Bachelor's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Humanities
Department of Historical and Classical Studies

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Guns Throughout The Hundred Years' War.

An analysis of the technological evolutions of gunpowder weapons and their efficiency throughout the Hundred Years' War.

Bachelor's thesis in History
Supervisor: Dr. David Brégaint
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Contents.

Abstract.

This paper analyses the advancements of gunpowder technology through the Hundred Years' War and goes through the uses of these weapons in a historical context. Throughout this work there will be analyses aimed at understanding the reasons why the use of gunpowder technology increased throughout the period, and will contextualise this in a historical way

Oppsummering.

Denne bachelor oppgaven analyserer utviklingen av kruttvåpen under Hundreårskrigen, i løpet av oppgaven analyseres teknologiske aspekter og historiske aspekter som la til grunne at denne utviklingen påvirket konflikten.

Chapter 1 Introduction.

Throughout the early mediaeval era the relationship between the kingdom of France and the kingdom of England was continuously affected by the feudal relationship between the kings of England and the kings of France. The English possessions in Normandy and later Gascony continued to complicate the relationships between two of the most powerful dynasties in Western Europe. The Plantagenets in England and the Capetians in France.[1] Through their holdings in France, the king of England was held in a feudal contract as a subservient to the king of France in these duchies.[2]

Eventually this paradoxical situation came to its conclusion, with Edward the third pressing his claim to the throne of France. Historians debate whether or not Edward ever wanted the throne, or if he pressed his claim to justify a predetermined war.[3] The ensuing conflict would mark the start of the Hundred Years' War, which would see the English eventually lose all their holdings in France, apart from Calais, by 1453.[4]

Throughout this period the gunpowder weaponry would emerge throughout Europe, and throughout this paper their impact on the conflict will be assessed. Gunpowder weaponry would be present, from the Battle of Crécy in 1346 to the Battle of Castillon in 1453.[5]

1.1 Research question and the scope of this paper.

Throughout the modern era, the existence of guns, cannons, artillery and other destructive forces are treated almost as something that has always been here. The enormous destructive capabilities of modern weapons are incomparable to the weapons of the late mediaeval era. Yet the introduction of the predecessors of these modern weapons had a monumental impact on the way warfare was treated during their own era. It is of course impossible to compare a late mediaeval bombard to a hydrogen bomb. However, somewhere along the lines, these mediaeval weapons would evolve into the weapons of the modern age.

This paper analyses the advancement and evolution of gunpowder weaponry throughout the Hundred Years' War, it does so out of a desire to observe how these weapons changed the way warfare was done, and out of a desire to know when and why these changes happened.

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[1] Curry, 1993, p.1-6
[2] Curry,1993, p.1-6
[3] Ibid, p.32-58.
[4] Ibid, p.1-6.
[5] Contamine, 1984, p.197-200.

The limitations of this paper arises when it comes to the size of the paper, this subject could span twice the length of this paper or even more, without covering the subject in its entirety. There are several pivotal people and moments throughout the period that have a limited appearance in this paper due to this. Due to these limitations this paper has decided on what the author considers pivotal moments and technological evolutions rather than a focus on the entirety of the conflict.

1.2 Research methodology and sources.

The research design chosen for this study is a qualitative approach, as it allows for exploration and analysis of historical sources. This approach aligns with the research subject, which aims to examine the impact of technological advancements related to gunpowder during the Hundred Years' War. By focusing on a qualitative method, it allows for a deep analysis of the sources available.

Throughout the process of researching for this paper, mainly two approaches were considered. Either using a wide variety of sources to create a wide capacity of information thus creating a broad knowledge regarding the subject, or choosing to narrow down the available sources yet using sources purely by what was considered extensively relevant. Although there are upsides to both perspectives, the specificity of the subject matter ended up being the decisive priority.

The evolution of this paper has been heavily directed by the utilisation of the source material. Although this period has been thoroughly covered by a large quantity of competent authors, the specific nature of the subject of this paper demanded a thorough use of a narrower number of sources. Taking this into consideration it was decided to focus on a narrower base of sources, but focusing on material by primarily mediaeval military historians, and experts in mediaeval technology. Even though this reduced the available sources, it amplified the amount of research needed to understand the strengths and weaknesses of the sources. Due to the specific nature of the subject the available sources tended to be research focusing on the advancing technology surrounding the mediaeval period, rather than purely focusing on the advancement of technology during the Hundred Years' War. However, thanks to the depth of analysis and detail in several of these works, particularly the work of Dr. Contamine, meant that these works were extremely relevant for the subject matter.

The process of narrowing down the amount of sources meant that the detailed quality of the selected work had to be at a high level to justify the selection of the work as a source.

Detailed approaches towards analytical sources available meant that an increasing emphasis was put on secondary sources. However, these sources detail the primary sources extensively, such as Dr. Spencer's analysis of shipping documents during the latter part of the Hundred Years' War.[6]

A significant challenge was presented during the research surrounding this thesis: the lack of accessible analyses from a French perspective. The majority of available analyses in English has been predominantly authored by historians with an anglophone background, and it is crucial to acknowledge this bias. Through this weakness in the sources used, the focus of large parts of the analysis has been put on the English evolution of gunpowder weaponry. However, efforts have been made to add perspectives from the French side as well, albeit to a lesser extent.

1.3 Key scholars and justification for their use in this paper.

Clifford J. Rogers.

Dr. Clifford J. Rogers is a military historian established at West Point, where he primarily focuses on the studies of mediaeval military history. Through his work he has delved into the Hundred Years' War several times, and his literature has been an impressive tool to be used in the creation of this work.

Throughout this work, several references are made to Dr. Rogers' published literature. This includes papers and books, as well as papers in books. Dr. Rogers' extensive knowledge of the campaigns of Edward the Third and Henry the Fifth has been greatly appreciated. While his works on these campaigns have been instrumental in describing the events and creating a narrative backbone for the subject matter, his contributions on the advancements of technology and weaponry have been equally relevant, if not more so. His research sheds light on the technological innovations that shaped the outcomes of these battles, and provides a deeper understanding of their historical significance.

