Now I am become Death, the destroyer of worlds. Physicist Robert Oppenheimer recalled these lines from the Gita after watching the first nuclear test in July 1945. With the world now sitting on a huge nuclear stockpile, can we hope to avoid that destruction?

"[Robert Jungk] does stress that all the great discoveries of [quantum mechanics] of the 20's and 30's were made purely for the sake of knowledge, without any thought of technological, let alone military, applications. It would be a great accomplishment if this book [Brighter Than a Thousand Suns] would contribute to an understanding of this fact by the public, and to an appreciation of the great spiritual adventure of science, which is often considered the handmaiden of technology" - Hans Bethe, 1958, p. 426; italics added.

"I will have nothing to do with a [nuclear] bomb." - Lise Meitner

Lise Meitner and her nephew, Otto Frisch, were the first to discover nuclear fission, the theoretical basis of the physics of the bombs that were dropped on Hiroshima and Nagasaki, on 6 and 9 August 1945, respectively (Sime 1966). Her opinion—even though it was, most likely, that of a minority among theoretical physicists—on the construction of the bombs, and therefore the organisation of the Manhattan Project, is as relevant as the letter drafted by Leo Szilard, the Hungarian physicist. It was Szilard, who, with fellow Hungarian physicists Edward Teller and Hans Wigner, delivered the letter to Albert Einstein, and persuaded that great man to sign and send it to US President Roosevelt, in 1939

1. By Way of an Introduction

No one item can be inferred as the cause of the Second World War, or the US entering it; it is like those who attribute the defeat of the Nazis to the breaking of the Enigma-code. Sime articulates it eloquently, the reactions, entirely laudable, of one physicist:

Among scientists worldwide, almost none refused outright to work on weapons during the war; among the Allies, nearly all scientists, especially refugees, were driven by fear of [4].

The reactions of scientists—not just physicists—who worked at various locations and on various aspects of the Manhattan Project was more nuanced, as highlighted by curator Martin Moeller’s discussion with Citylab’s Amanda Colson Hurley, on the “Secret Cities”—in Tennessee, New Mexico and Washington State—exhibition at the National Building Museum in Washington, DC [5].

The dropping of nuclear bombs on Hiroshima and Nagasaki had a horrific human toll, as the exhibition makes clear. Most of the people in the secret cities hadn’t known their work.

I really tried, in a small number of quotes [in the exhibition], to capture that range, because it was a range. There were people who jumped up and down and celebrated at what they did. One of my own colleagues, it turns out her parents were both at Oak Ridge, and they were very much in that position. They were working on this, and they did not know what they were actually working on.

There were more complex reactions in between. There were people who were relieved but sobered by the news of what happened. It also took a long time [for news] to get out of what [4].
Indeed, beneath his clown’s guise, Feynman was a sensitive man, suffering from both early grief and considerable anguish about the atomic weapons he had helped.empower. These do 

The year I arrived in Japan, 1965, to spend five years, the Nobel Prize in Physics was awarded—for their work on quantum electrodynamics (QED)—to the trio of Feynman, Schwinger and Tomonaga—only the second Japanese, in any subject, to be so honoured (at that time). The award, particularly to Tomonaga, together with a serendipitous encounter in reading and pondering over Robert Jungk’s fascinating book, Brighter than a Thousand Suns (Jungk, 1958), was instrumental in my decision to try to study at Kyoto University.

I, as an undergraduate engineering student at Kyoto University, was enamoured of the sciences, felt that studying physics was “the great spiritual adventure of science”. It was unfathomable for me that scientists would allow their discoveries to be used for the principles underlying the basis for the construction of the bombs that were dropped on the cities of Hiroshima and Nagasaki.

That Robert Jungk’s story about Edwin Reischauer (who was the US Ambassador in my initial year at the university) “saving Kyoto” (Jungk, op. cit., p.178) was fiction did not make any impact on me, in my desire to study at Kyoto University; I was selfishly grateful that a city with its cultural traditions was “saved” from the tragic fate that befell Hiroshima and Nagasaki.

2. Seventy-five Years of ‘Uneasy’ (Nuclear) Peace

“...in order to keep that Japanese dog quiet in the Pacific.” -Churchill to Roosevelt, May, 1940.

I visited Hiroshima just before the 20th anniversary of the dropping of the first nuclear (fission) bomb, “Little Boy” in that city. Three years later, in the summer of 1968, just before the anniversary of the day the bomb was dropped, I visited—deliberately, but with sadness—the city of Nagasaki. These visits, among other things happening in the 1960s, changed my complacent view of physics, in particular, and science, in general, and their role in social development and consciousness. I was permanently disabused of the belief in the objectivity of the pure and applied sciences—even mathematics and logic.

