

INFERTILITY IN SCIENCE FICTION AS A CONSEQUENCE OF WARFARE

Victor Grech
with Clare Thake-Vassallo & Ivan Callus

“There is a dark side: new science can have unintended consequences”
—Martin Rees¹.

Warfare is an indissoluble aspect of humanity, and is an equally indissoluble part of mythology. Greek mythology is replete with strife between the gods themselves, allegories of human strife, and the most epic aspects were the succession myths, with the primordial couple Gaia and Ouranos overthrown by the Titans, who were, in their turn, overthrown by the Olympians.²

Warfare is a common trope in all branches of fiction, including science-fiction (SF), and the old pulp magazines were replete with such stories, narratives that featured exotic weapons and that often had Faustian implications, with devastating consequences. Military organisations take technological advances very seriously, as several military works show,³ to the extent that the ‘line between science and science fiction [...] has never been totally clear. Today, as the military researches everything from death rays and force fields to Zen and ESP looking for military applications [...] that line certainly isn’t getting any clearer’.⁴

One of the earliest and most famous SF novels dealing with atomic warfare was Herbert George Wells’s *The World Set Free* (1914),⁵ which prefigures the misuse of atomic energy as a weapon of mass destruction. Wells was cognizant of the fact that technological development would lead to such deadly weapons as ‘[t]he history of mankind is the history of the attainment of external power. Man is the tool-using, fire-making animal’.⁶ Hence his statement seems strangely prescient:

Certainly it seems now that nothing could have been more obvious to the people of the earlier twentieth century than the rapidity with which war was becoming impossible. And as certainly they did not see it [...] until the atomic

bombs burst in their fumbling hands [...] All through the nineteenth and twentieth centuries the amount of energy that men were able to command was continually increasing. Applied to warfare that meant that the power to inflict a blow, the power to destroy, was continually increasing [...] There was no increase whatever in the ability to escape [...] Destruction was becoming so facile that any little body of malcontents could use it [...] Before the last war began it was a matter of common knowledge that a man could carry about in a handbag an amount of latent energy sufficient to wreck half a city.⁷

SF authors were more hopeful about the misuse of nuclear power, and crafted stories wherein

the sheer size of the forces nuclear power was expected to place at human disposal became a metaphor for the nearly magical fashion in which heroic scientists could overcome the inconvenient laws of nature and get spaceborne cowboys out to the endless frontier of intergalactic space.⁸

However, the potentially disastrous consequences of uncontrolled technology was also highlighted in stories such as Heinlein’s *Blowups Happen* (1940),⁹ which illustrates ‘hopes invested in the salaried but nonetheless independent and idealistic engineers whose initiative is separate from company policy or the pursuit of profit’.¹⁰

More recently van Vogt’s *Slan* (1946)¹¹ and Asimov’s

Foundation (1951)¹² used nuclear energy copiously, without inflicting mass destruction. But quite tellingly, of the many pre-Hiroshima narratives dealing with nuclear energy in contemporary settings, only Heinlein's *Solution Unsatisfactory* (1941) dealt with nuclear weapons, wherein military scientists developing weapons-grade radioactive dust are continually exposed to radiation.¹³

Warfare can be nuclear, biological, chemical or cyberwarfare. And it is abundantly clear that the entire corpus of work dealing with warfare and SF is too vast to be discussed. Reginald Bretnor has made inroads into this lacuna with three anthologies that assemble both fiction and essays with regard to potential future trends in warfare of all types.¹⁴

Furthermore although the author of this paper is a medical doctor, even the health aspects are too great to realistically discuss in one paper. Hence, only the intersection of infertility in warfare within the genre will be analysed. The approach will be thematic, and will attempt to list and taxonomise all narratives that deal with infertility inflicted by warfare in the SF.

Many of the narratives now appear dated with entirely new ways of waging warfare that were too far-fetched for 'that Buck Rogers stuff', such as electronic warfare,¹⁵ since for the 'present and for the foreseeable future, electronic systems serve and will continue to serve as the foundation of systems for the control of forces and weapons [...] in all branches of the armed forces'.¹⁶

What follows is a brief reading of key texts, a necessarily concise exercise due to the multitude of narratives that have delved into this intersection.

INFERTILITY AFTER NUCLEAR WAR

The setting off of the atomic bombs at Hiroshima and Nagasaki had unintended consequences for SF.

