Ships, technology and the birth of maritime thought: the epistemological influences on Mahan's first influence*

Navios, tecnologia e o nascimento do pensamento marítimo: as influências epistemológicas da obra "First Influence" de Mahan

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ABSTRACT

This piece aims to elucidate the influence of naval technology on Mahan's first work "The Influence of Sea Power Upon History 1660-1783". At the end of the nineteenth century, a scientific discourse creating new technologies had been increasing since the first industrial revolution. However, despite the striking changes in ships and warships amplifying maritime commerce, transforming naval warfare and changing ships' millennial wooden silhouette, Mahan does not mention the word "technology". Writing at the peak of this period in 1890, he extensively discusses England's naval history during the age of sail. Nonetheless, Mahan was part of the epistemological scene of nineteenth century United States, relying on a scientific view of history. Therefore, it will be demonstrated the extent to which his epistemological view was influenced by technology.

KEYWORDS: *Ships; Technology; Maritime Thought*

RESUMO

Este artigo procura elucidar a influência da tecnologia naval no primeiro livro de Alfred Thayer Mahan "The Influence of Sea Power Upon History 1660-1783". Um discurso científico criando novas tecnologias estava crescendo desde a primeira revolução industrial, processo largamente aplicado aos navios. Embora tendo ampliado o comércio marítimo, transformado a guerra no mar e modificado a silhueta dos navios, em madeira, há milênios, Mahan, que escreve no pico desse período em 1890, escreve sobre a história naval da Inglaterra no período da vela. No entanto, Mahan fazia parte do ambiente epistemológico nos Estados Unidos da América do Século XIX, escorando-se em uma visão cientificista da história. Com isso, demonstrar-se-á em que medida sua visão epistemológica foi influenciada pela tecnologia.

PALAVRAS-CHAVE: Navios; Tecnologia; Pensamento marítimo

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INTRODUCTION

The end of the nineteenth century was of particular importance for Naval history. The scientific atmosphere of the second Industrial Revolution and its technological advances had dramatically altered the silhouette of ships and completed the transition from sail to steam. Consequently, the importance of maritime trade was highlighted, and, equally, naval warfare changed for good. "In the 1870's and 1880's something happened in navies. Suddenly the maritime world seemed different" (HATTENDORF, 2013, p. 4). Ironclads, battleships and pre-dreadnoughts replaced the millennial use of wooden ships and its sails and rigs.

Not randomly, in the same period, in 1890, Mahan's seminal "*The Influence of Sea Power Upon History 1660-1783*"[1] was published, consolidating the so-called navalism - "that uncritical demand for sea power which was to spark the greatest warship building boom in history" (ROPP, 1962, p. 208) – and framing most of the great powers' foreign policy and maritime strategy until the middle of the next century.

A retired U.S Navy Captain, his writings made naval history a subject of serious study, pouring into the interests of monarchs, publicists, politicians and bureaucrats (SCHURMAN, 1965). For Arthur J. Marder until the moment he died, Mahan was the most influential naval writer. In Margaret Sprout's famous saying he was the "evangelist of sea power", an expression he coined on purpose in the first *Influence*. (*Op. cit*)

The articulation between scientific discourse, technology and military thought is not a novelty, however. As Azar Gat demonstrates, in the eighteenth and nineteenth century the intellectuals who tried to comprehend war's rationale and extract its laws were largely influenced by the French Enlightenment and, likewise, by Germany's Romanticism. That was the case, respectively, of Jomini and Clausewitz (GAT, 1991).

Similarly, Antoine Bousquet stands for a "scientific way of warfare" arguing that scientific ideas have been systematically mobilised to "inform thinking about the very nature of combat and the forms of military organisation best suited to prevail in it" (BOUSQUET, 2009, p. 3). Bousquet also argues that technologies cannot be considered simply in terms of material change, but also as conceptual figures which particular scientific frameworks revolve around. (BOUSQUET, *Op cit*.).

Following Bousquet's perspective, specially from the 1880's, ships and battleships were at the core of scientific developments as they had been incorporating most of the technological discoveries of the first and second Industrial Revolutions. "Throughout the nineteenth century the capital ship was the most complex and expensive machine constructed by man. It was unrivalled as the symbol of national power and, after 1860, of industrial maturity and economic stability" (LAMBERT, *Op cit*., p. 5). Hence, we can argue that warships were also the materialisation of the scientific discourse of its time.

Such discourse was fundamentally influenced by the ideas of social Darwinism and by Comte's "historically inevitability" (BERLIN, 2013). This *modus operandi* on sciences dominated the epistemological scene, dominating the production of knowledge and addressing to science the moral task of progressing a global sense of optimism.

