



Predicting the Future

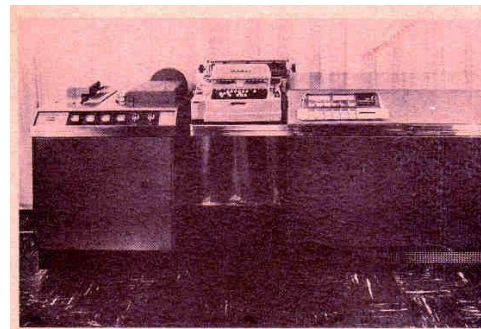
By
Michael McCollum

Since the time of Jules Verne and Herbert George Wells, it has been the conventional wisdom among the public that the function of science fiction and science fiction writers is to predict the future. As usual when the conventional wisdom is involved, nothing could be further from the truth. In fact, the track record for science fiction writers forecasting future events is dismal. That is not the fault of science fiction writers, but rather an artifact of the process by which the future comes about. Not only is it damned difficult to predict the future, it's actually impossible! The reason lies in a new field of mathematics, one to which most people have never been exposed. It is the field that goes by the rather grandiose name of *Chaos Theory*, and therein lies a tale...

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One winter day in 1961, M.I.T. meteorologist Edward Lorenz was playing with his primitive Royal McBee LGP-30 computer. Those of you who grew up on TRS-80 Model 1's and IBM PC's would undoubtedly sneer at the Royal McBee. It ran on vacuum tubes! Specifically, it had 113 electronic tubes and 1450 diodes and performed an amazing 60 calculations per second (versus the several million calculations per second speed of the computer on which I am writing this article).

Lorenz was studying a simple model of how thunderstorms work. This model, which consisted of three interrelated differential equations, allowed him to iteratively calculate the conditions in a simple convective cell in a thunderstorm. One day in that winter of 1961, he shut down his computer to go get some lunch, and upon his return, he decided to restart his calculation in midstream rather than go back to the beginning. So, looking up the exact conditions he had reached a few minutes before going to lunch, he typed in the data and started the computer cranking again. To his amazement, the numbers that spewed out of the machine failed to reproduce the results he'd gotten just two hours earlier. Rather, they diverged wildly from the previous track the data had been taking.



Royal McBee Corporati

Figure 1: The LGP-30
(The computer is the big box on the

Perplexed, he began looking into the problem in greater detail. Since computers only do what you tell them, and because his equations were completely deterministic, he couldn't explain why things were diverging from their previous values so radically. Upon further investigation, however, he realized that although his printout recorded the data to three decimal places, the machine actually calculated them out to 6 digits. In other words, when he input the data after lunch, he had been off the true values by approximately one-tenth of one percent. That tiny variation in the input had been sufficient to quickly drive the machine's output in a totally unexpected direction.

Most people would have shrugged their shoulders and forgotten about it. Not Lorenz. He realized that he had just tripped over one of the major flaws in Newtonian physics. Inherent in Newton's various laws is the assumption that if you understand a physical process, and know the initial conditions with fair accuracy, then you can always predict the approximate outcome of the process. What Lorenz discovered was that with initial data within 0.001 of the original point at which he tried to restart his calculation, he came nowhere near predicting the outcome. He was so startled by this result that he published a paper on the subject, and in the process, became one of the founding fathers of Chaos Theory.

To describe his results, Lorenz coined the term "butterfly effect." Essentially, the butterfly effect states that if a butterfly flaps its wings in Tokyo, the resulting disturbance in the atmosphere is liable to result in a hurricane in the Caribbean within a few weeks or months. The scientific term for the effect is "extreme sensitivity to initial conditions." The idea is a relatively simple one to grasp. The atmosphere is a complex system that suffers from extreme sensitivity to initial conditions. The few air molecules disturbed by the butterfly's wings will disturb other molecules, which in turn will lead to a cascade of events that eventually triggers the hurricane.

Now the example is fanciful, but the conclusions Lorenz reached are not. What he realized from his work with the primitive LGP-30 was that it is impossible to know the initial conditions in the atmosphere with sufficient precision to predict what will happen next. If you somehow managed to position a tiny weather station in each cubic centimeter of the Earth's atmosphere, you still wouldn't have enough data to predict how the atmosphere will behave. In other words, it isn't merely difficult to make long term predictions about the weather — it's impossible!

