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Avoiding the Paris Gun Trap:

The Future of America's Strategic Artillery

Ian P. Grundhauser, Major, US Army

US Army Command and General Staff College Press
US Army Combined Arms Center
Fort Leavenworth, Kansas

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Program Description

The Command and General Staff College (CGSC) Art of War Scholar's program offers a small number of competitively select officers a chance to participate in intensive, graduate level seminars and in-depth personal research that focuses primarily on understanding strategy and operational art through modern military history. The purpose of the program is to produce officers with critical thinking skills and an advanced understanding of the art of warfighting. These abilities sare honed by reading, researching, thinking, debating and writing about complex issues across the full spectrum of modern warfare, from the lessons of the Russo-Japanese war through continuing operations in Afghanistan and Iraq, while looking ahead to the twenty-first century evolution of the art of war.

Abstract

In an attempt to end the stalemate on the Western Front during World War I, German scientists and engineers created a supergun capable of firing a 233-pound projectile over 75 miles to bombard the citizens of Paris, France. These weapons, The Paris Guns, possessed the potential to achieve an exponential military advantage for the German Military. The Germans' folly became clear as they developed a weapon without first considering its ability to achieve the effects they desired. Today, the United States Army seeks to develop superguns capable of exponentially increased range, the strategic long-range cannons. The United States Army has defined a role for these weapons in deterring in competition, and penetrating and dis-integrating anti-access and area denial networks in armed conflict. This study examines the history and effects of The Paris Guns at the strategic level. It then measures the accumulation of these effects across the operational variables. This study concludes that The Paris Guns achieved some strategic effects; these effects did not benefit the Germans. Additionally, this study concludes that the United States Army's pursuit of strategic long-range cannons is viable, provided the pursuit avoids the same strategic errors of The Paris Guns during World War I.

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Chapter 1
Paris Guns A Strategic Perspective

> Absolutely out of the question…I only trust that the English field artillery will never consider their role is to sit behind a hill a mile and a half in the rear while the assault is taking place.
>
> —Major J. Headlam,
> *The German Method of Bringing Guns into Action*

Background

In December 2017, the United States National Security Strategy characterized China and Russia as global revisionist powers that were in competition with the United States. The National Security Strategy further stated, "China and Russia challenge American power, influence, and interests, attempting to erode American security and prosperity."[1] The definition of these states as competitors provided the impetus for the United States Department of Defense to address these states as security concerns and develop a strategy to "provide combat-credible military forces needed to deter war and protect the security of our nation. Should deterrence fail, the Joint Force is prepared to win."[2] In support of the United States National Security Strategy, the 2018 United States National Defense Strategy addressed the need to modernize critical capabilities.

One of these critical capabilities was joint lethality within contested environments stating, "The Joint Force must be able to strike diverse targets inside adversary air and missile defense networks to destroy mobile power-projection platforms."[3] This requirement addresses the need for the Joint Force to penetrate competitor and adversary anti-access and area denial networks. Anti-access and area denial networks are the integrated defensive systems and "mechanisms that prevent United States forces from entering an area of operations or expanding operations from an initial lodgment."[4] The United States National Defense Strategy addressed the 2018 United States Army Strategy by articulating four lines of effort to shape the future United States Army of 2028. This was in direct response to adversary anti-access and area denial and additional threat capabilities. One of these lines of effort is modernization, which ensures that the United States Army's is capable of competing and winning in six critical areas that are described as modernization priorities.[5] The first of these priorities is long-range precision fires, defined as, "platforms, capabilities, muni-

tions, and formations that ensure United States Army dominance in range, lethality, mobility, precision, and target acquisition."[6]

The United States national policy requirement to modernize the United States Army's critical capabilities became the creation of the United States Army's eight cross-functional teams. Army Directive 2017-24 mandated that these cross-functional teams oversee the development of capability documents, experimentation and technical demonstration, and further drive capability requirements through the Army Acquisition System.[7] The long-range precision fires cross-functional team, under the purview of the United States Army Field Artillery, oversees deep fires, the long-range precision fires missile, and extended range cannon artillery.[8] The United States Army articulated that, "Deep fires will provide the United States Army and joint force commanders with a surface-to-surface capability that can penetrate peer adversary defensive capabilities to engage key targets at strategic ranges."[9] The long-range precision fires cross-functional team maintains the ability to provide deep fires and meets the 2018 United States National Defense Strategy requirement to strike within adversary and competitor anti-access and area denial protected areas.

The United States Army seeks to develop advanced surface-to-surface weapon systems in response to competitor parity and overmatch with strategic long-range fires. This provides the Joint Force complementary assets to penetrate anti-access and area denial defended areas. The United States Army has publicly addressed two possible solutions for these strategic long-range precision fires capabilities. They are a strategic long-range cannon and a hypersonic missile launcher.[10] These proposed solutions seek to achieve the desired effects with a weapon system employed by the United States Army Field Artillery at ranges beyond 1,000 nautical miles (nautical miles) or 1,151 miles.[11] Achieving ranges of greater than 1,000 nautical miles will require echeloned surface-to-surface artillery, rocket, and missile capabilities. These capabilities reside alongside the other sub-elements within the long-range precision fires cross-functional team.[12] Additionally, range goals exceeding 1,000 nautical miles will challenge and compete with adversary surface-to-surface weapon capabilities. Achieving these ranges, at a minimum, provides the potential deterrence capability required by the United States Army and Joint Force.[13]

An appropriate historical parallel to these advancements in strategic long-range precision fires exists in the development and ultimate employment by the German Military of the Paris Guns targeting Paris, France, during World War I. In the Spring of 1918, the French did not anticipate the German Army engaging Paris with artillery until the German lines were

within at least 25 miles of Paris. This reasonable assumption relied on contemporary artillery ranges of weapons fielded by the Allied and German militaries, which achieved maximum ranges of only 41.1 kilometers (25.5 miles) and 47.5 kilometers (29.5 miles), respectively.[14] The French were shocked when the Germans began shelling Paris while the closest German lines were still over 60 miles Northeast of Paris. Between 23 March and 9 August 1918, the Germans would intermittently shell Paris with these weapons using approximately 352 total projectiles weighing 233.6 pounds and achieving ranges between 50 and 75 miles.[15] The German Military believed the dramatic increase in the capability and achieved ranges of these weapons meant they could achieve strategic psychological effects against the Parisian civilian population. The development and employment of this weapon system provides a historical parallel to the modern emergence of strategic surface-to-surface artillery weapon systems. They will provide the best information about the use of these weapon systems along the competition continuum.

Purpose

This manuscript provides recommendations for the use of future strategic long-range cannon artillery weapon systems that are currently in development for use by the United States Army Field Artillery. The impetus for the development of these weapons emerges from the competition with peer and near-peer competitors and adversaries of the United States whose militaries have continued to grow in recent decades, and who have invested increasing resources in force and technological modernization. These competitors and adversaries have developed their own strategic long-range surface-to-surface weapons systems. They have also invested in the development of anti-access and area denial systems to ensure a competitor stand-off. This increased stand-off creates a requirement for the United States Military to invest in modern efforts to achieve parity or overmatch with competitors and adversaries regarding strategic long-range weapons and further to defeat or deny anti-access and area denial stand-off capability.

Research Questions

How can the development and employment of the German Paris Guns inform the United States Army's use of strategic long-range cannon artillery weapon systems throughout the competition continuum?

- What were the facts and circumstances surrounding the development, employment, and effects of the Paris Guns during and after World War I?

- What effects did Germany desire in developing and employing the Paris Guns during World War I? Were these effects achieved?
- What societal, political, economic, and military strategic effects resulted from the employment of the Paris Guns by the German Military during World War I?

Definitions

In this manuscript, "Allied Powers" or "Allies" refers broadly to Great Britain (and the British Empire), France, the Russian Empire, and the United States of America.[16] In contrast, the "Central Powers" refers to Germany, Austria-Hungary, and Turkey; the powers with formal mutually-supporting treaties in opposition to the Allied Powers during World War I.[17]

Assumptions

This study includes the two following assumptions to ensure continued relevance to the information and future use of strategic long-range cannon artillery;

- First, the United States Army's long-range precision fires cross-functional team will continue to pursue the development, and ultimately the procurement and fielding of a strategic long-range cannon artillery weapon system which is capable of achieving ranges over 1,000 nautical miles with a conventional projectile. Soldiers from the United States Army Field Artillery will operate these weapon systems from mobile land-based platforms.
- Second, the United States will not enter into a limiting treaty, restricting the range of conventional surface-to-surface weapon systems before the projected implementation timeline for the Army's future operating concept in 2028. On 2 August 2019, the United States formally withdrew from the 1987 Intermediate-Range Nuclear Forces (INF) Treaty between the United States and Russia (the former Soviet Union). This treaty prohibited the possession, production, or flight-testing of land-based missiles between the ranges of 500 to 5,500 kilometers (310 to 3,418 miles).[18] The formal withdrawal from this treaty removed this restriction from the United States. It allowed the United States Army to pursue surface-to-surface weapon technology capable of achieving ranges greater than 500 kilometers.[19] The weapon systems in development by the United States Army will achieve desired

> ranges of at least 1,000 nautical miles. These ranges are not strategic in and of themselves but are strategic because they will allow the United States Military to position weapons on the periphery of adversary threat and anti-access and area denial defensive rings. This positioning will enable the United States Military to achieve the desired effects on targets within those threat rings. This capability will deny the adversary or competitor's anti-access and area denial system, therefore strategically diminishing their ability to project the elements of national power. In summary, this capability achieves an overall deterrence effect at the strategic level of war while remaining below the threshold of armed conventional or nuclear conflict.[20]

Scope

The primary research inquiry came from a request by the United States Army Field Artillery School, Fort Sill, Oklahoma. The question was: How can the United States Army use strategic long-range cannon and hypersonic weapon systems from competition to conflict? The emergence of hypersonic weapons system technology within the last two decades has not yielded an unclassified United States Military working prototype or case study for how these systems are most effectively employed. Despite this, there are historical examples of long-range cannon artillery use. For this reason, the author draws on the historical example of strategic long-range cannon's use as a parallel of information to compare the current strategic long-range cannon artillery currently under development by the United States Army. This historic example serves as a direct parallel between how historical and modern-day cannon can achieve potentially strategic effects. This parallel provides a study about how the United States Army should employ their modern strategic long-range cannon artillery.

Limitations

This qualitative analysis study relies on the examination of unclassified documents in the form of public records, research, reports, and books, as well as online periodicals, articles, and journals to identify how the Paris Guns were employed and what effects they achieved. Due to the sensitive and, in some cases, classified nature of the ongoing development of modern long-range precision fires weapon systems, the author was unable to conduct an unclassified quantitative analysis of the technical and tactical development of these weapon systems. For these reasons, this research

is qualitative in nature and seeks to make general recommendations for the strategic employment of these modern weapon systems.

A limitation in selecting the Paris Guns as the historical study for this research is that many of the primary sources for the development and employment of these weapons were in German. Correspondingly, many of the primary sources for the effects of these weapons were in French. For these reasons, much of the literature related to the Paris Guns exists only in the German or French languages. Because of the restriction of English-language sources, there is a potential underlying, if not overt bias present within this source material. That bias favors the allied nations, as many of the authors were from those nations. As a result, the author gathered as many translated primary source documents as possible, and when appropriate, relied on secondary source information related to these incidents.

Additionally, the author cross-referenced facts across multiple sources and relied heavily upon facts rather than speculation or opinion. Allied opinion, when used, supports a general feeling or sentiment within a given population, rather than an overt critique of German actions. The author attempts to represent both sides of this conflict equally, resolving factual incongruities where appropriate.

Delimitations

As detailed in the scope above, this study of the Paris Guns best parallels and informs the use of modern strategic long-range cannon artillery. The United States Army is also developing advancements in long-range hypersonic missile technology. With limited historical parallels for this emerging technology, it is difficult to inform the use of these weapon systems along the competition continuum. For this reason, the author focused this study on only the employment of strategic long-range cannon artillery based on a qualitative analysis of the Germany Military's use of the Paris Guns during World War I. If readers draw conclusions for the use of long-range hypersonic missile technology from this research, while of potential value, it is not the intended outcome or focus of this research.

Modern strategic long-range cannon artillery weapon systems are currently in development, and therefore, any attempt to explain their tactical employment is purely speculative. For this reason, the Paris Guns research will focus on the strategic development and employment of this weapons system. The strategic intent behind the Paris Guns is conceptual in scope, and therefore, its study can shape the conceptual future use of modern strategic long-range cannon artillery systems. For these reasons, this study

focuses on the strategic employment of these weapons and their associated effects along the competition continuum. Despite this focus, the discussion of the tactical employment of the Paris Guns, when appropriate, is included to provide adequate historical context and detail.

Summary

This study explores the development, employment, effects, and response to the Paris Guns from a strategic perspective. The research results will advise the United States Army and joint commanders on the potential strategic employment of these modern weapon systems. This seeks to close the gap in understanding of how to employ strategic surface-to-surface cannon artillery weapon systems, a capability not previously enjoyed by the United States Army.

Chapter 2 explores the historical literature and discusses relevant modern literature which establishes the framework and answers the research questions detailed above. Chapter 3 discusses the methodology for analysis of the Paris Guns. A qualitative study evaluates the effects of the Paris Guns across four of the operational variables. Chapter 4 provides the historical study of the development, employment, effects, and response to the use of the Paris Guns during World War I, and begins to answer research question one. Chapter 5 provides scrutiny against four of the operational variables: social, political, economic, and military. Additionally, this chapter supports research question two and addresses secondary research question three. Finally, chapter 6 provides conclusions drawn from the case study investigation. Recommendations for the future use of strategic long-range cannon weapon systems will be submitted to the United States Army Field Artillery, thus answering all research questions.

Notes

1. President of the United States, *National Security Strategy of the United States of America* (Washington, DC: The White House, 2017), 2.

2. Headquarters, Department of Defense, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: Government Printing Office, 2018), 1.

3. Headquarters, Department of Defense, *Summary of the 2018 National Defense Strategy,* 6.

4. Major Ben Jackman, "Understanding the Anti-Access and Area Denial Threat: An Army Perspective" (Monograph, School of Advanced Military Studies, Fort Leavenworth, KS, 2015), 7.

5. Secretary Mark T. Esper and General Mark A. Milley, *The Army Strategy* (Washington, DC: Government Printing Office, 2018), 7.

6. Esper and Milley, *The Army Strategy,* 7.

7. Secretary Ryan D. McCarthy, Army Directive 2017-24, *Implementation of Acquisition Reform Initiatives 1 and 2* (Washington, DC: Government Printing Office, 2017), 2.

8. Lockheed Martin, "Precision Strike Missile (PrSM)," Lockheed Martin, accessed 16 March 2020, https://www.lockheedmartin.com/en-us/products/precision-strike-missile.html. The name of this sub-element has since changed from Long-Range Precision Fires Missile to the Precision Strike Missile (PrSM). This change limits confusion between the name of the cross-functional team and this emerging weapon system.

9. Fires Center of Excellence, "Long-Range Precision Fires," *STAND-TO!,* 17 January 2018, accessed 30 September 2019, https://www.army.mil/standto/2018-01-17.

10. Sydney J. Freedberg Jr., "Army Building 1,000-Mile Supergun," *Breaking Defense,* 11 Ocrober 2018, accessed 9 October 2019, https://breakingdefense.com/2018/10/army-builds-1000-mile-supergun/.

11. 1 nautical mile is equal to 1.15078 statute miles.

12. Fires Center of Excellence, "Long-Range Precision Fires."

13. Chris Pleasance and Ariel Zilber, "'No Force Can Shake This Great Nation': President Xi Leads Spectacular Ceremony to Mark 70 Years of Communist Rule in China and Unveils Top-Secret Hypersonic DF-17 Missile for the First Time," *Daily Mail,* 30 September 2019, accessed 2 October 2019, https://www.dailymail.co.uk/news/article-7523145/Chinas-70-year-parade-economic-military-might.html.

14. Marc Romanych, Greg Heuer, and Steve Noon, *Railway Guns of World War I* (Oxford: Osprey, 2017), 33.

15. Gerald V. Bull and Charles H. Murphy, *Paris Kanonen - the Paris Guns (Wilhelmgeschütze) and Project HARP,* ed. Elmar W. Caspar, Wolfram Funk, Werner Hahlweg, Volker Schmidtchen, Ingo Weise, and Arnold Wirtgen (Herford und Bonn: Verlag E. S. Mittler and Sohn GmbH, 1988).

16. Editors of Encyclopedia Britannica, "Allied Powers," *Encyclopedia Britannica,* n.d., accessed 21 March 2020, https://www.britannica.com/topic/Allied-Powers-international-alliance. This broad definition of the Allied Powers prevents confusion associated with the various shifting timelines and alliances of all belligerent nations throughout the war. Formally, the Allied Powers were those countries in opposition to the Central Powers (Germany, Austria-Hungary, and Turkey) at the outset of WWI in 1914. These countries were Great Britain, France, and the Russian Empire. The Treaty of London signed on 5 September 1914, formally linked these countries into an alliance. The United States was never a formal member of the alliance, instead referred to as an "Associated Power" or a "Co-belligerent", as stated by US President Woodrow Wilson upon formal entry into the war on 6 April 1917. Despite this distinction, the US supported and fought alongside the Allied Powers against the Central Powers throughout their involvement in the war. For these reasons, and for ease of understanding, this thesis includes the US when referring broadly to the Allied Powers.

17. Editors of Encyclopedia Britannica, "Allied Powers."

18. Arms Control Association, "The Intermediate-Range Nuclear Forces (INF) Treaty at a Glance," Arms Control Association, last reviewed August 2019, accessed 9 October 2019, https://www.armscontrol.org/fact sheets/INF-treaty.

19. Lockheed Martin, "Army Tactical Missile System Block 1A," Lockheed Martin, accessed 1 October 2019, https://www.lockheedmartin.com/en-us/products/army-tactical-missile-system-block-ia-unitary-atacms.html.

20. Major General Stephen J. Maranian, interviewed by author, Fort Leavenworth, Kansas, 19 February 2020. At the time of this writing, Major General Maranian served as the Deputy Commanding General-Education, United States Combined Arms Center; as the Provost, Army University; as well as the Deputy Commandant, United States Army Command and General Staff College, Fort Leavenworth, Kansas. Major General Maranian previously served as the Commandant of the United States Army Field Artillery School and Chief of the Field Artillery; as well as the first director of the long-range precision fires cross-functional team, Fort Sill, Oklahoma. Major General Maranian oversaw the initial creation of the long-range precision fires cross-functional team and was instrumental in guiding the creation of the three initial focus areas or lines of effort for the cross-functional team: extended range cannon artillery, long-range precision fires missile (now: the precision strike missile), and deep fires.

Chapter 2
Paris Gun Trap Analysis

> War makes for progress—and I will leave it to my audience to surmise what will be the extreme distance to which shell may possibly be projected in 1921, assuming the rate of increase to be, at least, uniform.
>
> —Major J. Maitland-Addison, R.A.,
> reprinted from *Journal of the Royal Artillery,*
> *July 1918, The Field Artillery Journal*

The Guns, *Geschütze*

On the afternoon of 29 March 1918, faithful Catholics were celebrating mass on one of the holiest days of the Roman Catholic liturgical calendar, Good Friday. In the Church of St. Gervais in Paris, France, the faithful included men, women, and children as well as foreign travelers, dignitaries, and political figures. A three-hour mass had just concluded, and many parishioners were still present, kneeling in prayer. At 4:20 p.m., a shell burst against the outside wall of the clerestory, rocking the church. "Then the whole of the massive stonework supported by one of the huge pillars was hurled with a frightful crash down on the mass of kneeling people in the nave."[1] A projectile fired by one of the Paris Guns had just struck the Church of St. Gervais on the seventh day of the bombardment, resulting in the most significant tactical effect achieved by the Paris Guns: 88 killed and 68 wounded.[2] While tactically successful, this attack, coupled with the entire bombardment, had a net negative strategic impact and further diminished the worlds' view of Germany and its people. The guns that caused such destruction were a monumental technological achievement which had been accomplished in a time of global war. The technological leap they represented is unquestioned, but the purpose behind their development raises many questions for the military practitioner seeking to employ the tools of war.

To understand what the Paris Guns were, an explanation is useful to first clarify what they are not. Multiple names have been associated with them which has created confusion as to their design, function, and purpose. The following paragraphs attempt to describe the details about each Paris Gun reference.

"Big Bertha," *Dicke Berta,* is a name often associated with the Paris Guns. This name was editorialized and popularized in multiple publications following the employment of the Paris Guns. The Big Bertha was a type of 42-centimeter cannon first employed in Belgium to support the initial offensive operations conducted by the German Military in their attempt to defeat the French—in France by way of Belgium. The Big Bertha was a relatively short-ranged weapon that fired a large projectile at high elevations taking advantage of plunging fire and the more vulnerable overhead cover of most fortifications. A photo of a Big Bertha conveys its similarity to a large mortar, which takes advantage of high angle fire, see figure 2.1.[3] The Big Berthas' erroneous association with the Paris Guns may be due to sharing a developer and manufacturer. The Friedrich Krupp AG manufacturing corporation developed both weapon systems. The excerpt below, from *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP* by Doctors Gerald V. Bull and Charles H. Murphy, describes Big Bertha's manufacturing along with its primary use.

