"If You Are A Scientist You Cannot Stop Such A Thing": Scientific Assent and Dissent in the Manhattan Project

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In science, dissent is encouraged in the search for truth. Yet when it comes to some of the basic assumptions about science the scientific community is less tolerant. I will show how some of these assumptions were used by J. Robert Oppenheimer as premises for arguments that had the weight of science without having scientific validity. I will show how they were used to suppress dissent and justify the development and use of the first atomic bombs.

KEYWORDS: rhetoric of science, dissent, Oppenheimer, atomic weapons, nuclear physicists, indexing, Kenneth Burke, consummation, Los Alamos

1. INTRODUCTION

Teachers often use scientists as the prime examples of critical thinkers, mentioning Albert Einstein and Niels Bohr as examples of how one can make progress and approximate truths about the universe by questioning and testing one's assumptions. However, scientists are able to radically question the nature of reality only because they confine that questioning within the framework established by science: "It is specifically because science provides such a framework of rules and regulations to control and set bounds to paranoid thinking that a scientist can feel comfortable about taking the paranoid leaps" (Eiduson 106). When the questions go beyond what Thomas Kuhn calls the "puzzle form" of "normal science" scientists are often less able and willing to think critically. As Kuhn writes in *The Structure of Scientific Revolutions*, "A paradigm can . . . insulate the [scientific] community from those socially important problems that are not reducible to the puzzle form, because they cannot be stated in terms of the conceptual and instrumental tools the paradigm supplies" (37). And as argumentation research has shown, scientific experts may even be more prone to "overconfidence" and "polarization" if argument quality is "not sufficiently high in a domain" (Mercier 313).

As any god-term, "science" has been effectively used to justify many actions that are ethically highly questionable. Similar to religious orthodoxy, it is a tool that can be used to keep scientists in line and suppress dissent. As Michael Polanyi writes, "No one can become a scientist unless he presumes that the scientific doctrine and method are fundamentally sound and that their ultimate premises can be unquestioningly accepted" (45), and yet "the scientific doctrine" is not a closed canon and has taken various forms through the ages, at times making such doctrines as scientific racism and positivism interchangeable with "science" to scientists and lay people alike. The concepts, methods, and assumptions embodied by the term "science" differ from generation to generation, and yet scientists are often blind to this difference because of how their training and research experience reinforce a homeostatic view of scientific history (Kuhn 152-65). As a consequence, science, a model of reasoned debate, can become a tool to suppress dissent simply by labeling it anti-science. I will here present one such case where the choices of scientists deciding whether or not to complete the atomic bomb were defined not as political choices but rather as adherence to or disavowal of the basic tenets of science. The case I will discuss is the Manhattan Project, and in particular I will discuss the arguments and thinking of J. Robert Oppenheimer, the director of the Los Alamos Laboratory.

2. OPPENHEIMER'S SCIENTIFIC CREED

Oppenheimer better than most scientists integrated the rigor of science with his early sensibilities as an artist. Some of his closest friends early on thought his career would be as an "artist" or "writer" rather than as a scientist (Smith and Weiner 66).

Gradually, science and especially physics replaces literature as the medium for Oppenheimer's aesthetic expression and appreciation. He early on begins to call physics his "stern and uncompromising muse" (57), and later calls it an obsession (59), a fixation (63), and even claims in jest "my muse still craves blood" (72) and "I need physics more than friends" (135). His descriptions of math and physics resemble those usually used about works of art. He praises the "beauty and simplicity" of math, the language of theoretical physics (100), and states, "physics has a beauty which no other science can match, a rigor and austerity and depth" (155). He later refers to theories as "pretty" (168), calls an experimental result beautiful (180), refers to data as "beautiful" (198), and speaks of the nuclear bomb development as yielding "intellectual or

technical satisfaction" (312).[1] Infamously, he also stated about the potential method for developing an atomic bomb that it was "technically sweet" (USAEC 266) and that "when you see something that is technically sweet, you go ahead and do it and you argue about what to do about it only after you have had your technical success. That is the way it was with the atomic bomb" (266). There is a clear artistic and aesthetic dimension to Oppenheimer's work in physics that also was a motivating factor to develop the atomic bomb.

