Inspiration versus Perspiration: Innovation and Adaptation in War

Matthew Tattar
Brandeis University

Abstract

Conventional wisdom states that innovation is a necessary process in most competitive ventures. Firms must innovate to get ahead of their competitors. Government agencies must innovate to meet the challenges of domestic politics. Military organizations must innovate in order to be victorious. But, how far does military innovation get a combatant state in wartime? Are there "first-mover" advantages to innovation? Does it bring success in wartime, and under what circumstances are the adapters to innovation successful against the innovators?

Building on existing political science and business organization literature, this article lays the theoretical groundwork to test the decisiveness of military innovation. I posit that, as the adaptation grows more sophisticated and complex, the original innovation loses influence over the outcome of the war. Organizational capacity to adapt is the independent variable in my analysis. As the adapter's capacity increases, the innovation loses traction in the conflict.

Introduction

> Great transitions require the engineering insight to fuse several scientific potentialities into a dramatically different weapon or sensor, the tactical insight to see how the weapon will change the face of battle, and the executive leadership to pluck the flower of opportunity from the thorns of government. The inspiration for these transitions often comes from outside a navy. The perspiration always comes from within it (Hughs 2000, 243).

Conventional wisdom states that innovation is a necessary process in most competitive ventures. Firms must innovate to get ahead of their competitors and

adapt to the market. Government agencies must innovate to meet the challenges of domestic politics. Military organizations must innovate in order to be victorious. The wider project seeks to test this proposition in the realm of military innovation and adaptation. This paper lays out the theoretical groundwork for such a test, and ends with a brief outline of the findings of my research thus far. How far does military innovation get a combatant state in wartime? In other words, are there "first-mover" advantages to innovation? Does it bring success in wartime, and under what circumstances are the adapters to innovation successful against the innovators?

Viewed in the larger context of the causes of victory, innovation's effect is hard to isolate. Victory is often "over-determined." When innovations in technology, tactics, operations, or strategy have telling effects on the battlefield, other factors such as numbers, strategic surprise, leadership, strategy, and geography invariably also play significant roles. In trying to understand just how complex the sorting out of what factors that led to victory in a particular battle or war can be, it helps to look at the sporting event-battle analogy. Sporting events are often compared to contests on the battlefield (especially American football), yet there are some important differences between them, besides the obviously benign nature of sporting events relative to warfare. Sports have rules and officials. The size of the playing field, number of players, the length of the game, and what the players can do on the field are all fixed parameters. The effect of these parameters is twofold. First, it makes the opponents' skill the most important factor in determining the victor. Second, it makes analysis of why one side emerges victorious relatively straightforward: ideally, whichever side plays better wins.

If one carries the sporting analogy to the battlefield, the opponents not only try to fight with skill, but also try to change the number of players on both teams, affect the size of the field, as well as change the length of the contest for their own advantage. What would be considered grievous acts of cheating in the

realm of sports, are in fact strategies or "innovations" of various sorts on the battlefield. This makes determining innovation's effect on victory in wartime exceedingly difficult. Hence, this paper focuses on adaptation to innovation. While this more detailed focus does not completely eliminate the complexity problem, it provides a better understanding of innovation's effect by measuring opponents' ability to counter a particular innovation.

The project attempts to explain innovation's effectiveness by examining how it has been countered. The primary focus is on naval warfare, specifically on innovations in combating capital ships and the adaptations to counter those innovations. The capital ship for much of history has been the ship-of-the-line or battleship, followed by the aircraft carrier in the twentieth century. However, in order to improve the depth of the study, future research will draw on examples from land and air combat as well. The reasons for this focus are many. First, given the importance of capital ships throughout history, analyzing innovations that were at least initially successful against them will ensure that the project focuses on significant, rather than merely novel, innovations. Second, naval warfare has always imposed a high technological and expertise burden on any state that wishes to affect the balance of power at sea. Even in the era of the sailing ship, before computers, wireless communications, and the internal combustion engine, operating a single warship required a large amount of state resources. This also ensures that the innovations are significant because they are hard. Third, because we are discussing the centerpieces of great power fleets, both greater and lesser powers have had a great interest in finding weaknesses to exploit and ways to compensate for them. Maritime powers have always striven to maintain their dominance of the seas, while aspiring sea powers or even regional powers with coastlines have sought ways in which to undermine that dominance.

In extending the analysis to select examples of land and air combat, the project will provide a greater range of innovations and historical experience with

which to test the hypothesis. Major wars are rare, and significant, prolonged naval wars are rarer still. Therefore, expanding the cases examined should provide for a richer and more in-depth analysis.

The policy implications of this study are also important. The technological, operational, and organizational innovations surrounding the current "revolution in military affairs" (RMA) have led to an intense debate over how to allocate scarce national defense resources.

> Proponents of this information technology RMA (IT-RMA) argue that the US must embrace emerging technologies and rapidly transform its armed forces to guarantee its military superiority for the foreseeable future. The current technological lead, if preserved, would increase our military strength while cutting costs… and reducing the risk to US troops (Eliason and Goldman 2003, 1).

