Chapter One

Technology's Other Storytellers: Science Fiction as History of Technology

Thomas Haigh

More than twenty years ago John Staudenmaier helped to codify the concerns, themes and vocabulary of the history of technology in *Technology's Storytellers*.[1] The same title could, perhaps more obviously, be applied to science fiction writers. So as I immersed myself in the historical literature I was surprised by how infrequently historians invoked works of science fiction as evidence of cultural attitudes towards technology. Nothing says more about a society than its imagined futures. But instead we reach for more respectable cultural figures: Marcel Duchamp, Charlie Chaplin, Mark Twain. Neither is science fiction relevant merely as a window onto the technological unconsciousness during various periods. Science fiction writers themselves turn out to have a considerable self-awareness regarding the historical dimensions of their work, and some critics of science fiction have begun to situate the internal development of science fiction within the broader technological, cultural, and social histories of the western world

Hidden Kinships Between Science Fiction and the History of Technology

What does science fiction have to do with the history of technology? Both are marginal within their broader fields, tend to be written by people with technical training, and are often the subject of special pleading for unique critical standards. Both fields create narratives of technological change, showing the consequences of the invention and adoption of technologies on social worlds. Both require their authors to build worlds as well as stories.

The kind of science fiction I am concerned with here is work within a self-conscious genre, in which readers, writers, editors, and publishers share a set of expectations about fictional futures.[2] Within this genre aspiring writers are often told that every science fiction story begins with a question, posed in the form "What if?" Ask "What if we lived in a two-dimensional

world?" and answer this by writing *Flatland*.[3] Ask "What if the stars were only visible every few thousand years?" and write *Nightfall*.[4] You get the idea. This genre existed in a relatively well-defined and tightly demarcated form in the United States from the 1930s into the 1970s. Of course, aspects of the genre can be traced back further, sometimes as far as classical Greece.[5] Utopian fiction has a long tradition, and key elements of the science fiction narrative have been identified in Mary Shelly's *Frankenstein* and the "scientific romances" of H. G. Wells.[6]

At first blush the questions asked by the historian of technology seem to be quite different. We tend to ask "How did this technology/device/system come to be the way it is, and how has it been shaped by society and in turn reshaped it?" But implicit in that question, and lurking behind it, is the realization that things could have been otherwise. Only the awareness of an implied counterfactual narrative makes histories of technology more than pedantic chronicles of inevitable progression. So just behind the surface are always questions about "Why didn't," and those really are just questions of "What if" posed in a different way. "Why didn't we stick with gas-powered refrigerators?" asked Ruth Schwartz Cowan.[7] Why didn't DC power establish itself as the standard for electrical power networks? [8] Why didn't Betamax crush VHS?[9] These questions only exist because we appreciate historical contingency, the idea that things might have been other than how they are.

Science fiction writers have knowingly been drawn toward historical models and to the idea, no longer fashionable among academic historians, that the mechanics of historical change can be captured in laws, cycles, or grand theories. Ken MacLeod, one of the most successful science fiction writers to emerge in the past twenty years, has argued that "History remains the trade secret of SF… its influence is quite pervasive, among writers and readers alike. … History is an inexhaustible source of plots, and an indispensable map of the way in which societies work and how they can change." He notes particularly the popularity of cyclical notions of history, historical materialism, and the obvious modeling of classics such as Isaac Asimov's *Foundation* series and Frank Herbert's *Dune* saga on actual historical models.[10]

Science fiction writers and historians are both world builders, working with words as their only tools. Science fiction writers savor this as one of the defining characteristics of their genre. They construct not just a plot, characters, events, and the other furnishings of a "mainstream" novel but also fabricate the universe in which it takes place. This may be almost imperceptibly different from our present day reality or unrecognizably so. These differences usually involve developments in society as a result of technological change.

Historians of technology are also world builders. We, too, produce narratives in which the world is changed by (or, as technological determinism is far from fashionable, with) new technologies. Historians, like science fiction writers, are encouraged to create a strong narrative and integrate background material seamlessly within it. As we conduct our craft we are selecting sources from an almost infinite array, arranging them with great care, drawing out particular themes, demarcating certain individuals or social groups as actors, defining technologies in a particular way, writing with a particular intellectual agenda in mind, and in countless other ways constructing a unique world in which our story takes place.

This world is, of course, constrained by evidence of the past. Historians are expected to work fairly and cautiously in reconstructing lost worlds. Reading science fiction trains us in one of the crucial cognitive skills needed to research the history of technology. In early science fiction stories the details of each imagined universe were often conveyed in authorial asides or lengthy passages of stilted dialog in which characters informed each other of what they already knew. But soon the "infodump" was disparaged. Writers discovered ways of smoothly dropping hints about the operating principles of a future world into the narrative itself. Samuel R. Delaney, a writer turned critic, has argued that the interpretation of these hints is a crucial skill acquired by science fiction readers.[11] He takes as a paradigm a short sentence by Robert A. Heinlein: "The door dilated." Encountering such a bizarre statement an unprepared reader might miss its significance or become frustrated. The science fiction reader pauses to ask "What would the world have to be like for this statement to make sense?"[12]

Historians are charged with a similar task of reverse engineering the subjective world of our historical subjects from records of what they said, did, and wrote. Novelist L.P. Hartley famously wrote that “The past is a foreign country. They do things differently there.” A reader of science fiction might replace “foreign country” with “alien world.” We read our primary sources for clues about the world in which they take place. They serve as evidence for vital questions: how did these people understand their world and their place within it; what expectations did they have regarding a technology; what existing models did they use to understand new technologies. A classic example of this is Carlo Ginzberg’s *The Worms and the Cheese*, which reconstructs the cosmos as understood by a sixteenth-century miller from his statements as recorded in the official records of the inquisition.[13]

Science fiction writers of the “Golden Age” (the late 1940s and 1950s) tended to have backgrounds, and often advanced degrees, in science or engineering. Isaac Asimov, for example, earned a Ph.D. while writing his early stories and was already tenured at Boston University before finally giving up his career in biochemistry to write full time. Likewise pioneering historians of technology were often engineers approaching the field as an avocational interest. While subsequent generations of scholars have usually earned Ph.D.s in history, or some variant thereof, an undergraduate degree in engineering or computer science is still a common qualification. Both populations used to be almost exclusively male, and are now merely predominantly male. Both are interested in technology yet able, unlike many engineers, to write coherently and reasonably engagingly about it.

