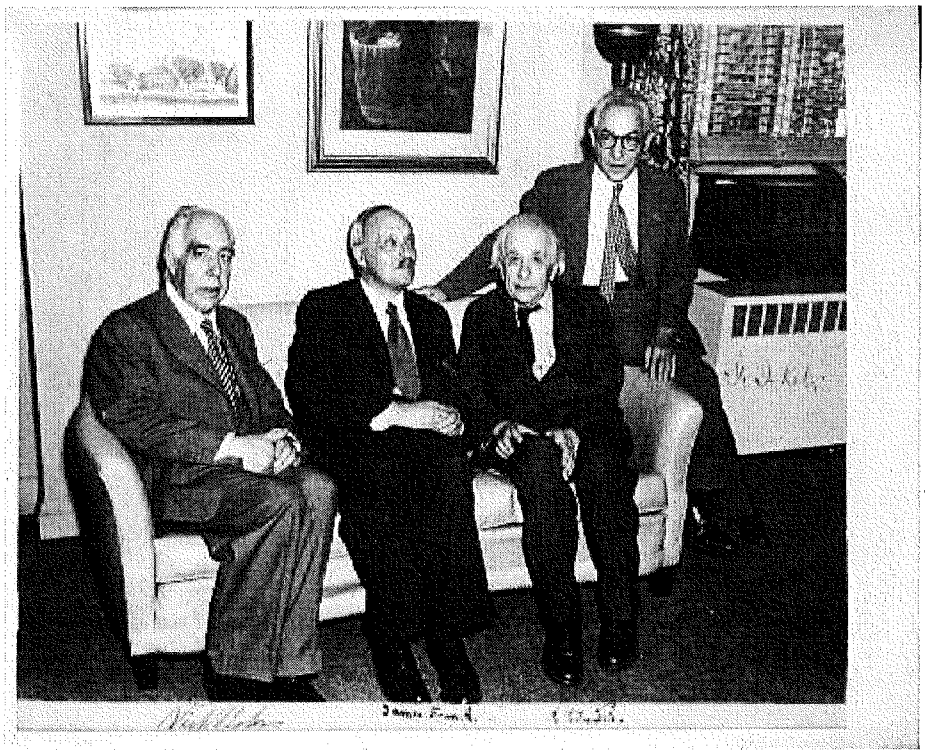
The Ultimate Battle:

Scientists as Political Activists Before, During,

and After the Creation of the Atomic Bomb



Scientists Niels Bohr, James Franck, Albert Einstein and Isidor

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Introduction

Debates around science and morality have been going on for centuries. The question of whether scientists and engineers should think about moral questions related to their work can be found at the heart of many current news stories. For example, in March of 2018, a computer engineer who created an Artificial Intelligence algorithm to track gang crimes responded to the question, "What about the ethical implications?" with "I'm just an engineer".[1] If it is not the engineer's job to think about the ethical implications of their work, then who should question these things? Furthermore, what happens when scientists and engineers speak up? Does anyone listen to them?

The creation of the atomic bomb tested the concept of scientists as political activists. Scientists appealed to the government before, during, and after the creation of the atomic bomb to try to get their opinions heard. They were the ones who initially pushed the government to invest in atomic bomb research and were also the ones to adamantly oppose the use of the bomb against Japan.[2] However, the atomic bomb scientists were largely ineffective in the political arena due to their lack of understanding of power politics and the nature of war. Their political naiveté prevented them from ever having a chance at influencing the government's decision to use the atomic bomb against Japan.

Scientists and Scientific Administrators

It is important to distinguish what I refer to as "scientists" from "scientific administrators". During the Manhattan Project, several high-level scientists held positions of

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[1] Mathew Hutson, Twitter Post, March 1, 2018, 9:01 am. https://twitter.com/SilverJacket

[2] Leó Szilárd and Albert Einstein wrote a letter to President Roosevelt in August 1939 to suggest initiating a nuclear research program to counter Germany's supposed atomic bomb project. Richard Crockatt, *Einstein and Twentieth Century Politics: 'A Salutary Moral Influence,'* (Oxford University Press, 2016) p. 111

influence within the government.[3] However, these scientists were very distant from the actual work going on in the Manhattan Project laboratories. In this section, I will give examples of some of these scientists and classify them as "scientific administrators" who are separate from the politically inept scientists working in the laboratories.

In 1943, General Groves appointed J. Robert Oppenheimer to direct the Los Alamos laboratory.[4] Under Oppenheimer's leadership, Los Alamos developed into a collaborative and productive research facility. Groves chose Oppenheimer for this position because of his strong understanding of both the experimental and theoretical sides of physics. He held the respect of his fellow scientists, which allowed him to encourage people to work together. In addition, Groves possibly selected Oppenheimer due to his tendency to defer to authority. In this way, Groves could rely on Oppenheimer to direct the project without worrying about insubordination.

Under Oppenheimer's directive, Los Alamos became a scientific utopia. Both Oppenheimer's leadership and the laboratory's isolation contributed to a sense of community and greater purpose that existed for the scientists there. As a leader, Oppenheimer relied on consensus rather than totalitarian authority. He tried to maintain openness within the laboratory and strove for maximal collegial equality among the scientists and engineers. He created a colloquium where scientists and engineers from different parts of the laboratory could present their work.[5] This built a sense of community within the laboratory and allowed everyone to feel that they were a part of the greater project. If it had not been for Oppenheimer's leadership and his ability to get people to collaborate, the atomic bomb may not have been ready in time to drop

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[3] Examples include James Conant, Vannevar Bush, Arthur Compton, and Robert Oppenheimer. S.S. Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* (Harvard University Press, 2009), p. 170

[4] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 156 - 158

[5] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 162 - 163

on Japan.[6] While everyone at the Los Alamos laboratory received credit for creating the atomic bomb, Oppenheimer bore the largest responsibility due to his active role in helping the project come together.