> Rausenberger and his predecessor at Krupp, Director Dräger, had designed the large bore 42 centimeter howitzer, known by the name given to it by its designers as *"Dicke Berta"* (Big Bertha). This gun and the SKODA 305 millimeter howitzer reduced the forts of the Meuse in rapid sequence, permitting Von Kluck's German First Army and Von Bülow's German Second Army to start their sweep through Belgium following more or less [*sic*] the time scale demanded by the Schlieffen Plan.[4]

"Long Max," *Langer Max,* was another artillery piece closely associated and sometimes confused with the Paris Guns. The Long Max was a 38-centimeter German long-range heavy siege and coastal defense gun, see figure 2.2. The Friedrich Krupp AG corporation also developed this gun, the L45 *"Max"* or *"Langer Max."* Its intended use was as a heavy naval and coastal defense gun. This gun was capable of firing a 38-centimeter (diameter) projectile weighing 743 kilograms (1638 pounds) 28 kilometers (17.4 miles).[5] Additional adaptation allowed their later use on land, in support of ongoing operations on the Western Front. Eventually, these weapons were further adapted and modified, providing the foundational mechanical architecture, carriage, and barrel for the Paris Guns. As explained in the next section, the Long Max weapon system required substantial modification to produce the Paris Gun. For example, the weight and diameter of the projectiles were reduced, and the barrels required substantial extension. These modifications resulted in significantly increased range as evident in the Paris Guns. The Long Max stands as an example of

German ingenuity and their ability to adapt existing technology to emerging requirements.

Figure 2.1. Photo of Big Bertha.

Source: Marc Romanych, "Big Bertha," *Encyclopedia Britannica,* n.d., accessed 4 February 2020, https://www.britannica.com/technology/Big-Bertha-weapon.

The "Paris Guns," (*Paris Kanonen* or *Paris Geschütze*) were a series of extreme long-range artillery pieces developed by the Friedrich Krupp AG corporation, see figure 2.3. These guns were also known as the William Gun, *Wilhelmgeschütze,* named in honor of the German Emperor, William II, *Wilhelm II.* Modified versions of the 38 centimeter (internal diameter) and 35 centimeter L45 "Langer Max" were adapted to create the Paris Guns. Ultimately, Krupp would retrofit and create between nine and thirteen of these weapons, using a total of eight barrels in the bombardment of Paris, France.[6] These weapons use the carriage and barrels of the L45, and were emplaced semi-permanently at specially prepared and designed

positions behind the German front lines on the Western Front. The 38 and 35 centimeter barrels received rifled barrel inserts of 21 meters (68.9 feet) in length. The rifled barrel had a smooth bore attachment affixed to the end of it, measuring 6, 9, or 12 meters (19.7, 29.5, or 39.4 feet) (selected based on desired range and tube wear) completing the barrel assembly. In this configuration, the weapon was capable of firing a 106-kilogram (233.6 pounds) projectile at least 75 miles (120 kilometers) and carrying 7 kilograms (15.4 pounds) of explosive TNT fill. The differences between The Long Max and the Paris Guns are evident; the Paris Gun barrel is substantially longer and requires an adjustable stiffening truss whereas the Long Max does not.[7] In total, these weapons fired 352 projectiles between 50 and 75 miles (80.5 and 120 kilometers) on 43 different days between 23 March and 9 August 1918, targeting Paris, France.[8] Ultimately these weapons killed 256 and wounded 620 people in Paris and surrounding areas.[9]

Figure 2.2. Photo of Langer Max.
Source: Wikipedia, "38 Cm SK L/45 'Max,'" Wikipedia, accessed 19 January 2020, https://en.wikipedia.org/wiki/38_cm_SK_L/45_%22Max%22.

Historic Literature

There are multiple primary and secondary sources available detailing the development, employment, and reaction to the Paris Guns. These works vary broadly in scope, some focus primarily on the technical and tactical elements of the Paris Guns, while others simply comment on their perceived strategic impact. The following section examines the merits of these works by establishing an information and analysis gap in the overall strategic effectiveness of the Paris Guns. This section lists primary and secondary sources supporting the authors' viewpoint of the merits or limitations of the Paris Guns.

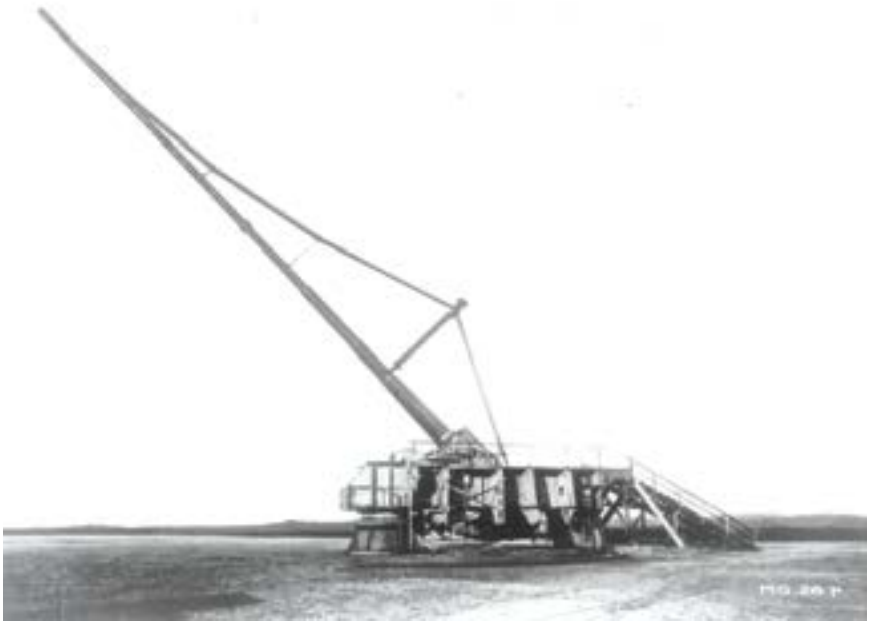

Figure 2.3. Photo of a Paris Gun.

Source: Joris Nieuwint, "The German Paris Gun–Super Gun Of WWI," War History Online, 17 October 2015, accessed 13 April 2020, https://www.warhistoryonline.com/featured/the-paris-gun.html.

Primary Sources

The unequaled American historical authority on the development and use of the Paris Guns was Henry W. Miller, a United States Army Ordnance officer during World War I. Miller was a professor of engineering drawing, the assistant dean of the College of Engineering, and the eventual head of the Department of General Engineering Drawing at the University of Illinois before the United States involvement in World War I. In 1917, he served as the organizer of the United Stataes Army School of Aeronautics. After the United States involvement in World War I, Miller was commissioned as a Major of Ordnance in the United States Army and supervised the technical service of the railway artillery for the American Expeditionary Forces.[10]

Later, Miller was promoted to Lieutenant Colonel and assumed the duties of chief engineer and chief of the technical service of all heavy artillery of the American Expeditionary Forces.10 Following World War I, he briefly worked in Washington, DC, "on the design of coast artillery and railway artillery, preparing texts and reference works for use at United States military schools and state universities."[11] In 1921, he took a position as professor and head of the Department of Descriptive Geometry, Mechanism and Drawing (later Mechanism and Engineering Drawing) at the University of Michigan. Miller later served in the United States Army Reserves and remained closely tied to the United States Army and Ordnance Department. Eventually, Miller achieved the rank of colonel, serving on the technical staff of the ordnance department and instrumental in the development of much of the artillery used during and after World War II.[12]

Over his lifetime, Colonel Miller published numerous works related to mechanical engineering and artillery in general. His three most influential works cemented his legacy as an expert on the Paris Guns. These included his comprehensive two-volume work on World War I railway artillery, *Railway Artillery: A Report on the Characteristics, Scope of Utility, etc. of Railway Artillery* published in 1921, an article he published in 1920 in the *Journal of the American Society of Mechanical Engineers* titled "The German Long-Range Gun", and his seminal work on the Paris Guns, *The Paris Gun: The Bombardment of Paris by the German Long Range Guns and the Great German Offensives of 1918* published in 1930. These three works provide much of the foundational literature that subsequent English-language research and writings on the Paris Guns have been built.

In his report, *Railway Artillery: A Report on the Characteristics, Scope of Utility, etc. of Railway Artillery,* Colonel Miller provides technical and

contextual descriptions of all railway artillery used by the major powers at the conclusion of World War I. Colonel Miller displays his expertise on the subject matter by indicating that this work is the personal conclusion of "over two years of close association with engineering work on railway artillery both in Europe and America."[13] Additionally, he established himself as not only a technical and historical expert but also as a primary source and direct observer of the effects of the bombardment of Paris, France. Colonel Miller writes, "The writer [Colonel Miller] was in Paris for several days at a time on four occasions during the bombardment by the long-range gun [Paris Gun]."[14] This report is of great value to the history of the Paris Guns, as it is both a primary source work and is also foundational in its scope. Of highest value to the proposal of this manuscript is Colonel Miller's discussion of the four purposes for railway artillery. These reasons include destruction, counter-battery work, interdiction, and distant bombardment for moral effect.[15]

Colonel Miller's discussion of distant bombardment for moral effect warrants additional consideration and direct quotation. It provides a viewpoint from an observer and informed commentator on the purposes and effects of weapons such as the Paris Guns. Colonel Miller first defines distant bombardment for moral effect, as follows;

> The objectives of bombardment for moral effect are large centers of population long distances behind the lines. The aim is to destroy any sense of security which the distance from the front lines may give the civilian, to undermine the spirit of the army by weakening the morale of the civil population, and to interfere to the maximum with the administration of the war.[16]

Colonel Miller goes on to describe an essential characteristic of this kind of fire as "extremely long range [*sic*], 100 to 120 kilometers or so."[17] To achieve desired effects requires, "At least one shot per hour is considered necessary to produce the desired effect, and absolute regularity in the bombardment is necessary for the maximum effect on morale."[18] This framework is valuable, though the context of World War I colors it, yet it seeks to establish that there are quantifiable methods and desired parameters to achieve intended psychological effects given a targeted population and methods of employment.

Colonel Miller continues giving a brief account of the reaction to the various bombardments and analysis of observed effects. Again, his first-hand insight provides a lens into what occurred and his perspective on what those effects were.

> On the first day of the bombardment, on 23 March 1918, there was considerable confusion, more because the people thought they were being bombed by airplanes from a great height than from any other apparent reason. From then on the effect could not be determined with any certainty. There seemed to be as many people on the streets during the days of most active bombardment as on quiet days. When a projectile would burst the people in that vicinity would appear startled but not frightened and always some would hurry in the direction of the explosion to see the damage. All of the trains going west or south from Paris were crowded in those days, but there was no evidence that the departure of those people who lived in Paris was not caused by the steady approach of the Germans and the possibility of the capture of Paris rather than through panic or fear of the bombardment.[19]

Colonel Miller's overall assessment of the effects of these weapons are clear;

> The damage done by the long-range projectiles was never very great. Further, the dispersion of the guns was so great that two projectiles would land within a kilometer of each other only by chance. Judging from the small extent of damage and the doubtful effect produced on the civil population, it would see extremely doubtful if such bombardment as this is nearly as effective either from the standpoint of material damage or effect on morale, as an equal investment in bombing planes and bombs.[20]

Colonel Miller's synopsis clarifys that he found these weapons valid in principle. Because of the circumstances of war or due to the German method of employment, these weapons did not achieve their intended negative psychological effects.

Colonel Miller's *Railway Artillery: A Report on the Characteristics, Scope of Utility, Etc. of Railway Artillery* has an appendix with an article published by Colonel Miller in 1920 in the Journal of the American Society of Mechanical Engineers titled "The German Long-Range Gun."[21] This article provides Colonel Miller's initial attempt to gather into one forum what he had learned about the Paris Guns in the two years since their initial employment. Colonel Miller provides a somewhat detailed synopsis of the bombardment beginning on 23 March and ending on 9 August 1918. Additionally, he provides technical information that he obtained regarding the design, development, and employment of the weapons. His later works

greatly expound upon this knowledge. Finally and of most significant relevance to this manuscript, Colonel Miller provides initial evidence that Allied Powers (France and Great Britain) may have invested in similar technology (long-range artillery) as a direct result of its appearance on the battlefields of World War I. "Both the British and the French Governments began the construction of a few [long-range guns], some of which have now been finished."[22] Overall, this article is foundational in scope and provides a considerable amount of detail that he later refines and corrects. For example, Colonel Miller contends that the Germans fired 303 projectiles throughout the bombardment.[23] Colonel Miller later corrects this number to 351 after his additional research.[24] Overall, this work was of considerable value, as it refrains from speculation and conveys the facts that Colonel Miller had gathered to that point.

In his seminal work, *The Paris Gun: The Bombardment of Paris by the German Long Range Guns and the Great German Offensives of 1918,* Colonel Miller recounts the circumstances surrounding the fielding, employment, and ultimate destruction of the Paris Guns by the German Military during World War I. Colonel Miller's narrative uses the German offensives of 1918 as a backdrop to provide a broader framework for how the bombardments fit into the overall war on the Western Front. In this work, Colonel Miller refines and expounds upon much of the technical and tactical considerations of the Paris Guns themselves, their employment, and the bombardment in general. The most critical aspect of this work is its foundational significance. All subsequent English-language writings draw heavily on the technical narrative which Colonel Miller collected and provided to his audience. In addition to this information, Colonel Miller uses primary source material as he directly quotes newspaper and citizen reactions to some of the bombardments of Paris. These quotations provide further evidence that initial fear existed within the population of Paris, but that this fear abated over time. Finally, Colonel Miller's work provided a substantial foundation for Doctors Gerald V. Bull and Charles H. Murphy to enhance and correct the overall narrative of the history of the Paris Guns while reconstructing in precise detail the technical characteristics.

In the late 1950s, a joint Canadian-American venture worked to develop a high-performance gun capable of firing a projectile into space as a low-cost, high-altitude space research system alternative to rocket launched technology. The program, the High Altitude Research Programme [UK spelling] (project HARP), was a collaboration of civilian and military institutions in the pursuit of scientific discovery. Bull led the Canadian element from his position as director of the Space Research Institute at

McGill University, Montreal, Quebec, Canada. Likewise, Murphy was the lead scientist for the United States Army at the Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland, United States of America.

In the late 1960s, the program lost its funding after achieving some of its intended objectives. Included was the construction of and firing of multiple projectiles as proof of concept in achieving altitudes of up to 180 kilometers (111.8 miles), see figure 2.4.[25] By their admission, project High Altitude Research Programme was unrelated to the Paris Gun, and at the time, the scientists working on project High Altitude Research Programme had little or no knowledge of the Paris Guns' construction or use during World War I. Bull and Murphy state, "While the Paris Gun was a military weapon, the High Altitude Research Programme project was dedicated solely to the application of modern technology to gun launched systems of the purpose of non-military oriented high altitude [*sic*] space research."[26] This program proved resourceful.

Following their work on Project High Altitude Research Programme, Bull and Murphy sought to publish a book detailing the history of the project. They intended to use the history of the Paris Gun as an introduction to this work; but there existed limited information in that, "The only comprehensive work on this gun was that of Lieutenant Colonel [later Colonel] Henry W. Miller."[27] By way of exhaustive research into Colonel Miller's work, German archival and personnel correspondence, and comprehensive computer and digital modeling, Bull and Murphy were able to correct the historical record of the development, employment, bombardment, and ultimate destruction of the Paris Guns. Additionally, they were able to recreate in exacting detail the technical characteristics of the Paris Guns, and give the world a comprehensive history of these weapons. Their work on the Paris Guns ultimately resulted in the first four parts of their five-part work: *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP,* with the fifth part detailing the history of project High Altitude Research Programme.

The first four parts of Bull and Murphy's work are critical to this manuscript and are worth examining in detail. Although Bull and Murphy provide secondary source analysis, their work contains multiple primary source documents both in their original forms as well as translations in English. Part I uses the supervisor's manuscript of the Paris Gun project, professor Dr. Fritz Rausenberger, managing director and member of the Board of Friedrich Krupp AG.[28] His manuscript and personal papers were unavailable following World War I and therefore unable to influence the work of Colonel Miller. Members of the project High Altitude Research

Programme team obtained these papers, which clearly influenced Bull and Murphy's later work. These papers are illuminating in that they provide technical and historical details that correct or confirm various assumptions or assertions made in Colonel Miller's previous work.

Part I contains an English translation of Rausenberger's manuscript titled, "The Development of Krupp's long [*sic*] Range [*sic*] Guns during the World War" as well as several annexes.[29] The annexes include: correspondence related to the publication of the manuscript, the obituary of Rausenberger, the original German manuscript, as well as two documents provided by the United States Army Ordnance Museum, Aberdeen Proving Ground, Maryland. The first of these documents provides contextual supporting information for Rausenberger's manuscript and was written by Captain Walter Kinzel, formerly attached (during World War I) to the ballistic command of long range [*sic*] guns of the German Navy.[30] Captain Kinzel's document provides specific insight into the conduct of the bombardment. It conveys the high level of involvement of the Germany Navy rather than the German Army in the conduct of the bombardment by the Paris Guns.

The final document in Part I is the "1918 Report of Captain Robert Kent, United States Army Ordnance on the English Long Range Gun."[31] Of highest value in Captain Kent's report is that he shares common perceptions within the United States Army Officer Corps as to the efficacy of the Paris Guns in 1918, as well as his thoughts on the matter. He states;

> Many officers expressed the opinion which has been cultivated by the newspapers in the public mind that the long range [*sic*] guns are of no practical military importance. Other officers, however, pointed[*sic*] to the undoubted military value of the disorganization of Government business in Paris caused by the bombardment of that city by the Germans and expressed the opinion that there are other specialized objectives for which long range [*sic*] guns will be useful.[32]

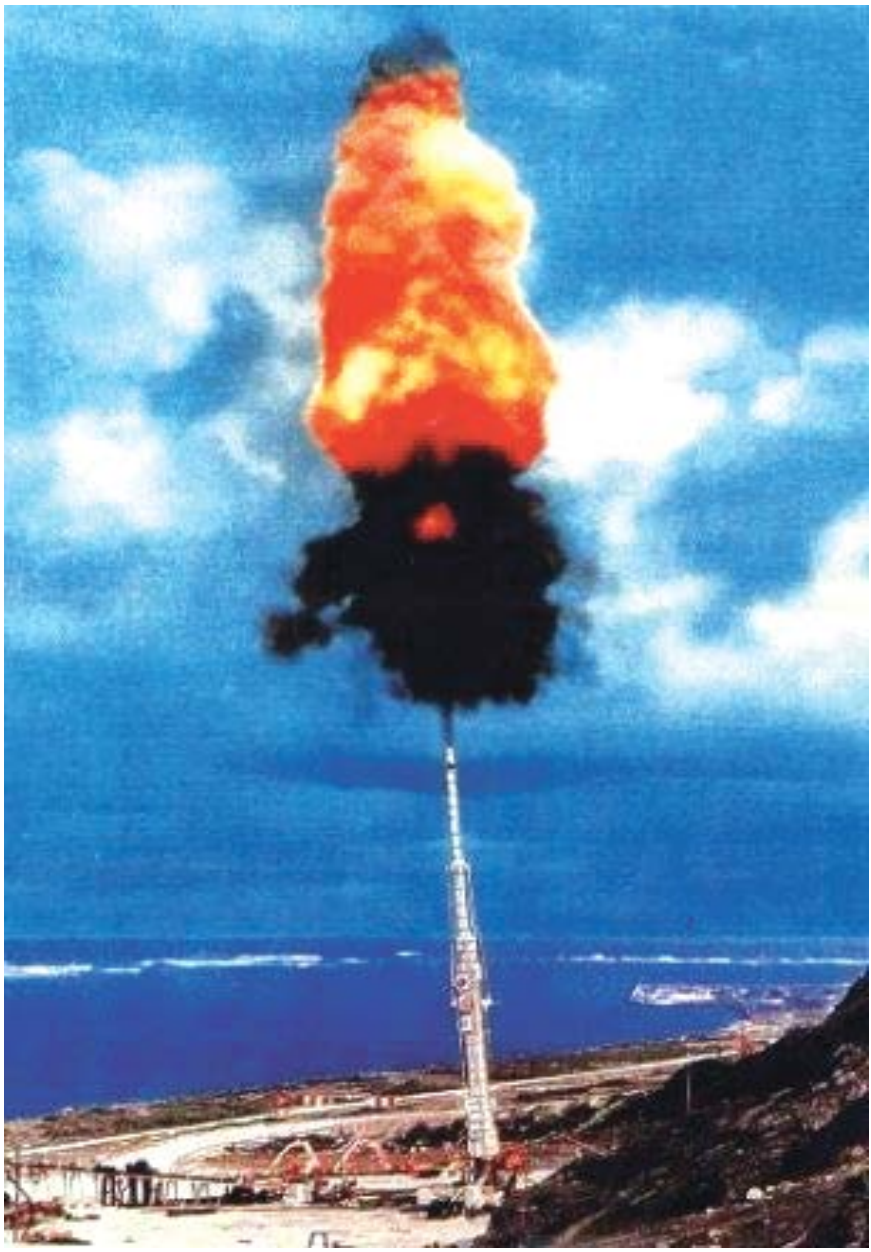

Figure 2.4. 16.7 Inch (42.4 Centimeter) L86 High Altitude Research Programme Barbados Gun Firing at 85° Elevation.

Source: Wikipedia, "Project High Altitude Research Programme," Wikipedia, accessed 14 April 2020, https://en.wikipedia.org/wiki/ProjectHARP#/media/File:Project_Harp.jpg.

