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Global History II 10.3

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Annotated Bibliography

Primary Sources

Einstein, Albert. "The Complaint of Peace." *Einstein on Peace*, 1988, p. 355, sites.harvard.edu/fs/docs/icb.topic1385132.files/Readings/Einstein.pdf. Accessed 15 Mar. 2017.

This primary source article is written by Albert Einstein and decades later appears in a selection of Einstein writing book edited by a Princeton University economist and forward by renowned Bertrand Russell. "The Complaint of Peace" also appears on a Harvard website. It is reliable.

I will use Einstein's writing in "The Complaint of Peace" as part of my counterclaim: "The release of atomic energy has not created a new problem. It has merely made more urgent the necessity of solving an existing one. One could say that it has affected us quantitatively, not qualitatively. As long as there are sovereign nations possessing great power, war is inevitable. This does not mean that one can know when war will come but only that one is sure that it will come. This was true even before the atomic bomb was made. What has changed is the destructiveness of war" (Einstein 246- 247).

Einstein, Albert. *Einstein Archives Online*. 2 August 1939. (Archival Call Number: 39-468).

This is an original letter written by Albert Einstein on August 2, 1939 letter to President Franklin D. Roosevelt. His letter is archived in the Albert Einstein Archives, so it is credible. In order to access these archives, I wrote an email to the appropriate address in Israel. I received a reply back with a digital copy of the Einstein's original letter. This primary source proves that immediately after the discovery of designing the first nuclear reactor in the Columbia labs, the physicists realized the potential for harm if this information was in the wrong hands, for example the Nazis. I intend to use it in my paper as the lead in to the Einstein-Szilard letter sent to the White House addressed to President Franklin D. Roosevelt on August 2, 1939 (also has an October 11, 1939 date due to the day Roosevelt acted on this information) which warned that Germany might develop atomic bombs. The letter proposed the United States should start its own nuclear program and set in motion the Manhattan Project which developed the first atomic bomb. This important source proves that Einstein never foresaw the harmful use of his theories. I will quote from it in my project. The letter is called the Einstein-Szilard letter. This is because although Einstein sent the letter to President Roosevelt, Szilard is the one who wrote it. Leo Szilard was a Jewish Hungarian-born physicist who fled mainland Europe in the 1930s and settled in England. He often worked with Einstein, and their collaboration is an example of the international efforts that existed during the buildup to the Atomic Age.

Einstein, Albert. *Einstein Archives Online*. 10 September 1945. (Archival Call Number: 56-894).

The September 1945 letter is an original primary source. This typed letter is written by Einstein himself. It shows Einstein's reaction to the news about Hiroshima and Nagasaki atomic bombs and predicts the Cold War on the 1950-60's. In his typed 1945 letter, Einstein says, "For me the problem is a purely political one" (Einstein 1). I will use it in my project to lead into the Cold War after WWII.

This letter of Robert J. Hutchins, the president of the University of Chicago, dated September 10, 1945, contains one of the first reactions by Einstein to Hiroshima and Nagasaki. To paraphrase Einstein, he warns that as long as nations demand unrestricted sovereignty we shall undoubtedly be faced with wars fought with bigger and technologically more advanced weapons. Einstein thinks the most important task of intellectuals is to make this clear to the general public and to emphasize over and over again the need to establish a well-organized world government. They must advocate the abolition of armaments and of military secrecy by nations.

Einstein, Albert. *Einstein on Politics His Private Thoughts and Public Stands on Nationalism, Zionism, War, Peace, and the Bomb*. Edited by Rose, David E. and Robert Schulmann, Princeton University Press, 2007.

Editor David Rose has edited more than seventy published books, both fiction and nonfiction. "Dave appreciates the interdependence of clear writing with clear thinking." During the war, Rose flew 34 missions in Lancaster bombers and then

became a producer for the respected BBC. Robert Schulmann was editor of the Collected Papers of Albert Einstein and director of the Einstein Papers Project and therefore is a respected source for Einstein information. This primary source is reliable.

Because Albert Einstein was also very political, although a pacifist most of his life, I will use his writings to show historical context and his political views and give historical context from WWI through the 1950's. In Einstein Archives 28-001: CPAE 7, Doc. 14e dated November 13, 1918, Einstein writes "On the Need for a Legislative Assembly". Here Einstein shows his political beliefs, in democracy and need to create a legislative assembly. Indeed, one year after this speech, a legislative-representative system and elections triumphed, not long after the armistice in Europe. That milestone was soon dashed and Einstein, a supporter of the German Democratic Party of liberal, middle-class, was labeled a Communist and anarchist by a shoddy German newspaper confusing Einstein with someone with a similar name, but not before the damage to Albert Einstein's reputation was done. My quote gives historical context about the political repression after WWI. Despite Einstein and other pacifists' efforts, political repression only increased under the Nazi Party until the end of WWII.

The political situation worsened and economic strife continued through 1921, making funding for scientific research scarce. In "The Plight of German Science: A Danger for the Nation", Einstein writes in 1921 about the need to exchange

scientific ideas too. “If scientific research crumbles, the intellectual life of the nation shuts down and, with it, numerous possibilities for future advancement” (Einstein 91).