Other notable scientists in positions of power included Arthur Compton, Vannevar Bush, and James Conant. Compton was the director of the Chicago Met Laboratory.[7] The Chicago laboratory created the first self-sustained nuclear chain reaction, which was a fundamental requirement for making the atomic bomb. Compton's role as director was similar to Oppenheimer's. Both were in charge of overseeing the project but were removed from doing actual laboratory work.

Bush and Conant primarily held governmental positions. In 1940, Bush was appointed president of the National Defense Research Committee.[8] He then became the director of the Office of Scientific Research and Development when it was established in 1941. This organization oversaw the Manhattan Project. Bush was the one who received Roosevelt's approval to begin constructing the atomic bomb. He also served on the Military Policy Committee and played an active role recruiting scientists for the Manhattan Project. Conant also held important administrative positions. He was appointed to be the scientific liaison between the United States and the United Kingdom.[9] He also served as the chairman of the National Defense Research Committee once it was absorbed under the Organization for Scientific

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[6] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 157
[7] "Arthur H. Compton." Atomic Heritage Foundation. https://www.atomicheritage.org/profile/arthur-h-compton (accessed 2 December 2018)
[8] "Vannevar Bush." Atomic Heritage Foundation. https://www.atomicheritage.org/profile/vannevar-bush (accessed 2 December 2018)
[9] "James B Conant." Atomic Heritage Foundation. https://www.atomicheritage.org/profile/james-b-conant (accessed 2 December 2018)

Research and Development. Conant and Bush were both scientists who oversaw the Manhattan Project from the government level.

These are just a few examples of some of the "scientific administrators" involved in the making of the atomic bomb. They were all trained scientists who held positions of authority connected to the government. Because of this, they were made privy to national secrets and were surrounded by an environment that allowed them to better understand the nature of war and the government's responsibilities. They also gained political influence and power politics skills from these positions. The scientific administrators of the atomic bomb project were a separate group from the scientists working in the laboratories. Scientific administrators acted as both scientist and politician in their roles, which combined with their prestige, gave them a political influence and knowledge that the laboratory scientists did not have. Their actions, as I will outline later, coincide more with the actions of other government officials than they do with the laboratory scientists. From here on, when I refer to "the scientists" I am referring to laboratory scientists and not scientific administrators like Oppenheimer, Compton, Bush, and Conant.

Before the Manhattan Project

The outspoken Hungarian scientist, Leó Szilárd, and his research group at Columbia University were some of the first to show that a nuclear chain reaction was possible.[10] Szilárd was originally inspired to pursue chain reaction research by H.G. Wells' book, *The World Set Fire.*[10] This post-apocalyptic novel describes the world after a nuclear war. While the possibility of creating a large-scale chain-reaction was promising for the development of nuclear power plants, Szilárd and his group were more concerned about the potential weapons

[10] Crockatt, *Einstein and Twentieth Century Politics*, p. 110

applications of the technology. This can be connected to Szilárd's original inspiration from Wells' novel. Szilárd had noticed that Germany was buying a lot of uranium core and had stopped exporting uranium from the mines in Czechoslovakia. To Szilárd, this behavior indicated the possibility of Nazi research into the creation of an atomic bomb. Szilárd and his group debated whether they should publish their positive experimental results.[11] They feared that their results would aid the Nazis in the development of a bomb.

Szilárd knew that his research group was not the only one working on fission research, and that it would not be long before another group found what he had discovered.[11] Therefore, in order to keep Nazi scientists in the dark about the full potential of nuclear chain reactions, Szilárd realized that he would need the cooperation of other scientists to withhold their findings from the Nazis. Szilárd knew that he alone could not generate such a movement. Lacking prestige and visibility, Szilárd felt that other scientists would not be likely to heed his warning.

The secrecy movement's goal was to isolate German uranium research in order to prevent or delay the creation of a Nazi atomic bomb.[11] In an attempt to gain support for their movement, Szilárd and his colleague, Wigner, met with Niels Bohr on March 16, 1939.[12] Bohr was a prominent nuclear physicist who was often referred to as the "father of quantum mechanics".[13] Szilárd and Wigner hoped to gain Bohr's support for their secrecy movement. They believed that his prestige would push more scientists to also withhold their findings.[12] Bohr, however, refused to support their plan for the secrecy of fission research. Bohr had spent most of his life advocating for openness within the international physics community.[12] He encouraged scientists to publish all their findings, even negative results, to facilitate the sharing and spread of

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[11] Richard Rhodes, *The Making of the Atomic Bomb*, The 25th Anniversary Edition (Schuster Paperbacks, 2012), p. 293

[12] Rhodes, *The Making of the Atomic Bomb,* p. 294

[13] Crockatt, *Einstein and Twentieth Century Politics,* p. 114

knowledge. Bohr thought that open communication among scientists would increase collaboration, allow for better error correcting, and lead to a more efficient way to search for new knowledge. Szilárd's proposal went against Bohr's core values. He refused to support it because he said that he would not introduce secrecy into the physics community.[14] Bohr's opinion portrays science as a collaborative utopia where everyone is working together to advance their understanding of the world. This view of openness and universal collaboration does not fit with the fundamentals of power politics. Gaining political influence often does not involve being open and collaborating with everybody. It also does not fit into the secretive and manipulative nature of war. This utopian view of science is one factor that prevented many scientists from successfully influencing the government during World War II.

