Innovation, Wargaming, and the Development of Armored Warfare

by

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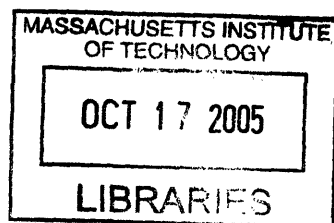MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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ABSTRACT

This thesis examines the role of simulation in the development of armored warfare doctrine during the interwar period. All the Great Powers faced the challenge of how to integrate new technologies, particularly the tank, radio, and aircraft, into a coherent combined arms doctrinal framework. I compare the French and German experiences in order to assess the role that wargames played in driving doctrinal development.

The case studies show that wargames, on the map and in the field, gave the German army a significant edge as it sought to develop new doctrine for armored warfare. This finding is an important addition to existing theory on military innovation, which tends to view doctrine as the product of geopolitical and organizational forces. Wargames provided a means of testing doctrinal ideas in a simulated wartime environment, and the lessons learned during these simulations fed into ongoing debates on doctrinal development.

Wargaming well is a technically challenging business, and requires particular technical skills and capabilities. The Germans developed these capabilities earlier than their French counterparts, in part because the German army traditionally favored a rationalist, corporate approach to the management of military affairs. This cultural outlook made it easier to develop a rigorous wargaming capability, and also meant that lessons learned in games were taken more seriously than they were in France. Given the right conditions, wargaming can be a powerful tool for developing new military doctrine during peacetime, thus conferring a significant edge on the battlefield should war erupt.

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I. Introduction

Military innovation occurs when a military organization, an army, navy, or air force, successfully develops new doctrine to exploit new technologies and weapon systems. Emulation is not innovation: the real challenge is developing new doctrine as a first mover, when it has not been done before.

This kind of first mover innovation is notoriously difficult and fraught with uncertainty, but is also a vital part of staying competitive in the context of ever faster technological change. Forces that go to war with a more effective doctrine have a great advantage on the battlefield compared to those that have allowed doctrine to stagnate. Of course, making the wrong changes can be worse than making none at all.

In this paper I argue that existing theory, which focuses on high level political and organizational explanations for the presence or absence of military innovation, leaves the process of doctrinal development itself unexamined. Military organizations have developed a set of tools for managing doctrinal change, the quality of which strongly influences the quality of the resulting doctrine. This set of tools provides a means of testing different doctrines and weapons systems in a systematic way under simulated wartime conditions. Because the main source of uncertainty when developing new doctrine arises from the inability to test new ideas in combat, the ability to simulate wartime constraints and enemy responses is critical. This is why wargaming, and

wargaming well, is so important to the overall success of the doctrinal development process.

To support this argument I compare two cases of doctrinal development during the interwar period: the German development of a new doctrine for armored warfare, now known as blitzkrieg, and the evolution of French doctrine for the use of armor in the methodical battle.[1] The Germans innovated successfully and the French did not. I argue that wargames, on which the Germans relied heavily when developing blitzkrieg, played a decisive role in shaping what proved to be a superior doctrine. I show that the different doctrines were the result of different approaches to the process of doctrinal development itself and, in particular, to differences in the way the two sides wargamed.

II. The Sources of Military Doctrine: Existing Theory and Literature Review

Political science research on the sources of military doctrine has been primarily concerned with elucidating the links between the pressures on the state by virtue of its position in the international system and the doctrine it develops.[2] Argument centers on which actors or organizations play the leading role in mediating those systemic pressures,

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[1] The *bataille conduite*, or "methodical battle" was the core doctrinal concept of the French army throughout the interwar years. It envisioned large, carefully planned, and synchronized engagements in which mass and firepower would be employed to crush the enemy. The mental image was of the successful French battles during the second half of 1918.

[2] This approach reflects the realist worldviews of Posen and Rosen, the two most important theorists involved. According to realist theory, the balance of power determines state behavior and hence should be reflected in the military posture the state adopts.

what organizational interests typically stand in their way, and what this means for prospects of doctrinal innovation.

This is a body of work with which any inquiry into the roots of interwar armor doctrine has to engage, and I therefore present a brief overview below.[3] However, it turns out that these theories are not particularly helpful in explaining the content of specific doctrines.

Barry Posen, in *Sources of Military Doctrine* (1984), argues that military innovation is the result of three strong organizational causes: past failure in war, external pressure on the organization (civilian intervention, competition from another service, loss of resources), and a desire to expand in size, wealth, or responsibility.[4] Of the external sources of pressure, civilian intervention in the military's affairs is the most important. There is another weaker cause of innovation, new technology, but it is usually insufficient to trigger change.[5] This is because the new technology is typically bolted on to old doctrine, which cannot be proved ineffective in peacetime, and because militaries have a hard time learning from other states' wars.[6] A change in doctrine that makes a more offensive military posture possible should stand a higher chance of being embraced,

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[3] This is not meant to be an exhaustive survey of the literature, but a brief summary of the principal strands of thinking on the subject.

[4] Barry R. Posen, *The Sources of Military Doctrine : France, Britain, and Germany between the world wars* (Ithaca, NY: Cornell University Press, 1984).

[5] Ibid, p. 55.

[6] Ibid, pp. 55-56.

since the offense is usually preferred.[7] Internal innovation, by which Posen means innovation by the military in the absence of the three organizational causes above, is rare.

Since civilians lack the expertise to "dream up whole new doctrines" they are limited to "choosing from the thin innovation menu thrown up by the services". Successful innovations are therefore incubated by the services themselves. The question is why these organizations would invest resources in developing ideas that could later be used against them, and why internal innovation remains rare despite such research and development work. Posen's answer is that civilians ally with "mavericks", military officers who have the necessary specialized skills but who have become disillusioned with the doctrinal status quo.[8]

Stephen Rosen, in *Winning The Next War* (1991), argues that military organizations have two defining characteristics: they have no way to prove their effectiveness in peacetime, and they are controlled by officers who rose through a hierarchy.[9] Defeat and civilian intervention are not adequate explanations for peacetime innovation. Instead, innovation is driven by senior military officers who work to change the organization from the top down. The key to innovation lies in getting people who adhere to a new and better "theory of victory" promoted. This requires the creation of new promotion pathways so that the would-be reformers can build support for their agenda. Innovation is only

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[7] Ibid, p. 56. Offensive doctrines are attractive because they usually require greater resources and give the armed forces greater freedom in deciding how to employ them.

[8] Ibid, p. 57.

[9] Stephen P. Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, Cornell University Press, 1991), p 8.

complete once those believers have risen to high rank and overturned the previous theory of victory.

Elizabeth Kier, in *Imagining War* (1997), argues that culture is the prime determinant of military doctrine.[10] It operates in two ways. The military organization itself has its own culture and favors certain doctrinal solutions because they fit with its cultural traditions. The civilian decision-makers are also affected by culture, this time the national political culture,[11] which includes prescriptions for managing civil-military relations. She argues that rather than pursuing utility-maximizing interests that are common to all large organizations, military organizations have unique cultures, and may favor quite different doctrines from one another, even if the circumstances are similar.

Despite their disagreements, Posen and Rosen do agree on a number of points. Both are realists, and believe that systemic pressures ultimately dictate what doctrine should be. Innovation takes place when those who correctly perceive what the international situation requires, whether they are civilians or military officers, overcome resistance to their ideas. Both also see technology alone as a weak cause of innovation.[12] And both argue that military organizations in peacetime cannot prove the validity of doctrinal ideas because they cannot conduct combat testing. Thus old doctrine cannot be proved to be

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[10] Elizabeth Kier, *Imagining War: French and British Military Doctrine Between the Wars* (Princeton, N.J., Princeton University Press, 1997).

[11] In practice different political parties have different understandings of national political traditions, including divergent views on how to manage civil-military relations.

[12] Rosen makes an exception for nuclear fission, which he claims is a "unique" kind of military innovation. Rosen, *Winning the Next War*, p. 7.

inferior, and new doctrine cannot be proved to work. This uncertainty plays into the hands of organizational interests. Kier offers a different perspective, arguing that the impact of culture on doctrine is underestimated because systemic pressures are indeterminate: there are often multiple doctrinal solutions to a particular strategic problem. Culture determines which solution will be chosen.

III. Problems with Existing Theory

There are three problems with these theories. First, the dependent variable, doctrine, is poorly specified. Second, they do not explain the origins of particular doctrines, focusing on various constraints on the range of acceptable doctrinal choices rather than on explaining why one particular solution was developed and adopted. And third, they assume that there is no way to test doctrine during peacetime.

I define doctrine as the set of operational and tactical instructions that shapes the way force is applied in a given military situation. At the tactical level, doctrine offers guidance on what weapons and tactics should be used to achieve a particular goal, such as reducing a fortified position. At the operational level, doctrine defines what the key military objectives should be, and how they should be prosecuted. One example would be the way blitzkrieg defines the enemy's command and control system as his center of gravity, and prescribes armored operations in depth as the chosen means of striking at it. Doctrine guides training and influences procurement, as well as combat operations.

Posen sometimes uses doctrine in the sense of "a set of instructions" as I have just

defined it. However, at other times he uses doctrine as shorthand for the military's order

of battle, its posture, and its reasoning for both: what the military thinks it is doing, and

why.[13] This expansive definition is problematic. Take his RAF case as an example: is

doctrine the know-how to run an air defense system, or manage a bombing campaign? Or

is it the decision to put most of the resources into bombing rather than air defense? Posen

seems to use it in both ways.[14]

Rosen avoids using the term doctrine altogether, preferring the even vaguer "innovation",

which he defines as a change in "the ideas governing the ways [a combat arm] uses its

forces to win a campaign."[15] On the face of it, this is quite similar to my "set of

instructions" conception, but Rosen also defines military innovation as nothing less than

a change in the entire "theory of victory" of the military organization. The prevailing

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[13] This is how Posen defines doctrine in *Sources of Military Doctrine*: "A set of prescriptions... specifying how military forces should be structured and employed to respond to recognized threats and opportunities. Ideally, modes of cooperation between different types of forces should be specified." (p. 13) "It reflects the judgments of [military and civilian] leaders about what is and is not militarily possible and necessary.... Military doctrine... is strongly reflected in the forces that are acquired by the military organization." (p. 14). Doctrines can be offensive, defensive, or deterrent, depending on what the state's grand strategy calls for. If doctrine does not support grand strategy it is "disintegrated". Doctrine is also described as a concatenation of standard operating procedures into "programs", a small number of which are "doctrine" (p. 44).

[14] In later work, Posen distinguishes doctrine in this wide sense from "operational and tactical doctrine": "By operational and tactical doctrine I mean the way the French army and airforce planned to fight fights, battles and campaigns. This should be distinguished from a higher order concept that goes by many different names: national military strategy, strategic doctrine, political-military doctrine, or 'military doctrine,' (the term I have used in my past work)." Barry R. Posen, *Still Strange Defeat? France 1940* (unpublished, 1999) p. 14.

[15] "Major innovation involves a change in the concepts of operation of [a] combat arm, that is, the ideas governing the ways it uses its forces to win a campaign, as opposed to a tactical innovation, which is a change in the way individual weapons are applied... A major innovation also involves a change in the relation of that combat arm to other combat arms and a downgrading or abandoning of older concepts of operation and possibly of a formerly dominant weapon. Changes in the formal doctrine of a military organization that leave the essential workings of that organization unaltered do not count as an innovation by this definition." Rosen, *Winning the Next War*, pp. 7-8.

theory of victory determines mission priorities and resource allocations and is more

sweeping than any one "concept of operations". [16] Both scholars are thus mixing

questions of doctrinal content, about what the set of instructions should be, and questions

about strategy, posture, and mission priorities.[17]

Kier identified the second problem when she argued that systemic pressures do not

determine doctrinal outcomes. There are often several plausible ways of solving a

strategic dilemma. That is certainly the case in the development of armored warfare.

German revisionist aims clearly required an offensive strategy, and therefore supporting

offensive capabilities, but this is not sufficient to explain blitzkrieg. It had to be on the

table as a doctrinal option before it could be selected. It is easy to imagine a

counterfactual scenario in which armor doctrine took a far less radical form, despite

supporting an offensive strategic posture. As late as February 1940 there were variants of

Fall Gelb that employed armor in markedly conservative ways.[18] Systemic pressures did

not determine doctrinal developments in the French case either. The French were well

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[16] There are further problems with the way Rosen defines innovation. He muddies the waters by talking dismissively of "formal doctrine" as something with no real content, and then seeks to draw a firm line between "concepts of operations" and "tactics" by limiting the later to questions concerning a single weapon system, an arbitrary distinction at best. The result is that it is never quite clear what actually changes when innovation takes place.

[17] This is partly an unintended consequence of the organization theory that underpins their arguments. Organizational dysfunctions can explain both suboptimal doctrines and suboptimal choices about what strategy to adopt and what missions and capabilities to spend money on. The confusion is also a consequence of the question being asked. These scholars as seeking to understand "military innovation" and both changes in doctrinal content and changes in mission priorities can be described that way. Since improvements in doctrinal content often lead to changes at the military-strategic level and, vice versa, it is easy to conflate the two phenomena under a general rubric of military innovation, the absence of which can always be explained by appealing to organization theory.

