

A HISTORICAL PERSPECTIVE ON COPENHAGEN

Copenhagen, a thought-provoking drama by Michael Frayn that has played to sold-out audiences in London, has now opened in New York with much well-deserved attention.¹ Despite the sparse set, the three-person cast, and the technical nature of the subject matter, this play appears to speak on some level to almost everyone. (See PHYSICS TODAY, May, page 51.)

One reason for the play's appeal may be the confluence of past, present, and future within its confines; today, as we rush headlong into a future filled with the promise of potentially astonishing scientific and technological advances, we are continually drawn back to the lingering questions of the 20th century—questions that are so profound that they, like the characters of *Copenhagen*, seem to transcend time itself. How was it possible for the most culturally and scientifically advanced nation of the world to produce the genocidal killing machine that was Nazi Germany? And a related question: How was it possible that Werner Heisenberg, one of the most gifted of modern physicists, a man educated in the finest tradition of Western culture, who was neither a Nazi nor a Nazi supporter—how was it possible that such a man would not only choose to remain in National Socialist Germany for its entire twelve years of existence, but also actively seek a prominent academic position in Berlin at the height of the war—a position that included the scientific directorship of nuclear fission research for the German army at war?

These are two of the many difficult questions that people have studied and debated ever since the end of World War II. The often emotional debate continues today, at times even more intensely than ever. And it will continue at some level perhaps *ad infinitum*, unless there is some new breakthrough, or perhaps some fresh new perspective, such as the perspective of historical drama. This was, in fact, my hope when I first heard about the play. I am delighted that *Copenhagen* has succeeded so well in bringing these historical issues (and even some of the science) to the public and in taking the first steps toward resolving such difficult issues from the theatrical perspective. But, as a historian, I must admit to some disappointment.

Despite the breadth of topics covered by the play—from nuclear fission and quantum mechanics to family backgrounds and personal tragedy—what tends to disappoint me is what is still missing from the play: a fuller sense of the larger historical issues raised earlier, as well as a much broader appreciation of the historical setting of

What was Werner Heisenberg trying to tell Niels Bohr during his visit to Copenhagen in 1941, and what did he want from Bohr?

David C. Cassidy

answers to the questions that the author does attempt to answer: What was Heisenberg trying to tell Bohr during this meeting, and what did he want from Bohr?

Of course, no one else was there to observe and record the outdoor encounter between these two men, and so we cannot know for certain what exactly was said or implied during their walk together. However, to use the metaphor of the uncertainty principle, one can narrow the breadth of uncertainty regarding this seemingly mysterious visit by expanding the focus of the play's historical spotlight.

The restricted historical focus is signaled early in the play when Heisenberg states: "... there are only two things the world remembers about me. One is the uncertainty principle, the other is my mysterious visit to Niels Bohr in Copenhagen in 1941." It is difficult to know just what the world remembers about Heisenberg. But I would suggest that what it remembers are his many contributions to the creation of quantum mechanics, of which the uncertainty principle is only one; and his leadership role in German nuclear fission research during World War II, of which the Copenhagen visit in 1941 was only one manifestation.