There are many consequences of aggressively pursuing "transformation" along the lines of the IT-RMA, including costs to readiness, translating military advantage into political influence, and decreased interoperability with less advanced but increasingly vital allied militaries (Eliason and Goldman 2003, 2-6). If the potential impact of military innovation depends a great deal on the capabilities of an adversary to react to it, as my hypothesis asserts, then achieving a significant qualitative lead in one area may not mean a great deal if the adversary adapts in an asymmetric way. Also, the US has fought two recent major ground wars with a philosophy heavily influenced by the current RMA, with varied results. The initial invasions of Afghanistan and Iraq proved to be quite decisive. However, new methods of fighting have yielded little success against both the remnants of the Afghan Taliban and a growing Iraqi insurgency.[1] This study can potentially shed light on whether or not the costs of innovation are worth the risks.

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[1] For an in-depth discussion of the US planning for the Iraq war (and the influence on that process of the Afghan campaign) see Gordon and Trainor (2006)—administration

This paper will proceed in four parts. First, I will demonstrate that there is a significant opportunity for original research in this subject area. Second, I will review the literature on military innovation. What is it? What is its relation to outcomes in war? Third, I will discuss the organizational capacity of an opponent to adapt to an innovation. I will use a combination of political science, history, and business literature to develop this independent variable. It will also allow me to develop a typology of adaptation that will assist in analyzing the effectiveness of innovation. Fourth, I will discuss methodology. Given the nuanced process of innovation and adaptation, the case study approach is most desirable. Finally, since I have been able to accomplish much research since this paper was first presented, I will briefly recount the findings of my first three cases.

Innovation and War Outcomes: A Case for Further Study

Numerous works address military innovation's significance in war, but none attempt a systematic analysis of its effect on outcomes in particular armed struggles. As I have discussed above, innovation's decisiveness is extremely hard to isolate in such a complicated human endeavor as armed conflict. I will briefly review the literature that comes closest to doing this before moving on to theory development.

Barry Posen places a considerable amount of importance on military organizations' ability to innovate. In his study of German, French, and British doctrines in the interwar period, Posen argues that innovation (or its converse, stagnation) plays an important role in victory and defeat. For example, French military doctrine suffered from military conservatism and political neglect, resulting in an army that was ill-prepared for the fluid maneuver battles of 1940. The army favored firepower over maneuver, first because of its experience during World War I, then because the level of training among its rank and file

planners (led by Secretary of Defense Donald Rumsfeld) continually pressed Central Command to "do more with less."

suffered with shortened terms of service. Fighting maneuver or encounter battles requires a high degree of professionalism, something short term conscription could not produce. Tanks were subordinated to the infantry, and there were no units of the army capable of supporting a breakthrough of enemy lines.

However, French politicians sought to "buckpass" the task of balancing against Germany to its Eastern European allies and to Great Britain; hence they did not press the army to find innovative ways to combat Germany's rising military power (Posen 1984, 130-132). Conversely, British politicians were dissatisfied with the Royal Air Force's focus on offensive bombing and pressed for better defensive measures. This led to the organization of Fighter Command and development of radar, both instrumental in the Battle of Britain (Posen 1984, 167; 174). German army doctrine remained offensive in nature, even after World War I. "Hutier" or infiltration tactics, as well as single and double-envelopment operations were institutionalized in the Wehrmacht. However, German doctrine stayed integrated with Hitler's geopolitical strategy of unlimited expansion by attempting to maintain a high operational tempo once hostilities started. Massed armored formations, motor transport, close air support, and an emphasis on deep penetration and disruption of enemy rear areas all were intended to induce rapid collapse of enemy resistance. The doctrine remained consistent with that of World War I (and as such not strictly innovative), but was innovative enough to remain "integrated" with Hitler's political strategy (Posen 1984, 190-212).

Richard Overy also asserts that innovation was an important reason for the Allied victory in World War II. During the war at sea, the allies maintained a numerical advantage in the Atlantic and built one in the Pacific. While it is tempting to argue that preponderance of resources was the key to victory, Overy argues, triumphs during the Atlantic convoys and the battle of Midway came when that preponderance was not yet established. "Tactical and technical innovation won the war at sea before sheer numbers came to matter" (Overy

1995, 62). Likewise, the Soviets achieved their victories at Kursk and Stalingrad through better central planning, improvement of technology and tactics, and superior morale (Overy 1995, 100).

Kier Lieber demonstrates that technology is not the arbiter of victory and defeat. Lieber's work comes the closest to observing innovation's relationship with military outcomes. However, the goal of his book is to challenge the "technological core" of offense-defense theory. The broad version of offense-defense theory includes as factors geography, resources, nationalism, regime popularity, alliance behavior, force size, and military doctrine. Lieber argues that this version is "atheoretical and unfalsifiable" (Lieber 2005, 30-33). The technological core states that "changes in military technology shift the relative advantage of attack and defense" (Lieber 2005, 29). As such, his work addresses primarily technology-driven innovation. By closely examining the wartime use of railroads and the revolutions in firepower, armored vehicles, and nuclear weapons, Lieber tests the most theoretically rigorous version of offense-defense theory. He finds it wanting in that "changes in the offense defense balance of technology have little influence on combat outcomes" (Lieber 1995, 3).

