment but you probably cannot train them in the environment. You will also have to bring in food and supplies , which the terrain makes difficult to transport. The movement of information is similarly difficult.

In many ways, urban and jungle warfare are quite similar. Lines of sight are short. Raids and ambushes predominate over pitched battles because held ground is easily flanked and/or blocked. Further, clearing ground means destroying the environment, and often only makes combat more difficult as well as inherently indecisive.

Gangs

Indeed, one may argue that cities are inherently war environments because of the prevalence of gangs. Such groups are often primitive organizationally, proto-tribes or chiefdoms, who possess the simplest of policy structures As such, they come frequently to war, just because so little can be done through the "normal means" of policy.

Lacking external means of supply and resources however, the war of these gangs is limited by how much resources they can parasitically appropriate without destroying the resource environment.[118] As a result, combat is shaped by a trade-off between controlling ground to acquire some of the resources on that ground and destroying the environment, thus eliminating the resources entirely.

Thus, the city environment is often always an environment of war.

States

This carries over to the war of city and nation states. Their warfare in cities is very similar to gang warfare with one small distinction. Gangs fight over access to resources

[118] This is the root of the urban renewal approach to gang reduction/elimination. It also illustrates the on-going nature of human interaction with the environment, whether natural or artificial.

and thereby the ground (area/volume) where those resources are. In most cases, those resources had to come from outside and this place is just where they accumulate (for whatever reason.) The elaboration in state warfare is that resources (supplies) must be able to (reasonably) freely move to holding areas. Areas that cannot be supplied cannot be held. Thus gangs fight over supply dumps while state forces fight over supply routes (in cities.)

This difference explains much about city warfare. State forces contending with gangs are fighting to different sets of rules. The state forces have difficulty defeating gangs (who they want to treat as criminals because of sovereignty!) because they generally don't want to destroy the resource node. Gangs are relatively ineffective against state forces because the state forces control the resources (and can be easily reinforced or replenished.) When state fights state, their forces cannot look to the gangs for allies, as both are often natural enemies. Further, while both sides may want to control what cities embody, either resource concentration points or network nodes of resource transport (or both,) desperate needs to deny enemy access to certain areas often result in (short term) irreversible destruction and fundamental reductions in decisiveness.

It is small wonder then that the common military view of cities is that combat in them is to be avoided, even to the extreme of total destruction. Because of the terrain tightness and absence of resources, city warfare is inherently indecisive and highly attritional.

Informational Warfare

There is a profound similarity between informational warfare and urban warfare. The terrain of the city is streets and buildings. The terrain of the information network is links in the network (along which information moves,) and computers on the network (where information is stored/stockpiled.) Thus we have a set of analogies of street and link, buildings and computers, and resources and information. This is why increasingly we talk about communication and information, and indeed, C^3, in logistics terms.

Just as city warfare is about either resource concentration or resource routes, informational warfare is fundamentally about information concentrations or routes. There is however, as in urban warfare, an elaboration. That elaboration is that while material resources are essentially conservative, information is not. By this, I meant that if I have a can of SPAM (the meat) I cannot duplicate it arbitrarily. On the other hand, a block of information can be duplicated arbitrarily.[119] Both, of course, suffer a secondary re-

[119] Obviously, I am concentrating on the data-like aspect here. Having duplictaed the block, I have double

striction of storage capacity, which is usually truly secondary with resources but may become primary with information.

It is worth noting that informational warfare is not limited to the electronic network although thus far we have primarily used that vernacular. It also applies to networks of rumor, meme, and bull session, and to organic as well as mechanical storage sites.

Having made that elaboration, we note that informational warfare has both offensive and defensive components. Offensive informational warfare seems to be more successfully prosecuted by civilian, recreational hackers than by formal, organizational hackers. This would appear to be indicative of the fragility of legacy military organizations. Also noteworthy, student hackers show considerable effectiveness, indicating an unexpected relevance of the academic environment.

Defensive informational warfare is often more effective in the absence of secrecy (which contrasts secrecy's static nature with the dynamicism of security,) and hierarchical rank (which is a departure from both military and bureaucratic practice.) This may be indicative of an inherent value and robustness in network complexity. regardless, it also indicates a fragility in classical organizations. To camouflage this, defensive informational warfare is often draped in offensive terminology.

The nature of offensive informational warfare is conceptually simple although it is not necessarily technologically simple. It is directed at the storage sites and the transportation routes. That is, informational warfare seeks to either disrupt the flow of information along the routes, or to corrupt the information in storage. The means of doing these are manyfold, but each means is fundamentally one or both. For example, using viruses to suborn contact lists and flood the network with propagating e-mails, a practice known as phishing ("fishing",) is disruptive. Using viruses, similarly transmitted, to erase files, is corruptive.

Defensive informational warfare is almost a "Catch 22". The more effort expended on protecting the network, ultimately the more vulnerable it becomes. Too much information defense has the same effect as a successful information offense - it compromises or reduces the performance of the network. This is not strictly an original situation. It has an interesting parallel in the evolutionary obsolesence of the battleship and potentially the aircraft carrier and the tank. [Friedman and Friedman 1996]

Nonetheless, a defense must be mounted just to maintain some network performance.

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the data-like aspect but have not changed the knowledge-like aspect.

How much defense is needed however, is a difficult matter that will not be understood for a long time to come.

Economic Warfare

Like informational warfare, economic warfare exists in an artificial environment. It is, none the less, just as real.

Money was originally developed to decouple the fundamental exchange of barter about the same time that cities were being developed. Since then, the use of money has become all pervasive and effectively indispensable because of the complexity of society. As a result, money also comes to embody a form of warfare.

Traditionally, the assurance of money has been a function of the governance organization. In wartime, those organizations are in need of increased amounts of money to purchase necessities of war. The ideal way to have such is to store up money in peacetime for use in wartime. This is difficult to do for several reasons. Many governments are not good at saving, and indeed, removing too much money from circulation damps the economy. Thus, in wartime, governments may be inspired to print or coin more money, which has the effect of reducing the value of money, increasing costs accordingly (but neither linearly, nor uniformly,) and thus weakening the economy and thereby the support of the war. Of course, the enemy can always do the same thing. They can counterfeit their foe's currency and thus weaken the foe's economy. This is one of the oldest tactical forms of economic warfare.

At this point, it may be advanced that this is nothing more than a logistic strategy. Our answer would be that this is the case. What is noteworthy is how easy it is to recognize this as a form of war. The natural question that arises is why is economic warfare not more commonly recognized as such?

Of course, embargoes are a form of economic warfare, and sieges may be, but usually are not. One difficulty in the recognition of economic warfare is that it does not commonly embody the use of military force. We have become so used to the association of the military occupation with war that when war becomes separated from the military we are often unable to recognize it as war.

Even when prepared and observant, this recognition is still not simple. To a much greater extent than the classic exercise of military force, the use of economic "other means" is difficult to define and bound. Counterfeiting another states's money is a fairly clear

exercise of such other means, but is something more subtle like manipulation rate of your and the other state's monies such?

This leads us rather naturally to the duality of intent and perception. Even the shakiest bridge over this duality presumes enough commonality of culture that innocent intent not be improperly perceived. This however, is itself a weakness and thus something to be exploited in war. Subverting the expectation of contention is an attractive strategy.

This difficulty becomes particularly acute when considering organizations with different cultures. The economic machinery of a free market state is much different from that of a social autarky. If one is being damaged by the economic machinations of the other, is this normal competition between states or the use of economic "other means".

Even more difficult to assess is the situation with commercial organizations. The control over commerce exercised by Bronze Age states largely disappeared in the Middle Ages, although small size tended to make commercial organizations apparently subordinate to the governance organization. Indeed, this relationship matured to define conquest in terms of governance of both political and commercial environments. Since the end of the Second World War, and especially since the end of Containment, corporate organizations have increasingly transcended the scope of governance organizations. Further, within the context of the United Nations' guarantee of nation existence, the scope of modern war has shifted from classic military action to commercial competition.

The situation described as evidence of the demise of the state [Crevald 1996] may be viewed as the ascendancy of the commercial organization. Just as governments develop as providers of services, commercial organizations develop as providers of goods and services. Today, commercial organization, not nation states, are seen as agents of competition, and human association is increasingly with those providers of goods. Indeed, nation states are increasingly cloaking themselves in the guise of commercial organizations. It may be more accurate to advance that consumerism is replacing nationalism rather than that the state is dying. Rather, the state and some of its derivative organizations are merely being relegated to a lesser role. Whether that role will be subsumed by the commercial organizations and a new addition made to the anthropological taxonomy is yet to be determined.

Still, it is worth noting that states found chiefdoms hard to digest. In fact, one has to wonder just how the state evolved from the chiefdom.

The problem, of course, is the centrality of control within the bureaucracy. If a state over-

whelms a chiefdom, the loyalty and identity of the members remains vested in the chief. If the chief (and often his family) are eliminated, then a new chief emerges. Successful absorptions of chiefdoms by states seem to involve either the complete destruction of the chiefdom or its containment by overwhelming force (albeit not necessarily military.)

If we may accord the commercial organizations the status of membership in this taxonomy, we may observe that they coopt states (and chiefdoms) whenever possible rather than absorbing them. This is most evident in the tactical forms of economic warfare. Crudely put, the commercial organizations want the control without the responsibility.

Economic warfare between commercial organizations and states often takes the form of compromising the governance of the state. In democracies, whose spread can be traced in part to their susceptibility to economic warfare, this often takes the form of political contributions or even bribes. The effectiveness of this is a demonstration of how war proceeds between two organizations whose cultures are at different levels of Maslow's Hierarchy. (Alternately, in Dawson's [Dawson 2001] terminology, we might say that the commercial organizations are fighting a Darwinian or Hobbesian war (depending on viewpoint) while the state is fighting a Clausewitzian war.) So important is the appearance of sovereignty that many times the state cannot admit to itself that it is in a war.

Alternately, economic war between commercial organizations is often amalgamative rather than alliant. The paradigm of the offensive type of this tactical form is the takeover, hostile or otherwise. The defensive is the merger. Both illustrate the difficulty for the commercial organization for distinguishing what constitutes "other means". They also illustrate the will imposition aspect of the relationship between organization and war.