I have found 9 texts by Oppenheimer that were particularly instructive and relevant to his vision of nuclear weapons. Most of these are short letters, but the last one is a comprehensive speech to the Association of Los Alamos Scientists outlining his clearest vision for what nuclear weapons mean for the world. These texts show some of the developments in Oppenheimer's thoughts about science and nuclear weapons and the arguments he used to make scientists complete the nuclear bomb work. I will analyze these using the method Kenneth Burke called "indexing" (LAPE; Isaksen), looking for the key terms and god-terms Oppenheimer uses to fuse his vision for nuclear weapons with his concept of science.

2.1 Peace through War

The first of these documents is a letter written to Frank Oppenheimer written March 12th, 1932, and it is the clearest statement from Oppenheimer outlining his life philosophy and ethics before he became involved with the Manhattan Project. In the letter, he speaks briefly about the excellences of physics and biology (his brother was choosing between them for his vocation) before moving on to speak about "the virtue of discipline" (155). Oppenheimer claims discipline is fundamentally good for the soul and that it is the key to achieving "detachment" and ultimately "peace." However, he claims that discipline cannot be achieved without another real (though ultimately minor) objective. Oppenheimer organizes his thoughts in this letter by a logic of means and ends. The means to achieve discipline, which should therefore be "greeted with profound gratitude" are study, duties to men and to the commonwealth, war, personal hardship, and even the need for subsistence. These are some of all the real objectives that can lead a person to the virtue of discipline (the next level in the hierarchy). Discipline has value because "it is good for the soul" and is able to bring about an even more favorable

[1] This shift goes parallell to a transition from Sigmund Freud to Bertrand Russell as Oppenheimer's metaphysical reference point of choice. Oppenheimer often refers to Freud in his early years, especially in connection with his fiction writing (Smith and Weiner 13, 24, 48), but later seems to hold Russell as his metaphysical guide (Smith and Weiner 24, 48, 54, 71, 111).

condition. Robert Oppenheimer describes this more favorable condition as "detachment" and "that detachment which preserves the world which it renounces." This detachment is described as an ability to "see the world without the gross distortion of personal desire," to "learn to preserve what is essential to our happiness in more and more adverse circumstances" and to "abandon with simplicity what would else have seemed to us indispensable." This again leads to the final goal of peace, serenity, charity, and a small measure of freedom from the accidents of incarnation. This peace and serenity is arrived at by accepting finally "more easily our earthly privation and its earthly horror." Thus, war leads to discipline, discipline leads to detachment, and detachment leads to peace. In other words, out of war and striving, humans can gain peace for themselves.

Freeman Dyson, fellow physicist and colleague of Robert Oppenheimer at the Princeton Institute for Advanced Study, writes in *Weapons and Hope* that these words "contain a key to the central core of Robert's nature, to the sudden transformation which changed him eleven years later from a bohemian professor to driving force of the bomb project at Los Alamos" (125). For Dyson, this philosophy or ascesis of peace through war seemed a remnant of the nationalist ideologies preceding WWI, which had been brought to life again in left-wing circles supporting the Loyalist side in the Spanish Civil War (125-31). In either case, it seems significant that Oppenheimer would include war as one of those things that lead to discipline and therefore should be greeted with profound gratitude. This is a snapshot of the mental framework Robert Oppenheimer brings to the emerging problem of nuclear weapons and world war.

2.2 From Scientific Adventurer to Obedient Soldier

In January 1939 Oppenheimer writes a letter when he has just learnt about nuclear fission and is reacting to that discovery. Glenn Seaborg says of the time, "I do not recall ever seeing Oppie so stimulated and so full of ideas" (Smith and Weiner 207). The sense of excitement is palpable throughout the letter.[2] Oppenheimer starts the letter saying "The U [uranium] business is unbelievable" (207) and describes the frenzy among the scientists as they conduct all kinds of experiments, creating the same reactions and seeing "unbelievable ionization" (207). All the physicists are fixated on the question of a possible explosion: "Many points are still unclear. . . most of all, are there many neutrons that come off during the splitting or from the excited pieces? If there are then a 10 cm cube of U deuteride *should be quite something*. What do you think? It

[2] Letter to William A. Fowler, 28th of January 1939.

is I think exciting . . . in a good honest practical way" (208). He expresses a similar sentiment to George Uhlenbeck on February 5th, 1939: "I think it really not too improbable that a ten cm cube of uranium deuteride *might very well blow itself to hell*" (209). From the last statement it seems that the main interest in the chain reaction is not the possibility of making a nuclear reactor for power, but rather the possibility of creating an explosive nuclear reaction: an atomic bomb. The physicists sound almost giddy, like boys playing with firecrackers, excited about the potential for nuclear explosions with almost no sense of gloom or worry about what the consequences of them could be.

