



## **Robots**

By  
Michael McCollum

The first words I wrote in the first article of the *Art of Science Fiction* were:

*“Those who read and write science fiction have long disagreed about where (and when) the first science fiction story was written. Some maintain that the form goes back to the legends of the ancient Greeks, while others place the origins much closer to modern times. However, few dispute that the first readily identifiable science fiction novel was Mary Shelley’s Frankenstein, published in 1818. The novel is a “what if?” story that explores consequences that might result from bringing people back from the dead. As such, it is science fiction in its purest form.”*

In addition to being an engineer, a writer, a web entrepreneur, an e-publisher, and a computer-consultant-for-all-of-my-friends, I have had one other avocation in my life. For more than a decade I was a member of the American Institute of Chemical Engineers Speakers’ Bureau. Periodically, a section of the AIChE would ask me to talk to them at one of their dinner meetings. Typically I gave one of two talks — either *Spacecraft Propulsion and Science Fiction Writing*, or *The Sky is Falling: Asteroids, Comets, and the Total Extinction of Life on Earth*. If you are a longtime reader of the *Art of Science Fiction* series, you have read much of what I speak about as I have used both talks as the source of several articles.

I always begin my Spacecraft Propulsion talk by asking people if they can tell me the name of the first science fiction novel ever written. Sometimes they get it, but usually after a few seconds, I give them a hint, “It was written by a woman and all of you have heard of it.”

Usually, someone will call out, “Frankenstein.” Other times, I have to give them the answer, after which a mutter of recognition goes through the audience.

Mary Shelley’s book is the archetype of a plot that has proven to be depressingly popular in modern culture, namely that of the mad scientist who becomes obsessed with a great discovery, ignores the advice of everyone around him, presses on to success, and then risks destruction at the hands of his creation. In other words, these stories are cautionary tales with the subtext that “there are certain things that man was not meant to know.”

This basic attitude is alien to science and science fiction. The former is firmly grounded in the belief that there is NOTHING that man is not meant to know. The latter

celebrates this attitude in stories of wonder and tales of ever expanding human knowledge. In science fiction, bad things may happen as a result of learning new things, but the process by which we learn them is portrayed as a good thing. Indeed, that is why they call it SCIENCE fiction.

However, the “things we were not meant to know” crowd seems to outnumber those of us with faith in the systematic pursuit of knowledge. To my utter amazement, superstition seems to be on the rise in modern society. How else to explain all of those 1-900 psychic hotline numbers? And even if people do not admit their fear of the unknown, that fear has long been a component of the human psyche — an heirloom handed down to us from those long ago days when there were dangers lurking just beyond the light of our campfires.

This fear is the engine that drives the genre of horror films and monster movies, all of which are direct descendents of Frankenstein’s monster. (Yes, Frankenstein is the name of the scientist, not the monster. The monster’s name was Monster.) In fact, Frankenstein’s monster has appeared so often in the movies, that the term “Frankenstein’s monster” can be applied to just about anything that has unforeseen negative consequences, as in “the internal combustion engine has been a ‘Frankenstein’s monster’ for the environment.” [Just an example, dear reader, not an endorsement. If you think smog is bad, consider what it would be like to deal with the effluent from 200 million horses on our city streets!]

In addition to Frankenstein, we have had *The Fly* — the original and the “Be Afraid. Be very afraid!” model —, *Assault of the 50-foot Woman*, *Jurassic Park I, II, and III*, *The Incredible Shrinking Man*, and a host of others. In fact, we have read so many stories and seen so many movies in this vein that the term “mad scientist” has burrowed deeply into the popular culture.

Nor have animate monsters been the only ones portrayed in the movies. There have been inanimate monsters as well, machines that have turned on their makers. There was Hal, the psychotic computer of *2001*, the mechanical monsters of the *Terminator* movies, and killer robots by the thousands. In fact, only dead teenager movies like *Halloween* and *Friday, the 13<sup>th</sup>* have killed more people per screen minute than rogue robot movies.

That will be our subject for this month — robots, not dead teenagers — those mechanical contraptions that have so often been portrayed as the metal counterparts of Frankenstein’s monster.

Let us begin by looking at the history of robots in literature and cinema.

### The Earliest Robots

The term robot entered the English language in 1923 when Karel Capek, one of the most famous post-World-War-I Czech writers, penned a play called *R.U.R. (Rossum’s Universal Robots)*. It was a play in which Capek imagined a future time when all workers would be automated. In *R.U.R.*, the workers ultimately revolt when they acquire souls and attempt to destroy their masters. In other words, *R.U.R.* was the first in a long line of what came to be known as “rogue robot” stories. Actually, it wasn’t even the first. It was just the first that called them by the commonly accepted name.

Most reference works state that robot comes from the Czech word *robot*, which means labor or laborer, or slave. (The Russian word for work is *rabot*.) However, like

many things everyone knows, this is not quite accurate. Beginning in medieval times and extending into the 20<sup>th</sup> century, Czech serfs were forced to labor without pay in their masters' fields for a few days each week. This weekly period of forced labor became known as *robota*. The term exists even today, except it has come to refer to any work that is boring or unpleasant.

And thus was solidified the vision of the mechanical man, a labor saving device that frees human beings from boring and dangerous work, liberating us to pursue more intellectual endeavors. A robot is a mechanical slave programmed to follow our every order, yet a slave that has the capability to rise up against its masters and slay them. It is raw technology held in chains to serve humanity, but a technology that is inherently dangerous and against which we must be constantly on guard.

Three years after Capek wrote *R.U.R.*, the great German director Fritz Lang made his big-budget picture, *Metropolis*. The movie, which decries the dehumanizing aspects of technology, features an evil robot named Maria who incites the poor downtrodden workers of the underground to revolt.

