

Revisiting Farm Hall [DOI: 10.1051/epn:2007015]

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In his book *Hitler's Scientists*, writer John Cornwell [1] relates a pilgrimage style visit, in November 2002, to a mansion named Farm Hall, near Cambridge (UK), by a small party of science historians, Heisenberg scholars, and other writers. Farm Hall had served as a detention house for a group of ten nuclear academics and other scientists captured in Germany at the end of WWII by a special Anglo-American intelligence mission codenamed ALSOS and directed by Samuel Goudsmit [2] of electron spin fame. The interned group was composed of six prominent German professors, Werner Heisenberg, Otto Hahn, Carl F. von Weizsäcker, Paul Harteck, Walter Gerlach and Karl Wirtz, along with three younger nuclear assistants, Kurt Diebner, Erich Bagge and Hans Korsching, plus one prestigious outsider, Professor Max von Laue. They were kept incommunicado at Farm Hall from July to December 1945, a period covering the Hiroshima-Nagasaki bombings of August 6 and 9 and during which time their conversations were recorded without their knowledge. The recordings were translated on the spot from German into English and sent to a few top UK and US military and intelligence wartime authorities. These so-called "*Farm Hall Transcripts*" (FHT) were kept secret but were known to exist, e.g. through the memoirs published in 1962 by one of the recipients, the head of the American Manhattan project, General Leslie Groves [3]. Only in 1992 were they released to the public. A complete version was first published in 1993 by The Institute of Physics with a detailed technical background introduction by Sir Charles Frank, FRS [4].

The 2002 gathering at Farm Hall gave the learned visitors an opportunity to exchange privately their contrasting opinions on the German nuclear scientists on the inspiring premises of their detention. I will list the names of the debating scholars, since their books about science in the Third Reich and related issues represent a good literature sampling for further reading. In addition to Cornwell [1], there were playwright Michael Frayn of "*Copenhagen*" fame [5], science historian Mark Walker [6], nuclear physicist and science writer Jeremy Bernstein [7], Heisenberg scholar and historian Paul Lawrence Rose [8] and biochemist and author Walter Gratzer [9]. I cannot discuss the writings of these authors on the FHT nor their private deliberations at Farm Hall [1]. However I would like to single out Bernstein's book [7] which presents the complete text of the Transcripts with expert scientific and historical annotations. The book includes an extensive prologue outlining the history of fission up to Farm Hall, important technical appendices and an excellent summary on the German wartime nuclear program by David Cassidy [10], one of Heisenberg's most trusted biographers.

Before the release of the Transcripts, dozens of books, biographies, personal letters, diaries, magazine articles, etc... had appeared expressing diverging views on the moral responsibility of the German nuclear researchers working under the Nazi regime. The major controversy arose from the prevailing tone that the scientists liberated from Farm Hall used to report publicly on their wartime research activities. For ex-

ample, in a detailed paper entitled "*Research in Germany on the Technical Application of Atomic Energy*" written in 1947 for *Die Naturwissenschaften* and translated for *Nature* [12], Heisenberg states in the opening paragraphs: "*In view of the possibility that England and the United States might undertake the development of atomic weapons, the Heereswaffenamt (Army Weapons Bureau) created a special research group (the so called Uranverein or Uranium Society), under Schumann, whose task it was to examine the possibility of the technical exploitation of atomic energy.*" The reader may have detected the careful choice of words: atomic **weapons** on the Allied side, atomic energy on the German side. Heisenberg's statement is moreover self contradictory since a vague exploitation of atomic **energy** (e.g. for ship propulsion) is not the type of project which would have appeased the anxieties of the Heereswaffenamt in the face of the threat of a terrific new bomb from the Allies. Senior readers may also have balked at the blatant inversion of the historical truth. //Namely that German scientists, who duly warned their authorities of the possibility of a super bomb already in 1939, led them (???) to firmly believe that they were the only ones capable of developing it and therefore that, even late in the war, the Reich had no nuclear surprise to fear from the Allies, contrary to Heisenberg's statement.// By contrast, it was the veritable terror of the threat of a Nazi Germany wielding nuclear weapons which prompted the refugees - the likes of Einstein, Fermi, Szilard, Wigner, Teller, Frisch, Peierls and dozens of others who had personally experienced the brutal ways of the Nazi regime - to press the governments of their host countries for nuclear action. At the end of his report, Heisenberg briefly discusses moral implications, as he sees them, along the following lines: "*Finally - and this is a most important fact - the undertaking (a German atomic bomb project) could not even be initiated against the psychological background of the men responsible for German war policy. These men expected an early decision of the war, even in 1942, and any major project which did not promise quick returns was specifically forbidden. From the beginning, German physicists had consciously striven to keep control of the project and had used their influence as experts to direct the work into the channels (towards a peaceful, energy-generating uranium reactor) which have been mapped in the foregoing report. In the upshot they were spared the decision as to whether or not they should aim at producing atomic bombs.*" The FHT and what follows will reveal to the reader just what kind of *conscious striving* there was at the beginning of the war and even up to 1942.