Captain Kent continues, with his own opinion, "long range [*sic*] guns are bound to have a permanent place in any military establishment."[33] Part I and its seven annexes, provides the most comprehensive history of the Paris Guns and serves to amplify and correct undiscovered errors as conveyed by Colonel Miller. Bull and Murphy provide additional historical context in parts II and III. These sections contain articles written by members of the German Military, and provide an additional German viewpoint of the Paris Guns and the bombardment of Paris. Bull and Murphy include these articles for comparative purpose, but view them as less credible than previously presented documents. These documents are from a German perspective and appear to editorialize German actions and objectives, whereas the previous works, especially Rausenberger's, appear more objective.

Finally, part IV is the direct work of Bull and Murphy, titled, "A Computer aided Analysis and Reconstruction of the *Wilhelmgeschütze*."[34] This exhaustive study details the origin, development, design, testing, and employment of the Paris Guns. This highly technical section describes the iterative process of developing the gun, projectiles, and propellant to achieve the desired range capability (100 to 120 kilometers). While highly technical in scope, this section is exceptionally informative for contextual information related to the Paris Guns. In the introduction of this section, Bull and Murphy appear perplexed by the intended effects of the Paris Guns, stating:

> But aside from a momentary shock, lasting less than a few days, the Paris Gun bombardment failed to affect the operations of the great city. It remains a mystery as to how effectiveness was planned, since the earlier bombardment of Dunkerque [UK spelling] had produced no catastrophic results even though far more tonnage of high explosives (about 400 shells of approximately one ton each) had been used.[35]

In the conclusion of this section, Bull and Murphy provide their definitive analysis as to the ability of the Paris Guns to achieve their desired effects, stating:

> As a psychological weapon it failed completely to achieve any major disruption to Paris life. At the outset with the new, unknown element present, Paris authorities did stop activities during bombardment and some public concern arose. But this did not last for long; as the bombardment became understood it became of a rather minor nuisance value, suggesting the avoid-

> ance of congregated masses. But it only hardened the will to resist, and in the long run was regarded as somewhat of an expensive folly by the Allied Defence [UK spelling] authorities.[36]

Bull and Murphy concluded the definitive work on the history of the Paris Guns, and their view on the efficacy of these guns as psychological weapons cannot and should not be ignored.

This manuscript incorporates additional primary source material beyond the works of Colonel Miller and Bull and Murphy. One such primary source is military intelligence and information summaries obtained from the American Expeditionary Forces records. Military intelligence reporting provides a lens into what military staffs, and by extension, their commands deem essential, relevant, or critical to the ongoing conduct of warfare. In a survey of every military intelligence and information report from 24 March to 1 September 1918, compiled by the American Expeditionary Forces, there existed only five references to the bombardment of Paris by long-range cannon artillery.[37] These compilations contain a total of over 500 pages of intelligence and information summaries, yet only mention the bombardment five times. The lack of reporting on the bombardment is an indicator that the United States Military and perhaps the Allied Powers, in general, believed these weapons to be ineffectual, or to bear no real military significance when compared to other events and actions occurring on the Western Front. The reports contain brief factual summaries with little analysis. These reports imply an overall indifference to the bombardment of Paris by the command of the American Expeditionary Forces.

An additional indicator of a military's opinion of the efficacy of emergent technology is identified by which technologies they choose to invest. There were many boards conducted in the years following World War I to either capture lessons learned by the American Expeditionary Forces, to recommend future doctrinal and material pursuits to the United States Army, or both. Two boards relevant to this manuscript focused on artillery. The first board, colloquially referred to as the "Hero Board" was a board appointed by the general headquarters, American Expeditionary Forces, office, chief of artillery, and chaired by Brigadier General Andrew Hero, Jr., United States Army. Its purpose was to "make a study of the experience gained by the Artillery of the American Expeditionary Forces, and to submit recommendations based upon such study."[38] In the 842 pages of this document, the Paris Guns, either by name or description, are not referenced or considered.

Another board, colloquially known as the "Westervelt Board" or "Caliber Board," convened on 12 January 1919. It consisted of "a Board of Officers, chaired by Brigadier General William I. Westervelt, [and] was convened to consider the experience gained by artillery during World War I while serving with the American Expeditionary Forces."[39] This board addressed the concept of super-heavy guns and howitzers but limited the definition as such, "This does not apply to guns of the type used to bombard Paris; such guns have no military value and their construction is not justifiable."[40] Clearly, the United States Military did not consider these weapons of value after World War I. If there were dissenting voices to this opinion, their ideas were not favored or pursued as viable options for future development of United States artillery weapon systems.

Civilian news reporting provides an additional window into the sentiments or opinions of the public as to the importance or efficacy of military matters. Between 24 March 1918 and 12 August 1918, the *New York Times* published 64 articles related to the bombardment of Paris by the Paris Guns. These articles range in content from simple to complex reports of bombardment events through civilian, military, and political responses to these bombardments. They chronicle the bombardment throughout its duration and juxtapose it alongside the German offensives taking place along the Western Front throughout 1918. Additionally, they provide a large quantity of primary source material and information related to the bombardment of Paris. Of note, these articles derive from multiple sources. The majority do not have listed authors, but are instead the compilation of information reported in Parisian, French, and British news sources, and subsequently cabled to the *New York Times.* In this way, the information is mostly free of bias and remains relatively objective beyond a generally positive (French and Allied) tone. Despite this bias, information is easily verified and cross-referenced against other primary source materials available for this study. The general conclusion drawn from these articles is that the bombardment of Paris may have created a brief negative psychological effect for the people of Paris. These fears waned as the bombardment continued. Ultimately, the bombardment may have engendered in the people of Paris and the French as a whole their spirit and strengthened their resolve.

Secondary Sources

Bethany Groff's document analysis, "On the Paris Gun," provides an investigation of a primary source historical report from the United States ambassador to France (William Graves Sharp) to theUnited Statessecretary of state (Robert Lansing). This reasoning details the bombardment of

Paris, France, on Friday (Good Friday), 29 March 1918, and the resulting destruction of the St. Gervais Church, which killed 88 and wounded 68. Groff included a reprinting of the letter with her findings. Lansing quotes Sharp's opinion of the attack, stating;

The exceptional circumstances under which this tragedy occurred, both as to the sacred character of the day and the place, have greatly aroused the indignation, of the people of Paris toward an enemy who seeks to destroy human life without regard to the immunities prescribed by the laws of civilization and humanity, and, instead of terrorizing the people, shells of the great cannons, as well as the bombs dropped from the German airplanes, only serve to strengthen the resolve of the French to resist, to the last man if necessary, the invasion of such a foe.[41]

Sharp's opinion, as relayed by Lansing, conveys the idea that the Paris Guns may have achieved an unintended and indeed the opposite of the Germans' desired effect. Groff goes on to examine the content of the report, providing the following conclusion: "Whether the Paris Gun served to strengthen or weaken Parisian citizens' resolve could be debated, but its destruction of St. Gervais was reported as an example of Germany's disrespect for the laws of war and the sanctity of life."[42] Groff's conclusion builds additional source material contributing to the global sentiment towards the perceived brutality of the German Military.

"The Big Berthas: How Successful?," an article in *Military Review* by Rear Admiral William H. Langenberg provides a general history of the development, characteristics, and employment of the Paris Guns. Rear Admiral Langenberg concludes that the "primary purpose of these weapons [the Paris Guns] was to destroy French morale and bolster that of the German armies by shelling Paris from enormous range."[43] He then offers a general answer to why the Paris Guns failed, "They [the Paris Guns] failed in their principal mission because of the indomitable spirit of the Parisians who realized the Germans' objective yet refused to be daunted by the new form of bombardment."[44] This generalized assertion is worth exploring in detail, as such assertions ignore the nuance of the bombardment of Paris by the Paris Guns. Rear Admiral Langenberg concludes that anti-morale weapons are ineffective in achieving strategic objectives "when employed against a determined and indomitable enemy."[45] Again, this generalization ignores the nuance of the bombardment and the way the Germans employed them. The German employment of these weapons and their means of linking tactical action to strategic effects is worth further consideration.

The article, "The Biggest Gun in the World," published in *Military History,* by Stephen F. Hurst again provides a general history and synopsis of the German employment of the Paris Guns in a bombardment of Paris, France. This article marvels at the technological achievement of the weapons but finds them strategically lacking. Hurst states, "The Paris Gun was an undeniable technological achievement, but in the end it actually had little impact on the course of the war."[46] Hurst is yet another author declaring the overall ineffectiveness of the Paris Guns when viewed from strictly a psychological perspective.

The journal article, "Paris Under the Gun," by Major General (Retired) David T. Zabecki, provides a general account of the history of the Paris Guns, including their characteristics as well as an account of their employment against Paris. Major General Zabecki also contends that the Germans made a strategic error in employing them against the Parisian population center rather than critical Allied military infrastructure. Unlike many of his contemporaries, he offers a possible alternative to this manner of employment, stating, "they [the Germans] could have directed its [Paris Gun's] power against far more militarily significant targets."[47] This alternative method of employment offers a means to achieve potential strategic effects beyond just targeting a population.

Major Jonathan T. Palumbo's manuscript, "U.S. Field Artillery After World War I: Modernizing the Force While Downsizing," details the changes made to the doctrine, personnel, and materiel in use by the United States Army Field Artillery following World War I. It details World War I identified requirements to recommended changes to weapon systems following the war. This work indicates that the United States Army Field Artillery did not emphasize the development of a long-range artillery weapon following World War I. Major Palumbo makes further reference to the German long-range gun (the Paris Guns), by citing the historian Boyd Dastrup, he contends that the Paris Guns had no value as tactical or operational weapons. He argues that the Germans used them as purely a psychological tool.[48]

Michael S. Neiberg's book, *Fighting the Great War: A Global History* briefly discusses the German use of the Paris Guns in 1918 against Paris, France. In this discussion, he refers to the shelling of Paris by the Paris Guns as a "random terror bombardment."[49] Additionally, Neiberg further describes the role and the effects of the Paris Guns, "Its only mission was to frighten the capital and induce panic. It failed to do so, but eventually killed 256 civilians and wounded 620 more."[50] This brief account of the

Paris Gun asserts that it did not achieve any strategic effects, much less its intended psychological effects.

The Rocket and the Reich, a book by Michael J. Neufeld, details the origins of the German missile program and the ultimate development of the rockets and missiles employed during World War II. Several of the scientists and engineers who originally pioneered the development of the Paris Guns ultimately transitioned their work to the German missile program. Neufeld's work states the following;

> Dornberger's specifications reveal the flawed thinking that lay behind the German missile program from the outset. The Paris Gun had been the greatest technical accomplishment of German artillerists up to that time, yet it had failed to have much effect on the French in 1918. The gun was a triumph of narrow technological thinking: the technical fascination of being able to break through traditional limits and fire over such unprecedented distances had overwhelmed any rigorous analysis of its likely impact on enemy morale. The interwar German artillery community completely failed to grasp that point. Those specialists, led by Becker, saw the gun only in terms of artillery reaching its technological limits in muzzle velocity and range.[51]

This quotation further illustrates the widespread position in the relevant literature that the Paris Guns did not achieve strategic or, at a minimum, their intended psychological effects. It further articulates the position that the development and employment of these guns was misguided from the outset and fails to account for or consider the intended effects of their use.

Major Maitland-Addison discusses the Paris Guns in "The Long Range Guns." This document is an extract from the transcript of a lecture delivered at the Royal Artillery Institute by Major J. Maitland-Addison, R.A., and reprinted in the *Field Artillery Journal* (United States), July-September, 1918 from the *Journal of the Royal Artillery,* July 1918.[52] In this lecture, Major Maitland-Addison indicates that the French are indifferent towards this weapon; but he does contend that "a marked advance has been made in artillery."[53] This perhaps indicates an indirect effect; the gun had not instilled fear in the French; instead, the artillery community at the time viewed its introduction as worthy of note and a requirement for further study and consideration.

In his book, *Field Artillery and Firepower,* Major General Jonathan B. A. Bailey discusses the Paris Guns and their strategic potential. From

Major General Bailey, "By March 1918, artillery deep operations even included surface-to-surface strategic attack, a conceptual precedent set by the German Paris gun."[54] Bailey continues, "It was an astonishing achievement in technical terms, but the means and tactic of the day proved inadequate for the revolutionary strategic objective."[55] Bailey goes on to explain how some of the scientists and engineers who developed the Paris Guns went on to work on the German rocket programs before and during World War II. This may indicate a flaw in the understanding and linking of desired effects to the development of the weapon systems. The confirmation bias displayed itself in these scientists and engineers. They took their concept of a psychological weapon from World War I and overlaid the same intent on a new weapon system in a new war, World War II. Bailey explains, "The Paris gun of 1918 was a strategic artillery system that was conceptually innovative, technologically remarkable, but still wanting in effect."[56] Major General Bailey established a fundamental flaw in the development of the Paris Guns, that function follows form. The purpose of these weapons was a technological achievement. Little consideration was given to their intended use, or if they could even achieve their intended effects.

The primary sources available for this study provide a comprehensive historical picture of the events and circumstances surrounding the development, fielding, employment, the reaction to, and the effects of the Paris Guns. These works yield the tactical, technical, and contextual information to frame and shape analysis of the Paris Guns from a strategic perspective. They further provide the data required for compilation and summary in chapter 4 and analysis in chapter 5.

The secondary sources available indicate a noticeable gap in the analysis of the effects of the Paris Guns. Without exception, this investigation focuses on the efficacy of these weapons as psychological weapons; the Germans intended purpose. The consensus is clear that they were not valid in this regard. Little consideration is given to what other effects they achieved, and apart from Major General Zabecki, what better purpose they might have served. This manuscript investigates the effects these guns achieved, both intended and unintended, and how this conception shapes our current understanding of strategic effects.

Strategy, Deterrence, and the United Sates Army's Future Operating Concept

To understand the impetus for this case study, it is first necessary to understand the United States Military's conception of strategy, the compe-

tition continuum, effects, and the United States Army's Future Operating Concept: Multi-Domain Operations 2028.

Strategy, the Competition Continuum, and Effects

The United States Military defines strategy in Joint Publication 3-0, *Joint Operations* as, "A prudent idea or set of ideas for employing the instruments of national power in a synchronized and integrated fashion to achieve theater, national, and/or multinational objectives."[57] The instruments of national power encompass all means available through the diplomatic, informational, military, and economic exercise of national influence.[58]

The United States uses the elements of national power along the competition continuum to achieve its strategic objectives.[59] The competition continuum is the range of interactions between international actors "from peaceful cooperation, through competition below armed conflict, to armed conflict."[60] The United States Military defines the various states along the competition continuum as follows;

- "Cooperation includes mutually beneficial relationships between strategic actors with similar or compatible interests. Although interests will rarely be in complete alignment, cooperative relations underpin the international order, enhance collective security, and deter conflict."[61]
- "Competition below armed conflict exists when two or more strategic actors view one another as competitors (as opposed to adversaries) that have incompatible interests. Competitors may cooperate with one another or engage in behavior detrimental to [the] other strategic actor's interests."[62]
- "Armed conflict involves the use of violence as the primary means by which a strategic actor seeks to satisfy its interests or react to provocation."[63]

These states along the competition continuum are not finite, and further, the United States may be in multiple states with a single, or multiple actors at any given time. To influence actors along the competition continuum, the United States Military seeks to achieve effects against various adversary or competitor targets to attain strategic objectives. "An effect is a change in the physical or behavioral state of a target system, a target system component, a target, or a target element that results from an action, a set of actions, or another effect."[64] A strategic effect is the direct, indirect, cumulative, cascading, or unintended change in the physical or behavioral state of an actor's ability to project the elements of national power.[65] A strategic weapon system is, therefore, any weapon system capable of

achieving a strategic effect against an actor's source(s) of diplomatic, informational, military, or economic power; such that its (the strategic weapon system's) use or threat of use alone can achieve or aid in the achievement of national policy or security objectives.[66]

Deterrence and Coercion

During the competition state along the competition continuum model, there is an obvious requirement to act in such a way as to prevent a competitor from conducting or initiating armed conflict. Traditionally, these actions are referred to as deterrence. The RAND Corporation published a monograph titled "Conventional Coercion Across the Spectrum of Operations: The Utility of United States Military Forces in the Emerging Security Environment." This study discusses the theory of coercion and how it relates to United States foreign policy. Research argues that deterrence is ultimately just another form of coercion, on the international scale. It states, "Coercion is causing someone to choose one course of action over another by making the choice preferred by the coercer appear more attractive than the alternative, which the coercer wishes to avoid. In the international arena, coercion seeks to change the behavior of states."[67] The study continues, stating that all of the elements of national power are employed in a coercive manner. It then focuses on military deterrence, quoting another RAND Corporation study, stating, "Coercion is the use of threatened force, including the limited use of actual force to back up the threat, to induce an adversary to behave differently than it otherwise would."[68] For this research, the relationships outlined above between deterrence and coercion provide an adequate definition for the United States Army's actions to deter global aggression. These relationships provide an understanding of how strategic long-range cannon weapon systems' existence or positioning potentially deters competitors and compels them to continue to compete, avoiding armed conflict.

The United States Army in Multi-Domain Operations 2028

On 6 December 2018, the United States Army Training and Doctrine Command published the future operating concept for the United States Army, *The U.S. Army in Multi-Domain Operations 2028.* This document is conceptual and seeks to inform the force management and modernization of the United States Army through 2028. The central idea is, "Army forces, as an element of the Joint Force, conduct multi-domain operations to prevail in competition; when necessary, Army forces penetrate and dis-integrate enemy anti-access and area denial systems and exploit the resultant freedom of maneuver to achieve strategic objectives (win) and

force a return to competition on favorable terms."[69] This central idea addresses the problem of strategic competitor states using anti-access and area denial systems to create multiple layers of stand-off to separate the United States and partners politically in competition, and the Joint Force in time, spaces, and function during armed conflict.[70] The method of addressing this problem is to compete below the level of armed conflict, and in the event of armed conflict, to enable the rapid defeat of aggression and then to re-compete.[71] Each of these actions deserves additional independent analysis.

Competition requires the Joint Force to defeat an adversary's efforts to achieve its strategic goals and deter military escalation. The Joint Force accomplishes this "by expanding the competitive space for policymakers through multiple options for employing the elements of national power."[72] If competition escalates to armed conflict, it is the role of the Army forward presence and expeditionary forces to penetrate, dis-integrate, and exploit. Essential to this study, this document states, "Army long-range fires converge with joint multi-domain capabilities to penetrate and dis-integrate enemy anti-access and area denial systems to enable Joint Force freedom of strategic and operational maneuver."[73] This definition is critical to this manuscript, as it clearly articulates the strategic role template for the "deep fires" weapon systems in development by the long-range precision fires cross-functional team. After the defeat of an adversary's aggressive actions during armed conflict, the Army re-competes below the level of armed conflict in an attempt to deter and prevent future armed conflict.

The U.S. Army in Multi-Domain Operations 2028 clearly articulates a requirement for a strategic long-range weapon system to converge along with Joint capabilities to penetrate and dis-integrate enemy anti-access and area denial. Additionally, it implies that the presence of these weapon systems in or near a theater of operations will potentially achieve a deterrence effect in the competition phase of operations. These roles stand opposed to the intended use of the Paris Guns, as strategic long-range cannon is not a psychological weapon for use against an adversary's populace. This stark contrast may allow strategic long-range cannon to achieve desired critical effects if employed in a manner in congruity with those ends.

Strategic Long-Range Cannon Artillery

Since the creation of the long-range precision fires cross-functional team in October 2017, little has been published about strategic long-range

cannon artillery. The reason for this is the sensitive or classified nature of the technical requirements of its development. Despite this limitation, documents such as *The U.S. Army in Multi-Domain Operations 2028* imply its intended use. In addition to this document, general conceptual information about these weapon systems exists in several open-source articles. The summation of this information provides a lens into strategic long-range cannon's intended use and potentially its shortfalls or limitations in the ability to achieve or assist in the achievement of strategic effects. These articles primarily emphasize range as the defining element to achieve a strategic effect against an adversary.

Sydney J. Freedberg Jr. wrote a 23 March 2018 article in *Breaking Defense,* titled, "Army Will Field 100 Kilometer Cannon, 500 Kilometer Missiles: Long-Range Precision Fires Cross-Functional Team." This article indicates that the Army is modernizing three artillery systems including missiles, "for very deep or even strategic strikes against targets in the enemy rear and homeland."[74] This article relies on an interview of (then Brigadier General) Major General Stephen Maranian, the first director of the long-range precision fires cross-functional team. Major General Maranian stated, "We're looking at how we can increase the range, the volume of fire, and the lethality of our surface to surface fires…and then exploring what's in the art of the possible at strategic ranges."[75] Freedberg summarizes Major General Maranian's nomination of potential strategic long-range cannon targets stating, "The artillery will take out enemy aircraft and missiles on the ground."[76] This article is of value because it indicates that range for the sake of achieving range is not the objective of the long-range precision fires cross-functional team. Instead, it assumes, that range, volume of fire, and lethality are all elements that will make strategic long-range cannon a viable strategic weapon system.