Finally, both science fiction and the history of technology have strained relationships with their parent fields. Science fiction fans are often dismissive of the pleasures of what they call “mainstream” literature, and many adult readers of high- or even middle-brow fiction regard science fiction as fit only for teenagers and the emotionally stunted. Some critics within the genre argue that for a work of science fiction to be great it must also be a great work of fiction. They apply the same expectations for prose style, depth of characterization, and elegance of

plotting to works within the genre as to those filed by chain bookstores in the category of "literature."[14] Others engage in special pleading. They argue that science fiction is inherently different from other kinds of fiction, and cannot therefore be held to the same terms.[15] The mission of world building is different from that of other writers. Since the 1970s science fiction has become more respectable, and a large and fairly well-defined body of "literary" science fiction has emerged. Meanwhile ideas, devices, and sensibilities from science fiction have increasingly appeared in the work of "literary" writers, creating a liminal body of literature dubbed "slipstream," populated by lauded writers such as Don DeLillo, Thomas Pynchon, and Steve Erickson.[16]

The history of technology has internalized a similar tension. The creation myth of the Society for the History of Technology relates a split from the History of Science Society when the latter refused to treat technology as important. As the field developed its practitioners aspired to incorporate the techniques and concerns of higher status historical scholarship, just as the science fiction writers of the 1970s sought literary respectability. Technology (and its euphemistic twin "material culture") have won some legitimacy as objects of historical study among what I have sometimes heard people call "mainstream historians." Yet the history of technology remains a rather insular field, despite efforts by many of its leaders to increase its diversity and import (often with a time lag of a decade or two) concerns from social and cultural history. Others argue that the history of technology has unique concerns, shaped by its early alliance with museums and industrial archeology, and that these must be preserved.[17] As in science fiction, this debate began in the 1970s and has shifted in favor of those seeking more integration.

But What About The Future?

Let us not ignore the obvious difference between these two enterprises. Most science fiction is ostensibly about the future. Indeed, it is this concern with the future as a locale that sets works of genre science fiction aside from earlier traditions. Exotic locations were distanced

more often by space rather than time in the works of authors such as Jules Verne, Arthur Conan Doyle, Edgar Alan Poe, and H.G. Wells. In contrast, claims to apply science and predict what lies ahead were made in the 1920s for the new genre of "Scientifiction" by its creator Hugo Gernsback (who consequently seems to many of science fiction's more literary-minded critics more a mad uncle confined in its literary attic than a founding father). These claims were retained and reinforced by John W. Campbell, who as editor of *Astounding Science Fiction* exerted tremendous influence over the work and careers of the leading science fiction writers of the 1940s. Science fiction fans believed that they were getting a head start on readers of less imaginative work. They agreed with celebrity inventor Charles Kettering when he said that "we should all be greatly concerned about the future and try to make it the best possible. For… it is where we are all going to spend the rest of our lives."[18] General Motors, Kettering's employer, endorsed a science fiction view of the future with its famous Futurama exhibit at the 1939 World's Fair.

Sometimes science fiction writers scored with a technical prediction or two. Robert A. Heinlein, for example, believed himself to have invented the waterbed and described one in his 1942 novel *Beyond This Horizon*.[19] As we know, the waterbed was an essential item for the swinging bachelor of the 1970s. Score one for science fiction! Likewise Arthur C. Clarke claimed to have published (in 1945)[20] the first proposal for a geosynchronous communications satellite, and John Brunner described a self-replicating "tapeworm" program in 1975 to inspire the creation of computer worms in the real world. Atomic technology remains science fiction's proudest accomplishment as a literature of prediction. *Astounding Science Fiction* ran a series of editorials and stories featuring atomic power and atomic weapons. In 1944 Campbell received a visit from Army intelligence officers after publishing a story that happened to have some technical elements in common with the top secret Manhattan Project.[21]

But science fiction was never really about the future. By the 1960s science fiction writers themselves were becoming uncomfortable with the idea that they were charged with predicting

the future. Space travel had left the pages of pulp magazines and arrived in the newspapers. It proved something of a disappointment, particularly for the group of writers gathering in Britain under the banner of “New Wave” science fiction. They rejected claims for the genre’s powers of prediction along with its faith in technological progress and fascination with gadgets and machines.[22] J.G. Ballard mocked the iconography of the space program, and called for the examination of “inner space.” Brian W. Aldiss baldly stated, "It is part of SF's gaudy misleading label that it predicts.”[23]

His fellow writer Gwyneth Jones agrees. She has written that science fiction “more than any other literary genre … reflects the exact preoccupation of the present.” The future invoked

> has to be as close as possible to a future which is seen as likely or relevant by most people at the time of writing. Otherwise nobody will think it is any good. Thus, the very books that seem to critics and audience the most intelligent, most exciting, the most uncannily accurate future-guessing, become ten years later the most dated—providing merely an *uncannily accurate* reverse image of the year in which they were written. Tell me what you think is going to happen tomorrow, and I’ll tell you what is happening to you today.”[24]

Critic John Clute used a similar logic to suggest the concept of a “real decade” in which a story takes place.

> Sometimes, reading a novel, one is able to play a game with the thing. Disregarding the ostensible date of the narrative, which may of course be anywhen at all, one can try to estimate the real decade in which the story is set. This real decade will be the period most nearly reflected by the book’s characters in their feelings about the proper relationship between the sexes, for instance, or about the thread of international communism, or about how great an economic sway should be exercised (across the galaxy) by entrepreneurial capitalism, or about the inevitability of man’s victory over the stars in their courses. … It is of

> course a fundamental rule of this game that no sf novel … can be actually set in the future … [in fact] sf novels tend to be set much further into the past than most 'mainstream' non-generic novels.[25]

To focus on the occasional widget described in science fiction shortly before its appearance in the real world is therefore to miss the obliviousness of most science fiction writers to the social and cultural developments not just of the future (which is hardly their fault) but of their own times. As Clute observed, science fiction is often more dated in this way than work in other genres. Despite his success with the waterbed I'd date most of Heinlein to 1890 and the remainder to about 1938. Heinlein knitted many of his stories into the grandly titled "Future History" series, presented with a table summarizing humanity's political, cultural, and technical progress over several thousand years. But Heinlein's futures have a distinctly nineteenth-century feel. He never accepted the rise of big government and big science in the Cold War period. He didn't really seem to approve of big business, either. In Heinlein's future (given in the 1950 story "The Man Who Sold the Moon") the moon landings are accomplished in 1978, not by the military-industrial-academic complex that brought us the Apollo program, but by an entrepreneurial hustler and "robber baron" who finances the project via schemes such as designating the rocket as a post office so that stamps can be cancelled on the moon and sold to collectors.

Yet Heinlein's future worlds remain a fascinating window onto our real past. He retains a considerable libertarian following, and is famous for his free-market, small-government ideas. But reading him today one is struck by the divergence of his thought from current political assumptions. Some of his work is much as one would expect. Heinlein was clearly unhappy with much of the New Deal and in "The Roads Must Roll" (1940) he presents unionized workers as the irrational dupes of populist agitators.[26] *Beyond This Horizon*, one of his first novels, describes a near utopia with considerable crossover appeal to readers of Ayn Rand. Men are expected to carry guns. Insults lead rapidly to deadly duels, which Heinlein suggests are very

effective as a means of encouraging social harmony ("an armed society is a polite society"). Yet, lurking incongruously in this libertarian paradise is the Department of Finance, in which sits a "huge integrating accumulator." Every economic transaction in North and South America is encoded onto holes punched onto paper tape inside each "auto-clerk". The data, suitable aggregated, is constantly fed into this special-purpose machine, which in turn manipulates subsidies, adjusts government allowances, and makes other economic tweaks necessary to "make the production-consumption cycle come out even."[27] His ruggedly individualistic duelists are also big government Keynesians who have surrendered monetary and financial policy to a giant machine run by unelected experts. Suddenly one gains an appreciation for the wrenching shock the Great Depression gave Heinlein's generation and the enormous amount of intellectual and cultural work done in the decades since to make personal freedom and macroeconomic deregulation appear inseparable.