He wasn't saying that predicting the weather is beyond our current capability, mind you. He was saying that it is absolutely, completely, and theoretically impossible. It doesn't matter how big and powerful the computers become, we will never know enough about the atmosphere from moment to moment to predict the weather on any long term basis.

"Then what are all of those weather people who follow the Six O'clock News doing if they aren't predicting the weather?" you ask. They *are* predicting the weather, but not in the long term. When a line of thunderstorms forms on the eastern horizon and the wind is blowing to the west, it doesn't take a degree in meteorology to predict rain. But can you do it a week in advance? How about two weeks, a month, or a quarter-year in advance? That is the difference between what most people mean by "predicting the weather" and what Edward Lorenz meant. When the cumulonimbus are flowering about the horizon and the lightning and thunder begin, no number of butterflies flapping their wings will change the inevitable. But the anvil-headed clouds, the flashes of actinic light,

and the booming sound of air rushing in to fill a superheated vacuum are not the cause of the storm. They are its effects. Once those effects become obvious, then predictions become possible. But not having sufficient weather measuring equipment to fully characterize all of the causes means that we can never predict the results of these tiny variations that combine to form next week's weather.

This idea that predicting the weather is impossible is stunning in both its simplicity and its audacity. And like many of the seminal ideas of science, Lorenz's 'butterfly effect' has had some fairly widespread consequences. Prior to Lorenz, what is now known as the National Oceanic and Atmospheric Administration invested hundreds of millions of dollars annually in a program to predict long term climatological changes via computer. After Lorenz, they cancelled the program. Having had the futility of what they were trying to do demonstrated scientifically, they naturally switched the money to something that might actually bear fruit someday.

What does all of this talk of weather forecasting have to do with predicting the future? It has everything to do with it. After all, what is weather forecasting other than the attempt to predict the future in a limited way and on a limited scale? And if the interactions involving turbulent convective flow in the atmosphere are sensitive to initial conditions, what of the vastly more complex "atmosphere" of long term human interactions, a subject that we know by the generic name "history." For despite the complexity of the ways in which they interact, air molecules are at least logical. Human interaction is vastly more complicated than computational fluid dynamics.

Many a science fiction writer has made this point while explaining the background to his or her time travel story. One of my favorite explanations comes in H. Beam Piper's *Lord Kalvan of Otherwhen*, when the hero muses to himself about what it was that caused the Aryans to move west out of India on his home timeline (Euro-American), but east on the timeline in which he finds himself stranded (Aryan-Transpacific). Perhaps the tribe's shaman woke up with a headache on the day they were to begin the migration.

So, by analogy to the problems faced by weather forecasters, is it not obvious that prognosticators of the future are faced with an even more complex and impossible task when they try to foretell events? I do not wish to cast aspersions on generations of Gypsy fortunetellers, but the future is much too complex and its underlying causes too varied for anyone to measure them with an instrument as simple as a crystal ball.

Yet, if predicting the future is impossible, why do so many people believe that we science fiction writers can do it? Partly it is the fact that people don't feel comfortable acknowledging the complexity of life. Partly it is caused by the operation of our own self-aggrandizing propaganda machine. It is touching that they have so much faith in us. I only wish that we deserved it.

Let us explore, then, how this myth came to be and whether or not there is any truth to the rumor that we can see into the future? After all, just because something is impossible doesn't mean that science fiction can't do it, right? So, let us return to those thrilling days of yesteryear (before Edward Lorenz) when the world was young and everything seemed possible. In the beginning, God created the heavens and the Earth; and a little while later, the science fiction writers...

Jules Verne and H. G. Wells Predict the Future

In the beginning there was Jules Verne, a failed French lawyer and playwright who was forced to support himself writing stories for magazines read by adolescent boys. His first successful story was *Five Weeks in a Balloon* (1863) about a balloon safari into Africa. The story was an immediate sensation and showed Verne the way that he could make money and put bread on the family table. It wasn't as glamorous as writing for the Paris stage, but it was a way to eat.

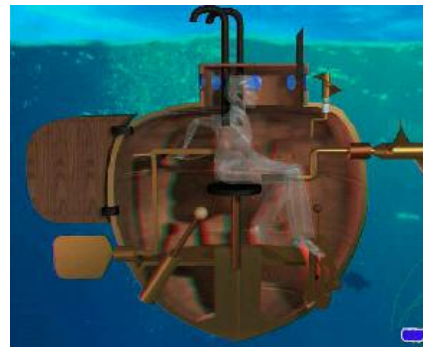
Strictly speaking, Jules Verne did not write science fiction. What he wrote were stories of *voyages extraordinaires*, trips taken by fantastic conveyances that allowed his readers to unleash their imaginations. And since his initial readers were teenage boys, whose imaginations were barely in check in the first place, he ignited a fire that still burns brightly a century and a half after his time.