Travels

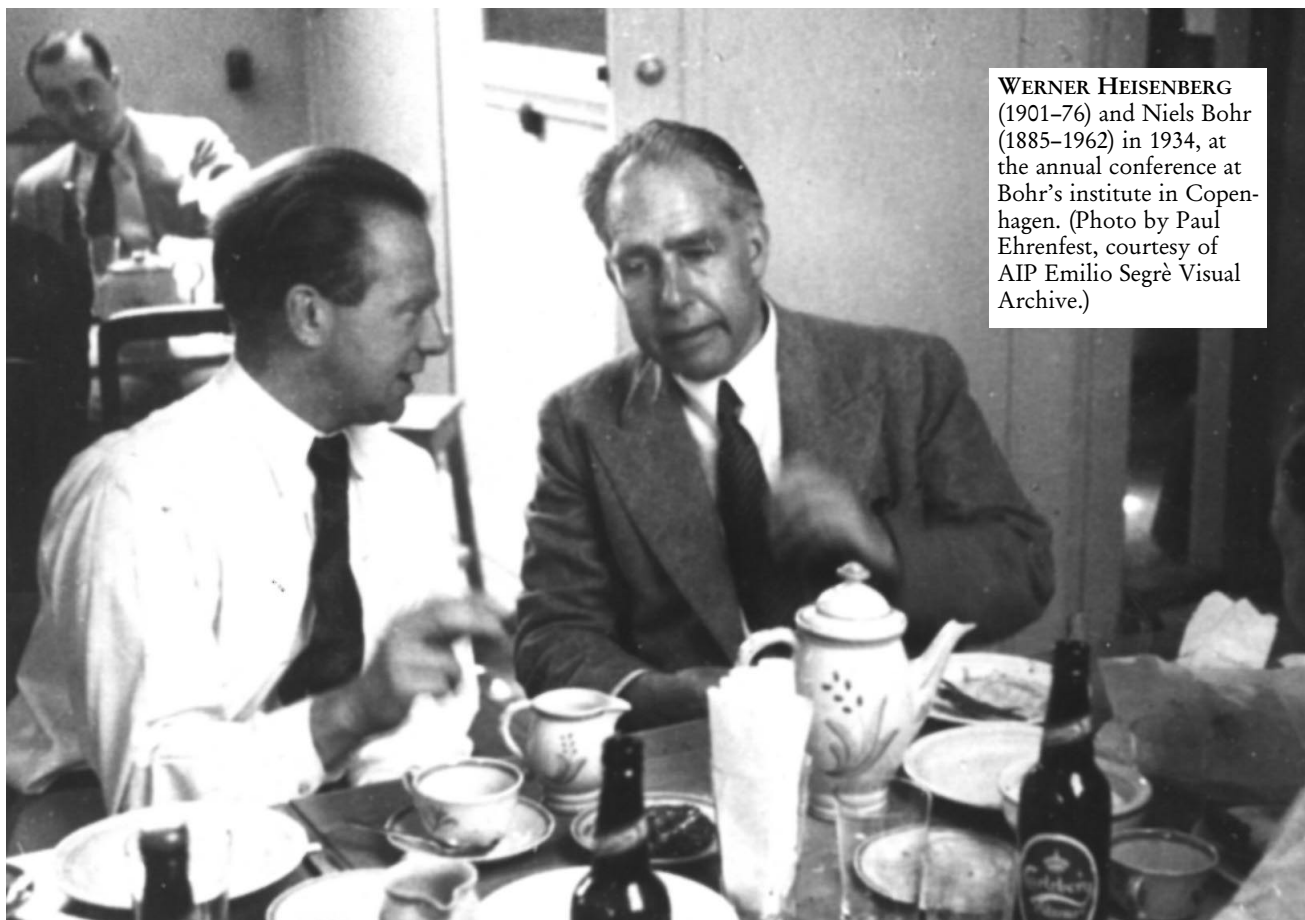
While emphasizing the single episode—perhaps for good dramatic reasons—the play leaves out at least ten other equally controversial visits that Heisenberg made to Nazi-occupied countries and to German-speaking Switzerland during the war. Among these travels were trips . . .

- ▷ To German-occupied Budapest in 1941 and 1942.
- ▷ To Switzerland in 1942 and 1944.
- ▷ To the occupied Netherlands in October 1943, just after the deportation of many Dutch Jews to Auschwitz.
- ▷ To Krakow, Poland, in December 1943 as a guest of the infamous Dr. Hans Frank, general governor of Poland, just months after he and his murderous henchmen had annihilated the heroic inhabitants of the Warsaw ghetto.
- ▷ Copenhagen twice in 1944 after Bohr had fled to England and America.
- ▷ To Königsberg in East Prussia (now Kaliningrad, Russia) in February 1944.