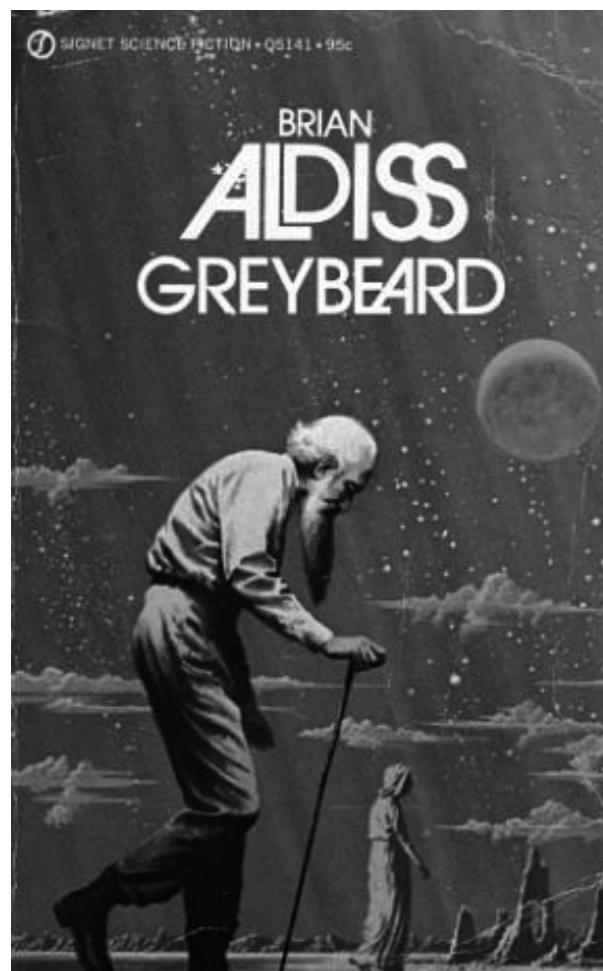
The writers of pulp-magazine science fiction found themselves in an ambivalent position [...] acknowledged as prophets proven right by the course of events. Some of them began new careers as writers of popular science and as consultants and participants in government- and university-sponsored seminars on social and technological change.¹⁷

Financial gains were also present as

[e]ven those who remained close to their roots in magazine fiction found themselves newly prosperous as [...] For the first time, mass-circulation magazines [...] began to publish stories [...] previously confined to the genre pulps, [with] higher rates paid by such magazines, together with reprint royalties from the SF anthologies rushed into print by eager publishers.¹⁸

The biological effects of radiation on fertility are very real, as with increasing doses, individuals first experience temporary sterility, followed by permanent sterility.¹⁹ Indeed, space travel itself is probably hazardous even for the developing fetus, as ambient space radiation levels may result in the production of infertile female babies.²⁰

It is logical to commence this reading with Brian Aldiss's *Greybeard* (1964)²¹ as he deals with the ultimate



dystopian scenario: total global sterility. The novel was written in 1964 and not only portrays the cold-war tensions of the time, but also uses them as a springboard to lead to the cause of human infertility: nuclear bomb testing progressively contaminating the Earth, with radioactivity adversely influencing the entire animal kingdom. As if this were not enough, the first of man's forays in space – by both the 'West' and by the communist block countries – were used to test nuclear weapons in orbit. Aldiss was almost certainly influenced by the then ongoing United States atomic bomb testing in 1958, which included Operations 'Argus' and 'Fishbowl', rocket launched airburst explosions in the Pacific.²²

Aldiss narrates that the ensuing massive explosions caused the van Allen radiation belts²³ to be thrown into an unusual state of violent activity, causing their contraction on two rapidly successive occasions, ducking the biosphere twice in hard radiation, an unforeseen consequence with extremely deleterious effects on all biological organisms. In the short term, pregnant women miscarried or carried deformed fetuses to term and acute radiation sickness was common. Radiation sickness affected the younger age groups more severely and ranged from a mild, flu-like illness in adults to death, especially in the childhood age group. The novel commences with the youngest human aged fifty years, and the vicissitudes of old age and the inevitable degeneration of civilisation are repeatedly and realistically highlighted. The novel ends with the discovery that a few children are being born since the excess ambient radioactivity had been 'absorbed' by soil, and that women – in a very biblical matriarchal manner as the youngest women are

now in their sixties – can suddenly begin to conceive and bear children.

In SF, post nuclear war infertility dystopian scenarios are not uncommon, and in Harry Harrison's *The Committed Men* (1971) where a future Britain is awash with radioactivity, sterility is common, and the protagonists, a doctor and several companions, attempt to deliver a mutant baby to a group of its own, similar kind, the likely successors of ordinary humanity.²⁴ Broderick has noted this specific theme, leading to the creation of a 'Homo nuclearus', a

recurring genre ploy associated with the long term effects of nuclear war questions not only how the human species will survive but also in what form [...] the theme of radiation mutation on human and animal life over the years-some suggesting that deliberate experimentation would make it possible to breed a race capable of survival in the hostile post-holocaust environment.²⁵

In Octavia Butler's *Dawn* (1988), aliens save a human race devastated by a nuclear war through a program of interbreeding,²⁶ despite the extremely low probability of this possibility ever coming to pass.²⁷ The alien 'Oankali' continually seek partner species with whom to intermingle their own genes. This is because the Oankali have managed to evolve specialized organs and subcellular structures with which to manipulate their own genes along with genes assimilated from other species, in order to maximize fitness in different environments and in their own special environment, a self-sustaining starship which is itself a living organism. However, the Oankali tend to repeatedly engineer themselves into an evolutionary dead end, losing all genetic diversity and therefore the ability to adapt to changes, and they recover this diversity by interbreeding with entirely new species.²⁸ They therefore offer to nurse the survivors back to health and intermarry and interbreed with the humans so as to allow humanity to survive, albeit in half-alien and half-human form.

