

STUDENT SKIT: *COPENHAGEN* AND FARM HALL  
Notes and arrangement by Alex Wellerstein

This is the script for a skit that students performed in Peter Galison's "Einstein Revolution" course at Harvard University in Spring 2009. It combines selections from Michael Frayn's 1998 play, *Copenhagen*, and excerpts from the transcripts at "Farm Hall" in 1945, where German scientists were taken to a British manor and surreptitiously recorded as they discussed both the German nuclear program and their responses to the news of the bombing of Hiroshima.

Volunteer undergraduates were solicited to perform the skit in front of the lecture course as a whole. The script as written requires eleven (11) students (3 for *Copenhagen*, 8 for Farm Hall – one student plays the same HEISENBERG in both). In the "Einstein" course, which had 170 undergraduates that year, this was not such an impossible quota to meet.

The skit was proposed by Professor Galison both as a means of involving the students in a fun (and relevant) assignment involving assigned readings, and as a means of emphasizing the ways that producing a coherent narrative of past events – a *Lesart*, to use Max von Laue's term – is central to both texts. In their discussion sections, the undergraduates were subsequently encouraged to compare and contrast these two dialogue-based texts.

The script begins with excerpts from *Copenhagen* and then transitions to "Farm Hall" as a play-within-a-play (it is positioned to be something of a "flashback" for Heisenberg). The *Copenhagen* script takes some passages out of order to make the discussion more logically coherent to the purposes of the skit (apologies to Michael Frayn). The "Farm Hall" transcript contains some significant editing in places to make it adhere to the number of actors (in some places, characters are now composites), and to make it more "natural" for a listening audience (fixing some fumbling grammar and clarifying/simplifying some technical discussion). Additionally the end of the "Farm Hall" section is an excerpt from a letter by Von Laue from 1959.

The full reading requires some 15-20 minutes. Our students did not memorize their scripts (too much work for the purpose), and so for our performance we made "name tags" (reading "OTTO HAHN," "WERNER HEISENBERG," etc.) that were printed on letter paper and held on the back of the scripts, so that while the student held up their script to read it, their names would be visible to those in the audience.

Note that HEISENBERG is the most demanding role and should be given to someone with a lot of charisma. MAJ. RITTNER needs to be able to speak officiously and authoritatively. LAUE only has a couple lines but the last monologue is kind of important.

The performance as written is meant to be done in front of a PowerPoint slide show that includes an audio excerpt from the BBC radio announcement of the bombing of Hiroshima. (It is not clear that this is the same exact announcement that the scientists at Farm Hall actually heard, but it is close enough.) The only other "prop" is a set of large, old-fashioned headphones to be used by MAJ. RITTNER to indicate when he is monitoring the scientists at Farm Hall.

## STAGING

The staging is as follows:

### I. *Copenhagen*

MARGRETHE, HEISENBERG, and BOHR read their lines. Slide #1 (Niels Bohr's house) the entire time is projected behind them.

At the end of *Copenhagen*, HEISENBERG will say he remembers Farm Hall. MARGRETHE and BOHR recede to background and the Farm Hall scientists come out. Switch to slide #2 (Farm Hall).

### II. Farm Hall

MAJ. RITTNER is the narrator (the proceedings are part his report). After he talks, he steps to the side of the stage and puts on large (old-style) headphones (he is listening in on the scientists).

As RITTNER reads the report heading, change to slide #3 (Memo).

As he names each scientist, the student steps forward and reads MAJ. RITTNER's description of them. Change slides accordingly (Slides #4-11, HAHN through DIEBNER).

After introductions, change to slide #12 (Farm Hall).

At one point in the transcript, the script will callout for playing the BBC radio announcement for August 6, 1945. Change to slide #13 (radio), and play BBC audio clip. Note that the clip is not extremely loud – check the volume ahead of time.

After the BBC clip, change to slide #14 (Farm Hall, again).

Make sure to start clapping at the end!

## **COPENHAGEN SCRIPT**

[Because of copyright regulations, I have not here reproduced the script from *Copenhagen*. Instead, I have indicated my arrangement of selections (which, if typed in below, would occupy about three pages of text) which one can get out of the play. Page numbers refer to the following edition: Michael Frayn, *Copenhagen* (New York: Anchor Books, 2000). ]

[The selections, once compiled, have MARGRETHE, BOHR, and HEISENBERG ruminating about Heisenberg's visit, discussing plutonium, and end with Heisenberg recounting Farm Hall. I think they make for a nice transition into the Farm Hall script, which then becomes something of a play-within-a-play (even though it is not, in fact, a dramatization).]