In a later article for *Breaking Defense,* titled "Army Building 1,000-mile Supergun," Freedberg provides refined information about the technology in use for the future strategic long-range cannon weapon systems. This article indicated that the deep fires element of the long-range precision fires cross-functional team was pursuing two technologies to achieve the desired strategic effects. These technologies were a hypersonic weapon system using advanced rocket or missile technology as well as the strategic long-range cannon. The article expressed confidence from the long-range precision fires cross-functional team in achieving the desired 1,000-mile range requirement, in that the gun(s) rely on proven artillery and rocket-assisted technologies, only scaled up. The article further explains the proposed technical solution for strategic long-range cannon, "It

would use a cannon barrel to launch artillery shells with built-in rocket boosters that ignite in mid-air. Since the cannon is reusable, this should be significantly cheaper than using one-shot rockets for every phase of flight. Lower price for shot, in turn, allows the Army to take out large numbers of lightly protected targets."[77] Again, this article articulates a need for a weapon capable of delivering multiple projectiles precisely at ranges over 1,000 miles. It also nominates potential targets for these weapons beyond an adversary's population.

A *Defense News* article from 14 October 2019, titled "Strategic, Long-Range Cannon Preps to Jump Its First Tech Hurdle" by Jen Judson, provided a progress update on the development of strategic long-range cannon artillery. This article indicated that the Army was on the verge of conducting its first early ballistic test as a proof of concept. The new Director of the long-range precision fires cross-functional team, Colonel John Rafferty, further articulated the requirement for strategic long-range cannon within the Army's arsenal, stating, "layered enemy standoff at the strategic level was really the fundamental problem. One of the ways to solve that problem is to deliver surface-to-surface fires that can penetrate this [anti-access, area denial] complex and disintegrate its network and create windows of opportunity for the joint force to exploit."[78] Again, this article, with supporting information provided by the director of the long-range precision fires cross-functional team, further articulates what the Army believes will make strategic long-range cannon a critical weapon system: range coupled with the ability to penetrate adversary anti-access and area denial networks effectively.

These contemporary discussions of the strategic long-range cannon weapon systems states the intended use and concept for achieving strategic effects. The United States Army, through director interviews of the long-range precision fires cross-functional team, have articulated that the ability for a weapon to achieve extreme ranges alone, does not make that weapon strategic. The United States Army contends that range coupled with precision, and married with affordability to achieve massing effects will achieve a strategic effect. These attributes have the potential to achieve these effects across the competition continuum. In competition, these weapons will position to negate an adversary's anti-access and area denial system, thereby offering a level of deterrence. In armed conflict, they could penetrate and dis-integrate to provide a window of opportunity for the Joint Force to conduct strategic or operational-level maneuver.

Notes

1. New York Times, "Paris Shelled Again; 8 Killed," *New York Times,* 31 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/31/102684190.html?pageNumber=1.

2. Lieutenant Colonel Henry W. Miller, *Railway Artillery: A Report on the Characteristics, Scope of Utility, Etc. of Railway Artillery* (Washington, DC: Government Printing Office, 1921).

3. Marc Romanych, "Big Bertha," *Encyclopedia Britannica,* n.d., accessed 4 February 2020, https://www.britannica.com/technology/Big-Bertha-weapon.

4. Bull and Murphy, *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP,* 12.

5. Bull and Murphy, *Paris Kanonen,* 21.

6. Bull and Murphy, 76. It is unclear how many Paris Guns Krupp AG developed. Some guns provided service only as testing platforms, while some did not see combat during the bombardment of Paris. Bull and Murphy contend that the following guns were available at the start of the development project, and it is therefore conceivable that the total of these guns is the upper limit of the number created for both testing and combat: 1 experimental 35.5 centimeter, 52.5 caliber long gun, 2 or 3 standard Navy 38 centimeter, 45 caliber long guns, and 9 35 centimeter, 45 caliber Navy guns complete except for rifling. Bull and Murphy, 34. Dr. Rausenberger's manuscript indicates that the total conduct of the bombardment used eight barrels. This total includes five barrels with a diameter of 21 centimeters, as well as two barrels rebored to 23.2 centimeters, and one barrel rebored to 22.4 centimeters. The three barrels were rebored due to tube wear from firing on Paris, France. It is unclear how many total carriages were employed; this number did not exceed eight as this was the maximum number of barrels employed in the bombardment.

7. Bull and Murphy, 82.

8. In tables presented in *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP* and *Railway Artillery: A Report on the Characteristics, Scope of Utility, Etc.,* the number of total projectiles fired is 351. The author believes this is an accounting error generated in a pre-digital age of accounting. When totaled, the actual sum of the projectiles in the "Number of Bursts" column is 352. Additionally, the author believes this accounting error has propagated throughout historical records as this number (351) appears in several sources as the number or projectiles fired by the Paris Guns. To amend the historical record, this manuscript will use the corrected total of 352 bursts throughout.

9. University of Michigan, "Bio Henry W. Miller," The Michigan Alumnus, modified 2011, accessed 19 March 2020, http://faculty-history.dc.umich.edu/faculty/henry-w-miller/bio.

10. University of Michigan, "Bio Henry W. Miller."

11. University of Michigan.

12. University of Michigan, "Famed Ordnance Expert Deep In Wartime Training," The Michigan Alumnus, 1943, accessed 19 March 2020, http://faculty-history.dc.umich.edu/faculty/henry-w-miller/famed-ordnance-expert-deep-wartime-training.

13. Miller, *Railway Artillery,* 6.

14. Miller, 83.

15. Miller, 81.

16. Miller, 82.

17. Miller, 82.

18. Miller, 82-83.

19. Miller, 83.

20. Miller, 83.

21. This article appears as an appendix with minor changes in *Railway Artillery: A Report on the Characteristics, Scope of Utility, Etc. of Railway Artillery.* Changes to this article include the removal of some pictures and tables as well as the overall formatting of the article. Despite these changes, the overall content and scope of the article remain the same as the original version.

22. Liuetenant. Colonel Henry W. Miller, *Railway Artillery: A Report on the Characteristics, Scope of Utility, Etc. of Railway Artillery* (Washington, DC: Government Printing Office, 1921), 728.

23. Lieutenant. Col. H. W. Miller, "The German Long-Range Gun," *The Journal of the American Society of Mechanical Engineers,* February 1920, 99, US Army Heritage and Education Center (AHEC) Archives, Carlisle, PA.

24. The author found evidence that the actual number was 352 total rounds used in the bombardment.

25. Bull and Murphy, *Paris Kanonen,* 145-147.

26. Bull and Murphy, 146.

27. Bull and Murphy, 11.

28. The German corporation responsible for much of the design and manufacture of German artillery in use during WWI. Designed, developed, tested, built, and supervised the employment of the Paris Guns.

29. Bull and Murphy, Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP, 21.

30. Bull and Murphy, *Paris Kanonen,* 54.

31. Bull and Murphy, 59.

32. Bull and Murphy, 59.

33. Bull and Murphy, 59.

34. Bull and Murphy, 73.

35. Bull and Murphy, 73.

36. Bull and Murphy, 136.

37. General Headquarters American Expeditionary Force Papers, Second Section Intelligence Summaries January to November 1918, Box 8, Folder 2, US Army Heritage and Education Center Archives, Carlisle, PA. General Headquarters American Expeditionary Force Papers, *Second Section Information*

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44. Langenberg, "The Big Berthas: How Successful?," 32.

45. Langenberg, 32.

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49. Michael S. Neiberg, *Fighting the Great War: A Global History* (Cambridge, MA: Harvard University Press, 2005), 314.

50. Michael S. Neiberg, *Fighting the Great War: A Global History,* 314.

51. Michael J. Neufeld, *The Rocket and the Reich* (New York: The Free Press, 1995), 51-52.

52. Major J. Maitland-Addison, "The Long Range Guns," *The Field Artillery Journal* 8, no. 3 (1918): 321, accessed 3 December 2019, http://sill-www.army.mil/firesbulletin/archives/1918/JUL_SEP_1918/JUL_SEP_1918_FULL_EDITION.pdf.

53. Major J. Maitland-Addison, "The Long Range Guns," 321.

54. Jonathan B. A. Bailey, *Field Artillery and Firepower* (Oxford: The Military Press, 1989), 269-270.

55. Bailey, *Field Artillery and Firepower,* 270.

56. Bailey, 279.

57. Headquarters, Department of Defense, Joint Publication (JP) 3-0, J*oint Operations* (Washington, DC: Government Printing Office, 2017), GL-16.

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59. Headquarters, Department of Defense, Joint Doctrine Note (JDN) 1-19, *Competition Continuum* (Washington, DC: Government Printing Office, 2019), 2.

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71. Department of the Army, 24-26.

72. Department of the Army, 24-25.

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Chapter 3
Methods and Means of Study

> Basic research is what I am doing when I don't know what I am doing.
>
> —Dr. Wernher von Braun, 16 December 1957, *The New York Times*

Overview

The purpose of this manuscript is to provide recommendations to the United States Army for the future use of strategic long-range cannon artillery weapon systems that are currently in development for the United States Army Field Artillery. A qualitative analysis case study of the development, fielding, and employment of the German Paris Guns answers the primary and secondary research questions. This qualitative inquiry will investigate the effects of the employment of the Paris Guns, and what strategic impacts, if any, resulted. The outcome of this case study provides recommendations to the United States Army Field Artillery on how to employ strategic long-range cannon artillery weapon systems throughout the competition continuum.

Case Study Framework

The instruments of national power are diplomatic, informational, military, and economic. An actor must possess some or all of the following qualities to achieve strategic effects through the elements of national power: moral strength, the will to act, physical strength, and freedom of action.[1] Any change to an actor's source of power which provides these characteristics will affect their ability to employ the instruments of national power. Changes to use any or all of the instruments of national power, whether through direct, indirect, intended, or unintended actions by an adversary, constitutes an achieved strategic effect.

Moral Strength

This study assumes that a kinetic effects-oriented weapon system is unable to affect the moral strength provided through the diplomatic instrument of national power. The moral strength of an actor relates to the legal, ethical, and moral authority enjoyed by the citizens. External actors provide moral authority and are therefore unaffected by a kinetic weapon system's direct, indirect, or cumulative effect on the actor's diplomatic capability.

Conversely, this study assumes that a kinetic effects-oriented weapon system could affect an actor's physical strength, freedom of action, or will to act. These factors are internally derived sources of power; therefore, an external action by an effects-oriented weapon system could conceivably affect the relative power of an actor provided by these attributes.

Will to Act

A national or state citizen's will to act is the desire of the majority to continue along the present course. Because the will to act is a human behavior-based variable, it is difficult to measure from the individual or collective human behavior level. Due to the inherent variance within a given population regarding perceived intent or popular support, it is difficult to quantify and therefore measure the relative will to act provided by the people of a given society. Additionally, reports of collective opinion or individual testimonies of their feelings regarding a given issue can vary greatly and are often anecdotal, and for this rationale, difficult to apply collectively across an entire population. For these reasons, popular support providing the will to act was not used as a metric for this qualitative analysis.

Physical Strength

A great power actor's physical strength is the measurable capability of, and ability to employ its military effectively. The summation of this strength is the military's combat power. In the United States Military's joint doctrine, combat power is measured individually and collectively by seven joint functions: command and control, information, intelligence, fires, movement and maneuver, protection, and sustainment.[2] A change to the capability of any of these functions constitutes a change in physical strength provided by the actor's military. Because a nation's physical strength results from their ability to employ their military effectively, the study of effects on physical strength is evident in freedom of action. For this reason, physical strength is explored as a facet of freedom of action, as described below.

Freedom of Action

A great power's freedom of action has a direct relationship to its ability to achieve an increased stand-off. Stand-off can refer to tangible concepts such as distance, time, and space, as well as intangible concepts of freedom such as information or economic. The operational variables presented in the United States Military's joint doctrine: military, political, economic, social, infrastructure, and information provide an appropriate

framework to describe and measure stand-off. Any ability for an actor to increase stand-off for themselves or correspondingly, to reduce relative stand-off for their competitors or adversaries within these six operational variables constitutes an achieved strategic effect.

Methodology

A qualitative analysis historical case study will answer the primary and secondary research questions. This case study will use a focused document review of unclassified primary and secondary source material related to the development, employment, and effects of the Paris Guns of World War I. Additional analysis of unclassified literature on the current development of future United States Army doctrine and weapon systems provides the context for lessons learned about the Paris Guns.

As detailed above, there is a direct relationship between the elements of national power and the national actor's moral strength, will to act, physical strength, and freedom of action. The citizen's ability to employ the elements of national power relies on their capacity in these subordinate elements. Any increase or decrease in these capacities constitutes an achieved strategic effect. Therefore, an actor's relative strategic power is qualitatively measured through an analysis of relative capacity of its moral strength, will to act, physical strength, and freedom of action.

As previously stated, the most representative and applicable of these elements to the national strategic capacity gained from a stand-off is achieved by the development of an anti-access and area denial network—freedom of action. This stand-off is not limited to distance or range. Still, it can be measured both tangibly and intangibly across all joint operational variables: military, political, economic, social, infrastructure, and information. Figure 3.1 next page displays the relationship between tactical action manifesting as target effects, measures across the operational variables, and yields strategic effects on an actor's freedom of action to employ the elements of national power. The flow of these effects from tactical-level action to strategic outcomes is the framework methodology for this case study.

Given the available primary and secondary source documentation of the Paris Guns, the most applicable of these operational variables is a qualitative study about the societal, political, economic, and military variables. Source documentation provides evidence of the achieved strategic effects within each operational variable. These consequences are not one-sided or limited only to the Germans or the Allied Powers. These effects provide holistic evidence of both the intended and unintended effects of the Paris

Guns across each operational variable. This analysis determines whether the German Military was able to increase stand-off across the four operational variables, and therefore achieve strategic effects. In the conclusion of this manuscript, lessons learned from the actions resulting in these strategic effects will become recommendations for the use of strategic long-range cannon in the 21st Century.

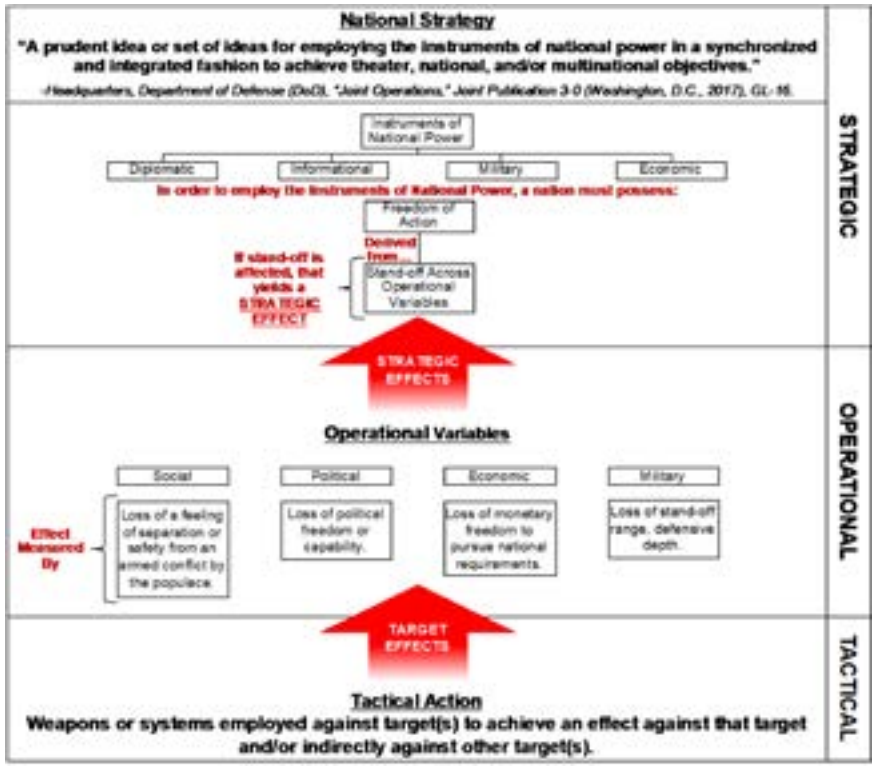

Figure 3.1. Case Study Methodology Framework.

Source: Created by author.

Secondary Research Questions

A narrative describing the events surrounding the development, deployment, and utilization of the Paris Guns will answer the secondary research questions in chapter 4. Chapter 5 will further support these answers through analysis using the previously stated operational variable

framework. This narrative and subsequent analysis will establish which actions did and did not achieve strategic effects, what the German's intended effects were, and if they resulted in any unintended consequences. Most specifically, if there was an effect on the French stand-off across the operational variables. This research and narrative intends to influence the modern development and ultimate employment and use of strategic long-range cannon artillery across the competition continuum for the 21st Century.

Data Collection

An analysis of the Paris Guns across the societal, political, economic, and military operational variables will yield qualitative data to support the conclusions and recommendations. A document review of historical primary and secondary sources provides data that is relevant to the development, deployment, and utilization of the Paris Guns by the German Army. This narrative seeks to convey qualitative text supporting the achieved strategic effects across the operational variables.

Data Analysis

Chapter 5 analyzes the narrative established in chapter 4, and provides additional primary source supporting documentation. The analysis qualitatively measures the effectiveness of the Paris Guns through perceived increases or decreases in stand-off capacity across the operational variables of the belligerent parties in World War I (Allied Powers and Germany). A net negative or positive strategic effect determination for either the Allied Powers or the Germans results from the evidence across the operational variables. Additionally, a determination and exploration of unintended strategic effects occurs to identify the potential pitfalls of the employment of strategic long-range cannon in the 21st Century.

Summary

A qualitative analysis through a focused document review of primary and secondary sources answers the primary and secondary research questions. The development, employment, and effects of the Paris Guns by the German Military in World War I serves as the historical case study. This case study provides conclusions and recommendations for the future employment of emerging strategic long-range cannon artillery currently under development in the United States Army Field Artillery. Chapter 4 examines details of the development, fielding, employment, and resulting effects of the German Paris Guns in 1918. Chapter 5 studies the details of chapter 4 determining what strategic effects the Paris Guns achieved.

Notes

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2. Headquarters, Department of Defense, JP 3-0, *Joint Operations,* GL-16.

Chapter 4
Development and Employment

> My dear colleagues, the subject now before us is the construction of the engine, its length, its composition, and its weight. It is probable that we shall end by giving it gigantic dimensions; but however great may be the difficulties in the way, our mechanical genius will readily surmount them.
>
> —Impey Barbicane, quoted in Jules Vern, *From the Earth to the Moon*

Introduction

This study explores literature detailing in the development, employment, effects, and adversary response to the Paris Guns that were employed by the German Military during World War I against the people of Paris, France. This manuscript provides information to the United States Army Field Artillery about the future employment and use of strategic long-range cannon artillery weapon systems that are currently in development. The following study describes the events surrounding the development, employment, and reaction to the use of the Paris Guns. This case study provides analysis for the future employment of United States Army Field Artillery strategic long-range cannon artillery weapon systems.

The Paris Guns Case Study

In March 1918, the conflicting national powers were beginning the fourth and final spring of World War I. Much like previous years, the new spring called for a new series of offensives. This year would be no different, and the German Military would deliver in hopes of finally defeating the Allied Powers and bringing the war to an end.

Background

The Friedrich Krupp AG arms manufacturer was a major arms producer for Germany throughout the latter 19th Century until the present day. This corporation produced cannons like the Big Bertha, the Langer Max, and the Paris Guns in addition to a multitude of other arms, projectiles, and instruments of warfare.[1] Bull and Murphy, themselves engineers and scientists, performed extensive research into the history of the Paris Guns, ultimately writing and publishing *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP* in 1988. While researching this seminal work of extremely long-range cannon artillery, they discovered

previously unavailable primary source documents from engineers and scientists who were involved in the Friedrich Krupp AG corporation's development and the ultimate employment of the Paris Guns by the German Military. Of particular importance, was the discovery of Doctor Rausenberger's original manuscript as well as photographs and correspondence relating to this development; He was the both managing director and a member of the Board of Friedrich Krupp AG from 1910 to 1921. These documents provided unique insight into the impetus for developing this technology as well as the refinement of assumptions and facts collected by the American authority on the Paris Guns, Lieutenant Colonel Henry W. Miller, in his seminal 1930 work, *The Paris Gun: The Bombardment of Paris by the German Long Range Guns and the Great German Offensives of 1918.* While Miller was largely correct in his assertions, some technical developmental details, as well as tactical employment insight, were gained from Rausenberger's original manuscript.[2]

The development section below yields is a summarized narrative which has been primarily sourced from Rausenberger's manuscript as well as supporting documents collected by Bull and Murphy. This unique historical evidence provides the most informative details and is the most likely truthful and accurate account of the impetus and ultimate development of the Paris Guns. Additional source material will amplify the summarized narrative; however, the majority of this narrative is derived from previously stated sources.

Development

Rausenberger introduced his manuscript by illustrating a strategic problem facing the German Military in the Fall of 1914. He explained that after the war had begun, in the autumn of 1914, the German high command's plans involved a continued troop advancement to the Northern French coast beyond the city of Calais. This advance would place the German Military in command of Cap Gris Nez (the closest point between the French and British Coasts). The city of Dover is the closest city to Cap Gris Nez at a distance of 33 kilometers (20.5 miles) over the English Channel. If the German Army continued their advance and succeeded in commanding Cap Gris Nez, a long-range artillery bombardment of the English Coast and city of Dover would be possible. A weapon firing from Cap Gris Nez would need to be capable of achieved ranges of at least 37 kilometers (23 miles) to account for wind and other meteorological conditions.[3] Rausenberger stated, "The German Army's artillery of 1914 had a maximum range of about 15 kilometers [9.3 miles] so that any possible

solution had to be found by exploiting the large caliber, newly developed naval guns."[4] An explanation is provided.

