FRAYN'S 'HEISENBERG':

FACT OR FICTION?

by

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"who am I?", "why am I here?"

I am quoting Ross Perot's running mate because being out here feels like he may have felt in the vice-presidential debate; being in the limelight not totally of my own choosing and not on my own behalf. My father has, of course, shared the stories of his life on many occasions. But in the controversies that surrounded him, he did not elaborate on the details, as he did not want to burden us with his own problems.

This worked fine for me until about 25 years ago. I was at a meeting of the American Physical Society and was told that Sam Goudsmit wanted to talk to me. When we met he took me aside and said he wanted to apologize for the pain he had caused my father's family. Not having been in the loop I was not sure what he was talking about even though I had heard about the Alsos Report. All I could utter was that I personally had not experienced any pain on his account. With this meeting he put me smack in the middle of the conflict and since then I have had to deal with those issues on both sides of the spectrum.

Thus I want to thank Brian Schwartz for giving me the opportunity to participate in the discussion and to present my current understanding of the issues which are of course strongly influenced by my father's accounts.

Let me start by thanking Michael Frayn for this intriguing play. All three times when I saw 'Copenhagen' I found myself deeply moved by it. On the one hand there is this comfortable familiarity, because I remember my father telling us about the various events from his life, which feature so prominently in the play. Yet it also is startling, since the language and demeanor of the Heisenberg figure do not correspond to my memory of him. Of course, the play was not written to reconstruct the Bohrs and Heisenberg true to life, nor did Frayn to my knowledge ever meet any of them. And so I may have permission to explore a little the extent to which the play depicts the reality of events and people, one of whom I know so well.

Often, it has been the historians who have taken on this particular task of dissecting nuances of events and the people in them, ascribing inadvertently a point of view here and a motive there, but nevertheless considering the outcome to be scientific and reliable. What is so refreshing about an artistic interpretation of the historical event of the Copenhagen visit is that it approaches truth as a multifaceted and ultimately delicate construct, and that we learn to respect it as such, doubts and all. Michael Frayn lets us participate in the struggles between these characters who are feeling as well as thinking human beings. His is an imagination that is as fair as it is passionate. We feel an enormous sense of compassion for all the protagonists in the turns and twists of possibilities and motives.

Much has been made of the indeterminacy parallel of my father as a person and in his actions. Here I beg to differ, because, while cautious, my father was extremely clear in his thoughts and actions. He certainly would not have ventured to visit Bohr under the rather difficult circumstances, had he not found the matter at hand to be of utmost and brutal importance. Staying home would have been so much easier.

Being neither a historian, nor a playwright, I will use my credentials as a son to tell you what I know of Werner Heisenberg and how it may relate to his Copenhagen visit. For me Werner Heisenberg was primarily my father. He was a good father, a warm, caring, and compassionate human being who taught us his love for the outdoors, for mountain climbing, music or the spiritual, which he called the central order.

I have said this in other contexts already, but it bears repeating: the emotional portrayal of the Copenhagen Heisenberg is off in some respects. His demeanor was modest, understated, even somewhat shy, though always friendly, forward, and positive. The brashness of the young protagonist on skis and in the presto musical performance was not his. In fact, he won my mother's affection in the **slow** movement of the Beethoven G-major piano trio, not the presto, a story often recounted at home. If he was fast, it was in his thinking. Actually it was frustrating to us kids to debate him. After a couple of seconds of arguing a point, he would give a reply that would stand up to any attempt at countering it. It stood – and we would wonder if he spent his entire free time in rehearsing such thoughts and any implications thereof, only to retrieve them at will from his memory store. His memory was impeccable anyhow. Again and again he would surprise us with reciting lengthy poems we had not heard before, or by telling new stories from his youth.

Music was my father's equivalent to emotional passion, if you will. He played regularly for himself and with others, and music was a connector to the people who were not his scientific peers. As children we benefited from this common language our parents taught us with such great care. If I know him so well now, it is partly because of the many hours of music we played together. It was through music that he shared the depth of his feelings about beauty and transcendence with us, although he did not go for the so-called romantic excess of emotion at all. A clean and classical exuberance was more his style, but above all else the slow movements were his true strength.