Such self exonerating statements as just quoted failed to prevent the recurrent dispute over the moral responsibility of the German scientists, especially that of the most prominent among them who were in a position to choose to work on or to keep away from a project which could have been decisive for an issue of the war in favour of the Nazi ideology. The role of the FHT in resolving that dispute is compared by Bernstein to that of the Rosetta Stone in deciphering the ...

... Egyptian Hieroglyphics [7]: the Transcripts indeed helped clarify to a great extent the true and changing intentions of the Germans under the Hitler regime.

The book-length Transcripts are far too extensive to discuss in this brief article [11]. Instead I will comment on a few fragments of conversations which took place just after the radio announcement of the Hiroshima bombing and which relate most directly to the moral stance taken by the detainees confronted with the momentous event and after the war.

During the few weeks of their rounding up in defeated Germany and detention prior to Hiroshima, the nuclear scientists expect to be revered by their guardians as proud and brilliant nuclear pioneers. At Farm Hall they receive a princely treatment in a generous enemy country gravely weakened by the war. In spite of this they manifest a great deal of impatience at being left guessing why they are interned and what is expected from them. They lament about the likely dreadful treatment inflicted by barbarous invaders on their families left behind in occupied Germany. They even threaten to escape and to sell their superior nuclear knowledge to Russia or to Argentina, etc....

Suddenly their haughty attitude is shattered by the news of the Hiroshima bombing announced by the BBC radio on the evening of August 6. Their shocked reactions to the news, which make the most gripping part of the FHT, are commensurate with their illusions of the previous days: incredulity first, then enormous stupor, devastation, sometimes scorn and anger towards each other. For hours, they wonder how the bomb was made, speculate on technical issues such as which isotope enrichment methods were used, what was the fissile mass, etc.... They scramble to understand how the Allies could have progressed so quickly in a research and technical field which they had themselves created by their discovery of fission and which they were confident to be alone developing. Then late on the evening of Hiroshima and the next day, an explanation gradually emerges as to why they have fallen so far behind in the nuclear adventure: a novel interpretation is skilfully crafted by von Weizsäcker in a declaration which after the war would cause the continuing controversy referred to above and which lingered even as late as 2002 amongst the distinguished investigators revisiting Farm Hall [1]:

von Weizsäcker: *History will record that the Americans and English made a bomb, and that at the same time the Germans, under the Hitler regime, produced a workable engine. In other words, the peaceful development of the uranium engine was made in Germany under the Hitler regime, whereas the Americans and the English developed this ghastly weapon of war.*

Upon reading this, one may remember Winston Churchill quipping “*History will be kind to me because I intend to write it*”. Some time after the war von Weizsäcker’s pronouncement was qualified by von Laue (who had nothing to do with the work of the Uranverein) as just a “*Lesart*”, a version or a reading of history. While von Weizsäcker’s statement hardly represents what factually occurred, its underlying moral message is definitely not what history will have recorded after publication of the FHT: the latter, combined with the post war reports of the liberated professors, show that the *Lesart* should be perceived not just as a personal interpretation of the facts by one particular individual but as a conscious attempt at a full, self-serving revision of history for future internal and ex-

ternal consumption. Bernstein reformulates it as follows [7]: “*The German scientists behaved morally in an immoral regime, while the allied counterparts did just the opposite*”.

On carefully reading the Transcripts it appears that von Weizsäcker’s conclusion did not come out of his imaginative mind all of a sudden: it was the final product of a previous period of groping by him and others of his colleagues to build up a high moral ground from which to explain, to the full satisfaction of their own conscience, why they had failed to produce an atomic weapon for Hitler. For example here are bits of conversations recorded in the FHT on the evening of Hiroshima (August 6) [7]:

von Weizsäcker: *I think it is dreadful of the Americans to have done it. I think it is madness of their part.*

Heisenberg: *One can’t say that. One could equally say “That’s the quickest way of ending the war”.*

Hahn: *That’s what consoles me.*

...

