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A PROBABILITY APPROACH TO PEARL HARBOR DILEMMA

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ABSTRACT. The purpose of the article is to try a probability approach to History, and to explain, on a concrete historical example, such concepts as *virtual events, historical events* and *miracle events*. The necessary historical expertise is taken from THE SECOND WORLD WAR by Winston Churchill and THE TWO–OCEAN WAR by S.E.Morison, the two-time winner of the Pulitzer prise and the official historian of the global war at sea. The article uses standard mathematical operations $\cup$ (set union) and $\cap$ (set intersection), and symbols $\subset$ (subset) and $\in$ (element).

The present article discusses a probabilistic approach to mathematization of History, in particular the use of sample space approach. As mentioned by Hans Zessin in his Introductory Remarks to the present Issue, the concept of individual "virtual history" has been considered by several authors before. However the present article does not touch the question about the nature of the points of the sample space we use. In fact,the Axiomatic Probability theory teaches that in many problems the nature of the points of the "sample space" is often totally unimportant. Hence we remain within the bounds of the following simple postulate:

The virtual events (or simply events) are represented by subsets of some space $\mathcal{X}$. *In* $\mathcal{X}$ *there exists a unique point* $\mathbf{r}$ *that corresponds to the real history. An event* $\mathbf{E}$ *is called historic, if the historical literature contains no controversy as regards* $\mathbf{r} \in \mathbf{E}$.

1. MIRACLES

Given a virtual event $\mathbf{E} \subset \mathcal{X}$, the traditional question to put is as follows: *does* $\mathbf{r}$ *lie in* $\mathbf{E}$ *or not?*, or, equivalently *is* $\mathbf{E}$ *historic or not?* But now we think about planting probabilities on the elements of subset algebras generated by finite collections $\mathbf{E}_1, ..., \mathbf{E}_n \subset \mathcal{X}$.

What is the need to consider probabilities of events in $\mathcal{X}$? That need exists whenever there is controversy about historic nature of concrete $\mathbf{E} \subset \mathcal{X}$. Controversy is always present in the so called conspiracy cases. One example is the book PEARL HARBOR–MOTHER OF ALL CONSPIRACIES by M.E.Willey, which, using our

terminology, reduces many aspects of the famous Pearl Harbor disaster of Dec. 7 1941 to *virtual* status. We cite from that book:

Joint Congressional Committee on the Investigation of the Pearl Harbor Attack, Nov 15 to May 31, 1946 proved that there had been so much reversion of testimony, cover-up and outright lies that the truth would have to wait until all Pearl Harbor records were declassified.

In "conspiracy" cases, to give an answer $\mathbf{r} \in \mathbf{E}$ or $\mathbf{r} \in \mathbf{E}^c$ ($\mathbf{E}^c$ is the complement of $\mathbf{E}$ in $\mathcal{X}$) is often difficult due to insufficient information. Answers of that kind loose in credibility when used for political propaganda, and then probabilities are preferable. To be credible, probability estimates should be constructed on the basis of sufficiently broad historical settings, involving as much as possible, different countries and prolonged time periods. We give an example of a rather narrow setting.

The chapter DISASTER AT PEARL HARBOR in THE TWO–OCEAN WAR by S.E.Morison tells about Japanese Striking Force on his route to Pearl Harbor: *Admiral Nagumo did not relish his assignment and rather hoped that his force would be detected by 5 December, in which case Yamamoto had instructed him to abandon mission and return. But only one ship, a Japanese freighter, was encountered; and not one aircraft.* One is tempted to say, that the Japanese Striking Force reached its destination by miracle.

W. Churchill's in the THE SECOND WORLD WAR, chapter PEARL HARBOR! describes how the news about Japanese attack on Pearl Harbor was met in Germany:

Both Hitler and his stuff were astonished. Jodl tells at his trial how Hitler "came in the middle of the night to my chart room in order to transmit this news to Field-Marshal Keitel and myself. He was completely surprised." Yet it is not clear if at that moment Hitler had any idea of what is now the Morison version of Pearl Harbor events: Yamamoto sent, as Morison puts it, *six newest and largest carriers of the Imperial Navy; a screen of nine destroyers and a light cruiser; a support force of two battleships and two heavy cruisers; three fleet submarines to support the flanks, and a supply train of seven or eight tankers*, to cross many thousands of miles in a hope for a miracle.