In 1945, Einstein gives a speech at the fifth Nobel anniversary dinner held at the Hotel Astor in New York called “The War is Won, but the Peace is Not” (Einstein 382) which also becomes a famous quote. In 1946, Einstein is appointed chair of the Emergency Committee of Atomic Scientists (ECAS) and campaigns for an international framework for the control of nuclear energy. Here is what he says in a New York Times interview titled “The Real Problem is in the Hearts of Men” New York Times Magazine, 23 June 1946; N & N 1960, 383-388: “...”a new type of thinking is essential if mankind is to survive and move to higher levels.”... In previous ages a nation’s life and culture could be protected to some extent by the growth of armies in national competition. Today we must abandon competition and secure cooperation.... Modern war, the bomb, and other discoveries or inventions, present us with revolutionary circumstances” (Einstein 383). Pacifist Einstein goes on to say: “We are still making bombs and the bombs are making hate and suspicion” (Einstein 385).

Here is Einstein’s organizational answer: Education. “This belief of physicists promoted our formation of the Emergency Committee of Atomic Physicists, with headquarters at Princeton, N.J., to make possible a great national campaign for

education on these issues, through the National Committee on Atomic Information” (Einstein 387).

Orwell, George Orwell. “You and the Atomic Bomb.” *George Orwell’s Library*, 19 Oct. 1945, p.1, orwell.ru/library/articles/ABomb/english/e_abomb. Accessed 21 Feb. 2017

Pen name George Orwell, for Eric Arthur Blair, was a respected English novelist and critic known for his political stances on social injustice, opponent of totalitarianism and supporter of democratic socialism. This chilling look at the future was written two months after atomic bombs were dropped over Hiroshima and Nagasaki, Japan by world renowned author George Orwell It was first published in London’s *Tribune* on October 19, 1945 and later reprinted in ‘The Collected Essays, Journalism and Letters of George Orwell’ — 1968. It is said “You and the Atomic Bomb” laid the groundwork for his famous novel, *Nineteen Eighty-Four*. Orwell’s essay from the Orwell library is a reliable source.

I will use this quote at the beginning of my project to show the public’s fear and confusion over the dropping of an atomic bomb: “Considering how likely we all are to be blown to pieces by it within the next five years, the atomic bomb has not roused so much discussion as might have been expected” (Orwell 1).

Roosevelt, Franklin D. “Albert Einstein and the Atomic Age,” *Einstein and the Bomb*, 1988, p.

256, sites.harvard.edu/fs/docs/icb.topic1385132.files/Readings/Einstein.pdf. Accessed 15 Mar. 2017.

This October 19, 1939 letter is from President Franklin D. Roosevelt and is written from The White House, so it is credible. It is printed in a book edited by a Princeton University economist, Otto Nathan, forward by renowned Bertrand Russell. It is on the Harvard University site too.

President Franklin D. Roosevelt acted at once to Albert Einstein's earlier letter, warning him the Nazi's might be making a bomb. Eight days after receiving Einstein's letter, the President writes from The White House: "I found this data of such import that I have convened a board consisting of the head of the Bureau of Standards and a chosen representative of the Army and Navy to thoroughly investigate the possibilities of your suggestion regarding the element of uranium" (Roosevelt 1).

Secondary Sources

"Albert Einstein – Father of the Atomic Age." Biography.com, 2017-TV-14 3:44, www.biography.com/people/albert-einstein-9285408/videos/albert-einstein-father-of-the-atomic-age-1453635737. Accessed 21 Feb. 2017.

Biography.com is a respected website from A&E Television Networks, LLC for information about famous people, so it is a credible, educational company. For

my project, I used quotes about Einstein's title as the Father of the Atomic Age and his biographical background. I use this source as proof that Einstein is a product of the Enlightenment, because he was uninhibited by the dictates of religion in his scientific explorations. German-born Albert Einstein is an example of European exceptionalism, because he was considered to be the genius of his time.

This secondary source webpage is titled "Albert Einstein – Father of the Atomic Age", therefore here is proof that Albert Einstein is called Father of the Atomic Age. On this site, there is a good summary of the time of the Nazis to final bomb that ended WWII.

This is a summary of how Einstein led to the Manhattan Project that developed the atomic bomb: "In 1939, Einstein and fellow physicist Leo Szilard wrote to President Franklin D. Roosevelt to alert him of the possibility of a Nazi bomb and to galvanize the United States to create its own nuclear weapons. The U.S. would eventually initiate the Manhattan Project, though Einstein would not take direct part in its implementation due to his pacifist and socialist affiliations" (Albert 1).

Here are the peace-making efforts globally and domestically on the part of Einstein: "Global and Domestic Activism After learning of the 1945 bombing of Hiroshima, Japan, Einstein became a major player in efforts to curtail usage of the a-bomb. The following year he and Szilard founded the Emergency Committee of

Atomic Scientists, and in 1947, via an essay for *The Atlantic Monthly*, Einstein espoused working with the United Nations to maintain nuclear weapons as a deterrent to conflict” (Albert 1). This quote is an example of the international effort of physicists working together from around the world.

Brain, Denis. *Einstein A Life*. John Wiley & Sons, Inc., 1996

This historical book is a valuable secondary source for political context. I will use it to show the social climate in Europe during the rise of the Nazi party and how intellectuals were treated by the Nazis. I will quote the story how Einstein became a refugee. Author Brian Denis is a journalist, a reporter for the Irish News Service and author of many books, so he is a reliable source.

I use this source for historical background. Fortunately, Einstein was not in Germany when the Nazi’s raided his apartment because he went to America to give a speech. Here is what happened: “Einstein was well on the way to America when he heard momentous scientific news that had not yet reached the newspapers: working at Cambridge University’s Cavendish Laboratory, “The nursery of genius, James Chadwick, had discovered neutrons at the heart of the atom”” (Brain 240).