As the war breaks out in Europe and grinds on from 1939-1941, Oppenheimer starts to think more about potential wartime applications of nuclear weapons. As his friend William Fowler goes to work for the National Defense Research Committee, Oppenheimer writes with encouragement, "I expect that as time goes on you'll have more and more a feeling of confidence and conviction in the work you are doing. . . I have a lot more misgivings even than you ever had about what will come of all of this; but even so I think surely if I were asked to do a job I could do really well and that needed doing I'd not refuse" (215).[3]

That request came in May 1942, when Robert Oppenheimer was asked to become "Coordinator of Rapid Rupture" which became a part of the new Manhattan Engineer District when it was established the next month. His letters start focusing on calculations of potential nuclear reactions, with the dual threat that the active material may either not be powerful enough to be worth the effort (a fizzle) or may be so powerful that it could set off a chain reaction that would ignite the atmosphere and kill off all of humanity (227-234).[4]

As it becomes clear that a new laboratory will need to be set up for the effort, Oppenheimer's concerns expand to recruitment for the laboratory. Smith and Weiner note that "it often took an interview with Oppenheimer, in which he cautiously but eloquently described a project that would *end the war* and have *peacetime applications of untold benefit to mankind*, to persuade a man to uproot his family and *join the adventure* in the New Mexico mountains" (239). The three motives of ending the war, providing "peacetime applications of untold benefit to mankind" (presumably electricity from nuclear power), and joining in an adventure were the main arguments Oppenheimer used to recruit scientists for the project.

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[3] Letter to William A. Fowler, spring of 1941.

[4] When Arthur Compton heard about that possibility, he thought, «Was there really any chance that an atomic bomb would trigger the explosion of the nitrogen in the atmosphere or the hydrogen in the ocean? This would be the ultimate catastrophe. Better to accept the slavery of the Nazis than to run a chance of drawing the final curtain on mankind!» (Rhodes 419).

After November 1942, Oppenheimer is increasingly concerned with cross sections (measuring the rates and possibilities for fission reactions) and what magnitude of explosion the project can deliver for the army. He insists the project "will be principally interested in energies of 5 MeV and above" (237) and states that "we should be wanton to strive for . . . a low goal" of only exceeding a 1,000 ton TNT equivalent (240). The key term for his correspondence during this time is purity (referring to the uranium and plutonium), with impurity as the worst quality. High purity of the radioactive elements = less worry about maximum speed, simplicity, reliability, energy release of over 10,000 tons of TNT, and the chance of predetonation reduced to the formula 0,5n% (240-2).[5] Increasingly, his language seems to mirror the lectures held later at Los Alamos in April 1943, published as *The Los Alamos Primer*.[6]

2.3 Ending All War through Nuclear Weapons

Niels Bohr comes to Los Alamos in the beginning of 1944 and he gives Oppenheimer a copy of his memo to Roosevelt in the summer of 1944, with a vision of using nuclear weapons as a means to end all war between nation states. There are many indications that he adopted and adapted that vocabulary with its thinking and arguments and used it to stifle dissent among the Los Alamos scientists. Oppenheimer says February 1946 that Niels Bohr had "helped us reach the conclusion" that international control of nuclear weapons and the end of all war was "not only a desirable solution" but also that "there were no other alternatives" (Smith and Weiner 322). Robert R. Wilson records that Oppenheimer used an adapted version of Bohr's vision to convince the scientists at a critical juncture to keep working on the atomic bomb.

Towards the end of 1944 it became clear to the scientists at Los Alamos that the Germans were not going to succeed in developing nuclear weapons and they would soon be conquered. The initial impetus and argument for initiating the program was now gone, and many scientists started to wonder in private and in small groups "What will this terrible weapon do to the world?" and how should it be used (Bird and Sherwin 284). Oppenheimer tried to discourage public discussion of the matter, citing concerns with the G-2 (military security) (283). Despite

[5] Letter to James B. Conant, November 30th, 1942.