A battle in space between humans and aliens in Blish's *A Life for the Stars* (1962) leads to radiation exposure of an entire flying human city, with an initial sterility-inducing dose of radiation followed by a lethal dose of radiation.²⁹ Brinkley's *The Last Ship* (1988) is set in a closer future after a nuclear war, with the crew of a United States Navy guided missile destroyer attempting to re-establish humanity and facing a poor success rate due to the high doses of radiation that the crew had to contend with.³⁰

Forced long-term underground shelter after a nuclear war is also depicted as causing sterility among men in the film *World Without End* (1956),³¹ and an equivalent state of affairs is portrayed in Pangborn's *The Company of Glory* (1975), where humanity struggles to survive with very decreased fertility and a high rate of birth mutations following a third world war,³² as well as in Robert's *Molly Zero* (1977).³³ The erroneous belief that high levels of ambient radioactivity would generate a common set of mutation/s that would ensue in entirely new species that would be adapted to radioactivity is perhaps most famously mooted in J. G. Ballard's, *The Voices of Time* (1960),³⁴ which fulfils 'the traditional role of the poet: to

meditate on time and death'.³⁵

Fertile androids are used to replace humanity and thereby overcome the sterility that afflicts humanity after a third world war in *Dream of Victory* (1953),³⁶ while *American Cyborg: Steel Warrior* (1993), a pastiche of *The Terminator*³⁷ and *The Children of Men*³⁸ describes a post-nuclear exchange humanity that is mostly sterile and hunted down by cyborgs, with one human foetus, albeit hand-carried in a bottle and not in the womb.³⁹

In *A Boy and His Dog* (1969), a few feral adolescents survive a post-war world, and a boy and his telepathic dog encounter an attractive young girl who seduces the boy and lures him to the ultra-conservative and middle-class 'downunder shelters' where he is to be used as a stud to impregnate women who are losing their fertility, a single fertile man trope that will be examined in greater detail later.⁴⁰

Sterility for the single individual may also be depicted as a consequence of warfare, and in del Rey's *Unreasonable Facsimile* (1952), a female scientist working on a model of a force field as a defence against an atomic attack is accidentally sterilised by the fields that she is adjusting, and during the hurried assembly of the field during an impending attack, a soldier also experiences the same fate.⁴¹ Futuristic computer games have also specifically depicted sterility due to nuclear explosions, and in the PlayStation game *Metal Gear Solid 4: Guns of the Patriots* (2008), one of the protagonists states that she is sterile as a consequence of irradiation due to atomic bomb testing in the 1950's, specifically mentioning the testing at Bikini Atoll.⁴²

Moreover, warfare has also been depicted as causing sterility on extrasolar, human colonised planets as in Morris' *Returning Creation* (1984), resulting in a populace wherein the most prized abilities are fertility and sexual prowess.⁴³ Aliens have also been reproductively challenged by warfare, and in Harrison's *Invasion: Earth* (1982), two tropes are combined in two alien species, ex-combatants, who are portrayed as radiation damaged, with a decline in birth rate and an increased mutation in offspring.⁴⁴ Similarly, the *Doctor Who* television episode *The Leisure Hive* (1980) also portrayed an alien race rendered sterile by a war.⁴⁵ Sterility is mentioned in other *Doctor Who* episodes,⁴⁶ and indeed, the Time Lords themselves are all sterile.⁴⁷ Individuals may also find themselves rendered sterile through warfare, as a side-effect of weapons discharge as shown in the anime *Eureka Seven* (2005).⁴⁸ And finally, the mutated alien survivors of a nuclear war are also depicted to be sterile in the anime *The City of Gold* (1987).⁴⁹

A variation on this theme is the novum of having just one fertile man in the entire world as a result of a nuclear disaster, as expounded in Frank's *Mr. Adam* (1946).⁵⁰ Authors of such stories 'were not really reacting to the bomb at all: they were glibly assimilating it to SF's long-established conventions. Nearly every aspect of nuclear doom was trivialized in some form or other'.⁵¹ This particular novel was influenced, in the first instance, by Shelley's *The Last Man* (1826),⁵² which inspired the silent comedy *The Last Man on Earth* (1924),⁵³ which in turn inspired the semi-musical comedy *It's Great to Be Alive* (1933).⁵⁴

An analogous situation exists in nature with regard to

males of the African Topi antelopes where the males are so forcefully pursued by pushy females that they refuse the advances of previous partners and even attack them to drive them off.⁵⁵ Likewise, Barr's *The Man with only One Head* (1955) postulates almost universal male sterility due to the explosion of a cobalt bomb that creates a blanket of fog around the Earth. Initially only one man remains fertile but fertility is eventually restored to all men by the discovery of a new medical treatment.⁵⁶ Men are also rendered almost universally sterile in the aftermath of a world war in Borodin's *Spurious Sun* (1948) wherein the few men who remain fertile are blacks, and red-headed, blue-eyed and black-bearded.⁵⁷ Similarly but without warfare, in Weston's *Comet Z* (1934), sterility afflicts all but one man after the Earth passes through a comet's tail.⁵⁸ The protagonist uses his crucial status to force universal disarmament, until the comet's effects dissipates. A slightly different approach is taken in Farmer's *Flesh* (1960) which follows an astronaut on an 800 year space trip, mostly in a state of suspended animation, and who returns to find an Earth populated entirely by women, an apt fate for a man called Space Commander Stagg.⁵⁹