In the summer of 1956, when I was 17, our family vacationed for three weeks in Denmark, in Liseleje, which is a beach town next to Tisvilde where the Bohrs had their summer house. My father had arranged this trip and he showed us many of the sites that were of significance in his life and that he had grown to love. With twenty-twenty hindsight it would have been so excellent, had I had the maturity or the understanding of history to ask my father pointed questions about any and all of his Copenhagen experiences. As a young scientist he had spent considerable time in Copenhagen. These had been his formative years, and I want to quote from a letter to his parents written during his early years there: *"The discussions with Bohr of course occupy only a few hours during the day; we typically take a walk to the free Harbor or the gardens. Quite often I*

end up spending the evening at Bohr's house and over a glass of port (or several) physics is being enriched by new discoveries. Occasionally the discussed points are still true the next morning."

When our family walked through Copenhagen at one point he said that this was the street on which he and Bohr had taken their walk in 1941. This was one of the occasions when he, like any father, was letting us share in the personal memories of his younger years. I could not hear anything resembling soul-searching. It simply was part of his life as he had lived it. He wanted us to know what he had done and what role he had played during the war but he also did not want to involve us in the controversies associated with it. He seemed to have accepted the past for what it was

This brings me to the question, why my father did not leave Germany before the imminent outbreak of the war.

Let me digress here to my own life a little to illustrate how my father approached a decision making process.

In 1969 I received a tempting offer from MIT to join their faculty. Even though it was an excellent opportunity, I had a difficult time deciding to leave family, friends, colleagues and the familiar environment and culture behind. After all, my father had **not** followed similarly good offers in 1939, and had instead chosen to stay in his own country. Certainly, his circumstances were vastly different: Coming to the US meant he could have removed himself and his family from the impending war – not a minor bonus, one would think.

When he faced his decision in 1939 he too wanted to talk it over, and with Max Planck they outlined the pros and cons sufficiently for him to then act as he felt he had to. Staying in Germany where he already was a public figure meant that he was going to be in a position of some influence to help his friends, his students, and his fellow scientists who did not have a similar option to leave. It meant weathering the turmoil under the dictatorship and the coming war. I am sure he also knew it meant that some people would misconstrue this decision as a sign of Nazi sympathies and of his personal ambition.

This, however, was far from the truth. He has had his own skirmishes with the Gestapo when he was defending modern physics and as a result was denounced as a "white Jew" who should be in a concentration camp. Other attacks called him the "Ossietzky of physics" (Ossietzky being a famous dissenter who at that time was already in Dachau). He fought his way through this and persisted; but an underlying fear and trauma remained. My mother has said that even later in life he would hear the noise of marching Nazi-boots and that he had dreams of the Gestapo storming into the bedroom. All of this was weighed in the decision and yet he stayed on in Germany. I would call this courageous, since he also knew that he would have very limited control at best.

Anyway, to come back to my situation: I was anxious about my decision and one day in Munich while I accompanied my father on his daily walk through the English Garden to his Institute, I tried to conduct my business by asking him whether in hindsight he ever felt that in one or another important decision he should have decided differently. He answered in his typical fashion, ignoring my state of unease, by factually pronouncing: *No, You can blame yourself only if you did not exercise enough thoroughness in the decision making process. If you considered all the facts available to you at the time, then there is no reason to blame yourself.* He then proceeded to analyze what in his experience would be the most likely scenario for my move to the US, discussing also some less likely possibilities. Not addressing my anxiety at all and focusing instead on the rational thought process, had the desired effect on me: it reduced my stress and allowed me the control I needed to make a decision. Needless to say, my career and life in the US followed very closely what he had given as the most likely course.

My sense is that my father himself was prepared to live with each and every consequence of his actions and therefore did not appear terribly concerned about explaining himself after the fact.

One of the things he probably did not foresee was the reality cropping up that a nuclear weapon was feasible. How he dealt with that situation accounts for much of the guess-work surrounding him after the war.