Verne did not invent any of the conveyances that he used. His balloon in *Five Weeks in a Balloon* was fancier than most, but otherwise was absolutely conventional aeronautics of the time. Later, in *20,000 Leagues Under the Sea* (1869), he invented a fantastic submarine that he named *Nautilus*. The *Nautilus* is cited as one of the prime examples of a science fiction writer predicting a future development. The correlation is tenuous at best. True, the submarine that could stay submerged for weeks and months at a time would seem to foreshadow the nuclear powered submarines of modern day. However, if you are going to write a story about a submarine that can travel 20,000 leagues (64,000 miles) beneath the sea, you will have to power it by something that outwardly resembles a nuclear reactor, won't you?

No, in the mid-nineteenth century, submarines were a well-developed concept in the public consciousness, and Jules Verne merely borrowed the idea for one of his extraordinary voyage stories. In fact, submarines had been in use for nearly one hundred years at the time of Jules Verne.

During the American Revolution, David Bushnell built the *Turtle* and sent it out to attack British ships in New York harbor. Not even the name *Nautilus* was original with Verne. Napoleon Bonaparte commissioned the first practical submarine in 1800. The submarine was designed by the American inventor Robert Fulton, and was named the *Nautilus*. Fulton and three mechanics descended to a depth of 25 feet in it in 1801 and demonstrated that it could successfully attack enemy ships in 1805. And, of course, six years before Verne wrote *20,000 Leagues*, the Confederacy's ill-fated *C.S.S. Hunley* sank the *Housatonic* (and itself) in Charleston harbor.

Verne wrote another story that is widely regarded as one of science fiction's major feats of prediction. In his *From Earth to the Moon* (1865), he has the American industrialist Victor Barbicane launch his spaceship from central Florida, not far from Cape Canaveral. This, then is a true prediction of things to come, right? Wrong. Actually, the ship wasn't a rocket, but a cannon shell and it was launched from central



**Figure 2: David Bushnell's
*Turtle***

Florida because Verne knew that the farther south one launched from, the more the rotation of the Earth would aid the flight. Besides, having just come through the Civil War, the United States had been much in the news, and therefore, the object of considerable interest among the French people. Also, Yankees even then had a reputation for cleverness, making the setting of the story quite logical.

So, by setting his story in a far-off, glamorous land (to a Frenchman, anyway), Verne was merely engaged in a time-honored literary tradition and the fact that his launching site was less than 100 miles from the point where the real moon rockets flew was the purest coincidence. But, of course, it is the sort of coincidence that people remember long after you are dead.

The first modern science fiction writer was Herbert George Wells, a failure as a draper's and chemist's apprentice, as well as several other professions. He also couldn't hold a job because he was a chronic consumptive. Wells made his reputation with *The Time Machine*, serialized in "The New Review" in 1894-1895. Unlike Verne, who concentrated on the mechanics of "getting there," Wells explored the philosophical implications of his fictional technology. And in so doing, he laid the basis for modern science fiction.

Yet, even he did not truly predict the future. He wrote interesting stories about times that had not yet happened, but made no claims that his future would turn out to be *the* future. And like Verne, who influenced him greatly, H.G. Wells borrowed liberally from earlier writers. His novel *The War of the Worlds* (1898) was in the tradition of the future war novel pioneered by Lieutenant-Colonel Sir George Tomkyns Chesney in the "Battle of Dorking" published in 1871. In fact, there were 22 such stories in 1871 alone. Some of these undoubtedly came to the notice of the seven-year-old Wells in 1873 when he was laid up with a broken leg and reading everything he could get his hands on.

Nor was the idea of Martians invading the Earth originally Wells's. Actually, the concept was thought up by his brother Frank. As Wells explained later:

"We were walking together through some particularly peaceful Surrey scenery. 'Suppose some beings from another planet were to drop out of the sky suddenly,' said he, 'and begin laying about them here!' ... That was the point of departure..."