Similarly, Raudzens argues convincingly against technological determinism in war outcomes. Through a discussion of a fairly broad swath of military history, he demonstrates that technology was rarely (if ever) decisive by itself. Other factors, notably superior doctrine, training, and discipline account for victory more often than not. This was true in great power wars, wars between greater and lesser powers, and imperial or colonial wars (Raudzens 1990, 403-434). Kenneth Waltz's Neorealism does not address military innovation specifically, but points to the homogenization of state behavior and imitation of great powers' weaponry as a major factor in international politics (Waltz 1979, 181). McNeill's landmark work analyzing the interaction of society and military force confirms this. Important innovations, such as systematic drill, improved use of artillery, fortified encampments, and regularized marching,

spread fairly quickly throughout Europe during the Thirty Years' War. They led only to "local and temporary" disturbances in the balance of power (McNeill 1982, 123-143).

While these works shed some light on the significance of innovation and war, none systematically tests the conventional wisdom that innovation is decisive in war. It is clear that successful innovation has important effects on the course of a war. Indeed, Posen demonstrates that its presence or absence among the allied militaries prior to 1940 was significant. However, integration of a nation-state's political goals and military doctrine was more decisive. Further, it is clear from the historical works that innovation by itself is not sufficient for victory. On the other hand, if innovation does not win wars on its own but is clearly important, how important is it? What is needed in the literature is a theory that can tell us how important innovation is in any given conflict. Policymakers rarely deal in absolutes such as whether to completely change their organizations or not innovate at all; rather they must decide on a course somewhere between those extremes. I argue that in order to answer the question of innovation's relative importance one must consider how an adversary adapts to innovation. I now turn to developing a theory that will illuminate innovation's importance by examining adaptation.

Military Innovation

A military innovation, for the purposes of this study, is a new mode of operation of a military service's combat arm that yields significant advantages, at least initially, to the innovator. The innovation may be developed in peacetime, but due to its timing (i.e. immediately prior to armed conflict) or other factors, the adversary's reaction to it comes during wartime. Concerning land warfare, an innovation may mean a change in how the infantry, armor, or artillery arms fight on their own or in concert with one another. The same is true with surface, subsurface, and air subunits in naval warfare. In air warfare, an innovation involves the operational behavior of strategic, air superiority and tactical aircraft.

Since this study aims at evaluating the effect of innovation by studying adaptations to it, "new" is a relative term in this context. A new mode of operation is one that is out of the realm of organizational experience or memory of an opponent. Depending on the type of warfare discussed, technology may play a major role in operational innovation. As the focus of warfare increasingly becomes a contest between machines, technology gains importance. Naval and air warfare are prime examples of this.[2]

The level of analysis on which this project will focus is the operational, or the behavior of corps and fleets. Wayne Hughes' definition of "fleet tactics" is most on-point: "operations involving coordination between multiple ships and aircraft, and the sensors that support them" (Hughes 2000, 7). I term this focus "operational" rather than following Hughes' lead in order to avoid confusion with a focus on the behavior of small units or individual ships (what he terms "maneuvers," more commonly known as "tactics"). The behavior of small units at the tactical level changes with a frequency that makes analysis exceedingly difficult and of limited utility. The behavior of fleets and corps is harder to change and more durable over time. Likewise, the project will avoid the realm of the strategic, which involves questions of why and when armies, navies, and air forces fight, not how.

My definition of military innovation draws heavily on that of Stephen Rosen, who argues that the source of military innovation lies within a military service, not from without. Military innovation, he argues, involves the change of methods of operation of a combat arm, the ideas governing how that combat arm contributes to victory, the creation of a new combat arm, or a change in the relationship between combat arms (Rosen 1991).

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[2] These machines are of course crewed and/or controlled by humans. My intention is not to minimize the human element, which is still vital, but to highlight the importance of technological advances as combat between human beings increasingly depends on machines.

Unlike Rosen, who separates innovation into peacetime, wartime, and technological types, my project does not consider peacetime innovation, and combines the wartime and technological types. This is justified by Evangelista's and Cote's definitions of military innovation. In his analysis of US and Soviet development of tactical nuclear weapons during the Cold War, Evangelista takes a technology-focused approach. Technological innovations involve weapons "that portend major organizational changes, reallocation of resources, possible diminished organizational autonomy, [or] significant changes in strategy" (Evangelista 1988, 12). The causal arrow in his analysis runs from new technology to new doctrine, demonstrating that in a combat arena that is "machine-centric" (e.g. nuclear weapons), technology plays a major role in changing, not just improving, modes of operation. Cote defines innovative doctrine as that which "exploits radically new weapons and/or beliefs about how to fight, and destroys old, outdated doctrine" (1996, 9). Cote's perspective also demonstrates the importance of technology in operational innovation. While most important military innovations have involved much more than simply the application of new gadgetry, new technology cannot be divorced completely from an analysis of the way a military conducts operations.