Science Fiction as Historical Literature

History is all about what already happened. So the historian and the science fiction writer might seem to be the two heads of Janus. One stares at the past, and tries to imagine how it might have been different and why it wasn't. The other stares at the future, and wonders how it will be. In fact historians tend to be exceptionally wary about making predictions. This is because we tend to regularly come across old predictions from marketers, futurologists, pundits, economists, and politicians and are aware that they are almost invariably wrong.

Yet upon closer examination even this apparent reversal of temporal polarity turns out to bring the two genres together. Kim Stanley Robinson has argued that science fiction is "an historical literature." He notes that in any work of science fiction "there is an explicit or implicit fictional history that connects the period depicted to our present moment or to some moment of our past." Thus science fiction and historical fiction "are more alike, in some respects, than either is like the literary mainstream… both are concerned with alien cultures, and with estrangement."[28] Similarly, Istvan Csicsery-Ronay included future history as one of his "seven

beauties" of science fiction in his book of that title, noting that "by maintaining a sense of the integral connections between the present and the future, sf constructs micromyths of the historical process…" He observes that "Unlike real prophecies, SF's are narrated in the past tense. They don't pretend to predict a future, but to explain a future past."[29]

This relationship is most obviously true in the case of alternate history stories, science fiction set prior to the year in which it is written. These tend to hinge on wars and battles: worlds in which the Nazis won the Second World War, the South did not lose the Civil War, or the Spanish Armada brought an early end to the English Reformation. Harry Turtledove, one of the most successful writers of alternate history, had clarified the relationship of this kind of fiction with other science fiction.

> Both [alternate history and science fiction] seek to extrapolate logically a change from the world as we know it. Most forms of science fiction posit a change in the present or nearer future and imagine its effect on the more distant future. Alternate history, on the other hand, imagines a change in the more distant past and examines its consequence for the nearer past and the present. The technique is the same in both cases; the difference is when in time it is applied.[30]

When, as it often is, this change is technological, the result is a sense of history which resonates with Marx's sense of historical materialism, shown his famous suggestion that "The windmill gives you society with the feudal lord: the steam-mill, society with the industrial capitalist."[31] Darko Suvin, a pioneering Marxist critic of science fiction, has posited the "novum" as a defining element of science fiction. In the words of Csicsery-Ronay, this is

> the historical innovation or novelty in an SF text from which the most important distinctions between the world of the tale from the world of the reader stem. … In practice, the novum appears as an invention or discovery around which the characters and setting organize themselves in a cogent, historically plausible way. The novum is a product of material processes …[32]

This is an interesting position to take, as historians of technology have increasingly stigmatized the idea of "technological determinism" by which social changes take place inevitably in response to an external process of invention and discovery.[33] Science fiction writers, in contrast, like to present their imagined universes as the inevitable result of a particular development or set of developments. This illusion of inevitability helps readers to, in the famous phrase, suspend their disbelief in the fictional world.

Computers in Golden-Age Science Fiction

The absurdity of science fiction as a literature of prediction, and its merit as a genre of historical writing, can be seen particularly clear in its treatment of computing. Computers show up in science fiction in the early 1950s, mirroring their arrival in the real world. The computers of the 1940s and early 1950s were slow, unreliable, and massive machines based around clicking relays and glowing tubes. They were used primarily for scientific calculation. Science fiction writers, even those with scientific backgrounds who prided themselves on their skills as prognosticators, generally depict the computers of the future in very much the same way. Consider the early appearances of computers in the work of Asimov, Heinlein, and Clarke—three prolific authors of short stories during the Golden Age of magazine science fiction in the 1940s who established themselves as bestselling authors of science fiction books as that market emerged in the 1950s.

Computers were unknown in Asimov's best-known work of this era, the *Foundation Trilogy* (originally published 1942-1950).[34] Fifty thousand years from now scientists have achieved some miracles of miniaturization, including shrinking nuclear reactors to the size of walnuts for use in atomic-powered dishwashers and personal force fields. But they don't seem to have invented computers. A separate stream of stories explored the three laws of robotics, depicting the development of ever more intelligent and human-like machines powered by the rather nebulous technology of "positronic brains." Robots are common but computers remain very rare; a handful of "thinking machines" with "super robot brains" are used for economic

control and scientific research. Asimov also wrote, from 1955 onward, a handful of stories concerned with a giant computer named Multivac, built with vacuum tubes and buried deep underground. This machine too fits the "giant brain" paradigm, and comes eventually to rule the world.[35]

Clarke, like Asimov, was a successful writer of popular science and journalistic futurology as well as an outstandingly successful writer of science fiction. Nobody in the 1950s knew high technology or the future better. Yet Clarke's computers are similarly bulky. In his 1960 story "Into the Comet" a spaceship faces disaster after its room-sized onboard computer malfunctions. Calculating the course for Earth would take "a hundred thousand separate calculations," seemingly impossible to carry out by hand when the computer was "a million times faster." Fortunately, a reporter on board had a Japanese grandfather and thus remembers more traditional calculating practices. He launches a successful effort to equip each crew member with an abacus and a part of the complex calculation.[36] Clarke's novel *A Fall of Moondust* (1961), set in a mid- twenty-first century which men have walked on Pluto and tour buses ply the moon, describes a computer as "a handful of cells and microscopic relays."[37] Relays had, as Clarke was writing, long since given way to vacuum tubes as the building blocks of computer logic. Tubes themselves were being replaced by transistors.

Heinlein's stories from this era made an effort to keep up to date with current developments in computing, but did little to significantly extrapolate any continued development. Again this was a notable contrast with his assumption of rapid developments in space travel. In 1947 he published "Space Jockey" in the *Saturday Evening Post*, giving its broad readership a depiction of a typical day in the life of a rocket pilot of the mid-1980s. Heinlein expected regular commercial flights to Lunar City within a decade of the initial moon landing. Responsibility for navigational calculations lay with a man identified as a "computer" (a usage soon to vanish in the real world).

> When the Skysprite locked in with Supra-New York, Pemberton went to the station's stellar navigation room. He was pleased to find Shorty Weinstein, the computer, on duty. Jake trusted Shorty's computations—a good thing when your ship, your passengers, and your own skin depend thereon. Pemberton had to be a better than average mathematician himself in order to be a pilot; his own limited talent made him appreciate the genius of those who computed the orbits.

Calculating routine commercial flight paths remained a matter for human virtuosity. Shorty did not work entirely without electronic assistance though, as some undefined contribution was made by “Mable, the giant astrogation computer filling the far wall.” Pemberton’s in-flight course corrections were limited because “his little Marchant electronic calculator was no match for the tons of IBM computer at Supra-New York, nor was he Weinstein.”