[18] Ernest May describes a wargame held on February 14th 1940 at German Twelfth Army headquarters, which cast doubt on the feasibility of an early Meuse crossing and led to more general doubts about the wisdom of independent armor operations. Ernest R. May, *Strange Victory: Hitler's Conquest of France* (New York: Hill and Wang, 2000), p. 263.

aware of the offensive potential of tanks, despite having a defensive grand strategy.

French experiments with armor aimed at developing doctrine for the offense; they were

not somehow at a disadvantage because they sought to find a defensive role for tanks.[19]

The methodical battle was meant to be an offensive battle, a carefully organized assault

that would crush the enemy using firepower and mass.

Rather than focus on the balance of power, organizational preferences, and civilian

priorities, all of which constrain doctrinal choices, I concentrate on how doctrine is

developed within military organizations. Unlike Kier, who argues that military

organizations develop whichever doctrine they find most culturally appealing within the

constraints imposed, I argue that militaries develop doctrinal alternatives and choose

between them based on lessons learned in wargames. The process is similar to the way in

which private companies run research and development programs that seek to turn new

technologies into new products. Several different approaches are put to the test and the

more promising ones are developed until the best become part of the "thin menu" of

doctrinal options available to civil and military leaders. The quality of this doctrinal

development process will affect the quality of the doctrinal options on the table, and may

also make it easier to choose between them.

This brings us to the third problem with existing theory. Whilst combat testing remains

the ultimate yardstick for measuring doctrinal effectiveness, wargaming can simulate

wartime reality with enough fidelity to develop new doctrine during peacetime. Old

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[19] Indeed, had they paid more attention to the question of using armor on the defensive they may have had more success mounting armored counter-attacks in 1940.

doctrine can be cast into doubt, even if it cannot be "proved" to be ineffective. Conversely, wargaming can generate enough confidence in the viability of new doctrine for it to be officially adopted and used in war.

Comparing different processes of doctrinal development gives us new traction for explaining why states sometimes develop such different doctrinal solutions to similar problems, and why the resulting doctrines vary in effectiveness. Higher level explanations that relate doctrine to grand strategy or the parochial interests of military organizations seek to identify what strategic or organizational environment is most likely to foster innovation. They cannot explain why particular cases, such as the German development of blitzkrieg, were spectacular successes. Since the number of cases of doctrinal innovation is relatively small, and the military impact of successful innovation is large, it is important to move beyond this framework and examine the internal innovation that takes place within the military so that we understand how the "thin menu" of doctrinal options is populated.

IV. Wargames as the Key to the Process of Doctrinal Development

Doctrinal development as a systematic process dates from the later nineteenth century. It is analogous to research and development, which became an institutionalized function within private companies at around the same time. Like any form of systematic research, doctrinal development requires a means of testing new ideas in the environment in which they will be used. Testing military doctrine is especially challenging in this regard, since

it requires simulating a wartime environment: hence the central role of wargames. In a first mover situation, where there is no other state to emulate and learn from, wargames are the only means of gauging whether new doctrine will work on the battlefield.[20]

A wargame is a simulation of war on the map or in the field that functions as a substitute for the real wartime environment. Different types of wargame simulate different aspects of the wartime environment since no comprehensive simulation of wartime reality is possible. There are many possible scenarios and many different levels of war, and individual wargames set out to simulate tightly bounded but relevant pieces of a larger reality. In this paper wargames include both simulations of war on a map, computer, or other medium[21] *and* military exercises involving real troops in the field. This makes sense in terms of function, and because both types of wargame are forms of simulation. The purpose of simulating wartime reality is to provide simulated wartime experience. Simulation thus reflects a prior belief that wartime experience is valuable, enhancing combat effectiveness, and validating doctrine and operational plans. The value of the simulated experience depends on the quality of the simulation itself, which will always be less than perfect. However, the opportunity to wargame scenarios repeatedly helps to offset shortcomings in quality.

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[20] Rosen argues that the most effective approach to technological change is to "prototype" a wide number of technologies as a strategy for managing uncertainty. This idea is in fact quite similar to the concept of doctrinal development, but applies only to weapon systems rather than to doctrine. Rosen, *Winning the Next War*, pp. 259-260.

[21] Today map maneuvers are computer-assisted, and require far fewer staff than during the 1930s, when teams of clerks would calculate movement, combat outcomes, weather effects, and so on using tables and dice. The complexity of calculation was a limiting factor, since lengthy pauses to compute outcomes broke up the flow of the game.

Doctrinal development is typically catalyzed by new technology, or by changing security requirements that demand new missions or capabilities. Once a new technology or mission requirement is recognized wargames are used to support the doctrinal development process in several ways. Early in the process they offer a cheap way of exploring problems, raising further questions, and ruling out options. At this stage the emphasis is on generating hypotheses, identifying problems, and trying out different approaches. These are then tested for feasibility in map maneuvers, which generate further questions. Field exercises can then be designed to build on and confirm what has already been learned from the map maneuvers, subjecting ideas that seem to work on the map to a different kind of test in the field. The process is iterative: map maneuvers or exercises may lead to new ideas, and more wargames, either on the map or in the field. They may also lead to the abandonment of a new concept if it turns out to be impractical or less effective than hoped. The goal is to reach a point at which the military organization is confident enough in the validity of the resulting doctrine, given its performance in wargames, to spend its resources to equip and train the force in order to use it.[22]

This is an idealized representation of the doctrinal development process. In reality there will always be resource constraints, and organizational preferences will loom large in the way that the process unfolds. Civilians may get involved by pushing the process forward or holding it back, based on their own preferences and assessment of the security

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[22] The earlier stages of doctrinal development are cheaper than the later ones since the wargames tend to increase in size and complexity. The last stages typically involve large exercises in the field, which are far more expensive than map maneuvers. But even these are much cheaper than the procurement and training costs of actually adopting the new doctrine.

situation. Nevertheless, despite these constraints, the process is important because it is the tool through which the specifics of doctrine as a set of instructions are developed.

It is also important to realize that wargames are used for purposes other than doctrinal development. They are familiar to all military personnel as training tools, their oldest and still most widespread application. Wargames are also used for operational planning, an activity that has much in common with doctrinal development, as we shall see.[23] Lastly, wargames may be used as a means of demonstrating new doctrinal ideas to military and civilian leaders, in an attempt to affect their decisions. Some believe that this makes wargaming no more than a lobbying tool, but this is not the case. If the wargames in question are purely for show, as in the case of exercises staged for visiting VIPs, then they are not being conducted for doctrinal development. Wargames make effective lobbying tools, but that does not mean they are not useful when used properly. In fact, their value in lobbying derives from their recognized usefulness as a tool.

As an example of the process of doctrinal development at work, and of the role of wargaming within it, consider the evolution of the concept of "deep battle", developed during the 1920s and 1930s in the Soviet Union by Marshal Tukhachevsky. Similar to what would later develop into blitzkrieg in Germany, deep battle operations envisaged exploitation in depth using armor, motorized infantry, and airborne forces with a view to paralyzing the enemy by destroying his command and control system and supply

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[23] In practice these three functions cannot always be neatly distinguished. Playing through a hypothetical scenario may yield lessons directly applicable to existing military plans, whilst the exploration of a specific warplan might suggest new operational possibilities, possibly highly innovative ones. Any wargame is also a learning experience for the players, whether that is the primary purpose or not.

network. There were several initial rounds of theorizing in articles published by Tukhachevsky and others, during which the basic outlines of the deep battle concept were sketched out, and a number of key issues identified. The idea was then put to the test in a series of map maneuvers. These wargames revealed a number of problems with the initial concept of deep operations, and raised a number of new questions. What was the proper operational depth for the attack to be effective but not lead to overstretched lines of communication? Should there be two echelons in the breakthrough force, or three? What was the appropriate force mix in terms of armor, infantry, cavalry, and artillery in each echelon? Some of these questions could be addressed in further map maneuvers; others were more suited to testing in field exercises. Unfortunately for the USSR, deep battle was not allowed to mature as a concept, becoming a victim of Stalin's purges, along with its author. However, it does illustrate how wargames, both on the map and in the field, can be used to keep the process of innovation moving forward. [24]

So far, I have described the process of doctrinal development, and argued that the better that process, the better the chances for innovation. Since the core of the process is wargaming, its overall rigor, or lack thereof, turns on the quality of wargaming. What, then, makes for a rigorous wargame? How would we know it when we see it?

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[24] Richard E. Simpkin and John Erickson (1987). *Deep Battle : The Brainchild of Marshal Tukhachevskii* (London; Washington, Brassey's Defence, 1987), pp. 42-44. Simpkin also believes that the concept of deep battle would have evolved more rapidly had there been more wargames, especially exercises, rather than more rounds of theorizing. One problem was the higher visibility of exercises, which generated more political opposition to the new ideas than the lectures and map maneuvers at the Frunze Academy (pp. 51-52).

There are three aspects of game design that are particularly important to the fidelity of the simulation. [25] The first requirement is to clearly define the wargame's purpose and translate it into a scenario.[26] The scenario defines the simulated wartime situation within which doctrine will be tested. Each individual game scenario has to keep the participants focused on the particular problem under investigation whilst allowing them the flexibility to try different ways of solving it. This is often a difficult balancing act. For a series of games, the question is how much variation in the scenarios there should be. The greater the range of scenarios gamed, the more is likely to be learned about how well doctrine performs and under what situations it should be modified. Balanced against this are time and resource constraints, which dictate that only those scenarios considered most likely to occur in wartime will be explored in detail.

The second technical requirement for effective wargaming is developing a robust and independent system for umpiring games. Umpires are individuals with a high level of expertise in the type of warfare being simulated who act as arbiters during the game.[27] They also introduce the kind of random events (bad weather, communication

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[25] There is no generally agreed way of breaking down the technical requirements of wargaming, although there is wide agreement on the importance of the three factors I have identified. For more on the art and technique of wargame design and use, see Peter P. Perla, *The Art of Wargaming : A Guide for Professionals and Hobbyists* (Annapolis, MD: Naval Institute Press, 1990) and Garry D. Brewer and Martin Shubik, *The War Game: a Critique of Military Problem Solving* (Cambridge, MA: Harvard University Press, 1979).

[26] The scenario is drawn up by the game designers and presented to the players (and umpires) in the form of a briefing and a set of orders and objectives. The designers have to decide how much information to give each of the parties at the outset.

[27] The trend in wargames of the early nineteenth century was towards "rigid" games, where losses were calculated according to tables and charts, often also using dice. The first suggestion for the use of umpires came from Colonel Von Verdy du Vernois, in 1876. Von Verdy's concern was to make wargames more accessible, but umpires also improved realism, particularly when used in judicious conjunction with fixed rules. Perla, *The Art of Wargaming*, pp. 29-30.

breakdowns) that disrupt military operations in the real world. They are particularly

important in determining combat outcomes in individual engagements, since close

combat is among the hardest military phenomena to model, involving as it does endless

possible combinations of forces and terrain and intangible factors such as morale, unit

cohesion, expectations about reinforcements, and so on. Independent, well-trained

umpires are vital to creating a realistic simulation of wartime.[28] During the wargames of

the interwar period umpires fleshed out the basic movement and combat models used in

map maneuvers and determined combat outcomes in both map maneuvers and exercises.

The third requirement is simulating a realistic and flexible enemy. Playing Red – from

the wargaming convention of coloring friendly units blue and enemy ones red – means

playing the role of the enemy in a wargame.[29] The Red player must act as though he were

thoroughly versed in enemy doctrine, rather than his own. Playing Red realistically

demands an unusual set of skills, and players are often drawn from the military

intelligence or foreign service communities in order to bring in as much expert

knowledge of the enemy's doctrine, organization, and political leaders as possible. [30] To

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[28] This was even more true in the interwar period than it is today, since there were no training aids such as MILES available. Fortunately, there were many WWI veterans available for training as umpires who could draw on their own experiences when adjudicating combat outcomes.

[29] The convention of using blue to represent friendly forces and red to designate the enemy originates with the very first wargame, designed in Prussia between 1816 and 1824. Andrew Wilson, *The Bomb and the Computer*, (London: Barrie and Rockliff, 1968) p. 4.

[30] In August 1942 Japanese naval intelligence officers returning home from Washington as part of an exchange of prisoners with the United States found themselves being escorted from their ships straight to the Tokyo Total War Research Institute to take part in a wargame as the U.S. The Japanese were particularly interested in how the United States would react politically to their military actions. The Japanese were not always able to provide a realistic simulation of American behavior in their wargames however. After the war, Commander Minoru Genda, air officer for Nagumo's staff, criticized Red play during another wargame that preceded the battle of Midway, claiming that it "might have given us the wrong impression of American thinking." Perla, *The Art of Wargaming*, p. 47.

support Red players, intelligence on enemy doctrine, capabilities, and plans must also be made available.

