



SCIENCE AND SCIENCE FICTION

by
Michael McCollum

One of the most basic requirements for being a science fiction writer is that you must understand science. This doesn't mean that you have to be a scientist or engineer. In fact, neither of those professions are particularly renowned for their skill at placing words on paper. To write science fiction, however, you must understand science well enough to avoid the simple mistakes that destroy a reader's belief in your story.

The principle is called "the willing suspension of disbelief." When someone picks up your book or story and begins to read, they enter into a contract with you, the writer. They agree to believe everything you say, no matter how outlandish, right up to the moment that you say something that they just can't believe! Usually that moment comes when you tell them something they know not to be true because they are more knowledgeable about the subject than you are. When you make some simple mistake that sticks in the reader's craw, then you lose them. You might as well have dumped a bucket of ice water over their head.

And the most egregious mistakes in science fiction are committed by people who don't understand the nature of science. Most people think science is a bunch of people in white laboratory coats cooking test tubes over Bunsen burners. They couldn't be more wrong.

At its most basic, science is simply a scheme for answering questions. In this respect it is no different from many philosophies and religions – the Chinese *I Ching*, for instance. These, too, are methods we fallible humans have invented for pondering the imponderable, for extracting understanding from ignorance. They are all methods for filling that void deep within us that comes from not knowing.

The one area where science stands head-and-shoulders above its competitors is the efficiency with which it provides useful answers to practical questions. It is, quite simply, the most successful answer generating machine ever invented. From its humble beginnings some five centuries ago, science has transformed the world in ways both good and bad. The scientific method at its most basic is simply:

1. Think up a question.
2. Think up an answer to the question. (Feel free to guess!)
3. Think up an experiment that will test your answer..
4. Perform the experiment and record the results.

5. Use the results to decide if your guess was the right one.
6. Revise your answer (hypothesis) to agree with the experiment.
7. Repeat steps 1 through 6 until you get it right.

You must have at least a passing acquaintance with science to be a science fiction writer, or else you may find yourself writing an unintentional comedy. One of the most common mistakes non-technical writers make involves the speed of light. Just about everyone knows that you can't go faster than light (186,000 miles per second). Why not, you ask? Because Albert Einstein said so, that's why.

Since exceeding the speed of light is often a necessity in a science fiction story, it is incumbent on the author to explain how he has achieved this impossible task. This is why Captains Kirk and Picard are always ordering "Warp Factor 10, and step on it!" Many neophyte writers use a very logical approach to exceeding the speed of light. They extrapolate the performance of our current staged rockets. What if you had a booster rocket capable of accelerating to 90% of light speed, and you launched a second rocket off its back that was also capable of accelerating its payload to 90% of light speed. Obviously, the resulting spaceship would then be going at 180% of the speed of light, right? Wrong! For those of you who do not understand why this doesn't work, please see next month's article in this series: "Einstein's Barrier – The Universal Speed Limit." Because he has extrapolated the common sense idea that $2 + 2 = 4$ into a field where common sense doesn't hold, the writer instantly loses his credibility and half his readership.

Like many of you, I enjoyed the special effects in the movie *Independence Day*. I also thought the plot was fairly dumb. Two examples: the hero introduces a computer virus into the alien ship at the proper time to allow the Earth to beat back the invaders. He uses a Macintosh Powerbook to do it. Isn't it lucky that the alien computer also uses an 8,N,1 communications protocol at 28,800 baud? Obviously, the director has heard about computer viruses, but doesn't know exactly what they are or how they work. Still, as long as the great unwashed don't catch on, right?

The second example involves the massed attack by F-18 fighters firing AMRAAM missiles. Now I worked on the F-18 for three and a half years and think it a fine aircraft. In fact, I was at Northrop just two days ago (as I am writing this) to discuss F-18 business. Still, I couldn't help ask myself when they lined up to begin firing on the 15-mile-diameter spacecraft, "What are they trying to do, scratch its paint?" If the target is 15 miles in diameter, you don't shoot AMRAAM missiles at it. You carpet bomb the sucker with B-52s! The scene was obviously put in because it was visually exciting. It would have been more so if the director and screenwriter had also used their heads.

