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THE EVOLUTION OF NUCLEAR STRATEGY

NEW, UPDATED AND COMPLETELY REVISED

Fourth Edition

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Preface

When this book was first published in 1981 it was 36 years since the first and still the only use of nuclear weapons in anger. At the time of publication tensions between the United States and the Soviet Union were on the rise and the nuclear issue had moved to the centre of political debate across the western world. A nuclear war was being actively discussed as a real possibility. This new edition is published with another 38 years having passed. There have been many terrible events during these years, including vicious conflicts that have left millions dead, wounded or displaced from their homes, but still a catastrophic nuclear war has been avoided. This fortunate state of affairs means that this fourth edition like the second and third can tell a continuing story of non-use while considering the preparations for war as well as attempts to reduce the risk through measures of disarmament and arms control. Unlike the second and third editions, however, which added new chapters to describe developments since 1981 this edition not only updates the story of nuclear weapons but also provides a complete revision of the original book.

There are a number of reasons for this updated and revised edition. The most obvious is that a mass of material has been published since 1981 on the first decades of the nuclear age, adding to our knowledge of the major strategic thinkers of the period and also the relationship between how the key issues were debated in public and how they were viewed by policymakers in private. This is also true for the periods covered in the second and third editions. In particular we now know a lot more about the development of Soviet nuclear strategy so the account can be less one sided. The opportunity to compare the internal policy debates with what was

being discussed in public makes it easier to evaluate the actual influence of some of the big books and ideas in contemporary strategic theory. Secondly, while it remains the case that the innovators in nuclear strategy have largely been American, with many more nuclear states and the Cold War over, it is important to review not just superpower strategies but the whole range of approaches to the nuclear issue, including those of states that decided that they could abandon their weapons programmes. Third, it is hard to get a unity of style when bringing together chapters written at different times over the past forty or so years.

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London, UK — Lawrence Freedman
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Introduction

Just after 7 am on 6 August 1945 a single aircraft flew over the Japanese city of Hiroshima. This B-29, known as Straight Flush, was checking weather conditions over the primary target for the dropping of the first atomic bomb. Two other aircraft were checking the conditions over the second and third possible targets. The all clear was sounded in the city below as the aircraft flew away. Another B-29, named Enola Gay after the mother of the pilot, Colonel Paul Tibbets, now prepared to drop the bomb it was carrying. Two other B-29s followed just behind carrying scientific instrumentation and cameras. One was named Great Artiste and the other was later named as Necessary Evil. An hour later at 8.15 am the bomb was dropped. At least 66,000 people died almost immediately from the explosion and fire-storm that followed. Tens of thousands more died in the aftermath, and many died over subsequent years as a result of their injuries and exposure to high doses of radiation. Three days after the first explosion, a second bomb was dropped on the Japanese city of Nagasaki. The immediate dead numbered some 40,000 people. The hilly terrain meant that the devastation was not as complete as with Hiroshima, although the explosion was larger. About 40 per cent of the city's structures were destroyed or severely damaged, as against 80 per cent in Hiroshima. On 15 August Emperor Hirohito announced Japan's surrender.

Thus began the nuclear age. It opened with key propositions: the bombs' effects were devastating; cities were their natural targets; there was no obvious defence; and they could win wars. Each of these propositions could be qualified or challenged. When announcing the destruction of

Hiroshima President Truman had described the target as 'an important military base'. This choice of words, indicating unease about targeting civilians directly, foreshadowed later debates about the purposes that might be served if nuclear weapons were directed against the enemy's armed forces. Those who had planned the attack were surprised by the death toll. They had assumed that people would have taken shelter, not realising how little alarm would be caused by the appearance of so few aircraft. As the weapons became even more powerful the possibility of surviving an attack declined, but concepts of defence based on intercepting weapons before they reached their targets continued to be explored. Later a debate began about whether the destruction of these two cities really did cause the Japanese surrender, especially as the Soviet Union coincidentally declared war on Japan. But first impressions count, and these reinforced the view that atomic bombs were transformational weapons. Despite their apparent ability to win wars the horrific human consequences of their use raised questions from the start as to whether they could ever be treated as normal weapons of war. Soon the emphasis was on deterring wars rather than winning them. This preference was reinforced once the Soviet Union acquired its own nuclear capabilities and the US monopoly was lost. In this respect the context of the developing Cold War between these two countries and their respective alliances shaped thinking about nuclear weapons. If the victors of 1945 had avoided a new round of conflict then they might have been able to work together to impose stricter controls on how nuclear energy was exploited for military purposes. Proposals were made but they soon foundered on Cold War suspicions. In these ways the big issues—of targeting, survival, deterrence and control—were framed from early on in the nuclear age and they continue to shape debates about their development, deployment and potential use.

The weapons that destroyed Hiroshima and Nagasaki produced explosions equivalent to that produced with roughly 14,000 and 20,000 tons of TNT respectively, an explosive power described as being 14 or 20 kilotons. Many of the nuclear warheads now in the possession of the major powers are in the megaton range; that is they would result in explosions equivalent to that produced with 1 million or more tons of TNT. If a 1-megaton bomb is exploded at the height necessary to achieve maximum destruction, all brick houses would be destroyed out to 3½ miles, with comparatively minor damage out to 13 miles. The blast would create winds sufficient to hurl objects (and even people) through the air at lethal speeds, out to 6½ miles. Within a radius of about 6 miles most fabrics and

paper will burst into flame. As far out as 11 miles the explosion could cause second-degree burns and ignite dry leaves. The explosion would take its toll in human life for the following weeks and months through radiation sickness.