Unless all three dimensions are addressed during the design and execution of a wargame, fidelity will suffer. Fidelity, the degree to which a wargame corresponds to the reality it is meant to simulate, affects how seriously lessons learned in wargames are taken. If the simulation is rigorous, and it is perceived as such, lessons learned will be treated similarly to lessons learned in real combat. The lessons may be ambiguous, but they are understood to be valuable. Unrealistic wargames are still useful for training purposes, but are not suitable for developing doctrine. A simple training game is, by design, little more than a demonstration of why existing doctrine is wise, and will punish deviation from it. Creating an open ended simulation of some aspect of wartime reality, and then trying different way to solve a particular problem is far more difficult. It is also inefficient if the primary goal is to train soldiers according to existing doctrine. From the perspective of doctrinal innovation, then, a rigorous or high quality wargame is one that addresses these three issues of scenario design, umpiring, and Red play, and is designed from the beginning as an experimental tool rather than a training device.

V. Predictions and Case Selection

A doctrinal development system that addresses all three of the above areas in the design of its wargames will be more robust and flexible than one that does not. A military organization that has developed this simulation capability as part of a systematic doctrinal

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development process will have a marked advantage in developing new doctrine. There is a greater chance that doctrine developed this way will be effective on the battlefield, and an appreciation of this fact lowers the perceived risks associated with doctrinal change. Doctrine developed this way is therefore more likely to be implemented and resourced.

France and Germany during the interwar period are good cases to look at because they are similar on so many dimensions. Both were developed industrial economies that had just fought the first large industrialized war against each other. Both had struggled to gain an advantage in that conflict by using new technologies, but by the close of hostilities neither had managed to develop a comprehensive doctrinal framework for their use. Both faced the challenge of doing so in peacetime, in the context of continuing technological development and the increasing likelihood that they would fight each other again.

At the close of WWI France and Germany did differ in some respects. Most obviously, Germany had been defeated. Each country also had its cultural and institutional peculiarities. But these were nevertheless peer competitors struggling with the same doctrinal dilemma: how to integrate the new technologies previewed in WWI into a doctrinal framework that exploited them more effectively. However, they also differ in another respect: Germany had a considerably more advanced doctrinal development process in place than did France, and had a greater appreciation of the importance of simulation. [31]

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[31] "The use of war games to suggest or test weapons, strategies, tactics, organizations, and procedures is probably more recent than their use for training or evaluation of plans, but it can be traced clearly back to the second half of the nineteenth century in Germany." Brewer and Shubik, *The War Game*, p. 50.

Doctrinal development is an iterative process. New doctrine at the tactical level gradually becomes integrated into a wider framework that makes the most of these new tactics at the operational level. There is a move from specific, tactical questions to more general operational ones, as the way to deal with the tactical problems become increasingly apparent. This progression from tactical to operational questions is evident in the case studies that follow.

VI. The Cases: French and German Doctrinal Development and Wargaming, 1918-1940

At the close of hostilities in 1918 France and Germany already had markedly different approaches to managing doctrinal development. Neither system was as developed as those that emerged in after WWII, but the German one was already more advanced that the French.

Prussia was the first state to adopt map maneuvers as a training tool during the early nineteenth century, and after the victory against France in 1870-71 wargames were credited both in Germany and abroad as one reason for German military successes in the wars leading up to unification.[32] This led to widespread emulation, and the first significant use of wargaming outside Germany. German texts on wargaming were

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[32] The credit for the first recognizably modern map maneuver goes to von Reisswitz the younger, who perfected his wargame sometime between 1819 and 1824, when he first demonstrated it to Prince William of Prussia. He built on his father's work, introducing dice to represent the element of luck in war, and was the first to create a game unarguably different from the various versions of "military chess" that had preceded it. Wilson, *The Bomb and the Computer*, pp. 3-6.

translated and deployed as training tools for officers in France, Britain, the United States,

Russia, and Japan. Although they were initially seen as educational devices for giving

officers a taste of higher command, wargames were soon put to use supporting

operational planning and doctrinal development. The US Naval War College in Rhode

Island, one of the first American military institutions to embrace wargames, initially

developed games as an educational tool, but quickly found itself supporting contingency

planning and acting as a de facto naval General Staff. Its wargaming capabilities were

also used to assess basing options and warplans, and to make recommendations on ship

design.[33]

By 1918 the German armed forces had therefore mastered the technical side of creating

realistic simulations. Wargames were a familiar tool, an integral part of officer training,

contingency planning, and doctrinal development.[34] Map maneuvers were used

extensively during WWI to prepare plans, and tactical innovations such as defense in

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[33] Analysis of wargames conducted at the college led to recommendations in favor of oil-fired rather than coal-fired ships (1896), and of all-big-gun battleships rather than the mixed calibers then in use (1901). Experience in games also led to a proposal to concentrate the fleet. Perla, *The Art of Wargaming*, p. 67. Perhaps the most important function of wargames at the college was to support its work as a de facto General Staff for the navy. As experience with wargames continued "it began to create a body of doctrine that could be used in the absence of a central strategic planning office in the Navy Department." This capability proved very useful during the Spanish American War of 1898. John B. Hattendorf et al, *Sailors and scholars : the centennial history of the U.S. Naval War College* (Newport, R.I., Washington, D.C.: Naval War College Press, 1984), p. 43.

[34] There is evidence of German wargames conducted for doctrinal development purposes going back to the late nineteenth century. After the introduction of the breech-loading rifle in the war of 1866 the Germans conducted games "to work out tactical procedures to take better advantage of this innovation. Empirical data generated by the American Civil War, especially on the use of railroads in logistical support of ground forces, were used by the Germans in wargames to research and redefine operational procedures later used in their successful war against France in the 1870s." (Brewer and Shubik, *The War Game*, p. 50). Wargames for training purposes were ubiquitous, and not just exercises. By the 1930s "regimental war games [map maneuvers] were obligatory one night per week in winter" (Wilson, *The Bomb and the Computer*, p. 29). The Germans used wargames as part of their planning for almost every military operation and contingency from the Franco-Prussian war through WWII. See Alfred H. Hausrath, *Venture Simulation in War, Business, and Politics* (New York: McGraw-Hill, 1971) pp. 23-37.

depth and infiltration tactics were put to the test in exercises before being put into practice on the battlefield.

In France, wargames were also used for training and planning purposes, but their wargames were less rigorous, and hence less useful for doctrinal development. As we shall see, French interwar attempts to use wargames for developing armor doctrine show a lack of awareness of the fundamental requirements of good simulation.

The two countries therefore started the process of developing a new doctrine for armored warfare with different simulation capabilities, but with the same set of questions: how to use tanks at the tactical level to first achieve a breakthrough, and how to then exploit it.

The breakthrough battle against an entrenched enemy was the logical starting point for any military innovator who had lived through the static warfare of WWI. Tanks had been used during battles in that war, though only by the Allied side, and had shown that they could indeed break through enemy lines. However, attackers using tanks had never managed to exploit their success in order to achieve more than local gains.[35] The tanks that were becoming available by the late 1920s and early 1930s were far more reliable, faster, and better armed and armored than their WWI counterparts. On the other hand the now widespread availability of anti-tank weapons had called their effectiveness into

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[35] The first use of tanks was at Flers-Courcelette on 15th September 1916. Exploitation in WWI was very limited however, even after a successful breakthrough such as the one at the beginning of the battle of Cambrai on 20-21st November 1917. There were no mechanized infantry to follow the tanks, and crossing no-man's-land in unarmored wheeled vehicles was next to impossible because of artillery fire and mud. In addition, the tanks themselves were slow, of limited range, and prone to breakdowns.

question. The first hurdle on the road to an effective doctrine for armored forces was therefore understanding how the tank could be used tactically to break through enemy lines, given the presence of anti-tank weapons, and then how to exploit that breakthrough to achieve more than a local success.

Despite the constraints imposed by the Versailles treaty, which denied them tanks altogether, the German army held a series of wargames during the late 1920s and early 1930s explicitly aimed at developing doctrine for armored forces. In 1927, Oswald Lutz, Heinz Guderian's superior as Inspector of Motor Transport Troops, began using the motor transport battalions under his command to conduct a series of experiments. These battalions were equipped with trucks, but they also included dummy tanks (cardboard cutouts on car chassis) and wooden artillery and anti-tank guns. All seven battalions took part in "experiments" from 1927 onwards, intensifying after 1930.

During 1931-1932 an important series of exercises was conducted at the Jüterbog and Grafenwöhr training grounds after which Lutz wrote a long report on the lessons learned.[36] He forwarded it to Colonel Walther von Brauchitsch, head of the *Truppenamt's*[37] Army Training Office, who was then working on the new version of the field regulations, *Leadership and Battle*. In his report Lutz argued that tanks should

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[36] Lutz concisely titled his report *Anregungen und Lehren aus dem unter Leitung der Inspektion der Kraftfahrtruppen abgehaltenen Übungen der Kampfwagen-Nachbildungs-Bataillone zusammen mit Infantrie under Artillerie auf den Truppenübungsplätzen Grafenwöhr und Jüterbog*. It is available on microfilm in the U.S. National Archives in Washington, reference OKH, H25/24, 300, 6250579-6250595. See Citino p. 218fn6 for the complete reference.

[37] The *Truppenamt's* was the German General Staff in all but name. The General Staff as an institution was banned under article 160 of the Versailles treaty. The *Truppenamt's* ("troop office") was established as the General Staff disbanded in 1919 under the terms of the treaty.

receive independent missions.[38] They should not be tied to the infantry, as this would rob

them of their advantages in speed and range. They should be used at the *Schwerpunkt* (the

decisive point of the battle) because of their high value, and should only be used *en*

masse, in battalion strength or above, to rapidly swamp anti-tank defenses. Lutz

emphasized the importance of surprise, favoring attacks at dawn, and recommended

echeloning the attack so that the focus of the action could more easily be switched during

the pursuit phase, or to deal with any counterattacks. The report also dealt at length with

combined arms and the ways in which the other arms were to support the tanks.

Independent missions as Lutz saw it did not mean that no other arms had a role, but rather

that tanks should be free to use their speed and mass when appropriate, even is this meant

advancing into enemy territory ahead of their supporting arms. Robert Citino claims that

"it is no exaggeration to say that the exercises of 1931-32, carried out by a disarmed

power with dummy tanks, marked the true birth of *Blitzkrieg*. The unchaining of tanks

from the speed of the infantry, the reliance on mass and surprise to tear a hole in the

bewildered defense, the exploitation by mobile reserves of all arms – it was this vision

that would revolutionize the face of warfare from 1939 to 1941."[39]

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[38] There is a great deal of confusion about the meaning of "independent missions." Lutz emphasized in his report that infantry had to follow closely behind the tanks as they attacked, staying as close as possible. Failure to do so, as was shown repeatedly during WWII, allowed the defenders to recover from the tank assault and return to their defensive positions in time to inflict heavy losses on the advancing infantry. For Lutz independent missions did not mean charging way ahead of the infantry during the initial assault. It meant pushing on to objectives deep in the enemy rear once the front was breached, rather than remaining with the infantry. However at the operational level "independent missions" can also mean allowing entire armored divisions, including their organic infantry, to operate independently of slower infantry formations. This is the way I use the term. Much of this confusion can be attributed to Doughty, who sometimes uses it to mean deep exploitation operations with a combined arms force (e.g. a panzer division) but sometimes simply to mean "tanks on their own". Robert A. Doughty, *Seeds of Disaster: The Development of French Army Doctrine 1919-1939* (Hamden, Conn.: Archon, 1985).

[39] Robert M. Citino, *The Path to Blitzkrieg: Doctrine and Training in the German Army, 1920-1939* (Boulder: Lynne Reinner, 1999), pp. 203-204. Citino is a professor of history, not a political scientist, and makes no attempt to develop a general theory of military innovation. His main concern in his work on the

By the end of the 1932 exercises, after five years of experiments, Lutz believed that massed armor, especially with the benefit of surprise, was capable of breaching the enemy line, overcoming anti-tank defenses, and pushing deep into the enemy position, possibly unhinging it completely. He also argued that without a rapid exploitation of the breach by a motorized combined arms force much of the initial advantage might be lost. Tanks could be used alone in the initial assault but they relied on the other arms to complete the exploitation and force the enemy to pull back. These conclusions might seem obvious in hindsight, but at the time there had never been an attack of the kind the Germans were simulating.

The Lutz exercises were models of good wargaming practice. They explored several variants of a particular scenario, a breakthrough followed by exploitation, and they did so within a framework that was flexible enough for commanders to choose the time, place, and tactics for an attack. This meant that it was possible for defenders to be surprised, and that the effectiveness of a range of different tactics could be assessed. The Red defenders were free to try new means of foiling an attack, and the result was a test against a reactive, flexible enemy. The exercises were supported by professional umpiring, a feature of all German exercises during this period. The 1921 army regulations included extensive guidelines for umpiring, especially for assessing combat outcomes.[40] Umpires

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development of blitzkrieg is to show the continuity in its development throughout the interwar period, beginning with von Seeckt in the early 1920s. Far from being an abrupt doctrinal revolution blitzkrieg doctrine had been slowly built up by men like Lutz.

