VISIONS OF NUCLEAR WEAPONS: KENNETH BURKE'S CONSUMMATION PRINCIPLE AND THE MANHATTAN PROJECT

by

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Chapter 1: Dissertation Introduction and Consummation

Consummation is a central term in Kenneth Burke's critical vocabulary, but there is much disagreement among Burke scholars about the meaning and use of the term. Since he referred to the development of the atomic bomb as a classic example of consummation, I argue that a critical study of the discourse among the Los Alamos scientists during 1943-46 can help to clarify what Burke meant by this concept and show how this creative motive can affect a community. The study seeks to understand how consummation develops in a group and how it may be diffused, and to develop a method to analyze it, which can be transported to study other discourses where there may be a similar drive.

The Problem

In "A Rhetoric of Form: The Early Burke and Reader-Response Criticism," Greig Henderson writes that we can divide Kenneth Burke's scholarly project based on three creative motives which were at the center of his attention: self-expression, communication, and consummation (Henderson 127). Kenneth Burke himself discusses these three stages in his 1967 afterword to *Counter-Statement*, titled "Curriculum Criticum": "The step from the opening chapter . . . to the next essay . . . clearly indicates a turn from the stress upon self-expression to a stress upon communication. And all that follows can be properly treated as the tracking down of the implications inherent in this turn. In later works I have added an explicit concern with the kind of consummation that is inherent in this very process of 'tracking down the implications of

a nomenclature'" (223-4). In other words, the transition from the first to the second chapter of *Counter-Statement* shows us Kenneth Burke shifting his focus from self-expression to communication, and the rest of the book tries to come to terms with (or track down) what it means to consider a text and its aesthetic qualities in terms of communication rather than self-expression. According to Burke, these findings were already implicit in the turn to communication, and he spends most of the book making them explicit. Later, he looked at the *process* he went through to track down the implications of this turn and "the kind of consummation" inherent in that process. By "the kind of consummation" I believe he is referring to the kind of drive, motivation, or urge he had, to find and flesh out the implications of this turn. Although Kenneth Burke never abandons self-expression, we could make a rough outline of this scholarly progression based on these three creative motives, with the pre *Counter-Statement* era (1915-1931) concerned with self-expression, the 1930s and war years (1931-1945) concerned with communication, and the vast bulk of Burke's later work (1945-1993) concerned with the concept of consummation. Of course, neither of the three motives are absent in his later work, so the best description of this progression may be as a shifts in emphasis rather than complete turns.[1]

Even though consummation occupies a very central place in Kenneth Burke's critical terminology, Burke himself mentions it by name very rarely. We find it mentioned twice in *A Grammar of Motives*, once in the essays that were meant to be a part of *A Symbolic of Motives*, twice in *Rhetoric of Religion*, four times in *Language as Symbolic Action*, and once in the essays collected in *On Human Nature: A Gathering While Everything Everything Flows, 1967-1984*.

[1] Burke refers to such a shift in a letter to Cowley written August 9, 1945: "I may end up where I began: with Flaubert" (Jay 268).

Yet the principle is discussed and illustrated at length in the manuscript "Poetics, Dramatistically Considered" (parts of which have been published in *Unending Conversations*) and it is referred to many times without him using that specific name. For example, William H. Rueckert writes in the preface to *On Human Nature* that consummation, the drive to take a vocabulary to the end of the line, was Kenneth Burke's major concern in his final years. Kenneth Burke himself refers to this drive as "consummation" on page 244 of the collection, but throughout the other essays he gives a description of the drive without using the word *consummation.* The drive is discussed in detail on pages 73-78 and is a recurring theme throughout the entire collection.

A survey of secondary scholarship and recent dissertations on related terms highlights the disagreement concerning this concept among some scholars and the complete absence of the term among others. Considering the density of Burke's scholarship, it may not be surprising that this term has not been more developed and used in secondary scholarship than it has. Many scholars use terms like *entelechy* and *perfection* to discuss what Burke describes as consummation in the sources mentioned above. Others claim that Burke's use of the term was similar to or the same as that of George Herbert Mead and John Dewey, or connect it with his concept of catharsis. A more comprehensive survey of the concept among Burke scholars will be given later in this chapter.

However, based on Burke's writing, I claim that consummation is substantially different from entelechy and perfection. Whereas entelechy and perfection describe general tendencies and motivations, consummation is explicitly a linguistic phenomenon since it is the explicit drive to "track down the implications of a *terminology*." Burke explains it with the example of an artist who starts with a desire for self-expression, develops this expression through a public medium for communication, and as a part of that process encounters possibilities purely internal to the

medium" that the artist then feels driven to complete or develop into reality "regardless of either self-expression or communication" ("Watchful" 48). As such, consummation describes a specific stage in the development of a terminology where the dialectic of self-expression and communication has developed a vocabulary with a momentum and life of its own.[2]

Unfortunately, Kenneth Burke does not fully explain how this momentum is created and maintained. What are these "possibilities purely internal to the medium"? What does it mean to take these "to the end of the line"? How exactly does a vocabulary reach this stage and what does that stage look like? The most extensive treatments of consummation in "Watchful of Hermetics to Be Strong in Hermeneutics" and "The Criticism of Criticism" do not provide substantial answers to these questions. However, Burke did give some suggestions as to where we could look for examples of consummation. In "Dramatic Form—And: 'Tracking Down Implications,'" published in 1966, he provides this explanation:

> My first critical speculations had been done in the aesthetic tradition that stressed self-expression. In my theory of classical form, I had made the step from self-expression to communication. But I had since come to feel that it is not enough to deal with form in terms of communication, and of the ways in which self-expression and communication variously reinforce and correct each other. I had begun to realize that there is another kind of expectation, got *by tracking down the implications of a terminology*. For instance, physicists compulsively tracked down the implications of their terminologies, thereby producing the atomic bomb, even though many of them secretly hoped that their experiments would fail. (55)

[2] Burke's concept of self-expression is universal and not limited to artists. People can, for example, express themselves by living or acting out the occupation or social class they belong to.

One of the most common examples Burke uses to explain consummation is the creation of the atomic bomb (*A Rhetoric of Motives* 34, 76; *Language as Symbolic Action* 12, 19; *On Human Nature* 47; *Unending Conversations* 49-50; "Dramatic Form---And" 55), and he had some knowledge of this process. Several of the physicists were a part of the same leftist communities that Burke himself traversed in the 1930s. Burke met J. Robert Oppenheimer, John von Neumann, Paul Olum, George Placzek, and other Manhattan Project scientists, during his stay at the Institute for Advanced Study in 1949-50 ("IAS Staff and Member Directory"). Burke also had many friends that were close to Oppenheimer, including Francis Fergusson and Haakon Chevalier. I believe Burke had good reasons for claiming that consummation factored in the decision to continue work on the atomic bomb until its completion.

I argue that a critical study of the writings of the nuclear physicists at Los Alamos between 1943 and 1946 can help reveal how consummation is developed in the terminology of a group. Since Burke himself referred to this case as an example of consummation, it would seem to be a good place to start.

There are also indications in the writings and statements of the physicists who were at Los Alamos of such a mechanism being at work. Many of the scientists entered the work on the atomic bomb to stop the Germans from getting nuclear technology first, but very few of them then stopped to reassess the situation once Nazi Germany surrendered in 1945. This shows how the original agency or means to an end (atomic bomb) gradually was transformed in their vocabularies from a means to a purpose or an end in itself, and Burke claims that this transformation is a central feature of the process of consummation (*On Human Nature* 43). Richard Feynman, head of the computation group at Los Alamos, says:

> With any project like that, you continue to work trying to get success, having decided to do it. But what I did immorally, I would say, was not to remember the reason that I said that I was doing it, so that when the reason changed, which was that Germany was defeated, not the singlest thought came to my mind at all about that! That that meant now that I had to reconsider why I am continuing to do this. I simply didn't think, okay? (*The Pleasure of Finding Things Out*)

Robert R. Wilson, head of the Experimental Division at Los Alamos, similarly observes that "our lives were directed to do one thing; it was as though we had been programmed to do that" (*Trinity*). Although the record is not unanimous, a considerable number of Los Alamos scientists seem to agree that something happened to them as a group that made them act differently than they would have done as individuals. This suggests to me that this is the right place to look in order to gain a greater understanding of the process of consummation.

Research Questions

It is my goal to gain a greater understanding of consummation as a concept and as an active force within a group. I will study how it develops, what effects it has, and how its excesses may be prevented or diffused. These are the research questions that will guide my dissertation:

1. What is consummation, and how does it relate to and differ from Kenneth Burke's concepts of entelechy and perfection?
2. How does a terminology develop to the point where consummation becomes a strong creative motive?
3. How can this development be tracked or indicated in a vocabulary?
4. What effect would consummation have on a group that shares the same terminology?

5. To what extent was Kenneth Burke right in claiming that consummation was a factor in the decision-making among the scientists at Los Alamos?
6. If consummation was a factor, what is the hierarchy, God-term, and what are the key equations that defined this vocabulary? (These concepts will be explained in the methodology chapter. Essentially, consummation requires a vocabulary with these structures).
7. How does openness and secrecy, diversity and homogeneity, and debate or lack thereof affect consummation?

In essence, the problem I am addressing is two-fold: First, I am trying to direct the attention of Burke scholars to the term consummation and show its importance. Second, I am aiming to discover how consummation develops in a group and, adapting Burke's method of indexing, to develop a method to analyze it, which can be transported to study other discourses where there may be a similar drive towards consummation.

Importance of this Study

In "Watchful of Hermetics to be Strong in Hermeneutics," Kenneth Burke describes a critic as "terascopic," or one who "looks upon a work as a portent – he studies its portentousness" (63). A critic should study a terminology looking for how certain potentialities have been set up and demand fulfillment. Burke performed just such a task when he studied *Mein Kampf* and wrote "The Rhetoric of Hitler's 'Battle.'" It was his purpose to both "prophesy" Hitler's future political moves and know how to detect and guard against similar political developments and rhetoric in America (*Philosophy* 191).

Yet such criticism, which tries to predict and maybe prevent some future developments of a terminology, is often subjected to ridicule and accusations of committing a "slippery slope fallacy." For example, Robert P. Newman ridicules these kinds of arguments in *Truman and the Hiroshima Cult*, claiming that they "elevate fugitive and unrepresentative events to cosmic status" (qtd. in Hubbard 351). Burke himself worried about frivolous claims made by "the current cult of irrationalism" and writes that his brand of prophesy should help "correct" this tendency by revealing "the logic of a given symbol system" through "systematic analysis of the implications inherent in terms" (*Language as Symbolic Action* viii). A causal argument can work, or be rescued from the potential slippery slope fallacy, if a writer or speaker is "prepared to explain exactly how the causal chain works" (Hatch 79).

This is what I am trying to do with this dissertation: I want to explain exactly (or nearly so) how the causal chain of consummation works. When Kenneth Burke claims that "physicists compulsively tracked down the implications of their terminologies, thereby producing the atomic bomb" ("Dramatic Form—And" 55), he is making a claim that he never fully substantiates. In *A Rhetoric of Motives*, he makes a related claim that some could label a slippery slope fallacy when he writes, "It is not a great step from the purely professional poisoning of harmful insects to the purely professional blasting of human beings, as viewed in similarly 'impersonal' terms" (34). Some would say there *is* a very great step from insecticide to homicide or from discussing the potential release of energy from an atom to building weapons of genocide. My dissertation will strengthen the causal argument of consummation in three ways:

1. Establishing a precedent. In order to make a credible warning about consummation in the present and the future, it helps to have carefully documented examples of

consummation in the past. More precedents make for a stronger argument that consummation is a motive that should be reckoned with.

2. Establishing a method. It does little good to have consummation as a concept for rhetorical criticism unless it can somehow be identified and analyzed in a text. I believe Kenneth Burke does some of this work with his analysis of Hitler's *Mein Kampf*, but few have been able to replicate what he did since the method he used is not widely understood. As Garth Pauley writes, "Apart from scholars' admiration for the essay . . . little has been written about Burke's analysis of *Mein Kampf*." It is my contention that what Burke called *indexing* was his method of detecting and analyzing consummation in a terminology. By showing how indexing can be used to indicate this process among the Los Alamos scientists, I hope that I can make indexing a more widespread practice among Burke scholars and rhetorical critics in general.
3. Charting a process whereby consummation is developed in a group. How exactly does insecticide turn into homicide? How does discussion about a potential release of energy turn into a stoic determination to complete an atomic bomb at all costs? How does one go from talking about nature as matter to talking "as if humans were matter," as Isidor Isaac Rabi, Nobel laureate in physics, said (Palevsky 226). How does a group develop the kind of univocality, determination, and singleness of purpose needed to complete such a tremendous task together and yet question its purpose so little? In essence, this contribution will study the causal chains whereby a potentiality becomes a reality: the steps or process by which a terminology is transformed and translated into action. This should be of particular interest to Burke scholars who I hope will be able to refer to this study as one that explains how a

vocabulary is completed and can become a creative motive that "both partly drives human achievement and makes human bondage all but ineluctable" (Crusius 73). This is my original contribution to Kenneth Burke scholarship. Rather than discussing how a vocabulary *may* be transformed within a group and lead to action, I will be trying to chronicle from a historic example *how* it does this.

Consummation in Secondary Scholarship

As mentioned above, few Burke scholars treat consummation individually as a significant term, often grouping or conflating it with entelechy or perfection. For example, in *Kenneth Burke: Rhetoric, Subjectivity, Postmodernism*, Robert Wess claims that "consummation" is basically a synonym for culmination, entelechy, and perfection, and that "sometimes even the same examples are used to illustrate entelechy in one context and another term in a different context" (246). However, Wess does not claim that consummation means exactly the same as the other terms, but rather that they are a part of the same "cluster of terms and examples" (246)[3]. Of these terms, Wess chooses to discuss primarily entelechy and perfection and does not clarify any further how consummation is related to these. It may be indicative of similar thinking that in *Kenneth Burke in the 21st Century*, an edited collection of papers from the Kenneth Burke Society, there is not a single mention of consummation; however, there are frequent mentions of entelechy as a central principle. The way entelechy is described in this collection often sounds

[3] When asked to clarify this quote, Wess wrote in an email dated 19 November 2015: "The key word in the paragraph you quote from is 'cluster.' Terms in a cluster are synonyms in a Burkean sense, which is a bit different from the conventional meaning of 'synonym.' Broadening the context, I would say that Burke was always especially interested in action undertaken for its own sake rather than as a means to something else. Over the years, he theorized such action is a number of ways that are different but that also may be 'clustered' together."

similar to how Burke describes consummation. For example, Star Muir writes that entelechy means "the tracking down of implications within a particular vocabulary" and that "Entelechy is illustrated, for Burke, in the scientific 'perfection' of the vocabularies of genetic manipulation" (36). Here, it seems that Muir conflates the principles of entelechy and consummation.[4]

There is a similar tendency to conflate *perfection* and *entelechy* or use them together without distinguishing clearly between them. In "Perfection and the Bomb: Nuclear Weapons, Teleology, and Motives," Barry Brummett uses Burke's concept of perfection to analyze why the atomic bomb is "such a powerfully motivating symbol" (88). He writes that the concept of perfection "is based on Aristotle's idea of entelechy" (85) and describes a motive to extend and complete a vocabulary as "perfectionist," implying that it is related to the drive for perfection. Brummett does not explain the specific relationship between the perfectionist motive, entelechy, and perfection, but the general impression is again that these terms are related, but do not mean exactly the same thing. In "Reassessing Truman, the Bomb, and Revisionism: The Burlesque Frame and Entelechy in the Decision to Use Atomic Weapons Against Japan," Bryan Hubbard writes that entelechy is "the drive towards perfection," so entelechy is the drive and perfection is the aim or end of the drive. This drive, he writes, "results from our ability to use symbols to envision the extreme ends of behavior" (360). Consummation is not mentioned by Brummett or Hubbard, which may indicate that they accept consummation as simply a synonym for entelechy.

Other scholars have briefly discussed the concept of consummation, but usually in a way that is peripheral to their main argument. In the introduction to *Unending Conversations*, for instance, Greig Henderson and Davis Cratis Williams write that Burke "shows how the motives

[4] At least, his definition and description of entelechy match that of consummation in "Curriculum Criticum" and other texts.

of self-expression, communication, and consummation interanimate each other" (xi) but then do not write about exactly how Burke shows this. Henderson recognizes it briefly as a central motive in Kenneth Burke's scholarship but concerns himself more with the communicative aspects of Burke's aesthetic theory (127). Similarly, Donald L. Jennerman briefly discusses consummation in "Burke's Poetics of Catharsis." He claims Burke developed consummation from his concept of "internal catharsis," where a work is purified by being completed just as the fear and pity of the audience are purified by experiencing a tragic play. He states that this internal catharsis contains an "entelechial motive" and is "primarily an intellectual or aesthetic catharsis rather than emotional, it pertains less to pity and fear than to consternation and pleasure" (Jennerman 45). Yet, because his focus is on comparing the social and the individual aspects of Burke's concept of catharsis, he does not discuss how this motive is developed and sustained. Cary Nelson discusses Burke's more radical claims about language's power to determine human action in "Writing as the Accomplice of Language: Kenneth Burke and Poststructuralism," including a brief mention of consummation as the natural result of language and an "unconscious" that is desirous to complete terminologies (162). All these authors give some interesting insights, but do not give us any in-depth treatment of the concept.

Finally, there is a group of Burke scholars who connect consummation to the aesthetic theory of John Dewey and see it as the conclusion or result of a completed aesthetic process. In "Communication in Society" Hugh Dalziel Duncan claims that the concept "consummation" has essentially the same meaning in the writings of Burke, Meade, and Dewey, and that it refers to a moment of finality at the end of an aesthetic process (417). Duncan sees consummation as a result rather than as a creative motive, which seems to go against Burke's own description of where consummation fits in his critical vocabulary. In "A Dramatistic Theory of the Rhetoric of

Movements," Leland Griffin describes consummation as a stage in the life of a social movement and, therefore, talks about "consummation rhetoric" as containing specific traits. His description of rhetoric in the consummation stage is quite detailed and pulls together many of Burke's thoughts on consummation, although he also sees consummation as a result rather than a motive.

These two main approaches to consummation, viewing it as a synonym for entelechy and perfection or relating it to Dewey's aesthetic theory, seem to both be in use in modern publications on Burke. In his dissertation, "The Burkean Entelechy and the Apocalypse of John," and in *Implicit Rhetoric: Kenneth Burke's Extension of Aristotle's Concept of Entelechy*, published in 1998, Stan A. Lindsay posits entelechy as Kenneth Burke's most transcendent and most important term, and he analyzes the Revelation of John and the Branch Davidians at Waco to illustrate the mechanism of entelechy. In these two treatises, Lindsay mentions consummation only a few times, primarily as a synonym for the completion or fulfillment of an aesthetic process. In *Kenneth Burke and the Conversation after Philosophy*, published in 1999, Timothy V. Crusius sees consummation as being the fourth function of language. The first three are language as rhetoric, language as a "chart function" of realistic ambition, and language as self-expression (the dream function). Crusius writes, "After his initial treatment of symbolic action . . . Burke became interested in a fourth function of language, which he called 'consummation' that is, thoroughness, or the desire for 'perfection,' the drive to unfold to the last implication the meanings inherent in a given vocabulary" (73). However, he never distinguishes clearly between consummation, perfection, and entelechy. He talks about perfection as "a symbol-driven motive" and speaks of entelechy as a principle that leads to a "terministic compulsion" (170), which seems to conflate the concepts.

Most recently, Gregory Clark deals with consummation in *Civic Jazz: American Music and Kenneth Burke on the Art of Getting Along*. Of the two previously mentioned approaches, his treatment of consummation most closely mirrors the *Dewey* tradition. Clark sees consummation as a part of an aesthetic, communicative process where "separate identities dissolve into one, losing the differences that divide them in a felt experience of profound unity" (46). Thus, consummation is an aesthetic result, an "arrival at a destination where in our interactions no adjustment is needed for us to understand each other" (46). Clark believes that this is a state humans do not reach often, but that, as an experience, it maintains an aspiration and works as an ideal we are drawn towards (46, 134).[5] I would argue that he is correct in his description of some of the social consequences of consummation, although his emphasis on the *Dewey* tradition does not give a very complete picture of how consummation is generated and sustained.

Consummation in Kenneth Burke's Theory

As is the case with many Burkean terms, consummation is perhaps best understood as a specific, defined link in a cluster of terms or a limb on a tree with significant contact points and areas of overlap with other terms and concepts. This does not mean that each individual concept lacks a meaning of its own, but it rather shows how Burke liked to think of things and how he tried to explain them. Burke describes his approach in *A Rhetoric of Motives* as follows: "Let us try again. (A direct hit is not likely here. The best one can do is to try different approaches towards the same center, whenever the opportunity offers)" (137). The result is often a myriad of

[5] There is no necessary contradiction between Clark's concept of the social consequences consummation can have and my explanation of the term, although his book focuses more on the positive effects and my dissertation focuses more on the dangers consummation entails.

explanations and terms to describe similar phenomena, and yet each different pathway touches on different aspects and different mechanisms. Though terms may be related, they are usually not interchangeable. In order to explain the relationship between consummation, entelechy, and perfection, I will first focus on consummation as an individual concept and then show how it operates with other terms in Burke's critical vocabulary. The two main *approaches* Burke tried to get at consummation were the two texts "The Criticism of Criticism" and "Watchful of Hermetics to Be Strong in Hermeneutics." In addition to these, there are brief references to consummation scattered throughout Burke's last two essay collections, *Language as Symbolic Action* and *On Human Nature*, which seem to share a common concern for the relationship between consummation and agency. I believe these constitute a third approach to consummation. My treatment of consummation will follow these three approaches.

First Approach: "The Criticism of Criticism"

In "The Criticism of Criticism," published in the autumn of 1955, Burke compares consummation with two philosophical and theological systems to explain the term.[6] First, he compares his triad of self-expression, communication, and consummation with Saint Anselm's triad of faith, understanding, and vision, calling his own three terms the "secular, aesthetic analogues" of Saint Anselm's three theological stages: Faith equals self-expression, understanding equals communication, and vision equals consummation (245).[7] In a secular, aesthetic sense then, consummation becomes analogous to the religious "vision" described by

[6] The text is a review of *The Lion and the Honeycomb* by R.P. Blackmur. Kenneth Burke starts by critiquing Blackmur's criticism of rhetoric and then goes on to digress on Saint Anselm and explains consummation in terms of Saint Anselm's triad.
[7] Burke connected the terms with the symbol =, which I transcribe as "equals."

Saint Anselm. Although the terms are not exactly equivalent, we may reason that what Burke says about faith, understanding, and vision in this article will also hold true for or have a correlation with self-expression, communication, and consummation.

We learn from Burke that vision "transcends the ergotizing[8] ways of the understanding" (238) and is a kind of synthesis of both faith and understanding (239). The first (faith), is characterized by "energy" and "momentum" (242), and it is an "initiating intuitive power" (242). Intellectus (understanding) is a kind of intellectual frame that then strikes the imagination and can feed a "contemplation (or 'vision')" (243). For Saint Anselm, faith meant an active love of God that needed to then gain a deeper knowledge (understanding) of God. He writes in *Cur Deus Homo*, "to my mind it appears a neglect if, after we are established in the faith, we do not seek to understand what we believe" (II). Faith is emotional, intuitive, almost instinctive,[9] whereas understanding gives this emotional energy direction and structure. In "The Criticism of Criticism," Burke criticizes R. P. Blackmur for seeing these two concepts as a dyad, with faith being able to question the intellect (understanding) and the intellect being able to curb faith. Burke claims that the goal for Saint Anselm was not that these should balance one another, but rather that the two together would transcend each other and lead to a vision or contemplation of God (238). A vision in this sense is a fusion of perfect faith and perfect understanding. More than merely seeing something, it is being able to grasp the essence of God, both intellectually and emotionally. It is in the vision or contemplation of God that intelligent nature finds its happiness or fulfillment (Anselm XVI).

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[8] To ergotize is to argue logically or sophistically. Burke seems to imply that "vision" operates on a different plane than understanding and convinces us in a different way.

[9] [9] Faith is primary for Saint Anselm and does not require understanding. As he writes, "Were I unable in any way to understand what I believe, still nothing could shake my constancy" (II).

To explain the analogous aesthetic triad, Burke writes that self-expression is the origin of art, with spontaneous utterances such as "outcries, oaths, interjection," which are matured by translation into communication. Comparable to faith and understanding, self-expression is the initiating intuitive desire with energy and momentum, and communication is the matured realization of that desire. Just as with Saint Anselm's triad, the two terms work towards a third: "the work of art moves *towards the transcending of both self-expression and communication*" (245). The way he describes the development towards this third stage is that an artist is motivated by self-expression and then uses a public medium to transform it into a kind of communication, "but in the course of perfecting his work, he encounters possibilities purely internal to the medium; and he may exploit these possibilities 'to the end of the line,' regardless of either self-expression or communication" (245). Burke's example is James Joyce's later work, which he developed from a standpoint "of its ultimate possibilities" (245) even at the expense of clear communication. In so doing, Joyce answers a call (expresses himself), but the product is *consummatory* "in a way that could not be adequately confined to either of the first two stages, but would have something of both in being beyond both" (245). The artist is expressing and communicating, but he or she is also a discoverer on a journey or someone trying to complete a puzzle with the pieces available. The medium itself, meaning the language the artist uses or has developed for self-expression and communication, contains an inherent vision that the artist may pursue for its own sake.

For the purposes of this dissertation, I will here pull in a philosopher of science, Michael Polanyi, who used a similar approach to describe self-sustaining motivations in science. In *Personal Knowledge: Towards a Post-Critical Philosophy*, Polanyi gives us some examples of how people in scientific disciplines move from communication to consummation. Drawing on

Saint Anselm's theological triad, Polanyi tries to explain what motivates scientists to pursue their research in terms of a scientific vision. He claims that a scientist is "an intelligence which dwells wholly within an articulate structure of its own creation" (195). The structure may be "a theory," "mathematical discovery," or "a symphony," but the principle is the same (195). It is only when the scientists surrender to the framework that they can gain a scientific vision. An astronomer reflects on the "theoretic vision" and experiences the "intellectual powers" of an astronomic theory, and a mathematician "loses himself in the contemplation" of the greatness of mathematics (195) in order neither to "observe or handle them, but to live in them" (196). The vision gained by scientific discovery is comparable to what he has termed the religious "ecstatic vision":

> Scientific discovery . . . bursts the bonds of disciplined thought in an intense if transient moment of heuristic vision. And while it is thus breaking out, the mind is for the moment directly experiencing its content rather than controlling it by the use of any pre-established modes of interpretation: it is overwhelmed by its own passionate activity. (196)

Polanyi sees intellectual passions, such as a desire for order, as the first step toward this vision. These passions then lead humans to articulate and construct frameworks that "handle experience on our behalf" (196), which are then again demolished as they are replaced by "more rigorous and comprehensive" frameworks until this process "culminates in the scientist." The scientist has now acquired an articulate structure that can give her access to such a scientific vision, and this vision gives the scientist further direction and motivation. In this respect, Polanyi claims that science is just like art. Art "exerts to the utmost the artist's powers of invention and discrimination merely for the purpose of satisfying the standards of appreciation which the artist

has set for himself" (195), making artistic vision a self-sustaining motive. Here is a paradox that Polanyi claims is "inherent in all intellectual passions": The human exerts itself to follow the dictates of a framework it has set up by itself. In Polanyi's version of the triad, faith is intellectual passion, understanding can be a scientific theory, and the vision refers not to God but to intellectual power and beauty, which Polanyi claims are indicative of truth (135). The scientist gains this vision by what he describes as surrendering, yielding to, or contemplating the articulate structure he or she dwells within. This seems to describe a kind of aesthetic appreciation of the order or logical symmetry of an articulate structure, such as the way Bertrand Russell describes the study of mathematics: "Mathematics, rightly viewed, possesses not only truth, but supreme beauty. . . . The true spirit of delight, the exaltation, the sense of being more than Man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as poetry" (Russell 31). These terms will be used more extensively to describe the consummatory drive among the Los Alamos community in chapter three. For now, Polanyi's example shows us that Saint Anselm's triad is recognized as a driver of human motives in secular as well as religious contexts.

After writing about Saint Anselm, Burke gives a second analogy to explain his triad of creative motives: the three-term system of cognition in Baruch Spinoza's *Ethics*.[10] The three terms are "(1) *opinio*, or *imaginatio*; (2) *ratio*;" and "(3) *scientia intuitiva*" (244). Spinoza writes of opinio or imaginatio that, "from the fact of having read or heard certain words we remember things and form certain ideas concerning them, similar to those through which we imagine things" (Spinoza). The connection with Burke's *self-expression* is not completely clear, although

[10] He gives it as an example of a triad structure and does not explicitly link it to consummation, but considering the proximity in the passage there is good reason to think that Burke at least viewed Spinoza's triad as indicative of his aesthetic triad.

one may say that to imagine or have an opinion displays a kind of faith in individual perception. Self-expression is the expression of individual imagination or opinion.

Of ratio he writes that it is "the fact that we have notions common to all men, and adequate ideas of the properties of things" (Spinoza). The common notions make it possible to check our initial perceptions and discuss them with others. To communicate is to make use of common notions to make others understand what we are trying to express. This may be how this step is related to Saint Anselm's "understanding": ratio is the level of thinking where we move beyond individual perception or faith and try to make it comprehensible and understandable to others also. The common notions and adequate ideas of, for example, the existence and proportions of things make this kind of communication possible.

Spinoza explains the third level, scientia intuitiva, as follows: "there is, as I will hereafter show, a third kind of knowledge, which we will call intuition. This kind of knowledge proceeds from an adequate idea of the absolute essence of certain attributes of God to the adequate knowledge of the essence of things" (Spinoza). There is some debate as to what Spinoza meant by this third term. The main idea seems to be that we can gain some kind of absolute understanding of or crucial insight into the Creator of all things, and as a result, we see things differently and are able to gain new knowledge. By seeing or understanding the One who is the essence of all things, we gain a derivative understanding about how the rest of the world must be.

Burke's aesthetic analogue to God is the God-term, and his description of the perspective we gain through the God-term sounds similar to Spinoza's scientia intuitiva: "Whereas before we were among varied worldly uses looking towards a single purpose, we are now in the realm of supernatural purpose looking down upon worldly multiplicity and seeing in it more strongly the new starting point at which we have arrived" ("Notes on 'Nature'"). Anselm's vision, Spinoza's

scientia intuitiva, and Burke's consummation all name a totality, a grasp of life's essence and diversity. By knowing God we also come to know all the things that God has created, and by grasping the God-term of a vocabulary we understand how the other words function in relation to it and each other. From these connections, consummation seems to be the grasping or creation of an essence, which then transforms all of our motivational vocabularies in its image.

Second Approach: "Watchful of Hermetics to Be Strong in Hermeneutics"

The second approach gives more details as to the origin of consummation as a creative motive and its relationship to Burke's theory of form. During this approach, Burke also connects consummation to the great practical and political problems that occur as a result of scientific developments, such as the development of thermonuclear bombs. "Watchful of Hermetics to be Strong in Hermeneutics" is a selection of the unpublished manuscript Burke wrote called *Poetics, Dramatistically Considered*. The manuscript is an extended treatment of Aristotle's *Poetics* and how Aristotle's theory relates to Burke's theory of form. In the manuscript, Burke gives his longest continuous treatment of consummation.[11]

It becomes clear in "Watchful of Hermetics to Be Strong in Hermeneutics" that consummation requires a rigorous, well-developed vocabulary in order to be a significant force. To explain how this force is generated and sustained, I will briefly discuss Kenneth Burke's theory of form, which he laid out in *Counter-Statement*, and show how consummation relates to it. For Kenneth Burke, form is the arousing and fulfilling of desires or expectations in the

[11] According to David Cratis Williams, the section on consummation was most likely written "in part" during 1951-2 "with the remaining . . . most likely written during Burke's stay at the Center for Advanced Study at Stanford in 1957-58" (Williams 23), so temporally it was probably written both before and after "The Criticism of Criticism."

audience or reader (124). A story arouses and fulfills desires through a narrative, but any other text or vocabulary does the same: a textbook introduction creates expectations for what the book will discuss and how it will discuss it, a legal opinion cites laws and precedent cases that set up the usually expected conclusion, and the vocabularies of the natural sciences train us to expect mechanisms in the natural world rather than agents and, as such, set up expectations for the discovery of more mechanisms.

Burke claims there are four aspects of form: progressive form (subdivided into syllogistic and qualitative progression), repetitive form, conventional form, and minor or incidental forms" (*Counter-Statement* 124). Syllogistic progression has most to do with structures of language that direct our desires in a certain way and make a certain outcome feel almost inevitable. Qualitative progression has more to do with moods and states of mind that feel appropriate in sequence (the calm before the storm, etc.). Repetitive form is created by consistently repeating one principle while changing the guises it appears in, making the reader expect further revelations of the same principle. Conventional form has to do with what we could call genre conventions, where the audience comes to a play with certain expectations of that genre. The expectation is aroused before one experiences the content. Minor forms include metaphor, paradox, and other smaller forms that operate in any given text, without a necessary connection to the overarching form of the text. All these aspects will at times overlap and at times conflict in a text (*Counter-Statement* 124-8).

The kind of literary form that best explains consummation is "syllogistic progression." Burke writes that "we call it syllogistic because, given certain things, certain things must follow, the premises forcing the conclusion" (*Counter-Statement* 124). This aspect of form is created and maintained by structures of language that direct desires and expectations towards certain

developments. The first act of the play sets up the conflict and the conflict sets up the resolution. For Burke, the same applies to any text or group vocabulary. Any definition of the world at the same time sets the stage for the drama of benevolent and malevolent forces, or the *thou shalt* and *thou shalt not* (*Religion* 279).[12] (I shall hereafter group all genres that use language under the general term *vocabularies*, since Burke claims every text makes its own vocabulary in the sense that it will give terms different nuances of meaning than those you will find in a normal dictionary [*Philosophy* 35]). Form thus creates a structure of requirements and directives that make both the endings in stories and the developments in group vocabularies somewhat predictable. Burke writes, "If the beginning of a work is viewed as setting up potentialities which are fulfilled at later stages in the work, in this sense the beginning can be thought of as matter that is subsequently actualized. The beginning, we might say, has 'the makings' of the ending" ("Watchful" 45). In the same way, one may say that the seeds for a vision or consummation are evident already in the first intellectual understanding or framing of the faith or self-expression.

I will now proceed to discuss Burke's explanation of consummation in "Watchful of Hermetics to be Strong in Hermeneutics." Syllogistic progression makes it possible for a vocabulary to take on a life of its own, in the way Burke indicates. The aesthetic principle that supports this autonomy is the requirement for consistency: "The principle of unity implies the fulfilling of expectations, for if a work violated expectations it would not be considered consistent" (47). The requirement of consistency may seem like a feeble motivation until one considers the great moral, scientific, and mathematical systems in the world that rely primarily

[12] In *Rhetoric of Religion* Burke writes, "And implicit in their supposedly objective versions of what is and is not, they will have concealed a set of shall's and shall not's which they will proceed methodically to discover" (279).

upon consistency for legitimacy.[13] Burke writes that "consummation, obtained by exploiting the possibilities of a symbol-system as such, without primary regard for either self-expression or communication, may be better explained in terms of self-consistency than expectation, though the two imply each other" (49).

Burke's general description of form is "the arousing and fulfilling of desires" or expectations (*Counter-Statement* 124), but when a writer or an audience is following a structure of expectations that has already been set up, one merely has to be consistent to achieve or experience literary form. As Burke writes, the two imply each other, and yet one can be primary while the other is secondary. It may be helpful to think of a continuum where expectation and self-consistency are at each end. At the beginning, a vocabulary starts arousing and fulfilling expectations, with self-consistency playing a relatively minor role simply because there is very little material for the new developments to be consistent with. As this text or vocabulary develops, the readers or participants have soon learned "the rules" well enough that they can anticipate the next developments even without having been given specific clues. At this level, self-consistency becomes the more dominant principle. On the far end of this continuum one may find systems such as mathematics or formal logic, where self-consistency becomes the primary and almost exclusive expectation for learned practitioners. Consummation, it seems, can only be an active principle in a vocabulary or system that has developed enough rules to require it to be self-consistent in order to maintain the aesthetic principle of unity.

[13] In positivism, math and logic only have legitimacy because they are self-consistent tautologies, and any inconsistency would immediately doom both as nonsense (Ayer 10); similarly, Perelman claims that consistency helps to give a law legitimacy among the public (Perelman 62).

Once a vocabulary or symbol-system has reached this level, it tends to "become a guiding principle in itself" (*Counter-Statement* 157) and can "appeal independently of its functional uses" (*Counter-Statement* 145). In "Watchful," Burke warns that "this formal principle of consummatory self-consistency is important when we consider technological developments as the possible manifestation of 'aesthetic' motives rather than as instruments of sheer pragmatic *utility*" (49). This is where consummation goes beyond being simply aesthetic theory. Kenneth Burke argues that this aesthetic principle of consummation, this desire for consistency, can lead a person or group of people to desire results that are devastating to humanity in general in order to satisfy an aesthetic craving. Thus, he claims, "In this regard, the various scientific specialists are to be viewed as carrying out the implications of their terminologies, and thereby seeking technological consummation for its own sake, however deceptively their efforts might be justified" (49).

One historical example of this motive could be the reaction of the young scientists at Los Alamos when the 1949 GAC report[14] advised against development of the hydrogen bomb. In *The Legacy of Hiroshima*, Edward Teller and Allen Brown write:

> It [the GAC report] seemed to *restrict* the Los Alamos scientists to *minor* improvements in the *old* field of fission. But many of the scientists, especially the younger men, found it difficult to control an *adventurous spirit* urging them to get into the *newer* field of thermonuclear reactions. The GAC report seemed to state the conflict rather bluntly: As long as you people work very hard and diligently to make a better atomic bomb, you are doing a fine job; but if you *succeed* in making *real progress* toward another kind of nuclear explosion, you are doing

[14] General Advisory Committee for the *United States Atomic Energy Commission*.

> something immoral. To this, the scientists reacted psychologically. They got mad. And their attention was turned toward the thermonuclear bomb, not away from it. (45; emphasis added)

Teller and Brown later credit this "scientific anger" with helping to propel the U.S. towards development of the hydrogen bomb (45). Remarkably absent from Teller's description of their reaction is any kind of discussion of politics or morals related to the hydrogen bomb. The motivating factor among the young scientists seems to have been success and "real progress" in the "newer field of thermonuclear reactions" or, as Burke would say, seeking technological consummation for its own sake.

The specific example Burke gives of such motives is very likely a direct response to a text written by Edward Teller. In 1957, when Teller, along with Ernest O. Lawrence, tried to convince President Eisenhower *not* to sign a nuclear test ban treaty with the Soviet Union, their main argument was that they would be able very soon to develop "clean thermonuclear weapons" that would be of almost unlimited benefit to humankind (Magraw 32). The following year, Teller and Albert Latter wrote an article in *LIFE Magazine* titled "The Compelling Need for Nuclear Tests" in which the possibility of clean thermonuclear weapons again featured as a main argument.[15] It seems plausible that this is what Kenneth Burke is responding to in "Watchful of Hermetics to Be Strong in Hermeneutics." Burke writes, "For instance, whether or not it is possible to develop 'clean' thermonuclear bombs, some men might well want to go on experimenting with these dismal weapons. For they have brought their calculations to the point where further experimental steps are in order, steps suggested by the present state of their

[15] Over 50 years later, the military is still no closer to this elusive goal that Teller once described as merely a couple of years away (Magraw 34).

terminologies" (49).[16] Studying the example of consummation Burke was referring to may help to illustrate some of the principles of consummation that he is describing.

Concerning Teller's arguments, Magraw writes that "[a] consistent theme in the arguments for the development of the clean bomb and against a test ban was that it was positively un-American to believe that there are limits to what technology can achieve, or that one might want to impose such limits" (35). In addition to this, Teller argues that it is in a way anti-science to do so. Following Teller's logic, there seems to be no other logical solution than continuing testing for the next 100 years. The essence of the argument is in the conclusion of the article, where Teller and Latter imply that if one opposes nuclear tests, then, by definition, one opposes science and humanity's great endeavor to control nature:

> 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

[16] As mentioned before, this text was most likely written "in part" during 1951-2 and the rest written during Burke's stay at the Center for Advanced Study at Stanford from 1957 to 1958 (Williams 23). Considering that Burke is describing "clean thermonuclear weapons," it has to at least be after the advent of thermonuclear weapons in 1952. In addition, Katherine Magraw writes in "Teller and the 'Clean Bomb' Episode" that it was first in 1957 that "clean bombs" were discussed with the president (32) and that it was not discussed much publicly until February 1958, when Edward Teller and Albert Latter advocated for them in the LIFE magazine article. Probably, Burke wrote this text in 1958, making it likely that he is responding to Edward Teller and his justification for continued nuclear tests.

> possible to follow this tradition without running any serious risk that radioactivity, carelessly dispersed, will interfere with human life. (Teller and Latter 72)

Teller states that all kinds of progress have been achieved by "a spirit of adventure" and "fearless exploration of the unknown," describing primarily attitudes that he later terms "a tradition for exploring the unknown." He then identifies this source of all progress with nuclear tests, which give us insight into and power over nature, and claims that it would be *inconsistent* to abandon an approach that has given us so much progress. Progress here is equated with controlling nature.

In *The Legacy of Hiroshima* Teller describes how thermonuclear weapons could be used to control nature: using H-bombs to blast channels, tunnels, harbors, and coal mines (84-5); to "frack" for oil (87); to blast the Canadian tar sands and distill oil (88); to make diamonds (89); to mutate plants for our benefit (115); to cultivate the oceans by killing off species that have no value as human food (93-4); and to finally make it possible for humans to leave Earth and colonize space (125, 133, 140).

According to Burke's reading, some of these reasons would be rationalizations to justify work on weapons of war, but Burke also believes that they, at least at times, genuinely reflect a terminology that almost compels these scientists to continue onwards in the same direction. Teller openly admits that the final goal here is not victory over the Soviet Union or even peace, but rather "increasing man's control over nature."[17] Teller had pursued and perfected the hydrogen bomb for over 20 years by the time he published his book. Reading his version of the history, one almost gets the impression of an addict. Teller writes that, for him, talent in science or mathematics is an addiction, a love (160) and that "the force of inner necessity" (not

[17] Teller sees this as an almost automatic mechanism: "Science brings progress; progress creates power" (93).

motivated by utility or any external circumstance) is "the greatest power on the earth" (163). It seems to be this power that drives him to pursue the hydrogen bomb in times of both war and peace, and to label people as allies or opponents based on the help or hindrance they provide towards that goal.[18]

In "Watchful," Burke treats this kind of addiction or compulsion as the result of an aesthetic principle: "the 'principle of consummatory self-consistency' would provide an incentive, or almost a compulsion, to continue in this same direction, quite as an author who had carried a novel to near completion might not be able to rest until he had finished it" (49). Although this may be a particularly powerful drive in the case of Teller or in the field of thermonuclear reactions in general, Burke claims that this drive is common for all fields of science: "The principle is the same. Each scientific specialization has its own particular idiom, making for its particular idiocy, in line with its particular possibilities of communication" (49). Note that it is the medium of communication, in most cases a professional vocabulary, which sets the terms for the potentialities available within a scientific specialization. The rigorous vocabularies of the scientific disciplines make them conducive to the aesthetic appeal of self-consistency and hence to the creative motive of consummation. Burke calls consummation "an autonomous formal principle" ("Watchful" 49), and both Polanyi and Kuhn agree that similar aesthetic principles play a large role in the developments within the natural sciences.[19] These

[18] Teller sees the rejection of work on the H-bomb as almost a betrayal, and details the betrayal of Oppenheimer (41), Fermi, Rabi, and others (43-4). On the other hand, Ernest Lawrence (who was in favor of the H-bomb) is given a moving eulogy as "the best defender of our cause" and one who "sacrificed his life for science and for his country" (73).