Plans for war during the first decades of the nuclear age assumed that any use would be on a massive scale. Later it became possible to envisage use on a limited scale, especially in a war between the smaller nuclear powers. It is unclear at what point in a nuclear war there would be a breakdown of social organization, with the consequential economic collapse and the spread of poverty, disease and hunger, nor the nature of the political and social consequences, although they would always be extreme.

One of the most profound thoughts to develop during the 1950s was just how quickly all or much of this could be accomplished. If the deed were to be done it could be done quickly. It remains within human decision. Our collective future has become hostage to continuing acts of self-restraint by the leaders of the world's major powers. It is not surprising that at times these leaders did not, and still do not, seem wholly suited to this responsibility, or that events appeared to be propelling them to a point where caution, and eventually everything else, might be thrown to the winds. Mass movements were mobilized on the basis of such anxieties, and pushed the question of prevention of nuclear war to high on the political agenda. The remedies proposed ranged from attempting to make nuclear weapons more usable by controlling their effects, to making them virtually impossible to use on the grounds that their effects could never be controlled. Some addressed the problem as essentially one of command and control; others were concerned with the size of the nuclear inventories and argued that they could and should be reduced dramatically—if possible to zero.

Advocacy of a nuclear-free world continues. Proponents of nuclear disarmament have been regular winners of the Nobel Peace Prize, no less than eight times, most recently the International Campaign to Abolish Nuclear Weapons (ICAN) in 2017. The only prize for an advocate of deterrence was to Thomas Schelling in 2005, and that was for economics and not peace.[1] Despite the advocacy and the practical work done on how

[1] Those awarded the peace prize for work on nuclear disarmament are Philip Noel-Baker (1959), Linus Pauling (1962), Alva Myrdal and Afonso García Robles (1982), International Physicians for the Prevention of Nuclear War (1985), Joseph Rotblat and Pugwash Conferences on Science and World Affairs (1995), Mohamed ElBaradei and International

to move to a nuclear-free world this remains a distant prospect. So long as we do not have a conflict-free world, so long as nuclear weapons remain attractive as symbols of power, and so long as the fear that the widely spread knowledge of how to develop and produce nuclear weapons will be exploited by the unscrupulous, there will continue to be limits placed on the possibilities for complete disarmament. Even if current stocks were eliminated, during the course of a conflict new stocks could be produced (especially if civilian nuclear facilities had not been eliminated). Nor do nuclear explosions exhaust the possible horrors that human beings can inflict on each other. More positively, the record suggests—even if it cannot prove—that the risk of nuclear disaster has been the source of a welcome caution in international politics over the past seven decades. For the moment it is as difficult to comprehend a future without nuclear weapons as it is to comprehend the consequences of their use.

This book is largely concerned with a different problem: given the horrific consequences of their use, and the possibility that any use might lead to retaliation in kind, how do states attempt to incorporate nuclear weapons into their security policies? Can they be used to deter any war between nuclear powers, or just nuclear use in those wars? In the event of war how might they be employed to gain a military advantage? To what extent does the credibility of deterrence depend on forms of effective and potentially decisive use being identified? Though these are questions that have preoccupied some of the best minds of our time there have been no definitive answers. The thankful lack of experience of nuclear warfare since 1945 has rendered highly speculative all thoughts on the likely causes of nuclear war, its course and its finale. Even when nuclear powers have confronted non-nuclear powers they have yet to take advantage of their supposedly decisive superiority. The likely dynamics and consequences of nuclear employment remain matters for inference and conjecture.

There are many aspects to the history of nuclear weapons—the science behind them, the construction of the first weapons and their use, the various means of delivering them and how these have been developed over time, forms of defence, practical steps to achieve arms control and disarmament, their role in holding together alliances and managing crises, proliferation and the possibility of 'terrorist bombs', and so on. All of these matters need to be considered in a history of nuclear strategy, which is the

Atomic Energy Agency (2005), and the International Campaign to Abolish Nuclear Weapons (ICAN).

focus of this book. As strategy is concerned with the relationship between political ends and military means our interest is with the theoretical and practical issues raised by attempts to extract political benefits from nuclear arsenals. Unlike most military strategy, which is about how forces might be employed against armed opponents, the discussion of nuclear strategy has been bound up with deterrence and how to cope if it fails. Deterrence is a notoriously difficult subject to pin down, for it succeeds when nothing happens and depends on how threats are communicated and understood. At moments of crisis governments do talk about the risks of nuclear war but at other times they tend to avoid speculating on the circumstances in which nuclear weapons might be used.

The 'evolution' in this book's title suggests a learning curve, implying steady progress in levels of understanding. Though in some respects that is true, because there has at least been an accumulation of knowledge, there is also a marked cyclical character to the debates. Moreover, if there is an underlying trend, it may be less towards the refinement of a theory strong in its inner core, but towards a steady resistance to the idea of an operational nuclear strategy. Operational concepts are still developed and plans are made but any implementation must confront the likelihood that the repercussions of use, foreseen and unforeseen, will outweigh any gains.