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13 Limitations to War

Violence

Definition 13.1 *violence is behavior involving physical force intended to hurt, damage, or kill.* [Pearsall 2002]

It is said that patriotism is the last refuge of the scoundrel and violence is the last refuge of the coward. Despite this we may not conclude, since our observations clearly preclude it, that all politicians are scoundrels or all soldiers (warriors) are cowards.

Nonetheless, we must recognize that war is linked to violence, but we also contend that violence in war is a by-product of war, at times and under certain circumstances necessary to the practice of war, but outside these times and circumstances, not necessary but natural.

This linkage is well recognized but lacks commonality of understanding. The hand wringing, lets play together nicely school of thought argues that the "military mentality... has always had the cold and steady awareness at the professional level that the key to military success is efficient killing." [Dyer 1985, p. 5.] The more rational survivalist military historian's view that "war may be defined - indeed often has been defined - as an act of force which consists of no rules, and in which, consequentially, all is fair." is not only more rational but more realistic, [Creveld 1989, p. 285.] and strengthened by its predecessor "one may wonder how any living being could survive in the storm of steel unleashed by rifled, quick-firing automatic small arms and artillery." [Creveld 1989, p. 265.]

The soldier military historian himself quotes Nathan Bedford Forrest "Fighting's for killing, son." [Dupuy 1987, p. 165.] although as a prelude to a discussion on Lanchester. A fairer treatment of Dupuy would note the subtitle of his work and the fundamental relationship between war and combat. The soldier of soldiers, the military mes-

siah, is direct "war is a clash between major interests, which is resolved by bloodshed." [Clausewitz 1976, p. 149.] However,he also says in describing the difference between theoretical and "real" war that "the origin and the form taken by a war are not the result of any ultimate resolution of the vast array of circumstances involved, but only of the features that happen to be dominant." [Clausewitz 1976, p. 580.]

From this we see both the expectation of violence and the expectation of limitation. The former is our immediate concern while the latter is our overall context.

Limitation

Just as Clausewitz drew a distinction between theoretical and real war, he draws a distinction between absolute (total) war and limited war. [Howard 1983, p. 47ff.] This limitation is inherent to war in practice and in fact as well as in theory.

The theoretical limitations have already largely been indicated but we will briefly sketch them here.

The first and primary limitation is found in the definition. The "continuation of political intercourse, with an admixture of other means" places two limitations on war at the root.

First, whatever the normal means of political intercourse are, those are not war. Second, whatever the other means are not, those are also not war.

In this context, we may readily see that activities such as diplomatic interchanges are not war. We have to be rather ambiguous about what is a normal means of political intercourse, since this may (and will) vary from organization to organization.

Similarly, what constitutes other means is also ambiguous, for the same reason. These usually are thought to include certain forms of military action but not all, as we shall discuss. Further, other means may include other forms of warfare, such as economic warfare, psychological warfare, and even biological warfare. Whether these, and others outside the classical idea of armed men clashing on a battlefield, are other means or not depend on both technical capability, and social and organizational rules.

For example, pre-Revolutionary War American Colonial forces used biological warfare against American Indians with primitive technology and few qualms. Modern nation states with considerably more advanced technologies may consider biological warfare more heinous than nuclear.

More Violence

We have already discussed the expectation of contention in some detail. This expectation arises from the nature of war to impose will. Clearly the imposition of will implies the use, or at least the potential of the use, of physical force on the part of the imposing agent. The expectation of contention, in turn, implies the same on the part of the resisting or counter-imposing agent. Thus, both sides in war have an inherent use of physical force.

At its simplest, this use of physical force does not have a violent intent. Its intent is to impose will. The difficulty that arises is that the imposition of will (or the avoidance thereof,) requires an effect. Is the threat, or even the actual use, of physical force adequate to effect the imposition of will?

To put this in terms of Lykke's model, the imposition of will is an end, and we have using physical force as a means. What are the ways of using physical force that are effective at achieving this end?

Obviously, we may use intimidation. So long as we have the imposing capacity and the perceived willingness, the threat of using physical force may assure the imposition of will. However, this is not a very effective way because the willingness will likely be contested and once the apparent capacity is removed, the willingness almost surely will.

No, the effective way to use physical force, at least in a military context, is to hurt, damage, even kill the opposing organization. The use of violence emerges because of its efficiency and effectivity. Simply put, violence is an effective way (in Lykke's taxonomy.) [120]

Violence against an organization may take several forms. This is one of the aspects of Clausewitz's Remarkable Trinity model. [Clausewitz 1976] One may attack the organization as a whole, as a part, or at the component or member level. What is important is whether the way is effective in achieving an end. Obviously, if the organization collapses, it no longer opposes the will. If the military is incapacitated, intimidation is not easily challenged. If the membership is depleted, the support of contention is reduced. It is this innate understanding of organization dynamics on the part of Clausewitz that leads us to the extension of the war definition in the first place.

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[120] This brings us to an interesting consideration. The Modeling and Simulation Community is currently being challenged to develop effects based models and simulations. That is, given a specific effect (end) is desired, how does one model or simulate that? Quite often, the manager who is asking for the model or simulation is oblivious to whether an effective way, or any way, exists to obtain that end. This is an example of the often tortured relationship between military science and military art.

From this recognition of violence as an effective and efficient use of physical force, we come to consideration of the limitation of violence. This has several dimensions.

First of all, not all violence in war is deliberate or intended. Much violence is incidental to the aims and missions of the war., the result of accident, or even entertainment. When soldiers (warriors) become inured to war, they tend to respond to situations with violence as a comfortable response or as part of the search for relief from the demands of hierarchical discipline. Further, when a military force collapses, gratuitous or low threshold violence may increase with the absence of command's control and succor. This dual role of the military organization to control and care, especially the latter, is often forgotten, as are the consequences of its absence. [LeBlanc 2003]

Because of this natural inflation of violence, it is one of the areas of war limitation that is most pronounced. Often, we find that so-called anti-war activists are really anti-violence activists who lack any meaningful alternatives to the role of war as decision maker in disagreements between organizations. It is not so much that their aims are not worthwhile, albeit simultaneously humanitarian and religious, and thus often contradictory, so much as they are devoid of constructivity.

Nonetheless, there is considerable effort to limit violence in warfare. Considerable effort is expended by sovereign organizations, nation states primarily in our era, to limit violence. The Geneva Convention is one example of this, and the Nuremburg Trials following the Second World War were another. Medieval chivalry had an aspect of this. In all of these examples, the limitation is on what other means could be used. In particular, these are consumed with which parts of the organization may be attacked and in what manners, at least proscriptively.

Further limitations may arise from sources other than the organization. When there is a social distinction between leaders and followers, officers and enlisted, certain forms of violence may be socially prescribed. Alternately, some prescriptions may be independent of rank such as the American Indian custom of coup counting. These cultural forms often extend to the use of violence against captive following combat.

Finally, limitations often arise at the individual level as soldiers rebel at orderly violence or acknowledge the value of contentious foes.

Political Limitations

The primary source of limitation is the imposing organization. Some of this limitation

has already been indicated and we shall not belabor that again except to mention the limitation of what constitutes other means.

Nation states, as we have noted, try very hard to limit what they will acknowledge as war to be interactions with other nation states. Nation states rather jealously guard their solitary right to wage war. Organizations who they view as not deserving are labeled as criminal and the wars against them police actions. Similarly, other nation states who use inappropriate "other means" are labeled as criminal, and, in the event of victory, treated as such.

Fundamentally, nation states want war to not develop into survival matters for the organization. Conquest or empire tend to be aberrant in the normal mechanics of nation states, perhaps recognizing that such organizations tend to be unstably dependent on constant (in a punctuated sense) growth. Nonetheless, conquest organizations do arise and their impact on war is often profound.

Absent such, organizations tend to limit the nature of their "other means" to neither present nor elicit survival threats. When they do present such a threat, great care is generally taken to limit the target of that threat to only part of the organizations, most often the government.

Along these lines, as well as for the sake of economy of resources, most organizations limit the size of their military forces, their means in Lykke's model. There are several aspects to this that do not need to be belabored other than to note that such are limitations of war.

Finally, organizations place limitations on war so that they may conclude war. We have already discussed how difficult decisiveness is. In absence of decisiveness, and often even with decisiveness, it is often necessary to return to the normal means of political intercourse. This is not always easy, given the difficulty of war and the natural inclination of the soldier to simplify as much as possible. [Howard 1983, p. 64.] This, return to the normal means of political intercourse necessitates limitations on war lest termination only be possible through collapse.

War Limits War

War inherently limits itself. Some of this limitation arises from the natural complexity and interdependence of the activities of war. Other limitation occurs because of what Clausewitz refers to as friction.

Fundamentally, war limits itself because it is a human activity and it is directed towards one or more, possibly conflicting goals. In fact, as Creveld notes, [Creveld 1989, p. 317.] war is more a matter of effect than efficiency. This is probably why it remains an inherently human activity as well as why, at least in part, it remains a central component of human civilization. Alternately, just when we want to conclude that what sets humans apart is their organizations' ability to change, we find something crucial that devolves from some fundamental characteristic of the humans themselves.

The (Counter) Will of God

We have already discussed the fundamental relationship between religion and war as two of the protection aspects of human organization, in particular, government. More, we want to address here two aspects of the interaction of the two.

These two aspects generally follow the lines of how the sides in a war align with the religion. Our discussion will be taken from the standpoint of the imposing side.

We first consider when forces on both sides are members of the same religious organization *in toto*. If the war is between two political organizations, then the religion (or its organization) will place or try to place moral (religious) limitations on the scope of the military actions that may be taken. These may limit the weapons that may be used (e.g., crossbows) or how captives may be treated (parole versus incarceration,) or some other reduction.

If the conflict is a political civil war, this reduction may be even more pronounced. This reduction takes its form to minimize the impact of the war on its membership, which may place the political organizations at odds with the religious organization.

If the imposing side is an alliance composed of several political organizations but only one religious organization, the effect is to complicate the mechanics of the alliance, which has both positive and negative aspects, but nonetheless limits the war. Alternately, if the alliance represents multiple political and religious organizations, this effect may be even more pronounced.