However, Dr. Rogers' analysis has faced scrutiny from other prominent figures in the field of mediaeval military research, with some believing that he places excessive reliance on technological evolution as the sole solution to complex inquiries. Among these critics is Dr. Kelly DeVries, who, despite sharing many views with Dr. Rogers, engages in debates over specific outcomes and technological advancements.[7] Such disagreements highlight the nuanced

[6] Spencer, 2015, p.179-192.
[7] DeVries, 1997, p.454-470.

nature of their scholarly discourse, wherein fine details regarding historical outcomes and the impact of technology become subjects of contention.

Through the discourse surrounding these matters it is important to seek alternative opinions and analysis, thus avoiding parroting one source rather than presenting the work in the entirety as it should. When reading Rogers' works I tend to agree on a lot of the things he has stated, although this does not prevent me from acknowledging the flaws in certain parts of his work.

One of the most captivating aspects of Dr. Rogers' work revolves around the debate surrounding the concept of "Military Revolution."[8] In "The Military Revolution Debate" he explores the influence of external factors on military ideas, which in turn drive advancements in technology as a means to counter evolving tactics and strategies. It is this very paper and idea that served as a catalyst for my own investigation into the intricacies of the Hundred Years' War, particularly considering the growing utilisation of gunpowder weaponry throughout that era. The notion of a transformative shift in military affairs, as proposed by Rogers, piqued my curiosity and motivated me to delve deeper into this fascinating period of history.

Kelly DeVries.

Dr. Kelly DeVries, a professor at Loyola University, specialises in mediaeval general history and mediaeval military history. His works have played a pivotal role in shaping this paper, providing valuable insights into technological advancements during the Hundred Years' War while offering contextual analysis of their benefits and drawbacks.

Throughout the course of this paper, focus has been placed on Dr. DeVries' research on mediaeval military technology. His analysis has expanded the range of analytical options when examining the development of gunpowder technology. The critique of early efficacy of gunpowder weapons has been a valuable analytical tool, providing perspective when evaluating other available sources.[9]

Disagreements between DeVries and Rogers.

One of the many reasons why this paper utilises the works of both DeVries and Rogers is the openness of their disagreements. Their debate regarding the efficacy of the longbow and their

[8] Rogers, 1995, p.1-15.
[9] Devries, 2005, p.429-446.

disagreements regarding the efficacy of the early available gunpowder weapons.[10] These debates provide insight into the different methods of working with the sources available and have been especially important in providing differing opinions on the material.

Although their disagreements complicate matters when it comes to analysing the period, their opinions are still valuable in strengthening the understanding of the subject for the observer. The nature of their disagreements and debates also opens up the availability for observers to realise that there are very few topics in which all experts agree, thus providing the opportunity for the reader to use caution and critically analyse during their research.

Phillipe Contamine.

Dr. Phillipe Contamine(1932-2022) was a well-respected mediaeval historian. His book "War in the Middle Ages" has been a very useful tool during this process. The detail in which the late French historian goes into regarding the processes and advancements of mediaeval warfare has been invaluable for the completion of the analytical work done in this paper. Although the portions of the book dedicated to gunpowder weapons is limited, the insight and detail those few chapters delve into is in no way lacklustre.[11]

Dan Spencer.

Dr. Dan Spencer might be the expert used in this work that has the most specialised knowledge related to this paper; his expertise being that of mediaeval gunpowder weaponry. His PhD being written focusing on late mediaeval English gunpowder weaponry.[12] His extensive knowledge on the English use of gunpowder weaponry has been used especially in the parts concerning logistical advancements as well as the Siege of Harfleur. Although Dr. Spencer has been referenced several times in this work, his limited bibliography does merit mentioning.

Dr. Spencer has through his work surrounding the latter parts of the Hundred Years' War made analysis of logistical documents surrounding the preparations for the invasion of the Loire valley available for the public, rather than being restricted to individuals with access to these documents.[13] His analysis of the siege of Harfleur has also been very useful as it goes into the

[10] Rogers, 1998, p.233-242.
[11] Contamine, 1984. p.137-207.
[12] Spencer, 2017, p.73,
[13] Spencer, 2015, p.179-192.

large scale investments made to manufacture a late mediaeval siege involving large amounts of ordnance.[14]

Anne Curry.

Dr. Anne Curry is one of the leading experts on the Hundred Years' War in England, her book titled "The Hundred Years' War" was published in 1993, and she researches the topic to this day. She has been heavily involved with several museums and archives in portraying the period as faithfully as possible.

1.4 The structure of this paper.

Throughout this paper, there are several chapters dedicated to vastly different subjects. The first chapter being dedicated to the context surrounding the conflict, mostly to contextualise the period. This part will also showcase the complications surrounding the categorisation of the period as "the Hundred Years' War".

The second chapter focuses on the advancements in technology and logistics surrounding gunpowder weaponry throughout the period. It analyses these advancements focusing on how and why these weapons were used.

The third and final chapter discusses how these weapons were used, and through analysis will discuss their efficiency in warfare. It also discusses some of the pivotal moments of the conflict, as well as important participating individuals throughout the conflict.

Chapter 2 Context.

The Hundred Years' War represents a paradoxical period in history, embodying the rivalry between the Plantagenets and the Capetians, while also being a conflict driven by the intricate feudal contract between two sovereign rulers.[15] It is crucial to approach this enduring conflict without imposing modern perspectives. As contemporary individuals it is easy for us to perceive the territories associated with modern-day France as always belonging to the nation-state and being invaded by the English. When discussing kingdoms during the mediaeval era, it is essential to avoid letting these modern notions cloud our historical judgement. In reality, the conflict was sparked by the kingdom of France's attempts to seize territories that the English

[14] Spencer, 2017, p.59-73.
[15] Curry, 1993, p.1-15.

kings believed were lawfully under the English crown's domain.[16] Although the period establishes a limiting time frame from 1337 until 1453, this is limiting in the form that it ignores the long lasting conflicts preceding and the subsequent complex diplomatic relationship between the two kingdoms lead on by the defined conflict.[17] This usage of the Hundred Years' War as a period of Anglo-French relations leads to many slippery slopes in terms of analytical opportunities; whilst the outcome of the war does limit English projection of power over continental Europe for a period of time, the outcome of the conflict does not represent the eternal resolution of French-English relations.[18]

The questions surrounding the intentions of the leading figures in the conflict remain largely unanswered. It is unclear whether Edward the third claimed to be the true king of France due to the restraints surrounding the feudal nature of the time, or if his intentions were driven by a desire to attain the French crown itself. It is possible that he utilised the dynastic claim as a tool to justify his military actions in order to retain his French possessions. Unfortunately, these questions delve into the realm of individual intentions, which are difficult for us to ascertain. It is challenging to gauge whether Edward truly saw himself as the rightful king of France, or if his claims were primarily aimed at negating the feudal implications of his vassalage to the king of France as the Duke of Gascony. Consequently, definitive answers to these inquiries may never be obtained.[19]

Although the intentions of the participating parties are hidden behind the veil of the past, the outcomes of these intentions are still readily available for us to view and react to. The outbreak of the conflict may have been led on by the intentions of these individuals, yet their actions can be judged more readily. Throughout this paper we will mostly delve into the artillery use of the English throughout the period. This is partially due to the scarcity of available sources in English regarding the French use of artillery, and partially as a narrative tool.