Organizational Capacity

The key proposition of my thesis is that the effectiveness of innovation in war is largely determined by the organizational capacity of the opponent to adapt to it. In other words, an innovation's effectiveness is a function of the adversary's ability to adopt it, counter it, or both. This places "organizational capacity" at the root of the analysis as the independent variable. What is it? How does it work? I will define the key elements of organizational capacity, drawing from the political science, military history, and business literatures. The key elements of organizational capacity to adapt are resources, centralization, and what I term the "innovation space" relative to the adapting organization.

Resources

The resources available to an organization are important in determining organizational capacity to adapt. The more uncommitted resources in the form of materiel and personnel an organization possesses, the greater should be its organizational capacity. These assets represent resources that can be allocated to problem solving relatively quickly, with minimal detriment to existing missions. This is critical in a wartime environment, when the stakes in allocating resources are very high.

Warfare is a technical business, so the knowledge base of an organization's personnel is also fundamentally important. Knowledge can come in the form of technical expertise or experience in successfully solving previous problems. Enough of the former allows the organization to think in the new context forced upon it by the innovation.

In their theorizing about the behavior of firms in the business world, Cyert and March identify organizational "slack" as an important asset in making innovation possible. They define slack as "the difference between payments required to maintain the organization and the resources obtained from the environment by [it]" (Cyert and March 1963, 278). Slack provides resources for "innovations that would not be approved in the face of scarcity" (Cyert and March 1963, 279).

Cohen and Levinthal identify a firm's knowledge base as significant in shaping its ability to innovate. They argue that innovation depends in large part on the ability to exploit knowledge originating outside of the firm. Exploitation of that knowledge requires some sort of internal knowledge related to that coming from the outside, otherwise the firm has little context within which to frame its efforts. They term this ability "absorptive capacity," and as this capacity goes up, so does the firm's ability to innovate and be proactive in the market (Cohen and Levinthal 1990, 128-152). While the authors focus on innovation, I submit that this knowledge base is equally important for effective

adaptation, especially if the organization is to attempt more sophisticated measures.

This application of the business administration literature to military innovation is not without precedent. Evangelista argues that slack and knowledge base help determine how innovative a military organization is. The greater the slack, the more receptive the organization is to innovation (Cohen and Levinthal 1990, 45). He also notes that organizational complexity, or the levels of skill and education of the organization's personnel, is "closely associated with innovation" (Evangelista 1988, 38). In other words, innovative organizations are more often than not smart organizations.

Centralization-Decentralization Balance

The degree to which an organization is centralized also affects its ability to formulate and implement change. On one hand, too rigid an organization can stifle effective adaptation to nasty surprises it encounters on the battlefield. However, an organization too loosely ordered will suffer from difficulty in disseminating information and implementing adaptations throughout its component parts. A military organization must strike an effective balance between the twin imperatives of creativity (aided by decentralization) and implementation (aided by centralization).

Sopolsky's study of successful bureaucratic innovation by the US Navy's FBM program points to numerous reasons for that success. Besides taking advantage of the latest managerial technologies and laying claim to its own niche within a broader US nuclear strategy (Sopolsky 1972, 44; 59), the organization developed the ability to manage technical complexity by decentralizing much of its research effort, encouraging competition among its subunits, and striking a balance between flexibility and discipline in its operations. The FBM program was able to successfully integrate the numerous complicated systems required for an operational Submarine-Launched Ballistic Missile (SLBM) force (Sopolsky 1972, 250). While the FBM program was itself decentralized, it represented an

important level of centralization: the Navy possessed a unitary, coherent subunit with one goal, the deployment of a complete SLBM weapon system.

Cohen and Gooch's study on failure in wartime illustrates the importance of the proper amount of centralization (1991). Their "failure to learn" is akin to what we are discussing in terms of adaptation. Their case study demonstrates that the root of failure to learn lies at the nature of the organization, or the arrangement of its subunits. Their exemplar is the inability of the US naval forces in the Atlantic to counter the U-Boat menace in 1942. Without a centralized organization to coordinate convoy protection and anti-submarine missions, the US Navy had little organizational efficiency, or ability to disseminate new tactics or tactical adaptations to its units. Once the Navy formed the Tenth Fleet, a large unit specifically organized to escort convoys and hunt submarines, it was able to centrally control its antisubmarine operations and adjust its doctrine in a coordinated way. Kills of U-boats grew six fold in the six months after its establishment. Adaptability was the key to US recovery and success against the U-boat after 1942 (Cohen and Gooch 1991, 75-76; 91; 94).

Evangelista also comments on characteristics of organizations that seem to affect organizational innovativeness. Centralization of leadership inhibits incentives to innovate, but more effectively enables mobilization of resources behind an innovation that is adopted by the organization (Evangelista 1988, 30). Formalization is the degree "to which an organization imposes set rules and procedures for its members to follow" and greater amounts of it generally impede innovation but encourage implementation, as does centralization (Evangelista 1988, 30). High interconnectedness, or the level of personal networks within an organization, encourages the dissemination of ideas and encourages innovation (Evangelista 1988, 42).