To make sense of all this, and to keep the strategic debates in context, requires addressing a vast and rich literature. It is difficult not to be overwhelmed by the sheer volume of the material that has been generated. In addition to professional writings of writers from the military and reflections of politicians presiding over nuclear arsenals, there has been a vast outpouring of books, articles, papers, and memos from civilians representing many academic disciplines and often organized into new research institutes concerned with few things other than the problems of modern strategy. As time has passed and archives have become declassified a vast documentary record of high-level deliberations, war plans and nuclear guidance has become available. The literature threatens to overwhelm any would-be historian of ideas. To help order and explain such a novel situation, new and arcane concepts have been developed, which sometimes serve to clarify but often only obfuscate. The uninitiated has to work through a forbidding miasma of acronyms and jargon.

An attempt to note each intended contribution to contemporary strategy would result in a work of great length and tedium. Inevitably a large proportion of the material is repetitive and derivative. In the same way that

a military historian is not expected to record every campaign so a historian of ideas does not have to record every documented thought. This work is selective, and in consequence the discussion of some areas such as conventional strategy, and particularly naval warfare, is inadequate; also, we have concentrated on the strategic debate in the United States, the most vigorous and fertile, though without neglecting the parallel debates elsewhere. Over time these parallel debates have become more important and distinctive, which is why they receive additional attention in this new edition of the book. The aim is to provide a systematic and reasonably comprehensive treatment of the major themes of nuclear strategy. To this end, the most important individual contributions to the debate have been analysed in some detail, but this is not a collection of critiques of great texts and so some favourite authors may not have got the attention they deserve. Similarly, while this is also not a history of decision-making we have sought to check declared policy with what was being said in private meetings in governments and international organisations. The number of strategic debates to be addressed has expanded with the number of nuclear powers. As these new powers face different challenges to those of the original powers we have explored the extent to which they have shown strategic innovation or have been caught by the same dilemmas and formulations which caught the others.

A book about strategy ought to begin with a definition of the subject. A comparable book in the Soviet Union would have opened with elaborate distinctions between military strategy, art, science, and doctrine. But as indicated above we have avoided restrictive terms of reference. Furthermore, there has been no constant and generally accepted definition of strategy, even during the post-war years. The origins of the word 'strategy' lie in the Greek *strategos*, meaning the art of the general. The word returned to the European vernacular in the late eighteenth century, just in time for the Napoleonic Wars, but it was defined largely in military terms, as military thought was fixated on battle. Strategy was about getting into the best position for a battle; tactics was about how it should be fought. By the twentieth century it was becoming harder to avoid questions of policy, covering peacetime preparations for future wars, including alliance formation, the purposes for which they might be fought, and the mobilisation of all national resources, economic and political as well as military, to win them. The relationship between military means and political ends was captured during the interwar years by Basil Liddell Hart—'the art of distributing and applying military means to fulfil the ends of

policy'.[2] It was non-committal about how military means were to be distributed while stressing the role of the political sphere as the source of strategic objectives. It also maintained the connection with military means. This is why Liddell Hart's definition still works, even in the nuclear age. The difference that nuclear weapons made to the concept of strategy was to turn the focus away from war-fighting to war prevention, and to forms of coercion and intimidation, including deterrence, as well as crisis management and arms control. When all the means of national power—political and economic as well as military—are being considered this is now normally described as grand strategy. It is reasonable to consider this wider context of diplomacy and general international relations but it remains important to remember that we are dealing with 'functional and purposive violence'.[3]

A further complication comes with the particular way the term strategy has come to be used in connection with nuclear weapons. When fledgling air forces, after World War I, were anxious to demonstrate that they possessed a means for getting right to the heart of the enemy's power and destroying it with some well-chosen blows, they described this as a 'strategic' capability. Thus they spoke of 'strategic bombardment', using 'strategic bombers', eventually under a 'Strategic Air Command' (SAC). In this spirit nuclear weapons, best able to perform this mission, came to be known as 'strategic weapons', and a war in which they were to be used would be a 'strategic war'. This use of the adjective 'strategic' has very little to do with the noun 'strategy'. The connection has now become even more tenuous, with 'strategic' now tightly defined, as in the 'strategic arms reductions talks', by reference to the ranges of certain weapons. A weapon that can be directed from the homeland of one superpower against the homeland of the other is strategic. Nuclear weapons designed to be used against enemy forces in battle were described as 'tactical', although any authorisation to use even these smaller-scale weapons would still be a highly strategic matter. It is difficult to avoid this sort of terminological usage, as it became the language in which nuclear issues are discussed. It also indicates the extent to which the dramatic entrance of atom bombs on

[2] B. H. Liddell Hart, *Strategy: The Indirect Approach* (London: Faber & Faber, 1968), p. 334. I deal with the history of the term in Lawrence Freedman, 'The Meaning of Strategy', Parts I and II, *Texas National Security Review*, 1:1 (2017), and 1:2 (2018).

[3] Michael Howard, 'The Transformation of Strategy' in Major-General J.L. Moulton (ed.), *Brassey's 1972* (London: William Clowes, 1972), p. 1.

to the international stage meant that they were discussed and understood in terms derived from the established theories of airpower.