Rausenberger went on to explain that the two most likely candidates for this task were the two major caliber naval guns available, the 30.5 centimeters L45 and the new 38 centimeters L45 Langer Max—theoretically able to achieve ranges of 24 kilometers (using a 405 kilogram projectile) and 28 kilometers (using a 743 kilogram projectile) respectively. The longest range any German weapon had achieved to that point, was only 21 kilometers (13 miles).[5] "Since none of the existing systems could attain the range required for the bombardment of Dover from Cap Gris Nez, some new development needed to be undertaken. Therefore, the Reichsmarineamt (German Naval Board) referred to the Krupp Firm to resolve the problem of extending the range of the large caliber naval guns to 37 kilometers [23 miles]."[6] He was not deterred by this.

On 21 October 1914, Krupp achieved the mandate from the Reichsmarineamt by firing a projectile 49 kilometers (30.4 miles).[7] Rausenberger explained how Krupp continued to advance technology by improving the ability to accurately predict fire while developing more massive guns able to achieve higher ranges for both the navy and the army. Rausenberger did not indicate what the impetus was for developing an ultra-long-range weapon system (100 kilometers), but does indicate that there did exist a "desire to increase the range still further, possibly to 100 kilometers [62.1 miles]."[8] It is reasonable to assume, based on the context and flow of Rausenberger's prose, that a line of direct communication existed between Krupp and the German Military. It is also likely that proposals for advancing technology by Krupp may have sometimes preceded a direct military need or intended use for such technology. Regardless of the genesis of this motive, Rausenberger indicated that the means to pursue this project did exist within the civil-military arms manufacturing process and that this proposal was not outside the realm of expectations by the German high command. Rausenberger's narrative below details the approval for Krupp to pursue the ultra-long-range cannons and exemplifies the civil-military arms manufacturing expectations and norms.

Rausenberger's suggested approach to developing a 100 kilometers cannon was to use a 21 centimeter projectile, weighing 100 kilograms, that accelerates to 1500 meters per second. Rausenberger's approach favored a long barrel which was fitted inside any of the large-caliber guns that were currently in existence and created by Krupp.[9] Rausenberger did not indicate if the German Military informed him of the gun's potential use, or

if he simply deduced its only practical application. However, his thoughts on the matter were;

> The only possible use of such a 100 kilometer range gun would be the bombardment of the Paris fortifications, an area target some 20 kilometers in width and breadth. A 21 centimeter shell weighing only 100 kilograms would be ineffective against smaller targets such as harbours [UK spelling], railway junctions, transfer points and depots situated deep behind enemy lines in view of the expected large range dispersion of several kilometers. Even the bombardment of Paris with such a relatively small shell containing only 8 kilograms of explosives (a limitation due to the high acceleration loading during in-bore travel), could only have a psychological effect on the enemy. Even to achieve this effect, it would be necessary to maintain a continuous bombardment, varying in intensity, for weeks or months.[10]

Rausenberger indicated that to consider developing such a gun, it would be necessary to have available at least ten guns to make this project effective. This requirement was due to the inherently short tube life of each gun, and that the initial firing tests and trials would completely wear out at least one tube. Rausenberger continued by stating that at the time this problem was considered in 1916, only 3 or 4 guns were actually be available, and only if these guns were diverted from their current position on the Western Front. Another option was to divert guns intended for use on new or under-construction battleships and heavy cruisers; this would not have been supported by the Reichsmarineamt as a viable option. The final untenable idea would be to manufacture new, recently designed guns. This required 18 months in manufacturing time and would have "placed an unacceptable workload on the Krupp factories, which were already struggling to meet the current needs of the [German] Army and Navy."[11] In Rausenberger's words, "at first glance, the possibility of realization of the desirable 100 kilometer, ultra long [*sic*] range bombardment system, seemed remote."[12] Still, he was optimistic.

Krupp overcame these obstacles, when "In the late autumn of 1916 the [German] Navy instructed Krupp to delay work on nine 35 centimeter guns intended for the large battle cruiser 'Ersatz Freya.'"[13] The following quotation from Rausenberger's manuscript evidences the relationship between Krupp and the German Military, and how the pursuit of technology

by civilian-military industry preceded a declared or articulated military need which was tied to objectives or strategy:

> Before proceeding further it was essential to determine whether the Oberste Heeresleitung (high command) would consider as worthwhile the bombardment of Paris with the relatively small 100 kilogram projectile carrying only 8 kilogram of high explosives. Thus I discussed our work on firing to 100 kilometers with my friend Colonel Bauer, the responsible section chief at the army general staff. He presented the project to both General Hindenburg and General Ludendorff. Their approval was immediate. They attached the utmost urgency to the project with instructions to proceed with all haste.[14]

After approval by the navy to divert the use of their guns for the new project, Krupp began work immediately. On 5 February 1917, General Ludendorff sent a letter with the following instructions to Krupp, "In view of new circumstances the maximum range for the 21/35 centimeter system must be 120 kilometers. I request that you proceed on this basis with your work."[15] Rausenberger then articulated how the operational need drove this change to the technological design, "This requirement resulted from the planned pull-back of the German front line, resulting in the bombardment range to Paris increasing to 120 kilometers."[16] This was encouraging.

Design and testing of the guns continued throughout 1917. Ultimately, the final design was tested and ready for operation in January 1918, which resulted in the *Wilhelmgeschütze* (William Gun) named in honor of Kaiser (Emperor) Wilhelm by the Krupp AG corporation. The 38 and 35 centimeter barrels received rifled barrel inserts of 21 meters (68.9 feet) in length. A smooth bore attachment to the end of the rifled barrel of either 6, 9, or 12 meters (19.7, 29.5, or 39.4 feet) (selected based on desired range and tube wear) completed the barrel configuration. The guns themselves were transported by rail for final assembly at prepared concrete and steel positions and predetermined locations.[17] Of particular interest in the employment of the Paris Guns was the critical role of German sailors. Because these were modified naval guns, the expertise in their employment lay with the German Navy. For this reason, the Paris Guns, compared to other heavy caliber railroad artillery weapons employed on the Western Front, were at least initially (until Army artillerymen were trained) employed and operated by German sailors in land combat. This unique role meant that in the case of the Paris Guns, the German Navy was the approval authority

for design modifications to Krupp, even though the weapons were tools of warfare needed by the German Army.[18]

Rausenberger indicated, "Having complete faith that the Krupp firm would succeed in their task, *Oberste Heeresleitung* (high command) had already selected the firing positions for the first battery of three *Wilhelmgeschütze* near Crépy, West of Laon, in the summer of 1917 and given the order to prepare the site positions."[19] Rausenberger stated that the work began and was confirmed by January 1918; these first positions were to begin firing from the Siegfried Linfe with Paris as a target by March 1918.[20]

Employment

"On the 22nd of March the high command issued the order to commence firing on Paris. The first shot was fired at 0715 on the 23rd of March 1918."[21] Table 4.1. illustrates the bombardments conducted by the Paris Guns that occurred by day, the number of bursts observed in and around Paris, and the number of casualties (both killed and wounded) from these bombardments. In total, the German Military fired projectiles at Paris on 43 different days between 23 March through 9 August 1918.

Three locations were used by the German Military to engage Paris. The original battery location was in Crépy, France, which conducted the initial bombardment on 23 March and remained until 1 May 1918. This location was at the extreme range of the Paris Guns, 120 kilometers (74.5 miles) from Paris. The second battery location was at Beaumont, France, at a range of 110 kilometers (68.3 miles), and used from 27 May through 11 June 1918. The closest location to Paris and the shortest range was 85 kilometers (52.8 miles) at Bruyères, France, during the July 1918 bombardment. The final firing location was once again at the Beaumont site during the August 1918 bombardment. These locations generally coincided with the advancement and ultimate contraction of the German lines as their 1918 offensives were initially successful then ultimately lead to retrograde.[22]

On 9 August 1918, the Paris Guns fired their last shots at Paris, expending 12 projectiles total.[23] These final rounds killed three and wounded six more, but the prolonged bombardment of Paris was finally over. Because of the Allied counter-offensive and the general German retreat, the guns were removed and ultimately destroyed. Their destruction resulted in preventing them from falling into Allied hands. It took the cumulative effort of multiple engineers and historians over the next century to resurrect the true history and characteristics of these World War I technological marvels.

Date			Number of Bursts	Killed				Wounded			
				Men	Women	Children	Total	Men	Women	Children	Total
Mar.	23	S	23	11	4	-	15	20	16	-	36
"	24	S	30	3	6	2	11	11	15	8	34
"	25	M	13	-	1	-	1	2	1	-	3
"	29	F	4	19	67	2	88	30	36	2	68
"	30	S	20	6	3	1	10	26	28	6	60
"	31	S	3	1	-	-	1	-	-	1	1
Apr.	1	M	4	2	4	2	8	3	3	2	8
"	2	Tu	4	-	-	-	-	-	3	-	3
"	3	W	3	-	-	-	-	-	-	-	-
"	6	S	9	-	-	-	-	2	1	-	3
"	7	S	1	-	-	-	-	-	-	-	-
"	11	Th	6	3	4	2	9	5	12	4	21
"	12	F	9	1	1	-	2	7	7	-	14
"	13	S	4	-	-	-	-	-	-	-	-
"	14	S	8	-	1	-	1	-	-	-	-
"	16	Tu	9	5	11	-	16	12	102	-	114
"	19	F	3	-	-	-	-	-	-	-	-
"	21	S	4	-	-	-	-	-	-	-	-
"	24	W	3	-	-	-	-	-	-	-	-
"	25	Th	7	-	1	-	1	-	-	-	-
"	26	F	3	-	-	-	-	-	-	-	-
"	27	S	2	-	-	-	-	-	-	-	-
"	30	Tu	3	-	-	-	-	-	-	-	-
May	1	W	3	-	-	-	-	-	3	2	5
"	27	M	10	2	2	-	4	10	10	-	20
"	28	Tu	10	1	-	-	1	-	1	1	2
"	29	W	11	-	1	-	1	2	2	3	7
"	30	Th	13	10	3	-	13	4	1	-	5
"	31	F	6	-	-	-	-	-	-	-	-
June	1	S	8	-	-	-	-	-	-	-	-
"	3	M	6	-	2	-	2	1	6	1	8
"	4	Tu	4	-	3	1	4	4	8	4	16
"	7	F	7	1	-	-	1	2	2	-	4
"	8	S	6	2	1	-	3	-	-	-	-
"	9	S	12	1	-	-	1	7	2	-	9
"	10	M	5	1	2	-	3	1	10	2	13
"	11	Tu	1	-	-	-	-	-	-	-	-
July	15	M	10	3	3	-	6	5	3	1	9
"	16	Tu	4	-	1	2	3	1	6	1	8
Aug.	5	M	17	25	6	1	32	34	25	2	61
"	6	Tu	19	6	2	-	8	35	4	-	39
"	7	W	8	4	3	-	7	24	19	-	43
"	8	Th	5	1	-	-	1	-	-	-	-
"	9	F	12	1	1	1	3	2	4	-	6
			351*	109	133	14	256	250	330	40	620

Table 4.1. Casualties Resulting from the Paris Gun Bombardment of Paris, France (23 March to 9 August 1918).

Source: Gerald V. Bull and Charles H. Murphy, *Paris Kanonen-The Paris Guns (Wilhelmgeschütze) and Project HARP (Herford und Bonn: Verlag E.S. Mittler and Sohn GmbH, 1988),* 137. NOTE: The total number of bursts recorded in this table was 351; however, the sum of all bursts in this column totals 352. Bull and Murphy acquired this table from the Ministère de la Guerre, and it is also present in the work of Colonel Miller. This error in the total of the number of bursts column may have been the genesis of this incongruity and error reported in subsequent works by various authors.

Notes

1. Editors of Encyclopedia Britannica, "Krupp AG," *Encyclopedia Britannica,* n.d., accessed 24 March 2020, https://www.britannica.com/topic/Krupp-AG.

2. Bull and Murphy, *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP,* 11-19.

3. Bull and Murphy, Paris Kanonen, 21.

4. Bull and Murphy, 21.

5. Bull and Murphy, 21.

6. Bull and Murphy, 21.

7. Bull and Murphy, 24-25.

8. Bull and Murphy, 26.

9. Bull and Murphy, 27.

10. Bull and Murphy, 27.

11. Bull and Murphy, 28.

12. Bull and Murphy, 28.

13. Bull and Murphy, 28.

14. Bull and Murphy, 28.

15. Bull and Murphy, 28.

16. Bull and Murphy, 28.

17. Bull and Murphy, 80-83.

18. Bull and Murphy, 14.

19. Bull and Murphy, 34.

20. Bull and Murphy, 34.

21. Bull and Murphy, 34.

22. Bull and Murphy, 131.

23. Lieutenant Colonel Henry W. Miller, *The Paris Gun: The Bombardment of Paris by the German Long Range Guns and the Great German Offensives of 1918* (New York: Jonathan Cape and Harrison Smith, 1930), 285.

Chapter 5
Effects of the Paris Guns

> It [the Paris Gun] was an astonishing achievement in technical terms, but the means and tactic of the day proved inadequate for the revolutionary strategic objective.
>
> —Major General (Retired) Jonathan B. A. Bailey, *Field Artillery and Firepower*

Analysis

As outlined in chapter 3, this case study scrutinizes the German ability to increase stand-off against the Allied Powers. The most prudent way to measure any change to increased stand-off is to use the following operational variables as a framework: social, political, economic, and military. This chapter will analyze both positive and negative effects achieved across each of these operational variables. Additionally, effects on society often manifest immediately, whereas effects in the political, economic, and military domains sometimes occur immediately, but are often delayed over time. For this reason, this chapter analyzes the social domain with evidence captured at the time of each incident. In contrast, the evidence provided in the politicasl, economic, and military domains may prove to manifest long after the bombardment and the war have concluded.

As indicated by Rausenberger, the Paris Guns "could only have a psychological effect on the enemy. Even to achieve this effect, it would be necessary to maintain a continuous bombardment, varying in intensity, for weeks or months."[1] For this reason, stand-off along the social operational variable will be evaluated first. The ability or inability of the German Army to achieve social effects on their adversaries drove effects across the other three operational variables.

The German high command hoped to use the Paris Guns to instill fear in the people of Paris. They further anticipated that this fear would break or reduce the will of the French people. Finally, they believed that a loss of will would degrade or lead to a reduced capability or capitulation of the French or Allied political, military, or economic means of projecting strategic power. This compounding of effects across multiple domains relied on the Germans' ability to achieve their initial strategic effect against the citizens of France and, in particular, the people of Paris.

At 7:20 a.m. on Saturday 23 March 1918, the German Military began the bombardment of Paris, France using at least two of the Paris Guns

fired from their initial firing positions "near the little town of Crépy on the eastern slope of the Mont de Joie in the St. Gobain Wood."[2] This is a range of approximately 120 kilometers (74.6 miles) from the center of Paris (intended target).[3] The bombardment of Paris continued, interrupted, and with varying degrees of intensity until the final round impacted on 9 August 1918, silencing these guns forever. In all, 352 rounds burst within Paris, killing 256 and wounding an additional 620 people.[4]

Social Effects

In the immediate aftermath of the initial bombardment on Saturday, 23 March 1918, and all subsequent bombardments throughout 1918, news reports captured the effects on Allied society. On Sunday, 24 March 1918, the *New York Times* reported the initial bombardment of Paris by the Paris Guns on the front page, under the title: "French Capital Under Fire Ten Killed and Fifteen or More Wounded in Mysterious Bombardment."[5] This article informed the reader that Paris "has been under bombardment of long-range guns today, beginning at 8 o'clock this morning."[6] The article also described the air raid alarms being sounded and advising citizens to take shelter. It went on to describe that the initial day's bombardment affected the city and its populace:

> Paris wore an aspect recalling the early days of the war in 1914. Telephone girls remained at their posts, very few taking advantage of the administration's permission to seek refuge if they wished. Tramways and auto buses stopped on the streets and the conductors and ticket collectors sought the nearest shelter. The subway trains ceased running, and the tubes were used by pedestrians to reach home on foot. The police were placed at each station to prevent repetition of the recent panic, and prevented people from assembling around the entrances. Nine hours thus passed, and then Paris learned that it was not being raided but bombarded.[7]

The interruption of Paris life was further captured in Colonel Miller's work, "The city just stopped, and it did not require long. From the usual Saturday morning activity at 9:15 a.m., it was reduced in a comparatively few minutes almost to midnight inactivity; the silence became painful, and for the next hour the explosions of the bombs landing even miles away could be heard."[8] Despite this abrupt change in the activity of the civilians in Paris, Colonel Miller went on to explain, "Fortunately, there were no signs of panic in this rapid transformation; [*sic*] no hysterical behaviour [UK spelling]. The war had developed in the people of France a

peculiar resignation to the unusual, an acceptance of the inevitableness of tragedy."[9] On the day after the first bombardment by the Paris Guns, the people of Paris were unnerved, but not panicked. Any fear they felt was aggregated from aerial bombardment and the renewed German offensive, bringing the Germans ever-closer to Paris. The bombardment by the Paris Guns had an initial shock or novel value. Without massive follow-up or follow-through, this shock at the technological achievement waned along with the novelty of a long-range cannon bombardment. The *New York Times* displayed this evidence throughout the bombardment from the Spring to the Fall of 1918.

On Monday, 25 March 1918, the *New York Times* captured the effects of the continued bombardment from Sunday (Palm Sunday). On only the second day of the bombardment, evidence suggested that the bombardment had already lost its effectiveness. The front-page title stated, "French Locate Gun 76 Miles Away; Hurls Shells at Paris Six Hours," and continued in the same positive vein, "Projectiles Drop at Intervals of 12 to 15 Minutes, but Fail to Unnerve Palm Sunday Throngs—Experts Admit Range Is Possible, but Doubt Military Value of Gun."[10] After just two days, the French Military had succeeded in successfully locating the firing points of the Paris Guns. This reporting intended to diminish any German counter-narrative and to instill confidence in the French people that their government and military were proactively working to reduce the threat of long-range bombardment. This article articulates the inability of a long-range bombardment to have a profound effect on the people of Paris:

> The gun bombarded Paris during the gsreater part of Sunday. The day was ushered in by loud explosions from the ten-inch shells, and immediately the alarm to take cover was sounded. This occurred at 6:55 o'clock, and many persons sought shelter, but greater numbers of them appeared in the streets on their way to the churches, which were almost as well filled as usual. The women who sell palm leaves on Palm Sundays did their usual thriving business. Their power to disturb the equanimity of the populace, however, seemed less, the people refusing to be distracted from their Sunday habits to any great extent.[11]

On 26 March 1918, the *New York Times* conveyed similar sentiments concerning the lack of terrorizing effect on the populace of Paris under the heading, "Big Guns Can't Spoil Palm Sunday in Paris German "Crashing Christophers" Are Taken Less Seriously Than Airplane Raids."[12] This article goes on to remark,

> Germany believes that she can break the civilian morale and expects Paris to go to pieces under the strain. As a matter of fact, the cannonade is less fearsome than air-raiding. It is always possible to find safety, because the shells can come only from a known direction. Also they do much less damage than air bombs. The percentage of killed to wounded is small.[13]

A second article on 26 March 1918, reflected the same under the title, "Long-Range Firing on Paris Continues."[14] After detailing the bombardment of 25 March 1918, the article states, "Work was resumed under normal conditions. All the transportation lines were running. The streets were full of people whose sole subject of conversation was the new battle of the Somme, which is generally compared with Verdun."[15]

The *New York Times* displayed, perhaps, the most telling evidence of limited societal effect in an article published on 27 March 1918, titled, "Paris Undamaged by Long-Range Gun Explosion of the Shells Is Not Powerful Enough to Wreck Buildings or Cause Havoc. Fails to Alarm the Public."[16] This article goes on to explain that the bombardment was seen as something novel, and may have achieved the opposite of the intended German effect: reducing psychological strain on the French populace:

> Life this morning is absolutely normal. All public services are working as usual, and it is literally true that Paris is taking no notice of the bombardment. In point of fact, the bombardment has done Paris morale no small service. To begin with, it had a general tonic effect on the whole population. Secondly, it has given Parisians a new thing to talk about, which certainly has been useful in keeping their minds off the offensive.[17]

The examples above indicate that almost immediately following the initial bombardment, a sense of novelty or apathy quickly replaced what little fear or uncertainty existed at the bombardment's outset. The fact that the bombardment was not producing great numbers of casualties, nor occurring at a regular interval, explains the general attitude towards the bombardment and the lack of a perceived negative psychological effect. Reporting on the bombardment in the *New York Times* would continue until the autumn of 1918. It would wax and wane relative to the regularity and volume of the projectiles fired (see Appendix A for further analysis and comparison of articles published versus the effects of the bombardment). The following reporting displays the most significant evidence and overall summation of the effect on the French populace following the sin-

gle-greatest casualty producing day of the bombardment of Paris by the Paris Guns: Friday (Good Friday), 29 March 1918.

