Feynman Unprocessed

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Perfectly Reasonable Deviations from the Beaten Track: the Letters of Richard P. Feynman, edited by Michelle Feynman. New York: Basic Books, 2005. 486 + xxiii pages. $26 in hardcover.

It would be quite a daunting task to try to master everything written by and about Richard P. Feynman. There are his specialized physics books; his *Feynman Lectures on Physics* and similar works for larger audiences of college students; his popular essays and lectures; his witty, irreverent autobiographical masterpieces; two major biographies; and lots of other contributions by other authors. The specialized works are of course beyond the understanding of many readers, but the popular essays and autobiographical stories are a delight to many, whether specialist or not. His scientific work earned him the Nobel Prize in Physics, but his desire and ability to communicate with non-experts turned him into a much greater celebrity than most Nobel laureates ever become.

Some of Richard Feynman's most famous works, e.g., *Surely You're Joking, Mr. Feynman*, include pieces that are obviously transcripts of interviews and conversations which have been edited to minimize the difference between the spoken and the written word. Truly they are a pleasure to read, yet they contain enough signals and cues of casual verbal expression to reveal that his role was sometimes not to write, but to talk. *The Meaning of It All*, for example, is a series of lectures that retained all their verbal stylistics, making them seem windy and ragged. By contrast, Feynman's colorful books about Feynman apparently used copy editors to good effect to shape the man's spoken words into a text for his reader-consumers. He himself said it effectively: "I don't speak writable English" (letter of 24 January 1977).

One can see this most clearly in the case of "Infinitesimal Machinery," a 1983 lecture at the Jet Propulsion Lab that was videotaped, and then published ten years later, after his death. The audio-visual record shows that the lecture is very informative, but also somewhat rambling, almost disjointed, with sudden inspired digressions. The presentation is almost zany, and the scientists in the audience behave as if they are at a comedy club when a celebrity stand-up comic is

performing. Not surprisingly, the text version of "Infinitesimal Machinery" is much more linear. It is far from dull, but it is definitely processed to convert the performance from more entertainment to more scientific information.

I am not hinting that there is anything deceitful or improper about copy-editing Feynman for his readers. On the contrary, the legions of Feynman fans ought to appreciate this way of bringing his words and stories to us. My point, rather, is that reading the processed Feynman makes one wonder if there ever was an *un*processed body of his writing, and what it might have been like. It would not have to be a cryptic book with a secret code that supposedly revealed the true essence of the man, as if his true self had been concealed all these years. His life was so well known that it would be silly for anyone to put forward a crypto-bio-psychological theory that claimed to discover the real Richard Feynman. No, the desire to see a body of unprocessed Feynman writing has a simpler, more modest reason behind it. This guy was lovable, and perhaps one could extend and prolong the way we enjoy him if we could read his heart-felt letters with little or no copy-editing.

That is the great value of *Perfectly Reasonable Deviations from the Beaten Path*. It contains no great secrets about how to shape your mind into that of a brilliant scientist, nor any manual about how to become a celebrity, nor how to acquire the irreverent wit that he perfected. It is, rather, a kind of friendly front-porch visit with someone you already know and like, if you already know Feynman's books about Feynman.

I have had my front-porch visit with him, which is to say that I have enjoyed reading this book. Instead of giving you a one-paragraph summary judgment that tells you how you ought to enjoy it, I give you a taste of the more interesting passages and letters so that you can align this book with whatever other works of his you have enjoyed.

Loving Arline

Much of the early part of *Perfectly Reasonable Deviations* concerns Feynman's marriage to the former Arline Greenbaum. She had a serious case of tuberculosis before they married, and Feynman's parents were less than enthusiastic about their son marrying a sick woman. In a letter to his mother in June 1942, Feynman showed himself to be clear-eyed and passionate about marrying her

anyway: “I want to marry Arline because I love her—which means I want to take care of her. That is all there is to it. I want to take care of her.”

Indeed he did. Most of the correspondence from his Manhattan Project years [1943-45] shows that he devoted enormous attention to her comfort, her happiness, her diet, and her other needs. Remember that Arline lived in a clinic in Albuquerque while he worked at Los Alamos. They had tried briefly to have her stay at the hospital at Los Alamos, but that quickly turned out to be a disaster (February 1945). The base hospital could not give her the care she deserved. He went to see her most weeks and also wrote several times a week. His letters also reveal that he was trying to understand tuberculosis (7 February 1944), and investigating whether a new therapy would cure her (December 1944), and lovingly prodding her to eat enough to keep up her weight.