Eventually, nuclear weapons became more powerful, more numerous and, crucially, possessed by more than one nation. New concepts and approaches developed in an attempt to come to terms with the possibility of a war in which the use of the most formidable weapons available would mean, in all probability, that it would be catastrophic for all concerned. Could any useful purpose be served by employment of devices which invited discussion using words such as 'holocaust', 'doomsday' and 'Armageddon'? And could any employment of nuclear weapons be sufficiently deliberate and controlled to ensure that political objectives were met. At issue has been whether a 'nuclear strategy' is a contradiction in terms. To the extent that there has been an effective nuclear strategy thus far it has depended on non-use, by deterring major war and helping to hold together alliances. The most intense debates over nuclear strategy took place during the Cold War but though that ended many years ago the weapons remain, ready for use. Behind the question of whether strategies based on non-use still have a role to play is the even larger question of whether it is possible for the habit of non-use to be sustained. There has been no use of nuclear weapons since August 1945. It is an impressive record, but is it one that can be sustained indefinitely?

Contents

CHAPTER 1

The Arrival of the Bomb

Nuclear strategy was the product of two lines of scientific and technological development, both of which can be traced back at least to the start of the twentieth century. The first, which began with the study of radioactivity, concerned the structure of the atom and the amounts of energy that might be released if the circumstances in which atoms broke up could be better understood. The second was the possibility of heavier than air flying machines which had been discussed during the previous century as a possibility and became a reality in 1903 when the Wright brothers completed the first manned flight at Kitty Hawk, North Carolina.

Our textbook image of the atom is one of a small solar system, with a heavy, positively charged nucleus, made up of protons and neutrons, orbited by light negative electrons. As each atom is electrically neutral, the number of protons in the nucleus is equal to that of the outer electrons. The atomic number of an atom, and its fundamental chemical properties, is determined by this number of protons. The number of neutrons in atoms of the same element is not necessarily constant. Variations, which can lead to differing properties, are known as isotopes. They are distinguished from one another by quoting the total number, neutrons plus protons, of particles contained in the nucleus (e.g. Uranium_{235}). A key characteristic of neutrons, which makes them potential agents of change in a nucleus, is that they are uncharged. Only certain combinations of neutrons and protons are stable. When few in number, equal amounts of

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protons and neutrons result in stability, but for larger nuclei, the proportion of neutrons required for stability is much greater.

The potential instability of certain atoms, to the point where one element transmutes into another, was originally explored through the study of radioactivity, a term coined by the French scientists Philip and Pierre Curie to refer to the emissions they detected coming from unstable isotopes of heavier elements. These discoveries began in the late nineteenth century. Almost immediately the possible military implications of the energy contained in individual atoms being released was recognised. The futurist H. G. Wells, who had already contributed a dire warning on the impact of airpower, published *The World Set Free* on the eve of the First World War, which imagined pilots throwing 'atom bombs' onto enemy cities.[1] As the workings of the atom came to be better understood other works of fiction also discussed the possibility. In Harold Nicolson's *Public Faces* (1932), a British atomic test accidentally destroys Charleston, South Carolina as well as several other American cities. Nicolson was provided the name 'atom bomb' and technical information from science writer Gerald Heard.[2] Other fictional works during this period discussed the atomic bomb specifically, as well as the weaponization of atomic-related components, for instance 'radioactive dust', and dealt with such issues as atomic demonstrations, deterrence, the failure of deterrence, and disarmament.[3]

1932 was the year in which the neutron and its role was been identified by James Chadwick. That year experiments by Enrico Fermi involved fission but he misunderstood his results and offered an alternative explanation of the phenomena he had observed. In 1933 Leo Szilard, an émigré scientist, born in Hungary living in London, who had read the books by both Wells and Nicolson,[4] was bothered by a report of a speech by one of

[1] H. G. Wells, *The War in the Air* (London: George Bell & Sons, 1908); *The World Set Free* (London: Macmillan, 1914).

[2] Harold Nicolson, *Public Faces* (Bath, Cedric Chivers Ltd., 1968). On the role of Heard, see the Introduction to this edition written by Nigel Nicolson.

[3] For a discussion of this literature, see: H. Bruce Franklin, *War Stars: The Superweapon and the American Imagination* (New York: Oxford University Press, 1988), pp. 131–48 and Merritt Abrash, 'Through Logic to Apocalypse: Science-Fiction Scenarios of Nuclear Deterrence Breakdown', *Science Fiction Studies*, Vol. 13, No. 2, Nuclear War and Science Fiction (Jul., 1986), pp. 129–38.

[4] On Szilard and Nicolson, see: Alvin M. Weinberg, 'The sanctification of Hiroshima', *Bulletin of the Atomic Scientists*, 41:11, 1985, p. 34 and Interview with Alvin Weinberg, Oak Ridge National Laboratory Oral History project, March 31, 2003. Edward Teller acquired a copy of Nicolson's book in 1933. See: Edward Teller w/Judith L. Shoolery, *Memoirs: A Twentieth-century Journey in Science and Politics* (Cambridge, MA: Perseus Publishing, 2001), p. 87.