On 30 March 1918, the headline of the *New York Times* contained the following, "Long-Range Shell Kills 75 in Paris Church."[18] Colonel Miller gives an account of the attack on the Church of St. Gervais that ultimately killed 88 and wounded 68 more:

> The worshippers had finished the three hours of service and were kneeling in prayer. The place was crowded. It was just 4:30. Suddenly the hundreds of kneeling worshippers were startled by a terrific crash overhead, an explosion. A projectile had struck the roof. Those looking up quickly saw a stone pillar crumpling, beginning to fall. Then the stone vault supported by this pillar began to crack, crumple, and in a second, scores of tons of stone, some blocks weighing a half ton [*sic*], were pouring down upon the mass of people. Among the dead were General Francfort, M. Henri Stroehlin of the Swiss Legation, Mlle. Bartin, daughter of the Belgian Consul General, French, British, American civilians, a few soldiers.[19]

This event had far-reaching effects outside the social realm. Its effects also impacted the political operational variable, and resulted in an unintended net negative effect for the Germans. The societal effects were immediate and graphically conveyed in the previously stated *New York Times* article, "The killing in the church has caused horror and intense indignation in Paris. Feeling runs high in Paris tonight. It is no peace crowd that walks the streets or congregates in the cafés, theatres and churches. The stern resolution to conduct the war to a successful termination is written on the face of every one [*sic*]."[20] These sentiments were again displayed in the following day's New York Times (31 March 1918);

> A wave of fury passed over Paris this morning when it learned the death roll [sic] in the church struck yesterday afternoon by a German shell. If anything were needed, which it is not, to steel the resistance of the French people, this futile slaughter of women and children would provide it. As one French Deputy said yesterday at the scene of the disaster: 'Each drop of this innocent blood shall bear a crop of hate in France for the children and children's children of these murderers.'[21]

Figure 5.1, next page, shows a picture of the destruction to the Church of St. Gervais described above. The targeting of a civilian populace result-

ed in increased indignation and resolve in the French people, and achieved the opposite of the Germans' intended effect.

Figure 5.1. Photo of the effects of one round impacting the Church of St. Gervais on Good Friday, 29 March 1918.

Source: Wikipedia, "Eglise St Gervais Paris Bombardement 1918," Wikipedia, last modified 1918, accessed 14 April 2020, https://en.wikipedia.org/wiki/File:Eglise_St_Gervais_Paris_bombardement_1918.jpg.

As Rausenberger indicated, the Germans intended to use the Paris Guns as psychological weapons, to degrade the will of the French and the Allied Powers. The initial bombardment on 23 March 1918, briefly interrupted daily life in Paris and instilled a sense of fear and amazement at German technological prowess. A sense of novelty or relative indifference quickly replaced any interruption caused by fear, as this was just one more way in which the people of Paris and the French in general faced the realities of war every day. Ultimately, these weapons achieved the opposite effect as they strengthened the resolve of the people, especially after the shelling on Good Friday, 29 March 1918, and continuing until the end of the war.

Political Effects

Like the societal effects detailed above, the *New York Times* captured many of the political effects resulting from the bombardment of Paris. Unlike the social commentary provided above, the political reporting contains less editorializing and directly quotes political figures from various powers throughout the world. A snapshot of this information yields a view of a general global outcry against the German Military shelling Paris. Additionally, the *New York Times* captured some unintended or unforeseen effects on the British, as they seemed wearier of the bombardment of Paris than did the French.

The *New York Times,* on 25 March 1918, conveyed political effects relayed in several French publications. The *New York Times* quoted the *Echo de Paris,* "the bombardment is designed to give the impression that Paris is within the range of German guns. 'It is a political cannon,' the newspaper says."[22] This article goes on to quote Premier Clemenceau's newspaper, *L'Homme Libre,* "Germany, has wished to make it a complete offensive on all fronts—the land, water, and air fronts, as well as the 'front of the rear.'"[23] "We are facing an enemy who wishes to end it as soon as possible. That suits us. Every shell that falls into Paris drives deeper into us the confidence in an ultimate victory."[24] These quotations illustrate that as early as two days after the initial bombardment, the French Government displayed political resolve and attempted to instill the same into the people of France.

In contrast with the French resolve displayed above, the *New York Times* evidenced British political concern in a 26 March 1918, article, "The Times [The *London Times*] today advises the British people to take seriously the long-range gun which has bombarded Paris, and adds: 'We may be quite certain that our own inviolate shores will soon learn what the new gun can do.'"[25] This fear was encouraged by an Exchange Telegraph dispatch reported in London on 27 March and reprinted in the *New York Times* on 28 March 1918, "Lieutenant General von Rohne, [German general officer] an authority on ordnance, says in the Vossische Zeitung of Berlin that the bombardment of Paris is merely in the nature of a trial for guns which are really intended to bombard London."[26] These quotations display a more significant indirect effect on the political and social bodies of Great Britain than they do the political and social bodies of France. In this way, the Germans potentially achieved an indirect effect on the British.

In contrast to the political situation resulting from the bombardment in France and Great Britain, global reporting displayed German political leadership actions. Bull and Murphy captured these actions in *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP.* Additional reporting in Amsterdam and reprinted in the *New York Times* on 29 March 1918, confirmed German political activity. In the *New York Times,* under an article titled, "Kaiser Thanks Krupps for Long-Range Gun," the following appeared;

> The Kaiser [Kaiser Wilhelm II, German Emperor] has sent a telegram of thanks to Dr. Krupp von Bohlen and Hlabach, the head of the Krupp Works. The telegram reads: "By the bombardment of Paris from a distance of considerably more than 100 kilometers your new gun has brilliantly stood the test. By the manufacture of the gun you have added a new page to the fame and history of Krupp. I therefore express to you and all your coworkers my imperial thanks for this achievement of German science and labor."[27]

The elation amongst the German political elite stood in stark contrast to the political outcry in France.

On 30 March 1918, the *New York Times* quoted several political leaders expressing their discontent and indignation at the continued bombardment of Paris, and in particular the shelling on Good Friday, 29 March 1918;

> M. [Minister] Grosseau said in the Chamber of Deputies tonight: 'The barbarian enemy resumed his bombardment on Good Friday and his victims are numerous. It is with extreme sorrow and intense indignation that I note that most of them were assembled in church. We must not forget that justice and right shall have the last word before God and before man.' Jean Bon, Socialist leader, said: 'We add our indignant protest to those of the faithful against the crimes of false believers, who mix blood with prayers. In France, England, and America there will be another conception of justice.'[28]

These examples of French political anger over these incidents yielded further resolution within the French and Allied Governments to continue pursuing the war, and not to capitulate to Germany. The *New York Times* further conveyed this point in quoting the Head of the American Red Cross, Henry P. Davison on 31 March 1918;

> When we see divine service on Good Friday interrupted by a shell from the German front, seventy-five miles away, and scores of men, women, and children killed and injured, it conveys some idea of what war in Paris means. Does it create panic? Not at all. People are still traveling on the streets with shoulders back and heads up, ready to meet whatever may come. The humblest would rather die than bend to an unworthy peace.[29]

Political ramifications went beyond the world's governments and included outcry from the world's religious bodies as well. In this way, Germany felt political pressure not only from its enemies and neutral states but also from the Holy Roman Catholic Church. A *New York Times* article reprinting a Reuters' dispatch on 2 April 1918, stated, "'Pope Benedict has lodged a protest with Berlin against the bombardment of Paris, and especially against the destruction of churches and the wholesale massacre of people."[30] Outcry from a neutral apolitical body, such as the Catholic Church, evidenced an unintended opposite strategic effect and a net negative for the Germany political establishment.

The Catholic Church again moderated against the Germans in response to the shelling of Paris on Corpus Christi Day (30 May 1918), a date the French and British had agreed not to bombard Cologne. The *New York Times* captured the outcry in a 5 June 1918, article titled, "Britain Protests to Pope: Paris Shelled After Allies Agreed Not to Bombard Cologne" The content of the article stated;

> The British Government has called the attention of the Vatican, Chancellor Bonar Law told the House of Commons today, to the fact that although France and Great Britain agreed, at the request made by Germany through the Vatican, not to bombard Cologne on Corpus Christi Day, the Germans shelled Paris on that day. "The action of the Germans," the Chancellor added, "will not be forgotten in the event that any similar appeal is made in the future."[31]

In this way, the German Government created an adverse political effect not only characterized by the outcry of their enemies, but also by the world's religious leaders. This negative political effect only compounded alongside the other adverse strategic effects resulting from the German employment of the Paris Guns.

An additional unintended political consequence with strategic implications stemming from the bombardment on Good Friday, 30 March 1918,

was the death of Minister Henri Stroehlin of the Swiss Legation in Paris.[32] Minister Stroehlin was a foreign official of a neutral power during World War I. His unintended death had potentially disastrous political implications for the German Government and required action to right this wrong. Minister Stroehlin's death was the accidental byproduct of using the whole of Paris as an area target and employing unguided relatively imprecise weapons. A *New York Times* article from 4 April 1918, captured the fallout of his death:

> BERNE, 3 April. The German Minister today visited the Foreign Office and expressed his Government's sympathy in the death of H. Strohelin [sic], Counselor of the Swiss Legation in Paris, who was killed during the recent bombardment of the French capital by a German long-range gun when a shell hit a church in which he was at worship. The Minister said the event would be sincerely regretted throughout Germany.[33]

These incidents had a compounding and cumulative negative effect against the German Government resulting in an ever-increasing loss of geopolitical capital.

Economic Effects

There were some short-lived economic effects on Paris as the bombardment had a minor disruptive effect on the daily commerce of the city when the bombardment warning would sound. This effect is difficult to quantify and is reliant on too many variables to be of any real value. Additionally, the cause of minor economic disruptions may have resulted from air-raids, the German ground offensives, or a myriad of other external factors affecting the local and broader French economies. Of note, if the Germans had intended to disrupt the Parisian economy definitively, their method of disruption was ineffective. Had the Germans been able to mass the effects of the Paris Guns or maintain a more consistent sustained rate of fire, they may have achieved a more disruptive effect. As it was, the intermittent shelling by low-yield weapons over a series of months did not achieve an overwhelming effect on either the Parisian or, by extension, the French economies.

There are limited examples of immediate disruptions to the Parisian economy caused by the bombardment of the Paris Guns. The *New York Times* presented some evidence in an article from 22 April 1918, "Dressmaking and allied trades which form one of the most important industries in Paris are undergoing a crisis due to a scarcity of customers. Many employers also have left the city and many employes [*sic*] who made enough

money last year are allowing themselves a holiday where there are no long-range guns or German raiding airplanes."[34] This quote illustrated effects on one industry; but the Paris Gun bombardment was not the undisputed cause of these effects. The war-ravaged economy of France, coupled with the relative proximity of Paris to the Western Front just as easily explain these adverse economic effects.

Many of the actual economic effects the Germans achieved were unintended, indirect, and would not occur until after the end of World War I. These effects had the potential to result in a net positive for Germany; but their benefit did not manifest in time.

The economic effect achieved by Germany was the result of great power competition, resulting in a continued need to pursue military technology to gain an asymmetric advantage over the competitor. The strategic economic effect resulted when both the French and British militaries invested in the development of long-range guns. In a 25 March 1918, *New York Times* article, Colonel J. E. Munroe, Commandant of the Watervliet Arsenal at Watervliet, New York, articulated this point. He stated, "Personally, I do not think it would be worth much to us to have such a carriage, for its cost would be tremendous, and the damage a gun would be likely to do at such a distance would be entirely out of proportion to the cost."[35] Before either France or Britian invested in this technology, a cost-benefit analysis was necessary for deciding to pursue such technology.

Bull and Murphy provided evidence suggesting the French and British pursued this technology. They articulated, "After the war both the French and British experimented with duplication of the Paris Gun, the French successfully, but the post-war lack of interest in armament work led the United Kingdom not to complete work on their system."[36] Bull and Murphy provided additional evidence with the reprinting of a 1918 report of Captain Robert Kent, United States Army ordnance, discussing the topic of the English Long Range Gun. He stated, "The following information was secured with regard to a long range [*sic*] gun which has recently been manufactured in England. This gun has not yet been fired on account of the difficulties encountered in the carriage."[37] Captain Kent goes on to explain the characteristics and specifications of this weapon, "It is the opinion of the writer that long range [*sic*] guns are bound to have a permanent place in any military establishment."[38] The captain gave his own opinion on the validity of these weapons.

Colonel Miller shared the most illuminating insight into the pursuit of this technology, in the February 1920 edition of the *Journal of the American Society of Mechanical Engineers,* stating;

> Long-range or super guns received consideration from the Allies for a very short period. There was a tendency at the time to favor construction of a great number of them, but a saner view soon prevailed and actual steps were taken for the construction of only a very few. Both the British and the French Governments began construction of a limited number, some of which have now been finished. They built them, however, with a clear understanding that they could hope for but little more from them than the Germans were getting from their own. American ordnance officers feel that it would not profit us to construct more than two or three such guns at the very most, and probably none at all.[39]

In contrast to the French and British efforts to develop ultra-long-range cannon artillery, the United States Military stood in stark contrast. As previously stated, various boards were conducted by belligerent nations following World War I to either capture lessons learned or to recommend future doctrinal and material pursuits to their respective nations. The United States Army convened two such artillery-specific boards to capture the lessons learned from the American Expeditionary Force's experience, and inform the future doctrine and material pursuits of the United States Army Artillery. These two boards solidified the sentiments articulated by Colonel Miller that American ordnance officers felt there was little value in pursuing ultra-long-range cannon artillery. For instance, the first of these boards, the 842-page "Hero Board," contained no reference, either by name or description, to the Paris Guns.[40]

Unlike the "Hero Board," the "Westervelt Board" considered the efficacy of the ultra-long-range cannon. This board addressed the concept of super-heavy guns and howitzers but limited the definition, "This does not apply to guns of the type used to bombard Paris; such guns have no military value and their construction is not justifiable."[41] Clearly, the United States Military did not consider these weapons of value after World War I. If there were dissenting voices to this opinion, their ideas were not favored or pursued as viable options for the future development of United States artillery weapon systems. Bull and Murphy articulate the implications of how these decisions continued to influence the present day, stating;

> The United States Westervelt Committee…concluded that the 155 millimeter system was the largest, long range [*sic*] field artillery compatible with mobility and range-effectiveness. To this day generations of 155 millimeter guns have evolved, in

> basic concept no different from the French de Bange system from which they all have been derived. Miller [Colonel Miller] disagreed with the conclusions of this Committee (as did many others) since they considered (correctly) that the Paris Gun was only just a first probe into the area of long range [*sic*] artillery. The board decision dictated United States Army military philosophy and in turn NATO philosophy unchanged to the present day [1988].[42]

The Germans achieved a strategic effect with the introduction of the Paris Guns onto the battlefields of World War I. That strategic effect was the requirement for Germany's adversaries to consider this new weapon as a change to the character of war. Further, it required them to consider pursuing similar versions of these ultra-long-range guns. Unfortunately, for the Germans, this effect was unintended, occurred indirectly, and did not manifest until after it was of little value to their strategic aims.

Military Effects

The military effects of the bombardment by the Paris Guns largely occurred at the tactical and operational levels of war. These effects did not include the destruction or degradation of military capability, as no targeting of military assets occurred.[43] A counter-argument to this assertion would be that all of Paris was a valid military target. If this were the case, then the Germans did affect a military target. For this section, effects related to military means are only those people, systems, structures, and materiel within the military apparatus or under its control. Under the limitations of this definition, the Germans did not achieve a direct strategic effect on a military target. The Germans did achieve indirect tactical and operational-level military effects by eliciting a response from the French Military. This response resulted in counterbattery fire against the Paris Gun emplacements and eventual casualties of German personnel. In addition to the immediate tactical response of the French military to attempt to silence the guns, there were additional effects achieved at the theater and army levels. These effects included military experts sharing their opinions of the weapon in news articles and interviews, and intelligence and information reporting on the weapons by the various armies.

Colonel Miller illustrated the immediate military response to the initial bombardment of Paris. The most immediate military impact occurred during the day of the initial bombardment on 23 March 1918. Colonel Miller stated, "To date the Service for the Defence [UK spelling] of Paris had not had to deal with guns. Since it became someone's duty to find, and,

if possible, silence the guns, the Army Artillery Service automatically became a part of the Paris Defence [UK spelling] Service."[44] This statement illustrated an organizational change within the French Military which resulted from the initial bombardment of Paris.This organizational change was limited to the tactical and perhaps the operational-levels of war only and, therefore, did not equate to a strategic effect.

An additional military effect achieved by the shelling was the requirement of the French Military to reallocate resources and personnel in an attempt to 'silence' the Paris Guns. The following account conveyed by Colonel Miller details the response to the shelling on 23 March 1918, and how the French Military accurately located the Paris Guns as early as 9:00 a.m., approximately two hours after the shelling began:

> Shortly after nine in the morning [23 March 1918], when it seemed certain to the artillerists that the bombardment was by artillery, guns or a gun, and the guess was hazarded that this gun was located in the Laon corner, possibly near Crepy [*sic*], this information was telephoned to General Headquarters at Provins and to General Bourgeois who was in command of the sound ranging division of the French armies. He was instructed to set some of his thirty-two units along the Front at the work of locating the gun firing on Paris. They had no success during the morning, their instruments registering only a confusion of sounds. But they reported noticeably increased volumes of sound at somewhat the same intervals as those between explosions in Paris and these sounds came from the suspected region of Crepy [*sic*]. The air reconnaissance service had also been busy and late in the day some observers returned with the report that all the area in the Laon corner was covered with a haze of smoke, surely from smoke pots, and that though they could not see anything clearly, it seemed that there were guns firing from some railway tracks near Crepy [*sic*]. Something had to be done to stop the bombardment, and at once. Orders were therefore telephoned late in the evening [23 March 1918] to Group Commander Stapfer at Mont Notre Dame to detach a battery of his 305 millimeter or 12 inch rifles on Batignolles railway carriages and start them at once for Vailly on the Soissons-Rheims railway. They were to be emplaced as quickly as possible on any available siding near Vailly and would begin firing at the earliest possible moment.[45]

On 24 March 1918, the French were able to respond with counterbattery fire, as detailed by Colonel Miller;

> The twelve inch railway battery, ordered up from Mont Notre Dame by way of Soissons the night before, reached Vailly at dawn [24 March 1918]. One gun was emplaced by noon, and at 12:30 [p.m.] the first shot was fired. They continued firing most of the afternoon. Reports reached them in mid-afternoon that no projectiles had fallen in Paris since 12:26 [p.m.].[46]

The initial counterbattery fire by the French was the only effective counterbattery fire to affect the Paris Guns. Dr. Rausenberger's account in *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP* explained the effectiveness;

> But while we were sitting outside enjoying the lovely Spring day [24 March 1918] and discussing our success, the first French heavy caliber shells exploded with a loud noise some 200 meters from us sending projectile fragments whistling by our heads. Unfortunately during the 3rd or 4th French salvo, one shell hit a large tree and exploded above ground wounding six or seven men from the Number 1 gun crew, including an officer. During the period that the batteries were located at Crépy, the French fired approximately 100 rounds against the Wilhelmgeschütze installations without inflicting any further significant damage.[47]

The German attempts to obscure their activity proved ineffective. The French Military quickly located and conducted counterbattery fire against the German positions. The discovery of the firing point locations was even reported in the French newspapers and reprinted in the *New York Times* under the article title, "French Locate Gun 76 Miles Away; Hurls Shells at Paris Six Hours."[48] These tactical actions by the French were the only direct military effect achieved by the bombardment of Paris. These tactical effects were not strategic, as they required the reorganization and reapportioning of only a relatively small number of tactical units to conduct counterbattery operations against the Paris Gun firing points. Additionally, the German use of smoke to obscure and masking fire by other cannons was overall ineffective.[49] It did not prevent the French from conducting counterbattery operations to 'silence' the Paris Guns.

One measure of the effect a certain battlefield action achieves is the quantifiable amount of reporting on that action in enemy intelligence reports and summaries. The bombardment received widespread reporting in

European news sources, and as discussed previously, was reported on in at least 64 articles in the *New York Times* between 24 March and 12 August 1918. While the content of these articles provides useful evidence towards the overall social effect the bombardments had, they provide little insight into the motivation to continue to report on this topic. The ultimate goal of reporting on 'newsworthy' topics is to sell more papers, for greater economic gain. The number of news reports does not prove the importance of the Paris Guns in the French mind. In contrast, military intelligence reports serve a purpose beyond monetary gain. Military intelligence reports inform the ongoing conduct of operations. For this reason, the quantity of intelligence reporting on a given subject provides a lens into what a military considers important, relevant, or critical to continued operations.

From a survey of every military intelligence and information report from 24 March to 1 September 1918, compiled by the American Expeditionary Forces, there existed only five references to the bombardment of Paris by long-range cannon artillery. These compilations contained a total of over 500 pages of intelligence and information summaries, yet only mentioned the bombardment five times. The lack of reporting on the bombardment is an indicator that the United States Military and perhaps the Allied Powers, in general, believed these weapons to be ineffectual, or to bear no real military significance when compared to other events and actions occurring on the Western Front.