An observation most people make when they research the Hundred Years' War is firstly the reality of the conflict lasting a hundred and sixteen years, and secondly that the construction of the Hundred Years' War as a singular event is a relatively modern phenomenon.[20] Hence the

[16] Curry, 1993, p.1-20.
[17] Ibid.
[18] Ibid, 151-155.
[19] Ibid.
[20] Curry, 1993, p.5-19.

modern idea of a long-standing conflict lasting for generations over the same causes, being perhaps untrue. However, this does not invalidate the modern analysis of the period. Although perhaps the conflict has been grouped together due to modern agendas, that does not invalidate most of the research into the topic. It is however important to note that these kingdoms were not in a state of war for a hundred and sixteen years. In the course of this period there were several truces and several war declarations.[21]

Although the "Hundred Year's War" is possibly a fabrication to group this period into a category, rather than investing the necessary analysis towards these separate parts of these conflicts. The events still happened even if they were not viewed by contemporaries as a singular conflict, this therefore does not invalidate the realities that have been analysed by historians since this grouping was done, yet it could still impact the analysis in an unintentional way.[22]

The Lancastrian and Valois rivalry does paint a great backdrop for the intrinsic modern popular view as a French-English conflict, even though both these royal dynasties had French roots and French customs. The idea that this was a war of nations and peoples is a relatively unfounded idea, as verifying any national ideas in this time period is incredibly difficult and mostly irrelevant. While the war can be viewed through a modern nation-state view, it is important to consider the complexities and contradictions that can arise. In the case of the region of Gascogne, for instance, the inhabitants today would be perceived as French. However, during the later stages of the war, they pleaded for reinforcements against the invading French forces as they claimed to be English subjects rather than French.[23] This highlights the complicated dynamics at play during times of war and the fluid nature of national identities. It illustrates that the perception of a national identity can vary depending on various factors, including historical context and regional affiliations. The situation in Gascogne serves as a reminder that the notion of national identity is not always clear-cut and can be influenced by shifting circumstances and individual perspectives.

Whilst discussing the details of several of the events and individuals mentioned throughout this paper there are opportunities to delve into extremely nuanced and interesting subjects, most of which are not covered in great detail throughout my work. This is due to a lack

[21] Curry, 1993, p.5-19.
[22] Ibid.
[23] Pollard,2005, p.134-140

of relatability towards the end goal of this work, the analysis of the impact of gunpowder weapons in the context of the Hundred Years' War. Although many of the most important events throughout the period are mentioned in the following chapters, this work would be lesser if certain events were not examined as to why they are not a deeper part of the work presented.

2.1 Agincourt.

The crowning achievement of one of the most famous and celebrated kings of the period, Agincourt, would be a natural focus on many papers written on the period. The battle does hold immense historical significance within the context of the Hundred Years' War. However, in the specific context of examining the development and impact of gunpowder weapons during the war, it provides little usefulness. This is primarily due to Agincourt showcasing traditional mediaeval warfare tactics, with a heavy emphasis on archery and close combat, rather than a significant deployment or influence of gunpowder weaponry.[24] As such, this paper will be focusing on gunpowder weapons and will therefore prioritise battles and sieges where these weapons played a more prominent role, allowing for an exploration of their technological advancements, tactical implications, and overall impact on the outcome of the war.

2.2 Joan of Arc.

Although Joan of Arc holds significance within certain aspects relevant to this paper, her relevance to the chosen analytical subject is limited. While she, like many other individuals of the period, has been extensively studied by experts and to this day continues to be a subject of research, her importance lies more in the turn of the conflict rather than in the analysis of advancements in gunpowder technology and efficiency.

While Joan of Arc was involved in sieges where the use of cannons and bombards was evident, there is little evidence displaying her direct impact on the development and utilisation of these weapons. However, it is important to note that this acknowledgment does not diminish her overall importance. It simply acknowledges the scope and focus of this paper, which primarily examines the broader advancements in gunpowder technology and efficiency rather than delving into the specific contributions of individuals like Joan of Arc.

[24] Rogers, 2004, p.400-428.

Chapter 3 Technological advances and a closer look at what mediaeval gunpowder weapons represented.

When discussing the eventual technological evolutions of the brand of gunpowder weapons throughout the period, it is hard to quantify exactly what made the canons and bombards of the latter portion of the conflict so dominant without first assessing what the state of the weapon class was coming into the conflict. Cannons and gunpowder weapons in general were present at the birth of the conflict, however their stature and efficacy would greatly improve throughout the 116 years of the conflict. The first concrete evidence of a type of gunpowder weapon in the literature is from a piece of work by contemporary author Walter De Milmente.[25] In his literary work "De nobilitatibus, sapientiis, et prudentiis regum" there is an illustration that shows a quite primitive version of a cannon, although if the illustration shows an actual type of cannon that was ever practical or efficient is unclear.[26] The French historian Philippe Contamine, in the English version of "War in the Middle Ages", describes the illustration without naming it in the following manner: "in the form of a large pot, placed horizonally on a trestle, from the mouth of which is a sort of large arrow emerges".[27] Although the aforementioned cannon is not named by Contamine. A French paper from 1854 describes the weapon and names it "pot-de-fer" partially due to the belief that the words "cannon" or "bombard" were not present in the French language at the time.[28]

3.1 Crécy

The evolution of the cannons from the start of the period and towards the end of the period are nothing short of impressive. The efficacy of the weapons present at Crécy in 1346 is unknown, but as no notable chroniclers seem to indicate their usefulness the safe assumption is that they were relatively unhelpful. The contemporary historian Jean Froissart shares some insight into the situation at Crécy, he claimed the English lines shot at the Genoese crossbowmen with cannons.[29] This however is doubted by certain historians as the earlier versions of Froissarts chronicle does not mention these cannons, and Froissart himself changed the details of his works