The business administration literature provides some useful theory when discussing optimal organizational arrangements. Burns and Stalker identify systems of management that represent "two polar extremities of the forms which

such systems can take when they are adapted to a specific rate of technical and commercial change" (Burns and Stalker 1961, 119). In a relatively stable (unchanging) environment, "mechanistic arrangements" of organization are suitable. These arrangements have standardized procedures, specificity of roles, power centralized at the top of the organization, and standard sources of information. "Organic arrangements" have low specificity of roles, authority is based on knowledge, and a flatter, more subordinate-centered power structure. Organic arrangements are more adaptable to complex (changing) environments, because it is more open to varied sources of information (Burns and Stalker 1961, 120-121). A third arrangement, "bureaucratic," is a mixture of the two, where both position and expertise form the basis of authority within the firm (Chakravarthy 1982, 38). "Organizational capacity" to adapt is greatest in the organic arrangement, and least in the mechanistic arrangement. It is difficult to envision a military organization having looking more organic than mechanistic. Weber describes military organizations as quintessentially bureaucratic (Weber 1964, 335), which would place it firmly in the middle of the mechanistic-organic continuum. However, military organizations that incorporate some organic characteristics should prove to be more adaptable than those that do not.

Heginbotham's analysis of varied increases of military effectiveness of the British and American militaries during World War II illustrates the importance of striking a balance between centralization and decentralization. Despite fighting the same opponent in North Africa and Europe, American military effectiveness steadily improved, while British units repeated their mistakes. Rather than a lack of innovative thinking on the part of the British, the structure of the army proved to be the decisive difference. Lessens learned in combat were rarely distributed throughout the army as a whole, inhibiting its ability to "remember" operational lessons. "In contrast, American forces benefited from a dense network of channels that allowed for effective communication within the force" (Heginbotham 1996).

Murray and Millett edit a volume that addresses how well various militaries innovated during the interwar period (1996). While not overly theoretical, this work highlights some important factors within military organizations that make innovation and adaptation easier or harder. According to Murray, the Wehrmacht was a successful innovator in armored warfare due to a number of important organizational factors. First, it studied the World War I experience in-depth and tolerated debate about it. Second, it also tolerated outspoken, less-senior officers such as Guderian and Manstein.[3] Third, there was an effective "feedback loop" within the organization, connecting thinkers on innovation with the operational world. Fourth, there was an extensive professional military education system, which was not divided along service branch lines and able to learn from battlefield experience. This is a prime example of a rigidly hierarchical organization striking an effective balance between centralization and decentralization in order to foster innovation. The British and French military establishments did not share these characteristics, which contributed to their lack of effective innovation or adaptation to German methods (Murray 1996).

Organizational Arrangement Relative to the Innovation

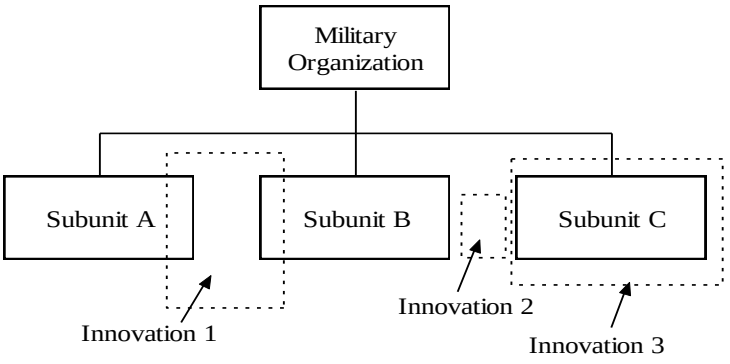
The third component of organizational capacity to adapt is the structure of the adapting organization relative to the primary focus of the innovation, what I term the "innovation space." While many, if not most, innovations have wide-ranging effects throughout adapting militaries, often they are intended with a particular class of targets in mind. For example, the development of improved anti-ship bombing by the Japanese prior to World War II affected the behavior of surface combatants and noncombatants of all types, but the innovation was developed to combat capital ships (Peattie 2001). The primary focus produces a

[3] Guderian later led part of the successful invasion of France in 1940, while Manstein demonstrated considerable skill on the Eastern Front. Both became field marshals in the course of the war, but were known for their sometimes outspoken disagreements over strategy with Hitler and the German High Command.

"space" in which an existing organization must act in its adaptation(s). Therefore, once we have determined the primary focus or "space" of an innovation, we can then determine which subunit of the adapter will be primarily responsible for responding to it. Because each military organization arranges its subunits differently, and the innovation space may not neatly correspond with one subunit's area of responsibility, it is not as straightforward as it might first appear. If the innovation space encapsulates one subunit, effective adaptation will be easier than if the space overlaps more than one subunit or lies outside of any subunits existing realm of responsibilities, other factors being equal. An innovation space that does not align neatly with one subunit presents a host of potential difficulties to the adapting organization. If two or more subunits have a legitimate claim on a portion of the innovation space, the subunits' desire to expand their missions and resources could encourage bureaucratic infighting. Conversely, an innovation outside of any subunit's area of responsibility may lead all subunits to shun additional output of scarce resources towards adaptation because the innovation space lies outside of their core mission areas. The relationship between subunits and potential types of innovation space is best envisioned as the innovation space graphically superimposed on the adapting military's organizational chart (see figure 1).