Fertility is controlled by a handful of men in H. M. Hoover's, *Children of Morrow* (1973), where a post-nuclear warfare, patriarchal and fundamentalist dystopia, with mostly infertile men, is run by a few remaining fertile men.⁶⁰

Another interesting variation on the warfare theme is the survival of just one single couple after a war that is provoked by Satan himself, in Knight's short story *Not with a Bang* (1961).⁶¹ Humanity's lot is shown to be redeemable as the couple are scientists who have a time machine, and intend to return to the past in order to restart the race. Similarly, in Bester's *5,271,009* (1954), the protagonist is the last man in a devastated Earth and encounters the last woman.⁶² This trope is prefigured by Grainville's *Le Dernier Homme* (1805), wherein the entire future Earth becomes sterile and the last man resists manipulation to father a new breed of monstrous cannibals by choosing death instead. This dystopic novel, which was published posthumously, as has been shown above, has had its trope recycled many times in the past two centuries.⁶³

INFERTILITY AFTER BIOLOGICAL AND CHEMICAL WARFARE

Biological warfare has also been depicted as a threat to human fertility. A contraceptive virus that would control rabbit or rodent populations has actually been mooted in the scientific literature,⁶⁴ and the main concern has always been that such viruses may cross species, a process that has actually been demonstrated.⁶⁵ This may potentially include include and involve the human species, as explored in Wyndham's *Consider Her Ways* (1979).⁶⁶ This trope was revisited in Proctor's *The Chicago Conversion* (1985), this time with humans producing a bacterial weapon against an alien invasion force, only to find out that the weapon blights food crops, causes mutations and stillbirths in animals, and respiratory ailments in humans living in areas with high concentrations of the bacteria.⁶⁷

Cloning as an alternative solution to racial extinction is a common trope, and cloning after a war fought with

biological and nuclear weapons is expounded by Kate Wilhelm in *Where Late the Sweet Birds Sang* (1974).⁶⁸ It is relevant to note, at this point, that despite qualms raised by religions and ethicists with regard to cloning, out of a world population of around 7 billion, more than 10 million are monozygotic (so-called 'identical') twins or triplets, natural clones of each other.

Brian Stableford's *Inherit the Earth* (1999) describes infertility as the result of deliberate biological warfare with micro-organisms that attack the uterus. The author then describes how this is overcome by the development of an artificial uterus,⁶⁹ and similarly, in Hamilton's *Confederation* universe, exowombs are also used for the treatment of fertility problems. Interestingly, Hamilton then projects the use of exowombs to rapidly boost the population numbers of extrasolar colonies from pre-fertilised zygotes in order to more rapidly make these colonies self-sufficient in terms of numbers of human inhabitants, particularly in the event of impending war.⁷⁰

However, SF has dealt with the human fate after global warfare in diverse ways, not only leading to sterility, and perhaps most famously in Miller's *A Canticle for Leibowitz* (1959), the result of a superpower nuclear exchange is not sterility but widespread genetic mutation.⁷¹ In this classic novel, radiation fallout causes genetic mutations in all surviving flora and fauna. Children born with deformities are extended the protection of the Church and even have an official patron, Saint Raul the Cyclopean (presumably a radiation mutated individual), patron of the misborn. It is for this very reason that these children come to be called the 'Pope's nephews' or the 'Pope's children', the symbolic offspring of an individual with self-imposed infertility due to abstinence.

More recently, in Simmons' *The Ninth of Av* (2002), an epidemic created by Arabs to destroy Jews backfires, killing 97% of the world's population, and leaving alive only a few thousand humans who, ironically, are all Jews, albeit sterile.⁷² An unusual form of biological warfare is practised in Vance's *The Asutra* (1974), with the barbaric male-only Roguskhoi humanoids engineered for biological warfare, unremittingly lustful and who can only mate with human females, having no females of their own ilk. The resulting offspring have no genetic relationship whatsoever to the mother who is intentionally also rendered sterile by this process.⁷³

Chemical warfare is depicted in Jones' *Implosion* (1967) where the USSR deliberately contaminates Great Britain's drinking water, leading to almost universal and irreversible female sterility.⁷⁴ Since the nation risks dying out, legislation is passed to force the few remaining fertile women into breeding camps, a trope that was famously amplified in Atwood's *The Handmaid's Tale* (1986).⁷⁵ The problem spreads worldwide as various countries also discover the chemical agent and sterilise perceived rival countries. Similarly, in Azzopardi's 'Dark Rain' (1997), biochemical warfare causes worldwide sterility, with the occasional child being born and providing a glimmer of hope that the race will eventually be perpetuated.⁷⁶