In one sweet passage, he describes to her the delights of picking locks—a well-known element of the Feynman legend—and writes this (4 April 1945): “I like puzzles so much. Each lock is just like a puzzle you have to open without forcing it. But combination locks have me buffaloed. You do too, sometimes, but eventually I figure you out. I love you, too.”

Arline Feynman passed away on 16 June 1945. While it is profoundly sad that a nasty disease robbed this man of the woman he passionately loved, I must say that anyone who is seriously ill ought to have a spouse as dedicated as he was to Arline.

Sixteen months after her death (17 October 1946), he dealt with his grief by writing her one last love letter. This, too, is a profoundly moving message, but he ends it with an impish twist: “Please excuse me for not mailing this—but I don’t know your new address.”

Manhattan Project

The knowledgeable Feynman aficionado is familiar with his brash irreverent recollections of his work at Los Alamos, like the time he prevented the Oak Ridge National Lab from blowing itself up. His private letters from that time, however, are very different. He is full of admiration, not for himself and his triumphs, but for the great scientists who lead the project. He works late, sleeps late, then works late again. His work proceeds with excruciating trial and error.

Often he is far from confident about his contributions. Here he writes to Arline on 22 March 1945:

> Nobody knows what's going on except me and the guy with the busted leg [i.e., his group leader]—and I don't know it so good. Hence I was up from 8 AM Tues. morning to 3 PM Wed. night, 31 hrs. and by that time the new problem was running smoothly. And where were we when I woke up? Exactly where we were when I went to sleep! Somebody made an error 15 min. after I left and we had to go back, correct it, and start over from there. That is why I have to work so hard.

Feynman's describes the Trinity test at Alamogordo in a letter to his mother (9 August 1945). In it you read his vivid portrayal of the anxieties of the scientists, including himself, then the awe he felt at the blinding sight and thunderous sound of the explosion, and finally the wild celebration of the happy scientists. He expressed no Oppenheimer-like moral conflict. On the contrary, "everything had worked as well as anyone could have dared to expect…It is a wonderful sight from the air to see the green area [that is, sand turned to glass by the heat of the bomb] with the crater at the center, in the brown desert."

Then and later he said that using the atomic bomb in August 1945 was justified because it helped to end the war. After the war he seemed to have stayed on friendly terms with both Oppenheimer and Teller; his letters contain no evidence that he took sides in the bitter investigation that humiliated Oppenheimer.

Resignation

The episode of Feynman's resignation from the National Academy of Sciences is the least flattering part of the book. When an assistant business manager sent him a note saying he was two years behind in his membership dues, he replied with a check to pay what he owed, plus a curt note on the bill saying "I have found that I have little interest in the activities of the Academy, so would you please accept my resignation as a member" (9 November 1959). This looked, of course, as if he was leaving the NAS in a fit of petulance, that is, resenting that he had been billed for what he owed. It alarmed Detlev Bronk, President of the NAS, who asked him to reconsider. Feynman explained that he was resigning because he was uncomfortable with the Academy's elitist situation. One of the activities of the members was to select new members. This he considered "a form of self-praise…How can we say only the best must be allowed in to join

those who are already in, without loudly proclaiming to our inner selves that we who are in must be very good indeed" (10 August 1961).

As you decide for yourself whether closed-membership academies are legitimate, notice the next development. Bronk tried to persuade Feynman not to resign, and he emphasized that the NAS conducted some worthwhile activities that should interest him—in other words, there was more to its life than admitting some people and rejecting others. Feynman, however, insisted on resigning, but he framed his feelings as "entirely personal and reflect in no way on my opinion of the Academy" (1 July 1968). This line of correspondence went on for years.

As I read the letters back and forth on this incident, it seemed that Richard Feynman was trying to have it both ways. He objected to NAS's elitist habits, and he used the dramatic decision to resign as a way to express his objections, but did not want this decision to be seen as a political protest. A mere personal idiosyncrasy, as he would have one see it.

How could it *not* be a political protest, and how could anyone else see it otherwise?

The other possibility, going back to the bill from the assistant business manager, is that Feynman reacted rashly, but then was too proud to see that he had been too rash. This way it would indeed imply nothing about his respect for the National Academy of Sciences. It would, however, indicate something about his inability to see that he had made a mistake that could have been corrected, especially since Bronk and a later NAS president, Philip Handler, graciously offered him reasons to remain a member.

Either way, the episode of the resignation shows us one of the few occasions when the power of Richard Feynman's great mind was less than the consequences of his impetuous words.

Truth and Beauty

Those of us who are constructivists, relativists, and other sorts of post-modernists are particularly curious to see whether Richard Feynman wrote anything that might corroborate our paradigms. Our question is answered with a short, stark, unambiguous "No." Feynman embraced a hard simple positivism in his scientific work, and he did so consistently.