Now, we consider the case where the two sides are members of different political and religious organizations. If the religious organization wants to recruit members of the opposite religious organization, then it will try to impose reductive military action limitations on its political counterpart. (We are treating the religious and political organizations as separate. Extension to a single organization is generally direct and we will not

treat such explicitly.) Alternately if the two religions are immiscible, and especially in the case where the war is a religious as opposed to a political civil war, the religious organization will try to impose limitations of a more stringent form. As an example, they may encourage the execution of captives as religious heretics rather than giving parole or incarcerating them.

Objective and Technology

We have already discussed the limitations imposed by the natural environment, by terrain and weather, that shape the form of warfare. It does seem worthwhile however to spend a few words on the limitations of objective and technology.

Of course, the whole matter of limitation is highly holistic, so some aspects of this have also been discussed, and being holistic, a piece-wise discussion is less than ideal. Unfortunately, we really have very little choice in this matter.

The objective of war, as derived from the definition, is the imposition of will on the enemy. The specification of the objective follows from the specific nature of the will to be imposed.

Similarly, the specific nature of the strategy of the war, the plan of how the will is to be imposed, follows from this objective, assuming adequate means and effective ways. Obviously, there is a minimum magnitude to this will, else it would have been accomplished by normal means, but even so there are sizes associated with what is to be imposed and these translate into how the war is planned. For example, disputes over trade duties or the legal treatment of citizens may be simple enough to be settled by demonstration of force, of willingness to fight over them while convincing a belligerent neighbor not to be warlike may require invasion and conquest.

In general, these limitations on the scope of war attempt to preserve (or at least not destroy) the enemy's population, infrastructure, and even the instrumentality of government. It is hard work to eliminate a population, and often brings troublesome competition. Similarly, occupation of a conquered country is difficult if the country is lacking public utilities or government bureaucracy.

Technology also tends to impose limitations on how wars are fought. Often the military technology that works in one environment does not work in others. Much contemporary military technology is designed and developed for classic military operations in a fairly open terrain and good to moderately bad weather.

Military operations tend to be suspended under conditions of extreme weather, which may be a source of surprise. Further, these technologies do not work well in closed terrain such as mountains, jungles, or cities. As a result, military operations in these environments tend to be limited.

Some technologies simply do not work well in a military context. The best example of these is nuclear weapons. Fundamentally, all nuclear weapons are good for is destruction, through blast, radiation, or fire. They thus primarily destroy population, infrastructure, and instrumentality, the things that are generally not desirable to destroy. Further, the destruction may render the area of war for years. Even neutron warheads destroy population and instrumentality although they do leave infrastructure. Of course, the mess to be cleared up afterwards is considerable.

It may be speculated that limitations on action that prevent the use of nuclear weapons are more due to their uselessness as instruments of extension of policy than to repugnance at their effects. This may also explain the contemporary love affair with guided (smart) weapons. Unfortunately these weapons tend to be inexpensive only when they are designed to operate in simple environments. Operations in the more complex environments of jungles, mountains, and cities may continue to be the province of face-to-face human combat.

Ideal and Actual

What does this consideration of limitation tell us? Is there such a thing as unlimited war? The answer to the second question appears to be no, every war we examine shows some sign of limitation.

Many cultures have a great battle or war at the temporal end of the world as a part of their religions. In the main these wars are between what that religion considers to be good and evil. Most predict a hard fought victory for good, although a few are fatalistic. Regardless, even these "perfect" wars, fought by the creator/chief executive of the cosmic all against his/her antithetical enemy, are limited in one or more senses.

Can there be such a thing as an unlimited war? Apparently not, reality seems to take the form of placing limitations of some form on the war. The closest we may expect to find to an unlimited war would be in a war of utter survival where the outcome of the war is the total elimination, extermination of the losing side. While even such a war will have limitations, many other will be eliminated or reduced. If the issue is the survival not just

of the organization but of all its members, no constraint that might possibly, however remotely, result in defeat can be accepted.

Wars of this sort are not, so far as historians' recordings indicate, common. However, having identified such wars as coming as close to unlimited as may be possible, there are some further insights to be gained.

Inner and Outer War

The Correlates of War (COW)[121] project is a repository of data and analysis on war. The data are divided between interstate and intrastate wars. That is, they are divided into wars between states and wars within a state. We might refer to these as outer and inner wars, respectively.

The latter are pretty much what we think of as conventional wars although some of them are quite protracted. The latter are primarily what we call civil wars, and it is these that draw our attention here.

There are very few religious wars in this repository, of either the inner or the outer type.

We have already discussed some of the details of these two types of wars. In particular, we noted that inner wars seemed to display a bit of paradoxical behavior. That is, we noted that inner or civil wars tended to have greater proportionate casualties than outer wars, but the individual battles had lower proportionate casualties. Thus, while civil wars kill or wound more soldiers, on a percentage basis, than do outer wars, the battles of outer wars kill or wound more soldiers, again on a percentage basis, than do the battles of inner wars. This leads us to the paradox - if the blocks are bigger how is the wall smaller?

The paradox was explained by the frequency of battles. Using the metaphor, the size of the wall also depends on the number of blocks used. If the war has a lot of battles, even if they individually have few casualties, then the war as a whole can be very bloody.

The question that we have not addressed is how this comes to be. The explanation presented thus far is based on observation and the direct analysis of those observations. It doesn't address the organizational aspects of the situation.

Martin van Creveld [Creveld 1989] has observed that the longer a war goes on, the less

[121] One has to wonder if this acronym is intended as a noun or a verb?

it is influenced by material technological differences between the two (or more) sides. In general, civil wars tend to be fairly long wars, so based on Creveld's observation, we can hypothesize that material technology is not a primary reason for the paradoxical behavior of civil wars.

We can advance that in most cases, inner wars are more important to organizations fighting the war than are outer wars. By this, we mean that most outer wars are fought for some well defined imposition but they are not fought as winner take all. Even when the objective is the elimination of the governance form of the enemy, the nation state organization abides albeit with some change in form of governance. As a result, the intensity of interest of the membership of the combatant organizations is limited. Put simply, such wars are often seen as something one does ones best at but simultaneously something to be survived to live a normal life again. Critically, the combatants foresee an existence after the war.

This is not the case with civil wars. From an organizational standpoint, civil wars are also about the form or the governance, or, at least, who will exercise the governance. Thus, for civil wars, the end of the war does not result in the continuance of the two organizations with some degree of changes. Rather, it results in the elimination of one of the two organizations.[122] Thus, what we have in a civil war is organizational (but not usually member) genocide.

Of course, there are borderline cases. In these, the civil war is geographically aligned in a compact manner. As a result, a third outcome state emerges where neither side is able to decisively prevail, but the geography permits a division and two governance organizations - nation states nominally - emerge. One must be careful in interpreting the history books about these wars, recalling that history books tend to be written by victors. Obviously, the "winning" side is going to claim they were successful in obtaining independence while the "losing" side claims that they successfully expelled the other from their otherwise perfect organization. Neither is going to claim that they failed to overcome the other.

It is interesting to examine American history in this context. It may be recalled that the American Revolutionary War began as a protest over policy and only turned into civil war once accommodation was declined. The resulting stalemate was then largely the result of geography, a crippled economic environment and governance organization, and the political interests of continental European states. Similarly, the American Civil War

[122] Yes, I am being simplistic here! The losing organization may abide in the form of an underground or resistance movement, or even a sham social club, but it ceases as a governing organization.

was largely a "Lost Cause" from its initiation, again largely the result of geography, a crippled economic environment and governance organization, and the political interests of European states.

We also need to note a phenomena of leveling that occurs during the course of inner wars. In many cases, one side starts the war with a military advantage over the other in terms of organization and individual skills. Unless the war is inherently politico-military in nature, this stronger side is usually the one retaining the mantle of sovereignty. Over time however, if the war lasts long enough, the initially weaker side gets stronger, that is, it acquires individual and organizational military skills, and the stronger side gets weaker, often due to dissatisfaction in the capabilities of those initial skills or the progress of the war in general.

Having recognized this spectrum of variability among inner wars, it still remains that there is often a perception of criticality among many, if not all, of the participants. As a result, there is a shared, almost universal desire, for successful resolution of the battle and the war for one's side. This desire translates into two military aspects: decisiveness; and conservation. With these, coupled with the natural (technological) limitations on control, the shape of inner and outer wars becomes evident.

Basically, we see now a natural scale being imposed on the battlefield, that of the span of control. Of course, this span depends on the level of technology, but for most of the period we have had history, that span has largely been fixed by the use of voice, vision, and messengers. As a result, small battles are those whose geographic extent (assuming a contiguous battle) are of the same size as span of control and large battles are those of larger size. Since formations (or at least concentration) are the norm, this translates directly into numbers, at least over periods and eras.

If the battle is strongly controlled, then when a situation emerges that clearly favors one side, the other will disengage to reduce losses and maintain force for another day. If the battle is weakly controlled, the fighting tends to just keep driving on. This is why small battles in inner wars are relatively bloodless. The commanders want to conserve strength. But in large battles, their desire to conserve strength is compromised by the collapse of control.

Similarly, this also explains the nature of outer wars. Because the ultimate risk is less, the perception of the need to conserve is less and the search for decisiveness predominates. Thus, both large and small battles are bloody. Indeed, there is some indication that large battles in outer wars are less bloody than large battles in inner wars, but the data are so

sketchy that the trend is not as definite. If this is so however, it would seem consistent with the force of perception of ultimate risk of outcome of the war.

Loss

A somewhat similar behavior is found in some "primitive" warfare. [Keeley 1996] Some cultures/organizations practice a rather strange form of warfare, which we might describe as war as occupation.

The descriptions in the literature seem to present some commonality of conditions. The organizations are somewhere in development between the Hunter-Gatherer band and a primitive tribe. Subsistence has moved beyond strict hunting and gathering but not to fully developed agriculture. The location is, of course, for these people's society to have survived to the present, removed, and seems to often have a beneficial environment where food, shelter, and materials are readily abundant.

