

Nuclear Power, Before It Was New

A large, iconic nuclear mushroom cloud explosion is shown against a dark sky. The cloud has a bright, glowing orange and yellow core that tapers into a thick column of white and grey smoke, which then spreads out into a wide, flat, white cloud at a high altitude. The ground below is dark and appears to be a flat, open landscape, possibly a desert or a coastal plain, with some faint structures visible in the distance. The overall scene is dramatic and powerful, capturing the scale of nuclear energy.

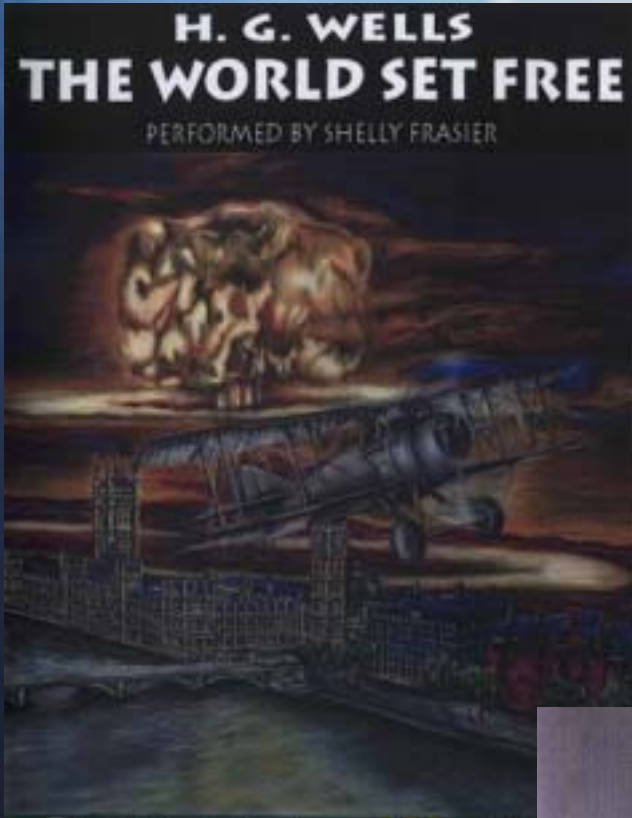
Professor Mark Brake, *Science Communication
Research Unit, University of Glamorgan*

Dawn of C20th



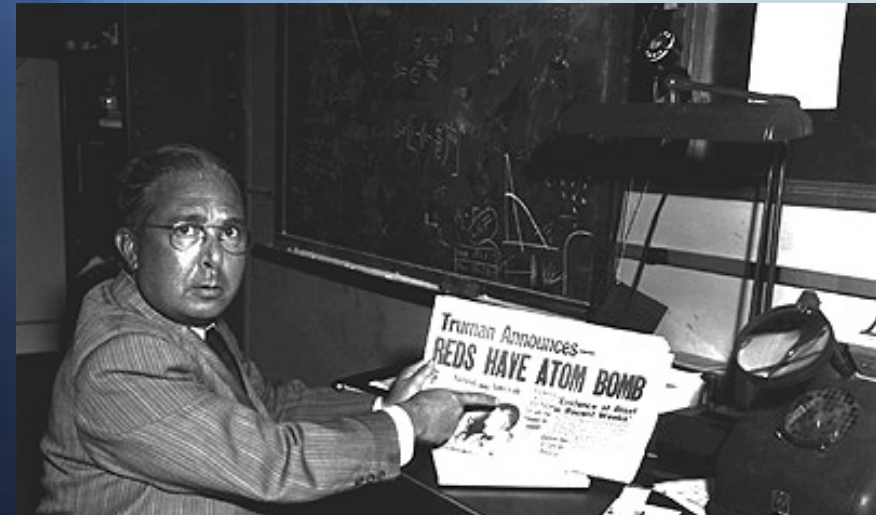
- *Thomas Chamberlin: atoms are seats of enormous energies*
- *Rutherford and Soddy: trusted nature to 'guard her secret'*
- *HG Wells begged to differ*