### CAST:

MARGRETHE - (NIELS) BOHR - HEISENBERG

[Insert text from Act 1, page 3: MARGRETHE and BOHR. From "But why?" through "Each time he explained it became more obscure."]

*(ENTER HEISENBERG)*

[Insert text from Act 1, pages 36-38: HEISENBERG and BOHR. From "There's no mystery about it." through "Our one chance to talk had gone forever."]

*(PAUSE)*

[Insert text from Act 2, page 75: MARGRETHE and HEISENBERG. From "A chain reaction." Through "I've never claimed to be a hero."]

*(PAUSE)*

[Insert text from Act 1, page 45: HEISENBERG. From "I refused to believe it, when I first heard the news of Hiroshima." through "To Farm Hall, in Huntingdonshire..."]

*(PAUSE AND TRANSITION TO "FARM HALL" SCRIPT)*

## FARM HALL SCRIPT

[Note that this is somewhat edited for the purposes of our class. Some things have been silently removed or changed slightly to enhance the reading. In one place I changed who said what in order to accommodate the number of characters. Don't rely on this transcript for verbatim quotes in your work! It is not an accurate historical document!]

[A note on rough pronunciation: WIRTZ is pronounced VIRTZ, WEIZSACKER is like VISE-SACKER spoken quickly (and as if the end of the VISE and the beginning of the SACKER are the same syllable), LAUE is LAO-EH. The others are probably how you would expect them to be.]

CAST:

MAJ. RITTNER

HAHN - LAUE - GERLACH - HARTECK

HEISENBERG - WEIZSACKER - DIEBNER - WIRTZ

MAJ. RITTNER     *(Speaking directly to AUDIENCE in CENTER stage, in FRONT of group of professors in a line)*

Top Secret Memo to Mr. M. Perrin and Lieutenant Commander Welsh, as well as Captain Davis for General Groves, from Major T.H. Rittner. August 6, 1945.

As part of Operation "Epsilon," we have assembled the following German scientists in Farm Hall, near Cambridge, England. Those detained are as follows.

*(As name is read, character STEPS FORWARD, briefly READS their own description, then steps BACK)*

MAJ. RITTNER     Professor Otto Hahn.

HAHN             The most friendly of the detained professors. He has a very keen sense of humor and is full of good sense.

MAJ. RITTNER     Professor Max von Laue.

LAUE             A shy, mild-mannered man. He cannot understand the reason for his detention as he professes to have had nothing whatever to do with uranium.

MAJ. RITTNER     Professor Walther Gerlach.

GERLACH Has always been very cheerful and friendly, but from his monitored conversations is open to suspicion because of his connections with the Gestapo.

MAJ. RITTNER Professor Werner Heisenberg.

HEISENBERG Has been very friendly and helpful ever since his detention. He seems to be genuinely anxious to cooperate with British and American scientists.

MAJ. RITTNER Professor Paul Harteck.

HARTECK A very charming personality. Appears to be interested only in his research work.

MAJ. RITTNER Professor Carl Friedrich von Weizsacker.

WEIZSACKER Outwardly very friendly and appears to be genuinely cooperative. He has stated that he was sincerely opposed to the Nazi regime and anxious not to work on an atomic bomb.

MAJ. RITTNER Doctor Karl Wirtz.

WIRTZ A clever egoist. Very friendly on the surface, but cannot be trusted.

MAJ. RITTNER Doctor Kurt Diebner.

DIEBNER Outwardly friendly but has an unpleasant personality and cannot be trusted.

MAJ. RITTNER Shortly before dinner on the 6th August I informed Professor Hahn that an announcement had been made by the BBC that an atomic bomb had been dropped. Hahn was completely shattered by the news and said that he felt personally responsible for the deaths of hundreds of thousands of people, as it was his original discovery which had made the bomb possible. He told me that he had originally contemplated suicide when he realized the terrible potentialities of his discovery and he felt that now these had been realized and he was to blame. With the help of *considerable* alcoholic stimulant he was calmed down and we went down to dinner where he announced the news to the assembled guests.

As was to be expected, the announcement was greeted with incredulity. The following is a

transcription of the conversation during dinner.