However, Mahan, differently from other thinkers[2], did not acknowledge the relevance brought about by this striking challenge. In fact, he did not even mention the word "technology" in the first *Influence*; the book that gave him an international reputation.

Instead of accounting for the major changes that scientific discoveries had infused on warships, Mahan deeply analysed British naval history during the age of sail.

Thus, considering the astonishing success of Mahan's book– it was translated into German, Italian, Spanish, and Swedish (GAT, 1991) – and, likewise, the turning point in naval warfare brought by the transition from sail to steam, it is worth posing the following problem: into what extent can we recognise the technological shift of such a period on Mahan's way of producing knowledge?

With the purpose of addressing that question, we will argue that the technological transformation of ships influenced Mahan's works by fostering the scientific discourse which he would eventually adhere to by studying and applying history for his sea power theory. History in the nineteenth century was deeply embedded in the scientific methodology common to the natural sciences, a kind of methodology he adopted from his mentor, commodore Stephen B. Luce.

Although several scholars have already produced ground-breaking works on Mahan's life and legacy as, together with Corbett, one of the masters of maritime strategy (HATTENDORF, 1990; GAT 1991; SEAGER, 1975; SUMIDA 2001; SCHURMAN, 1965; TILL, 2017; PULESTON, 1939), few have interweaved his thoughts with the epistemological background of the nineteenth century. Since many "sciences" were created in the same period on the same epistemological basis, the importance of such analysis relies on possible connections of naval history with other areas of knowledge, especially in a period of rapid technological changes.

Hence, this piece will be divided in three parts. The first one will highlight the main technological changes in ships and warships, seeking to show how ships incorporated the main transformations of the industrial revolutions. The next topic will examine nineteenth century history and its epistemological bases. Because our aim is to put Mahan's works in perspective, the third part will account for Mahan's works in connection with the socio-political atmosphere of his country as well as the influence of his mentor.

Mahan does not have a pre-ordained organic set of works, that is, his ideas changed over time, either due to his maturity as a writer or because of the political conjuncture (GAT, 1991). After writing more than 19 books, and publishing several articles, "he changed his mind or inadvertently contradicted himself" (SUMIDA, 1999, p.45). Therefore, our analysis will be restricted to the period before his first *Influence* and, by the same token, it will exclusively regard that book.

WARSHIPS AND NAVAL TECHNOLOGY AT THE END OF THE NINETEENTH CENTURY

The literature about technological development is vast and historians have agreed on the existence of two Industrial Revolutions[3] in history. The first occurred in the last third of the eighteenth century due to the emergence of new technologies like the steam engine, the spinning jenny and the Cort's process in metallurgy. The second around 100 years later, with the development of electricity, the internal combustion engine, science-based chemicals, efficient steel casting, the diffusion of the telegraph and the invention of the telephone (CASTELLS, 2010).

As Mokyr points outs, despite the differences between them, there are fundamental continuities, especially in replicating the key lesson that technological innovations are not an

isolated feature (1991). That lesson could be applied to the naval realm, especially with regards to the nineteenth century, when the political conditions of the *Pax Britannica* induced the "safe" atmosphere for thriving technological developments. Hence, "the revolution that transformed naval warfare after 1830 was the result not of one but several different developments" (CREVELD, 1991, p.33).

The end of the nineteenth century was of particular importance for the development of ships, given the rapid pace at which technology had evolved since the first Industrial Revolution, with the emergence of steam power and the dominion of iron construction. The idea of employing steam as a source of motive power was not entirely new and dates back to Roman times, evolving alongside sixteenth century research about vacuum qualities and Thomas Newcomen's atmosphere engine of the type in the eighteenth century (ibid).

However, the precise requirements for using steam engines inside ships had to be more specific in terms of size and economic consumption of fuel. Such requirements were achieved after the work of many prominent scientists, such as James Watt's separate boiler and Richard Trevitchik's steam engine under pressure (ibid). Robert Fulton is credited to be the one who linked the engine to a paddle wheel (PAYNE, 2013), although the former had been used by the Chinese centuries beforehand (MOKYR, 1990).

Likewise, the first Industrial Revolution permitted the adequate technological means – not the scientific understanding itself – for using iron in large-scale structures (CREVELD, *Op cit*). Accordingly, the change from wooden to iron hulls were also a major shift: whereas with the former, ships had to be limited in size – the largest oak ships were no more than 250ft. long, the average was even smaller (MOKYR, *Op cit*.) – with the latter, they could be made in any size, although the costs equally increased. Therefore, after millennials, ships changed their structure for good.

The first steamboat company was created in the United States of America, in 1807, connecting New York to Albany through the river Hudson. Two decades later, in 1838, the New York Herald was already celebrating the "Annihilation of Space and Time" after the arrival of the first commercially transatlantic steamship line on April 22nd of the same year (PAYNE, 2013). In England, Isambard Brunel succeeded in a similar attempt, crossing the Atlantic with the *Great Western* and reaching New York the following day (2013).