[40] The *Regulations for the Umpire Service During Troop Maneuvers* and its appendix "Guiding Principles for Judging the Efficacy of Arms," originally issued by General von Seeckt in May 1921 were repeatedly revised thereafter. The regulations included detailed instructions on judging the offensive and defensive

had their own communications network, were well organized and relatively numerous, and conducted their own post-exercise meetings to discuss both the lessons of the game and the lessons for future umpiring. Foreign observers repeatedly commented on the quality of German umpiring during exercises, and on their innovative use of simulated weapon systems.[41] The result of all this was that the conclusions drawn by Lutz in his report proved remarkably accurate, and then went straight to the man in charge of writing the army's new doctrinal regulations.

The first French unit assembled specifically for the purpose of experimenting with "modern methods of combat" was formed under the auspices of the School of Application for Infantry and Tanks in 1931. It included three companies of light D1 tanks and the three heavy B1 prototypes then in existence. The first exercises were conducted in September 1932 at the Camp de Mailly under the direction of Colonel Touchon, the School's commandant. Touchon had made his reputation teaching at the War College and later played a central role in drafting the 1938 infantry regulations.[42]

Following the exercises, Touchon, the "chief umpire" and principal post-game analyst, submitted a report on the maneuvers in which he claimed that the tanks would be

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effects of weapons, losses, and practical guidelines such as how to designate units as out of action. Citino, *The Path to Blitzkrieg*, pp. 106-116.

[41] Citino summarizes US Military Attaché Colonel Carpenter's report on the 1928 infantry exercises: "Their organization was complete, with a chief umpire for each part of the maneuver... there was an officer for each sector, a plethora of officers and noncommissioned officers functioned as subordinate umpires. At least one mounted umpire served each battalion of infantry, field artillery regiment and cavalry regiment. Two senior NCOs were assigned to each company of infantry, and one to each troop of cavalry and platoon of artillery. A separate telephone system for the umpires covered the entire area; it was clearly marked and considered unavailable for use by either the Red or the Blue side." Citino, *The Path to Blitzkrieg*, p. 184.

[42] Doughty, *Seeds of Disaster*, p. 145.

"doomed to failure" against an enemy with substantial artillery and minefields. He did

concede that tanks would be useful against a weakened or disorganized enemy.

Mechanized units, he argued, lacked the ability to take strongly defended enemy

positions, owing to the lack of supporting arms, especially artillery. "According to

General Weygand, this negative report on the September 1932 exercises virtually halted

the movement towards independent tank forces." [43]

The interesting point about these conclusions is that Touchon was correct in the specifics,

but that he failed to recognize how sensitive the exercise outcomes would be to changes

in the scenario being gamed. One of Lutz's main conclusions was that tanks required a

combination of mass, speed, and surprise in order to overcome defenders, swamping anti-

tank defenses in their path and pressing forward before artillery could react. By designing

a narrow WWI style scenario in which there was no room for surprise, Touchon set the

tanks up for failure. Tanks attacking prepared defenders backed up by artillery and

minefields would indeed suffer high losses. But it did not follow that tanks had to work in

close cooperation with the infantry and artillery at all times, and it certainly did not

follow that the tanks could not press forward far ahead of the infantry and artillery once

the front *had* been breached. Motorized exploitation forces were not even mentioned in

Touchon's report. The outcome of one scenario was assumed to be representative of a

much larger number of cases.[44]

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[43] Ibid, pp. 145, 211fn27.

[44] Ironically, Touchon later had another chance to learn about armor at first hand. On May 14th 1940 Gamelin ordered the newly formed "détachement d'armée Touchon," soon to be renamed the 6th Army, to stem the flow of German armor through what had become a 60 mile gap in the French line. http://www.charles-de-gaulle.org/chercheurs/publications/gorce/article_gorce_montcornet.htm. During the

The French exercises were not genuinely two-sided simulations. Anti-tank guns, mines, and artillery were assumed to be ready and waiting for the tanks to assault. The scenario consequently left no room for surprise, panic or shock among the defenders, or for exploiting poor enemy dispositions. The tanks simply performed a set-piece assault on fortified positions.

The French army held another series of exercises in 1933 at Coëtquidan, under Colonel Martin, who would later become Inspector General of Tanks. In his report Martin, who like Touchon was also chief umpire, concluded that tanks could not occupy positions without the infantry due to poor visibility from inside the vehicles. In fact, he claimed the main problem was tanks moving too far forward too fast. To deal with this he suggested that "way points" be set up every 1500 meters where the tanks would wait for the infantry to catch up. This would also make coordination with the artillery easier since timetables could be used, rather than relying on radios. The concept of way points was readily absorbed into the methodical battle doctrine and became an integral part of French armored doctrine.

Like the exercises the previous year, a narrow scenario and a passive enemy led to misleading conclusions. The way in which success was defined as "holding ground" meant that tanks *had* to be tied to infantry. At Coëtquidan the French were again testing the potential of the tank for taking and holding positions held by dug-in infantry

Riom trials of 1942 Touchon argued that German and French armored doctrine were "absolutely" the same, and hence French doctrine was "certainly sound." Doughty, *Seeds of Disaster*, p. 178.

supported by artillery and protected by mines. They did not consider exploitation at all. They were asking "can the tank alone undertake this core mission (the methodical breakthrough battle) as well as conventional forces?" and their answer was no.

Martin regarded tanks as a kind of armored field artillery,[45] and structured the exercise with this in mind. Rather than looking for alternatives to the methodical battle, this was an attempt to give the tank a role within it. Martin's multiple responsibilities as chief umpire, exercise designer, and analyst turned the exercise into a demonstration of the methodical battle. His report then offered suggestions for integrating the tank more tightly into existing doctrine, primarily through the use of way points.

The wargames conducted during 1932-33 decisively influenced French tank doctrine, confirming the primacy of the infantry support role. The tests had "shown" that tanks were too vulnerable to send in alone and that they were incapable of holding ground. Despite the poor quality of the simulation, the French made far-reaching doctrinal and procurement decisions based on these exercises. Their doctrinal development efforts were flawed because although their simulations were poorly designed they still affected policy. The French army clearly believed in the importance of testing and learning from wargames; their misfortune was that the games themselves were poorly executed and consequently misleading.

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[45] "The action of the tanks can substitute for the direct support and close protection demanded heretofore of artillery." Col. Julien F. R. Martin, in his post-exercise report, Doughty, *Seeds of Disaster*, p. 145, p. 210fn28.

One consequence of Touchon and Martin's reports was a procurement policy that favored

light tanks, a shift that began in 1933. To fulfill the infantry support role tanks had to be

plentiful and cheap, but did not need to be fast or have a long range. Heavier tanks were

earmarked for an anti-tank role, and a few would be used to lead the assault and deal with

particularly strong positions, but most tanks would advance with the infantry. There were

heavier, better protected vehicles, but their range and speed were still fairly modest. "By

June 1936 the General Staff had decided that three-quarters of the tanks should be light

and one-quarter medium or heavy."[46] Another consequence was that just over half of

French tanks were assigned to infantry or cavalry divisions that were still only partly

motorized, and therefore added nothing in terms of strategic mobility to the French

army.[47]

In April 1937, with rearmament finally underway, the army held a new series of field

trials at Sissone under General Delestraint. These exercises were part of a renewed

interest in armored units brought on in part by the Rhineland crisis of the previous year.

The crisis had not led to a rethinking of doctrine, but had focused attention on the

strategic advantages of having rapidly deployable motorized and mechanized units. At

the doctrinal level it is striking how little had changed. The exercises involved one

company of B1s, one of D2s, and three companies of R-35s, and were designed, once

again, to test the new machines' capabilities in a controlled breakthrough. The main

conclusion of the post-trial report was that it was possible to use massed tanks in the

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[46] Ibid, p. 150.

[47] Doughty gives figures of 1235 tanks in infantry or cavalry divisions, with 624 in the three DCRs and 582 in the three DLMs. Doughty, *Seeds of Disaster*, p. 177.

attack, using the larger machines to break through ahead of the light tanks and infantry, a tactic the French called "mass maneuver." This might have opened the way for a new and badly needed focus on the exploitation phase, but once again the scenario was too narrowly focused on the breakthrough battle. Although it concluded that the "mass maneuver" tactic was workable, the report by General Delestraint also stressed the need for artillery support for the tanks, to protect them from increasingly capable anti-tank weapons, and the role of infantry in holding ground. Given the difficulties in coordinating tanks and artillery, the chosen solution was to advance in stages according to an artillery timetable, much as had been suggested by Martin after the exercises at Coëtquidan four year earlier.[48]

These exercises laid the foundation for French armor doctrine. Although the official regulations for the use of armored units were not published until the end of March 1940, most of the doctrinal principles they contained had been known for some time.[49] The regulations made it quite clear that the infantry would set the pace during the offensive, the tanks being unable to capture and hold ground. Tanks were costly, and should therefore be used only with adequate preparation and protection. These measures were even more draconian than the post-exercise reports suggested. After extensive reconnaissance, usually including aerial photography, tanks would be committed only with protection from enemy artillery, tanks, anti-tank guns, and air attack. This meant

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[48] Ibid. pp. 153-154, 213fn53.

[49] "Already written for a long time, printed shortly after the cavalry regulations, the tank regulations codified the experiences gained in past maneuvers and studies, the conclusions of which had been widely disseminated within the army." Henry Dutailly, *Les Problèmes de L'Armée de Terre Française (1935-1939)* (Paris: Imprimerie Nationale, 1980), pp. 191-192 (my translation).

ensuring friendly artillery support, air cover, and "an echelon of mobile anti-tank guns

following in the wake of the infantry."[50] Not exactly lightning war.

Whilst the French conducted one set piece exercise after another, the German army

moved on to consider how armored units should be organized. Lutz had argued that a

combined arms team had to back up the tanks and, in order to keep pace with them, these

other arms had to be motorized. This presented new challenges in command and control

and logistics, but again the Germans were able to draw on lessons learned in wargames.

During 1932, the Germans tested a new type of unit, known as a Motorized

Reconnaissance Detachment (MRD), which consisted of armored cars, motorized

infantry, and tanks.[51] Operating in conjunction with spotter aircraft, the MRD was to use

its great mobility and range to maintain contact with the enemy on the ground. In a post-

game report drawn up in June 1932 General Wilhelm Adam, head of the *Truppenamt's*,

estimated that an MRD could patrol "a zone 50 kilometers wide, and 200-250 kilometers

deep, depending on the availability of fuel." In the advance "the MRD was to proceed by

bounds, echeloned in depth. As far as possible it should use the main road network. Great

crossroads were of particular importance."[52] Although these units were designed for

reconnaissance, rather than combat, they provided a way of practicing operations in great

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[50] Ibid, pp. 194-195.

[51] The exact composition of an MRD depended on the needs of each mission. As each MRD was to be attached to a cavalry division or corps, assets could be detached and assigned to the MRD as needed. The tanks used in the 1932 exercise were simulated by armored cars. Citino, *The Path to Blitzkrieg*, pp. 204-207, 214.

[52] Ibid, p. 205.

depth and explored the tension between initiative and central control. The unprecedented

pace of motorized operations demanded a more decentralized command system, a

requirement not especially at odds with existing German doctrine, which favored

initiative to a much greater extent than its French counterpart.

The unprecedented level of mobility afforded by these motorized units equipped with

radios presented new challenges in supply, coordination, and especially command and

control. The idea of commanding motorized units via radio played an important role in

the type of future war imagined by Fuller and others, but once again it was the Germans

who took the lead by using wargames to develop concrete doctrinal principles.[53] By the

end of summer 1932 a tentative doctrine for the use of mobile reconnaissance forces was

on the table, and was tested in the field again during maneuvers that fall.

During 1934 Krupps produced over one hundred PzKw I tanks, and the first real German

armor battalion was formed, under the designation of "Motor Transport Training Unit."

That same year Lutz was put in charge of a new Motorized Troops Command Staff, with

Guderian as his chief of staff. "This headquarters would coordinate the development of

the panzer arm and command it."[54] The first three Panzer Divisions were created in

October 1935. They had one armored brigade of 561 light PzKw I tanks (including

command tanks), a motorized infantry brigade, a motorized artillery regiment, an

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[53] By 1932 Fuller had developed a vision of future war where infantry was reduced to occupying positions taken by armored vehicles. As many as five different types of tanks would cruise the battlefield, in a similar way to fleets operating at sea. Fuller's ideas were flawed in a similar way to Giulio Douhet – they both tried to extrapolate too far into the future. J. F. C. Fuller, *Lectures on Field Service Regulations*, Vols. II ,III (London: Sifton Praed & co., 1931).