This quote shows how Nazi Germany treated pacifists, Jews and physicists in 1933. To boot, the German newspapers reported “fake news”: “His speech to fellow pacifists soon after incited a Berlin newspaper publisher to complain: “Einstein has been hardly a day in New York before has twice thrown his “powerful personality” against Germany. At a

pacifist meeting he was reported to have called for the moral intervention of the entire world against Germany and Hitlerism. Now at a time when America is mendaciously “informed” about Germany and egged on against her by unclean Marxists and Democratic propagandas.... This puffed up bit of vanity dares to sit in judgment on Germany with know what is going on here—matters that forever must remain incomprehensible to a man who was never a German in our eyes and who declares himself to be a Jew and nothing but a Jew.” The Nazis took quick action. Storm troopers raided Einstein’s Berlin apartment five times in two days and came up empty-handed. They had been outwitted by Margot, who had smuggled his most important papers to the French Embassy in Berlin” (Brain 244).

At age 54, Einstein found himself a refugee and ended up making Princeton, NJ his hometown. “It was a great occasion for Princeton. As science writer Ed Regis noted, “Virtually overnight, Princeton was transformed from a gentleman’s college town into a world center for Physics”” (Brain 251).

In the meantime, the political climate in Germany heated up. Intellectualism was decried and books from private homes and public libraries are burned: “On May 10, tens of thousands of “good Germans” poured into Franz Joseph Platz, a large public square between Berlin University and the State Opera House. There, they gave a frenzied welcome to a torchlight parade of students and beer-hall bruisers escorting a caravan of vehicles loaded with books. The parade stopped at a huge bonfire in the center of the square. Gleeful mobs joined them at the fire, grabbing books looted from private homes

and public libraries. As the crowd roared, the authors' names were called out and their books tossed into flames: "Einstein...Thomas Mann...Heinrich Mann...Freud...Jack London...Rathenau... Arnold Zweig...Stefan Zweig...Proust...Hemingway...H. G. Wells...Helen Keller...Gide...Zola...Dos Passos...Upton Sinclair..." Propaganda chief Joseph Goebbels gave the book burning an official stamp of approval by climbing to a rostrum, his face flushed by the flames, to yell, "Intellectualism is dead. The German national soul can again express itself" (Brain 246). This shows the pride Germans had in their newly formed nation, perhaps overzealous.

"The Burning of Books." *The History Place The Triumph of Hitler*, 2001,
www.historyplace.com/worldwar2/triumph/tr-bookburn.htm.

This secondary source has provided educational informational about landmark events in history for students since 1996. It including an entire section of "The Triumph of Hitler." It is a reliable source and from it I use a picture of the book burnings in Nazi Germany.

In 1930's Germany, intellectualism was decried and books from private homes and public libraries are burned: "On May 10, tens of thousands of "good Germans" poured into Franz Joseph Platz, a large public square between Berlin University and the State Opera House. There, they gave a frenzied welcome to a torchlight parade of students and beer-hall bruisers escorting a caravan of vehicles loaded with books. The parade stopped at a huge bonfire in the center of the

square. Gleeful mobs joined them at the fire, grabbing books looted from private homes and public libraries. As the crowd roared, the authors' names were called out and their books tossed into flames: "Einstein...Thomas Mann...Heinrich Mann...Freud...Jack London...Rathenau... Arnold Zweig...Stefan Zweig...Proust...Hemingway...H. G. Wells...Helen Keller...Gide...Zola...Dos Passos...Upton Sinclair..." (Brain 246).

Propaganda was rampant and its chief, Joseph Goebbels, gave the book burning an official stamp of approval by climbing to a rostrum, his face flushed by the flames, to yell, "Intellectualism is dead. The German national soul can again express itself" (Brain 246).

"Cold War international politics." Encyclopædia Britannica, 2017,
www.britannica.com/event/Cold-War. Accessed 19 Jan. 2017.

This source is the respected The Encyclopædia Britannica, published by Encyclopædia Britannica, Inc. The Britannica is the oldest English-language encyclopedia still in production, first published around 1768. This educational research institution is a credible source, and my quote is written by The Editors of Encyclopædia Britannica.

I use this source to define what the Cold War is because I never studied it before.
"Cold War, the open yet restricted rivalry that developed after World War II

between the United States and the Soviet Union and their respective allies. The Cold War was waged on political, economic, and propaganda fronts and had only limited recourse to weapons. The term was first used by the English writer George Orwell in an article published in 1945 to refer to what he predicted would be a nuclear stalemate between “two or three monstrous super-states, each possessed of a weapon by which millions of people can be wiped out in a few seconds”” (Cold 1).

Devons, Samuel. “I.I. Rabi: Physics and Science at Columbia, in America, and Worldwide.” *Alumni Magazine*, Summer, 2001, www.columbia.edu/cu/alumni/Magazine/Summer2001/Rabi.html. Accessed 30 Nov. 2016.

This historical article appeared in the Alumni Magazine for one of the most prestigious universities in the world so it is credible. It is educational, research information about the diplomacy efforts of Columbia University Professor Rabi during WWII and afterwards via his international conference on "The Peaceful Uses of Atomic Energy". Rabi is considered a “Living Legacy” and there is “a standing ovation for Rabi after he teaches his last class” (Devons 1).

This quote from the late 1920’s shows historical background about how American physicist were considered inferior to European physicists, as reported by Col. Univ. theoretical physics Professor I. I. Rabi: “In Hamburg Rabi heard quite

casually an echo of the old theme: American science and physics were, at best, marginal” (Devons 1), and how Rabi had many global connections in and travelled much throughout Europe.