Likewise, Heinlein’s novel (1957) shows ship-to-ship space combat in the distant future conducted with fire control computers very similar to those used in World War II, but with a simulation capacity and the ability to record data similar to that then being advertised for the cutting edge SAGE system. Heinlein remained committed to the giant computer paradigm well into the 1960s, even as minicomputers began to proliferate. In *The Moon is a Harsh Mistress* (1966) a major lunar city apparently holds just one computer, Mike.[38]

> In May 2075, besides controlling robot traffic and catapult and giving ballistic advice and/or control for manned ships, Mike controlled phone system for all Luna, same for Luna-Terra voice & video, handled air, water, temperature, humidity, and sewage for Luna City, Novy Leningrad, and several smaller warrens (not Hong Kong in Luna), did accounting and payrolls for Luna Authority, and, by lease, same for many firms and banks.

Computers in science fiction had settled down into a comfortable pattern. In physical appearance and interface style they generally resembled those in the real world. On the other

hand they frequently developed intelligence. This generally took place spontaneously, as an accidental result of their increasing complexity. (That is in itself an interesting departure from the pattern with space and atomic technologies: in science fiction warp drives and nuclear reactors were usually the result of research and experimentation). Science fiction writers embraced the idea of the computer as a giant disembodied brain, functioning as an oracle to be questioned. (The same idea can be seen in cartoons well into the 1980s.) Robots had been around in SF long before the computer, but were now understood to incorporate, or be controlled remotely by, some form of computer. Giant computers continued to oppress mankind into the 197` 0s and beyond. [39]

This lack of engagement with computers within science fiction was particularly odd given the importance of the future to the computer industry. Real world discussion of computers was inextricably bound up with the conventions and assumptions of science fiction. Since the 1940s computer technology has been characterized by rapid obsolescence and abrupt change. New ideas and fads were promoted with predictions of the near future in which the technology or approach in question (for example, management information systems, bubble memory, or timeshared computer access on a public utility model) has become ubiquitous. Moore's Law provided a self-fulfilling prophecy of rapid technological advance in the capabilities of semiconductors. By the late 1970s personal computers were selling by the million and a thriving home computer industry had emerged. Widespread speculation over the impact on the near future of the "microcomputer revolution" and the shape of the "information society" drove product developments, political policies, and educational initiatives. Parents purchased computers to make sure that their children had the "computer literacy" needed to survive in this new world. Yet the actual science fiction writers of the 1970s lagged behind this broader discourse, even as industry leaders, politicians, market research analysts, futurologists and journalists embraced the techniques and sensibilities of science fiction to promote the idea of a world remade by computers.

The Old-Timey Future: "First SF"

The science fiction future remained, into the 1980s, a place where information technology had little direct influence on the lives of ordinary people. It gradually developed from something that at least claimed to be a good-faith attempt to predict the actual development of technology and society into a backdrop and set of symbols as familiar and comforting as that of the western or popular romance. Or rather, it had developed into a set of instantly identifiable generic futures. There was the post-apocalypse survivalist future, the galactic empire space opera future, the robot uprising future, and (perhaps most ubiquitous of all) the gee-whiz 1950s Jetsons future. Science fiction images and aesthetics, once confined to obscure magazines and books, have permeated popular culture. A host of technologies are instantly identifiable as futuristic: flying cars, domestic robot servants, jet packs, virtual reality helmets, meals ingested in pill form. Nobody necessarily believes any more that these things will ever be commonplace, but they remain part of The Future nonetheless.

Again John Clute has captured the essence of this.

> American genre SF began around 1925… and it entered the valley of the shadow around 1975 though its flashier icons only came to dominate popular culture after the kind of SF that created them had begun to die…. tall tales of the future as a platform we could pass into, a frontier we could pierce, an unknown we could domesticate. What this central spine or braid of American SF said for 50 years was that the future was us, and that it worked.[40]

Clute has used the term "First SF" to describe the genre defined by this consensus.[41] Since 1980, Clute believes, "the relationship between SF and the world" had "altered… almost out of all recognition. The genre which differed from the world in order to advocate a better one" had become simply "an institution for the telling of story." Much science fiction continued to be "a set of stories about the American Dream," written from the viewpoint of the industrialized Western world in which science, progress, the control of nature and the "taming of alien people

on other worlds" were unquestioned. This meant that "there is a decreasing resemblance between the world we inhabit today" and the still popular vision of the future traditionally found in science fiction. Clute feels that the First SF future "was deeply loved, even after it had become a kind of historical fiction, a form of defensive nostalgia in the minds of many…."[42] Science fiction's failure to get to grips with computers, Clute believed, was the single most important reason for the obsolescence of its collective vision. Writers had "almost deliberately, ignored the transistor" and "described computers in terms of bulk rather than invisible intricacies." Thus, with the rise of the Internet, "sf as a set of arguments and conventions… had been blindsided by the future."[43]

But, as Clute noted, elements of the First SF future have passed into the cultural mainstream. In 1942 Isaac Asimov had to carefully explain his "jump drive" as an enabling technology for galactic empire. By 1977 George Lucas could just have Hans Solo announce a "jump to light speed," blur some stars to mark its entry and exit from hyperspace, and deliver the Millennium Falcon promptly to its destination without attempting any further explanation (which is just as well, as light actually takes a very long time to move between solar systems from the viewpoint of those not moving at relativistic speeds). Recent shows such as *Battlestar Galactica* and *Firefly* have likewise relied on our common knowledge that starships have engines that propel them with great rapidity over interstellar distances. We know this without being told, just as we know that vampires need to be staked through the heart and leprechauns should not be trusted.

There's another reason the First SF future seems so familiar. We are living in it. Scientists and engineers grew up reading the stuff, and have done their best to bring its promises to life. Our ubiquitous array of electronic gadgets have been styled after and inspired by their science fiction counterparts. Cell phones were styled directly after the communicators in Star Trek. Recent graphical user interfaces, iPods, and the glowing lights and dials found in modern cars all betray the influence of science fiction aesthetics. Thomas M. Disch captured

this phenomenon brilliantly when he called a book of reflections on science fiction *The Dreams Our Stuff is Made Of: How Science Fiction Conquered the World*[44]

Cyberpunk—The Newish Future

The cyberpunk movement of the 1980s was, deliberately and self-consciously, an attempt to update the increasingly obsolete future of First SF with the technologies and attitudes of the electronic age. Its breakthrough achievement, William Gibson's *Neuromancer*, embraced personal computers, brand-name fashion, and portable media players. Unmistakably a product of its decade, the book mirrored the unexpected rise of Japan as the superpower of personal electronics and the video glitz of MTV. Indeed, while several puns have been discerned in its title I have always fancied that another can be found there: "New Romantic" was a term used by music journalists to describe the colorful fashions, heavy makeup, and asymmetric haircuts of electronic pop bands such as Spandau Ballet, Ultravox, and Japan.[45]

Science fiction plots are often crude, sharing with comic books an interest in stories of individuals transcending to states of superhuman mastery. But even First SF stories less blatantly invested in teenage wish fulfillment tend to be written from the viewpoint of the creators and masters of large-scale technologies. Heinlein's heroes, often dubbed by critics "competent men," were masters of their fate.[46] They could wield a slide rule, program a computer, patent an invention, or patch a space suit. They were prone to philosophize at length on the manly importance of controlling one's fate with such skills, and had little sympathy for those unable or unwilling to thrive in a frontier situation. One of the most popular science fiction short stories of all time, "The Cold Equations" by Tom Godwin, sets up a situation in which the reader is led to identify with its protagonist as he explains to a sweet, silly "girl" looking for "an exciting adventure" who has hidden in his little spaceship that her willful ignorance of the laws of physics means she will need to throw herself out of the airlock without a space suit if their vital humanitarian mission is to succeed.[47]