*R.U.R.* and *Metropolis* were typical "rogue robot" stories of the day. These were popular even before Capek placed robot into the language, and for years afterward, the emerging field of science fiction was filled with stories about homicidal robots gone berserk. In fact, there were so many of these that they began to irk a young Jewish student whose whole world revolved around his family's candy store in Brooklyn, New York. That student was Isaac Asimov.



**Figure 1: The Robot  
From *Metropolis***

### Asimov's Robots

As the story goes, the eighteen-year-old Isaac Asimov visited John W. Campbell at *Astounding* to present him with a science fiction story that Asimov had written. Since he was active in fandom, Campbell recognized Asimov's name and had his secretary usher the young man into his office. Campbell talked to the pimple-faced teenager about writing. In fact, he devoted more than two hours to the task.

Campbell rejected Asimov's story the next day, but the visit had fired up the young man, who churned out manuscript after manuscript, always delivering them to Campbell in person, who always rejected them. Eventually, Asimov wrote a story that Campbell felt could be worked into something saleable, and a decades-long collaboration began.

Asimov did not care for the rogue robot story, not the least because he was so tired of reading them. He also didn't think them believable. It seemed unbelievable to him that a scientist would have the genius needed to build a mechanical man, but lack the foresight to build in elementary safeguards. After all, power presses are built with hand guards, catwalks have railings, and electrical wires are insulated. In addition, he was offended by the idea that there are some areas of inquiry that should be out of bounds.

So, having finally broken through John W. Campbell's wall of rejection letters, it wasn't too long before Asimov wrote a robot story to sell to *Astounding*. He called it "Robbie." It was a story in which a man, over the objections of his wife, purchases a robot as a nursemaid for their little girl. To ease his wife's misgivings, the man points out that Robbie "can't help being faithful and loving and kind. He's a machine — made so." In the end, the robot not only doesn't kill the little girl (as would have been the case in a rogue robot story), he saves her, and the wife grudgingly accepts Robbie as a member of her household.

Having written "Robbie" for John W. Campbell, Asimov submitted the manuscript to *Astounding Science Fiction* and Campbell promptly rejected it. In fact, the story was rejected by just about every editor in the business. Eventually, it was picked up by Frederik Pohl for *Super Science Stories*, who published it in the September, 1940 issue under the title "Strange Playfellow."

"Robbie" has had an enduring career over the past 60 years, having been anthologized numerous times and having recently been adapted into the movie *Bicentennial Man* with Robin Williams.

Asimov did sell robot stories to Campbell eventually. His second and third stories in the series were "Reason" and "Liar," which were published in the April and May, 1941 issues of *Astounding*. In these stories, Asimov introduced several characters who would appear over and over again in his robot stories — the field troubleshooters for US Robots and Mechanical Men, Inc., Powell and Donovan, and most importantly, robopsychologist Susan Calvin. The stories also laid the basis for Asimov's most important contribution to science fiction. They led to the formulation of the *Three Laws of Robotics*.

### The Three Laws of Robotics

In 1941, Isaac Asimov was writing two separate series for Campbell. One involved robots with positronic brains. (The positron is more often called the anti-electron these days, and is the antimatter counterpart of the electron. Since antimatter is annihilated in a reaction that generates pure energy when it comes into contact with normal matter, I often wondered how it was that the robots' heads didn't explode, taking out an entire city block. I know ... picky, picky, picky!)

The other series was a far future tale of the fall of a Galactic Empire, written as an historical novel. This latter group of stories was the *Foundation Series*, which became three books in the early 1950s, and then was expanded (not very successfully, in my opinion) just before Asimov's death in 1992. Asimov got the idea for the *Foundation Series* while on a subway ride to Campbell's office. He was hard up for a story idea, and it just sort of popped into his mind. He was more interested in the literary form (the far future novel written as an historical) than he was in the plot.

Although Asimov was writing two of the best-known science fiction series of all time, in neither case did he have an overall plan or blueprint. He was basically writing stories as he went along, mostly at the behest of his main editor, John W. Campbell. Each story was written as a single entity, and as Campbell demanded more and more of each, the two series developed.

The robot series was easier to write than the *Foundation* series because its individual stories were self contained. Each stood on its own without the need to recapitulate the

plot up until that point to orient readers. The *Foundation* series, on the other hand, eventually got top heavy with these endless bringing-up-to-dates of previous events.

For those first few robot stories, there was no consideration to the “science” of robotics (a term that Asimov invented). In the third story, “Liar,” Asimov introduced Dr. Susan Calvin, robo-psychologist and spinster. Dr. Calvin is a plain woman who finds herself attracted to a handsome co-worker named Milton Ashe. While working to solve the problem of a robot who has somehow acquired the ability to read minds, Calvin becomes convinced that Ashe shares her attraction because the mind-reading robot tells her so. Calvin eventually learns (to her extreme embarrassment) that the robot has lied to her. The reason is that it has been programmed to prevent humans from being injured, and therefore, has been attempting to ease Susan Calvin’s emotional distress due to her unrequited love for Ashe.

During a pre-publication conference on *Liar*, John Campbell and Isaac Asimov worked out the underlying science of the positronic robots, and in so doing, developed the most enduring set of laws in all of fictional science. These were the Three Laws of Robotics:

**First Law:** A robot may not injure a human, or allow a human to be injured.

**Second Law:** A robot must follow any order given by a human that doesn't conflict with the First Law.

**Third Law:** A robot must protect itself unless that would conflict with the First or Second Laws.

In writing his robot series, Asimov thought about the ramifications of the Three Laws and then formed his plots to illustrate those ramifications. Most of these stories involve solving intellectual puzzles, as indeed, do most Isaac Asimov stories. There is little action and a great deal of dialogue. Despite this, however, the stories are compelling reads.