Professor I. I. Rabi changed that perception through diplomacy and exchange of ideas and experiments between Europe and America, and eventually the rest of the world: “Rabi's own success in Hamburg assured him that this attitude would soon be proved false. Numerous encounters with fellow students, visitors from America bent on similar paths of enlightenment, confirmed this view. They demonstrated that American physicists (or at least those who visited Germany) were a match, or more, for their German counterparts. And in Hamburg, the style of the Americans-their informality, lack of strict and regular hours, uninhibited expression of joy, anguish, or frustration in their work-had attracted attention and comment that “the American work method was, apparently, successful”; it might even be emulated” (Devons 1).

The early development stages of the Atomic Bomb were done in Col. Univ. Pupin physics labs: “The Second World War diverted most scientific efforts from these lines of investigation. However, there were some quite remarkable early discoveries. Only seven years earlier in Pupin, Urey had demonstrated the existence of the heavy hydrogen isotope “D.” Now with the powerful NMR technique, Rabi and his colleagues determined the shape of the D nucleus and its surprising departure from sphericity (the “electrical quadrupole moment”). What

could be a more apt recognition of Urey's magnanimity of 1934? Again it was a clear example of the rapid ascent to prominence of American basic research in physics. For Rabi personally, there was a sense of religiosity ("nearer to God") in these deepening investigations, perhaps complementing the traditions of his early home and youth" (Devons 1).

War became an industry of weapon-making all around the world. This quote is symbolic of the increase in the weapons industry and lifestyle changes of workers to support it at the beginning of World War II. "Rabi's-and Pupin's-wartime transformation was swift and effective. In November 1940, Rabi closed down his molecular beam laboratory in Pupin and transferred his energies to radar development" (Devons 1).

Here is how what was the Col. Univ. discoveries were transferred to the military:

"Cooperation with the military was outstandingly successful. At the end of 1941 there were only a handful of scientists and little data on radar to work with.

Within a couple of years, however, the few radar novices had grown to a mighty force of several thousand. In cooperation with the armed forces and industry, they designed, tested, set up for manufacture, and by war's end there were some 20,000 "3cm" radar systems in service. The technology was indispensable. In fact, military operations of any significant scale without radar had become unthinkable" (Devons 1).

This quote tells that Italy's top physicist escaped Italy's fascist government and came to Columbia: "Skepticism About the Bomb In 1939–1940, Columbia was already the locale of seminal activity that expanded into the awesome development of the atomic bomb. Enrico Fermi had escaped to Columbia from Mussolini's Italy; together with Urey, John Dunning '34GSAS, and visitor Leo Szilard, they were the inspiration and moving spirits in this effort. (Einstein was briefly but crucially drawn into the struggle.) After a couple of years, the project moved to Chicago, but the first federal government money-some \$10,000 to find suitable graphite for Fermi's uranium assembly-was a grant made to Columbia" (Devons 1). This is an example of the international effort of scientists working together. Einstein was a refugee from Germany, Szilard was visiting America at the time as a refugee living in England, and Fermi had escaped fascist Italy to come to America and work on the atomic bomb.

Like Einstein, Prof. I. I. Rabi suggested an organization method to assume WWII did not happen again:

"Early in 1954, Rabi suggested an international conference on "The Peaceful Uses of Atomic Energy." At first he met (as usual) with lukewarm response from some European colleagues. But familiarity with such initial circumspection and Eisenhower's own enthusiasm led him to persist in his efforts to persuade" (Devons 1).

"“Fat Man” Atomic Bomb.” National Museum of the US Air Force, 22 Apr. 2015,

www.nationalmuseum.af.mil/Visit/MuseumExhibits/FactSheets/Display/tabid/509/Article/196220/fat-man-atomic-bomb.aspx.

The clue that this source is credible is the museum's title: National Museum of the US Air Force. I will use a U. S. Air Force photo in my project. From this source I found the specs on the bombs that ended WWII.

Little Boy Fuel: Highly enriched uranium; "Oralloy" gun-type device (the critical mass is achieved when a uranium projectile which is sub-critical is fired through a gun barrel at a uranium target which is also sub-critical.)

Fat Man Fuel: Highly enriched plutonium 239 Implosion-type bomb

"A "Fat Man" bomb was dropped over Nagasaki, Japan, on Aug. 9, 1945, near the end of World War II. Released by the B-29 *Bockscar*, the 10,000-pound weapon was detonated at an altitude of approximately 1,800 feet over the city. The bomb had an explosive force (yield) of about 20,000 tons of TNT, about the same as the bomb dropped on Hiroshima. Because of Nagasaki's hilly terrain, however, the damage was somewhat less extensive than of the relatively flat Hiroshima.

"Fat Man" was an implosion-type weapon using plutonium. A subcritical sphere of plutonium was placed in the center of a hollow sphere of high explosive (HE). Numerous detonators located on the surface of the HE were fired simultaneously

to produce a powerful inward pressure on the capsule, squeezing it and increasing its density. This resulted in a supercritical condition and a nuclear explosion.” (Fat 1).

This secondary source is a U. S. military museum, so it is reliable. From it, I use a photograph of an a-bomb that ended WWII.

"Fat Man" was a 10,000-pound implosion-type bomb dropped over Nagasaki, Japan, on Aug. 9, 1945. The fuel was highly enriched plutonium-239 and had an explosive force of about 20,000 tons of TNT, about the same as the bomb dropped on Hiroshima. Because of Nagasaki's hilly terrain, however, the damage was somewhat less extensive than of the relatively flat Hiroshima.

To create a supercritical condition and a nuclear explosion, Fat Man's construction was a subcritical sphere of plutonium placed in the center of a hollow sphere of high explosive (HE). Numerous detonators located on the surface of the HE were fired simultaneously to produce a powerful inward pressure on the capsule, squeezing it and increasing its density (Fat 1).