Additionally, the development of the screw propeller[4] after Brunel's *Great Britain* crossed the Atlantic in 1845[5], incremented the consequently relative independence of weather conditions and the capability of navigating freely through inland waters, features that enabled incontestable changes in maritime trade and in overseas expansions. The Suez Canal opened in 1869, for instance, could only be effective because ships were able to navigate through its narrow waters. More obviously, ships were also able to carry more goods at a faster pace: whereas during the days of sails it had taken from four to six weeks to cross the Atlantic, after the introduction of steam, that time was reduced to two weeks in the 1830s and in the 1880s, only ten days (FERGUSON, 2011).

After 1850 the development of steel and chemicals set the stage for new alterations in shipbuilding. Since in the late 1870s steel began to replace iron as the main construction material, by 1891, over 80 percent of all ships under construction were made from steel (FLETCHER, *apud* MORKYR, *Op cit*.). Larger ships meant lower

shipping costs, allowing the realization of economies of scale, and a sharp decline in ship freight (ibid). Likewise, changes in propulsion would also result in major shifts. Although steam engines gradually became more efficient, cheaper and easier to maintain, a new concept was enabled when Charles Parson invented the turbine in 1884. This met the requirement of electrical generation and ship propulsion when higher speeds were needed. A step further was given in 1897 when Rudolf Diesel built an internal combustion engine that burnt heavy liquid fuel.

Hence, maritime trade equally increased, as from 1870 to 1910 the world fleet doubled from 16.7 million to 34.6 million gross tonnage (CORBETT et all, in OECD, 2008), which could be related to the growth in steamer transport from 15% do 75% of the tonnage (STOPFORD in COBERTT, OECD *Op cit*) in the same period. The maritime realm became even more important as in 1889 a set of international proceedings were established at the International Maritime Conference in Washington to regulate maritime traffic. Rules for the preventions of collisions; regulations to determine seaworthiness of vessels; proceeding for saving life and property from shipwreck; night signals for communicating information and so forth were discussed by several countries.

Yet, if by the end of the nineteenth century, maritime commerce increased considerably, similar changes had been taking place since the first Industrial Revolution on the means to provide the safety of such commerce: warships. Britain was the strongest navy at this point, and its military and naval personnel, for instance, almost doubled from 367,000 in 1880 to 624,000 in 1900 (KENNEDY, 1989, p.229). Britain's Warships tonnage also raised from 650,000 to 1,065,000 in the same period (Ibid.).

Steam gave warships manoeuvrability, permitting confident navigation close inshore, affecting the tactical, operational, and strategic potential of naval power (BLACK, 2017). It is worth noting however, that early steam vessels were hybrids, navigating with sail rigs as well as steam power, a practice that had continued until the end of the century (TUCKER, 2000). Hence, at the beginning, this new technology had a local influence on conflicts like the Portuguese Civil War in 1828; the French Invasion of Algeria in 1830, which counted on seven flat steam vessels towed and severed as courier; the US invasion of Vera Cruz in March 1847, assisted by paddle and screw steam ships; the British campaign in China in 1840-1842 (HARDING, 2016) to mention a few.

Nevertheless, as Andrew Lambert highlights (1994), the tactical role of steam ships before 1840 was limited to towing and conveying messages, given the unreliable, exposed machinery that the paddle wheel represented, as well as its place in the ship reducing heavy calibre guns, with pivot guns on the upper deck (ibid)[6]. After the introduction of screw propellers, wooden screw steam warships started to adopt normal broadside armament for line of battle tactics, becoming the dominant asset of the navies from 1850 to 1860 and "offering a hitherto unimagined combination of firepower, speed and manoeuvrability" (ibid., p.38). However, wooden hulls started to be a problem for the evolving technology, as they were never strong enough to resist the heat, damp, vibration and the strains created by steam engine, heavy guns and hard service (ibid).

Moreover, the evolution of gunnery brought by the introduction of shells as proved by the Russians at the battle of Sinope in 1853, rifled guns, armoured turrets, and screwed gun carriages

rendered wooden ships vulnerable (TUCKER, 2000), especially in conducting close blockade. Thus, the introduction of the 4.5inch iron armour plating the wooden hulls were firstly employed by the French ironclad *La Gloire* in 1858. In response, the following year, the British HMS *Warrior* was launched (SOUNDHAUS, 2001), starting what Lawrence Soundhaus would call the "Ironclad Revolution".

