Thomas Söderqvist

Fear and anxiety in scientific practice

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My interest in the role of passion in science has grown out of my studies of the genre of biography, particularly biographies of scientists. Biographies of artists, politicians and authors are full of references to the passions, but the passions are rarely a topic of biographies of scientists. In fact, the widespread use of the term `scientific biography' bears witness to a traditional focus on the intellectual and cognitive aspects of the lives of scientists, at the expense of the passions, which, if treated at all, are usually restricted to `a passion to know'.

You will probably not be surprised to hear, however, that I consider the passions to be a central element of lives in science. If you read their autobiographies, scientists have used a rather rich passionate lexicon. They report about the feelings of fear, anxiety, even terror during the process. Sociologists are eager to emphasize the social nature of scientific practices -- scientific knowledge is said to be a "social construction -- but scientists themselves nevertheless write about their work as a most lonely activity, and a painful one as well. Pain, in fact, colours and runs through the lives of scientists, irrespective of their disciplinary affiliation, scholarly status or gender.

I want to give you three autobiographical examples to illustrate this. The first example is taken from a letter from the Danish-born immunologist and Nobel laureate Niels Kaj Jerne, in which Jerne describes how he felt when he formulated his second major immunological theory: the so called `somatic generation theory of antibody diversity':

“[In early July of 1969] I was hit by a spell of creativity that lasted until the day before yesterday. Being aware, I followed my own behaviour quite carefully; I felt that all the chores (such as farewell speeches in Frankfurt, etc) were merely nothingness. I had the feeling that I had a good idea somewhere though I did not quite understand what it was. Fact is, that I was very nervous, stopped eating, writing, etc. until 20 July like a log coming slowly to the surface of a lake, I knew what I wanted to understand. It is now lead down in the attached manuscript that I got finished a few days ago.” (Letter to Günther Stent, August 8, 1969; Jerne papers, Box 1969, Royal Library, Copenhagen).

A more expressive example can be found in a collection of oral autobiographical reports by women scientists collected by Joan Dash. In these interviews it is clearly demonstrated that the passions of scientists are strong and pervade their whole existence. One of Dash's interviewees told her that:

"You go through this long, hard period of filling yourself up with as much information as you can. You just sort of feel it all rumbling around inside of you ... Then ... you begin to feel a solution, a resolution, bubbling up to your consciousness. At the same time you begin to get very excited, tremendously elated pervaded by a fantastic sense of joy ... But there's an aspect of terror too in these moments of creativity.... Being shaken out from your normal experience enhances your awareness of mortality.... It's like throwing up when you're sick" (Joan Dash, A Life of One's Own: Three Gifted Women and the Men They Married. New York: Harper & Row, 1973, p.318).

Scientific research has its drudgeries and long stretches of boredom and routine, "yet", Dash concludes,

"it seems universal among those engaged in original research, from the merest postdoctoral fellow to men of Nobel caliber, that they tend to describe their feelings about their work in such vivid terms that everything else in life – everything – sounds pale beside it".

Do not believe, however, that passions and bodily sensations like these are restricted to women scientists. The theoretical physicist Paul Dirac, active in Britain between the wars, once spoke about the "feelings of a research worker when he is hot on the trail and has hopes of attaining some important result which will have a profound influence". Scientists are full of hopes and fears, said Dirac: "I don't suppose one can ever have great hopes without their being combined with great fears". Dirac also discusses how fear can hold a scientist back from completing his work. With specific reference to his older colleague, H. A. Lorentz's, who was about to formulate the theory of relativity, but made a "near miss", Dirac says: "He did all the hard work all the really necessary mathematics, but he wasn't able to go beyond that and you will ask yourself, why?". In his explanation, Dirac does not refer to the standard logical or cognitive explanations given by philosophers of science:

"I think [Kramers] must have been held back by fears. Some kind of inhibition. He was really afraid to venture into entirely new ground, to question ideas which had been accepted from time immemorial. He preferred to stay on the solid ground of mathematics. So long as he stayed there his position was unassailable. If he had gone further, he wouldn't have known what criticism he might have run into. It was the desire to stay on perfectly safe ground which I presume was dominating him" (Max Dresden, H. A. Kramers: Between Tradition and Revolution. Berlin: Springer Verlag, 1988, p.462.

The point here is not whether Dirac was right or wrong in his interpretation of Lorentz or not. The point is, that drawing on his own experience of scientific work, Dirac identified passions, such as fear, as a pervasive element in scientific work. In this respect Dirac is more realistic in his understanding of scientific practice, I think, than most philosophers of science, and most historians of science.