HG Wells



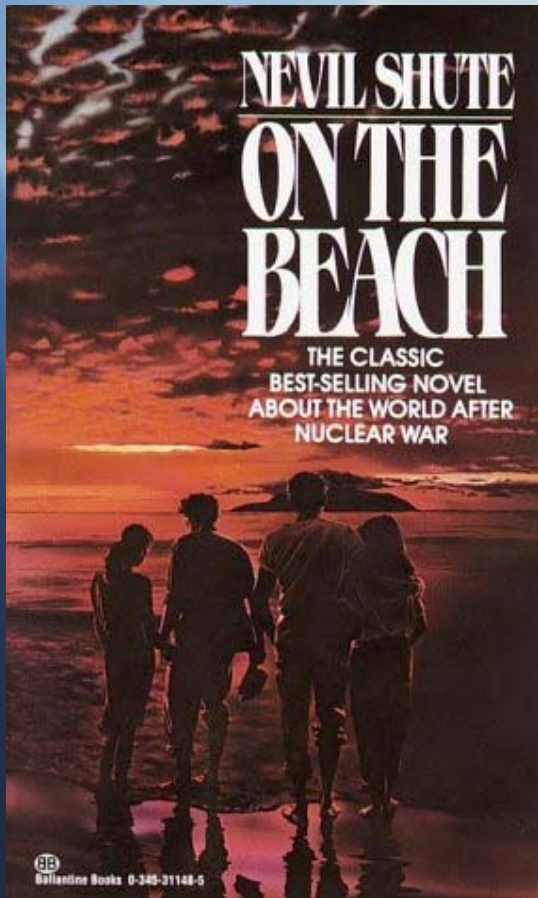
- *Wells' 1914 novel, The World Set Free*
- *Book christens the term 'atomic bomb'*
- *The weapons portrayed are truly nuclear*
- *Intelligent and prescient*

Leo Szilárd



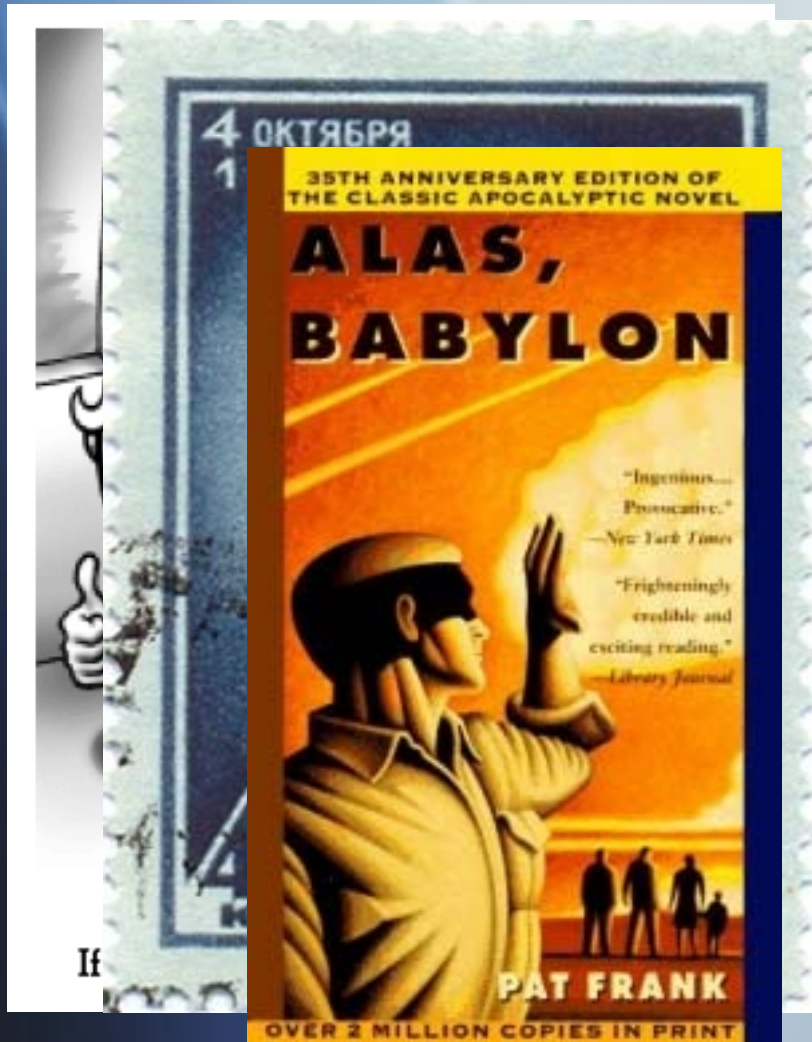
- *Jewish-Hungarian émigré physicist*
- *Wanted to negotiate a nuclear future*
- *Influenced by Wells*
- *Patented nuclear chain reaction*
- *Einstein-Szilárd letter*