What makes these people rather noteworthy in our context is that they "fight" battles quite frequently, in some cases, daily. Further, these battles are ended or concluded as soon as the first casualty occurs. The battles are often held on pre-agreed ground, and their structure is also different. The initial stages of the battle are characterized by the warriors on each side threatening and taunting each other, reminiscent of the behavior across the line in American football. The threats and taunts continue until someone initiates physical violence or everyone gets tired and goes home.

If physical violence does break out, it ceases as soon as one warrior is killed or wounded, and everyone goes home until the next battle.

The situation here is very much like those in civil wars. Although the battles are not very bloody, they seem to occur with such frequency that the percentage of organizational casualties is quite large. Keeley [Keeley 1996, p. 119.] advances that this behavior is a form of population control to keep the total population at or below the carrying capacity of the environment.

The cause is of some interest to us in determining whether this is really war or not. It does not seem to satisfy Turney-High's definition of True War. [Turney-High 1949] It is also hard to see this as war within the context of our definition.

Clearly, there is no will that is being imposed on the other side, no extension of the normal means of interaction between organizations. Thus, there would appear to be no

war. This assessment however, may be premature.

If Keeley is correct and this warfare is being conducted as a form or population control, or even if he is not, but there is some organizational reason (policy) for this warfare, then this may indeed be war, but war of a very different kind than we normally encounter. Specifically, what we have here, if these conditions hold, is a case where an organization is making war upon itself.

This sounds rather unsane, but it may make sense. If an organization needs to control its population to avoid collapse, and it cannot do so using "normal means", then its only choices are to accept the inevitability of collapse (go quietly into the dark,) invoke the deity to visit some miracle on the organization (super- or supra-natural event,) or they must resort to "other means". Ideally, if you are going to do the latter, you probably want to pick some way that doesn't result in civil war, although, civil war would address the problem for a while. From a control aspect, there are even some good reasons for adopting the latter.

What now becomes interesting is that what is necessary here is an alliance or coalition of organizations. That is, since there have to be at least two sides in the conflict, at least two organizations must agree to cooperate in this war upon their own members. In effect, two (or more) organizations agree to impose a common will, a policy, of population control on their own populations by warfare. This is indeed inner war to the extreme!

Why would this occur? The obvious answer is to avoid a condition of mor general war. If the population is allowed to exceed the carrying capacity, a natural response would be the use of other means to try to acquire more resources, more ground. This would be contended and actual war would follow that would be more devastating and disruptive. In this sense then, the form of the battles becomes evident. The cessation after one casualty is indicative of the control of the process. After all, neither organization wants these population control battles to degenerate or escalate into real war.

For that matter, does this violate expectation of contention? here we have two (or more) organizations making imposing policy on their own populations in the form of warfare. In effect, each organization is making war on itself, or at least its own membership. Should we not therefore expect that the membership will contend with the organization?

We must recall that these organizations are rather simple. They are still largely egalitarian in nature. As a result, one surmises that the membership must recognize the necessity of their activity to preclude more general warfare and that contention is either absorbed

in the governance process, or directed against the pseudo-enemy.

What is somewhat amazing however, is that such simple organizations can arrive at such a complex agreement. Is there some way that this end could have been achieved without cooperation between the two organizations?

One may postulate that these battles arose as a means of deterrence. The method of initiation seems problematic, but no more so than in the theory of self-war for population control. Again, this has the purpose of avoiding real war and if it becomes established enough, becomes indistinguishable from the self-war.

Finally, another alternative is occupation. Gardening agriculture is more effective than gathering (time average) but less effective than true agriculture. Nonetheless, it relieves some of the demand on hunting. If the environment is bountiful (population not yet near the carrying point,) then hunting will not be highly time consuming. As a result, the hunters will not be occupied all day and their relevance to the organization may be questioned. To assure the validity of their role in the organization, we may envision the hunter-warriors initiating these pseudo-battles either directly or as a development of raids. Notably, this would be war as occupation and, like the first model, a form of war by the organization upon itself. In effect, the organization would be imposing a policy that its hunter-warriors were critical members upon itself through the other means of warfare.

Surprise

It may be surprising that we discuss surprise in conjunction with limitation. A bit of thought quickly shows that the two are closely related. Surprise is usually the result of the suspension of limitation. As we have already indicated, there are many types of limitation on war, ranging from the physical to the political to the psychological. Surprise occurs when a limitation changes or ceases to apply. These war changes may be brought about by a technological change, but more often by a social or cultural one.

Revolution

In this sense then a Revolution in Military Affairs is a form of change in limitations. The new system, often organizational, but occasionally technological, has different limitations than the old system. This new set of limitations is such as to permit the new

organization to consistently prevail over the old.

In both cases, of surprise and revolution, we see immediately that the advantages may be achieved by adoption and imitation. The difference is largely a matter of the difficulty of the process. The easier the change in limitations is to adopt, the less advantage is to be accrued by their adoption, however necessary that adoption may be. Nonetheless, the difference between simple surprise and revolution is largely one of the magnitude of complexity.

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14 Trends

Predicting

Predicting the future is largely a thankless activity. If one is remembered at all, it is either because one was wrong and therefore pitiful, or because one was subtly right enough to engender change that alters the prediction and thus one is again wrong.

By the same token, one does not want to predict too far into the future because that alienates the pragmatists who want to know how we will get to that future and attracts the romantics and mystics who will divide into those who want to live in that future and those who do not, and the two sides will fight. (Although it will likely be little more than that since neither is likely to form an organization and formulate policy, much less extend it!) Alternately, if one predicts too close to the present, one alienates the romantic and mystics with a future that is too mundane and antagonizes the pragmatists with a future that is either too critical of current policy, or too contrary to it.

That the future can be predicted is demonstrated every day when we turn on our televisions to see what tomorrow's weather will be. the problem is that our society and culture are so complex and so poorly understood that we cannot reliably integrate our extrapolations into a whole. We cannot reliably foresee the effects of technological change whose social and cultural consequences are sometimes annoyingly non-linear, and we cannot predict the irreversible "changes of state" of society and culture that our linear policies, laws, and endeavors cause.

Observing

Let us consider several trends that may have some impact on the nature of future warfare.

As we have stated before, the Information Age is upon us although it seems unlikely that we have passed through the turbulent boundary layer between it and the Industrial Age. Also, if the pace of technological, social, and even cultural change continues to

increase, it seems unlikely that this turbulent boundary layer will be passed before we encounter the onset of the next. This situation illustrates the fundamental uncertainty we deal with. Some trends indicate a continued increase in the pace of change with no indication of any stability in the future other than that change. Other trends indicate a dampening of that change. Regardless, any prediction of what the future will look like is almost hopelessly muddled.

The Crisis of Energy

For most of the period of human organization, man's use of energy has been modest. The Hunter-Gatherer lifestyle, which persisted until the end of the last cold phase about 12 KYA, did not lend itself to the acquisition of property. As such, humans made use of the energy of the sun through either the consumption of food or the burning of wood for cooking and heating. The primary source of constructive (and destructive) endeavor by humans however, was the energy of their physical bodies.

Admittedly, the source of this energy was derivative, as we have indicated, but the fact abides that until very near the end of the cold phase if man wanted to exert force to perform work, the energy to achieve this came from man himself.[123] This had both a good and a bad aspect. The bad aspect was the limitation on what could be accomplished. Motion or movement was not rapid, tools had to be small enough to be wielded by a single individual, and materials could not be moved easily. Indeed in many cases effort was brought to the materials rather than the other way about. Thus, projects tended to be small.

The good aspect of this limitation was a contributing factor to the development of human society. The Principle of Concentration came into play, leading to larger organizations so that cooperative effort could be exerted and larger products produced. It would be unrealistic to imply that this was the only course. Indeed, we have discussed others previously in this volume, but the drive to greater things had to be part of the impetus to development of the human organization.

Once sedentaryness became possible, this development took off. While the Hunter-Gatherer life style permitted, even necessitated, observation, it was not conducive to experimentation nor the development of research knowledge. The sedentary life style was. In relatively short order, allowing for the pace of activity and the low density of knowledge, agriculture had developed enough to acculturate the sedentary life style, tools and

[123] Work here is used in the sense of both meanings: force over distance; and constructive labor.

material products proliferated (notably cloth and pottery!) and animals were domesticated and bred to purpose.[124] Of course, the later would give rise to the development of nomadic society on the steppes and plains. This transition also started man on a path to greater energy usage.

The domestication of plants gave man a source of sustenance not dependent on searching. The breeding of these plants made that source fundamentally dependable and enhanced the structure of existence with greater access to materials and energy. Similarly, the domestication of animals provided a source of meat independent of hunting. The breeding of these animals not only increased the quantity of that meat supply, but offered means for the expansion of man's energy resources.

Once beasts of burden became available the scope of work expands. Larger machines (tools) are possible, and are developed, larger projects may be assayed, and movement is speeded. The amount of materials that may be moved is increased, as is the range and speed of the movement. In many ways, the horse is an archetype of this process if we consider its introduction, possibly first as a food animal, its breeding first as a wagon pulling beast and then as a riding beast, and the technological developments of the horse collar and the saddle.

Throughout all of this, and continuing, has been a dependence and a reliance on natural aeconomic sources.[125] The energy of man and animal derives from their food. In this sense, agriculture has only provided means to better use the energy of food.

Utilization of the energy of the natural flow of fluids, air and water, via wind mills and water wheels (mills), was later in coming, not until relatively late in the historical period (1180 and 700 CE.) Such are limited however to locations where that flow is reasonably consistently present. Thus, the more widespread use of non-animal energy had to await the development of the external combustion engine by James Watt (1775 CE). [Grun 1979] With this development man's use of energy entered a new domain of scope.

The external combustion engine was one of several fundamental technologies that made the Industrial Age possible. In particular, the availability of controlled energy began to

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[124] It is somewhat amusing when hearing discussioon today of the revolution of biological technology to remember that the transition of huuman society to sedentaryness and the development of civilization was made possible by a revolution of biological technology.