[25] Contamine,1984, p.139-140.
[26] Milmente,1326, p 140.
[27] Contamine 1984, p.139
[28] Lacabane,1854, p.37.
[29] Contamine, 1984, p.198

various times throughout his life.[30]Although the sources remain unclear when it comes to verifying whether or not any types of cannons were present at the battle, the consensus indicates a belief that cannons were present. although their usefulness at Crécy is still in doubt.[31]

3.2 Advancements in logistics

Although the Battle of Crécy presents us with little proof regarding the efficacy and use of cannons, the campaign had another significant situation where the use of cannons is well documented. The siege of Calais presents us with valuable information in two main ways. Firstly, it gives us an opportunity to analyse the two differing modes of combat: field versus siege. Secondly, the longer lasting nature of sieges results in a larger time frame and thus a larger amount of documentation available, and thus can be used to present information not necessarily available at battles like Crécy. Some of this documentation would be the documentation from a London based apothecary, in which the crown purchased "912 lbs of saltpetre and 886 lbs of sulphur".[32] Through these documents we can see that the logistics involved in carrying out warfare with cannons involved not only the military, but the workers in cities as well. The numbers of cannons employed at Calais is supposed to be around 10, which given the number of resources purchased for the siege, shows the immense logistical weight around the use of these weapons in sieges.[33]

For observers at the siege of Calais in 1346, the cannons employed by Henry the fifth at Harfleur in 1415 would most likely be unrecognisable. The size of the cannons used by Edward in 1346 would thus be significantly dwarfed by the much larger bombards employed by Henry just 69 ds later.[34] Certain named bombards at the siege of Harfleur weighed over 3500 lb, one weighing as much as 4480 lbs being named the "Messenger".[35] These bombards at Henry's command would most likely have been constructed during the reign of his father, Henry the fourth. Henry of Bolingbroke had spent a vast amount of resources in improving the artillery available to the English crown, partially due to the influences of people at his court, but also

[30] Dahm, 2011, p.10.
[31] DeVries, 2012, p.144.
[32] Contamine, 1984, p.140.
[33] Spencer, 2017, p.60-61.
[34] Ibid, p.60-63.
[35] Spencer, 2015, p.184.

partially due to his own interest in the advancing technology.[36] Henry's experiences in battles and sieges with his father also likely influenced his own personal use and ideas related to the weaponry that he later would unleash upon the French once he received the crown.

The increase in focus on these bombards and cannons would also require an increase in the logistical capabilities of the English crown. Not only would the increase in size of the cannons require larger amounts of gunpowder, the larger numbers of cannons would also require an even larger investment in gunpowder.[37]On the surface appears only to be a monetary investment. However, the investments into personnel and materials required to prepare the English artillery might be viewed as even more costly. Prior to Henry's campaign in France, the artillery branch of the English forces would be incomparable to the one present in Edwards campaign. There had been investments into the personnel on a rather high level: there were German and Dutch cannoneers hired for their specialities, blacksmiths on a permanent payroll crafting further cannons, and labourers throughout the country gathering the raw materials required.[38] This event led to a ban of the export of gunpowder, showing the impetus put onto the cannon-industry.[39] Analysing this information presents us with an idea, the idea: that even though the earlier uses of gunpowder weapons were relatively modest, the potential was seen by the contemporary leadership, as shown by the investments made.

Throughout the later portions of the period the English manufacturing of artillery seems to gravitate towards London. Whilst earlier campaigns, like the campaign by Henry the fifth, seemed to include large portions of the country. Whilst only twenty-three years later the expedition of the Earl of Salisbury seemed to be almost entirely funded by the city of London, where almost all of the production was done.[40] This could be viewed as an over-reliance on the production of the kingdom itself, compared to if the production of these weapons would be done in the “occupied” parts of France.

3.3 Advancements in the perfection of gunpowder.

So far we have delved slightly into two parts of what makes cannons and bombards efficient weapons of war, namely logistics and method of usage. The next component could be

[36] Spencer, 2017, p.63-64
[37] Ibid, p.60-66.
[38] Ibid, p.62-65
[39] Ibid, p 65.
[40] Spencer, 2015, p.188-190

viewed as such a fundamental idea that it might even be overlooked: the powder. When it comes to mediaeval gunpowder weapons, what propels the projectile forward would be the explosion formed by the ignition of a mixture of sulphur, saltpetre and charcoal. Our first European source on this powder is from the priest Roger Bacon.[41]The ratio of which of these ingredients are mixed is not mentioned in the text by Roger Bacon, which either implies that he only knows the rudimentary ideas of the process or that he is withholding information. It is most likely the first. The technology itself does not seem to have taken too long to be implemented and put into production however, and regional differences in the production of the powder could also have produced higher or lower quality versions of the product.[42]

The modern view on the optimal mixing of the materials seems to indicate a "74.64 per cent saltpetre, 11.85 per cent sulphur and 13.51 per cent charcoal".[43] Although these measurements would indicate the perfect mixture of the ingredients, we can see that certain members of the conflict mixed their gunpowder in various different measurements. The closest to the modern view in terms of their mixture would be the Burgundians.[44] Contextually this would make sense, given the reputation of the Burgundian artillery divisions, the size of their arsenal and the investments in gunpowder weapons shown by Duke Philip the Good.[45]

Another notable reality regarding the production of the powder would be the purity of the ingredients. Contamine notes that regarding the similarity to the modern standard could be impacted by the quality of the ingredients used, thus poorer raw materials could lead to a potential "worse" mix of the ingredients.[46] Whether in reality the quality of the powder was much impacted by the raw materials is hard to gauge; what can be noted however is the changes from the first known recipe, shared by Roger Bacon in 1267, and the French and Burgundian variants circa 1413-1430.[47] It is important to specify that we are aware of further variants within the French arsenal. The "petite poudre" consisted of a relatively high dose of sulphur, whilst the

[41] DeVries, 2012, p.138.
[42] Contamine, 1984, p.196.
[43] Ibid, p.196.
[44] Ibid, p.196
[45] DeVries, 2004, p.429-435.
[46] Contamine, 1984, p.197.
[47] Ibid, p.196.