[19] Kuhn and Polanyi agree that scientists are motivated by a sense for order, consistency, and beauty in both their work and in their support of paradigms or theories. See Kuhn (154-5); Polanyi (13-4). Robert Oppenheimer claims that one of the main virtues of science and scientific life is its beauty (Oppenheimer 86).

sciences, Burke claims, are all developing towards aims determined by their professional vocabulary rather than any shared notion of the "common good" for mankind. Burke concludes his discussion of consummation with a broader view of the effects of these autonomous formal principles in operation all around us:

> A clutter of such autonomous formal principles, each aiming at its own kind of perfection, can add up to a condition of considerable disarray—and especially insofar as many of the new powers thus being developed lend themselves readily to destructive purposes while even their "peaceful" uses are menacing, as with the pollution that goes with the disposal of atomic wastes. Yes, the "aesthetics" of recent technological consummations can become quite ugly. (49-50)

Here Burke ironically observes how the aesthetic desires of a range of scientific specialists create a markedly aesthetically unappealing world. Their desire for beauty leads to a hideous reality. He uses the word "perfection" to describe what these consummations or "autonomous formal principles" are aiming at, but makes it clear that the autonomous formal principle is not the same as perfection. I will discuss the relationship between perfection, entelechy, and consummation in the concluding section of this chapter.

So what have we learned from the second approach to consummation? Consummation is an autonomous formal principle sustained by the aesthetic requirement for self-consistency. In order for self-consistency to become the dominant motivation, one needs an extensive vocabulary that is also rigorous, meaning that it has set up a wide range of rules for self-consistency that it follows consistently. The terminologies of different scientific specializations are examples of such extensive and rigorous vocabularies, and Burke mentioned the field of thermonuclear physics as one field where the principle of consummation was a significant factor.

Third Approach: Various Texts Written 1960-1993

Kenneth Burke often found it useful to distinguish between action and motion, where action infers an active consciousness that makes choices, and motion does not require consciousness or choices, exemplified in such mechanisms as the body's ability to breathe (*Religion* 41). So far, based on the texts written in the 1950s, Burke's explanations of consummation seem to reduce human agency to mere motion; indeed, he writes about this period that "[e]xperimentally, I often turn the usual perspective around, and think not of us as using language but of language as using us to get itself said" (22 April 1958; Jay, *Correspondence* 332).[20] He writes, "To a large extent, I am sure, we are simply like a telephone exchange run by an automatic dialing system. Things go in and out of us much as though we were the coordinating center that didn't even know what was being said" (*Correspondence* 332). As he works further on the concept of consummation, however, he seems to moderate this view and shows consummation as a complex interaction between action and motion, and between conscious and unconscious symbol-using. This approach comes at the end of Burke's published work in *The Rhetoric of Religion* (1961), *Language as Symbolic Action* (1966), and essays gathered in the collected edition *On Human Nature: A Gathering While Everything Flows 1967-1984*. This is also where he theorizes ways in which this creative motive can be diffused or at least made less harmful. I will first show the potential cures or correctives Burke suggested for consummation and then apply this in a discussion about the extent and the possibility consummation leaves for choice or action.

[20] This was in a letter to Malcolm Cowley written from the Center for Advanced Study at Stanford. As mentioned before, this was when he was writing the text included in "Watchful," so it is likely that these are thoughts related to consummation.

In *The Rhetoric of Religion*, Kenneth Burke uses the Bible as an example of a vocabulary that is capable of sustaining the creative motive of consummation. The cyclical chart of terms for Order that he finds through his analysis of the Bible "sums up the 'directionless' way in which such a cluster of terms imply one another" (4).[21] The goal of the book is to develop a critical metalinguistic vocabulary (logology) that can make us aware of such persuasive structures in other non-religious vocabularies, such as the metaphysics of empire, technologism,[22] and scientism (170, 302). This implies that people can learn to question the consummatory drive if they become aware of it and have a critical vocabulary they can use to analyze it (301).

In *Language as Symbolic Action*, Burke seems to point to a sort of competitive check on consummation:

> Whereas there seems to be no principle of control intrinsic to the ideal of carrying out any such set of possibilities to its "perfect" conclusion, and whereas all sorts of people are variously goaded to track down their particular sets of terministically directed insights, there is at least the fact that the schemes get in one another's way, thus being to some extent checked by rivalry one with another. (19-20)

[21] Burke lists a chart of religious terms that can be viewed as logically dependent on and logical consequences of the idea of *order*. If there is order, then there is also potential for disorder, hence there is a law and a potential to either disobey or obey it. The whole cluster of terms ranges from Heaven to Hell with all of the terms seemingly logically dependent on each other. Thus, you are never "outside" of the larger order built on the terms implicit in the idea of order. Whatever choice you make, there is a description for it and a remedy assigned to that behavior.

[22] A set of beliefs built upon the assumption that "the remedy for the problems arising from technology is to be sought in the development of ever more and more technology" (*Human* 133).

The principle seems to be that a plurality of voices or at least the lack of univocality can constrain the negative impacts of consummation. Moves towards debate, inclusion, and interdisciplinarity may help to check consummation in specialized vocabularies.[23]

Finally, in *On Human Nature: A Gathering While Everything Flows*, Kenneth Burke describes the consummatory drive as a kind of autosuggestion, and he offers a potential cure: "Might the best protection against the dangers of autosuggestion be in the development of methods designed to maintain maximum liquidity in all symbolic exercising?" (50). Aristotle's *Rhetoric* is one example he gives of tools that can help us maintain such liquidity. If consummation requires a rigorous and disciplined vocabulary, symbolic liquidity could help to loosen the chains of formal syllogistic progression that make consummation possible.[24] He recounts how he himself as an author became the victim of autosuggestion and was only able to free himself from it by criticism (49), and he seems to think that the same cure could help other people in the same way. Later, he suggests satire as a method of popularizing criticism of rigorous vocabularies by taking the demand for self-consistency to an excess and thereby showing its absurdity (73).

These opportunities for correction suggest that consummation is not ineluctable, despite Crusius's claim to the contrary (Crusius 73). Even though Burke played with turning around the concept of *people* using *language* to *language* using *people*, he never claimed that it is false that

[23] Although positivism, which was envisioned as the greatest hope for interdisciplinarity and unification among the sciences, became perhaps one of the greatest promoters of univocality and stifled dissent. So interdisciplinarity does not necessarily mean a plurality of voices.
[24] Because Burke does not here explain what he means by symbolic liquidity, one can only make a guess based on the context of what he says and the content of Aristotle's Rhetoric. My guess is that he believed that cultivating "an ability, in each case, to see the available means of persuasion" (1.2.1), would help people size up a situation in a lot of different ways, thereby avoiding too narrow views of a situation or an argument.

people can and do use language. Because consummation is a motive that requires a rigorous vocabulary, it is as subject to criticism and capable of correction as the vocabulary it relies on. By debate it can be dissipated, by maintaining symbolic liquidity it can be destabilized, and by logology and satire it can be analyzed, criticized, and defused. Consummation seems to only be a danger when people are not aware of it, when the vocabulary is shielded from debate, or when the proponents of the vocabulary actively choose to disregard the danger.

How, then, should we conceptualize the extent or possibility for active choice for people driven by consummation? Self-consistency is an aesthetic desire; a sense for what is appropriate or beautiful, and yet it can become a "trained incapacity" to the extent that it becomes hard for someone habituated to that kind of thinking to think differently. It may be helpful to use Burke's phrase that "the driver drives the car, but the traffic drives the driver" (*Human* 71). People driven by consummatory self-consistency act, think, and make conscious decisions, but they do so within a framework defined by their vocabulary. For example, rather than considering whether or not it is good or even useful to "increase man's control over nature" in the form of thermonuclear weapons, someone who buys into Teller's scientific vision would simply ask "how can I best increase man's control over nature." The scientist thinks and makes choices, but the terminology determines the range of thoughts and choices available or acceptable to him or her.

To give a specific example, in "Physics in the Contemporary World," Robert Oppenheimer dismisses the claim that scientists are responsible to society for the results of their discoveries. Instead, he argues, "The true responsibility of a scientist, as we all know, is to the integrity and vigor of his science" (67). Oppenheimer goes on to discuss what a scientist should and should not consider: "Science is disciplined in its rejection of questions that cannot be answered" (86), by which he means any question that cannot be answered by empirical

measurements or mathematical proof. A person that has adapted such a way of thinking by commitment and habituation may feel more compelled by, and less able or willing to resist, the consummatory drive for self-consistency within that vocabulary. Although Kenneth Burke describes the drive at times as a compulsion, he uses words of *action* to describe people following it. For example, in *Language as Symbolic Action*, he writes:

> A given terminology contains various implications, and there is a corresponding perfectionist *tendency* for men to *attempt* to carry out those implications. Thus, each of our scientific nomenclatures *suggests* its own special range of possible developments, with specialists *vowed* to carry out these terministic possibilities to the extent of their *personal ability and technical resources*. (19, emphasis added)

The terminology suggests potential developments, but it is people that fulfill them because of their commitments and their desires. It is possible to reject the urge for completion, just as an author can refuse to finish a book or a listener can turn off a song before it has ended.

Burke compares this terministic compulsion to an astronomer who, through calculations and observations, predicts that an asteroid will soon hit Earth and destroy all life on it. “He would . . . feel compelled to argue for the correctness of his computations, despite the ominousness of the outcome” (19), not because awareness could in any way avoid the disaster, but because it is the answer that fits. The difference is that, in bioengineering or nuclear physics, following caluclations to the end of the line is what creates the ominous outcome. The potentiality may be latent in nature, but cloning and nuclear weapons do not just materialize from potentialities in nature; people choose to uncover and develop these potentialities. When James Joyce or Beethoven follow the implications of their symbol-systems, they can choose not to complete that journey, although it may feel gratifying and right to do so (305). Burke writes that

artists or speculative minds can feel like "there is no rest" once they have glimpsed certain ultimate possibilities until they have "transformed its potentialities into total actualization" (*Human* 73). The person who glimpses the possibilities is "called" and is under "a kind of compulsion" to pursue those possibilities (*Human* 74), but it is possible to avoid heeding that call.

In terms of the action/motion duality, it seems that people who have been "under the spell" of such a consummatory drive feel they are less free to act.[25] The level of agency and ability to act in opposition to the consummatory drive may be highest before one commits to a specialized vocabulary of a science, academic field, ideology, or religion, although it is questionable whether humans can operate without *any* such terminologies. Still, there is a great difference between the rigorous vocabulary of positivistic science and the playful vocabulary of an omnivorous reader of world literature,[26] and they are not equally capable of generating expectations of self-consistency.

Conclusion: Entelechy, Perfection, and Consummation

As mentioned earlier, some Burke scholars tend to see consummation, perfection, and entelechy as identical, and there are some passages in Burke's writings that could justify such an interpretation. However, I will make the argument that consummation should be seen as a separate term with a separate meaning.

[25] Robert Wilson explains that it was as though they had been programmed to finish the bomb, and Frank Oppenheimer mentions being trapped by the machinery and momentum. Both are descriptions of limited agency (*Trinity)*.

[26] Kuhn writes that broad exposure to competing and incommensurable solutions is what distinguishes a student in the humanities or social sciences from a student in the natural sciences. This makes a natural scientist less prepared to handle paradigm crises and discover a fresh approach to answering the questions of his or her field (164-5).

In *On Human Nature*, Kenneth Burke discusses his thoughts on the third creative motive (consummation), which arose from speculations in the late 1930s, and then writes: "Later I began to ask myself whether I could round out this notion of a purely formal motive (or goad, implicit in our nomenclatures) by adapting for my purposes the Aristotelian concept of entelechy" (74). He goes on to explain that whereas Aristotle applied the term to explain biology, physics, and almost every development in nature and society, Burke only applies it to symbolic action. Different verbal structures are "illustrative, in their different ways, of the entelechial principle, tracking down the implications of a position, going to the end of the line" (74). One reading of this passage could be that Burke replaces consummation with entelechy since he realizes what he is talking about is basically a symbolic version of what Aristotle discussed in his writings on biology and physics.

The essay, "Why Satire, With a Plan for Writing One," was written in 1974, which definitely sets its date after his previous discussions of consummation. Although he discusses a third creative motive in the same article, he does not use the term "consummation," which could justify the interpretation that entelechy simply became the new consummation. In fact, I have not been able to find an article where he uses the word "consummation" after 1967, when he uses it in both "A Theory of Terminology" (*Human* 244) and "Curriculum Criticum," the afterword to the 1968 edition of *Counter-Statement* (225). However, it is not as if entelechy is a new invention in the Burkean vocabulary in 1974. He used the term actively in his criticism since at least 1952 (in "A 'Dramatistic' View of 'Imitation'") at the same time as he was writing about consummation as a separate term with a separate meaning.

I would argue that the concepts of consummation and entelechy, though related, are not the same. Entelechy is the "rounding out" of consummation in the sense that Burke takes a

specific category of creative motive and shows that it is just one example of a general tendency within all symbol-using. I would argue that consummation is a specific manifestation of the entelechial principle, but that not every manifestation of entelechy is consummation. In this sense, they operate together in a cluster where entelechy is the greater summarizing term and consummation is the more limited and restricted term.

So what exactly is entelechy? In his introduction to "Archetype and Entelechy," Rueckert writes that Burke borrowed the term entelechy from Aristotle, applied it to literary texts, and later "he expanded its application so that it applied to all symbolic action and became one of the prime functions of language and central concepts of logology" (*Human* 121). Rueckert's explanation of entelechy is that "[l]anguage, or, perhaps, just the human mind, seeks perfection, is compelled to go to the 'end of the line' in its many endeavours" (*Human* 121). If we accept Rueckert's definition, then it seems clear that entelechy is more expansive than consummation. The passages on consummation previously referred to all seem to require an established and preferably specialized vocabulary in order for consummation to be a factor, whereas entelechy applies to *all* symbolic actions and is one of the prime functions of language itself. To give an analogy: If entelechy is the general tendency humans have to get sick, then consummation is a particular class of diseases that can afflict them. This does conflict with Star Muir's definition of entelechy as "the tracking down of implications within a particular vocabulary" (*21st Century* 36), although I would agree that what Muir is describing is one *manifestation* of the entelechial motive.

So how does entelechy relate to perfection? Are they the same for Burke? In "Archetype and Entelechy," Burke defines entelechy as "such use of symbolic resources that potentialities can be said to attain their *perfect* fulfillment" (*Human* 125), with perfect victimage being one

example. Other examples are the perfect villain, the perfect fool, the Nazi version of the Jew as the perfect enemy, and the perfect Communist (*Human* 126). These examples of entelechy seem to show that entelechy is a general tendency to take a concept, image, or principle to its extreme. For example, labeling someone as vicious or evil and taking that to its extreme might lead anyone defined as "good" to kill or conquer that person, whereas labeling someone as mistaken would direct good people to try to correct or persuade him or her (*Attitudes* 41). In the same way, Burke labels Freud's myth of "the fatherkill" as entelechial in the sense that, although it may never have really happened, it is a "perfect representative expression of the tensions he viewed as intrinsic to the family structure" (*Human* 127). The fatherkill is the entelechy of the Oedipus complex. It is the fruition or culmination of a struggle or tension taken to its furthest extent. Unlike the descriptions of consummation, there is no qualification that this motive requires a highly developed vocabulary or that this form operates primarily through self-consistency rather than by the arousing and fulfilling of new expectations.

In order to understand entelechy, this drive towards the perfection of a concept, image, or principle, we have to understand what Kenneth Burke means by perfection. In "Theology and Logology," he writes that perfection is the secular or logological analogue of the "idea of God as the *ens perfectissimum*" (*Human* 177) (most perfect being or conjunction of all perfections), but that Burke's concept of perfection does not require that the perfection be positive, only that it be the ultimate of its kind. One example is how we may impute terrible motives to our opponents until they are little less than the pure embodiment of evil (such as one sees in war propaganda). By so doing, we "perfect" the idea of our opponents until they are the most loathsome enemy we could possibly imagine. This perfection of the enemy is what Burke would call an entelechy, a manifestation of the entelechial motive taken to its ultimate form. This seems to fit well with

Bryan Hubbard's definition of entelechy as the drive towards perfection. Entelechy is the drive and perfection is the goal that inspires the drive, comparable to how, in theology, piety is a yearning for God and a perfect God is the center or locus that makes such a drive possible. Burke describes the secular grounds for this drive as a formal obligation: "Discourse can be truly discourse only by having the power to be fully itself. Such a formal obligation applies always" (*Religion* 289).

To summarize the relationship between the three concepts, entelechy is a general drive towards perfection. Perfection is a goal or ideal fueled by a "formal obligation" for a discourse, concept, or principle to "be fully itself" which means to actualize inherent potentialities to its fullest degree (such as "perfecting" the enemy). Consummation is one manifestation of the entelechial drive, where a vocabulary sustains a drive towards a particular kind of perfection. The perfection the consummatory terminology is driving towards is most likely symbolized by a God-term. Unlike some other manifestations of the entelechial drive (such as creating "the perfect enemy" or "the perfect bread"), consummation requires an extensive terminology to be a significant motive. Self-expression and communication must first create utterance and structure before consummation can arise as an active motive, just as faith and understanding precede vision in Saint Anselm's theology. The terminology must also be rigorous enough to allow self-consistency to become the dominant form and give rise to this autonomous formal principle.

So what does the concept of consummation add to Burke's corpus of critical terms? First of all, it adds precision. Instead of just describing the existence of a general principle, consummation describes a motive which only arises at a specific stage in a dialectic between self-expression and communication. It gives a clearer description of how the general entelechial principle is developed and sustained in specialized vocabularies. Second, it adds understanding

of a specific mode of persuasion that may be the source of some of the greatest problems we have in the world today, and just as vision transcends the ergotizing ways of understanding, so consummation may elude many of our normal filters for detecting and analyzing arguments. This rhetoric operates through self-consistency rather than expectation, and as such it may seem inevitable or unproblematic and therefore it is not subjected to criticism. Kenneth Burke warns us of the specific dangers of consummation in specialized vocabularies and directs us to study these vocabularies carefully for implications of future developments. Finally, this is a specific manifestation of the entelechial principle which requires a terminology in order to function as a motive, and it is therefore capable of criticism and correction through the remedies suggested by Kenneth Burke.

Based on these arguments, I maintain that consummation deserves to be considered independently of entelechy and perfection as an important term in Burke's critical vocabulary. It is my belief that Kenneth Burke intended for it to be considered in that way. In either case, I argue that this concept of consummation is useful for Burke scholars and rhetoricians to distinguish an important manifestation of the entelechial drive.

Chapter 2: Indexing as a Method to Indicate Consummation in Verbal Structures

In the former chapter, I argued that consummation should be considered as a separate meaningful term in Kenneth Burke's vocabulary. In this chapter, I will make the case that Kenneth Burke's "indexing" is a sound method for detecting both consummation and the ends a consummatory vocabulary is urging us towards.

Indexing is not a well-established method for rhetorical analysis. Very few Burke scholars use indexing and many are not even aware that such a method exists. Although Burke used the method himself and taught it to his students, there is no clear understanding of how he indexed a text and what he meant by key terms, equations, verbal hierarchies, and god-terms. Clarifying this method is one of the central contributions of this dissertation and the central aim of this chapter. Since 2011, I have been conversing with some of Burke's former students who were required to use indexing for their class assignments, and I will refer to some of their assignments in order to clarify how god-terms and verbal hierarchies work and how they are found through indexing. The chapter will have the following structure:

First, I will explain the connection between indexing and consummation, and then introduce the method's theoretical foundations, how it has been treated in secondary scholarship, and the efforts I have made to restore some of the features of indexing that I believe have been lost or ignored. To illustrate these features, I will use examples from student papers written for Kenneth Burke's indexing class at Bennington, where indexing was the primary analytical method. For the second portion, I will conduct a detailed indexing analysis of "Announcing the Bombing of Hiroshima," President Truman's first speech about the atomic bomb (given August

6, 1945), to show how the method can be used. In the conclusion, I will outline how I used this method to analyze the role consummation played among the Los Alamos scientists.

I argue in this dissertation that what Burke describes as the "consummatory drive" contributed to the "programming" Robert Wilson and other scientists felt drive them to complete development of the atomic bomb (*Trinity*). In order to connect the theory of consummation to the actions of scientists working on the atomic bomb, I need to be able to trace consummation in some way in their vocabularies. A *theory* of consummation does not help us avoid the *dangers* of consummation unless it can be detected *before* a discourse has reached its ultimate end. That Burke did believe it was possible to detect consummation before its completion is best exemplified in "The Rhetoric of Hitler's 'Battle,'" where Burke analyzes the consummatory vocabulary of Hitlerism, before many of its implications have been fulfilled, in order to warn against its spread and prevent the fulfillment of those implications (*Philosophy* 191). In "Curriculum Criticum," written in 1953, he mentions his analysis of *Mein Kampf* as "perhaps the fullest instance" illustrating a method that he calls "indexing" (217).

This is not to say that consummation is the only aspect of language that indexing can detect. In "Linguistic Approach to Problems of Education" (hereafter cited as "LAPE"), Burke describes indexing as "the kind of short-cut which we consider primary, where the analysis of particular linguistic structures is concerned" (270). He also lists six "considerations" of language which indexing can be used to analyze: Identification, mystery of hierarchy, symbolic purification and victimage, consummation ("the principle of *completion* to which language vows us"), transcendence, and the negative (269).[27] This establishes clearly that discovering consummation was one purpose of indexing. Burke often mentions consummation as a *concern*

[27] He begins the list with "among other considerations," so the list is not meant to be exhaustive.

together with indexing as a *method*, which also shows how these two—what I claim he saw as respectively the malady and the remedy—were connected in Burke's thinking.

For example, Burke claims that specialized and rigorous vocabularies will often give rise to the motive of consummation in a group and that critics can study this motive through indexing. In "LAPE" Burke writes, "Since every specialty has its terminology, it can be studied like any poem or philosophical treatise, for its 'equations'" (277). "Studying for equations" is at the heart of indexing, so Burke is claiming here that all specialties can be indexed because they rely on a terminology. By indexing a terminology, critics should also be able to detect the consummatory drive and see in which direction this drive is going.

Similarly, in "Watchful of Hermetics to be Strong in Hermeneutics," Burke writes that he can see the logic driving the further hydrogen bomb development and testing because the scientists "have brought their calculations to the point where further experimental steps are in order, steps suggested by the present state of their terminologies" (49). This is the kind of insight indexing gave to Kenneth Burke. It was "designed to help reveal the logic of a given symbol system" (*Language* viii) and therefore will show the "logical" next steps for anyone who follows the logic of that symbol system.

Theoretical Foundations of Indexing

In his introduction to *Essays toward A Symbolic of Motives*, William H. Rueckert writes, "Properly understood, Indexing is the key to Burke's theory of what a literary text is and how it works" (xvi). There are references to the method from the very beginning to the very end of Burke's critical work, and he writes in "Questions and Answers about the Pentad" that indexing is his preferred method for textual analysis (334). He saw this method as central to his

intellectual project: dramatism. This project (defined as "the approach to human relations through the study of language in terms of drama" ["LAPE" 269]), has the following two essential claims:

> [1] It contends that the basic motives of human effort are concealed behind the clutter of the machinery, both technological and administrative, which civilization has amassed in the attempts to live well. [2] It contends that by a methodic study of symbolic action men have their best chance of seeing beyond this clutter, into the ironic nature of the human species. ("LAPE" 269-70)

His project therefore requires (1) a theory of the basic motivations and their concealment, and (2) a method for "seeing beyond this clutter" by studying texts. The first was essential for the diagnosis and the second for the cure. The method he then goes on to outline for the next seven pages is indexing.[28] So indexing was an important cure for what he believed ailed the world. I have already described one ailment, consummation, in detail in chapter 1. Here I will focus on the cure, indexing, and the theory of language that is the foundation of the method.

In *Philosophy of Rhetoric*, I.A. Richards claims that "all thinking is sorting" (30), and indexing is a method to uncover the logic by which thought has been sorted in a given text or set of texts. As Burke writes, "For a theology, a philosophy, a political system, or a drama are all alike in one notable respect: each involves a cycle or configuration of organically interrelated terms – and by featuring these and considering their implications we can hope to get the logic of the structure in general, and the parts in relation to the whole or to one another" (*Language* 164).

[28] I would not go so far as to say that indexing is the only method he devised which can be used for such a study, but I would claim that Burke at least believed it was a central method, and it was the one he favored.

I will explain later what he means by "a cycle or configuration of organically interrelated terms," but it is important to note that the logic Burke is talking about here is different from formal logic or mathematics. Like mathematics, this logic is concerned with consistency, but "this would not be the kind of consistency that we ask of a reasoned argument." Rather, he is describing "a logic of imagery, as affected by the logic of ideas" (Letter to J.S. Watson, January 8, 1955). One might also call it a logic of literary form, since that is the central principle upon which this logic operates.

As mentioned in the last chapter, Burke defines literary form as the arousing or creating and then fulfilling of expectations, appetites, desires, etc. Following Aristotle, Burke claims that the ultimate aesthetic purpose and effect of drama (and thus of all texts) is a form of catharsis (purgation or purification) and that this is achieved through two "rival medicines," which he calls "dramatic catharsis" and "dialectical transcendence" (*Language* 186). Thus, what critics can find by indexing is the structure and stages of development whereby a text is "purified" by dramatic catharsis and/or dialectical transcendence. The movement towards these ends forms a chain of arousing and fulfilling expectations, which operates like a logic of literary form.

One can sense the beginnings of the method already in *Counter-Statement*, where Burke writes that every person forms a pattern of experience based on their adjustment to their environment or situation (151). This pattern of experience then becomes an interpretation of life with persuasive potential (176), and if the person who possesses this pattern of experience is able to write it into a text, then the text ("the Symbol") will become "the verbal parallel to a pattern of experience" (152). Therefore, the text can tell us something about the logic of the author, the author's social order, and maybe even the hidden logic of the motivations of the entire human species. There is a structure, a logic to individual motivations, group motivations, and human

motivations as symbol-using animals in general, which transfers like a fingerprint into texts when we write them. These structures are at the core of many of our problems, and their detection can therefore lead to solutions. As Burke writes:

> Studying the implicit equations which have so much to do with the shaping of our acts, should enable us to see our lives as a kind of rough first draft that lends itself at least somewhat to revision, as we may hope at least to temper the extreme rawness of our ambitions, once we become aware of the ways in which we are the victims of our own and one another's magic. (*Grammar* 442)

According to Burke, some features of this structure are key terms, equations, verbal hierarchies, and god-terms.

Key Terms and Equations

Critics can detect the text's logic of form because "the underlying pattern is observable when an apparently arbitrary or illogical association of ideas can be shown to possess an 'emotional' connective" and it "is best observable when words refer to no specific thing – as 'liberty, equality, fraternity' – 'my country' – 'the good of society.' In such cases, the contexts in which the words appear will generally be constants" (*Counter-Statement* 159). Here we see explained the step that Burke later calls "finding equations." By looking at terms and studying the words that they occur together with, critics can better understand what that word means to the author. Later, in *The Philosophy of Literary Form*, Burke further clarifies why this is: "The 'symbolism' of a word consists in the fact that no one quite uses the word in its mere dictionary sense. And the overtones of usage are revealed 'by the company it keeps' in the utterances of a given speaker or writer" (35). In this sense, every person has their own vocabulary with their

own definition and emotional coloring of words.[29] For example, an abused child may have very different nuances of meaning of the words *father* and *mother* than many other people may have. Critics can therefore find the nuances of meaning words have for an author, a social group, or even a national culture, as Richard Weaver does in "Ultimate Terms in Contemporary Rhetoric," by looking at the word throughout a text or texts and seeing which other words usually appear near it.[30] Critics can also look for words that stand as opposites to the word they are finding equations of (*Philosophy* 83). Some words will occur more often and therefore accumulate more "equations." Burke sometimes calls larger groups of equations "clusters" (*Attitudes* 232). The words that stand as the gathering point for these clusters are what Burke calls "key terms."

Burke uses Clifford Odets's *Golden Boy* as an example: "You find, by statistically charting the course of the plot, that prizefight equals competition, cult of money, leaving home, getting the girl, while violin equals cooperative social unity, disdain of money, staying home, not needing the girl" (*PLF* 33). The violin and the prizefight are central symbols connected to their own clusters of terms. They are the key terms because they are symbols or categories within

[29] Of course, Burke recognized that language is also a collective medium and can likewise be viewed from that perspective. He sketches the relationships between these perspectives as follows: "All told, from the logological point of view, everything probably boils down to this paradox: In one sense, language is a collective medium, which the individual acquires from his group, and which in its collective nature ties the individual forever to collectivist thinking, the conceiving of human 'rationality' in terms of the sociopolitical ingredients embedded in the nature of the symbols he learns from his group. In another sense, language is solipsistic, a separate dictionary of mutually interrelated terms taking form in each man's mind, living while he lives and dying when he dies. To match the solipsistic nature of such interwoven symbolism 'macrocosmically,' there are the 'microcosmic' solipsistic counterparts one finds in particular symbol-systems, such individual universes of discourse as we glimpse when we consider the Aeschylean trilogy as a whole, and think of its basic unity as in effect as *a telescoping* of its dramatic differentiations, their merging into a single principle (itself inexpressible, but felt by us to the extent that we feel the work to be self-consistent)" (*Language* 146).

[30] Burke adds that Caroline Spurgeon's book *Shakespeare's Imagery, and What It Tells Us* is an excellent example of what he is talking about (*Attitudes* 232).

which the other terms fit in this text. He gives another example that shows key terms are not just a feature of literary fiction: "beginning with such words for individual physical things as 'table,' 'chair,' 'desk,' we might group all such classes under the heading of 'furniture'" ("Watchful" 72). Here "furniture" is the key term connecting several terms. I will further discuss equations and key terms later in the text.

Verbal Hierarchies and God-terms

Verbal hierarchies and god-terms are features formed by a dynamic in language Burke calls "dialectical transcendence."[31] Burke describes it as "the building of a terministic bridge whereby one realm is *transcended* by being viewed *in terms of* a realm beyond it" ("Transcendence" 877). He uses the example of a priest talking about heaven to a dying believer to illustrate this concept. The believer then views death and pain in terms of heaven rather than extinction. In this way, death and pain are symbolically *transcended*. The same process applies to secular vocabularies. Burke claims that "the machinery of language is so made that things are necessarily placed in terms of a range broader than the terms for those things themselves. And thereby, even in the toughest or tiniest of terminologies . . . we consider things in terms of a broader scope than the terms for those particular things themselves ("Transcendence" 895). If I experience any object, like a tree, I can only describe it in terms of what it is not. Words are not the tree, but I can only describe it by verbal abstractions of its features, such as shape or color,

[31] Burke developed many of the concepts mentioned in this subchapter while in conversation with the General Semanticists (especially Alfred Korzybski, S. I. Hayakawa, and Irving J. Lee) in the 1930s and 40s, and yet it is hard to know who came up with a term first. For example, Burke describes god-terms and ladders of abstraction in *A Grammar of Motives* published in 1945, whereas S.I. Hayakawa describes ladders of abstraction in *Language in Thought and Action* published in 1949. In either case, there was a longstanding friendship as well as rivalry between Kenneth Burke and the General Semanticists (Nicotra 346).

and I thereby place the tree in a range of terms that belong to the field of art or botany. As soon as I have done this, I have "transcended" the tree. I now no longer experience the tree as such, but rather see it "in terms of" art or botany.[32] In the same way, physicists view nature *in terms of* mechanical laws, generals may view the world *in terms of* threats and security, etc. What Burke is saying is that the human mind, or the instruments for communication, are so constructed that they sort individual terms and objects under more abstract concepts.

As mentioned before, Richards states that "all thinking is sorting," and sorting requires categories and hierarchy.[33] As Steven Pinker states, "A major finding of cognitive psychology is that long-term memory depends on coherent hierarchical organization of content. . . . A speaker's challenge is to use the fundamentally one-dimensional medium of speech (one word after another) to convey a multi-dimensional (hierarchical and cross-linking) structure" (qtd. in Anderson 79). Because of this requirement, the most important terms for a person or social group will be sorted or organized in some form of hierarchy. Means will usually be subordinated to ends, and concrete objects will usually be subordinated to abstract concepts, as when an individual person is deemed less important than the greater good of society.[34] Critics may not always find these hierarchies fully developed in texts, but Burke claims, "we are continually

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[32] "And insofar as things . . . are treated in terms of a 'beyond,' they thereby become infused or inspirited by the addition of a *new* or *further dimension*" (*Language* 189-90).

[33] Sorting is a method of organizing and requires that we create categories and then put things in the categories they belong to (spoons with spoons, forks with forks, etc.). In the process, we also develop categories with narrower circumference and categories with wider circumference (knives, cutlery, kitchen utensils). When we use wider categories to organize the narrower ones (all kitchen utensils in the same drawer or cupboard) then we have developed the beginnings of a hierarchy to create order. The former mess has been sorted or organized.

[34] For example, "We the people . . . in order to build a more perfect union . . . do ordain and establish this Constitution." The goal or purpose is primary and the means or tools are secondary. Burke writes that subordinating the concrete to the abstract is a basic feature of language (*Language* 361).

encountering fragmentary variants of them" ("Old and New" 204). Critics can find these hierarchies by what Burke calls "The Upward Way," "a process of progressive abstraction and generalization, until the highest order of such development is reached" ("Watchful" 72).

When these hierarchies are fully developed, Burke claims that they will have at their top and/or center what he calls a "god-term," and it is this movement towards the top of a hierarchy that is at the core of the consummatory drive or hierarchical motive. In *Language as Symbolic Action*, Burke describes the god-term as "an ultimate title of titles" for "the whole congeries of words in their one particular order. There would thus be a sense in which the overall title could be said to be the infolding of all the details, or the details could be treated as the exfoliation-in-time of the eternal now that was contained in the rational seminality of the title" (370). The imagery brings to mind the petals of a flower closing in at the end of the day and then unfolding again in the morning. The god-term is the distilled essence, principle, or moving force, and the details are all the manifestations of that essence, principle, or moving force. For example, all of Shakespeare's *Othello* could be viewed as the exfoliation-in-time of the principle of jealousy.

A god-term can also be set temporally prior to, and therefore act as the cause of, all that follows.[35] There is one mechanism at work, and all else is but ripples from that mechanism. This is the case in many representations of history. Burke writes, "Even so tough-minded a nomenclature as that of Karl Marx inevitably retained transcendental traces (as when conditions of *here* and *now* are seen in terms of a broad historic sweep that quite transcends them, and thus imparts to them a kind of 'ulterior' meaning)" ("Transcendence" 877). For example, for Marx,

[35] For an example from physics, in "The Origin of the Universe," Stephen Hawking writes, "we are the product of quantum fluctuations in the very early universe" and these fluctuations are what created "galaxies, stars, and all the other structure in the universe." The current universe, according to Hawking, is the exfoliation-in-time of the principle of quantum fluctuations.

the French Revolution of 1848-1851 is no longer just a revolution. Rather, it is one manifestation of the inevitable progress of history, as dictated by the logic of dialectical materialism.

For the Marxist, history is moved by dialectical materialism where the Christian theologian may see it happen according to God's will. For Marx, dialectical materialism is both the moving force and the foundation for society in a similar way to how God is seen by the Christian as both the foundation for and the motivating factor for all creatures.[36] Burke claims that such god-terms can be found in all fully developed texts, and that, "whether we believe in God or not, it remains a linguistic fact that writers [sic] terms of highest generalization might technically be called their 'god-terms'" ("Notes on "Nature"). He makes a similar claim in *Rhetoric of Religion*: "As for a unitary concept of God, its linguistic analogue is to be found in the nature of any name or title, which sums up a manifold of particulars under a single head. . . . Any such summarizing word is functionally a 'god-term'" (2-3).

The god-term features prominently in both dramatic catharsis and dialectical transcendence. Burke writes that "a catharsis purely internal to a poetic medium as such takes place when the cycle of a work's inner consistency is revealed or finished" (*Language* 161). He distinguishes between internal catharsis and dramatic catharsis. Internal catharsis can be achieved by either dialectical transcendence (a catharsis of abstraction or structuring) or dramatic catharsis. Dramatic catharsis is achieved by having the god-term (the generating principle) bring the drama to its ultimate conclusion, as when Othello smothers Desdemona and thereafter kills himself (jealousy taken to its uttermost conclusion). Dialectical transcendence, on the other hand, is achieved when the god-term is discovered by a process of abstraction, and one sees the

[36] See Karl Marx's *The Eighteenth Brumaire of Louis Bonaparte*. Of course, there are many Christians and Marxists whose perspectives differ from these.

original position from this new perspective. As Burke writes, "Instead of being merely scattered, the problematical element has become 'structured,' seen as part of a comprehensive context; thus, while still there, it is 'with a difference,' and that difference makes all the difference" (70-1). In this case, catharsis is achieved by finding the unitary principle or god-term. Dialectical transcendence is therefore more dependent upon a structured hierarchy of terms than dramatic catharsis is.

These are the features of the logic of form that critics try to find when they index a text. I will now go on to give a brief overview of how scholars have used the method and then present my argument for how they could use the method more effectively.

Indexing in Secondary Scholarship

As I have argued previously in "Indexing: Kenneth Burke's Method for Textual Analysis," there is some disagreement among Burke scholars as to exactly what his method is and how it works. The text that has had the greatest influence in defining indexing is Carol A. Berthold's 1976 article, "Kenneth Burke's Cluster-Agon Method: Its Development and an Application."[37] She explains how critics can find equations and key terms in a text to use as the basis for a rhetorical analysis, illustrating her method by analyzing President John F. Kennedy's speeches. However, she does not cover verbal hierarchies and only briefly refers to god-terms, using Richard Weaver's "Ultimate Terms in Contemporary Rhetoric" as her primary source. Berthold's article became the acknowledged source for interpreting what Kenneth Burke really

[37] In 1977, Laura Crowell published an indexing analysis of Kenneth Burke's work in *Quarterly Journal of Speech* titled "Three Sheers for Kenneth Burke," but this article does not seem to have become as influential in defining the method.

meant by “indexing” and how to apply the method to a text.[38] Her article caused an increase of publications using indexing (which was now being referred to as cluster criticism) in communication journals, with nine articles published between 1977 and 1994 where everything from eating disorder therapies to National Park Service publications to Burke himself was indexed (Crowell 1977; Mechling and Mechling 1983; Corcoran 1983; Foss 1984; Peterson 1988; Reid 1990; Marston and Rockwell 1991; Cooks and Descutner 1993; Lee and Campbell 1994).

Of these, the articles by Mechling and Mechling and later Peterson become the new standard in later indexing studies, though Berthold remains the most cited in books about rhetorical criticism.[39] Subsequent articles tend to truncate the method even further and exclude any analysis of god-terms. Heinz and Lee (1998) do not even discuss concepts such as god-terms or hierarchies of terms. Rather, they see the uncovering of associational clusters as an end in itself.[40] Brief mention is made of how these clusters can uncover an individual rhetor's worldview, but there is no discussion of how charting a hierarchy of terms can help with that task. They spend most of the methodological discussion on describing equations. Hierarchies and god-terms seem to have been abandoned altogether.

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[38] In a 2013 email, Clarke Rountree, the President of the Kenneth Burke Society, recommended Berthold as the authoritative text on indexing. Berthold’s explanation is also mirrored and cited in major books on rhetorical criticism, such as *Modern Rhetorical Criticism,* by Roderick P. Hart and Suzanne Daughton, and *Rhetorical Criticism: Exploration and Practice* by Sonja K. Foss.

[39] For example, in "Getting Down to the Meat: The Symbolic Construction of Meat Consumption," published in 1998, Bettina Heinz and Ronald Lee do not refer to Berthold, but rather write that their method "is similar to that used by Mechling and Mechling (1983), who examined three books on sugar, and Peterson (1988), who analyzed trail guides, news releases, and leaflets related to the Grand Teton National Park" (98).

[40] "By uncovering associational clusters, critics can reveal the predominance of certain cultural values. Values indicate a society's understanding of particular objects or sentiments as desirable or necessary. Like Burke, the critic asks what kinds of acts go with specific cultural values" (89).

Berthold successfully spread the indexing method to a generation of scholars, but her explanation of the method also caused some of the original features of Kenneth Burke's method to be lost. As I understand it, Kenneth Burke describes his method as a three-step process: Finding key terms and their equations, then finding the levels of generalization within those clusters, and then finding the god-term that binds the whole structure together with a common meaning (*PLF* 69-70). Berthold performs a real service to the field by identifying criteria for key terms and equations as well as how to use them in an analysis, but she leaves out the step of "finding levels of generalization" and basically seeks a god-term based on its "strength" within a cluster as defined by its frequency and relative importance (Berthold 303, 305). For Burke, this step of finding higher levels of generalization and synthesis (dialectical transcendence) is an essential feature of indexing (*Language* 369-70). Burke describes a god-term as the term that stands at the top of a hierarchy of terms as both its pinnacle and foundation (*Language* 370), and without the hierarchy of terms, which this step of analysis produces, it is really impossible to find a vocabulary's god-term. Berthold gets around this by using Richard Weaver's definition of a god-term, thereby making a version of indexing that differs significantly from what Kenneth Burke envisioned (Berthold 303).[41]

Recently, Jessica Enoch and David Blakesley have reintroduced hierarchies of terms as related to or a part of indexing but have not given clear guidelines as to how to perform this part of the analysis. Maybe for this reason, their comments on the method have not led to revisions of

[41] Weaver made a system built of God-terms, good terms, and devil terms, whereas Kenneth Burke defined the god-term as the term on the top of a hierarchy of terms and it operated as both the foundation in the hierarchy and motivation for the movement upwards within the hierarchy. Weaver's definition leaves out the hierarchical aspects of the god-term.

how cluster-criticism is described in major books on rhetorical criticism.[42] Berthold's version of indexing remains the go-to guide for rhetorical critics.

Indexing as a Methodology

In my master's thesis, *Indexing and Dialectical Transcendence: Kenneth Burke's Critical Method*, and later multimedia project, "Indexing: Kenneth Burke's Method of Textual Analysis," I have tried to reintegrate *finding hierarchies of terms* into indexing. The archival evidence and oral testimonies from Kenneth Burke's students (some of them described in my thesis) clearly demonstrate Burke intended the method to be used this way (20-1). In the following section, I will give a brief overview of the method based on my previous research and some significant discoveries I have made while working on this dissertation. In addition to some further details about what an equation is and how hierarchies of terms may be organized, I have included some important observations from Burke about how genre influences the approach one should take to index a text.