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 (the bomb).*

von Weizsäcker: *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.*

...

Wirtz: *I think it is characteristic that the German 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.*

...

Hahn: *Surely you are not in favour of such an inhuman weapon as the uranium bomb ?*

Gerlach: *No. We never worked on a bomb.... You cannot prevent its development. I was afraid to think of the bomb, but I did think of it as a thing for the future, and that the man who could threaten the use of the bomb would be able to achieve anything. That is exactly what I told Geist, Sauckel and Murr (political authorities).*

Gerlach (of the Stern-Gerlach experiment) became the Uranverein top administrator late in the war. In these exchanges, Heisenberg and Hahn contradict von Weizsäcker, Gerlach contradicts himself and von Weizsäcker and Wirtz claim for all of them moral superiority over the Americans. In the Transcripts one comes across such statements until the *Lesart* is promulgated and implicitly endorsed by all at Farm Hall. An attenuated form of it (with the finger-pointing toward the Allies removed), namely that the Uranverein worked exclusively on a peaceful uranium engine, was incorporated in a memorandum written and signed at Farm Hall by all detainees (with reservations from von Laue), which represents their common version of the goals and achievements of the Uranverein [7],[11].

After the war, the *Lesart* would become, shall we say, the official ideological party line, with its ethical import explicitly or implicitly used by several of the detainees in their recollections and memoirs, and by their apologists, such as author Robert Jungk [13], Heisenberg’s biographer Thomas Power [14] and Heisenberg’s wife Elisabeth [15].

However, while von Laue was well placed to denounce the Lesart, several post war historians and commentators also raised strong objections to reports inspired from it. Among the most famous are Goudsmit [2], Rose [8], Arnold Kramish [16] and Aage Bohr [17]. Also crucial for gauging the credibility of the Lesart are the poignant letters (recently released [18]) written by Niels Bohr to Heisenberg concerning their fateful 1941 meeting in Copenhagen so artfully fictionalised by Frayn [5]. The controversy boils down to just one question: did the German nuclear researchers intend to build an atomic bomb for the regime or, as the Lesart implies, did they intentionally refrain from ever working on the bomb since the launch of the Uranverein in 1939? As put most directly by Walker, “were they Nazis or anti-Nazis?” [6].

In his introduction to the FHT, Sir Charles Franck [4] remarks: “having, for whatever reason, renounced work on the bomb it would be only human to reinforce that decision with a sense of virtue”. Implicit in this judgment is that to be in a position of *deciding to renounce work on the bomb*, the Uranverein members must have had the *intention to build one in the first place*. Did they really have such a plan? Indeed the FHT leave absolutely no doubt that the *initial goals* of the Uranverein included *both* the building of nuclear explosives *and* the construction of a not-so-peaceful Uranium engine, that is a natural-uranium reactor moderated by heavy water which, to the full knowledge of the scientists, could breed a fissile transuranic element, Pu239 (used for the Nagasaki bomb). Here are the relevant oral exchanges in the FHT of August 6, post Hiroshima:

Bagge: *We must take off our hats to these people for having the courage to risk so many millions.*

Harteck: *We might have succeeded if the highest authorities had said “We are prepared to sacrifice everything”*

von Weizsäcker: *In our case even the scientists said it (the bomb) couldn't be done.*

Bagge: *That is not true. You were there yourself at that conference in Berlin. I think it was on 8th September (1939) that everyone was asked – Geiger, Bothe and you Harteck were there too – and everyone said “it must be done at once”. Someone said “Of course it is an open question whether one ought to do a thing like that”. Thereupon Bothe got up and said “Gentlemen it must be done.” Then Geiger got up and said “If there is the slightest chance that it is possible – it must be done.”*

These explicit early commitments to making a bomb are aggravated by the fact that these persons, Bothe, Geiger, Harteck, Heisenberg, etc... were not even Nazi sympathisers, let alone party members. Lest such oral recommendations be viewed by apologists as nothing more than opportunistic, thoughtless boastings, one should note that these initial intentions were confirmed by several of the prominent scientists who did go out of their way to inform, *this time in writing*, high-ranking military or political authorities of the wonderful virtues of nuclear explosives. In a letter dated April 24, 1939, Harteck from Hamburg, with his assistant Wilhelm Groth wrote to Erich Schumann, the head of the Heereswaffenamt that [7],[19] “*We take the liberty of calling to your attention the newest developments in nuclear physics, which, in our opinion will probably make it possible to produce an explosive many orders of magnitude more powerful than the conventional ones. That country which first make use of it has an unsurpassable advantage over the others*”. At conferences organized in Berlin in February and June 1942 to inform high-level Nazi dignitaries (including Himmler, Speer,...), Heisenberg lectured on the Uranverein program describing most explicitly what could be achieved with a Uranium reactor then under prototype development in Germany [7]: “*As soon as such a machine is in operation, the question of the production of a new explosive takes a new turn, according to an idea of von Weizsäcker. The transformation of uranium in the machine produces, in fact, a new substance (element 94) which ...*