To declare that $\mathbf{r} \in \mathbf{E}$ is false or true is often a matter of belief. For example, on Dec. 8, 1941, Roosevelt in his address to Congress accused Japan for undertaking a surprise offensive extending throughout the Pacific area. The reaction of US Congress was an immediate (on the same Dec. 8) declaration of war on Japan: Congress simply believed Roosevelt, without asking for more details of what had really happened. As regards the naval losses at Pearl Harbor, "severe damage" was all that was said in

the address. Roosevelt spoke about great geographical dispersion of the attacks. We cite:

Yesterday, December 7, 1941 - a date which will live in infamy - the United States of America was suddenly and deliberately attacked by naval and air forces of the Empire of Japan. [...] The attack yesterday on the Hawaiian Islands has caused severe damage to American naval and military forces. I regret to tell you that very many American lives have been lost. In addition American ships have been reported torpedoed on the high seas between San Francisco and Honolulu. Yesterday the Japanese Government also launched an attack against Malaya. Last night Japanese forces attacked Hong Kong. Last night Japanese forces attacked Guam. Last night the Japanese forces attacked the Philippine islands. Last night the Japanese attacked Wake Island. This Morning the Japanese attacked Midway Island. Japan has therefore undertaken a surprise offensive extending throughout the Pacific area.

On December 8, 1941 this could lead to the idea, that Japanese aircraft carriers were dispersed "throughout the Pacific area", rather then concentrated at Pearl Harbor.

A statement $\mathbf{r} \in \mathbf{E}$ we propose to call a *miracle* if the probability of $\mathbf{E}$ is estimated as small ($\simeq 0$). We stress, that the verdict that $\mathbf{r} \in \mathbf{E}$ is a miracle is by no means equivalent to the statement, that $\mathbf{r} \in \mathbf{E}$ is false. The situation resembles what we have in probability theory. Let ζ_n be a random variable that takes the value 0 with probability n-1/n and the value n with probability 1/n. Even for very large n, the value n may appear in a sample of realizations of ζ_n, although the mean value of ζ_n always equals 1.

2. PROBABILITY EVALUATION IN A HISTORICAL SETTING

In some cases, for a concrete $\mathbf{E} \subset \mathcal{X}$ and a concrete *historic event* $\mathbf{F}$ a reasonable (or common sense) *evaluation* of the conditional probability

$$P(\mathbf{E} \,|\, \mathbf{F})$$

is possible. In that case $\mathbf{F}$ we call a *historical setting* for $\mathbf{E}$.

As an example, we consider two mutually complementary virtual events:

$\mathbf{J}$ = six Japanese aircraft carriers bombed Pearl Harbor on December 7, 1941, and

$\mathbf{S}$ = no Japanese aircraft carriers were present in Pearl Harbor waters on December 7, 1941.

(There is no heresy in thinking about $\mathbf{S}$: we remind that both events lie in the space of virtual histories $\mathcal{X}$.)

For the historical setting we choose the historical event $\mathbf{C} \cap \mathbf{H}$, where

$\mathbf{C}$ = declaration of war on Japan by the US Congress, December 8, 1941, and

$\mathbf{H}$ = Hitler declared war on America on December 11.

Within that setting, the inherent symmetry implies the estimate

$$P(\mathbf{S}\,|\,\mathbf{C}\cap\mathbf{H}) = P(\mathbf{J}\,|\,\mathbf{C}\cap\mathbf{H}) = 1/2. \tag{2.1}$$

Here an explanation is in order. The treaty within the triad of Germany, Italy and Japan compelled them to declare war to any country attacking a member of the triad. However, it stipulated no automatic entrance of the allies into war on the side of a member of the triad who would unilaterally attack a fourth country. So, when Germany attacked USSR in summer 1941, Japan did not declare war on the USSR. Whether Hitler would declare war on America after **C** was for a few days a big unknown. In December 1941, Hitler could hope for victory in the European war that started in 1939 only by avoiding war with the United States. Hitler could avoid or delay declaration of war on USA by simply accepting the Roosevelt claim that the attackers at Pearl Harbor were the Japanese. As regards Dec. 11 declaration of war on USA by Hitler, there are two possibilities. One is that by that time Hitler had some serious reasons to believe that $\mathbf{r}\in\mathbf{S}$. The other is that Hitler believed that $\mathbf{r}\in\mathbf{J}$, yet he undertook **H** as a bluff, aimed say, at giving new arguments to the anti-Roosevelt (pacifist) propaganda, and eventual withdrawal of the US from the war.

Since $\mathbf{S}\cup\mathbf{J}$ is a historical event, the evaluation (1) poses a problem of finding a historical setting that would destroy the symmetry (1). To ensure credibility, it is preferable to avoid conditioning by *miracle* events. To avoid bias, the setting should be sufficiently symmetrical. It seems that these two conditions are satisfied in what follows.