[125] All societies advance by the aeconomic use of some resource. By aeconomic, we mean that the cost of this resource is shielded in some way, usually in terms of replacement. Petroleum is the great current example of this since its price is based on the cost of finding, mining, refining, and distributing it (plus a modest profit,) not on conserving some energy (e.g.,) balance.

transfer the burden of labor from man and animal to machine. Goods could be produced with steadily decreasing human oversight and intervention. Once produced, they could be transported cheaply and quickly over great distances. The standard of manufacture moved steadily from expensive, long lasting goods (e.g., the fountain pen,) to inexpensive, quickly replaced goods (e.g., the "BIC" pen.) These goods are often described as shoddy although they are manufactured under the most exacting of conditions to assure a minimum cost of manufacture and a maximum price the consumer will pay.

This shift in energy resources has had its impact on society. While energy is not the sole cause of these, it is fundamental. This fundamental relationship between the availability of energy and human society is why we are considering this now.

The trend in human society, largely due to this proliferation of energy has increased the independence of the individual. Until recently, humans had to be highly cooperative to live. In effect, the Principle of Concentration acted to force people to live and work together. Part of this was economy, both of money and resources. It is "cheaper" to heat a large house with (e.g.,) five people in it, than to heat five small houses with one person in each. Similar scales apply to the other basic activities of growing and preparing food, manufacturing and maintaining clothing, etc.

The proliferation of energy has largely changed this. Goods and services are now largely provided in individual units. The need for human cooperation in daily life has largely been eliminated. For example, in the last hundred years we have largely moved from the extended, multi-generation family to the one/two-generation family to single parentage. The energy necessity of marriage has largely been eliminated as we have moved from the expectation of early marriage, often with some degree of arrangement, to unconstrained marriage (love matches,) to the expectation of late, no, or several marriages.

This individual independence comes at a price. Cooperative skills have diminished, prompting workplace and schoolhouse efforts to establish by formal training what was once socially innate. The result is often a poor substitute and highly consumptive of resources. Interestingly, such efforts often conflict with economic efforts to move the workplace back into the home (by using the Internet!)

Other impacts have included the proliferation of employment categories and skill requirements. We have progressed (e.g.,) from manufacturers of goods selling their own wares, to the emergence of selling as a separate activity, to specialities of selling so compartmentalized that the salesman of one brand of product may not be considered qualified to sell another brand of the same product. The latter is often bridged by simplified,

propagandistic, training programs, which further illustrate the transition from education to training. Universities no longer trumpet the merits of a liberal education, but the relevance of their curricula; themselves designed to maximize instructional revenue rather than student understanding.

This too is understandable. Schools, almost the only remaining organizations with tenured employment, find themselves increasingly burdened with too many irrelevant faculty and a product of decreasing relevance. Accompanying this is a decrease in professionalism as occupations are selected less for interest in the discipline and more for the expectation of economic reward. With the abandonment of the hobby aspect of profession, technical competence and personal excellence evaporate to be replaced with certification and licensing, further driving the transition from education to training.

All this is driven by the aeconomic proliferation of energy. This proliferation was "fueled" by, first, wood, then coal, and then petroleum. Because these energy sources were used without the accompanying expense of replacement,[126] each experienced a crisis when surplus ran short and failed to meet demand.

Actually, that statement is a bit of an exaggeration! There was a wood crisis when Eurasia, Africa, and parts of America had become deforested. This crisis was bridged by a shift to coal although not without economic disruption and a shift in social structure. Still, the proliferation of energy was able to increase.

Strictly speaking, the coal crisis was anticlimactic compared to the wood crisis. There are still large resources of coal available, and coal is still used for industrial applications. Much of this coal however, is not deemed exploitable for economic reasons! The mini-crisis was over "clean" coal and was itself largely economic, being relieved by the introduction of petroleum products.

Recent events indicate that we may be entering an petroleum crisis. Certainly it appears that demand has exceeded processed supply, if not fundamental supply. Based on history we might expect this crisis, if it is such, to be resolved by a shift to some other medium. Certainly, atomic energy has been predicted for many years to be this medium.

History is not science. Even if atomic energy is the successor for petroleum, conversion will be expensive and depress economics beyond the period of conversion. Most critically, during this period the trend in growing individual independence may be reversed. For example, we do not know how to run small vehicles (such as cars and trucks) on

[126] Admittedly, it is not obvious what replacement means for nonreplenishable resources.

atomic power. Thus, we may expect the cost of transportation to rise.

What impact may we expect from this? If the cost of transportation increases, then we may not only expect the cost of goods to increase but the cost of traveling as well. From this we may project the further growth of cities and a reversal of certain trends.

One reversal may be in the nature of manufactured goods. If the cost of these goods increases, then the consumer will likely want them to last longer, so we may expect a shift in this direction. Another reversal may be in the nature of service industries. We may expect that businesses based on customers traveling to the business site may be adversely impacted.

Trends that may continue or intensify are those that reduce travel. Telework may well be one of these. We will explore this in greater detail when we consider trends in the internet.

We may expect a reversal in the trend from education to training. As travel and transportation become more expensive, the marginal cost of retaining employees will shift and greater flexibility of the workforce will be needed. This will necessitate greater trust between employer and employee.

We may also expect greater localization, possibly reversing the globalization trend. As the cost of transportation increases, it becomes more economical to shift to smaller factories closer to their customers. We may expect this trend reversal to compete with the obvious trend to growth of cities.

One of the biggest questions in all this is what will be our progress in science? At the risk of being Pollyannish, the deterioration of our scientific research capabilities may actually help bridge this (possible) energy crisis.

Einstein identified two major types of scientific researcher. One was the professional, the hobbyist who is paid to practice his hobby; the other was the rabbinical, the hobbyist who has a job to pay for his hobby. Up until about the middle of the nineteenth century, the progress of science was dominated by the rabbinical scientist. After that the professional increasingly took over with the acceptance of the sciences in universities, and the increasing interest in science by technological corporations.

After the end of World War II,the use of "command technology" [Kaufman 2004] became increasingly prevalent, first in Departments of Defense, and then throughout government and industry. Under this model, scientific and technical research and develop-

ment is directed towards predefined goals.

The result of this was a marginalization of science. A situation arose akin to political correctness where grants were awarded based on a review committee's determination of relevance and practicality. Thus, the only research that was being funded was that which was doctrinaire and incremental. Risk was generally avoided.

In this environment, which was abetted by the overextension of the universities and corporations' dependence on large dividends, professional science has largely deteriorated. The situation with rabbinical science is not much better. Government regulations have largely eliminated freedom to experiment. Fundamentally, we have difficulty determining how vital rabbinical science is since the print media of books and journals are increasingly closed to all but elite populations.

Nonetheless, the very fact that the rabbinical scientist is not fettered by academic and peer review committees and corporate managers means that some vital research is likely going on and when the situation becomes dire enough, that research may find practical application.[127]

Global Warming

It has been about twelve thousand years since the last cold phase ended and we entered the current warm phase, sometimes called the Neothermal. [Clark 1987] The nature of this term illustrates the complexity of this matter. Somewhat brutally translated into American, Neothermal means new heat or new hot.

The reference to heat is not difficult for the reader of this work to cope with. We have discussed the apparently rather critical relationship between the end of the last cold phase and the rise of sedentaryness on the one hand, and the human settlement of the Americas on the other. Interestingly, the end of this "Ice Age" also seems to have ended Western Europe's role as the leading socio-technical hot bed of the period.

It is rather difficult to talk about ice ages as it is warm ages. The climatological evidence indicates rather clearly that there have been alternating periods of warm and cold. However, the cold periods have never been so cold that there have not been regions that were ice free, nor have the warm periods ever been so hot that there have not been regions that were continually iced. Significantly, there have been warm periods that have been

[127] Of course, we also have to understand that much of what rabbinical scientists are doing is ridiculous garbage. For every Copernicus, there are a thousand or ten thousand crackpots building orgone boxes.

hotter than the current one.

The period of duration of this warm period has already exceeded what we think is the mean for such, and thus we may expect the on-set of a new cold phase. This is disturbing, because, as we have seen in our previous discussion of the short cold snap just before the Neothermal, the transitions between warm and cold phases can be quite rapid in generational terms.

The advent of a cold phase would be much more devastating than it probably was the last time, 24 thousand years ago. The reason this would be so devastating is simple, it is civilization. If the ice sheets come again, civilization would be sorely tried, perhaps even destroyed. Despite the diffusion of modern technical infrastructure across the planet, we still have a state of considerable inequity between north and south.

Should the ice come again, this would change. In effect Russia and the top half of Europe would be covered in ice. Similar conditions would prevail in Canada and the northern half of the United States. Of the industrialized nations, only India, China, and Japan would be largely ice free. Even their operations would not be uncompromised as the seas receded and the land bridges returned linking America and Japan to Asia and England to Europe.

The devastation would not only be industrial. The ice sheets would cover much of the arable land and the climate of the remainder would shift. Perhaps the Gobi, the Sahara, and the interior of Australia would become lush, green, and temperate. The bulk of the human race would not see this, even if it were to come about, at least in current terms.

This loss of food production and manufacturing capacity would be enormous, and have dire consequences. One may estimate that at best something of the order of 70% of the current human population would not survive, and that estimate is optimistic, based on a rapid disintegration of transportation and services so that refugees from the frozen north did not overwhelm the south too badly. The pessimistic estimates give numbers so close to 100% that we have to consider at least the end of civilization if not the human race itself. Obviously, the potential for war in these circumstances is great, especially *ad hoc* wars of conquest as disindustrialized northern hordes descend on the un-iced south. Perhaps it is a good thing that the industrial independence made possible by cheap transportation has largely eliminated the local communities (clan, tribe, family) in the industrialized nations?

Happily, the scientific search for a new cold phase has been largely unsuccessful. Instead

there are concerns over an intensification of the warming attributed, in some circles, to man's technological progress. So we don't have to worry about the end of the world?

The answer is maybe. If we are entering a warmer period or phase, regardless of whether our aeconomic technological pollution is causing greater retention of planetary heat, or the change is a natural product of orbital mechanics, climatology, and the like, then warming has an impact.