the pioneering students of radioactivity, Ernest Rutherford. Rutherford was of the view that transforming individual atoms would be an inefficient way to release energy. According to Szilard the reason why Rutherford was wrong came to him as a revelation as he crossed a road. If the neutrons released when individual atoms were split in turn went on to split other atoms then a chain reaction could result resulting in a massive release of energy. So alarmed was he by this discovery that he patented his description of a self-sustaining chain reaction in secret.[5] In December 1938 Lisa Meitner, an Austrian scientist who had moved to Sweden to escape the Nazis, heard from the German Otto Hahn of an experiment in which Uranium appeared to turn into Barium. With her nephew Otto Frisch she realised that incoming neutrons had caused the Uranium atom to split. This phenomenon was named fission by Frisch, because of its similarity to the division of a biological cell.[6]

As a result of this intensive period of research by early 1939 the international scientific community understood that when uranium atoms were bombarded with neutrons they could split into approximately equal parts with the release of enormous quantities of energy. They also knew that when fission occurred some free neutrons were released which were capable of causing fission in other nuclei which could in principle result in a chain-reaction, spreading through a mass of fissile material and yielding enormous power. An atom (or fission) bomb was therefore a theoretical if not yet a practical possibility. It required a chain-reaction to create an explosion. This required an amount of fissionable uranium or plutonium isotopes (U_{233}, U_{235} or Pu_{239}) to reach a critical mass from which free neutrons could not escape or be captured by non-fissionable material. In addition, for explosive purposes, this reaction would need to build up extremely rapidly, for otherwise the device would fly apart and the reaction would stop. It was the brevity of this period that caused most technical problems in the construction of the first bombs.

As governments became aware of these developments, and with the real possibility of another European war, members of this international community had to pick sides. A German nuclear weapons effort began in April

[5] Richard Rhodes. *The Making of the Atomic Bomb* (New York: Simon & Schuster, 1986), p. 44. On Szilard see William Lanouette, *Genius in the Shadows: A Biography of Leo Szilard, the Man Behind the Bomb* (Chicago: University of Chicago Press, 1994).

[6] The process was described in L. Meitner and O. R. Frisch, 'Disintegration of Uranium by Neutrons: A New Type of Nuclear Reaction', *Nature*. 143: 3615 (1939): pp. 239–40.

1939, although many Jewish scientists who would have made a significant difference to the project had fled and came to make vital contributions to the British and then the American projects. The lukewarm attitude of many German scientists to the project and Hitler's belief that the war could be and had to be won quickly, before such a weapon would be necessary, hampered its progress.[7] In Britain, Winston Churchill, who had long taken an interest in nuclear energy, in part because he read closely the works of H.G. Wells, accepted a recommendation to establish an investigation into the possibility of an atomic bomb in June 1940.[8] By July 1941 enough work had been done to demonstrate that a new and more powerful bomb using uranium might well be feasible. The key paper was written by Frisch, now based in Britain, and another émigré scientist, Rudolf Peierls.[9]

In the United States Szilard persuaded Albert Einstein, the most famous scientist of his day, to write to President Roosevelt warning of the possibility of 'extremely powerful bombs of a new type' and the risk that the Germans might produce them first. Just one such bomb 'carried by boat and exploded in a port might very well destroy the whole port together with some of the surrounding territory'.[10] Roosevelt took it seriously, although at first he only authorized exploratory research. In 1942, informed by the progress the British and Canadians had made, the Americans established what became known as the Manhattan Project. This immense scientific and engineering endeavour was tasked to see if fission—or atomic—bombs were feasible, and if they were, to build them.[11] This was an enormous effort, led by recently promoted Brigadier General Leslie Groves from the Army Corps of Engineers and chief scientist Robert

[7] Thomas Powers, *Heisenberg's War: The Secret History of the German Bomb* (New York: De Capo Press, 2000).

[8] Graham Farmelo, *Churchill's Bomb: A Hidden History of Science, War and Politics* (London: Faber & Faber 2013). Churchill wrote in 1931: 'There is no question among scientists that this gigantic source of energy exists. What is lacking is the match to set the bonfire alight, or it may be the detonator to cause the dynamite to explode'. 'Fifty Years Hence', *Strand* (December 1931). On the British project see Margaret Gowing, *Britain and Atomic Energy*, 1939–1945 (London Macmillan, 1964).

[9] Jeremy Bernstein, 'A memorandum that changed the world', *American Journal of Physics*, 79: 440 (2011), pp. 440–6.

[10] The letter continued: 'However, such bombs might very well prove to be too heavy for transportation by air.' Einstein to President Roosevelt, 2 August 1939, http://www.atomicarchive.com/Docs/Begin/Einstein.shtml.

[11] Richard G. Hewlett and Oscar Anderson, *The New World 1939/46*: Vol, I of a history of the ASAEC (Pennsylvania: Pennsylvania University Press, 1962). See also Rhodes, *op.cit.*

Oppenheimer. It was spread throughout the United States, with the central hub in Los Alamos New Mexico, where the bombs were designed, but also a large facility at Oak Ridge, Tennessee to enrich Uranium and Hanford, Washington to produce Plutonium. The first successful chain reaction was overseen by Fermi on 2 December 1942 in Chicago. In July 1945 the first Plutonium device was tested at Alamogordo in New Mexico. Two types of atomic bombs were constructed and used. The first, known as 'Little Boy', used Uranium-235 with a gun-type design, and was dropped on the Japanese city of Hiroshima on 6 August 1945. The second, known as 'Fat Man', was an implosion device using Plutonium. It destroyed Nagasaki three days later.

