How true to science should a science play be?

By Ira Hauptman

When I was a freshman in college, I read C.P. Snow's famous 1959 essay on the "two cultures"—scientific and literary—which is the ur-text on the subject. In preparing for this conference I decided to take another look at it. I was appalled.

Snow, who was a British scientist and novelist, argued that scientific and literary people didn't communicate because they had nothing in common. The intellectual life of western society was increasingly being split into two polar groups which viewed each other with hostility and lack of understanding.

In the essay's most famous passage, Snow wrote

"A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking something which is the scientific equivalent of: *Have you read a work of Shakespeare's?*

I now believe that if I had asked an even simpler question — such as, What do you mean by mass, or acceleration, which is the scientific equivalent of saying, *Can you read?* — not more than one in ten of the highly educated would have felt that I was speaking the same language. So the great edifice of modern physics goes up, and the majority of the cleverest people in the western world have about as much insight into it as their neolithic ancestors would have had."

All right. I had to check Wikipedia before I could continue reading. I knew that I had once known the second law of thermodynamics, but I also knew I didn't any more. I wondered if that put me in a third culture of broadly but thinly educated people who represent either the success or the failure of American education.

As I resumed reading, re-educated, it seemed clearer and clearer that the problem for Snow was that professors in different disciplines at Oxford or Cambridge had trouble communicating with each other when eating at high table. Apparently they were a geeky lot who couldn't engage in anything but shop talk. When forced to socialize with alien scholars from across the quad, they could only play "gotcha" with questions about the second law of thermodynamics or about Dickens. And this stalemate represented a crisis of western civilization to Snow.

Now in my experience, professors from different disciplines normally have no trouble talking while eating. They talk about their colleagues and their administrators and what's happening in the university. They gossip. They talk about the things people thrown together always talk about—politics, movies, sports, restaurants, their families, their vacations. When all else fails, they top each other with anecdotes about how ignorant their students are of anything in the world that happened more than two years ago.

Apparently, Snow's friends couldn't do any of this. Nor do his literary intellectuals even sound like literary intellectuals. For a representative literary utterance, Snow quotes T.S. Eliot on the need to revive verse drama to usher in a new Elizabethan age. If any literature professor tried to seriously discuss this over dinner, his literary colleagues would stuff some fruit in their pockets and run for the exit. The odds are that only overly polite scientists at the table would pretend the idea was worth pondering.

So Snow apparently hung out with some very introverted and culturally challenged scholars. And somehow his impoverished social life proved to him the existence of a broad, deep crisis in the western world.

In Snow's vision, literary types are also apolitical, unconcerned with politics, economics or world problems because of their tragic, fatalistic outlook. This is a very odd conclusion. Especially when the essay was written, after the British theatre was stormed in 1956 by the angry young men who gave us Look Back in Anger and other assaults on the social establishment.

But most crucially, what Snow didn't seem to realize is that the science and art of an era both tend to represent the zeitgeist of that era and are never very far apart. In the 1920s, for example, the cultures of science and the arts seemed both to be rooted in what we would now call a modernist sensibility.

When I teach a famous play of the period, Pirandello's Six Characters in Search of an Author, I make a connection to a concept of physics from the period—Nils Bohr's idea of complementarity. If Pirandello encouraged us to regard a figure on stage as both a character and a person, Bohr encouraged us to regard an electron as both a particle and a wave.

If James Joyce encouraged us to see both modern Dublin and the world of Homeric epic in Ulysses, and Picasso taught us to see a face from multiple perspectives, then Werner Heisenberg taught us to understand the shifting connection between a particle's position and momentum. All of this in the same historical era. So what's the point of the scientists and artists who work in the same period belittling each other? The odds are that they're doing the same thing. And it's very strange when each side accuses the other of being bizarre and incomprehensible.