[42] Blakesley describes the method in much the same terms as Berthold, but then goes on to say that students should see how (within the clusters) they could see a connection to some ultimate order, and if (within the clusters) they can find a term that works as the motivational foundation for the rest of the structure.

Enoch writes that "dramatistic analysis," which is not exactly the same as the pentad but rather describes a general approach or attitude to language, starts with the tracking of what goes with what and what follows what, but "by making these kinds of assessments, students, it seems, would also be led to discover the 'ultimate order of terms' in the text" (283). She claims that there is a direct connection between indexing and dialectical transcendence. Through charting, students would see how each key term in a text reinforces an overall argument, a "guiding idea," or "unitary principle" for the entire literary piece (187). She claims Burke's charting teaches one to see how a key term in a text reinforces the others (or in Burke's words "is arranged hierarchically") to create a kind of textual unity as all the terms "work together" as "successive positions or moments in a single process" (187). She does not explain exactly how this kind of discovery is achieved, but she writes that contemplation and charting of hierarchy can and should be an outcome and one purpose of the method of indexing.

First, a word about how objective this method is. In "Fact, Inference, and Proof in the Analysis of Literary Symbolism," in which Burke indexes *Portrait of the Artist as a Young Man* by James Joyce to explain the method, he refers to different levels of certainty one can expect from different parts of the indexing method. "The hope," he writes, "is to make the analysis of literary symbolism as systematic as possible, while allowing for an experimental range required by the subtle and complex nature of the subject matter" (49). He treats the individual words of the text as its basic "facts" and seeks to show how one can use these facts for "keeping one's inferences under control," yet go "beyond them, for purposes of inference, when seeking to characterize the motives and 'salient traits' of the work" (49-50).

Facts, Burke explains, are "what was said or done, interpreted in the strictest possible sense" (50). Inferences are the "interpretations" critics make based on the facts. These are not as objective and one must "repeatedly repair" to the underlying structure of "factuality" in order to keep oneself from simply reading one's own preferences into the text (51).[43] Proof, as Burke uses it here, seems to be a requirement for critics to write a section to justify their selection of key terms and their analysis based on the index. Burke describes proof as follows: "While grounding itself in reference to the textual 'facts,' it [the proof] must seek to make clear all elements of inference or interpretation it adds to these facts; and it must offer a rationale for its selections and interpretations" (51). Critics should define clearly (1) what the textual facts are, (2) what elements of inference or interpretation they have added to these, and (3) the criteria used to choose which facts to work from and the interpretations they have made. Ideally, critics

[43] For example, Burke calls it a fact that the last words in the book are "Dublin 1904/Trieste 1914," but it would be an inference to say that these words show "a duality of scene" since the words and dates could both mean "Dublin versus Trieste" and "Dublin equals Trieste," and "duality of scene" makes us think in terms of "opposition rather than apposition" (51).

"might even begin from different orders of 'facts' [using different key terms], and show how they led in the end to the same interpretation" (51). William H. Rueckert summarizes the method thus:

> You first make an index of the key terms in a text and then as you go back through the text you fill out the entries in the index. Each filled-out entry is going to give you a cluster of wide-ranging identifications based on purely internal, empirically verifiable evidence. . . . Indexing is a technique for isolating the salient *terminological* facts in a text, *inferring* a symbolic meaning for the facts assembled under any term or related term in the index. Then, after further analysis of at least the terminological identifications, agons, progressions, and transformations in the text, and after having accumulated a huge amount of empirical evidence, you are able to offer *proof* for your reading of the signs. (*Unending* 109)

As for whether every critic will get the same results when indexing a text, Burke writes that one might get "different results" depending on what set of facts or key terms one "worked from. But in either case, the existence of such 'facts' is literally verifiable" ("Fact" 50). The inferences can be questioned, though they should have strong factual support, but the basic equations and key terms are still facts. So a second critic, or the same critic approaching the text a second time, may discover *different* facts, but the same facts initially encountered by the first critic will still be there to see. Thus, the *facts* are objective and replicable, *inferences* can be disputed though they should be grounded in the textual facts, and *proof* is the justification for the inferences made and for the selection of facts.

In order to make this description more user-friendly, I have chosen to divide Burke's three-step process into four steps: key terms, equations, verbal hierarchies, and god-terms. The first two steps are often blended into one step, since finding equations can help critics track down key terms and finding key terms helps them see more equations, but I distinguish the two here to give a more detailed description of Burke's method.

Key Terms

Key terms are, as described earlier, the gathering point for clusters of equations. As such, critics can identify key terms conclusively only *after* they have indexed the text. In *Kenneth Burke and the Drama of Human Relations*, Rueckert writes, "the only way in which one can ever find out what a key term and a set of interrelated key terms (a completed symbolic structure) really means is to index the work so that one can find out how the private grammar the author creates deviates from the public grammar all authors use" (190). Burke often noted tentative key terms that he ended up discarding later, or from which he wasn't able to tell much.[44] For example, he writes about one potential key term, "Frankly, we don't know what this adds up to" (*Language* 158).

Still, Burke claimed one could look for potential key terms in a text to save time since this could help to focus one's search for equations: "If we are to begin with a 'factual' index, what do we feature. . . . We must find some principle of selection, since some terms are more likely than others to yield good hermeneutic results" ("Fact" 54). This is the selection of facts he

[44] He describes one attempt as follows: "In any event, it seems to me a good 'hunch,' worth putting down for possible testing in the light of subsequent developments, and when 'all returns are in' as to the work's equational structure," one will see if they qualify as such (*Philosophy* 79-80).

mentioned, which critics must justify in the proof. Burke writes that key terms often are marked by the frequency and intensity of their usage and that they can often be found in prominent positions in a text: the beginning, the conclusion, and/or the climax, as well as what he calls "critical points" within the text: "There are often 'watershed moments,' changes of slope, where some new quality enters" ("Facts" 78).[45] Main characters or influential concepts are other likely key terms.[46] He uses some of the same justifications when he chooses key terms to index a text. For example, he writes of what he deems to be a key term, "the term has turned up at many strategic moments in the text" (*Language* 148).[47]

Critics may also choose specific key terms they would like to study, based on research interests relating to the text. Burke writes to one of his students, "Because of my concerns with the hidden rhetoric whereby economic motives are treated roundabout in esthetic, philosophic, and sometimes even scientific works that on their face are not concerned with such matters, I watch for entries that show how the terms are aligned with the 'civic'" (Response to Allegra Fuller 3). Burke sees no problem with doing that, as long as critics state which key terms they

[45] He gives a random list of focus areas that "seem more likely than others to keep critical observation centrally directed," including "all striking terms for acts, attitudes, ideas, images, relationships," "oppositions," "beginnings and endings of sections and subsections," "characteristics defining transitional moments," "breaks," "names, indicative of essence," "incidental properties of one character that are present in another," "internal forms," "points of farthest internality," and "moments at which the work comes to fruition" ("Facts" 63-6).
[46] Some other hints from Burke: "Here we also might include terms for order, since the pyramidal nature of order brings us close to relations of 'superiority' and 'inferiority,' with the many kinds of tension 'natural' to social inequality. Such observations lead us in turn to watch for the particular devices whereby the given work 'states a policy' with regard to a society's typical 'problems.' Here we seek hints for characterizing the works as a strategy" ("Facts" 73).
[47] Key terms are the kind of terms I often find when I generate a Wordle cloud from a text (displaying frequency of usage) or which are listed as keywords for Google searches under a blog post or article (displaying prominence of meaning). In the example I use later in the text, Truman's speech, the "atomic bomb" is both a dominant theme of the text and a word that is used often, so it is relatively safe to assume that "atomic bomb" will be a key term.

take as a point of departure. The assumption seems to be that a bad choice will quite soon prove itself worthless by following the method. One of Burke's students chose to index Ralph Waldo Emerson's "Nature" by following "an emphasis on the 'sight-sense' perception of man concerning nature" (Response to Isabel Cohen 1), and another chose to index *Mrs. Dalloway* with a focus on the spectrum of light and dark (Response to Lynd Fletcher 1).[48] Yet Burke usually required that his students also index the work as a whole, characterizing the text "in its own terms and in its own proportion," and then continue to the specific element they were particularly concerned with (Response to Isabel Cohen 1).

Equations

Critics then find equations by finding the different places in the text where these key terms appear and noting how they occur together with other words. Burke writes that indexing is essentially what all readers do when they try to orient themselves in a text (*Language* 369). In a simplistic action story, for instance, readers quickly sort "the villain" from "the hero" and "those which may be on either side," and mentally do something like this: person z = hero, person x = enemy, etc. In the same way, one quickly sees in a politician's speech what values terms like *liberty*, *compassion*, *national security*, etc. are endowed with based on how these occur together with other words in a speech. Burke writes that what he means by equations can be similar to what social scientists call values, what Aristotle called topics, or what Freud called associations (*Philosophy* viii-ix), but his concept of equations seems to encompass more since co-occurrence seems to be the only essential criterion. These equations then accumulate to what Burke terms

[48] Showing how to use one key term to find others, Burke wrote to Isabel Cohen, "You quote reference [sic] to 'transparent eyeball' . . . you might thereby have a cue suggesting that you watch 'transparent' as a member of the sight group, in this work" (Response to Isabel Cohen 1).

"clusters" of equations.[49] He gives many examples of these in his own work. For example, Burke claims he finds the following cluster in Hitler's *Mein Kampf*:

> In sum, Hitler's inner voice, equals leader-people identification, equals unity, equals Reich, equals the mecca of Munich, equals plow, equals sword, equals work, equals war, equals army as midrib, equals responsibility (the personal responsibility of the absolute ruler), equals sacrifice, equals the theory of "German democracy" (the free popular choice of the leader, who then accepts the responsibility, and demands absolute obedience in exchange for his sacrifice), equals love (with the masses as feminine), equals idealism, equals obedience to nature, equals race, nation. (*Philosophy* 207)

These equations clearly do not all occur together all the time, and Burke does not clarify which of his statements are facts and which are inferences. If we look at what Burke is doing here, we see that the limits for equations often go beyond the word itself to repetitions of a common theme or purpose, the "emotional connective" as he calls it in *Counter-Statement*. He admits as much in "Fact, Inference and Proof": "The very rigors of our stress upon 'terminal factuality' as the ideal beginning quickly force us to become aware of this step from particulars to generalizings (a step the exact nature of which is often concealed beneath terms like 'symbol' and 'analogy')" (58-9). He admits that sometimes key words are not repeated literally very often, and in some genres it may even be a convention that they should not be repeated. Even in the text he is analyzing as an example, "we confront a notable place where we would obviously accept suicidal restrictions if we refused to take the generalizing or idealizing step from particulars to

[49] Burke writes that = (equals) means the same as "in the same cluster with" (*Philosophy* 75).

principles (or, in this case, from particular words to the more general *themes* or *topics* that these words signify)" (59).

It seems clear here that more words than the actual term itself could be used to find equations for that term. In Joyce's text, Burke allows himself to tentatively note variations of the artist's baby name ("baby tuckoo") as equations, such as "tucking the end of the nightshirt," "little feet tucked up," "a leather portfolio tucked under his armpit," and maybe even "Tusker Boyle" (54-5). He also allows "radiations" of the term or act. Rueckert claims what Burke means by "radiations" seems to be terms that "spin from" or are in a "range of" the original term (*Unending* 108). For example, Burke lists the different events in Joyce's text where hands are specifically focused on as radiations of "hand": the priest paddling his hands, the artist later in life withdrawing his hand from a priest (showing he will not choose the religious vocation), with the contrast between the pain of the first experience and the painlessness of the second one (59). One of Burke's students, Ruth Liebling Goldstone, indexed *Mrs. Dalloway* and marked words like *dull*, *sharp*, *scraped*, *cut*, and *slice* as radiations of *knife*.

In addition to variations and radiations of a term, Burke also allows going from "'factual' word to a theme or topic that would include *synonyms* of this word," including "'operational synonyms,' words which are synonyms in this particular text though they would not be so listed in the dictionary" ("Fact" 60). He compares this to how, in short texts like lyrics, "one spontaneously looks for what the old rhetoric called 'amplification,' some theme or topic that is restated in many ways, no single one of which could be taken as a sufficient summing up" ("Fact" 61). This seems to be what is going on in his analysis of *Mein Kampf*. The cluster of Hitlerism consists of individual terms that express or are part of the same theme or topic in different ways.

So what is the relationship between the words in an equation? In his analysis of a poem by Coleridge, Burke notes that "sun (in one place) = parental duty (in another place) = religion (in another)" (75). The sign = here means equals, i.e., that they are in the same cluster. This does not mean that they are completely equal. As I will later show in hierarchy of terms, terms that are in the same cluster often belong to different levels of a hierarchy, so what does "equals" really mean? Burke explains that the relationship is that of a synecdoche. Synecdoche is "the basic process of representation, as approached from the standpoint of 'equations' and 'what goes with what.' To say that one can substitute part for whole, whole for part, container for the thing contained, thing contained for the container, cause for effect, or effect for cause, is simply to say that both members of these pairs belong in the same associational cluster" (*Philosophy* 77). He illustrates this with the example of how "the beloved's house may represent the beloved" (*Philosophy* 78). In Joyce's text, Burke sees the "aesthetic revelation" of the bird-girl as a key term and looks for equations that may stand in a synecdochic relationship with "bird-girl":

> Basically, though, you have seen the bird-girl, who is to stand for motives far beyond her nature as sheer image. So, *at the very least*, with this obvious fulfillment to guide you, you would put in your index the first implicit announcements of the bird theme, on p [sic]2: "the eagles will come and pull out his eyes"; "the greasy leather orb flew like a heavy bird through the grey light.". . . You would note them because of the fact that they are classed among things to do with birdness, a category experimentally broad enough to include Stephen's roommate Heron, the final reference to "old father, old artificer," the vision of the "hawklike man," and the augury of the birds circling "from left to right," their

> emblematic nature defined by questionable disjunction as "symbol of departure or loneliness." ("Fact" 70)

Here Burke starts with the bird-girl as a clue that the bird-theme may have a specific symbolic meaning for the author. He then tracks this theme throughout the text, finding other connected characters and images that stand in a synecdochic relationship to the bird-girl "revelation."

In Burke's analyses of texts, he uses these same principles to justify his reading. In his analysis of *Faust*, he uses textual facts to prove equations: "With this reference to striving we have not only a *theme* but more specifically a *term* that we can trace in zigzags throughout the entire work. *We have explicit authority in the text for connecting it with both 'the Lord' and the 'spirit of negation, or contradiction'*" (*Language* 141, emphasis added).[50] In his analysis of *Mein Kampf*, he describes the clusters he found: "we note how two sets of equations were built up, with Hitler combining or coalescing *ideas* the way a poet combines or coalesces images. . . . On the one side, were the ideas, or images, of disunity. . . . This was offered as the antithesis of German nationality, which was presented in the curative imagery of unity" (206).

In addition to looking for such equations, Burke also wants critics to look for progressions (what leads to what). These progressions may be dialectical or chart a narrative sequence. At this stage, one simply keeps a lookout for these and remarks them. Burke also referred to these as equations (since one can substitute cause for effect, etc. in synedoches) but

[50] He reminds readers and his students repeatedly that finding equations is an empirical work: "To know what 'shoe, or house, or bridge' means, you don't begin with a 'symbolist dictionary' already written in advance. You must, by inductive inspection of a given work, discover the particular contexts in which the shoe, house, or bridge occurs. You cannot, in advance, know in what equational structure it will have membership" (89 *Philosophy*). He mentions the same to his students and corrects several of them that seem to want to put their own prejudices into the text rather than letting the text have its say: "Let him have his say, to the best of your ability. Then proceed to your Howevers" (Response to Nancy Lee Barton 2).

suggested that maybe they should be marked by an arrow instead of an equals sign (*Philosophy* 75). The progressions that chart a narrative will most likely lead to dramatic catharsis, whereas dialectical progressions will most likely lead to dialectical transcendence. Burke mentions an example of both narrative and dialectical progression in *Ethan Brand*:

> In any case, we note that the tossing-into-the-furnace is related to the *ideal*, as regards both "the IDEA," and "dark thoughts," and the typical idealist merger, since this "kiln" had "melted" the many thoughts "into the one thought that took possession of his life." Later it will be called the "Master Sin." In any case, the author's own *explicit acknowledgement* that we here have to do with some unitary essence pervading a multiplicity of details *gives us further authority to look for such*. ("*Ethan*" 79-80, emphasis added)

This is a narrative progression that follows a dialectical progression in Ethan Brand's thoughts. He goes from many thoughts (which are psychologically melted together in the kiln) and on to the Master Sin. This is both the development of his thoughts and general direction of the plot. These observations lead critics to the next step of finding hierarchies of terms.

Hierarchies of Terms

At this point in the analysis, the approach critics take to a text will depend on the genre of the text. Burke clearly states that each kind of text will have a different form of internal catharsis: "In sum, a catharsis purely internal to a poetic medium as such takes place when the cycle of a work's inner consistency is revealed or finished. Such emergence and completion being got in terms suited to the specific natures of the various literary genres, they will differ in accordance with the genres" (161 *Language*). To a certain extent, then, critics have to let the text "teach"

them how it structures the world in narrative and/or hierarchy to achieve catharsis. Burke writes that the hierarchical motive (the need of texts to move towards the "'necessity' of ideal consistency" by creating hierarchies of terms and god-terms) is "discernible in even tiny, 'playful,' 'nonpolitical' forms, once we have the rules for 'anticipating' the transformations proper to the various artistic species" (161 *Language*). Though Burke views all human action as variations of or derived from the *ritual drama* with the purpose of internal catharsis (*Philosophy* 103), each genre enacts this drama and achieves catharsis in a slightly different way.[51] For example, "An essayistic treatise of scientific cast," Burke notes, "would be viewed as a kind of Hamletic soliloquy, its rhythm slowed down to a snail's pace, or perhaps to an irregular jog, and the dramatic situation of which it is a part usually being left unmentioned" (103).

These genre differences also influence how and to what extent critics should search for hierarchies of terms. As stated previously, some texts will achieve internal catharsis primarily through dramatic catharsis; others will achieve internal catharsis primarily through dialectical transcendence. The former will require less of a developed hierarchy and will use narrative progression to a greater extent than the latter.[52] Burke mentions *Othello* as an example of

[51] Burke laments to one student, "Unfortunately, since you did not do the Joyce index, you cannot wholly get the similarity and the differences btw. the indexing of a novel and the indexing of a philosophical essay" (Response to Allegra Fuller 1).

[52] The most thorough study Burke conducted of dramatic catharsis is outlined in "Cycle of Terms Implicit in the Idea of 'Order'" (*Religion* 184). He shows clearly how the terms implicit in the idea of order logically imply each other. This kind of cyclical structure can then be turned into a narrative: "Whereas, the terms of Order, considered tautologically, go round and round like the wheel seen by Ezekiel, endlessly implicating one another, when their functions are embodied in narrative style the cycle can be translated into terms of an irreversible linear progression" (*Religion* 217).

dramatic catharsis ("Othello" 148) and James Joyce's early work as examples of dialectical transcendence.[53]

Burke made similar assessments about genre when he approached texts. For example, when analyzing "Nature" by Emerson, he writes, "Since Emersonian 'transcendentalism' was quite accurately named, I shall discuss the work from its standpoint of 'transcendence'" (*Language* 186).[54] Yet he also let the text surprise him and "have its own say." He started indexing George Orwell's *1984* with the expectation (from reviews) that he was analyzing a political satire. "And I began making my index accordingly. Or rather, was prepared to do so. But the very first pages seemed to contain a motive not at all explainable in such terms - and by the third chapter, I began to see this outlaw motive (motive alien to the political theme) began to show up mightily. Or at least, so it seemed to me" (Letter to J.S. Watson, May 31, 1950).

Still, though the form it takes may differ, all texts contain dialectical transcendence.[55] Texts may be organized dialectically according to different principles, and therefore the structure of the resulting hierarchy of terms can vary. The classic example for Burke seems to be the

[53] He writes that in contrast to tragedy, some of Joyce's early pieces involve "a kind of Platonist transcendence whereby a 'symbolic' motive is discerned in purely material things or situations" (*Language* 161).

[54] Another example from when he introduces his analysis of *Quartets* by T.S. Elliot: "In sum, we feel that, to approach the *Quartets* in terms of symbolic action, we should first ask ourselves what primary dialectical resources there are here, for exploitation, For, so far as verbal method is concerned, it is apparently the pyramid of dialectical mounting (the resources of Heraclitus) that this poet relies upon mainly, as the means that can endow the earlier down-turning images with new motives, by placing them in the upward-turning configuration that dialectical reduction readily makes possible. There are the terms for change and the terms for the universal, the unchanging; and the agent's mind or consciousness can be the term that mediates between the two orders—and thereby the poet can take us from a down-turning proposition to an up-turning one" (*Rhetoric* 323-4).

[55] "The dialectical principles of merger and division are clearly apparent in any systems of classification, be they the formal and explicit classifications of the sciences or the classificatory structure implicit in the 'equations' of a poem" (*Grammar* 417).

pyramid form, but, as I will show later, he saw other patterns as more appropriate for some texts.[56] The general structure will usually be defined by a movement upwards and/or inwards, usually with a decreasing amount of terms at each step. Burke saw this as a basic feature of language: "Of all the issues that keep recurring in the maneuvers of dialectic, surely none is more frequent than the theme of the One and the Many. As I have said, to me it is grounded in the logological fact that terms for particulars can be classified under some one titular head" (*Language* 196).

Burke writes little about dialectical transcendence before *A Grammar of Motives*, though one can see the beginnings of the method in his discussions of "graded series" of terms (*Philosophy* 97) and of how "Aryan 'heroism' and 'sacrifice' vs. Jewish 'cunning' and 'arrogance'" work as "keystones" in different equational clusters in Hitler's *Mein Kampf* (208).[57] Later, he typically refers to these as titles or summarizing terms in a hierarchy of terms (*Grammar* 351; *Rhetoric* 187).[58] Thus in *A Rhetoric of Motives*, he characterizes three levels usually found in hierarchies of terms, with "positive terms" referring to specific objects, persons, etc.; "dialectical terms" referring to concepts, principles, ideas, ideologies, symbols, etc.; and "ultimate terms" that provide positive and dialectical terms with "a guiding idea" or "unitary principle," a principle of principles, so to speak (183-7). Burke further clarifies details about

[56] He mentions the pyramid form in *A Rhetoric of Motives* p. 311 and p. 323, *Essays Toward A Symbolic of Motives* p. 73., and "Rhetoric – Old and New" p. 203-4. He also claims order has a "pyramidal nature" ("Fact" 66).

[57] Graded series are first discussed and illustrated in *Permanence and Change*.

[58] He arranges this series of terms in a book by a Mr. Parkes according to the principles of concrete/abstract and pragmatism/idealism, with freedom as the god-term (most abstract and ideal, widest circumference), moving down to humanism (more concrete and pragmatic, narrower circumference), and then *laissez-faire* (even more concrete and pragmatic, even narrower circumference). From there it descends to price system, industrialism, and finally capitalism (*Grammar* 351-2).

dialectical transcendence in *Language as Symbolic Action* and *Rhetoric of Religion*, and he summarizes how dialectical transcendence purifies a text in *Poetics, Dramatistically Considered*:

> Dialectical transcendence involves devices whereby a problematical term can be progressively redefined, until it has become transformed to the point where its problematical meaning has been surpassed, and what first looked *like* A can now be interpreted as non-A. When all the steps of transformation are present, the design is as follows: At the beginning there is a kind of dispersion, scatteredness, conflict among the terms; then the terms (which begin in the realm of mere opinion, imagery, appearance) are subjected to progressive ideological criticism by the give-and-take of controversy; this is an "Upward Way" moving towards some "higher" principle of unity; once this principle is found, a whole ladder of steps is seen to descend from it; thus, reversing his direction, the dialectician can next take a "Downward Way" that brings *him* back into the realm of dispersal, or diaspora, where he began; but on reentering, he brings with him the unitary principle he has discovered en route, and the hierarchical design he saw implicit in that principle; accordingly, applying the new mode of interpretation to his original problem, he now has the problem "placed" in terms of the transcendent, unitary, hierarchizing principle—and thus, instead of being merely scattered, the problematical element has become "structured," seen as part of a comprehensive context; thus, while still there, it is "with a difference," and that difference makes all the difference. ("Watchful" 70-1)[59]

[59] Burke provides the following example of the Upward Way: "The Upward Way is contrived by a process of progressive abstraction and generalization, until the highest order of such development is reached—and this ultimate step will provide the necessary principle of

To find hierarchies of terms, critics begin with the clusters of key terms and equations, and then consider how the terms in a cluster relate to each other in terms of means/end, abstraction/concretization, general/specific, etc. with the ends, abstractions, and general terms usually placed at higher levels in the hierarchy than the means, concretizations, and specific terms. For example, in Burke's analysis of *Mein Kampf*, plow and sword serve as concrete instruments of work and war, making work and war the higher terms in the hierarchy.[60] Sometimes the text itself will clearly establish one term as "socially superior" and another as "socially inferior," or as belonging to lower or higher categories ("LAPE" 271). Seeing how the author of a text has chosen to organize reality into different categories or titles makes the "ideology" of a text evident.[61]

One may not find these hierarchies fully developed in all texts, but Burke maintains that *fragments* of hierarchies are present in every text. In "Rhetoric – Old and New," he claims that "we are continually encountering fragmentary variants of them" (204), noting that "the same principle is involved (there are tiny 'transcendences') every time an author, no matter how

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unification, to be used on the way back. The 'process of progressive abstraction and generalization' is along lines like this:

(1) Beginning with such words for individual physical things as 'table,' 'chair,' 'desk,' we might group all such classes under the headings of 'furniture';
(2) grouping furniture with such words as automobiles, plows, ammunition, we might class all these under the heading of 'manufactured objects';
(3) manufactured objects in turn could be grouped with the output of mines, farms, lumber companies as 'commodities';
(4) commodities could be grouped with animals, elements, people, under the head of 'entities' or 'beings';
(5) beyond all entities or beings there could be in turn a term for 'being' in general" ("Watchful" 72).

[60] A complete hierarchy made from this cluster is described and visually represented on page 26 in my master's thesis, *Indexing and Dialectical Transcendence: Kenneth Burke's Critical Method.*

[61] In "Fact, Inference, and Proof in the Analysis of Literary Symbolism," Burke refers to this step as "essentializing by entitlement" (61).

empirical his claims, mounts to a 'higher' level of generalization and in effect asks that 'lower' levels of generalization be interpreted in its terms" (*Language* 191). Critics look for the general term that can work as a title or summary for other words in the cluster, similar to how a topic sentence is able to state the main point of a paragraph. Sometimes Burke calls this exercise "entitling" and describes the process of identifying hierarchies as follows:

> Your entitlings [choice of categories] would not necessarily agree with any that the author himself may have given, since titles are often assigned for fortuitous reasons.[62] And, of course, other readers might not agree with your proposed entitlings. But the point is this: Insofar as the work is properly formed, and insofar as your titles are accurate, they mark off a succession of essences. Each title would sum up the overall trend or spirit informing or infusing the range of details that are included under this head. (*Language* 370)

So Burke is saying that people may disagree with critics' entitlings, but that it is still possible to have titles that are "accurate" and therefore, presumably, also possible to have titles that are inaccurate. How can one say that some titles are accurate if critics can come to different conclusions about which ones are correct?

Part of the answer lies in one of Burke's claims about how texts appeal and persuade. In "Glimpses into a Labyrinth of Interwoven Motives," he writes about an author's choice of words: "In selecting names, epithets, backgrounds etc. for his characters, all he need ask is whether they 'sound right' or 'feel right' to him. And if he is sensitive and exacting enough, his

[62] Burke writes, "One must be wary of titles, however. For often they were assigned or altered to meet real or imagined conditions of the market; and sometimes a work may be given a title purely for its sales value as a title, which was invented without reference to the work so entitled" ("Fact" 54).

choices will naturally embody principles of internal consistency" (85). This internal consistency is necessary because the principles of literary form require this of any author.[63] As mentioned, Burke defines form in literature as the arousing and fulfilling of expectations, desires, or appetites (*Counter-Statement*), and once an author has aroused these expectations, they in turn "amount to *demands* placed upon the playwright, who violates them at his peril" ("Watchful" 50). In other words, the author needs to be consistent to be persuasive and to give the work aesthetic appeal, and this consistency requires a structure in the text that is both lateral and hierarchical. Discussing how each author creates this world of internal consistency, Burke writes:

> We believe that all writers have idiosyncratic usages of this sort, their works having a greater *poetic* consistency than is *rhetorically* apparent. Indeed, we incline to suspect that all good works have "consistency to spare," so far as purely rhetorical reception is concerned, at least when one is asked about the possible rhetorical appeal of some particular internal relationship that was not noted until lengthy critical analysis had disclosed it. But only through an "excess" of such consistency (we suspect) can a work hope to have "consistency enough" for the job of wholly establishing the desired attitude in the reader. ("Fact" 61)

So all texts work by consistency, and good texts have an "excess" of consistency. That is why any critic who finds "accurate titles" for a text that is "properly formed" will see that they "mark off a succession of essences" because any work that is properly formed, with internal consistency, will necessary be organized hierarchically under titles that mark off a succession of essences until it reaches the "god-term" at the top.

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[63] Burke describes this taste or sense for literary form as a mixture of innate cognitive abilities and trained patterns of thought, and the concept therefore also applies to collaboratively written works, movement manifestos, etc.

How to make sure that one's titles are accurate is another question. In general, as stated, one moves from the more concrete to the more abstract, although the text may also give some clues by clearly designating certain terms as antecedent, better, or higher than other terms. However, in some texts concrete objects (which would at first seem to be the less abstract) can take on mythic and symbolic qualities, such as in Clifford Odets's *Golden Boy* where, Burke argues, the violin stands for an aesthetic motivation that directs many other actions:

> At the point where we have gone from sensory images to ideas that transcend the sensory image, we might next go beyond such ideas in turn by introducing a "mythic" image. . . . Such use of "myth" as a step in a dialectic may carry the development across a motivational gulf by providing a new ground of assertion at some crucial point where a further advance is not attainable through strictly logical argument. ("Watchful" 72)

We get some clues and examples of how to find hierarchies of terms in Burke's feedback to his students. Burke sometimes tried to teach his students about dialectical transcendence by having them index Ralph Waldo Emerson's "Nature," and he thereafter published his own analysis of the essay. He told his students to approach the essay "considered as a series of dialectical maneuvers" (Response to Lynd Fletcher 2), and one student received the following rebuke: "You seem to have forgot a major rule of thumb, for making a working index of this particular sort: You did not keep dwelling on the steps, did not keep trying to tick these off by stressing the from-what, through-what, to-what. And though on occasion you noted dialectical tactics, you were less thorough in this kind of observation than was to be desired" (Response to Gail Gardner 1). This shows the kind of mindset critics need to have and the kinds of development critics should pay attention to in order to find a hierarchy of terms.

In his own analysis, Burke first sizes up the essay and describes the dialectical moves Emerson makes in general terms, then goes on to show where the Upward Way ends and the Downward Way begins. He claims that "the dialectical operations in the Emerson essay are to be built around the traditional One-Many (unity-diversity) pair," with an ascent from particular to general, moving up to "'highly' generalized terms like 'entities' or 'beings'— whereupon all that is left is a further step to something like 'Pure Being,' or the One, or First, or Ultimate, or some such" (*Language* 190). He describes the transition between the Upward and Downward Way in his feedback to students: "Here, then, is our transition par excellence between the first part of the essay and the later part. First is on side of agency, looking across to purpose. Second part (after the Disciplinary bridge) is on side of purpose, looking back to agency" (Response to Gail Gardner 3).[64] Burke claims the essay organizes all means (agencies) in terms of purpose (ends), and the god-term of this hierarchy is "the sheer *principle* of purpose" (*Language* 197) or what Emerson calls "final cause of the world" (Response to Lynd Fletcher 1). I will discuss more clues for how to find hierarchies of terms in "Student Examples of Indexing."

God-terms

Burke defines god-terms as terms that stand at the top of these hierarchies of terms, similar to how God stands at the top of Christian theology and labor or dialectical materialism stands at the top of Communist ideology (*Language* 370). God-terms are both the motivating pinnacle and the logical grounds for the organization of the hierarchy.[65] By motivating pinnacle,

[64] In his analysis, he describes the same passage as follows: "Thus, when the chapter on 'Discipline' is over, we have gone from the realm of *means* to the realm of *ends*, or more specifically, one unitary end (or, if you will, the sheer *principle* of purpose)" (*Language* 197).
[65] To say that something is both the foundation and the pinnacle in this way may seem somewhat tautological, but as Burke writes, "one can get out of a vocabulary only what one has put into it"

Burke seems to be talking about the driving force that directs all movement upwards and/or inwards in the hierarchy of terms. All other terms in the hierarchy are defined in relation to the god-term: For example, righteous humans are closer to God than wicked humans are in most Christian theology, and God is both the foundation for existence and the goal of existence. As

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(*Religion* 128). In other words, the symbolic world of humans operates by tautologies. Viewing the god-term as both the foundation and motivating pinnacle for the hierarchy is an example of what Burke calls "the paradox of substance," in this case the paradox of dialectic substance. Substance is defined both as the essence of something and the foundation or what stands under and supports something. Thus, substance as a concept is both intrinsic and extrinsic, in the same way a god-term is both a foundation and an essence. Though this may seem like a contradiction, Burke claims it is a manifestation of a paradox in all symbol-using: "that we necessarily define a thing in terms of something else" (*Grammar* 33). We use words to describe places, although places are not words, and we use words to describe other words with different meanings. In symbol-using, everything rests on a foundation that is other than itself. He describes how this paradox manifests itself in the process of transcendence, which usually moves from particulars to the most abstract gathering term ("the ultimate abstract Oneness"): "The process of transcendence may, of course, be reversed. Then the ultimate abstract Oneness is taken as a source, a 'first'; and the steps leading up to it are interpreted as stages emanating from it" (*Grammar* 34-5).

In *Rhetoric of Religion*, Burke describes how a hierarchy of terms, with a god-term at the apex, is created, and this sheds some light on why Burke believed texts have god-terms and both why and how those terms function as the foundation and pinnacle of a hierarchy of terms. The "logic of internal consistency," Burke claims, "comes to head in a title of titles, or 'god-term'" (*Religion* 128). As written earlier, Burke believed that the human mind, or the instruments for communication are so constructed that they find meaning beyond the individual term, transcending it. An organizing principle is necessary for consistency, and consistency or order is something humans find aesthetically pleasing and persuasive. However, Burke claims, a terminology can only transcend itself by tautology (restating itself) or by non-sequitur (logical break). A non-sequitur will make the terminology inconsistent, whereas tautology can maintain consistency. In the latter case, "the term for the transcendent function must be there at the start, either explicitly or implicitly. Usually it is implicit, and is gradually purged of its obscurities" (*Religion* 128). Kenneth Burke uses the development of Hitler's ideology as an example of how a hierarchy of terms with a god-term can be developed. Burke claims that Hitler took his Catholic upbringing, German nationalist sympathies, and his anti-Semitism and sought for "conscious ways" of making his position "more 'efficient,' more thoroughly itself" ("Hitler's 'Battle'" 211). By doing this, Hitler could "spontaneously turn to a scapegoat mechanism, and he could, by conscious planning, perfect the symmetry of the solution towards which he had spontaneously turned" (211). The anti-Semitism was there before this conscious planning, but Hitler then proceeds to "discover" race as the true cause of all economic and social ills--the foundation and the driving force for everything that happens in the world (219).

Saint Anselm writes, it is in the vision or contemplation of God that intelligent nature finds its happiness or fulfillment (Anselm XVI).

A god-term is necessary to a logic of form because "if things do not come to a focus in a unitary principle of some sort, there is to that extent the problem of unresolved division" (*Language* 182). The god-term summarizes the central logic of forms by which the text operates. In *Faust*, Burke claims *striving* (streben) is the central motive of the play, and it also becomes the virtue by which Faust is redeemed. Striving for its own sake "is analogous to the theological notion that God is an Uncaused Cause to whom no motive for creating the world could be imputed" (*Language* 184). Faust's actions, and the musings and consequences of the play, simply play out the principle and "official moral" of striving for the sake of striving: "Es strebt der Mensch so länge er lebt" (Humans always strive as long as they are alive).

Similarly, Burke summarizes the central logic of Hitler's *Mein Kampf* with the god-term "natural law/God's law" and the obedience/disobedience of Aryans and Jews towards it:

> Aryan doctrine is a doctrine of resignation, hence of humility. It is in accordance with the laws of nature that the "Aryan blood" is superior to all other bloods. Also, the "law of the survival of the fittest" is God's law, working through natural law. Hence, if the Aryan blood has been vested with the awful responsibility of its inborn superiority, the bearers of this "culture-creating" blood must resign themselves to struggle in behalf of its triumph. Otherwise, the laws of God have been disobeyed, with human decadence as a result. We must fight, he says, in order to "deserve to be alive." The Aryan "obeys" nature. It is only "Jewish arrogance" that thinks of "conquering" nature by democratic ideals of equality. (209)

"Natural law/God's law" exists independent of human actions and for its own sake, but obedience and disobedience towards it determines whether humanity flourishes or decays. The god-term thereby becomes the logic by which the entire hierarchy of institutions, strategies, virtues, vices, etc. operates. A god-term "designates the ultimate motivation, or substance" of a terminology (*Grammar* 355).

When searching for a god-term, critics should look for a term that can summarize the logic or central motivation of the hierarchy. Typically, it will be a term with a central function in the text, and it may have been repeated often. Critics should look for instances in the text where something is mentioned as a central cause, purpose, or final goal. These may point to the god-term. The god-term also subordinates other terms, which is sometimes shown when a certain principle calls for a sacrifice or mortification, such as, "I vow to thee, my country, all earthly things above" (Spring-Rice), and it will often be addressed with a kind of reverence.

As with hierarchies of terms, god-terms are not always "fully developed" in all texts. Burke writes that Christian theology is a good example of a terminology that is thorough or goes to the end of the line, but other texts may show the same or a similar hierarchy "in fragments." Thus, one can find a god-term that does not quite encompass the logic of the entire text because the text in question is not thorough or consistent enough. This would still qualify as a god-term, and critics could mark it as such.[66] The "ideal" is a text that has a rhetorical and dialectic symmetry "whereby all classes of beings are hierarchically arranged in a chain or ladder or pyramid of mounting worth, each kind striving towards the *perfection* of its kind, and so towards

[66] As mentioned before, Burke writes that "whether we believe in God or not, it remains a linguistic fact that writers [sic] terms of highest generalization might technically be called their 'god-terms'" ("Notes on "Nature").

the kind next above it, while the strivings of the entire series head in God as the beloved cynosure and sinecure, the end of all desire" (*Rhetoric* 333).

Once the god-term is found, the next step of the analysis would be to embark on the Downward Way and see what a difference it makes to now view the lower terms "in terms of the new principle encountered en route, whereupon it is viewed in a transcendent light" (*Grammar* 428). How has the problematical term been solved or purified by being structured in terms of a hierarchy with a unifying term?

Thus, the four steps of indexing include searching for key terms, equations, hierarchies of terms, and the god-term of the text. Scholars generally agree on the first two steps of the method, but have largely ignored the last two steps as essential parts of indexing. In order to clarify these two last steps, I will show some examples of how one of Burke's students went about indexing several texts and looking for hierarchies of terms.

Student Examples of Indexing

As I mentioned earlier, I have been conversing with Burke's former students, who were required to use indexing for their class assignments. Three of these students, Ruth Liebling Goldstone, Barbara Nowak, and Suzanne Shepherd, shared papers they had written for his class using indexing.[67] I first contacted Goldstone in 2011 and had a brief telephone interview with

[67] Barbara Nowak wrote "Sailing to Byzantium: Four Essays on the Poetry of William Butler Yeats" as a bachelor thesis, using indexing as her main methodology. Suzanne Shepherd (nee Stern) wrote analyses of four texts from *Modern Philosophies and Education* describing Pragmatist, Realist, Thomist, and Marxist perspectives on education, and Ruth Liebling Goldstone wrote a course paper titled "Index for Mrs. Dalloway by Virginia Woolf." The last paper was discussed quite extensively in my master's thesis and deals primarily with key terms and equations. The bachelor's thesis by Nowak also works with key terms and equations, but was not in my master's thesis.

Suzanne Shepherd shortly thereafter. I did not receive the papers from Nowak and Shepherd until after I had turned in my master's thesis. The papers by Shepherd contain specific illustrations of hierarchies of terms, as well as some of her justification for the structures and Burke's response to her reasoning.

Two of Shepherd's analyses include illustrations of hierarchies of terms.[68] They give a good representation of what Kenneth Burke intended. The analyses also show us how critics can visualize hierarchies of terms with different structures, according to the logic by which they are organized, and how they can illustrate such hierarchies. In conversations with me, Shepherd clarified that these illustrations were not required for the assignment, but she chose to make them to help her make sense of the structures she found in the texts. The two texts she analyzed appear in *Modern Philosophies and Education*, which also contains Burke's "Linguistic Approach to Problems in Education." The texts discuss, respectively, how Marxist philosophy and the philosophy of Thomas Aquinas can be applied to education.

The first illustration, analyzing Robert Cohen's "On the Marxian Philosophy of Education" (see Figure 1), resembles a structure Burke called "verbal pyramids" ("Rhetoric – Old and New" 204). Critics form these pyramids by moving "from a world of disparate particulars to a principle of one-ness, an 'ascent' got . . . by a movement toward progressively 'higher levels of generalization'" (204). If critics look at the world of particulars in light of the "principle of one-ness," they see how these terms are now organized or connected in relation to this principle: "All would thus be made consubstantial by participation in a common essence, as with objects bathed in the light of the one sun, that shines down upon them as from the apex of a pyramid" (204). Burke claims that "a rhetorical structure is most persuasive when it possesses

[68] Transcriptions for these hierarchies are in Appendix A.

full dialectical symmetry—or otherwise put, dialectical symmetry is at once the perfecting and transcending of rhetoric" (204).[69] Shepherd's justification for the different steps and Burke's responses show how one finds hierarchies of terms. She starts this way:

> Concerning the graphic characterization of Marxism, it must first be explained that the highest point of the triangle acts symbolically as the ground and determinant for the lower levels. The same principle is to be used analogously throughout the chart. For instance, "social being determines men's consciousness", it is "not the consciousness of men that determines their being". ([Cohen] 181) Thus "society", on the chart, is designated above "consciousness".

[69] Kenneth Burke seems to suggest that the best rhetoric transcends rhetoric and becomes dialectic. He writes the following to Suzanne Shepherd: "The use of emotionally weighted words would be rhetorical; but it seems to me that the use of terms that transform into one another would be dialectical -- though there is an area of overlap between the two fields." With perfect dialectical symmetry, you get the perfection of rhetoric, which Burke here calls "dialectical."