Galison, Peter. "The Einstein Revolution," edX, Inc. HarvardX, Mar. 2016, <online-learning.harvard.edu/course/einstein-revolution?keywords=physics>. Accessed 23 Dec. 2016.

edX is an educational website for top academic institutions. The author of this HarvardX course is Peter Galison. He is the Pellegrino University Professor in History of Science and Physics at Harvard University. He received his Ph.D. from Harvard in Physics and the History of Science in 1983. His publications include *Image and Logic: A Material Culture of Microphysics* and *Einstein's Clocks, Poincaré's Maps: Empires of Time*. His most recent co-authored book is titled *Objectivity*. This is a credible source.

This is an online course from Harvard Online is called “The Einstein Revolution”. This link is a 14 week online course, assuming the viewer puts in about 5-7 hours/week. A viewer needs to register to take the course. It covers the life and work of Albert Einstein, the changing role of physics in the 20th and 21st centuries, Einstein's engagement with relativity, quantum mechanics, Nazism, nuclear weapons, philosophy, the arts, and technology. I watched this course for historical context from 1920- 1950, because I never studied that social history time period before. For my project, I watched over 10 lessons of videos on the entire website. In my project, I will include a discussion of nuclear weapons which is part of my global history project. From these lessons, I garnered historical context for my project from these specific lessons:

Lesson 6 > The Philosophy of Relativity > The Fate of the Philosophers under the Nazis

The Nazis were fascist and outlawed socialism and communism.

Lesson 7 talks about the contribution of women physicists to the Atomic Age.

Lesson 7 > Fission, Women in Physics and the Rise of the Nazis > Between Nazis

& Nuclei: This lesson discusses Marietta Blau and fission discoveries in 1939

Lesson 7 > Fission, Women in Physics and the Rise of the Nazis > Between Nazis

& Nuclei: This lesson discusses Lise Meitner and neutron discoveries in 1932. At

the end, this lesson talks about how this led to nuclear weapons

Philosophy connections to Einstein are discussed in Lesson 6 > The Philosophy of

Relativity > The Fate of the Philosophers under the Nazis

This quote in Lesson 6 “The Fate of the Philosophers under the Nazis” section

gives social historical context. It shows how Einstein’s group of

philosophers/physicists, also called The Olympia Academy, and other

intellectuals and artisans were discriminated against by the rising Nazi Party. This

is the beginning of the dismantling of these groups. It also shows how

intermingled different social groups were in Europe. For example, physicists,

artists, and philosophers all associated with each other in the 1920s, pre-Nazi

times.

“The Vienna Circle and Dessau Bauhaus shared a great deal in supporting each

other, but they also shared a fate. The Nazis were rising in the early '30s and

attacked both of them” (Galison 1).

This quote in Lesson 6 “The Fate of the Philosophers under the Nazis” section shows how the philosophers were targeted in particular by the Nazis. Einstein was associated with the Vienna Circle of Philosophers; since his college days, Einstein relied on philosophy as inspiration and the pathway to develop his revolutionary theories.

“At the same time, the Nazis absolutely despised the philosophers of the Vienna circle, suspicious about their rather goal views, their challenging of the German spirit, the idea of the Falk, saying that these sorts of concepts were meaningless, mere utterances without any signification” (Galison 1).

Lesson 6 “The Fate of the Philosophers under the Nazis” section continues with accounts of their lives on the run as the Nazi power grew. The same fate happened not long after to the German physicists in Germany, Austria and Europe

“The Vienna circle also had to flee. Carnap made it to the United States, barely escaping with his life. Otto Neurath got across the English Channel in a rowboat. Moritz Schlick was assassinated in 1936. Philipp Frank made it to the United States, but it was really a brutal time. At one point, Neurath wrote that Bertolt Brecht had come over, and that everybody was gathering what little money they could make, and put together some form of an escape route, but many it already landed in some of the worst concentration camps” (Galison 1).

Lesson 7 > Fission, Women in Physics and the Rise of the Nazis > Between Nazis & Nuclei: Lise Meitner

Lesson 7 is about the woman physicist who discovered the neutron in 1932, Lise Meitner. Unfortunately, she was not initially recognized as discovering nuclear fission.

“For Meitner—left out of the discovery and credit for [nuclear fission]—her career was seriously endangered. She struggled from year to year. Never received, really, the recognition of being part of those many years that led up to this experiment...” (Galison 1).

At the end of Lesson 7, it talks about how Meitner’s work led to nuclear weapons. “These discoveries [of nuclear fission by Lise Meitner] quickly cascaded in work that was done in the United States and Britain...And [they] led, in very short order, to the creation of nuclear weapons programs in Germany and in the United States” (Galison 1).

Green, Nancy V. and Eric Ward. “The Atomic Age: The Discovery and Evolution of Nuclear Science.” A Linde Hall Library Online Exhibition Linde Hall Library, atomic.lindahall.org/timeline.html. Accessed 21 Feb. 2017.

This gallery exhibition was on display at the Linda Hall Library, Kansas City, MO from October 6, 2010, to March 11, 2011. It was curated by Nancy V. Green and Eric Ward. A public library is a reliable source.

There are different dates for the beginning of the Atomic Age. This educational link from a library organization gives a start date of 1895. For my project, I will use the quotes below starting with the year 1940 because that is the year when the components for building the a-bomb was begun. I will pay particular attention to physicist Fermi who was at Columbia University not long after he escaped fascist Italy and before he went to Chicago. Not long after Fermi was at Columbia, The Manhattan Project began.

“1940-1942

The work of physicists begins to focus on the essential components for building an atom bomb. The U.S. government brings organizational structure and financial support to the undertaking.