Infertility may also be a cause and not an effect of warfare and only three examples will be given: alien-alien, alien-human and human-human warfare. Alien infertility leading to warfare among two intelligent alien species is seen in *Hunter's Moon* (1985) on the extra-solar

planet Medea. Fuxes are six to eight legged creatures that resemble a cross between a fox and a centaur while the balloons are literally balloons filled with hydrogen for buoyancy. The two species coexist peacefully and when balloons die, they drift to the ground and decompose or are eaten by fuxes. However, in a circumscribed area of Medea, the balloons change this behaviour pattern, allowing themselves to drift off and die elsewhere. Shortly afterwards, the fuxes experience an increased incidence of miscarriages and infertility and blame this on the balloons' new and unnatural behaviour. The fuxes declare war against the balloons and feel vindicated when they discover that fuxes that eat balloons subsequently give birth successfully. The human colonists discover that balloons concentrate manganese, a trace element that is vital for the fuxes' fertility, and the humans therefore abort the war by providing the fuxes with manganese themselves.⁷⁷

There is a human parallel here in that deficiency in vitamins or trace elements may well result in morbidity and mortality in the developing human fetus. Probably the most well known and preventable cause of foetal malformation in humans is folic acid deficiency which predisposes to neural tube defects such as spina bifida.⁷⁸

Alien infertility prompts a stealthy attack on humanity in Asimov's *The Gods Themselves* (1984). The alien inhabitants of a planet in a parallel universe are trisexual and the sexual act requires the absorption of energy from sunlight. However, the aliens' sun is waning, and the aliens therefore manipulate the transfer of energy from this, our universe, to theirs, a process that will eventually lead to the explosion of our sun.⁷⁹

Finally, human-human warfare is depicted in Nourse's *Raiders from the Rings* (1962). After a sojourn in space of any length with exposure to cosmic rays, men (who then become known as 'spacers') are unable to father female children, so they steal women from Earth as future mates. Interestingly, despite their radiation exposure, spacers are neither more prone to sterility nor more prone to father mutations. However, they are distinguished by white hair by the end of their teens and tend to live longer than the norm.⁸⁰ The author, a doctor, attempts to explain these facts by asserting that male sperm that carry an X chromosome have this chromosome put out of commission, so that the X behaves like a Y. Naturally, the protagonist, a young spacer, does not know what it means to have a sister. The story poses some unanswered questions in that we are never told whether cosmic radiation affects females in any way, or whether this radiation has any effects on other species. Interestingly, longevity in spacers occurs at the price of partial infertility in that spacers can only father males.

It is worth pointing out, that in most mammalian species, gender is determined by the XY sex chromosomes. Females are homogametic with two of the same kind of sex chromosome (XX) while males are heterogametic having two different sex chromosomes (XY). Some species (including humans) have a sex-determining region, a gene located on the Y chromosome that determines maleness. In humans, males produce Y and X bearing sperm while females produce only X bearing ova. During conception, it is therefore sperm that determines gender such that an X bearing sperm will produce a female baby because of

an XX combination, while a Y bearing sperm will produce a male baby because of an XY combination. In the case of 'spacers', it is therefore impossible for the X chromosome to behave like a Y chromosome but it would be possible for the Y to behave like an X if the SRY gene were knocked out of action, producing only females.

CONCLUSION

The individuals who first explored the possibilities and the catastrophic consequences of uncontrolled atomic energy, SF authors, were unwilling to believe that weapon of mass destruction would be used on Earth. Even Cartmill, whose *Deadline* (1944) described a 'nuclear bomb that was sufficiently close to the one under construction at Los Alamos to earn both Campbell and Cartmill visits from security agents',⁸¹ set the action on a distant alien planet with humanoid but tailed aliens, and not on Earth.⁸²

While SF authors may have been initially pleased with their futuristic predictions coming true, as 'their fiction developed and controlled nuclear energy long before the Army got around to it',⁸³ like the general populace, they were also 'disappointed in and fearful of the ways in which the government proposed to handle its "ultimate weapon,"' the bomb as ultimate deterrent in a MAD (mutually assured destruction) stalemate.⁸⁴

The astounding power of the new weaponry of mass destruction even gave SF authors pause, when mankind 'learned on August 6, 1945, that he alone is big enough to kill himself, or to live forever'.⁸⁵ Truly 'writers seemed to have difficulty adjusting to the scale of the new weapon'.⁸⁶ Even individuals such as Asimov regretted being 'salvaged into respectability at the price of a nuclear war hanging like a sword of Damocles over the world forever'.⁸⁷

The genre, in its usual optimistic vein, bounced back, responding with stories that depicted far-fetched devices that would neutralise atomic explosions, such as force fields, a subject raised seriously by Campbell in an *Astounding* editorial.⁸⁸ In this way, new weapons were seen as 'not an apocalyptic horror, but a problem to be solved',⁸⁹ albeit often at the expense of dystopias, as the genre often predicated

post-holocaust life as a site for ideological contestation, [...] renderings of long-term post-nuclear survival appear highly reactionary, and seemingly advocate reinforcing the symbolic order of the status quo via the maintenance of conservative social regimes of patriarchal law (and lore).⁹⁰

