Science and Science Fiction

Robert Scherrer

Department of Physics and Astronomy, Vanderbilt University
Jan. 21: Einstein’s Cosmic Speed Limit
Jan. 28: Alien Life
Feb. 4: Quantum Mechanics
   Time Travel
Feb. 11: Cosmology
   Genetics
Feb. 18: Giant Creatures
   Does Science Fiction Predict the Future?
How are ideas used and presented in science and science fiction?

- The “ground rules” for introducing unproven ideas
- How are ideas presented?
- Should scientists try to write science fiction?
...and by “science”
I mean theoretical physics
Both SF writing and theoretical physics are a form of “disciplined daydreaming.” Both involve the development of new ideas, but within tightly-constrained boundaries.
Types of Theoretical Physics

- Data analysis
- Comparison of models with data
- Model building
- “What if?”

The last of these is closest to the process of doing science fiction.
• What if the speed of light is constant?

• What if energy is not continuous, but discrete?
A New Idea in Theoretical Physics

- Must be consistent with known experimental results
- Should fit into the pre-existing theoretical framework of physics (even quantum mechanics and relativity)
- But, must go beyond what is already known/proposed
Trying to hit the “sweet spot”
Can only invoke the Tooth Fairy Once

This places a limit on the progress of physics – theory cannot get very far ahead of experimental data. Invoke multiple tooth fairies, and no one will believe you, even if you are correct!

Example: 19th century explanation of the source of the sun’s power

But we have a modern counterexample, which will be interesting to watch to see how it turns out in the end.

STRING THEORY
Much (but not all) of Science Fiction also uses the “What If” model.

• What if our evolution had been guided by superior beings?

• What if all living things on the planet suddenly experienced increased intelligence?

• What if dreams could change reality?
Science fiction, while obviously open to more speculative ideas than is theoretical physics, operates under similar constraints.

- New ideas must be *plausible*, even if they are not rigorously scientific (must “sound like” science)
- Only naturalistic explanations are acceptable
- New ideas should be rationalized in some scientific way, but detailed explanation will slow down the story
- However, some very implausible ideas have become part of the “fabric” of SF, to the extent they no longer require justification (time travel, faster-than-light travel)
- Many of the strongest stories/novels invoke the tooth fairy only once
A series of types of fiction, with progressively fewer constraints
Physics class joke: if you come up with an idea on unifying quantum mechanics and general relativity, let me know – I’ll help you write it up.

Science fiction joke: I have this great idea. Why don’t you write a story about it and we’ll share the credit.

Science: Idea is everything; development is secondary, and writing/presentation is tertiary

Science Fiction: Writing/presentation is primary; idea is secondary
The exposition of a new idea does NOT make a science fiction story.

Need characters/plot/something to keep the reader interested. Idea by itself is almost always insufficient to maintain interest.

“Need to predict not the car, but the traffic jam” – in reality neither is sufficient to make a story.
How are ideas presented?

In science, very straightforward:

• Discuss background and motivation for the project
• Discuss previous work (especially the author’s)
• Present results
• Summarize conclusions
• Abstract at the beginning
In science fiction, it’s not so simple...
Joe Waltham burst into the ship’s control room. Klaxons wailed, and the neutrino gauges flickered wildly. “Bill,” he shouted, “the solar neutrino detectors have gone crazy.”

The sun produces neutrinos in the course of its fusion reactions. Two protons bind to form deuterium, producing a positron and an electron neutrino. The electron neutrino can escape from the sun’s core.

Bill rushed over to check the detector feeds. “I don’t see anything wrong at this end.”
Joe Waltham burst into the ship’s control room. Klaxons wailed, and the neutrino gauges flickered wildly. “Bill,” he shouted, “the solar neutrino detectors have gone crazy.”

Bill rushed over to check the detector feeds. “I don’t see anything wrong at this end.” He turned to Joe. “As you know Joe, the sun produces neutrinos in the course of its fusion reactions.”

“Yes,” said Joe, “I know that.”

“And you also know that two protons bind to form deuterium, producing a positron and an electron neutrino.” Joe nodded. “Yes, I know that too. But why are you telling me all of these things that I already know?”

As you know, Bob
Exposition is tricky. Need to introduce new information without interrupting the flow of the story. Usually done in bits and pieces, with an occasional expository chunk.
Jimmy Dyson pushed his bicycle through the sun-baked field behind Benny Krauss’s house, spraying clouds of dandelion seeds into the air and jostling the precious cargo in the basket mounted on the handlebars. Withered thistles caught on the scratchy wool socks his mom always made him wear, even in the St. Louis summer.