stronger versions substituted the increase in sulphur with an increase in saltpetre, thus reducing the share of the powder being made up by sulphur.[48]

Economically we can see the effect of the increase in investments towards gunpowder production through the lens of costs and availability. During the earlier parts of the Hundred Years' War, the procuring of gunpowder would possibly be a rather expensive ordeal. Per pound of gunpowder, the French crown would be expected to pay 10s. t. however this price would be halved within fifty years.[49] Contextually this could be viewed as the increase in demand for the product, the product would be produced more efficiently and cheaper, thus reducing the price. Although the financial aspects of the improvement of the quality of gunpowder is uncertain, the link between an improvement in the ratio of the ingredients and the reduction of cost of the finished product, there is an argument to be made that this symbolises both an increase in investment towards the production and study of the powder.[50] It is however hard to establish whether the improvements of the ratio was due to studies or bettering of the raw materials available, the end results remains the same, a cheaper and "better" powder was produced by the Burgundians and French compared to the early recipes shared by Roger Bacon.[51]

The improvement to the available gunpowder would most likely have improved the performance of cannons and bombards used in the conflict. However, this cannot be deemed the only factor in improvements made between the outbreak and end of the conflict. The improvements made towards the "optimal" mixture of the ingredients could have made a larger impact than we are aware of, or it could have made less of an impact than we are aware of. The only things we know for certain is that the recipes advanced closer to the modern standard of mixing, as well as the reduction in price of the powder itself over time.[52]

3.4 Projectiles.

When discussing the advancement of technologies related to gunpowder weapons associated with the Hundred Years' War, a large emphasis might be put on what fired the projectiles, rather than the design of the projectiles. Although this is understandable, it removes a large part of the complexity of the weapons themselves. The typical person might expect

[48] Contamine,1984, p.196
[49] Ibid, p.197.
[50] Ibid, p.196-200.
[51] Ibid, p.196-200.
[52] Contamine, 1984, p.196-200.

cannons to fire cannonballs made of iron or lead, artillery to fire shells, and handguns to fire small projectiles meant to injure or kill. This is partially a reality when discussing the projectiles of the period as well. However, the earliest illustrations of European gunpowder weapons show a metal pot using some type of arrow shaped projectile.[53]

When it comes to evaluating the advancements made in terms of the technological improvements made towards projectiles. It is important to note the factors detailing the different types of projectiles, especially when it comes to the intended use of these weapons. The primary weapons used were the bombard and general cannons, with the bombard requiring much larger projectiles than the regular cannons.[54] Although there are some sources indicating a usage of metal in the projectiles, most analysts seem to agree that the primary material used during the period was stone.[55] The weight of these projectiles fired by bombards would vary greatly based on the makings of the bombard itself, the size of the bombard and mixture of powder would impact the size of stone fired.[56] For the siege of Orleans, the Earl of Salisbury brought 1,214 stones to use for the invasion of the Loire valley.[57] This enormous amount or projectiles shows the investments into the weapons, and could be argued to display the contemporary belief in the efficiency of the weapons especially during sieges.

Although the bombards and cannons mostly used stone as their projectile of choice, the smaller calibre of weapons had a variety of alternative projectiles. The handguns primarily used relatively small balls made of lead, which then would be fired out of the handheld gun.[58] Although the handguns fired metal projectiles, there are also some mentions of larger guns also firing metal projectiles, such as wrought iron. This however seems to be very rare, compared to the much-used stone projectiles.[59]

Having mentioned the arrow shaped projectiles, it would be unfair not to delve slightly deeper into their existence. Although the texts show that these projectiles existed, it is hard to ascertain whether they were ever useful.[60] A relatively easy presumption to hold as to why these

[53] DeVries,2012, p.138-141.
[54] Contamine, 1984, p.146-150.
[55] Ibid, p.146-150.
[56] Ibid, p.138-150
[57] Spencer, 2015, p.182.
[58] DeVries,2012, p.153-156.
[59] Ibid, p.152-156.
[60] Ibid, p. 140-142.

types of projectiles fell out of use, might be as simple as that early cannons were not overly useful on pitched battles compared to sieges.[61] The contemporary gunsmiths could be seen moving away from this type of projectile relatively fast, and if it had any widespread use is difficult to confirm.[62] Speculations might lead to the conclusions towards arrows being shaped for anti-personnel use, whilst the round cannonballs would be more useful during sieges. However, it is difficult to base these assumptions on the source material.

Chapter 4 The Gunpowder Revolution.

4.1 Historical contextualization of Crécy and longbows.

When explaining the expanding influence of gunpowder weapons during the Hundred Years' War it is important to note exactly what types of weapons these gunpowder weapons would either challenge or replace. Perhaps the biggest celebrity of the Hundred Years' War in terms of weaponry must be the longbow, the technological advantages such a weapon possessed compared to a crossbow or a regular bow is well known to this day. The longbow possessed both a greater *range* of fire and a greater *rate* of fire, thus leading to an area of a battlefield in which the opposing forces would be in danger yet have no reasonable way to counter this danger apart from moving towards the English lines to attempt to respond to the bombardment of arrows. One of the earliest examples of the superiority of the longbow during the Hundred Years' War was at the Battle of Crécy in 1346.[63] Crécy was a mixture of arrogance and ingenuity in terms of the battle itself, the English forces being station on a hill overlooking what is described as a flat and muddy area where the French forces would eventually attack from, the English longbowmen would outrange and force the Italian crossbowmen to flee leading the French cavalry to charge uphill on muddy ground facing the English forces whilst simultaneously being shot at by the longbowmen, the Battle of Crécy is at times described as a massacre.[64] A little-known detail surrounding the battle is that the English possessed another type of ranged weapon during that battle, cannons, whilst not much is known about their use on the battle, if they had any impact at all or even how many cannons there were.[65] Whilst the longbow would be known as the primary

[61] Contamine, 1984, p. 198-207.
[62] Ibid, p.138-145
[63] Rogers, 1998, p.238.
[64] Koch, 1982, p.130-135.
[65] Contamine,1984, p.140-141.

factor leading to the victory at Crécy, the cannons would be one of the primary factors leading to the change in European warfare for the coming decades.