‘On the Beach’



- *Linus Pauling: “some years from now we can look back and say that ‘On The Beach’ is the movie that saved the world”*
- *The movie was so popular, Eisenhower’s Cabinet drew up a reply*

'Nuclear Paranoia'



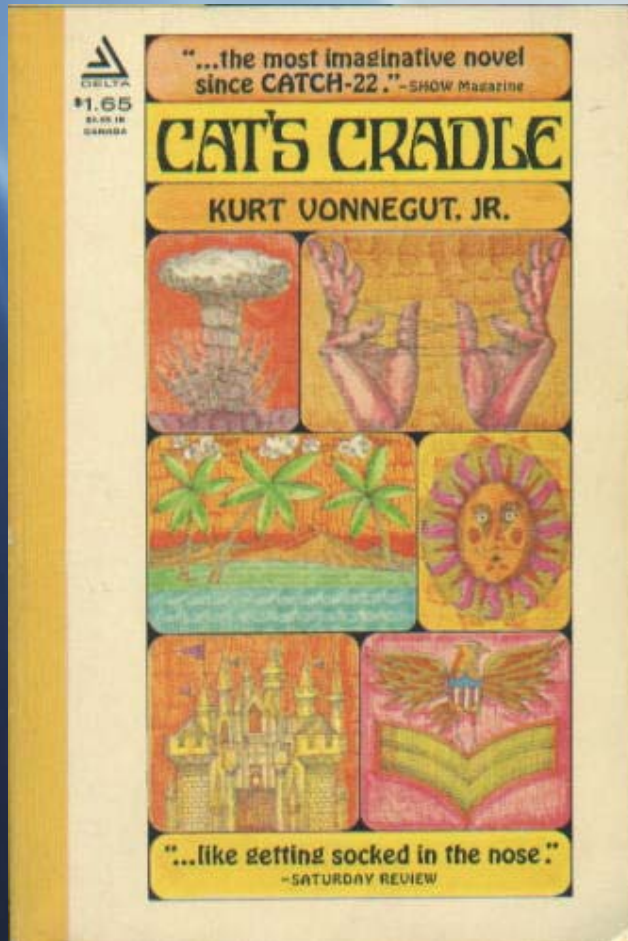
- *The 'Duck and Cover' campaign*
- *Sputnik paranoia, 1957*
- *Pat Frank's 'Alas, Babylon', 1959*
- *Civil Defence authorities used Frank's book*

Kurt Vonnegut



- *Firebombing of Dresden*
- *Slaughterhouse Five, 1969*
- *“People were trying to re-invent themselves and their universe. Science fiction was a big help”*

'Cat's Cradle'



- *Vonnegut's 1963 anti-Bomb novel*
- *Dyson and Oppenheimer*
- *'Felix Hoenikker'*
- *No experts on winning nuclear wars*

Karl Guthke, 'The Last Frontier'



- *“Science Fiction is in fact a special form of philosophical literature that allows a writer grappling with the philosophical questions thrown up by scientific advances to extrapolate more boldly and give more rein to his imagination than those who write only as physicists are able to do”*

Leonard Isaacs, 'Darwin to Double Helix'



- *“The creative morphing of scientific ideas into symbols of the human condition, is often an unconscious and therefore particularly valuable reflection of the assumptions and attitudes held by society. By virtue of its ability to project and dramatise, science fiction has been a particularly effective, and perhaps for many readers the only, means for generating concern and thought about the social, philosophical and moral consequences of scientific progress”*