In contrast, Gibson borrowed from film noir the idea of the protagonist as a small-time, marginal figure who blunders through secret conspiracies and the machinations of the powerful and corrupt with little idea of what is actually going on. They are not world shakers or history makers. David Langford summarized this elegantly in his review of the anthology *Burning Chrome*, noting that the title story is "that one about the young punks who get hold of a .45 and try the big heist, only Gibson's punks are computer jockeys and the .45 is a Russian military killer program."[48] *Neuromancer*'s convoluted plot echoes that of the film noir classic *The Big Sleep*. In both cases what endures in your mind is not the precise detail of the complex series of double-crosses and revelations but the general sensation of perverted conspiracy among the privileged overwhelming the cynicism of a small time protagonist who fancied himself street-smart. When noir heroes are foolish enough to make a moral stand, they generally make a bad situation worse (most notably in the nuclear explosion at the end of the film *Kiss Me Deadly*). Darko Suvin noted that "there is a real rebellion in the best of Gibson; there is sympathy for the little people."[49] This mirrors the shift of academic history during the 1970s and 1980s toward the social history, characterized by an interest in representative experiences, neglected perspectives, and a skepticism towards the idea that historical change is driven by the decisions of great men. E. P. Thompson, one of the founders of the "new social history," called this approach "history from the bottom up."

Cyberpunk represented a shift from the producers of technology to its users, and from the massive, thundering technologies of the space age to the more personal technologies of consumer electronics. Gibson did not write from any position of special technical expertise, but rather as a consumer of technology and someone with an eye for popular culture. He wrote that "the Street finds its own uses for things—uses the manufacturers never imagined…. While science fiction is sometimes good at predicting things, it's seldom good at predicting what those things might actually do to us."[50] Gibson understood that the VCR, the home computer, and the Walkman had a much more profound impact on our daily lives than the Apollo Program ever

did. His imagined technologies of implants and genetic engineering turned technology inward, remaking the human body itself.[51] This shift parallels the development, around the same time, among historians of technology of a new appreciation for users and for the technologies of everyday life.

Indeed, Gibson knew little about computers or networking when he wrote *Neuromancer*, composing it on an antique Hermes manual typewriter. Its characters "jack in" to an immersive virtual world known as "the matrix." This involves a piece of consumer electronics known as "a deck" with which they have the same kind of relationship as a fanatical biker with his motorcycle. Gibson snows us with brands and model numbers. He implies that decks can be tinkered with like old cars or stereos but never really tries to explain them. All we know is that they are connected, for best results, directly to some kind of interface implanted in the head of the user. Given the enormous power of this network connection it came as a shock to Gibson's more computer savvy readers when the book's hero, facing a particularly tricky situation while jacked into the matrix, asks his companion to hand him a modem.[52] Compare this with another influential early treatment of what would soon be called virtual reality: Vernor Vinge's novella "True Names." There are similar elements: conspiracy, a powerful network, a rogue artificial intelligence, and connection via brain electrodes to a network known as "the Portal." As a mathematics professor and computer expert Vinge could document baud rates and give a detailed account of hopping around his futuristic network from bulletin board to satellite relay to dusty APRANet facility. He even creates a plot excuse to have his protagonist use a simple textual user interface. But Vinge's technology has dated faster than Gibson's, so the now obsolete verisimilitude of his technology provides an odd contrast with the implausibility of his actual plot (an old fashioned confection of spontaneous superhuman transcendence in the service of a world-shaking battle between good and evil).

During cyberpunk's brief career as an active literary movement its chief propagandist was Bruce Sterling. His *Schizmatrix*, the other seminal novel of the cyberpunk movement,

provides a similarly bracing challenge to the historical assumptions of First SF as it blends cyberpunk ideas and aesthetics with the sweeping interplanetary settings. Sterling's novel follows the life of one man, Abelard Lindsay, across several hundred eventful years. As in much of the science fiction of the 1950s, for example, Heinlein's early work, the solar system has been colonized and political intrigues have factionalized humanity. And like a Heinlein hero, Lindsay is implausibly capable, excelling as a political leader, theatre promoter, diplomat, business man, professor, explorer and pirate. The technologies are different of course. Pretty much everyone has transformed their minds and bodies, and the main ideological issue driving the book's wars is whether this is best accomplished via computer implants or genetic engineering. Lindsay himself comes to espouse the "posthumanist" cause. But what strikes me most about the book is its sense of the fragility of history, the tendency of nations and eras to collapse and shatter the dreams of even the superhuman. Wars rage hot and cold, aliens arrive, economies boom and bust, ideologies wax and wane, states are founded and fall. All that is solid melts into air, again and again. This view of history might seem intuitive to someone from Central Europe. It was not, however, well represented in American science fiction. In First SF heroes overthrow existing political orders, struggling at the beginning of the story but eventually imposing happy endings on mankind as part of a superhuman destiny. Lindsay strives but, resourceful as he is, often fails and is forced to begin again as a refugee. As he notes, towards the end of the book, "Nations don't last in this era. Only people last, only plans and hopes." [53]

Steampunk and Retrofuturism

Since the advent of cyberpunk science fiction's one straightforward relationship with the future has crumbled, in ways that further expose the genre's rich relationship with history. Gibson's first published story, "The Gernsback Continuum" made explicit Gibson's fascination with the history of technology and the rediscovery of old futures. A freelance photographer agrees to photograph surviving examples of the futuristic architecture of the 1930s. He starts to glimpse, in the manner of characters in many Philip K. Dick novels, flashes of another reality

lying beneath our own. Seeking out futuristic gas stations and crumbling factories he finds himself haunted by images of a distinctly fascist urban landscape of crystal spires, zeppelins, and silver cars. Rejecting the vision shared by Hugo Gernsback, early industrial designers, and the corporate propaganda of the 1940s, he saves himself only through immersion in the "really bad media" of the 1980s (game shows, soap operas, and porn). He chooses "the human near-dystopia we live in" over the inhuman grandiose elegance of the gleaming First SF future.

The influence of retrofuturism can be seen even in the phrase "cyberpunk" itself, so often taken as a defiant assertion of modernity. It comes from "cybernetics," a phrase coined by Norbert Weiner in the 1940s.[54] A scientific fad, cybernetics was widely discussed in the 1950s as a new metadiscipline able to unify hitherto unrelated areas of knowledge. The vocabulary and imagery of cybernetics made its way into popular culture and business by the 1960s. By the 1980s, however, cybernetics had fallen from scientific respectability and was increasingly the domain of cranks. Even within popular culture its luster had faded. Thanks to Gibson, of course, "cyberspace" birthed a new litter of cyberterms closely associated with the spread of the Internet in the 1990s.[55] But when Gibson was writing, "cyber" was slipping into the realm of the obsolete future, the charmingly obsolete.