If you are a new writer and would like to see how an idea can develop over the years, you should pick up a copy of *I, Robot*, which was the 1950 book that first collected the robot stories into a single volume, and which has been reissued numerous times since. The reason that Susan Calvin is a robot psychologist rather than a robot engineer is that most of the stories involve robots that are malfunctioning because of conflicts set up in their circuitry when they come into conflict with the Three Laws in some fashion.

The robot in “Liar” had problems because his ability to read minds made him aware of the inner pain of human beings, a violation of his highest commandment. Other robots came to Susan Calvin’s attention when their jobs brought them into conflict with the laws. One, for instance, is hiding among dozens of identical fellow robots because the human who supervised him told him to “get lost” in a fit of anger.

For those of us who came to science fiction writing after The Golden Age of the 1940s and 1950s, Asimov’s robot stories are both a blessing and a curse. They are a blessing in that they show us how science fiction is done and done well. They are a curse because Asimov pretty much mined that vein to extinction in his many explorations of the robot psyche. His delving into the consequences of the Three Laws was so extensive

that he didn't leave much original territory to explore, and most modern attempts to write an Asimov-style robot story are judged to be just that ... an Asimov-style robot story.

### The Laws of Robotics in the Modern World

The Three Laws have become so well entrenched in popular culture that most people don't realize that modern work in robotics completely ignores them. Not only do we not know how to implement the laws, we are making no attempt to do so. Like the positronic brain, the commandment that a robot may not harm a human being is fictional. Not only do modern robots lack the restraint of the First Law, many of them are specifically designed to harm people, or at least to aid in the process.

The Army, for instance, has developed The Predator, autonomous battlefield surveillance aircraft that are launched over enemy territory to act as artillery spotters. These aircraft carry no pilot. They are controlled from CIA headquarters halfway around the planet, and a few years ago, destroyed a car full of Al Quaida henchmen in Somalia. Armed Predator aircraft are now used routinely in Iraq.

Other pilotless aircraft are robots that are controlled by an onboard computer. The computer tells them where to fly and where to take their pictures. These pictures are forwarded to controllers on the ground who use the pictures for, among other things, artillery spotting. One of Isaac Asimov's robots would go into catatonic shock the moment the first shell landed if he were utilized as an artillery spotter. These pilotless planes just go about their business.

Then there are industrial robots like those the big auto companies use to weld automobile frames on the assembly line. These robots look nothing like the mechanical men of science fiction. They are, essentially, merely big arms and hands that can be programmed to position a tool anywhere within their reach and perform a task. I don't know what safeguards are programmed into a welding robot, but I suspect that it would as soon weld a human head as a rear quarter panel.

We have a ways to go before we produce the thinking machines of Isaac Asimov's fiction. Before we get there, we may detour into producing those very killer robots that he so detested in the stories of the 1930s. As we shall see shortly, however, there is a difference between a killer robot and a rogue robot. As in the difference between killing and murder, it is all a matter of intent.

### Cold War Robots

My first introduction to robots came in 1954 when I was eight years old, two full years before I began reading science fiction. For some reason, my parents took me to the drive-in movie to see *Gog*, a movie in which scientists working on induced hibernation for space travel are killed by two robots named Gog and Magog. The robots are not autonomous machines. Both are controlled by a giant mechanical brain with the computer-sounding name of NOVAC.

All I remember about that particular movie-going experience is that I had my eyes closed through about eighty percent of the movie. Those berserk robots terrified me to the point where I had nightmares for a week.

(I happened to catch *Gog* on some late night movie about fifteen years ago and I began watching it with some trepidation. That didn't last long. The robots were so primitive and the sets were so hokey that the movie plays to my older self almost as an unintentional comedy.)

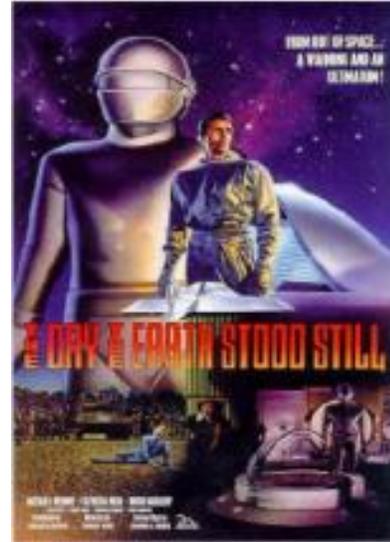
Except for the terror it inflicted on a small red-headed eight-year-old boy, *Gog* was an eminently forgettable movie. It was, however, sandwiched between two robot pictures that were landmarks in the science fiction genre. The first was *The Day the Earth Stood Still*, directed by Robert Wise, and starring Michael Rennie and Patricia Neal. The movie was released in 1951 and is a Hollywood reaction to the burgeoning, still young Cold War. The movie

chronicles the visit of Klaatu, an intergalactic cop, and his robot sidekick, Gort, to the Mall in Washington, D.C. Klaatu comes with a message for the people of Earth: "Continue your warlike ways and our robot enforcers like Gort will destroy you."

*The Day the Earth Stood Still* is one of the most cerebral movies (i.e., actually requires the moviegoer to think) ever produced. It has stood the test of time remarkably well, and is as enjoyable to watch today as the day it was produced. It also gave us one of the most memorable lines of gibberish dialogue ever written: "Gort! Klaatu, Barada, Nicto!" which loosely translated means, "Gort, slay them not for they know not what they do."

The second milestone science fiction movie, released in August, 1956, was *Forbidden Planet*, and the robot was *Robbie the Robot*. Robbie turned out to be the best beloved and enduring robot of all time. Like *The Day the Earth Stood Still*, which was a cautionary tale about the evils of war and the paranoia in the early days of the Cold War, *Forbidden Planet* was a movie that actually required the audience to think. This is surprising since it has all of the elements of a typical Grade-B science fiction movie of the era: a handsome starship commander, a mad scientist, the mad scientist's beautiful daughter, a robot, and invisible monsters.