After hearing Bohr's response, Szilárd and his group decided to publish their results.[15] They acknowledged that the only way to truly hide such results from the Nazis was a mass secrecy movement. Without Bohr's support, this seemed very unlikely. They published their results because they knew that if they did not then somebody else would.

The Columbia research group also thought it important to notify the United States government about their observations.[16] They wanted to convey the implications of their research and remark on Germany's behavior regarding uranium exports. The group elected Enrico Fermi to travel to Washington, D.C..[16] They hoped that Fermi's Nobel prize would allow him to have more influence on the government officials. Fermi secured a meeting with the technical assistant to the Chief of Naval Operations, Stanford C. Hooper for March 16, 1939, the same day as the

[14] Rhodes, *The Making of the Atomic Bomb*, p. 294
[15] Rhodes, *The Making of the Atomic Bomb*, p. 295 - 296

meeting between Szilárd, Wigner, and Bohr.[16] This meeting between Hooper and Fermi marked the first meeting between physicists involved in nuclear fission and the government.

The goal of Fermi's presentation was to warn the government about the realities of nuclear fission and to get them to do something about Germany's uranium research.[17] However, his presentation focused more on the theoretical work the research group had performed rather than the concrete experiments that suggested the possibility of a chain reaction.[18] As Rhodes puts it, Fermi's presentation was an "hour long lecture" on nuclear physics.[18] He attempted to teach nuclear physics to the assembled officers in order to demonstrate the possibility of nuclear fission. At one point in the presentation, one of the officers asked how much uranium would need to be assembled in order to produce an explosion and whether it could fit inside a gun barrel. Fermi took slight offense to the officer's preoccupation with the wartime applications of physics. He offhandedly responded that he did not know but that it could potentially be the size of a small star.[18] Fermi was more concerned with preserving the integrity of physics than he was with appealing to the Navy's military interests. The structure of Fermi's presentation and his responses to officer questions was not persuasive in a military context. As a result, the government did not take further action after the meeting.

Despite this failure, the Columbia scientists were still concerned about Germany's uranium activity. Instead of trying to go back to the government, they decided to approach Albert Einstein.[19] Einstein was a friend of the Belgian queen. At the time, Belgium owned uranium mines in the Congo. Szilárd's research group decided to ask Einstein for his signature on a letter addressed to the Belgian queen requesting that Belgium stop selling uranium core to

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[16] Rhodes, *The Making of the Atomic Bomb*, p. 293
[17] Rhodes, *The Making of the Atomic Bomb*, p. 293
[18] Rhodes, *The Making of the Atomic Bomb*, p. 295
[19] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 43

Germany. The mathematician Oswald Weblen heard about the letter and encouraged the group to also send a copy to the State Department.[19] This suggestion was met with skepticism. Szilárd, especially, had hesitations about approaching the U.S. government again.[20] Fermi's presentation's failure discouraged the physicists and they were unsure of how to better assert their influence on the government. After much deliberation, they decided to send a copy of the letter to the State Department anyway.

On July 12, 1939, Szilárd and his two colleagues, Wigner and Teller, met with Einstein to discuss the letter.[20] They described the results of their research, its implications, and whether Einstein would be willing to sign a letter for the queen. Einstein, who was slow to adopt the postulates of quantum mechanicals, was surprised by Szilárd's results.[21] He readily agreed to sign a letter but asked that it be sent to the Belgian ambassador rather than to the queen herself.[21] He instructed Szilárd to draft a letter for him to sign.

Alexander Sachs found out about Einstein's letter through a mutual contact with Szilárd.[21] Sachs knew his way around politics. He had written speeches for Roosevelt during his presidential campaign and had held a high position in the National Recovery Administration.[21] Sachs set up a meeting with Szilárd where he convinced him that a copy of the letter should also be addressed to Roosevelt himself instead of just the State Department.[21] He wanted Szilárd to convey the potential military and economic gains of nuclear fission, as well as to warn the President of Germany's possible uranium research. Sachs had direct access to Roosevelt and offered to deliver the letter to him personally.[21] On October 12, 1939, Sachs met with Roosevelt to deliver the letter and discuss its contents.[22] Unlike Fermi's presentation to the Navy, Sachs

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[20] Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* p. 44
[21] Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* p. 45
[22] Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* p. 46-47

succeeded in convincing Roosevelt to investigate fission research. After the meeting, Roosevelt instructed his military aide, General Edwin M. Watson, to act as his liaison on the matter.[23] He asked Watson to introduce Sachs to Lyman Briggs, the director of the National Bureau of Standards.[23] He requested that Sachs stay an extra day to talk with Briggs immediately. Roosevelt also asked that a committee be set up under Briggs to discuss the possibilities of fission research and its potential applications. With Einstein's signature and Sachs as the delivery person, Szilárd and his research group finally got the attention of the government. While Einstein's signature probably caused Roosevelt to take more notice of the letter due to his prestige in the scientific community, I would argue that it was Sachs's political knowledge and personal relationship with Roosevelt that finally pushed nuclear fission onto Roosevelt's agenda. Sachs's ability to translate the scientific observations in the letter into political realities most likely allowed Roosevelt to better understand the implications of fission research. Sachs was also the one that Roosevelt instructed to meet with Briggs, not Einstein or Szilárd. Sachs's political expertise is what enabled him to persuade Roosevelt to investigate nuclear fission.