Here is another piece of my anecdotal memory that may shed some light on how he applied his influence in politics. One day in Munich during the 1960's, he came back from a committee meeting with politicians, very pleased since apparently the decision had gone his way, which he, of course, believed to be the right way. Elaborating further, he explained that the best way to deal with politicians is to strip all ideology from the decision making process and by sheer virtue of the objective facts a proposal would yield consensus.

I believe that this also applied to 1936, when the Nazis wanted to prohibit the teaching of Einstein's theory of relativity. He did not attack the ideology of Anti Semitism in this. Instead, he argued on the objective facts that it would be wrong to withhold a correct theory from the students. This was a totally factual and obvious statement and prevailed as a successful line of argument. It was clever and cunning, allowing the continuation of modern physics despite the prevailing madness of ideology. Even though he knew that the scientific truth is only one of several realities, he believed that objective facts and rational thought were the only legitimate basis for decision making in society as a whole. Other considerations paled by comparison, and when he was up against any irrational ideology, he relied on the power of objective and rational persuasion. Passionate debates were not his style, and he abhorred the Nazis' reliance on stirring up passions to their racist ends in German society.

One may assume that he approached the infamous meeting in 1942 with Albert Speer of the army ordnance ministry in the same way. The meeting was scheduled in order for the researchers to - among other topics -advise the government on the possibilities of building nuclear bombs. Up to this point the research had been only a feasibility study to figure out whether such devices could be built and how, and what the requirements would be if one would attempt such a project. In my father's accounts it says that at that time the knowledge base in Germany was close to what it was in the US. This, in general terms, is corroborated by the research papers of that time, published in my father's collected works. Germany knew that there are two ways, namely either to separate U^{235} from U^{238}, or to have a reactor that eventually will produce what is now called Pu^{239}. Thus Bohr sounds right in his recently published letters where he remembers my father saying that he is familiar with the details – he was.

Looking at the feasibility was essential for my father, because, as he said, if it was trivial building one then nobody could avoid doing so, however, if it was impossible, the point was moot. Of course there is a lot of gray area between those two extreme possibilities. My father at this time had

made a serious effort to estimate the requirements for such a bomb project. While they had not solved all the problems, they knew enough to make a realistic assessment of such a task. In an interview with the 'Spiegel Magazin'in 1967 he states that his estimates were that it would require a critical mass about the size of a pineapple. This would translate into a development time frame of about three years under the best of circumstances; and those definitely did not exist in wartime Germany.

This was exactly how he, Otto Hahn, and other scientists presented the situation to the government. Albert Speer's memoirs confirm this. My father knew very well that his recommendation meant that there would be no bomb project in Germany. He always stressed that these were the objective facts. He did not have to distort anything, as the facts alone necessitated the conclusion.

My father always defended this as a rational, and not a moral decision. He has rejected the moral motive in interviews and he objected to Robert Jungk's overblown account in 'Brighter than a thousand Suns'' Considering the way he approached decisions I can only concur. Did he deliberately deceive the government? 'Deliberately' yes; 'deceiving' is incorrect, because he presented estimates that were, in fact, very close to what was encountered in the U.S. Manhattan project.

After this decision the German scientists focused on building a nuclear reactor, which they expected to be useful after the war to generate power. Besides this project, my father worked on a long philosophical essay, which was completed by the end of 1942. This work was never published during his lifetime but after his death it was published under the title 'Ordnung der Wirklichkeit' and is now included in his collected works. He could only show it to trusted friends because it contained a scathing analysis of governments like the Nazi dictatorship. When I read these parts I knew for sure that he was not somebody who wanted to build a bomb for Nazi Germany. I think, this essay shows more than any of his public statements do what thoughts were in his mind during these dark years.

Let me point out here that after the war he did, what he always said he wanted to do: He helped rebuild and shape science in Germany. He continued to oppose arming Germany with nuclear weapons by participating in the declaration of the "Göttingen 18" in 1958; and to the end of his days, as president of the Alexander-von-Humboldt-Foundation, he was actively expressing his belief that science is international.