Despite its neon sheen, Gibson's early fiction acknowledges the tiny marks history leaves all around us. The Third World War was contained, somehow, before it wiped out city life entirely. This is not the traditional radioactive wasteland but a decaying urban jungle. People function in a world of junk, navigating the wreckage of the past as they go about their futuristic business. Technological gadgets new and old are piled on the floor of shabby apartments or stuffed into the back rooms of shady establishments. In an afterword Jack Womack notes "how many references you find therein to events or incidents that occurred at some unspecified time before the narrative begins, and to nostalgic reveries of That Which Is No Longer the Way It Was; how often his characters grow dimly aware of vague regrets for which they have no name." This, he suggests, leads Gibson to images of "evocative clutter and disarray…. The

outmoded toaster ovens, the mildewed paperbacks, the scratched LPs… detritus that accumulates in the desk's bottom draws; the lint in the navel of a private civilization, hinting at an apocalypse that (if apocalypse at all) could have been nothing other than personal." [56] Philip K. Dick warned that kipple ("useless objects, like junk mail or match folders after you use the last match") proliferates while we sleep so that "No one can win against kipple, except temporarily and maybe in one spot."[57] First SF futures had no room for kipple. Gibson shows us what life looks like after kipple has won.

Bruce Sterling's subsequent career further demonstrates the importance of technological history to the cyberpunk sensibility. By the early 1990s cyberpunk had run its course, its once radical sensibilities having been assimilated into a new kind of communal future in which body modification, cyberspace, and petty crime were now familiar elements of genre entertainment.[58] A decade after launching cyberpunk as a movement Sterling went back to pamphleteering mode to launch a new initiative: the Dead Media Project. This title was a humorous complement to the then-fashionable term "New Media." Sterling called for "a deeper, paleontological perspective right in the dizzy midst of the digital revolution." [59] The result was an online community, powered by a website and email list, devoted to documenting obscure and forgotten media technologies such as the stereopticon, pneumatic mail tube, automatic typewriter, hectograph, and even defunct computer platforms. Perhaps fittingly, the project itself has now vanished from the net. Even Neuromancer's much quoted first line "The sky above the port was the color of television, turned to a dead channel" now celebrates a dead medium. So contemporary and media-savvy when it came out, it describes an analog technology now almost extinct. Digital televisions do not show snow. Analog televisions now show nothing else, regardless of how or where the dial is turned.

The historical sensibility latent in cyberpunk became explicit in the 1990 novel *The Difference Engine* by Sterling and Gibson, a seminal work in the emerging "steampunk" genre. Steampunk works are hard to categorize, but tend to be playful work set in alternative pasts

where high-technology artifacts (cloning, artificial intelligence, robots) have been created with incongruously old-fashioned means. Seizing on Charles Babbage's vision of a programmable mechanical computer, Sterling and Gibson describe a Victorian world in which steam driven calculating engines have transformed politics and society. Like most computers in science fiction they are developing self awareness. The authors have great fun with this setting, making Byron prime minister, turning America into a patchwork of little countries, and having Ada Lovelace discover what appears to be the Church-Turing thesis. As Clute observed, it is the absence of information technology that most clearly separates the First SF future from our own present. The steampunk setting allowed Sterling and Gibson to playfully amend this by inserting modern information technology into the prehistory of science fiction.

The popularity of steampunk in recent decades surely reflects changing experiences among the readers and writers of science fiction. Gibson himself has argued that a science fiction fan of his generation, coming of age reading First SF classics written twenty years earlier, had to become a kind of historian of technology to appreciate the genre. Recalling his boyhood, he writes

> I learned of science fiction and history in a single season…. Much of the science fiction I was reading, American fiction of the nineteen-forties and fifties, had already become history of a sort, requiring an acquired filter for anachronism. I studied the patent Future History timeline Robert Heinlein appended to each of his novels and noted where it began to digress from history as I was coming to know it. I filtered indigestible bits of anachronistic gristle out of this older science fiction, reverse-engineering a model of the real past through a growing understanding of what these authors had gotten wrong.[60]

Today the science fiction future lies behind us. The works of Clarke, Asimov, and Heinlein have become, to modern readers, a kind of inadvertent steam punk with their giant, self=aware vacuum tube computers and nuclear powered dishwashers. Unlike today's high-

technology breakthroughs, the imagined technologies of steampunk function are on a recognizably human scale and lend themselves to creation by lone inventors or mad scientists. So the vogue for steam-powered computers is at once a mockery of First SF faith in the technological future and a reaffirmation of the genre's traditional pleasures.

A Few Recent Futures: Robinson, Banks & MacLeod

Steampunk is not, of course, the only development in science fiction's relationship to history during the quarter century since the publication of *Neuromancer*. Neither is it necessarily representative. Science fiction has, in recent decades, become increasingly diffuse. Films and television series have far more impact than novels, so science fiction fandom has boomed even as its members have drifted away from the classic works of the 1950s (or in many cases from the written word in general). Meanwhile, genre boundaries between science fiction and fantasy have largely collapsed when faced with the growing popularity of fantasy and the ever dwindling credibility of the claim that science fiction is a separate enterprise concerned with real science and rigorous extrapolation, rather than a subset of fantasy with a specialized set of props and expectations. In 2001, the Hugo award for best novel, the field's highest honor, was given to a Harry Potter book. Fantasies of magic won again in 2004, 2005, and 2009.[61]

Yet a brief consideration of a few of the major current authors of science fiction reveals considerable subtlety in the genre's attitude to history. Kim Stanley Robinson is one of the most respected American authors of science fiction working today. He was never associated with the cyberpunk movement but, like Gibson, is obsessed with the workings of history. His major work, the three volume ,[!need this] deals with the terraforming of Mars and its eventual independence from Earth. This is the most exhaustively detailed and plausible future history ever created, conjuring not just political and social developments but also the trajectories for developments in economics, science, and engineering. Robinson's early novel is based around multiple incompatible reconstructions of future history based on the same evidence. Three of his other early novels provide a deliberately contrasting set of futures for Southern California in the mid-

twenty-first century. Many of his short stories are concerned with counterfactual history and the unpredictable implications of historical agency. His recent novel, *The Years of Rice and Salt*, tells ten different stories over a six-hundred-year period in a world where Christianity was largely extinguished by the Black Death. Robinson's stories of future life on Mars, like his alternative history stories, are grounded in serious interest in the dynamics of historical change, the subjective nature of historical narrative, and the interplay of technology and society. As he has said, "Science fiction is the history that we cannot know."[62]

Space opera (stories featuring interstellar warfare and rousing adventure) has enjoyed a surprising renaissance in recent years, largely in the hands of Scottish writers. The most successful has been Ian M. Banks with his stories of the "Culture," a utopian updating of the traditional galactic empire setting. Inside the Culture life is, for the most part, leisurely and satisfying as the peace is kept by enormously powerful military vessels equipped with artificial intelligence, devastating weapons, and whimsical names such as Grey Area, Unfortunate Conflict of Evidence, and Little Rascal. The Culture's main challenges are boredom and smugness, so plots revolve around its efforts to deal with threats from lesser civilizations (such as ours) without compromising its ethics.[63] Ken MacLeod is best known for his Fall Revolution series, set in a high-technology near future of political instability and utopian revolutionary movements.[64] MacLeod's background includes both radical student politics and computer programming, and his books are in part a deadpan examination of a world in which the arcane feuds of Trotskyite student politics in the 1970s really did turn out to be the crucial turning point in world history their participants imagined them to be. Both Banks and MacLeod love tinkering with the traditional apparatus of First SF stories, playfully rearranging them to different ends under a very different set of assumptions about human nature, politics, and historical progress. Their work reflects the end of the Cold War. MacLeod described his work as an answer to the question: "What if capitalism is unsustainable and socialism is impossible?"[65] He challenges the traditional dominance of liberal and libertarian politics within the genre. Likewise, in Banks's

more recent novels, the Culture often seems to be a parody of America's image in the 1990s: an unchallenged high-technology superpower with good intentions but a tendency to meddle blithely in other cultures.[66] Their work simultaneously celebrates and undermines the genre traditions they inherited, an attitude I would characterize as fundamentally postmodern.