The following is a comprehensive listing of the five instances mentioning the bombardment of Paris within the intelligence summaries followed by the information summaries. The first mention of the bombardment occurred in an official German communique dated 24 March 1918, 8:39 p.m., and stated, "We have bombarded the fortress of Paris with a long-range gun."[50] There was no further analysis of this information. The next occurrence was in an official German communique dated 25 March 1918, 2:49 p.m., and stated, "We bombarded Paris with long-range guns."[51] Again, no analysis of this information occurred. The next occurrence was again in an official German communique dated 26 March 1918, 2:48 p.m., and stated, "We continued to shell the fortress of Paris."[52] The final mention of the bombardment within the intelligence summaries occurs in the 30 March 1918 bulletin and is a reprint from the French 2nd Army Bulletin dated 27 March 1918. This reference is a longer entry describing information discerned from the initial investigation of the weapon bombarding Paris. This report articulated assumptions about the capabilities of the weapon and the German attempts to mask its use.[53]

The final mention of the bombardment of Paris occurred in the American Expeditionary Force's information summary from 3 April 1918, and is an excerpt from the French Armee G. Q. G. Grand Quartier General Bulletin dated 2 April 1918. Again, this is a more extended entry, and contained facts and assumptions about the technical characteristics of the weapon and projectiles in use to bombard Paris.[54]

In addition to the limited occurrence or mention of the bombardment of Paris by long-range cannon artillery in the American Expeditionery Force's intelligence and information summaries, it is worth examining the sources of this information. These daily reports contain official communiques from all principal belligerents within the war, including but not limited to: the British, the French, the Germans, the Italians, the Russians, and the Austrians. Beyond the French and Germans, none of the other belligerents mention the bombardment of Paris. Within the intelligence summaries, the Germans generated three of the four mentions of the bombardment within their official communiques. The French only discuss the topic once in their 2nd Army Bulletin, which the American Expeditionary Forces reprinted on 30 March 1918. Additionally, the one occurrence within the information summary was once again the product of French reporting. Based on this evidence, it is likely that the bombardment of Paris had little military significance due to the lack of reporting or analysis conducted.

Summary

The preceding analysis contradicts those authors who have chosen to quickly write off the Paris Guns as ineffective and unable to achieve any measurable effect. These statements often lack prior explanation or in-depth analysis. For example, Major General Zabecki writes, "Though the Paris Guns were an awesome technological achievement they had no impact on the outcome of World War I."[55] This research has shown that the Paris Guns did achieve effects, nuanced though they may have been. Table 5.1, next page, seeks to summarize and capture these effects across the operational variables, if those effects manifested immediately or were delayed, and the general sources of evidence supporting those effects. As indicated, any positive effects achieved, if strategic, were fleeting. Ultimately, these effects manifested as net negatives for the German cause or were replaced outright by the delayed manifestation of negative effects. Additionally, any effects at the tactical or operational level were unintended. Finally, the cumulative impact of the achieved indirect effects had a net-negative strategic effect on the Germans.

Operational Variable	Negative Effect for Germans		Positive Effect for Germans		Notes
	Immediate	Delayed	Immediate	Delayed	
Social		X	X		**Immediate** (Positive) Fear. Disruption of daily life. -Evidenced in Lt. Col. Miller's work and *NYT* articles. **Delayed** (Negative) Indifference, apathy, novelty. Strengthened resolve of French. -Evidenced in Lt. Col. Miller's work and *NYT* articles.
Political	X	X			**Immediate** (Negative) Political outcry from adversaries and neutral actors. -Evidenced in *NYT* articles. **Delayed** (Negative) Political outcry from adversaries and neutral actors. -Evidenced in *NYT* articles and Paris Kanones.
Economic			X	X Too Late to be of Value	**Immediate** (Positive) Minor disruptions to daily life and commerce. -Evidenced in *NYT* articles. **Delayed** (Neutral – not of value) Allied consideration and pursuit of own "Paris Gun". -Evidenced in Lt. Col. Miller's work and *NYT* articles.
Military	X Tactical / Operational Only	X	X Tactical / Operational Only		**Immediate** (Negative + Positive) (N) Paris Guns received counterbattery fire. (P) French reallocated tactical / operational resources. -Evidenced in Lt. Col. Miller's work *Paris Kanones* and *NYT* articles. **Delayed** (Negative) Germans invested in technology that was militarily insignificant in the manner it was employed. -Evidenced in Lt. Col. Miller's work and *Paris Kanones*.

Table 5.1. Summary of Effects Caused by the German Bombardment of Paris, France.

Source: Created by author.

The Germans may have achieved short-term positive strategic effects in the social and economic domains. The net-negative effects in the social, political, and military domains heavily outweighed any achieved positive effects. There are multiple lessons to be learned from the failings of the Paris Gun employment. Given that these weapons did achieve some critical effects, it is crucial to capture the lessons of the Paris Guns. In order to achieve the desired strategic effects of strategic long-range cannon artillery within the 21st Century, it is necessary to avoid the pitfalls confronted by the Germans during World War I.

Notes

1. Bull and Murphy, *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP,* 27.

2. Miller, *The Paris Gun: The Bombardment of Paris by the German Long Range Guns and the Great German Offensives of 1918*, 2. Bull and Murphy, *Paris Kanonen,* 131.

3. Bull and Murphy, *Paris Kanonen,* 131.

4. Bull and Murphy, 137.

5. *New York Times,* "French Capital Under Fire," *New York Times,* 24 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/24/issue.html.

6. *New York Times,* "French Capital Under Fire."

7. *New York Times*.

8. Miller, *The Paris Gun: The Bombardment of Paris*, 16.

9. Miller*,* 16.

10. *New York Times,* "French Locate Gun 76 Miles Away; Hurls Shells at Paris Six Hours," *New York Times,* 25 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/25/issue.html.

11. *New York Times,* "French Locate Gun 76 Miles Away."

12. Charles H. Grasty, "Big Guns Can't Spoil Palm Sunday in Paris," *New York Times,* 26 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/26/102681381.html?pageNumber=3.

13. Grasty, "Big Guns Can't Spoil Palm Sunday in Paris," 3.

14. *New York Times,* "Long-Range Firing on Paris Continues," *New York Times,* 26 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/26/102681380.html?pageNumber=3.

15. *New York Times,* "Long-Range Firing on Paris Continues," 3.

16. *New York Times,* "Paris Undamaged by Long-Range Gun," *New York Times,* 27 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/27/102682013.html?pageNumber=3.

17. *New York Times,* "Long-Range Firing on Paris Continues."

18. *New York Times,* "75 Are Killed and 90 Wounded in Paris Church by a Shell Fired by German Long-Range Gun," *New York Times,* 30 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/30/102683655.html?pageNumber=1.

19. Miller, *The Paris Gun: The Bombardment of Paris*, 59-60.

20. *New York Times,* "75 Are Killed and 90 Wounded in Paris Church," 21. *New York Times,* "Paris Shelled Again; 8 Killed."

22. *New York Times,* "French Locate Gun 76 Miles Away."

23. Prime Minister of France, Georges Eugène Benjamin Clemenceau.

24. *New York Times,* "French Locate Gun 76 Miles Away."

25. Grasty, "Big Guns Can't Spoil Palm Sunday in Paris."

26. *New York Times,* "Long-Range Shell Is a Twin Affair," New York Times, 28 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/28/102682935.html?pageNumber=22.

27. *New York Times,* "Kaiser Thanks Krupps for Long-Range Gun," New York Times, 29 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/29/102683127.html?pageNumber=2.

28. *New York Times,* "75 Are Killed and 90 Wounded in Paris Church."

29. Charles H. Grasty, "Davison Finds Paris Strong Under Trial," *New York Times,* 31 March 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/03/31/102684190.html?pageNumber=1.

30. *New York Times,* "Pope Protests to Berlin Against Shelling of Paris," New York Times, 2 April 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/04/02/102686010.html?pageNumber=3. *New York Times,* "Britain Protests to Pope," *New York Times,* 5 June 1918, accessed 21 January 2020,https://timesmachine.nytimes.com/timesmachine/1918/06/05/102706689.html?pageNumber=10.

31. *New York Times,* "Britain Protests to Pope."

32. Miller, *The Paris Gun: The Bombardment of Paris,* 60.

33. *New York Times,* "Fifth American Victim of Shell," *New York Times,* 4 April 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/04/04/102979454.html?pageNumber=13.

34. *New York Times,* "Paris Promenades, Heedless of Big Guns," *New York Times,* 22 April 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/1918/04/22/102694384.html?pageNumber=3.

35. Grasty, "Big Guns Can't Spoil Palm Sunday in Paris."

36. Bull and Murphy, *Paris Kanonen,* 136.

37. Bull and Murphy, 59.

38. Bull and Murphy, 59.

39. Miller, *The Paris Gun: The Bombardment of Paris,* 91.

40. General Headquarters, American Expeditionary Forces, "Hero Board," *Report of Hero Board; Proceedings of the Board of Officers Convened by the Following Order, General Headquarters, American Expeditionary Forces, Office, Chief of Artillery.*

41. Chief of Staff, War Department (Caliber Board), *Report of Board of Officers Appointed by Para. 143, Special Order No. 289-0, War Dept., 1918,* 20.

42. Bull and Murphy, *Paris Kanonen,* 136.

43. Jack Wren, *The Great Battles of World War I* (New York: Madison Square Press, 1971), 366.

44. Miller, *The Paris Gun: The Bombardment of Paris*, 17.

45. Miller, 27-30.

46. Miller, 45.

47. Bull and Murphy, *Paris Kanonen,* 34.

48. *New York Times, "*French Locate Gun 76 Miles Away."

49. Miller, *The Paris Gun: The Bombardment of Paris,* 27-28. General Headquarters American Expeditionary Force Papers, *Second Section Intelligence Summaries January to November 1918,* 301.

50. General Headquarters, *Second Section*, 270.

51. General Headquarters*,* 275.

52. General Headquarters*,* 281.

53. General Headquarters*,* 301.

54. General Headquarters American Expeditionary Forces Papers, *Second Section Information Summaries October 1917 to July 1918,* 321.

55. Zabecki, "Paris Under the Gun," 65.

Chapter 6
Conclusions and Recommendations

> The massive, clumsy, nature of the Paris Gun, the general approach of accelerating a projectile to the high velocities required through the brute-force technique of working at extremely high pressures and temperatures, at the limits of steel, made this type of long range [*sic*] weapon a non-feasible military weapon. More importantly, the minor lethality coupled with indicated enormous dispersion convinced the Allied military tacticians to abandon this approach, and the concept of ultra-long range [*sic*] artillery bombardment.
>
> —Gerald V. Bull and Charles H. Murphy,
> *Paris Kanonen-the Paris Guns (Wilhelmgeschütze)*
> *and Project HARP*

Conclusions

This manuscript summarizes the events and circumstances surrounding the development, employment, bombardment, and ultimate destruction of the Paris Guns by the German Military during World War I. This is followed by scrutinizing the weapons effects while using the four operational variables as a framework. Then the positive and negative outcomes aligned with each variable, are contrasted to determine the overall strategic impact of the Paris Guns. This analysis goes beyond the standard psychological effect metrics typically used to measure the effectiveness of the Paris Guns. This methodology provides insight into multiple, often unintended strategic effects not yet thoroughly analyzed in other literature on the topic.

The conclusion of this inquiry determines that the Germans' use of the Paris Guns likely achieved short-term positive strategic effects along social and economic variables. These positive effects eventually manifested themselves as a net-negative for the Germans—as the bombardments continued throughout 1918. The cumulative adverse effects within the social, political, economic, and military variables ultimately outweighed any short-lived positive effects which had been achieved by the Germans with these weapons. If captured and applied, the lessons of the Paris Guns may prevent a repeat of the same mistakes during the 21st Century.

Effects Across the Operational Variables

Social Effects

The Germans intended to use the Paris Guns as psychological weapons to degrade the morale of the French people, and ultimately weaken their support for the war effort. The initial bombardment on 23 March 1918, interrupted daily life in Paris and instilled a sense of fear and amazement at the German technological capability. Despite this initial positive strategic effect for the Germans, the interruption and fear transformed into a sense of novel interest or indifference as this was just one more way in which the people of Paris and by-extension the French—faced the realities of war every day. These random attacks on civilians galvanized the resolve of the French, and provided additional fodder for the global stereotyping of Germans as war criminals and barbarians. The Roman Catholic Cardinal Amette was quoted at the Church of St. Gervais following the Good Friday attack, he captured this sentiment, "The wretches! Once more German crime will rouse the reprobation not only of the world of believers, but of the whole civilized world. France and Paris will never forget it."[1] In the end, these weapons achieved the opposite of their intended effect. Instead, they strengthened the resolve of the people of France, most tellingly, after the shelling on Good Friday, 29 March 1918.

Political Effects

One facet of the indiscriminate area bombardment of a civilian population is that sometimes, collateral damage leads to unintended strategic effects. The Germans surely anticipated outrage from the people of Paris, and by extension, all French people. Additionally, the Germans likely foresaw the indignation of the Allied Powers at their bombardment. An adversary and its allies naturally react negatively in response to random terror attacks of this kind. The Germans did not foresee the outcry from the neutral global community, which further tried the German Military and its people in the court of public opinion. Throughout the war, the Germans built a negative public image on the world stage that resulted from perceived or actual atrocities and viciousness. The bombardment by the Paris Guns only exacerbated the Germans' global public image problems. Ultimately, the Paris Gun bombardments did not further the Germans' political cause, but rather, added one more negative data point towards drafting the Treaty of Versailles and the peace to follow World War I.

Economic Effects

The Germans did achieve a strategic economic effect. They created a challenge and response dilemma with the Allied Powers by introducing new technology to the battlefield. This technology necessitated consideration by Germany's adversaries, with the British and French ultimately pursuing the development of their own ultra-long-range guns. This was an unforeseen and unintended effect of the Paris Guns' development which manifested sometime after it would have been of any benefit to the Germans. This effect, while unintended, also was an indirect result of the bombardment of Paris. These effects illustrates that the consequences of strategic actions have far-reaching second and third-order effects. A national power cannot account for or anticipate all of these effects, nor will the same have a positive result.

Military Effects

The military effects created by the employment of the Paris Guns occurred mainly at the tactical or operational levels of war. These effects did not entail the destruction or degradation of some military target, as no military target was deliberately targeted or damaged.[2] As previously noted, the Paris Guns did not achieve a direct military effect on a military target; but they did achieve indirect tactical and operational-level military effects by eliciting a response from the French Military. These effects included the reallocation of units and materiel to conduct counterbattery operations against the Paris Guns' positions. This reallocation of resources, at best, achieved effects at the operational level of war. The lack of intelligence and information reporting by the American Expeditionary Forces further illustrated the lack of strategic military effects. In the context of the Western Front in 1918, the bombardment of Paris by the Paris Guns was militarily insignificant.

Recommendations

Challenge and Response

There are dangers in pursuing new technologies not the least of which are monetary, organizational energy, and the possibility that it is merely the wrong technology. The Allied Powers avoided these dangers, by choosing not to build their own "Paris Gun."

The German introduction of the Paris Guns, a wholly novel and unforeseen capability, created a challenge and in response a dilemma for the French and the Allied Powers in general. The Germans had introduced a new capability, necessitating a response from the French and Allied Pow-

ers. The Allied Powers had to respond in kind or with a means to deny this German capability. A definition for challenge and response is, "Under various circumstances a power (or group of powers) will wish to extend its authority or influence at the expense of another power (or group of powers). The power (or powers) threatened will respond to the challenge that this represents, other things being equal, with efforts to block this design."[3]

Examples of challenge and response dilemmas colored World War I. For example, the widespread adoption of indirect fire for artillery, the advent of the tank, the use of poison gas, and the incremental increase in the roles and functions of aircraft during World War I were just some of the many developments in warfare that occurred throughout the war.[4] These technologies resulted from a problem presented by one side of the conflict, and a reactive action by the opponent to overcome that problem or challenge. The German Military created one of these dilemmas by introducing the Paris Guns onto the battlefield on 23 March 1918. These guns gave the Allied Powers a choice: dismiss the Paris Guns as novel and use conventional countermeasures already at their disposal to combat them, or develop a 'Paris Gun' themselves.

As evidenced previously, in the short term, the French chose to dismiss the Paris Guns. In the long term, the French and British pursued the technology. This pursuit of technology-to-technology parity was an unintended strategic outcome accomplished by the Germans. It arrived too late to affect the outcome of the war. The pursuit of technological parity may have a corollary today.

On 1 October 2019, China celebrated the 70th anniversary of the founding of its People's Republic. At this celebration, the Chinese Military displayed 15,000 troops, 160 aircraft, and 580 pieces of equipment. On display was the Dongfeng 100 hypersonic missile. This weapon can achieve ranges as high as 1,800 miles while reaching hypersonic velocities, adjusting to new targets mid-flight, and able to bypass all current United States Military air defense capabilities.[5] The United States Military is currently overmatched by this technology, as it does not possess a weapon system or systems to counter its effects or achieve capability parity.

The United States Military's pursuit of hypersonic weapon systems and strategic long-range cannon artillery therefore exemplify the manifestation of a challenge and response dilemma at work in the 21st Century. The British and French avoided both the cost and potential trap of pursuing Paris Gun-like technology and instead abandoned these pursuits while choosing to focus their research and development into other means of

warfare. The United States Military could have drawn on this lesson and realized that their adversaries had already achieved a critical effect, simply by introducing their own "Paris Gun."

How Strategic Long-Range Cannon Can Succeed where the Paris Guns Failed

The intended purpose of strategic long-range cannon is not to achieve parity of range with United States competitors solely for range' sake. Its purpose is to provide a deterrent option to negate the effect of competitor anti-access and area denial stand-off ranges, to work in concert with Joint Force fires capabilities, and to echelon with overlapping United States Army Artillery assets.[6] Beyond deterrence in competition, intended targets in armed conflict include enemy long-range air defense assets, critical elements of enemy long-range fires systems, and command and control systems. Affecting these target sets enables both strategic and operational maneuver to achieve local superiority while facilitating operations by the Joint Force.[7] The articulation by the United States Army that these weapons will achieve effects beyond short-sighted or limited strategic objectives is reassuring, such as psychologically weapon targeting a competitor's population. Additionally, it is promising that articulation exists which is intended for employment within the United States Army's future operating concept. This articulation means the Army seeks to tie the effects of these weapons to tactical, operational, and strategic objectives and end states. The supportive concepts for these weapons alone will neither result in their effective use nor achieve the desired strategic effects.

The next discussion is about how the United States Army can avoid the pitfalls displayed by the Germans in the development and ultimate employment of the Paris Guns. This list is not all-inclusive; but it identifies significant shortcomings which prevented the Paris Guns from achieving their intended effect, and also potentially the effects the United States Army intends to achieve with modern strategic long-range cannon artillery.

Technical Capability, tied to Tactical Action can Result in Strategic Effects

Already, the United States Army is developing weapons to meet requirements and intended strategic effects. The United States Army will use strategic long-range cannon artillery to deter competition while penetrating and dis-integrating during armed conflict. Tying tactical action to a desired strategic effect (introduction of the Joint Force, and ultimate end of armed conflict) stands in stark contrast to the development of the Paris Guns. The Paris Gun stands as a monument to function following form,

and misalignment of technical capability, tactical action, and the intended strategic results.

The German high command sought a weapon that could shoot ridiculously far. They sought range for range's sake, and technology for the sake of technology. When the Paris Guns were completed and capable of shooting only 100 kilometers, Paris was further than this range from the German lines. The solution was simple: just increase the range capability of the gun. When the gun could shoot 120 kilometers, German leadership determined that the gun would achieve a psychological effect if it bombarded Paris. Rausenberger's words best illustrated this point, "The only possible use of such a 100 kilometers range gun would be the bombardment of the Paris fortifications."[8] Additionally, when the guns were ready for use, they were used only incidentally in conjunction with the German offensives, and employed generally as part of an overall German offensive plan.

The illogical nature of this thinking, is best captured by Neufeld, "The gun [Paris Gun] was a triumph of narrow technological thinking: the technical fascination of being able to break through traditional limits and fire over such unprecedented distances had overwhelmed any rigorous analysis of its likely impact on enemy morale."[9] Strategic long-range cannon artillery should maintain its current concept, and let that concept drive its development, and eventual use. Should the strategic long-range cannon be subject to the narrow whims of an ever-changing and ever-elusive specific target set, it will fail to provide the technical capability, tactical action, and intended strategic effect desired by the United States Army.

Target Selection

In target selection, again, function followed form for the Paris Gun. The Krupp AG corporation presented the German high command with the concept for a long-range gun. The high command approved. When the gun was nearing completion, they requested it shoot slightly further. Once achieved, it was deemed suitable for bombarding the people of Paris. Zabecki argues that the Germans had a much more viable and practical target available to them throughout the war: the British Expeditionary Force's lines of communication. Zabecki contends that by Rausenberger's admission, as early as 1914, the Germans could construct a gun capable of hitting Dover.[10] Zabecki contends that Dover in Britain, and Calais in France, both port cities, were vulnerable throughout the war, and if bombed would have achieved much further reaching effects than the intermittent bombardment of Paris in 1918. The following adage best exemplifies this type

of thinking: just because you can, does not mean you should. Zabecki states, "Any degree of pressure on the British Expeditionary Force's ports would have caused far greater disruption than any sense of terror among the civilian population in the French capital."[11] Correspondingly, in the case of the Paris Guns, just because you can *bombard Paris,* does not mean you should *bombard Paris.*

When selecting targets for strategic long-range cannon, the United States Army should consider the technical capabilities of the weapon system. Just because it *can* strike a target 1,000 miles away, does not mean that the identified target at 1,000 miles will be the successful strategic object during armed conflict. More importantly, in competition, the battery or weapon emplacement location should not be limited to the extreme range of the weapon system. Rather, the United States Army should select the location that provides the most viable target options at various ranges to achieve the most significant deterring effect on the adversary. For example, one position may offer only one military target at a range of 1,000 miles. Another position may offer multiple equally valid targets at shorter ranges. In this scenario, the United States Army should emplace their strategic long-range cannon weapons systems at the latter position, thereby achieving the most significant deterring effect, and the most numerous and advantageous effects should armed conflict occur.