▼ **Fig. 1:** The ten German nuclear scientists held at Farm Hall: **upper line left to right:** W. Heisenberg, O. Hahn, M. Von Laue, C. F. von Weizsäcker, P. Harteck **lower line left to right:** W. Gerlach, K. Wirtz; K. Diebner, E. Bagge, H. Korsching.



... is most probably, just like U235, an explosive of the same unimaginable effect. This substance can be obtained much more easily from uranium than is U235 because it may be separated chemically from the uranium". The mechanism of plutonium breeding in a reactor, advertised by von Weizsäcker as the "open road to the bomb", was described in a written document sent by him to the Heereswaffenamt again, with a copy to Heisenberg, as early as July 1940 [7].

Albeit only lukewarm regime supporters, what these top scientists were doing by dangling the *unsurpassable advantage* of the nuclear explosive at the nose of power hungry military and political dignitaries can hardly be qualified as a "conscious striving" at directing the work towards peaceful applications! Did they perhaps feel that their own recommendations were not realistic and would not be taken seriously? Fortunately for them and for the rest of the world, they indeed were not. The Nazi authorities never felt it urgent to take their scientists at their own word since, as mentioned earlier, they were led to believe that Germany could not be surprised by atomic weapons from their enemies any time soon. On that count they were right by only a few weeks at the end of the war in Europe.

How is it then that, if not from ethical restraint, the Uranverein failed to achieve its initial objectives in spite of a 2½ years head start over the Manhattan project? There are many concrete elements of explanation [20] one of which has to do with the *critical mass* of U235 or Pu239 required for a bomb. It appears that on this crucial question, at the very beginning of the war, *two technical mistakes* were made which have influenced the course of events decisively but in opposite directions for the German and Allied programs. On the one hand, as argued in great detail by Rose throughout his book [8], already in 1940 Heisenberg is said to have made an initial evaluation based on an erroneous use of the random walk process for calculating the scattering and multiplication of neutrons in a fast fission bomb. The conceptual error, which Heisenberg reproduces at Farm Hall in answer to Hahn's questioning on how the bomb works [11], leads to a grossly *over evaluated critical mass amounting to several tons*. Coming from the prestigious head of the Uranverein, this wrong model would have been uncritically accepted by the nuclear community and caused the German bomb project to be pushed on the back burner. On the other hand, in the UK at about the same time, Otto Frisch and Rudolf Peierls [7] solved the correct neutron diffusion equation to evaluate the critical mass but used too optimistic nuclear constants [20]. This resulted in a serious under evaluation of merely one pound, which had the immediate effect of giving to the British bomb project a status of highest priority and, some time later, helped kick start the Manhattan project [19].

The consequences of this spectacular, somewhat serendipitous technical divergence between the German and Allied sides were further amplified by the contingencies of the war. In Germany, with the great military successes of the Blitzkrieg and all its attendant self-assurance and self-delusion, no one in a position of power felt *any immediate need* for weapons more potent than the conventional ones. After the set-backs in the air war against Britain and especially after 1942-1943, with their first serious reverses in Russia, the German armies went on the defensive and *it was now too late* to think of

diverting massive resources for a hypothetical nuclear weapon system (such resources as still remained available were already committed for other "wonder weapons", jet engines, cruise missiles and ballistic rockets). Then the Uranverein could retreat into a state of limbo which would suit most of its members, all good patriots holding to their own head but none fanatic Nazis. By contrast, on the Allied side, the same initial successes of the Axis Powers in the European and Pacific wars put the Manhattan authorities under great pressure to explore all possible avenues of making a nuclear bomb [19] and to maintain this effort until reaching the explicit objectives of hastening the end of the war and of gaining the coveted "*unsurpassable advantage*" for the post war era.