“Benny, it came yesterday!” Jimmy shouted, lifting a brick-red box from the basket and waving it in the air. “It has Bob Gibson on the cover!”

“Extra Innings,” Analog, Nov. 2004
In science fiction (especially) it is important to establish setting and characters at the very beginning of the story, because the choices are so large: are we on Earth, or the moon, or some other planet? Is it the present day, the near future, or the far future. Is our protagonist human, or a slimy multi-tentacled creature?

But this has to be done without interrupting the flow of the story.

You don’t always want to explain everything immediately.
My deathday is July 18th. I spent it this year as I have every year for the past ten: at home in bed, with my wife nearby. I can’t afford a private doctor, and I’ve heard too many iatrogenic horror stories to check into the hospital for the day. So I just lay quietly, imagining all of the different ways it could happen. A sudden squeezing pain in my chest? Or maybe a jackhammer headache, announcing a burst blood vessel in my brain.

“Happy Deathday”, Analog, Jul/Aug 2001
In science fiction, Must strike a balance between giving too much information up front (BORING) and too little (INCOMPREHENSIBLE)

In science, ALL the information goes up front (in the abstract). All terms are defined as soon as they are introduced (or should be). BORING is OK, INCOMPREHENSIBLE is not.

But both types of writing have one goal in common:

READ ME!
Writing Styles

- In Science writing:
  - Passive voice
  - Qualify everything
  - Numerous parenthetical clauses
  - Compound nouns (a relic of German?)

- In science fiction:
  - Avoid passive constructions at all costs
  - Emphasize vivid verbs/adjectives; avoid adverbs
Jimmy Dyson pushed his bicycle through the sun-baked field behind Benny Krauss’s house, spraying clouds of dandelion seeds into the air and jostling the precious cargo in the basket mounted on the handlebars. Withered thistles caught on the scratchy wool socks his mom always made him wear, even in the St. Louis summer.

A bicycle was pushed by Jimmy Dyson through the sun-baked-Benny-Krauss-house field. Thus, dandelion seeds were dispersed into the air, and the cargo in the handlebar-mounted basket was somewhat jostled. Thistles (fairly withered: see discussion in Part II, below) were caught on Dyson’s socks. This story takes place in St. Louis, in the summer.
Preferred writing styles can change

Tom Swifties
“Then go ahead, you absurd feathered fool!” grumbled the King…

“Don’t go, Billina,” said Dorothy, earnestly. “It isn’t easy to guess those orn’ments, and only luck saved me from being one myself. Stay with me and we’ll go back to the Land of Ev together….”

“I Indeed I will,” said Evring, with much dignity.

“Don’t worry, my dear,” cried Billina, with a cluck that was meant for a laugh. “I may not be human, but I’m no fool, if I AM a chicken.”

“Oh, Billina!” said Dorothy, “you haven’t been a chicken in a long time. Not since you—you’ve been—grown up.”

“Perhaps that’s true,” answered Billina, thoughtfully.

Ozma of Oz, L. Frank Baum (1907)
Do Scientists have an advantage in writing Science Fiction?

Science Fiction authors with a science background:

Isaac Asimov, Ph.D. in Chemistry
Robert Heinlein, graduate work in physics
Arthur C. Clarke, B.Sc. Physics and Math
Larry Niven, B.A. in Math
Michael Crichton, M.D.

Scientists who have dabbled in science fiction:

John Cramer, U. Washington
Don Clayton, Clemson
Craig Wheeler, U. Texas
Very few active research scientists have contributed significantly to Science Fiction

Fred Hoyle, “Nobel-class” scientist, author of 10 influential SF novels

Gregory Benford, (U.C. Irvine plasma physics)
Do Scientists have an advantage in writing Science Fiction?

Yes, but not the advantages everyone thinks.

**Difficulties:**

It is actually HARDER to write about your own area of research, because you apply very high standards on what is “plausible”. Easier to speculate about things you know less about.

Writing styles of science and science fiction are diametrically opposed: need to fight your natural writing tendencies.
But there are advantages...

A mundane, but important advantage: basic writing skills.

Scientists have mastered the skills of extrapolating new ideas from known facts.

Can be more realistic in writing about the process of doing science (if that’s what the story is about) [e.g., scientists give “talks”, not “speeches”]
Next Week

Einstein and Science fiction