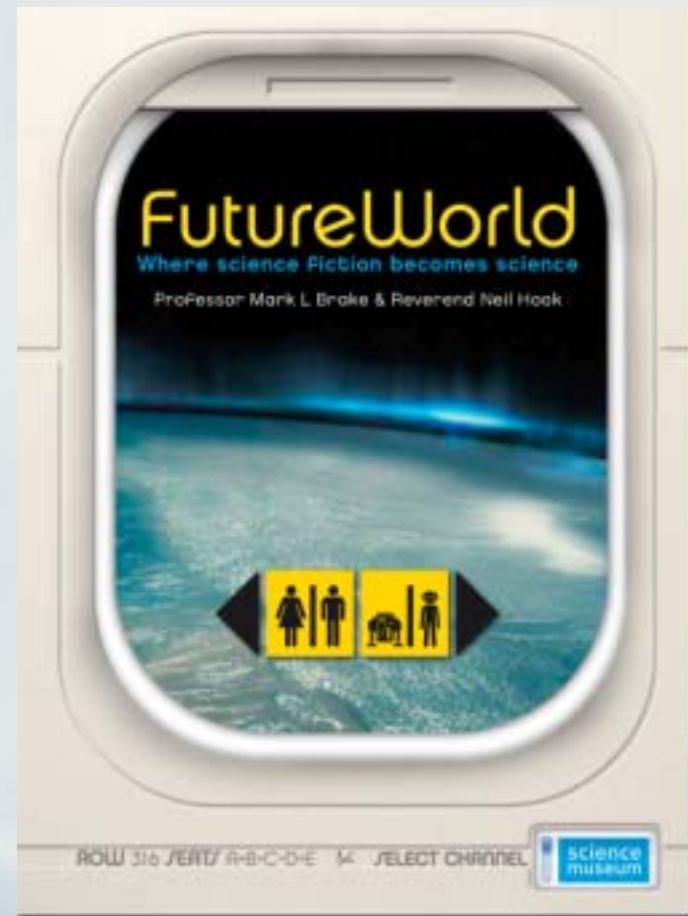
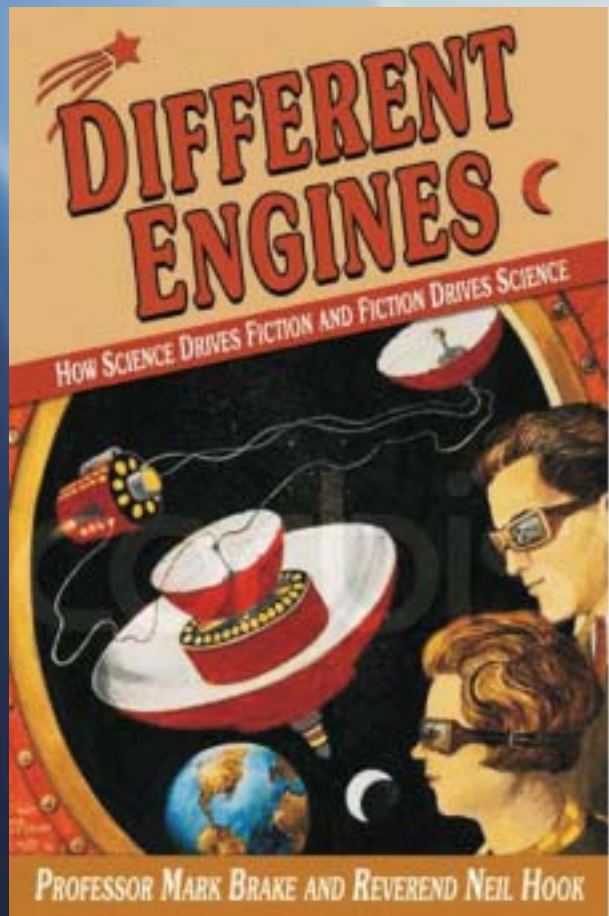
The Taste and Feel of Science



- *“If the labours of men of science should ever create any material revolution, direct or indirect, in our condition, and in the impressions which we habitually receive, the poet will then sleep no more than at present, but he will be ready to follow the steps of the man of science, not only in those general indirect effects, but he will be at his side, carrying sensation into the midst of the objects of the science itself”*

William Wordsworth

Further Reading



Nuclear Power, Before It Was New: The Role of Fiction in the Development of the Nuclear Age

I'm going to focus my presentation on the role that fiction played in negotiating nuclear power in the first half, or so, of the twentieth century. In particular, I'd like to look at the way in which literature seems to have anticipated some of the implications of that power before physicists themselves.