Broderick has taxonomised these disaster stories in nuclear war, a classification that may be extended to any form of warfare dealing with weapons of mass destruction, into

three distinct ways in which people might respond to threatened atomic war: prevention by heightened surveillance and counterespionage, resignation and soescaping from targeted areas to assumed havens, and immunization from attack by using a comparable or superior defensive technology.⁹¹

Broderick has further taxonomised these disaster stories into

at least three distinct discursive modes [...], renewal films, which posit the war as promoting socio-cultural rebirth usually in the form of the heterosexual couple, the family, or the small community; catharsis films, which graphically depict the destructive impact of nuclear war and the problematics of survival; and terminal films which portray the end of the human species by showing long-term survival as impossible.⁹²

More mainstream authors who have gone 'slipstream' and delved in the genre, such as Wylie, Caidin, and Shute have been more realistic and have more 'successfully outlined the horrors of the Nuclear Age, [...] struck much closer to home than the fantastic extrapolations of most SF.'⁹³ It is almost as if authors were expressing a 'fantasy of [...] Armageddon as the anticipated war which will annihilate the oppressive burdens of (post)modern life and usher in the nostalgically yearned-for less complex existence of agrarian toil and social harmony through ascetic spiritual endeavors'.⁹⁴

The situation today is such that the populace is blasé about advanced warfare, and indeed '[k]iller robots seem to be everywhere'.⁹⁵ Virtual warfare in the form of computer games is widely practised on individual computers, and across the Internet, to the extent that books now exist that purport to 'allow anyone with no programming background to make exciting war games for Windows'.⁹⁶

These narratives are clearly examples of 'the disaster, unexperienced. It is what escapes the very possibility of experience, it is the limit of writing. This must be repeated: the disaster describes'.⁹⁷ However, these stories all share the same trope, 'visions of [...] Armageddon concerns itself primarily with survival as its dominant discursive mode',⁹⁸ that of the happy ending, with humanity somehow surviving after hubris is punished by tragedy. These stories are therefore representative of the corpus of entire genre, which tends toward optimism, after recounting stories that constitute *gedankenexperiments*, 'Promethean and Frankensteinian myth-warnings of unrestrained alchemical and technological advance'.⁹⁹

Chernus has observed that these stories also partake of our desire to see heroic figures perform heroic deeds, as

this scenario speaks not to the logical mind but to the unconscious yearning in each of us to be a hero. The myth of the heroic survivors [...] is merely one instance of the more general myth of the hero, which is perennially popular in our culture as in every other.¹⁰⁰

These modern myths 'to varying degrees rely upon discursive strategies which combine rhetoric and imagery to warn explicitly the human protagonists (and by extension, the audience) of the dangers of [...] conflict' and by further extrapolation, the foolishness of the unleashing of any other kind of mass destruction since they 'relate cautionary tales with regard to potential obsessive overreaching, with insufficient thought as to the consequences of our actions'.¹⁰¹

If that were not enough, SF has further admonished

us, as already mentioned, with terminal stories that depict mankind's extinction, narratives such as *On the Beach* (1957)¹⁰² and *Dr. Strangelove* (1964),¹⁰³ should we fail to heed these warnings.

(ENDNOTES)

- 1 Martin Rees, *Our Final Hour* (New York: Basic Books Inc, 2003).
- 2 Robin Hard, *The Routledge Handbook of Greek Mythology* (London: Routledge, 2004), pp. 65-69.
- 3 Mark D. Mandeles, *The Future of War* (Washington: Potomac Books, 2005).
- 4 Chris Hables Gray, "'There Will Be War!': Future War Fantasies and Militaristic Science Fiction in the 1980s", *Science Fiction Studies*, 21 (1994), 315-336, p. 315.
- 5 H G Wells, *The World Set Free* (London: Macmillan and Co., 1914).
- 6 H G Wells, 'Anticipations: An Experiment In Prophecy', *The North American Review*, 1901, p. 1.
- 7 Wells, *The World Set Free*, pp. 103-104.
- 8 Albert I. Berger, 'Nuclear Energy: Science Fiction's Metaphor of Power', *Science Fiction Studies*, 6 (1979), 121-128, p. 121.
- 9 Robert Heinlein, 'Blowups Happen', *Astounding Science Fiction*, September 1940.
- 10 Berger, 'Nuclear Energy', p. 124.
- 11 A. E. van Vogt, *Slan* (Sauk City: Arkham House, 1946).
- 12 Isaac Asimov, *Foundation* (New York: Gnome Press, 1951).
- 13 Robert A. Heinlein, 'Solution Unsatisfactory', *Astounding Science-Fiction*, May 1941.
- 14 Reginald Bretnor, ed. *Thor's Hammer, The Future at War Series Volume 1* (New York: Ace, 1979), Reginald Bretnor, ed. *The Spear of Mars, The Future at War Series Volume 2* (New York: Ace, 1980), Reginald Bretnor, ed. *Orion's Sword, The Future at War Series Volume 3* (New York: Ace, 1980).
- 15 For a review of the potentials for electronic warfare, see Sergei A. Vakin and others, *Fundamentals of Electronic Warfare* (London: Artech House, 2001).
- 16 *Ibid.*, xiii.
- 17 Albert I. Berger, 'The Triumph of Prophecy: Science Fiction and Nuclear Power in the Post-Hiroshima', *Science Fiction Studies*, 3 (1976), 143-150, p. 143
- 18 *Ibid.*
- 19 Tore Straume and others, 'Radiation Hazards and the Colonization of Mars', *Journal of Cosmology*, 12 (2010), 3992-4033.
- 20 *Ibid.*
- 21 Brian Aldiss, *Greybeard* (London: Cox and Wyman Ltd., 1964).
- 22 Marc Trachtenberg, *A Constructed Peace: The Making of the European Settlement, 1945-1963* (Princeton: Princeton University Press, 1999).
- 23 The Van Allen belts are named after the physicist who first described them. For an introduction to this subject see J. A. Van Allen and L. A. Frank, 'Radiation around the Earth to a radial distance of 107,400 km', *Nature*, 183 (1959), 430-434 and Martin Walt, *Introduction to Geomagnetically Trapped Radiation*, (New York: Cambridge University Press, 1994).
- 24 M. John Harrison, *The Committed Men* (London: Hutchinson, 1971).
- 25 Mick Broderick, 'Surviving Armageddon: Beyond the Imagination of Disaster', *Science Fiction Studies*, 20 (1993), 362-382, p. 371.
- 26 Octavia Butler, *Dawn* (New York: Popular Library 1988).
- 27 For a tongue in cheek exposition on the unlikelihood of the possibility of interspecies mating, see Larry Niven, *Man of Steel, Woman of Kleenex*, in Larry Niven, *All the Myriad Ways* (New York: Ballantine, 1971).
- 28 For a more detailed biological review, see Joan Slonczewski, *Octavia Butler's Xenogenesis Trilogy: A Biologist's Response*, presented at SFRA, Cleveland, June 30, 2000.