[54] Charles Messenger, *The Blitzkrieg Story* (New York: Charles Scribner's Sons, 1976), p. 79.

armored reconnaissance battalion, an anti-tank battalion, an engineer battalion, a signals battalion, an anti-aircraft battalion, and divisional service units. Whilst the entire force could move at the speed of the tanks, most of its personnel were not actually manning tanks.

The new divisions were prototypes. They did not yet have a fully developed doctrine, and their tanks, though numerous, were very light.[55] However, now that they were formed they could be put through their paces in exercises, refining the basic concepts of operation Lutz had proposed. They also served to train the core of what would become a much larger armored force. As slightly heavier PzKw II tanks became available in 1935-1936 they were incorporated into units that already had some experience of the unique challenges involved in armor operations.

The Mecklenburg exercises in the fall of 1937 were on a large scale, involving some 160,000 troops, including a full Panzer Division (the 3rd) on the Red side.[56] This exercise was the first in which a panzer division was used as an independent operational unit, with its own particular mission.[57] The Red X Corps commander, with the support of his Army

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[55] Political considerations may have played a part in the early formation of the first three panzer divisions. Hitler's strategy at the time was a form of coercive diplomacy that relied on intimidation to achieve his goals. The more modern weapons that could be paraded around, the better. Hitler was also worried about the possibility of being attacked whilst rearmament was still ongoing, and flaunting German strength helped convince the Allies that that window of opportunity had already closed.

[56] The exercise also included a panzer brigade on the Blue side, for a total of 21,000 vehicles including 830 tanks. Citino's account of this exercise is based on the post-exercise report, *Bericht über die Wehrmachtmanöver (Heer) 1937*. Citino, *The Path to Blitzkrieg*, p.236, p.146fn57.

[57] The 1935 exercises at Munsterlager predated the formation of the armored divisions, and the 1936 fall exercises were principally concerned with assessing the quality of the NCOs and men in the newly expanded Wehrmacht. 1937 was therefore the first time that the panzer, which by now were receiving PzKw II tanks, participated in such large exercises. Citino, *The Path to Blitzkrieg*, p. 239.

commander, chose to mount an immediate assault on a key Blue bridgehead in order to exploit a temporary superiority in numbers. Redeploying over 100km in less than 24 hours, the 3rd Panzer Division led the assault on the bridgehead's southern flank whilst the 22nd and 30th infantry divisions assaulted Blue's position from the west. On the second day of the attack the panzers managed to break through into Blue's rear area, cutting the main supply road into Blue's position and forcing a general withdrawal with heavy losses. Blue infantry were well dug in and equipped with anti-tank guns and artillery, and managed to inflict heavy losses on the Panzer Division. However, once the Blue defensive line had been penetrated the mobility of the remaining panzers was used to devastating effect, and Blue's position crumbled.

Observers were surprised at how successful the Panzer Division's assault was. There had been relatively little artillery preparation and Blue anti-tank defenses had not been neutralized when the massed armor attack was launched. The Blue defenders did indeed manage to inflict substantial losses on the Panzer Division, but held out for just one day. Although there are no exact figures for these "heavy" losses the 3rd Panzer Division suffered, the subsequent drive on to Stavenhagen and Malchin, deep inside Blue's position, would imply that its combat power was still substantial.

The 3rd Panzer Division demonstrated great operational mobility, both in getting to the action quickly and during the exploitation phase of the battle. The mass of tanks, together with some supporting artillery and the division's own infantry units, had proved enough to tear a hole in the enemy line, a hole which the tanks then widened and deepened

rapidly. The battle had highlighted the value of having a strong organic infantry component. The single Panzer Brigade assigned to Blue in these exercises had no organic infantry and found it difficult to coordinate its actions with those of other Blue infantry units. In addition, the wargame showed that anti-tank defenses were less effective than many had thought, and that mass and speed could overcome them before they inflicted excessive casualties among the tanks. The anti-tank guns were effective enough when presented with a target, but their lack of mobility meant that if the tanks could defeat them in a single sector, remaining anti-tank defenses could be bypassed or enveloped. This was an important conclusion because much of the skepticism about armor operations arose from claims that anti-tank guns would leave tanks highly vulnerable.

Not everyone was ready to accept this. General Ludwig Beck, then chief of the General Staff (and a man who was skeptical of the claims of the armor enthusiasts), intervened to overrule the umpires and arbitrarily ordered the 3rd Panzer Division withdrawn from the exercise, to prevent it coming to a premature end. Beck felt that the umpires had been overly optimistic when assessing tank losses, since the troops of the 32nd Infantry Division defending against the panzers did have considerable anti-tank capability.[58]

Whatever Beck's opinions the Mecklenburg exercises undoubtedly strengthened the case being made by armor advocates like Lutz and Guderian. A set of doctrinal guidelines on

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[58] Beck's unusual reaction (no high level officer had overruled a game's umpires since the days of the Kaiser) is all the more interesting when one considers that in 1938 he ordered a map maneuver simulating the planned invasion of Czechoslovakia and used the results to try and persuade Hitler to abandon his planned invasion. Wilson, *The Bomb and the Computer*, p. 29. Clearly he had come to believe that wargames could be an effective way to influence military decision-making.

the use of panzer divisions was issued to students at the *Kriegsakademie* (the German War College) the following year emphasizing how flexible and mobile the new formations were. [59] The central themes were combined arms, rapid advances of up to 150km per day, the use of surprise, night marches, and reconnaissance by air and land. Tanks might lead an assault or follow the infantry, depending on the situation, but would always be used *en masse*. Students were told that it was "false to restrict the mobility of the unit to that of the infantry." Along with these guidelines the students were given a "tactical exercise" – the opportunity to play a map maneuver in which they could practice some of these new techniques. During that wargame the Blue 1st Panzer Division repeatedly broke through Red lines, scattering reserves, destroying artillery, and threatening Red forces with encirclement.[60]

The 1937 exercises were important because they helped settle the ongoing debate about the use of the new armored divisions in favor of those who believed in independent armor operations, and because they resulted in new doctrinal principles that were the first real draft of blitzkrieg doctrine. Organized into panzer divisions tanks could do more than break through enemy lines. Armored units had the potential to transform the way operations could be conducted, and hence how campaigns should be planned. The lessons learned at the tactical level during the Lutz exercises had again been confirmed, this time in much larger exercises.

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[59] This report reached the United States via Captain Wedemeyer, who was sent to attend the *Kriegsakademie* after he graduated from General Staff school at Fort Leavenworth, Kansas, in 1936. Albert C. Wedemeyer, Berlin, to War Department, 7 April 1938, *The German Armored Division*, in USMI XIV, p. 424-499.

[60] Ibid. USMI XIV, p. 470.

In France the situation was quite different. The continued doubts about the tactical value

of tanks advancing beyond their supporting arms undermined the rationale for large

independent armored formations. If a successful assault relied on masses of infantry and

artillery as well as tanks, why create combined arms formations based around the tank?

The French believed that the sort of penetration and exploitation for which the Germans

were building their new panzer divisions simply could not happen if a defender was

adequately prepared and equipped. In a sense, the French never got past the breakthrough

problem and on to the vital questions about exploitation. Having concluded, wrongly, that

the methodical battle remained the only way to break through the enemy line and actually

hold the ground that was won, there was no attention paid to how to conduct a deep

penetration by armor and motorized supporting units. Even more importantly for the

outcome in 1940, no attention was paid to how to deal with such a penetration by the

enemy.

The doubts expressed by Touchon, Martin, and Delestraint undermined the rationale for

creating armored units that could conduct such an exploitation mission. The result was

repeated delays to the creation of French armored divisions. As General Gamelin told the

Superior Council for War in April 1936, "the problem of constituting ... large [tank]

units has been studied in France since 1932; the development of the anti-tank weapon has

caused the renouncing of this conception."[61] Although they were deeply flawed, the

wargames held during 1932-33 and in 1937 were held up as evidence that French armor

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[61] General Maurice Gamelin, quoted in Doughty, *Seeds of Disaster*, p 163.

doctrine was sound, and that tank warfare did not fundamentally challenge the central doctrinal concepts of the methodical battle. It would have been more true to say that the wargames themselves could not have offered such a challenge given their design and execution.

One reason that the French army, dominated by the infantry branch, had felt able to neglect deep exploitation as a potential mission for tank formations was the fact that the cavalry branch was developing this capability independently. The problem was that the mission, like the cavalry branch itself, was thought of as a secondary capability. For these secondary missions the cavalry branch developed the *Divisions Légères Mécaniques* (DLM). In terms of weapons mix, these units were similar to panzer divisions, though somewhat lighter, but in terms of doctrine they were heirs to the traditional cavalry missions of reconnaissance, skirmishing, screening, and pursuit.[62] They would be employed mainly at the beginning of a conflict, before continuous fronts had been established, and later sent in to pursue an enemy beaten in the methodical battle.

The process of doctrinal development that led to the DLM is outside the scope of this paper, but the main point is that it occurred quite separately from the development of armor doctrine within the bulk of the French army. The DLMs evolved in parallel, developing their own doctrine and equipment, such as the excellent SOMUA S35 tank. Outside the cavalry the emphasis remained very much on the methodical battle, in which

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[62] When de Gaulle put forward his plan for an armored professional army to act as a covering force in *Vers L'Armée de Métier* (1934) he proposed six armored divisions *and* "a light division, carrying out the same role as the new DLM." Even an armor advocate like de Gaulle saw the DLM as something separate and specialized. Messenger, *The Blitzkrieg Story*, p. 89.

the DLM had no role. This compartmentalization of tasks had several unfortunate consequences. First, the DLMs did not serve as models for the development of armored units serving with the bulk of the army. Second, the DLMs did not train to counter armored penetrations of the front, since the methodical battle doctrine assumed that such a penetration could be halted and a continuous front maintained. Third, the DLMs were not used to simulate an attacking German force during exercises, despite the fact that they were the only units in the French order of battle that were in a position to do so in terms of doctrine and equipment. Since the DLMs were seen as a separate and specialized force the French army never once had the opportunity to practice defending against the kind of armored units the Germans would employ in 1940.

Rather than competing to develop the most effective armored warfare doctrine, the two branches instead developed separate pieces of what should have been an integrated doctrine. This allowed the core of the army to ignore exploitation in depth, dismissing it as "pursuit", and to remain focused on the methodical battle. It also led to a great deal of duplication of effort, as each branch developed its own tank designs and tactics. In effect, the infantry hived off a mission that it regarded as secondary, whilst the cavalry remained too weak institutionally to influence the doctrine of the rest of the army. The benefits of the cavalry arm's more successful doctrinal development efforts did not diffuse back into the main body of the army.

In the months before the German offensive in 1940 the French finally created their version of armored divisions, the *Divisions Cuirassées de Réserves* (DCRs), based

around medium H39 and heavy B1*bis* tanks. These formations arrived very late in the

buildup to war.[63] The high command had repeatedly delayed the creation of the first DCR

because of a lack of B1s.[64] To compound this, the DCRs fell victim to budget cuts as late

as the end of 1938, when General Gamelin delayed the creation of more DCRs in

response to Daladier's demands for savings.[65] As a result France created its first two

DCRs only in January 1940.

The new DCRs were not assigned a specific mission, but were to be used in accordance

with the official manual for armored combat, which laid down the way tanks should be

employed to support the methodical battle in accordance with the recommendations of

Touchon, Martin, and Delestraint.[66] In fact, DCRs were not armored divisions in the

German sense of the word, and their formation did not in any sense augur a change of

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[63] In May 1940 there were three cavalry DLMs, with a fourth being formed, and three DCRs, again with a fourth unit in the process of being formed.

[64] The B1 and B1*bis* tanks had to be built by hand, and competed with other programs (notably the navy) for scarce production facilities. The numerous bottlenecks in the production process and the complex design meant that by May 1940 there were only 274 in the French order of battle. Though well armored, it was quite slow and had a limited range. For more details on financial and industrial problems during France's rearmament see Robert Frankenstein, *Le Prix du Réarmement Français, 1935-1939* (Paris: Publications de la Sorbonne, 1982).