Historian Mark Walker has pointed out, in a study of Heisenberg's war-time travels, that Heisenberg undertook each of these trips to occupied nations, including his trip to Copenhagen in 1941, as an explicit representative of the German office for cultural propaganda.² On several of

the play's focus—Heisenberg's September 1941 meeting with Niels Bohr. I am speaking here solely as a historian. Certainly a viewer or a playwright would have other considerations. However, because of the absence of the broader perspectives, the play seems to glide right past the most obvious

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WERNER HEISENBERG (1901–76) and Niels Bohr (1885–1962) in 1934, at the annual conference at Bohr's institute in Copenhagen. (Photo by Paul Ehrenfest, courtesy of AIP Emilio Segrè Visual Archive.)

these trips, Heisenberg is reported to have made compromising and deeply painful statements to his foreign colleagues. One of Heisenberg's Dutch colleagues later attributed the following statement to him during his visit to the occupied Netherlands in October 1943:

Democracy cannot develop sufficient energy to rule Europe. There are, therefore, only two alternatives: Germany and Russia. And then a Europe under German leadership would be the lesser evil.³

One wonders if Heisenberg really had anything different to say in Copenhagen two years earlier.

The war years

In fact, looking more broadly at Heisenberg's attitude regarding Germany's war aims, especially in 1941, it seems more likely that he did not. As I have developed at length in my biography of the man, Heisenberg's outlook throughout this period was very much in line with that of other patriotic non-Jewish Germans among artistic, academic, and military circles.⁴ Out of nationalistic and patriotic pride, this social grouping eagerly supported the German cause for the sake of the German nation. As the German army blitzed across Europe during the early years of the war, these circles welcomed the news of victories on all fronts. Final victory, they believed, was close at hand in September 1941.

However, while this cultural and military elite wanted Germany to win the war, this did not mean that they wanted Hitler or the Nazi regime to win. They were not Nazis but proud, upstanding nationalists. They resigned themselves to supporting the Hitler regime for the sake of the nation, while clinging to the naive belief that Hitler and his "ruffi-

ans" could be replaced somehow as soon as they had won the war for the "real Germany"—German culture. When the country's fortunes turned for the worse as the war dragged on, these men turned against Hitler and the regime, unleashing the failed assassination plot of June 1944 in the hope that the world would recognize that "another Germany" had existed alongside Hitler's Germany.⁵

That Heisenberg shared the ultimately fatal outlook of his peers is evidenced not only by his close association in Berlin with many of the members of the assassination plot,⁶ but also by his participation from 1936 onward as a reserve corporal in a German mountain infantry unit, despite his personal aversion to the Nazi cause. Although all adult men under the age of 45 were required to participate in reserve training, for Heisenberg it was more than a mere duty. For instance, during the Sudeten Crisis of 1938, Heisenberg expressed no regret as he and his unit prepared to strike into neighboring Czechoslovakia. War was narrowly averted at the last moment when the Western European nations appeased Hitler at Munich by ceding the Sudetenland to Germany without a fight. Heisenberg's only reaction afterwards was one of detached resignation toward Hitler's war aims and toward the marching orders that he well knew could end his life. Writing to his mother as his unit placed its weapons back in storage for the time being, he noted: "It is strange to think how the fate of every individual and the deaths of many hundreds of thousands can hang on the decision of one man."⁷

In 1942 he seemed to display even greater resignation toward the prosecution of the war when he wrote in a then-unpublished manuscript:

For us there remains nothing but to turn to the simple things: we should conscientiously

FAMILY PHOTO showing Heisenberg (right) with his father and brother in 1914. (Max Planck Institute photo, courtesy of AIP Emilio Segrè Visual Archive.)



fulfill the duties and tasks that life presents to us without asking too much about the why or the wherefore . . . And then we should wait for whatever happens . . . reality is transforming itself without our influence.⁸

Is there much doubt that Heisenberg would also have accepted the required task of representing German war aims in his travels abroad, even when traveling to German-occupied Copenhagen in 1941?

Fission project

Once again the answer grows more certain—although, like Heisenberg's physics, it never attains zero uncertainty—when we broaden the historical spotlight still further to examine why Heisenberg chose to accept the position of

scientific director of the German nuclear project for the German army at war.