During the Manhattan Project

Once the Manhattan project began, scientists had very little impact on the government or the direction the project took. In an effort to include the scientists in the decision-making process, Truman and Stinson created the Scientific Panel as part of the Interim Committee.[24] The Scientific Panel had as its members, Robert Oppenheimer, Enrico Fermi, Arthur Compton, and Ernest Lawrence.[25] These four men were significant scientific-administrators of the

[23] Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* p. 46-47
[24] Gar Alperovitz, *The Decision to Use the Atomic Bomb,* (Vintage Books, 1996), p. 183
[25] Henry L. Stinson. "The Decision to Use the Atomic Bomb." *Harper's Magazine,* Feb 1947, p. 3

Manhattan project.[26] Vannevar Bush and James Conant, two other scientific administrators, served on the Interim Committee itself.[27] Alperovitz argues that Stinson created the Scientific Panel to placate the scientists rather than to use the panel as a resource.[28] He quotes Stinson talking about the importance of not having any bickering among the scientific community once the bomb was made public.[28] Regardless of the motivations behind the creation of the Scientific Panel, the scientists on the panel were disconnected from the scientists who were tasked with building the bomb in the laboratories. As a result, the panel's opinion did not always reflect the viewpoints of all the scientists involved in the Manhattan project.

Until 1943, many atomic bomb scientists felt justified in their work because they were "saving Western democracies" from a Nazi atomic bomb.[29] In March of 1943 however, the German government pulled its funding for the Nazi atomic bomb project.[30] The army claimed that it no longer believed the atomic bomb project would determine the outcome of the war. German research and production facilities were also being destroyed or taken over by invading armies, which made continuing the research project difficult. While nuclear energy continued to be studied after the army's withdrawal, it occurred with private funding and much fewer resources. The German government gave up on the atomic bomb in 1943, but the United States did not. If anything, atomic bomb research intensified during this time period under Oppenheimer's directive at the Los Alamos laboratory.[31] Without the threat of a German atomic bomb, the scientists began to question the legitimacy of the project.[32] Many feared the

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[26] Alperovitz, *The Decision to Use the Atomic Bomb*, p. 186
[27] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 165
[28] Alperovitz, *The Decision to Use the Atomic Bomb*, p. 184
[29] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 156
[30] Kristie Macrakis, *Surviving the Swastika : Scientific Research in Nazi Germany*, (Oxford University Press, 1993), p. 175 - 176
[31] Oppenheimer became the director of the Los Alamos laboratory in 1943, which was in charge of actually assembling the atomic bomb. Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 157
[32] As indicated by the Franck Report, Szilard's petition, and Bohr and Einstein's interactions with the government.

implications of using an atomic bomb offensively against Japan and attempted to voice their concerns to the government during the later years of the Manhattan Project.

The scientists in the Chicago laboratory organized the Committee on Social and Political Implications under the direction of Nobel Prize winner, James Franck, in order to analyze the potential consequences of dropping an atomic bomb on Japan.[33] They drafted the Franck Report as a summary of their opinions. The report strongly discouraged using the atomic bomb in a military surprise attack against Japan. The report argued, "Within ten years, other countries may have nuclear bombs, each of which, weighing less than a ton, could destroy an urban area of more than ten square miles" and that "the United States, with its agglomeration of population and industry in comparatively few metropolitan districts, will be at a disadvantage compared to nations whose populations and industry are scattered over large areas".[34] From these observations, the scientists concluded that using the bomb in a military attack was inadvisable. A more favored option would be a technical demonstration in an uninhabited area.

The report also brought up the significance of a technical demonstration in avoiding an arms race after the war.[33] The scientists argued that if the United States used the atomic bomb against Japan without any warning, that it would be hard for other countries to take the United States seriously when negotiating nuclear weapons policies after the war. This, combined with the previous remarks on the state of the world in ten years, led the scientists to warn against a military use of the atomic bomb.[33, 34] The potential for an arms race and the devastating impact an atomic bomb would have if used against the United States propelled the scientists to action. The authors of the Franck Report were more concerned about the implications of using atomic

[33] Alperovitz, *The Decision to Use the Atomic Bomb*, p.185
[34] "The Franck Report." *Atomic Heritage Foundation*. https://www.atomicheritage.org/history/franck-report (accessed 2 December 2918)

weapons than they were about winning the war. In June of 1945, when the Franck Report was issued, it can be argued that the government was more concerned with ending the war than with the implications of using nuclear weapons.

This view was made clear by the response of the Scientific Panel to the Franck Report. James Franck traveled to Washington D.C. on June 12, 1945 to personally deliver the report to Secretary of War, Henry Stinson.[35] When he arrived, he was told untruthfully that Stinson was away from the capital and could not see him. Franck left the report with one of Stinson's assistants, but it is unclear whether Stinson actually saw the report.