It is true, of course, that he was comfortable with many sources of inspiration; and that he wanted us to know that science is fun; and that he showed us how scientists can be charismatic. When young people or their parents wrote to him to ask how to plan a career in science, his advice was that would-be scientists should follow their own passionate curiosity, as opposed to planning a long-term linear path. You read this again and again in those sorts of letters.

And yet, as he became famous and received letters from scientists and fans and cranks, he repeatedly advocated the same clear and simple formula for doing science:

1. *Scientific truth is international*. He objected to being labeled an "American" scientist or a "Jewish" scientist because, in his thinking, this violated the transnational essence of science.

2. *The reason for doing science is to satisfy a curiosity about nature* (which he usually capitalized as "Nature.") When he heard that the poet W.H. Auden wanted to know what scientists "want the knowledge for," Feynman replied that "We want it so we can love Nature more." Too few people, he complained, understood "the emotions of awe, wonder, delight and love which are evoked upon learning Nature's ways…My lament is that a kind of intense beauty that I see given to me by science, is seen by so few others" (24 October 1967).

In a 1959 television interview, he was asked how he took into account the social and economic implications of science. He declined to discuss that topic: "The reason that I do science…is…not the usual motivation for helping human beings. The main motivation is the curiosity and interest to find out about the world we're in" (pages 419-420). He easily conceded, of course, that scientists see the consequences of their work, but he adamantly bracketed their motivations from the applications of that work which the rest of the world experiences.

3. *The experiment is the great and final adjudicator of truth*. Scientific ideas must be focused into predictions and experiments, which are almost always in mathematical language. When asked about the "scientific method," he wrote "the only principle is that experiment and observation is the sole and ultimate judge of the truth of an idea. All other so-called principles of the scientific method are by-products of the above" (30 April 1963). Again, twenty years later: "I like science because when you think of something you can check it by

experiment; 'yes' or 'no', Nature says, and you go on from there progressively. Other wisdom has no equally certain way of separating truth from falsehood" (28 February 1983).

With that as *his* philosophy of science, he declined to engage in broader discussions of philosophy of science or the other humanities-based investigations that we now call Science and Technology Studies. In his influential 1961 article on "The Future of Physics," he spoke of protecting science from "the encroachment of professional philosophers and fools…Since they are absolutely unable to make any predictions, we see that their philosophy does not have real understanding of the situation" (p. 438).

For the most part, he expressed admiration for other people's appreciation of art, poetry, and other aesthetic pleasures, but he kept those tastes at arm's length from his own love of science. When someone suggested that Feynman's famous hobby of playing the bongo drums was a way for him to make himself well-rounded by balancing his music with his science, he reacted angrily:

> The fact that I beat a drum has nothing to do with the fact that I do theoretical physics. Theoretical physics is a human endeavor, one of the higher developments of human beings—and this perpetual desire to prove that people who do it are human by showing that they do other things that a few other humans do (like playing bongo drums) [original brackets] is insulting to me. I am human enough to tell you to go to hell (4 January 1967).

We see that Richard Feynman was extremely generous whenever he was asked to share his views with nonexperts, to their great benefit. But we also see that he required you to come to his views on science on his terms, especially in the media interviews. How then could this citizen-scientist interact with nonexperts who did not possess his understanding of science? Could these citizens too have a role in science policy?

Yes, yes, I recognize that I am asking a man who passed away in 1988 to speak to the issues of 2005. Embryonic stem cell research, nanotechnology, genetically modified organisms: these and many other topics show us that nonscientists too have a stake in the outcome of science policy debates. They also have roles to play when science policy is created through legislation, litigation, lobbying, appropriations, regulations, referendums, and other procedures, none of which

are under the exclusive control of scientists. The contributions of someone like Richard Feynman are extremely valuable, but our boisterous interest-driven democracy does not give scientists a monopoly on the making of science policy. So, could the nonexpert fit into Feynman's world?

Citizen

With his intense dedication and brilliance, Richard Feynman was a very formidable citizen-scientist. One comment from 1959 points to the idea that citizen-*non*scientists have a contribution to make:

> It seems to me very difficult for citizens to make a decision as to what's going on when you can't say what you're doing. And the whole idea of democracy, it seems to me, was that the public, where the power is supposed to lie, should be informed. And when there's secrecy, it's not informed (1959 television interview).

Unfortunately, the context of this statement shows that Feynman was arguing against the kind of cold war secrecy that most scientists despise, which does not necessarily translate into advocating democratic mechanisms that include nonscientists in science policy. Feynman's work in the process of selecting science textbooks for California public schools, with some passages from that work included in this book, shows that he was more than willing to rub shoulders with the nonscientists who choose which schoolbooks our children read. It also shows how exasperated he was by the textbooks that came before him and his fellow readers.