Firstly, my reason for suggesting that the questionable credit for creating nuclear arms and foretelling Armageddon belonged not to physics, but to fiction, lies mainly in the first four decades of the C20th. For almost half a century, nuclear weapons were to be found only in the pages of pulp fiction. And fiction has since been inextricably linked with the threat of real nuclear war.

Secondly, and more contentiously, I'd also like to suggest that the atom bomb which exploded over Hiroshima in 1945 was invented by HG Wells.

I think there's little doubt that, by the first light of the twentieth century, it was clear that some form of atomic energy must be responsible for powering the Sun and the stars. In 1899 American geologist Thomas Chamberlin had reasoned that atoms were "*seats of enormous energies*" and that "*the extraordinary conditions which reside in the centre of the Sun may ... set free a portion of this energy*".

The consensus in physics was that, although this nuclear energy may be potentially lethal, it would never be possible to control its release. The nuclear physicist Ernest

Rutherford is alleged to have said, "*some fool in a laboratory might blow up the universe unawares*". And Rutherford's co-worker, Frederick Soddy, trusted nature to 'guard her secret'.

HG Wells begged to differ.

Wells' 1914 novel *The World Set Free* led non-stop to the launch of the Manhattan Project. The book features the building of what Wells here christens the 'atomic bomb', "*...And these atomic bombs which science burst upon the world that night were strange, even to the men who used them*". Wells was aware that the Holy Grail of the atom offered the opportunity for great good or sheer evil.

On the eve of the First World War, Wells presented an ill-omened vision of future warfare. The book foresaw a holocaust where some of the world's key cities are annihilated by small atomic bombs dispatched from airplanes. This is no mere guesswork. The weapons portrayed are truly nuclear; Einstein's equivalence of matter converted into fiery and explosive energy, triggered by a chain reaction.

There had been earlier super-weapons in pulp fiction. But they had fallen prey to cliché; the naïve notion that the tangential mind of a single genius could change the course of history. Human problems could be solved by the techno-fix of a scientific miracle. Wells was wise enough to realise that the level of technical advance does not come from the know-nothing notion of genius. It comes from the dialectic between nations and their productive forces. Wells here predicted the emergence of the military-industrial complex.

His schedule for the development of nuclear capability is astoundingly accurate. In *The World Set Free*, the 1950s scientist who uncovers atomic energy feels, "like an imbecile who has presented a box of loaded revolvers to a crèche". Wells' fictional physicist

realised there was no going back. The fictional scenario portrayed by Wells was very prescient indeed. After the factual Bomb was used, Wells' remarks were later echoed by Robert Oppenheimer, who spoke for many physicists when he declared, "In some sort of crude sense which no vulgarity, no humour, no overstatement can quite extinguish, the physicists have known sin; and this is a knowledge which they cannot lose."

In Wells' book, global tensions become menacing, with governments "spending every year vaster and vaster amounts of power and energy upon military preparations, continually expanding the debt of industry to capital".

Wells was a great influence on Orwell, whose Cold War classic vision in *1984* was one of a world living in the shadow of the Bomb. Orwell's dystopia was one where superpowers colluded in a tacit agreement never to use the superweapon. Each superpower is evidently the archenemy of the other two. But the truth is different. In fact the power blocs "prop one another up, like three sheaves of corn". When the Iron Curtain finally fell, Orwell's account of the politics of power blocs seemed incredibly perceptive.

But it was Wells' fictional Bomb that led straight to Hiroshima.

His visionary novel was the guiding inspiration for the brilliant Hungarian physicist Leo Szilárd. After reading *The World Set Free* in 1932, Szilárd became the first scientist to seriously examine the science behind the creation of nuclear weapons. "The book made a very great impression on me", Szilárd recalled. Thirty years later he still remembered Wells' anticipation of a nuclear future:

" ... a world war ... fought by an alliance of England, France, and ... America, against Germany and Austria, the powers located in the central part of Europe. [Wells] places

this war in the year 1956, and in this war the major cities of the world are all destroyed by atomic bombs”.