As for his physical descriptions of Mars, he may have been inspired by the work of a French writer of scientific and cosmic romances, Camille de Flammarion, particularly *La Fin du Monde* (1894) and *La Planete Mars* (1892). And the Martian Heat-Ray may owe something to Bulwer-Lytton's *Vril*, or perhaps to a description of John Hartman's electric gun published in London newspapers in the 1890s. (Note: We have met Bulwer-Lytton before in this series. He lends his name to the Bulwer-Lytton Fiction contest, colloquially known as "The Dark and Stormy Night" contest. It is a contest held each year at the University of San Diego where writers attempt to write the worst possible opening for a novel. The winners are so bad that they are hilarious!)

So, like Jules Verne, H.G. Wells wasn't trying to predict the future. That would have seemed grandiose. Rather, he wrote stories that entertained the audience while repackaging ideas that were already well known at the time, the better to make a few quid for himself, his wife, his ex-wife, and a variety of mistresses.

Yet, even though predicting the future is impossible, both Verne and Wells are widely credited with that ability. So what is it in the human psyche that makes people want to think someone can perform this particular act of legerdemain?

The Psychological Need for Certainty

I have long been fascinated by an interesting quirk in the human makeup. There seems to be an obsessive need for certainty in a large number of people, a need that will drive them to believe the most amazing things. I am speaking now of that curious sub-culture known as “conspiracy theorists.”

You’ve all crossed paths with these people in your life. Perhaps you *are* one of these people. No harm in that. We all have our little quirks.

Conspiracy theorists believe that there must have been something more cosmic involved in the assassination of John F. Kennedy than one loan nut with a rifle. They see conspiracies everywhere and people Dealy Plaza with enough gunmen to hold a mini-NRA convention. You see the syndrome build to the point that every fifteen years or so, some left-leaning Hollywood producer or director will make a movie purporting to show that Kennedy’s assassination was the work of right-wing fanatics. I can think of two of these efforts at the moment: *Executive Action* (1973) and Oliver Stone’s *JFK* (1991). I recently saw *Executive Action*, where Burt Lancaster asks the evil Republican millionaire (Will Geer, I believe) why he feels he needs to assassinate Kennedy. “Why not dig up some political dirt on him instead?” the hired gun asks. The millionaire’s response turns the movie into unintentional comedy. He says, “We’ve tried, but we just couldn’t find anything!”

Now whether you are pro-Kennedy, anti-Kennedy, or just don’t care, I think you will agree that the stories of Judith Exner and Marilyn Monroe indicate that a serious opponent would have had little trouble “digging up dirt” on John Kennedy. He may not have been able to use it, but he certainly would have found it.

That is just one example of conspiracy theory. There is the ever popular “Jewish bankers are the secret rulers of the world” conspiracy, the missile attack on TWA Flight 800 conspiracy, and the various paranoid fantasies the *X-Files* serves up each week. (Don’t get me wrong. I love *The X-Files*!) So why do all of these people believe these outlandish things despite the lack of evidence to support their view? Indeed, why is it that conspiracy theorists cite the total lack of evidence as proof that the conspiracy exists?

I dub the phenomenon “the need for certainty.” People are more comforted by the idea that some evil force is guiding history than they are with the thought that it all “just happens.” It is this psychological need for certainty that causes most people to take comfort in the idea that there exists somewhere in the world a group who can actually predict the future. It never seems to occur to them to ask, “if these people have this ability, why aren’t they rich?”

Nor is this need for certainty limited to conspiracy theorists. Rather, it is within all of us. Uncertainty brings with it mental anguish and we would all rather believe something that is untrue than feel mental anguish. That, at its heart, is the source of a human being’s ability to “believe seven impossible things before breakfast.”

The Track Record of Modern Science Fiction in Predicting the Future

We have discussed the fact that neither Verne nor Wells was engaged in predicting the future in the first place. What about more modern science fiction writers? Haven't some of them come a lot closer to forecasting what actually came to pass?

I'm afraid not. We modern science fiction writers have about the same record as Verne and Wells. We are currently batting approximately 001 in the accuracy of our future predictions. While we generally miss actual events by a wide mark, occasionally one of us will get lucky and score a direct hit through no fault of our own. Don't believe me? Then let's review one of the most cherished myths in all of science fiction, namely that SF writers predicted the coming of the atom bomb prior to World War II.

Actually, there were many stories about atom bombs before the war. These weren't so much predictions about the development of such weapons as they were extrapolations of modern physics. I doubt most writers seriously believed such devices were possible, and none believed that they would exist within a decade of when the story was written. It was all just too fantastic for even science fiction writers to believe.