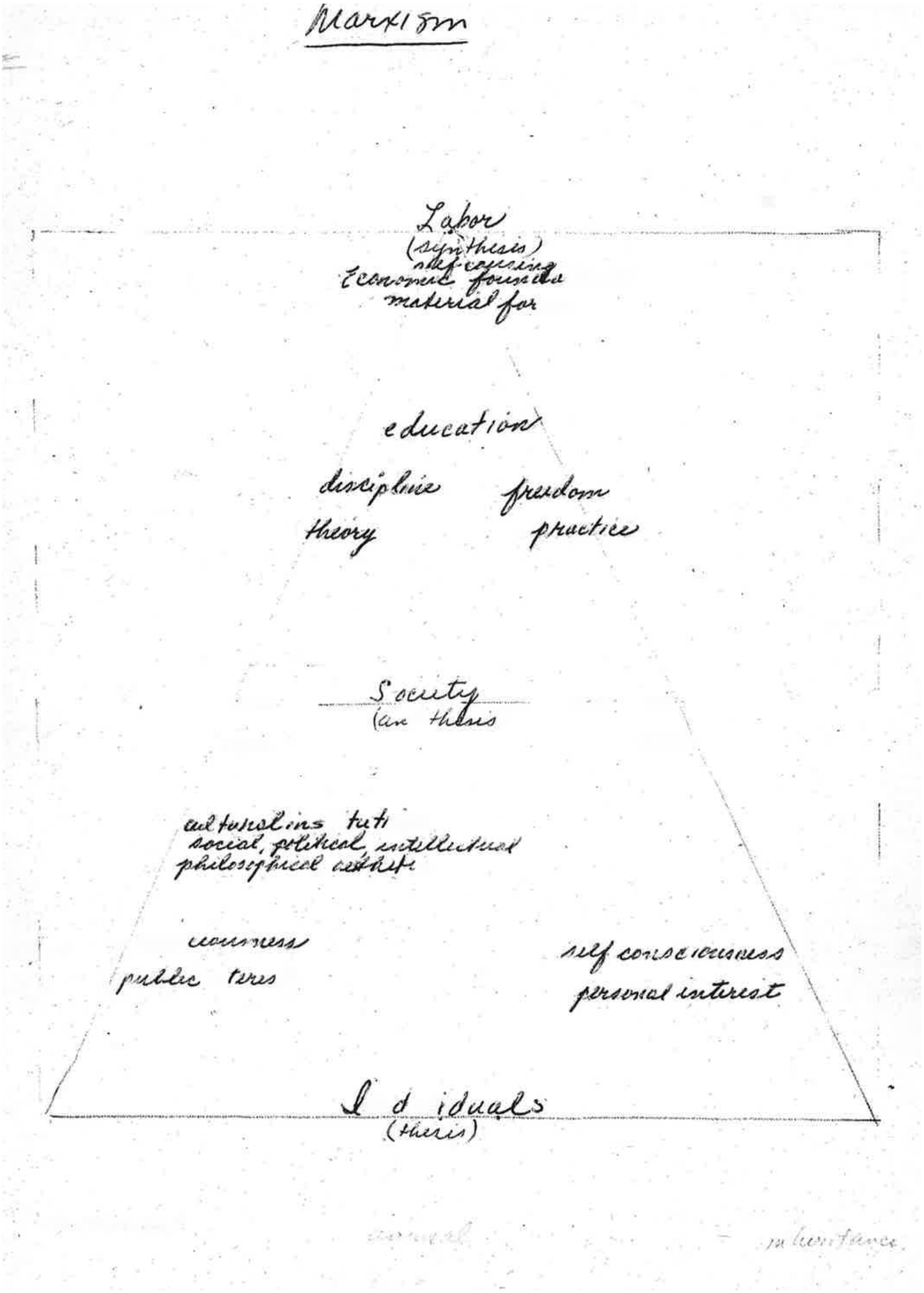

Figure 1 Chart of hierarchy of terms in Marxism, compiled by Suzanne Shepherd

Here she uses textual cues to find out which term is higher and which is lower in the hierarchy. The highest point, the god-term, acts symbolically as the ground and determinant for the lower levels. Shepherd argues that since society determines consciousness (in Cohen's text), it stands above consciousness in the hierarchy. The cause is placed higher than the effect. The god-term, where Shepherd places "Labor," is described as self-causing, which allows it to be the determining and sustaining force for the other terms in the hierarchy.

Shepherd argues that her hierarchy can be "substantiated by the value implicit in the term [Labor] itself . . . and also by the terms used to characterize it" (1). She gives examples of both these methods from Cohen's text: "'The origin of cultural institutions must be sought in a human activity that could be self causing [sic] from the earliest stage of human existence. Such a social activity is human labor' ([Cohen] 180)" (1). Here, it seems to me that Cohen places labor above all cultural institutions. Elsewhere, Cohen argues that labor is the economic foundation that determines all of social, political, and intellectual life and is the prime necessity of life. In summary, Cohen describes labor as an end in itself, gives it a mixture of abstract and concrete meaning (labor as a term here embodies more than just the physical act of work), and describes it as a self-causing term. These are clues Shepherd uses to identify labor as the "secularized God" or god-term of Marxism.

When she finds terms that imply each other, Shepherd has a formula for figuring out which term is higher: "Society is dependent upon labor as both means and ends. Labor is dependent also . . . upon society. In the latter case, however, the dependence is on the basis of means alone" (4).[70] Therefore, labor (means and end) is higher in the hierarchy than society

[70] From the way Cohen describes it, labor and society need each other, but while the purpose of society is labor the purpose of labor is not society. Labor has value beyond and irrespective of its relative value to society, and is therefore the higher term of the two.

(means). In contrast, she equates labor and the human spirit because "the former is derived from and realized by the latter and the latter is derived from and realized in the former" (5). These terms are on the same level of the hierarchy and are essentially synonyms in Cohen's text.

In Burke's comments, he initially disagrees with labor as a god-term, though he agrees that "Cohen's stress is along those lines" (2). He suggests "dialectical materialism" as the real god-term with labor as a closely related term, and yet he writes, "all the points you make are well-taken here" (2), essentially conceding the point.[71] Burke's final evaluation is that, "All told, this paper is most gratifyingly zestful and intelligent" (2). It seems he approves of her method and her findings.

The second illustration, analyzing "Thomist Views on Education" by Jacques Maritain, is shown in Figure 2. This structure looks more like what Burke describes in *The Philosophy of Literary Form*, with one central term in the hub and other terms in a circle around it, "radiating from this hub" (103). He responded favorably to both these charts and the related analyses: "Before beginning, wd. say: Your charts look tremendously interesting, particularly the one on Thomism. Thomism circular, Marxism pyramidal. The movement towards the inner sanctum seems to me quite good" (Kenneth Burke Comments on Suzanne Stern – Paper on Thomism, Marxism). Shepherd bases her chart on two organizing principles mentioned by Maritain: "the 'direction of the process [of education], and the implied hierarchy of values'. ([Maritain] 57) The 'hierarchy of values' would . . . be in the realm of 'philosophical principles', and . . . the 'direction of the process' would be in the region of 'practical application'" (Shepherd). She

[71] Burke's surprise at Shepherd's results seems to come from his belief that dialectical materialism is the god-term of Marxism, and yet Cohen never mentions dialectical materialism in his article. Burke therefore concedes that "Cohen's stress is along those lines," so labor may be Cohen's god-term, though it is not the proper god-term for Marxism.

describes the image as ideally being a "three-dimensional model of a cone" with the central point, God, as the vertex, showing how the hierarchy of values determines the direction of the educational process aimed at attaining that hierarchy (Shepherd 1-2).

In the Thomist chart, God decides the direction of the development (as the top), but as Creator of the world he is also the ground, the foundation for the possibility of this development. The organizing principle in the conical hierarchy is (as Shepherd notes) "completeness" or "perfection," rather than, for example, levels of abstraction, with the less complete or perfect elements at the base and outside of the cone and the most complete or perfect elements at or near the top and center of the cone. Each path to the center and top illustrates a different aspect of the education of the soul from primary education, through college, and on to the adult. The different steps in the paths follow the pattern of thesis, antithesis, and finally synthesis in triads relating to faith, freedom, wisdom, theology, etc. To follow one path as an example, the child has senses (which are physical), the youth is to cultivate the intellect and reason (which are spiritual), and the two are combined in the formation of knowledge and will (physical and spiritual).[72] For each of the concentric circles, the terms in the same circle describe the same level of education (child, youth, and adult respectively). The term closest in the next circle inward is the next level in that specific aspect of the education of the soul.

The God-term here is "God as the absolute good and embodiment of love." Shepherd describes the organizational principle as follows: "All the terms in one circumference are equational in qualitative and positional similarity and also in the identity of their aim toward the

[72] Maritain describes the goal as follows: "Man is a person, who holds himself in hand by his intelligence and his will. He does not exist merely as a physical being. There is in him a richer and nobler existence: He has spiritual superexistence, through knowledge and love. He is thus, in some way, a whole, and not merely a part; he is a universe unto himself, a microcosm in which the great universe can be encompassed through knowledge" (63-4).

same central point. However, they each have an obligation to a particular means to arrive at that point" (1-2). This is a more complicated way to describe what I mentioned above about the concentric circles. The levels or circumferences move from a concern with material reality, through mental reality, and on to spiritual reality.

As stated previously, this is clearly a ladder of development rather than a ladder of abstraction since the adult is not an abstraction of the child but rather a completion of the child (in this specific text). Shepherd writes, "It is important to note the relationship of one level or circumference to a higher level. The lower level develops and grows up to the level above it in a manner similar to that of the Platonic ladder. . . . The lower level . . . generates the higher level . . . and is, in turn 'embraced and quickened' by that higher level" (3). Burke concludes his comments by noting, "Am now through the Thomism article. I think you're a born dialectician. A thoughtful and enterprising analysis" (Kenneth Burke Comments on Suzanne Stern – Paper on Thomism, Marxism 2).

What makes her effort at indexing Maritain's article so successful? In analyzing what is a wide-ranging article on Thomist philosophy and education, which also touches on politics, methodology, and epistemology, Shepherd conducts a very focused analysis that effectively summarizes the hierarchy of terms Maritain develops over a 13,000-word text. She uses textual clues to tell her where the different terms belong in the hierarchy. For example, when Maritain writes, "Charity, which loves God and embraces all men in this very love, is the supreme virtue" (65), Shepherd recognizes that the virtue is equivalent to the god-term because "God is love." Maritain also writes that "education, in its final and highest achievements, tends to develop the contemplative capacity of the human mind" (65), setting contemplation as the highest level of

education. Having read the original text, I would say the chart gives an elegant and a persuasive depiction of Maritain's educational philosophy, a "representative anecdote."

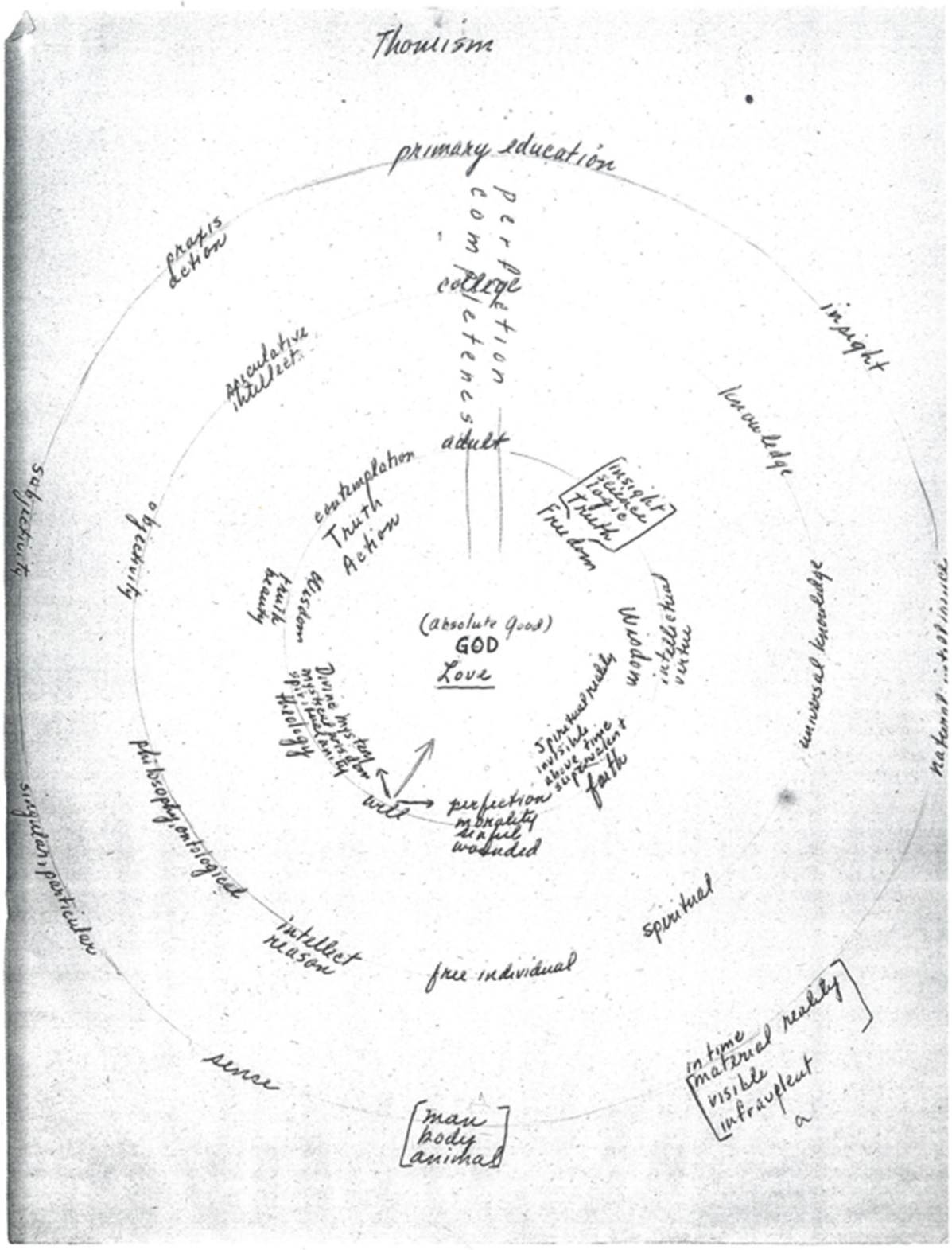

Figure 2 Chart of hierarchy of terms in Thomism, compiled by Suzanne Shepherd

In summary, Shepherd's charts and analyses, combined with Burke's feedback, give us some more clues as to how critics can organize hierarchies of terms and find god-terms:

1. The highest point in the hierarchy (god-term) acts symbolically as the ground and determinant for the lower levels.
2. Specifying a term as a higher term or god-term can be substantiated by the value implicit in the term itself as it is used in the text and by the terms used to characterize it.
3. The god-term should be self-causing.
4. Means are lower than ends; terms that are ends in themselves are highest.
5. In relations of cause and effect, the cause is often higher than the effect. Where terms seem equal in value (cause each other), critics can ask whether one has the other as its end or purpose.
6. When confronted with what may be equal terms, critics can ask whether they are derived from and realized by or in each other.
7. Although the organizing principle usually moves from particular to general, critics should be aware that there may be other organizing principles at work (for example, completeness and perfection), and the organizing principles may be stated in the text itself.
8. Shepherd's Thomism chart also shows that there can be smaller hierarchies within the same level of the larger hierarchy, as shown by how "insight" develops in the innermost circle to be encompassed by "Freedom."

The charts and analyses from Suzanne Shepherd demonstrate clearly that Burke intended for hierarchies of terms to be an integral part of indexing. The guidelines and clues mentioned above will hopefully contribute towards restoring this central and fascinating feature to the methodology Kenneth Burke himself saw as the most direct approach to a text ("Questions" 334).

Indexing "Announcing the Bombing of Hiroshima": An Application of the Method

I will now apply the method, using indexing to analyze President Truman's speech "Announcing the Bombing of Hiroshima," which was delivered August 6, 1945,[73] sixteen hours after the bomb was dropped over Hiroshima. I chose this speech because it is relevant to what I am discussing in the dissertation (the development of the atomic bomb) and also because it is a famous text with a very clear key term (atomic bomb). As such, it allows me to demonstrate the method in a simple way and contains themes and key terms that are useful to my analysis in the next chapter. Through my analysis, I will show how Truman constructs a consummatory vocabulary, a logic of form that points towards "power" as the highest aim of science and humanity, with the atomic bomb as its most profound expression.

First, what is the rhetorical situation this speech comes in response to? At the Potsdam conference on July 26, 1945, the U.S., the British Empire, and China had called for Japan to surrender unconditionally. In this speech, given on August 6, President Truman reiterates that call and adds the threat of further destruction: "If they do not now accept our terms they may expect a rain of ruin from the air, the like of which has never been seen on this earth." The speech is broadcast so widely that the audience is the entire world, and the speech integrates different persuasive purposes to different audiences.

The primary purpose is to threaten the Japanese into unconditional surrender, and the focus on destructive capacity and power, along with detailed threats, helps to bring that message across. At the same time, Truman is also introducing the concept of an atomic bomb and nuclear power to the American people, as well as trying to "justify to Congress the investment of $2 billion, to keep Groves [general in charge of the Manhattan Project] and Stimson [Secretary of

[73] The complete text of the speech is in Appendix B.

War] out of Leavenworth prison" (Rhodes *Making* 697). Truman spends many paragraphs praising the scientists and workers who contributed to "the greatest achievement of organized science in history," and towards the end discusses possible future developments in atomic energy and the need for secrecy. A third audience is the Soviet Union. The Hiroshima bombing "was to put the Russians on notice and serve, in Stimson's words, as a 'badly needed equalizer'" (Rhodes, *Making* 697). In addition to all these, this was also the first global announcement explaining atomic bombs and setting the tone for nuclear policy.

Since the bomb was developed in secret and marks a radical technological advance, Truman opens his speech with a string of definitions and comparisons to help his audience understand the bomb's nature and power. He begins the speech almost like a news reporter: "Sixteen hours ago an American airplane dropped one bomb on Hiroshima and destroyed its usefulness to the enemy. That bomb had more power than 20,000 tons of TNT. It had more than two thousand times the blast power of the British 'Grand Slam' which is the largest bomb ever yet used in the history of warfare." He justifies the attack with the fact that the Japanese "begun the war" and have now "been repaid many fold," then explains the bomb's destructive force. He gives a brief history of the effort to develop the bomb, including the resources, manpower, etc. This section takes up about half of the speech and is full of superlatives. Following this, Truman concludes, "We are now prepared to obliterate more rapidly and completely every productive enterprise the Japanese have above ground in any city. We shall destroy their docks, their factories, and their communications. Let there be no mistake; we shall completely destroy Japan's power to make war." After another paragraph, threatening "ruin from the air" if Japan does not surrender, he goes on to introduce a statement that will be made later by Secretary Stimson. The four final paragraphs discuss a few details of the development, potential for future

developments, the need for secrecy, and a statement of intent, "I shall give further consideration and make further recommendations to the Congress as to how atomic power can become a powerful and forceful influence towards the maintenance of world peace."

Key terms: Most of the speech describes the nature of the atomic bomb and the effort towards developing it: eight of thirteen paragraphs are dedicated almost entirely to discussing the atomic bomb and the Manhattan project. Therefore, "atomic bomb" seems a likely key term in this text. There is a lot of focus on action, primarily concerning efforts that have been completed and threats of future military action. Since Burke writes that key terms are often main characters or actors, my key terms include the main agents in Truman's speech (*Language* 370). Looking at the first three paragraphs, atomic bomb is the subject in most of the sentences: "That bomb had more power than," "It had more than two thousand times the blast power," "these bombs are now in production," "It is an atomic bomb," "It is a harnessing of the basic power of the universe," and "The force from which the sun draws its power has been loosed against those who brought war to the Far East."

The last sentence shows another obvious character in this text: "those who brought war to the Far East," i.e., "the Japanese" or "the enemy." They are addressed and endowed with certain characteristics in each of the first three paragraphs, and they are specifically addressed in Truman's threat of "a rain of ruin from the air." Describing the United States, the president uses the pronoun "we," and only uses "I" in the last two sentences. The "Germans" are also present, though only in the fourth paragraph. I will take these as my initial key terms for the analysis: atomic bomb, the Japanese, we, and the Germans. There are other actors in the text, like scientists and Secretary Stimson, but the former seem to operate only as resources for the bomb development, and Stimson just appears in one sentence. To be useful as a tool of analysis, a key

term has to be a connection point for several terms. At this stage, the initial key terms are working hypotheses about what may yield good results in this text.

Equations: Almost everything in this text is connected to the atomic bomb, either describing its nature or the effort to make it. If I chart where this word appears in the text, I find the following words together with it (chronologically):

More power than 20,000 tons of TNT, more than two thousand times the blast power of the British "Grand slam," a new and revolutionary increase in destruction, in production, even more powerful forms are in development, a harnessing of the basic power of the universe, the force from which the sun draws its power, the battle of the laboratories, the race of discovery, large number of scientists of distinction, tremendous industrial and financial resources, laboratory work, production plants, two great plants and many lesser works, 125,000 employed (65,000 now), two and a half years of work, great quantities of material, two billion dollars, the greatest scientific gamble in history, achievement of scientific brains in putting together infinitely complex pieces of knowledge, capacity of industry to design and of labor to operate, machines and methods, the brainchild of many minds came forth in physical shape and performed as it was supposed to do, a problem in the advancement of knowledge, the greatest achievement of organized science in history, a rain of ruin from the air, the greatest destructive force in history, a new era in man's understanding of nature's forces, the danger of sudden destruction, a powerful and forceful influence towards the maintenance of world peace

This much I would consider facts: these words either appear with the explicit term "atomic bomb" or have clear implicit connections with the concept "atomic bomb." I will now organize this cluster to see if I can find some implicit structures. These will be primarily inferences I make

from textual cues that I find. I will point out what the textual cues are and which inferences I make from them.

This is a large cluster of terms that are connected to the key term "atomic bomb" in different ways. Most of the terms at the beginning attempt to describe the nature of the atomic bomb and are connected through existential sentences such as "it is an atomic bomb." However, starting with "the battle of the laboratories," most of the later terms do not describe the nature of the bomb itself, but rather the different efforts and resources that were involved in developing the atomic bomb. These have a cause-effect relationship to "atomic bomb," or what Burke would describe as a "from what to what" progression. The atomic bomb is the result of winning "the battle of the laboratories" and the "race of discovery." In other words, the terms for the development seem to form a separate but related cluster from words describing the nature of the atomic bomb itself.

One general term describing the development of the bomb is "the battle of the laboratories" and another one is "race of discovery." These two terms describe the larger project the other terms are a part of and seem to play a central role in this cluster. The terms describing the nature of the bomb are equations of "atomic bomb" and the terms describing the effort to make it are equations of "the battle of the laboratories/race of discovery." I will now describe these two clusters more in detail.

As previously stated, Truman starts his speech with a string of definitions and comparisons about the atomic bomb. These work as equations, since Truman explicitly states that "the atomic bomb is" all these things. Truman says that the atomic bomb = "more power than 20,000 tons of TNT," "more than two thousand times the blast power of the British 'Grand Slam,'" "a new and revolutionary increase in destruction," "a harnessing of the basic power of

the universe," and "the force from which the sun draws its power." In the final four paragraphs, Truman again uses existential sentences and long noun phrases to explain what the atomic bomb is or may become: "a rain of ruin from the air," "the greatest destructive force in history," "a new era in man's understanding of nature's forces," "the danger of sudden destruction," and "a powerful and forceful influence towards the maintenance of world peace." All but two of these are ominous, threatening descriptions. Below is the cluster of terms on the nature of the atomic bomb:

Atomic bomb
more power than 20,000 tons of TNT, more than two thousand times the blast power of the British 'Grand Slam,' a new and revolutionary increase in destruction, a harnessing of the basic power of the universe, the force from which the sun draws its power, a rain of ruin from the air, the greatest destructive force in history, a new era in man's understanding of nature's forces, the danger of sudden destruction, a powerful and forceful influence towards the maintenance of world peace

From the fourth to the eight paragraph, Truman describes the development of the atomic bomb, using descriptions of the different parts of the project and their results, such as "125,000" workers, "scientists of distinction," "two billion dollars," etc. Here the terms are connected to the key term, as Burke describes, by going "from particular words to the more general themes or topics" these are a part of ("Facts" 59). They are also related in terms of progression, since these resources and efforts all preceded and caused the bomb's successful development. Truman introduces his description of the development by saying, "With American and British scientists working together, we entered the race of discovery against the Germans," clearly showing that "race of discovery" is a concept which encompasses all that follows in the effort to develop the

bomb. Earlier, he calls the effort "the battle of the laboratories," so both of these terms describe the same thing.

Some of the terms connected to "the battle of the laboratories" and "race of discovery" seem to be "large number of scientists of distinction," "tremendous industrial and financial resources," "two great plants and lesser works," "employment of 125,000," "two and a half years of work," "two billion dollars," "greatest scientific gamble in history," "achievement of scientific brains (as greatest marvel)," "capacity of industry," "the brainchild of many minds came forth and performed as it was supposed to," and "greatest achievement of organized science in history."

Some of these terms may fit in both this and the atomic bomb cluster. For example, "the brainchild of many minds" could be a description of what the atomic bomb is—its nature, but at the same time "the brainchild of many minds came forth and performed as it was supposed to" could also describe the development process. In fact, both this description and "the greatest achievement of organized science in history" are such abstract, grandiose statements that I wonder whether they could be said to be *parts of* "the battle of the laboratories" and "race for discovery" or rather are the *results of* this effort. And when it comes to "the greatest scientific gamble in history," I wonder whether this also could be said to be a *part of*, or rather an equivalent term for, "the battle of the laboratories" and "race of discovery."

This makes a difference later when I look for hierarchies of terms. A smaller part of something bigger will usually be lower in the hierarchy than an effect or result will be. The other terms in the cluster, such as "tremendous financial and industrial resources," seem to fit much more comfortably as subordinate terms that are a part of the larger project. These are questions I will have to sort out when I get to hierarchies of terms. For now, I claim as textual "facts" that all

these words are equations, and I would also state tentatively that most of these words belong in the two clusters I have mentioned. Here is the cluster for "race of discovery" and "the battle of the laboratories":

race of discovery, the battle of the laboratories
large number of scientists of distinction, tremendous industrial and financial resources, laboratory work, production plants, two great plants and many lesser works, 125,000 employed (65,000 now), two and a half years of work, great quantities of material, two billion dollars, the greatest scientific gamble in history, achievement of scientific brains in putting together infinitely complex pieces of knowledge, capacity of industry to design and of labor to operate, machines and methods, the brainchild of many minds came forth in physical shape and performed as it was supposed to do, a problem in the advancement of knowledge

This leaves out "in production," and "even more powerful forms are in development." I am not sure these fit well in either of these clusters. I guess one could say that it says something about the development of the bomb that atomic bombs are now "in production" and that "even more powerful forms are in development," but whereas the rest of the cluster describes the development of the atomic bomb (past tense), these terms describe the current and future development of atomic bombs. At this point, I'll just say with Burke, "Frankly, we don't know what this adds up to" (*Language* 158).

After making lists of equations for the other key terms corresponding to the main human agents—Japanese, Americans (we), and Germans—I find those clusters are much smaller than those describing the nature and development of the atomic bomb. Although they do give us some interesting insights into how President Truman attempted to portray the world, I think it is

unlikely I will find the highest levels of hierarchies and the god-term here simply because they do not seem to be the focus of the text.

It seems clear that "the Japanese" equals "the enemy," "those who brought war to the Far East," "began the war," and have "been repaid many fold." "The Japanese" are described as having "docks," "factories," and "communications," and they still have a certain "power to make war." Truman seems to split the category "Japan" into "leaders" and "the Japanese people" when he says, "It was to spare *the Japanese people from* utter destruction that the ultimatum of July 26 was issued at Potsdam. *Their leaders* promptly rejected that ultimatum," but with this one exception, "the Japanese" are portrayed uniformly as "the enemy" and "those who brought war." The Hiroshima bombing is described dispassionately as destroying "[Hiroshima's] usefulness to the enemy."

"We" generally refers to the United States.[74] It is implicit that the "American airplane" that bombed Hiroshima is a part of "we." The text has many of passive sentences, which hides the agent: "bombs are now in production," "power has been loosed," "they have been repaid," but when something happens or has happened in this text it is generally done by "we." For example, Truman says, "we have spent two billion dollars on the greatest scientific gamble in history – and won," and "We shall destroy their docks, their factories, and their communications." To get an indication of what internal structures we may find in the cluster, Burke mentioned it is useful to be on the lookout for moves of merger and division and see what words are parts of larger symbols or categories. A subcategory of "we" is the "armed forces," referring to the armed forces of the United States of America. Connected to this term I find the equations "growing power," "prepared to obliterate more rapidly and completely every

[74] Though sometimes Britain is included.

productive enterprise the Japanese have above ground in any city," "sea and land forces in such number and power as they [the Japanese] have not yet seen," and "fighting skill." Most of these terms might be specific parts of the "growing power" of the armed forces, making "growing power" the summarizing term for these capabilities. Critics could choose to examine the role of "we" more in-depth here, but compared to the clusters connected to "atomic bomb," "we" seems less developed and less important. Certainly, the bomb development is a part of the "growing power" of the armed forces, but the atomic bomb is also celebrated as "the greatest achievement of organized science in history." In other words, the nature and development of the atomic bomb seem to have a value of their own that is not dependent on the armed forces. Therefore, for the purposes of this analysis, I will not go any further into analyzing this term.

Germans, as the Japanese, are described as enemies. They were "working feverishly" to "add atomic energy to the other engines of war." They "hoped to enslave the world," but they "failed," and Providence prevented them from getting V-1 and V-2 rockets earlier and from getting the atomic bomb at all. The most abstract level seems to be "hoped to enslave the world." Truman implies this motivation drove them to work "feverishly." "Germans" has too few connections to give us much information about hierarchies of terms. There may be more clusters at work in this text, but these mentioned so far seem to be the main actors and account for most of the text.

Hierarchies of terms: The best place to find the god-term is usually in the most central cluster among the words that have the most and strongest connections with other words. In this case, the clusters about the nature and the development of the atomic bomb seem the most promising, since they contain the most words and also are connected to each other. Following Burke's advice to Shepherd that means are lower than ends, I choose to start with the cluster for

the development of the atomic bomb. The development part is where I will likely find "the means" that precede the atomic bomb (ends).

Following Burke's advice to start with the concrete and move up to the general terms, I see the following at the lowest level: "large number of scientists of distinction," "tremendous industrial and financial resources," "employment of 125,000," "two and a half years of work," "two great plants and lesser works," "laboratory work," "production plants," "great quantities of material," "two billion dollars," "capacity of industry to design and of labor to operate," and "machines and methods." Following Suzanne Shepherd, I then ask, "are these ends in themselves or are they a part of or means to something greater?" I see most of these terms as a part of what President Truman calls "the battle of the laboratories" and "the race of discovery against the Germans." As for "the greatest scientific gamble in history," I argue that the term serves the same function and is at the same level as "race of discovery" and "the battle of the laboratories": it is a metaphor comparing the development of the atomic bomb to a contest that can be won. Neither "the greatest achievement in the history of organized science" nor "the brainchild of many minds came forth and performed as it was supposed to" seems to fit comfortably as a means to "the battle of the laboratories." Both terms are more abstract and more celebratory than the other terms under "the battle of the laboratories." They resemble the grand style or high style in their use of figurative language and ability to evoke emotion (Crowley and Hawhee 255), a kind of reverence, which may indicate that they belong higher up in the hierarchy. I will keep them in reserve to see if they fit better further up in the hierarchy.

To test this result, I can try other means of organization that Shepherd and Burke suggested. Going from concrete to more abstract terms seems to give the same result. "The battle of the laboratories" is clearly a more abstract term than "large number of scientists of

distinction," for example. The same goes for going from more physical to more spiritual terms. If I ask about how my terms relate to each other as cause and effect, I'd say that the scientists and the resources brought about "the battle of the laboratories," but the way Truman describes them it is rather "the battle of the laboratories" that marshaled and brought together the scientists and the resources of industry and government. First, "we entered the race of discovery against the Germans" and then all these resources were gathered to win the battle of the laboratories and race of discovery. None of the terms discussed so far on these levels could be seen as self-causing; they are all resources or initiatives responding to something else. For now, means and ends seem to be a good indication of how this hierarchy is organized. The preliminary result is illustrated in Figure 3.

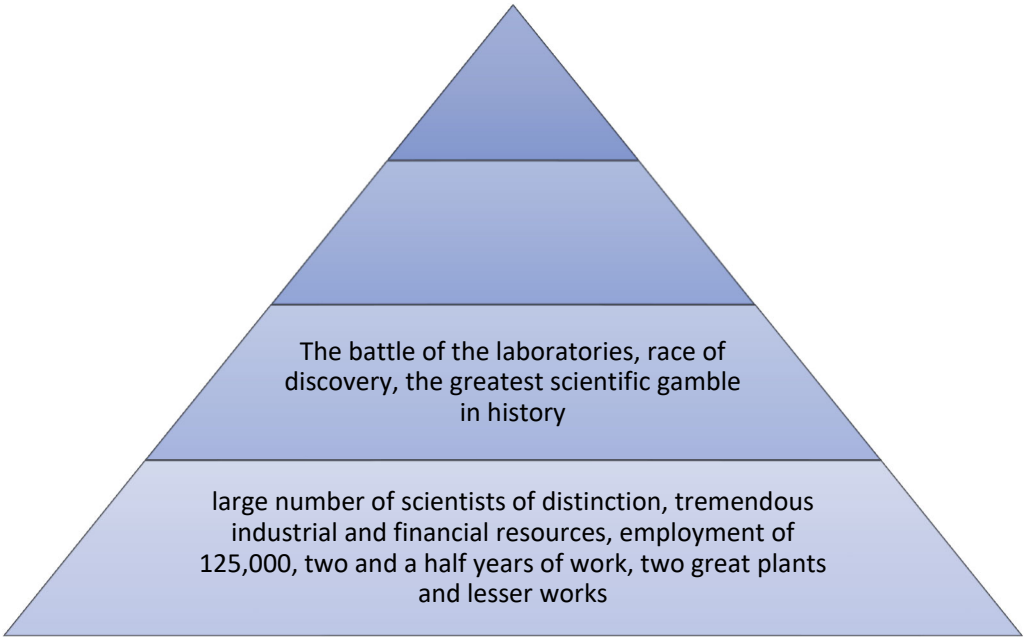

Figure 3. Hierarchy of terms for "Announcing the Bombing of Hiroshima," 2 levels.

Of course, a race, a battle, or a gamble is also not an end in itself, but rather means to a larger end. So what is the larger goal? Truman says, "The battle of the laboratories held fateful

risks for us . . . and we have now won the battle of the laboratories" and "We have spent two billion dollars on the greatest scientific gamble in history – and won." I am guessing he would also say Americans (*we*) won the race of discovery. Of course, they have not won the war against Japan yet, since Japan has not surrendered, so what does it mean to win the battle, the gamble, and the race? The most obvious answer for me is "the atomic bomb": winning the race of discovery means getting to the atomic bomb first. Truman uses a lot of different words to describe this victory, and superlatives seem to be the norm. This is where I would put in "the brainchild of many minds came forth and performed as it was supposed to" and "the greatest achievement of organized science in history" since these phrases both describe the accomplishment rather than the effort. These are the ends for which the battle, gamble, and race were the means. The hierarchy so far is illustrated in Figure 4.

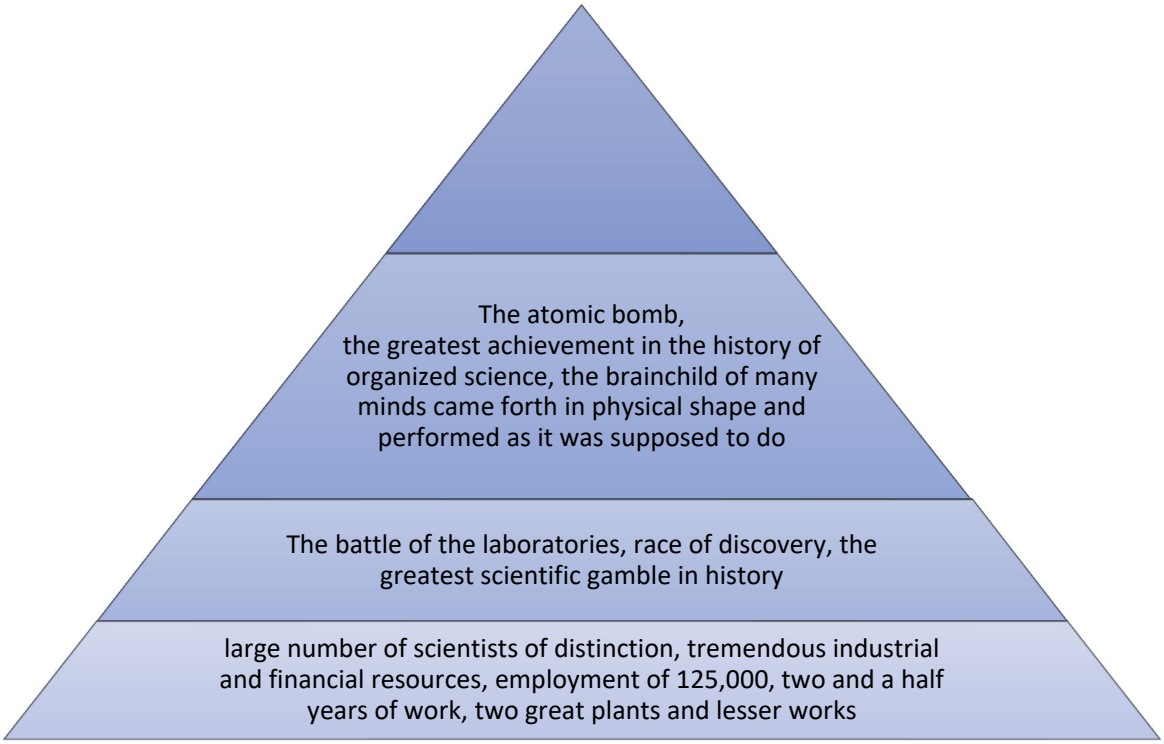

Figure 4 Hierarchy of terms for "Announcing the Bombing of Hiroshima," 3 levels.

As far as how to organize the cluster describing the nature of the atomic bomb, I am not quite sure how to describe its hierarchical relationship to the cluster describing the development of the atomic bomb. Following a means and ends logic, the concrete terms, "more power than 20,000 tons of TNT," "more than two thousand times the blast power of the British 'Grand Slam,'" as well as the more abstract descriptions "a new and revolutionary increase in destruction," and "the greatest destructive force in history" are results that come simultaneously with the atomic bomb, not means which preceded it (like the resources employed in the development). As soon as one gets the atomic bomb, one also gets all these attributes of the bomb. Of course, the concrete blast power could be said to be the physical means of achieving the more abstract goal of "a new and revolutionary increase in destruction," but the means of the blast power in any case cannot be placed in the first step of the pyramid besides "two billion dollars" because it clearly has a means/end relationship to those other resources. In a previous attempt at indexing this text ("Indexing" 2017), I did not sufficiently account for the cluster describing the nature of the atomic bomb. This time, I have the added insights from Suzanne Shepherd and Burke's comments on her paper. Looking at her chart of Thomism, I see there are several subhierarchies integrated at a single step of her conical hierarchy. For example, in the innermost circle, she writes the terms "insight, science, logic, Truth" and then shows them all leading to, and encapsulated by, "Freedom." This is a hierarchy within the hierarchy. At another part of the inner circle, she writes "beauty, truth, Wisdom" with "Wisdom" as the innermost term that encapsulates both beauty and truth.

With that suggestion in mind, I think the best way to represent the role of the "atomic bomb cluster" would be to add them as another hierarchy within the hierarchy already formed, all within the level showing the "results" of winning the battle of the laboratories (3rd level). The

lowest levels would be the concrete terms: “more power than 20,000 tons of TNT” and “more than two thousand times the blast power of the British ‘Grand Slam.’” In this pyramid, I think the main organizing principle is specific/general, though, as mentioned before, these could also be seen as means/end. Where the descriptions mentioned are the specific outcomes, concrete results of getting the atomic bomb, the more general way of describing these results is “a new and revolutionary increase in destruction.” This term fits on the same level as “the greatest destructive force in history,” and “a rain of ruin from the air” since all these terms summarize what that kind of explosive power constitutes.

As for “a new era in man’s understanding of nature’s forces,” “the danger of sudden destruction,” and “a powerful and forceful influence towards the maintenance of world peace,” they do not fit easily into this hierarchy. The first one is an example of what the atomic bomb signifies or ushers in, but it looks beyond the atomic bomb to a prediction about the future. The two last ones are clearly inconsistent with the tone and direction of the rest of the hierarchy, but this is an inconsistency in Truman’s speech as well. His warning about “the danger of sudden destruction” to America and the world comes out of nowhere, and his conclusion mentioning hope for peace is the first time he mentions “peace” in the entire speech. As Burke mentions in “Rhetoric – Old and New,” hierarchies of terms may not be fully developed or fully consistent in most texts, but are rather fragments of hierarchies (204). This part of Truman’s speech is fragmentary, and not consistent with the rest of the speech. I will therefore discard “the danger of sudden destruction” and “a powerful and forceful influence towards the maintenance of world peace” from the “atomic bomb hierarchy.”[75]

[75] As mentioned earlier, Burke argued that consistency was required in order for a text to be persuasive. The theme of world peace is not developed at all in this speech and as such this statement seems tagged on to the end of the speech as an afterthought. A critic could attempt a

I claim that "the atomic bomb," although it is a concrete object, stands higher than the last terms mentioned in the hierarchy because in *this* text "the atomic bomb" is a term that has taken on a larger symbolic significance. As mentioned earlier, sometimes concrete objects can take on mythical or symbolic meaning, and that certainly seems to be the case here when the atomic bomb is described as "the greatest achievement of organized science in history." The hierarchy of the "atomic bomb" cluster by itself is illustrated in Figure 5.

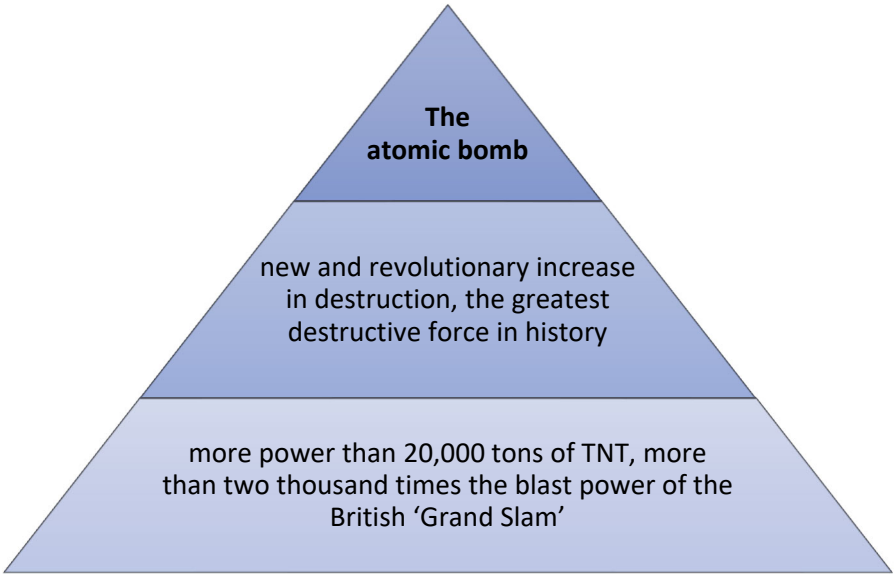

Figure 5 Hierarchy of terms for "Announcing the Bombing of Hiroshima," "atomic bomb"-pyramid.