Now Szilárd was a survivor of a devastated Hungary. He was a lasting humanitarian, with a passion for the freedom to communicate ideas. Wells’ book echoed in Szilárd the need to negotiate a nuclear future, one which could save mankind, “only through the liberation of atomic energy could we obtain the means which would enable man not only to leave the Earth, but to leave the solar system”.

A year after reading Wells’ book, Szilárd fled to London to escape Nazi persecution. There he read an article in *The Times* by Rutherford, who was still rejecting the idea of using nuclear energy. A legendary quick thinker, Szilárd was so incensed at Rutherford’s dismissal that he dreamt up the idea of the nuclear chain reaction while waiting for traffic lights to change on Southampton Row in Bloomsbury, London. One year later he filed for a patent on the concept.

Influenced by Wells, Szilárd became the driving force behind the Manhattan Project. It was Szilárd’s idea, along with Einstein, to send the confidential letter in August 1939 to Franklin D Roosevelt outlining the possibility of nuclear weapons. An allied bomb might not be superior to a Nazi Bomb, but Szilárd was looking for deterrence not discord.

He was to be disappointed, of course. Though Szilárd led a petition, signed by 70 Chicago scientists, urging President Truman to demonstrate the Bomb, not use it against cities as in *The World Set Free*, Wells’ nightmare became factual terror over Japan.

So much for Szilard’s humanitarian atom bomb. Nuclear capability became a MAJOR issue, and Los Alamos marshalled a project with double potential. A weapon with which to win the war, and a weapon with which to win the peace in the post-war world. A world in which the politics of the twentieth century would be newly negotiated.

Such was the climate of the Cold War, a phrase coined by George Orwell in his 1945 essay, *You and the Atomic Bomb*. In Orwell's words, "We have before us the prospect of monstrous super-States, each possessed of a weapon by which millions of people can be wiped out in a few seconds, dividing the world between them."

But fiction not only helped build the Bomb. It helped come to terms with living under its shadow. The future wasn't what it used to be. Gone WERE the monorails, gone was the silver suits, and gone were the generation starships of pulp fiction. In their place were catastrophe, and the ominous image of the thermonuclear mushroom.

The first Soviet Bomb was exploded in 1949. The Americans had believed themselves to be invincible in the aftermath of the war. So when Moscow entered the atomic age, Washington was stunned. There was a growing international tension between superpowers equipped with the H-bomb, and the post-apocalypse world became a staple fixture in fiction.

Into this increasingly tense environment came the first film to take a serious look into the post-nuclear future. Stanley Kramer's *On the Beach* was adapted from Nevil Shute's novel of the same name. The book was a worst-case post-apocalyptic picture. Shute's novel was based on the principle that fallout knows no boundaries, and that nuclear devastation will be complete.

It got a mixed reception. Nobel Prize winning chemist Linus Pauling suggested that, "in some years from now we can look back and say that *On The Beach* is the movie that saved the world". Pauling himself went on to win the Nobel Peace Prize in 1962 for his crusade against nuclear testing.

Nuclear physicist Edward Teller disagreed. He said that "Shute's elimination of any

practical attempt to survive is frightening because it corresponds with the attitude of the overwhelming majority of our people". Indeed, the movie was so massively popular that Eisenhower's Cabinet discussed ways of replying to its message.

Mass media campaigns on the question of nuclear conflict made a message of survivability the dominant one. US propaganda contained only a positive message; practical measures to be taken in the event of a nuclear attack. The infamous Duck and Cover campaign was a case in point; perhaps only serving to increase the sense of paranoia.

Neville Shute's *On The Beach* was the most famous of the 1950s anti-Bomb movies. It was greatly publicised, much debated, and very effective propaganda for the anti-nuclear lobby. When Sputnik was launched in October 1957, shock waves were felt across America, and future fiction hit far harder.