Although technology was evolving at a rapid pace, its value for fleet actions in naval warfare was still questionable (HARDING, 2016). Accordingly, the Crimean War (1854-1856) provided important lessons for costal defences, as the Russian's Black sea fleet did not come out to challenge the Anglo-French squadrons, and the Baltic sea fleet sheltered behind Sveanbourg and Kronstadt (Ibid). Likewise, during the Franco-Austrian War of 1859, although France had sent a large fleet including six screw ships of the line off the Adriatic Sea, the Austrian navy did not challenge it (SOUNDHAUS, Op cit). The battle of Lissa in 1866 also served to increase this blurry scenario, because it proved to be indecisive, even after Austrians breaking through the Italian line and hours of gunnery involved (HARDING, *Op cit*).

The American Civil War (1861-1865) witnessed the most intense use of new naval technologies of its time, such as the use of mines, spar torpedoes, early submersible and ironclads. The riverine battle of Hampton Roads in 1862 is of remarkable importance, given the hours of engagement between *CSS Virginia* and *USS Monitor* with neither vessel inflicting decisive damage on the other (ibid). However, in Harding's words, "as dramatic as these new weapons were, they were still too few or too ineffective to have a decisive impact on the overall balance of the war at sea" (Ibid., p. 33).

In the 1880s the tension between armour and armament, weight and manoeuvrability increased size and cost of major warships (BLACK, Op cit). Guns became more rapid in firing, after 1870's evolution of breach loaders. The development of detonators, improvements on projectiles, high explosives, torpedoes and torpedo boats, steel technology replaced iron in armouring warships. Of particular importance is the development of the torpedo, as it not only served as the technological driving force behind the French Jeune Ecole, but also helped fostering the development of submarines. Not randomly, Black states that:

> concern about torpedoes, which appeared to many to be the weapon of the future, reconceptualizing firepower and mobility, and as both a means and a symbol of change, was an aspect of wider sense of uncertainty about the role of large warships and the nature of naval warfare (BLACK, Op cit., p. 23).

These changes made gunnery become more effective. If in the age of sail the key element was not much sinking the ships, but destructing the personnel, the ringing and the masts in order to incapacitate the weapons system, the new industrial naval firepower aimed at the destruction of the platform itself. Instead of broadsides gunnery, center-line turrets were mounted and were able to fire end-on as well as to turn (ibid). The paroxysm of such development culminated in the British Dreadnought in 1905.

HISTORY AND ITS EPISTEMOLOGICAL WEIGHT

This intense technological transformation both influenced and was influenced by the epistemological background of the last third of the eighteenth and throughout the nineteenth century. In Europe, new conceptions about history emerged, especially in France

and Scotland. The belief that a rational plan would be a driving force infusing the course of history became consistent, even if humankind disagreed or was unaware of it.

Immanuel Kant sought to explain man as a proper "human being", that is, predominantly rational being gifted with synthetic or analytical apriori judgments, regardless of the conditions of space and time. Therefore, human's rational actions would compound a collective process of progress. Then, Europe would become more civilized, shifting from a primitive to a complex and evolved condition. (COLLINGWOOD, 2001, pp. 114-123; BOURDÉ & MARTIN, 2003, pp. 44-48). In other words, rational actions were associated to progress.

Alongside Kant, other thinkers also developed philosophies of history, such as Turgot and Condorcet. Friedrich Hegel's phenomenology of the spirit is of determining importance. Hegel accounted for the State as the protagonist actor in accomplishing universal objectives coupled to dialectical evolution of the World Spirit (CHÂTELET, 1995; ANDERSON, 1992, p. 16). Karl Marx, a former "young Hegelian", coined the so-called historical materialism inverting Hegel's view and anchoring history on material causes. Thus, the "pace" of history would be dictated by class conflicts which, when surpassing the modes of production, would thrive (HOBSBAWM, 1998, p. 176; GARDINER, 1984, pp. 163-169; WATKINS, 1966, p. 69). In Isaiah Berlin words:

> When Hegel, and after him Marx, describe historical processes, they too assume that human beings and their societies are part and parcel of a wider nature, which Hegel regards as spiritual, and Marx as material, in character. (BERLIN, 2013, p. 137)

Auguste Comte's Positivism, with his three stages theory, the scientific as the last and more evolved one, (COLLINGWOOD, 2001, pp. 145-151); Alfred Russel Wallace and Charles Darwin's evolutionism with "the origin of the species" together with the concept of natural selection were the main paradigms of the second half of the nineteenth century (BITTENCOURT, 2009, pp. 39-49). Accounting for Comte, Berlin states that:

> For Comte's view have affected the categories of our thought more deeply than is commonly supposed. Our view of the natural sciences, of the material basis of cultural evolution, of all that we call progressive, rational, enlightened, Western; [...] and consequently our view of history itself owe a good deal to his teaching and influence. (BERLIN, 2013, p. 120)

Thus, in order to become scientific, the understanding of phenomena should be organised and classified, using a rational and systematic method, eventually serving as the light for humanity's progress. On the other side, the field of study not framed by such perspective was doomed to vanish, like astrology, alchemy and homeopathy.