Figure 1

Innovation "Space" and Organizational Capacity to Adapt

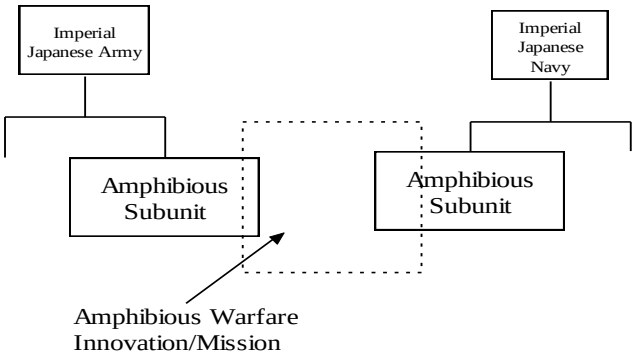


*****Given comparable resources and similar balance between centralization/ decentralization, a military organization forced to adapt to innovation 3 will be more able to adapt than one faced with innovations 1 or 2.*****

In his amphibious warfare case, Millett asserts that successful adaptation "must have a foundation in intellectual commitment, and a major embrace of a new mission," not just manpower, publications, and professional education (Millet 1996). Japan's amphibious forces were divided between the Army and the Navy, and were viewed by both services as peripheral to their central missions. Also, once the initial campaigns of conquest in the Pacific were complete, and Japan felt it had an adequate strategic buffer around the Home Islands, its strategy turned in a decidedly defensive direction. Amphibious operations were inconsistent with this new orientation and both services allowed the mission capability to atrophy. Figure 2 illustrates this relationship.

Figure 2

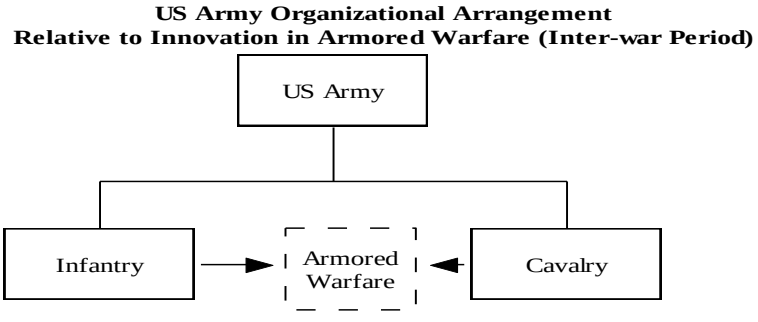
Japanese Amphibious Warfare Organizational Arrangement Relative to Innovation Space



Great Britain was relatively advanced in theorizing about amphibious operations, but its "thinkers" on the subject had no "firm organizational foundation or funding." In stark contrast to the other two powers, the US had an independent Marine Corps that committed itself to the type of mission (Millet 1996). These case studies provide important clues as to the significance of superior organization in efforts to innovate and adapt among militaries. They also justify an organizational approach to understanding innovation and adaptation.

Johnson's examination of the US Army from 1917 to 1945 provides more evidence that organizational characteristics affect how effectively militaries adapt to their environment. In fact, "internal arrangements" account for the lack of innovation by the US Army before World War II (Johnson 1998, 220). Infantry and cavalry officers gained control of deciding what the role of tanks would be. Hence, American tanks were designed for infantry support or traditional cavalry duties (i.e. scouting and exploitation), and were ill-suited to facing German armor designed to fight other tanks head-on. While Johnson labels these failures as those of innovation, much of the problem can be described as failure to adapt. Innovations in armored warfare and close air support had already been accomplished by the Germans with telling effect. After the Army failed to innovate, its internal arrangements inhibited it from meaningful adaptation until the costly land battles in Europe, when it developed better air-ground coordination. Again, Johnson describes this as "bottom-up innovation" (1998, 226), but we could just as easily (and perhaps more soundly) call it "adaptation," because the Army was playing catch-up to the Wehrmacht after its belated entry into WWII. Figure 3 illustrates the US Army's organization relative to the innovation space.

Figure 3:

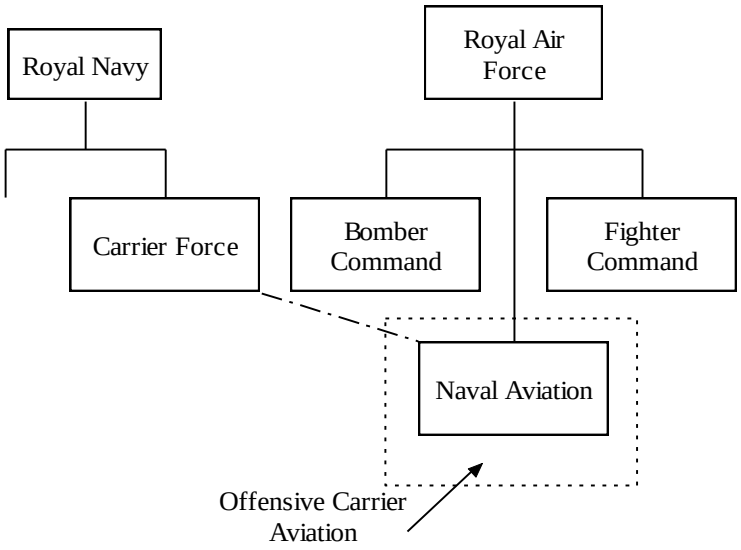


In her discussion of the diffusion of carrier air power, Goldman (2003) states that strategic necessity is the stimulus for adoption of a technology or idea, but capacity determines how states react and what innovations they pursue.