The scientists also sent the report to the Scientific Panel, who did review the report.[36] After deliberating, the panel concluded that it could not advise any other course of action besides a military use of the bomb to end the war. Oppenheimer played a large role in persuading other members of the panel to come to this conclusion.[37] He believed that a military use of the bomb would prevent future war from breaking out once people saw the damage the bomb could cause. In addition to Oppenheimer's views, the panel also worried that a technical demonstration would not bring about an end to the war.[36] After the panel's discussion, Compton attached a cover letter to the report Franck left with Stinson's assistant.[36] In the letter, Compton openly criticized the scientists' opinions. He claimed that the report did not address that a failed technical demonstration would prolong the war and cost move lives. He also stated that only a military demonstration could impress upon the world "the need of national sacrifices in order to gain lasting security".[36] In other words, Compton believed that only a military demonstration could warn the rest of the world about the power of the atomic bomb. Despite the scientists' efforts,

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[35] "The Franck Report." *Atomic Heritage Foundation*. https://www.atomicheritage.org/history/franck-report (accessed 2 December 2918)

[36] Alperovitz, *The Decision to Use the Atomic Bomb,* p. 186

[37] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 167

the Franck Report did not impact the government's decision to drop the bomb. The scientists failed to draft a compelling argument to change popular opinion within the government. Not addressing the need to win the war quickly contributed to this failure. Franck's interaction with Stinson's office showcases the low priority scientists held on the government's agenda. Scientific administrators, like Compton and Oppenheimer, were able to influence opinions more than the laboratory scientists themselves.

As a result of the Franck Report, Groves asked Compton to further survey the Chicago scientists on their opinions on how to use the bomb.[38] More than half of the scientists were polled. The most popular answer to the question, "Which of the following five procedures comes closest to your choice as to the way in which any new weapons that we may develop should be used in the Japanese war?" was "Give a military demonstration in Japan to be followed by renewed opportunity for surrender before full use of the weapons is employed".[38] However, the definition of "military demonstration" is ambiguous. In the cover letter of the survey, Compton also wrote that this choice was his preferred option and was considered to be the "strongly favorable procedure".[39] Through his cover letters on both the survey and the Franck Report, Compton skillfully framed the attached documents in regard to his opinions. His ability to politically manipulate the scientists allowed him to gain support for the government's desire for a military demonstration of the bomb. The scientists, however, were unsuccessful in influencing the government. This exhibits the separation between scientific administrators and atomic bomb scientists.

Despite the rejection of the Franck report, Szilárd decided to draft his own petition and circulate it throughout all the laboratories for signatures.[39] Szilárd's petition reiterated all the

[38] Alperovitz, *The Decision to Use the Atomic Bomb*, p. 187
[39] Alperovitz, *The Decision to Use the Atomic Bomb*, p. 188

points made in the Franck report. Szilárd was fairly certain that a simple petition would not change the minds of government officials.[40] However, he continued to circulate it because he felt it would be good for the public to see that some scientists were opposed to the use of the bomb against Japan. Szilárd was correct in his prediction that the petition would not create any change of opinion. In fact, Truman never saw the petition.[41] It got held up in various offices until after Truman left for Potsdam. This is another testament of how little political impact the scientists had on the government. They lacked the knowledge to effectively communicate the weight of their concerns and create change.

Even prestigious scientists struggled to change the government's mind about the atomic bomb. Niels Bohr had been trapped in occupied Denmark until 1943.[42] When he finally escaped and learned about the atomic bomb project, he came to the United States to contribute his knowledge in the Los Alamos lab. Bohr believed that it was important for all three Allied powers to be on the same page regarding the bomb before it was dropped.[43] He wanted to avoid an arms race and thought it would be better if the Allies had a draft of nuclear weapons policy before the first use of the bomb. In August 1944, Bohr wrote a document addressed to Roosevelt that outlined his views and urged the President to bring the Soviet Union in on the atomic bomb.[44] Bohr sent this document to Supreme Court Justice, Felix Frankfurter, whom he knew well. Frankfurter met with Roosevelt and communicated Bohr's concerns with the President. Roosevelt agreed with Bohr's views and told Frankfurter to "tell our friends in London that the President was anxious to explore ways for achieving safeguards in relation to X [the atomic

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[40] Alperovitz, *The Decision to Use the Atomic Bomb*, p. 188-189
[41] Alperovitz, *The Decision to Use the Atomic Bomb*, p. 189
[42] Rhodes, *The Making of the Atomic Bomb*, p. 329
[43] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 55
[44] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 56

bomb]".[45] This caused Bohr to seek a meeting with Churchill. Frankfurter arranged for Bohr to meet with Churchill a few days before D-day. At the meeting, Bohr failed to communicate his concerns to Churchill, who was preoccupied with D-day preparations. When Bohr met personally with a political leader rather than having Frankfurter, who was more experienced in politics, relay his views for him, the result was not as favorable. Churchill's preoccupation did not make Bohr's goal any easier to achieve, yet he still lacked the ability to convey his ideas in a manner that would get Churchill to change his mind. He also strongly relied on Frankfurter's assistance to obtain both of these meetings, demonstrating his lack of influence.