3. APPROXIMATION TECHNICS

We say, that an event $\mathbf{F}\subset\mathcal{X}$ approximates $\mathbf{E}\subset\mathcal{X}$, if the chances to have $\mathbf{r}\in\mathbf{E}\,\Delta\,\mathbf{F}$ can be ignored (Δ stands for symmetric difference). The motivation for this concept is clear: in case a necessary historical expertise concludes that $\mathbf{r}\in\mathbf{F}$ is true, then **F** receives a historical setting status, and an approximate estimate follows:

$$P(\mathbf{E}\,|\,\mathbf{F}) \simeq 1. \tag{3.1}$$

We give an example. The chapter PEARL HARBOR! describes the following *historic event*:

Ph = between Dec.8 and Dec.10, 1941 the Japanese air force started a grand offensive against the Philippines in the South China sea.

We cite from the chapter PEARL HARBOR!: *At 3 a.m. on December 8 Admiral Hart [at Manila] intercepted a message giving a staggering news of the attack on Pearl Harbor. He at once warned all concerned that hostilities had begun, without waiting for confirmation from Washington. At dawn the Japanese dive–bombers struck, and*

throughout the ensuing days the air attacks continued on ever–increasing scale. On the 10th the naval base at Cavite was completely destroyed by fire, and on the same day the Japanese made their first landing in the north of Luzon. Disasters mounted swiftly. Most of the American air forces were destroyed in battle or on the ground, and by December 20 the remnants had been withdrawn to Port Darwin, in Australia.

In the same chapter W. Churchill describes another *historic event*:

$\mathbf{M}$ = sinking of British battleships PRINCE OF WALES and the REPULSE, near Kuantan (Malaya), by Japanese torpedo bombers on Dec.10.

The event $\mathbf{Ph}\cap\mathbf{M}\cap\mathbf{J}\subset\mathcal{X}$ deserves special attention. Under $\mathbf{J}$, the Japanese striking force of six aircraft carriers were still thousands of miles away from the South China sea and could not participate in the battle. If so, then where from did the Japanese torpedo and dive-bombers operate? In the absence of aircraft carriers, $\mathbf{Ph}\cap\mathbf{M}$ implies

$$\mathbf{r}\in\mathbf{N}^c\cup\mathbf{W},$$

where

$\mathbf{N}$ = no airfields controlled by the Japanese existed near the objects of Dec. 8-10 attacks ("near" means within the *effective range* of the Japanese torpedo or dive - bombers), $\mathbf{N}\subset\mathcal{X}$, and

$\mathbf{W}$ = the attacks of Dec. 8-10, as described by W. Churchill, were implemented by reduced Japanese forces, i.e. by the forces that did not include six main Japanese aircraft carriers engaged at Pearl Harbor, $\mathbf{W}\subset\mathcal{X}$.
By a standard probability rule

$$P(\mathbf{J}\,|\,\mathbf{Ph}\cap\mathbf{M})\;=\;P(\mathbf{J}\cap\mathbf{N}^c\,|\,\mathbf{Ph}\cap\mathbf{M})\;+\;P(\mathbf{J}\cap\mathbf{W}\,|\,\mathbf{Ph}\cap\mathbf{M}),$$

and we have

$$P(\mathbf{J}\cap\mathbf{W}\,|\,\mathbf{Ph}\cap\mathbf{M})\;<\;P(\mathbf{W}\,|\,\mathbf{Ph}\cap\mathbf{M}).$$

Churchill's description of the the disaster inflicted by the Japanese on American forces at Philippines suggests that the value of $P(\mathbf{W}\,|\,\mathbf{Ph}\cap\mathbf{M})$ is rather small. If so, then $\mathbf{N}^c$ receives the approximation status for $\mathbf{J}$, while $\mathbf{N}$ - a similar status for $\mathbf{S}$. In case the answer of the historians happens to be $\mathbf{r}\in\mathbf{N}$, we would conclude that

$$P(\mathbf{S}\,|\,\mathbf{N})\simeq 1,\qquad P(\mathbf{J}\,|\,\mathbf{N})\;\simeq\;0. \tag{3.2}$$

What follows contains further confirmation, that $P(\mathbf{W}\,|\,\mathbf{Ph}\cap\mathbf{M})$ should be considered as small.

3.1. **The effective range, torpedo and dive-bombers.** W.Churchill in PEARL HARBOR! and S.E.Morison in the chapter DISASTER IN THE FAR EAST of his book, both essentially state, that

$$\mathbf{r}\in\mathbf{W}. \tag{3.3}$$

Victories achieved with minor forces are often attributed to miracles. These two chapters seem to be no exception.