History, by then seen as "the art of telling the past", was frequently considered mere chronicles or memory telling, needed to fit in this scientific framework, otherwise it would be depreciated. Nineteenth century historians had to look for the true history, largely relying on documents. Not only the archives grew in importance, but after 1840, monumental collections were transcribed. German historian Leopold von Ranke was the major figure in this movement. In Ranke's view the historic fact should be presented "as it was", freed of any interference or personal interpretations (HOLANDA, 1974, pp. 431-

482; BURKE, 1992, pp. 233-234), otherwise it would be antiscientific.

Therefore, in order to frame history in this scientific framework rooted in Kant, it needed to rely on an aprioristic hypothesis validated by a sensible experience, or the remnants of the past, the so called synthetic a posteriori judgment. The result, then, was a *synthetic knowledge a priori,* only made possible by universal categories. Therefore, the sensible experience – the documental investigation, or the empirical research on the archives – demanded a careful method. Not for other reason, Charles Langlois and Charles Seignobos founded a school called the "methodical school".

This perspective of history was quite often sponsored by the States, entity that was gradually evolving. Therefore, the emphasis was on themes that could increase the States' grandeur: politics, war, great heroes and detailed events in a diachronic narrative. The need to craft a common past from which a sense of nationality could emerge became relevant, and so did History, inasmuch as it gave legitimacy to the States. For Hobsbawm, nationalism was not a natural process. National elements like a common language, identity, culture or people did not exist. Instead, that process was invented by the states, by creating a collective past, a sense of belonging: states come before the nation.

MAHAN'S INFLUENCE ON HIS FIRST INFLUENCE

Therefore, the United States at the end of the nineteenth century was of growing political importance. It was America's period of stunning economic development: The end of the Civil War (1864-1869), its rich agricultural land, the vast amount of raw material, a consistent technological maturity and the relative absence of foreign dangers were some of the factors that can help us understand why. As Paul Kennedy points out, "United States seemed to have all the economic advantages which some of the other powers possessed in part, but none of their disadvantages" (KENNEDY, 1989, p. 243). Hence, the U.S' role in the international atmosphere was increasingly growing.

The American imaginary was filled by a sense of expansionism, as it was getting fitter and more capable of competing for its survival, even with Europe. Social Darwinism was present, especially after 1890's census showing that the country had finally settled its frontier on both coasts. The historian Frederick Jackson Turner enabled a convenient thesis, associating America's exploitation of its frontiers to progress and civilisation.

> But we have in addition to this a recurrence of the process of evolution in each western area reached in the process of expansion. Thus, American development has exhibited not merely advance along a single line, but a return to primitive conditions on a continually advancing frontier line, and a new development for that area. American social development has been continually beginning over again on the frontier. This perennial rebirth, this fluidity of American life, this expansion westward with its new opportunities, its continuous touch with the simplicity of primitive society, furnish the forces dominating American character [...] In this advance, the frontier is the outer edge of the wave the meeting point between savagery and civilization (TURNER, 1993, p. 59).

Although Mahan was hardly familiar with the book, it is worth emphasizing

the political and social atmosphere around him. As Robert Seager shows, the ten years before the first *Influence* publishing was a political changing point, due to the crescent attention given by the political opinion to maritime expansionism. Many members of the American congress had constantly been discussing the need to expand maritime commerce, and consequently the navy. To cite one example, the representative Ellis of Louisiana in 1882 proclaimed that "if we ever expect to obtain commercial supremacy, if we ever expect to have our proper rank among the nations of the earth, we must have a navy" (SEAGER, 1953, p. 501).

In Seager's words, geographical isolationism, ideological social Darwinism perverting the inevitability of commercial expansion, and the belief that, historically, countries should arm for peace were the basic corollary paving the way for Mahan's work. (SEAGER, 1953).