[6] The lectures were held by Robert Serber, one of Robert Oppenheimer's former students at Berkeley, and they followed the same trajectory as Robert Oppenheimer's thoughts on the project up to that point, with purity and maximizing damage and efficiency as key concepts.

this, there seem to have been three or four public meetings discussing the ethics and potential impact of nuclear weapon development.[7]

Oppenheimer attended these meetings and used different arguments to persuade the scientists to continue developing the bombs. To one group he said they had "no right to a louder voice in determining the gadget's fate than any other citizen" (284). To another group he said that "although they were all destined to live in perpetual fear, the bomb might also end all war" (284). This second argument echoes Bohr's words. Wilson gives the most detailed explanation of the argument Oppenheimer used in the meeting Wilson organized on "The Impact of the Gadget on Civilization":

> The war . . . should not end without the world knowing about this primordial new weapon. The worst outcome would be if the gadget remained a military secret. If that happened, then the next war would almost certainly be fought with atomic weapons. They had to forge ahead . . . to the point where the gadget could be tested. He pointed out that the new United Nations was scheduled to hold its inaugural meeting in April 1945—and that it was important that the delegates begin their deliberations on the postwar world with the knowledge that mankind had invented these weapons of mass destruction. (285)

This vision or argument convinces the other scientists to complete the project,[8] but Oppenheimer is given a sobering wake-up call when he finds out that this vision is not shared widely in President Truman's administration (Smith and Weiner 301).[9] In letters from August to November 1945, Oppenheimer keeps reiterating the hope that the bomb "may serve as a real instrument in the establishment of peace" adding at one point, "That is almost the only thing right now that seems to matter"

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[7] Louis Rosen, a junior physicist, remembers "a packed daytime colloquium held in the old theater," the chemist Joseph O. Hirschfelder remembers a "discussion held in Los Alamos' small wooden chapel" in "early 1945," and Robert R. Wilson organized a meeting on "The Impact of the Gadget on Civilization" in March 1945 (284). In addition to this, there was a later meeting in April or May discussing whether or not nuclear scientists should unionize that also touched on the impact of nuclear weapons on the world (Wilson 3).

[8] As Wilson states, "It was to be the end of war as we knew it, and this was a promise that was made. That is why I could continue on that project" (285).

[9] A meeting with Truman (who initially rejected Oppenheimer's ideas for international control of nuclear weapons) famously has Oppenheimer stating "I feel like I have blood on my hands" and Truman dismissing him as a "cry-baby scientist" (Bird and Sherwin 332).

(303).[10] In November 1945, Oppenheimer arrives at one of his most well-formulated and enduring statements about science, the development of the atomic bomb, and his vision for a nuclear future. He imitates Bohr in this statement but he also diverges from him in important ways. The statement is titled "Speech to the Association of Los Alamos Scientists" and was given November 2nd, 1945.

2.4 Weapons Development as an Organic Necessity

The speech is roughly 6,000 words long, and it can be roughly divided into four parts: (1) Setting the scene and explaining the immediate impact of the bomb, (2) explaining the nature of science, (3) the qualitative change the bomb has brought to war and the world, and (4) Oppenheimer's vision for the future along with some of the challenges of implementing it. One of these sections stands out among the rest: why does he make what seems like a digression to talk about the nature of science? The other three parts function perfectly well together and are unified by the theme of the bomb. I argue that the section about the nature of science makes up the moral and philosophical foundation for the rest of the dynamics in the text. According to Oppenheimer, the bomb came because of the nature of science, the future is being formed by science and should be structured to best nurture the growth of science. This subordination of almost all other things to the nature of science (either being caused by science or being deemed less valuable than science) indicates that this is the god-term in this text, and the structure of the text is dramatic catharsis where the logical implications of a god-term are gradually unfolded.