By the outbreak of war in September 1939, Heisenberg had already lived through nearly 7 of the 12 years of the Third Reich. A lot had happened during those years, and any questions for him about entering into the compromises required to remain in Germany had already been long resolved. With the establishment of the regime's anti-Semitic programs, many of Heisenberg's students and colleagues had been driven from Germany. Then, in 1937, the SS turned its attention to Heisenberg himself, accusing him in an SS publication of teaching so-called "Jewish physics"—that is, modern theoretical physics.⁹ The article called Heisenberg a "white Jew" and a "representative of the Einsteinian 'spirit' in the new Germany,"



AIP EMILIO SEGRÈ VISUAL ARCHIVE

1932 CONFERENCE AT BOHR'S INSTITUTE IN COPENHAGEN. Heisenberg is at the far left; Bohr, third from left.



ELISABETH AND Werner Heisenberg flanking Niels Bohr in Copenhagen in 1937. Victor Weisskopf is in the background on the left.

implying that he was a traitor to the nation and that a concentration camp was the suitable remedy. Finally, after a year-long Gestapo investigation, Reichsführer-SS Heinrich Himmler personally exonerated Heisenberg of all accusations of disloyalty to the regime. This protected him from further attacks, but the damage had been done.

Heisenberg now saw compromise in the face of dictatorship even more clearly as the price required for remaining in Germany. His determination to stay under such circumstances arose not only from his personal attachment to the German nation and culture, but also from his misguided belief that if he personally could survive in Germany until the end of the war and the eventual removal of the Nazi regime, then so, too, would decent German science survive until better times. With such an outlook, the famed Nobel Prize winner now interpreted every favor bestowed upon him—every appointment to a prominent position, every permission to travel to occupied countries, every invitation to address a public audience—as further evidence of rehabilitation of himself and of contemporary theoretical physics in Germany.

The outbreak of war in Europe in 1939 suddenly provided Heisenberg and his closest colleagues with an ideal opportunity to prove their worth at last to their rulers by contributing their scientific expertise to German war aims. And nuclear fission, the discovery and development of which owed much to so-called “Jewish physics,” provided a splendid opportunity for the scientists to gain the protection of the German army through a sustained project that might produce a powerful new weapon for the German arsenal—or at least a new and plentiful source of energy to power German ships and the German economy. As Heisenberg later put it: “The official slogan of the government was: ‘We must make use of physics for warfare.’ We turned it around for our slogan: ‘We must make use of warfare for physics.’”¹⁰

By August 1941—one month before the Copenhagen visit—Heisenberg and his fission colleagues in Leipzig and Berlin suddenly faced a new crisis. First, Heisenberg’s Leipzig reactor research team was nearing the world’s first evidence of neutron multiplication, which it was able to confirm by the following spring. Not only was the prospect

of a nuclear weapon no longer just a theoretical possibility, but the Germans were also convinced—and they were right—that they were far ahead of Allied fission research at that time. However, they soon lost that lead.

Second, Fritz Houtermans, working with another group in Berlin, had shown theoretically that the element now known as plutonium could be produced by a working reactor and could also be used, in addition to uranium, to power a nuclear weapon. This discovery suddenly blurred the distinction between work on a reactor and work on a nuclear weapon.

Years later Heisenberg recalled: “It was from September 1941 that we saw an open road ahead of us, leading to the atomic bomb.”¹¹ With a visit to the cultural propaganda institute in Copenhagen already planned, the open road to the atomic bomb—which Heisenberg may or may not have wanted—led straight to Niels Bohr’s front door. All of which brings us back to the questions raised by this play: What was Heisenberg trying to tell Bohr during their meeting that September? And what did he want from Bohr?

The moral issue

Heisenberg’s own answer, which appeared in several of his post-war writings, was published by the journalist Robert Jungk in 1958 and has been accepted by many nonhistorians, popular writers, and TV producers ever since.¹² As Heisenberg put it in a 1948 document and in other writings, as well as in the play, he wanted an answer from Bohr to the question: “Does one as a physicist have the moral right to work on the practical exploitation of atomic energy?”¹³

My problem with this explanation is that there is no evidence in any other sources throughout the war, and especially in 1941, that moral issues regarding nuclear fission research were of particular concern for Heisenberg—nor for many other physicists, for that matter. Of course, this does not rule out such a concern, but if it was so great as to bring Heisenberg to Copenhagen under such difficult circumstances, clues would have turned up in other sources from that period.