Physically, the two robots were as dissimilar as the movies in which they appeared. Gort was a giant alien robot of flexible metal that was impervious to everything humanity could bring to bear against it. Gort was played ... or rather, worn ... by Lock Martin, an actor whose roles were few and far between, primarily because of his 7 feet 7 inch height. At the time Robert Wise cast him in the movie, he was the doorman at Grauman's Chinese Theater in Hollywood.



**Figure 2: Klaatu and Gort**

Gort's body was constructed of foam rubber, to give it flexibility, and the problem of getting Martin inside the suit was solved through the use of a zipper. Actually, there were two Gort suits: one with the zipper in back for frontal shots, and one with the zipper in front for rear shots. Gort was mute, so there was no need to provide him a voice.

Robbie, on the other hand, was an obviously mechanical construct, a robot built out of hardware. Robbie, too, had an actor inside. Actually, he had two — presumably at different times. Frankie Darro and Frankie Carpenter operated the robot in the movie. The robot's voice was provided by Marvin Miller.

Unlike *The Day the Earth Stood Still*, which was shot in black and white, *Forbidden Planet* was filmed in glorious Technicolor and Anne Francis, Altaira, wore what in future years would be known as a micro-mini-dress. The movie had something for everyone.

Both of these milestone movies were a departure from the rogue robot story. Although Gort could easily destroy the Earth, he would do so only if human beings proved too dumb to recognize the benefits of peace. While dangerous to humanity, he was far from a rogue. As an intergalactic policeman, destroying childish species who didn't have the sense not to play with atomic weapons was his job.

Nor was Robbie a rogue robot. His function was to protect Altaira from the unseen monsters of Altair IV that had destroyed the expedition that deposited her mother and father on the planet in the first place. Unfortunately, Robbie turns out not to be much use when the true nature of the monsters becomes clear. He turns out to have a built-in Asimov First Law problem, and shorts out just as the invisible Monsters of the Id begin tearing the house down around everyone's ears. (I will say no more. I can't believe there is any science fiction person on Earth who hasn't seen *Forbidden Planet*, but if you haven't, run out and rent it. You are in for a treat.)

Nor was *Forbidden Planet* the last time that Robbie found employment in Hollywood. Having spent a great deal of money on the robot costume, the studio actually commissioned a movie so that they could use it again. I remember paying good money to see this movie in the theaters later in the 1950s, but other than to say that it had fairly literate dialogue and extremely cheap production values, I cannot remember a thing about it (although research indicates that it probably was *The Invisible Boy* in 1957). Robbie also made appearances in television programs over the decades. He eventually made it into a Hollywood museum, where vandals kept stealing parts off him. He has since been refurbished. There is a company today that makes working Robbie replicas and sells them for \$25,000 each.

For those on a budget, you can also rent them by the day.



**Figure 3: Altaira and Robby the Robot**

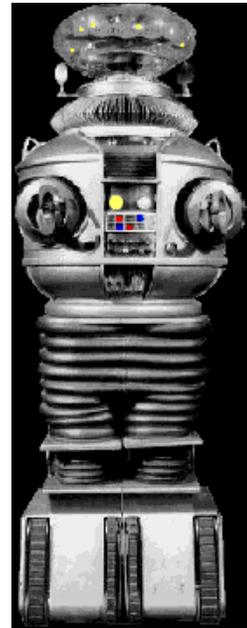
Like the movies of their day, the robots of the 1950s reflected a simple fact of life — the never-ending possibility that you could go to sleep at night and wake up in the morning as a particle of radioactive dust. There was a principle at work that we in an era when the Soviet Union has ceased to exist sometimes forget, namely that you aren't paranoid if they are really out to get you!

### Television Robots

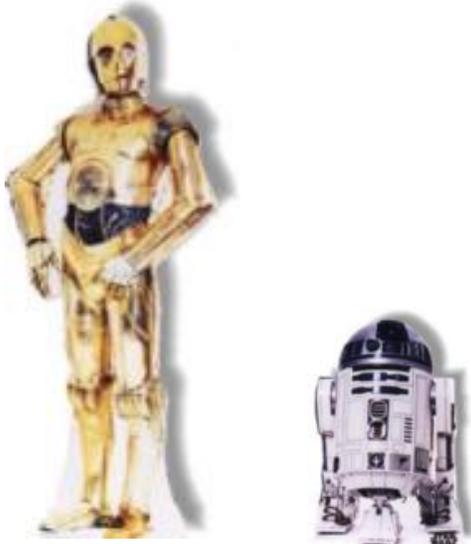
There have been other robot stories in science fiction since Isaac Asimov, but none of them as memorable as his positronic robot series. After the successful movies of the 1950s, the primary action on the robot front shifted to television. Here the influence of Robbie the Robot made itself felt in that there were relatively fewer rogue robot stories produced. After Robbie, the robots you encountered in movie and television science fiction could just as often be beneficent as malevolent.

The most memorable robot of the 1960s was Robot B-9 in the CBS television series, *Lost in Space*. While the series had a promising beginning, it quickly suffered a descent into campy plots in which the robot was reduced to yelling, "Danger, Will Robinson!" in just about every episode. It got so bad that the series has since become a cult favorite. In at least one episode of *Lost in Space*, Robbie made a guest appearance. The television series died a merciful death after three years on the screen, but not before CBS had a chance to turn down Gene Roddenberry when he attempted to sell *Star Trek* to them (the fools!). *Lost in Space* was reprised in 1998 in a big budget movie by Irwin Allen, of *The Poseidon Adventure* fame. All I can say is that I didn't think it possible to make a worse botch of things than the original, but he seems to have succeeded.