As for the psychological implications of the Lesart, one may wonder why von Weizsäcker and his colleagues attempted to cover up their true initial intentions. After all, if the evil nature of the Nazi regime may be disregarded for a while, their commitment to work on all applications of nuclear fission, including the military, could claim the same legitimacy as that of the allied scientists, namely that provided by the emerging concept of nuclear deterrence. Then why did they pretend to have consciously avoided work on a bomb from the very beginning, when in fact their conversations at Farm Hall prove the contrary and even reveal [7] that in 1941 the Kaiser Wilhelm Institute for Physics filed a patent for an atomic bomb on their behalf? Could it be that, upon being informed of the Hiroshima horror, some of them experienced an acute retrospective sense of guilt (repeatedly expressed in the Transcripts by Hahn about his discovery of fission) aggravated by their knowledge of the atrocities committed by the Nazi regime under which they chose to remain and work [11]. For von Weizsäcker (who belonged to a notorious family of diplomats), for Heisenberg (the adulated hero of Quantum Mechanics) and for some of the others, that guilty conscience may have been personally so embarrassing for their anticipated post-war image, that they found it necessary to repress it and go so far as to substitute for it a sense of virtue, to use Sir Charles's phrase.

The FHT make a fascinating reading and constitute a totally trustworthy set of documents [11]. What indeed can be more factually reliable and psychologically revealing than the conversations between uninhibited collegial experts who confide themselves to each other, exchanging their immediate and spontaneous thoughts in total confidence, unaware of being overheard. This cannot be said of many of the post-war writings of the protagonists and apologists which, as in the case of Heisenberg's Nature paper [12], are most likely to have been influenced by a great deal of afterthoughts and copious editing.

The delay in publishing the FHT so long after their recording, imposed by military state secrecy and humanitarian concern for the liberated professors, goes a long way in explaining why the Lesart could take root and why a big ensuing controversy was allowed to develop in the post-war literature on this dramatic episode of science history. ■

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References

- [1] John Cornwell, *Hitler's Scientists, Science, War and the Devil's Pact*, Penguin Books, N.Y. (2003).
- [2] Samuel Goudsmit, *ALSOS*, Henry Schuman Inc., N.Y. (1947).
- [3] Leslie M. Groves, *Now it Can Be Told*, Da Capo Press, N.Y. (1962).
- [4] *Operation Epsilon. The Farm Hall Transcripts, with an Introduction by Sir Charles Franck*, IOP Publishing Ltd, Bristol (2003); translated in French by Vincent Fleury, *Opération Epsilon*, Flammarion, Paris (2003).
- [5] Michael Frayn, *Copenhagen*, Anchor, N.Y. (2000).
- [6] Mark Walker, *Nazi Science, Myth, Truth, and the German Atomic Bomb*, Perseus Publishing, Cambridge, MA (1995).
- [7] Jeremy Bernstein *Hitler's Uranium Club*, Springer-Verlag N.Y., Inc.(2001).
- [8] Paul Lawrence Rose, *Heisenberg and the Nazi Atomic Bomb Project*, Univ. of California Press, Berkeley (1998).
- [9] Walter Gratzer, *The Undergrowth of Science, Self-Deception and Human Frailty*, Oxford UP (2000).
- [10] David C. Cassidy, *Uncertainty, The Life and Science of Werner Heisenberg*, W.H. Freeman and Cy, N.Y. (1992).
- [11] Amand A. Lucas, *Bombe Atomique et Croix Gammée*, Mémoire de la Classe des Sciences, Académie Royale de Belgique (2005). This reference presents in detail my personal interpretation of extended pieces of the FHT conversations.
- [12] W. Heisenberg, *Nature* **4059**, p211. (1947).
- [13] Robert Jungk, *Brighter than a Thousand Suns*, Penguin Books Ltd, Hardmondworth, Middelsex (1956).
- [14] Thomas Power, *Heisenberg's War, The Secret History of the German Bomb*, Jonathan Cape, London (1993).
- [15] Elisabeth Heisenberg, *Inner Exile, Recollections of a Life with Werner Heisenberg*, Birkhäuser, Boston (1984).
- [16] Arnold Kramish, *The Griffin*, Macmillan, London (1986).
- [17] Aage Bohr, *The War Years and the Prospects Raised by the Atomic Weapons*, in S. Rozental, ed., *Niels Bohr: His Life and Work as Seen by his Friends and Colleagues*, Amsterdam and New York (1967).
- [18] Niels Bohr's Letters to W. Heisenberg, Niels Bohr Archive, Documents released 6 February (2002).
- [19] Richard Rhodes, *The Making of the Atomic Bomb*, Touchstone Book, N.Y., (1986).
- [20] Amand A. Lucas, *Bulletin de la Classe des Sciences* 7-12, 335 (2000).