For Oppenheimer, science is not just a method or an approach to the world, but it is also a moral philosophy and an amalgam of practices and core beliefs similar to that of a religion. He postulates these beliefs, behaviors, and practices in a kind of "scientist's creed" where people who do not follow these "stop being scientists" (317). Some of these are rather uncontroversial even today: "It is not possible to be a scientist unless you believe it is good to learn" (317), unless you "think it is of the highest value to share your knowledge . . . with anyone who is interested" (317), and unless you believe "it is good to find out how the world works and what the realities are" (317). To learn, to teach, and to understand, these are the core values of science (325). However, there are some tenets of Oppenheimer's "science" that sound less benign: If you are a scientist you believe it is good "to attain a gradually greater and greater control over nature" (325), believe that "the knowledge of the world, and the *power* this gives, is *a thing which is of intrinsic value* to humanity" (317), and

[10] Letter to Marcelle Bier, August 31st, 1945.

believe "it is good to turn over to mankind at large *the greatest possible power to control the world*" (317). In essence, following the logical implications of these claims, there is no technology or weapon, no matter how destructive, that scientists would not be morally obligated to develop and turn over "to mankind at large" (317) as long as these tools would also give mankind greater understanding of and control over nature.[11]

This becomes his justification for the Manhattan Project: after mentioning some of the justifications from different scientists who joined the project, Oppenheimer states, "But when you come right down to it the reason that we did this job is because it was an *organic necessity*. If you are a scientist you *cannot stop such a thing*" (317). And yet, even though Oppenheimer admits that because of the work of science both "the life of science" and "the life of the world" are threatened (322) he still states that scientists resist "anything which is an attempt to treat science of the future as though it were rather *a dangerous thing*, a thing that must be watched and managed" (317-8).

For Oppenheimer, science has a power, direction, authority, and value that is connected to the core virtues of *knowledge of* and *power over* nature, and these are "a thing of intrinsic value" (317). Science, as the god-term and central motive, produces knowledge and power. These two can possibly be collapsed into one since, as Francis Bacon stated, "knowledge is power" (Scientia potentia est). In either case, "science" provides the logic that makes it "an organic necessity" or consummatory drive for scientists to discover and develop knowledge of and power over nature and spread this to the rest of humanity.

This drive leads to shocking and groundbreaking discoveries that force humans "to re-consider the relations between science and common sense" (315-6). As Oppenheimer states:

> They forced on us the recognition that the fact that we were in the habit of talking a certain language and using certain concepts did not necessarily imply that there was anything in the real world to correspond to these. They forced us to be prepared for the inadequacy of the ways in which human beings attempted to deal with reality, for that reality. (316)]

He mentions relativity, the whole development of atomic theory, and Bohr's interpretation of it "in terms of complementarity" (315) as some examples of such discoveries.

However, with the development of the atomic bomb, science has gone a step further from merely abstract concepts to real world

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[11] As Kenneth Burke writes in *The War of Words*, "Power itself is impersonal and pitiless" (246).

developments that provoke profound change and unrest in human society. Oppenheimer compares "the impact of the creation of the atomic bomb and atomic weapons" to "the times when physical science was growing in the days of the renaissance" when "the threat that science offered was felt so deeply," or "when the theories of evolution seemed a threat to the values by which men lived" (316). By pushing the limits of power and knowledge, science provokes radical shifts in society, and Oppenheimer sees the development of atomic weapons as one of the most profound of these.

Oppenheimer argues that the development of atomic weapons is not just a dramatic quantitative change (increased magnitude of destruction, relatively cheap, with shifted advantage of aggression/attack compared to defense) but it also constitutes a change in quality: "wars have changed" and "if these first bombs . . . can destroy ten square miles, then that is *really quite something*" (318).[12] It signifies "a change in the nature of the world" where "wars have become intolerable" and mankind faces a "common problem," "peril that affects everyone," and a situation where "the life of science and the life of the world is threatened" (318-9). In essence, this development has created "a new situation" and "and new field" or "new opportunity for realizing preconditions" (319).

So far Oppenheimer has outlined a logical sequence from the nature of science and from scientists following its "organic necessity," but the next step consists of possible rather than necessary developments. According to Oppenheimer, this new situation creates "a possibility of realizing . . . those changes which are needed if there is to be any peace" (319). He describes them as "very far-reaching changes" in "relations between nations" in "spirit," "law," "conception" and "feeling" (319) based on a "complete sense of community responsibility" (319).