PEARL HARBOR! contains some discussion as regards the effective range of Japanese bombers. We cite from that chapter:

On November 26 [the Japanese striking force] sailed under the command of Admiral Nagumo. Keeping far to the northward of Hawaii, amidst the fog and gales of these northern latitudes, Nagumo approached his goal undetected. Before sunrise on the fateful day the attack was launched from a position about 275 miles to the north of Pearl Harbor.

Let us suppose for a moment that $\mathbf{r} \in \mathbf{J}$. Then to ensure safety of the attacking aircraft carriers, their position had to be chosen at about maximally possible distance from the airfields housing the possibly counterattacking US planes. Conclusion: Churchill's 275 miles point at the Japanese estimate of the *effective range of their torpedo and dive-bombers*, the main weapon of the Japanese aircraft carriers. In the chapter CRETE: THE BATTLE that describes the British disaster of May 1941 at Crete, inflicted mainly by the German air force, writes Churchill:

As the agony in Crete approached its climax, I telegraphed to President Roosevelt: "Battle in Crete is severe, because, having no airfields within effective range, we can not bring air force into action either to aid the defense or protect our patrolling squadrons. Two of our cruiser and two destroyers were sunk today."

A glance at the map of Mediterranean shows, that the African coast, where British certainly possessed many airfields, is about 300 miles away from Crete, in good accord with 275 miles "Japanese" estimate. Remarkably, Churchill did not even mention long range bombers that could traverse much greater distances. Probably, he assumed that Roosevelt was aware about low efficiency of long range bombers in military situations that required torpedo and dive-bombers.

W.Churchill hints, that Admiral Phillips [commander of the British ships in the episode **M**] was aware about presence of Japanese *long range bombers* in the region. His chief anxiety however was the torpedo bombers. We cite from PEARL HARBOR!:

In judging the actions of Admiral Phillips during these calamitous days it should be emphasized that there were sound reasons for his belief that his intended attack at Kuantan would be outside the effective range of enemy shore–based torpedo bombers, which were his chief anxiety, and that he would only have to deal with hastily organized strikes by ordinary long–range bombers [...]. The distance from the Saigon airfields to Kuantan was four hundred miles, and at this date no attacks by torpedo bombers had been attempted at anything approaching this range. The efficiency of Japanese

in air warfare was at this time greatly under-estimated both by ourselves and by the Americans.

Conclusion: the ordinary long range bombers could not be easily converted into torpedo bombers. And yet one page earlier in the same chapter, Churchill describes transformation of the Saigon–based Japanese planes, that were going to attack Singapore, into torpedo bombers. Since Singapore is about 1.200 kilometers from Saigon, we conclude, that the Japanese planes in question were in fact just ordinary long–range bombers. We site from PEARL HARBOR!:

...on the 9th [...] the Japanese 22nd Air Flotilla, based near Saigon was loading bombs for an attack on Singapore. They immediately exchanged bombs for torpedoes and decided to make a night attack on the British ships, i.e. PRINCE OF WALES and the REPULSE. On the next day, we cite, *The Japanese air fleet had ranged as far south as Singapore without sighting anything. It was returning home on a northerly course, which by chance led them straight to their quarry.*

Both British ships were sunk by torpedoes (not bombs) as witnessed by PEARL HARBOR!: *The PRINCE OF WALES was struck simultaneously by two torpedoes [...] received two more torpedo hits at about 12.23 p.m. and another shortly afterwards.*

Churchill abstained from mentioning, from which bases came the Japanese bombers in the episode **Ph**. But S. E. Morison in his book THE TWO–OCEAN WAR says bluntly: the Japanese bombers came from Formosa. Describing the day of Dec. 8 at Manila, writes Morison:

...there was hesitation at Manila about unleashing the B-17s against Formosa, or the fighter planes to intercept a bomber strike from Formosa.... As the Japanese bombers approached, *fighter planes were grounded on Clark, Nichols, Iba and other fields of the airdrome complex around Manila.*

The distance of 850 kilometers separating Formosa from Manila could be OK for "ordinary long–range bombers" (and fighters?), but not for the dive bombers. Morison states that the attack on that day was committed by *108 twin-engine Japanese bombers escorted by 34 fighters. [The bombers] dropped their bombs from 22.000 feet altitude and were off and away. [...] Finally came a full hour's strafing attack by 34 fighter planes.* So, citing from Morison: *after one day of war, and despite ample warning, the Far eastern Air Force as an effective combat unit had been eliminated.*