December 1942

Enrico Fermi, head of the University of Chicago's Metallurgy Laboratory, and colleagues produced the world's first self-sustained nuclear chain reaction in a reactor named Chicago Pile-1. Fermi conducted the test under the west stands of the university's 50,000 seat football stadium. Using a coded message Arthur Compton telephoned James Conant with news of the event: “the Italian navigator has reached the New World.”

The Manhattan Project

1943-1945

Hidden in remote cities and factories across the United States, scientists and ordinary citizens work in secrecy to produce the hardware and fissionable material to build an atomic bomb.”

Gutfreund, Hanoach and Jurgen Renn. *The Road to Relativity The History of Meaning of Einstein's "The Foundation of General Relativity" featuring the Original Manuscript of Einstein's Masterpiece*. Princeton University Press and The Hebrew University of Jerusalem, 2015.

This source is credible because the manuscript was written by Albert Einstein. Additionally, the commentary places Einstein's remarkable handwritten theory in historical and scientific context. The commentary is by two Einstein experts. One is Theoretical Physicist Hanoach Gutfreund, a professor emeritus at the Hebrew University of Jerusalem. Professor Gutfreund has held the Andre Aisenstadt Chair in theoretical physics since 1985. The first Board of Governors of this prestigious university included Albert Einstein, Sigmund Freud, Martin Buber, and Chaim Weizmann. Also, Hanoach Gutfreund is academic director of the Albert Einstein Archives. The other Einstein expert is Jurgen Renn, Director at the Max Planck Institute for the History of Science in Berlin.

For my project, I used a quote from the very first paragraph of the first chapter, “Einstein's Intellectual Odyssey to General Relativity” because it shows how

revolutionary Einstein's Special Theory of Relativity was for its time. This same theory lead to the Atomic Age.

"Einstein's famous 1905 papers shook the foundations of classical physics"
(Gutfreund 7).

"I.I. Rabi Scholars Program." Columbia College, 2017,
www.college.columbia.edu/academics/rabi.

This secondary source is the website of prestigious Columbia University. Therefore, it is a reliable source. From it, I use a picture of Professor I. I. Rabi from a page about his scholarship fellowships for outstanding students.

Theoretical Physicist Israel Isaac Rabi was a Columbia University Professor and Nobel laureate for his 1944 discovery of nuclear magnetic resonance. His leadership on the Manhattan Project, diplomacy efforts, and frequent European trips were crucial to a successful, collaborative effort.

After WWII, he used the same skills on his international conference, "The Peaceful Uses of Atomic Energy". There was "a standing ovation for Rabi after he teaches his last class" (Devons 1). At Columbia, the Rabi Scholars Program was established in memory of I. I. Rabi.

“Little Boy and Fat Man.” *Atomic Heritage Foundation*, 2017,
www.atomicheritage.org/history/little-boy-and-fat-man.

The Atomic Heritage Foundation is a non-profit dedicated to preservation and interpretation of the Manhattan Project and *Atomic Age*. From this prestigious site, I use a photograph of one bomb that ended WWII.

“Little Boy was the name of the atomic bomb dropped on Hiroshima, Japan on August 6, 1945, by the bomber plane *Enola Gay*, piloted by Colonel Paul Tibbets” (Pickover 388). “Atomic bombs generally rely on nuclear fission in which certain isotopes of uranium or plutonium split into lighter atoms, releasing neutrons and energy in a chain reaction” (Pickover 388). Little Boy’s fuel was highly enriched uranium. It was a gun-type device and the critical mass is achieved when a uranium projectile is fired through a gun barrel at a uranium target. The destruction caused by such nuclear fission by *Little Boy* marked the end of World War II in Japan.

Marks, Robert B. *The Origins of the Modern World: A Global and Environmental Narrative from the Fifteenth to the Twenty-First Century*. 3rd ed., Rowman and Littlefield, 2007.

This historical college book is written by Whittier College’s Richard & Billie Deihl Distinguished Professor of History. As it is a Social Studies reading assignment for a CSS class, it must be reliable.

I will use this secondary source to show this is how World War II ended, "...by 1944 U.S. resistance to using military force against civilizations was overcome. U.S. warplanes joined the British in the firebombing of Dresden in Germany; then in Japan they firebombed Tokyo and sixty-three others cities, before dropping the first atomic bombs on Hiroshima and Nagasaki in August 1945" (Marks 172).

WWII was not the end for the use of nuclear weapons. After World War II, a Cold War started and so was M.A.D., for the first time in humankind, "...very different visions of the place of newly independent colonies in the world led to tensions between the United States and the Soviet Union that would produce the Cold War, an arms race with horrifying new nuclear weapons that each side realized could never be used, but which could deter the other from attacking. MAD, it was called: 'mutually assured destruction'" (Marks 174).

It continued to the 1960s all around the world. By then, each side had thousands of I.C.B.M.'s. "By the 1960s, with each side having thousands of ICBMs and nuclear warheads, a nuclear attack could have ended not just human civilization but quite possibly humans as a species. As it was, although there were numerous threats of nuclear attack, the world came to 'the brink' just once in the early 1960s, when the Soviet Union moved missiles to Cuba shortly after Fidel Castro came to power" (Marks 178-179).

“The Nobel Prize in Physics 1938,” *Enrico Fermi Nobelprize.org*, 1938,
www.nobelprize.org/nobel_prizes/physics/laureates/1938/fermi-bio.html.

This secondary source is the website for the prestigious Nobel Prize organization so it is reliable. From it, I use a photograph of Enrico Fermi who won the 1934 Nobel Prize in Physics.