The Battle of Crécy is viewed as one of the catalysts in which the English seized the upper hand in the earlier parts of the Hundred Years' War, through which the English forces would pivot into besieging Calais and enforcing a zone of control in Normandie.[66] The utter collapse and failure of the French military, viewed as one of the best feudal armies in the entirety of Europe at the time, had consequences both militarily and politically in the French kingdom. Not only did the Battle of Crécy result in major casualties in terms of the army being destroyed, a large portion of the aristocracy of France and its allies were present, and in accordance with their chivalric ideals, participating in the fighting, often on horseback.[67] Compared to these loses purely being a statistical view on the conflict, It is important to note that these nobles would be administratively in charge of regions of the kingdom, relations built between these people would impact how the governing of the kingdom would be done, and losing such a vast amount of people in administrative positions would impact the conflict in the coming years.[68]

4.2 Siege of Calais

After the Battle of Crécy, the Plantagenet forces, led by King Edward the third, marched towards the port city of Calais.[69] Through their victory at Crécy, the remaining military opposition in Normandie lay primarily in fortified castles or walled cities.[70] Calais was one of these walled cities, the siege of Calais has been criticised by numerous historians as a strategically questionable move.[71] However, historian Clifford J. Rogers believes the siege of Calais was both a strategically sound move, as well as a move to draw the Valois forces towards a defensively sound battlefield.[72] During the siege of Calais we find the second mention of cannons being used throughout the conflict, where 10 cannons and ribauldequin were utilised.[73]As the siege ended in a surrender, It is hard to gauge how effective the cannons truly were.

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[66] Rogers, 2000, p.273-285
[67] Ibid, 262-272.
[68] Ibid, 273-285
[69] Ibid.
[70] Ibid.
[71] Ibid.
[72] Ibid, p.274-276
[73] Contamine, 1984, p.140-144

Throughout the earlier portions of the Hundred Years' War there were relatively few uses of gunpowder weapons, and their use was often primarily in sieges, such as the aforementioned siege of Calais. There are arguments to be made though that the earlier cannons of the Hundred Years' War were not particularly effective in either standard warfare or sieges, due to uncertainties in their use leading to success at battles like Crécy and sieges like Calais.[74] The use of cannons in battlefield warfare was virtually non-existent during the time, as the English preferred to use the chevauchee method, focusing on raiding, burning, and luring out French defenders from castles instead of committing to a siege.[75] Invading forces were heavily reliant on man-at-arms and cavalry to carry out their attacks.[76] Attempting to lure out French defenders from castles instead of committing to a siege, these invading forces would be heavily focused on the man-at-arms and cavalry in general.[77] This type of warfare would not be suited to the use of cannons in a general way, due to the speed and movement required, which would be detrimental for the cannoneers.

4.3 Henry the Fifth and the siege of Harfleur

Our first proper introduction to the efficacy of the weapons was during the reign of Henry the fifth, particularly at the siege of Harfleur. Although cannons and bombards were used prior to the siege of Harfleur, exactly how effective these uses were is difficult to ascertain. This is partly due to a lack of documentation, but maybe most importantly the lack of sieges being successful.[78] Henry, investing the town of Harfleur on the 18th of August 1415, had the great fortune of pillaging a French convoy in which there were guns and gunpowder.[79] Due to this, it is uncertain how many of the cannons he used at the battle were brought with him when he crossed the channel. However, what is certain is that the use of these cannons resulted in a relatively quick siege; the town agreed to surrender on the 22nd of September the same year, after the English had blown a sizable hole in the walls surrounding the city.[80] This being noted as one of the few early examples of a successful use of bombards and cannons in the conflict.[81]

[74] Contamine, 1984, p.l40-144
[75] Rogers,2000, p.238-273
[76] Ibid.
[77] Ibid.
[78] Ibid
[79] Spencer, 2017, p 66-67.
[80] Spencer,2017, p.67.
[81] Koch, 1982, p.127.

The success of Harfleur is often attributed to the logistical advancements made by Henry, and his increased use of expertise aimed at the use of bombards during sieges.[82] Whereas this use of bombards is notably more efficient in the context of the Hundred Years' War, it is not an anomaly when it comes to the broader European lens.[83] Yet the success at Harfleur posed a significant economic and military burden on the war effort, primarily due to losses of lives and the losses of gun stones and gunpowder.[84] Estimates around depletion of gun stones and powder range around two thirds of the total brought from England.[85] Thanks to the success of the siege, Henry the Fifth would finally have a feasible strategy of siege warfare, compared to relying on chevauchees into Valois occupied France, in efforts to entice field battles.[86]

4.4 The Earl of Salisbury and the siege of Orléans.

Following Henry the Fifth's early demise, the command of the war effort on the continent was inherited by the Duke of Bedford. During his regency and leadership, the English forces conquered most of Normandy.[87] Through this period of the conflict the English imposed their authority on several parts of the French territories, conquering cities and advancing further than previously.[88] However, we are going to be focusing on a particular part of this period: the English Loire Campaign of 1429. The primary reason for this is the famous Siege of Orléans, however, we will not really go into detail regarding the most famous part of the siege, being the arrival of Joan of Arc.

The preparations for the invasion of the Loire valley started in England early in the year of 1428. At the behest of the Earl of Salisbury, Thomas Montagu, the English crown prepared for an expedition towards the Loire valley.[89]During these preparations the English crown procured a large arsenal of cannons consisting of: "seventy-one cannons, consisting of seven large cannons, forty-eight fowlers and sixteen hand-cannons"[90]. This dwarfed the available ordnance available at Harfleur only 13 years earlier. The ordnance was shipped to France, and then to the frontlines

[82] Spencer, 2017, p.60-67
[83] DeVries, 2012, p.140-145
[84] Spencer, 2017, p.60-67
[85] Ibid.
[86] Ibid, p.72-74.
[87] Spencer, 2015, p.179-182.
[88] Spencer, 2015, p.179-182.
[89] ibid, p.179-185
[90] Ibid, p.183

along with the 2694 men brought from England.[91] It is noted that the type of ordnance shipped from England, notes the intended use of the cannons, their use being primarily siege warfare.[92]