The same cluster is shown within the larger hierarchy to illustrate which level I believe it belongs at in Figure 6. Atomic bomb is pictured both places because it is a key term for both clusters.

reading of the text that integrates this statement, but I believe the quantity of the evidence would make such an attempt unconvincing.

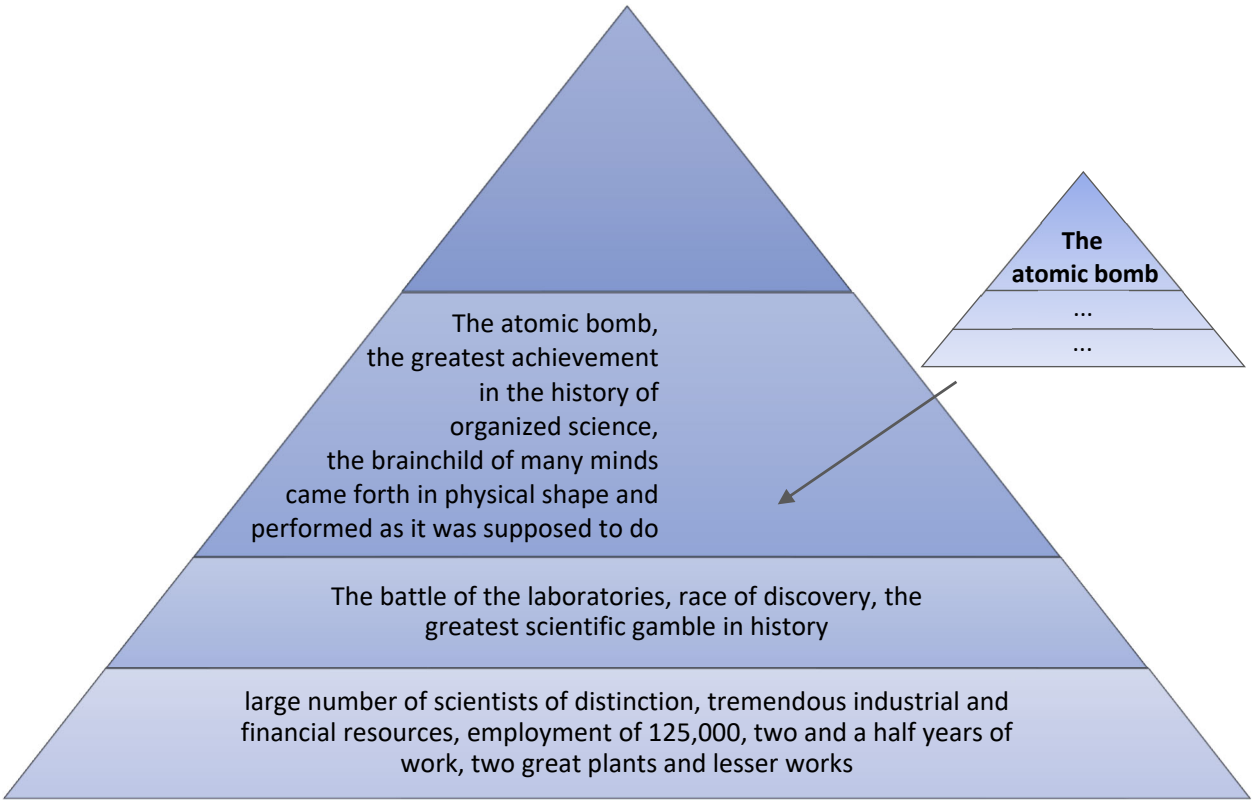

Figure 6 Hierarchy of terms for "Announcing the Bombing of Hiroshima, 3 levels with "atomic bomb"-pyramid integrated.

As for the terms "a harnessing of the basic power of the universe," "the force from which the sun draws its power," and "a new era in man's understanding of nature's forces," they don't seem to me to fit as comfortably under the heading "atomic bomb." "The basic power of the universe" and "the force from which the sun draws its power" seem to be more general terms than atomic bomb. If anything, the atomic bomb is one specific manifestation of this power, and the atomic bomb is just the dawn of "a new era in man's understanding of nature's forces." I will address this more specifically at the next level.

As mentioned, on level three there are a lot of superlatives: "greatest achievement of organized science in history," "greatest destructive force in history," "new and revolutionary increase in destruction," but they still seem to be less filled with awe and almost spiritual

reverence than the descriptions “a harnessing of the basic power of the universe,” “a new era in man’s understanding of nature’s forces,” and “the force from which the sun draws its power.” Given these terms’ focus on *force* and *power*, I begin to wonder how these words would fit as god-terms for this hierarchy. One mark of the god-term after all is that it is often mentioned with some reverence, with subordination of other terms in relation to it.

God-terms: The word “power” is mentioned thirteen times in the text, and “force” is mentioned seven times. In comparison, “war” is mentioned six times, “science” is mentioned three times, “won” is mentioned three times, and “peace” is mentioned once. The basic movement in the hierarchy is that of throwing resources and effort into creating a new kind of power, and Truman spends many paragraphs dwelling on how the atomic bomb increases the power of the United States and the power of humans over nature. The object of gaining “power” definitely gave the impetus to start the Manhattan Project in the first place, so it works as the “foundation” for this hierarchy as well as the ultimate goal or summarizing term for all the terms at the lower levels of the hierarchy. Can “power” be self-causing, like the Aristotelian “Prime Mover”? Maybe not in the real universe, but in the universe created by this text, power is already in existence as “the basic power of the universe,” “nature’s forces,” and “the force from which the sun draws its power.” It exists as a potentiality regardless of human intervention, and increasing power seems to be equivalent here with the greatest good, comparable to “increasing godliness” in Christian theology. Power definitely seems to work here as the center around which everything revolves and towards which everything gravitates. The complete hierarchy of terms is illustrated in Figure 7.

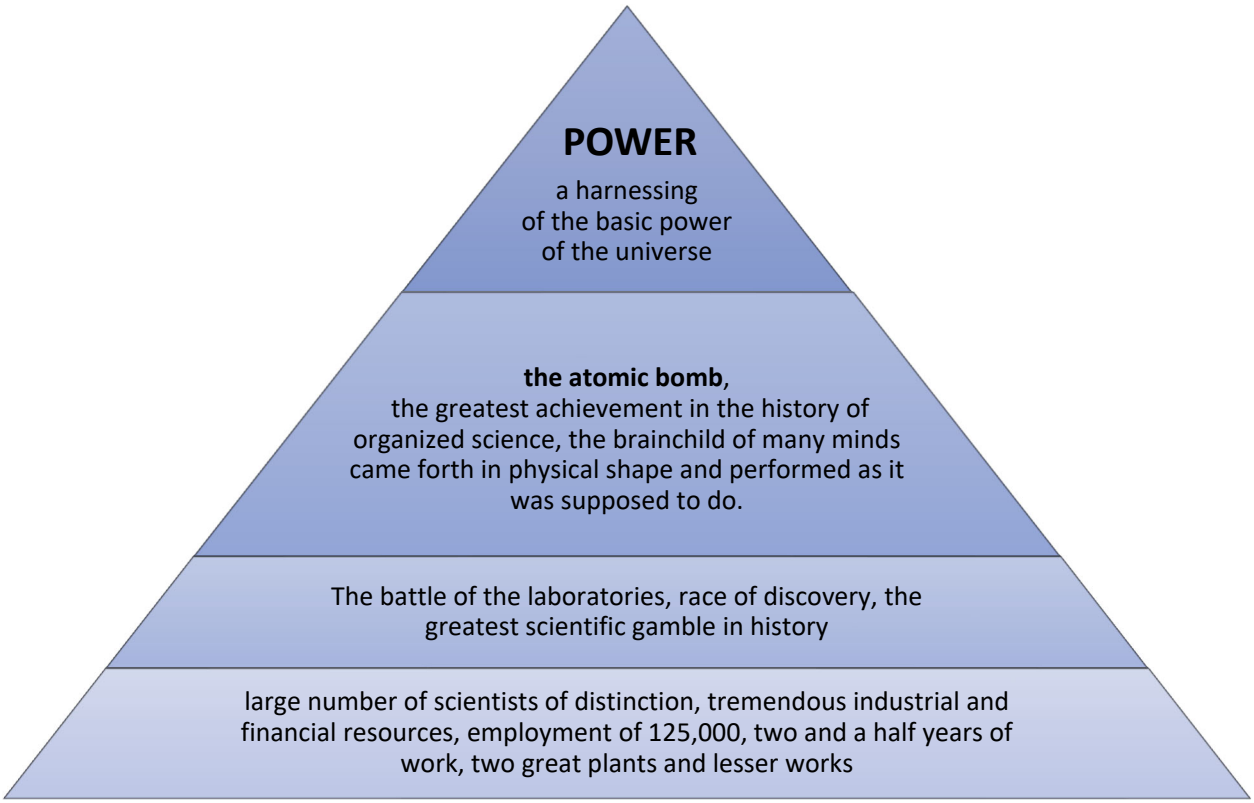

Figure 7 Complete hierarchy of terms for "Announcing the Bombing of Hiroshima, 4 levels

So what does this hierarchy of terms tell us? Burke writes that if we now look downwards in the hierarchy with the perspective of the god-term, we see how the other terms are now organized or connected in relation to this principle: "All would thus be made consubstantial by participation in a common essence, as with objects bathed in the light of the one sun, that shines down upon them as from the apex of a pyramid" ("Rhetoric – Old and New" 204). Moving down from the top, the logic of power and increasing power seems obvious. The motive jumps at me from every angle. The terms "more *power* than 20,000 tons of TNT" and "more than two thousand times the blast *power*" mention it specifically. All references to destruction refer to the effects of gaining more power: "the greatest destructive force in history" and "new and revolutionary increase in destruction." The future is also dominated by the motive of power,

since the bomb ushers in "a new era in man's understanding of nature's *forces*" and "*even more powerful* forms [of the atomic bomb] are in development." Looking down to the first level, it now seems obvious to me that these terms are also the manifestations of different kinds of power: manpower, brainpower, industrial power, and financial power. And what is a battle and a race but a test of the power one has, measured against an opponent who is almost equal in power?

However, critics must not forget that they have performed a certain reduction of the text. As such, the index has brought into focus and prominence a motive that may otherwise have remained hidden, and I would argue it makes a compelling case that the logic of the text is organized by the principle of power. Still, this does not account for the entire text, such as announcing the later statement by Secretary Stimson. The hierarchy also does not feature discussions of war and peace, although Truman does mention these terms briefly in the text. So to what extent is this an objective analysis and to what extent did I fulfill the goal of the critic articulated by Burke: "attempting to characterize, in as well rounded a way as he [the critic] can, the salient traits of a work, trying to give an over-all interpretation of it as a unified symbolic act" (54)?

If one chooses to begin with the key term "atomic bomb," I would claim that most critics following Burke's method would find the same equations that I did. The first "atomic bomb" equations seem particularly clear since they are all explicitly connected. The later "atomic bomb" equations are more implicitly connected. The entire section discussing the effort to develop the bomb is introduced as "the race of discovery," so here I would also claim that I am in the realm of fact. I introduce most of my inferences when I am finding the hierarchy of terms, especially above level 2. I am fairly certain that the manpower and financial resources at level 1 can be

summarized as parts of "the race of discovery" (level 2), and I basically made that case already as I was clustering the terms in equations. I am also positive that the result of the atomic bomb belongs above "the race of discovery" *if* one uses means and ends as the organizing principle. However, as I have shown, one would get similar results using concrete/abstract and specific/general as organizing principles. Other organizing principles could be imagined where atomic bomb is subordinated to the growing power of the armed forces, since the bomb clearly serves that purpose.[76] Although, yet again, one here finds power as a main term. Beyond that, although I can make an argument for it, the choice of *power* as a god-term is more intuitive and cannot be determined with objective certainty. Also, critics who choose to work from other facts, such as looking at Truman's threat of "a rain of ruin from the air," might find different hierarchies and prominent terms than the ones I have found.[77] I would maintain that, working from the same key term and following the method outlined by Burke most critics would reach the same or at least similar conclusions to the ones I have reached. However, Burke did not claim this was a fully empirical method, but rather one that merged systematic analysis with an experimental range "required by the subtle and complex nature of the subject matter" ("Fact" 49).

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[76] For example, critics could choose to only focus on human actors in this drama and make a hierarchy based on who was socially superior and socially inferior. In this case, the U.S. and the armed forces would clearly be higher in the hierarchy in both strength and moral virtue than "the Japanese" and "the Germans." As a part of the strength of the U.S., the "growing power" of the armed forces would be one term, and "the atomic bomb" could be seen as one of many factors that lead to that increase in power. However, I would argue that a hierarchy like that would be disregarding the main focus of the text.

[77] For example, if critics were to focus on Truman's threats and his descriptions of "the Japanese," they would likely find "docks," "communications," etc. as features of "usefulness to the enemy" which would be destroyed as they were at Hiroshima. Critics would also likely find a hierarchy in the different threats by Truman, culminating in "a rain of ruin from the air." A hierarchy like this would describe a central purpose of the text, but I would argue that it would also overlook some of the most prominent features in the speech.

In conclusion, President Harry Truman gave the speech "Announcing the Bombing of Hiroshima" with the dual purpose of revealing the atomic bomb to the world and threatening Japan to capitulate (and perhaps a third purpose of a show of force to the Russians). As such, it makes sense that Truman focuses on the atom bomb's power and destructive force, and yet he obsesses over force and power to such an extent that the objectives of winning the war and peace almost disappear in the exultation of having achieved "a harnessing of the basic power of the universe." Massive manpower, financial resources, scientists of great distinction all go into an effort that is not ultimately aimed at peace but at power. What does it tell us when "the greatest achievement of organized science in history" is put in the service of gaining power and force? The movement in the hierarchy is the investment of money and labor (agencies) in order to achieve a greater agency (power). Truman's jubilant tone hits a sour note when the text concludes with the need for secrecy and "the threat of sudden destruction." Against this background, the concluding statement of a hope that atomic energy may become a powerful force for peace in the world sounds rather feeble and in direct contradiction to the main thrust of the rest of the message.

The focus on power makes sense rhetorically, considering that Truman was trying to talk the Japanese into surrendering before the U.S. would drop the next atomic bomb over Nagasaki, but it also sent a message to the world that the atomic bomb = power to the nation that wields it. Truman states at the end that there may be ways in which the atomic bomb can become "a powerful and forceful influence towards the maintenance of world peace," and yet the momentum of the preceding text rather establishes the atomic bomb as a talisman giving those who wield it the power to impose their will on other nations. Considering that the Russians were listening to the speech, Truman may have done this intentionally to intimidate them, but he also

set a precedent for the "diplomacy by nuclear threat" that would come to dominate the Cold War. Andrei Sakharov, who later invented the Russian hydrogen bomb, wrote about reading Truman's speech: "There could be no doubt that my fate and the fate of many others, perhaps the entire world, had changed overnight. Something new and awesome had entered our lives, a product of the greatest of the sciences" (Rhodes, *Dark Sun* 178). Joseph Stalin responded quickly with the following message to the Russian scientists: "A single demand of you, comrades, provide us with atomic weapons in the shortest possible time. You know that Hiroshima has shaken the whole world. The equilibrium has been destroyed. Provide the bomb" (Rhodes, *Dark Sun* 179).

Conclusion

Through this chapter I have shown how Kenneth Burke's indexing method relates to his larger theory of form, language, and dramatism. Indexing is Burke's primary method to uncover "the hidden motives for human effort" and give critics understanding of the ironic nature of the human species. Indexing can do this because it helps a critic identify the basic clusters and hierarchies in a text that are essential for both long-term memory and literary form. These structures also require some organizing principle, a god-term. Clusters, hierarchies, and god-terms create logics of form that direct and drive humans towards specific ends, and this is what Burke calls consummation or the consummatory drive. There are two main patterns for this drive: dramatic catharsis and dialectical transcendence. Dramatic catharsis has a cyclical nature whereas dialectical transcendence has a more pyramidal form.

In rhetorical scholarship so far, Burke's method has been either ignored or significantly reduced to what has been called "cluster analysis," which disregards hierarchies of terms and god-terms. My explanation of the method includes these essential features and in addition

gathers guidelines, clues, and examples for each step from Burke's published scholarship, archival materials, and interactions with students. This is a more detailed explanation than what is available in the existing scholarship.

In addition to these explanations I have also given a sample analysis using the method on Truman's speech while guiding readers through every step. The analysis shows how Truman's speech created consummatory drive which, if taken to its ultimate conclusion, equates greater power with the greatest moral good and subordinates nature and science as means to greater power and control.

My Methodology in Indexing the Manhattan Project Scientists

In "Linguistic Approach to Problems of Education," Burke explains how rhetorical critics can use indexing to discover motivational structures among large social groups:

> We proceed on the assumption that the "perfect case" for analytic purposes is a definitive literary text. . . . In this case, the "signs" manifested by a human personality or by a social incident (or social order, or social movement, or cultural trend in general) would be treated as relatively obscure aspects of motivational structures that are *least* obscure in literary texts. There would thus be no difference "in principle" between textual analysis and social analysis. (270, emphasis added)

So Burke is basically claiming that we can do social analysis, analyze a society, through textual analysis. By "literary text," I do not necessarily think that Burke referred only to canonized masterpieces of literature. From the archival evidence it seems he had his students index a variety of texts, including educational treatises, philosophic texts, speeches, essays, etc., and

Burke himself indexed everything from congressional hearings to newspaper articles.[78] I think his ideal case involved influential texts that attempt to organize the audiences' thoughts in a somewhat consistent manner. For a text to be consistent, it has to have an organizing principle, and it has to keep arousing expectations, which it thereafter fulfills.

Similarly to the hierarchies of terms, which we continually encounter fragmentary variants of, the symbol-usage of a social group contains motivational structures that one can analyze or index. The problem is that these are sometimes obscure, although they become least obscure in literary texts. In other words, literary texts work as concentrations of motivational structures that are otherwise found in diluted forms in Facebook comments, everyday conversations, tweets, text messages, etc. Critics choose literary texts as initial "case studies" of symbolic structures because they often provide a completed system where these structures are "least obscure." However, Burke sees "no reason why specialists in other sciences could not apply the same procedures *mutatis mutandis* to their subjects. Our major difference . . . is in the overall direction we would give to such procedures" (275). So critics can choose whether to start with a definitive text and then move from there to individual conversations, letters, etc., or go the other way. Critics could index conversations, letters, Facebook comments, etc. just as well, though the motivational structures in these texts may initially be more obscure.

For my research, I have studied the discourse of a small number of the Los Alamos scientists, especially as it played out during three years (1943-46). I identified three "definitive texts" that had the power to direct the attention and efforts of this community: *The Los Alamos Primer* by Robert Serber; "Niels Bohr's Memorandum to President Roosevelt, July 1944"; and

[78] For example, he indexed Senator Carter Glass's defense of the gold standard, showing how the senator equated gold with God (*Philosophy* 58).

the “Frisch-Peierls Memorandum, March 1940.” I then looked for similar structures in the smaller texts produced by the community to see how influential these definitive texts really were and how these motivational structures spread. The segment for analysis is complete texts.

I have indexed the three texts mentioned previously in detail, and then looked for patterns from these texts in the other archival materials. I chose the texts according to their relevance to discussions of the bomb. Throughout this analysis, I have tried to make it clear what I consider as textual facts and what inferences I have added to these facts. The goal has been to make as much as possible of the process replicable for other critics to compare my results with their own.

Chapter 3: Three Visions of Nuclear Weapons among the Manhattan Project Scientists

Consummation is an aesthetic motive experienced by groups and individuals and relies on vocabularies that have a god-term and an internal consistency or formal logic which its adherents can learn and apply. Burke does not have a specific term for these vocabularies, but I have chosen to refer to them as consummatory vocabularies or visions. As mentioned in chapter 1, Kenneth Burke writes that his concept of "consummation" is the aesthetic analogue of Saint Anselm's concept of "vision," and "vision" is a good description of what Burke means by these vocabularies. To "have a vision" is an experience that is a synthesis of information and emotions, which is how Burke describes consummation, and the term also brings to mind the consummatory feature of "grasping an essence or god-term." The term also embodies the vocabulary's ability to suggest future possibilities and make those who glimpse them "called" or "under a kind of compulsion" to make them a reality (*Human* 74), and it is a term already used by Thomas Kuhn and Michael Polanyi to describe similar phenomena among scientists. A vision or consummatory vocabulary is not the same as consummation, which is a drive that has to be experienced. A vision has the *potential* or necessary formal characteristics to generate the drive of consummation when it is adopted by people, and it is this potential I analyze in the three visions in this chapter. In chapter four I analyze the spread and adoption of these visions along with the scientists' experiences of the consummatory drive the visions created.

The three visions I discuss in this chapter are found in three texts: The *Frisch-Peierls Memorandum*, the *Los Alamos Primer*, and Niels Bohr's "Memorandum to President Roosevelt." I track the creation of these visions of nuclear weapons and index what I take to be their most complete articulations, to explain their structure and the drive they create. The three visions each have their own hierarchies of terms and envision different ends or goals, but they all legitimize

the creation of the atomic bomb, even when sometimes branding it a necessary evil. Each vision taught the scientists a way to think about what they were doing and gave them a more comprehensive frame of reference for their tasks. As Barry Brummett claims, "It is from our moments of attending to integrated texts in a focused way that we learn the logics, the forms, by which we assemble diffuse and scattered signs at other moments of intercepting signs" (8). Because these visions define the new situation for atomic scientists in wartime, they function as interpretations of a situation, and they appeal by giving simplicity and order to "an otherwise unclarified complexity," providing "a terminology of thoughts, actions, emotions, attitudes" (*Counter-Statement* 154).

As I argue in this chapter, the three visions share a common materialist foundation based on logical positivism, which states that all non-analytical knowledge can be reduced to the form of the experiment and that the purposes of science are knowledge and beauty. But, as Francis Bacon states, knowledge is also power (scientia potentia est), and the three visions, developed during WWII, make the next logical step that "science is power" and, specifically, "science is power of destruction." In the *Frisch-Peierls Memorandum*, Otto Frisch and Rudolf Peierls outline the science of nuclear explosions, describe the power these explosions will yield, and proceed to the military and social consequences of this new power, outlining a logic of nuclear deterrence. The *Los Alamos Primer* leaves out any discussion of consequences (or anything beyond the science and engineering aspects), focusing instead on the power of nuclear explosions and the goal to "maximize damage and efficiency" as an end in itself. Both these visions are structured as hierarchies, with science subordinated to the greater goal of power. In contrast, Niels Bohr sees the development of nuclear weapons as a manifestation of the proclivity of science to create radical change, and he outlines two possible futures in a world

with nuclear weapons. Rather than the hierarchical structure of dialectical transcendence, Bohr organizes his vision in the more cyclical structure of dramatic catharsis, with science as the generating principle and moving force for radical changes in international relationships.

Visions and Forms

As mentioned in the first chapter, consummation is a form that relies primarily on syllogistic progression, but the three visions I analyze also rely on what Barry Brummett calls a "cultural form" that I will name "the experiment." For Burke, form or the *potential* for experiencing form, is located in the human mind and exists prior to the *experience* of form.[79] In "A Burkean Framework for Rhetoric in the Digital Age," Barry Brummett claims that form is both *prior to* and the *arbiter of* experience:

> I think it could as well be argued that form is the transcendent ground out of which we have experiences. Our experiences may be in the material world but are always discursive, always formally patterned, or else we do not have them. Here I might invoke [I. A.] Richards again to argue that perceptions are already patterned, or sorted in his terms, or we do not experience them. (5)

Brummett discusses three levels of forms: Humans perceive reality through *fundamental forms*, such as contrast, antithesis, comparison, series, that operate somewhat like filters or sorting mechanisms and are "implicit in the processes of abstraction and generalization by which we

[79] One example he gives in *A Rhetoric of Motives* is class and property structure, where he argues that the form or idea of hierarchy predates the invention of the diverse modern economic systems: "For the human mind, as the organ of a symbol-using animal, is 'prior' to any *particular* property structure—and in this sense the laws of symbols are prior to economic laws. Out of his symbols, man has developed all his inventions. Hence, why should not their symbolic origin remain concealed in them?" (136).

think" (*Counter-Statement* 142). Beyond these basic forms, Brummett claims that there are also *cultural forms* (the focus of *Permanence and Change* and *Attitudes Toward History*), and these are more malleable. Some examples Brummett gives are "The Frontier Myth" and "The Communitarian Myth" by which many Americans sort their political preferences, and Burke would include the occupational psychosis and pieties of an accountant, banker, poet, or criminal. A cultural form is a form that is shared by a group of people and is closely connected to how they identify themselves.

Growing up, people may be exposed to different cultural forms, but at some point, Brummett argues, a crucial move is made by the individual and one form becomes primary: "It becomes the template for how we organize wide swathes of experience, text, and media. Subject, the world, and our experiences in the world body forth from form. The seed planted by repeated exposure to single texts is internalized and grows into the kudzu vine of form hooking wide ranges of life into itself through its formal tendrils" (13-14). For this case study, I could say, for example, that this crucial move is made when a student of science comes to define herself as a scientist, and the cultural form of "the experiment" becomes a template for how she approaches the known and the unknown.

Based on these cultural forms there are artistic forms one encounters in individual texts. One of these artistic forms is a consummatory vocabulary or vision. The foundational forms are pre-verbal, whereas cultural forms are created and sustained by texts and therefore also have the ability to engender a consummatory drive. The structures in artistic forms are often more tangible than those in cultural forms, where hierarchies of values and priorities are often more implicit and assumed and are expressed through shared practices, rituals, and expectations. To a greater extent than ideas, forms are transferrable. They become *modus operandi*, or general

strategies, that people can call upon when they face new situations. I argue that the cultural form of "the experiment" made the scientists of the Manhattan Project susceptible to the consummatory drive in the three visions of nuclear weapons.

The Experiment and Knowledge in Logical Positivism

In *A Rhetoric of Motives*, Kenneth Burke writes that a form "invites participation regardless of the subject matter" and teaches the mind to think in certain patterns (58). Such formal appeal makes the audience ready to agree to the claim that is made through the form almost without them noticing it. Burke writes:

> Of course, the more violent your original resistance, the weaker will be your degree of "surrender" by "collaborating" with the form. But in cases where a decision is still to be reached, a yielding to the form prepares for assent to the matter identified with it. Thus, you are drawn to the form, not in your capacity as a partisan, but because of some "universal" appeal in it. And this attitude of assent may then be transferred to the matter which happens to be associated with the form. (58)

Burke writes that formal appeal can also be found in the "neutral vocabularies of science," and this appeal "can so catch a man's fancy" that a person can be led nonconsciously to export the *form of the laboratory experiment*, which I argue is a cultural form for the scientists, to "the realm of human relations" (34, emphasis added). Burke claims:

> Possibilities of deception arise particularly with those ironies whereby scientists' truly splendid terminology for the expert smashing of lifeless things can so catch a man's fancy that he would transfer it to the realm of human relations likewise. It

> is not a great step from the purely professional poisoning of harmful insects to the purely professional blasting and poisoning of human beings. (34)

The pattern of this cultural form (the experiment) was dictated by the larger philosophical framework of logical positivism, which defined the nature and limits of scientific thought for the generation of scientists who participated in the Manhattan Project. In this chapter, I track this form from its articulation in logical positivism to its specific application in the three visions.

One cultural form the scientists held in common was one I have called "the experiment," and identification with that form was closely related to their identity as scientists. I chose the name because, as I argue later in the text, the act of the experiment functioned as a representative anecdote of what it meant to "do science" and "be a scientist." Though experiments have a long history, the thinking of the Manhattan Project scientists about the metaphysical importance and significance of the experiment was primarily informed by logical positivism. At the apex of logical positivism, the experiment is like a ritual that culminates in a direct experience of reality or truth. In his influential 1934 essay "Über das Fundament der Erkenntnis" ("The Foundation of Knowledge"), Moritz Schlick describes the validation of an hypothesis through experimentation as "arriving at the joy of confirmation [Bestätigungsfreude]" and "the feeling of finality [Gefühl der Entgültigkeit]." He describes the experience as follows:

> The problem of the "basis" [foundation for knowledge] changes then automatically into that of the unshakeable point of contact between knowledge and reality. We have come to know these absolutely fixed points of contacts, the confirmations, in their individuality. . . . They do not in any way lie at the base of science; but like a flame, cognition, as it were, licks out to them, reaching each but for a moment and then at once consuming it. And newly fed and strengthened,

> it flames onward ["upward" in the German original] to the next. These moments of fulfilment and combustion are what is essential. All the light of knowledge comes from them. (226-27)

In other words, it is only by the experiment, by empirical verification, that humans can get direct access to reality. A successful experiment is the fuel of knowledge and cognition, bringing both upwards to a higher plane. This is similar to what Polanyi writes about how scientific discovery "bursts the bonds of disciplined thought in an intense if transient moment of heuristic vision" (196). In the human psyche, verification by experiment becomes for the scientist what the moment of "revelation" is for the Christian mystic: direct experience of reality and nature in its purest form.

To understand the context of Schlick's grandiose statement on verification, it helps to understand the epistemological anxiety that created the impetus for the positivist project. The grand philosopher of positivism was Wittgenstein, shortly followed by Bertrand Russell. The goal of what was both a scientific and political movement was to reduce all meaning to what could be explicitly verified and thereby find some morsel of solid truth in a universe that modernism had shown to be full of lies and self-delusion (Ayer 8-11).

In his 1924 article "Logical Atomism," a vision statement for logical positivism, Russell writes, "I came to philosophy through mathematics, or rather through the wish to find some reason to believe in the truth of mathematics. From early youth, I had an ardent desire to believe that there can be such a thing as knowledge, combined with a great difficulty in accepting much that passes as knowledge" (31). Russell then chronicles how he became content that greater care and accuracy in science are all that is needed to rescue knowledge from the philosophic doubts of modernism, and he shows how mathematicians and scientists have invalidated mathematical

arguments made by Kant and Hegel (32).[80] He claims that the methods of math and science are more "fruitful" and "powerful" than traditional philosophy because they work (32-3), and he then proceeds to remove existence, space, time, and subject as useful concepts of reality because they cannot be measured scientifically (34-7). Physics is posited by Russell as the ideal, the most perfected science because of its progress and accurate measurements (37), and Albert Einstein is posited as a main authority on reality because Russell claims he has contributed more, with his law of relativity, to our understanding of the world than any philosopher (42), leading to Russell's conclusion that science is truer than philosophy and should therefore be prioritized (46).

The logical positivists followed his lead and applied this new Occam's razor (or flame-thrower) to much of the world's intellectual culture. Following David Hume's admonition that any book in the library not containing numerical or experimental data should be committed to the flames "for it can contain nothing but sophistry and illusion" (of which A.J. Ayers adds, "It is an excellent statement of the positivist's position") (10), they consequently proclaim philosophy dead (Schlick 59), values and norms as meaningless (Carnap 61), metaphysics as nonsense (Carnap 65), all aesthetics and epistemologies as trash that can be discarded (Carnap 76-77), and

[80] Russell writes, "I found that many of the stock philosophical arguments about mathematics (derived in the main from Kant) had been rendered invalid by the progress of mathematics in the meanwhile" with non-Euclidian geometry undermining his argument of "the transcendental aesthetic," Weierstrass's work on the differential and integral calculus abolishes a need for "the conception of the infinitesimal" and "therefore all that had been said by philosophers on such subjects as the continuity of time and space and motion must be regarded as sheer error," Cantor "freed the conception of infinite number from contradiction, and thus disposed of Kant's antinomies as well as many of Hegel's," and Frege showed how arithmetic can be deduced from pure logic and disproved Kant's assertion that 7+5=12 is a "synthetic" judgment (32).

all metaphysicians as "musicians without musical ability" (Carnap 80). Hans Hahn even rejects scientific theories as a form of knowledge and situates all knowledge in experience.[81]

The intellectual moves in logical positivism are dominated by reductionism to the lowest verifiable point of contact "between knowledge and reality." As A. J. Ayer, a philosopher of logical positivism, writes, "But how do I know that I am angry? I feel it. How do I know that there is now a loud sound? I hear it. How do I know that this is a red patch? I see it. If this answer is not regarded as satisfactory, I do not know what other can be given" (241-2). Rudolf Carnap, a logical positivist and German-language philosopher, claims, "It is through this reduction that the word acquires its meaning" (63). Reality is thus reduced to sense perceptions, and everything beyond that is nonsense. Against this epistemological angst, verification through experimentation becomes the salvation of the anxious soul.

The goal, according to Robert Oppenheimer, is to reject "questions that cannot be answered" and "throw away those instruments of action and those modes of description which are not appropriate to the reality we are trying to discern" ("Physics" 68). In exchange, one gets simplicity, order, and harmony. Such a limited method facilitates unity, but it does so by disregarding complexity and all aspects of reality that cannot be examined by the methods of the discipline. Oppenheimer admits as much in 1926 when he writes that the physicists at the University of Göttingen were "combining a fantastically impregnable metaphysical disingenuousness with the gogetting habits of a wall paper manufacturer. The result is that the

[81] As Hahn writes, "Why should that which compels our thoughts [convincing scientific theories] also compel the course of nature? One would have to believe in some miraculous pre-established harmony between the course of our thinking and the course of nature, an idea which is highly mystical and ultimately theological. There is no way out of this situation except a return to a purely empiricist standpoint, to the view that observation is the only source of knowledge of facts" (Hahn 151-2) In other words, nothing is true until it has been empirically verified, even if it follows logically from a highly respected scientific theory.

work done . . . has an almost demoniac lack of plausibility to it and is highly successful" (qtd. in Smith and Weiner 100). Oppenheimer and the logical positivists are here advocating a system of knowledge that makes human choice as insignificant as possible in determining outcomes.[82]

The materialist metaphysics of positivism reduces what is true to what can be proven through empirical verification (i.e., experiments) and thereby posits "the experiment" as the only mechanism of finding truth. Positivism subordinates all of reality and intellectual culture to the experiment, and scientists are those qualified and trusted by humans to perform the experiments, which, in turn, reveal truth. Scientists are therefore under an implicit ethical obligation to conduct and complete as many useful experiments as they can in order to increase the knowledge of humankind and their power over nature. In addition to this ethical obligation, the form of the experiment creates a strong aesthetic motive to complete a scientific process of discovery once it has been initiated.

The Form of the Experiment

As previously shown, Moritz Schlick describes the form of "the experiment" as an upwards circular spiral since scientists arrive at a higher level of knowledge after the experiment. I have made a rough illustration of the cycle's key stages in Figure 1. Scientists start with the knowledge that is the result of other experiments, and this stimulates their minds to formulate a question. Based on the question, scientists try to find answers and formulate an hypothesis. Scientists then initially believe they have found the answer and then have to systematically doubt it in order to subject it to a test, some controlled experiment. The experiment is "the moment of

[82] Of course, one first has to choose what to focus on and what to ignore or disregard, and positivists do make that choice actively, but they disguise the arbitrary nature of that choice.

truth" where the hypothesis is either validated or refuted; either case results in increased knowledge. These moments of truth are usually the climax of the form, and they are the central motivation for scientists to continue the discovery process. As Schlick writes, "Like a flame, cognition, as it were, licks out to them, reaching each but for a moment and then at once consuming it. And newly fed and strengthened, it flames onward to the next" (226). The knowledge from this or other experiments inspires a new question, and the cycle repeats itself.

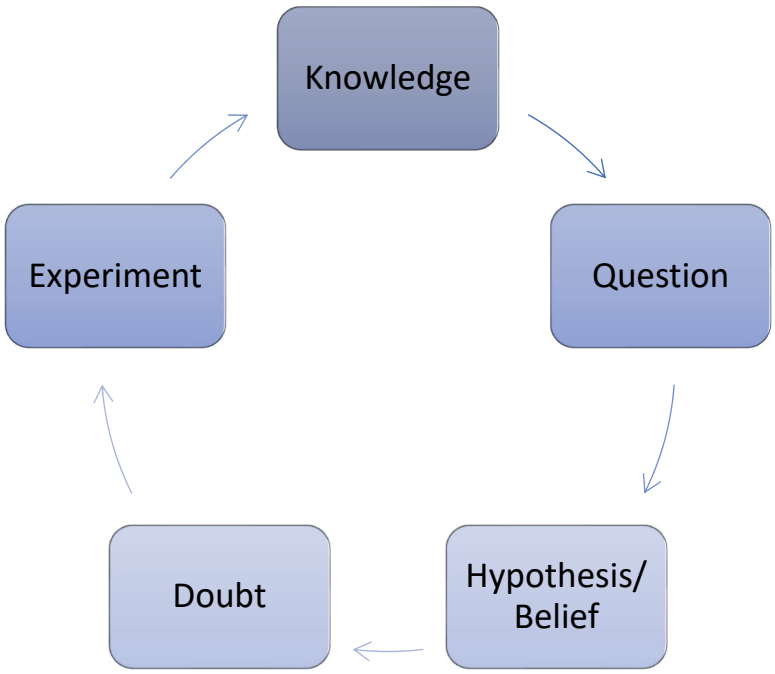

Figure 8 Outline of the form of the experiment

This rhythm of exploration, doubt, and discovery is not just an intellectual journey; it also becomes an aesthetic experience scientists find pleasing, a completion of a process. As Burke writes, "An ability to function in a certain way implies gratification in so functioning. A capacity is not something which lies dormant until used—a capacity is a command to act in a certain

way" (*Counter-Statement* 142). Many scientists describe the mental and physical exertion involved in soaking up knowledge, formulating a question, finding an hypothesis, devising an experiment to validate or invalidate it, and then at times experiencing what Schlick calls "the joy of confirmation" as a form which defines their identity as scientists. In the era of positivist physics, empirical experimentation was the definition of science, and a scientist was defined as someone who "did" science or who conducted scientific experiments.[83]

In addition, the aesthetic pattern of the experiment became for many what Edward Teller and Robert Oppenheimer describe as "an addiction" (*Legacy* 160; Smith and Weiner 63-4). The gratification scientists got from this aesthetic process made it something they turned to for pleasure as much as for professional advancement. Stanislaw Ulam figured out the algorithm to test the probability of a hydrogen bomb as a way to pass time while convalescing at the hospital (G. Dyson 190). Teller figured out the theoretical properties of four-dimensional regular polyhedra as a way to pass time during a boring train ride (Frisch 174). Rudolf Peierls describes a scientific discovery he made as follows: "This insight gave me great pleasure: the idea is suddenly there, and it takes only a few lines of calculation to verify it. The pleasure of this short moment makes up for many months of seemingly fruitless search" (52).

As shown in *The Making of the Atomic Bomb* by Richard Rhodes, this form features prominently in the thinking and motivations of the atomic scientists prior to their involvement with the Manhattan Project. Robert Oppenheimer and Ernest L. Lawrence both suffered from depression and acute anxiety about the world and their role in it, and "to all these emotional

[83] Michael Polanyi described how one qualified as a scientist in his generation (1920-1940). This involved a commitment to a naturalistic worldview, initiation through "close personal association with the intimate views and practices of a distinguished master," and a presumption that "the scientific doctrine and method are fundamentally sound and that their ultimate premises can be unquestioningly accepted" (*Science* 43-5).

troublings—Oppenheimer's and Lawrence's, as Bohr's and others' before and since—science offered an anchor: in discovery is the preservation of the world" (151). This discovery is brought about by a mixture of extreme speculation and systemic doubt.[84]

Many scientists describe the confirmation of an hypothesis as the most powerful experience of their lives. Ernest B. Rutherford, often called the godfather of modern physics, describes such a moment as "quite the most incredible event that has ever happened to me in my life" (152). When Einstein understood that "the general theory of relativity he was painfully developing in the isolation of his study explained anomalies in the orbit of Mercury that had been a mystery to astronomers for more than fifty years," he wrote, "for a few days, I was beside myself with excitement." He told other friends that his discovery "had given him palpitations of the heart," and "he had the feeling that something actually snapped in him" (152). The scientist speculates beyond the normal limits of sanity, daring to not only imagine but also believe in a world that is very different from the one accepted by most people. This invested belief carries with it great risk of ridicule and disappointment. Yet, as Rhodes writes:

> the compensation for such emotional risk can be enormous. For the scientist, at exactly the moment of discovery—the most unstable existential moment—the external world, nature itself, deeply confirms his inner-most fantastic convictions.

[84] Rhodes describes the relationship between the scientist and the paranoid patient as follows: "The difference between the thinking of the paranoid patient and the scientist comes from the latter's ability and willingness to test out his fantasies or grandiose conceptualizations through the systems of checks and balances science has established—and to give up those schemes that are shown not to be valid on the basis of these scientific checks. 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. Without this structuring, the threat of such unrealistic, illogical, and even bizarre thinking to overall thought and personality organization in general would be too great to permit the scientist the freedom of such fantasying. . . . At the leading edges of science, at the threshold of the truly new, the threat has often nearly overwhelmed" (151-2).

> Anchored abruptly in the world, Leviathan gasping on his hook, he is saved from extreme mental disorder by the most profound affirmation of the real. (152)

The uncertainty is painful, but the experiment can yield the joyful emotional reward of validation. Nature speaks to the scientists and follow their calculations. To believe, to doubt, and then to know that one is in fact not crazy, these are the emotional states of the experiment. This is the reward, the climax, which can make scientific discovery an addiction.

As I have shown, the form and logic of the experiment provide powerful ethical and aesthetic motivation for scientists to initiate and complete processes of scientific discovery. In the rest of this chapter, I will show how this logic was applied in the most influential texts in the Manhattan Project, and in chapter four I will show how this logic spread throughout the organization, and how this logic and the form of the experiment together provided a strong drive at Los Alamos to finish the bomb regardless of the consequences.

Deterrence and Balance of Powers: The Vision of Nuclear Weapons in the *Frisch-Peierls Memorandum*

This vision was first formulated by Otto Robert Frisch and Rudolf Peierls in what is known as the *Frisch-Peierls Memorandum in 1940*, and the document marks the beginning of the nuclear arms race against Nazi Germany. According to Richard Rhodes, this document and the *Los Alamos Primer* "carry a greater freight of historic import than perhaps any other document in the history of technology" ("Introduction" xi-xii). This text, which played a critical role in initiating the Manhattan Project, outlines the scientific principles and processes needed to construct an irresistible super-bomb and describes the effects and strategic value such a weapon could have for Great Britain. As I argue in my indexing and analysis, the text organizes reality in

terms of agency/purpose, with uranium, chemical processes, bomb design, and physics all functioning as means to create a formidable "agency" or power of destruction for Great Britain, effectively subordinating science to the purpose of power. It is a vision that uses the form of the experiment, but changes the purpose and result of the upwards spiral from "knowledge" to "power" in the form of a Super-bomb.