With the temperature rising, the ice recedes, dumping water into the environment. Most of this water stays in the oceans, but because of the greater temperature, the amount of water in the atmosphere increases as well. As a result, instead of land bridges forming, we lose land. Instead of sea lanes disappearing under ice sheets, we have coastal cities being flooded. And because the atmosphere has more moisture in it, and is thus more dense, it has a higher energy density. As a result, the weather changes. Thus, we may expect local (geographic) climatological changes. In particular, we may expect more rain and possibly more storms. This rain changes the local climate and thence the ecology. The storms cause flooding and other destruction.

Both have an impact on food production, as does the temperature rise itself. The temperature change tends to move the delineations of tropical, temperate, and arctic away from the equator and towards the poles. The increase in water changes both what crops may be grown and the growing season. The storms are just generally destructive. As a result, the supply of food will not only change in nature but also decrease in quantity.

The promise of global warming is that our ports will be inundated so that raw materials (including oil - remember the energy crisis) can't get in and manufactured goods can't get out. Additionally, the climate changes will alter the nature of the food supply and reduce it. And both manufacturing and food production will be further reduced by any increased instances of storms.

The energy crisis will also get worse because cooling is less efficient than heating and the waste heat dumped into the environment makes the warming worse.

So what does this mean for war? Obviously, we have competition for resources. But we also have the refugee scenarios where the displaced from the inundated coastal regions and the baked south come north looking for food, shelter, and cool.

Global warming is not universally accepted. There is some degree of scientific evidence that the warming trend is natural rather than man made. This is not reassuring, for if the warming is man made, then it should be reversible by altering our technological practice.

If the warming is natural, then we will simply have to live (and many die) with it.

The Internet

It seems to be the nature of information networks that they are conceived for the distribution of illumination but quickly become an arena of commerce. We could start this story quite far back in history, but until commercial organizations become clearly distinguished from government, military, and religious organizations, the story would not take a form clear to our modern world view.

Early in the colonial period of North America, several of the colonies instituted postal services that quickly became network-like as the barriers posed by different colonies' systems were bridged.[128] Much of the cost of these postal systems was bourne by newspapers, who, despite special pricing that continues to this day, bought the largest fraction of the "stamps" that funded the systems. Ironically, this was the North American colonies' first stamp rebellion, albeit a positive one, in that it built an information network that connected the colonies more "tightly" to themselves than to their parent. In effect, this early information network assured the colonists of information interior lines in their revolution, their war with the organization. And the health of the network was assured by the predominate use of the network to transmit information for commercial purposes.

Of course, this service was adopted by the new central government, but the next two networks were creatures of commerce from the start. It is difficult to separate the diffusion and development of the telegraph and the specialized delivery services such as the Pony Express. The latter were always temporary solutions until the former could be established, then they either withered away or became instruments of the postal service, at least in part. The other network part involved the transport of goods and/or people.

The improvement that these two networks had to offer over the mail was transmission time. This rapidity had considerable appeal to other commercial organizations. The nature of this information transfer was node to node, but that was to be broadened by the introduction of first radio, then television. Both of these were originally conceived as beneficial for education, and indeed they are still used for such in environments where face-to-face concentration is impractical or presentation excellence is desirable. Unlike the previous postal and telegraph networks, these lend themselves to widespread broad-

[128] We may recall that in addition to biological warfare, one of Benjamin Franklin's earliest political jobs was postal administrator.

cast so the mode of receiver operation is reversed. In the postal and telegraph network, information is carried from the originator to the recipient; in a broadcast network, the recipient must take action to receive the information.[129]

The social impact of television and radio do not require extensive discussion. Like the telegraph, both networks are commercial enterprises, with government rules for content and behavior, but the government only using the networks in non-competitive ways. It is noteworthy however that the fraction of the "channels" of the network that cooperatively broadcast special government information, such as Presidential or Gubernatorial addresses to the populace, has steadily decreased with the expansion of the network. This would appear to be symptomatic of the evolution of the social roles of commercial organizations.

One of the distinctions of the internet is that it has multiple modes of transfer. If has the point-to-point originator to recipient aspect of mail, and it has a broadcast-like aspect akin to radio and television. It also, however, has a reverse of the mail aspect, analogous, rather loosely, to visiting a bookstore or library or bulletin board. Increasingly the latter is expanding to the dimension of visiting a store although the material goods must still be transported to the physical location of the recipient.

This additional aspect, with the great speed and geographic delocalization offered by a robust internet, is the great advance that makes the internet of great value to organizations. It allows them to amass information in a central location without having to use resources to either transmit specific information to specific recipients (after determining who needs what,) or to transport the recipients to the repository.

This information localization is not a panacea. The vision of Kurzweil [Kurzweil 1999] for human-computer linkages does not seem likely to be either a marvel or a concern. [Hershey 1975] Fundamentally, there is currently no better coupling mechanism between human and computer than created image or sound into the human eye or ear, or human muscular action into the computer. Further, bandwidth has fundamental physical limitation over the network that fall far short of human sensory bandwidth, to say nothing of the resolution and bandwidth mismatches between mechanical and human (organic) sensors.

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[129] This is admittedly a somewhat difficult point to make. One may quibble that an individual has to look in his mailbox to receive mail, and has to turn on his radio to listen to a broadcast. The key difference is temporal depth. If the recipient is late turning on his radio, he does not receive the information. If he is late in opening his mailbox, the letter is still there. The introduction of recording devices to capture broadcasts does not change this in that the recipient must still recognize the time when the information will be broadcast and "program" the recorder accordingly.

The internet started as a government and academic network largely residing on commercial property. The telephone lines were and are commercial property. As with radio and television, the internet is largely commercial in nature, although its rich admixture of different aspects of information transport and access make this complex. As with previous network commercializations, idealists decry the good being pushed out by the bad.[Lessig 2002] More critically for our consideration is the question of war and the internet.

In principle, the internet is the greatest opportunity for human society since the invention of spoken and written language. It is also the greatest threat of oppression offered to human society since sedentaryness.[130] The promise derives from the geographic and short term atemporality of the internet. Much of the promise of human society is compromised by people having to be close to each other at the same time to communicate and enrich individual knowledge through expanded collective information.

The threat derives from the centrality of information on the network. Simply put, one does not have to work hard at broadcasting propaganda if one can control all of the information that is available. Just as the Europeans of the Middle Ages thought everyone was Catholic until Muslims, Vikings, or Mongols showed up on their doorstep, [Manchester 1992] because they had no access to contrary information (and might not have thought of it if they had?), future humans may be similarly trapped by the masters of the internet. This is a tyranny so chilling as to make Orwell look petty and cast Lessig in a much brighter light if one considers the plasticity of law.

Nor does the control of the content have to be consistent or universal. The other half of the threat is access to the content. All that is required to limit the average citizen's information to what is desired is a set of sites with the desired propaganda, and control of search engines to exclude other sites. What is left uncontrolled is essentially a word-of-mouth diffusion (logistic-like) that is slow compared to broadcast.

Thus, the internet is a new arena for contention, and thereby war.

Evolution of Commercial Organizations

We have commented before that Nature, and thereby, man and his organizations, are remarkably cavalier in selecting modes of accomplishment. To misuse a catch phrase,

[130] It is hard, almost impossible, to efficiently oppress Hunter-Gatherer nomads. They can walk away and still survive. One may thus kill them, or eliminate their habitat, but direct oppression is difficult. Witness Australia as an historical example.

"the end justifies the means." In many instances, it is the failure to obtain the end, not the nature of the means, that has brought forth the strongest reaction.

The development of civilization is one of the great accomplishments of mankind. It is a monument to itself and the human nature of accomplishment. Only this can adequately explain how the first cities came into existence given the initial and persisting difficulties that are presented to them.

There is some evidence that the first cities, Sumer in particular, had to be started where settlement was sparse, rather than being some natural accumulation.[131] Given the difficulty that established cities have with both feeding and supplying their populations, and the repeated replacement of that population, it seems somehow contradictory that cities would have to be established in places where there were few people, and thus, little of peoples' industry.

As a result of this difficulty, trade and commerce early became fundamental components of cities and thus civilization. There is another catch phrase having to do with the entrapment of flies that seems applicable. Despite the state having enormous command and coercive powers, seizing farmers' crops and reducing them to servitude does not make them likely to strive to increase their yields, a fact understood rather quickly by our ancestors but a fact that evidently escaped the grasp of Communist bureaucrats. Exchange of crops for other things, manufactured or even mystical, not only encouraged greater production, but also reduced overhead by eliminating all but peacekeeping need for military presence. But, as we have noted, this organizative nature of man, released by the shift to sedentaryness, is much stronger than either egalitarian or communal politics.

The importance of this exchange is demonstrated by the invention of money after only about a kiloyear of city existence. [Grun 1979] The delay seems less a matter of a lack of imagination or planning than a lack of technology. The technology, of course, was the smelting and striking of suitable coinage metals.

As indicated previously, the early human organizations were not highly differentiated. While the government, religious, and military organizations had differentiated their administrative instrumentalities by this time, there was still considerable commonality at the senior levels, culminating with the head of all three often being invested in a single person. This would prove to be a remarkably persistent organizational artifact.