By 1890, Mahan was teaching naval history and tactics at the US Naval War College, an institution created in 1886 and product of the peculiar condition of the "professionalism wave"[7] spreading across the country in the 1870s and 1880s. (SPECTOR, 1977). The institution was idealised by Mahan's mentor, Commodore Stephen B. Luce, who relentlessly wanted to transform military arts into a science that could be taught in "a place of original research on all questions related to war and to statesmanship connected to war" (Ibid., p.14)

Luce's idea of science was fully entangled with Social Darwinism. If he believed that war should be rationalised as a science, it was because "war led the way to civilization" (LUCE in SEAGER, *Op cit*. p. 494) in the first place. And war at the age of steam was of particular importance for him, as he clearly stated at the first session of the Naval War College in 1885:

> Steam tactics and naval warfare under steam are comparatively new studies, and readily admit of modern and scientific methods of treatment. The formation of the line-of-battle, composed of large ironclads, carrying heavy guns and auto-mobile torpedoes the use of [...] torpedo boats and its place in the order of battle, are subjects which require the most careful consideration. (LUCE, in HATTENDORF et al, 1977, p. 50)

As we can see, the role of warships' technology is evident. The changing character of "naval warfare under steam" ignited his "careful consideration" on the subject and, more importantly, instigated the application of scientific methodology to understand it. In other words, warships as the materialisation of the scientific discourse paved the way for the beginning of the maritime thought. If scientific discoveries led to the creation of professions through a body of knowledge about it, warships could be considered the equivalent to maritime thought, inasmuch as evoked the appliance of scientific methods.

By "scientific method" Luce meant a deep understanding of history manifestly "scientific" by mathematical logic. In order to find a solution for the challenged posed by ships' technology, he suggests looking for immutable principles, and then turning to history to find them and eventually formulating laws. Because "[t]here is no question that the naval battles of the past furnish a mass of facts amply sufficient for the formulation of laws or principles", Luce's idea was, after an inductively and deductively conducted analysis, to compare these historical facts:

> Hence, we have not only comparative anatomy and comparative

> physiology, but comparative philology, comparative grammar, comparative religion, comparative literature, and why not, we ask again, comparative war, or a comparative study of the military operations of a sea army and a land army? Attention has been called repeatedly by various writers to the close analogy between military and naval operations (Ibid., p. 57)

History, shaped by the distinctly scientific comparative discourse of the nineteenth century, was the framework used by Luce. Such framework could only be enacted in tandem with warships' evolving technology of the end of the nineteenth century. Therefore, the best way to approach naval warfare would be by relying on history, collecting empirical examples and comparing them. History would only be the guide for an alleged science of war, because it was structured as a science beforehand.

After accepting Luce's invitation to be instructor at the US Naval War College, Mahan grappled with this framework, not without an early "profound ignorance"[8] (MAHAN, 1906). Accordingly, Mahan was not a historian and had little experience with the subject. By studying history, he would apply its scientific approach to dig out principles and laws, stressing continuity between eighteen century's and his contemporary development of naval warfare (HATTENDORF, 1989). If technology stressed the When he came across Theodor Mommsen´s *History of Rome* at the Phoenix Club (English Club) in Lima[9] he had his first historical insight about the supremacy of naval power. He realised Rome's victory against Cartage was due to its superior navy (MAHAN, 1906) and that led his train of thought to write the first *Influence*.

Mahan's historical approach was notably marked by the scientific deterministic and comparative method Luce defended. In the first lines of the *Influence* he already highlights the traces of such method, stating that his definite objective was to employ an "examination of the general history of Europe and America with particular effect of sea power upon the course of that history" (MAHAN, 1987). That is, he firstly presumes that history has a course, an ordained and aprioristic pathway towards progress, for then, to assume that the sea power has its weight on it.

But what is sea power? Mahan neither asked nor answered that question, although he willingly coined the expression to drag the attention of the public (GAT, 1991). However, in the first – and undoubtedly most famous (1991) – chapter of his book he discusses its six elements and writes that:

> The policy has varied both with the spirit of the age and with the character and clear-sightedness of the rulers; but the history of the seaboard nations has been less determined by the shrewdness and foresight of governments than by conditions of position, extent, configuration, number and character of their people – by what are called, in a word, natural conditions. (MAHAN, 1987, p.28).

Those elements cannot be considered principles, however. Rather, they suffice to expose the "causes and effects" throughout history, connecting facts in order to expose the principles of naval warfare and strategy. In other words, the elements of sea power are more like the "grammar" for the discovery of the immutable principles of naval war. Once gathering the historical facts and comparing them to the present conjuncture, by the lens of the elements of sea power, statesman could check and perhaps improve their policies. Then, these "natural conditions" directly

affect the prosperity of nations. Analysing the history of England from 1660 to 1783 – respectively, when Charles II came back as the King of England, and the end of the American Wars of Independence – Mahan seeks to use this method. Quite similarly to Luce's words, he writes that:

> It is then particularly in the field of naval strategy that the teachings of the past have a value which is in no degree lessened. They are there useful not only as illustrative of principles, but also as precedents, owing to the comparative permanence of the conditions (MAHAN, 1890, p. 9)

Thus, following Barry Gough's analysis, sea power is this particular understanding, that is, the political ability to grasp the teachings of history and develop an effective naval strategy. (GOUGH *in* HATTENDORF, 1990).