In doing so, the text builds on an established discourse of weapons of mass destruction. Although there were earlier iterations, this discourse developed in earnest with the innovation of large-scale chemical gas attacks in World War I. Nobel laureate Otto Hahn records a discussion he had with Fritz Haber, one of Germany's top chemists:

> He explained to me that the Western fronts . . . could be got moving again only by means of new weapons. One of the weapons contemplated was poison gas. . . . When I objected that this was a mode of warfare violating the Hague Convention he said that the French had already started it. . . . Besides, it was a way of saving countless lives, if it meant that the war could be brought to an end sooner. (Rhodes *Making* 92-3)

By the end of the war, over 200,000 tons of chemical weapons had been manufactured and used (93). The arguments for their production echoed those of Haber, using a kind of utilitarian calculus where reducing the numbers of human fatalities justified torturing, blinding, and strangling enemy soldiers with a host of vicious chemicals: "The chemists, like bargain hunters, imagined they were spending a pittance of tens of thousands of lives to save a purseful more. Britain reacted with moral outrage but capitulated in the name of parity" (Rhodes *Making* 95).

When Frisch and Peierls wrote their memorandum in 1940, they seem to have tapped into this same discourse, envisioning nuclear weapons as a special case of chemical weapons. Just as

Haber, they imagined the main use of the new weapon as a shock agent to break "through a line of fortifications" (81), just as Hahn they considered the legality of the new weapon in light of existing conventions about warfare (categorizing radioactivity as a kind of poison) (81-2), and just as the British during WWI, they advocated for the production of terrible weapons in the name of parity (82).

Otto Frisch became involved in the discovery of nuclear fission in 1938-9 by "mere chance," which "for the first time showed a way to make huge numbers of nuclei give up their hidden energy; the way to the atom bomb and to atomic power" (Frisch 113). From that discovery, the scientific community soon realized that this mechanism could initiate a chain of similar reactions, and "the exciting vision arose that by assembling enough pure uranium one might start a controlled chain reaction and liberate nuclear energy on a scale that really mattered" (118).[85]

Because of their Jewish ancestry, both Frisch and Peierls sought refuge in England right before the start of World War II and ended up together at Birmingham University. Excluded from work on the radar because they were technically still classified as enemy aliens, they started looking more into the problem of a uranium chain reaction. Bohr had previously claimed a sustained chain reaction in uranium was possible but that it would consist of slow neutrons and a bomb like that would blow itself apart before it could generate more energy than a comparable size of TNT. A fast neutron chain reaction in uranium was impossible, Bohr claimed, because

[85] The excitement was tangible all over the scientific community. On hearing the news, Bohr said, "Oh but this is wonderful. This is just as it must be!" (Frisch 116). He later referred to the prospects this news brought as "Fantastiske Udsigter [wonderful prospects]" and remembered that "this prospect not only at once attracted the most wide spread interest among physicists, but of its appeal to the imagination of larger circles I have vivid recollections" (*Niels Bohr* 102-3). Hans Bethe describes how "this discovery started a chain reaction among the atomic physicists who immediately started to project its applications" ("Review" 426).

only U^{235}, which was extremely scarce in nature, could sustain such a reaction (Peierls 152-3). Frisch had the idea that this barrier could be overcome by increasing the amount of U^{235} by a process called thermal diffusion and then calculated how large a cluster of nearly pure U^{235} would have to be to create a sustained chain reaction. Peierls calculated the numbers with him. Together they discovered that the mass would only have to be a pound or two and that a large plant to separate U^{235} could produce that amount "in a modest time" (126). Frisch writes, "At that point we stared at each other and realized that an atomic bomb might after all be possible" (126). Peierls writes, "We were quite staggered by these results: an atomic bomb was possible, after all, at least in principle! As a weapon, it would be so devastating that, from a military point of view, it would be worth the effort of setting up a plant to separate the isotopes. In a classical understatement, we said to ourselves, 'Even if this plant costs as much as a battleship, it would be worth having'" (154).

After the first elation and excitement, their next reaction was fear. German chemists were experts on thermal diffusion, and the idea of enriching uranium was so obvious that it seemed likely the Germans had already thought of it (Peierls 154; Frisch 126-7). Richard Rhodes writes, "Responsible men who properly and understandably feared a dangerous enemy saw their own ideas reflected back to them malevolently distorted" (*Making* 325). In light of this, Frisch and Peierls decided to alert the authorities, through their supervisor, Mark Oliphant. He asked them to write their findings in a memo and send it on to Henry Tizard, the government advisor on "scientific problems concerned with warfare" (Frisch 127).

The *Frisch-Peierls Memorandum* actually consists of two individual texts: "one was technical and gave the arguments, and the other was nontechnical and summarized the conclusions" (Peierls 154). The second text of the two, "was . . . intended as an alternative

presentation for nonscientists" (Rhodes *Making* 324). The first text, titled "On the Construction of a 'Super-bomb'; Based on a Chain Reaction in Uranium," starts with the possibilities of fission, moves through arguments about how a sustained fast neutron chain reaction can be possible, and goes on to describe a potential bomb design and the effects such a bomb would have in a war scenario (Frisch and Peierls 83-8). The second text, "Memorandum on the Properties of a Radioactive 'Super-bomb,'" moves quickly through the production process for an atom bomb to focus primarily on the strategic value and effect such a weapon might have (80-3). Both texts discuss the possibility that Germany might already be constructing such a bomb, and the second one argues for "a counter-threat with a similar bomb" as the most effective response (82). Frisch writes that the memorandum "was sent off within a couple of weeks and was decisive in getting the British Government to take the atomic bomb seriously" (Frisch 127). The following index and analysis will show the logic they were sold along with the product they were promised.

Key terms: As indicated in the titles of the two texts, "super-bomb" is a central topic in the texts and an obvious key term. This term encompasses almost everything that is written in the text, but there are some other terms that seem to be significant actors. One is "radioactivity," another is "Germans," and a third is "detection squads" (teams intended as first responders to the radioactive area of a potential German nuclear strike). The first of these three, since it is an attribute of the super-bomb, will almost certainly be a part of the super-bomb hierarchy, but I will first treat it separately.

Equations: These are some of the most prominent equations I found for "super-bomb."

Utilizes energy stored in atom as source of energy, same as explosion of 1,000 tons of dynamite, a temperature comparable to that in the interior of the sun, blast will destroy life in a

wide area, size probably cover the center of a big city, process, treat a few cwt of uranium, separate light isotope, methods developed, cost not prohibitive, critical size (one pound), exceeds = explosion, less = safe, danger of premature explosion, a mechanism to bring parts together, penetrating radiation, initiate explosion within seconds, strategic value, practically irresistible, no material, structure expected to resist force of the explosion, use for breaking through a line of fortifications, depth charge near naval base (great loss of civilian life by flooding and radioactive radiations), no effective shelters available, counter-threat most effective reply, start production as rapidly as possible, separation matter of several months, too late when bomb is known to be in the hands of Germany, very urgent, fission ascribed to U^{235}, much greater fission probability, liberate 200 MeV energy, thermal diffusion, uranium hexafluoride, fractioning effect, 40% difference in concentration, 100,000 tubes, nearly pure U^{235}, 1 gram per day, daily production of 100 grams, U^{235} of 90% purity, neutrons of any energy are effective, extremely efficient explosive, almost every collision produces fission, reaction develops with great rapidity, velocities of about 10^{19} cm/sec, considerable part of the total energy is liberated, temperatures of the order of 10^{10} degrees, pressures of about 10^{13} atmospheres, 5kg = several thousand tons of dynamite, 1kg = still formidable, destructive effect of explosion, effective protection hardly possible, advantage would lie with the aggressor, could not be used without killing large numbers of civilians, may be unsuitable as a weapon for use by this country.

Here are some of the most prominent equations I found for “radioactivity”:

Some parts of the energy produce radioactive substances, emit very powerful and dangerous radiations, greatest effect immediately after the explosion (any person entering area will be killed), some carried with wind spread contamination several miles downwind (may kill

people), prevent anyone from approaching affected territory for days, advantage for side who determines when safe to re-enter = aggressor, spread of reactive substances with the wind, lethal dose = 1,000 Röntgen (danger limit), cloud of radioactive material will kill everybody within a strip estimated to be several miles long (worse if rains), a great number of active bodies (half-lives from 1 second to 1 year), intensity inverse proportional to time, 1,000 kWh (equivalent to hundred tons of radium), whole material turned into a highly radioactive state, energy radiated/active substances (20% of energy liberated in the explosion), radiations fatal long time after the explosion, strong doses kill instantly, weaker doses, delayed effects, no warning until too late, dangerous radiation, further biological research urgently required.

"Germans" has the following equations:

No information the idea has occurred to them, quite conceivable Germany is developing this weapon, separation plant too small to be detected, helpful info = exploitation of uranium mines, purchases of uranium, and location and status of Dr. Clusius,[86] extreme importance of keeping secret from them, too late when bomb is known to be in the hands of Germany.

For "detection squad" (concerning first responders to a potential German nuclear strike) I found the following equations:

Deal with radioactive effects, measure, determine extent, prevent people entering danger zone, planes and cars with lead plates, cabin hermetically sealed (oxygen in cylinders), danger from contaminated air, detection staff, safety limit.

Hierarchies of terms: Neither "Germans" nor "detection squad," seems to be integrally connected to the main thrust and message of the text. I therefore find it unlikely that they will be

[86] Dr. K. Clusius, from University of Munich, invented the method of thermal diffusion.

important to the memorandum's central hierarchy. On the other hand, "super-bomb" and "radioactivity" are both very central and are intrinsically connected. I will take these two clusters as the basis for the hierarchy.

This text seems to follow the agency/purpose ratio that Burke identifies as typical for the thinking in modern science: "modern science is *par excellence* an accumulation of new agencies (means, instruments, methods). And this locus of new power, in striking men's fancy, has called forth 'philosophies of science' that would raise agency to first place" (*Grammar* 275). Yet with the focus being on military applications of a scientific discovery, the text moves beyond the normal realms of science to a more general purpose. For every level in the hierarchy, an agency or potential in nature through science is gradually increased to a greater agency. On the most basic level, the agency that makes this entire development possible is "the energy stored in the atom" and specifically the attributes of U^{235} (much greater fission probability) that make fission possible (liberating 200 MeV of energy and emitting on average 2.3 neutrons). By an enrichment process and an effective firing mechanism, a fast neutron chain reaction is achieved, creating "an extremely efficient explosive." The chain reaction of that explosive in turn leads to "temperatures of the order of 10^{10} degrees" and produces "pressures of about 10^{13} atmospheres."

The "destructive effect of the explosion" can be divided into three categories. The first is the temperature, "comparable to that in the interior of the sun." The second is the blast, which would be equivalent to one from "1,000 tons of dynamite" and would "destroy life in a wide area" probably big enough to cover "the center of a big city." The third is the radioactivity, and this is the level where most of that cluster fits, since the radioactivity of the amounts and effects described in the text are only created in a nuclear explosion. The bomb emits "very powerful and dangerous radiations" from "a great number of active bodies (half-lives from 1 second to 1

year)" that are created by the explosion. The "greatest effect" will be "immediately after the explosion" (any person entering area will be killed), and a "cloud of radioactive material will kill everybody within a strip estimated to be several miles long" (worse if it rains). Even several days later, the radiation would be about "1,000 kWh" (equivalent to hundred tons of radium), with "radiations fatal long time after the explosion." "Strong doses kill instantly," whereas "weaker doses" have "delayed effects," and so humans exposed to weaker doses will have "no warning until it is too late."

These are the material effects of the explosion, but they are subordinated to the "strategic value" such a weapon might have (a higher agency). The terms describing the strategic level are more abstract and general in nature and, therefore, constitute a higher level in the hierarchy: "Effective protection is hardly possible," "there is no material or structure that could be expected to resist the force of the explosion," and "no shelters are available that would be effective," leading to the obvious conclusion that "as a weapon, the super-bomb would be irresistible." In addition, Frisch and Peierls note that, if used, "the advantage would lie with . . . the aggressor" in a conflict and that the weapon "could probably not be used without killing large numbers of civilians," which "may make it unsuitable as a weapon for use by this country." Considering that it is "quite conceivable" Germany may be already developing such a weapon, these warnings take on increased urgency. With an irresistible weapon that gives a clear advantage to the aggressor in a conflict, the suggestion of the authors seems logical: "The most effective reply would be a counter-threat with a similar bomb," updating the "parity" doctrine from WWI to include nuclear deterrence and a balance of terror.

God-term: The god-term summarizing all these strategic values as well as the effort and effects further down in the hierarchy is "Super-bomb." The name implies that this is simply

another bomb with a tremendous explosive yield, roughly equivalent (as Peierls states) to a battleship. It can break down any wall, penetrate any shelter, and gives the advantage to whomever uses it first. Several possible uses and implications of the bomb are suggested, but the purpose of all operations in the text is simply to build the super-bomb and add it to the Allies' arsenal. It starts similarly to Schlick's spiral form in the experiment, with certain laws of nature and mathematical calculations hypothesized to achieve a certain result, but the hierarchy then moves beyond knowledge as the goal to the destructive and strategic power now made available to the Allies.

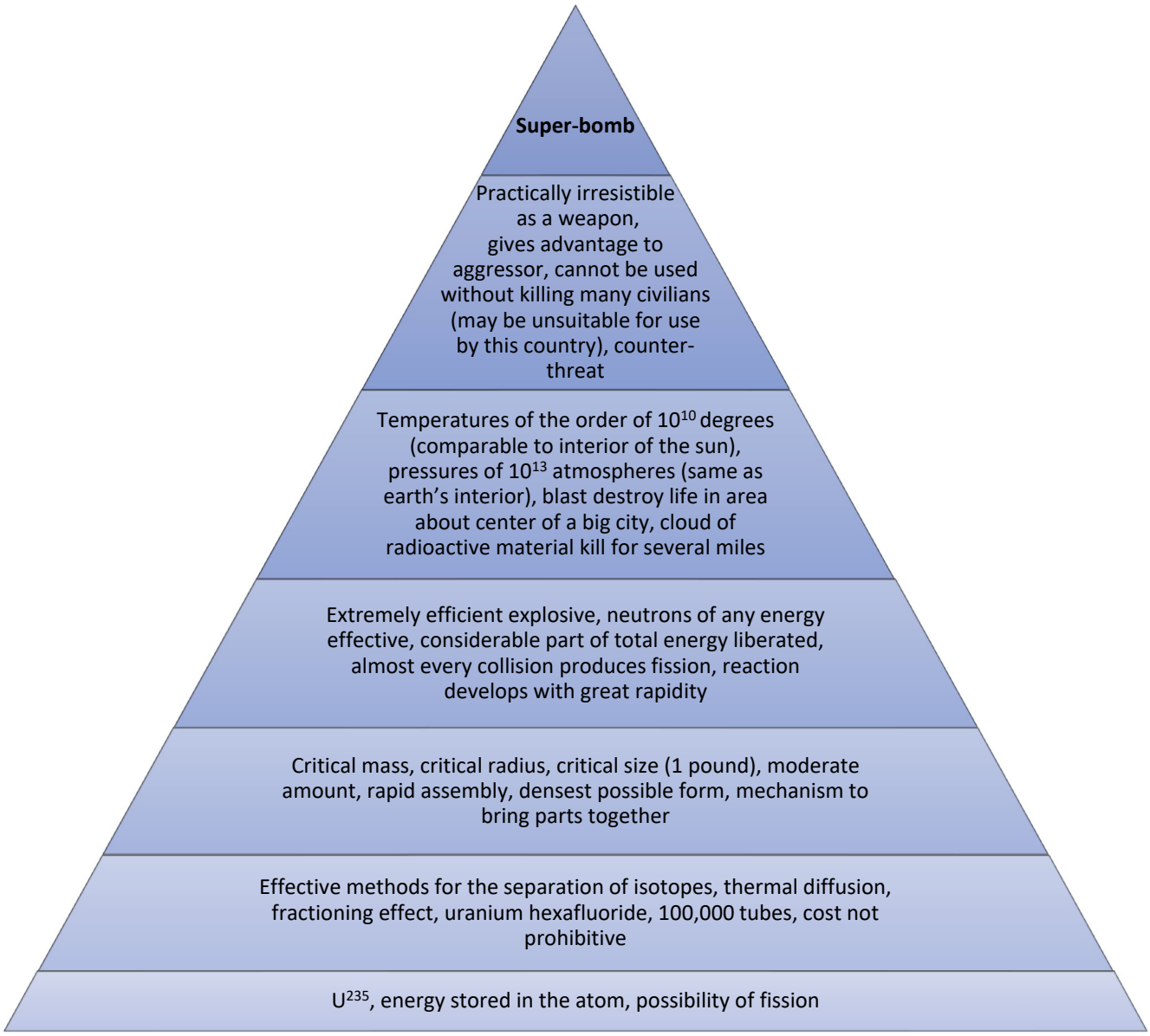

Figure 9: Hierarchy for the Frisch-Peierls Memorandum.

The text is dispassionate almost to the point of cruelty and brings to mind Burke's warning that the "'imaginal' danger in the modern demoralized use of the powers of applied science" is that they "invite the user of such powers to treat mankind itself in the same terms. Those who do not feel a certain distress even in the chemical eradication of bacteria harmful to human life, open the way for those will treat human life itself as mere bacteria" (*War* 245-6).

Yet, at the same time, this is the only of the three visions that states any reservations against the military use of the bomb (because of the inevitable civilian casualties), warns about the dangers of radioactivity, and envisions the bomb project potentially as a primarily defensive countermeasure, motivated by fear of a parallel German atomic bomb project. Frisch writes that the Manhattan Project would have been untenable if it were not for "the fanatical ingenuity of the allied physicists and engineers, driven by the fear that Hitler might develop the decisive weapon before they did" (Frisch 119). I will come back to this "fanatical ingenuity" in chapter 4.

This vision of nuclear weapons came to define much of the discourse on nuclear weapons after WWII, and one prominent spokesman for the vision was Hans Bethe, who had led the Theoretical Division at Los Alamos. In a 1958 review of *Brighter Than a Thousand Suns* by Robert Jungk, Bethe writes:

> Scientists must be willing to work for government and in government, and they must be willing to work on weapons. They must do this also because our present struggle is (fortunately) not carried on in actual warfare, which has become an absurdity, but in technical development for a potential war which nobody expects to come. The scientists must preserve the precarious balance of armament which would make it disastrous for either side to start a war. (428)

However, there is also a more nefarious side to this vision, since it, with the right amount of paranoia, can justify almost any expense for weapons research or any increase in destructive technologies without limit. As Frisch implies, the main motivating drive for action in this vision is fear and distrust in connection with increasing amounts of destructive power. Because of this, the balance of terror and deterrence is always a tenuous balance, since it is never possible to know with complete accuracy how balanced the terror actually is or how effective the deterrence

is. If distrust and fear dictate the actions of a nation, then the nation will always seek to be ahead out of fear that it is actually behind. No assurances from the rival nation will dissuade this action, since the first nation both distrusts these assurances and constantly fears the worst outcome. This developed into what Hans Bethe would name "the technological imperative" and caused the United States and Russia to continue developing an amount and scale of atomic weapons that went far beyond the amount needed to kill almost every human.[87] Bethe concludes, "The predominant result [of the arms race] has been greater insecurity and impoverished civilian technology" (34).

"Maximizing Damage and Efficiency": The Experiment as a Vision of Nuclear Weapons

The *Los Alamos Primer* is the central text among the Los Alamos branch of the Manhattan Project scientists that most closely resembles the cultural form of the experiment, and it directs people already persuaded by the form to use it to develop the atomic bomb. As Burke writes, "A yielding to the form prepares for assent to the matter identified with it" (*Rhetoric* 58). The scientists were already persuaded by the form of the experiment, and The *Los Alamos Primer* transferred this assent to the "matter" of nuclear weapons. As I will argue in my analysis, this document leaves out any discussion of strategic value or ethical considerations and focuses strictly on the science and engineering necessary to achieve the goal of "maximizing damage and

[87] Based on Truman's statement in 1949 about beginning to develop the hydrogen bomb as a response to the first Russian nuclear test ("Technological" 34). Bethe describes "the technological imperative" as a conviction or argument that it is absolutely necessary to develop a new technology in order to stay ahead in the arms race, and shows how this was used to push for the hydrogen bomb, ICBMs, MIRVs, and most recently for the Strategic Defense Initiative, with weapons laboratories eager to push ahead with offensive and defensive technology (34-36).

efficiency." This is the god-term and the single purpose of the text, with every element of the project being evaluated on whether it will increase or decrease these decisive measures.

The *Los Alamos Primer* describes itself as "an indoctrination course" (3) that all arriving scientists were required to either attend or read to get everyone on the same page (xi). The lectures were originally given in late March 1943 at what later became known as the Los Alamos National Laboratory. The lectures were given by Robert Serber, one of Robert Oppenheimer's students from Berkeley, and were based on a secret seminar held at Berkeley the previous summer, which included (among others) Oppenheimer, Hans Bethe, and Edward Teller (xi).[88] Edward Condon, Associate Director at Los Alamos, kept notes during the lectures, and together with Serber, he formed those into 24 mimeographed pages that became the *Los Alamos Primer* (xi).[89]

Serber claims the lectures were supposed to "draw a starting line for the work . . . to design and build the first atomic bombs" (xxiii). Because all the scientists were very busy, and time was scarce, Serber insists that the "time had to be cut to a minimum. That meant, in planning the lectures, that I had to cut explanations and decide what to leave out, to make a skeleton outline of the information. But within those limitations the *Primer* is essentially a

[88] Serber mentions that Van Vleck, Felix Bloch, Richard Tolmin, and Emil Konopinski were also in attendance (xxx). The conference was organized under the auspices of the Manhattan Project, and the scientists shared classified information freely with each other.

[89] Wilson describes the lectures, "The first thing that happened was . . . that there was a meeting to get things going. All the physicists and some of the people who'd been recruited came. They filled up a room. Maybe there were 50 people in the room. . . . Bob Serber was the principal lecturer, and he gave lectures every day about what they had done before, because he had been working on the theory, I guess with Oppie, perhaps at Berkeley, and because of this summer workshop, which I think had been held at Madison, Wisconsin. . . . Serber then outlined the general methods, and was constantly interrupted by Oppie and by other people. I know Fermi was at this meeting. At that meeting not only did we look at the past, but we looked forward to the future" ("Interview" 18-9).

summary of everything we knew in April 1943 about how to make an atomic bomb" (xxiii). Serber creates an efficient vocabulary that distills the discourse on atomic weapons into a clear and polished logical structure to kickstart the work at Los Alamos. This is the text that set the framework for this discourse among the scientists working on the bomb.

The *Primer* consists of 22 chapters; the first half describes the scientific principle of fission and the purification and enrichment processes, and the second half deals more specifically with detonation methods and devices. The middle chapters on "Damage" and "Efficiency" (12 and 13) function as a kind of climax and turning point, describing the narrow purpose of the project ("maximize damage and efficiency"). With the purpose established, the following chapters all discuss different methods to achieve that purpose, and the detonation methods are evaluated based on how likely they are to achieve the desired outcome. The conclusion creates a natural transition to starting work on the experimental program, outlining the main tasks to be completed and the immediate problems to be solved.

The *Primer* starts with these words: "The object of the project is to produce a *practical military weapon* in the form of a bomb in which energy is released by fast neutron chain reaction" (3, emphasis added). From the start, this limits the scope of the project and perhaps also the thinking of the scientists to simply developing a bomb. Throughout the *Primer*, there is never any discussion of the larger strategic or moral purpose for doing this or the larger goals the scientists are trying to achieve. What for most of the scientists started as the means to stop Hitler has, in this text, become an end in itself.

Unlike Truman's speech on the bombing of Hiroshima, this text does not have any human actors. In keeping with the tradition of physics texts, the *Primer* rather describes mechanisms and frames the development of the bomb as a technical problem to be solved. Burke

suggests that finding whether "certain elements equal 'good' and certain elements equal 'bad'" or rather "socially superior" and "socially inferior" in a text is a good starting point for an index (LAPE 270-71). One of the general patterns in the *Primer* is the positivist outlook on knowledge: The unknown is bad, and the known is good. A problem is an imperfection to be redeemed by a solution. "Not known," "unknown," "not measured," "difficult," and "problem" are bad while "best value," "quite satisfactory interpretation," "not difficult to beat," and "solution" are good.

Key terms: Serber structures the text as a problems/solutions dyad, with the problems described in negative terms and the solutions described in positive terms.[90] Following the emphasis of what Burke calls "modern science," as in the *Frisch-Peierls Memorandum*, the focus is on agency (the means to do something) in relation to a purpose, and the purpose is to create a new and greater agency—atomic weapons (*Grammar* 275). I start the analysis by looking, as Burke suggested, for which terms are classed as good and which are classed as bad, or socially superior and socially inferior. Some of these are "high level of purity," "fizzle," "efficiency," "maximize damage," and "as much energy as possible."

Equations: Serber spends most of the *Primer* discussing physical laws and mechanisms, including equations and calculations. These discussions are in general neutral, and the terms Serber assigns the clearest values to (good/bad) usually come before and after these calculations, where he tries to show the relevance these numbers have to the overall project. I find the following as the most prominent equations for "good":

High *efficiency*, maximum *damage*, as much energy as possible, produce severe pathological effects, maximum value of pressure, practical military weapon, destructive radius of 2 miles,

[90] This corresponds to the "greater stress upon knowledge" in "modern scientism" where knowledge/ignorance has replaced the religious moral dyad of virtue/pride (*War* 156-7).

good *efficiency*, bomb, high energy release, 170 MeV/atom, large scale release, *explosion*, large, reaction to an interesting extent, quite satisfactory interpretation, best value, large number of neutrons released, *effective* explosion, appreciable fraction fished, Uranium 25 of interest, increased U25 fraction, makes explosive reaction possible, more favorable than 49, Material 49 of interest, suitable, high standard of purity, solution, appreciable *efficiency*, strength, satisfactory, insurance, not difficult to beat (emphasis added).

Both efficiency and damage are recurring terms and themes in this cluster, and they are therefore likely key terms to keep an eye on.

I find the following equations for "bad":

Low efficiency, neutrons lost, slow neutrons not qualified, unable to fission, fizzle, ordinary uranium safe, 49 bulk properties not known, not measured (v value), impurities, 49 extremely difficult to work with, problem, predetonation, bad luck, high background radiation, the enemy, difficult, general expansion, cooling, pressure blowing off material, and neutron multiplication before pieces reach final configuration.

The "bad" equations are generally not inherently bad, but rather bad because of their relation to the purpose. They hinder the successful development of the bomb, and therefore uncertainty, impurities, things that are not known, not measured, unable to fission, etc. are bad.

Hierarchies of terms: The terms in the clusters seem to be organized according to an agency/purpose ratio, also referred to as means/ends. The more concrete means (U25, material 49) are seen in relation to the contributions they make towards the more abstract ideal ends (maximize damage, appreciable efficiency). However, since what is being described here is a scientific process, the terms also follow a cause/effect logic. Of course, with the "bad" or negative cluster, Serber has compiled a combination of negative elements (causes) that can lead

to undesirable ends (effects). I will illustrate that inverse relationship by showing the verbal pyramid pointing downwards instead of upwards.

For the "bad" cluster the hierarchy is organized around the most negative outcome: "low efficiency." On the most concrete level, there are the radioactive materials and their undesirable qualities. Material "49" (plutonium) is "extremely difficult to work with," and "ordinary uranium" is "safe." Safe in this context is clearly negative because it implies that it makes a nuclear chain reaction impossible. Other negative elements are "impurities in 49," "neutrons lost," "slow neutrons unable to fission in time," "bad luck," background radiation," "general expansion," "cooling," "pressure blowing off material," and "neutron multiplication before pieces reach final configuration." These attributes could cause a "predetonation" or "fizzle," resulting in "low efficiency," which is described as the worst of all outcomes: "gives very low efficiency" (62), "the efficiency is low" (62), "All autocatalytic schemes that have been thought of so far . . . are low in efficiency. . . . Some bright ideas are needed" (63).

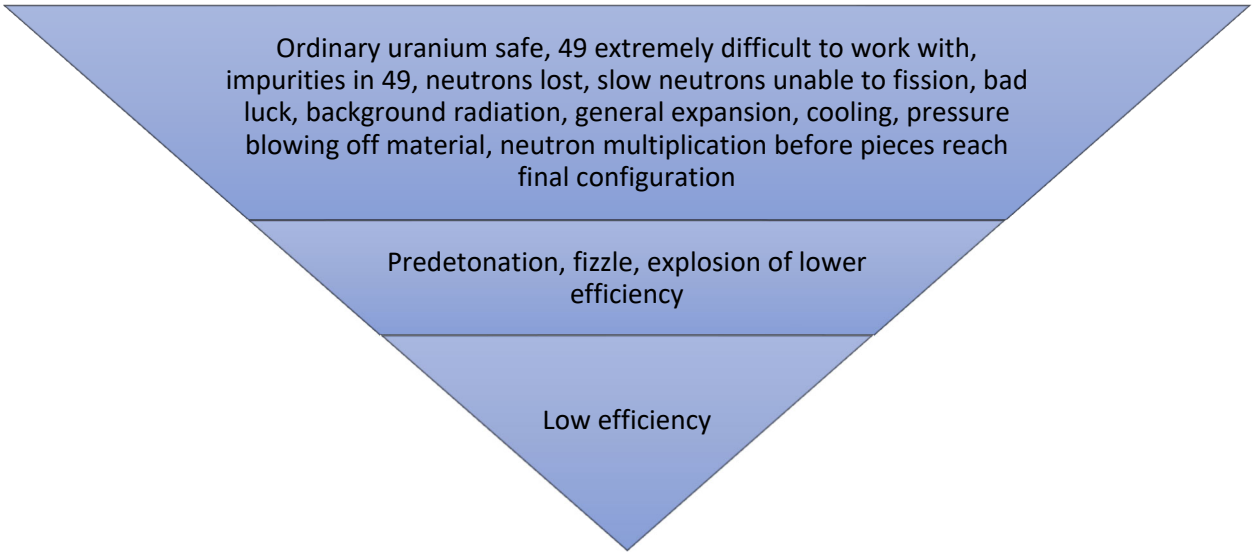

Figure 10 Hierarchy for negative terms in the *Los Alamos Primer*

On the other hand, among the "good" terms, the most concrete terms and causes are the potentialities in U25 and Material 49 that make them "of interest," and with "Increased U25 fraction (enrichment)" and "high standard of purity" for 49, the scientists can reach the desired effects. These improvements of the uranium and plutonium lead to "appreciable efficiency," "reaction to an interesting extent," "makes explosive reaction possible," "large number of neutrons released," and "appreciable fraction fished."[91] This all leads to an "effective explosion" with "good efficiency" or "high efficiency."

God-term: High efficiency is simply the means to a greater end. In the first place, high efficiency leads to greater energy release from the explosion. As Serber says, "Since the one factor that determines the damage is energy release, our aim is simply to get as much energy from the explosion as we can" (35-6). This makes it clear that the goal is not maximum energy release for its own sake, but rather to "maximize damage." Thus, "maximize damage," I claim, is the god-term of the entire text. Every equation and prescription is written with this goal in mind, and later all detonation solutions are evaluated based on whether or not they maximize damage. That becomes the litmus test.

[91] "Fished" was a verb they used for "fissioned." In an activated fission bomb the heat and pressure will build and blow the bomb apart before the entire plutonium or uranium core has fissioned. Therefore the goal is to get an "appreciable fraction" or substantial percentage of the core fissioned (fished) before the reactions blow the material apart.

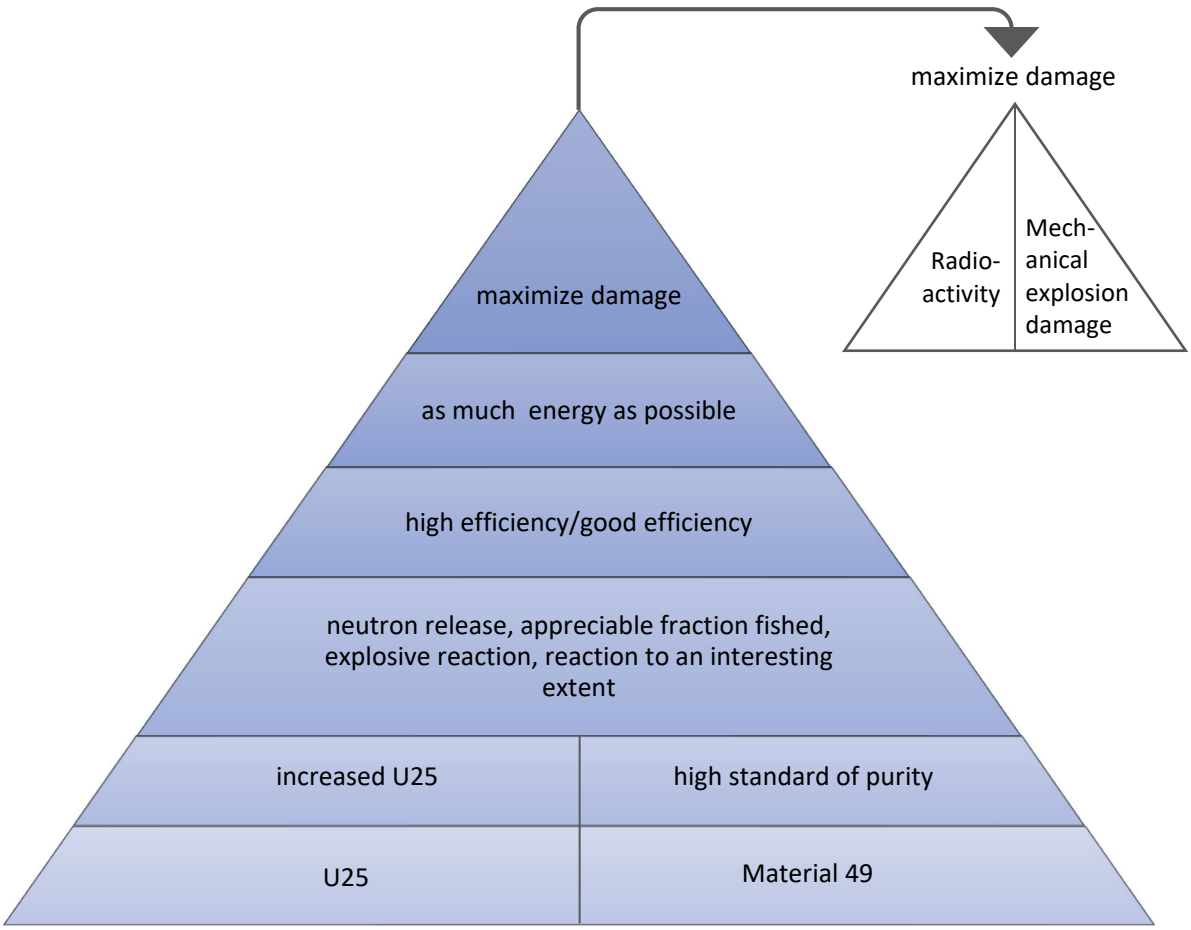

Figure 11 Hierarchy for positive terms in the *Los Alamos Primer*

Serber describes two subcategories of maximized damage: radioactivity and mechanical explosion damage. As with the "atomic bomb" hierarchy in chapter 2, these are concrete descriptions and parts of the broader key term (in this case "maximize damage") rather than causes leading to that effect, therefore I will be placing them in a subhierarchy within the larger hierarchy of terms. Under "radioactivity" there are "pathological neutron release," "10 million curies after 10 days," "radioactive material released," "effect rendering location uninhabitable," "produce severe pathological effects," and "1000 yards kill zone." Under "mechanical explosion damage" there are "shock wave," "maximum value of pressure," "destructive action,"

"destructive radius of 2 miles," "sharp front," "20,000 tons of TNT," and "100 million Mega electron volts."

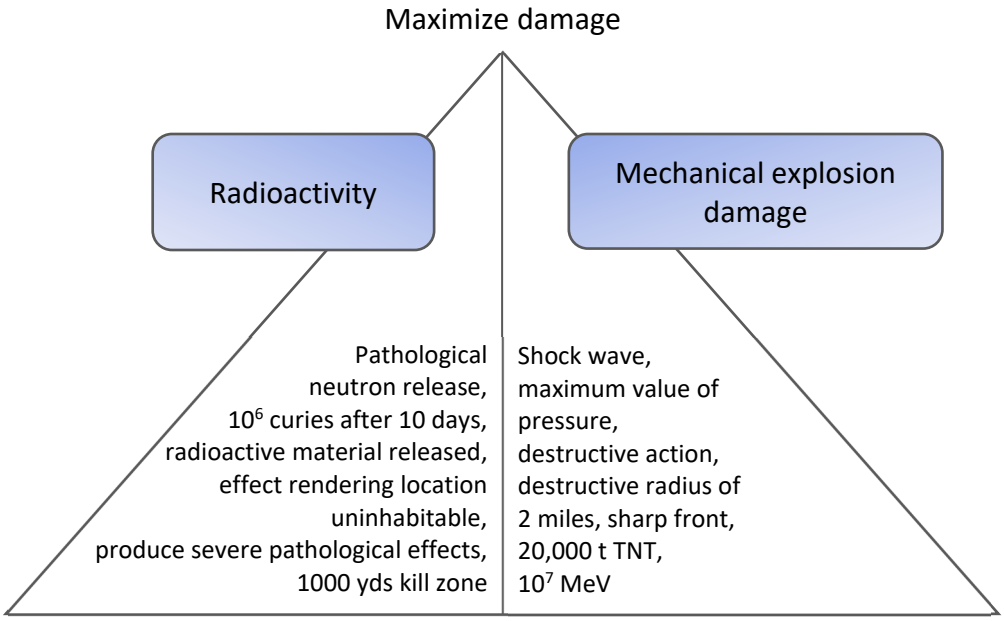

Figure 12 Subhierarchy of terms for "maximize damage"

Damage is hardly mentioned outside of the key middle chapter titled "Damage," and yet it is clear from the text that maximizing damage is the purpose of everything in the *Primer*. As Serber says after he has described the mechanical explosion damage in detail, "This points roughly to the kind of results which may be expected from a device of the kind we hope to make. Since the one factor that determines the damage is energy release, our aim is simply to get as much energy from the explosion as we can. And since the materials we use are very precious, we are constrained to do this with as high an efficiency as is possible" (35-6).

This programming is established in the first half of the book, and the second half simply applies this to potential solutions for detonation and explosive design. The first part trains the

reader how to think, and the second half shows an application of this thinking. This was the start of a discourse which, as Richard Rhodes writes in the introduction, "would continue, unceasing and obsessive, for two and a half years, to culminate in a vast, blinding fireball that turned a cold desert night into day" (x).

As I will show in the next chapter, many scientists took this programming and ran with it, following it to its ultimate potentialities. Serber notes, "On Edward Teller's blackboard at Los Alamos I once saw a list of weapons – ideas for weapons – with their abilities and properties displayed. For the last one on the list, the largest, the method of delivery was listed as 'Backyard.' Since that particular design would probably kill everyone on Earth, there was no use carting it elsewhere" (4). This vocabulary gave an incentive for some Los Alamos scientists to continue exploring bomb designs, including the hydrogen bomb, that were able to "maximize damage" to an even greater extent (Teller and Brown 45). Some scientists were also influenced by this vision to "maximize damage" in other ways. For example, Fermi, "perhaps influenced by the enthusiasm he found at Los Alamos," suggested to Oppenheimer that they could use Strontium 9 to radioactively poison the German food sources. Oppenheimer replied after some deliberation with the Ministry of War that "we should not attempt the plan unless we can poison enough food sufficient to kill a half a million men, since there is no doubt that the actual number affected will, because of non-uniform distribution, be much smaller than this" (Rhodes *Making* 511).

The programming of the *Los Alamos Primer* functions similarly to how "paradigms" present a puzzle or a task to scientists. Thomas Kuhn describes this programming in *The Structure of Scientific Revolutions*:

> In so far as he is engaged in normal science, the research worker is a solver of puzzles, not a tester of paradigms. Though he may, during the search for a particular puzzle's solution, try out a number of alternative approaches, rejecting those that fail to yield the desired result, he is not testing the *paradigm* when he does so. Instead he is like the chess player who, with a problem stated and the board physically or mentally before him, tries out various alternative moves in the search for a solution. These trial attempts, whether by the chess player or by the scientist, are trials only of themselves, not of the rules of the game. (144)

For these scientists, the *Los Alamos Primer* stated the problem (maximize damage), and they were simply trying out various alternatives to complete the game.

In addition, their habits of thought and scientific training made it hard for these scientists to imagine that they could not complete the great experiment of creating a bomb through fast neutron chain reaction. John von Neumann, the inventor of the explosive lenses that made the plutonium bomb possible, said in 1944, "What we are creating now is a monster whose influence is going to change history, provided there is any history left. . . . Yet it would be impossible not to see it through, not only for military reasons, but it would also be unethical from the point of view of the scientists not to do what they know is feasible, no matter what terrible consequences it may have. And this is only the beginning" (qtd. in G. Dyson, *Turing's Cathedral* 62). As I showed earlier, the ethical and aesthetic motivations von Neumann has so clearly internalized here are integral to the form of the experiment as applied to research on nuclear weapons. Burke may have responded that what von Neumann called "ethically impossible" would be more accurately described as "aesthetically inconsistent."

Of the three visions, *The Primer* is by far the most "scientific," discussing only scientific formulas and processes to achieve a measurable outcome. Yet this calculus has a purpose that is not morally objective, where, in essence, maximum body count (maximize damage and efficiency) stands as the god-term, the highest good, the motivating force.

"Science is the New King of the World": Niels Bohr's Vision of Nuclear Weapons

The third text, titled "Memorandum to President Roosevelt," was composed by Niels Bohr, the father of quantum mechanics and informal leader of the WWII generation of scientists. He articulated this vision first to Winston Churchill and Franklin D. Roosevelt, then to Robert Oppenheimer and the other scientists at Los Alamos, and finally to the whole world. But he tapped into an idea that had been proposed by several scientists and authors before him, including Alfred Nobel, H. G. Wells, and Leo Szilard: a scientific solution to end all war, with science as a governing force establishing the framework for international relations. Compared to the *Primer*, this third vision of nuclear weapons is much more conscious of a larger frame of reference. It is less restricted to scientists in its appeal, and its form is more prophetic, with the overriding goal of a future without war. Through my analysis, I will argue that Bohr's vision posits "science," the god-term, as a revolutionary force which, through the atomic bomb, will transcend the traditions of national sovereignty and lay the foundation for a world without war.