Conclusion

In recent decades authors such as Bruce Sterling, William Gibson, Ian M. Banks, and Ken MacLeod have shown a deep understanding of the history of their own genre and the complex relationship of imagined futures to present-day concerns. Likewise, John Clute and other science fiction critics have begun to attain historical distance from the genre's "golden age" of the 1950s, historicizing its concerns and linking them to broader currents in American history. This challenges historians of technology to begin a similar dialog, engaging with science fiction as a complex cultural phenomenon and treating science fiction works as substantive contributions to the underlying discussions shaping our own field.

All science fiction is grounded in the concerns and assumptions of the era in which it was written, exposing not just the beliefs of its authors about their futures but also their understanding of the historical trajectory leading to their current position. Science fiction writers, like historians of technology, tell stories about where technologies come from and how they shape the direction of history. Science fiction is not, and never really was, a literature of prediction, science, or serious futuristic extrapolation. But it is not worthless just because it tells us about the past rather than the future. Leszek Kołakowski was a Polish philosopher and intellectual historian who began as a communist but eventually won fame as a critic of Soviet Marxism. His skepticism toward all assumptions of historical determinism is captured in his remark that "We learn history not in order to know how to behave or how to succeed, but to know who we are."[67] Science fiction, I have argued here, is best read and often written as a genre of historical fable. Its study offers a similar reward: to know who we are, who we were, and why we have changed.

Acknowledgements

The author would like to thank Ed Benoit for his assistance, and Paul Ceruzzi and Rob MacDougall for their helpful comments on draft versions of the paper.

NOTES

[1] John Staudenmaier, *Technology's Story Tellers: Reweaving the Human Fabric* (Cambridge, MA: SHOT and the MIT Press, 1985).

[2] Thus my perspective here is more closely aligned with that of Gary Westfahl, *The Mechanics of Wonder: The Creation of the Idea of Science Fiction* (Liverpool: Liverpool University Press, 1998).

[3] Edwin A Abbott, *Flatland: A Romance of Many Dimensions* (Seely & Co, 1884).

[4] Isaac Asimov, "Nightfall", *Astounding Science Fiction*, September 1941.

[5] Adam Roberts, *The History of Science Fiction* (New York: Palgrave, 2006).

[6] Brian W Aldiss and David Wingrove, *Trillion Year Spree* (London: Victor Gollancz, 1986).

[7] Ruth Schwartz Cowan, "How The Refrigerator Got Its Hum", in *The Social Shaping of Technology*, ed. Donald MacKenzie and Judy Wajcman (Philadelphia: Open University Press, 1985):181-201.

[8] Thomas Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore, MD: Johns Hopkins University Press, 1983).

[9] Michael A. Cusumano, Yiorgos Mylonadis, and Richard S. Rosenbloom, "Strategic Maneuvering and Mass-Market Dynamics: The Triumph of VHS over Beta", *Business History Review* 66, no. 1 (Spring 1992):51-59.

[10] Ken MacLeod, "History in SF: What (Hasn't Yet) Happened in History", in *Histories of the Future: Studies in Fact, Fantasy, and Science Fiction*, ed. Alan Sandison and Robert Dingley (New York: Palgrave, 2000):8-14.

[11] Samuel R Delaney, "About Five Thousand Seven Hundred and Fifty Words", in *The Jewel-Hinged Jaw* (Elizabeth, NY: Dragon Press, 1977).

[12] Delaney writes that a colleague reported having applied this technique to reading Jane Austen, with informative results. Samuel R Delaney, "Science Fiction and

'Literature'", in *Speculations on Speculation: Theories of Science Fiction*, ed. James Gunn and Matthew Candelaria (Latham, Maryland: Scarecrow Press, 2005):95-118

[13] Carlo Ginzburg, *The Cheese and the Worms: The Cosmos of a Sixteenth-Century Miller* (Baltimore: Johns Hopkins University Press, 1980).

[14] This question is given a thoughtful and insightful examination in David G. Hartwell, *Age of Wonders: Exploring the World of Science Fiction* (New York: Tor, 1996).

[15] While the case is often made rather crudely by fan writers, as a rejection of the ability of academic research to illuminate science fiction, it can also be expressed as a call for scholars of science fiction to create their own standards and critical vocabulary, as in Delaney, "Science Fiction and 'Literature'" .

[16] Bruce Sterling, "Slipstream", *SF Eye*, July 1989.

[17] Terry S Reynolds, "On Not Burning Bridges: Valuing the Passe", *Technology and Culture* 42, no. 3 2001):523-530.

[18] Quoted in Stuart Leslie, *Boss Kettering* (New York, NY: Columbia University Press, 1983), 311.

[19] Robert A Heinlein, *Expanded Universe* (New York: Grosset & Dunlap, 1980), 516-518. Heinlein never built a waterbed, but featured them in several stories and claims to have offered a sufficiently detailed description of the modern waterbed to prevent the idea from being patented by others.

[20] Arthur C. Clarke, "Extra-terrestrial Relays", *Wireless World*, October 1945.

[21] Aldiss and Wingrove, *Trillion Year Spree*, 224.

[22] Roberts, *The History of Science Fiction*, ch. 11.

[23] Brian Aldiss, *The Detached Retina: Aspects of Science Fiction and Fantasy* (Syracuse, NY: Syracuse University Press, 1995), 189.

[24] Gwyneth Jones, "Getting Rid of the Brand Names", in *Deconstructing the Starships* (Liverpool, UK: Liverpool University Press, 1999):9-21, 15-16.

[25] John Clute, *Strokes: Essays and Reviews: 1966-1986* (Seattle: Serconia Press, 1988), 32. This review originally appeared in 1977.

[26] Farah Mendlesohn, "Corporatism and the Corporate Ethos in Robert Heinlein's 'The Roads Must Roll'", in *Speaking Science Fiction: Dialogues and Interpretations*, ed. Andy Sawyer and David Seed (Liverpool: Liverpool University Press, 2000):144-157.

[27] Robert A Heinlein, *Beyond This Horizon* (Reading, PA: Fantasy Press, 1948), 3-7. See also the discussion of economics and the role of government on pages 71-72 and 102-3.

[28] Kim Stanley Robinson, "Notes for an Essay on Cecelia Holland", *Foundation* 40 (Summer 1987):54-61?.

[29] Istvan Jr. Csicsery-Ronay, *The Seven Beauties of Science Fiction* (Middletown, CT: Wesleyan University Press, 2008), 6&76.