Mass, Accuracy, and Precision

Rausenberger identified one of the most significant flaws and misalignments between technical capability and desired effects, stating, "Even the bombardment of Paris with such a relatively small shell containing only 8 kilograms of explosives…could only have a psychological effect on the enemy. Even to achieve this effect, it would be necessary to maintain a continuous bombardment, varying in intensity, for weeks or months."[12] Rausenberger knew what the German high command did not, that without the ability to mass the effects of the bombardment, and sustain a relatively high tempo, these weapons would not achieve their intended psychological effect. One of the principles of joint operations is *mass,* meaning, to "concentrate the effects of combat power at the most advantageous place and time to produce decisive results."[13] Strategic long-range cannon weapon systems must be able to independently mass their fire on selected targets, or synchronize the massing of theirs' and other weapon systems' effects to achieve strategic results.

If strategic long-range cannon weapon systems are unable to mass fire, they will fall prey to the inadequacies of the Paris Guns, which at most

only had three weapons in position ready to fire with an average reloading time of 30 minutes, fired intermittently to achieve impacts every 5 to 15 minutes.[14] On top of lag between shots, these weapons were fired at an area target (Paris), resulting in projectiles sometimes impacting miles apart. Coupled with the short tube life (50 to 60 rounds per tube), and the low availability of the weapon systems, the bombardment of Paris resulted in only 352 projectiles fired over 139 days—an average of fewer than 2.5 rounds per day.

Strategic long-range cannon weapon systems will be inherently large weapons, and which require increased reloading times. It is also likely that they will have reduced tube life due to the same problems faced by the Paris Guns: large quantities of required charges, resulting in high muzzle velocity, thus creating increased tube wear. For these reasons, it is incumbent upon the United States Army to create a vast number of these weapons making it feasible to provide a near-continuous mass effect for an extended period. If the United States Army does not meet this requirement, the strategic long-range cannon weapon system will likely face the same challenges as the Paris Guns: the inability to mass fire at decisive points for an extended duration while also possessing the ability to move and avoid adversary counterbattery fire.

Regarding accuracy, the United States Army's Field Manual 3-09, *Fire Support and Field Artillery Operations* states;

> The goal of any indirect firing unit is to achieve accurate first-round fire for effect (FFE) on a target…If the requirements for accurate fire cannot be met completely, the firing unit may be required to use adjust-fire missions to engage targets. Adjust-fire missions can result in reduced effect on the target, loss of surprise, increased ammunition expenditure, and greater possibility that the firing unit will be detected by hostile TA [target acquisition] assets.[15]

These principles are as true today as they were during World War I. Accuracy depends not only on the ability to determine a target's location but also on the United States Army's five defined requirements to accurately predict fires. These requirements include: accurate target location and size, firing unit location, weapon and ammunition information, meteorological information, and computational procedures.[16] Each of these requirements must be met to ensure timely massing of fires on a given target and the survivability of the attacking weapon system and its crew.

The problem of accuracy has increased exponentially since World War I. The Paris Guns enjoyed a static area target some 12 miles in diameter, the city of Paris, France. On the modern battlefield, targets are extremely mobile and employ a host of countermeasures and integrated systems to prevent detection. The increased need for accuracy coupled with the exponential increase in the difficulty of actually achieving it, necessitate advanced targeting systems and structures to inform the strategic long-range cannons of their targets. These targeting processes and systems must provide accurate real-time targeting data at strategic long-range cannon's potentially great ranges (>1000 nautical miles), to enable the timely massing of effects.

In addition to meeting the requirements to achieve accuracy, the modern battlefield also requires strategic long-range cannons' munitions to achieve the precision of contemporary weapon systems. Again, *Field Manual 3-09* states, "A precision munition is a munition that corrects for ballistic conditions using guidance and control up to the aimpoint or submunitions dispense with terminal accuracy less than the lethal radius of effects."[17] The Paris Guns did not enjoy this precision guidance capability, and therefore achieved rather limited massed effects on point targets. A precision capability works hand-in-hand with accuracy to achieve desired strategic effects, especially given the likely high-end nature and strategic value of strategic long-range cannon's intended target sets.

Mobility

Finally, the strategic long-range cannon weapon systems must be relatively mobile. Acknowledging that these weapon systems will likely be larger and less mobile than artillery platforms currently employed by the United States Army, they must remain semi-mobile to avoid counterbattery fire after accomplishing their fire missions. The Paris Guns are an example of the fatal cost of an inability to move. The Germans attempted to mask their fire using heavy gun batteries of artillery (to defeat Allied sound-ranging systems).[18] French artillery units were able to locate the guns after the first day's bombardment and return counterbattery fire within 24 hours of initial engagement. This counterbattery fire wounded six or seven crewmembers.[19]

The Paris Guns are fired from prepared fixed positions after first being moved by rail and assembled.[20] This mobility required the creation of a newly prepared concrete and steel position, then disassembly, movement by rail, and then reassembly. Even using rudimentary technology, the

French were able to locate the guns, reposition railway artillery within 24 hours, and provide accurate counterbattery fire. Through the exponential growth of technological capabilities, the United States' adversaries need only minutes, and possibly seconds to respond to the firing of a strategic long-range cannon weapon system. For this reason, these weapons must be mobile enough or have some means of defensive capability to provide adequate survivability on the modern battlefield. If these criteria are absent, then after the initial volley, strategic long-range cannon will be unable to continue firing in support of strategic objectives.

Additional Research

These conclusions, recommendations, studies, and analysis expose additional areas for future research. The foremost requirement is the tactical and operational employment of strategic long-range cannon weapon systems. The technology is emerging with capabilities and specifications unknown or unavailable to the general public; so it is impossible to comment on strategic long-range cannon's use at the tactical or operational levels within these constraints. As technology develops and capabilities improve, additional research and recommendations should focus on these areas to inform the United States Army Field Artillery about their employment.

Another topic area outside the scope of this work is the future hypersonic missile program in development by the long-range precision fires cross-functional team. For the same reasons aforementioned but further constrained due to limited historical parallels, the use of these weapons' is even more challenging to explain and understand. Once again, as technology emerges, additional study and recommendations are required to inform the United States Army Field Artillery about their proper use and employment.

At present, the United States Army is pursuing strategic long-range cannon, not as a stop-gap or interim weapon systems, but as an integrated part of overlapping long-range artillery capability. Should the development of surface-to-surface fires far outpace strategic long-range cannon and even hypersonic weapons, then the advancement of strategic long-range cannon technologies should cease; also, the United States Army's focus should shift in agreement with the emerging technological capabilities. Investing time and money in outmoded or outdated technology results in the United States Army being further behind its adversaries, a result the multi-domain operations concept and cross-functional teams seek to avoid. If a technology exists that provides an overwhelming exponential

capability far outpacing that of strategic long-range cannon or hypersonics, then the United States Army should shift its organizational energy into this technology. Only in this way, will the United States Army outpace its adversaries and overcome current capability deficits.

Currently, the United States Army's future operating concept does not envision a specified role for long-range precision fires beyond the dis-integrate phase of multi-domain operations. Additional research will determine how strategic long-range cannon weapon systems can be employed to support the Joint Force during exploitation and the transition back to re-competition. Strategic long-range cannon may have a different role and function to play during these phases and it may be more practical to achieve the desired effects at the tactical and operational levels. As this technology advances, researchers should find a place for strategic long-range cannon throughout all stages of the competition continuum and across the full range of military operations. This requirement is simply a matter of efficacy; pursuing technology for use in only a limited range of operations is both wasteful and inefficient, especially given the varied and ever-changing requirements of the modern battlefield.

An interesting parallel exists between the Paris Gun project and the German rocket programs of World War II. Many of the scientists from the Paris Gun went on to lead the development of the German rocket programs, carrying with them many of the same logical fallacies and misunderstandings of the strategic outcomes they could hope to achieve with "psychological" weapons. There is a future research opportunity to study this relationship in detail to assist the United States Army with the transition from conventional cannon artillery to the future of hypersonic weapon systems. Future research could help the United States Army long-range precision fires cross-functional team avoid many of the pitfalls of the German engineers in World War II.

The Paris Guns were almost lost to history when the Germans destroyed them before the end of World War I. Without a few dedicated researchers, including Colonel Henry Miller, Dr. Gerald V. Bull, and Dr. Charles H. Murphy, the incredible story of these technological wonders built far before their time would have been lost to history. We have to thank them for reconstructing the story of the Paris Guns and allowing us to learn their lessons today. A critical lesson of the Paris Guns is that pursuing technology for technology's sake seldom achieves the desired end state. More significantly, the lesson that weapons aimed at civilians are seldom effective, and further, even if they do achieve an end to a conflict, at what cost was that end achieved? Perhaps in the future, nations will no

longer target civilian populations, and perhaps we will discover that the simplest solution to the technology of our adversaries is, in the end, the most effective.

Notes

1. *New York Times,* "Shell Hits Paris as City Worships," *New York Times,* 1 April 1918, accessed 21 January 2020, https://timesmachine.nytimes.com/timesmachine/ 1918/04/01/102685536.html?pageNumber=1.

2. Wren, *The Great Battles of World War I,* 366.

3. Andrew M Scott, "Challenge and Response: A Tool for the Analysis of International Affairs," *The Review of Politics* 18, no. 2 (April 1956): 215, accessed 16 April 2020, http://www.jstor.org/stable/1405069.

4. David T. Zabecki, "Military Developments of World War I," *1914-1918-Online, International Encyclopedia of the First World War,* Last updated 7 May 2015, accessed 24 March 2020, https://encyclopedia.1914-1918-online.net/article/military_developments_of_world_war_i.

5. Editors of *Encyclopedia Britannica,* "Supersonic Flight," Encyclopedia Britannica, n.d., accessed 24 March 2020, https://www.britannica.com/technology/supersonic-flight. Hypersonic velocity is characterized as a velocity exceeding Mach 5, or five times the velocity of sound. The velocity of sound varies with atmospheric temperature and pressure, but is generally understood to be approximately 1,225 kilometers per hour (kph) (760 miles per hour (mph)) at 15°C (59°F) at sea-level. Pleasance and Zilber, "'No Force Can Shake This Great Nation': President Xi Leads Spectacular Ceremony to Mark 70 Years of Communist Rule in China and Unveils Top-Secret Hypersonic DF-17 Missile for the First Time."

6. Major General Stephen J. Maranian, interviewed by author, Fort Leavenworth, Kansas, 19 February, 2020.

7. Department of the Army, Training and Doctrine Command, TRADOC Pamphlet 525-3-1, *The US Army in Multi-Domain Operations 2028,* 26.

8. Bull and Murphy, *Paris Kanonen-the Paris Guns (Wilhelmgeschütze) and Project HARP,* 27.

9. Neufeld, *The Rocket and the Reich,* 51-52.

10. Bull and Murphy, *Paris Kanonen,* 21.

11. Zabecki, "Paris Under the Gun," 65.

12. Bull and Murphy, *Paris Kanonen,* 27.

13. Headquarters, Department of the Army, Army Doctrine Publication (ADP) 3-0, *Operations* (Washington, DC: Government Printing Office, 2019), 2-1.

14. Bull and Murphy, *Paris Kanonen,* 133.

15. Headquarters, Department of the Army, Field Manual (FM) 3-09, *Fire Support and Field Artillery Operations* (Washington, DC: Government Printing Office, 2020), 4-10.

16. Headquarters, Field Manual (FM) 3-09, *Fire Support,* 4-10 - 4-11.

17. Headquarters*,* 4-10.

18. Zabecki, "Paris Under the Gun," 64.

19. Bull and Murphy, *Paris Kanonen,* 34.
20. Zabecki, “Paris Under the Gun,” 62.

Appendix
Additional Figures

Bombardment Statistics

Below, are a series of author created tables. These tables compare four facts: quantity of rounds (bursts) exploding in Paris by day, the number of casualties (both killed and wounded), and the number of New York Times articles related to the bombardment appearing on that day.

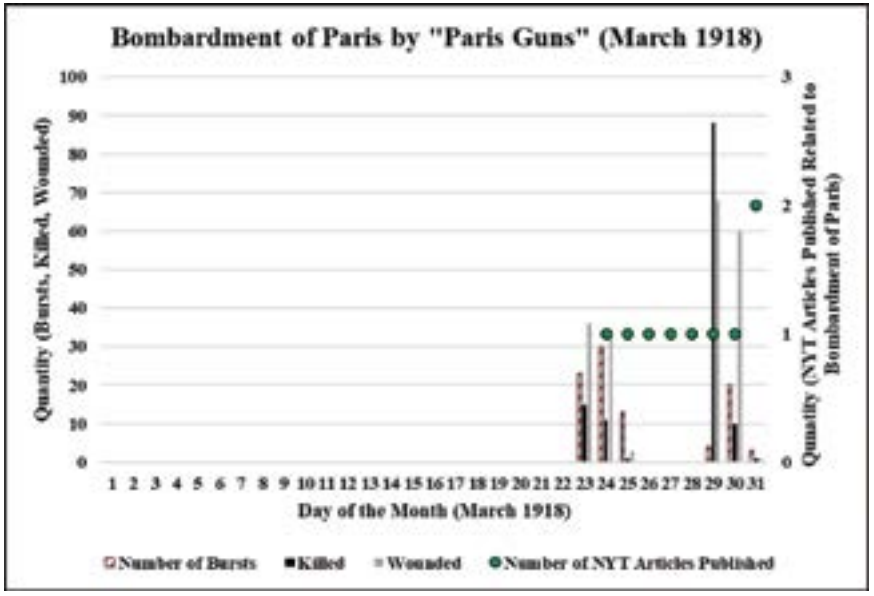

Figure A.1. Bombardment of Paris by "Paris Guns" (March 1918).
Source: Created by author.

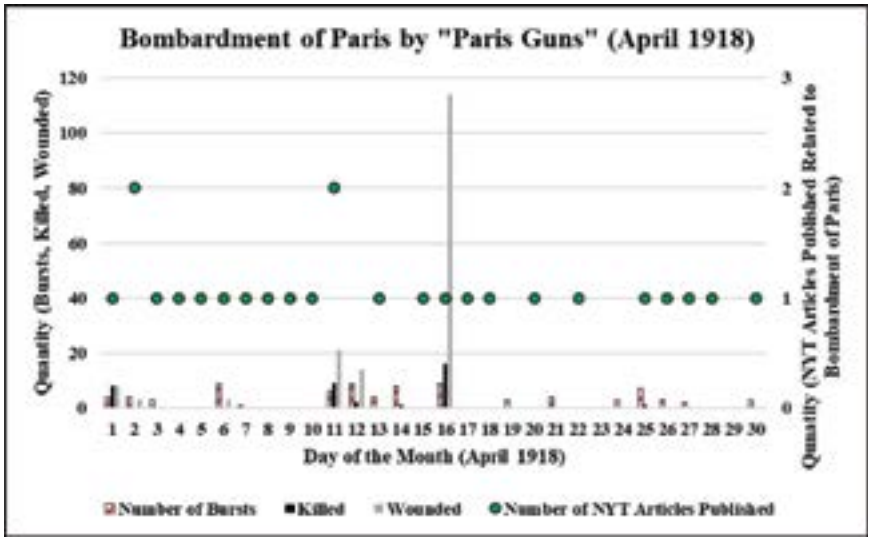

Figure A.2. Bombardment of Paris by "Paris Guns" (April 1918).
Source: Created by author.

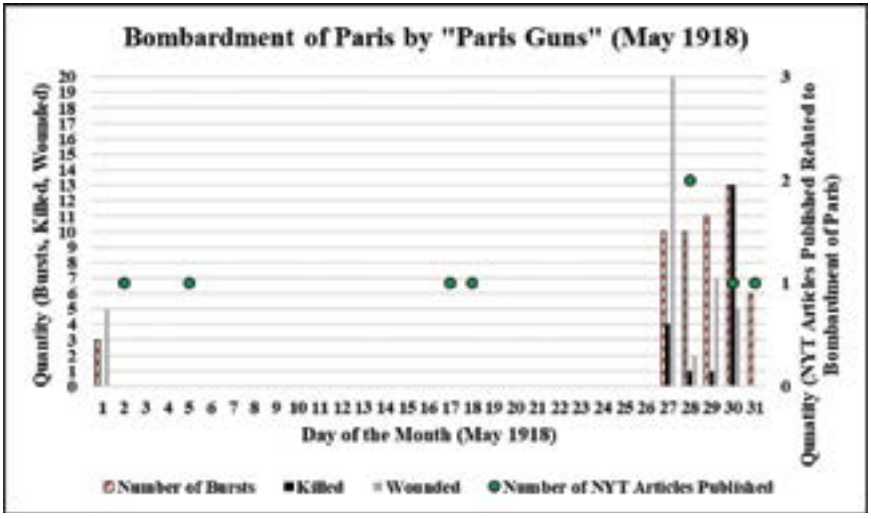

Figure A.3. Bombardment of Paris by "Paris Guns" (May 1918).
Source: Created by author.

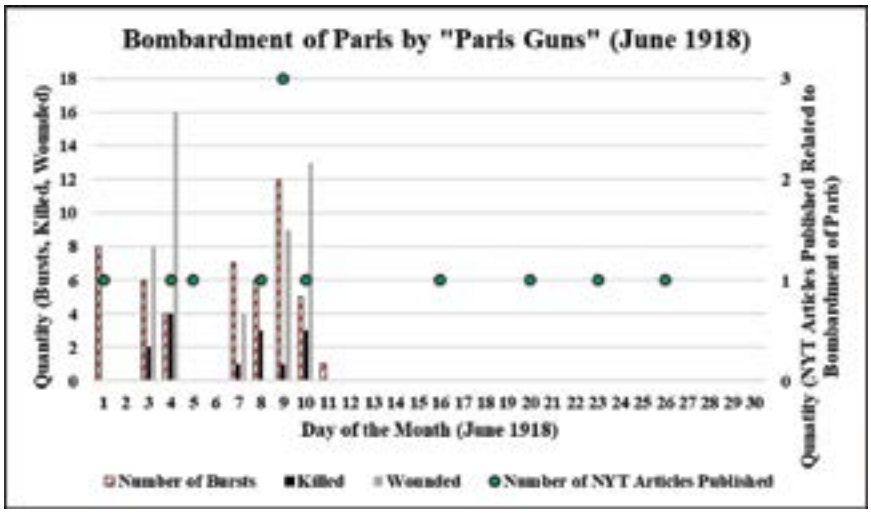

Figure A.4. Bombardment of Paris by "Paris Guns" (June 1918).
Source: Created by author.

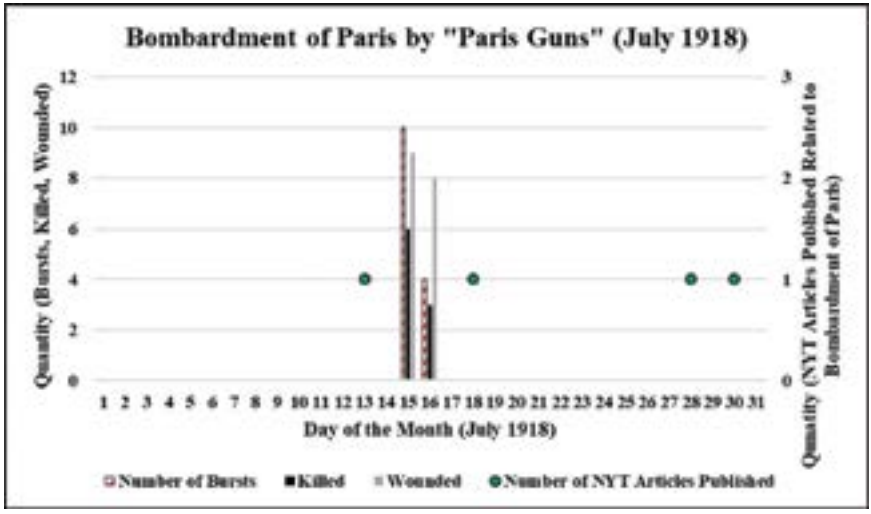

Figure A.. Bombardment of Paris by "Paris Guns" (July 1918).
Source: Created by author.

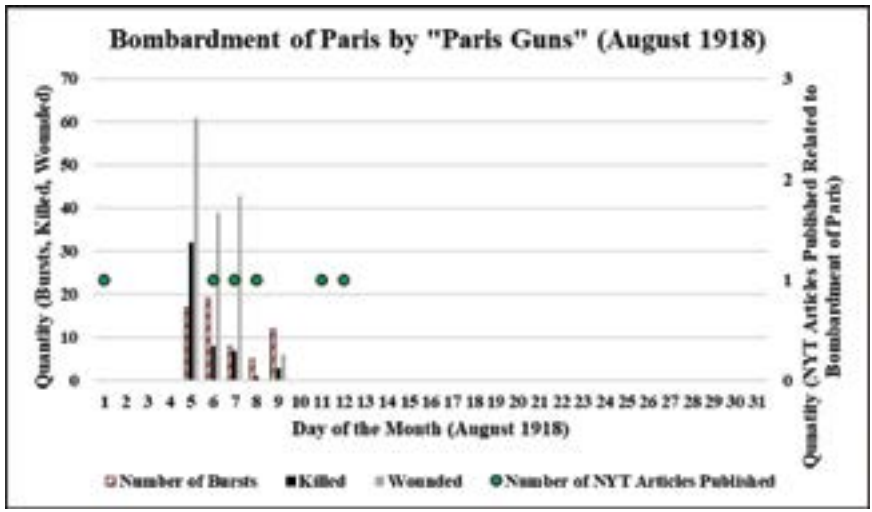

Figure A.6. Bombardment of Paris by "Paris Guns" (August 1918).
Source: Created by author.

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