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MASTER OF MILITARY STUDIES

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**A NOVEL APPROACH TO MILITARY LEARNING**

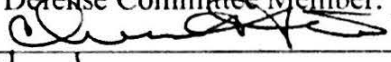
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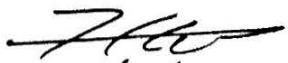
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## *Table of Contents*

	Page
EXECUTIVE SUMMARY .....	i
INTRODUCTION: DOCTRINE AND LEARNING.....	1
PART I: ORGANIZATIONAL LEARNING LITERATURE REVIEW .....	3
PART II: WHAT IS DOCTRINE?.....	7
Current US Doctrine Development Methodology .....	9
Case 1: Cold War Doctrines of the US Army .....	16
Case 2: The Weapons Succession Process .....	17
PART III: OPEN SOURCE .....	19
The Recursive Polis Considered by Organizational Learning Theory .....	21
Case 3: Anonymous .....	28
PART IV: A PROPOSAL FOR A MILITARY OPEN SOURCE DOCTRINE DEVELOPMENT CAPABILITY .....	31
CONCLUSION AND IMPLICATIONS.....	38
APPENDIX A: ORGANIZATIONAL LEARNING THEORY .....	40
APPENDIX B: SUPPLEMENTAL CASE STUDIES .....	50
Traditional Case B1: The Thor/Jupiter Missile Affair.....	51
Traditional Case B2: The M-16 Rifle Development Controversy.....	52
Traditional Case B3: The Soviet Response to US Army Cold War Doctrines .....	54
Traditional Case B4: Testimony of Current Leadership.....	56
Open Source Case B5: The Islamic State .....	57
Open Source Case B6: Current US Government Open Source Efforts .....	58
APPENDIX C: A BRIEF HISTORY OF OPEN SOURCE.....	60
FIGURES.....	62
ENDNOTES .....	64

*Figures*

	Page
Figure 4. The Joint Doctrine Development Process .....	62
Figure 5. The Joint Doctrine Publication Hierarchy .....	63

## Executive Summary

**Title:** Open Source Doctrine Development

**Author:** Lieutenant Commander Robert Stephen Ramsey, US Navy

**Thesis:** Open Source (OS) is an organizational learning model that exceeds the tempo of traditional military doctrine development methods by at least two orders of magnitude. OS learning models are parallel, recursive, adaptable, and fast. These characteristics are structural; current military doctrine development methodology is doomed to fail when pitted against OS competitors. Only by adoption of significant elements of the OS paradigm will militaries be able to prevail against rapidly learning OS competitors.

**Discussion:** Organizational learning in a military context is doctrine development. Significant research in Organization Theory and Organizational Learning demonstrates how learning at the individual level inevitably gives rise to macro-level limitations to organizational learning (power struggles, internal politics, etc.). Since organizational learning is an emergent structural property, traditional militaries will exhibit severe restrictions on their ability to learn regardless of leadership, training, education, or any other factor of the individual.

The current military's formal doctrine-development process is a clear example of this limited-learning system in action. In ideal operation, most Service doctrine takes 18 months or more to simply issue a doctrinal publication, which often will remain in force far beyond the point at which it becomes out of date, irrelevantly or perhaps dangerously so. These malign effects are structural, beyond the ability of individuals to change. Both theory and case study support this contention.

Open Source is a novel idea in human history and presents an organizational form, the Recursive Polis, which completely avoids the organizational learning limitations that bedevil traditional bureaucracies. As before, recursive poleis learn as they do because of their structure, which presents the opportunity for the US military to adopt the structural form and apply its terrific learning advantages to its own doctrine development problems. Building military recursive poleis for doctrine development would give concrete form and meaning to the profession of arms. Further, recursive poleis require values in operation which are inherently liberal and Western, providing an opportunity for the US to embrace an enduring advantage over any illiberal foe. It does present a radical departure from military cultural norms, most notably the requirement to let it go, for commands to refrain from attempts to externally direct its goals or methods.

**Conclusion:** Historically, the organizational learning limitations imposed by the traditional military structure have not been weaknesses since all militaries share the same hierarchical bureaucratic form. However, the recent emergence of the Open Source idea upends this status quo. By adopting Open Source models such as the Recursive Polis for doctrine development, the US military could reduce its organizational learning cycle time by orders of magnitude. Such an adaptive advantage would enable the US military to maintain its advantage over emerging Open Source competitors and would be an enormous structural advantage over any traditionally constructed military opponent.

## Introduction and Thesis: Doctrine and Learning

All human organizations learn or die. For military organizations entrusted with the defense of the state, the imperative to learn is paramount, yet doctrine development - the heart of organizational learning in the military context - is often maddeningly slow. While modern military doctrine writers struggle to build consensus within their feuding bureaucracies, the Internet age has given rise to the idea of Open Source and its characteristic organizational form, the Recursive Polis, which exhibits none of the “military limits” to organizational learning.

Open Source is a novel organizational learning model whose learning pace exceeds the tempo of traditional military doctrine development methods by at least two orders of magnitude. Open Source learning models are parallel, recursive, adaptable, and fast. These characteristics are structural; the implication of which is that current military doctrine development methodology is doomed to fail when pitted against Open Source competitors. Only by adoption of significant elements of the Open Source paradigm will militaries be able to prevail over highly adaptable Open Source competitors.

Doctrine,<sup>a</sup> the particular combination of military ends, ways, and means that attempts to achieve the political purposes of the state, is the military’s answer to state defense problems; the continuous evolution of doctrine is organizational learning within the military context.<sup>1</sup> Doctrine may be formal - promulgated by high authority - or informal - the collection of military folk wisdom simply known by all. It may deal with high concepts or low tactics but all of it arises from the consensus of the military profession on how to solve the problems of war. Doctrine develop-

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<sup>a</sup> This paper will use the word doctrine loosely, to refer to both formal and informal doctrine, inclusive of allied, joint, and service doctrine at all levels, from capstone doctrine to unit-level tactics, techniques, and procedures (TTPs).

ment is ultimately a sifting mechanism that builds consensus within the profession of arms, and like any mechanism, its operation is supremely dependent on its structure.

Militaries typically take the form of a classic Weberian bureaucracy<sup>2</sup> with all the strengths and limitations the form entails.<sup>b</sup> Militaries have well-understood structural limitations in their capacity for organizational learning,<sup>3</sup> most notably that they are limited to learning models that iterate toward an optimal solution without questioning the purposes, values, and assumptions of the organization.<sup>4</sup>

To support this thesis, this paper will review the literature of organizational theory in order to establish a common framework for exploring specific organizational cases. It will explore the current methods for generating and maintaining US military doctrine, make predictions using organizational theory and attempt to demonstrate these predictions in case study. The paper will then present the Recursive Polis as a non-Weberian organizational form, analyze its capabilities via organization theory, make predictive tests, and attempt to demonstrate predictions within contemporary examples. It will compare Open Source organizational learning capacities with traditional military doctrine development capacities and present implications.

Finally, it will present a course of action for the development of a non-Weberian military Open Source doctrine development capability, one that will radically improve the building of consensus within the profession of arms and therefore doctrine. The US military should embrace Open Source, establish the Recursive Polis, let it go to learn and adapt like no other human organization can.

## **Part I: Organizational Learning Literature Review**

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<sup>b</sup> This paper will regularly use the word “military” as both an adjective and a noun. In all cases, the word military will mean “a classic Weberian bureaucracy created for the purpose of utilizing organized mass violence.” If other organizational forms are being described they will be referred to specifically.

Organizational Theory (OT) is a large and varied literature which seeks explanation for organizational behavior by analysis of organizational structure.<sup>5</sup> OT holds that all organizations pursue purposes rationally by seeking to control their environments and the behavior of individual members, leading to the general rule: Organizations abhor and seek to reduce uncertainty.<sup>6</sup>

Organizational Learning (OL) is a subset of OT founded on the postulate of uncertainty reduction. Drs. Chris Argyris and Donald Schön note that to pursue their purpose, organizations maintain “theories of action” which are organizational knowledge in the form of systems of belief, prototypes for action, or procedural prescriptions.<sup>7</sup> Using Dr. Graham Allison’s terminology, theories of action are analogous to “repertoires,” built up hierarchically from SOPs that govern simple tasks.<sup>8</sup> Repertoires may be either espoused or in-use; in bureaucracies it is common to have differences between the two types.<sup>9</sup>

When the output of an in-use repertoire fails to serve the organizational purpose or conflicts with the expected output of the espoused repertoire, individuals within the organization experience a personal increase in uncertainty. On behalf of the organization they engage in inquiry, a combination of thought and action seeking to reduce doubt, in order to reduce the mismatch that caused their uncertainty.<sup>10</sup> This personal learning reduces individual uncertainty. Organizational learning occurs when a critical mass of the organizational members share the learning and/or when members embed the learning into the artifacts of the organization.<sup>11</sup>

OL operates in loops, modifying, testing, and further modifying repertoires until uncertainty is reduced to an acceptable level. These loops operate on two levels, depending on whether the inquiry challenges the values and norms of the organization. Single-loop learning is the first level, where only the SOPs within a repertoire are refined.<sup>12</sup> Double-loop learning is the second level, where the first loop results fuel inquiry into the values and norms of the organization.<sup>13</sup>

Single-loop learning is common in militaries, the Boyd cycle and Six Sigma are familiar examples. Double-loop learning is rare because challenging values and norms produces uncertainty by design and organizations therefore resist it.

Even single-loop (first level) learning is made extremely difficult by the presence of defensive reasoning in individuals and organizations. A priori, human beings seek to avoid giving or receiving threats or embarrassment.<sup>14</sup> As Argyris and Schön observe, when confronted with such threatening situations, virtually everyone seeks to unilaterally protect themselves by manipulating their environment and others. Individuals bypass and cover up problems instead of resolving them, because such resolution involves creation of threats, embarrassment, and uncertainty.<sup>15</sup> As problems mount, individuals form groups and create SOPs (organizational defensive routines) that serve to increase their collective ability to resist threats and embarrassment.<sup>16</sup> Argyris and Schön term this free play of individuals and organizations engaged in uncertainty avoidance as a Model I limited learning system. Model I behavior leads directly to the intricate worlds of organizational politics and is the normal condition of bureaucracies.<sup>17</sup> It is because of this behavior that Dr. Barry Posen observes the inevitable slide of doctrine toward being “offensive, stagnant, and disintegrated with political ends,” unless governed intrusively by civilian overseers or unequivocally defeated.<sup>18</sup>

Double-loop learning is impossible in the face of defensive reasoning.<sup>19</sup> Normally, militaries will not utilize double-loop learning unless defeat or external force of civilian authority compels them.<sup>20</sup> Therefore, the normal condition of military (Model I) organizational learning is punctuated equilibrium, where a military establishes its values and norms, then engages in first-order (single-loop) learning for long periods of time until some external shock threatens its purpose and causes second-order (double-loop) learning that revises the military’s normative foun-

dations. The principal problem is that the military can get out of sync with its environment for long periods of time, perhaps leading to catastrophic defeat. Alternatively, normal OL system for a recursive polis is a double-loop (Model II) where its members continuously challenge the values and norms of the polis, causing it to track reality quite closely. Figure 1 below depicts the normal learning patterns of militaries and recursive poleis in comparison with an arbitrary environmental position.

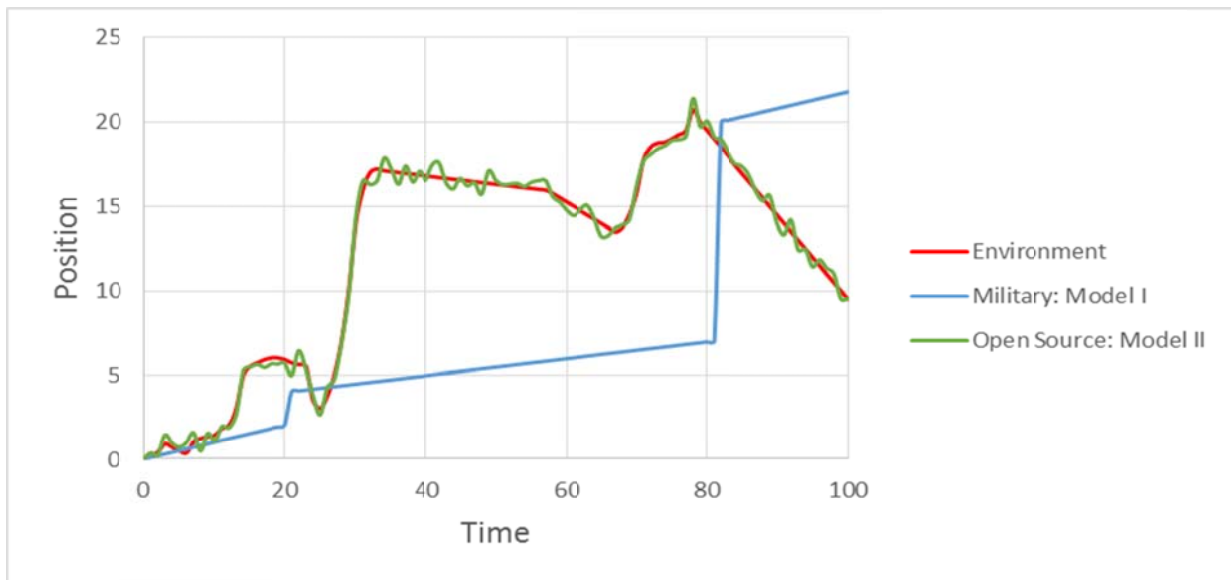


Fig. 1: Comparison of organizations utilizing Model I and Model II learning patterns.

Finally, the level of (group) aggregation matters a great deal, because OL is an emergent behavior positively correlated with group size. An organization is a group of individuals that has become “a recognizable vehicle for collective decision and action,” which is a “polis” in the classic Greek sense.<sup>21</sup> Above a certain size and complexity, groups become organizations and OT and OL are predictive. Below this size, OT and OL fail and theories of individual behavior, individual learning, and small-group dynamics should be predictive.

OL must arise when group size increases beyond the maximum number of stable relationships any human being can maintain, or “Dunbar’s number,” hypothesized to be 150 rela-

tionships.<sup>22</sup> Human beings are social creatures who evolved in small family groups; it is easiest and most natural for us to operate in a setting where everyone knows everyone else. Organizational formation is intellectually and emotionally taxing, causing groups to resist it until such formation is absolutely required to pursue the group's purpose. Therefore, large organizations are typically composed of numerous small groups, all of whom see the others as essentially alien.

The military context bears this prediction out. The basic unit of command authority is the company of approximately 150 soldiers and has been so since the 16<sup>th</sup> century. A company operates with a minimum of organizational behavior and formal artifacts (paperwork, written procedures, etc) because the great majority of its operation is by small-group dynamic, the natural condition of human beings. At the battalion level evidence of purely organizational behavior appears, because the purpose of the organization (making war) has required a groups larger than Dunbar's number and therefore rules-governed organizational behavior.

## **Part II: What is Doctrine?**

Doctrine is the consensus of military professionals on the combination of *existing* military ends, ways, and means best suited to achieve the political ends of the state and is simultaneously the military's repertoire of programs and SOPs.<sup>23</sup> "Doctrine development" in a limited sense means the creation of written doctrinal publications (artifacts within the military culture) and more holistically, the process of organizational learning within the US military.

Doctrine may be either informal or formal. Formal doctrine is an espoused theory of action endorsed and promulgated by high authority figures in the military chain of command. It exists in a reciprocal relationship with organizational culture, where both continuously influence the other. Leadership may use it as a tool for education, for leadership, or for command, depend-

ing on their purposes.<sup>24</sup> From studies on human cognition, formal doctrine is an expression of the highest level of human knowledge, *scientific knowledge*, where rigorous theory and organized skepticism are required elements.<sup>25</sup> Formal doctrine suffers from tendencies to ossify, constrain individual creativity, and over-promise its explanatory power in the face of the complex problems of war.<sup>26</sup>

Informal doctrine is “the result of repeated experiences that produce similar results and subsequently produce beliefs – sometimes personal, sometimes broadly held – about what usually works best.”<sup>27</sup> It is the inevitable result of human tendency to invent heuristics, or rules of thumb, to explain observations and reduce individual uncertainty. Informal doctrine rests on a lower level of human knowledge, *informal* or ‘*folksy*’ *knowledge*, which is knowledge used in routine activities, where “the justification is often local and involves both tradition and immediate experience.”<sup>28</sup> Informal doctrine tends to be easy to develop but suffers from a high possibility of error due to experience bases which may be either too shallow (e.g. too few repetitions to draw accurate generalizations) or too narrow (ie: combating only one type of enemy).<sup>29</sup> A good example of informal doctrine is the evolution of fighter-plane tactics in World War 1, where pilots had success by attacking from behind and out of the sun, and generalized that advice to train new pilot trainees.<sup>30</sup>

In an ideal case, informal doctrine should arise from the experience of field units and be tested, analyzed, compared against policy, and if found worthy, be transformed by command authority into formal doctrine and promulgated to the force. The processes that form the bridge between informal and formal doctrine, specifically those processes for capturing field experience and then building consensus regarding its general validity, become critical. As Lieutenant Colonel Dennis Drew, USAF, faculty of the School of Advanced Air and Space Studies observes:

All of this leads to a set of difficult questions. Do we recognize the pervasiveness of informal doctrine? Does our official doctrine bubble up from informal doctrine? Do we actually ask our warriors in *field units* for their beliefs about what usually works best? How do we sort out sound beliefs from those that are unsound? Who does the sorting, and what biases do they bring to the task?<sup>31</sup>

The US military's current answer to Lt. Col. Drew's questions regarding the bridging function from informal to formal doctrine is a complex process which suffers from all the severe limitations that large bureaucracies face when engaging in organizational learning. Open Source, as will become clear later, represents an alternate bridge, a completely different and much superior way of getting from informal to formal doctrine.

### **Part II.1: The Current US Military Doctrine Development System**

The espoused theory of action for US military doctrine development begins with Joint Publication 1-01 *Joint Doctrine Development System*, currently dated 5 July 2000. The Joint Staff created this publication in 1987 and it represents an amalgam of the Service doctrine development publications that preceded it. Doctrine created through JP1-01 authorities and processes is "joint" and is therefore authoritative over Service doctrines. All Service doctrine development processes comply with or directly copy the processes of JP1-01. The document assumes a large, functionally specialized, and geographically dispersed military. It defines hierarchical and functional responsibilities and establishes a linear doctrine development process with a goal of generating a broad consensus prior to signature.<sup>32</sup> The JP1-01 process consists of four sequential phases, *initiation, development, approval, and maintenance*. The initiation phase requires:

1. A proposal endorsed by a high official.<sup>33</sup>
2. A front-end analysis by a specialist organization, United States Joint Forces Command Joint Warfighting Center (USJFCOM JWFC).<sup>34</sup>

3. Validation by a committee of vested interests, the Joint Doctrine Working Party (JDWP).<sup>35</sup>

The major initiation phase output is a formal program directive which communicates the decision of the J-7 to reject the proposed change, modify existing doctrinal publications, or create a new publication. Furthermore, the program directive provides the frame that guides the development (and approval) process, shown in Figure 2, below.