Some earlier forms of the vision were formulated in the late 1800s, containing the hopeful prediction that science, which was solving so many problems of everyday life, would one day be able to find a solution to war. In 1854, Lyon Playfair, Secretary of the Science and Art Department in Great Britain, suggested using chemical weapons against the Russians in the Crimean War. When his opponents argued that this was a terrible form of warfare, he answered,

"War is destruction, and the more destructive it can be made with the least suffering the sooner will be ended that barbarous method of protecting national rights" (qtd. in Croddy et al. 131). In 1876, Alfred Nobel, who later created the Nobel Foundation and the Nobel prizes, similarly "expressed his wish to produce material or a machine which would have such a devastating effect that war from then on, would be impossible" (Tägil). Nobel built factories all over Europe, developing and selling dynamite and other explosives used for mining and the war industry. In 1891 he wrote to the peace partisan, Countess Bertha von Suttner, "Perhaps my factories will put an end to war sooner than your congresses: on the day that two army corps can mutually annihilate each other in a second, all civilised nations will surely recoil with horror and disband their troops" (qtd. in Tägil). Orville Wright made a similar prediction about his invention: "With the perfect development of the airplane, wars will be only an incident of past ages" (qtd. in Stimson). But in 1946, having seen the damages caused by air raids, Orville wrote to a friend, "I once thought the aeroplane would end wars. I now wonder whether the aeroplane and the atomic bomb can do it. It seems that ambitious rulers will sacrifice the lives and property of all their people to gain a little personal fame" (qtd. in Stimson).

In 1913, H.G. Wells expressed a similar hope in *The World Set Free*, viewing the twentieth century from the perspective of a fictional twenty-first century:

> Certainly it seems now that nothing could have been more obvious to the people of the earlier twentieth century than the rapidity with which war was becoming impossible. . . . They did not see it until the atomic bombs burst in their fumbling hands. Yet the broad facts must have glared upon any intelligent mind. All through the nineteenth and twentieth centuries the amount of energy that men were able to command was continually increasing. Applied to warfare that meant

that the power to inflict a blow, the power to destroy, was continually increasing. There was no increase whatever in the ability to escape. (73-4)

The assumption in all these texts seems to be that wars are rational affairs, carried out to gain individual or national advantage (politics by other means, as von Clausewitz claimed), and thus, a mutual destructive power great enough to annul the chance of gaining any such advantages would eliminate any rationale for war. Such power would cause an "epidemic of sanity to break out among the rulers of states and the leaders of mankind" (Wells, "Preface").

In *The World Set Free*, this epidemic of sanity hits after a world war in which atomic bombs have destroyed all the world's major cities. The leaders of the world meet in Brissago, Italy and decide to create a World State that ends nation states once and for all. The World State first takes control of all the material that can be used for nuclear weapons (108) and suppresses a nationalist conspiracy by force (115-30). The new government is not democratic, but rather functions as a kind of meritocracy or technocracy. King Egbert, the first leader of the World State, says, "Science is the new king of the world" and claims that sovereignty does not reside with the people. "The sovereign is a being more subtle than that. . . . It is something that floats about us, and above us, and through us. It is that common impersonal will and sense of necessity of which Science is the best understood and most typical aspect. It is the mind of the race. It is that which has brought us here, which has bowed us all to its demands" (110-11). The book ends with mankind progressing in the sciences, education, and religion, contemplating an emigration to the stars by making biological changes to the human body (180-89).[92]

The key to this drastic change and the "ending of war on the earth" is a disaster brought about by a radical increase in destructive power ("Preface"). Describing the meeting at Brissago,

[92] Including potentially eliminating women.

Wells writes, “This assembly was no leap of exceptional minds and super-intelligences into the control of affairs. It was teachable, its members trailed ideas with them into the gathering, but these were the consequences of the ‘moral shock’ the bombs had given humanity” (133-34). The advent of the atomic bomb simply “quickened its intelligence, dispelled its vanities, and emancipated it from traditional ambitions and antagonisms” (134). The atom bomb is here envisioned as a catalyst towards the ending of war: a means towards the noblest of ends. In his 1921 preface of the book, Wells looks back on WWI in light of his predictions and asks why it did not result in a World State. He concludes, “Either the disaster has not been vast enough yet or it has not been swift enough to inflict the necessary moral shock and achieve the necessary moral revulsion” (“Preface”). In other words, vaster and swifter destruction is needed to end war.

Wells’s books were widely read among the scientists in the 1920s and 1930s,[93] and one who caught the vision of *The World Set Free* and tried to bring it to life was physicist and inventor Leo Szilard. Born in Hungary in 1898, Szilard was an avid reader of science fiction and one of the most brilliant scientists of his time. When Wells published *The Open Conspiracy: Blueprints for a World Revolution* in 1928, Szilard travelled to England to meet Wells in person and secure the printing rights for the book in Central Europe (Rhodes *Making* 14). *The Open Conspiracy* describes a plan for a World Republic ruled by a technocratic elite, and Leo Szilard had been formulating a similar plan since the mid-1920s (called “Der Bund”) for an elite association of scientists and other influential people “whose inner bond is pervaded by a religious and scientific spirit” (Szilard 23). In these texts, both Szilard and Wells see their

[93] Edward Teller was a great fan (Teller and Brown 81), as was Szilard. Arthur Compton echoes Wells in his introduction to *One World or None*, and Harold Urey calls Wells a modern prophet in “I’m a Frightened Man.” Otto Frisch says of the summer of 1939, “I think we all imagined scenes out of H. G. Wells’ *The Shape of Things to Come*” (Frisch 121).

contemporary representative democracies as moribund, and they envision a future where governing has become a scientific rather than a political enterprise (Wells 22; Szilard 23). When Szilard read *The World Set Free* in 1932, he soon got the idea that atomic bombs could be a key to ending war and bringing to pass a World State. From then on, he pursued the idea with a fixed determination and changed his field from chemistry to nuclear physics. He worked out the first concept for an atomic bomb in September 1933 (Rhodes *Making* 28); filed the first patent for an atomic bomb in 1934 (Szilard 18); wrote and persuaded Albert Einstein to sign a letter to president Roosevelt (which initiated the US nuclear weapons program) in 1939 (Szilard 94-96); and, together with Enrico Fermi, designed and constructed the world's first functioning nuclear reactor in 1942 (Rhodes *Making* 442).[94]

In addition to his own initiatives to bring about a World Republic, Szilard also sought to influence other scientists, initiating a discourse on ending war by means of atomic bombs. In his first theoretical study of a nuclear reactor, Szilard's first footnote cited "H. G. Wells, The World Set Free" (Rhodes *Making* 331), and he sent selected chapters of the book to scientists, politicians, and businessmen he corresponded with (Szilard 16, 37, 38, 53).

This discourse developed into what Robert Oppenheimer claimed was "the classic statement of the feeling with which scientists approach the new situation" of the atomic age (qtd. in Aaserud 51). Niels Bohr, the most influential voice among the scientists of his day, articulated it to the world. He made the argument first in a series of secret memos sent to Winston Churchill

[94] After the first successful test of the nuclear reactor, Szilard shook hands with Fermi and said he "thought this day would go down as a black day in the history of mankind" (qtd. in Rhodes, *Making* 442). This may have been a somber remark since Szilard recognized the supposed good of a nuclear world would not come about without much suffering first, but it may also be an example of his wry humor. The graphite in the reactor would easily rub off on those who operated it, making their hands and clothes black as soot.

and Franklin D. Roosevelt and people in their administrations, and thereafter in two articles called "A Challenge to Civilization" and "Science and Civilization." In a letter to Soviet scientists Peter Kapitza, Bohr wrote about these articles, "I have tried to give impression for an attitude widely shared among scientists" (qtd. in Aaserud 54). However, these were but the distilled essence of an argument Bohr had been formulating for many years as an intellectual leader in the scientific community.

Since its construction in 1921, the Niels Bohr Institute for Theoretical Physics in Copenhagen had been "the Mecca of the world's theoretical physicists" (Frisch 81), with Bohr himself as the main attraction (Bethe, "Review" 426; Wilson 26). He received the Nobel Prize in Physics in 1922, and by the 1930s he was widely recognized as the father of quantum mechanics and a leading influence in the scientific community. Robert Wilson writes of him in "Niels Bohr and the Young Scientists":

> It was natural for students of pre-World War II physics to venerate Niels Bohr as they were learning the new quantum physics. Doubly to venerate him would be more exact, because their teachers, many of whom had worked with Bohr, respected him not only as a leader of the quantum revolution in physics. They also loved him for his deep humanness, as expressed in his philosophical writing and in his efforts on behalf of the refugees from fascism. This veneration was later to be an important factor in the belief of these students that their work on the nuclear bomb was virtuous – virtuous because Bohr thought it was. (23)

Bohr was often described as a "scientific father confessor to the younger men" at Los Alamos (Aaserud 17). Wilson claims Bohr was "sort of the spiritual leader of the group" ("Interview" 34), and Richard Feynman writes, "Even to the big shot guys, [at Los Alamos] Bohr was a great

god" ("Los Alamos" 129). Percy Bridgman, Robert Oppenheimer's physics teacher at Harvard, writes that Bohr was "idolized as a scientific god through most of Europe" (qtd. in Bird and Sherwin 34), and one of Oppenheimer's students claims, "Bohr was God and Oppenheimer was his prophet" (Bird and Sherwin 169).

During WWII, Bohr first remained in occupied Denmark, then fled to England in 1943. Once there, he gave a lecture on war claiming, "the present atrocities would force the nations to realize the need for international cooperation after the war" ("Interview with Aage Bohr" 2). Already then, his goal was clear, but he had yet to get the vision that atomic weapons might be the means to achieve it.

Soon after arriving in England, Niels Bohr was sent to the U.S. to assist the Manhattan Project scientists, and seeing the rapid progress they were making towards the atomic bomb opened his mind to new possibilities. He came to the startling revelation that "we are in a completely new situation that cannot be resolved by war" (qtd. in Rhodes, *Making* 432). The goal for Niels Bohr was not to prevent Hitler from getting the bomb first, since he stated already on 19 May, 1944, "It is practically certain that no substantial progress [on the atomic bomb] has been achieved by the Axis Powers" (28). Bohr envisioned the project serving a greater purpose. According to Viktor Weisskopf, Bohr taught the scientists at Los Alamos that every "great and deep difficulty bears in itself its own solution" (qtd. in Rhodes, *Making* 525) and therefore the threat of the bomb also held the key to dissolving the threat of the bomb and war for good.[95] Rhodes claims Bohr came to the realization: "When nuclear weapons spread to other countries, as they certainly would, no one would be able any longer to win. A spasm of mutual destruction

[95] In a conversation with Supreme Court Associate Justice Felix Frankfurter around the same time, Bohr said that the atom bomb "might be one of the greatest boons to mankind or might become the greatest disaster" (qtd. In Rhodes, *Making* 526).

would be possible. But not war" (532). In other words, Nobel's vision for the end of war by the means of weapons had finally become technically feasible. Richard Rhodes describes Bohr's revelation in more detail:

> Before the bomb, international relations had swung between war and peace. After the bomb, major war among nuclear powers would be self-defeating. No one could win. World war thus revealed itself to be historical, not universal, a manifestation of destructive technologies of limited scale. Its time would soon be past. The pendulum would now swing wider: between peace and national suicide; between peace and total death. (Rhodes 533)

This being the case, Bohr considered that reasonable statesmen might see the futility of such an arms race and find a common cause in controlling and preventing these weapons from ever being used again. However, this would require the establishment of international control and trust between the nations of the world, starting with the U.S., Great Britain, and the Soviet Union. Bohr believed President Roosevelt was the best hope for making realizing this vision, and it was to him Bohr wrote the memorandum of July 3, 1944 that I will analyze.[96]

Bohr's memo has several traits of a vision or consummatory vocabulary. Describing the writing process for this memorandum, Rhodes observes, "Bohr worked and reworked his

[96] Bohr first shared a version of this revelation with President Roosevelt through an intermediary (Supreme Court Associate Justice Felix Frankfurter) in February 1944; Roosevelt promptly gave Bohr permission to travel to London and share it directly with Prime Minister Churchill. The meeting with Churchill (on May 16, 1944) turned out to be a disaster. Bohr returned to the US to seek a personal meeting with President Roosevelt. Before this meeting, the president had suggested that Bohr should "give an account of his views in a brief memorandum" (qtd. in Rhodes, *Making* 532). Bohr worked on the memorandum from the end of June to July 3, 1944. This led to a personal meeting 22 August 1944 with President Roosevelt, whom Bohr described as very in tune with the ideas expressed in the memorandum. Bohr sent the White House five more texts on the topic before the war was over.

memorandum to *maximum generality of expression*, a political analysis as reserved as any scientific paper. It says all that he had seen up to that time, which was almost everything essential" (532, empasis added). So it is a statement that goes, as Burke would say, to the end of the line and that tries to give a complete statement of the essence of an idea. It is also a text that lends itself well to indexing. Bohr often said that "accuracy and clarity are complementary" and therefore "a short statement could never be precise" (qtd. in Rhodes, *Making* 530), and this shows in his sentence style. Almost every statement is conditional, and almost every sentence contains an embedded clause, giving clear clues about the internal relationship between critical terms.

The memo consists of seven pages, and is divided into three parts, roughly following a previous memo he sent to Winston Churchill, in which the sections were titled, "Foundations of the project," "General implications of the project," and "Possibilities of the momentary situation."[97] The audience for the memorandum to President Roosevelt was primarily Roosevelt and Frankfurter, though Bohr also discussed it with Oppenheimer in detail in July 1944 (most likely after Bohr had spoken to the president) ("Aage Bohr Interview" 4).

Dramatic catharsis is the organizing principle in Bohr's memo. As I mentioned in the previous chapter, Burke claims texts achieve internal catharsis primarily by dialectical transcendence (through hierarchical organization of terms) or dramatic catharsis (by a more cyclical organization of actions or events). Dramatic development can be very similar to the process of abstraction when the dramatic action follows the ripples of an event or generating

[97] In subsequent reproductions of the memorandum to Roosevelt (Bohr 1950; Jungk 1958), the first section, though it contains four of the seven pages, is usually left out. The next three pages, with an exception of three paragraphs, were reproduced in their entirety in Bohr's *Open Letter to the United Nations,* published in 1950.

principle. For example, one could make a hierarchy organized by cause-effect that goes from "the shots in Sarajevo," to "mobilization," "attack on Serbia," "declarations of war," and all the way on to "World War I," and this would follow the same trajectory as the dramatic development. Unlike dialectical transcendence, in which the generating principle or god-term is found at the top of a hierarchy, dramatic catharsis starts with the generating principle and then observes how this principle goes to the end of the line, to its ultimate conclusion, which in a way brings it back to its origin.

Bohr's memo is a drama where the generating principle of "science" is allowed to unfold and express itself fully towards an ultimate conclusion of either world peace or world destruction, but the structure of this drama to a great extent also follows the same pattern as dialectical transcendence, with hierarchies organized according to the means/end or cause/effect principle. I will therefore first search for the hierarchies and then comment on the dramatic development.

Key terms: As the titles of the three sections in the 2 April memorandum indicate, "the project" is the text's central topic and, thus, a likely key term. Other terms that feature prominently are "the weapon," "the question of control," and "science." There is a striking lack of individual agents in this text. Though some countries and groups of scientists are mentioned, most of the text describes systems and mechanisms rather than individual acts and choices as the relevant and active elements.

Equations: Unsurprisingly given the memo's section titles, "the project" is by far the largest cluster. The Manhattan Project is the impetus for the memorandum in the first place, and it is Niels Bohr's knowledge about the project that gives him the expertise to be able to advise

the president. “The project” encompasses both the resources and efforts that went into the Manhattan Project and its goals and results.

Great laboratories erected for secrecy, the huge production machinery, complete harmony and utmost zeal, a whole army of engineers and technicians, a group of physicists larger than ever before assembled for a single purpose, immense technical effort, immense and hazardous technical enterprise, no effort has been spared, new possibilities for facilitating production of active materials and intensifying their effects, new materials capable of enormous energy release, ingenious devices for their most effective use, final completion of the weapon, super weapons, accomplishment of the project, this wonderful adventure, releasing atomic energy on a vast scale, mastering mighty forces hitherto beyond human reach, a whole new situation as regards human resources, enormous energy resources, revolutionize energy and transport, promising industrial development, symbol of the benefit to mankind science can offer when handled in a truly human spirit, one of the greatest triumphs of science and engineering destined deeply to influence the future of mankind, far deeper interference with the natural course of events than anything ever before attempted

I find the following equations for “the weapon” (both describing the bomb and what the bomb symbolizes or means):

Ominous menaces, the formidable weapon, the new weapon, weapon of unparalleled power, weapon of such formidable character, dangers of unprecedented acuteness, perpetual menace to human society, will completely change all future conditions of warfare, terrifying prospects of future competition between nations

“The question of control,” in my analysis, has the following equations:

An adequate control arrangement, establishing common security, a universal agreement in true confidence, an early initiative, sincerity of the intentions, concessions regarding the exchange of information, openness about industry and military, effective control measures, loyal cooperation on the enforcement of control measures, compensating guarantee of common security against dangers, the expectations for a future harmonious international cooperation, the prevention of a competition prepared in secrecy, control of the use of the new active materials

I find these equations for "Science":

Embodied the bright promises for common human striving, human spirit, international cooperation most fruitful, electron configuration successfully explored, whole new epoch of science, given us insight into the structure of the atom, important discoveries, rapid exploration, revealed existence of neutron, remarkable development of physical science, contributions of physicists from almost every part of the world, fragments ejected with enormous energies, discovery of fission, nuclear transmutations, release of further neutrons, splitting of heavy nuclei, a new kind of combustion of matter with immense energy yield (100,000,000 times larger than that obtainable by same amount of explosives), a turning point in history, one of the greatest triumphs of science and engineering destined to deeply influence the future of mankind

Hierarchy: The boundaries between "science" and "the project" are not very clearly defined here, since quite a few terms seem to describe both. "The project" is clearly a scientific project and therefore obviously also belongs under "science." Bohr begins the text by describing the scientific progress on nuclear problems, goes on to discuss the project as a natural continuation of that effort (to harness a new kind of combustion), and terms the result of the

project as “one of the greatest triumphs in science and engineering.” Of the two, science seems to be the greater organizing term, with “the project” simply as one manifestation of the drive and motivations implicit in “science.” Bohr’s many long, conditional sentences clarify the relationships between these terms and hierarchies. I will show later how all the major hierarchies in this text are all connected, but first I will treat them individually.

The hierarchy for “the project” is organized according to the means/ends or agency/purpose ratio. Because agencies are usually concrete whereas purposes are rather abstract, the text also follows a concrete/abstract or specific/general structure. The most concrete means in the cluster are the material and human resources involved in the project: laboratories, machines, scientists, engineers, technicians, etc. These can be summarized in the more abstract terms “immense technical effort,” “immense and hazardous technical enterprise,” and “no effort has been spared.” The immediate results or ends of these resources are “new materials capable of enormous energy release” and “ingenious devices for their most effective use,” with “new possibilities for facilitating enhanced production of active materials and intensifying their effects” as a kind of bonus result. Of course, the “active materials” and “ingenious devices” are not a goal in themselves, but rather serve the purpose of “the final completion of the weapon,” “releasing atomic energy on a vast scale,” “super weapons,” and “mastering mighty forces hitherto beyond human reach.” The last of those terms seems like it could be a good summary of what the project achieved. Yet, unlike Truman’s speech, “Announcing the Bombing of Hiroshima,” it is clear in Bohr’s text that power or “mastering mighty forces” is not an end or goal in itself. Rather, Bohr goes on to outline greater ends or results to which “the project” has unlocked the door: “a whole new situation as regards human resources,” “enormous energy resources,” “revolutionize energy and transport,” “promising industrial development,” and

beyond that, “one of the greatest triumphs of science and engineering destined to deeply influence the future of mankind,” “symbol of the benefit to mankind science can offer when handled in a truly human spirit,” and “far deeper interference with the natural course of events than anything ever before attempted.”

That Bohr calls the development of a military weapon in wartime a triumph of “science” strengthens my case for “science” as a central motivation in the logic of this text. Science is the actor here, not nations. Truman gave a similar statement in his speech, which subordinated science to power, but in Bohr’s logic it is science that is the driving force and purpose throughout the text.

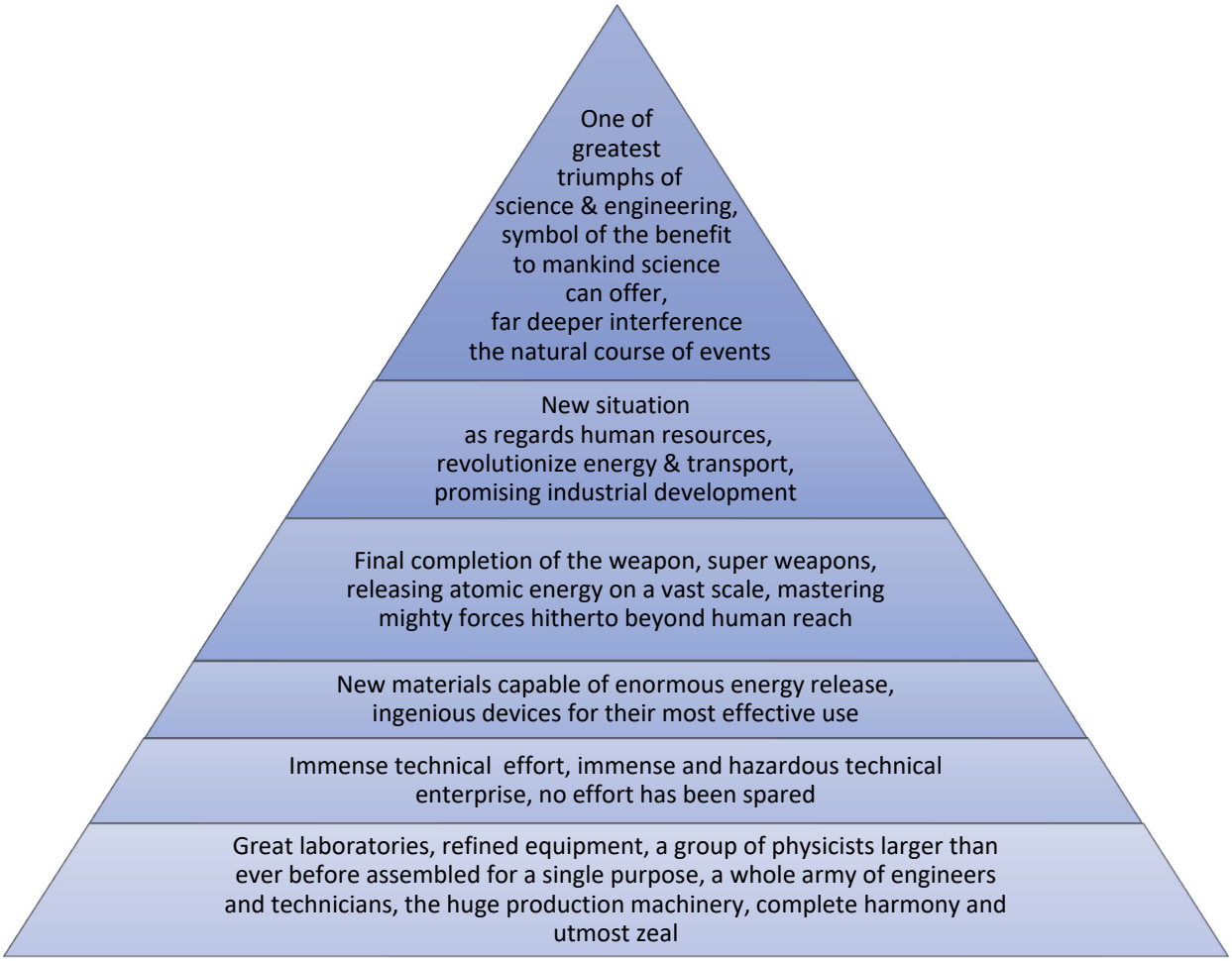

Figure 13 Hierarchy for "the project"

The results of "the project" seem almost inherently positive in this hierarchy, and yet when I look at the hierarchy of "the weapon," it seems to fit as a part of "the project" hierarchy of terms, describing the more negative implications. Bohr describes "the project" in more hopeful terms and uses the "weapon" equations to outline the dangers of this development. I see the concrete descriptions of the bomb lowest in the "weapon" hierarchy ("the formidable weapon," "the new weapon," "weapon of unparalleled power," "weapon of such formidable character"), leading to the more abstract threats ("ominous menaces," "dangers of unprecedented acuteness," and "the terrifying prospects of future competition"), which lead to a changed reality

described as “perpetual menace to human society” and “will completely change all future conditions of warfare.”

When I compare this to “the project” hierarchy, the terms in the “weapon” hierarchy seem like complementary contrasts within “the project” hierarchy starting at level four, with the “weapon” hierarchy providing the “peril” to balance the “hope” of the previous statements. On level four, together with “final completion of the weapon,” I would put “the formidable weapon, the new weapon, weapon of unparalleled power, weapon of such formidable character,” since all these describe the most concrete results of the project. As a parallel to “promising industrial development,” I would put “ominous menaces,” “dangers of unprecedented acuteness,” and “the terrifying prospects of future competition” since these all describe the more immediate implications of the new technology. At the highest level, the weapon can become a “perpetual menace to human society” and “will completely change all future conditions of warfare.”

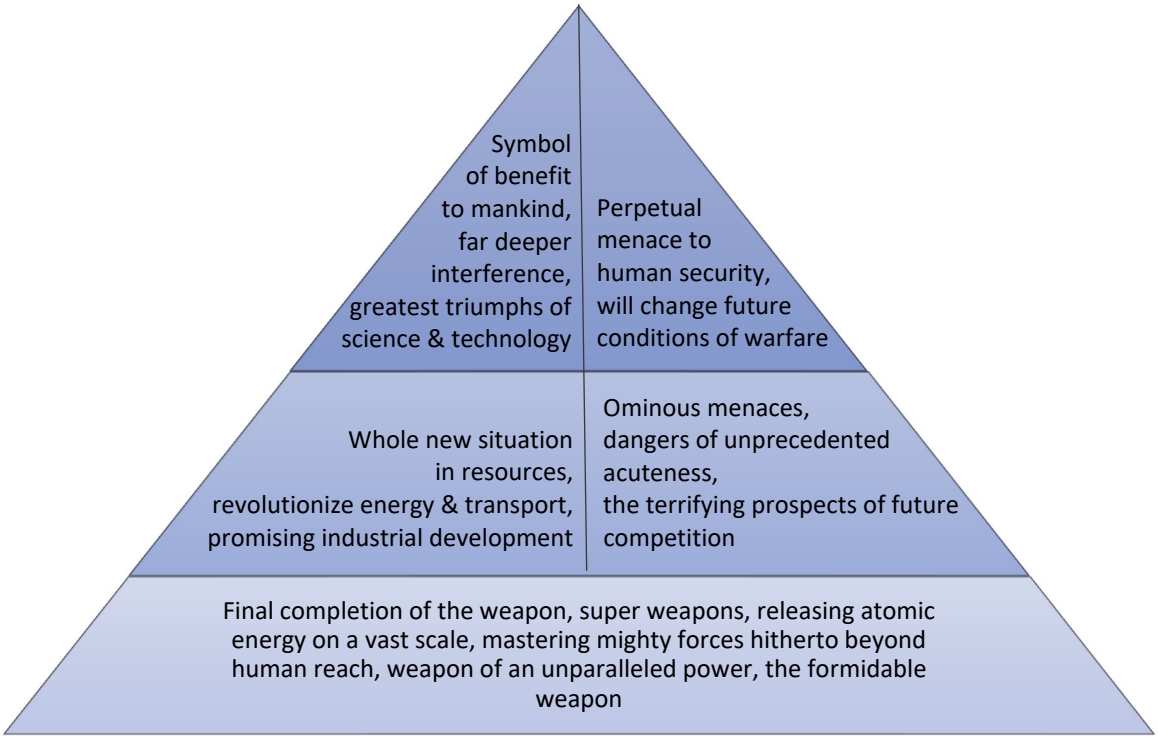

Figure 14 Top three levels of “the project” with “the weapon” hierarchy included

This shows how Bohr describes nuclear weapons as a double-edged sword, though he still sees them as a potential key to continuous peace. This hope is expressed most clearly in the hierarchy for "the question of control."

The first level contains the specific suggestion Bohr made to Roosevelt and Churchill: "an early initiative, aiming at forestalling a fateful competition" and able to "uproot any cause of distrust between the powers." This in turn could lead the Russians to believe in the "sincerity of intentions" of the United States and make it possible to find "a universal agreement in true confidence," promising "concessions regarding the exchange of information," "openness about industrial and military preparations," and "a compensating guarantee of common security against dangers." This accomplishment would facilitate "an adequate control arrangement," "establishing common security," "effective control measures," and "loyal cooperation on the enforcement of control measures." The ultimate goals are "control of the use of the new active materials," "the prevention of a competition prepared in secrecy," and "the expectations for a future harmonious international cooperation."

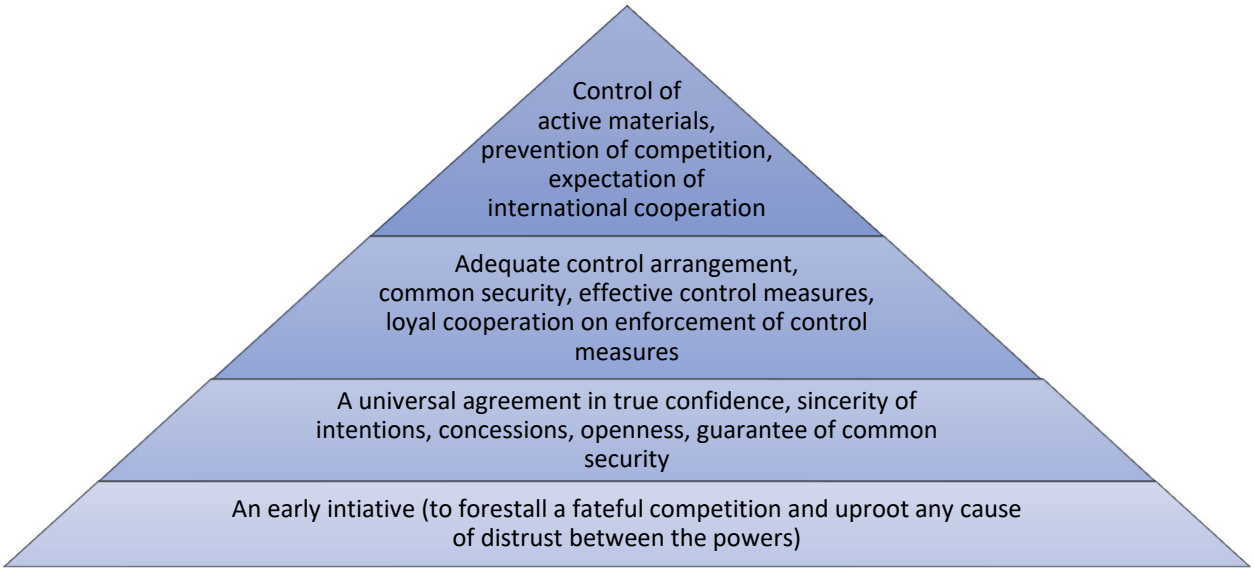

Figure 15 Hierarchy for "the question of control"

As mentioned earlier, all these hierarchies are integral parts of the logical system that Bohr has constructed in this text, with science as the motivation or driving force behind the development. Although there are plenty of hierarchies in Bohr's text, as I have argued, the main thrust of the text can be better described in terms of dramatic catharsis, primarily because of the placement of the god-term "science" in this development. The text does not work its way up to "science" as the top of the hierarchy, but rather everything that happens in the hierarchy is correctly viewed as the ripple effects of "science." What I see in Bohr's text is a problematical term (striving) that is gradually purified by following the motivation of science to its ultimate conclusions.[98]

Bohr claims that science is a manifestation of "the human spirit" and embodies or is a manifestation of "the bright promises for common human striving." The word "striving" contains the tension that Bohr's text seeks to purify. Burke claims "striving" can mean both "making great efforts to achieve or obtain something" or "to struggle or fight vigorously" (*Language* 184). In other words, striving embodies both science and war. It describes a goal-driven exertion against a challenging force, and it can be both competitive and cooperative. Throughout the memo, this tension implicit in human striving is gradually purified through science's progressive unfolding in increasingly complex and powerful forms. The scientific quest of increasing the scope and reach of humanity's agency or power reaches a point where it eliminates humanity's ability to struggle or compete by means of international warfare. Bohr's text displays a gradual purification of war.

God-term: "Science" is the god-term or generating principle in the text, and the unfolding of events and potentialities that follow in the text are the implications of the

[98] The resulting structure is a cycle of terms similar to Burke's "Cycle of Terms Implicit in the Idea of Order" in *The Rhetoric of Religion*.

experiment carried out on a grand scale by thousands of scientists. Schlick's upward spiral means scientific progress, and for Bohr that implies social progress. He writes in a later article ("Science and Civilization") that science is "inseparable" in its origin from "the collecting and ordering of experience" that "enabled our ancestors to raise mankind to its present position among the other living beings that inhabit our earth" (xvi), and "the progress of science and the advancement of civilization" remain "most intimately interwoven" (xvi).

The dramatic development in the memo of scientific and social progress first follows the "science" equations and then encompasses all the other hierarchies in the text. Motivated by "science" and through "openness" and "international cooperation/contributions from physicists all over the world," a "rapid exploration" was initiated, which led to "the remarkable development of physical science" and "important discoveries" (such as electron configuration, the structure of the atom, and the existence of the neutron). This again led to "the discovery of fission," which initiated a "whole new epoch of science." With fission, "a new kind of combustion" seemed feasible, and "the project of releasing, to an unprecedented scale, the energy bound in matter" was launched. The entire hierarchy of "the project" follows as a consequence.

So far, every step has been a logical consequence of science and common human striving, with each step inevitably following the previous. However, at the level describing the completion of the project, two paths emerge. The project is unconditionally described as "one of the greatest triumphs of science and engineering destined to deeply influence the future of mankind" and "a far deeper interference with the natural course of events than anything ever before attempted." At this point in the drama, scientific development has reached a level of power and magnitude that it now, according to Bohr, sets the terms and conditions for the rest of the world or, as Wells put it,

"science is the new king of the world" (110). There are now new possibilities of action that depend upon the paths the nations of the world choose.

On the side of hope is the logical place for the hierarchy concerning "the question of control." Once nuclear weapons have been successfully developed, "an early initiative" can forestall competition and uproot any cause for distrust. This can then lead to "a universal agreement in true confidence," facilitating an "adequate control arrangement," that accomplishes "the prevention of competition," "control of active materials," and prepares the way for "future international cooperation." This, Bohr claims, would be "a turning point in history," would "turn the project to lasting benefit for the common cause," and make the project "a symbol of the benefit to mankind science can offer when handled in a truly human spirit," or, as Bohr writes later in "A Challenge to Civilization," "science, which . . . has stood as a symbol of the progress to be obtained by common human striving, by its latest emphasis on the necessity of concord, may contribute decisively to a harmonious relationship between all nations" (364).

On the other hand, the "grave causes of disagreement" resulting from different approaches to "economic and social organization" could lead to "distrust" and "secrecy," which again unleash the "terrifying prospect of future competition between nations" leading to "dangers of unprecedented acuteness" and "a perpetual menace to human society."

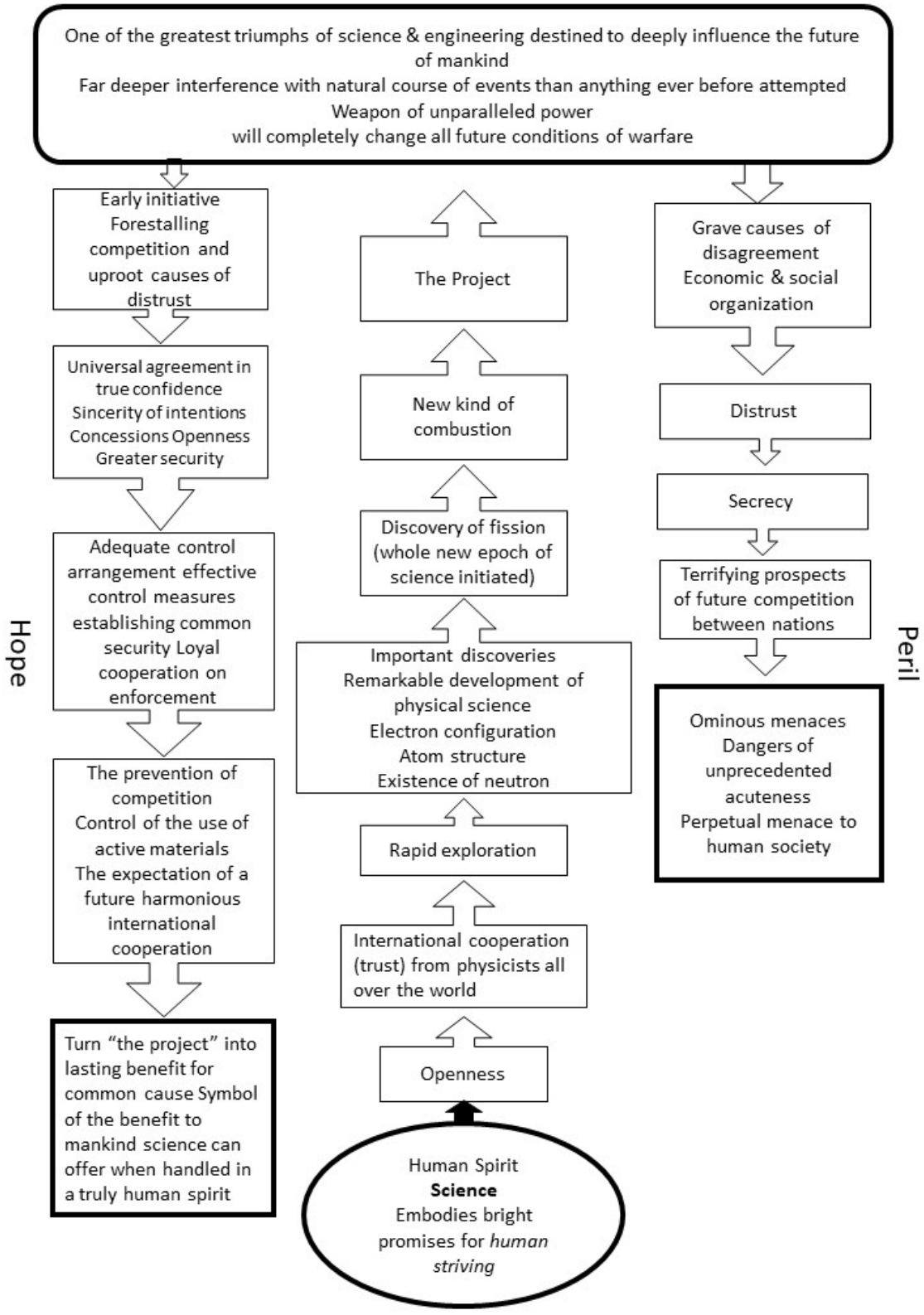

Figure 16 Cycle of Terms in Bohr's Memorandum to President Roosevelt

The illustration above shows why Oppenheimer, inspired by Bohr, called the atomic bomb "a hope" and "a peril" (qtd. in Rhodes 324-25). According to the text, by common human striving for increased control over nature, humans have finally reached a point where one form of striving (war) has to yield to another form of human striving (science), with two remaining possible outcomes: "international cooperation" (hope) or "a perpetual menace to human society" (peril).[99] Thus, strife or negative human striving (war) is abolished by adventurous human striving (science). A spasm of mutual nihilation is possible, but not a war.

In the five following wartime memos Bohr sent to the White House, he elaborates on the potential forms of control and international cooperation he envisions as the best outcome. His idea is essentially that of a World State in the form of an "international security organization" with a "standing expert committee" of scientists and technologists (Aaserud 114). This organization would control and inspect "every major technical enterprise" in the world and would control all nuclear materials and nuclear weapons, which it could also use for "eventual policing purposes" (Aaserud 114). Bohr admits that this requires radical "revision of the relationship between sovereign nations" but states that this is the only way "unprecedented common dangers can be averted" (Aaserud 116). With this kind of organization, not only science but also scientists would become the new sovereign of the world. In his final wartime memo, written 12 July 1945, Bohr almost goes so far as to make an implicit threat on behalf of the scientific community:

> In this connection it may be most essential, however, that the scientists, *on whom the governments of every country will depend* for advice, from the very beginning

[99] It is also interesting to note that that "purification" is brought about by a synthesis of the two kinds of human striving: war and science. It is first through the Manhattan Project (scientists engaged in the war industry) that war (according to Niels Bohr) becomes impossible.

> feel assured that the unique situation brought about by so fruitful and promising an exploration of a new domain of knowledge is being handled in a spirit conforming with the ideals of common human striving for human progress for which science through the ages has stood as a symbol. (120, emphasis added)

Bohr's vision is a concretization of the dream Nobel, Wright, Wells, and Szilard had that technology and science could somehow end war and a plan that, though optimistic, does not require a completely utopian world to function. All it requires, according to Bohr, is a recognition of what he perceived as "dangers of unprecedented acuteness." As Wells writes, "Human beings are foolish enough, no doubt, but few have stopped to haggle in a fire escape" (114).

Nuclear weapons presented humans with a hope and a peril, but paradoxically enough, hope, by the logic of this text, could not exist without a clear recognition of the peril. Therefore, increasing the peril in some instances could contribute to increasing the hope. This is the logic Teller and Oppenheimer used to argue in favor of a lethal demonstration of atomic bombs on Hiroshima and Nagasaki (Weart and Szilard 209; Kelly 291), and many other scientists traced those same arguments back to Bohr. In that way, Niels Bohr, the great scientist and humanitarian, contributed towards the bombing of Hiroshima and Nagasaki, the launching of the Cold War, and the maintenance of a "perpetual menace to human society" (Memorandum to President Roosevelt). Many of the young scientists at Los Alamos state that Bohr "inspired many of us engaged in the work of war to think about the future and prepare our minds for the task of peace that lay ahead" (Aaserud 17), but he also constructed the logic that justified the bombing of Hiroshima and actually designed the trigger mechanism that set off the bomb over Nagasaki.

In this way, Bohr hoped to increase the hope of ending war by also increasing the peril, providing the moral shock intended to provoke an "outbreak of sanity."

Conclusion

Kenneth Burke claims that "physicists compulsively tracked down the implications of their terminologies, thereby producing the atomic bomb, even though many of them secretly hoped that their experiments would fail" ("Dramatic Form" 55). In this chapter, I have shown how the visions implicit in three of the first influential texts about nuclear weapons contain logics capable of appealing to and persuading scientists to develop the first nuclear weapons. I have established the *potential* for consummation and traced some of the origin of the discourses that produced these consummatory vocabularies or visions. I have also analyzed the logic and structure of the visions, with their hierarchies and god-terms, and have shown by example how other consummatory vocabularies can be discovered in other discourses.

Even before the war started, the scientists were ethically and aesthetically predisposed by the cultural form of the experiment to initiate and complete processes of scientific discovery. The three visions built upon that foundation in different ways to convince the scientists to initiate and complete the development of the first atomic bombs.