Upon arriving at Orléans, the English forces had to face defensive structures built near the end of the bridge from Orléans across the Loire .[93] Near the bridgehead entering Orléans, the French had added small towers built by mud or dirt, filled with artillery and other types of missile troops near the end of the bridge. The sources name the fort at the southern side of the bridge the "Tourelles".[94] These defensive structures were built primarily to handle the ever-increasing use of artillery during sieges, in an effort to respond with cannon fire when approached by besieging armies.[95] An additional outcome of the use of these earthen structures was the distancing of artillery from the city-walls proper. Through the use of these boulevards the French troops could inflict damage to the English forces without risking the loss of integral structural pieces of the walls.[96] These fortifications would likely be the death of the Earl of Salisbury, who was killed by debrief caused by cannon fire during the siege.[97]

These earthen fortifications were then reused by the English during the siege, as a method to defend from counterattacks from the besieged city, as well as its strategic location to bombard the city.[98] Throughout the siege of Orléans, the English forces would use enormous amounts of cannon stones as well as gunpowder. The sources tell us of days where the English fired as much as 124 projectiles at the city, through the use of bombards.[99] It is also highly likely that in addition to the boulevards captured by the English, that they built additional defensive structures to protect the ordnance whilst besieging Orléans.[100] These defensive structures are pictured in contemporary literature: "Vigiles de Charles VII".[101] Through these illustrations we can get a slight insight into the type of warfare that was in use, it is however worth noting that the work possibly possesses a pro-French bias.

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[91] Spencer, 2015, p.181-183.
[92] Ibid, p.189-191
[93] DeVries, 2012, p.277.
[94] Ibid.
[95] Ibid.
[96] Ibid.
[97] Ibid, p.156.
[98] DeVries, 2012, p.277
[99] Contamine, 1984, p.200
[100] Ibid, p.201.
[101] Koch, 1982, p.132

The siege of Orléans ended after the arrival of French reinforcements led by Joan of Arc. Although the siege ended up as a failure, it is still a strong indicator of the value put on cannons and bombards, especially considering the logistics required to transport and produce the weapons used at Orléans[102] Interestingly several of the bombards used at the siege of Orléans can be found in documentation through their given names, such as the "Newgate", "Henry" and "Towerwarf of Cumbria".[103] It is likely that several of these bombards were then captured by the French forces after the lifting of the siege of Orléans, as large parts of the ordnance was captured.[104]

Through the failure of the siege of Orléans, the English expansion seemed to be at an end. The raising of the siege led to a turning of the tide in the conflict. For the first time since Henry the Fifth, the English were now on the defensive.[105] With the French gaining the upper hand on the conflict, the English would not be entirely out of the conflict due to the siege of Orléans. Believing the siege to be the only reason why the French won the war, is folly and short-sighted analysis, it is however a factor, one that is noteworthy in the context of this paper due to the large

[102] Spencer, 2015, p.181-189.
[103] Ibid, 190.
[104] Ibid, 183.
[105] Curry, 1993, p.111-118

presence of ordnance at the siege.[106]

 [107]

4.5 The Battle of Castillon

Throughout this paper we have so far mentioned several sieges and only one field battle, there is however a decisive field battle in which the strengths of cannons on this stage were properly shown. The Battle of Castillon is considered the finale of the Hundred years' war by many.[108] The background for the battle has been questioned, whether it was out of sound strategic planning, or if it was out of unease in Bordeaux due to the Earl of Shrewsbury's refusal to march out to meet the French troops.[109] One thing we know for certain is that upon arriving at the priory of St Lauren, John Talbot did not heed the advice of his subordinates, and launched an attack on the fortified French forces.[110] It is difficult to be certain whether the attack was out of

[106] Curry, 1993, p.111-118

[107] French forces assaulting English fortifications at Orléans https://gallica.bnf.fr/ark:/12148/btv1b105380390/f126

[108] Ibid, 151

[109] Pollard, 2005, p.136-140.

[110] Ibid.

recklessness, desperation or poor judgement, What is certain is that there were moments where Talbot could have turned back.[111]

The French forces, led by Jean Bureau, had arrived at Castillon a week before Talbot and the English.[112] Upon arriving at the future scene of the battle, the french forces had fortified a position close to the river Dordogne, likely similarly constructed to the boulevards used at Orléans.[113] This fortification ended up creating better vantage points for the use of ordnance in a field battle, creating a form of siege battle in a field battle situation.[114]

On June 17th, 1453, the English aspirations and ambitions of gaining control over French soil came to an end as the Earl of Shrewsbury, John Talbot, recklessly led a charge against the fortified French army at Castillon.[115] Accounts and details of the battle vary, the only truly certain things are that the battle lasted less than 2 hours, and that the defensive positioning of the french army led to a shattering defeat for the English forces. The body of John Talbot was found the day after the battle, there are still uncertainties around his death, the only certainty being that he died at the field.[116]

Castillon provided several observations regarding the evolution of warfare, the importance of defensive positions and the increasing popularity and destructive force belonging to armies capable of utilising ordnance to its potential.[117] Within 107 years, gunpowder weapons underwent a remarkable transition, from being periphery objects at Crécy to becoming weapons capable of hitherto unseen destructive potential. The Battle of Castillon effectively ended the English campaigns for dominion over France, and within a short time, their ability to retain their original holdings in Gascony and Normandy, save Calais.[118]

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[111] Pollard, 2005, p.133-145.
[112] Pollard, 2005, p.133-145.
[113] Ibid.
[114] Ibid.
[115] Ibid.
[116] Ibid, p.138
[117] Contamine, 1984, p.199
[118] Pollard, 2005, p.138

Chapter 5 Conclusion

The target of this paper has been to prove the usefulness of the advancements made to gunpowder technology throughout the Hundred Years' War. Although the technological advancements made throughout the period were undoubtedly a part of the evolution of the use of gunpowder weapons, we have seen throughout the work that this was not the only factor. The verifiable factors throughout the period point towards an increase in investment towards the improvement of the capacity of the participating armies to carry substantial amounts of gunpowder ordnance, as well as an increase in speed of acquisition of these tools.[119]

It became evident throughout the research done that the English receive large amounts of credit for utilising the emerging technology relatively early.[120]. However, their early adaptation seems to reveal little evidence of the actual capacity of these weapons during this period of the conflict. For instance, the siege of Calais seemed little accelerated by the use of gunpowder ordnance.[121] It seems evident that the French forces used gunpowder weapons in a defensive capacity during the aforementioned sieges, yet these incidents received less attention. This is verifiable during the siege of Harfleur, where the English forces looted an artillery train headed towards the city. [122] This siege also established the presence of defensive artillery and strategic methods of utilising the defensive strength of artillery by constructing "boulevards" outside of the cities fortifications.[123]