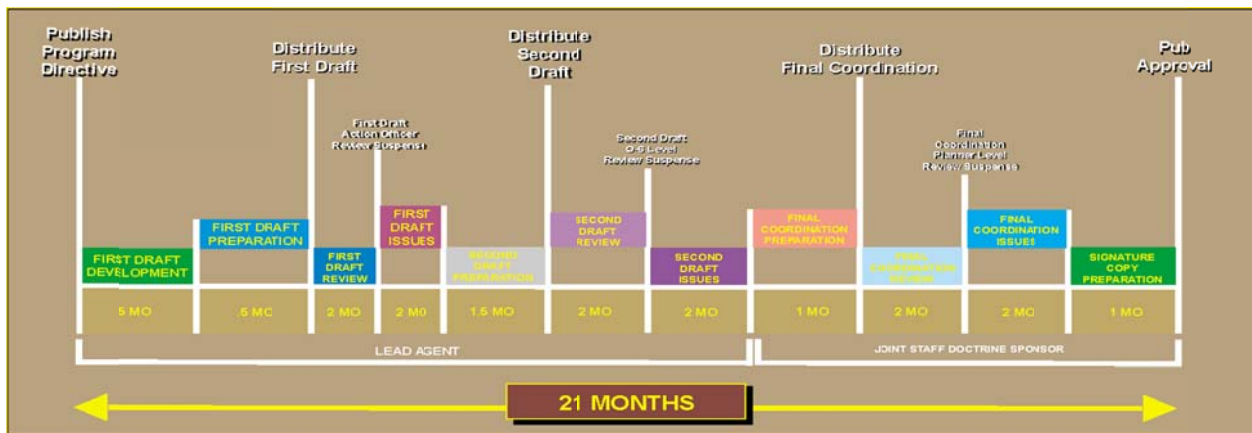


Fig 2. Joint Doctrine Development Process (JDDP)<sup>36</sup>

The JDDP attempts to build a consensus document by drafting, receiving comments, resolving concerns through working groups, and redrafting. It requires four iterations at ~5 months each, for a total design time of 21 months. Two variant procedures exist: (1) A “fast-track” process (12.5 months total) which removes a review iteration and cuts the time in most steps, and (2) A “test and evaluation” process (27-33 months total) where the publication is formally tested by specialist organizations after the second draft is distributed.<sup>37</sup>

Joint doctrine is arranged in a functional hierarchy modelled on traditional military staff codes, per Fig 2 below. Joint Staff policy requires regular revision every five years through the JDDP (Fig 1). Changes in the interim are handled as follows: Urgent changes will be executed at any time by the J-7. Substantive changes are circulated amongst the vested interests to build con-

sensus and approved at not lower than the O-6 level. Administrative changes wait until the next scheduled revision. Missed milestones trigger escalating involvement of flag officers.<sup>38</sup>

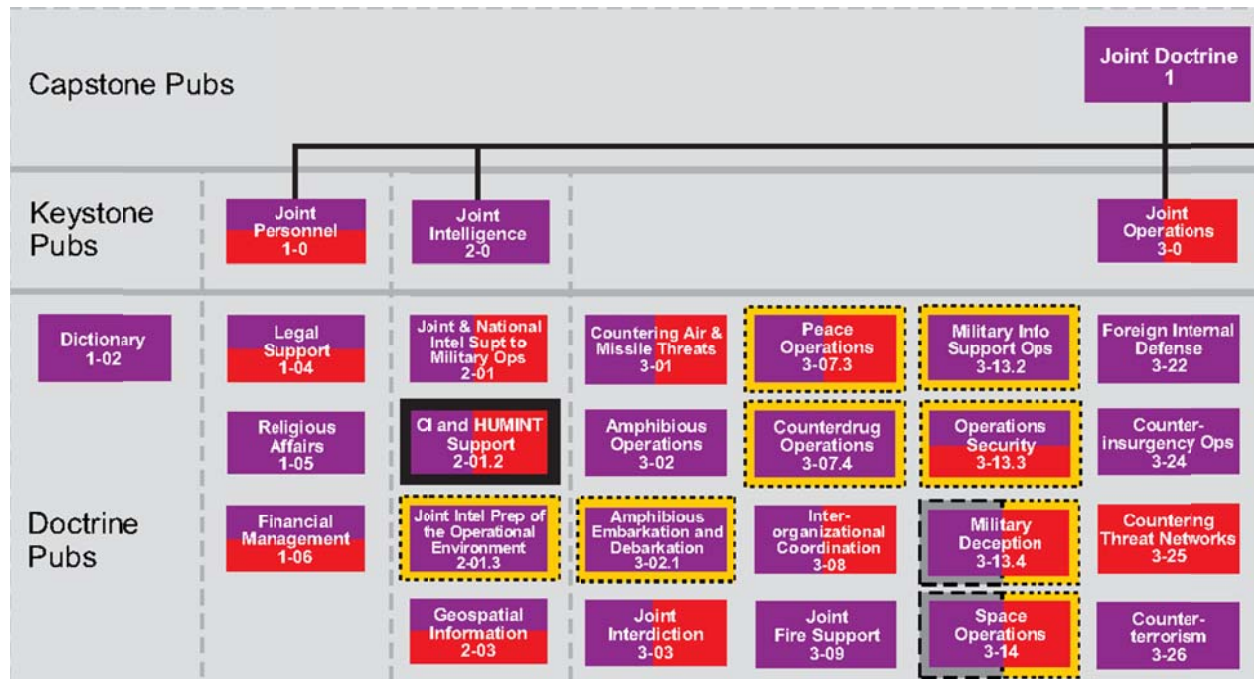


Fig 3. Joint Doctrine Hierarchy<sup>39</sup> (cropped portion shown, full chart as Figure 5 in Appendices)

None of the Service programs are substantially different from the joint model. The Army, Marines, and Navy all maintain a doctrine-development publication, while the Air Force uses JP1-01. All Services review publications every 5 years. The Army and Marine publication review processes take 18 months, whereas the Navy process takes 12 months. The size of the doctrinal hierarchy and the level of doctrinal detail vary greatly, however.<sup>40</sup>

As a final note on supporting systems, all the Services utilize some form of *Lessons Learned* system where military members can provide feedback on military operations in general. The Joint Staff has aggregated a wide variety of systems through a common portal, the Joint Lessons Learned System (JLLS), which exhibits some Open Source characteristics and will be discussed later.<sup>41</sup> Similarly, the Services maintain an extensive *Training & Education* system that must promulgate doctrine convincingly in order for it to be effectively absorbed by the Service.

The Services have a very wide variety of specialist *Research, Development, Test, & Evaluation* (RDT&E) organizations to utilize in the testing of doctrine. Though a survey of these organizations is beyond this paper's scope, the capability appears to exist to test any doctrine likely to arise from within the joint system.

From an OT perspective, several observations emerge. "Change ideas" must navigate complex hierarchies of functionally specialized organizations. Because organizations will arise from groups above 150 individuals, it is probable that every echelon of command in every hierarchy will be comprised of at least two organizations. Even the lowest doctrine level (TTPs) is typically approved at the brigade (O-6) echelon and will have to navigate at least 10 organizations;<sup>c</sup> high-level doctrine will navigate exponentially more. Since consensus-seeking is explicitly directed in all doctrine development programs, "common sovereigns" over these small organizations will be reluctant to act decisively, enabling an anarchic free play of organizations which will maneuver toward middle-ground settlements rather than holding out and risking the imposition of an extreme position by the common sovereign.

Individuals promoting or reviewing doctrinal change may know the espoused programs (theory of action) of other organizations, but they cannot know the actual programs of others (theory-in-use)<sup>d</sup>, thereby creating defensive reasoning and conditions for error typical of the Model I limited learning system and causing the organizational anarchy that takes the form of defensive "turf battles." Since organizations seek to reduce uncertainty, their goal will be to reduce any proposed doctrinal change to the smallest possible modification of their existing pro-

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<sup>c</sup> From the military "rule of three," 3 companies in a battalion, 3 battalions under a brigade, 1 brigade staff ( $3 \times 3 + 1 = 10$ ).

<sup>d</sup> Theories-in-use are often tacit and can only be determined by close observation of individuals within an organization. Such observation is infeasible given the geographic dispersion of the US military.

grams. Since most organizational defensive routines unilaterally seek control over or isolation from their environment, proponents of doctrinal change should witness contentious battles over control (proponency, lead agent, review authority) or evidence of isolation strategies, like an inability to obtain quality review from affected organizations.

Regardless of organization, idea vetting is dependent on military rank; a (typically) O-4 action officer provides product upward to an O-6 review/supervisor, then to the (O-7+) Joint Staff (JS) planner (O-6) and finally approval level (O-7/8/9/10). This fact makes important the organizational culture of military officers, particularly the high degree of power distance, low in-group assertiveness, and high egalitarianism.<sup>e</sup>

By law and policy, US military officer promotion and assignment is seniority-based with the merit components assessed almost solely by the intangible opinions an officer's immediate and next-level superiors. Since both the officer and his/her dependents may suffer negative consequences, and because redress of any grievance by authority beyond these two superiors is not usually possible, an officer's relationship with these two superiors is very likely to occur under conditions of threat and embarrassment.<sup>42</sup> Any benefits of doctrinal change accrue generally to the organization, but not to the officer specifically because of the influence of seniority on both promotion and assignments. Under these influences, military-officer culture will likely reinforce officers' individual defensive routines even when considered as individuals separate from their organizations. When specific ideas are considered, officers are also likely to expend considerable effort to anticipate the desires of superiors regardless of the merits of those ideas.

The exception to the limitations of officer culture should be at the very senior ranks, when officers are at their terminal rank and personally secure in their status and post-military

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<sup>e</sup> Gerras, et al. Power distance in organizations, "where those in position of authority expect, and receive, obedience." Assertiveness is the propensity to and forcefulness of dissent. Egalitarianism is the tendency to view all individuals as equally capable and value contributions as a part of a collective, vs individually.

benefits. “General Officers” are senior individuals charged by law and policy to rise above their branch origins and serve the entire purpose of the whole military. They are also likely either the approval authority for new doctrine or very near to it, meaning their personal input on doctrine should not be constrained by OT’s “limit uncertainty rule.” True doctrinal innovation may arise from these individuals when they perceive an adversary doctrine, technology, or capability threatens their purpose: the security of the state.<sup>43</sup>

In actual practice, military organizations generally follow the doctrine-development process as presented above, except in cases where they expect substantial resistance to consensus. In normal cases doctrinal projects follow the mandated review steps but exceed timelines at every step as the imperative to build consensus trumps timeliness. For example, the current Joint Doctrine Hierarchy contains 81 publications, of which 29 should always be in revision in order to maintain the 5-year review cycle. In actuality, only 18 are in normal revision, while another 10 are in “change in lieu of revision,” a review status within JP1-01 which has no specified timeline.<sup>f</sup> Senior leaders consistently complain about sluggishness in the normal doctrine development system.<sup>g</sup>

In more contentious cases, organizations create ad hoc procedures that skip steps in the development process, extend timelines, and generally drag the doctrine development process out. Creating these ad hoc procedures is an organizational defensive routine, an effort to unilaterally control the environment and tasks of an organization perceiving threat or embarrassment, and is a classic Model I anti-learning behavior. As demonstrated by Major Jason Evenson, USAF, the unchecked growth of the Effects Based Operations (EBO) concept at USJFCOM during the 2000’s is an excellent example. USJFCOM adopted EBO without reaching internal consensus

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<sup>f</sup> See Fig 2a – Joint Doctrine Development Hierarchy

<sup>g</sup> See Appendix B, Traditional Case B3 – Testimony of Current Leadership

based on the merit of EBO as an idea. Instead EBO achieved consensus by meeting the needs (mostly respect and funding) of numerous contractor-dominated organizations within USJFCOM. Because EBO was a concept and not doctrine, USJFCOM was able to avoid the JP1-01 doctrine development process and engaged in a campaign to develop and sell the concept throughout the Services and Combatant Commands. Ultimately EBO lingered in publications controlled by USJFCOM and as idea fragments in joint doctrinal publications themselves, confusing just about everyone until 2008, when Lieutenant General James Mattis took command at USJFCOM and killed it.<sup>44</sup>

In summation, the structure of the doctrine development process seeks to build consensus among functionally specialized organizations with mutually unknowable theories-in-use regarding change. Furthermore, change ideas are structurally required to move upward through a hierarchy of military officer vital interests. OL theory therefore predicts the military's theory-in-use for doctrine development should be a classic Model I limited learning system. Double-loop learning should be precluded and doctrine therefore become stagnant, which should be manifest as delay in the review cycle beyond stated norms, a persistence of ideas across revisions that are widely held by individuals to be out of date, and resistance toward establishing or testing ideas that change organizational functions or overlap multiple organizational boundaries.

Case study of doctrine development easily supports this thesis. Examples abound, but the case of the Cold War-era US Army doctrines and of the US weapons succession process provide fine examples of how organizational structure determines the manner in which that organization learns.

### **Case 1: Cold War Doctrine – Development by the US Army**

The U.S. Army in 1976 produced the doctrine of Active Defense, a high-tech, though fundamentally defensive doctrine that resulted from the application of a systems approach based on attrition theory. It was and remains an abnormality in Posen's characterization that militaries will prefer offensive doctrines because they reduce uncertainty and favor organization interests such as increased budgets and morale.

Active Defense was a result of a highly centralized doctrine development effort at US Army Training and Doctrine Command (TRADOC) with significant personal drafting by General William Dupuy, TRADOC commander. The Soviet threat, Congressional budget limitations, and other factors external to the Army motivated General Dupuy. His is an example of a senior leader secure in personal position and thinking about the organization as a whole. He did not attempt to build consensus and nakedly played Army organizations off one another in order to achieve his vision. While this approach resulted in a revolutionary doctrinal approach, disregarding subordinate organizational interests, particularly in Training & Educational organizations, caused the field Army to resist the new doctrine. Because General Dupuy designed Active Defense tightly around the Soviet threat in Central Europe, it met few of the needs of defense organizations outside that theater. Ultimately the consensus of the whole Army determined Active Defense was a failure and a search for its replacement began immediately after General Dupuy retired.<sup>45</sup> Despite the appropriateness of Active Defense to the strategic and budgetary situation of the late 1970s, its rejection by the Army is a pointed example of organizational defensive routines impeding a single-loop learning system.

Active Defense's replacement was 1982 AirLand Battle, which General Donn Starry (TRADOC Commander) developed using a broad, consensus-building process similar to the current JP1-01 guidance. Doctrine writing respected organizational interests, and with threat re-

duced by the larger budgets of the 1980s, the Army broadly accepted AirLand Battle. The result was an offensive doctrine emphasizing deep battle, mission command, technical skill, without much consideration for nuclear or other unconventional weapons, and justified not by systems analysis but by historical case study.<sup>46</sup> In 1986 TRADOC modified AirLand Battle in response to external criticism, becoming slightly more defensive and more fully incorporating nuclear weaponry. However, a victorious combat test in the 1991 Gulf War largely eliminated external concerns about doctrinal weakness and the 1992 modification (ALB Future) became even more aggressive than the original.<sup>47</sup> The Gulf War validated the values of AirLand Battle, prompting the various Army organizations to move even closer to those values. AirLand Battle accepted organizational interests and is thus an example of a successful single-loop learning system, but by that very acceptance of organizational interests, TRADOC precluded double-loop learning. The underlying values and assumptions of AirLand Battle remained unchanged and continued forward until individuals conducting that repertoire failed to achieve their expected results in the Iraq counterinsurgency of post-2003.

## **Case 2: The US Weapons Succession Process – A Bridge to the Future**

Doctrine development is a fundamental part of the succession processes of weapons systems,<sup>48</sup> which are described by Dr. Mary Kaldor as being driven by either war or supply institutions. During peacetime, military leaders maintain a “dominant scenario,” their plan for the ends, ways, and means around which they will design the military. The dominant scenario represents the values and assumptions of the military and therefore requires double-loop learning to change. For the US military, this is a total war utilizing all instruments of national power against a peer adversary in the model of WW2. Military suppliers (the weapons innovators) have two character-

istics: (1) Sovereign or Non-Sovereign, in that they are responsible for their own financial viability, or their budget is guaranteed by the state; (2) Dependent or Independent, in that they rely in whole or in the majority on government contracts, or they derive most of their financial viability from a variety of non-governmental sources. There are four possible combinations.

Sovereign/Dependent suppliers are like most Western defense contractors. Responsible for their own viability, they must keep intact productive design teams working, and therefore propose a steady stream of weapon systems. Such suppliers will only forward proposals that comply with the military's dominant scenario. Until the values underlying the scenario change, suppliers will continue to propose marginally better and more costly solutions to mission sets defined decades ago. The technologies may be radical but the mission sets are not. Kaldor describes this model of change as "baroque."<sup>49</sup> This incremental improvement of an idea without changing the underlying values and norms is indicative of the first level of organizational learning, the single-loop.

Sovereign/Independent suppliers are like most European defense contractors. Kaldor describes them as "revolutionary," in that they will propose weaponry not tied to the dominant scenario because they are not dependent on government contracts for their survival.<sup>50</sup>

Non-Sovereign/Dependent suppliers were like the Soviet arms ministries. Fully dependent on the military for production, governments do not allow them to fail. The state budget subsidizes any excess capacity. Kaldor describes them as "conservative" because they have no survival incentive to innovate.<sup>51</sup>

All three of Kaldor's supplier types suffer the same structural limitations to OL. All exhibit classic Model I behavior with its defensive reasoning and organizational politicking. Despite lifetimes of effort by the best and brightest leaders, the weapons bureaucracies remain plac-

es where ‘the whole is stupider than the sum of its parts,’ because OL is not dependent on individual behavior, but instead on organizational structure.

But yet, Kaldor’s theory has a hole. It predicts a class of Non-Sovereign/Independent suppliers, a type which Kaldor cannot find in the real world.<sup>52</sup> She speculates:

Is there a fourth category, that of non-sovereign, independent institutions? Is it possible to conceive of enterprises whose budget and employment are guaranteed by the state, but which are responsive to non-governmental consumer preferences? Such institutions would be designed to be flexible and responsive to change without involving the brutality of the market mechanism.<sup>53</sup>

There is. Expanding on Kaldor’s question, such an enterprise would be non-sovereign in that it was not concerned with maintaining financial viability and not necessarily made so by state guarantee. It would also be independent of government contracts and non-governmental consumer preferences might be irrelevant as well. Kaldor re-published her essay in 1999, too early to see the answer arise from the Open Source movement, which is the Recursive Polis.