As we shall discuss below the attacks on Japan had their own strategic rationale, but this rationale depended on some fundamental shifts in the nature and character of war that had already taken place over the first decades of the century. The idea of dropping explosives on an enemy was not new. It had been attempted from balloons by the Russians on the French in 1812 and the Austrians on the Venetians in 1847. The first actual victims of an air raid were Libyan villagers attacked by the Italians during their 1911–1912 war with the Ottoman Empire. Alarms were further raised by the small-scale Zeppelin and Gotha raids of the First World War. In addition to the reality of air raids against defenceless populations it was evident that aircraft would acquire longer ranges and faster speeds. It was also unclear whether effective defences could be developed.

During the inter-war years it was almost taken for granted that the next war would open with vast air raids that would cause mayhem and slaughter. Particularly alarming was the possibility that the air raids would not merely drop high explosives and incendiaries on defenceless populations but also poisoned gas. Chemical weapons, another innovation from the past war, were at first seen as a means of attacking the enemy army, but, as with air power, the natural assumption was that having been shown to have such a crippling effect against soldiers there would be an even greater effect against civilians. So appalling was this prospect that an international agreement was reached to ban their use. The 1928 Geneva Protocol prohibited the use of 'asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices' and 'bacteriological methods of warfare'. This depended for enforcement on the possibility of retaliation in kind, and so did nothing to prevent the production or stockpiling of such weapons. Few were confident that they would not be used in a coming war, although in the event this was one area where restraint was shown

after 1939. The value of chemical weapons was limited against military targets and with civilian targets there were fears of retaliation.[12]

The expectations of irresistible air attack were summarized succinctly in a famous 1932 speech of British Prime Minister Stanley Baldwin:

> Any town which is within reach of an aerodrome can be bombed within the first five minutes of war from the air, to an extent that was inconceivable in the last war, and the question will be whose morale will be shattered quickest by the preliminary bombing? I think it is well for the man in the street to realise that there is no power on earth that can protect him from being bombed. Whatever people may tell him, the bomber will always get through.[13]

Around these expectations, and the rapid expansion of air forces after 1918, a strategic theory soon took shape. It was promoted by ambitious airmen making the case for a separate and autonomous service commanding a major share of the military budget and potentially able to win a war all by themselves. It appealed to a futuristic vision, attracted by the possibility of a more mechanised and efficient form of warfare, offering an alternative to the gruelling, murderous stalemate of the trenches.[14] A bomber offensive capable of bringing matters to a swift conclusion could be contrasted with the previous war when the defences on the ground had prevented any sort of conclusion for four years.

This assumed that air power would be used in a particular way. The doctrine accepted that the most effective use of aircraft was to attack the social and industrial heart of the enemy, so producing internal collapse and obviating the need for a traditional battlefield victory. This in turn reflected the presumptions of total war. The whole society, rather than just an armed segment, had become intimately involved in the waging of war. Success was dependent upon the numerical and industrial strength of nations, and the willingness to concentrate them in a titanic struggle. In the war just ended this led to a process of mutual exhaustion, with defeat coming to

[12] Edward Spiers, *A History of Chemical and Biological Weapons* (London: Reaktion Books, 2010).

[13] *Hansard*, 10 November 1932, cols. 613–8.

[14] Azar Gat, *Fascist and Liberal Visions of War: Fuller, Liddell Hart, Douhet, and Other Modernists* (Oxford; Clarendon Press, 1998). On the origins of the theory see Mark Clodfelter, *Beneficial Bombing: The Progressive Foundations of American Air Power 1917–1945* (Lincoln: University of Nebraska Press, 2010); Tami Davis Biddle. *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing* (Princeton: Princeton University Press, 2002).

those countries which collapsed first. Such wars involved severe drains on national resources and energies. They demanded patience and perseverance; a satisfaction with the enemy's lack of progress rather than tangible progress of one's own. Few military thinkers applied themselves to the perfection of the means of fighting a war of attrition.[15] Soldiers do not like to plan for long-drawn-out and inconclusive campaigns. That is why they are often so unprepared to fight one when it is forced upon them. Aerial bombardment offered a new way to avoid attrition. Naval blockade contributed to the German defeat in the First World War by undermining its economy and adding to civilian misery, but its effects took time to have an impact. The impact of air raids would be felt immediately, and so too, it was assumed, would be their political consequences.

As the new air forces began to take shape, they offered a prospect of quick victories. This led them to play down alternative uses of airpower, for example in support of armies, and the possibility that ways could be found to resist a massive air attack. Bureaucratic and operational independence, the élan of the airmen, and the primacy of the strategic bombardment mission were all bound up in a general sense of the uniqueness, in its power and directness, of the heavy bomber.