Capacity is determined by resources available, bureaucratic rivalry, administrative authority, and compatibility between the innovation and the organization. Great Britain was a leading innovator in carrier aviation, but because of the Royal Navy's defensive orientation (focused on protecting imperial lines of communication) and lack of control over its air arm, it ended up with offensively weak carriers (see figure 4). Japan and the US were followers, but their navies' greater capacity resulted in more powerful, offensive oriented carrier fleets (Goldman 2003, 301-303).

Figure 4:

Organizational Arrangement of Royal Navy Air Arm Relative to Offensive Carrier Aviation Development, Inter-war Period



A Typology of Adaptation

Once an innovative method of warfare makes its appearance on the battlefield, the adapter can pursue many different options in attempting to redress the decrease in its ability to accomplish its mission. There are five broad categories of adaptation. At this first stage of research, I will not develop hard and fast rules regarding the association of a particular type of adaptation with high or low organizational capacity. However, developing a typology will provide guidelines for research. I suspect that the relationship between

organizational capacity and typology of adaptation depends on the situation and will be illuminated by the details of the case studies. However, I have briefly outlined below the reasons why adapters with both low and high organizational capacities may pursue each option.

First, the adapter can do nothing; he can absorb the costs of the innovator's new mode of operation. This option arises from two possibilities: in the case of low organizational capacity, the adapter is unable to take any action; or, the adapter analyzes the problem and calculates that the costs of adaptation outweigh the costs of doing nothing. The latter signifies conscious analysis and decision making on the part of the adapting organization and hence a higher organizational capacity.

Second, the adapting organization may use quantity to counter the increased quality of the enemy's innovation. Using numbers in this way may be a product of low organizational capacity in that the adapter can do little more than throw more of what it already has at the problem. However, this may also be the result of a rational calculation that any other adaptation (besides numbers) is more trouble than it is worth.

Third, the adapter may imitate the initial innovation. A military with high organizational capacity may encounter an innovation and recognize that it would serve its needs with relatively little modification. Organizations with relatively less capacity may imitate because their capability to solve problems does not extend much beyond the ability to mimic others.

Fourth, the adapter can counter-innovate, or develop a new, dissimilar mode of operation designed to counter the initial innovation. As counter-innovations can be either simple or complex, organizational capacity would be vital in determining why the organization chooses this option. Presumably, if an organization counters a sophisticated innovation with a relatively simple countermeasure because that is all it can do (and the simple countermeasure is

not the ideal solution, compared to a more complex or sophisticated response), its organizational capacity would be relatively low.

Fifth, the adapter can pursue a combination of two or more of the options above (besides doing nothing of course), what I term "compound" adaptation. It is hard to envision a military with low organizational capacity pursuing this course of action. However, an organization may accomplish a sort of uncoordinated compound adaptation, reflecting a large pool of available resources but a capacity that is insufficient to effectively coordinate their use.

A quick survey of history gives us examples of each of these types of adaptation to military innovation. The advent of effective siege artillery had a significant effect on feudal society. Feudal aristocrats depended upon complex and expensive fortifications for their security. The advent of siege cannon severely undermined the strength of these fortifications. In 1449-50, Charles VII of France managed to re-conquer Normandy in sixteen months. Given that he successfully reduced sixteen castles in that period (Brodie and Brodie 1973, 51), it is reasonable to assume that no adaptation by the defenders was possible. Throughout the seventeenth century, the Royal Navy countered superior tactics, seamanship, and gunnery of its enemies with sheer numbers and brute close-range firepower. Conversely, the German development of the acoustic homing torpedo in 1943 prompted countermeasures relying on noise-producing decoys (Brodie and Brodie 1973, 222). In land warfare, the American militia's success with the long rifle prompted the British Army to imitate them by raising a unit of riflemen of its own during the Revolutionary War (Brodie and Brodie 1973, 105). British reaction to the V-1/V-2 menace late in World War II was complex and varied, and certainly fell into the compound category. The V-1 could be countered by fighter aircraft and strategically placed antiaircraft guns with proximity-fused ammunition. Little that could be done to defend against the ballistic V-2, but both missiles could be countered by attacking their launch sites, which the allied attempted with gusto (Brodie and Brodie 1973, 231).