The Cold War, the Chinese Communist Revolution of 1949, the Korean War, the Vietnam Conflict, the ‘external’ Indo-Pakistani rivalry that began with Partition and independence in 1947, Israeli-Palestinian/Arab conflicts), the deposing of Prime Minister Mohammad Mossadegh in Iran in 1953 and many of the ‘minor’ wars and conflicts in various parts of Asia, were all post-Second World War events, although the seeds may have been sown in the many pre-war years. Almost as a result, at least three (China, India and Pakistan) of the involved countries have become members of the “nuclear club”, and a fourth, Iran, may now embark upon the “adventure”. Many other countries have chosen—not without debate and discussion—to opt out of this club of weapons of nuclear-powered destruction (but all of them continued in the physics, and other scientific, nuclear research, in both pure and applied senses).

Therefore, it behoves us—the survivors, the contemporary observers and active participants of current events—to make a serious effort to understand at least recent history, if we are not to repeat “mistakes” and indulge in regrettable actions. Certain aspects of the tragic story of Hiroshima and Nagasaki, reflected in this the 70th anniversary of the first occasions of dropping nuclear bombs in fairly densely populated cities, is a sobering exercise. I think it is a case of the “Present as History” especially because the events are still “alive” in contemporary discussions of science and technology.

After the bombing of Hiroshima and Nagasaki: Robert Oppenheimer (in a light coloured hat) and General Groves (to Oppenheimer’s left), head of the Manhattan Project, at the site of the detonation of the first ever nuclear test (9 September 1945) | Wikimedia

It is, surely, possible to constructed alternative histories by means of counterfactual hypotheticals: had Hitler not invaded the Soviet Union, and tried to conquer Moscow, respecting the Molotov-Ribbentrop pact to the letter; had he also respected the Munich Declaration and the accord with Neville Chamberlain, had he been satisfied with the acquisition of the Sudetenland, had the Japanese not attacked Pearl Harbour, had Mussolini satisfied himself the way Franco did, would the Manhattan Project be implemented—let alone successfully—in the “race” to construct the bomb before Hitler (or, the fusion bomb before Stalin and the Soviet Union?).

The same counterfactual hypotheticals could be harnessed to wonder whether it was necessary for any of the other so-called nuclear powers, including India, Pakistan and, possibly Israel (and apartheid-dominated South Africa) to develop these nuclear potentialities of destructive capabilities. India, Pakistan and Israel— even Iran—are well-endowed with high-calibre physicists (and other scientists) who will develop the frontier of the pure and applied aspects of these subjects as parts of epistemological advances, entirely in the senses in which Bethe outlines it.

The art and science of promoting self-restraint, while allowing free reign for research in the fundamental aspects of all sciences has to be many-faceted, particularly institutional and organisational. Marxists would call it a means to bridge the gap between forces of production and relations of production but confine the analysis to the sphere of political economy. It leaves open the field of exploitation to unenlightened politicians like India’s Atal Bihari Vajpayee and Pakistan’s Nawaz Sharif. But they were pawns in a larger framework of research institutes developing nuclear programmes, over many previous regimes (and years), with the specific aims of producing weapons of mass destruction.

The self-restraint can be of a moral nature, but that is hard, if not impossible, to monitor. Therefore, the self-restraint has to be via treaties of a verifiable and observable nature, many of them depending on the goodwill and honesty of both autocratic and democratic regimes.
In 1986, I was invited, I think by mistake, to participate in the Summer Institute at the Ettore Majorana school of Theoretical Physics, in Erice, Sicily. Although ostensibly confined to questions of theoretical physics, part of the discussions seemed to be about restraint in the production of intercontinental ballistic missiles (ICBM) by the (then) Soviet Union and the United States. The discussions about the nature and scope of the treaty reached an impasse when Professor Antonio Zichichi made the second mistake! He called upon me to try to tell a story in an attempt to break the impasse. In a moment of inspiration I narrated the story from the Mahabharata of the death of the warrior Karna, at the hands of Arjuna while he struggled to lift the wheels of his chariot, with Arjun and his charioteer Krishna refusing to heed Karuna’s call to stay the battle in accordance with the code of valour. I spoke of how earlier when Karna unleashed his most powerful weapon at Arjuna, Krishna had the chariot lowered into the ground so that missile pierced Arjuna’s helmet and not his body.

My point was that the “umpire” knew the potentials of both parties and he was able to nullify the effects of their powers, but without falsifying them!

The physics, chemistry, the quantum versions of them as well as most of the other pure and applied sciences (including mathematics and logic) of the underpinnings of the building, testing and manufacture of nuclear material, especially ingredients that go into the production of bombs, are reasonably well-known to those employed in various institutions, especially in so-called industrially advanced countries. But with India, Pakistan and smaller countries like Israel, North Korea, and, in the recent past even Libya, possessing or near to possessing nuclear weapons, the concept of “advanced countries” is, to say the least, ambiguous.