[65] In late 1938 Daladier, the Minister for War, "deferred formation of full armored divisions, accepting the argument of the army's conservative inspectorates that more time was needed for planning." May, *Strange Victory*, p. 183. Daladier had recently imposed a spending ceiling in an attempt to reverse the flight of capital abroad, and this may have contributed to his decision to delay. Capital flight was a recurrent problem during French rearmament, especially during the leftist Blum administrations. Frankenstein, *Le Prix du Réarmement Français.*

[66] The official manual for armored combat was only approved by Daladier on March 27th 1940, although its contents were widely known and accepted long before official publication. According to the French army's official history, the delay was due to arguments between the Inspector of Tanks, who wanted to form armored divisions, and the Inspector-General of Infantry, who "still believed in the effectiveness of mixed infantry and tanks during the offensive." This official explanation seems to be advanced with the benefit of hindsight. Before 1940 there is no mention of the Inspector of Tanks pushing for the adoption of different doctrine. Rather the arguments were over the repeated delays in the formation of armored units and the production of the tanks themselves. Dutailly, *Les Problèmes*, p. 191.

heart about how armor should be used. Rather, the high command regarded these units as a pool of heavier "mass maneuver" tanks, organized into battalions that would be at the disposal of higher commanders as the need arose. What they really saw, I would argue, is not what we understand as an armored division but something more akin to an army tank reserve.[67] Commanders would be able to use one or more battalions of a DCR to reinforce their forces prior to an assault, or if a threatened sector needed reinforcements. There is some evidence to support this view, beyond the fact that *Divisions Cuirassées de Réserves* translates as "Reserve Armor Divisions". The DCRs were not given any missions outside of the methodical battle framework, and had only two batteries of organic artillery and one battalion of motorized infantry (reinforced), which strongly suggests that they were not meant to be used alone. When the campaign opened, two of France's three DCRs were attached to the General Reserve whereas all ten German panzer divisions were committed from the outset.[68] The official French army history concludes that "the few original ideas that are developed [in the 1940 regulations] are framed within a set of prescriptions conceived for the previous war. Furthermore, they fail to address the use of the armored division. They therefore encouraged the belief that large armored units were, like armor brigades, only administrative formations [i.e. not integrated units but a collection of assets], to be used piecemeal according to demand."[69]

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[67] The DCRs were originally organized with this in mind, with few assets other than tanks. The rest of the unit was to be filled out in wartime. The lone dissenter on the Superior Council in December 1938, when this decision was made, was General Héring, who argued that the DCRs should have enough communications, air defense, supply, and artillery assets to be capable of autonomous operations. He was overruled. Doughty, *Seeds of Disaster*, pp. 22-23, 23fn37, 166.

[68] Seven with Army Group A in the south, three with Army Group B opposite Holland and northern Belgium.

[69] Dutailly, *Les Problèmes*, p. 196 (my translation).

VII. Evidence of the Impact of the Doctrinal Development System on Military Innovation

Germany began the interwar period with a better doctrinal development system than France. The German army was a world leader in wargaming and simulation, and this expertise was very much in evidence during the Lutz exercises of 1927-1932. The succession of carefully crafted scenarios, the professional umpiring, and the simulation of a realistic enemy paid off. Lutz's conclusions about the basic principles of tactical armor doctrine proved remarkably accurate. Furthermore, since the method by which these conclusions were reached was familiar and respected by the rest of the German officer corps, Lutz's recommendations were acted upon. German experimentation with armor moved on to consider questions of unit composition and operational doctrine, culminating in the 1937 exercises, which led to the first draft of blitzkrieg doctrine.

It seems clear from the cases that the French doctrinal development process, and their wargames in particular, let them down. There was less attention to simulating a flexible and reactive enemy, and umpiring was less independent and professional. The practice of appointing the commanding officer, who had a vested interest in the outcome, to be both exercise designer and chief umpire certainly conflated too many functions in one person. Separating game designers, umpires, and game "consumers" is a basic requirement for good wargaming. Brewer and Shubik make this point repeatedly in *The War Game: a Critique of Military Problem Solving* (1979), which includes a lengthy code of best practice for wargame design (pp. 259-326).

During French exercises Red players were actually discouraged from operating according to German doctrine. Although "*manœuvre à l'allemande*" was considered appropriate during map maneuvers, according to 1939 training guidelines it "must never be done when maneuvering with troops [i.e. during exercises], which would risk distorting their ideas and learning."[70] French exercises posited a French enemy, one that operated on the same assumptions as those that underpinned the methodical battle doctrine. Even French exercises that dealt with the problem of deploying the covering force[71] at the outset of war, a scenario that involved considerable maneuver, assumed a cautious and slow-moving enemy. Their poor simulation of enemy forces in scenarios simply helped to convince them that they were right to be skeptical of offense dominant German doctrine. It allowed them to believe that they had correctly identified the "nature" of modern war, and that they could confidently prepare for it without reference to German thinking on the subject.

However, the most important shortcoming in the French effort to develop new doctrine was the poor choice of scenario. The narrow set-piece assault scenario that framed the trials conducted in 1932, 1933, and again in 1937, so restricted the scope for learning that it effectively crippled the doctrinal development process. The narrowness of the scenario

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[70] *Note sur l'instruction en 1939*, S.H.A.T. 7N4001, November 7th, 1938, in Dutailly, *Les Problèmes*, pp. 234-235 (my translation).

[71] The covering force consisted of France's active duty professional soldiers and the contingent currently completing national service. In the event of attack, this relatively small force would have to secure France's borders whilst the mass of reservists mobilized.

led to narrow conclusions about what tanks were good for. The exploitation phase of the battle, on which the tank was to have a revolutionary impact, was never simulated.

The paradox is that the French, who had no deep respect for wargaming, let these poorly designed wargames guide procurement and doctrine. Either everyone involved genuinely thought that future wars would be dominated by the WWI style engagements they simulated, or there was never any real remit for challenging the methodical battle concept. The scenario they gamed and the doctrinal solutions they selected strongly suggest that the purpose of these trials was limited to finding a means of integrating tanks into the methodical battle.

The parochial interests of the dominant infantry branch of the French army may have led them to deliberately restrict experimentation. The infantry had no wish to see the infantry-centric methodical battle replaced by doctrine in which armored formations would play a more prominent role. The official French army history emphasizes that the infantry branch drafted the armor regulations of 1940. The chairmen of the commission that wrote the regulations were Generals Dufieux and Garchery, the two Inspectors-General of Infantry between 1936 and 1940, who took over the commission because they knew it might otherwise produce "structural changes" that they did not want.[72] One of the vice-presidents of the commission was Martin, by then a General and Inspector of Tanks.

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[72] Dutailly, *Les Problèmes*, p. 192.

The French case therefore fits the predictions made by organization theory, which would expect parochial interests to try and fend off threatening doctrinal changes. However, simple risk aversion may have also played a part. Given their lack of familiarity with wargaming as a means of doctrinal development, the French may have believed that no simulation could provide evidence compelling enough for them to abandon their tried and trusted doctrinal framework in favor of something new. They therefore concentrated on upgrading and improving the methodical battle doctrine by devising ways to use armor within it.

French failure was thus overdetermined: not only did the French not possess the simulation tools available in Germany, but the infantry branch had strong reasons for limiting the scope of any doctrinal development effort that called into question the infantry's status as "the queen of the battlefield". Given the esoteric nature of the military problems involved in armored warfare, there was little interference by civilians.[73]

Yet even if the infantry did deliberately limit the scope of doctrinal development efforts, there was still an opportunity to identify the key doctrinal problem presented by an opponent with armored forces: how to contain a penetration by fast moving armored and motorized units. Insuring against such an attack did not require abandoning the methodical battle. The DLMs might have been given the mission of containing an enemy

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[73] The attempt by de Gaulle to obtain civilian support for military reform was not concerned with armored doctrine so much as with questions concerning the covering force and by arguments over the size of the professional army. Civilian intervention was in any case made harder by the complexity of the doctrinal problems involved and the lack of clear doctrinal alternatives to the status quo. There were no mavericks to help them, because there was no alternative vision for armor doctrine within the army.

breakthrough, or some kind of rapid response reserve units with anti-tank capabilities could have been created. The fact that no such measures were taken shows that exploitation was considered simply infeasible, a fact that owes more to poor wargames than organizational interests. Even small changes to the way the French wargames were run, such as allowing for the possibility of surprise during a dawn attack, could have alerted them to the difficulties of containing an armored exploitation once it was underway.

In France, poor simulation and parochial branch interests reinforced each other. In Germany, wargames helped overcome institutional resistance to doctrinal change. There were plenty of skeptics there too, as Beck's reaction to the 3rd armored division's success in the 1937 exercises attests. The difference was that armor advocates were allowed to use wargames to make their case. The German commitment to a rational doctrinal development process overcame the forces of conservatism and branch interest allied against any changes to the status quo.

I have argued that the German use of wargames was decisive in shaping first the tactical and then the operational dimensions of blitzkrieg doctrine. The operational planning that eventually resulted in the *Fall Gelb* war plan for the campaign against France demonstrates this same approach in a different context. Operational planning is not, strictly speaking, doctrinal development, but it draws on the same set of skills, and demands the same commitment to a rational, empirical approach.

In the following section I present a brief summary of the *Fall Gelb* planning process. It shows that far from being a stroke of luck, the German development of blitzkrieg doctrine was typical of the way they went about military preparations generally. The planning process made extensive use of wargames, proceeded through multiple rounds, and its eventual conclusions were based on the best evidence that simulations could provide.

VIII. Planning for *Fall Gelb*: The German Approach Pays Off Again

Developing a war plan for the campaign against France involved translating the operational insights that had resulted from the 1937 exercises into a workable plan that put the mobility and firepower of the panzer divisions to good use at the campaign level. The Germans had done this once before, in Poland the previous fall. Their success there had confirmed that blitzkrieg doctrine (the term had been coined during the Polish campaign) was highly effective against a less mobile enemy. The doctrine itself was refined based on lessons learned in combat. Additional infantry was added to the panzer divisions, partly because it had proved its worth, partly because reassigning tanks allowed the creation of new armored divisions. Captured Czechoslovak tanks were added to the order of battle. The two light armored divisions that had fought indifferently in Poland were given heavy tanks and turned into ordinary panzer divisions. The speed with which the lessons of the Polish campaign were acted upon is yet another example of German doctrinal development at work.

Now the General Staff faced the challenge of putting these doctrinal principles into

practice in the unique setting of the French campaign. If doctrine represents the common

guidelines that lay down the way to fight, operational planning is the process of deciding

what doctrinal principles to emphasize and which to modify at the operational level given

the specific setting and the unique nature of the enemy. It is the process of customizing

doctrine for use in a single scenario.

The main problem for planners was the fact that the vast majority of German units were

not armored, and most were not motorized at all. The challenge was to find a way to

exploit the mobility of the ten available armored divisions to give the army as a whole an

advantage. The geography of the Franco-German border and the nature of the enemy also

presented far greater challenges than those faced in Poland. The French and British were

better armed than the Poles, had a far greater anti-tank capability, thousands of tanks of

their own, and an air force.[74] The sheer number of Allied troops expected to move into

Belgium, the depth of their deployment, and the confined geography of the Belgian plain

offered little opportunity for maneuver, and there were fears that a German offensive

would become bogged down. On the other hand, if the Ardennes and the Meuse could be

crossed, the more open and weakly-defended terrain of northern France might offer an

opportunity for exploitation and maneuver. Wargames helped first to identify this

opportunity, and then plan a campaign to exploit it.

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[74] On May 10th 1940 135 German divisions faced 119 Allied divisions, of which 104 were French. The neutral Belgians and Dutch provided another 33 divisions between them. Quality was comparable, with almost identical proportions of first and second-line divisions on each side. The Allies had 3894 tanks to the German's 2439, and although some were obsolete designs many were actually superior to the German machines. Only the German air force had a distinct edge, with newer, faster aircraft. May, *Strange Victory*, pp. 477-479.

Fall Gelb [75] was gamed and re-gamed exhaustively between October 1939 and the end of

April 1940. As the intelligence-gathering and the wargames continued through the winter

and spring of 1940 many German staff officers came to believe that there was simply no

alternative to the Ardennes variant that offered a chance of decisive victory.

Initial ideas for *Fall Gelb* were hurriedly put together on Hitler's orders in October 1939,

in the face of considerable opposition on the part of the German army high command,

most of whose members thought the undertaking hopeless.[76] The initial concept was

similar to the Schlieffen Plan, with the main axis of attack through Belgium, and possibly

parts of Holland. The planning process therefore began amid great skepticism within the

military high command, and took a conventional contingency plan as its starting point.

As in the development of blitzkrieg, a combination of rigorous simulation and careful

analysis eventually convinced military leaders (and Hitler) to attempt something risky

and new.

By late November 1939 General Erich von Manstein was pushing for a greater role for

Army Group A (the southern army group) and by mid-December he was arguing that

instead of meeting the Allied armies head-on in Belgium, the German *Schwerpunkt*

should be further south, around the area of Sedan on the Meuse. If the Meuse could be

crossed, German forces would be well placed to outflank the enemy to their north,

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[75] "Case Yellow", or "Plan Yellow".

[76] May, *Strange Victory*, pp. 215-226.

possibly even enveloping them completely if they reached the Channel coast. However,

at this stage the German high command was leaning towards the more conventional

northern plan, whilst Hitler preferred a "play-it-by-ear" concept, in which German forces

would be redeployed south if the Allies drove into Belgium and if crossings on the Meuse

could be secured. At this stage the debate gave way to a whole series of map maneuvers

designed to answer specific questions about the rival warplans.