Even more telling, however, was his 1986 experience with the commission investigating the causes of the *Challenger* tragedy. In a long eloquent letter to his wife and daughter on 12 February 1986, Richard Feynman burned with anger about the politics of the *Challenger* investigation. He accepted the mandate of the commission in good faith and worked at full throttle, but found that the chair of the commission, William Rogers, was overly concerned about not rocking the boat, not leaking to the press, not criticizing the ways NASA made decisions, and so on. We then see that Feynman was clever, but not obnoxious, in finding ways to circumvent Rogers and so discover the technical information that Rogers preferred to avoid. The most memorable event of Feynman's work on the *Challenger* commission was his dramatic demonstration, on television, of the way the booster rockets' O-rings failed in cold temperatures. His pursuit of the

serious flaws in NASA decision-making was much less sexy, but it constituted a much more substantive contribution to our understanding of the reasons behind the tragedy, and he knew that clearly.

In the end, Richard Feynman was disgusted with the behind-the-scenes politics that he saw in those days. "Nothing short of a subpoena from Congress will get me to Washington again," he wrote after the commission was finished (5 December 1986).

Privately Readable Deviations

The title of this collection comes from a memo that Richard Feynman wrote to the California State Curriculum Commission on 13 April 1966. Regarding a fifth-grade science textbook, he objects that "the teacher's manual doesn't realize the possibilities of correct answers different from the expected ones and the teacher instruction is not enough to enable her to deal with perfectly reasonable deviations from the beaten path." Since that phrase is used to label this record of his life, presumably it is meant to remind us that Feynman himself was different from other people—no kidding—but that his eccentric brilliance was perfectly reasonable in its own way.

I find this choice of title to be peculiar. Richard Feynman's idiosyncrasies were fully celebrated in *Surely You're Joking, Mr. Feynman* and *What Do You Care What Other People Think?* But this collection of his letters does not really continue the "eccentric genius" tone of those two earlier books. Instead it shows a loving husband, loving father, hard-working scientist, friend to strangers, frustrated citizen, loyal friend, and other admirable parts of his personality that come to life even when the public is not watching. Although there is plenty of wit in these letters and there is no shame when his idiosyncrasies arise, a reader looking for the classic Feynman-the-entertainer will be surprised by the content of this book. I feel strange saying this, but I would not recommend *Perfectly Reasonable Deviations* as a reader's first introduction to this man. *Surely You're Joking* and *What Do You Care* represent a good way to get hooked on Feynman, after which *Perfectly Reasonable Deviations* lets us see a more private side of him, and that sequence serves his memory very well. I fear that if one were to meet him first in this collection of letters displaying the anguish of Arline's death, the patience with which he explained things to strangers, the frustrations of the citizen-scientist, and similar sentiments, and then later read the two collections of anecdotes, then the Feynman of the earlier books would

subsequently look like one of those entertainers who is a little too eager to please his audience by exaggerating his own eccentricities.

Let us finish with the problem of "writable English," as he called it. A letter to his mother, Lucille Feynman, on 30 August 1954 shows a man painfully struggling to make his words come out right. He tries to tell her that she has everything that money can't buy, and that he will provide for all of her material needs. In saying this, he racks up one garbled cliché after another, e.g., "wealth is not happiness nor is swimming pools and villas. Nor is great work alone reward, or fame." Ouch. What his mother really wants, he admits, is for him to write more often. He promises he will. A note from the editor, his daughter Michelle Feynman, says that the problem of the son who wrote too seldom was solved, not by a quantity of letter-writing, but by having the mother move to Pasadena to be near her son.

If that was Richard Feynman's unwritable English at its most difficult, it did not last forever. There was nothing awkward or problematic with the writing in Feynman's letters by the mid-1960s. Maybe this reflects his self-confidence; or maybe many years of writing many letters led to a distinctive and effective style. At any rate, some of the letters from the last twenty-five years of his life are great documents, especially those in which he has to explain something—not necessarily something scientific—to his reader. The letter to his wife and daughter about the politics of the *Challenger* investigation (12 February 1986) is especially memorable.

I do not assume that the letters in *Perfectly Reasonable Deviations from the Beaten Path* are entirely free of copy-editing. There could well be some, and of course Michelle Feynman must have had to exclude some items when she included the ones we see here. But almost all of these were written with no expectation that they would be published someday—remember the sweet letter to Arline after she died—so they are free of the sense that Feynman was writing with a third-party reader (i.e., you or me) looking over his shoulder. As such, Feynman unprocessed is a lovely complement to the side of him we see in his delightful autobiographical works.

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