We summarize: Both S.Morison and W.Churchill mentioned Saigon and Formosa as the only possible bases for Japanese air operations in South China sea. Given the distances of 1.200 km. and 850 km., this speaks for

$$P(\mathbf{N} \,|\, \mathbf{Ph} \cap \mathbf{M}) \simeq 1.$$

The two authors had presented **Ph** in significantly different ways reflected by the following "correlation" table:

historian	plane type	base airfield
Churchill	dive-bombers	not mentioned
Morison	long range bombers + fighters	Formosa

The above citations disclosed two *miracles* supporting the estimates

$$P(\mathbf{W} \,|\, \mathbf{Ph} \cap \mathbf{M}) \simeq 0 \quad \text{and} \quad P(\mathbf{S} \,|\, \mathbf{N}) \simeq 1 :$$

miracle 1: the conversion of long-range bombers into torpedo bombers in Saigon; miracle 2: the extreme effectiveness of long-range bombing from Formosa, despite ample warnings and presence of American fighter planes at Manila.

3.2. **Symptoms of sabotage.** The high probability of the event **S** raises the problem of probabilistic explanation of the heavy losses inflicted on American navy at Pearl Harbor. We consider the event $\mathbf{S}_0 \subset \mathbf{S}$:

$\mathbf{S}_0$ = the heavy losses inflicted on American at Pearl Harbor were due to sabotage, and list from Morison's book the episodes that support the event $\mathbf{S}_0$. The passages in italic are citations from the chapter DISASTER AT PEARL HARBOR.

Many US ships suffered interior explosions. Morison explains this, stating that the Japanese *dive - bombers dropped not only conventional bombs but converted 16 - inch armor - piercing shells which penetrated the deck and exploded below.* The armor - piercing effect of a shell depends on its speed: the necessary speed exceeds many times the speed that can be reached by a shell dropped from an airplane. So the cited explanation is essentially nonsense. Within $\mathbf{S}_0$, the internal explosions could be produced by charges placed beforehand.

Describing the air attack at Pearl Harbor, writes Morison: *Hardly anyone, for seconds or even minutes, even after seeing the red 'meat ball' on the fuselages, recognized the planes as Japanese. Some thought that they were United States Army planes camouflaged to give the Navy a scare. Others assumed that this was an air drill and thought it too realistic.* That first reaction is reflected in the famous message about the attack sent from Pearl Harbor to Washington: –

Air Raid, Pearl Harbor - This is no Drill

(no mention of the Japanese or an enemy).

Three US aircraft carriers left Pearl Harbor a few days before December 7. The presence of the US carriers not too far from Pearl Harbor is vital for the $\mathbf{S}_0$ version: for the latter has to explain, from where the "drilling" airplanes came. Could planes

from the US carriers reach Pearl Harbor at the moment of the attack, i.e. were the US carriers located near enough? *Saddest of all accidents was the shooting down at night of four dive–bombers from the carrier Enterprize. These had landed at Ford Island during the morning lull [Dec.7] and were then sent out to search for the enemy. When they returned after nightfall with running lights on, an antiaircraft gunner, who failed to get the word because the air base communications had been ruptured, opened fire....* Within $\mathbf{S}_0$, the purpose of this story could be to explain the real losses among the planes from the US carriers that participated in the "drill".

Within $\mathbf{S}_0$, the "fifth columnists" had to act in a way to enable a propaganda claim for $\mathbf{J}$. In particular, this dictated the purpose of extermination of US air power at Pearl Harbor. Explanation: given a relatively low speed of the ships, the US planes surviving the raid would necessarily have started a systematic search for the virtual Japanese, thus making the absence of the Japanese armada evident. Morison tells that *wing to wing [or] as close as possible* parking of the planes on US airfields near Pearl Harbor has resulted in enormous losses during the air raid. Describing 8 December daybreak at Pearl Harbor, writes Morison: *Nobody knew where the Japanese task force was; the one radar fix on it was interpreted 180 degrees wrong, so many a ship and most of the flyable planes were sent scurrying southward.* Under $\mathbf{J}$, the Japanese ships could be found in the North. Under $\mathbf{S}_0$, to hide the absence of the Japanese armada, the fifth columnists sent the planes in the opposite direction.

The US Army was *responsible for five or six mobile search radar stations, spotted around the coast of Oahu.* Morison mentions that following a special order, on the morning of the attack all radars had been switched off a few minutes before the Japanese planes got into the air. However, one of the radars failed to comply with that order immediately and saw the approaching planes. A "green lieutenant" on duty, instead of sending alert orders *listened in a bored manner and told them [the subordinate operators] to "forget it".* Within $\mathbf{S}_0$, the lieutenant simply recognized friendly planes.

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