However, it is also the assumption of immutable principles that makes Mahan underestimate the role of technology, confining it to the tactical realm. "Condition and weapons change", but when it comes to the strategic realm "history has a great deal to say" because they show how the latter always remains the same.

However, although not directly discussing the changes in warships' technology, "Mahan viewed that history was scientific, that is, that it had principles" (GOUGH, Op cit., p. 12). Those principles were also borrowed from Jomini, whose influence encouraged Mahan to "study […] the many naval histories before him [me]." (MAHAN, 1906, p. 282). Therefore, principles like strategic concentration of force and tactical boldness at a tactical level, were also borrowed from the swiss-born strategist. Likewise, "Mahan's theories experienced the very same problems which Jomini's had met in confronting changing historical conditions and technological conditions" (GAT, Op cit, p.1999).

Ironically, although neglecting technological changes, Mahan was fostering the discourse that had produced and would increase warships' technology in the future. By replicating the scientific method espoused by Luce when analysing history, he emulated the very construction of the battleships that he would later on criticise; the Dreadnoughts. The focus on boldness at sea was an unambiguous admiration of Lord Nelson at Trafalgar, which eventually would lead to the "decisive battle" truism, that is, in order to achieve the control of the seas, naval strategy should always seek to annihilate the enemy's fleet.

Therefore, Mahan served as a propaganda instrument for Tirpitz, Bulow and Kaiser Wilhelm II to increase Germany's navalism, directly influencing the construction of Dreadnoughts. Although even before reading Mahan, Tirpitz was aiming at the High Seas Fleet expansion, the *Influence* was certainly an important factor (KEEGAN, 2004).

For Barry Gough, Mahan's historical methods did not entirely stem from Luce's, although Robert Seager corroborates the stark influence in this regard. Based on the letters to Mahan, he even suggests that Luce might have provided the theoretical model for the principles of waging maritime war in a historical approach (SEAGER, 1975). Hence, the impact of technology in Mahan's way of producing knowledge is subtle, but no less concrete and powerful.

CONCLUSION

In conclusion, we demonstrate that the ships and Warships of the late nineteenth century had become the most complex machine of its time, serving as conceptual figures to the scientific discourse in question. Most of the technological inventions brought by the industrial revolutions had reached naval warfare, moving it to the centre stage of the political debate from the mid-1880s on.

Science was then marked by the "inevitability of progress" as if it could master nature and unveil its laws. Social Darwinism and Positivism was shaping the epistemological atmosphere of several disciplines, including history.

The United States was experiencing a period of political and economical changes. Therefore, when the above-mentioned conditions set the stage for a period of intense professionalization, one of its products was the creation of the U.S Naval War College. Stephen Luce, one of the main responsible for such process, invited Mahan to join the institution, and largely influenced his methods.

Luce was profoundly inspired by science and saw in history a possibility to access the solution for the challenges posed by the steam naval warfare. These challenges revealed the need to grasp the immutable principles of war and that could only be found by history: that was Mahan's biggest goal. The "*The Influence of Sea Power Upon History 1660-1783*" succeeded by a comparative method, using history as a scientific instrument.

Mahan compared historical facts to see if they matched aprioristic "natural conditions" of prosperity, the elements of sea power, which could be found inasmuch as statesman understood the importance of the sea. It could be argued that Mahan inverted the rules of scientific method, once he assumes his conclusions beforehand, and uses history, not to prove a hypothesis, but to show the effects of an eternal truth. That is why Margaret Sprout's expression is quite accurate, that is he can actually be considered an "evangelist of sea power".

Therefore, the connection between history and the waging of war rests upon history as long as it was responsible for providing the repository of past experiences, a paradigm consolidated by Kant. In other words, although Mahan scarcely read the philosopher of Konigsberg, he attested such paradigm, by turning to history as the sheer conservation of the experiences of the past. Hence, not only history should repeat itself, but also - merit of its scientific method - find the one and only Truth of the past. Once it succeeded and past were truly acknowledged, prosperity could be found.

History, once validated and like a science, could offer a undeniable past, or undeniable to the extent that new discoveries were found by the means of such method. In any case, it served as the condition for ideas capable of shaping the actions of the present – like Mahan's "natural conditions". Naval Warfare could acquire a profound structure or an essence, immune to professionals. Moreover, the understanding of history espoused by Mahan could create the conditions for deep roots or elementary universal forms of the art of naval warfare.

Either way, if we can admit that warships' technology impacted Luce and motivated him to scientifically analyse naval warfare by such nuanced historical approach, and that process reached Mahan, then, we see the extent to which technology influenced his writings.

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NOTES

[1] Thereafter we will refer to as "The First Influence". Two years later, Mahan published a second volume of the book encompassing the French Revolution and France's empire period.