As a continuation of his meeting with Churchill, Frankfurter also arranged for Bohr to meet personally with Roosevelt.[45] At the meeting, the President expressed his concern with the fact that Bohr had allowed Justice Frankfurter to become privy to the atomic secrets without permission. Aside from this mistake, Bohr felt that the meeting went well. However, in September of 1944, Churchill met with Roosevelt and convinced him that the atomic bomb should remain a secret, putting an end to Bohr's effort to alert the Soviet Union of the atomic bomb's progress.[45] Both Roosevelt and Churchill agreed that they should investigate Bohr and place him under surveillance to ensure that he did not leak private information to the Soviets. Bohr did not understand the importance of secrecy in politics. Referencing his response to Szilárd in 1939 when asked to help promote the secrecy of fission research, Bohr valued openness and communication.[46] Especially during wartime, national defense measures are kept under lock and key. Bohr's involvement of Frankfurter demonstrates his lack of understanding about the importance of secrecy in wartime politics.

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[45] Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* p. 56
[46] Rhodes, *The Making of the Atomic Bomb,* p.294

Bohr's experience trying to persuade Roosevelt and Churchill lowered his morale and caused him to warn other scientists against attempting the same thing. Albert Einstein was not directly involved in the Manhattan Project, although the extent of his knowledge on the project is questionable.[47] In 1944 he discussed the project with Otto Stern from the Chicago laboratory.[48] Both were concerned about an arms-race developing after the first use of an atomic bomb. They concluded that they had to warn politicians about this danger, and that the most effective way to do so would be through the influence of prominent scientists in the Allied countries. Einstein wrote a letter to Bohr in December 1944 explaining the plan and asking for his support.[49] In his letter, Einstein asserts that "since the politicians don't know of these possibilities they are unaware of the magnitude of the threat. Every effort must be made to avert such a development".[49] From this statement, it can be inferred that Einstein and Stern wanted to warn the government about the possibility of an arms race and expected this warning to trigger action. As scientists, Einstein and Stern probably felt that a simple warning would be enough and that the government would be able to make logical conclusions about the dangers of such an arms race. This demonstrates a lack of understanding of the nature of politics and how to persuade political leaders to act.

Bohr visited Einstein on December 22 to discuss the letter.[50] He persuaded Einstein to remain silent, suggesting that there would be "deplorable consequences" if he spoke out.[56] He also informed Einstein that both the United States and British governments were aware of the potential for an arms race after the bomb was dropped. After his own failure to convince government leaders, Bohr advised Einstein against pursuing his plan. Bohr was also under

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[47] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 58
[48] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 53
[49] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 54
[50] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p. 56

surveillance at the time and had to submit a report of his meeting to Washington. For his own personal safety, it would have been hard for him to advise Einstein in any other way.

Bohr, Einstein, the Franck committee, and Szilárd all attempted to influence the government's nuclear policy during the creation of the atomic bomb. These scientists advocated for various methods to avoid an arms race after the dropping of the first atomic bomb. Sigal argues that the scientists' actions were primarily motivated by a concern for the future funding of their research.[51] This theory illustrates part of the scientists' incentives, but, in my opinion, it does not encompass their entire motivation. If an arms race developed, then the government would most likely control the funding for future fission research. Government funding would restrict the scientists to investigating military applications of nuclear fission, which Sigal argues was undesirable to some.[51] Scientists preferred having the freedom to study other aspects of fission. Bohr's commitment to openness within the scientific community supports Sigal's argument. Government-controlled research would restrict scientists from sharing their findings with the global community. This was probably a factor that motivated Bohr to meet with Roosevelt and Churchill. Overall it is interesting that it seems a majority of the opposition to an arms race came from the scientific community rather than from political leaders. Political leaders, like Roosevelt, Churchill, and the Scientific Panel, seemed to be more concerned about ending the war than they were with the consequences of using the atomic bomb. The scientists, however, were much more concerned with post-atomic-bomb nuclear policy. I would argue that concern for future funding and freedom of investigation also contributed to the discrepancy between scientists and political leaders. This concern caused more scientists to worry about the consequences of an arms race, but it was not the only reason why they chose to approach the

[51] Leon V. Sigal, *Fighting to a Finish: The Politics of War Termination in the United States and Japan, 1945*, (Cornell University Press, 1988)

government. Szilárd, for example, circulated his petition to have evidence of the scientists' disagreement with the government once the bomb was dropped. It would be a stretch to say that Szilárd was motivated to do this in order to obtain more open funding for fission research. It seems more likely that he created the petition to provide evidence of the scientists' moral objections to using the bomb without prior warning.

After the Manhattan Project

Despite the scientists' efforts, the United States used the atomic bomb in a surprise military attack against Japan. With the war over and tensions increasing between the United States and the Soviet Union, the scientists turned their attention towards internationalizing the control of nuclear weapons and atomic energy.[52] The May-Johnson Bill, which had been introduced into Congress during the war, posed a significant threat to their goal of open international exchange.[52] If passed, the bill would place all nuclear fission research under the control of the U.S. government. This was what the scientists feared would happen, but they were determined to try to overturn it. Szilárd played a leading role in the scientists' opposition.[53] He testified against the bill before Congress and made numerous phone calls soliciting support from colleagues across the country.

Oppenheimer, Conant, and Bush all testified in favor of the May-Johnson bill.[54] Oppenheimer urged Congress to pass the bill quickly so that the nuclear physicists could get back to work. He also wanted to pass the bill so that the United States could give a concrete position to the United Nations Committee on International Control of Atomic Energy. These

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[52] Paul S. Boyer, *By the Bomb's Early Light : American Thought and Culture at the Dawn of the Atomic Age,* (University of North Carolina Press, 1994), p. 51

[53] Boyer, *By the Bomb's Early Light : American Thought and Culture at the Dawn of the Atomic Age,* p. 52

[54] Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* p. 169

scientific administrators trusted the government more than the laboratory scientists. As administrators, they also would not feel the effects of restricted research areas.