### **Part III: The Idea of Open Source**

Open Source is an idea that ideas should be open to all, free to use, freely modifiable, and returned freely to the world for the betterment of humanity. Open Source (OS) has given rise to the Recursive Polis, which is a *novel form of human organization* brought into being along with the Internet. OS arose from the culture of geeks<sup>h</sup> and the Internet they built, but it is no longer merely a novel method for creating software, it is an idea of human organization that is moving into the physical world and upending traditional organizations as it goes. Because OS is an evolving idea, most popular writing uses OS loosely, as an adjective describing some Internet

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<sup>h</sup> “Geek” is a general term for a technology enthusiast. Other common names are “hacker, programmer, nerd, techie, etc.”

magic, with worries about hacker militias<sup>54</sup> and self-organizing communities<sup>55</sup> feeding the public fear of the unknown. Using the term Recursive Polis to describe organizations constructed in tight accord with OS principles provides a meaningful definition with which to distinguish between truly OS organizations and mere claimants. **Military professionals must understand Open Source and harness useful recursive poleis.** Wikipedia, Linux, Connexions, Anonymous, Synthetic Biology, ISIS... all are fully or partially formed recursive poleis which sprang from nothing to upend and dominate their respective fields. No one has yet “weaponized” a recursive polis, but the possibility is very real.

First and foremost, a recursive polis is not a Weberian bureaucracy. Recursive poleis learn in a continuous double-loop and are orders of magnitude faster and more adaptable than Weberian bureaucracies. They are more akin to a community or movement where the members contribute freely to the development of some central thing in which they are vitally interested. Members create, maintain, use, and improve the thing by discussing and modifying it in real time. Use of the thing is free to all. Dr. Christopher Kelty coined the term “recursive public,” though recursive polis interlocks better with OT above:

A recursive public is a public that is vitally concerned with the material and practical maintenance and modification of the technical, legal, practical, and conceptual means of its own existence as a public; it is a collective independent of other forms of constituted power and is capable of speaking to existing forms of power through the production of actually existing alternatives.<sup>56</sup>

The title of recursive public is specific and important. The term recursion is a concept from mathematics defined as “the application of a function to its own values to generate an infinite series of values.”<sup>57</sup> Recursion in Kelty’s definition above refers to the “material and practical maintenance of the ... means.”<sup>58</sup> First described by the philosopher Dr. Jurgen Habermas, a public is a collection of private persons who assemble and claim the public sphere as their own inde-

pendent of constituted authority in order to engage in rational debate over the rules governing society.<sup>59</sup> Originally, the “public sphere” was a collection of physical places (salons, coffee-houses, taverns, etc.) but the concept evolved to become all places where the discussion of the public did pass. The philosopher Dr. Charles Taylor makes a crucial extension beyond Habermas, that for any discussion to be of the public and define the public sphere, it must not be unrelated noise. The discussion and therefore the public must share a conception of itself, a “social imaginary,”<sup>60</sup> or per Dr. Edgar Schein, “basic assumptions.”<sup>61</sup> Again, Taylor:

I am thinking rather of the ways in which people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and imagines that underlie these expectations.<sup>62</sup>

A public in the conception of Habermas and Taylor is a very broad concept and does not equate to an organization as presented by OT. When such a public arises online and grows into truly organizational behavior it merits the term recursive polis.

In summary, a recursive polis is an organization whose shared social imaginary engenders a vital concern for the theoretical and practical making and remaking of itself. Kelty describes it as “a collective technical experimental system.”<sup>63</sup> This concept is a radical departure from the Weberian bureaucratic norm.

### **Part III.1: The Recursive Polis Considered by Organizational Learning Theory**

To be a recursive polis, an organization’s structure must conform tightly to the idea of Open Source. Synthesizing the ethnographic research of Dr. Christopher Kelty with the testimony of OS practitioners in the software world yields the following seven structural features that any recursive polis must contain. Argyris and Schön provide the theoretical grounding (OL theory) that explains why these structural features contribute positively to double-loop learning. Sim-

ilarly, various OL practitioners attempting to teach OL to traditional businesses (OL practice) have amassed a series of structural prescriptions that facilitate double-loop learning.<sup>64</sup> Most groups that claim the OS label do not warrant it. True recursive poleis are rare for the same reason they are powerful: They are a novel organizational form and the conditions that give rise to and sustain them are not obvious.

1. Recursive poleis require the Internet.<sup>65</sup> Specifically, they require near-instantaneous, massively parallel communications that leaves a persistent searchable record. Members conduct the majority of communications without face-to-face contact. The technical layers of the communications media must be accessible and modifiable as far down as individuals wish to dig.<sup>66</sup>

Research from Drs. Caroline Haythornthwaite and Anna Neilsen demonstrates the key point: the impersonal nature of the Internet strips away non-verbal aspects of human communication, requiring individuals to work harder at written communication to achieve the clarity and understanding that was implicit offline. Individuals judge each other more on the quality of their argument and ideas, therefore reduced cues can increase participation rates and remove social stigmas associated with gender, class, or race. The asynchronous nature of most Internet communications allows time to think, cool down, and respond in a more dispassionate manner. **But does it? Stowe.** Groups are required to make conscious decisions about communications standards and protocols.<sup>67</sup> The searchable permanent record allows collective long-term refinement of argument not possible in physical groups. OL theory: Increased clarity reduces perceptions of threats and embarrassment, making individual defensive reasoning much less likely. OL practice: Use the Internet as a mechanism for fast, public feedback.

2. Recursive poleis require a large argument about their nature and meaning. The polis is a public first, a group of individuals drawn together by their own accord and shared social imag-

inary. The polis must be sovereign within that social imaginary and free to debate, argue, and change its efforts. The polis is autotelic, no outside force can impose concept, mission, or an authority, nor can the polis itself compel any individual to join, leave, or participate in a task.<sup>68</sup> For individuals to form and maintain a polis a certain critical mass is required, probably at or near Dunbar's number of 150 individuals.<sup>69</sup> Bigger is better: The number of vitally interested members correlates directly to the strength of a recursive polis.

OL theory: Rational argument and individual choice to align with goals determines the direction of the polis, which privileges the Model II governing values.<sup>i</sup> The non-threatening and unbounded nature of this argument means the members will question the values and norms of the polis during inquiry, which is Model II behavior.<sup>70</sup> OL practice: This argument of nature and meaning is a mechanism for “surfacing and criticizing implicit organizational theories of action.”<sup>71</sup>

3. Recursive poleis must share their original work freely within the polis. Members must gift original work to the polis freely, where it must remain accessible and modifiable by all polis members. Transferring work across multiple platforms and domains (porting), teaching to new members, and creating branches from existing work (forking) are core activities.<sup>72</sup> Two key tools are required, (1) a distributed version control system that must itself be an OS product,<sup>73</sup> and (2) a discussion board or “wiki-type” forum to enable peer review.<sup>74</sup>

OL theory: The polis is an internal gift economy where reward is the joy of creation and reputation freely conferred by peers. Since every member of the polis is known to share this motivation, uncertainty is greatly reduced. Further, joy and reputation are valued-yet-infinite goods, which basically eliminates win/lose power conflicts between members. Both points greatly reduce Model I behavior. Sharing within the polis is a foundational Model II behavioral strategy.<sup>75</sup>

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<sup>i</sup> Valid information, free and informed choice, and internal commitment.

OL practice: Motivation by joy and reputation is an excellent incentive system for promoting sharing and therefore (by theory above) organizational learning.

4. Recursive poleis must have a shared conception of openness. In order to remain a polis and not transform into another closed hierarchy, the polis must have a commitment to openness in thought and in action. While this conception will vary between individuals and poleis (see large argument above), openness is required for new entrants to join and when given technological from, to enable sharing. Such openness is a very liberal, Western concept<sup>76</sup> and must be a deeply held philosophy in order to resist powerful influences such as profit motive and secrecy which tempt the polis to close. The products and tools built by the polis must reflect and reinforce this philosophy.<sup>77</sup>

OL theory: Uncertainty is greatly reduced when everyone in the polis is known to share a deeply held conception of an open society, the perception of which is regularly reinforced by the member's contribution to products that enable that open society. Openness enables critique by all of the meaning and creation process of any new concepts invented by the polis. Such critique of meaning and underlying process is a double-loop learning strategy by definition. OL practice: A philosophy of openness lends toward flat, decentralized organizations, promotes public critique, and is a specifically noted ideology corresponding with Model II success.<sup>78</sup> Openness also brings in new members quickly, enabling the recursive polis to grow explosively.

5. Recursive poleis must adapt around other paradigms. In the beginning of OS history, intellectual property law was an alternate paradigm and a major initial stumbling block.<sup>j</sup> Modern US copyright law seeks to incentivize individuals to undertake lengthy and expensive development efforts by rewarding them with exclusive right to the software and punishing sharing.

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<sup>j</sup> An enormous free-rider problem arose when individuals took community efforts to package and sell for individual gain.

Worse still, the law assumes and reinforces secrecy, hierarchy, and control by extending copyright automatically to any software creator. The entire idea is in conflict with the social imaginary of the OS public, which holds foundationally that knowledge should be free to all. The GNU Public License<sup>79</sup> finally solved the problem by rewarding developers with credit while simultaneously releasing all creations and all future derivatives from those creations into the public domain. In that way the original recursive polis 'hacked' intellectual property law, adapting around it in order to continue pursuing their purpose of free software creation. Other innovative licensing solutions now exist,<sup>80</sup> illustrating that recursive poleis will seek to adapt themselves around alternate paradigms in pursuit of their purposes rather than set themselves in opposition.<sup>81</sup>

OL theory: As a stand-alone driver of Model II learning, adaptation resolves conflict between the social imaginaries of the recursive polis and of traditional proprietary firms and governments. The rights of use for products of the polis become known and legally recognized, reducing uncertainty. Further, utilizing recognized elements of a conflicting social imaginary can help further the purpose of the polis, as demonstrated by the use of modern copyright to preserve the authorship credit which is central to building members' reputation within the polis.

6. Recursive poleis must collaborate and coordinate without planned goals. Coordination within a recursive polis merges the social and technical aspects of creation and thus creates meaning for the participants. Just as a mix of theory and practice is most satisfying in any discipline, the polis members derive meaning from managing the social aspects of decision-making and management concurrently with the technical aspects of versions, conflicts, and extensions.

In all cases, the OS model "privileges adaptability over planning."<sup>82</sup> The model does not presuppose that there will never be common goals, only that such goals may not compel the par-

ticipants involved. There can be no goals imposed by forces outside the polis, nor by any internal leadership. Individuals must be free to pursue their own lines of inquiry, bounded by the shared social imaginary of the polis. It is a method based on reasoned critique, rough consensus, with success judged by a strict meritocracy of ideas.<sup>k</sup> Adaptability over planning does not mean anarchy. It is instead a specific method for balancing the virtuosity of an individual with the requirement for a stable collective product. With goal-less adaptation, all participants experience the joy of creation instead of merely reserving this joy for a leading minority who does the planning. When a large problem arises, the polis attacks it by rapidly nibbling away those pieces of the problem that can be resolved by consensus, leaving only the central conflict. Good governance structures such as the Apache model<sup>83</sup> are important for these cases to prevent the polis from splintering.<sup>84</sup>

OL theory: Goal-less inquiry, or valuing adaptability over planning, reserves to the individuals the joy of creation, which is their first motivator for contribution. If individuals freely align behind a common effort, their peers will recognize and reinforce their efforts, which is an individual's second motivator for contribution. Success reinforces further success, realigning the social values of individuals toward interpretations consistent with Model II. OL practice: The large possible size of a successful recursive polis means there are an enormous number of individuals and small groups conducting inquiry, increasing the chances for Model II learning to occur.

7. Recursive poleis require a working prototype of their compelling idea. Similar to the requirement for a critical mass of membership (#2 above), the compelling idea around which the recursive polis organizes must have a working prototype in order to begin the recursive collabo-

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<sup>k</sup> Famously, "We reject kings, presidents, and voting. We believe in rough consensus and running code." – David Clark, Internet Engineering Task Force (IETF), from Kelty, *Two Bits*, 58.

ration. This is an observation arising from OS practitioners in the software field, that there must be a working code-base, a prototype that serves to both demonstrate the possibility of the organizing idea and provide a physical thing to work upon and adapt.<sup>85</sup> The more compelling the idea, the less solid the prototype can be. Ergo, the requirement remains for an individual visionary to build the prototype, an outstanding idea given form, one that provides the spark to start the fire.

OL theory: Individual visionaries are still required to start the process or reinvent the project at any major fork. These visionaries are the heroes of the OS software movement and have derived a lifetime of joy from their accomplishment.<sup>1</sup> The motivation for any individual developer to be the next Linus Torvalds could not be higher. OL practice: There would be no Linux today had Linus Torvalds not first created a working prototype of an OS operating system and given it freely to the community. The technical means of Linux have changed many times over since its inception, but the idea remains and compels.

As demonstrated, the structure of a recursive polis is quite different from a traditional Weberian bureaucracy, and from this structure arises the power of OS: a recursive public is the only known organizational form that operates in a continuous double-loop state. In direct competition, a recursive polis will crush a traditional Weberian bureaucracy not by out-smarting it with the brilliance of its planning, but by sheer speed of reactive adaptation.

The following short case study will attempt to map the seven structural requirements of a recursive polis to Anonymous, an existing non-software organization that demonstrates some indicators of a recursive polis: extreme speed and adaptability, decentralization, and the inability of traditional militaries to understand them. The following case study considers the Anonymous

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<sup>1</sup> Linus Torvalds – Linux. Richard Stallman – GNU tools and the GPL. Bill Joy – JAVA programming language and the VI text editor. There are many others.

hacker community as a possible recursive polis in direct competition with various traditional organizations in both the physical and cyber domains.

**Case 3. Anonymous.**

Anonymous is an online hacker collective which has risen to prominence since 2009. Media routinely describe them as anarchist as they conduct both computer hacking and physical actions in support of an unpredictable variety of political and social activist causes. Per Dr. William Pendergrass's dissertation on the collective, Anonymous originated on <http://4chan.org>, a chat website which became popular and received a huge number of posts.<sup>86</sup> The purpose of the posts is for amusement only, typically dark or ironic humor at someone else's expense.<sup>87</sup> There is no archive and no site moderation, allowing specific postings to rise in the number of views by popularity alone. There is no real name policy and most users post under the default name "Anonymous," making it appear almost as Anonymous was one person making an enormous number of posts. Long chains of discussion will follow popular postings, effectively building consensus around an idea.<sup>88</sup>

In 2009, "Anonymous" proposed project Chanology, a combination of hacking and physical protest action against the Church of Scientology. Consensus built around dislike of the Church and the 4chan posts began a self-reinforcing cascade of advice and technical assistance for individuals trying to hack the Church. Anonymous "declared war"<sup>89</sup> and the combined online and physical disruption campaign against the Church lasted several months. Since 2009, Anonymous has undertaken multiple campaigns of increasing sophistication against various targets, including against the Islamic State.<sup>90</sup>

Anonymous has many of the structural characteristics of a recursive public. They originated on the Internet and require it to operate. There is a continuous debate over the nature and meaning of Anonymous with an enormous number of users.<sup>91</sup> There is a practice for sharing all information back with the collective, but no requirement. For example, in the HBGary case Anonymous made numerous references to information held by “only one or two individuals.”<sup>92</sup> Most often Anonymous members post back proof of their exploits but not necessarily the technical means underlying them, a weakness particularly acute in their physical actions. Anonymous does have a shared conception of openness, with a well-defined organizational culture built on the idea of freedom of information.<sup>93</sup> They do not typically deal with copyright,<sup>94</sup> which is important because such refusal is a failure to adapt to the different moral-technical order of the modern hierarchical world. Anonymous tends to absolutism, raging at the “evil” of the modern world without applying its collective abilities to adapt around facets of that world in support of a larger goal.

Anonymous does collaborate massively but they try to impose goals on their membership. Because they lack the internal power structure with which to compel their membership, they rely on consensus-building alone, leading directly to a lack of staying power for their operations. By attempting to plan towards goals they dilute or remove the joy of creation and reduce the status of non-leaders, thus threatening the sources of their members’ motivation. Without the ability to compel action, hard work erodes group consensus and individual joy causing operations to simply fade away. Finally, Anonymous does not really provide a working prototype of a compelling idea. They will provide a compelling idea and build consensus around it, but without providing the free access to the social and technical layers that underlie the idea. Without access

to the workings behind the idea, membership can not modify the idea itself as their operations continue, thus restricting Anonymous to single-loop learning.

Anonymous is a marginal case for a recursive polis. Ultimately they fall short due to their inability to provide free access to the social and technical strata underlying their ideas and their attempts to plan without recourse to compellence which erode the motivations of their membership. As a result, Anonymous exhibits a massively parallel single-loop learning system that provides great adaptive advantages for limited periods of time before internal consensus degrades. They do not exhibit the combination of staying power and continuous adaptation that is the hallmark of a true recursive polis.

Still, when Anonymous achieves a consensus they effectively “fix” their values and norms for a short period of time, during which the collective can operate in an uninhibited single-loop learning mechanism, allowing them to adapt ferociously and overwhelm their opponents’ cyber defenses. Despite applying massively superior resources, traditional companies have suffered grievous financial losses and occasionally been destroyed during these campaigns. The military lesson is clear. While Anonymous’ consensus holds, their OODA loop is several orders of magnitude (100+) times faster than their bureaucratic opponents. If they were able to engage in continuous double-loop learning, they could maintain consensus and thus their adaptive advantage over long periods of time, and would become a truly terrifying adversary. Anonymous’ learning potential should be warning enough to the US military to experiment with recursive polises within the profession of arms, before some future adversary weaponizes a recursive polis against the United States.

#### **Part IV: A Proposal for a Military Open Source Doctrine Development Capability**

Why doctrine? The doctrine-development process is organizational learning in a military context. As demonstrated, the current process is very slow, uncreative, stagnant, and poorly integrated with national political ends. Organization theory argues convincingly that these severe limitations are structural. Inspired leadership can force change in doctrinal artifacts, but the organization resists and change is only temporary. JP1-01 explicitly states that doctrine development should be consensus-driven.<sup>95</sup> Instead of a consensus of feuding Model I organizations, a superior idea is to build a *consensus of the profession of arms* and encourage the formation of a recursive polis from within this public. At a stroke, senior leadership would give the profession of arms concrete form and meaning, as any member of that social imaginary could join the recursive polis, freely contributing his/her expertise and dedication to the cause of excellence in the common defense. Doctrine development, aka military organizational learning, would flourish within the Recursive Polis, the only human organizational model whose structure is optimized to facilitate organizational learning.