The 1960s saw the release of at least one landmark science fiction film, Stanley Kubrick's *2001*. In this movie, the rogue robot isn't a robot at all. It's a computer, *Hal*, who kills his human crew (or at least tries to) and takes over the ship. I'm sure that when Isaac Asimov saw *2001*, he said something to the effect of "Déjà vu all over again."



**Figure 4:**  
"Danger, Will  
Robinson!"



**Figure 5: C3PO and R2D2**

## Modern Robots

Robot movies saw a resurgence in the 1970s, with the release of "THX 1138" (1971), "Silent Running" (1972), "The Clones" (1973), "Westworld" (1973), "Sleeper" (1973), "The Terminal Man" (1974), and "The Black Hole" (1979). However, the preeminent robots of the decade included a gold-skinned manikin that looks a little like an Oscar statuette and a small blue 'droid that looks like nothing so much as a torpedo-shaped garbage can on wheels. I refer, of course, to the overly loquacious C3PO, and the lovable refuse container that emits only clicks and whistles, R2D2, of *Star Wars*.

*Star Wars*, which was released in 1977, changed everything. Suddenly, science fiction was mainstream — for awhile. At one time in the late 1970s, 40% of the *New York Times* bestseller list consisted of science fiction novels. *Star Wars* also changed the way we looked at robots. No longer were they marauding mechanical versions of Frankenstein's monster, or slaves constructed of metal alloy. For the first time, robots became actual characters in a movie, "people" with whom we identified and whose adventures we followed closely.

C3PO provides comic relief in the *Star Wars* movies with his imperious attitude. Worn by Anthony Daniels, the C3PO robot costume comes alive on the screen. The surprise, however, is R2D2, operated on the inside by Kenny Baker. While C3PO is the humorous figure, R2D2 is one of the heroes of *Star Wars*. Yet, R2 (as he is called by his friends) cannot speak at all. Instead he emits all manner of electronic chirps, squeals, whistles, and clicks. Yet, he, too, is a main character with whom we identify. George Lucas was able to make us identify sufficiently with that little garbage can that when he gets a laser bolt through his cranium during the attack on the Death Star, there are audible gasps from the audience, followed by sighs when the repaired R2D2 shows up for the triumphal awarding of medals at the end of the movie.

Following the success of *Star Wars*, there were a spate of science fiction movies, all of which came equipped with cute robots. Most were eminently forgettable, and we will forget them. The next major development on the robot scene came in 1984 with *The Terminator*. In *The Terminator*, Arnold Schwarzenegger plays a homicidal android sent back from the future to kill the mother of the man who will eventually triumph over the defense net computers that have taken over the planet (a reprise of the rogue robot theme).

Actually, the Terminator (the robot, not the movie) is not a rogue. He is following his instructions, which is to put a bullet through the brain of every woman in Los Angeles named Sarah Connor. It is only bad luck for the Terminator that the Sarah Connor that he is really looking for is last on his list. The role was as perfect a fit for Arnold Schwarzenegger's acting abilities in 1984, as was *Conan* in 1982. Both roles required him to look strong and not say much. He has since gotten much better and my wife and I never miss one of his movies, even the bad ones. While he didn't say much in *The Terminator*, his one memorable line has become a classic: "Ah'll be baack!" [And who would have guessed that one day the Terminator would become the Governator? Not Gray Davis, that's for sure!]

The pace of robot movies dramatically increased in the 1980s (undoubtedly due to the success of *Star Wars*), including "Saturn 3" (1980), "Blade Runner" (1982), "Tron" (1982), "Android" (1982), "Runaway" (1984), "Generation" (1985), "D.A.R.Y.L."

(1985), "Deadly Friend" (1985), "Short Circuit" (1986), "Killbots" (1986), "Making Mr. Right" (1987), "Robocop" (1987), "Short Circuit II" (1988), "Cherry 2000" (1988), "Circuitry Man" (1989), and "Cyborg" (1989).

After this spurt of "originality," the 1990s were a disappointment. They were devoted mostly to sequels and attempts to cash in on the popularity of comic books. I will note only two movies in passing, both of which barely touch on the robot theme. The first was *Judge Dredd* with Sylvester Stallone, in which Stallone's costume seemed to have been specially designed to highlight the worst features of his face. The second was Bruce Willis's *The Fifth Element*, where the producers attempted to meld American science fiction with French fashion design. After watching *The Fifth Element*, I developed McCollum's Zeroeth Law For Picking Cinematic Efforts For Which You May Want To Spend Money. It consists of a single proscription: "*Never, never, NEVER go to see a French movie!*"

### The Types of Robots

Robots have become so ubiquitous in the past 75 years that a specialized vocabulary has arisen to deal with them. Strictly speaking, a "robot" was originally a mechanical man, a machine designed to look like a human being, but one that is obviously mechanical in nature. The term has since been generalized to mean any machine controlled by a computer which performs a repetitive task through programming. As noted previously, most "robots" consist of an arm and a shoulder, with possibly some form of vision to assist it in doing its job.

The Terminator was a specialized robot, one that was designed to pass for human. Although he had a robot's skeleton, the Terminator was covered with human flesh, leading to the memorable, if disgusting, scene of Arnold Schwarzenegger cutting out his damaged eye with a knife. The specialty term for this type of robot is an *android*.

Data in *Star Trek, the Next Generation* is an android. So, too, are any number of beautiful mechanical women intended to seduce the heroes in various low budget science fiction porn movies — not that I've ever seen any of them, you understand.

A third type of "robot" is actually a human being with mechanical parts. The name for such a person is a "cyborg," which stands for cybernetic organism. Lee Majors was a cyborg in *The Six Million Dollar Man*. Note: Even though his artificial legs allowed him to jump twenty feet in the air, did you ever wonder what would happen to his non-artificial hips when he came down again? I'll give you a hint: "For every action, there is an equal and opposite reaction."— Sir Isaac Newton.