The 1930's political climate in Germany and Italy was very anti-intellectualism and many physicists feared for their lives. Many of the physicists working on the early stages of the a-bomb escaped Europe and settled in England and America. Italy's top physicist, Enrico Fermi, escaped Mussolini's fascist government and first settled at Columbia University where in 1939–1940, he worked with other physicists including Einstein and CU Chemistry Professor Urey (1934 Nobel Prize for Chemistry for his discovery of the heavy form of hydrogen known as deuterium) on a federally funded project to find suitable graphite for Fermi's uranium assembly—the beginning stages toward making an a-bomb.

Norton, John D. “How Hume and Mach Helped Einstein find Special Relativity.” *University of Pittsburgh*, 2005,

<https://pdfs.semanticscholar.org/e4f5/fc1378af01ca10cfa1423ce77d2cef2270b2.pdf>.

Accessed 18 Dec. 2016.

This secondary source website is an academic institution and a forum for scholarly/research information. The writer of this science and philosophy article is a distinguished professor in the Department of History and Philosophy of Science at the University of Pittsburgh. Therefore, it is credible.

This article explains how theoretical physicist Albert Einstein “connected all the dots” when mathematicians and others could not. It is important because gave Einstein the edge in his revolutionary discoveries and shows the interconnectedness of different fields of studies. Einstein looked to the nature of the concepts of two philosophers, Hume and Mach, when inventing his physics theories. It is no secret that Albert Einstein was inspired by philosophers: “Einstein’s avowal of intellectual debts to Hume and Mach have long been recognized and examined” (Norton, 2).

Theoretical physicist Albert Einstein was inspired by selective parts of these philosophers’ writings, in particular their accounts on the nature of concepts, to think “outside-the-box” in formulating his revolutionary theories. When this acknowledged genius applied Hume’s and Mach’s views on concepts to scientific theories, Einstein found a new path to rethink early 20th century physics. This radical way of thinking is the creative edge theoretical physicist Einstein had over mathematicians who worked on parts of the theory. In 1915, “He [Einstein] informed [philosopher Moritz] Schlick that he [Einstein] studied Hume’s “treatise on understanding,”” shortly before finding relativity theory” (Norton, 20).

Pickover, Clifford A. *The Physics Book: 250 Milestones in the History of Physics*. Barnes & Noble, Inc., 2013.

The author of this secondary source book is a respected writer of numerous math and science resource books. In addition, Clifford Pickover is Editor-in-Chief of the *IBM Journal of Research and Development*, so his book is credible.

One quote I use from the Chapter “1945: Little Boy Atomic Bomb” to give background information on the WWII-ending bomb is as follows: “*Little Boy* was the name of the atomic bomb dropped on Hiroshima, Japan on August 6, 1945, by the bomber plane *Enola Gay*, piloted by Colonel Paul Tibbets” (Pickover 388). I use this quote to inform or remind the reader of the closing events of WWII and introduce them to the atomic bomb.

I also use the following quote on page 388 of this resource book about WWII in 1945. It describes how *Little Boy* uses nuclear fission to work, and it is important because it ties in the many earlier physics discoveries leading up to that moment: “Atomic bombs generally rely on nuclear fission in which certain isotopes of uranium or plutonium split into lighter atoms, releasing neutrons and energy in a chain reaction” (Pickover 388).

The destruction caused by such nuclear fission by *Little Boy* marked the end of World War II in Japan. “Over a period of time, as many as 140,000 people were killed – roughly half due the immediate blast and the other half due to the gradual effects of the radiation” (Pickover 388).

Schweber, Silvan S. “Einstein and Nuclear Weapons.” *Einstein for the 21st Century His Legacy in Science, Art, and Modern Culture*, Edited by Galison, Peter L. and Gerald Holton and Silvan S. Schweber, Princeton University Press, 2008.

This historical book is a collection of articles by world renowned physicists include Harvard Professor Peter Galison. The author of the article “Einstein and Nuclear Weapons” is an American theoretical physicist and science historian. Silvan S. Schweber is Professor of Physic and Emeritus Richard Koret Professor in the History of Ideas at Brandeis University. In 2011, he won the Abraham Pais Prize for History of Physics. This secondary source is reliable.

In my project, I will use this quote that shows the steps toward building a nuclear bomb and it is not on the timeline found elsewhere. The early stages of building the bomb happened in Columbia’s Pupin labs, “In early spring of 1939, Carl Anderson, Enrico Fermi, and Szilard, working together at Columbia, were the first to measure the average number of neutrons released during fission and to establish the viability of a chain reaction. Szilard and Fermi shortly thereafter designed the first nuclear reactor” (Schweber 74).

In this project, I will also use this quote, dating from after Einstein sent his August 2, 1939 letter to President Franklin D. Roosevelt. This letter warned the President that the Nazis might have the capability to develop atomic bombs, “After it had been established that on average 2.5 neutrons were emitted in the fission of U^{235} , Szilard became deeply troubled about the dangers that an atomic bomb—now a real possibility—would pose if developed by Nazi Germany” (Schweber 75).

I will also use a quote about Einstein’s reaction to learning from fellow Hungarian physicist Szilard that “... his experiments establishing secondary neutron emissions in fission and of his calculations indicating the possibility of a chain reaction in a uranium pile moderated by graphite, Einstein exclaimed: “That never occurred to me! [*Daran Habe ich gar nichts gedacht*]” (Schweber 75).

Shara, Dr. Michael M. “Peace and War The Manhattan Project.” Einstein’s Revolution, www.amnh.org/exhibitions/einstein/peace-and-war/the-manhattan-project/. Accessed 15 Jan. 2017.