[2] In France, Admiral Theophile Aube and Gabriel Charmes set the foundations of the *Jeune École*, mixing historical experiences with analysis of technological change in a teleological optimism (ROSKUND, 2007). Because it accounted served for fleets with limited budget, the *Jeune Ecole* had a considerable impact on smaller navies. In Brazil, for instance, it served as the strategic paradigm behind the Divisions of Evolution in 1888 (VIDIGAL, 1985). However, it did not last long. Enthusiasm with the torpedo subsided with the introduction of the destroyer, designed to protect battle-fleet from torpedo boats. Moreover, telegraph communications made easier to track down French raiders (GAT, 1991). In Britain, even before the first *Influence* was published, the Colomb brothers had been writing about naval warfare. The youngest, Vice-Admiral Phillip, was the first in the Anglophone world to address the strategic concept of fleet-in-being strategy in his book "Naval Warfare" (HATTENDORF, 2014). Nevertheless, he only achieved modest reputation, mainly in the most professional circles. In Gat words, it was partly because "Mahan's Influence book was more suited to the general public, more historical and less technical" (GAT, *Op cit*, p. 209). Sir Julian Corbett had also a major impact on British foreign policy, and is considered, alongside Mahan, one of the masters of maritime strategy (TILL, 2017). Corbett was a gifted lawyer graduated in Cambridge. After 1882 he retired from practice, and, having studied history, arts, archaeology; travelling around Canada, India, Egypt and United States, at the age of forty-four he published his first eminently naval historian work, "*Drake and the Tudor Navy: With a History of the Rise of England as a Maritime Power"*. Due to his juridical formation, Corbett had a more accurate sense of the limitations of the sea power (TILL, 2013), and probably that gave him a more critical perspective about it. In his most prominent work "*Some Principles of Maritime Strategy*" (1911), he insisted on the reflexive study of strategy through the articulation between historical theory and practice. Largely influenced by Clausewitz's concepts, he stated that in his theory war should be considered the "continuation of policy by other means" (CORBETT, 1911, p. 21) and it must not be detached from land warfare, "since men live upon the land and not upon the sea". Corbett understood the importance of technology and even defended the so called "materiel school" to which Admiral Fisher belong, defending the construction of Dreadnoughts (LAMBERT, 2017). However, in his books he was more

concerned with a meticulous historical analysis, emphasizing British supremacy at sea throughout the modern ages. However, he only became more widely known during the Cold War, because of his approach on joint operations and amphibious operations (HATTENDORF, 1989).

[3] Joel Mokyr (1991) highlights the scrutiny that the concept of Industrial Revolution has been coming through. The author argues that Industrial Revolution should not be understood merely as a primally macroeconomic event that led to a sudden acceleration of the rate of growth. Rather, it is appropriate to acknowledge such concept in terms of accelerating and unprecedent technological change, perspective we will assume in this paper (MOKYR, 1991).

[4] As Mokyr points out, addressing the author of the screw propeller is a particularly difficult task. In 1753 the idea was mathematically proposed by Daniel Bernoulli, but empirical experiments were only successfully conducted in the early 1830s by Frederic Sauvage. John Ericson and Francis Smith further improved the invention in 1838 in England (MOKYR, 1990).Andrew Lambert *et al*. (1994) corroborates Mokyr points, adding however, that "there had been at least five worthwhile and proven 'inventions' of the screw before 1836: those of Stevens in 1804; Owen in 1816, Ressel in 1827, Woodcroft in 1832 and Wilson in 1833. None had been able to secure the financial support required for extened trials […]" (LAMEBERT et al., 1994, p. 31)

[5] The first screw propeller steamship was the 200-ton *Archimedes* launched in 1838 whose influence motivated Brunel's entrepreneurship (Ibid.)

6 For a detailed approach of every class of paddled steam warships see Lambert et al, 1994 p. 29.

[7] "professionalization is the process by which an occupational group acquires or develops a specialized, theoretical body of knowledge related to its area of expertise, develops a heightened feeling of group identity which is usually accompanied by the emergence of professional associations and journals, and takes on a body of rules and standards which regulates its relationship to the public"(SPECTOR, Op cit. p. 3). The development of science resulted in professional organisations, varying from occupations like lawyers, to medics and engineering.

[8] "I tackled my job much as I presume an immigrant begins a clearing in the wilderness, not troubling greatly which tree he takes first. I laid my hands on whatever came along, reading with the profound attention of one who is looking for something" (MAHAN, 1906, p. 225).

[9] Mahan was stationed in Peru with the South Pacific Squadron, commanding the steam sloop *Wachusett* for the War of the Pacific (1879) between Chile, Peru and Bolivia. Phoenix Club was also called the "English Club" because British expatriates' leaders had established it (FERREIRO, 2008).