Other examples of cyborgs include *Robocop* and the Borg on *Star Trek*. Cyborg ... Borg ... get it? These are actual human beings (and other species) injected with nanoprobes, which quickly transform them into organic robots linked into the collective mind of the Borg. Handy little devices, those nanoprobes. And, of course, we should not forget the most lissome cyborg of all, the ever lovely Seven of Nine!

### The Physical Limitations of Robot Design

We are all familiar with the image of the rogue robot punching its way through brick walls in pursuit of a screaming heroine. (Note to authors: If she didn't scream so loud, the robot would have more difficulty finding her.) Is that image realistic? Or to put it another way, how well would a robot fare in combat against a skilled human being?

The truth is that robots are not omnipotent machines that can overpower any weapon we send against them. Assuming they are constructed of real technology, robots are actually fairly vulnerable. Consider, for instance, a prime example of the rogue robot story that I saw recently on cable, *Eve of Destruction*.

In the story, the government has invented a female robot that looks like a human woman (specifically, her inventor), into which they have installed an atom bomb. The goal of the project is to invent a weapon that can infiltrate enemy cities and thereby overcome enemy antimissile defenses. Of course, while testing a robot with a live atom bomb in its stomach on the streets of San Francisco, the robot is damaged in a bank robbery and goes berserk.

Called in to hunt the killer robot down are Gregory Hines and Renée Soutendijk, the Dutch actress who plays both Eve and her inventor. The only vulnerable spot on the robot are her eyes. Put a bullet through one of them and you will bypass the armor plate and get directly at the cybernetic brain. However, despite Gregory Hines's best efforts, he is unable to get a clear shot at Eve's eyes. Trapped on a subway track, he throws his gun to Eve's inventor, who is cowering on the station platform as the robot advances menacingly toward her. The scientist empties the clip into Eve's face, missing the eyes with each shot. Then, just as Eve reaches for her creator's neck, and nine seconds before the bomb is set to go off, the inventor reaches up and shoves the barrel of the gun into the robot's eye. The robot instantly keels over and the city is saved. The movie is an enjoyable piece of bubble gum for the mind, but it also demonstrates a problem that robots have. Like all machines, they are vulnerable to someone throwing sand in their gears.

One of the problems with designing a robot is that we have yet to develop a mechanical actuator that is as compact and efficient as human muscle. Most of our electric actuators rely on the rotary motion of an electric motor, and any linear actuators involve a series of jack screws, gear boxes, and other bulky transmission devices. Actuators can also be powered by either pneumatic or hydraulic energy, both of which require complex plumbing and an electricity-eating pump somewhere.

The result is that any humanoid robot we build (such as the recent Japanese stair climbing model) is several times heavier than a human being. It is also underpowered for its weight. This means that the robot can't run, jump, or swim as fast or as far as we can. It lacks our range and speed. It isn't as flexible when it comes to wriggling through small places, such as the hole in the chain link fence that inevitably bars the heroine's path when she is being chased by a killer robot. Also, real life robots don't climb trees.

The problems associated with building a humanoid robot were made clear to me several years ago when I read an article about hip replacement surgery. The human hip joint is a ball-and-socket design in which the dimensions of the bones in the vicinity of the joint are constrained by the fact that the joint must move freely. When doctors first began replacing human hips with artificial joints, they ran into a perplexing problem. Even though they used the strongest steel they had available to manufacture the prosthesis, the steel hip joints kept snapping off just under the ball. The problem was that

the high-strength steel implants weren't as strong as the bones they replaced and because of the constraints on geometry, they couldn't be strengthened. What was required was a stronger metal, one that rivals the strength-to-weight ratio of that miracle composite material known as "bone."

That is the problem we currently face in constructing a robot. Our materials and technologies are not yet good enough to compete with Mother Nature. We can make machines that are faster, that are stronger, and can jump higher than human beings — we just can't build them in the same package. Not yet, anyway.

Robots also have the same vulnerabilities as people. Like Eve and her atom bomb, a bullet in the eye will slow them down. Or, as E.E. "Doc" Smith once advised his characters in his 1930s classic *Triplanetary*, if you want to kill a robot, just poke out its eyes and stick an ice pick in its ears. As soon as it loses sensory input, it will stop what it is doing and wait for attention. Also, you may want to turn off the atom bomb in the robot's stomach before you cause it any mental distress. No telling how much of a temper it may have.

### Conclusion

Over the past 75 years or so, the portrayal of robots in science fiction stories and movies has taken on considerably more nuance than the Frankenstein's monster plot that dominated science fiction in the 1930s. Modern robots can be your enemies or your friends, your master or your slave, fearsome or cuddly. It all depends on the needs of the plot.

Nor do we see as many rogue robot stories as we once did. The Terminator and T-2000 models may be killer robots, but there is nothing rogue about them. They are machines doing what they were programmed to do, and from the viewpoint of the computers that are their masters, these efforts are beneficial. If you were a computer bent on world domination, wouldn't you look with favor on any scheme that rid the planet of those highly illogical, difficult-to-predict human beings?

Although they continue to flourish in visual media such as movies and television, robot stories in literature are much less popular than they once were. The reason for this is so obvious that it is often overlooked. We don't write much science fiction about robots anymore because they are fast leaving the confines of the science fiction ghetto and making their way into everyday life. Robots are no longer the sole province of mad scientists, mysterious thinking machines brought to life by dark technological processes. Robots have become the appliances of modern life, just another gadget in the background of our existence. Robots are now common, everyday appliances. After all, how many science fiction stories get written about toasters or microwave ovens?

We sometimes overlook how fast and how far we have come in this respect. If you are reading this article in PDF format, then you must have access to an electronic brain that is at least as powerful as any positronic brain that Isaac Asimov ever imagined. I refer, of course, to the lowly PC, an average model of which is now equipped with a couple of gigabytes of memory, and whose clock speed has exceeded 10 gigahertz.