One exception was John W. Campbell, who wrote an article entitled *Atomic Power* in *Astounding Science Fiction* in 1934. Five years later, Campbell, who was editor of the magazine, wrote an editorial extolling the fact that German Otto Hahn had succeeded in splitting the atom! Nor was Campbell through with atomic energy. The story generally cited as evidence of the predictive nature of science fiction actually comes from the war itself. Campbell arrived at his office at *Astounding Science Fiction* one day during World War II to discover the FBI waiting for him. They wanted to ask about a story he had just published concerning a project to develop an atom bomb in Manhattan Beach, California. Naturally, since the atom bomb project was code-named the Manhattan Project, the FBI was curious as to who had leaked the information. As the story goes, Campbell convinced them that it was merely a coincidence and that stories about atom bombs had been published for years in *Astounding* (including his own writings on the subject) and for them to suddenly cease appearing would be suspicious. That, anyway, is how the myth is usually told.

The truth is somewhat different. In fact, John W. Campbell was a physicist by training, but became a magazine editor because he couldn't find work as a scientist in the Great Depression. When, at the beginning of World War II, he received a memorandum from the government with a long list of elements and materials that were no longer to be mentioned in print, he noted that uranium was one of the materials on the prohibited list. Having followed nuclear developments avidly for years, he was well aware of the uses to which uranium could be put. Now it happened that all of his regular writers were in the service or otherwise occupied with the war effort and he had a pulp magazine to get out. He did so by hiring what could be charitably called "hacks" and feeding them complete story lines. The hacks would write up the story and send it to Campbell, who would publish it.

This was how the atom bomb story was put together. The story was about two contending groups, the Seilla and the Sixa, which are merely the Allies and the Axis spelled backward. The whole thing was a put-up job on Campbell's part, although the FBI didn't believe him when he told them that. They thought he was being arrogant. It turns out that the FBI wasn't the least bit concerned about the Germans learning about the

Manhattan Project from the story, which was so badly written that they figured no self-respecting German spy would read it. What concerned them greatly, however, was the possibility that the engineers and workers at Oak Ridge, Tennessee; Richland, Washington; and Alamogordo, New Mexico might read the story. And having read it, they would begin putting two and two together and figure out what it was that they were working on. So it wasn't external security that worried the government. It was internal security!

The atom bomb story wasn't so much a prediction about how the future would be as it was John Campbell's extrapolation of clues he had received early in the war. If you suspect that there is a large, secret government project dedicated to building an atom bomb, it isn't really predicting the future when you cause a story to be written to that effect. Having seen the thunderheads in the distance, Campbell predicted rain!

There was one accurate prediction about atomic energy that did come out of the pre-World War II era. That was a story by Robert Heinlein, *Solution Unsatisfactory*, published in *Astounding* in May 1941. In it, the United States invents a radioactive dust rather than a bomb. They use it on Germany to subdue Hitler. If Heinlein missed on the technology, he was dead on when he predicted the sociological result of inventing such an ultimate weapon. In his story, after the Allies use the dust to destroy Berlin, a deadly standoff develops between the United States and Russia. It was a standoff eerily akin to the Cold War's doctrine of deterrence: Mutually Assured Destruction. *Solution Unsatisfactory* is one of Robert Heinlein's main claims to fame in the predicting business. Unfortunately, it is about his only such claim in that department. Like the rest of us, his record of correctly predicting the future is poor.

And, in fact, it is instructive to look at some of the other predictions he made and how close they came to the mark.

Robert Heinlein: Future Prognosticator

Robert Heinlein burst on the science fiction scene with a story called "Life Line," in the August, 1939 issue of *Astounding*. (I have a copy of that issue hanging on my wall. I spent \$5.00 for the magazine at a science fiction convention, and \$20.00 for the frame.) He was quickly recognized as one of the field's stars and in a long, eventful career, managed to define just what it meant to be a modern science fiction writer. Not without justification do people call him the Dean of Science Fiction. Even his detractors admit that he was probably the most influential science fiction writer of the modern age.