#### Here to There: Establishing the Recursive Polis

To create an OS doctrine development organization, the most important thing will also be the hardest for a traditional military: Set the conditions for the recursive polis to arise from the profession of arms and then... *let it go*. Such a decision will be a conscious surrender of power and control by a military structure built to maximize control. *Let it go...* and trust that the shared social imaginary of the profession of arms will bound it. The military should follow the example of the Defense Advanced Research Projects Agency (DARPA), another organization granted enormous autonomy within DoD, whose behavior will probably reach the limit of its own social

imaginary before reaching the hard limits of its autonomy. The adaptive power of a recursive polis is like nothing the world has seen before. Formal control is not that important... *let it go*.

1. Recursive poleis require the Internet. The newly established polis cannot be classified. Access to classified networks is highly limited, which would restrict the ability of new members to join and participate. Further, the technical environment that enables participation must itself be open to modification, which is not feasible at present.

2. Recursive poleis require a large argument about their nature and meaning. The shared social imaginaries within the profession of arms is the key concept here. As a result of history and tradition, each military Service has a different social imaginary. Therefore, one must establish the recursive polis around the Service most committed to letting it go, and trust the Service-level social imaginary to bound the behavior of the polis.<sup>m</sup> No such social imaginary exists at the joint level. Further, the polis members will desire to inquire deeply into root causes, so the technical and social layers underlying doctrine must be accessible and modifiable as deep as the polis members wish to dig. In a purely joint realm, such inquiry would rapidly hit Service doctrine and be forced to stop at that formal limit, introducing an unresolvable contradiction that would become the source of defensive reasoning and disrupt the Model II learning system.

Bounded by a Service social imaginary, formal authorities should allow the recursive polis to adopt whatever doctrinal project it seizes upon as a compelling idea. Rather than obeying a hypothetical revision timeline, the debate within the polis will rapidly resolve on the project that needs creation, update, or revision the most at that moment. A polis would likely adopt mid-level

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<sup>m</sup> "Giving a new technology to the most traditional branch of a service is perhaps the worst way to assure its effective exploitation." – Posen, Barry, *The Sources of Military Doctrine*, 132.

doctrinal pubs first.<sup>n</sup> Formal authority should support spin-off projects into training and education as well as RDT&E. Failure of the polis to adopt a particular project is evidence that the doctrine contained works satisfactorily, regardless of its age.

To build the initial membership, one must rely on the internal motivation of polis members: they are those driven by individual joy of creation and reputation. One should select a few individuals with an existing professional reputation for creative thought. In such an environment, pitch the idea and let them freely join or not. Regardless of decision, one should ask these individuals for recommendations of other individuals who might be interested. One then follows these recommendation chains, individual by individual, until at least 150 polis members have conditionally accepted, after which the supporting Service can formally activate and release the recursive polis.

3. Recursive poleis must share their original work freely within the polis. The sharing element is primarily a technical problem. First, one could host the project on [forge.mil](http://forge.mil) or set up a DVCS<sup>o</sup> in the Connexions model. Secondly, establish a forum for discussion and peer review either on or in the model of MilWiki. Both [forge.mil](http://forge.mil) and MilSuite appear to be CAC-enabled and entirely OS at this point.<sup>96</sup>

4. Recursive poleis must have a shared conception of openness. In establishing the membership of the recursive polis, one must spread the belief in the importance of openness in thought and action. One can use philosophy, history, modern case study, lessons learned from

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<sup>n</sup> Capstone and other high-level publications are already in line with the social imaginary of the military and are unlikely to face challenged initially. Only after the double-loop learning model repeatedly challenged underlying values and norms and built consensus for their modification would it find high-level pubs out of sync with the social imaginary and in need of revision. Low-level pubs (TTPs, etc) are functionally specialized and would likely have a hard time becoming a compelling idea to organize the entire polis around. A mid-level publication is big enough to provide a compelling idea and would spin off sub-projects to revise the subordinate TTPs while providing the required vital interest for the polis to organize around.

<sup>o</sup> Distributed Version Control System. Github is the community standard. [www.forge.mil](http://www.forge.mil) appears to be a centralized VCS, which isn't ideal because of the single point of failure problem, but it's acceptable to start with.

practical application and theory to present a convincing case on all possible grounds. The recursive polis will have to resist continual Model I pressure to close or classify itself under the premise of OPSEC, the use of proprietary shortcuts, or restriction of new entrants. An important norm of the polis must be that individuals with write access to the project(s) share the polis social imaginary, because not everyone within the military profession does. One tests for the social imaginary, the culture of the profession of arms, by professional reputation. If a person considers his/herself part of the profession of arms, contributes to the recursive polis, and is called a member of the profession of arms by others inside the polis, then that person is a member of the profession of arms.<sup>97</sup>

5. Recursive poleis must adapt around other paradigms. From an OS point of view, the alternate paradigm presented by the military is command. Underlying command is a *belief* in control, more important than actual control itself, over what a person can access, use, modify, and redistribute. In a military context, the belief in freedom to access and modify is upheld by guarantees against threats to freedom from within the military and from without.

Orders and policy uphold belief in freedom inside the military structure. The highest levels of the sponsoring Service must publicly endorse the recursive polis' freedom to choose and follow projects in order to overcome the existing cynicism<sup>P</sup> of potential polis members toward the idea that a military hierarchy would relinquish control. The polis' belief in freedom of action is crucial to maintaining open inquiry and inhibiting individual defensive reasoning that preserves the Model II learning system. Senior leadership must grant the polis a simple public man-

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<sup>P</sup> Cynicism of this type is an excellent example of individual defensive reasoning inhibiting an unconventional idea. Every individual pulled into the recursive polis will be bringing a career's worth of Model I assumptions and social virtue definitions with them. The irrationally held internal motivation of the initial members to "make it better" will likely start a project, but it won't stave off entrenched Model I behavior in the absence of an explicit guarantee that the Service won't undercut the Model II results.

date, “We will promulgate what you come up with. Go where it leads you.” Ideally this guarantee would come in the form of a signed instruction.

Traditional legal control strategies uphold belief in freedom outside the military structure. The recursive polis will resist proprietary systems that lock layers of the social and technical strata underlying doctrine.<sup>9</sup> An important spin-off project of the polis will likely be to inquire into the existing OS license policies within the Federal Acquisitions Regulations (FAR)<sup>98</sup> and draft open licenses<sup>99</sup> that allow free access, modification, and forking by the polis while retaining US government ownership.

6. Recursive poleis must collaborate and coordinate without planned goals. Several issues arise: Governance, Time and Recognition, Meritocracy and Anonymity, and Funding.

Governance is crucial to keep the recursive polis from splintering and reducing itself below the critical mass of membership. The following governance model is based on the Apache foundation, under the strict principle of meritocracy. In order of increasing dedication to the project, and voted upward by their peers, members may be (1) users of the project, (2) developers who contribute thought or effort and who are active in discussion, (3) committers who have write access to the project, or (4) PMC (Project Management Committee) members who have write access to the project, vote during conflict resolution, and may propose individuals to committer status. The PMC controls the project and must vote on any formal release of the project. Finally, (5) the PMC elects a PMC Chair who serves as the primary interface between the military hierar-

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<sup>9</sup> Resistance to proprietary ideas will likely come naturally. Nearly every creative thinker in the military has attempted to solve mission-critical problems and run into obstacles arising from proprietary ideas owned by contractors and from the defense acquisitions system built to support that regime. Contractors are widely seen as a necessary evil that who would be done away with if possible. The current acquisitions process is generally despised.

chy and the polis.<sup>r</sup> The PMC has no set size. The polis makes changes to its projects by “lazy consensus,” where a committer proposes a change to the PMC and silence is consent. Without consensus, contentious issues are resolved by voting: +1 (yes), 0 (no opinion, have not reviewed yet), or -1 (no, problem identified). No votes serve as a veto and must be accompanied by a detailed description of the problem or an alternative proposal, or else they have no weight.<sup>100</sup> Resolving veto disagreements requires understanding why an individual perceives a problem at the level of assumptions, values, and norms. An Apache-style governance structure therefore requires Model II learning in order to resolve such disagreements.

Members of the polis will spend time and effort on their developmental efforts, which the external military hierarchy should respect and recognize. First, senior leadership should explain and promote the OS program down traditional command chains, in order that leaders at all levels understand the value of the time their troops spend on “not-my-job” efforts. The following incentives should apply for individuals at the committer level and above.<sup>s</sup> Senior leadership should promote a “Google rule,” where committers are authorized up to 20% of their work time to spend on OS projects. The greatest benefit of such a rule is the symbolic commitment to innovation; Google found that only a fraction of their workforce made use of the rule, and even then not fully, so the net loss of productive time to directed projects was minimal.<sup>101</sup> Officer FITREPs, enlisted evals, and civilian annual performance reviews should recognize Committer-level participation. Promotion-board precepts and enlisted point systems should positively weight such participation. Temporary and permanent duty-assignment processes should also

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<sup>r</sup> To coordinate across all projects, a level of leadership corresponding to the ASF (Apache Software Foundation) will be needed. As before, elevation to foundation level is by vote of peers.

<sup>s</sup> OS lesson learned: Success of a project is directly correlated with the number of active committers, those who are active and skilled enough to be granted write access to the project by their peers. While having a broad user base is important, having a broad committer base is vital. From OL theory: Committers and above can be relied upon to be motivated by joy of creation and peer reputation. See Kelty, Fogel, Raymond, Stallman, et al.

provide incentives to committers, since these individuals have been identified by their peers within the profession of arms as being creative, driven, and talented.

Anonymity within the recursive polis should be the norm. The process of double-loop inquiry will challenge values and norms. It will raise uncomfortable questions and challenge existing hierarchies. The record of an individual's statements is intentionally recorded and searchable. To protect individuals who speak truth to power within the polis, and to prevent the self-censorship that comes from rank inequality, the members should have the right to anonymity. When a new member joins the polis, they should adopt a screen name upon which to affix all OS records. Anonymity should be the norm, yielding only to required public use of real name when a member becomes the PMC Chair.<sup>t</sup> If a member must use or wishes to opt out and use his/her real name, he/she should refrain from hierarchy cues (rank, title, job, location, etc.) in order to preserve rule by merit of ideas alone. A primary duty of the PMC Chair should be to write official testimony on behalf of anonymous committers for inclusion in promotion board packages and other incentives. The right to anonymity might appear in conflict with the principle of openness, but openness of identities is less important than the openness of ideas and meritorious critique. As the recursive polis is successful and the OS concept gains respect within the profession of arms the desire for anonymity should gradually reduce.

A small amount of funding is essential. The amount depends on the project adopted but the recursive polis will want to experiment with ideas, fund injects to existing exercises, conduct travel for observation, etc. OS software projects have a history of being very cheap in relation to their proprietary counterparts.<sup>102</sup> A small amount of freely usable funding within the polis is preferable to a larger amount with considerable review. PMC vote should authorize any expendi-

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<sup>t</sup> Access to the recursive polis is shielded by Common Access Card (CAC), therefore preserving anonymity is a minor technical hurdle.

tures. If a project can attract and maintain a certain number of committers, the Service should grant an appropriate level of funding under the simplified acquisition rules. Before a polis can generate a detailed funding justification it should be granted \$100,000, a Government Purchase Card, and expenditure authority up to micro-purchase threshold.<sup>103</sup>

7. Recursive poleis require a working prototype of their compelling idea. The working prototype for doctrine exists already. Military members are familiar with the doctrinal publications and can follow their inquiry through the existing milieu of instructions and policy as deep as needed. Tying the incentive of experimental funding to the number of committers will focus the polis on a manageable number of doctrinal projects in a short period of time. Visionaries are only required to generate a new concept or a fork from existing doctrine, both of which result in entirely new publications. Despite the lack of absolute need, such visionaries will arise and propose new compelling ideas. Who will be remembered forever for the concept that cracked the Anti-Access / Area-Denial problem? Likely many will try.

### Conclusions and Implications

The Recursive Polis is a novel form of human organization which is built to learn in a Model II double-loop. It is the only known organizational form which learns in this manner. Through theory and case study this paper attempts to demonstrate that this advantage is structural, independent of leadership, training, or any other individual factor. The doctrine-development process is the military organizational learning process and is in great need of improvement. The learning strengths of Open Source match exactly with the areas of US military need.

Establishing a recursive polis from within the profession of arms would be a radical departure from the military organizational norm. For that reason alone the US military should ex-

periment with it. Military history records that the world shakes when new forms of human organization appear.<sup>104</sup> No one has yet weaponized an Open Source recursive polis, so the US is in an excellent position to be the first. Open Source is a descendent of radically liberal, radically Western ideas, ones which the US's likely adversaries will find even more alien than the US military does.

Imagine a world where the recursive polis is successful. In this world the US profession of arms immediately incorporates every small advantage it discovers into training and education. In this world, the military could construct a doctrine around production-on-demand weapons, where weapon design is "patched" and missiles are printed onboard ship, adapting in real time to changing defenses. In this world the military organization gets better and better and better and better with every recursion, never out of sync with its environment, political goals, or threats. Counterinsurgency and other wicked problems could fall. In this world the enemies of the US must choose between defeat and adopting the recursive polis. To adopt it is to establish a fearsome learning organization built on liberal Western values, entrust it with the weapons of war, and hope against hope its liberal social imaginary does not turn around and overthrow you.

Current US military Open Source efforts merely apply a technological veneer like paint over the framework of the existing bureaucracy. The power of Open Source comes from its structure, not its technology. Senior leadership is encouraged to take a risk, establish the recursive polis within the profession of arms, then ... **let it go** and learn, for learning is terrifying beauty of Open Source.

**QED.**

**Appendix A: A Theoretical Framework for Organizational Learning**

Learning is not something modern organizations do well. Counterintuitively, organizational learning is overwhelmingly a function of organizational structure and not greatly affected by individual members, leadership style, training, or other factors commonly held to be important. To understand why organizations are notoriously resistant to learning and how this condition could change, a review of Organization Theory (OT) from a learning perspective is essential.

Organization Theory (OT) has a large and varied literature that conceptualizes decision making as a function of organizational structure.<sup>105</sup> Graham Allison's Model II (Organizational Process) and Model III (Bureaucratic Politics) and Kenneth Waltz's "second image" of political theorizing best conceptualize this central tenet.<sup>106</sup> As Posen illustrates, OT holds that three factors explain organizational behavior and structure: Purpose, People, and Environment. Organizations are created for a specific purpose, the pursuit of which requires rational coordination, planning, and supervision in order to reduce uncertainty. "To pursue their purposes, organizations must coordinate and control the contributions of large numbers of variable human beings in the context of an uncertain environment. Purpose demands rationality. Uncertainty is the enemy of rationality. Organizations attempt to reduce both internal and external sources of uncertainty."<sup>107</sup>

Organizational Learning Theory (OL) is a subset of OT and relies heavily on structural analysis using the postulate that organizations abhor uncertainty. As Argyris and Schön note, to pursue their purpose, organizations and individuals maintain "theories of action" which are "organizational task knowledge in the form of systems of belief that underlie action, prototypes from which actions are derived, or procedural prescriptions for action."<sup>108</sup> Using Allison's terminology, theories of action are analogous to "repertoires," built up hierarchically from Standard

Operating Procedures (SOPs) at bottom, clusters of SOPs becoming “programs,” and a menu of programs becoming the organization’s repertoire.<sup>109</sup> Allison’s terminology is clearer and will be used from this point onward unless specifically citing OL theory. Repertoires may be either “espoused” and/or “in-use;” it is common, indeed normal, in Weberian bureaucracies to have differences between repertoires espoused and in-use.<sup>110</sup> The distinction correlates well with Schein’s concept of levels of organizational culture, with “espoused theories and beliefs” acting above the level of tacit “basic assumptions” which can only be discerned by actual observing patterns of individual and group activity within the organization.<sup>111</sup>

For example, a US Navy submarine crew’s repertoire is everything they have learned organizationally about operating their submarine. To be organizational, this repertoire knowledge is known by a critical mass of the crew and is encoded into the artifacts of the organization such as training manuals, drills, and plans. The submarine repertoire is assembled from subordinate programs such as Engineering, Weapons, Navigation, etc. The Engineering program is in turn made up of a large group of SOPs varying in size and complexity, including nuclear reactor operations, electrical repair, and pipe leak repair. Most SOPs have specialist crew dedicated to their performance (i.e. nuclear reactor operations) while some are known generally (i.e. damage control). The espoused repertoire is what the crew tells outsiders about what they do, whereas the in-use repertoire is what that crew actually does. When an external inspection team reviews the submarine’s written tactical SOP or asks the crew about that document, the inspectors are viewing the espoused repertoire. When those inspectors board the submarine and closely observe daily operations, they’re seeing the repertoire in-use. The submarine crew may or may not be aware of any differences between their espoused and in-use repertoires, indeed pointing out such discrepancies is a major rationale for outside inspections.

Returning to Argyris and Schön, when the output of a repertoire-in-use does not match the expected output of the espoused repertoire and/or serve to advance the purpose of the organization, individuals within an organization experience “surprise” which increases their personal uncertainty. Individuals acting on behalf of the organization react to the surprise and engage in a process of Deweyian inquiry,<sup>112</sup> an “intertwining of thought and action that proceeds from doubt to the resolution of doubt,” seeking to reduce organizational uncertainty by modifying their espoused or in-use theories.<sup>113</sup> Argyris and Schön summarize organizational learning as follows (*emphasis mine*):

Organizational learning occurs when individuals within an organization experience a problematic situation and inquire into it on the organization’s behalf. They experience a surprising mismatch between expected and actual results of action and respond to that mismatch through a process of thought and further action that leads them to modify their images of the organization or their understandings of organizational phenomena and to restructure their activities so as to bring outcomes and expectations in line, thereby changing the organizational theory-in-use. *In order to become organizational, the learning that results from organizational inquiry must become embedded in the images of the organization held in its members’ minds and/or in the epistemological artifacts (the maps, memories and programs) embedded in the organizational environment.*<sup>114</sup>

Argyris and Schön continue, once this inquiry becomes organizational, the learning itself is conducted through established programs which can be broadly classified as *single-loop* or *double-loop*. Single-loop learning conducts inquiry into the SOPs and programs operating within the repertoire without changing the values and norms that underlie the repertoire.<sup>115</sup> Single-loop learning has obvious parallels to Kuhn’s “normal science” conducted within a paradigm.<sup>116</sup> In real-world organizations<sup>u</sup> single-loop learning is the overwhelmingly dominant model.<sup>117</sup> Single-loop learning is often sufficient for mature organizations in stable environments but it doesn’t handle complex problems well. Simply put, an organization can solve “the problem” with single-loop learning but always remains at risk that they are solving the wrong problem. Furthermore,

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<sup>u</sup> Task-improvement curves and the Boyd cycle, aka “the OODA loop” are familiar examples of single-loop learning in a military context.

Argyris and Schön observe that real-world organizations are often terrible even at single-loop learning, exhibiting familiar tendencies such as byzantine internal politics, “bureaucracy,” perverse incentives, etc., which are inimical to learning.<sup>118</sup> Unfortunately this problem is structural and affects virtually everyone.<sup>119</sup>

Double-loop learning refers to the first loop’s inquiry into SOPs and programs and subsequently utilizes the observed first loop results to conduct inquiry into the values and norms of the organization.<sup>120</sup> *Deuterolearning*<sup>121</sup> is metacognition<sup>122</sup> of learning systems, or “learning about learning,” which occurs when inquiry is directed at learning systems of either individuals or organizations.