In December 1939 General Franz Halder "ordered a day-long wargame to test three

possible versions of *Fall Gelb*."[77] Played at Zossen on December 17th, the map

maneuvers tested the feasibility of each of three warplans: a *Schwerpunkt* for the panzer

divisions centered on the Belgian plain, a *Schwerpunkt* for the panzer divisions centered

on Sedan and its surrounding area, and Hitler's play-it-by-ear concept. The Allies were

played by a team led by Colonel Ulrich Liss, the head of the "Foreign Armies West"

branch of the Abwehr, German military intelligence. Liss was an expert on the French

military, and played the role of General Maurice Gamelin, the Allied commander-in-

chief.

The first Zossen game yielded some valuable insights. According to Liss, it showed that

"a German attack through the Ardennes would offer the best prospects to achieve a

breakthrough in open territory and to catch the whole enemy force at its hinge."[78] Adolf

Heusinger, assistant to the head of the German team, General Stülpnagel, later claimed

that the game showed the play-it-by-ear concept to be unworkable. Redeployments took

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[77] Ibid, p. 257.

[78] Ulrich Liss, *Westfront: 1939/40; Erinnerungen des Feindbearbeiters im O.K.H.*, (Neckargemünd, K. Vowinckel, 1959), pp. 106-107.

too much time for opportunities to be exploited, and the initiative was lost. Heusinger

also thought the game showed that another Schlieffen Plan would not work, as the

Germans would meet the bulk of Allied forces head on in Belgium.[79]

Shortly after the Zossen game another map maneuver was held at Eighteenth Army

headquarters in Düsseldorf, which again cast doubt on Army Group B's ability to reach

the Belgian coast, should the Allies rush the bulk of their motorized and armored

formations north from the French border. "Partly as a result of additional war games,

partly just through analysis of details of transport, supply, and the like, Halder leaned

increasingly towards a Plan Yellow with an Ardennes *Schwerpunkt*."[80]

In early January 1940[81] a second game was held at Zossen, to examine in more detail the

possibility of an offensive through the Ardennes. Two new pieces of intelligence

concerning French dispositions were now available. First, the Abwehr had learned that

the French Seventh Army, which included a large proportion of mechanized forces, had

been designated the "Army of Intervention in Belgium." Second, intelligence revealed

that the Sedan sector was defended by the Second Cavalry Division, a second line and

still largely horse-borne unit. This information made Liss, who again played the role of

Gamelin, more confident that the French would indeed rush the bulk of their forces north

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[79] May, *Strange Victory*, p. 260.

[80] Ibid, p. 261.

[81] The exact date is not clear from the records, but the game occurred after December 28th and before the Mechelen incident on January 10th.

into Belgium. It also suggested that forcing the Meuse crossing might be easier than previously thought.[82]

In early February Halder and Guderian attended another wargame, this time held in Koblenz, at the headquarters of Army Group A. Following the game, "Halder agreed to add another panzer division to the assault force, but it remained an open question when the force was to reach the vicinity of Sedan and how many divisions would have to arrive before an attempt was made to cross the Meuse."[83] Three months later, on May 13th during the crucial battle on the Meuse "the operational orders that Guderian issued to division commanders were, word for word, those he had used in his last wargame at Koblenz."[84]

Another game, held on February 14th at Twelfth Army headquarters, suggested that a crossing might not be possible until day nine of an offensive, by which time strategic surprise would have been lost and Allied redeployment south could be expected to be underway. Halder reported that even Guderian now seemed doubtful of success. Adding a further note of caution, Rundstedt and Sodenstern, his chief of staff, now revived other concerns about the risks of independent armor operations. If the armored spearheads could not cross the Meuse on their own, it might be safer for the tanks to wait for the

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[82] May, *Strange Victory*, pp. 261-262.

[83] Ibid, p. 262.

[84] Ibid, p. 428.

infantry coming up behind them and attack together.[85] Unfortunately, the additional time

that it would take to bring up the infantry undermined the whole rationale for an

Ardennes *Schwerpunkt,* since the Allies would have time to recover from their surprise.[86]

This was confirmed during a wargame at Zossen in mid-March, which convinced Halder

that the Rundstedt and Sodenstern plan would have no chance of success. New

intelligence now placed two French DLMs, the best armored units in the French order of

battle, with the French First Army in central Belgium, not with the Seventh on the

Channel coast. Furthermore, the Germans now knew that France was forming three or

perhaps even four new DCRs somewhere in northeastern France. This allowed Liss,

again heading the Red team, to mount an Allied counter-attack sooner. The game

suggested that unless the Germans could get substantial forces across the Meuse in *less*

than five days the Allied counter-attack would be effective, threatening the whole of

Army Group A with annihilation.[87]

The timing of a Meuse crossing was therefore crucial, and waiting for the infantry

divisions and more artillery was out of the question. Since a northern *Schwerpunkt* would

probably result in stalemate and a war of attrition that Germany could ill afford, Halder

decided to risk the independent use of the armored formations to force the river crossings

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[85] This was not necessarily at odds with the letter of German doctrine. The 1938 regulations specified that tanks or infantry could lead the way, depending on the situation. German doctrine incorporated blitzkrieg as a new set of tactical and operational techniques, not as a replacement for all previous doctrine.

[86] May, *Strange Victory*, p. 263.

[87] Ibid, p. 264.

rather than abandon the Ardennes plan altogether. There were no other options on the

table that promised at least a chance of decisive victory.

Yet more games were held in March to identify transport problems along Army Group

A's axis of advance.[88] At the end of the month another big game was held at Zossen that

identified a potential weakness in the Ardennes variant of *Fall Gelb*. During play,

General Fedor von Bock's Army Group B became bogged down in fighting around the

Albert Canal in Belgium. This allowed Liss, once again playing Gamelin, to redeploy

additional troops south to strengthen the counter-stroke against Army Group A, which

had again managed to cross the Meuse. Halder responded to the game by urging the

Luftwaffe to provide more support for Bock in the early days of the campaign, to ensure

that Army Group B kept moving forward long enough to keep a large part of the Allied

force pinned down in Belgium. Planning continued, particularly concerning the logistics

of the drive through the Ardennes and the deception concerning the true location of the

Schwerpunkt, but the general shape of *Fall Gelb* had been settled.[89]

Wargames played a critical role in the development of *Fall Gelb*. Hitler's play-it-by-ear

concept was rejected as unworkable, despite its source. The balance of opinion within the

high command slowly shifted in favor of the southern option as evidence mounted that

the most likely outcome in the north would be stalemate and, conversely, that there was a

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[88] Aerial photographs as well as maps were used, and field units had to report the exact strengths and march intervals of all the units involved down to individual repair trucks. " Wilson, *The Bomb and the Computer*, p. 30.

[89] May, *Strange Victory*, pp. 264-266.

possibility of success further south. Wargames helped convince key actors like Halder

that an offensive through the Ardennes was possible, and that it offered at least a chance

of a decisive victory, whereas a frontal clash in Belgium did not. Rundstedt and

Sodenstern's attempts to impose a more conventional, less risky, approach to securing the

Meuse crossings were rejected based on map maneuvers. Successive games identified the

timing of a Meuse crossing as one of the keys to success, and the number of days

available for doing so was carefully calculated. Wargames also showed that the Meuse

could be crossed in time, given what was known of Allied dispositions. If the Meuse

could be crossed and the Allies rushed north, map maneuvers showed that an

envelopment was possible, which led to a renewed interest in how best to draw them into

Belgium by feigning strength in the north.[90]

The attention to the three basic requirements of rigorous wargaming seen in the Lutz

exercises was in evidence again, this time in map maneuvers rather than exercises. This

being an operational plan, the scenario was already set, but the multiple rounds of testing,

the professional umpiring, and the care with which French responses were simulated by

Liss and others are all reminiscent of the doctrinal development process. The German

predilection for rational, empirical answers to difficult military problems and the faith in

testing and simulation are again in evidence.

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[90] In fact, Allied plans called for a rapid drive north anyway. The Breda variant of the Allied warplan which was put into effect on May 10th called for a mechanized drive as far as Breda, in the southern Netherlands. The Allies did not have a play-it-by-ear strategy either, and the drive north was not in reaction to the German feint. For a discussion of Plan D and its Breda variant see Robert A. Doughty, *The Breaking Point: Sedan and the Fall of France, 1940* (Hamden, Conn.: Archon Books 1990).

IX. Explaining the Variation between French and German Approaches

The two case studies show that wargaming was an important driver of doctrinal development during the interwar period, especially in Germany. The last section is further evidence that wargaming has particular value in explaining the fall of France, both in terms of explaining the superiority of German doctrine and the development of *Fall Gelb*, which leveraged that doctrine to maximum effect. The cases show that the Germans were using simulation to help them innovate and plan much more effectively than the French. In this section I offer a tentative explanation of why that was.

I have made the point that military simulation requires technical expertise. Because the Germans designed wargames that paid attention to the three basic problems of game design, they created more powerful tools. But this simply begs the question: why did the Germans do so, whilst the French did not? Wargaming was hardly classified technology, and the French could have improved their simulation capabilities had they wanted to.

The key difference was cultural. Wargaming was one manifestation of a German cultural mindset that favored rational analysis, empirical testing, specialization, and professionalization. In short, German culture in general, and the organizational culture of the military in particular, had adopted Weberian norms characteristic of advanced industrialized societies in which bureaucracy was becoming the dominant organizational form. [91] This transition was underway across the developed world, but had progressed

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[91] Max Weber, *Wirtschaft und Gesellschaft*, part III, chap. 6, pp. 650-678.

further in Germany than in France, especially in the realm of military affairs. Dallas

Irvine makes just such a Weberian argument to explain the origins of Capital Staffs (more

usually called General Staffs).[92] Irvine argues that, during the course of the nineteenth

century, increasing complexity and new technology demanded new institutional

structures to plan for war during peacetime and manage military forces. The two key

functions of Capital Staffs were to collect information on potential enemies, and to

prepare contingency plans for use in wartime. Irvine also notes that these changes took

time to be accepted, and that innovation was uneven across the Great Powers, with

Germany taking the lead. A similar argument can be made about the systematizing of

doctrinal development, an area where Germany again took the lead. Where the General

Staff arose as a response to the need for better military planning, wargames developed

into the means of making those plans. Both were responses to the same underlying

pressures: an increasingly bureaucratized society in which the military was grappling

with the increasing complexity of modern warfare.

Increasing bureaucratization made a systematic doctrinal development process founded

on wargaming possible. Accelerating technological change made it necessary. Successive

wars might now be quite unlike each other because of the pace of technological change,

and this brought with it a new emphasis on doctrinal development in peacetime.[93] For

most of history technological and doctrinal diffusion has been the driving force behind

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[92] Dallas D. Irvine, "The Origin of Capital Staffs", *Journal of Modern History*, Vol X, No.2, June 1938.

[93] I suspect that there has also been a shift in the timing of innovation. Most significant innovation today occurs in peacetime, as Rosen argues (*Winning the Next War*, pp. 252-253), whereas before the nineteenth century most military innovations probably occurred in wartime, and were then widely emulated.

military change. Significant changes in doctrine and weapons were infrequent, and their diffusion sometimes took decades. Doctrine was a matter of tradition and the particular battlefield tactics favored by individual commanders, not the formalized and overarching structure it later became. By the 1890s, the increasing size, complexity, and technological dependence of the armed forces required a new approach. A formal doctrine was now a necessity, as a means of disseminating a code of best practice through such large armies, and of maintaining some unity of command. The problem was that the technology that had made a formal doctrine necessary kept evolving, which meant that doctrine had to evolve with it. Wargames can be seen as an attempt to rationalize the development of doctrine in this increasingly complex and fluid environment.

I do not propose to explain why Germany adopted the values of a bureaucratized "Weberian" state more readily than its neighbors, but there is plenty of evidence that it did. There are other manifestations of the same mindset visible in military developments going back a half century before the interwar period. The creation of the General Staff, a new institutional arrangement that placed a premium on professional military training and corporate leadership is one. The pioneering use of railways during the wars of unification, and the systematic planning capability this required is another. Doctrinal adaptation during WWI and the comprehensive effort to distill lessons learned from that war under von Seeckt in the early 1920s also compare favorably with French efforts, again because they were more rational and systematic.

The transition from the early wargames used for officer training since the 1820s to the use of simulation for planning and doctrinal development occurred gradually, reflecting the increasing bureaucratization of the state and its military apparatus. The first games held in support of doctrinal development, such as the trials of the breech-loading rifle, were held in the 1860s.[94] By the 1890s, Bucholz claims that wargaming had become the "keystone of Prussian war planning because it integrated the other three elements [organizational, educational, and representational] under simulated battle conditions." [95] Bucholz was looking at the development of war planning capabilities rather than doctrinal development, but as we have seen with *Fall Gelb*, the two activities are similar. His main point is that in the years prior to WWI the German army moved towards a more analytical approach in military education, management, and war planning.

Brian Nichiporuk argues, in his Ph.D. dissertation, that one reason the German army developed superior doctrine during the interwar period was because it approached the problem of analyzing the lessons of WWI in a more scientific way than did its French counterpart.[96] He charges the French with relying on a "geniuses" model of military leadership, where despite having put in place a General Staff-like institutional structure actual power still rested with a handful of leading figures who each cultivated entourages

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[94] Brewer and Shubik, *The War Game*, p. 50.