In our own time, the mathematician Greg Chaitin offers three proofs of the infinite number of prime numbers. He calls them classical, modern and postmodern. These are descriptive terms that I, at least, tend to associate more with the arts and literature than with science. And literary criticism was for a while taken over by structuralism, which my teachers in graduate school dismissed as scientific criticism. So the differences between what the artists and scientists of any age actually do may be more superficial than Snow acknowledged.

But what happens when playwrights try to move beyond these inevitable cultural similarities and actually deal with science or math in the content of their plays? Does their ignorance of science make that a hopeless endeavor? Even more important, does their pursuit of a good story or even a good scene make them disregard their obligation to their scientific source material? Is Snow right about the fundamental indifference of art and science toward each other?

I encountered these questions in two of my own scripts about science and math. The first was Partition, a fact-based play about two mathematicians in the early twentieth century which was part of the Ensemble Studio Theatre/Sloan Project's First Light festival in 2002. The second was Starry Messenger, a play about Galileo and his family that was part of the Sloan Foundation initiative at the Magic Theatre in San Francisco in 2007. Both plays also had readings here at the Graduate Center.

The mathematicians in Partition are Srinivasa Ramanujan and G.H. Hardy. Ramanujan was an Indian genius without college education whose work came to the attention of Hardy, who was a Cambridge don. At Hardy's urging, the university brought Ramanujan to England to work with him. After a few mathematically remarkable years, Ramanujan became ill with tuberculosis, and after lengthy medical treatment returned to India, where he soon died. This story is becoming increasingly familiar to us, partly because of the play A Disappearing Number by Simon McBurney and Theatre Complicité.

I compounded the usual problems of truthful storytelling by introducing two non-realistic characters. There's a Hindu goddess who brings Ramanujan equations in his sleep, which Ramanujan said happened, and there's Pierre de Fermat, a seventeenth century French mathematician who bequeaths an agonizingly difficult problem and then returns as a smug ghost. The problem is a real one, Fermat's Last Theorem, which states that no three positive integers a, b and c can satisfy the equation $a^n + b^n = c^n$ for any integer value of n greater than two. Fermat wrote in the margin of a book that he had a marvelous proof that the margin was too narrow to contain. A proof wasn't devised until 1994.

In my play Ramanujan works on the problem at Hardy's urging, which most likely did not happen. Ramanujan is lonely and depressed in England, and I have Hardy set him to work on Fermat's Last Theorem to give him purpose. But he can neither prove it nor stop working on it. And it's his overwork which is partly responsible for his illness and death.

Partition had its premiere at the Aurora Theatre in Berkeley, and attracted the attention of the Mathematical Sciences Research Institute at the university. The production was reviewed by Professor Ken Ribet in the Notices of the American Mathematical Society. Ribet is a distinguished mathematician whose own work contributed to the eventual proof of Fermat's Last Theorem. Ribet wrote as follows:

"The presence of Monsieur Fermat in a play about mathematics in Cambridge in the early years of the last century is something of a surprise. He was most welcome in "Fermat's Last Tango," but what is he doing here? The short answer is that he is entertaining us while having a good time for himself. A longer answer is that the Hardy of "Partition" sets out Fermat's Last Theorem as a challenge to Ramanujan's mathematical skills….

"Partition" was performed by the Aurora Theatre Company of Berkeley….It goes almost without saying that the theme of Hauptman's play made it of special interest to mathematicians. When I attended a performance in May, I recognized many acquaintances as I looked around the audience. Professional mathematicians who saw the play were disturbed by the prominent roles given to Fermat and his Last Theorem, since the real Ramanujan and Hardy did no work on this particular problem. I personally was startled by the implicit anachronistic suggestion that Ramanujan was close to finding a proof of Fermat's Last Theorem that relied on Galois representations, modular forms, Euler systems and Selmer groups.