*(MAJ. RITTNER MOVES to SIDE of stage, PUTS ON HEADPHONES, is listening to the conversation surreptitiously.)*

HAHN They can only have done that if they have uranium isotope separation.

WIRTZ They have it too.

HAHN I remember Segre's, Dunning's and my assistant Grosses' work; they had separated a fraction of a milligram before the war, in 1939.

LAUE "235"?

HAHN Yes, "235".

HARTECK That's not absolutely necessary. If they let a uranium engine run, they separate "93."

HAHN For that they must have an engine which can make sufficient quantities of "93" to be weighed.

GERLACH If they want to get that, they must use a whole ton.

HAHN An extremely complicated business, for "93" they must have an engine which will run for a long time. If the Americans have a uranium bomb then you're all second-raters. Poor old Heisenberg.

LAUE The innocent!

HEISENBERG Did they use the word uranium in connection with this atomic bomb?

ALL *Nein!*

HEISENBERG Then it's got nothing to do with atoms, but the equivalent of twenty-thousand tons of high explosive is terrific.

WEIZSACKER It corresponds exactly to the factor 10-to-the-forth.

GERLACH Would it be possible that they have got an engine running fairly well, that they have had it long enough to separate "93".

HAHN I don't believe it.

HEISENBERG All I can suggest is that some dilettante in America who knows very little about it has bluffed them in saying "If you drop this it has the equivalent of twenty-thousand tons of high explosive" and in reality it doesn't work at all.

HAHN At any rate Heisenberg you're just second-raters and you may just as well pack up.

HEISENBERG I quite agree.

HAHN They are fifty years further advanced than we.

HEISENBERG I don't believe a word of the whole thing. They must have spent the whole of their five hundred million pounds in separating isotopes; and then it's possible.

WEIZSACKER If it's easy and the Allies know it's easy, then they know that we will soon find out how to do it if we go on working.

HAHN I didn't think it would be possible for another twenty years.

WEIZSACKER I don't think it has anything to do with uranium.

DIEBNER We always thought we would need two years for one bomb.

HAHN If they have really got it, they have been very clever in keeping it secret.

WIRTZ I'm glad we didn't have it.

HARTECK Who is to blame?

WIRTZ *Hahn is to blame.*

(EVERYONE PAUSES)

WEIZSACKER I think it is dreadful of the Americans to have done it. I think it is madness on their part.

HEISENBERG One can't say that. One could equally well say, "That's the quickest way of ending the war."

HAHN That's what consoles me. Once I wanted to suggest that all uranium should be sunk to the bottom of the ocean. I always thought that one could only make a bomb of such a

size that a whole province would be blown up.

HEISENBERG If it has been done with uranium 235 then we should be able to work it out properly. It just depends upon whether it is done with 50, 500, or 5,000 kilograms and we don't know the order of magnitude. We can assume that they have some method of separating isotopes of which we have no idea.

WIRTZ We only had one man working on it and they may have had ten thousand.

WEIZSACKER Do you think it is impossible that they were able to get element "93" or "94" out of one or more running engines?

WIRTZ I don't think that is very likely.

HAHN Well, I think we'll bet on Heisenberg's suggestion that it is a bluff.

*(MAJ. RITTNER to CENTER stage, TAKES OFF HEADPHONES, SPEAKING TO AUDIENCE)*

MAJ. RITTNER All the guests assembled to hear the official announcement at 9 o'clock. They were completely stunned when they realized that the news was genuine. They were left alone on the assumption that they would discuss the position and the following remarks were made.

*(MAJ. RITTNER MOVES to SIDE of stage, PUTS ON HEADPHONES.)*

*(BBC RADIO ANNOUNCER, SCIENTISTS LISTEN)*

HARTECK They have managed it using mass-spectrographs in enormous quantities. It is perhaps possible for a mass-spectrograph to make one milligram in one day - say of '235'. They could make quite a cheap mass-spectrograph which, in very large quantities, might cost a hundred dollars. You could do it with a hundred thousand mass-spectrographs.

HEISENBERG Yes, of course, if you do it like that; and they seem to have worked on that scale. 180,000 people were working on it.

HARTECK Which is a hundred times more than we had.

DIEBNER That shows at any rate that the Americans are capable of real cooperation on a tremendous scale. That would have been impossible in Germany. Each one said that the other was unimportant.