One of the most fundamental changes, which Oppenheimer describes as "an enormous change in spirit" (320) concerns the most basic commitment of the American people to their ideals:

There are things which we hold very dear . . . I would say that the word "democracy" perhaps stood for some of them as well as any other word. There are many parts in the world in which there is no democracy. There are other things which we hold dear, and which we rightly should. And when I speak of a new spirit in international affairs I mean that even to these deepest of things which we cherish, and for which Americans have been willing to die . . . even in these deepest things, we realize that there is something more profound than that; namely, the common bond with

[12] He uses the same term to describe his excitement of what kind of explosion one could get from nuclear fission in his first letter describing the newly discovered phenomenon.

other men everywhere. It is only if you do that that this makes sense. (320)

It is clear that Oppenheimer is here preparing scientists that they may have to give up some of their democratic ideals, at least temporarily, in order to achieve security for the world. It is unclear in the text exactly what he is referring to when he warns that "only by a profound revision of what it is that constitutes a thing worth fighting for and a thing worth living for can this crisis be met" (322) or how far such a radical change would have to go.[13]

The final goal of all these changes goes beyond the control of nuclear weapons to "a world that is united, and a world where war cannot occur" (320). He elaborates on this vision and the role of scientists in realizing it in his article "The New Weapon: The Turn of the Screw," published in the book *One World or None: A Report to the Public on the Full Meaning of the Atomic* Bomb:

> Scientists are . . . humanists; science is . . . universally human. It is therefore natural for scientists to look at the new world of atomic energy and atomic weapons in a very broad light. And in this light the community of experience, of effort, and of values that prevails among scientists of different nations is comparable in significance with the community of interest existing for the men and the women of one nation. It is natural that they should supplement the fraternity of the peoples of one country with the fraternity of men of learning everywhere, with the value that these men put upon knowledge, and with the attempt – which is their heritage – to transcend the accidents of personal or national history in discovering more of the nature of the physical world. (63)

The god-term of this structure is science. Science is the driving force of change in human history, and its final state is peace (leading to more scientific cooperation, which again leads to greater knowledge and power).

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[13] The least controversial reading of Oppenheimer here would be that he is simply arguing for restraint and humility on the part of the US, "because if you approach the problem and say, 'We know what is right and we would like to use the atomic bomb to persuade you to agree with us,' then you are in a very weak position and you will not succeed" (320). However, he may also be sharing the assumptions made by H. G. Wells, Leo Szilard, and Niels Bohr that world government and democracy will be (at least initially) incompatible. The global Atomic Development Agency Oppenheimer later proposes in the Acheson-Lilienthal Report of 1946 can hardly be classified as a democratic organization, even though it would have a mandate superseding the individual nation states.