Although gunpowder weaponry provided a defensive benefit, the evident winner in the efficiency scale seems to be the offensive use of ordnance as siege weapons. The siege of Harfleur establishes an unprecedented speed of forcing a fortified settlement to surrender.[124] Comparing the length of the siege of Harfleur with the siege of Calais, reveals that the expertise and efficiency of the ordnance had improved drastically.[125] Although Harfleur indicates the destructive power the bombards were capable of, this success would not be a regular occurrence until the mid-1420s, when artillery caused surrenders would be a regular occurrence.[126]A

[119] Spencer, 2015, p.172-192.
[120] Rogers, 2000, p.272-324.
[121] Ibid.
[122] Spencer, 2017, p. 66.
[123] Ibid, p.66-69.
[124] Spencer, 2017, p.66-69
[125] Ibid.
[126] Rogers, 1995, p.66.68

worthwhile criticism to note is that although the technology and logistics surrounding the weaponry improved, there remained very few examples of successful field battles in which gunpowder weaponry played a part. An outlier regarding this point being the Battle of Castillon, yet this outlier occurred in a particular way utilising the defensive advantages of cannons in a pseudo siege-like condition.[127] The weaknesses of artillery weapons were still very prevalent at this stage of its evolution, a poor rate of fire and a lack of mobility meant that the upsides of using cannons during field battles were often outweighed by the downsides.[128]

Through these observations the reality surrounding the efficiency of gunpowder weaponry during the Hundred Years' War becomes clear. The increase in investment both technologically and logistically shows a trend towards increasing the presence of gunpowder weaponry in the military arsenal. We also observe a trend where the increase in expertise leads to an increase in efficiency, where ordnance experts would be hired from different kingdoms at high cost in attempts at utilising the destructive power of these weapons to their fullest.[129]

The analysis done reveals the efficiency of gunpowder weapons increased throughout the conflict, especially in the closing stages of the Hundred Years' War. Throughout the paper observations have been made in regard to the increasing trends towards technological advancements resulting in an increasing presence in the source material, indicating an increased priority placed on the development of these weapons. Following these conclusions, the results indicate that the increased presence of gunpowder weapons lead to an increased efficiency in warfare, although primarily in siege warfare.

[127] Pollard. 2005, p.133-145.
[128] Contamine, 1984, p.199-200.
[129] Spencer, 2015, p.179-192.

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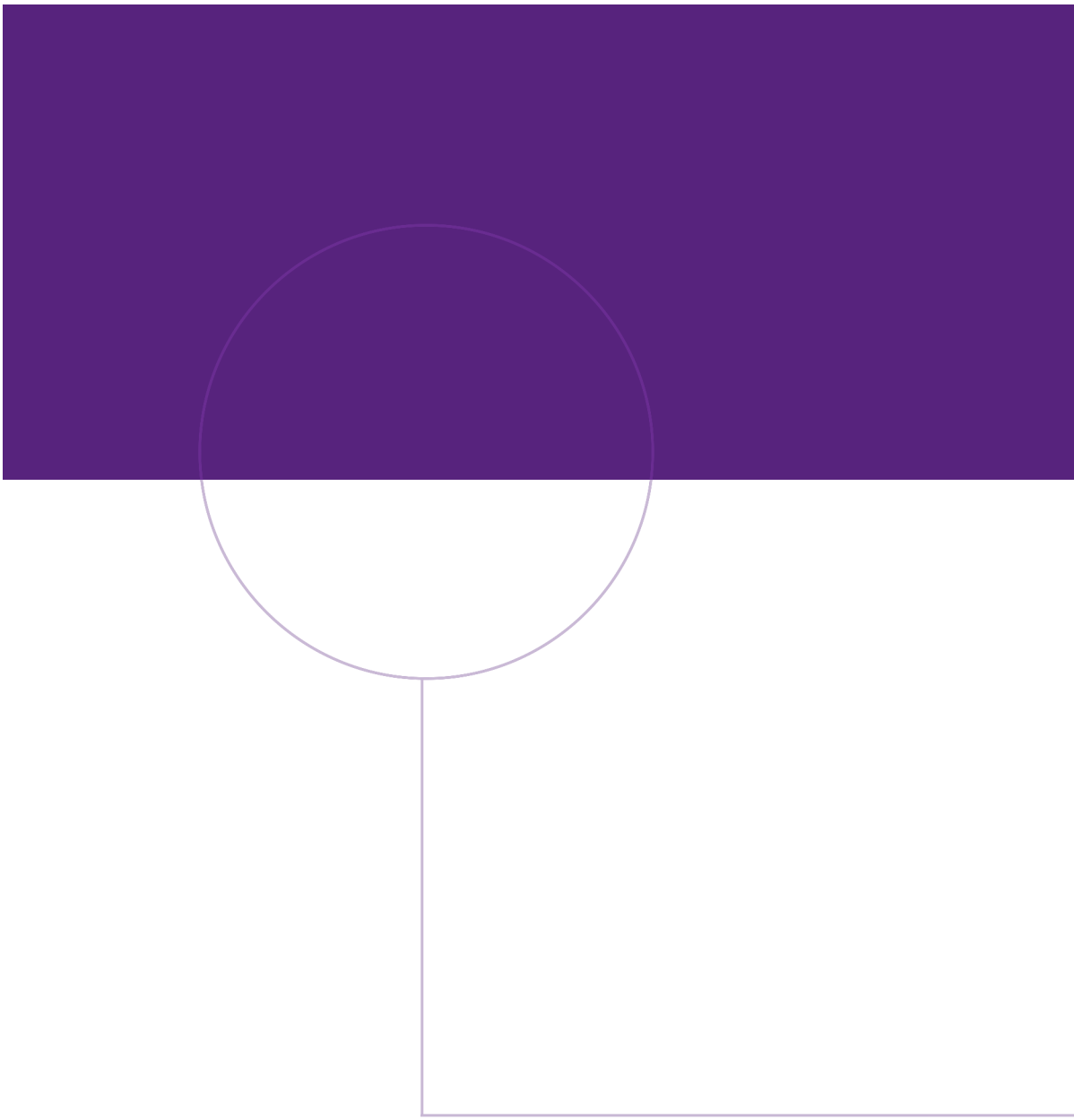

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