So if he was so good, why does he have detractors? That question is somewhat related to his ability as a prognosticator of the future. For in his career, he gave two major addresses to the science fiction community. The first was on July 4, 1941, shortly after he made his mark with his "future history"

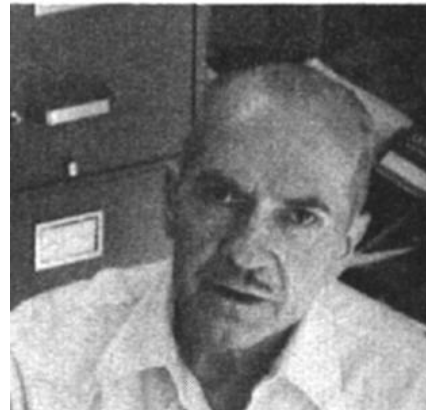


Figure 3: Robert Anson Heinlein

series. The second was exactly twenty years later, on July 4, 1961. Each speech marks a major milestone in his career, and each was ostensibly billed as Robert Heinlein's look into what the future would hold. It is instructive from our perch 60 years futureward of that initial speech to review his predictions and to judge how well he succeeded.

The 1941 speech was given as Guest of Honor at the Third World Science Fiction Convention in Denver, Colorado. Its title was "The Discovery of the Future." In that speech, Robert Heinlein made one single prediction about the future: That there would be war!

Consider the date: July 4, 1941. Predicting war on that date wasn't even in the category of seeing the thunderstorms on the horizon. By July 1941, the war had been going on for close to two years in Europe and the United States' entry was only five months away. Far from predicting that a storm was coming, Heinlein was in the position of someone drenched to the bone and deafened by thunder, who is predicting rain. Of course there *would be* war because there *was* war. As for the duration of the war, he stated:

"The important thing is to hang on to your sanity, to preserve sanity while it happens — no matter what bad things happen to the world. As individuals it may be difficult for us to do anything about it, even though all of us in our own ways, and according to our lights, are trying. But this series of wars that we find the world in now may go on for another five years, ten years, twenty years — it may go on for another fifty years — you and I may not live to see the end of it."

Actually, the war went on for another five years and was then supplanted by another war (the Cold War) that continued for 46 years after that. So his prediction that the "series of wars" could go on for another fifty years was accurate. So, too, was his prediction that "you and I may not live to see the end of it." In truth, many in his audience did not survive World War II, and Robert Heinlein died on May 8, 1988, three years before they hauled down the Hammer and Sickle for the last time. However, neither of these can truly be claimed to be a prediction about the future so much as a rhetorical device to stir his audience in 1941.

The rest of that pre-World War II speech was devoted to advice on how his listeners could retain their sanity in the dark days to come. He advocated the use of the scientific method to separate facts from wishes, and to insulate oneself from the passions of the day. This is still good advice sixty years later.

If his first Guest of Honor speech was something of a bust as a predictor of the future, his second more than made up for the oversight. Indeed, it was his Guest of Honor Speech at the 19th World Science Fiction Convention on July 4, 1961 in Seattle, Washington, that more than anything formed people's opinions about Robert Heinlein, the author. The title of the speech was "The Future Revisited," and it was billed as a retrospective on the speech that he had given in 1941.

He began the speech by discussing "The Cold Equations," a chilling classic of a science fiction story in which the utter ruthlessness of the laws of nature is epitomized. The message of that story was "It not only isn't nice to fool Mother Nature, it isn't possible!" He then went on to give his prescription for proper prognostication:

“The secret of correct prediction is to shun wishful thinking and coldly believe the Cold Equations. Shun pessimistic thinking, too — as I am doing and as I shall presently prove to you. Treat the world the way a research scientist treats a problem — examine the data, try to organize, try to predict coldly and logically. Not what you *want* to have happen — but what *can* happen and what is most *likely* to happen — and then, and *only* then, what you yourself can do about it, to make things easier or better or safer for you and your kids.”

He then went on to make his predictions for the evening. That they startled many in the audience is an understatement. At the risk of pushing the “fair use” laws too far by quoting too extensively from copyrighted material, hear Robert Heinlein in his own words:

“Ninety percent of the possible futures ahead of us fall into two groups, none of them good...”

(He then discusses a series of events that are highly improbable before getting down to his main predictions. — M.A.M.)

“The remaining nine chances out of ten, the probable futures, break into two parts. The first part — I won’t say “first half”; there is no way to estimate the percentages — the first part is the blowup, the catastrophe, the one most science fiction stories have been written about or assumed as a condition, present or past; for the sixteen years since Hiroshima — I mean World War III, all-out and with all the trimmings, from H-bombs on Seattle and New York and fifty other targets to biological warfare and any other nastiness your imagination cares to contrive — and you can be sure that if your imagination picked the wrong choices, what *will* happen will be still nastier.