This source is the American Museum of Natural History, so it is a credible, educational organization. It is a major U. S. museum website and contains educational research information. This site has facts proving 1938 Germany could build an a-bomb.

These details prove why the world had reason to be concerned that the Nazi knew how to build an atomic bomb: “In 1938, three chemists working in a laboratory in Berlin made a discovery that would alter the course of history: they split the uranium atom. The energy released when this splitting, or fission, occurs is tremendous--enough to power a bomb. But before such a weapon could be built, numerous technical problems had to be overcome” (Shara 1).

Here are the facts about the bombs dropped on Japan that ended WWII in the east: “On August 9, 1945, the United States dropped an atomic bomb on the city of Nagasaki, Japan, three days after bombing Hiroshima. By the end of 1945, an estimated 200,000 people had died in the two cities” (Shara 1).

Shara, Dr. Michael M. “Peace and War Nuclear Arms Race.” Einstein’s Revolution, www.amnh.org/exhibitions/einstein/peace-and-war/nuclear-arms-race. Accessed 15 Jan. 2017.

This source is the American Museum of Natural History, so it is a credible, educational organization. It is a major U. S. museum website and contains educational research information. “Einstein Revolution” curator lists facts about the escalating nuclear arms race.

Here are facts about the Cold War that lasted for four decades: “Known as the Cold War, this conflict began as a struggle for control over the conquered areas of Eastern Europe in the late 1940s and continued into the early 1990s. Initially, only the United States possessed atomic weapons, but in 1949 the Soviet Union exploded an atomic bomb and the arms race began. Both countries continued building more and bigger bombs. In 1952, the United States tested a new and more powerful weapon: the hydrogen bomb. The Soviet Union followed with its own version in 1953” (Shara 1).

Here is proof of Einstein’s peacemaking efforts and the length of the Cold War, four decades: “But Einstein never gave up his fight for peace. In the years between 1945 and 1955, Einstein was at his most active politically, frequently speaking and writing about his desire for peace through international cooperation and elimination of all nuclear weapons. Einstein was not alone in promoting these ideas—quite a number of leading scientists of the time shared his views—but international fame made Einstein one of the most effective representatives of the cause. Yet even Einstein could not reverse the political tide: The Cold War lasted for more than four decades” (Shara 1).

Strayer, Robert W. *Ways of the World*. 2nd ed., Bedford/St. Martin, 2013.

Robert W. Strayer has his Ph.D. from University of Wisconsin. In Ethiopia, Strayer taught high school world history and at varied universities around the world. He received the Chancellor's Awards for Excellence in Teaching and for Excellence in Scholarship.

This secondary source textbook quote shows Environmentalism in Action and concerns about nuclear is worldwide and has a global impact. I use this quote, “South Korean environmental activists [wore] death masks and [held] crosses representing various countries during an anti-nuclear protest in Seoul in 1996, exactly ten years after a large-scale nuclear accident at Chernobyl in the Soviet Union. The lead protester [held] a placard [that read] ‘Don’t forget Chernobyl!’” (Strayer 1169).

Vujovic, Dr. Ljubo. “Albert Einstein (1879 - 1955).” Tesla Memorial Society of New York Website, www.teslasociety.com/einstein.htm. Accessed 16 Jan. 2017.

This article was written by the Secretary General for the respected Tesla Memorial Society of New York, so it is a credible organization. It is an institution in honor of famed Serbian-American inventor Nikola Tesla. The site has an educational article about Tesla’s interaction with Einstein during the early stages of the Atomic Age.

I use information from this site for facts on the early stages of The Manhattan Project in Columbia’s Pupin Hall and prove how international it became.

The early work for the Manhattan Project was done at Columbia University:

“Much of the early research on the Manhattan Project was done at Columbia University in Pupin Hall and at one time employed 700 people on the project.

Tons of uranium were stored in warehouses in the Chelsea, Manhattan neighborhood; the Columbia football team was sometimes recruited to move it” (Vujovic 1).

An international effort was required for the Manhattan Project, despite its naming after the island in New York City. “The Manhattan Project was the project to develop the first nuclear weapon (atomic bomb) during World War II by the United States, the United Kingdom, and Canada. Formally designated as the Manhattan Engineer District (MED), it refers specifically to the period of the project from 1941–1946 under the control of the U.S. Army Corps of Engineers, under the administration of General Leslie R. Groves. The scientific research was directed by American physicist J. Robert Oppenheimer” (Vujovic 1).

In my project, I use a photograph of Albert Einstein (1879-1955), the mastermind behind the quintessential equation, $E=mc^2$, who created his Special Relativity theory in 1905. Most people credit Albert Einstein as the Father of the Atomic Age (Albert 1). Many do not know Einstein was a lifetime pacifist, for which he was heavily discredited in the Nazi propaganda during the 1930’s. While history records Einstein as a genius, the Nazi’s called their fellow German a “...puffed up bit of vanity...” (Brain 244) and raided Einstein’s home while on a trip to America. At

age 54, Einstein found himself a refugee and ended up making Princeton, NJ his hometown. “It was a great occasion for Princeton. As science writer Ed Regis noted, “Virtually overnight, Princeton was transformed from a gentleman’s college town into a world center for Physics”” (Brain 251). I also use a photograph relating an atomic bomb explosion to $E=mc^2$.

From this source, I also use an image of the Einstein–Szilárd letter to President Franklin D. Roosevelt. “In 1938, three chemists working in a laboratory in Berlin made a discovery that would alter the course of history: they split the uranium atom” (Shara 1). In reaction, Einstein wrote a letter to “...President Franklin D. Roosevelt to alert him of the possibility of a Nazi bomb and to galvanize the United States to create its own nuclear weapons” (Albert 1).