In this environment, it is hardly surprising that commerce and trade were closely con-

[131] There may thus also be a requirement that the sparse area be fertile ground for enhanced production through administrative, rather than material, technical innovation.

trolled at this senior level, especially beyond the geographic borders of the organization. The difficulties of interaction between organizations (states) assured that barter remained the norm for long after the internal adoption of currency although the extent of trust evidently extended to the acceptance of debt obligation and was not limited to immediate *quid pro quo* barter.[132]

The human desire to delegate work applies to organizations as well as to individuals. As a result, the human organization not only differentiated among its three primary components, but it came to differentiate commercial activity as well. Governments "commercialized" different types of activities including the collection of taxes, the minting of money, and even the direction of government itself, not always with equal or better result. The military, when it was not itself contracted out, a practice that seems to have an annoying tendency to result in replacement of the government, seems to contract out up to everything short of actual soldiering, thus perhaps lending to Clausewitz's distinction between actual war and its preparations. The religious, which does not seem to be contracted out, possibly because of the difficulty of obviously and demonstrably delivering product, appears to do some contracting of its more mundane functionality, up to and including the retailing of doctrine and those intangible benefits. Again, as with contracting out the military function, the results of this can be quite unpleasant. [Manchester 1992]

The commercial organizations developed slowly, possibly awaiting a sufficiency of technology to be turned into manufacturing and transportation capacity. The ancient world was not lacking in imaginative and creative individuals, [James Thorpe 1994] but it did lack the capacity for commercial organizations to expand beyond locality and luxury. Instrumentality aside, it appears the power of the state was too strong for the development of commerce. The key to the emergence of the commercial organization may have been the fall of Rome.[133]

We have already indicated that one of the key changes that occurred towards the end of the Middle Ages was need for technical manufacture that was not available locally. [Beeler 1971] These goods could only be obtained with money and that money had to be able to cross organizational boundaries. This monetary revolution spread and, in its turn, gave rise to a military revolution that turned war into something other than fair weather sport. First the bankers, then the craft leaders, and then the merchants obtained political influence. By accepting the exchange of property, either land or people, for money as

[132] There are interesting parallels between these state trade relationships and the potlach customs of Pacific Northwest Amerinds. [Saggs 1989]

[133] There is some speculation that such development may have been occuring at the end of the Bronze Age but was halted by the localization of the Iron Age. [Drews 1993]

the medium of command and control, the way was opened for the differentiation and evolutionary development of the independent commercial organization.

With this shift, cities came back into prominence, and the role of money increasingly dominated the activities and policies of government. By the Eighteenth Century, the three aspects of the fundamental human organization had fully diverged, at least in Europe, although there continued to be some cross-linkage at the top level. Wars increasingly had commercial components, reflecting the increased role of the commercial organizations and their importance to the governments. Indeed, it may be argued that the American revolution was as much about commercial disagreement as governmental.

The next leap of the commercial organizations also appears to be a result of state collapse, in this case, that of the European empires following the two world wars. The power vacuum left in many regions, one is loathe to call them states or nations because they are often today collections of tribes and/or chiefdoms wrapped in the facade of a government, was filled either directly or indirectly by commercial interest. The latter, of course, was largely the result of American democratic evangelism or interventionism. American politics have always been a remarkable trinity of people, government, and business with the latter gaining dominance in the latter half of the Twentieth century. That dominance has, of course, diffused in temporal parallel across the planet and given rise to commercial organizations whose scope and magnitude transcend that of nation states.

It appears to be in the "nature" of commercial organizations that they will compete and grow until there are only two or three such, either destroying or absorbing their weaker competitors in the process. Then the two or three somewhat slowly collapse to a single organization. This single organization will persist for a considerable time until it at last collapses and the commercial environment fragments again. This "natural" process seems to have been suppressed throughout most of human organizational existence by the strength of governments and strong geographic boundaries and barriers.

Increasingly however, government is influenced, even controlled by these commercial organizations. This control is both reflected and enhanced by what we might call consumerism. Humans are increasingly defining themselves more in terms of the products they want to consume than by the politics of the governments they are citizens of. They may be taxpayers but they increasingly want these taxes spent in a business-like manner and only on things that are immediately obvious and effective. Increasingly, local politics is more about access to advertised goods and services than collective and individual well-being and security. Even war and religion are subjected to commercial metrics.

Themes of Previous Wars and Ages

In addressing the nature of war and organization, we are sorely limited by history. In terms biased by mathematics, the limitation of history is not so much its domain, although the density of history within the domain is often limiting, but rather it is the range of history that is limiting. History's range is essentially bounded on the lower end by the invention and perfection of writing (circa 2000 BCE) and in a considerable sense effectively bounded in the period of Classical Greece with the first instances of historical methodology (circa 500 BCE).

The limitation that we obtain here is that by the time history comes to be, the evolution of human organization was largely as developed as human evolution itself. As a result, we have no direct insight into the warfare of the Hunter-Gatherer band, the larger anthropological band, the tribe, or the chiefdom when these organizations were developing or in their prime. Indeed we have little history of the warfare of the state during its early development. Thus, despite the best efforts of archaeologists, our insight into the range of warfare is largely limited to what has been observed since the development of the state. We are thus limited to a considerable (four thousand years, approximately) but still small segment of human existence and thus, we must hypothesize, war.

We do not ignore here the Rousseauian idea of the noble savage living in idyllic peace. As we have noted previously however, while such may have existed, it existed in localized, transient instances. What evidence exists, and this largely for legacy organizations in niche environments, indicates that the idyllic situation was temporary or transitory. In the main, it appears that these organizations either invented some form of warfare, often ritualized, to serve as a form of occupation (and control the population size,) or they reproduced so prolifically that they exceeded the capacity of their environment and physical violence became necessary for survival. [LeBlanc 2003] The warfare of these legacy organizations is often strange, (e.g.,) battles concluding at the first casualty but occurring with great frequency.

We have already discussed the evolution of the fundamental human organization earlier, so we shall here only briefly review the co-evolution of warfare. In particular, the role of captives has steadily evolved from captive refusal (killing on the battlefield) to captive taking, first incorporation, and then return.

In a similar manner, we have also reviewed the nature of war within the context of the Tofflerian taxonomy. In this we see the increasing role of property in the nature of

warfare. While we know little of warfare in the Age of Hunting and Gathering, we have advanced that warfare in this age was highly primitive, largely due to the acomplexity of the human organization, the fundamental restrictions of the hunting and gathering life style, and the small size of the organization. Of course, all of this began to change with the adoption of sedentaryness.

With this adoption, material and organizational technology could grow. Moreover, it had to grow, or the sedentary life style would have collapsed under its own population weight. From the success and failure of the development we project the development of warfare across the transition period from the end of the last cold phase to the full flowering of the Agricultural Age with the development of cities and armies.

By this time we see that wars are primarily about property. The history of the Agricultural Age may be portrayed by the progression of terms: peasant; serf; subject; citizen; indicating the relationship between organization and organization member. Political and social variations aside, the progression of the state of the organization member through the Agricultural Age was one of some mutual property relation. This is in no small part the result of the organizational technology of law.

In this regard, we see that the normal wars of the Agricultural Age are largely about property, often land and resources, with the role of people in these wars largely reflecting their role in relation to these land and resources. This also points to the nature of wars of revolution, which were also about property, either in the form of how the organization members would be regarded as property, or in how they could own property.

The Industrial Age, by its name, is characterized by a shift in importance from the agricultural to the mechanical; organizationally, from city and farm to transport network and factory. This was largely the result of advances in material and organizational technologies and changes in the society of the fundamental human organization. Just as the transition to the Agricultural Age was realized with the organizational technology that enabled the city, the Industrial Age was realized with the organizational technology that enabled the citizen. It is thus small wonder that the American and French Revolutions straddle this transition, albeit they both propagate from the earlier English Revolution (Civil War).

This is reflected in the nature of Industrial Age wars. These wars are increasingly wars concerned with ideology, over the shape and doctrine of the organization. In effect, these are wars influenced, even determined by the emergence of citizenship. The emergence of the citizen is accompanied by the evolution of the commercial organization. As a

result, we see normal wars of the Industrial Age increasingly concerned with land and resources not so much for the sake of accretion of physical domain as some assurance of control.

Rather simplistically, at the end of the Agricultural Age and proceeding through the Industrial Age, we see a shift in governance from ownership of the members of the organization to a simpler control of the members. Of course, the rise of democracy follows from this, as does the flowering of commercial organizations, which in many governments are treated as pseudo-citizens.[134] This is reflected in the wars of the Industrial Age. The scope of wars changes from ownership to control. Territory, *per se*, becomes important only if the resources or capabilities therein are supportive of the balance between agriculture and industrialization, although this restriction is still enormously broad. For example, territory may be desirable in this sense as a preliminary for further acquisition, as a source of raw materials or commercial market, or even as fertile ground for the ideology of the citizen based government.

Similarly, the wars of revolution are also about this evolution from ownership to control. Obviously, the transition wars of the Age, the Americans and French Revolutions are largely concerned with the transition from subject to citizen. As is often the case with such wars, the result overcarried not only to citizenship but to democracy. Having successfully made the transition, the victors find themselves with the problem of reestablishing some tighter form of control. In the one case, Federalism soon emerged, while the other soon reverted to reinventing monarchy by way of oligarchy.

As the Age progressed, most wars of revolution were more temperate, being more concerned with the scope of that control within the framework of an existing but evolving government organization. In this regard, the Russian Revolution may be seen as the passing of the last (?) ownership dinosaur (government), and the Chinese Revolution as the reestablishment of a Chinese state (states?) by the eradication or desorption of the *noyaux* that developed during and following the fall of the empire. Indeed, as a result of a series of wars of largely economic scope, that *noyaux* formation may presage some aspects of the Information Age.

[134] In fact, it appears that one may track the evolution of commercial organizations as shadow members of the fundamental organization, first as pseudo-peasants; then pseudo-serfs, then pseudo-subjects, and finally pseudo-citizens.

Information Age Wars

It would seem that I can no longer postpone the risk of making a fool of myself by predicting the nature and scope of the wars of the future. I undertook this work as an exposition of observation on the nature of warfare, and having presented at least some of that observation on the past, which is imperfect in our ignorance due to a lack of recorded and preserved information. It now seems fitting, perhaps even necessary, that some observations on the present and the future they imply be presented, noting that this is also imperfect in our ignorance of what has yet to occur.

While the period we are entering may be called the Information Age, it is not clear that information so much defines as shapes the nature of the warfare of the Age, any more than industry or agriculture did the previous Ages. In keeping with the theme expressed throughout this work, and thus being rather linear, the wars of the Information Age will be about human beings and the organizations of these humans. Lacking any substantial mutation in the humans, we must look to the evolution of the organizations for the nature of that warfare.[135]

We have already noted the progression peasant-serf-subject-citizen. Now we appear to need to add customer (or consumer?) to the progression. In a sense, this is a break from the previous model, and by that deviation from consistency, the whole model is brought into question. This however, is what the model propagates, and thus we must make note of it even while observing that previous deviations may have occurred. The most obvious of these deviations have resulted from the changes in the nature of the religious organization. We shall discuss that aspect shortly.