The immediate motivation for broaching this difficult subject, one which has ‘festered’ in my mind for over half-a-century—was my visit to Hiroshima in the summer of 1965, Nagasaki at about the same time in 1968 and the understandings of the message of, at least, part of the Bhagavad Gita, I feel that one of the ways to monitor, in a verifiable and observable way, and achieve a modicum of success, is by developing a model of a mutually destructive potential due to nuclear power as a two-person, finite, full-information, game which can be implemented. Such a modelling strategy gives full scope for a ‘neutral’ umpire (of course, independent of institutions like the United Nations, Organisation for Economic Cooperation and Development and so on).

3. By Way of a Conclusion

“The stars are dead. The animals will not look. We are left alone with our day, and the time is short, and History to the defeated May say Alas but cannot help nor pardon.” - Wystan Auden

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Many of us do not want to ‘become Death’ or be ‘destroyer of worlds.’

In the tortured, morally troubled, mind of Robert Oppenheimer, as he witnessed the detonation of the nuclear bomb, on 16 July 1945, he is supposed to have uttered these lines from the Bhagavad Gita: ‘Now I am become Death, the destroyer of worlds.’

The immediate motivation for broaching this difficult subject, one which has ‘festered’ in my mind for over half-a-century—was my visit to Hiroshima in the summer of 1965, Nagasaki at about the same time in 1968 and the stay in India when, under the BJP government of the time, it too, entered the ‘nuclear club’ (to be followed by its neighbour, Pakistan), both of them doing so in 1998.

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Write to editor@theindiaforum.in

References:

Tags: Hiroshima Nagasaki Nuclear Bomb Nuclear Nuclear Power Science Physics Research Little Boy Robert Oppenheimer
nuclear disarmament. They expressed anger over what they said was the Japanese government's reluctance to help and listen to those who suffered from the atomic bombing.

Einstein's letter was dated 2 August 1939 and was delivered to President Roosevelt on October 11, 1939. Sadium, famously, came around to be the Reluctant Father of The Atom Bomb (Haldás & Haldás, 1974), but I would add 'the reluctant physicist (or scientist) father.'

This discussion between Moeller and Hurley should be read soberly and in its entirety, to understand the scope of the Manhattan Project, and its later impact of city structure, human behaviour and much else.

As Halpern, in his excellent birth centennial note on Feynman states: “His Nobel-prize-winning work on quantum electrodynamics included methods that even he saw as a sleight-of-hand for removing infinite terms from calculations. Yet, his results — equivalent to more systematic, rigorously expounded mathematical techniques independently proposed by co-laureates Julian Schwinger and Sin Itiro Tomonaga — matched atomic-physics data beautifully” (Halpern, 2018, p. 164).

It was not until the late 1980s that I read Reischauer’s own statement about Jungk’s mythical claim: “I probably would have done this [i.e., saved Kyoto] if I had ever had the opportunity, but there is not a word of truth to it. As has been amply proved by my friend Otis Cary of Doshisha in Kyoto, the only person deserving credit for saving Kyoto from destruction is Henry L. Stimson, the Secretary of War at the time, who had known and admired Kyoto ever since his honeymoon there several decades earlier.” (Reischauer, 1986. P. 101)

See the opening quote.

The Kim dynasty in North Korea may have concentrated on nuclear development of weapons of destruction, with little attention to freedom in the research of the fundamental sciences.

The next morning I was the subject of the reports, all positive, in most of the leading dailies in Italy, of doing my part to ‘ridicule the assumptions of the two hostile parties’ (my intention was not to ridicule their assumptions, but to point out the role of the knowledge of the umpire).

I want to avoid any invoking of the axiom of choice, the law of the excluded middle and any reliance of proof by contradiction. The hypothesis of finiteness does not restrict the size of the prefix normal forms (alternating quantifiers) involved in implementing such games.

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Notes

1. Quoted in Sime (1996), p.305; Italic in the original. I was unable to find out, in this book, exactly when Lise Meitner opined thus, but it may have been in 1943 (ibid, p. 305), when she “was asked to join a group of British scientists, including Otto Frisch, who were bound for Los Alamos to work on the atomic bomb.”

2. Einstein's letter was dated 2 August 1939 and was delivered to President Roosevelt on October 11, 1939. Sadium, famously, came around to be the Reluctant Father of The Atom Bomb (Haldás & Haldás, 1974), but I would add 'the reluctant physicist (or scientist) father.'

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6. See the opening quote.

7. The Kim dynasty in North Korea may have concentrated on nuclear development of weapons of destruction, with little attention to freedom in the research of the fundamental sciences.

8. See The Washington Post article of 30 September 2019 by David Nakamura (which is also relevant for the observation in the previous footnote)

9. The next morning I was the subject of the reports, all positive, in most of the leading dailies in Italy, of doing my part to ‘ridicule the assumptions of the two hostile parties’ (my intention was not to ridicule their assumptions, but to point out the role of the knowledge of the umpire).

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