This use of airpower was described as 'strategic bombardment'. As we have already noted, this terminology assumed that bombardment of socio-economic targets behind the enemy lines provided an independent means to the strategic end of enemy defeat. Adding the adjective 'strategic' to blockade or invasion or territorial defence would seem superfluous. Its use in the case of bombardment came from a desire to distinguish the envisaged role from that of a tactical variety, undertaken in support of surface forces in battle. This distinction between 'strategic' and 'tactical' roles made little sense for armies and navies. Here battlefield success, or the probability of such success, was an inevitable concomitant of the attainment of the strategic end. The distinction worked for the proponents of airpower because it differentiated between independent operations and those dependent upon other services. It also captured a belief, that later turned out to be fallacious, that strategic bombardment did not involve contact with the enemy's forces. Air Marshal Trenchard explained: 'It is not necessary, for an air force, in order to defeat the enemy nation, to defeat its armed forces first. Airpower can dispense with that intermediate

[15] Carter Malkasian, *A History of Modern Wars of Attrition* (Westport, CT: Praeger, 2002).

step…'.[16] This then created the issue of whether a government confident in its strategic air power could dispense with its army and navy. However impressed they might be with the potential of strategic air power none even considered going that far or even making such a capability an overriding priority.

The Italian Giulio Douhet organized the apparent logic of airpower into a systematic theory. Though the theory of strategic bombardment has come to be associated with his name it would be a mistake to overestimate his influence. Similar notions occurred to many airmen in many countries quite independently. The theory had a natural appeal. Here was an exciting, and still improving, new medium of warfare, capable of speedier and more distant operations than hitherto considered possible. Rather than dabble inconclusively in surface engagements on the periphery, how much more effective to aim right at the centre of the enemy's power—the industries and workforce which sustained its military effort.

Much advocacy of strategic bombardment was immoderate and simplistic, relying on intuition more than analysis. In part, this was because it was propaganda for a new branch of the armed services. But even the most detached writers on this subject were working in the realm of speculation. They could not be sure what changes new technological advances would bring; they could only guess at the impact of bombardment on modern social structures. (In Britain, for example, much of the RAF's confidence in strategic bombing derived from its apparent efficiency in controlling tribesmen in Somalia and Iraq.) Under the influence of these theories, military writers were straying beyond their area of competence. It might be hard to challenge military expertise on the tactics of battle; but now they were commenting on the ability of civilians, indeed whole societies, to withstand a certain sort of pressure.

Douhet had few doubts about the unassailable primacy of the offence in the air and of the defence on the ground. For an adequate military posture it would be necessary and sufficient to be in a position to gain command in the air. This would be when one was 'in a position to prevent the enemy from flying while retaining the ability to fly oneself', achieved by aggressive bombardment of the enemy's air bases rather than through aerial combat. These bases would be a key feature of the set of targets

[16] Quoted in George Quester, *Deterrence Before Hiroshima: The Influence of Airpower on Modern Strategy* (New York: John Wiley, 1966), p. 52.

marked out for immediate attack. In these attacks the essential motto would be 'hit first and hit hard'.

> Whatever its aims, the side which decides to go to war will unleash all its aerial forces in mass against the enemy nation the instant the decision is taken, without waiting to declare war formally.[17]

The belief in the critical importance of the first blow (and the readiness to abandon a principle of international law by failing to declare war) was based on the premise that this could be a war-winning event, less because of the physical than the psychological consequences. The total paralysis of society would require time and favourable conditions. However, the proponents of strategic bombing believed that the desired result would come earlier because of the vulnerability of civilian morale to aerial attacks. Before bomb damage had made it impossible to sustain fighting forces at sea and on land, the collapse of morale would lead to offers of surrender.

The identification of morale as a critical target was borrowed from those conventional theories of warfare in which the morale of the armed forces was emphasized as being as much a critical determinant of strength as numbers and equipment. The Prussian theorist of war Carl von Clausewitz wrote in his book *On War*, of the importance of 'spirit', describing physical force as the 'wooden hilt' of the sword, whereas moral force was the 'shining blade'.[18] At the time when the early theories of strategic bombardment were being formulated 'morale' was a central concept in military thought. The French Army in particular, inspired by the theories of Du Picq and Foch, saw war as the clash of opposing wills, with defeat the punishment of the force whose will broke first. There had been a tendency, which Foch mournfully acknowledged after World War I, to believe that 'morale alone counted', seeing victory as almost a triumph of mind over matter.[19] But even those who kept the moral factor more in perspective did

[17] Giulio Douhet, *The Command of the Air*, as translated by Dino Ferrari (New York: Coward-McCann Inc., 1942), pp. 220, 202. On Douhet's influence see Col. Phillip S. Meilinger, "Giulio Douhet and the Origins of Airpower Theory", in Col Phillip S. Meilinger, ed., *The Paths of Heaven: The Evolution of Airpower Theory* (Maxwell Air Force Base, Alabama,: Air University Press, 1997).

[18] Carl von Clausewitz, *On War*, trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1989).

[19] Raymond Recouly, *My Conversations with the Marshal* (New York: Appleton, 1929), p. 108.

not deny its importance. Bad morale meant indiscipline and desertion; good morale meant resourcefulness and courage on the battlefield.