“This first part, World War III, splits logically into two subdivisions: one in which we win, one in which we lose. Some people like to add a third case here, in which both the US and the USSR are so crippled that neither one wins — but that is not truly a third situation — because in that case China wins...”

(Heinlein then polled the audience to see how many of them had built fallout shelters. Neither, it seemed, had he. He then went on to the second most likely scenario for the future — M.A.M.)

“...The other part that makes up the ninety percent of our possible futures is simpler, slower — and just as deadly in the long run. In due course, with no more than minor brush wars unfelt by any but the poor blokes who get killed in them, the United States will find itself in a situation where the simplest, easiest, and safest thing to do will be to surrender. Maybe it won’t be called surrender — maybe it will be called a “realistic accommodation” by the editorial writers that year — or a “treaty of non-aggression with commercial agreements for mutual trade” — or anything. The name doesn’t matter; the idea is that the Kremlin will be giving the orders here rather than Washington.

“Death then comes to many of us with that whimper rather than the big bang and, of course, not nearly as quickly. But just as thoroughly. The laddies who liquidated the trouble in the Ukraine, and used tanks on the schoolboys of Budapest, won’t hesitate to liquidate the bourgeois mentality here...”

(Robert Heinlein then went on to fill in one last possibility. — M.A.M.)

“...Let me define it. The remaining possibility is that, if we avoid an all-out World War III, that in time the Communist Axis would reform internally, cease to be aggressive and imperialistic, cease to menace us and the rest of the world, start being a peaceful, socialistic neighbor, something like Sweden. Or that, if we just wait long enough and avoid war, the Russian people themselves and the Chinese people will rise up, throw off their oppressors — and save us the headaches.

“Okay, it’s physically possible, we must add it to the list.

“But *not* in the ninety percent.

“This must be placed over in the fraction of wildly unlikely possibilities, along with the Galactic Overlords and Nikita Khrushchev learning to sing “Jesus, Lover of my Soul.”

The foregoing illustrates far better than anything I can say the utter hopelessness involved in predicting the future. Nikita Khrushchev, who was featured so prominently in Heinlein’s speech, was overthrown three years later. And despite Heinlein’s “pessimistic realism,” the two most likely scenarios utterly failed to come to pass. In fact, it was his third scenario, the one about as likely as the arrival of the Galactic Overlords, that is the way history truly happened.

So how did the greatest mind in science fiction, the acknowledged seer of our age, bobble it so completely? For one thing, there is the question of whether he was truly trying to predict the future or merely attempting to whip the troops into a patriotic frenzy as a result of the controversies of the day.

To understand the foregoing excerpts from the 1961 Guest of Honor speech, you have to know something about July 1961 and Robert Heinlein. The Soviet Union began the Space Race on October 4, 1957 (a date that I have no need to look up). I remember it well. I was 11 years old and the news that the Russians had orbited Sputnik was like a lightning bolt from out of the blue. I remember the deep feeling of chagrin and shame that overcame me when I heard that the Russians had beaten us into space. I wasn’t the only one. The entire nation began that day a spasm of soul searching and recriminations that went on until the moon landings late in the next decade.

If you read any number of novels published in the late-1950s or early-1960s, you will be struck by the pessimism in them. The Russians are all ten feet tall and we in the United States are a bunch of bunglers who can’t do anything right. Defeatism is rampant in these books and the inevitability of communism taking over the planet is a subtext.

I owe my profession to that time. When the Russians beat us into orbit, and then again when they orbited Yuri Gagarin, it was cited as evidence that the United States was lagging badly in the sciences. The call went out to beef up the US educational system, to train more scientists and engineers. I heeded the call. I felt it was my duty to take up a scientific profession. At first I wanted to be a nuclear physicist, but when my grades in physics turned out less than stellar, I switched to engineering. True, my personality tends to fit that peculiar niche known as “engineer-think” (derided by one and all), but the primary reason I became an engineer was because my country needed me.

Robert Heinlein was buffeted by the same societal winds as the young Mike McCollum. Only, he was buffeted much more directly. For Robert Heinlein and his wife Virginia happened to have the honor of touring the Soviet Union at the precise moment when Francis Gary Powers was shot down in his U-2 spy plane. They suffered a tense couple of days while the Russians berated him about US perfidy and much of what he saw on his tour seared him to the soul.

