Chapter 5

(Note by editor: This is the text with edit changes accepted.)

Conclusion

"History is complicated." This phrase has been used so often among historians and students of history that it often elicits eye rolls. People repeat this phrase because of the truth behind the words. Any argument made to simplify the description of the Hundred Years War, or any other, to a single statement of fact ignores so many facets of history that a true understanding of the complex subject is hindered. A myriad of factors influenced the course of the Hundred Years War, from the politics, to the strategy, and down to the tactics applied. Modern historians, either to revise a perceived inaccuracy or to sensationalize the story they endeavor to tell, have made the error of simplifying history with a single story line; the French lost the Hundred Years War to the English simply because of the high efficacy of the English longbow.

In regards to the effectiveness of English arrows against French armored men-at-arms, DeVries pointed out that while many of the English sources praise the superiority of the longbow, some French sources dismiss it as pivotal to the battle outcomes.[1] Just because some French sources do not agree with the English sources does not mean that historians should discount either of the sources because both sides' perspective offers information pertinent to the analysis. England had political reason to self-congratulate and pin-point a reason for their victories just as the French had political reason to dismiss the longbow as a superior weapon

[1] Kelly DeVries, "Technological Determinism of Victory at the Battle of Agincourt," *British Journal for Military History* Vol. 2, no. 1 (November 2015), accessed May 15, 2019, https://pdfs.semanticscholar.org/e127/54a734813ffe20817475a2acf0e69748e799.pdf.

because its use did not support their ideals of chivalry and nobility. Objective historians evaluate both views as counterbalances, acknowledging that the longbow was an effective weapon, but not the only reason that the English won the war. The summary information reviewed in Chapter One of this work supports the idea that the warbow was a weapon which shifted English battlefield tactics towards fighting from the defensive, a strategy which allowed the English archers and men-at-arms to support each other to great effect.

While English sources believe that the longbow was effective against the French armored man-at-arms, sources also believe that the French armor was effective in warding off damaging arrows. French tactics were developed to enhance the capability of their armored men-at-arms who were either dismounted or charging from atop a warhorse. French armor was adapted to support those strategies; the most vulnerable anatomy was the first to be armored in plate. French plate armor offered as much technological innovation as did the English longbow. The two combatants entered an arms race. Bowyers worked to develop technology to overcome plate armor, the design of which was under continual refinement to resist not just arrows, but all damaging blows a knight might endure in battle. It was the development of hardenable steel plate (carbon steel heat treated, quenched and tempered to increase its strength), in particular, that marked the end of longbow dominance on the battlefield. A tactically significant percentage of French fighters did not adopt the new plate armor design which afforded better protection against longbow arrows, and as long as this was true the longer the longbow remained effective, and the longer before it fell into obsolescence.

To substantiate the English sources' claim of the longbow's effectiveness, testing of longbow performance was required. The goal of the testing was to determine if the force generated by a longbow and its arrow was great enough to pierce the armor worn at the time.

Calculating the joules of energy in a specifically weighted arrow at a certain speed was easy enough. The first unknown to solve was the range of speed with which a longbow could deliver an arrow. One variable to consider was the longbow's pull weight, the force needed to hold the string at a set draw length. Determination of draw weight caused arguments between historians who could not agree on the attributes of the typical longbow. Before the recovery of the longbow staves from the *Mary Rose*, historians assumed that the combat longbow draw weights were approximately the same as those of the target longbows currently in use recreationally. The draw weights of the *Mary Rose* bows have been calculated to be higher than those possible with today's target longbows and, using reconstructions of the *Mary Rose* bows made with modern yew, these calculations were substantiated. While some estimates put warbows at a higher draw weight, it was expected that good bows have a pull of between about 120 and 140 lbs. Bows with draw weights in this range can cast arrows with an impact adequate for war when heavier arrows are used to mitigate any loss of speed. During the testing an arrow struck with approximately ninety joules of force at close range, and some arrows were recorded as striking with as much force as 100 joules. The energy delivered by the warbows of the tested draw weight with arrowheads that were hardened and shaped to maximize penetration of armor presented a deadly threat to the man-at-arms not armored in the best materials.

Just as the bow's strength was a mystery due to a dearth of testable artifacts, so too was the resiliency of armor questioned. Williams led the way in understanding the metallurgy of medieval Europe and the level of protection those armors provided. His testing of armor artifacts revealed that the approximate durability of iron plate and medieval mild and hardened steels could be considered as equivalent to modern mild steels of the same thickness. He also meticulously measured early armors to survey the thicknesses used in the construction of plate armor. Though the plates' thicknesses vary wildly over time, in the fourteenth and fifteenth century the thickest plate was used to produce the helmet and the cuirass, the armors used to protect the anatomy most vulnerable to serious injury. The thickest armor plate measured is between one and a half and two millimeters. Other, thinner plate armor is less than one millimeter thick. Just as the thickness was important, the material used had much to do with the armor's characteristics. The three major materials used in the early fifteenth century were iron, mild steel, and hardenable steel. Each of those materials had greater defensive performance than the one listed before it. Rogers estimated that only a small percentage of the men-at-arms at Agincourt owned hardened steel armor, with a majority of those wearing plate still relying on iron for protection. Testing was conducted on both modern mild steel and a modern iron that shares many characteristics with its medieval counterpart. In the tests conducted by Williams, it was revealed that the curvature of armor influenced the strength of the armor. Shooting at a flat sheet of metal from a thirty-degree angle replicated the effect of the curve on an arrow's penetration. These tests, when considered in conjunction with the results of the evaluation of the longbows' power, resulted in the revelation that iron armor was very vulnerable to arrows unless it was at least two millimeters thick. Either type of steel was resistant to arrows with mild steel providing reasonable protection at range and hardened steel being almost impervious to all but the most direct hits or strikes to the thinnest plates.

Williams assigned armors a resistance value; these resistance values were adopted by most scholars currently researching this field. Williams tested padded armor, *cuir-bouilli* (boiled leather), and mail. He estimated that padding under armor added about fifty joules to the resistance of armor against a lance, but resistance to arrows remained untested. Testing that Williams conducted against mail hinted at the reason a lance tip cannot be evaluated as equivalent to an arrow. Mail resisted impact forces greater than 200 joules from a lance but failed with only 120 joules from an arrow.