For example, when Helge Kragh in his (definitely `scientific'!) biography of Dirac, summarizes all the anecdotes that circulated about his austere and shy subject, he concludes that theoretical physics was for Dirac "a substitute for human emotions". This is the historian of science's interpretation, however. According to Max Dresden, who had known Dirac personally for years, we meet instead a "deeply compassionate human being ... with concerns, hopes, fears, and ambitions" and not surprisingly Dresden repudiates Kragh's portrait of Dirac for "its lack of passion".

Max Dresden's own biography of the Dutch physicist Hendrik Kramers gives yet another example of the pervasive impact of passion in a scientist's life and work. As a university professor in the 1920s, Kramers was supposed to live "in a world of pure reason, a world where there is no fear, anxiety, inadequacy, anger, or passion". But Kramers knew that this picture, one that philosophers love to paint, is a caricature of a life in science, and privately he frequently expressed frustration: "He was more often torn by doubts and beset by fears, which often guided him in paths which led nowhere", says Dresden. "Fear and anxiety about his role in physics were his constant companions".

Did passions like these have cognitive implications as well? One of the few historians of science who has dealt with the passions of the scientist, namely Lewis Feuer, suggests that scientists look for conceptual worlds that will answer to their `emotional longings' and that established theories are `isomorphic' with the world `emotionally sought':

"[W]e must necessarily enter upon biographical and psychological considerations to ascertain what indeed were the basic emotional longings of the scientist, what the kind of world it was that he, on emotional grounds, sought to realize in his scientific theorizing?"

What, in other words, asks Feuer, was the scientist's `emotional a priori?'

In the case of Hendrick Kramers, Dresden demonstrates that the Dutch physicist was continuously plagued by doubts and concerns about the shortcomings of his accomplishments and returning feelings of fear and uncertainty:

"[He] expected to mold [the development of his science] and guide it along lines consistent with his views. The resulting struggles, disappointments, successes, heartbreaks, frequently missed opportunities, and rare moments of elation all these are now hardly remembered. Yet it is only through a detailed understanding of these conflicts and struggles that a genuine appreciation of the significance of the advances can be obtained".

And then Dresden makes an interpretive move which is pretty unusual for a physicist, not to mention for a theoretical physicist, and quite unheard of in the philosophy of science: he claims that there is a connection between Kramers' difficulties in committing himself to physics and his difficulties in committing himself to his wife: "There is", says Dresden,

"a striking similarity between Kramers' unwillingness or inability to commit himself to physics in his student years, thereby giving up all other intellectual pursuits, and his indecision in his relation to Storm [i.e., his wife] which would similarly involve a commitment, with a corresponding renunciation of other options".

These are just a few examples, taken from a few biographies of, and autobiographies by, scientists. Time does not allow me to make any lengthy theoretical interpretations. Just two short final remarks. Having read a number of biographical and autobiographical portraits like these, one might suggest an analytically colored interpretation of the kind that Harold Bloom makes in his book The Anxiety of Influence of 1973. The `anxiety of influence' is Bloom's term for the "horror of finding [one]self to be only a copy or a replica" of somebody else. It is not only the fear that one's works will be forgotten or ignored, but also that, "even if they are preserved and noticed, nobody will find anything distinctive in them", that they will be redescribed in terms of later writings, or reduced to replicas.

Bloom's concept of the `anxiety of influence' applies well to the case of Niels Kaj Jerne. But Dresden's story of Kramers is more in accordance with Roberto Mangabeira Unger's concept of the passions. The passions, as Unger sees them, embody the realization of the tension between the conditions for self-assertion, that is, on the one hand, our desire to engage with other people and through this engagement to establish ourselves in the world; on the other hand, our need to prevent this engagement from subjugating and depersonalizing us. Fear, despair, vanity, pride, jealousy, and envy are the results of a failure to achieve empowerment; hope, faith, and love are expressions of our success in this respect.

In terms of Unger's theory of the passions, the ability to handle the enabling conditions of self-assertion lies at the heart of the life and work of every scholar and scientist. In our attempts to assert ourselves through scientific and scholarly work, we are permanently at risk. In projecting our existential projects into the social space, we are constantly at the peril of being rejected and overwhelmed by others. Scientists who choose to go their own way are committed to acts of courage, "always risking a fearful penalty if they are wrong".