So, having suffered through the indignity of having the Russians beat the United States into space, having toured the “evil empire” at the height of its powers, is it any wonder that Robert Heinlein gave a speech that can best be described as a clarion call to action? Was he literally attempting to predict the future, or merely to stir his contemporaries to vigilance? That can only be known by those who knew him well at the

time. However, the fact that he was his polite, congenial self the next day around the pool may be an indication that he was not nearly as fearful of the future as he let on.

The Present Day Projected into the Future

The truth is that we all tend to project our present day situation into the future. “That which is happening today will go on forever,” is one of the unwritten rules of the human psyche. The truth, of course, is that nothing goes on forever. Not communism, not the Cold War, not even Robert Heinlein. For although he was fond of predicting that he would live well into his second century, he died at the age of 81; an impressive span of years, but not all that far beyond average.

And when we project our current situation into the future, we have a tendency to do it linearly. If gasoline prices rose 10% this year, they will rise 10% every year *ad infinitum*. Life is a series of trends, with the future merely being more of the same trend as the past. That, at least, is the conventional wisdom.

I’ve warned you before about the conventional wisdom. It is almost always wrong. In fact, the future is a series of cataclysmic events set in motion by other events so insignificant that it may take a century or more to recognize their importance. Want examples?

Take the invention of the personal computer, for one. I know of no science fiction writer who even hinted that someday we would all have machines sitting on our desks that were vastly more powerful than all the computers in the Pentagon in 1960. Yet, the 200-MHz Pentium Pro on which I am writing this article (I just upgraded to 96 megabytes of RAM and 13.5 gigabytes of hard drive storage) [Note written on March 31, 2002: God that seems old fashioned, doesn’t it? – M.A.M.] is more powerful than the computers they envisioned to run the Safeguard ABM system in the late 1960s. In fact, they cancelled the ABM system for the precise reason that no such computer existed, or was likely to exist in the foreseeable future.

Or take the end of the Cold War. Even as late as 1990, knowledgeable thinkers were pontificating that Mikhail Gorbachev was reforming communism and that the Soviet Union would eventually stabilize into the “peaceful socialist state,” essentially the development that Robert Heinlein scorns so in the latter part of his speech. Since the Cold War had been ongoing for nearly half a century, it was difficult for some people to let go of it even two years before it died a well deserved death.

I spent my professional life building things to shoot Russians out of the sky. Now I number among my best friends people who spent their professional lives building things to shoot Americans out of the sky. One of these friends, Valerie Sandratsky, had some advice for my daughter, who I often describe to people as “the vegetarian communist.” He said, “Tell your daughter that I was a member of the Communist Party for 25 years and she is making a mistake!”

Do I ever miss the Cold War, when engineers ruled the roost and finance people were barely tolerated? Not even a little bit. True, we no longer build our machines to eke out that last little iota of performance. Now we have to watch our pennies and the finance people are the Gods of Aerospace. Still, it’s a better world for all of that, and the fact that no one predicted it doesn’t change reality one iota.

For once you realize that predicting the future is impossible, you find that you are liberated from some of the strains of modern life. It's true that there are long-term trends and that you can often extrapolate them into the future to gain some idea of how things will be. This is akin to spotting the thunderstorms in the distance and alerting everyone to the prospect of rain. Sometimes this approach actually works.

But the long-range future is the product of too many seemingly insignificant events. Like Edward Lorenz's simple weather predicting computer, the future is a dynamic system with "extreme sensitivity to initial conditions." Don't believe me? Then ask yourself if, in December 1997, you predicted that the President of the United States would be impeached in December 1998? You didn't? Surely you must have known the catastrophic effect one pair of thong underwear would have on world history!

Or a more classic example. Did you predict on September 10, 2001 that the United States would be at war on September 11, 2001? Me neither.

If you botched that one, how can you possibly arrogate to yourself, or any mortal human being, the ability to pull back the curtain of time and see how things will be in the future? Just because we science fiction writers claim the ability to predict what it will be like "in times to come" doesn't make it so. In truth, we predict the future by what can best be called the shotgun approach to prognostication. We predict all possible futures, then take credit for the one that happens to come true. It isn't very elegant, but it's a system.

Besides, it works ... some of the time.

#

The End

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NOVELS

1. Life Probe - ^{US}\$5.00

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}\$5.00

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\$5.00

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\$5.00

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\$5.00

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\$5.00

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. 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\$5.00

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.