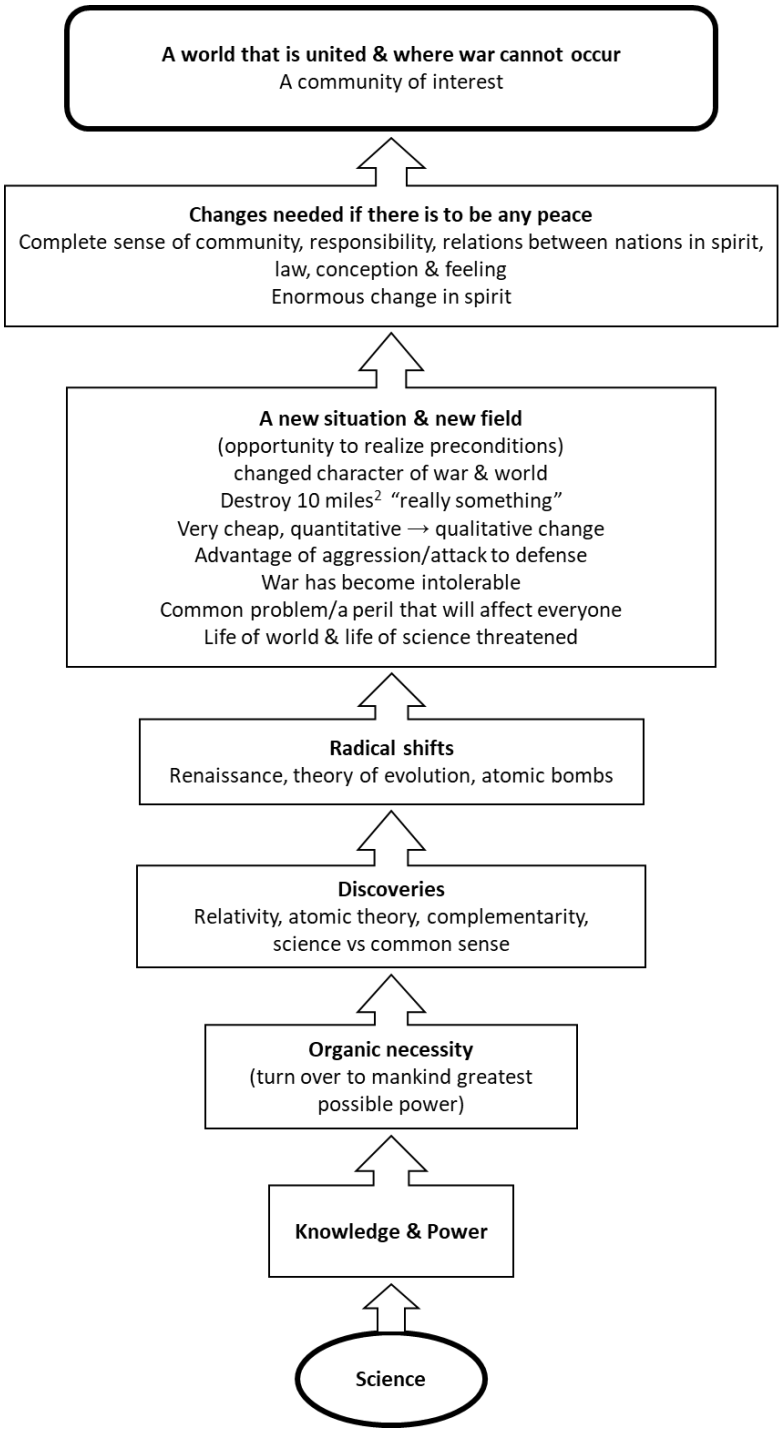

Figure 1 – Hierarchy of terms for Oppenheimer's Los Alamos Speech

There are interesting similarities between the process Oppenheimer describes here and the one he describes to his brother in his letter from 1932. Both describe a transition from a state of turmoil (struggle/war vs. profound social change and shock) to a new condition (discipline vs. new situation). By choosing to use this new situation to purify oneself of the unnecessary (detachment which renounces the world it preserves vs. profound revision of what it is that constitutes a thing worth fighting and living for, such as democracy), one has the chance of obtaining the final goal of peace, which is the same in both texts. These similarities may indicate that Oppenheimer's mind had a preference for thinking in these patterns, transcending a situation that looks like a problem by appreciation (gratitude for struggle and war) and a form of ascesis ("learn to preserve what is essential to our happiness in more and more adverse circumstances" and to "abandon with simplicity what would else have seemed to us indispensable").

3. CONCLUSION

Throughout this text, Oppenheimer argues that no scientist can stop scientific or technological developments since this goes against all it means to be a scientist. Edward Teller would later borrow the same form of argument to insist on developing the hydrogen bomb and later "clean bombs" and neutron bombs:

> The spectacular developments of the last centuries, in science, in technology and in our own everyday life, have been produced by a spirit of adventure, by a fearless exploration of the unknown. When we talk about nuclear tests, we have in mind not only military preparedness but also the execution of experiments which will give us more insight into the forces of nature. Such insight has led and will lead to new possibilities of controlling nature. There are many specific political and military reasons why such experiments should not be abandoned. There also exists this very general reason—the tradition of exploring the unknown. It is possible to follow this tradition without running any serious risk that radioactivity, carelessly dispersed, will interfere with human life. (Teller and Latter 72)

There are echoes of the same argument among scientists pushing for human gene-editing and the development of weapons with artificial intelligence. Science is a wonderful tool for critical thinking, but we must also be able to think critically about all that this endeavor entails in any given generation, and the hierarchy of values it contains. Otherwise,

science may also be used as a tool to stifle dissent and perpetuate harmful assumptions.

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