Helen Clarkson's *The Last Day* (1959) exposed the sheer futility of civil defence measures, and won significant support in the US. The approval of Senator Clinton Anderson, Chairman of the Congress Joint Committee on Atomic Energy, adorned the book's cover. Having charged the AEC for years with secreting details on the dangers of fallout, Anderson praised the novel for injecting "a little diet of realism" into the nuclear debate.

Clarkson's book was a timely remedy to the chronic survivalist narratives of the decade. Pat Frank's *Alas, Babylon* (1959) was typical. Frank's book was notorious for depicting nuclear war as essentially winnable. *Alas, Babylon* is laden with the piety of US civil defence propaganda. The family will stay as society's nucleus and the house its refuge. Frank's novel presents the post-apocalypse as severe but survivable. The government continues to run the areas uncontaminated by fallout, while helping survivors in 'contaminated zones'. Indeed, the US Government was so impressed with

the power of Frank's propaganda that Civil Defence authorities used the book to guide local officials in ordering provisions in the event of a real nuclear attack.

As the anti-nuclear campaign grew apace, many felt that fiction was alone in its ability to project ways out of the predicament. It became the means by which a mass audience was confronted with the possibility of holocaust and mutually assured destruction. Fiction had been partly instrumental in the development of the apocalyptic threat. Now it was time fiction helped bail us out.

One of the most significant contributions came from American writer, Kurt Vonnegut. Vonnegut was witness to the senseless slaughter of 135 000 people in the wanton British firebombing of the city of Dresden in 1945. He'd spent a quarter of a century trying to come to terms with such outrageous carnage, and finally faced his Dresden demons in his late sixties novel, *Slaughterhouse Five*.

Vonnegut himself used science fiction to confront the growing horrors of the twentieth century. As he put it, people were "trying to re-invent themselves and their universe. Science fiction was a big help." Perhaps if his readers could stand the unreality of science fiction, they could face a little bit more reality *after* reading his books than they could *before* they read it; "everything there was to know about life was in *The Brothers Karamazov*, by Dostoevsky. But that just isn't enough any more."

Vonnegut's 1963 anti-Bomb classic, *Cat's Cradle*, confronts the increasing possibility of the wiping out the world through human folly. The book critically questions the social responsibility of scientists.

On his last visit to Los Alamos, Austrian journalist, Robert Jungk, had told of his encounter with a mathematician, "His face was wreathed in a smile of almost angelic

beauty. He looked as if his gaze was fixed upon the world of harmonies. But in fact he told me later that he was thinking about a mathematical problem whose solution was essential to the construction of a new type of H-Bomb". For this true-life scientist, who never observed a single explosion of the bombs he helped detonate, "research for nuclear weapons was just pure mathematics, untrammelled by blood, poison or destruction". And as Italian physicist Enrico Fermi famously said, "Don't bother me about your scruples. After all, the thing is beautiful physics".

Vonnegut's response in *Cat's Cradle* is a comic portrayal of scientists stripped of all moral responsibility. The main problem, according to Vonnegut, was not unrestrained technology, but the failure to be fully human that is especially dangerous. English physicist Freeman Dyson had suggested that "scientists rather than generals took the initiative in getting nuclear weapons programs started", and that they were "motivated to build weapons by feelings of professional pride as well as of patriotic duty" rather than strategy.

Dyson also acknowledged the draw of nuclear physics, "I have felt it myself, the glitter of nuclear weapons. It is irresistible if you come to them as a scientist. To feel its there in your hands – to release this energy that fuels the stars – to lift a million tons of rock into the sky", he felt was, "partly responsible for all our troubles".

And in Robert Oppenheimer's words, "when you see something that is technically sweet you go ahead and do it ... that is the way it was with the atomic bomb. I do not think anybody opposed making it; there were some debates about what to do with it after it was made".

H-Bomb pioneers such as Dyson and Oppenheimer are the butt of Vonnegut's satire. In *Cat's Cradle* a Felix Hoenikker is the 'the father of the atom bomb'. And the novel

presents the contrasting options that faced such scientists. After a test detonation of the Bomb, a physicist turns to Felix Hoenikker and says 'science has now known sin', a clear reference to the celebrated Oppenheimer quote. Hoenikker's ingenuous response was to ask, "What is sin?" In great contrast, once the Bomb is dropped on Hiroshima, another scientist announces he is quitting because "anything a scientist worked on was sure to wind up as a weapon, one way or another", and that he "didn't want to help politicians with their fugging wars anymore".