OL explains the rise of poor organizational learning outcomes as a result of a nearly universal individual behavior. A priori, people seek to avoid giving or receiving threats and embarrassment.<sup>123</sup> When confronted with such situations, virtually all human beings use a specific theory-in-use that Argyris & Schon refer to as “Model I,” where individuals attempt to unilaterally protect themselves and others by manipulating their environment and tasks to minimize threats or embarrassment. These attempts are defensive, manipulative, and controlling; they are perceived as such by other individuals. Underlying problems are bypassed and remain a source of uncertainty which cannot be resolved through individual inquiry, which causes the bypass to be covered up, the cover-up to be made off-limits to discussion, and finally the off-limits status itself is made undiscussable.

Individuals engaged in Model I behavior characteristically make attributions and evaluations that are not testable, because such untestable statements block lines of inquiry that are generating threats and embarrassment. The underlying problem and its cover-up remain unresolved, setting “conditions for error,” an environment where individuals become more and more likely to

make decisions that generate threat, embarrassment, and uncertainty.<sup>124</sup> Social virtues become defined in ways that reinforce Model I.<sup>v</sup> At the organizational level, individuals form groups in order to increase their collective defensive abilities and create SOPs and programs (organizational defensive routines) that powerfully constrain individual behavior. All such routines purposefully create mixed messages, refuse to recognize the resultant ambiguity, and progressively make the ambiguity beyond discussion.<sup>125</sup> Obviously, this creates dilemmas for individual people. Argyris and Schön pose the following dilemma that should catch solution-focused individuals:

If we do not discuss the defensive routines, then these routines will continue to proliferate. But if we do discuss them, we are likely to get into trouble.<sup>126</sup>

Argyris and Schön contend that as a result of such dilemmas individuals experience threat, embarrassment, and uncertainty, react to it defensively, thus ultimately perpetuating the organizational defensive programs. Such programs become self-perpetuating and self-fulfilling, leading to cynicism and mistrust as individuals avoid challenging them in the interest of local peace.<sup>127</sup>

For example, when a battalion commander considers an order that his company commanders consider tactically unsound, the battalion commander places his subordinate commanders in a threatening situation. In any pre-decisional challenge the battalion commander is likely to perceive resistance as embarrassing since he did not foresee the tactical delinquency, or threatening if he feels his authority is being challenged. Instead of stating the tactical delinquencies plainly and possibly drawing the ire of a superior, the company commanders make their criticism indirect and complain tactfully through the executive officer, as well as attempt to modify the plan through the orders review process and by liaison with the operations staff. All of these behaviors are unilateral attempts by the company commanders to control their environment and

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<sup>v</sup> Ex: Concern and caring become: “Act diplomatically; say things that people want to hear.” Strength becomes winning unilaterally, maintaining control, and protecting one’s own perceived vulnerability. Argyris and Schön, *Organizational Learning II*, 96.

their tasks. They are inherently defensive and are perceived as such. When the battalion commander reprimands one of the company commanders down for slow-rolling the plan, he is using formal authority to cover up the underlying tactical problem. The reprimand is embarrassing for the junior officer involved, so all the other officers in the battalion refrain from discussing it. When a platoon commander finally gets the battalion order and observes the original tactical mistake, perceives threat and questions it, he's told the order is from battalion and "that's just the way it is," which is an assertion impossible to test. Thusly the very fact that the issue undiscussable is set off limits for discussion. Ultimately the platoon executes the order, two soldiers die in an ambush, and the battalion commander wonders why low morale and cynicism is the norm.

The free play of individual and group defensive behavior toward threat, embarrassment, or uncertainty leads to the intricate worlds of organizational politics, where vast energies are expended managing delicate balances of power within any large organization. This condition is so normal for organizations that most OT practitioners accept it as "inevitable, natural, and immune to management or influence."<sup>128</sup> Indeed, it is *the* foundational assumption of the bureaucratic politics model, which is highly influential in international relations,<sup>129</sup> technology development,<sup>130</sup> and doctrine.<sup>131</sup> In such a condition, because single-loop learning leaves the purposes, values, and assumptions of the organization alone, it has a chance of proceeding without generating uncertainty and triggering defensive programs. Double-loop learning generates uncertainty by design and will not exist in the presence of individual or organizational defensive reasoning.<sup>132</sup> As Argyris and Schön note:

Individual and supra-individual unities exist in circular, interdependent relationships with each other. When embarrassment or threat are involved, these relationships interact to create self-fueling, limited-learning processes. For double-loop learning to occur and to persist at any level in the organization, the self-fueling processes must be interrupted. In order to interrupt these processes, individual theories-in-use must be altered.<sup>133</sup>

Argyris and Schön's Model II is behavioral state within an organization where a double-loop learning system can occur. During double-loop learning an organization first conducts inquiry into its programs, then uses the single-loop results to conduct inquiry into the values, norms, and basic assumptions of the organization. Double loop organizations get better at solving the problem (first loop) and use those results to adapt themselves to the problem (second loop), thus tracking the problem as it changes. If problems are complex<sup>w</sup> or wicked<sup>x</sup> then double-loop learning is required to make headway.

OL practitioners use ethnographic study and give prescriptive solutions to create Model II conditions in a firm. Most importantly they observe that any intervention into an existing organization in order to set conditions for Model II learning should focus on breaking the defensive reasoning behaviors endemic in Model I. Argyris and Schön conducted a literature review of OL practitioners and described the following structural prescriptions for Model II learning systems:

- Flat, decentralized organizational structures;
- IT systems that provide fast, public feedback on the performance of the organization and its constituent parts;
- Mechanisms for surfacing and criticizing implicit organizational theories of action, cultivating systemic programs of experimental inquiry;
- Measures of organizational performance;
- Systems of incentives aimed at promoting organizational learning, and;
- Ideologies associated with such measures, such as total quality, continuous learning, excellence, openness, and boundary-crossing.<sup>134</sup>

Academics working in OL describe a Model II organization as one with an ideal process in place (ways and means) and not as some goal (ends) that might be achieved.<sup>y</sup> The governing values in Model II are “valid information, free and informed choice, and internal commit-

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<sup>w</sup> Complex problems are those where many factors influence outcomes. Systems theory exists to predict outcomes in complex problems.

<sup>x</sup> Wicked problems are those where many factors influence outcomes in unknown ways that tend to change the problem itself. Counterinsurgencies are often described as wicked problems.

<sup>y</sup> Endstates are meaningless in an organization that continually questions its own values and nature.

ment.”<sup>135</sup> Model II does not reject skill in advancing individual purposes, but it would reject the unilateral control strategies that triggers individual defensive reasoning. To resolve threatening and embarrassing situations, Model II relies on articulate advocacy of individual positions with an invitation to others to confront everyone’s views and emotions. Argyris and Schön’s words are best:

(Model II) seeks to alter views in order to base them on the most complete and valid information possible and construct positions to which people involved can become internally committed. ...

Every significant Model II action is evaluated in terms of the degree to which it helps the individuals involved generate valid and useful information (including relevant feelings), solve the problem in a way that it remains solved, and do so without reducing the present level of problem-solving effectiveness.

The behavioral strategies of Model II involve sharing power with anyone who has competence and is relevant to deciding about implementing the action in question. Definition of the task and control over the environment are shared... Saving one’s own face or that of others is resisted because it is seen as a defensive, antilearning activity.<sup>136</sup>

If new concepts are created under Model II conditions, the meaning given to them by the creator and the inference processes used to develop them are open to scrutiny by those who are expected to use them. Evaluations and attribution are minimized. When they are used, however, they are coupled with directly observable data and the reasoning that led to their formation. The creator feels responsible for presenting them in ways that encourage their open and constructive confrontation.<sup>137</sup>

Under a Model II repertoire, the meaning of social virtues changes in ways which reinforce Model II behavior.<sup>z</sup> The consequences of Model II should be incisive organizational inquiry where the values, norms, and culture central to the organizational repertoire can be “surfaced, confronted, tested, and restructured.”<sup>138</sup>

To achieve double-loop or even efficient single-loop learning, all members of the organization must seek to confront underlying problems by making assertions and evaluations which are testable, while simultaneously removing threat or embarrassment from their communications.

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<sup>z</sup> Ex: Strength becomes defined as skilled advocacy for one’s position combined with inquiry and self-reflection. “Feeling vulnerable while encouraging inquiry is a sign of strength.” Argyris and Schön, *Organizational Learning II*, 120.

In the battalion example, should the battalion commander invite criticism of the pre-decisional order by emphasizing the unit's common purpose, adopting a non-threatening manner and remaining calm while receiving criticism, the company commanders will likely state their objections. Quite likely the battalion commander will have to patiently draw out their specific objections because the junior officers will instinctively avoid clear statements they foresee to give threat or embarrassment. For single-loop organizational learning, the battalion commander's goal is to arrive at a verifiable truth without triggering defensive reasoning in his subordinates and then remedy the tactical deficiency. For double-loop learning to occur, individuals must build up enough trust in each other that defensive reasoning is abandoned. One of the company commanders may then observe that the reason the tactical deficiency originally appeared in the order is a battalion-wide over-reliance on vehicle mounted patrols. The mounted patrol tendency is a norm for the battalion, and after the battalion changes that norm by modifying its tactical SOP and conducting extensive foot-patrol training, double-loop organizational learning has occurred.

A final theoretical distinction from Argyris and Schön is now vital. "What is an organization that it may learn?"<sup>139</sup> An old critique of OL is that organizational learning is a "category mistake," that only individuals learn, an organization is merely an arrangement of individuals, and therefore it makes no sense to assert that an arrangement can learn.<sup>140</sup> For example, if ten people are standing in a line and one learns a new fact, are the chances of the other nine learning the new fact improved by the group standing in a circle? Most OL theorists sidestep this definition problem by either assuming that organizations are rational actors or by adopting the position of an observer so distant that individuals cannot be resolved and only a monolithic organization is perceptible.<sup>141</sup>

Argyris and Schön posit that groups of people (collectivities) become organizations when individuals within the group become “a recognizable vehicle for collective decision and action,” which is a “polis” in the classic Greek sense.<sup>142</sup> For the observer, the level of (group) aggregation therefore matters a great deal. Below some maximum loose-group size, a group isn’t organized enough to be an organization so OT and OL fail, and theories of individual behavior, individual learning, and small-group dynamics should be predictive, though such exploration is beyond the scope of this paper. Above this maximum loose-group size, groups become organizations and OT and OL is predictive. Organizational Learning is therefore an emergent behavior.

The maximum loose-group size can be no greater than Dunbar’s number, which is “the cognitive limit to the number of individuals with whom any one person can maintain stable relationships.”<sup>143</sup> Dr. Robin Dunbar observed that social group size in non-human primates is correlated with the volume of those primates’ neocortex. Extending the regression to homo sapiens, Dunbar estimates the maximum social group size in humans to be 148 individuals.<sup>144</sup> Below this size, groups can maintain cohesion and pursue common purposes through personal loyalties and direct interpersonal contact. Above this size, groups must either form organizations or splinter into factions. Conscious formation of organizations increases uncertainty and is therefore intellectually and emotionally taxing on group members. Groups resist increasing their size above Dunbar’s number and necessitating organizational formation until such formation becomes an absolute requirement to pursue the group’s purpose. Therefore, large organizations should be comprised of many small groups sized below Dunbar’s number, all of whom see other organizational subgroups and organizational learning programs as essentially alien.<sup>aa</sup> This simple predic-

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<sup>aa</sup> Organizations may arise below Dunbar’s number if driven by exceptional individuals who expend effort to fulfill Argyris & Schon’s rules (*Organizational Learning II*, pg 8), but these cases aren’t stable since people will revert to the natural state of informal social relationships if the leaders’ will to organize is removed.

tion is easy to support. The basic unit of command authority is the company of approximately 150 soldiers and has been so for millennia. Naval ship crew sizes or functional divisions within a large ship's crew also tend to obey this limit. Other examples abound. In a military context, this prediction seems valid.

Argyris and Schon wrote their foundational text on OL in 1978 and their theoretical description of a Model II organization remained unchanged through the 1996 edition and to their deaths.<sup>145</sup> There is no indication they ever considered Open Source as an idea or the Recursive Polis as an organizational type.

### **Appendix B: Supplemental Case Studies**

The cases below are supplementary, providing further reinforcement to the idea that organizational structure determines organizational learning. The traditional cases consider Weberian bureaucracies and illustrate the classic Model I limited learning system in action. The Open Source cases analyze non-software organizations using the framework of the Recursive Polis. The organizations analyzed demonstrate decentralization, extreme adaptability and high tempo, all indicators of a possible recursive polis at work.

#### **Traditional Case B1: The Thor/Jupiter Missile Affair**

M. H. Armacost records that during the Thor/Jupiter controversy of the mid-1950's, the US Army and US Air Force competed fiercely and publicly for control of the Intermediate Range Ballistic Missile (IRBM) concept. Both Services developed their own missile system (USA-Jupiter, USAF-Thor) and the concepts for both systems were clearly a linear evolution of thought from the closest existing parallel in each Service. Each concept reflected a consensus of

numerous organizations functionally specialized around a particular program or SOP and seeking to maintain their organizational relevance as technology opened a new doctrinal field. The resulting concepts clearly indicate a single-loop limited learning model operating within both Services. For example, the Army's Jupiter missile was a mobile concept that viewed the IRBM as an extension of the artillery function, reflecting the Army's European WW2 experience.

(The Army's) strategy for control (of the IRBM program) was directed toward (1) facilitating the Jupiter with all deliberate speed; (2) deferring a decision on roles and missions as long as possible; and (3) designing a missile compatible with their tactical doctrine, able to exploit the unique skills of the artilleryman, and capable of maximizing the importance of established Army performance of supporting missions in logistics, geodesy, and survey...<sup>146</sup>

and...

(The Army's) deployment concept, sharply differentiated from that of the Air Force, was serviceable for both deterrence strategy and their on tactical needs. As a mobile missile, it would enjoy immunity from surprise or pre-emptive attacks. Invulnerability could be achieved through dispersion and concealment, as well as mobility. Significantly, the Army alone could handle the weapon under field conditions. Their competence in camouflage and field defense, in logistic support of dispersed units, in the acquisition of target information from reconnaissance drones, in survey and geodesy, and in providing transportation to launching sites was vastly superior, they contended, to Air Force capabilities.<sup>147</sup>

Note the strategies for doctrinal control, delaying doctrinal development, and for doctrine built from existing organization's programs. The passage mentions at least eleven different Army specialty functions and more organizations are present in the major consortiums of defense contractors which were allied with the opposing Service concepts.<sup>148</sup> Since ground forces in all states under nuclear threat were struggling for relevance during the paradigm shift of the early nuclear era,<sup>149</sup> individuals developing ground force doctrine would be acting under conditions of threat and embarrassment, leading to individual then organizational defensive reasoning, then to bureaucratic politics as observed,

In the Thor-Jupiter controversy the service departments performed prodigious feats of lobbying. The activities of the Secretary of Defense and his assistants more nearly resembled the interest aggregation functions of political party leaders.<sup>150</sup>

Eventually the USAF was awarded control of both programs and perfectly exhibited their lack of any double-loop learning (which would question their values and assumptions):

Although the Jupiter was specifically designed for field mobility, in November 1958, the Air staff directed the Army to remove this feature completely as if it were something unholy. The reason for this attitude is hard to determine. – General Maxwell Taylor, USA Chief of Staff<sup>151</sup>

As Armacost demonstrates, doctrine for the USAF's Thor program was developed in the same limited learning fashion. **Get the SST book back from the GRC, write the case from the USAF side as well.**

### **Traditional Case B2: The M-16 Rifle Development Controversy**

In the late 1950's, Eugene Stoner developed the AR-15 assault rifle. Multiple organizations tested the AR-15 under combat conditions and found clearly superior to the M-14, the US Army rifle of the day. The Army's ordnance corps, in charge of rifle development since 1885, was dominated by several organizations (the "gravel-bellies") whose program for evaluating rifles was based on the value that the aimed fire of the marksman at long range was of utmost importance in battle.<sup>152</sup>

To the US Army, it was more than a premise, it was a creed that had evolved over nearly a century since the service adopted its first rifle in 1855. – Thomas McNaugher, RAND<sup>153</sup>

The "ordnance corps" is a colloquial expression for the Army's arsenal system, an informal collection of "weapons laboratories, private contractors, and the Army Material Command."<sup>154</sup> **Clarify the ordnance corps with Dr. Rudd. Usage is per reference in SST.** Their rifle development program was a classic single-loop learning system; the M-14 was an "automatic-firing, less solidly made version of the Army's previous standard, the M-1."<sup>155</sup> These organizations fiercely

defended their existing programs, even when their efforts were clearly impeding the overall purpose of the Army. Per James Fallows, noted author and journalist:

In its sociology, the ordnance corps was small-time, insular, old-fashioned. Its first instinct, when presented with a new technical possibility, was to reject it and stick to its own, traditional solutions. Twice since the Civil War, American Presidents have had to force the ordnance corps to adopt new rifles that had come from outside its own shop.<sup>156</sup>

Accordingly, the ordnance corps rejected the AR-15 in the early 1960's, but other US government organizations with independent purchasing authority bought the AR-15, fought with it in Vietnam and found it exceptionally useful. Despite numerous combat testimonies, the **ordnance corps** would not reconsider the AR-15, bringing forward excuse after excuse that served the purpose of delay. Finally in 1963 the Secretary of Defense ordered a retest of the AR-15, during which the gravel-bellies' resistance to changing their marksman value was so strong it caused them to actually rig the tests against the AR-15, then declare it insufficiently developed and require design changes that would bring it into compliance with their SOPs based on the marksman value. These modifications, resisted by Stoner, reduced the AR-15's effectiveness and reliability, leading to an epidemic of jamming in field conditions that directly resulted in uncounted deaths of Soldiers and Marines for two years of war.<sup>157</sup>

The M-16 disaster is a brutally clear example of a limited learning system. The introduction of an outsider (Stoner) into a protected organizational specialty (rifle manufacture) places the existing organizations (the gravel-bellies) under conditions of threat and embarrassment, leading directly to individual and organizational defensive routines that resisted even single-loop learning (improvement of the M-14), and totally precluded double-loop learning (modification of the marksman value) that would have furthered the purpose of the organization (adoption of the superior AR-15).

**Traditional Case B3: The Soviet Response to US Cold War Doctrines**

The Soviet reaction to the US Army's introduction of AirLand Battle led to a doctrinal innovation by the Soviet General Staff away from a purely offensive doctrine to one that incorporated the strategic defensive. This evidences double-loop learning which was enabled in this Soviet case due to the structure of their doctrine development process in the Gorbachev reform era.