Methods and Case Selection

This research project is designed to "tease out" the independent effect of innovation through analyzing the reaction of adapters. The best method to examine the effects of innovation on military outcomes would be to conduct a number of detailed case studies. By studying innovation in terms of adaptation, we can ascertain whether or not the innovation process shortened a given war or had negligible effect. This method is what George and Bennett refer to as "process-tracing," whereby the researcher examines detailed historical records to ascertain whether or not the "causal processes" of a theory are actually at work in a given situation (George and Bennett 2005, 6).

The research must first establish that an innovation in military or naval operations took place. All of the conflicts I have proposed for study have been thoroughly documented, so this step can rely on secondary scholarly works. Research into primary documents, such as archival records, would be necessary in order to uncover in detail if and how the organization 1) recognized the appearance of the innovation, 2) formulated a response 3) promulgated that response to its subordinate units, and 4) effectively carried out operations that incorporated the adaptation(s). It is in this investigation into the causal process between the innovation and the adapter's actions on the battlefield that I expect to find the adaptation(s), which I will then classify according to the typology outlined above. Also, primary and secondary documents should reveal how well-equipped, in terms of organization, the adapting organization was to face the innovation. As noted above, the relationship between the type of adaptation and organizational capacity may depend on the situation. Therefore, the reasons why an organization pursues a particular type of adaptation will be instrumental in determining organizational capacity. Primary documents such as after-action reports will further reveal the relationship (if any) between the adaptation and success on the battlefield. When an innovator faces a sophisticated adapter with

high organizational capacity, its rate of success should be less than against an adapter with less capacity (see figure 5).

Figure 5:

Again, victory in warfare is almost always overdetermined. I will look for success (both for the adapter and the innovator) in terms of operational victories and low casualty rates. By tracing the effects of that innovation on the adversary in a number of cases, we can go a long way in determining how decisive it was in the confrontation.

Cases

I will study a mixture of cases, the majority of which focus on naval warfare. The land and air warfare cases provide historical depth, and provide for a more robust test of the thesis. I have selected cases from a survey of wartime innovations (see Table 1).[4] I include in wartime innovations those that were developed in peacetime but that made their first significant appearance at the outbreak of war. This is because the adaptation had to occur in wartime, and it is on wartime adaptation that this project is focused.

[4] This table was developed from a survey of Holmes (1988).

Table 1 **Wartime Innovations**

War	Innovation
Napoleonic Wars	Corps System
Wars of German Unification	General Staff
WWI	Submarine Warfare
WWI/II	Combined Arms Warfare (Land)
WWII	Carrier Warfare
WWII	Amphibious Warfare
WWII	Strategic Bombing/Nuclear Weapons
Vietnam/Yom Kippur War	Integrated Air Defense
Falklands/Various	Anti-Ship Missiles/Sea Denial
Gulf War I/II	Precision Guided Munitions/ Network-Centric Warfare

Table 2 details my findings thus far. Resources are certainly important in determining the ability of the adapter to meet the innovation. However, the adapter's organization determines how well it uses those resources. The Royal Navy cases demonstrate that a poorly positioned organization faces wastes some resources in its adaptations. Future cases will include Egyptian anti-tank operations (1973) and Vietnamese integrated air defense (1965-73). The value of more in-depth research into these academically well-trodden cases lies in why the adapters pursued the courses of action they took and the detailed results of those actions in terms of operational success and the costs in lives and resources.

Preliminary Findings of Research

Innovation	Innovation Details	Adaptation	Typology	Organizational Capacity of Adapter	Success of Innovation
U-Boat as Commerce Raider (Germany, 1914-18)	Guerre de Course using submarines astride shipping lanes, Unrestricted Submarine Warfare	Arming of Merchants, Offensive Patrols, Anti-submarine nets, depth charge, sonar, convoy (UK - Royal Navy)	Compound	Resources - High; Centralization and Innovation Space - Low, then High	Initial Success (heavy casualties inflicted), Rapid Failure After Convoy adopted
Improved Anit-Ship Bombing - heavy support of battle line (Japan 1941-3)	Accurate, effective delivery of ordnance (bombs and torpedoes) against capital ships in support of battleships	Increased anti-aircraft armament, increased combat air patrol, carriers replace battle line	Countermeasures	High	Initial Success (Pearl Harbor), Rapid Failure
Sea Denial Operations (Argentina, 1982)	Use of Exocet anti-ship missile, extreme low-level bombing	Picket ships, chaff (radar decoys), ad hoc increased anti-aircraft armament, tactical adjustments (UK-RN)	Some countermeasures, numbers	Resources - High; Centralization - medium; Innovation Space - low	Some Success (Many RN warships sunk/damaged), but insufficient for victory

The disadvantage of this case selection is that in most of these cases, the adapters were the eventual victors in the conflict. This may lead an observer to the "if it explains everything, then it explains nothing" critique. However, this is misleading. This project's operational focus produces cases in which innovators and adapters accomplished their missions with wildly varied expenditures of blood and treasure. Even if the adapter won in every case, his level of success varied in the numbers of ships sent to the bottom and lives and equipment lost. All states make a decision to go to war based in some part on whether or not they think they can win. How difficult or easy that victory is to achieve is sometimes an even greater concern.

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