In order to enjoy the play, one must relax the implicit identification between the historical Hardy–Ramanujan and the characters on stage."—Thank you, Dr. Ribet—"Theatergoers who have little problem observing a goddess in discussion with a 17th century mathematician on stage can make their peace with a historical distortion that allows the audience to hook up with a familiar and famous problem. Once I was able to separate the real Hardy and Ramanujan from their counterparts on stage, I found only good things to say about "Partition."

I'm grateful for the conclusion Dr. Ribet came to. But there's also another way to look at these kinds of inaccuracies. Perhaps scientists shouldn't see them simply as misinformation that's excusable because of artistic license. They have to consider the possibility that they're actually essential to the play. Scientists and others who know the facts have to consider why playwrights decide to be inaccurate. I made Ramanujan work on Fermat's Last Theorem because he should have, and I wish he had. It's simply a mistake of history that he didn't. His radically original, non-Western mind should have jumped into the Western fray. So I allowed that to happen. Of course I didn't have him actually prove the theorem, or I would have taken the play into pure fantasy, where I didn't want to go. But it's pretty factual that Hardy set Ramanujan on difficult mathematical tasks, and that Ramanujan's relentless work on them helped cause the deterioration of his health. So why not go all the way with these difficult mathematical tasks, and make them Fermat's last theorem?

In Starry Messenger, the play about Galileo, I practiced a different kind of falsification. In order to bestow an ethical dilemma on this early scientist, I wanted to give him a vision of the dark and illogical sides of scientific progress to come.

In one scene, Galileo's daughter Livia, who was a nun known as Suor Arcangela, tries to persuade him to recant his assertion that the earth moves around the sun, a recantation which of course he eventually made. But Suor Arcangela is possessed by demons who force her to speak what they want, and fill her with visions of the dark and mysterious discoveries that science will produce. The demons know that if science replaces religion, they will disappear, and so science must be stopped.

My main point in the scene was to show the horror of nuclear weapons, and link it to a path of investigation and discovery that could be said to go back to Galileo. But I also wanted to evoke the idea that if Galileo thought that investigation of the world would lead to truth and fact, then the future of science betrayed him. Investigation turned out to lead to the emergence not of facts but of such theories as uncertainty and strings—theories that don't offer us stable verities but endless intellectual play. This is presumably not what Galileo had in mind when he said that Jupiter has moons or that the earth moves and the sun does not, and that these are facts. I wonder what he would have thought of modern science's insistence that he was one of its founders.

But to dramatize this problem, I had to give Galileo a glimpse into the future, so I allowed his daughter to be possessed by demons who fed her visions. That's not something that would seem very plausible to audiences. And yet I proceeded.

Well why not? Mathematicians and scientists have given us so much that's strange and counterintuitive. Why should playwrights stick to the literal? If scientists are required to have imaginations, why should playwrights be content to be conventional journalists and historians?

Playwrights who write about science bridge the alleged two cultures, but usually not in the way that Snow recommends. We don't know the second law of thermodynamics—some of us—and we don't write plays about science so we can finally learn it and share it. We don't see science as knowledge, or a collection of facts and discoveries to be imparted to an ignorant public. We see science, if I can speak for my fellow playwrights, as excitement and energy that we want to share. We see science as a model for art. Not a different culture from ours, but the same culture. In fact, scientists are more like artists than artists are, at least as artists are often portrayed in the popular media.

In other words, I would hesitate to write a play about a painter or composer because those are usually about "inspiration," not about the work that defines scientists and nearly all actual artists. In Peter Shaffer's Amadeus, Salieri is the heavy because, unlike Mozart, he has to work at composing music. The play is about Art with a capital A, so it isn't really about artists. If I'm writing the fourth draft of a play, I don't feel much affinity with the effortlessness of Mozart, or with an old Hollywood movie about a painter staring at a sunset and then rushing to the canvas. But I feel a lot of affinity with a scientist in the lab toiling toward uncertain results. And if his or her work unexpectedly illuminates something, well I wish I could do that too. And the next best thing is to put him or her in a play about that work and that illumination.