In the Soviet system, the General Staff is a powerful organization independent of the Services, with a distinct professional culture that officers adopted when entering appointed from the Services into the General Staff.<sup>158</sup> While many officers were General Staff qualified, the number in the Staff at this time appears to be small, less than Dunbar's number (~150) and so functioned as a single organization. Long service and personal connections mitigated individual defensive reasoning within the Staff. Concurrent with the introduction of AirLand Battle, Soviet Premier Gorbachev introduced a cadre of civilian experts into the process of doctrinal creation. These civilian experts did not impose, instead they joined and expanded the doctrine-formation community by attempting change from within, building military-technical expertise, and enlisting respected retired military officers to serve as bridges into the General Staff.<sup>159</sup> The Soviets carried out their doctrinal debate over five years (1982-1987), mostly in the form of publications on various aspects of political and military strategy in a variety of journals. Eventually, in May 1987 the Warsaw Pact declared a priority on defensive military doctrine.<sup>160</sup>

As an example of OL, this case is profound and rare. It shows a military organization questioning and changing an underlying value and assumption, the primacy of the offensive, which is particularly poignant considering that Soviet doctrine had been extremely offensive in character since the 1930s. During WW2, the Soviets adopted offensive doctrines based on mass

and simplicity and maintained the underlying value until 1987. This value maintenance is evidence of the expected single-loop learning within Weberian bureaucracies. Indeed, the single-loop system was alive and well; the Soviets continued force modernization efforts despite the doctrinal shift to the defensive.<sup>161</sup>

This double-loop learning occurred because of doctrinal development was the purview of a single organization, the General Staff, whose members shared a distinct professional culture and long service, so organizational defensive routines (aka internal politics) were not in play. The introduction of outsider opinions allowed questioning of the offensive-primacy value. These outsiders took pains to effect change from the inside, to establish their own credibility over time, and to build respect for their ideas on grounds of merit. Promotion by seniority and the career-pinnacle nature of General Staff positions meant individuals could advocate organizationally threatening concepts without career risk. Finally, members of the General staff discussed change ideas horizontally and impersonally, in reasoned arguments published in journals available to all, which placed emotional distance between change proponents and conservatives and cut down individual defensive reasoning.

#### **Traditional Case B4: Testimony of Current Leadership**

Senior leaders in the US military seem to agree that the current system for doctrine development is “broken,” meaning slow and not innovative.

Right now, I think the way we do doctrine, it is constipated. We are trying to do too much. I think there is a more effective way to review the doctrine that we have and keep it both relevant and current. One important reason to speed the review of doctrine is to preserve lessons learned. – Brigadier General William Mullen, Director of Marine Corps Combat Development Command (MCCDC)<sup>162</sup>

General Mullen is actually observing the slow operation of a single-loop learning system. Infantry Company Operations, a foundational doctrinal publication, was “published in 1978 and is now languishing in a review process that has lasted years.”<sup>163</sup> The article lists part of MCCDC’s solution as decentralization of proponentcy, particularly for TTPs, reducing the number of people involved in doctrine writing, and creation of a working group to conduct a top to bottom review. General Mullen admits that even the stated timelines of the doctrine review process are grievously violated in foundational cases. Or another example from US Central Command:

Central Command is two thousand indentured servants whose life is consumed by the whims of Tommy Franks... I am convinced that much of the information that came out of Central Command is unreliable because he [Franks] demands it instantly, so people pull it out of their hats... Also, everything has to be good news stuff... you would find out you can’t tell the truth. – Anonymous senior military officer at Central Command (CENTCOM)<sup>164</sup>

While CENTCOM is not a doctrine-writing command, it has a large influence on the construction of doctrine at the Joint level. The quote serves to illustrate the problem of that can result from having identical chains of command for career advancement and idea generation. With even one hostile leader creating situations of threat and embarrassment, the quality of ideas completely breaks down and individuals spend an inordinate amount of time on relationship management.

### **Open Source Case B5: The Islamic State**

The Islamic State in Iraq and Syria (ISIS) is a world-wide militant organization dedicated to the reestablishment of an Islamic Caliphate under an extremely conservative version of Islam-

ic law. It has a substantial online presence and is noted for its organizational resilience and adaptability.<sup>bb</sup>

ISIS uses the Internet extensively, making use of a wide variety of online tools to raise funds, recruit new members and coordinate transnational activities. There are a large number of “members” of ISIS<sup>cc</sup> though evidence of an argument about ISIS’ nature and meaning is scant outside the digital realm. ISIS has a clearly defined organizational structure headed by the Caliph and descending from him as a Weberian bureaucracy. Within that leadership structure, the nature and meaning of ISIS is not up for debate. The effect is almost one of an online public in the service of a traditional bureaucracy.

ISIS does have a sharing tradition, both in the online and physical realms. ISIS doesn’t have a shared conception of openness. Their conservative ideology actively suppresses dissenting speech with measures including extreme violence. The toleration of different viewpoints within the ISIS diaspora likely has more to do with the caliphate’s limited ability to police dissent rather than their acceptance of it. Furthermore, ISIS makes wide use of secrecy, particularly the cell-type organization where individual ISIS members may only know the members of their particular cell.

Similar to Anonymous above, ISIS doesn’t easily adapt around other paradigms, even in the general sense of making accommodation with a competing worldview in order to pursue a greater goal. ISIS collaborates well, rapidly training new fighters to participate in both physical and online actions. They make available to their membership a great deal of the technology and

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<sup>bb</sup> Given the military audience for this paper, the author presumes familiarity with ISIS on the part of the reader.

<sup>cc</sup> Membership in the sense of a polis is a matter of degree. Leaders, fighters, managers, supporters, and sympathizers are all members in this sense.

methods they utilize, enabling rapid single-loop learning. Finally, ISIS does provide a working prototype of their compelling idea: the prototype of the reestablished Caliphate exists in the territory they have seized and controlled in Iraq, Syria, and other parts of the world.

Like Anonymous, ISIS is also a marginal case for a recursive polis. Their strengths include sharing, collaboration and provision of a working prototype of the compelling idea. They make available to their members' modification much of the technical and social methodology underpinning their project. However, their lack of openness, rigid core ideology, and failure to adapt around other moral orders effectively prevents Model II learning. ISIS has enabled a very fast single-loop learning system which is working and will continue to work as long as their conceptual environment (piecemeal expansion of the caliphate against minor regional powers) remains stable. When that conceptual environment changes their Model I learning system will no longer be solving the right problem and their observed advantage in adaptability will diminish.

**Open Source Case B6: Current US government Open Source Efforts.**

Currently, the US Government has two major OS efforts underway, both narrowly targeted at software, neither of which are even close to the definition of a recursive polis.

[www.Forge.mil](http://www.Forge.mil) is a DoD website that serves as a centralized version control system (VCS) for various OS software development efforts. It was established in 2009 and has some 24,000 users and 900 projects. Forge.mil explicitly states its primary goals as reducing dependence on proprietary vendors and reducing software costs.<sup>165</sup> It may be that a few of these software projects have become the compelling idea around which to build a recursive polis, but the author has not found one yet. There is no indication that there has been any underlying structural change to DoD organizations in support of Forge.mil.

[www.milSuite.mil](http://www.milSuite.mil) is a DoD website that provides a variety of web-enabled tools restricted to the DoD community. It is CAC-enabled and provides an internal analogs of popular commercial software, such as forums, video-sharing, and social networking. The most developed of these tools appears to be the forum milWiki, where a large number of government documents have been placed and are editable by anyone Wikipedia-style. Two doctrine-relevant points stand out: (1) A variety of units, particularly reserve component, have posted their unit Tactical SOPs to the site, though none of them appear to have a large number of contributing authors. (2) The Army has posted their entire library of the lowest level doctrinal publications, Army Tactics, Techniques, and Procedures (ATTP) documents, to milWiki. Unfortunately, these ATTP display a top-line banner warning stating that the online ATTP is not the authoritative version and has not been approved (by traditional authorities) for use. The author was unable to find any ATTPs with a large number of changes or contributing authors. Most appeared untouched after posting. Again, there is no indication that any structural change to DoD organizations has occurred in support of milSuite.

While laudable on their technical merits, the DoD's current OS efforts indicate a lack of understanding about the nature of a recursive polis and organizational learning. The DoD is considering OS merely a tool for the use of the traditional military bureaucracy. It is unlikely that these efforts alone will lead to sustained Model II learning.

### **Appendix C: A Brief History of Open Source**

During the 1950's and 60's, various researchers in the nascent field of computing followed the common practice of academia and shared computer software source code in the public domain. Software was free in the sense that it was available without cost and could also be modified and reused without restriction. Because computers were rare and often custom-built, modifi-

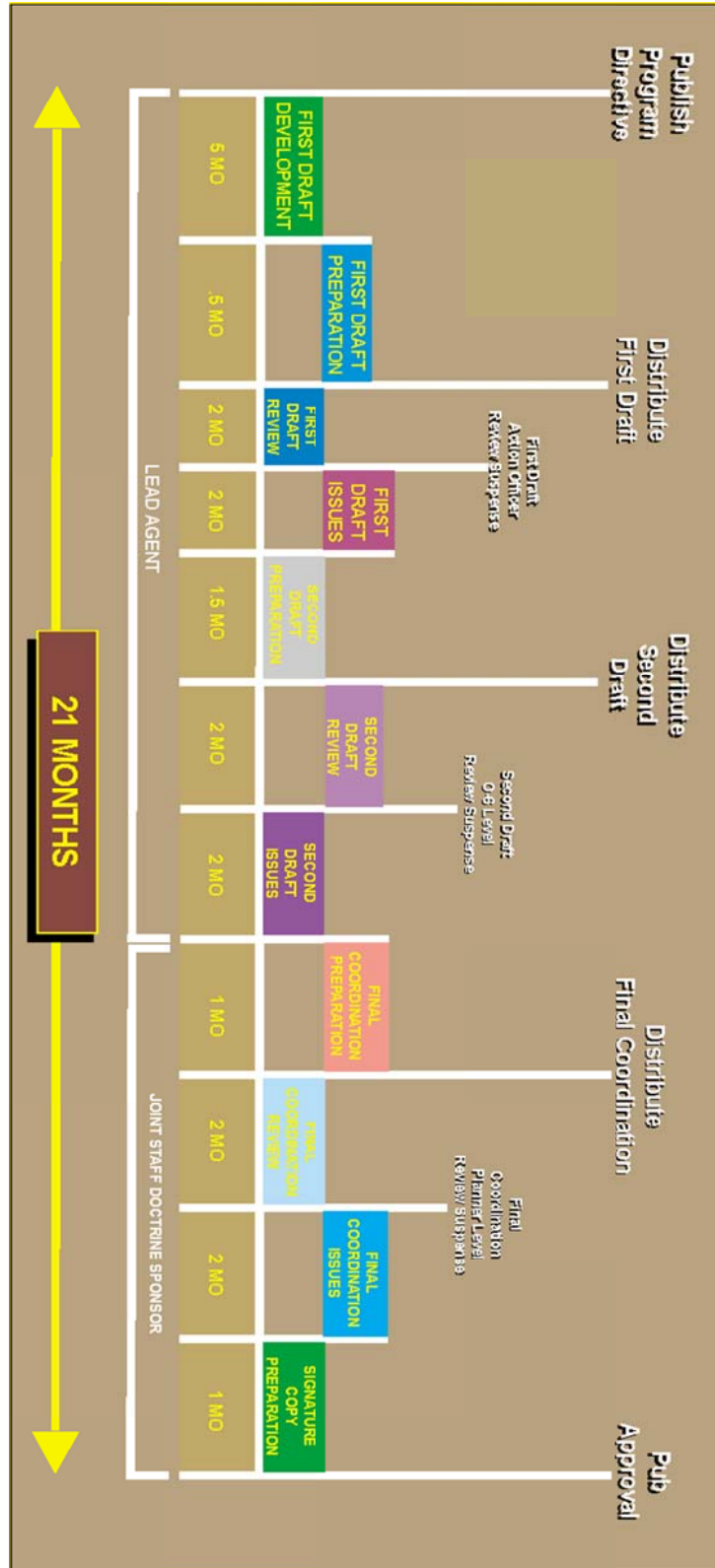
cation of source code was also a technical requirement for shared programs that would run on multiple platforms. This academic process culminated with ARPA's open "Request for Comments" process whereby the contribution of the community led directly to creation of the ARPANet, the precursor to the modern Internet.<sup>166</sup>

During the 1980s the costs for computer hardware plummeted and the emergence of a proprietary software industry caused the costs of software to increase dramatically.<sup>167</sup> Additionally, changes to US law in the 1976 and 1980 caused a conceptual shift toward copyrighting software.<sup>168</sup> Against this backdrop of software becoming "less free," in 1983 Richard Stallman wrote the GNU Public Manifesto and launched the GNU Project to write an operating system completely free of usage or modifiability constraints. In 1989, Stallman released the GNU Public License (GPL),<sup>169</sup> a *copyleft* license wherein creators expressly grant all users free right to access, modify, and reuse software without restriction.<sup>170</sup> In 1991, Linus Torvalds created an initial version of the Linux operating system, released it under the GPL, and began developing Linux as the leader of a loose but massive group of co-developers.<sup>171</sup> In 1997, Eric Raymond published a "reflective analysis of the hacker community and free-software principles"<sup>172</sup> entitled *The Cathedral and the Bazaar*,<sup>173</sup> which served to illuminate the social imaginary. The community adopted the term "Open Source" in 1998 and exploded into public view later that year when Netscape Corp. released their popular Netscape browser into the public domain under the GPL.<sup>174</sup>

Today, Linux is the dominant operating system worldwide, having defeated Microsoft in every computing sector but desktop computing, beating Apple in handheld devices, and a host of other competitors in various sectors.<sup>175</sup> On Jan 1, 2016, Microsoft and Apple had a combined

market value of \$1.02 trillion.<sup>176</sup> Linux was free.<sup>177</sup> The story is the same for most true OS efforts.<sup>178</sup>

Figure 4: The Joint Doctrine Development Process<sup>179</sup>





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**ENDNOTES**

<sup>1</sup> Posen, Barry R. *The Sources of Military Doctrine – France, Britain, and Germany Between the World Wars* (Ithaca, NY: Cornell University Press, 1984), 13.

<sup>2</sup> Weber, Max, *Economy and Society – An Outline of Interpretive Sociology*, ed. Guenther Roth and Claus Wittich (Berkeley, CA: University of California Press, 1978), Ch XI – “Bureaucracy”, 956-1003. The six characteristics of a bureaucracy: (1) Formal hierarchical structure, (2) Management by rules, (3) Organization by functional specialty, (4) An “up-focused” or “in-focused” mission, (5) Purposely impersonal, (6) Employment based on technical qualification.

<sup>3</sup> Weber, Max. “Legal Authority With a Bureaucratic Administrative Staff,” in *Economy & Society*, Vol 1, Ch III, 3&4, 217-226; Weber, Max, “The Position of the Official Within and Outside of Bureaucracy,” in *Economy & Society*, Vol 2, Ch XI, 2; Weber, Max, “The Objective and subjective Bases of Bureaucratic Perpetuity,” “The Indeterminate Economic Consequences of Bureaucratization” and “The Power Position of the Bureaucracy,” in *Economy & Society*, Vol 2, Ch XI, 9-11.; Posen, Barry R., “Sources of Military Doctrine,” 44-59.; Zisk, Kimberly Marten, *Engaging the Enemy - Organization Theory and Soviet Military Organization, 1955-1991* (Princeton, NJ: Princeton University Press, 1993), Ch 1-2. Argyris and Schön, “Defensive Reasoning and the Theoretical Framework that Explains It – Model I and O-I,” in *Organizational Learning II – Theory Method, and Practice* (Reading, MA: Addison-Wesley Publishing Company, 1996), Part II, 73-108. Weber states that bureaucrats seek power and personal security through monopolization of technical knowledge. Bureaucracies therefore seek stability above all else. Learning is inherently destabilizing and is resisted. Posen and Zisk cite Weber and concur for the case of military bureaucracies. Argyris and Schön provide the theoretical framework that shows organizational resistance to learning arising from the tendencies of individuals.

<sup>4</sup> Argyris and Schön, *Organizational Learning II*, Part II, 73-107. See particularly “Conclusion, 106-107.”

<sup>5</sup> Allison, Graham T., “Conceptual Models and the Cuban Missile Crisis,” *The American Political Science Review*, Vol LXIII, no 3 (September 1969): 689-718; Weber, Max. *Economy & Society*; Posen, Barry. *The Sources of Military Doctrine*; Bernard, Chester I. *The Functions of the Executive* (Cambridge, MA: Harvard University Press, 1968); March, James and Simon, Herbert. *Organizations* (New York, NY: John Wiley & Sons, 1958); Thompson, James D. *Organizations in Action* (New York, NY: McGraw-Hill, 1967); Stinchcombe, Arthur L. *Constructing Social Theories* (New York: Harcourt, Brace, & World, 1968). Credit to Posen for the short literature review.

<sup>6</sup> Posen, Barry R., *Sources of Military Doctrine*, 43-44. Allison, Graham T., “Conceptual Models and the Cuban Missile Crisis,” 700-701.

<sup>7</sup> Argyris and Schön, *Organizational Learning II*, 13.

<sup>8</sup> Allison, Graham T., “Conceptual Models and the Cuban Missile Crisis,” 700.

<sup>9</sup> Argyris and Schön, *Organizational Learning II*, 13-15.

<sup>10</sup> Argyris and Schön, *Organizational Learning II*, 11-12.

<sup>11</sup> Argyris and Schön, *Organizational Learning II*, 16.

<sup>12</sup> Argyris and Schön, *Organizational Learning II*, 20-21. Assumptions that underlie SOPs and programs may also be investigated in single-loop learning.

<sup>13</sup> Argyris and Schön, *Organizational Learning II*, 21-28.

<sup>14</sup> Argyris and Schön, *Organizational Learning II*, Ch 4, 75-84. “Definition of *antisocial*,” Dictionary.com, accessed February 15, 2016. <http://dictionary.reference.com/browse/antisocial>.; “Antisocial Personality Dis-

order," Psychology Today, accessed February 15, 2016.

<https://www.psychologytoday.com/conditions/antisocial-personality-disorder>. Failure to naturally avoid threats and embarrassment is so rare it is diagnosable as a disorder: Sociopathy or Antisocial Personality Disorder, which occur in about 2% of the world population overall.

<sup>15</sup> Argyris and Schön, *Organizational Learning II*, 85-99. See especially, Primary Inhibitory Loop.

<sup>16</sup> Argyris and Schön, *Organizational Learning II*, 98-107.

<sup>17</sup> Argyris and Schön, *Organizational Learning II*, 101.

<sup>18</sup> Posen. *Sources of Military Doctrine*, Ch 2, 34-80. See particularly "Summary, 79-80." Other authors (Zisk, et al) do make more hopeful cases for military innovation arising from within military organizations. Such examples involve breaking up the typical Model I limited learning system and will be discussed later.