This bill evolved into the Atomic Energy Act of 1946.[55] It was passed by Congress and established a civilian Atomic Energy Commission. Many scientists considered the passage of this act a success because they felt it was less stringent than the May-Johnson bill. However, the Atomic Energy Act had secrecy precautions almost as severe as those of the May-Johnson bill. It included a Military Liaison Committee within the Atomic Energy Commission that gave the military the control they originally sought. The military got almost all the restrictions it outlined in the May-Johnson bill, so it was not as much of a success as people thought it was. The scientists were outmaneuvered by politicians once again. Unlike previous attempts to influence the government, the scientists' protest against the May-Johnson bill resulted in some change. The bill was diverted, but the limitations the government was trying to impose were not altogether averted.

In 1946, Byrnes appointed a committee to draft America's position and recommendations to the UN International Atomic Energy Commission (IAEC).[56] Bush and Conant were appointed to this main committee, while Oppenheimer was appointed to the advisory committee. They attempted to draft a plan that would protect the world from the atomic bomb, protect American interests, and have a chance of being accepted by the Soviet Union.[57] The result included a plan to place all atomic research and development under an international Atomic Development Authority. The Authority would have two key responsibilities; (1) control all dangerous aspects of atomic energy such as separating U-235 and running reactors, (2) promote peaceful

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[55] Boyer, *By the Bomb's Early Light : American Thought and Culture at the Dawn of the Atomic Age,* p. 52
[56] Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* p.170
[57] Schweber, *Einstein and Oppenheimer: The Meaning of Genius,* p.171

applications of atomic energy.[58] This plan was not accepted by the Soviet Union and therefore it did not pass in the United Nations. It is interesting that Bush, Conant, and Oppenheimer advocated for the international control of atomic energy after testifying in support of the May-Johnson bill. Whether or not they were influenced by the atomic bomb scientists is debatable. It is widely accepted that Oppenheimer was influenced by Bohr's views on the international control of atomic energy. Even though this plan did not come into fruition, it is possible that some of the ideas from the scientists' movement influenced these scientific administrators in their decision making.

Overall, the scientists' movement was short lived after the war. By the fall of 1946, criticism of the movement discouraged many scientists from continuing to fight.[59] The movement completely collapsed after the failed UN negotiations to internationalize the control of nuclear energy. Oppenheimer advised the scientists to retreat from the political arena and remember that they were "after all, intellectuals and not politicians".[59] Many followed his advice.

The Nuclear Non-Proliferation Treaty was drafted by the United Nations long after the scientists' movement ended. It was opened for signatures in 1968 and went into effect in 1970.[60] The treaty's goal is to "prevent the spread of nuclear weapons and weapons technology, to promote cooperation in the peaceful uses of nuclear energy and to further the goal of achieving nuclear disarmament and general and complete disarmament".[60] These goals align with many of the scientists' goals during the 1940s. The treaty introduced some international control over atomic weapons and nuclear energy, which is what the scientists had been advocating for.

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[58] Schweber, *Einstein and Oppenheimer: The Meaning of Genius*, p.171

[59] Boyer, *By the Bomb's Early Light : American Thought and Culture at the Dawn of the Atomic Age*, p. 95

[60] "Treaty on the Non-Proliferation of Nuclear Weapons (NPT)". *United Nations*, https://www.un.org/disarmament/wmd/nuclear/npt/ (accessed 25 November 2018)

Whether or not the scientists' movement influenced the creation of the Nuclear Non-Proliferation Treaty is debatable. The movement ended well before the treaty was passed, but it is possible that ideas from the movement inspired members of the United Nations to create the treaty. In 1995, the treaty was extended indefinitely.

Conclusion

The atomic bomb scientists lacked the skills and political knowledge necessary to assert their influence on the government. They did not have political influence to begin with, as was made evident by the failed warning Szilárd's research group tried to impart to the government. Due to their lack of initial influence, their political ineptness, and their lack of understanding of the nature of war, the scientists never had a chance of changing the government's mind about how to use the atomic bomb. James Franck's reception at Stinson's office and the withholding of Szilárd's petition demonstrate the scientists' continued lack of influence throughout the war. Furthermore, the scientists never framed their ideas in the current military context, which contributed to their inability to assert themselves. After the war, the scientists' impact is debatable. The diversion of the May-Johnson bill and the plan for international control of atomic energy presented to the United Nations indicate that their efforts imparted some change. However, the magnitude of this change was small compared to the scientists' goals and they ultimately did not succeed in internationalizing the control of atomic energy. The Nuclear Non-Proliferation Treaty eventually passed in the UN, but whether or not this was due to the scientists' action is also debatable.

So, what happens when scientists and engineers attempt to speak out about the moral issues related to their work? I would argue that the result depends on the context in which this

activism occurs. In the case of the atomic bomb scientists, their efforts as political activists were ultimately doomed to failure due to the nature of war at the time and their lack of political expertise and influence. I believe that science and morality go hand in hand with one another. It is important for scientists and engineers to be aware of the moral implications of their work. They have a right and a responsibility to question these morals and the lasting impact their work will have on society. I argue that the majority of atomic bomb scientists fulfilled their responsibility of analyzing the moral and societal implications of their work both during and after the Manhattan Project. However, their voices went unrecognized due to their inability to navigate the political arena and assert their influence in a wartime situation.