The visit in Copenhagen with its consequences is intricately linked to world history. Was it all a tragic misunderstanding, or what went wrong? Michael Frayn poses the crucial question right up front: 'Why did he come to Copenhagen?'

My immediate answer is: because he needed to talk to his trusted friend Niels Bohr and because he felt responsible for his safety.

My father's answer has not changed much whether he talked in public or whether the topic came up within the family. He stated that

1. He wanted to assure that the institute remained under Danish control.
2. He was concerned about the Bohr family's personal security and wanted to let him know who the people in the German embassy were that could be trusted.
3. He wanted to tell Bohr that it was now certain that nuclear bombs were a possibility; but that because of the huge industrial effort necessary for such a project Germany would not get into the development of a bomb.
4. He assumed Bohr would soon have to flee Denmark and join the allies, and he was expressing his hope that the other physicists would come to the same conclusion.

Bohr acknowledges at least part of the first two points. My father said to us that it was his intent to convey these messages but that he failed. Because of his own safety he was trying to say these things between the lines, the way he was used to communicating inside Germany. He felt this was essential for his own survival, whereas Bohr was not used to this practice. My father believed that herein lay the main cause of the misunderstanding. He never filled us in on the details of the miscommunication or spoke of the emotional repercussions for them both. He did not speculate to his kids as to what Bohr might have heard him say. Things were never the same afterwards despite their cordial behavior and several visits back and forth.

One has to understand that in Germany like in any totalitarian regime one could **only** say things in public that conformed to the party line. As a result, people first assessed who was talking and from that judged whether somebody only was giving lip service. Unlike my brother, I do not recall any specific discussion, but from the way my father would talk about these times, I think, he would readily agree. Generally, he avoided political statements; however, when challenged and when he felt he was in a place subject to Gestapo surveillance he made statements representing the party line while in private he did state his true opinions but even there only between the lines. This was necessary so that he could travel and maintain contact to physicists in other countries. He also knew that the party line would keep him at the helm of research rather than being replaced by someone truly loyal to the Nazis.

My father admits that the way he handled his cautious talk with Bohr was a mistake. We too are left wondering why, when they finally were away from surveillance on their walk he did not as a first statement point out the split to reestablish trust. How else was Bohr to understand the split and put it in perspective? Thus it is easy to understand how Bohr got the impressions and reacted with the outrage he expressed in the recently released documents.

On the other hand, Bohr did sense the concern that my father had for Bohr's safety. In light of this we could ask why didn't Bohr open the discussion by asking Heisenberg whether he really believed his offensive political statements?

In their earlier work together their mutual trust rested on science's absolute truth: Heisenberg could tell Bohr in brutal honesty that his math was off, but he could not talk to Bohr about his feelings or his emotional state; he came from a generation where this simply was not done. All he could

do was to project: I have the trust and feelings toward you, and so I assume you have that too. In 1941 this clearly could no longer apply.

Even though my father did not let on to us children about any unresolved feelings between Bohr and himself, he talked to his closest associate Hans Peter Dürr about them shortly before his death. We also get a glimpse of his preoccupation and pain from a letter he wrote to a family member around 1962 where he summarizes his poignant outlook on relationship: *"The relationship between two people is the most important thing in our existence. At this central point from which derive happiness and unhappiness to the highest degree, one should not make any unnecessary mistakes."* The way it ends is also characteristic: *..." you are not supposed to reply" ...* He could not or would not talk about things like that – and he too never sent that letter.

When you read Bohr's own relentless attempts at sending a letter to Heisenberg you also get the distinct feeling that he had difficulty confronting him on such a deeply personal issue. Thus it is quite fitting that Frayn has to move this discussion into the afterlife where they are no longer burdened by human limitations.

If I have been rambling, please forgive me. What must be interesting and curious to you and me has also become once again so very controversial. I can always only repeat more of the same. My father believed that the truth would prevail, ultimately, and presenting his recollections once or twice was enough for him. And I too intend to follow that route from here on in. Thank you for your attention.

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