<sup>19</sup> Argyris and Schön, *Organizational Learning II*, 111.

<sup>20</sup> Posen. *Sources of Military Doctrine*, Ch 2, 34-80. See particularly "Summary, 79-80."

<sup>21</sup> Argyris and Schön, *Organizational Learning II*, 6-11. See especially pg 8. To form a polis, the individuals in a group must consciously or unconsciously (1) devise agreed-upon procedures for making decisions in the name of the collectivity, (2) delegate to individuals the authority to act for the collectivity, and (3) set boundaries between the collectivity and the rest of the world.

<sup>22</sup> R. I. M. Dunbar, "Neocortex Size as a Constraint on Group Size in Primates," *Journal of Human Evolution* 22, Issue 6: 469-493. Dunbar postulates the maximum number of stable relationships that human beings can maintain to be approximately 150 due to physical limits in the brain. Other studies postulate higher maxima (notably Bernard & Killworth, ~231), but I have found no credible sources higher than 250, which is a small number of individuals in the context of bureaucracies, militaries, and Open Source.

<sup>23</sup> US Joint Chiefs of Staff, *Joint Doctrine Development System*, JP1-01 (Washington, DC: Joint Staff, July 5, 2000), Ch 1, 2-7. Chairman of the Joint Chiefs of Staff, *Joint Doctrine Development System*, CJCSI 5120.02D (Washington, DC: Joint Staff, January 5, 2015), Encl A, 1-7. *Future Concepts* refers to ends, ways, and means that do not currently exist. Both concepts and doctrine may utilize the same development programs and organizations, leading to confusion.

<sup>24</sup> Hoiback, Harald, *Understanding Military Doctrine – A multidisciplinary approach* (New York, NY: Routledge, 2013), Ch 8, 149-179.

<sup>25</sup> Hoiback, Harald, *Understanding Military Doctrine*, 19.

<sup>26</sup> Hoiback, Harald, *Understanding Military Doctrine*, 11-14.

<sup>27</sup> Lt. Col. Dennis M. Drew, "Informal Doctrine and the Doctrinal Process: A Response," *Air University Review* (September-October 1984): <http://www.airpower.maxwell.af.mil/airchronicles/aureview/1984/sep-oct/drew.html>

<sup>28</sup> Hoiback, Harald, *Understanding Military Doctrine*, 19.

<sup>29</sup> Dennis M. Drew, "Informal Doctrine and Doctrinal Process," *Air University Review*, 1.

<sup>30</sup> Major General Irving Brinton (I. B.) Holley, "Concepts, Doctrines, Principles: Are You Sure You Understand These Terms?" *Air University Review* (July-August 1984): <http://www.airpower.maxwell.af.mil/airchronicles/aureview/1984/jul-aug/holley.html>

<sup>31</sup> Dennis M. Drew, "Informal Doctrine and Doctrinal Process," *Air University Review*, 2.

<sup>32</sup> Joint Chiefs, *JP1-01*, Ch II, 1-7. The Joint Staff J-7 has cognizance over the entire program and will sign out all but the top-level publications. Lead Agents (LA) are the organization charged with pushing the development. The Primary Review Authority (PRA) is the primary researcher and drafter, may also be the LA. Coordinating Review Authority (CRA) and Technical Review Authority (TRA) holders review the development at steps in the process. CRAs are usually service organizations. TRAs are technical or administrative specialist organizations.

<sup>33</sup> Joint Chiefs, *JP1-01*, III-1. The high official can be: A military Service Chief, a Combatant Commander, or a Director of a Joint Staff directorate.

<sup>34</sup> Joint Chiefs, *JP1-01*, III-3.

<sup>35</sup> Joint Chiefs, *JP1-01*, Ch III, 3-4. Voting members of the JDWP are the Service Headquarters, the Combatant Commands, and the J-7 (for the Joint Staff). Max membership: 16.

<sup>36</sup> Joint Chiefs, *JP1-01*, III-2.

<sup>37</sup> Joint Chiefs, *JP1-01*, Ch III, 1-13.

<sup>38</sup> Joint Chiefs, *JP1-01*, Ch III, 13-19. Chairman of the Joint Chiefs of Staff, *Policy on Action Processing*, CJCSI 5711.01A (Washington, DC: Joint Staff, March 1, 1999), Encl A.

<sup>39</sup> Joint Chiefs, *Joint Doctrine Hierarchy Chart*, updated January 5, 2016.  
[www.dtic.mil/doctrine/doctrine/status.pdf](http://www.dtic.mil/doctrine/doctrine/status.pdf)

<sup>40</sup> Chief of Naval Operations, *The Naval Warfare Library*, NTRP1-01 (Washington, DC: US Navy, May 2014); US Army Training and Doctrine Command, *The TRADOC Doctrine Publication Program*, TRADOC Regulation 25-36 (Fort Eustis, VA: TRADOC, September 4, 2012); US Marine Corps Combat Development Command, *MCCDC Doctrine Development Chart* (Quantico, VA: July 19, 2010), [https://www.doctrine.usmc.mil/images/DoctrineDevelopmentChart\\_19Jul10.ppt](https://www.doctrine.usmc.mil/images/DoctrineDevelopmentChart_19Jul10.ppt). The Army maintains over 400 pubs, USMC ~300, Navy ~150, USAF 33.

<sup>41</sup> "Joint Lessons Learned System (JLLS)," Joint Staff J-7, accessed Feb 12, 2016, <https://www.jllis.mil/>. DoD Common Access Card (CAC) is required for access.

<sup>42</sup> Gerras, Stephen J., Leonard Wong, and Charles D. Allen, *Organizational Culture: Applying A Hybrid Model to the U.S. Army* (Carlisle, PA: U.S. Army War College, 2008), 14-17 and 21-23. While the authors use Army examples, the other Services are very similar.

<sup>43</sup> Zisk, Kimberly Marten, *Engaging the Enemy - Organization Theory and Soviet Military Organization, 1955-1991* (Princeton, NJ: Princeton University Press, 1993), Ch 1 & 2. In militaries with a General Staff system the influence of parochial organizations on senior leadership is less than in the US service-competitive system. Also, the General Staff itself is an organization with strength enough to have its own organizational culture.

<sup>44</sup> Evenson, Jason W., "Assessing USJFCOM's Role on Joint Doctrine Development – An EBO Case Study" (final paper, Naval War College, 2009), [www.dtic.mil/dtic/tr/fulltext/u2/a502909.pdf](http://www.dtic.mil/dtic/tr/fulltext/u2/a502909.pdf)

<sup>45</sup> Jeffrey C. Long, "The Evolution of U.S. Army Doctrine – From Active Defense to AirLand Battle and Beyond" (Master's Thesis, US Army Command and General Staff College, 1991), 234-261.

<sup>46</sup> Jeffrey C. Long, "Evolution of USA Doctrine," 261-293.

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- <sup>47</sup> Jeffrey C. Long, "Evolution of USA Doctrine," 120-121.
- <sup>48</sup> Kaldor, Mary, "The Weapons Succession Process," in *Social Shaping of Technology*, 2<sup>nd</sup> edition, ed. MacKenzie, Donald and Judy Wajcman (Buckingham, PA: Open University Press, 1999), Ch 29.
- <sup>49</sup> Kaldor, Mary, "The Weapons Succession Process," in *Social Shaping of Technology*," 412, 414. See Fig 29.1.
- <sup>50</sup> Kaldor, Mary, "The Weapons Succession Process," in *Social Shaping of Technology*," 413-414. See Fig 29.1.
- <sup>51</sup> Kaldor, Mary, "The Weapons Succession Process," in *Social Shaping of Technology*," 413-414. See Fig 29.1.
- <sup>52</sup> Kaldor, Mary, "The Weapons Succession Process," in *Social Shaping of Technology*," 412-414. See Fig 29.1.
- <sup>53</sup> Kaldor, Mary, "The Weapons Succession Process," in *Social Shaping of Technology*," 416.
- <sup>54</sup> Richard B. Andres, "Cyber-Gang Warfare," *Foreign Policy* (February 12, 2016), <http://foreignpolicy.com/2013/02/12/cyber-gang-warfare/>. A simple internet search for "cyber militias" turns up 488,000 hits on this date.
- <sup>55</sup> David Ticoll, "Get Self-Organized," *Harvard Business Review* (September 2004), <https://hbr.org/2004/09/get-self-organized>. Simple internet search for "online self-organizing communities" turns up 94,700,000 hits on this date.
- <sup>56</sup> Kelty, Christopher M., *Two Bits – The Cultural Significance of Free Software* (Durham, NC: Duke University Press, 2008), 3.
- <sup>57</sup> "British definition of Recursion," Dictionary.com, accessed February 16, 2016. <http://dictionary.reference.com/browse/recursion?s=t>. For example:  $f(n+1) = 1+f(n)$ . This function will yield infinity unless a recursive limit is set.
- <sup>58</sup> Kelty, *Two Bits*, 3.
- <sup>59</sup> Habermas, Jurgen, *The Structural Transformation of the Public Sphere – An Inquiry into a Category of Bourgeois Society*, trans. Thomas Burger and Frederick Lawrence (Cambridge, UK: Polity Press, 1989), 27-43.
- <sup>60</sup> Charles Taylor, "Modern Social Imaginaries," *Public Culture* 14, no 1 (2002): 91-124. See especially section 3. For example, military officers share a social imaginary, a vision of themselves and the boundaries of their discussions as officers, therefore the debate between Majors over lunch which is later refined and published in a military journal becomes part of the military discussion and helps define their public sphere.
- <sup>61</sup> Schein, Edgar H., *Jossey-Bass Business and Management – Organizational Culture and Leadership*, 4<sup>th</sup> edition (Hoboken, NJ: Jossey-Bass, 2010), Ch 2, 23-33. <http://site.ebrary.com/lib/usmcu/detail.action?docID=10418988#>
- <sup>62</sup> Charles Taylor, "Modern Social Imaginaries," *Public Culture*, 106.
- <sup>63</sup> Kelty, *Two Bits*, 15.
- <sup>64</sup> Argyris and Schön, *Organizational Learning II*, 187.; Mark Dodgson, "Organizational Learning: A Review of Some Literatures," *Organization Studies* 14, No 3 (1993), 375-394.
- <sup>65</sup> Vinod Valloppillil, "The Halloween Memos," <http://www.catb.org/esr/halloween/halloween1.html>.

<sup>66</sup> Kelty, *Two Bits*; Et al. OS arose from software development over the Internet and no other network than the Internet exists that could fulfill these requirements. The vast majority of writers simply take the requirement for the Internet as a given without understanding why it is important.

<sup>67</sup> Haythornthwaite, Caroline and Anna L. Nielsen, "Revisiting Computer-Mediated Communication for Work, Community, and Learning," *Psychology and the Internet – Intrapersonal, Interpersonal, and Transpersonal Implications*, 2<sup>nd</sup> ed., edited by Jayne Gackenbach (Sydney, Australia: Elsevier, 2007), Ch 7.

<sup>68</sup> Kelty, *Two Bits*, Ch 3, 97-117. Kelty's first concept, "the practices of argument and disagreement about the meaning of Free Software," forms the loose basis for the author's contentions.

<sup>69</sup> Vinod Valloppillil, "The Halloween Memos," <http://www.catb.org/esr/halloween/halloween1.html>. Valloppillil notes that in 1998 Linux had about 200 committed developers and over 1000 who submit small sections of code periodically. Linux has grown massively since then.

<sup>70</sup> Argyris and Schön, *Organizational Learning II*, 117-122.

<sup>71</sup> Argyris and Schön, *Organizational Learning II*, 187.

<sup>72</sup> Kelty, *Two Bits*, Ch 4, 118-142. Kelty's second concept, "sharing source code," forms the loose basis for the author's contention. Kelty's examples of OS included only software development. He began extending the concept but not as far as the author.

<sup>73</sup> Github is the premier example. <http://www.github.com>. A distributed version control system (DVCS) is a system that keeps track of every version of every effort that is being made by multiple users simultaneously. It provides features to reconcile edits to the same products and will display the evolutionary path of the project through multiple versions and forks. It saves all source code for all versions of all projects. Its distributed nature means that there is no central server, individuals download the project in part or whole to their local machines, work on it, and then return it to everyone else via peer-to-peer sharing. Lack of a central server increases speed and reliability, as well as removes a central target for hackers, disaster, or Murphy's Law. The DVCS must be OS as well because the methods and norms of collaboration are up for modification as well as any project. With a proprietary DVCS, new methods of collaboration would be impeded by the unchangeable architecture of the sharing platform.

<sup>74</sup> StackOverflow is the premier example. <http://www.stackoverflow.com>. These forums allow any individual to post any question and have it answered by the community. The community rewards members for good responses to questions by peer recognition within the community which is tracked by individual member, slowly identifying types and levels of talent.

<sup>75</sup> Argyris and Schön, *Organizational Learning II*, 117. "The behavioral strategies of Model II involve sharing power with anyone who has competence and is relevant to deciding about implementing the action in question. Definition of the task and control over the environment are also shared..."

<sup>76</sup> Bergson, Henri, *The Two Sources of Morality and Religion*, trans. R. Ashley Audra and Cloudesley Brereton (London, England: Macmillan and Co., 1932), Ch IV.; Popper, Karl, *The Open Society and Its Enemies* (Princeton, NJ, Princeton University Press, 1966).

<sup>77</sup> Kelty, *Two Bits*, Ch 5, 143-178. Kelty's third concept, "conceiving openness," forms the loose basis for the author's contention. The TCP/IP architecture of the Internet is a good example. It is an open communications standard that privileges no platform or person, whose very structure reinforces the belief that openness is good, because it works within the open tool.

<sup>78</sup> Argyris and Schön, *Organizational Learning II*, 187; Mark Dodgson, "OL Literature Review," 387-391.

<sup>79</sup> “GNU General Public License,” Free Software Foundation, 2007, <http://www.gnu.org/licenses/gpl-3.0.en.html>. GNU is a recursive acronym that stands for “Gnu is Not Unix.”

<sup>80</sup> “About the Licenses,” Creative Commons, <https://creativecommons.org/licenses/>. Creative Commons pioneered the idea of “some rights reserved” and has created a suite of licenses that are applicable to any work, not just software.

<sup>81</sup> Kelty, *Two Bits*, Ch 6, 179-209. Kelty’s fourth concept, “writing copyright licenses,” forms the loose basis for the author’s contention.

<sup>82</sup> Kelty, *Two Bits*, 211.

<sup>83</sup> “How it works,” The Apache Software Foundation, <http://www.apache.org/foundation/how-it-works.html>

<sup>84</sup> Kelty, *Two Bits*, Ch 7, 210-240. Kelty’s fifth concept, “collaborating collaborations,” forms the loose basis of the author’s contention.

<sup>85</sup> Fogel, Karl, *Producing Open Source Software: How to Run a Successful Free Software Project* (Creative Commons Attribution-ShareAlike (3.0): Karl Fogel, 2015), Ch 2 – Getting Started.; Raymond, Eric S., “The Mail Must Get Through,” in *The Cathedral and the Bazaar*, <http://www.catb.org/esr/writings/cathedral-bazaar/cathedral-bazaar/ar01s02.html>.

<sup>86</sup> “Random,” 4chan.org, <http://4chan.org/b/>. 4chan is a simple bulletin board posting website with a large number of individual boards. The “random” board, 4chan/b/, is one of the more active, with 150,000-200,000 postings reported daily. It is primarily an image board, and is definitely not safe for work (NSFW).

<sup>87</sup> “Definition of lulz,” Urban Dictionary Online, <http://www.urbandictionary.com/define.php?term=lulz>

<sup>88</sup> William Stanley Pendergrass, “What Is Anonymous? – A case study of an information systems hacker activist collective movement” (doctoral dissertation, Robert Morris University, 2013), 25-28.

<sup>89</sup> “Message to Scientology,” Youtube, <https://www.youtube.com/watch?v=JCbKv9yiLiQ>

<sup>90</sup> “Anonymous Declares War on the Islamic State,” Daily Mirror Online, <http://www.mirror.co.uk/news/world-news/anonymous-declares-war-islamic-state-6839030>; “Anonymous Declares War on ISIS,” Youtube, <https://www.youtube.com/watch?v=TeV9VTCRoS0>

<sup>91</sup> Pendergrass, “What is Anonymous?,” Ch 5, 284-292.; “Anonymous (online group),” Wikipedia, [https://en.wikipedia.org/wiki/Anonymous\\_\(group\)](https://en.wikipedia.org/wiki/Anonymous_(group)). Wikipedia is a trustworthy source in this regard. Because Wikipedia is very widely used, open for editing to all and not currently under attack by Anonymous, acceptance by Anonymous with the information presented can be presumed.

<sup>92</sup> “Negotiation between Anonymous and HBGary CEO,” <http://pastebin.com/x69Akp5L>. HBGary Federal is a defunct internet security company which attracted the ire of Anonymous when a senior employee declared that he had information on the real identities of a large number of Anonymous individuals. Anonymous declared war on HBGary, hacked the company’s servers, wiped them completely, and then began publishing internal data online in various public forums. The HBGary CEO (Penny in the chat log) attempted to negotiate with Anonymous for a cessation of hostilities and prevention of further corporate and personal data leaks.

<sup>93</sup> Pendergrass, “What is Anonymous?,” Ch 4, No 6, 267-283.

<sup>94</sup> Pendergrass, “What is Anonymous?”; “Anonymous,” Wikipedia, [https://en.wikipedia.org/wiki/Anonymous\\_\(group\)](https://en.wikipedia.org/wiki/Anonymous_(group)). Author: The only evidence of adaptation to the existing

modern order is in Anonymous' very recent cooperation with intelligence agencies against ISIS. Even that appears to be a temporary alliance of convenience.

<sup>95</sup> Joint Chiefs, *JP1-01*, Executive Summary, pg vi.

<sup>96</sup> Aaron Lippold and Guy Martin, "Software Forge – Collaborative Development and Reuse of Open Source / DoD Community Source Software," (Powerpoint presentation, RedHat Summit, Chicago, IL, September 2, 2009), [https://www.redhat.com/f/pdf/summit/alippold\\_320\\_softwareforge.pdf](https://www.redhat.com/f/pdf/summit/alippold_320_softwareforge.pdf); Todd Miller, "milSuite and Open Source," (Powerpoint presentation, PEO C3T, August 20, 2013), <http://www.slideshare.net/milSuite/milsuite-and-open-source>.

<sup>97</sup> "What is a Hacker" in *How to Become a Hacker*, Eric S Raymond, <http://www.catb.org/esr/faqs/hacker-howto.html>. Adapted from the section: "There is a community, a shared culture, of expert programmers and networking wizards that traces its history back through the decades to the first time-sharing minicomputers and the earliest ARPAnet experiments. The members of this culture originated the term "hacker." Hackers built the Internet. Hackers made the UNIX operating system what it is today. Hackers make the World Wide Web work. If you are part of this culture, if you have contribute to it and other people in it know who you are and call you a hacker, you're a hacker."