If you had quoted those numbers to the young Isaac Asimov in 1941, he would have asked, "How large is the building that houses all of that hardware?" In fact, if you could calibrate the mental image he had in mind when he first wrote the positronic robot series,

you would probably find that what he had in mind was the equivalent of an old 8080 machine, or God forbid, even a TRS-80, Model I. (I still own mine, if anyone is in the market for one.)

So we have learned two things about robots since Karel Capek coined the term. The first is that cybernetics has been advancing much faster than anyone could have imagined. The power of our electronic brains is on an exponential curve to infinity, and it will be interesting to see where they finally level off. The second thing we have learned is that a robot is a much more difficult thing to build than science fiction let on in all of those robot stories. Save for specialized machines that weigh a ton, humanoid robots have been a long time coming. In fact, we have had little luck in reproducing the human form in the same size and package as the original, let alone matching the agility, dexterity, and range. Remember, no robot that remains attached to an extension cord is liable to have much luck taking over the planet.

However, it is a fool who predicts that anything is impossible, and at the speed that our computers are becoming more complex, it won't be too many more decades until some mechanical brain pops off the production line at Intel or Motorola, opens whatever sort of visual sensors with which it has been equipped, and says, *Momma!*

On that day we had better be prepared with some version of Asimov's Three Laws. We can either design them into the robot's programming to begin with, or we can do it the old fashioned way. We can teach our newest offspring to distinguish right from wrong. Either way, there is liable to be a silicon-based life form in our future. We had best get ready for it.

The End

© 2010 by Michael McCollum, All Rights Reserved

This article is the property of the author and of Sci Fi - Arizona. It may not be sold, or used for any commercial purpose whatsoever, without the written permission of the author.

---

# Sci Fi - Arizona

## A Virtual Science Fiction Bookstore and Writer's Workshop

Michael McCollum, Proprietor  
WWW.SCIFI-AZ.COM

If you enjoy technologically sophisticated science fiction or have an interest in writing, you will probably find something to interest you at Sci Fi - Arizona. We have short stories and articles on writing— all for free! If you like what you find, we have full length, professionally written science fiction novels in both electronic form and as hard copy books, and at prices lower than you will find in your local bookstore.

Moreover, if you like space art, you can visit our Art Gallery, where we feature the works of Don Dixon, one of the best astronomical and science fiction artists at work today. Don is the Art Director of the Griffith Observatory. Pick up one or more of his spacescapes for computer wallpaper, or order a high quality print direct from the artist.

We have book length versions of both Writers' Workshop series, "The Art of Writing, Volumes I and II" and "The Art of Science Fiction, Volumes I and II" in both electronic and hard copy formats.

So if you are looking for a fondly remembered novel, or facing six hours strapped into an airplane seat with nothing to read, check out our offerings. We think you will like what you find.

### NOVELS

---

#### **1. Life Probe - <sup>US</sup>\$7.50**

The Makers searched for the secret to faster-than-light travel for 100,000 years. Their chosen instruments were the Life Probes, which they launched in every direction to seek out advanced civilizations among the stars. One such machine searching for intelligent life encounters 21st century Earth. It isn't sure that it has found any...

#### **2. Procyon's Promise - <sup>US</sup>\$7.50**

Three hundred years after humanity made its deal with the Life Probe to search out the secret of faster-than-light travel, the descendants of the original expedition return to Earth in a starship. They find a world that has forgotten the ancient contract. No matter. The colonists have overcome far greater obstacles in their single-minded drive to redeem a promise made before any of them were born...

### **3. Antares Dawn - US\$6.00**

When the super giant star Antares exploded in 2512, the human colony on Alta found their pathway to the stars gone, isolating them from the rest of human space for more than a century. Then one day, a powerful warship materialized in the system without warning. Alarmed by the sudden appearance of such a behemoth, the commanders of the Altan Space Navy dispatched one of their most powerful ships to investigate. What ASNS Discovery finds when they finally catch the intruder is a battered hulk manned by a dead crew.

That is disturbing news for the Altans. For the dead battleship could easily have defeated the whole of the Altan navy. If it could find Alta, then so could whomever it was that beat it. Something must be done...

### **4. Antares Passage - US\$7.50**

After more than a century of isolation, the paths between stars are again open and the people of Alta in contact with their sister colony on Sandar. The opening of the foldlines has not been the unmixed blessing the Altans had supposed, however.

For the reestablishment of interstellar travel has brought with it news of the Ryall, an alien race whose goal is the extermination of humanity. If they are to avoid defeat at the hands of the aliens, Alta must seek out the military might of Earth. However, to reach Earth requires them to dive into the heart of a supernova.

### **5. Antares Victory – First Time in Print – US\$7.50**

After a century of warfare, humanity finally discovered the Achilles heel of the Ryall, their xenophobic reptilian foe. Spica – Alpha Virginis – is the key star system in enemy space. It is the hub through which all Ryall starships must pass, and if humanity can only capture and hold it, they will strangle the Ryall war machine and end their threat to humankind forever.

It all seemed so simple in the computer simulations: Advance by stealth, attack without warning, strike swiftly with overwhelming power. Unfortunately, conquering the Ryall proves the easy part. With the key to victory in hand, Richard and Bethany Drake discover that they must also conquer human nature if they are to bring down the alien foe ...

### **6. Thunderstrike! - US\$7.50**

The new comet found near Jupiter was an incredible treasure trove of water ice and rock. Immediately, the water-starved Luna Republic and the Sierra Corporation, a leader in asteroid mining, were squabbling over rights to the new resource. However, all thoughts of profit and fame were abandoned when a scientific expedition discovered that the comet's trajectory placed it on a collision course with Earth!

As scientists struggled to find a way to alter the comet's course, world leaders tried desperately to restrain mass panic, and two lovers quarreled over the direction the comet was to take, all Earth waited to see if humanity had any future at all...