It is true that Heisenberg engaged in an occasional

ethical discussion with Bohr in earlier years. But after Hitler's rise to power, and especially after the SS affair, Heisenberg turned for any needed moral or ethical advice to his upright German colleagues, Max Planck and Max von Laue, both of whom were still readily accessible in Berlin in 1941. There is no indication that he ever consulted either of them about the morality of nuclear fission research.

If morality was not the main concern, then Heisenberg must have had another motive for seeking out Bohr in occupied Denmark—a motive that more likely harkened back instead to their much more frequent discussions in earlier days of international relations. Indeed, it was during his earlier visits to Copenhagen and his encounters with Bohr and Bohr's many other international guests during the 1920s that Heisenberg first gained a real appreciation of the international community of physics. He even learned to speak Danish and English as a result of his extended visits to the international oasis that is still the Niels Bohr Institute today.

By September 1941, the international situation looked quite bleak for the world but quite positive for Germany. As is noted in the play, by this time the Reich had reached its greatest extent. Most of continental Europe was under Nazi occupation, German panzer divisions were plunging into Soviet Russia, and the United States was still officially neutral. Heisenberg had learned from his German coworkers that an atomic bomb was not just a theoretical possibility but that it could indeed become a practical reality. Whether the war ended with the German army in place, or bogged down in a protracted conflict reminiscent of World War I, it was easy to suppose that the United States would have enough time and resources to catch up with German researchers and build a nuclear weapon, which they might well use or threaten to use on Germany. In a memoir, Elisabeth Heisenberg wrote that throughout the war her husband "constantly tortured himself" with the thought that the better equipped Allies might build the bomb and use it on Germany.¹⁴ At the same time, Heisenberg probably knew or strongly suspected that Bohr was in contact with Allied scientists through underground sources.

So, what was Heisenberg trying to tell Bohr during this meeting, and what did he want from Bohr? The broader historical setting and a fuller appreciation of Heisenberg's outlook and relationship to the war and to fission research strongly suggest that he wanted to convince Bohr that the seemingly inevitable German victory would not be so bad for Europe after all. The alternative, as Heisenberg later noted to his horrified Dutch colleagues, was a Europe ruled by the Soviet Union. Having witnessed a traumatic Soviet revolution in Bavaria as a teenager, Heisenberg always considered Soviet domination an even worse evil than Nazi domination.

What he apparently wanted from Bohr was for Bohr to use his influence to prevent Allied scientists, who were surely far behind the Germans, from working toward building a bomb that could be used against Germany.

Bohr, to his credit, immediately sensed Heisenberg's intentions and broke off the conversation. Heisenberg returned home intent on continuing fission research. He had already resigned himself to the march of events, and after the visit to Bohr, events now appeared to be marching toward a possible nuclear war, regardless of what he may or may not have wanted. In an unpublished letter to a Leipzig colleague, a historian of the middle ages, written just one week after his return to Germany, Heisenberg alluded to a capability to destroy the world, quite appar-

ently a veiled reference to the inevitable possession of nuclear weaponry:

I really liked the passage in your book about the mind-set of the middle ages in contrast to our epoch. In this connection it suddenly came to me that such a transformation could occur once again in the near future. For perhaps we humans will recognize one day that we actually possess the power to destroy the earth completely, that we could very well bring upon ourselves the "end of the world" or something closely related to it.¹⁵

Just three months later, the army decided to abandon its fission project on the recommendation of its closest advisors, choosing to concentrate instead on rockets and jet aircraft. This shift eventually dashed any German hopes for sweeping success in fission research.

In the end, the spotlight of uncertainty dissipates much of the mystery of Heisenberg's trip. It reveals Heisenberg as neither a hero nor a fiendish villain, but as a highly talented, cultured individual who was unfortunately caught up in the dreadful circumstances of his time for which he, like most people, was totally unprepared.

I based this article on a talk I gave at the symposium "Creating 'Copenhagen,'" held at the Graduate Center of the City University of New York on 27 March 2000.

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