Nor are the booby traps in science fiction writing always so obvious. You can go awry on extremely subtle points. One of the most famous examples of a little knowledge being a dangerous thing was published in *Isaac Asimov's Science Fiction Magazine* several years ago. The story was about a huge coffee-can-shaped space habitat that had lost its spin, leaving the inhabitants in zero gravity. The space station was one of the big Lagrangian colonies that were so popular in the mid-1980's. (A Lagrangian colony is one placed in either the Earth-Moon L4

or L5 spot, where they will seem to be stationary with respect to the Moon.) Since the inhabitants had no method for getting the station spinning again, they hit upon the idea of having a relay team of runners jog around the station at the equator for several months, always in the same direction. It was basically your average space jogging story. The friction of the joggers' shoes on the circumferential running track caused the station to begin spinning about its axis again, thereby restoring the artificial gravity.

I remember being bothered by this story when I first read it. However, it wasn't until six months later when letters began hitting the feedback column that the reason for my discomfort became clear. The author obviously knew Newton's Third Law, namely that for every action there is an equal and opposite reaction. He used the principle to set up what was basically a cute little story. And while it is true that if someone starts running clockwise around the inside of a giant coffee can in space, the coffee can will naturally begin to rotate counterclockwise. So far, so good. What the author obviously didn't know was that when each individual runner halts, the equal-and-opposite reaction will decelerate the station, canceling whatever spin the runner originally imparted. In other words, the station stops spinning as soon as the runner stops running! That is because the runners and space habitat are part of a closed system and the momentum of a closed system must forever remain unchanged – in this case net zero.

Now if the inhabitants had agreed to commit suicide by all going to an outside airlock and jumping off the station as fast as they could (always in the same direction), then the story would have worked. As it was, the letters column was filled for three months with people making fun of the author and the magazine editor for letting such a howler slip into print.

The violated principle of the story is so subtle that a long time engineer and science fiction writer did not pick up on the mistake. Even so, it bothered me, and in so doing, ruined my enjoyment of the story. What difference does it make, you ask? Entertaining readers is what a writer does. If you don't entertain them, you aren't going to sell them too many more stories.

One last example of what I am talking about. A book I enjoyed immensely was *The Flight of the Old Dog* by Dale Brown. However, halfway through the book, the United States launches a laser battle station into space to hover directly above the north pole. As I remember, the station was named *Ice Palace*. Now everyone knows about satellites that hover perpetually over one spot on the globe in a geosynchronous orbit. What Mr. Brown obviously didn't know was that such an orbit can only exist above the equator – *never above the pole!* That is because these orbits are not really stationary. The satellites in them are moving much faster than we do here on the ground as we make our 1000 mile per hour journeys from west to east. But the satellites at 22,300 miles above the equator take precisely 24 hours to go once around the planet, just as we do. And for that reason they appear to hover perpetually above a single spot on the globe. The north pole, however, doesn't move at all. It is stationary (or else it wouldn't *be* the pole, now would it?). Any satellite placed perpetually above it will just fall down.

And that's an important point if you want to be a science fiction writer. People pay attention to the tiny things and will tell you when you get them wrong. I learned that while writing my novel, *Thunderstrike!* For reasons of plot, I need the phase of the moon to be just past new on July 17, 2087. (Just past its new phase means that the moon is between the sun and the Earth, which places the side that always faces the Earth mostly in darkness). Frankly, I had no idea what the phase of the moon would be on that date, and therefore didn't worry about it. About six months after the book was published, I received a letter from a reader who pointed out that the moon would be nearly full on the date in question and asked if I had made a mistake. He

explained his method to me and it turned out that it isn't that difficult a thing to compute. For the record, I used July 17 as the date because that happens to be my wife's birthday.

Can a writer avoid all mistakes? No, he can't. But by minimizing them, he will lose the fewest readers when they fall out of their "willing suspension of disbelief." And a science fiction writer who understands what science is – and isn't – will be far more successful than someone who merely throws in some jargon and technospeak because he thinks it sounds good. If you write gibberish, you will quickly get the reputation of being a writer of gibberish. Needless to say, there are better ways to launch a writing career.

© 2007 by Michael McCollum, All Rights Reserved

This article is the property of the author and of Sci Fi - Arizona. It may be freely copied distributed so long as the text remains unaltered, and the copyright notice and the address of Sci Fi - Arizona remain unchanged.

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 - US\$4.50

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 - US\$4.50

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\$4.50

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\$4.50

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\$7.00

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\$6.00

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\$4.50

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\$4.50

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 — \$6.00

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 — \$7.00

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. Gridlock and Other Stories - US\$4.50

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

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.