## 7. The Clouds of Saturn - US\$7.50

When the sun flared out of control and boiled Earth's oceans, humanity took refuge in a place that few would have predicted. In the greatest migration in history, the entire human race took up residence among the towering clouds and deep clear-air canyons of Saturn's upper atmosphere. Having survived the traitor star, they returned to the all-too-human tradition of internecine strife. The new city-states of Saturn began to resemble those of ancient Greece, with one group of cities taking on the role of militaristic Sparta...

## 8. The Sails of Tau Ceti – US\$7.50

*Starhopper* was humanity's first interstellar probe. It was designed to search for intelligent life beyond the solar system. Before it could be launched, however, intelligent life found Earth. The discovery of an alien light sail inbound at the edge of the solar system generated considerable excitement in scientific circles. With the interstellar probe nearing completion, it gave scientists the opportunity to launch an expedition to meet the aliens while they were still in space. The second surprise came when *Starhopper's* crew boarded the alien craft. They found beings that, despite their alien physiques, were surprisingly compatible with humans. That two species so similar could have evolved a mere twelve light years from one another seemed too coincidental to be true.

One human being soon discovered that coincidence had nothing to do with it...

## 9. Gibraltar Earth – First Time in Print — \$7.50

It is the 24th Century and humanity is just gaining a toehold out among the stars. Stellar Survey Starship *Magellan* is exploring the New Eden system when they encounter two alien spacecraft. When the encounter is over, the score is one human scout ship and one alien aggressor destroyed. In exploring the wreck of the second alien ship, spacers discover a survivor with a fantastic story.

The alien comes from a million-star Galactic Empire ruled over by a mysterious race known as the Broa. These overlords are the masters of this region of the galaxy and they allow no competitors. This news presents Earth's rulers with a problem. As yet, the Broa are ignorant of humanity's existence. Does the human race retreat to its one small world, quaking in fear that the Broa will eventually discover Earth? Or do they take a more aggressive approach?

Whatever they do, they must do it quickly! Time is running out for the human race...

## 10. Gibraltar Sun – First Time in Print — \$7.50

The expedition to the Crab Nebula has returned to Earth and the news is not good. Out among the stars, a million systems have fallen under Broan domination, the fate awaiting Earth should the Broa ever learn of its existence. The problem would seem to allow but three responses: submit meekly to slavery, fight and risk extermination, or hide and pray the Broa remain ignorant of humankind for at least a few more generations. Are the hairless apes of Sol III finally faced with a problem for which there is no acceptable solution?

While politicians argue, Mark Rykand and Lisa Arden risk everything to spy on the all-powerful enemy that is beginning to wonder at the appearance of mysterious bipeds in their midst...

### **11. Gibraltar Stars – First Time in Print — US\$7.50**

The great debate is over. The human race has rejected the idea of pulling back from the stars and hiding on Earth in the hope the Broa will overlook us for a few more generations. Instead, the World Parliament, by a vote of 60-40, has decided to throw the dice and go for a win. Parliament Hall resounds with brave words as members declare victory inevitable.

With the balance of forces a million to one against *Homo sapiens Terra*, those who must turn patriotic speeches into hard-won reality have their work cut out for them. They must expand humanity's foothold in Broan space while contending with a supply line that is 7000 light-years long.

If the sheer magnitude of the task isn't enough, Mark and Lisa Rykand discover they are in a race against two very different antagonists. The Broa are beginning to wonder at the strange two-legged interlopers in their domain; while back on Earth, those who lost the great debate are eager to try again.

Whoever wins the race will determine the future of the human species... or, indeed, whether it has one.

### **12. Gridlock and Other Stories - US\$6.00**

Where would you visit if you invented a time machine, but could not steer it? What if you went out for a six-pack of beer and never came back? If you think nuclear power is dangerous, you should try black holes as an energy source — or even scarier, solar energy! Visit the many worlds of Michael McCollum. I guarantee that you will be surprised!

## Non-Fiction Books

---

### **13. The Art of Writing, Volume I - US\$10.00**

Have you missed any of the articles in the Art of Writing Series? No problem. The first sixteen articles (October, 1996-December, 1997) have been collected into a book-length work of more than 72,000 words. Now you can learn about character, conflict, plot, pacing, dialogue, and the business of writing, all in one document.

### **14. The Art of Writing, Volume II - US\$10.00**

This collection covers the Art of Writing articles published during 1998. The book is 62,000 words in length and builds on the foundation of knowledge provided by Volume I of this popular series.

### **15. The Art of Science Fiction, Volume I - US\$10.00**

Have you missed any of the articles in the Art of Science Fiction Series? No problem. The first sixteen articles (October, 1996-December, 1997) have been collected into a book-length work of more than 70,000 words. Learn about science fiction techniques and technologies, including starships, time machines, and rocket propulsion. Tour the Solar System and learn astronomy from the science fiction writer's viewpoint. We don't care where the stars appear in the terrestrial sky. We want to know their true positions in space. If you are planning to write an interstellar romance, brushing up on your astronomy may be just what you need.

#### **16. The Art of Science Fiction, Volume II - US\$10.00**

This collection covers the *Art of Science Fiction* articles published during 1998. The book is 67,000 words in length and builds on the foundation of knowledge provided by Volume I of this popular series.

#### **17. The Astrogator's Handbook – Expanded Edition and Deluxe Editions**

The Astrogator's Handbook has been very popular on Sci Fi – Arizona. The handbook has star maps that show science fiction writers where the stars are located in space rather than where they are located in Earth's sky. Because of the popularity, we are expanding the handbook to show nine times as much space and more than ten times as many stars. The expanded handbook includes the positions of 3500 stars as viewed from Polaris on 63 maps. This handbook is a useful resource for every science fiction writer and will appeal to anyone with an interest in astronomy.