[30] Quoted in Andy Duncan, "Alternate History", in *The Cambridge Companion to Science Fiction*, ed. Edward James and Farah Mendlesohn (Cambridge, UK: Cambridge University Press, 2003):209-218, page 211.

[31] Karl Marx, *The Poverty of Philosophy* (Chicago: Charles H. Kerr & Company, 1910), 119.

[32] Istvan Jr. Csicsery-Ronay, "Marxist Theory and Science Fiction", in *The Cambridge Companion to Science Fiction* ed. Edward James and Farah Mendlesohn (Cambridge, UK: Cambridge University Press, 2003):113-124, page 119.

[33] Merritt Roe Smith and Leo Marx, eds., *Does Technology Drive History: The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press, 1994).

[34] To give Asimov his due, when the Foundation stories were first assembled in book form he did add a new opening chapter in which Hari Seldon, the heroic founder of Foundation, owns a kind of programmable calculator small enough to be carried on the waist.

[35] The Multivac stories are available in Isaac Asimov, *Robot Dreams* (New York: Berkley, 1986).

[36] Arthur C Clarke, "Into the Comet", in *Best of Arthur C. Clarke* (London: Sphere, 1973):181-193.

[37] Arthur C Clarke, *A Fall of Moondust* (1961), 21.

[38] To be fair to Heinlein, one should note that this can also be read as a reflection of the then-fashionable idea of the computer utility – so he may truly be reflecting the late 1960s as well as the late-1940s. Also his entire plot of a computer aided revolution depends on the colony having decided to centralize all administration and control activities in a single computer.

[39] The literature is summarized with respect to real world changes in Brian Stableford, *Science Fact and Science Fiction: An Encylopedia* (New York: Routledge, 2006). In particular the entries on Computer, Artificial Intelligence, Virtual Reality, and Robot.

[40] John Clute, *Scores: Reviews 1993-2003* (Harold Wood, UK: Beacon Publications, 2003), 92-93.

[41] Clute has used the term in many reviews, providing a clear definition in John Clute, *Look at the Evidence: Essays and Reviews* (Liverpool, UK: Liverpool University Press, 1995), 8-11. It is analyzed in Andrew M Butler, "Purloining of an Agenda: Or... A Spectre is Haunting John Clute", in *Polder: A Festchrift for John Clute and Judith Clute*, ed.

Farah Mendlesohn (Baltimore: Old Earth Books, 2006):258-266 and Graham Sleight, "Last and First SF", in *Polder: A Festchrift for John Clute and Judith Clute*, ed. Farah Mendlesohn (Baltimore: Old Earth Books, 2006):258-266.

[42] John Clute, "Science Fiction from 1980 to the Present", in *The Cambridge Companion to Science Fiction*, ed. Edward James and Farah Mendlesohn (Cambridge, UK: Cambridge University Press, 2003):64-78.

[43] Ibid .

[44] This of course reversed the phrase “The stuff that dreams are made of,” from The Maltese Falcon, itself patterned on Shakespeare’s “Of such stuff that dreams are made on” from The Tempest.

[45] The book’s title is explored in Norman Spinrad, "The Neuromantic Cyberpunks", in *Science Fiction in the Real World* (Carbondale, IL: Southern Illinois University Press, 1990):109-121.

[46] Alexi Panshin, *Heinlein in Dimension* (Chicago: Advent Publishers, 1968).

[47] Tom Godwin, "The Cold Equations", *Astounding Science Fiction*, August 1954.

[48] David Langford, *The Complete Critical Assembly* (Holicong, PA: Wildside Press, 2002), 145. Originally published in White Dwarf, 1986.

[49] Horst Pukallus, "An Interview with Darko Suvin", *Science Fiction Studies* 18, no. 54 1991):253-262. Suvin’s opinion of Neuromancer was equivocal – see Darko Suvin, "On Gibson and Cyberpunk SF", *Foundation*, no. 46 (Autumn 1989):40-51.

[50] William Gibson, "Rocket Radio", *Rolling Stone*, June 15 1989.

[51] This aspect of cyberpunk has been widely discussed in academic circles, most famously in Donna Haraway, "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century", in *Simians, Cyborgs and Women: The Reinvention of Nature* (New York: Routledge, 1991):149-181 though she does not, oddly, cite Gibson.

[52] William Gibson, *Neuromancer* (New York: Ace Books, 1984), 143.

[53] Bruce Sterling, *Schizmatrix* (New York: Arbor House, 1985), 259. This shift from triumphant supermen to individuals adrift in the currents of history may reflect a return to the perspectives of what critics have termed the Scientific Romance, work such as the stories of H.G. Wells written before the establishment of science fiction as a genre and the associated spread of First SF norms. John Clute has summarized the difference in attitude thus: “The protagonists of the Scientific Romance tend to be observers of the great world, while American heroes tend to *win* it.” Clute, *Look at the Evidence: Essays and Reviews*, 81.

[54] Norbert Wiener, *Cybernetics, or Control and Communication in the Animal and the Machine* (Cambridge, MA: Technology Press, 1948).

[55] The process by which “cyberspace” was picked up beyond the science fiction community and applied to real-world networks is discussed in Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006), 162-174.

[56] William Gibson, *Neuromancer* (New York: Ace Trade, 2000).

[57] Philip K Dick, *Do Androids Dream of Electric Sheep* (New York: Doubleday, 1968), 65.

[58] For a perspective on this from Sterling himself, see Bruce Sterling, "Cyberpunk in the Nineties", *Interzone*, June 1991.

[59] Bruce Sterling, *The Dead Media Manifesto* (1995 [cited April 1 2010]); available from http://www.alamut.com/subj/artiface/deadMedia/dM_Manifesto.html.

[60] William Gibson, *Time Machine Cuba* (The Infinite Matrix, January 23 2003); available from http://www.infinitematrix.net/faq/essays/gibson.html.

[61] The evolving place of written science fiction within the broader genre is discussed thoughtfully in Roberts, *The History of Science Fiction*, 295-325.

[62] Bud Foote, "A Conversation with Kim Stanley Robinson", *Science Fiction Studies* 21, no. 1 (March 1994):51-60.

[63] Patrick Thaddeus Jackson and James Heilman, " Outside Context Problems: Liberalism and the Other in the Work of Iain M.Banks", in *New Boundaries in Political Science Fiction*, ed. Donald M Hassler and Clyde Wilcox (Columbia, SC: University of South Carolina Press, 2008):235-258.

[64] Andrew M. Butler and Farah Mendlesohn, *The True Knowledge of Ken MacLeod* (Reading, UK: Science Fiction Foundation, 2003).

[65] Ken MacLeod, "The Falling Rate of Profit, Red Hordes and Green Slime: What the Fall Revolution Books are About", in *Strange Lizards from Another Star* (Framingham, MA: NEFSA Press, 2006):223-230, page 229.

[66] In other respects, however, the Culture is a pointed divergence from American society, being essentially communist. Banks believes in the superiority of a planned economy, dislikes religion, and thinks greed and work are things that civilized species will outgrow.

[67] Leszek Kołakowski, "The Idolatory of Politics", in *Modernity on Endless Trial* (Chicago: University of Chicago Press, 1990):146-161, page 158.