Focusing attention on to civilian morale as well as that of the armed forces seemed appropriate to an age when warfare was losing its separateness and becoming a test of strength between whole societies rather than simply the armed representatives of those societies. The welfare of civilians had always been at stake in warfare, but until the nineteenth century their contribution to performance in war had not been significant. Even in sieges non-combatants were more of a drag than a spur, spoken of as *bouches inutiles*—useless mouths. With warfare relying more upon a society's total resources of manpower and industrial capacity, the roles of 'national will' and a smooth process of war production grew in relative importance. The ability to interfere with production and undermine the national will might be as important as battlefield successes in weakening the enemy. Civilian suffering might be a cause of defeat—not just a consequence. Furthermore, civilian morale appeared as a more attractive target than military morale. Civilians were unready to face military danger and lacked discipline when it came. So Douhet argued that there would be no need to pound at the sturdy and prepared military shield provided by the army and navy. The 'air arm … will strike against entities less well able to resist, and helpless to act or counteract. It is fated, therefore, that the moral and material collapse will come about more quickly and easily.'[20]

There was a prevalent belief in a basic division between the mass and the élite, that could be traced back to the theories of the emotional crowd (compared with the rational individual) popularised by the Frenchman Gustave Le Bon.[21] Mass hysteria and panic after populations had been bombed would lead to demands for merciful release through national capitulation. On the actual mechanisms through which the mass would force the élite to change its conduct of the war, the theorists and practitioners of strategic bombardment were notably vague, Their writings were replete with references rarely more specific than 'breaking morale', attacking the 'will to resist' and bringing a nation 'to its knees'. Douhet explained how:

> A complete breakdown of the social structure cannot but take place in a country being subjected to … merciless pounding from the air. The time

[20] Douhet, *op. cit*, p. 128.

[21] Gustave Le Bon, *The Crowd: A Study of the Popular Mind* (New York: The Macmillan Co., 1896), http://etext.virginia.edu/toc/modeng/public/BonCrow.html.

> would soon come when, to put an end to horror and suffering, the people themselves, driven by the instinct of self-preservation, would rise up and demand an end to the war.[22]

Writing in 1923 the British military theorist Major General J.F.C. Fuller wrote about how London would be transformed into a 'vast raving Bedlam' following an air attack and how the Government at Westminster would be 'swept away by an avalanche of terror'.[23]

On both sides during World War II there were assertions that the enemy élite in crucial ways was alienated from the mass, committed to the war for its own purposes but able to use the state apparatus to mobilize the mass to follow its lead. There was an obvious propaganda element in such assertions. At the same time, they reflected a widely-held assumption that the government's hold over the population was tenuous. In this sense the mass was the élite's 'Achilles heel'—a soft target that was also the foundation of the national effort. Aerial bombardment would jolt the populace into an awareness of the risks they were running for the government's war policy. The relationship between the mass and the élite would be disrupted: either the people would cease to do the bidding of the government through a generally lack-lustre approach to war projects or else, preferably, they would demand of the government that it sued for peace.

Even accepting a crude élite/mass distinction such reasoning suffered from three fallacies. The first was the belief that a change in attitudes would automatically result in a change in behaviour and that this would take the form of activism rather than apathy; second, that the means would be available for mass activism to transform the government's conduct of the war. The third fallacy was that even if mass behaviour was affected that this would favour the attacker's objectives. In the event it could also be used by the 'elite' to *bolster* national will against the attacker.

It was true that military morale could be built and reinforced more readily than that of civilians, but the consequences of its collapse were also proportionately greater. A despondent and dispirited leadership was a recipe for battlefield disaster. Even for the individual soldier—normally controlled within a command structure—the physical proximity of the enemy

[22] Ibid., p. 58.

[23] Quoted in Quester, *Deterrence before Hiroshima*, p. 56. For the extent of these fears see Brett Holman, *The Next War in the Air: Britain's Fear of the Bomber, 1908–1941* (London: Ashgate, 2014).

meant that there was an option to desert or surrender. Direct and immediate results could flow from a collapse in military morale in a way in which they were unlikely to do with a collapse in civilian morale. Because of the lack of immediate consequences and the added difficulties facing an enemy attempting to press an advantage, recovery was more possible at home than at the front. So long as the economy was functioning sufficiently well to service the military machine, and this was itself performing adequately in combat, the strategic impact of a miserable and dejected population was limited, though it might be a source of vicarious pleasure for the raider. It could be hoped that a government that sympathized with, or indeed experienced, the suffering of the people would be so appalled that the desire for relief would cause a reconsideration of the national commitment, but there would be no compelling reason why it would do so.

In practice the objective misery of the population, whether resulting from bombardment or scarcities or battlefield losses, was not critical on its own. As, if not more, important were basic factors of social cohesion and political structure, as well as more specific ones relating to the extent of the understanding of and support for the war policy and its execution. To replace a government, or to get an existing one to change its mind, required both political means and an alternative policy. 'Peace' could suggest far greater evils if it was firmly believed that 'democracy' or 'civilization' was imperilled. Most important, for a fundamental change to take place there needed to be an environment in which some form of opposition could develop and grow. This was always going to be particularly problematic in totalitarian and authoritarian political systems.

At the start of World War II, rather than embark on the course of uninhibited bomber offensives the belligerents exercised restraint. This was a consequence of uncertainty as to whether strategic bombardment could bring the war to an early and satisfactory conclusion plus the knowledge that it could well lead to reprisal raids.[24] The devastation resulting from the systematic pounding of each others' cities appeared as a frightening prospect. No government wished to cope with the consequent social and economic strains.

[24] The efforts to secure formal international agreement on restraint are described by Donald Cameron Watt in 'Restraints on war in the air before 1945', in Michael Howard (ed.), *Restraints on War: Studies in the limitation of Armed Conflict* (London: Oxford University Press, 1979).