- 29 James Blish, *A Life for the Stars* (New York: Avon, 1962).
- 30 William Brinkley, *The Last Ship* (New York: Viking, 1988).
- 31 *World Without End*, dir. by Edward Bernds (Allied Artists Pictures Corporation, 1956).
- 32 Edgar Pangborn, *The Company of Glory* (New York: Pyramid, 1975).
- 33 Keith Roberts, 'Molly Zero', in *Triax*, ed. by Robert Silverberg (New York: Pinnacle, 1977).
- 34 J. G. Ballard, 'The Voices of Time', *New Worlds*, October 1960.
- 35 Charles Nicol, 'J.G. Ballard and the Limits of Mainstream SF', *Science Fiction Studies*, 3 (1976), 150-157, (p. 157).
- 36 Algis Budrys, 'Dream of Victory', *Amazing*, August to September 1953.
- 37 *The Terminator*, dir. by James Cameron (Orion Pictures, 1984).
- 38 Phyllis Dorothy James, *The Children of Men* (London: Penguin Books, 1992).
- 39 *American Cyborg: Steel Warrior*, dir. by Boaz Davidson (The Cannon Group, 1993).
- 40 Harlan Ellison, 'A Boy and His Dog', *New Worlds*, April 1969.
- 41 Lester Del Rey, 'Unreasonable Facsimile', *Future Science Fiction*, July 1952.
- 42 Kojima Productions, *Metal Gear Solid 4: Guns of the Patriots* (Tokyo: Konami, 2008).
- 43 Janet Morris, *Returning Creation* (New York: Baen Books, 1984).
- 44 Harry Harrison, *Invasion: Earth* (East Rutherford: Ace, 1982).
- 45 'The Leisure Hive', dir by Lovett Bickford, *Doctor Who*, August 1980.
- 46 Another example of sterility in the *Doctor Who* universe includes 'The Remote', a sterile group of humans who replace their dead from simple, raw biomass and the personality of the new individual is reconstructed from memories of other individuals who knew the deceased recently deceased. See Lawrence Miles *Interference: Book One* (London, BBC Books, 1999).
- 47 Marc Platt, *Lungbarrow* (London: Virgin Books, 1997).
- 48 Kazuhisa Fujie, *Eureka Seven Unlimited Answers: A Roadmap of Gekkostate and Beyond* (Tokyo: Cocoro Books, 2009).
- 49 Deyriès Bernard and Edouard David, dir. 'The City of Gold', *The Mysterious Cities of Gold*, March 1987.
- 50 Pat Frank, *Mr. Adam* (New York: J. B. Lippincott, 1946).
- 51 Paul Brians, 'Nuclear War in Science Fiction', 1945-59, *Science Fiction Studies*, 11 (1984), 253-63 (p. 258).
- 52 Mary Wollstonecraft Shelley, *The Last Man* (London: Henry Colburn, 1826).
- 53 *The Last Man on Earth*, dir. by John G. Blystone (Fox Film Corporation, 1924).
- 54 *It's Great to Be Alive*, dir. by Alfred L. Werker (Fox Film Corporation, 1933).
- 55 This allows males to conserve sperm, allowing mating with new females and increasing the possibility of additional offspring. See J. Bro-Jørgensen, 'Reversed Sexual Conflict in a Promiscuous Antelope', *Current Biology*, 17 (2008), 2157-61.
- 56 Densil N. Barr, *The Man with One Head* (London: Rich & Cowan, 1955).
- 57 George Borodin, *Spurious Sun* (London: Werner Laurie, 1948).
- 58 George Weston, *Comet Z* (London, Methuen & Co., 1934).
- 59 Philip Jose Farmer, *Flesh* (New York: Beacon, 1960).
- 60 H. M. Hoover, *Children of Morrow* (London: MacMillan, 1973).
- 61 Damon Knight, 'Not with a Bang', in *The Big Book of Science Fiction*, ed. by Groff Conklin (New York: Crown Publishers, 1950).
- 62 Alfred Bester, '5,271,009', *The Magazine of Fantasy and Science Fiction*, March 1954.