Hoenikker is a social imbecile, a solipsistic 'genius' who cares nothing for the applications of his research. Irresponsible in family matters as well as professional ones, the widower Hoenikker is looked after by his daughter who dresses him, along with her little brothers, each morning, "only we were going to kindergarten, and Father was going to work on the atomic bomb".

Later, Felix Hoenikker becomes so absorbed with turtles that he stops working on the Bomb. Anxious Manhattan Project officials pay a visit to his daughter, desperate for advice. Take away the turtles, is her simple solution. Indeed, the mind of this eminent research physicist is so puerile that he "came to work the next day and looked for things to play with and think about, and everything there was to play with and think about had something to do with the atom bomb".

Cat's Cradle is a comic portrayal of a scientist stripped of all moral responsibility. Felix Hoenikker is a cultural Neanderthal. Sealed off in his research lab, and never having read "a novel or a short story in his life", he simply cannot imagine the brunt of his 'technically sweet' dabbling on flesh and blood humans.

In contrast, Robert Oppenheimer was famed for his erudition and his intimate knowledge of literature and scripture. His collusion in the Bomb culture is even more

disturbing. "If scientists as sensitive as Oppenheimer can indeed wall off their moral sensibilities so completely and successfully", wrote Philip M Stern, "then technology is an even more fearsome monster than most of us realise".

Cat's Cradle drops a fictional H-bomb on technocracy. The novel also blasts the tendency to make mindless Felix Hoenikkers expedient scapegoats. In condemning the complicity of physicists and politicians, the reader may fail to recognise their own responsibility. Vonnegut understands there are no experts on nuclear negotiation. No real experts on strategy, tactics or deterrence. And no experts on winning nuclear wars. Only by becoming engaged in the debate can we act as responsible humans in the nuclear age.

CONCLUSION

In conclusion, I think that the example shown in the relationship between nuclear fiction and physics, shows that literature has much to offer in negotiating new sciences. Historically, science fiction in particular could be considered a response to the cultural shock created by the sense of wonder, or estrangement, we feel from new realities, as unveiled by science and technology. Estrangement implies a state of imperfect knowledge, the result of coming to understand what is just within our mental horizons.

As the American scholar, **Karl Guthke** suggests, (*The Last Frontier: Imagining Other Worlds, from the Copernican Revolution to Modern Science Fiction*):

"Science Fiction is in fact a special form of philosophical literature that allows a writer grappling with the philosophical questions thrown up by scientific advances to extrapolate more boldly and give more rein to his imagination than those who write only as physicists are able to do".

And similarly from Leonard Isaacs (*Darwin to Double Helix: the Biological Theme in Science Fiction*):

“The creative morphing of scientific ideas into symbols of the human condition, is often an unconscious and therefore particularly valuable reflection of the assumptions and attitudes held by society. By virtue of its ability to project and dramatise, science fiction has been a particularly effective, and perhaps for many readers the only, means for generating concern and thought about the social, philosophical and moral consequences of scientific progress”.

Finally, there’s an interesting quote from **William Wordsworth**. Most mainstream fiction since the Renaissance has been unconcerned with the nonhuman world revealed by science. Poetry had little to do with the laws of physics. But for the Romantics, and for science fiction, a dialogue with the nonhuman is the key concern. Wordsworth’s interest in science, is much like the science fiction that was to follow:

“If the labours of men of science should ever create any material revolution ... in our condition ... the poet will then sleep no more than at present, but he will be ready to follow the steps of the man of science, not only in those general indirect effects, but he will be at his side, carrying sensation into the midst of the objects of the science itself.”

Trying to best express, “the taste, the feel, the human meaning of scientific discoveries”, is how science fiction works. I think SF has been a provocative and compelling touchstone of the dialectic of science and progress. It has presented a mode of thinking whose discourse is the reducible gap between the new worlds uncovered by science, and the fantastic strange worlds of the imagination.