[95] Bucholz identifies four components of Prussian war planning: the organizational aspect, including the creation of the General Staff; the representational aspect, creating accurate maps and teaching officers to use them to control their forces; the educational aspect, the study of military history; and the analytical aspect, wargaming. Arden Bucholz *Moltke, Schlieffen and Prussian War Planning* (Oxford: Berg, 1991), pp. 12-17.

[96] Brian Nichiporuk, *Learning the lessons of war: The Impact of WWI upon the Interwar Great Powers* (Ph.D. Thesis, M.I.T., 1993).

of officers personally loyal to them. Nichiporuk argues that all round staff officer training

suffered as a result, and that this style of leadership made it more difficult to undertake

any systematic examination of the lessons of WWI.

Ironically, despite this poor record of historical analysis, the French were more reliant on

the study of military history for doctrinal development than the Germans. Ladislas

Mysyrowicz's identifies four schools of thought on military innovation within the French

officer corps during the interwar period, three of which depended entirely on using the

lessons of history to guide future development.[97] The labels he uses are somewhat

fanciful, but the descriptions are revealing. The "historians", the largest of the three

groups, continued the long tradition of distilling military lessons about the future from the

past. The "exceptionalists" and "materialists" were also "historians", but believed that

WWI was unique, having been the first modern war, and that all previous military history

was irrelevant. Some argued that only principles "proved under fire" were valid. Others

turned the use of battlefield terrain into a complex science in its own right, subdividing

the landscape of the trenches and no-man's-land into "cells" and analyzing patterns of

crossfire and potential routes of advance. The last school, the "artists", rejected the

codification of doctrine altogether, claiming that all decisions should be left to the

judgment of the commander, a position that came down to endorsing the military genius

conception of leadership. None of these intellectual schools emphasized experimentation

of any kind. Instead of the practical and empirical German efforts under way across the

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[97] Ladislas Mysyrowicz, *Autopsie d'une défaite: origines de l'éffondrement militaire Francais de 1940*, (Lausanne: Éditions L'Age D'Homme, 1973).

border, the French engaged in an introverted and theoretical debate about the "nature" of modern war.[98]

The German embrace of bureaucratization was a great advantage when developing a modern system of doctrinal development. Such a system reflects many of the features of bureaucratization itself: specialization and professionalization (umpires, game designers, and so on); the emphasis on rationality and empirical testing, and the corporate model of leadership. Above all bureaucratization encouraged the integration of disparate elements (exercises, map maneuvers, theoretical debates, foreign intelligence, the lessons of WWI) into one institutionalized process. Nichiporuk identifies what he calls a scientific approach to learning from history, but this is only one part of a larger system of doctrinal development, in which wargaming played the central part.

In France there was no wholehearted embrace of modernity and of new analytical methods, and this reflected the lower level of bureaucratization, especially within the army. With their rudimentary doctrinal development system the French had no way of building consensus in favor of a radical change in doctrine, and the infantry branch remained entrenched in its dominant position. Throughout the interwar period there appears to have been no mandate to test and develop doctrine outside of the methodological battle framework established in the 1921 regulations. It should be noted that there is no direct evidence that Touchon, Martin, and the rest rigged the exercises

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[98] Marc Bloch, the author of *Strange Defeat: A Statement of Evidence Written in 1940*, heard a graduate of St. Cyr exclaim during the collapse of 1940: "Should we believe that history has mislead us?" Mysyrowicz, *Autopsie,* p. 40.

they conducted. There was no controversy over the results. No disgruntled group of officers came forward at Riom or in 1945 to argue that the army had deliberately curtailed efforts at reform in this way. Nevertheless, the narrow scenario that was repeatedly gamed suggests that the French were not interested in finding radically new roles for armored units.

However, as I argued above, the fact that organizational interests may have limited the scope for new doctrine does not mean that the low quality of the French doctrinal development process was immaterial. Rather, the two problems reinforced each other. The lack of an effective means of developing new doctrine meant that arguments about the future of armored warfare could not be resolved, which in turn militated strongly in favor of the infantry's preferred solution, which was to update the methodological battle doctrine. Nor is it clear that the infantry's position of leadership would have been put in question by the development of better tactical armored doctrine. After all, these same military leaders went ahead and created the DCRs, to say nothing of the parallel process underway within the cavalry branch, which was developing the DLMs. Since French strategy was broadly defensive, armored units would be unlikely to achieve the kind of prestige and independence that might have compromised the infantry's dominant position within the high command. They could have been used to counter German armored thrusts, as the inadequate DCRs in fact attempted to do. Without a doctrinal development process capable of settling disputes over what armor could and could not do, the French high command decided that the risks of a radical doctrinal departure were unacceptably high.

Though the French case lends some support to the organization theory argument advanced by other theorists, the cases presented here do not support the argument that systemic pressures contributed to French doctrinal inadequacy. The argument is that the defensive nature of French grand strategy privileged a defensive doctrine, which had no use for an offensive armor doctrine. Posen makes this argument in *Sources*, adding that alliance politics further increased the pressure on the French to maintain a defensive posture. However, this argument overstates the influence of the balance of power on ongoing doctrinal development. Many of the problems examined in wargames, including how to conduct armor operations, are not obviously related to the specifics of alliance policy or current international tensions. The efforts of the British and Soviets to develop armor doctrine during the 1920s and early 1930s were not driven by offensive strategic aims.[99] They were attempts to stay abreast of new technology and remain competitive in an age of industrialized war when technology was becoming ever more important. What is more, early doctrinal development efforts are cheap: there is no need for the state to invest significant resources in order for it to explore new doctrinal possibilities. Strategic demands dictate the allocation of resources between different military capabilities, but they do not determine doctrinal content. Thus, the British developed new armor doctrine quite independently of their strategic needs, but baulked at committing the resources to transform their army in line with that vision. In 1940, France lacked balanced armored units (with sufficient organic infantry and artillery) and a tactical doctrine for their use.

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[99] I have already mentioned the development of the Soviet deep battle doctrine. The British conducted wargames involving experimental armored units during 1926-1931 and 1931-1934 during Lord Milne's tenure as Chief of the Imperial General Staff (1926-1934). His more conservative successors discontinued the program.

Developing these would not have necessitated changing French strategy or significantly altering the allocation of resources; the French built thousands of tanks, and formed six division-sized armored units, with two more being stood up by the spring of 1940. Whilst it is true that French strategy did not require the kind of offensive capabilities at the onset of war that German strategic aims did, it does not follow that there was no need for an effective armored doctrine at the tactical level, or for use in later offensive operations.

The lack of an intimate connection between the prevailing balance of power and the direction of doctrinal development is visible in the German case too. The development of what became blitzkrieg began before the rise of Hitler, at a time when not only was Germany weak and on the defensive, but armored vehicles and military aircraft were banned outright. It is hard to imagine a doctrinal framework more at odds with the prevailing geopolitical situation. Having taken a close look at French and German doctrinal development, balance of power considerations seem to have been of little consequence in determining the content of doctrine. Differences in technical expertise and in the institutional and cultural environment were more important.

X. Conclusion: What Does This Mean For The Study Of Military Innovation?

Perhaps the most important point is that it is not enough to build a theory of military innovation that treats doctrinal content as an emergent quality of a set of constrains, whether these are bureaucratic interests, civilian preferences, cultural beliefs, or systemic pressures. These variables do affect the chances for innovation to take place, as they

shape the environment in which doctrine is developed. But they do not determine

doctrinal content. One reason that theorists have not come to grips with this fact is the

ambiguous usage of the term doctrine, which is often used as shorthand for other

concepts, such as strategic posture. I have chosen to consider operational and tactical

doctrine as a set of instructions on how to fight. It is, after all, the content of these

instructions that determines whether or not doctrine is innovative.

In first mover situations, new doctrine is developed within the military itself. There is no

alternative source of expertise, and nobody to imitate. When Posen claims that internal

innovation is uncommon, he means that new internally developed doctrine is unlikely to

be spontaneously embraced by the military leadership, for organizational reasons. The

ideas themselves are developed internally. The cases support this view, but also show that

the quality of the ideas and the chances for their acceptance are both affected by the

nature of the doctrinal development process itself.

In the French case, the infantry branch constrained efforts to develop new armor doctrine.

The problem was not just the threat to the infantry's parochial interests, but the pervasive

uncertainty about what tanks were capable of doing. Rigorous wargaming as part of a

systematic doctrinal development system could have reduced this uncertainty. Whether

the existence of a better system would have been enough to overcome the entrenched

supporters of the methodical battle in the French case is difficult to assess. But it might

have helped, perhaps leading to more extensive modifications of the methodical battle

doctrine with a focus on the key issues of countering enemy penetrations and

exploitation. This might have made all the difference in 1940, and would not have required abandoning the methodical battle concept, as these new capabilities could have been built into the DCRs that France was already committed to creating.

The planning for *Fall Gelb* and the Mecklenberg exercises of 1937 illustrate the way that insights gleaned from games become a factor in debates within the military organization and the civilian leadership.[100] This suggests that wargames are another way that civilians can obtain the required expertise in military affairs to act as interveners, a problem that Posen addresses by invoking mavericks. The conclusions generated by successive rounds of wargames can develop into new doctrinal options that become part of the "thin menu" from which civilian policymakers have to choose. Within the military, the same dynamic explains how reformers are able to build a base of support for their ideas. Military officers interested in new ideas will do a better job of convincing others of the need for change if they have tangible evidence to back up their arguments with their peers and with potential civilian allies.[101] Rosen and Posen are wrong to argue that there is no way of knowing if doctrine will work in peacetime. Although combat experience remains the ultimate arbiter of a doctrine's validity, wargames can provide a degree of confidence in doctrine even in peacetime.[102] Historical studies of military innovation contain many

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[100] Wilson quotes a "German officer" who claimed that one of the main purposes of the first Zossen wargame played during the development of *Fall Gelb* was "to provide a chance of raising and discussing several controversial problems within a carefully selected and critical circle." Wilson, *The Bomb and the Computer*, p. 30.

[101] Wargames therefore provide a better explanation for the shift in doctrinal beliefs within a military organization over time that Rosen's promotion pathways, which imply that individual beliefs are fixed and that only the promotion of believers from below can alter the views of the organization as a whole.

[102] Such confirmation is often called validation. Doctrine that has proved consistently successful in wargames is considered validated, albeit to a lesser degree than combat tested doctrine.

instances in which key actors become converts to new ideas and go on to build a
constituency for change as much through persuasion as through the promotion of their
supporters.

Wargaming data can therefore be used by officers to justify breaking rank, and can
provide civilians with powerful arguments to compel the military to consider a new
course of action. This seems to have happened in the German case after the 1937
exercises, where the success of the Red armored division led to changes in the
Kriegsakademie curriculum and to concepts of operation put into practice in Poland two
years later. The quick acceptance of these ideas, despite a considerable level of
skepticism at the top (demonstrated by Beck's criticism during the exercises) owes much
to the way that the exercises bolstered the case that armor advocates had been making.
The role that wargames play in shaping the debate within military organizations, and
between military and civilian leaders clearly requires further research. The two cases
investigated here support the hypothesis that wargames play a prominent role in shaping
decision-making during the doctrinal development and war planning processes.

The underlying reason for German superiority in doctrinal development and operational
planning was the high degree of bureaucratization of the society as a whole and of the
army in particular. This cultural mindset privileged rational, methodical, and empirical
approaches to problems. German wargaming expertise was one manifestation of this, and
opened up new ways of developing doctrine through simulation in peacetime, an
undertaking which itself reflects the same rational, systematic mindset. I have not tried to

explain why bureaucracy as an organizational form was in a more advanced stage of development in Germany than in France, merely arguing that it was, and that this had important consequences. Weber thought of bureaucratization as an unavoidable consequence of modernity, and if he is right France would have eventually developed a better system for managing military innovation, but it had not done so by the interwar period.[103]

The German triumph in 1940 was the product of a superior doctrinal development process and of meticulous operational planning. German doctrine and planning were both heavily dependent on wargames, in which the Germans were world leaders. Wargames, in turn, were the product of a bureaucratized culture that recognized that modern warfare requires constant adaptation, and sought an institutionalized solution. In the words of the *Truppenführung*: "The conduct of war is based on continuous ongoing development. New tools of war give armed conflict an ever changing shape."[104] Rising to the challenge, the German army developed a way of managing this ever-changing complexity, developing a system of doctrinal development that allowed them to make full use of these "new tools of war."

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[103] One interesting area for future research would be to compare post-WWII systems of doctrinal development to see if differences in quality and rigor are still associated with cultural differences.
[104] Bruce Condell and David T. Zabecki (eds.), *On the German Art of War, Truppenführung*, (Boulder, Colorado: Lynne Reinner, 2001), p. 1.