- 63 Jean-Baptiste François Xavier Cousin de Grainville, *Le Dernier Homme*, trans. by I. F. Clarke and M. Clarke (1805; Middletown, CT: Wesleyan University Press, 2002).
- 64 C. H. Tyndale-Biscoe, 'Virus-Vectored Immunocontraception of Feral Mammals', *Reproduction, Fertility, and Development*, 6 (1994), 9-16.
- 65 W. J. Martin and R. T. Glass, 'Acute Encephalopathy Induced in Cats with a Stealth Virus isolated from a Patient with Chronic Fatigue Syndrome', *Pathobiology*, 63 (1995), 115-8.
- 66 John Wyndham, *Consider Her Ways* in John Wyndham, *Consider Her Ways and Other Stories* (Harmondsworth, England: Penguin, 1979).
- 67 George W. Proctor, *The Chicago Conversion* (New York: Pinnacle, 1985).
- 68 Kate Wilhelm, *Where Late the Sweet Birds Sang* (New York: Harper & Row, 1974).
- 69 Brian Stableford, *Inherit the Earth* (New York: Tor Books, 1999).
- 70 Peter F. Hamilton, *The Confederation Handbook* (New York: Tor Books, 2000).
- 71 Walter M. Miller, Jr, *A Canticle for Leibowitz*, (New York: J. B. Lippincott, 1959).
- 72 Dan Simmons, 'The Ninth of Av', *Worlds Enough and Time* (London: HarperCollins, 2002).
- 73 Jack Vance, *The Asutra* (London: Coronet, 1974).
- 74 D. F. Jones, *Implosion* (New York: G. P. Putnam's Sons, 1967).
- 75 Margaret Atwood, *The Handmaid's Tale* (New York: Ballantine Publishing Group, 1986).
- 76 Mario Azzopardi, dir. 'Dark Rain', *The Outer Limits*, February 1997
- 77 Poul Anderson, 'Hunter's Moon', in *Medea, Harlan's World*, ed. by Harlan Ellison, (New York: Bantam, 1985).
- 78 K. M. Laurence and others, 'Double-Blind Randomised Controlled Trial of Folate Treatment Before Conception to Prevent Recurrence of Neural-Tube Defects', *British Medical Journal*, 282 (1981), 1509-11.
- 79 Isaac Asimov, *The Gods Themselves* (New York: Del Rey Books, 1984).
- 80 Alan E. Nourse, *Raiders From The Rings* (New York: David McKay Co., 1962).
- 81 Berger, 'The Triumph of Prophecy', p. 144.
- 82 Cleve Cartmill, 'Deadline', *Astounding Science Fiction*, March 1944.
- 83 Berger, 'The Triumph of Prophecy', p.143.
- 84 Ibid, p.143.
- 85 Theodore Sturgeon, 'August Sixth, 1945', *Astounding Science Fiction*, December 1945.
- 86 Brians, p. 254
- 87 Isaac Asimov, *Opus 100* (Boston: Houghton Mifflin, 1969), p. 148.
- 88 John W. Campbell, 'Atomic Age', *Astounding Science Fiction*, November 1945.
- 89 Brians, p. 255.
- 90 Broderick, 'Surviving Armageddon', p. 362.
- 91 Broderick, 'Surviving Armageddon', p. 367.
- 92 Broderick, 'Surviving Armageddon', p. 368.
- 93 Brians, p. 261.
- 94 Broderick, 'Surviving Armageddon', p. 362.
- 95 Armin Krishnan, *Killer Robots, Legality and Ethicality of Autonomous Weapons* (Farnham: Ashgate Publishing Limited, 2009), p. 1.
- 96 Jason Darby, *Going to War: Creating Computer War Games* (Boston: Course Technology, 2009), xii.
- 97 Maurice Blanchot, *The Writing of Disaster*, trans. by Ann Smock (Lincoln: University of Nebraska Press, 1986), p. 7.
- 98 Broderick, 'Surviving Armageddon', p. 362.
- 99 Broderick, 'Surviving Armageddon', p. 363.
- 100 Ira Chernus, *Dr. Strangegood: On the Symbolic Meaning of Nuclear Weapons* (Columbia: University of South Carolina Press, 1986), p.8.
- 101 Broderick, 'Surviving Armageddon', p. 368.
- 102 Nevil Shute, *On the Beach* (London: Heinemann, 1957).
- 103 *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb*, dir. by Stanley Kubrick (Columbia Pictures, January 1964).