The evolution of the relationship between government organization and its members to citizen has also altered the relationship of the commercial organization, as we have previously mentioned. Just as the emergence and development of citizenship has resulted in considerable relaxation of the restrictions on the government organization's membership and made that government more directly influenced by its membership with the diffusion of democracy, so too has the commercial organization, benefiting from the protection of citizen status, at least as a legal construct, emerged from the shadow of the government, religious, and military organizations.

It may be recalled that the American Revolution was caused at least in part by the restrictions of the British government on the commercial development of the North American

[135] The retained ability into maturity to digest milk, a mutation propagating largely through the Americas, does not have any obvious influence on warfare that I can perceive.

colonies. The Boston Tea Party demonstrates both this and the relationship between governmental and commercial organizations, in this case specifically the British government and the British East India Company.

Of course, the Industrial Age was largely about the development of commercial organizations and their separation from the shadow of the older human organizations. Today however, there are many such commercial organizations that are larger than most government organizations. Indeed, in many cases these government organizations have come to model themselves on these commercial organizations. Similarly, government organizations are often more concerned with the needs and protection of these commercial organizations than they are with the needs and protection of their individual human members.

This has not occurred without changes in the citizenry. Until recently, the human element had come to define itself in terms of employment, usually in terms of these commercial organizations. As the Industrial Age progressed, and commercial organizations grew in size and power, humans employed by these organizations defined themselves in terms of their employment by these organizations and their position in society was defined in part by that employment and the status of the organization. As the governments came to control these commercial organizations less and be controlled by them more, this definition of self by membership in (as an employee of) a commercial organization came to rival and then in some cases surpass definition by membership in a governmental organization.

Recently this trend has partly reversed itself by the economic need for many commercial organizations to repudiate their pension and/or medical insurance programs, thus rather fundamentally disrupting the loyalty (trust) relationship between organization and membership.[136] This reversal may be temporary but for the immediate future it has served to accelerate another trend that appears to be key to our consideration of future warfare.

That tend is what we might call consumerism. In part as a result of the success of modern advertising and the democratization of fashion, humans now increasingly define themselves in terms of the manufactured goods they consume. In most cases, this identification is relatively mild, existing in parallel with older identifications associated with membership in governmental and/or religious organizations. In other cases however, this identification is quite pronounced. Notably, much of this definition or identification is made more complex by association of the manufactured goods with other commercial

[136] This desruption has also given rise to legal innovations that are intended to accommodate this disruption but by being legal have at least the short term effect of further weakening the organization-member bond.

(or semi-commercial) activities (and thus organizations) such as athletics or entertainment.

This identification, of course, is largely the result of the progression to citizen and the accompanying democratization of governance with the expectation and right of participation without the requirement to do so.[137] Equally, the identification is encouraged by the commercial organization in the interest of selling more consumer goods, both material and what we might loosely call informational. Critically, the commercial organizations, desiring to sell as much as they can, also exert pressure on government organizations to accord them access to the local marketplace and leeway for the government's membership to be consumers of the offered goods and services.

In a sense, this is the break we mentioned earlier. In previous ages, there were essentially only governmental organizations and their members. Thus we were able to define two types of wars: wars between (mostly) governmental organizations; and wars between a governmental organization and at least some of its membership. This model was sufficiently general from its postulation that it could accommodate wars within the organization as middle ground. In that regard, we now extend the model without great fanfare to accommodate the emergence or differentiation of the religious and military subordinations into fully distinct organizations.

Thus, we argue that while the emergence of the commercial organization and the implication of war on their part is a break with the previous advance of the model, it is nonetheless a direct generalization. The break occurs because we must generalize to accommodate war without the direct and/or unique involvement of a government organization. We recognize this however, as being a generalization of previous instances that were treated as variations, such as the Renaissance wars fought by the Vatican. Accordingly, we must now admit an increased complexity of a spectrum of war ranging from war fought between organizations and war fought between organization(s) and membership. In this context the domain of economic warfare thus becomes fully part of the model.

With this elaboration, we may advance that the nature of war in the immediate future, if not for the bulk of the Information Age, may be shaped by this consumerism. Some of this has already been developing. For example, we may expect wars between governmental organizations for access and control of natural resources to be used to produce consumer goods to continue, as will wars for access to consumer populations, although

[137] The requirements of government organization membership is now largely reduced to paying taxes, obeying laws (although increasingly less rigorously,) and perhaps jury or military service.

these wars may become more obviously fought for the sake of commercial organizations than the government organization *per se.*

It is in this type of warfare that the information aspect becomes more clear. To see this we must consider the difference between accuracy and consistency. Accuracy is a quality of realism while consistency is a quality of absence of variation. Propaganda does not have to be highly accurate to be effective, but it does have to be consistent. While the instrumentality of the information revolution offers great potential for personal expression and communication, it also offers great potential for organizational control. For example, much of the physical component of the Internet is the property of commercial organizations and increasingly the information content is either their property or legally regulated, largely at their behest. [Lessig 2002] Thus we may expect wars to be fought by government organizations on the behalf of commercial organizations but portrayed to the citizenry as in their best interest and widely accepted as such by those who have become consumers.

Lest this be seen as some conspiracy theory, it is anything but. By nature a conspiracy is both covert and contrived. The proposition advanced above is both overt, and in that it exists in the framework of human society, natural. It is both commonly known and commonly ignored because of basic human nature.

It is because of human nature however, that additional complexity in war exists and will likely continue to be found so in the future. We may expect that wars between commercial organizations will continue, and we may expect occasional instances of war between a government organization and a commercial organization. The details of these latter will depend on the local balance between citizen and customer character, whether the populace sides with the government or the commercial organization.

This latter may also spawn what we might call wars of semi-revolution as the relationship between human member and organization, either governmental or commercial, is contested conditional on the other type of organization. We may also see true revolution directed against governmental or commercial organization alone or for definition of member rights.

In considering this, we must recognize that consumerism may be compared to the relationship between government and serf or subject (more so than citizen.) That is, if a commercial organization may influence a consumer to always buy their brand of good, then a measure of control is exerted that is comparable to that exerted by a state over a serf or subject. Just as wars of revolution have resulted in greater freedom for gov-

ernment organization members to not be property, to own and acquire property, to hold views and beliefs, and to participate in the governance, we may anticipate wars of revolution intended to result in greater freedom for commercial organization members. What is not clear is whether that freedom will be exercised through governmental organization, directly, or through new organization. Since this is not clear, it seems safe to advance it will be by all three.

It may be advanced that this type of war of revolution or semi-revolution is already evident. One consequence of consumerism, with the freedom of commercial organizations to compete and of humans to purchase their goods, is an enforced accommodation of a social form. Part of this social form is an inherent materialism, if not hedonism. Another part is the adoption of democratic capitalistic governance. The latter carries with it an expectation, if not an actuality, of a fair rule of law.

The effect of the latter is often the alienation of specificist, often elite, groups of members. In many cases, formerly ruling elites may be disempowered, or previously socially unempowered groups may be empowered and thus desirous of social equality as well. Alternately, the administrative role of government to assure fair rule of law and democratic practice may be seen as intrusive and improper. Finally, the social aspects of consumerism, especially the materialistic with its rapid aspect of fashionable change to maximize revenue, may be seen as threatening in a society of a more spiritual nature.

The response to this by a group (organization) may very well be contention to either maintain a contested existing will or to repel or eradicate the will being imposed. In particular we may readily identify local political and/or religious organizations as likely candidates. Those with an elite aspect are particularly likely, as are those who do not embrace a strong differentiation between government and religion. Because the local government will be under substantial pressure to accept these aspects of consumerism, the contending suborganizations may act on their own as well as attempt to gain control of their local government. In these circumstances it naturally follows that the protecting, sponsoring governments behind the commercial organizations will respond to the contending organizations in a measured governmental fashion.

On Terrorism

This rather abstract description becomes concrete if we look at terrorist activity over the last decade or so. While disempowerment of conquest may be the cause of some, Palestine is the obvious example, most terrorist activity may be seen as war (contention)

against consumerism. From an American perspective, much domestic terrorism may be related to perceived administrative intrusion to assure fairness. Foreign terrorism, whether committed domestically or on home ground, may be similarly related.

Of particular note are Muslim terrorists or extremists, both of which terms seem less than accurately applicable. The Muslim religion is highly spiritual and in many instances at best weakly differentiated from the governmental organization. Given a general inability of governments to decline consumerism and a derivative view of the failure of their governments to resist and uphold their spiritual society, a contentious response seems historically natural, albeit at best temporarily successful. It also seems natural that contention will be directed not only at the commercial organizations but at their government sponsors as well.

In terms of the taxonomy of Jones, [Jones 1987] terrorism is a raiding strategy. It is a means for the weak to prosecute war against the strong. In a sense it is an almost ultimate form of the raid if the terrorists intend to die in the commission of their attack as this assures a form of ultimate security to the raid. That is, counter-raiding can not be effective against such terrorists because they cannot be intercepted and captured or destroyed while returning to their safe base of supply.

Thus, if one is the target of a terrorist strategy one can effectively respond militarily only with a persisting strategy. One can only go in and raze the base of supply.

It is important here to recognize what this means. This is not a simple counter-raid where we kill or capture everyone and burn what can be burned. No, we must kill or capture everyone who is a part of this, we must destroy the structure until no two stones touch, and then we must sow the ground with salt.

There are, of course, two other dimensions to this, the combat and the logistic. In general, the latter is the more important. Since terrorism is a strategy of the weak against the strong, it would be foolish of the attacker to assault the strengths of his foe, at least unless he has surprise. Thus, the terrorist, confronted by a persisting combat strategy, does not engage in battle with his foe. No, instead he hides and strikes only from ambush or assassination. If necessary, he hides until his enemy is tired or must use his troops elsewhere.

This is why the persisting logistic strategy is the more important against terrorism. The terrorist organization must be bankrupted. Its resources: people; supplies; money; freedom of movement; must be reduced below the point of existence.

That is what must be done if one is to defeat terrorism. It is neither pretty, nor quick, nor even obviously decisive, but it is what has to be done.

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A References

B Index

This appendix contains the index.