GERLACH You really can't say that as far as the uranium group is concerned. You can't imagine any greater cooperation and trust than there was in that group. You can't say that any one of them said that the other was unimportant.

DIEBNER Not officially of course.

GERLACH (*Shouting, upset*). Not unofficially either. Don't contradict me. There are far too many other people here who know.

HAHN Of course we were unable to work on that scale.

HARTECK We really knew earlier that it could be done if we could get enough material. They kept on arguing as to what to do because no one was prepared to spend then millions if it could be done for three millions.

HEISENBERG On the other hand, the whole heavy water business which I did everything I could to further cannot produce an explosive.

HARTECK Not until the engine is running.  
(*EVERYONE PAUSES*)

HEISENBERG We wouldn't have had the moral courage to recommend to the Government in the spring of 1942 that they should employ 120,000 men just for building the thing up.

WEIZSACKER I believe the reason we didn't do it was because all the physicists didn't want to do it, on principle. If we had all wanted Germany to win the war we would have succeeded.

HAHN I don't believe that, but I am thankful we didn't succeed.

HEISENBERG It is possible that the war will be over tomorrow.

HARTECK The following day we will go home.

DIEBNER We will never go home again.  
*(EVERYONE PAUSES)*

HARTECK If we had worked on an even larger scale we would have been killed by the 'Secret Service'. Let's be glad that we are still alive. Let us celebrate this evening in that spirit.

DIEBNER Professor Gerlach would be sitting in Luxembourg as a war criminal.

WIRTZ If one hasn't got the courage to mount a major effort, it is better to give up straightaway.

GERLACH *(Upset)* Don't always make such aggressive remarks!

DIEBNER The Americans could do it better than we could, that's clear.  
*(GERLACH leaves the room, angry)*

HEISENBERG The point is that the whole structure of the relationship between the scientist and the state in Germany was such that although we were not 100% anxious to do it, on the other hand we were so little trusted by the state that even if we had wanted to do it, it would not have been easy to get it through.

DIEBNER Because the official people were only interested in immediate results. They didn't want to work on a long-term policy as America did.

WEIZSACKER Even if we had got everything that we wanted, it is by no means certain whether we would have got as far as the Americans and the English have now. It is not a question that we were very nearly as far as they were but it is a fact that we were all convinced that the thing could not be completed during this war.

HEISENBERG Well, that's not quite right. I would say that I was absolutely convinced of the possibility of our making an uranium engine but I never thought that we would make a bomb and at the bottom of my heart I was

really glad that it was to be an engine and not a bomb. I must admit that.

*(HAHN leaves the room, upset.)*

WEIZSACKER If we had started this business soon enough we could have got somewhere. If they were able to complete it in the summer of 1945, we might have had the luck to complete it in the winter of 1944.

WIRTZ The result would have been that we would have obliterated London but would still not have conquered the world, and then they would have dropped them on us.

WEIZSACKER I don't think we ought to make excuses now because we did not succeed. If we had put the same energy into it as the Americans and wanted it as they did, it is quite certain that we would not have succeeded as they would have smashed up the factories.

DIEBNER Of course they were watching us all the time.

WEIZSACKER One can say it might have been a much greater tragedy for the world if Germany had done the uranium bomb. Just imagine, if we had destroyed London with uranium bombs it would not have ended the war, and when the war did end, it is still doubtful whether it would have been a good thing.

HEISENBERG I think we ought to avoid squabbling amongst ourselves concerning a lost cause. In addition, we must not make things too difficult for Hahn.

HARTECK We have probably considered a lot of things which the others cannot do and could use.

WEIZSACKER It is a frightful position for Hahn. He really did do it.

WIRTZ I think it characteristic that the Germans made the discovery and didn't use it, whereas the Americans have used it. I must say I didn't think the Americans would dare to use it.

*(LAUE STEPS FORWARD, ADDRESSES AUDIENCE)*

LAUE

After that day, we talked much about the conditions for an atomic explosion. Heisenberg gave a lecture on the subject in one of the colloquia that we prisoners had arranged for ourselves. Later, during the table conversation, the version - *Lesart* - was developed that the German atomic physicist really had not wanted the atomic bomb, either because it was impossible to achieve it during the expected duration of the war or because they simply did not want to have it at all. The leader in these discussions was Weizsacker. I did not hear the mention of any ethical point of view. Heisenberg.. was mostly silent.