Bibliographic Essay

My initial essay idea led me to read several books about Albert Einstein's role in the development of the atomic bomb. These works included details on several other key atomic bomb scientists, and ultimately sparked my interest in looking at scientist activists. From there, I continued to follow sources and citation trails to accumulate an array of works that relate to my topic of scientific activism.

Paul S. Boyer (By the Bomb's Early Light: American Thought and Culture at the Dawn of the Atomic Age) (University of North Carolina Press, 1994) was the only author I read who primarily focused on the scientists' movement after the war. His book describes various aspects of American culture and opinion after the atomic bombs were dropped. His analysis of the May-Johnson bill and the scientists' efforts to overturn it was very helpful for my paper. This analysis focused on the scientists opposing the May-Johnson bill and did not discuss the supporting side in much depth.

S.S. Schweber (Einstein and Oppenheimer: The Meaning of Genius) (Harvard University Press, 2009) also discussed some of the scientists' actions after the war. Unlike Boyer, Schweber focused the role of scientific administrators rather than the laboratory scientists. He provided an interesting view of the May-Johnson bill from the perspective of the scientific administrators who supported it. It was interesting to read these two perspectives and present both in my essay. Schweber's book focuses on the careers of Einstein and Oppenheimer and the impact they had on society. Schweber provides a broad perspective of events without focusing on technical details. He prefers to discuss the motivations behind the scientists' actions, sometime in greater detail than the actions themselves. I received most of my information about scientific administrators from Schweber's book.

Richard Crockatt (Einstein and Twentieth Century Politics: 'A Salutary Moral Influence') (Oxford University Press, 2016) proved to be a valuable source for information about Szilárd's research, Szilárd and Einstein's letter, and Bohr's appeals to the U.S. and British governments. Like Schweber, he tended to present more high-level details rather than specifics. The work is a comprehensive overview of Einstein's involvement in twentieth century politics. Crockatt primarily focuses on political impact in the book. This was extremely helpful for my paper because he discusses the lack of political impact caused by the actions of these scientists. Crockatt did not go into as much technical detail as some of the other authors, but his book provided a nice holistic perspective.

In contrast to Schweber and Crockatt, Richard Rhodes (The Making of the Atomic Bomb, 25th Anniversary Edition) (Schuster Paperbacks, 2012) focuses on all the small details. This work follows the making of the atomic bomb, including giving extensive background information on all the scientists involved in the project. Rhodes also presents the evolution of science and the discoveries that led up to the atomic bomb being possible. I used information from Rhode's book to fill in al the technical details that were missing in some of the other works. His detailed account of Fermi's presentation to the Navy was also helpful.

Leon Sigal (Fighting to a Finish: The Politics of War Termination in the United States and Japan, 1945) (Cornell University Press, 1988) provided another interesting perspective on the scientists. His work focused on analyzing and assigning motives based on bureaucratic divisions. I only used his opinion about the scientists' motivations because I found it interesting. Of all the authors I read, Sigal had the most condescending view of the scientists and their movement.

Like Sigal's condescending view of the scientists, Gar Alperovitz (The Decision to Use the Atomic Bomb) (Vintage Books, 1996) provided a condescending view of the government. Alperovitz represents the revisionist perspective of the atomic bomb. I included his opinions about Stinson's motivations for creating the Scientific Panel, as well as his discussion of the Franck Report and Szilárd's petition.

After reading the above authors, I realized that I needed supplemental information about the transition between the scientists advocating for the creation of the bomb and their protests against it. Kristie Macrakis (Surviving the Swastika: Scientific Research in Nazi Germany) (Oxford University Press, 1993) provided an account of the German atomic bomb project that helped fill in this transition. I used Macrakis's information about the decline of the German atomic bomb project in my paper to transition between the scientists supporting the U.S. atomic bomb project and not supporting the bomb's use against Japan.

I used several articles from the Atomic Heritage Foundation to provide background knowledge on some of the key scientists. I read articles on Vannevar Bush ("Vannevar Bush") (Atomic Heritage Foundation), James Conant ("James B. Conant") (Atomic Heritage Foundation), and Arthur Compton ("Arthur H. Compton") (Atomic Heritage Foundation). These articles provided me with the information I needed to introduce these three scientists and classify them as scientific administrators. I also used an article on the Franck Report ("The Franck Report") (Atomic Heritage Foundation) for supplemental information and quotes.

I used several other supplemental sources in my paper. Henry Stinson ("The Decision to Use the Atomic Bomb") (Harper's Magazine, 1947) was a supplemental resource I used for more details on the creation of the Scientific Panel. I also used a Nuclear Non-Proliferation Treaty ("Treaty on the Non-Proliferation of Nuclear Weapons (NPT)") (United Nations) article to

discuss the treaty and whether or not the scientists' movement had any impact. My final supplemental resource was a tweet from Mathew Hutson (Twitter Post) (March 01 2018, 9:01am) that I used in my introduction to highlight the issue of science and morality.

There are a lot more sources on this topic that I did not read for my essay. All the sources I read were helpful in creating my final essay. They each provided different perspectives and slightly different information that allowed me to be able to synthesize ideas and come to my own conclusions in the essay.

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