<sup>98</sup> "DOD Open Source Software (OSS) FAQ," Chief Information Officer, US DoD, [http://dodcio.defense.gov/OpenSourceSoftwareFAQ.aspx#Frequently Asked Questions regarding Open Source Software .28OSS.29 and the Department of Defense .28DoD.29](http://dodcio.defense.gov/OpenSourceSoftwareFAQ.aspx#Frequently%20Asked%20Questions%20regarding%20Open%20Source%20Software%20OSS.29%20and%20the%20Department%20of%20Defense%20DoD.29); "Federal Acquisitions Regulations (FAR)," General Services Administration (GSA), <https://www.acquisition.gov/?q=browsefar>. The FAR generally requires only commercial rights to software it acquires. The US government retains unlimited rights to software it develops internally. Some

<sup>99</sup> "About the Licenses," Creative Commons, <https://creativecommons.org/licenses/>. A first point of departure for such an open license would be Creative Commons, who provide licenses to the general public for any kinds of non-software items with varying degrees of restriction.

<sup>100</sup> "How it works," The Apache Software Foundation, <http://www.apache.org/foundation/how-it-works.html>

<sup>101</sup> Mediratta, Bharat and Julie Bick, "The Google Way: Give Engineers Room," *New York Times online edition*, October 21, 2007, <http://www.nytimes.com/2007/10/21/jobs/21pre.html>; D'Onfro, Jilian, "The truth about Google's famous '20% time' policy," *Business Insider*, April 17, 2015, <http://www.businessinsider.com/google-20-percent-time-policy-2015-4>. Google became famous for allowing employees to work up to 20% of their paid time on projects of their own choosing. Google News, Gmail, and AdSense are all enormous projects that came from this effort to enable creativity. Only about 10% of Google employees used the policy, and even then only used 5-10% of their time vs the 20% allowed.

<sup>102</sup> Shaikh, Maha and Tony Cornford, "Total cost of ownership of open source software: a report for the UK Cabinet Office supported by OpenForum Europe," 2011, London School of Economics and Political Science, London, England. [http://eprints.lse.ac.uk/39826/1/Total cost of ownership of open source software \(LSERO\).pdf](http://eprints.lse.ac.uk/39826/1/Total%20cost%20of%20ownership%20of%20open%20source%20software%20(LSERO).pdf)

<sup>103</sup> "FAR – Part 13 Simplified Acquisitions Procedures," *Federal Acquisitions Regulations*, <http://farsite.hill.af.mil/reghtml/regsfar2afmcfars/fardfars/far/13.htm>; "Federal Acquisition Regulation; Inflation Adjustment of Acquisition-Related Thresholds," *Federal Register*, <https://www.federalregister.gov/articles/2015/07/02/2015-16206/federal-acquisition-regulation-inflation-adjustment-of-acquisition-related-thresholds>. 2016 Simplified Acquisitions threshold: \$7M max per program, can be spent in one or multiple expenditures. 2016 Micro-Purchase threshold: \$3K max per expenditure. \$100,000 is roughly the cost of a single doctrine writer, Major-equivalent, on a Lead Agency staff. The polis would be responsible for compliance with all acquisitions rules, including GPC training and recruit-

ing a contracting officer into the polis if necessary. The PMC Chair will be ultimately responsible for expenditures.

<sup>104</sup> MacGregor Knox and Williamson Murray, ed., *The Dynamics of Military Revolutions – 1300 to 2050* (Cambridge, England: Cambridge University Press, 2001), Ch 4, 57-73. Robert Stephen Ramsey, “Military Revolutions – The American Civil War” (working paper, USMC Command and Staff College, 2015).

<sup>105</sup> Allison, Graham T., “Conceptual Models and the Cuban Missile Crisis,” *The American Political Science Review*, Vol LXIII, no 3 (September 1969): 689-718; Weber, Max. *Economy & Society*; Posen, Barry. *The Sources of Military Doctrine*; Bernard, Chester I. *The Functions of the Executive* (Cambridge, MA: Harvard University Press, 1968); March, James and Simon, Herbert. *Organizations* (New York, NY: John Wiley & Sons, 1958); Thompson, James D. *Organizations in Action* (New York, NY: McGraw-Hill, 1967); Stinchcombe, Arthur L. *Constructing Social Theories* (New York: Harcourt, Brace, & World, 1968). Credit to Posen for the short literature review.

<sup>106</sup> Allison, Graham T., “Conceptual Models and the Cuban Missile Crisis,” 698-715; Waltz, Kenneth. *Man, the State, and War* (New York, NY: Columbia University Press, 1954, 1959, and 2001): Ch 4 & 5, 80-158.

<sup>107</sup> Posen, Barry R., *Sources of Military Doctrine*, 43-44. Allison, Graham T., “Conceptual Models and the Cuban Missile Crisis,” 700-701.

<sup>108</sup> Argyris and Schön, *Organizational Learning II*, 13.

<sup>109</sup> Allison, Graham T., “Conceptual Models and the Cuban Missile Crisis,” 700.

<sup>110</sup> Argyris and Schön, *Organizational Learning II*, 13-15.

<sup>111</sup> Schein, Edgar H., *Organizational Culture and Leadership*, Ch 2, 23-33.  
<http://site.ebrary.com/lib/usmcu/detail.action?docID=10418988#>

<sup>112</sup> Felix Kaufmann, “John Dewey’s Theory of Inquiry.” *Journal of Philosophy, Inc.* 56, no. 21 (October 8, 1959), 826-836; Boisvert, Raymond D. *John Dewey – Rethinking Our Time* (Albany, NY: State University of New York Press, 1998), Ch 1 & 2, 1-48.

<sup>113</sup> Argyris and Schön, *Organizational Learning II*, 11-12.

<sup>114</sup> Argyris and Schön, *Organizational Learning II*, 16.

<sup>115</sup> Argyris and Schön, *Organizational Learning II*, 20-21. Assumptions that underlie SOPs and programs may also be investigated in single-loop learning.

<sup>116</sup> Thomas Nickles, *Thomas Kuhn* (Cambridge: Cambridge University Press, 2002), 103-105.

<sup>117</sup> Argyris and Schön, *Organizational Learning II*, 112. “Neither of the authors knows of an organization with a fully developed Model O-II learning system.” Both authors are highly respected theoreticians and practitioners who worked in the field of organizational learning for their entire lives.

<sup>118</sup> Argyris and Schön, *Organizational Learning II*, 89-96.

<sup>119</sup> Argyris and Schön, *Organizational Learning II*, 96. Argyris and Schön have found that “close to 99%” of individuals utilize Model I reasoning patterns that are inimical to organizational learning.

<sup>120</sup> Argyris and Schön, *Organizational Learning II*, 21-28.

<sup>121</sup> Argyris and Schön, *Organizational Learning II*, 28-29.

<sup>122</sup> Facione, Peter. "Critical Thinking – What It Is and Why It Counts." *Insight Assessment* (2011 update), 7: <http://spu.edu/depts/health-sciences/grad/documents/ctbyfacione.pdf>.

<sup>123</sup> Argyris and Schön, *Organizational Learning II*, Ch 4, 75-84. "Definition of *antisocial*," Dictionary.com, accessed February 15, 2016. <http://dictionary.reference.com/browse/antisocial>.; "Antisocial Personality Disorder," Psychology Today, accessed February 15, 2016. <https://www.psychologytoday.com/conditions/antisocial-personality-disorder>. Failure to naturally avoid threats and embarrassment is so rare it is diagnosable as a disorder: Sociopathy or Antisocial Personality Disorder, which occur in about 2% of the world population overall.

<sup>124</sup> Argyris and Schön, *Organizational Learning II*, 85-99. See especially, Primary Inhibitory Loop.

<sup>125</sup> Argyris and Schön, *Organizational Learning II*, 98-107.

<sup>126</sup> Argyris and Schön, *Organizational Learning II*, 101.

<sup>127</sup> Argyris and Schön, *Organizational Learning II*, 101-102.

<sup>128</sup> Argyris and Schön, *Organizational Learning II*, 101.

<sup>129</sup> Allison, Graham T., "Conceptual Models and the Cuban Missile Crisis," 707-715.

<sup>130</sup> MacKenzie, Donald and Judy Wajcman, ed., *The Social Shaping of Technology*. 2<sup>nd</sup> ed. (Buckingham, PA: Open University Press, 1999), Ch 4 Introduction, 343-350.

<sup>131</sup> Posen. *Sources of Military Doctrine*, Ch 2, 41-59 (Theory), Ch 4, 116-130 (France), Ch 5, 167-176 (Britain), Ch 6, 181-215 (Germany). All cases are from the Interwar Period, 1919-1939.

<sup>132</sup> Argyris and Schön, *Organizational Learning II*, 111.

<sup>133</sup> Argyris and Schön, *Organizational Learning II*, 102-103.

<sup>134</sup> Argyris and Schön, *Organizational Learning II*, 187.; Mark Dodgson, "Organizational Learning: A Review of Some Literatures," *Organization Studies* 14, No 3 (1993), 375-394.; Argyris & Schön reviewed the work of Garvin, Ulrich, Jick, & Von Glinow in the "learning organization"; Thorsrud, Herbst & Emery, in "sociotechnical systems"; Bowman and Overmeer in "organizational strategy"; Hayes, Wheelwright & Clark in "production"; Hirschman in "economic development"; Forrester and Senge in "systems dynamics"; Jones & Hendry in "human resources"; and Schein in "organizational culture." Dodgeson's literature review is even more comprehensive and too lengthy to list herein. While the author has not reviewed every primary source mentioned, Argyris & Schön's conclusions seem valid enough to quote outright.

<sup>135</sup> Argyris and Schön, *Organizational Learning II*, 117.

<sup>136</sup> Argyris and Schön, *Organizational Learning II*, 117.

<sup>137</sup> Argyris and Schön, *Organizational Learning II*, 119.

<sup>138</sup> Argyris and Schön, *Organizational Learning II*, 119.

<sup>139</sup> Argyris and Schön, *Organizational Learning II*, 3. This quote is the title of Chapter 1.

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<sup>140</sup> “Gilbert Ryle,” Stanford Encyclopedia of Philosophy, last revised Feb 4, 2015, <http://plato.stanford.edu/entries/ryle/>. Gilbert Ryle (1900-1976) was an influential British “ordinary language” philosopher best known for his 1949 book *The Concept of Mind*, which introduced the concept of the category mistake. He is independently famous in the Open Source world for a phrase he coined during his fierce critique of Cartesian Dualism (Rene Descartes: physical body and a non-physical mind), terming the non-physical mind “the ghost in the machine.” The phrase has been widely adopted by “geek culture” to describe and anthropomorphize poorly understood and unpredictable effects arising from computer networks and other high-tech systems. “The ghost in the machine” has become an imaginary figure to blame for all the weird things computer do.

<sup>141</sup> Allison, Graham T., “Conceptual Models and the Cuban Missile Crisis,” 689-691. See also Waltz, Posen, Zisk, et al.

<sup>142</sup> Argyris and Schön, *Organizational Learning II*, 6-11. See especially pg 8. To form a polis, the individuals in a group must consciously or unconsciously (1) devise agreed-upon procedures for making decisions in the name of the collectivity, (2) delegate to individuals the authority to act for the collectivity, and (3) set boundaries between the collectivity and the rest of the world.

<sup>143</sup> R. I. M. Dunbar, “Neocortex Size as a Constraint on Group Size in Primates,” *Journal of Human Evolution* 22, Issue 6: 469. Dunbar postulates the maximum number of stable relationships that human beings can maintain to be approximately 150 due to physical limits in the brain. Other studies postulate higher maxima (notably Bernard & Killworth, ~231), but I have found no credible sources higher than 250, which is a small number of individuals in the context of bureaucracies, militaries, and Open Source.

<sup>144</sup> R. I. M. Dunbar, “Neocortex Size as a Constraint on Group Size in Primates,” 469-493.

<sup>145</sup> Chris Argyris (1923-2013). Donald Schon (1930-1997)

<sup>146</sup> Armacost, Michael H., “The Thor-Jupiter Controversy,” in *The Social Shaping of Technology*, 2<sup>nd</sup> edition, ed. MacKenzie, Donald and Judy Wajcman (Buckingham, PA: Open University Press, 1999), Ch 28, 399.

<sup>147</sup> Armacost, Michael H., “Thor-Jupiter,” in *Social Shaping of Technology*, 400.

<sup>148</sup> Armacost, Michael H., “Thor-Jupiter,” in *Social Shaping of Technology*, 399. For USAF, contractors included Boeing, North American, General Dynamics, and United Aircraft, overall 13 of the top 20 defense contractors. For Army, Chrysler corporation and its constellation of suppliers in the US auto market.

<sup>149</sup> Carver, Michael, “Conventional Warfare in the Nuclear Age,” in *Makers of Modern Strategy*, ed. Paret, Peter, Gordon A. Craig, and Felix Gilbert (Princeton, NJ: Princeton University Press, 1986), Ch 26.

<sup>150</sup> Armacost, Michael H., “Thor-Jupiter,” in *Social Shaping of Technology*, 397.

<sup>151</sup> Armacost, Michael H., “Thor-Jupiter,” in *Social Shaping of Technology*, 402.

<sup>152</sup> Fallows, James, “The American Army and the M-16 rifle,” in *Social Shaping of Technology*, 2<sup>nd</sup> edition, ed. MacKenzie, Donald and Judy Wajcman (Buckingham, PA: Open University Press, 1999), Ch 27.

<sup>153</sup> Fallows, James, “The Army and the M-16,” in *Social Shaping of Technology*, 384.

<sup>154</sup> Fallows, James, “The Army and the M-16,” in *Social Shaping of Technology*, 384.

<sup>155</sup> Fallows, James, “The Army and the M-16,” in *Social Shaping of Technology*, 384.

<sup>156</sup> Fallows, James, “The Army and the M-16,” in *Social Shaping of Technology*, 385.

<sup>157</sup> Fallows, James, "The Army and the M-16," in *Social Shaping of Technology*, 387-393.

<sup>158</sup> Zisk, Kimberly M., *Engaging the Enemy*, 11-14, 33-46.

<sup>159</sup> Zisk, Kimberly M., *Engaging the Enemy*, 122-130.

<sup>160</sup> Zisk, Kimberly M., *Engaging the Enemy*, 162-173.

<sup>161</sup> Zisk, Kimberly M., *Engaging the Enemy*, 170.

<sup>162</sup> James K. Sanborn, "Marine Corps officials begin doctrine overhaul," *Military Times*, October 1, 2013.

<sup>163</sup> James K. Sanborn, "Marine Corps officials begin doctrine overhaul," *Military Times*, October 1, 2013, pg 2.

<sup>164</sup> See Thomas E. Ricks, *FIASCO: The American Military Adventure in Iraq* (Penguin Press: New York, 2006), 33.

<sup>165</sup> "How Forge.mil changed the way US DoD develops software," Opensource.com, <https://opensource.com/government/15/4/how-forgemil-changed-way-dod-develops-software>; Wennergren, David M, DoD Chief Information Officer, "Clarifying Guidance Regarding Open Source Software (OSS)," Memorandum to DoD leadership, October 16, 2009.

<sup>166</sup> "Free Software before the 1980s" in *History of free and open-source software*, Wikipedia, last modified February 17, 2016. [https://en.wikipedia.org/wiki/History\\_of\\_free\\_and\\_open-source\\_software](https://en.wikipedia.org/wiki/History_of_free_and_open-source_software). While Wikipedia is not normally considered a reliable source in traditional academic writing, it is an exemplary example of an Open Source organization and can be relied upon for to correctly express the history of its own social imaginary.

<sup>167</sup> "Initial decline of free software" in *History of free and open-source software*, Wikipedia, last modified February 17, 2016. [https://en.wikipedia.org/wiki/History\\_of\\_free\\_and\\_open-source\\_software](https://en.wikipedia.org/wiki/History_of_free_and_open-source_software).

<sup>168</sup> Kelty, *Two Bits*, 199-201.

<sup>169</sup> "GNU General Public License," Free Software Foundation, 2007, <http://www.gnu.org/licenses/gpl-3.0.en.html>.

<sup>170</sup> Kelty, *Two Bits*, 183-206.

<sup>171</sup> Kelty, *Two Bits*, 212-222.; "Linux (1991-)" in *History of free and open-source software*, Wikipedia, last modified February 17, 2016. [https://en.wikipedia.org/wiki/History\\_of\\_free\\_and\\_open-source\\_software](https://en.wikipedia.org/wiki/History_of_free_and_open-source_software).

<sup>172</sup> "The launch of Open Source" in *History of free and open-source software*, Wikipedia, last modified February 17, 2016. [https://en.wikipedia.org/wiki/History\\_of\\_free\\_and\\_open-source\\_software](https://en.wikipedia.org/wiki/History_of_free_and_open-source_software).

<sup>173</sup> Raymond, Eric S., *The Cathedral and the Bazaar*, [www.catb.org/esr/writings/cathedral-bazaar/cathedral-bazaar/](http://www.catb.org/esr/writings/cathedral-bazaar/cathedral-bazaar/).

<sup>174</sup> Kelty, *Two Bits*, 99-103.

<sup>175</sup> "Usage share of operating systems," Wikipedia, [https://en.wikipedia.org/wiki/Usage\\_share\\_of\\_operating\\_systems](https://en.wikipedia.org/wiki/Usage_share_of_operating_systems).

<sup>176</sup> “Market Capitalization of Microsoft,” Yahoo Finance Charts, [https://ycharts.com/companies/MSFT/market\\_cap](https://ycharts.com/companies/MSFT/market_cap); “Market Capitalization of Apple,” Yahoo Finance Charts, [https://ycharts.com/companies/AAPL/market\\_cap](https://ycharts.com/companies/AAPL/market_cap).

<sup>177</sup> “10 of the Most Popular Linux Distributions Compared,” How-To-Geek, <http://www.howtogeek.com/191207/10-of-the-most-popular-linux-distributions-compared/>

<sup>178</sup> Vinod Valloppillil, Executive, Microsoft Corporation, to Bill Gates et al, Senior Leadership, Microsoft, August 11, 1998, aka “The Halloween Memos,” edited by Eric S. Raymond, accessed February 20, 2016, <http://www.catb.org/esr/halloween/halloween1.html>. This is an internal Microsoft strategy white paper that was leaked and has been confirmed authentic. Valloppillil notes numerous examples of the threats to Microsoft business interests by OS groups.

<sup>179</sup> Joint Chiefs, *JP1-01*, III-2.

<sup>180</sup> Joint Chiefs, *Joint Doctrine Hierarchy Chart*, updated January 5, 2016. [www.dtic.mil/doctrine/doctrine/status.pdf](http://www.dtic.mil/doctrine/doctrine/status.pdf)