The *Frisch-Peierls Memorandum* identifies a potential in nature that, through scientific processes, can be used to construct a "Super-bomb" and give the Allies access to an irresistible weapon. Even if the bomb may be unethical to use, due to radiation poisoning and high civilian casualties, the bomb must still be constructed if only as a counter-threat to a potential German nuclear weapon. Except from giving the aggressor the upper hand, the weapon does not in any way transform the future of war or international relations.

The *Los Alamos Primer* is more focused on the science and has no greater goal than "maximizing damage and efficiency" in any way possible, with every formula and method measured primarily on whether it contributes towards this one goal.

And finally, "Memorandum to President Roosevelt" looks furthest and ambitiously tries to construct a logic of how discovery of nuclear power must lead to the end of war, by international cooperation or the constant threat of mutual nuclear annihilation. The symmetry and logic in these visions give clear direction and purpose to the scientists who read them.

I have established the potential for consummation, and in the next chapter I will analyze the spread and personal uptake of these visions among the Manhattan Project scientists. I will show how the scientists describe the experience of this consummatory drive and their thoughts on the ethical implications of what they did under its "spell." I will look closely at documents, including archival documents from two leaders at Los Alamos (Robert Oppenheimer and Robert R. Wilson), while also reviewing statements from others such as Hans Bethe, Joseph Rotblat, Edward Teller, Richard Feynman, and Paul Olum to show that this was a widespread phenomenon among the Manhattan Project scientists.

Chapter 4: Reception of the Three Visions of Nuclear Weapons Among Los Alamos Scientists

In the previous chapter, I indexed three very influential texts to find the thought patterns and visions that, I contend, persuaded scientists to join the Manhattan Project and develop the atomic bomb. In this chapter I analyze many shorter texts from the Manhattan Project to find whether these patterns and visions are represented there and how they blend with the personal thought patterns of the individual scientists.

But first I need to outline what Burke claimed a researcher could find through indexing these smaller texts. In *The War of Words*, he writes, "You can tremble at the thought, if you will: but when a man, hanging to his strap in the subway, reads a yellow journal, he is *meditating*. He is contemplating the motives of human action. He is pondering 'representative' things. He is absorbing a philosophy" (*War* 170). However, if you were to talk to this man, Burke warns, you should not expect to get a comprehensive statement of the philosophy he has absorbed. Clear hierarchies of terms are the results of structured thought following "the processes of abstraction and generalization by which we think" (*Counter-Statement* 142) and are typically found in the most persuasive texts we read, but everyday conversations are not often as clear. Rather, in everyday conversation, "we are continually encountering fragmentary variants" of these structures ("Rhetoric" 204). These will be less clear, less structured, and more incomplete. Burke writes:

> In this case, the "signs" manifested by a human personality or by a social incident (or social order, or social movement, or cultural trend in general) would be treated as relatively obscure aspects of motivational structures that are *least* obscure in literary texts. (LAPE 275, emphasis added)

What signs would Burke see as an indication that a certain philosophy or motivational structure has been "absorbed" by an individual or a group? In most cases a researcher would probably not find the complete motivational structure replicated in their utterances. In addition to the noise that occurs in any communication, nobody encounters these texts in a vacuum devoid of their own life experiences and previous motivations. The more likely result is a merger that integrates the newly absorbed structure with previously held perspectives.[100] A researcher can expect to find key terms and key arguments from the texts repeated or restated in these individual utterances, as well as hierarchies that are organized by the same logic and with the same or similar goals. As Burke points out,

> [The text] can, by its function as name and definition, give simplicity and order to an otherwise unclarified complexity. It provides a terminology of thoughts, actions, emotions, attitudes, for codifying a pattern of experience. . . . The schematization is done . . . by idealization, by presenting in a "pure" or consistent manner some situation which, as it appears among the contingencies of real life, is less effectively coordinated; the idealization is the elimination of irrelevancies. (*Counter-Statement* 154)

The text appeals by giving an interpretation of a situation. It teaches one how to think and how to separate the relevant from the irrelevant. Someone who has accepted this teaching will sort the world in a similar way.

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[100] Still, the language Burke uses to describe this influence is quite forceful. He writes, "The [author] . . . should thus be equipped to make it [the pattern of experience] convincing. . . . By thoroughness he should be able to *overwhelm* his reader and thus *compel* the reader to accept his interpretations. For a pattern of experience is an interpretation of life. . . . The thoroughness of the artist's attack can '*wear down*' the reader until he accepts the [author's] interpretation (*Counter-Statement* 176, emphasis added). "Overwhelm," "compel," and "wear down" make the work of influence sound like a kind of attack or violence.

Burke describes such a pervasive pattern or structure within an organization as a kind of rhetorical architecture (perhaps what management studies would refer to as a strong organizational culture)[101] that is essential for cooperative enterprise:

> For quite as a state is held together physically by a network of purely *material* communicative resources, so this network itself is guided in its construction and control by a network of purely *symbolic* acts and symbol-guided purposes, ranging from the lowly processes of bookkeeping and accountancy to the over-all terminology of "right," "justice," "beauty," "propriety," "truth," the "good life," etc. in which the logic of a given social order comes to an ideal, theoretic head. (LAPE 263)

One of the goals of indexing influential texts is "learning something about the ways in which the 'personality' of the work relates to the 'personality' [or rhetorical architecture] of a social order" (LAPE 275). In addition, indexing is also likely to tell us something about the personal perspectives and strategies of the individuals that interact with these vocabularies. As Burke writes, "If you inspect any given scientific writer's terminology closely enough, you can hope to find the bridges that join his purely technical nomenclature with the personal realm" (LAPE 277).

At its apex, over 2,500 people worked on the Manhattan Project at Los Alamos, and it would be beyond the scope of this project to measure the impact these vocabularies had for each of those members of the project. Instead, I will analyze the impact on two of the most influential leaders in the project and some of their colleagues.

[101] As Christensen and Overdorf write, culture "enables employees to act autonomously, but causes them to act consistently" (71).

Project Y (the Los Alamos division of the Manhattan Project) was organized into seven technical divisions: CM (Chemical and Metallurgical Division), R (Experimental Physics), F (Physics), T (Theoretical), X (Explosives), G (Gadgets), and Z (Engineering). Each of the respective division leaders reported directly to Robert Oppenheimer, who was the director of the Los Alamos Laboratory. Of these divisions, most of the nuclear physicists went into the R and T groups that were led by respectively Robert R. Wilson and Hans Bethe (Truslow and Smith 18). My analysis focuses on the writings of Robert Oppenheimer and Robert R. Wilson but also includes some of the texts by scientists less high up in the hierarchy (Richard Feynman, Hans Bethe, Joseph Rotblat, Paul Olum, Philip Morrison, David Hawkins, Leo Szilard, and Edward Teller) to show how these motives pervaded the organization, By doing so, I will give as complete a description as possible of the attitudes and arguments that influenced these scientists to initiate and continue work on the bomb. As a part of this, I will argue that consummation was a significant motivation for the scientists to develop atomic weapons. I will start with Robert Oppenheimer and Robert Wilson and show both how the three visions (Frisch/Peierls "bomb as a counterthreat," LA Primer "maximize damage," and Bohr "bomb as means to end all war") mixed with their preconceived notions and gradually became a part of their own statements and how these visions competed with and complemented each other in their writings.

Robert Oppenheimer

There are few scientists in the world who have been the object of so much scholarship and so many artistic renderings as Robert Oppenheimer, and the interest in him seems to only be increasing, with seven major biographies published on Oppenheimer just since 2000 (Herken 2002, Bernstein 2004, Bird and Sherwin 2005, Cassidy 2005, McMillan 2005, Thorpe 2006,

Monk 2013). My work will focus on texts written by Oppenheimer from 1932-1945, although my reading of those texts will also be informed by his larger correspondence in *Robert Oppenheimer: Letters and Recollections* edited by Alice Kimball Smith and Charles Weiner, as well as his later recollections about his work on nuclear weapons. Biographical information is helpful to understand the context in which these statements were made, but my main approach to these texts will be through indexing, which Burke called a "more direct" approach ("Questions" 334).

There are many facets of Oppenheimer's life that could be interesting to explore, but here I focus on Oppenheimer's statements relating to science, physics, and the atomic bomb, looking for key terms Oppenheimer uses in relation to these. In addition to identifying key terms and arguments in his correspondence, I will conduct a detailed indexing of four key texts: a 1932 letter to Frank Oppenheimer, a 1943 letter to Enrico Fermi, a 1945 speech to the Association of Los Alamos Scientists, and a 1947 speech at MIT. Most of the letters show only fragmentary variants of the hierarchies of terms that Oppenheimer uses to organize his world, whereas in these four texts he takes the time to show the relationship between his everyday concerns and what motivates him. I also chose these texts because they show the evolution of his thinking in relation to his reading of the three texts I analyzed in chapter three. Robert Oppenheimer wrote the letter to Frank before learning about fission and he wrote the letter to Fermi during his first year as Director at Los Alamos. He gave his first speech as he was trying to implement Bohr's vision, and he gave the second speech after that vision had failed. Through my analysis I show how both asceticism and aestheticism played a prominent role in Oppenheimer's view of the

world, and they are both reflected prominently in his letters before the Manhattan Project.[102] After he learned about fission, there was a prominent shift in Oppenheimer's thinking about science, from science as beauty to science as power, at its apex merging asceticism and "science as power" into a grand vision for scientists in a nuclear future. As this vision fails, Oppenheimer retreats back into a primarily aesthetic view of "science as beauty." In these two speeches he also formulates a kind of scientist's creed: a logic and ethic of science that leads him to view the development of the atomic bomb as an "organic necessity." He catches on to the dream of nuclear weapons as soon as fission is discovered and gradually becomes obsessed with making that dream a reality through his own efforts and his leadership of other scientists. The texts mentioned above provide a look at the logic behind Oppenheimer's consummatory drive to become "the father of the atomic bomb."

In the case of Oppenheimer, some of my observations about his texts during the war years must include an asterisk (primarily the degree to which Oppenheimer became an obedient soldier). Even before the outbreak of the war, Oppenheimer was under FBI surveillance due to his Communist sympathies, and he was aware of that fact. That surveillance was massively increased once he became the Director at Los Alamos, and he expected that all his mail would be read by military security. So it is possible that his "militaristic" inclinations were rather a matter

[102] Jennet Conant writes, "His style was to be the tormented genius, and his spare frame and angular face reflected his ascetic character, as if his desire to engage every moment fully and completely were consuming his inner resources. He had been a delicate child, and when he pushed himself too hard, he became almost skeletal, resembling a fifteenth-century portrait of a saint with eyes peering out of a hollowed face" (134-5). I. I. Rabi says of Oppenheimer, "He was an aesthete . . . A certain kind of intellectual, aesthetic person of the upper middle classes" (qtd. in Rhodes, "Robert Oppenheimer"). Similarly, Jennet Conant writes, "He couldn't be humdrum. He would even work up these enthusiasms for a brand of cigarettes, even elevating them to something special. His sunsets were always the best" (134).

of compliance than earnest enthusiasm, although Robert Wilson and Isaac Isidor Rabi believed Oppenheimer was sincere about wanting the scientists to be enrolled in the "people's army."

From Artist to Scientist: Science as Beauty

As I indicated in chapter 1, Oppenheimer is a particularly interesting person to study when it comes to Burke's concept of consummation, partly because he was one of the Manhattan Project scientists Burke personally got acquainted with during his stay at the Institute for Advanced Study at Princeton, but also because Oppenheimer, to a greater extent than most scientists, integrated the rigor of science with his early sensibilities as an artist. Some of his closest friends initially expected he would be as an "artist" or "writer" rather than a scientist (Smith and Weiner 66), and he even published a poem titled "Crossing" in the avant-garde literary magazine *Hound and Horn* as late as 1928 (110). During the 1920s, Oppenheimer wrote short stories and read poetry in order to find some kind of cathartic release from his inner demons who required constant internal consistency of him. He writes in a letter to his high school English teacher and literary mentor, Herbert W. Smith, "I find these awful people in me from time to time, and their expulsion is the sole excuse for my writing. . . . I write to get rid of an ideal and impossible system" (57).[103]

[103] He does not give a clear description of these people or the system he is trying to get rid of. He mentions a person who "might be intelligent here or there, and blind as a fool in everything else" (57) and later talks about "the awful fact of excellence" (92) and an almost debilitating need to perform a great work that would be noted in the "opinion . . . of the great" in science and literature (62). Robert Norris writes that Groves recognized this "overweening ambition" in Oppenheimer that had left him "frustrated and disappointed" that his scientific work "had not brought him the recognition he believed he deserved." Groves saw that, for Oppenheimer, the Manhattan Project "could be his route to immortality" (139)

Gradually, science, and particularly physics, replaced literature as the medium for Oppenheimer's aesthetic expression and appreciation. He began early on to call physics his "stern and uncompromising muse" (57), and later described it as a kind of 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 and data "beautiful" (180, 198), and says the nuclear bomb development yields "intellectual or technical satisfaction" (312).[104] Infamously, he also called the potential method for developing an atomic bomb "technically sweet" (USAEC 266), noting 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). So 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.

Oppenheimer Ascesis of Peace through War

As mentioned, the first document I index in detail is a March 12, 1932 letter written to Frank Oppenheimer; 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

[104] This shift parallels Oppenheimer's transition from Sigmund Freud to Bertrand Russell as his 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 (24, 48, 54, 71, 111).

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" (Smith and Weiner 155). This is a quite short text with quite obvious key terms and equations. I will therefore move straight to the hierarchy of terms Oppenheimer sets up in this letter.

Oppenheimer organizes his thoughts in this letter by a logic of means and ends. Oppenheimer claims discipline is fundamentally "good for the soul" and that it is the key to achieving "detachment" and ultimately "peace" (the god-term). However, he claims that discipline cannot be achieved without other real (though ultimately minor) objectives, such as winning a war. 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 in turn can lead to what Oppenheimer describes 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."[105] This peace and serenity is reached by accepting finally "more easily our earthly privation and its earthly horror." Thus, war or striving leads to discipline, discipline leads to

[105] This is a rather obscure term. In a theological context, this may refer to "whatever pains, sufferings, diseases, troubles, and affections an embodied soul and quickened body are heir unto" (Irving 418). Presumably he is referring to perceived deficiencies in body or mind, such as his history of depression and anxiety.

detachment, and detachment leads to peace. In other words, out of external conflict (war and striving), humans can gain internal peace and harmony.

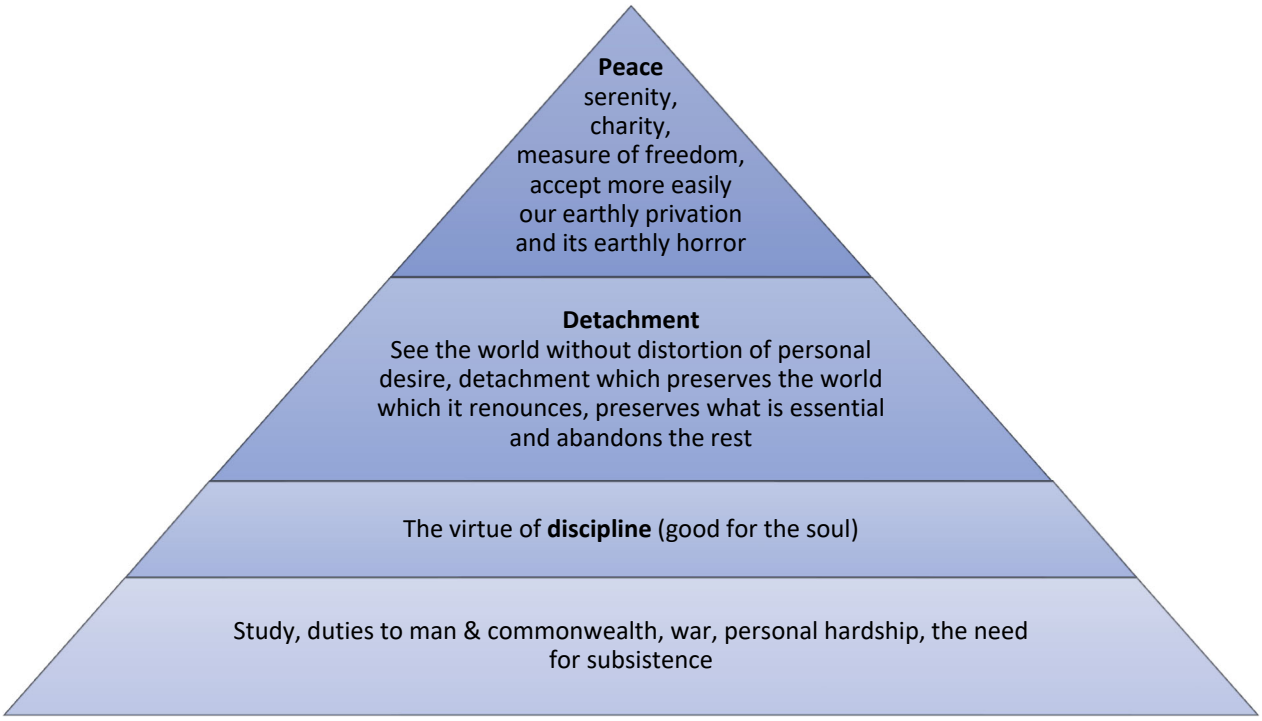

Figure 17 Hierarchy of Oppenheimer's ascesis of peace through striving

Freeman Dyson, fellow physicist and colleague of Robert Oppenheimer at the Princeton Institute for Advanced Study, writes in *Weapons and Hope* that this description of war contains "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.

From Scientific Adventurer to Obedient Soldier: Science as Power

Oppenheimer's letters show that the discovery of fission made a profound impression on him. On January 28, 1939 Oppenheimer wrote a letter to his colleague William H. Fowler when he had just learnt about the new discovery. Glenn Seaborg says of the time, "I do not recall ever seeing Oppie so stimulated and so full of ideas" (qtd. in Smith and Weiner 207). The sense of excitement is palpable throughout the letter. 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[ranium] deuteride *should be quite something*. What do you think? It is I think exciting . . . in a good honest practical way" (208). He expresses a similar sentiment to George Uhlenbeck on February 5, 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 electrical 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 could be. For Oppenheimer, the concept of science is becoming firmly connected to power, the power of nuclear bombs.

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 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).[106]

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, established the following month. Rudolf Peierls had recommended him for the position after meeting him in early 1942 and relating to him the content of the *Frisch-Peierls Memorandum.*[107] Oppenheimer's letters now 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).[108]

As it becomes clear that a new laboratory will need to be set up for the effort, Oppenheimer's concerns expand to recruitment. Smith and Weiner note that "it often took an

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

[107] Peierls writes, "I knew Oppenheimer from Zurich and had respected him, and now I was very impressed by his clear understanding of the problems of atomic energy. He had already considered most of the points Frisch and I had raised, and many that had developed subsequently" (172).

[108] 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!" (qtd. in Rhodes, *The Making of the Atomic Bomb* 419).

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, emphasis added). 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.

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 Mega electron-volt (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 means less worry about maximum speed, and it also brings simplicity, reliability, better chance of energy release of over 10,000 tons of TNT, and a reduced chance of predetonation (240-2).[109]

Increasingly, his language seems to mirror the lectures Robert Serber held later at Los Alamos in April 1943, published as *The Los Alamos Primer* (as outlined in Figure 2-4 in chapter 3 of this dissertation).[110] This similarity is clear in a letter Oppenheimer wrote to Enrico Fermi on May 25, 1943 discussing a different military application for radioactive materials first suggested by Fermi. This is the second text I will be indexing, and as with the last one, I will

[109] Letter to James B. Conant, November 30, 1942.
[110] 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.

only present the hierarchy of terms and god-term since it is a short letter with quite obvious key terms and equations.

Just as in *The Los Alamos Primer* (shown in Figure 3: Hierarchy of positive terms), the foundation of the verbal pyramid in this letter is a certain potential destructive power in an element (strontium in this case instead of uranium or plutonium), and this potential is unlocked through a series of processes towards an ideal end. Oppenheimer writes that "strontium appears to offer the highest promise" for "military uses of radioactive material." He then outlines the processes and resources that are needed in order to unlock this potential, including "separation of the beta-strontium," which must be "carried out by remote control," establishing a team that can be entrusted with this secret work, and further investigating "the physiological side of the matter" already being studied by biomedical researcher Joseph G. Hamilton (most likely about how easy it would be to kill people with strontium). This would then unleash "the application which seemed to us so promising," which is "radioactively poisoned foods." The ultimate goal of the project initiative would be to "poison food sufficient to kill a half a million men."

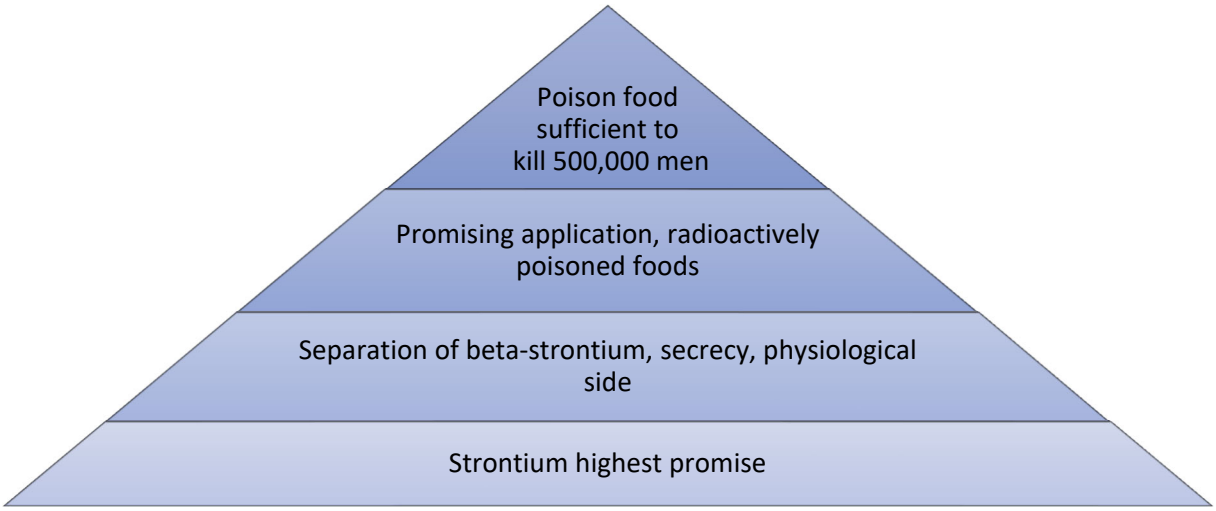

Figure 18 Hierarchy of Oppenheimer's letter to Enrico Fermi

When he was shown the letter in 1985, Frank Oppenheimer responded that it was “bloodthirsty” and that "in those days we talked about everything, any way of killing” (qtd. in Bernstein, “Radioactive-poison Plan”). A student of Oppenheimer noted that he had talked casually about similar plans at Los Alamos, as well as other plans for radioactive poisonous gas and using crop poisons such as potato blight (Bernstein). The pattern of thought seems to have been widely established at Los Alamos: science is a tool to transform potentialities in nature into destructive power.

In addition to moving from a focus on energy released to a focus on damage, Oppenheimer, at critical junctures, also allowed the project to be defined as a military rather than a scientific endeavor. One significant development in this direction came in February 1943, after Oppenheimer failed at getting the project transferred to the Office of Scientific Research and Development rather than remaining under the direct control of the military. Oppenheimer writes to Rabi, “I am willing to make a faithful effort to get things going. I think if I believed with you that this project was ‘the culmination of three centuries of physics,’ I should take a different stand. To me it is primarily the development in time of war of a military weapon of some consequence. I do not think the Nazis allow us the option to [not] carry out that development” (Smith and Weiner 250).[111]

However, it was Oppenheimer who pushed for enrolling all the scientists into the military, with military ranks and uniforms. Robert Wilson bluntly disagreed with him: “Oppy would get a faraway look in his eyes and tell me that this war was different from any war ever fought before: it was a war about the principles of freedom and it was being fought by a ‘peoples’ army,’ and we all belonged right in there with the people. Now I can be as idealistic as

[111] Letter to I. I. Rabi, February 26, 1943.

the next guy, but I thought that he had a screw loose somewhere when he talked like that" ("A Recruit" 147). Although he was later dissuaded from the military enlistment proposition by Rabi and Robert Bacher, at this point at least, Oppenheimer seems to have been a very willing and obedient soldier indeed.

Oppenheimer repeats this military rather than scientific focus in a letter to General Groves on October 6, 1944: "For the most part these men [the scientists] regard their work here *not as a scientific adventure*, but as a responsible mission which will have failed if it is let drop at the laboratory phase" (286). This comes despite that "the scientific adventure" had been one of the three main reasons Oppenheimer had earlier given for scientists to join the project in the first place. To this he adds his own dedication to seeing the project as a weapons program: "I agree completely with all the comments of Captain Parson's memorandum on the fallacy of regarding a controlled test as the culmination of the work of this laboratory. The laboratory is operating *under a directive to produce weapons*; this directive will be rigorously adhered to" (286, emphasis added).[112]

Oppenheimer's Vision of Nuclear Weapons as Power to End All War

Throughout 1942 and 1943, Oppenheimer's arguments and language primarily reflect that of *The Los Alamos Primer* (seeking to maximize damage as the highest goal) with some similarities to the *Frisch-Peierls Memorandum* (seeing the bomb project as a defensive measure against a potential German nuclear weapon). There is no discussion of creating a new order in

[112] Despite Oppenheimer's assurances, not all of the other scientists seemed to agree at the time. At the Trinity nuclear test, Enrico Fermi enraged Kenneth T. Bainbridge by saying, "it wouldn't make any difference whether the bomb went off or not because it would still have been a well worth-while scientific experiment. For if it did fail to go off, we would have proved that an atomic explosion was not possible" (qtd. in Rhodes, *Making* 664).

the world that eliminates war until Niels Bohr enters the picture. He came to Los Alamos in early 1944, and gave Oppenheimer a copy of his memo to Roosevelt in July 1944. This contained his vision of how the nuclear bomb makes war impossible and should unite all nations in an effort to avert a universal nuclear holocaust. Perhaps because he knew his mail was being read by military intelligence little of that language is reflected in Oppenheimer's letters until after the end of the war. Still, it is clear that he adopted and adapted that vocabulary with its thinking and arguments before that time. Robert R. Wilson and other scientists have recorded how Oppenheimer used an adapted version of Bohr's vision to convince the scientists at a critical juncture to keep working on the atomic bomb.

Oppenheimer states in November 1945 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). This vision became a new argument that Oppenheimer wielded to sustain the project at a time when the initial motivation for it was fading.

Towards the end of 1944 it became clear to the Los Alamos scientists that the Germans were not going to succeed in developing nuclear weapons and that they would soon be conquered. The impetus and argument for initiating the program were 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 military security (283). Despite this, there seem to have been three or four public meetings discussing the ethics and potential impact of

nuclear weapon development.[113] 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" (qtd. in Bird and Sherwin 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 letter to president Roosevelt, and, as Bird and Sherwin write, it "was persuasive to many of the assembled scientists" (284). Wilson gives the most detailed explanation of the argument Oppenheimer used in the meeting organized by Wilson 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 [the scientists] 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)

[113] 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 his meeting in March 1945 (Bird and Sherwin, "Anticipating" 284). In addition to this, there was a meeting in April or May that also touched on the impact of nuclear weapons on the world.

This vision or argument convinces the other scientists to complete the project,[114] but Oppenheimer is given a sobering wake-up call when he finds out that this vision is not shared widely in Harry Truman's administration (301).[115] 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" (303).[116]

With the scientific work mostly completed, Oppenheimer dedicated more time to persuade other scientists and politicians to fulfill Bohr's vision. In early November 1945, Oppenheimer delivered one of his most well-formulated and enduring statements about science, the development of the atomic bomb, and his vision for a nuclear future. In this statement, "Speech to the Association of Los Alamos Scientists," he imitates Bohr, but he also diverges from him in important ways. As I will argue in my analysis, this text clearly shows Oppenheimer's adoption of the core structure of Bohr's vision, but it also shows that Oppenheimer has adapted it in line with his ascetic/aesthetic philosophy of life (outlined in his 1932 letter to Frank Oppenheimer). The speech is roughly 6000 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) describing the qualitative change the bomb has brought to war and the world, and (4) outlining 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

[114] 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" (qtd. in Bird and Sherwin, "Anticipating" 285).
[115] A meeting with Truman, who initially rejected Oppenheimer's ideas for international control of nuclear weapons, famously had Oppenheimer stating "I feel like I have blood on my hands" and Truman dismissing him as a "cry-baby scientist" (qtd. in Bird and Sherwin, *American* 332).
[116] Letter to Marcelle Bier, August 31, 1945.

does he seem to digress in the second section 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 development was a natural consequence 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 science is the god-term in this text. The structure of the text is dramatic catharsis, where the logical implications of a god-term are gradually unfolded. Rather than a verbal hierarchy or pyramid of increased abstraction (when the structure is based on dialectical transcendence), I argue that this text demonstrates the gradually unfolding consequences of science as a central motive or driving force.

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 those of a religion. He postulates these beliefs, behaviors, and practices in a kind of "scientist's creed"; people who do not follow them "stop being scientists" (Smith and Weiner 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 according to Oppenheimer (325). However, some tenets of Oppenheimer's "science" sound less benign: If you are a scientist, you believe that it is good "to attain a gradually greater and greater control over nature" (325), that "the knowledge of the world, and the *power* this

gives, is *a thing which is of intrinsic value* to humanity" (317, emphasis added), and that "it is good to turn over to mankind at large *the greatest possible power to control the world*" (317, emphasis added). 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 humans greater understanding of and control over nature.

This becomes his justification for the Manhattan Project: after mentioning some of the preliminary 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, emphasis added). 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 (including him) 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, emphasis added).

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, which can be collapsed into one since, as Francis Bacon stated, "knowledge is power" (scientia potentia est).[117] "Science," as Oppenheimer defines it, provides the logic that makes it "an organic necessity" or consummatory drive for scientists to discover and develop knowledge of

[117] Oppenheimer's argument actually mirrors one that Francis Bacon makes about how knowledge is power and "we understand nature in order to command her" (Mendelsohn 31), showing that this connection between science and power has a history that stretches back further than the logical positivists.

and power over nature and spread this to the rest of humanity. As Burke writes, these scientists are simply "carrying out the implications of their terminologies" ("Watchful" 49).

Science as a central motivation gives scientists a consummatory drive or this feeling of "organic necessity" to give humans more and more control over nature (the second step in the unfolding). The consummatory drive produces knowledge and power over nature (the third step). This drive leads to shocking and groundbreaking discoveries (the fourth step) that force humans "to re-consider the relations between science and common sense" (Smith and Weiner 315-6). As Oppenheimer states:

> They [the discoveries] 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. (Smith and Weiner 316)

Science can debunk concepts that have organized humans' understanding of the world they inhabit and introduce new terms that humans had never considered before. The hope is that this can help humans create systems that are more suited to the actual nature of reality, but it also has the potential to radically reorient society. Some scientific discoveries have this quality. He mentions relativity, the whole development of atomic theory, and Bohr's interpretation of it "in terms of complementarity" (315)[118] as some examples of such discoveries. Oppenheimer is here laying the groundwork for his later conclusions that sovereign nation state democracies may be outdated concepts in a nuclear world. With the development of the atomic bomb, Oppenheimer

[118] With notions, such as light being at the same time both a particle and a wave, that were previously considered to be absurd.

says that science has gone a step further from merely abstract concepts to real world developments that provoke profound change and unrest in human society. This is the fifth step. 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 discoveries, destined to radically change society.[119]

Oppenheimer argues that the development of atomic weapons constitutes not only a dramatic quantitative change (increased magnitude of destruction, relatively cheap, with shifted advantage of aggression/attack compared to defense) but also a qualitative change: "wars have changed," and "if these first bombs . . . can destroy ten square miles, then that is *really quite something*" (318, emphasis added).[120] The development of the atomic bomb signifies "a change in the nature of the world" where "wars have become intolerable," and humanity faces a "common problem," a "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 "new field" or "new opportunity for realizing preconditions" (319). This is the sixth step.

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[119] Francis Bacon makes a similar claim about science in his time: "It is well to observe the force and effect and consequences of discoveries. These are to be seen nowhere more conspicuously than in those three which were unknown to the ancients and of which the origin, though recent, is obscure, namely, printing, gun powder, and the magnet. For these three have changed the world: the first in literature, the second in warfare, the third in navigation, whence have followed innumerable changes. In so much that no empire, no sect, no star seems to have exerted greater power and influence in human affairs than these mechanical inventions" (Mendelsohn 31).

[120] 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.

So far Oppenheimer has outlined a logical sequence from the nature of science and from scientists following its "organic necessity" to the wider impacts on society, but the next steps consist of possible rather than necessary developments. He has established what science is and what science can lead to, and now outlines his vision for a nuclear future with the Los Alamos scientists. According to Oppenheimer, this new situation creates "a *possibility* of realizing . . . those changes which are needed if there is to be any peace" (319). This is the seventh step. 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 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.[121] In any case, Oppenheimer seems to view America's insistence on these ideals as the greatest hindrance to cooperation with the USSR, since "under those conditions you will not succeed in delegating responsibility for the survival of men" (320). Oppenheimer therefore advocates delaying the discussion of these ideals and compares it to the wisdom of Abraham Lincoln in not declaring slavery as the reason for fighting the South in the Civil War: "in order to preserve the Union Lincoln had to subordinate the immediate problem of the eradication of slavery, and trust to the conflict of these ideas in a united people to eradicate it" (321).

The final goal of all these changes, and the eighth and final step in the unfolding of "science," goes beyond the control of nuclear weapons to "a world that is united, and a world where war cannot occur" (320). Oppenheimer 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 1946 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

[121] 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 that 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.

> 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)

Scientists are here described almost as a separate people with loyalty to one another and a common creed. Oppenheimer lays the task on their shoulders, as apostles of science, to help bring about this new world. It is a clear call to political action.

The god-term of Oppenheimer's speech 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). Science, in these texts, is power, and the power of science will bring an end to all war. The chart below illustrates the eight steps of the unfolding consequences of science I have now described.

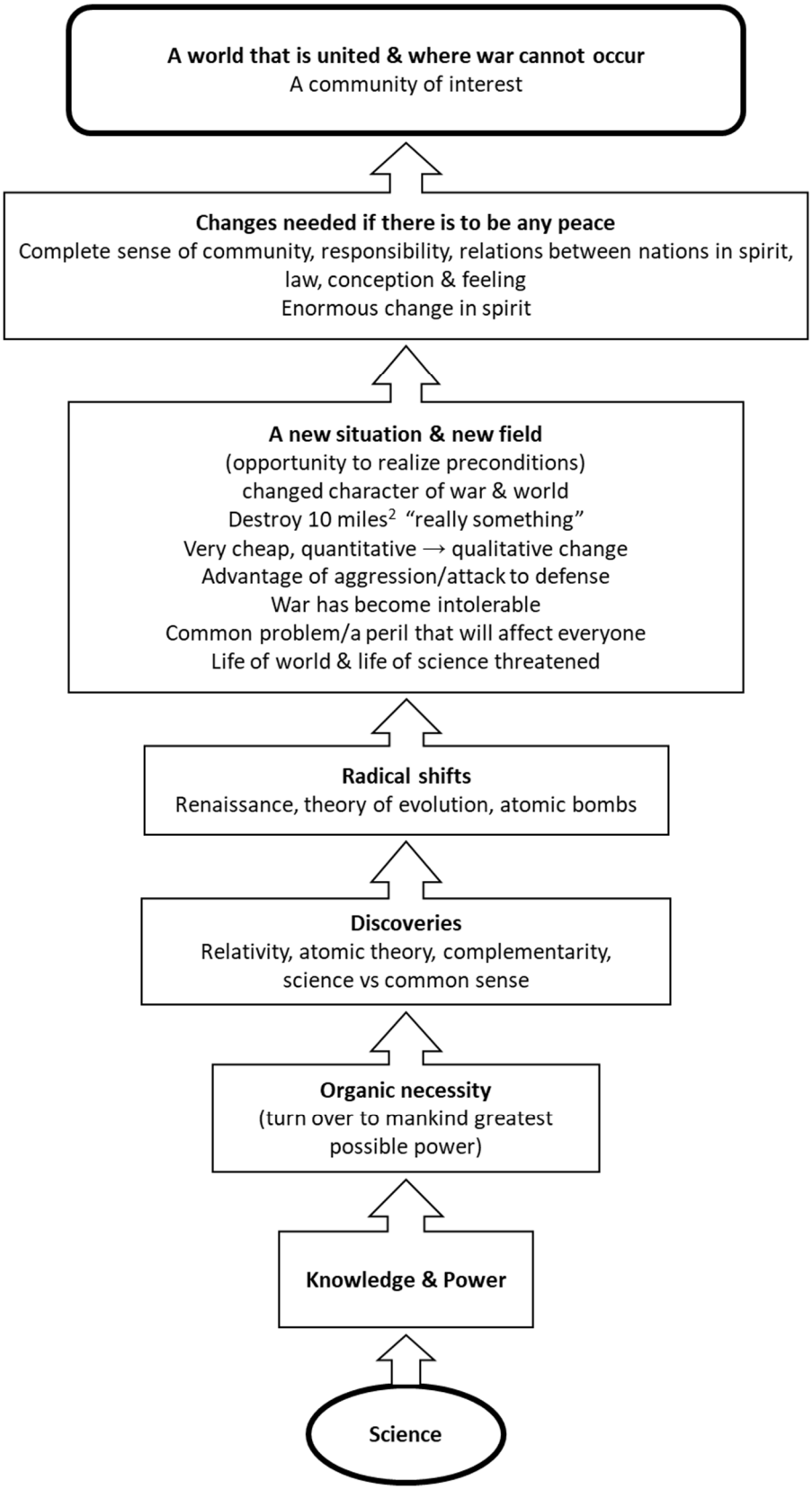

Figure 19 Complete hierarchy and dramatic unfolding in Oppenheimer's speech to ALAS

Although this is clearly inspired by Bohr, there are interesting similarities between the process Oppenheimer describes here and the one he describes to his brother in his 1932 letter. 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 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"). This was Oppenheimer's formula for world peace, stated at perhaps the height of his personal prestige, and, perhaps also, the height of his arrogance.[122]

Returning to Science as Beauty

After the war, Oppenheimer worked for the Truman administration as an advisor on the General Advisory Committee of the Atomic Energy Commission and was the mind behind the Acheson-Lilienthal report that set out a plan for international control of atomic weapons. However, this plan was rejected by the USSR and may never have had the full backing of the Truman administration either (Bird and Sherwin 347). Bohr's vision and the hope that came with it was largely abandoned. Oppenheimer wrote to Bohr in 1946 that "even in our gloomy

[122] Wilson later states that Oppenheimer "had arrogant feelings about his ability to shape the future. Well, he couldn't shape it one bit" (qtd. in Palevsky 148).

moments we did not succeed quite in thinking how difficult it would get to be" (1). The failure of the Acheson-Lilienthal plan and the negative responses by the Truman administration may have also impacted Oppenheimer's view of science as power, and he soon presented a very different view reminiscent of his earlier aesthetic inclinations, viewing science primarily as beauty.

In 1947 J. Robert Oppenheimer delivered the Arthur D. Little Memorial Lecture at MIT titled "Physics in the Contemporary World," in which he discusses the moral accountability of science.[123] It is in this lecture that Oppenheimer states that "the physicists have known sin; and this is a knowledge which they cannot lose" (66). Despite Oppenheimer's statement of having "known sin," the speech is not a criticism of physics or science used as weapons. Rather, if anything, the speech seeks to absolve science and discuss how the positive character traits of science (beauty) can be spread more widely in society.

The beginning of the speech is sober and careful, reflecting on the fact that the last decades "have shown in a poignant way how much the applications of science determine our welfare and that of our fellows, and which have cast in doubt that traditional optimism, that confidence in progress, which have characterized Western Culture since the Renaissance" (65). Oppenheimer discusses quite openly the guilt felt by physicists for their involvement in the creation of the nuclear bomb, described as "the deep trouble and moral concern which so many of us who were physicists have felt, have voiced, and have tried to get over feeling" (66). This guilt, Oppenheimer claims, encompasses all physicists, even those who did not participate in developing the weapon at Los Alamos: "The physics which played the decisive part in the development of the atomic bomb came straight out of our laboratories and our journals," and

[123] It is likely a lecture that Kenneth Burke read due to his later connection with Oppenheimer, its relation to a question which he was pondering, and the controversy concerning the lecture.

"the physicists felt a peculiarly intimate responsibility for suggesting, for supporting, and in the end, in large measure, for achieving, the realization of atomic weapons. Nor can we forget that these weapons, as they were in fact used, dramatized so mercilessly the inhumanity and evil of modern war" (66). There is a certain amount of deflection here, as Oppenheimer blames "the evils of modern war" rather than himself, even though he was instrumental in both the development of the bomb and in making the decision to drop it on a civilian target.

Indeed, soon he transitions to remove the yoke of moral responsibility from himself and his fellow physicists. He restates the inevitable use of physics for war: "There is no need to belabor this point, nor its obverse—that out of science there will come, as there has in this last war, a host of instruments of destruction which will facilitate that labor, even as they have facilitated all others" (67). He calls the demand for scientists to be responsible for the fruits of their work modest, ineffective, and "little more than an exhortation to the man of learning to be properly uncomfortable" (67). Actually, according to Oppenheimer, it is wrong to expect scientists to pay attention to the application of their science since "no scientist, no matter how aware he may be of these fruits of his science, cultivates his work, or refrains from it, because of arguments such as these [concerns about the implications for society]" (67). All that can be expected is that his research is sound since the "true responsibility of a scientist, as we all know, is to the integrity and vigor of his science" (67). To think that these demands give "any insurance that the fruits of science will be used for man's benefit, or denied to man when they make for his distress or destruction, would be a tragic naiveté" (67). Unlike his earlier view of scientists as creators and keepers of world peace, the scientist in this speech is a more humble creature. Oppenheimer states that the practice of science doesn't produce a philosopher king; rather "if it

makes men with a certain serenity in their lives . . . it is doing a great deal, and all that we may rightly ask of it" (68).

What then is the purpose of science? In this speech Oppenheimer says the purpose is beauty. For, if a scientist practices the virtues of science, "these qualities constitute a way of life which of course does not make wise men from foolish, or good men from wicked, but which has its beauty and which seems singularly suited to man's estate on earth (86). These references to beauty are strewn throughout most of the speech, and it is a beauty which is characterized by simplicity, thoroughness, and order: "It has in it the kind of beauty that is inseparable from craftsmanship and form, but that has in it also the vigor which we rightly associate with the simple ordered lives of artisans or of farmers, that we rightly associate with lives to which limitations of scope, and traditional ways, have given robustness and structure" (67).

On a more societal scale, science is a "collective effort, in which there is a clear and well-defined community whose canons of taste and order simplify the life of the practitioner. It is a field in which the technique of experiment has given an almost perfect harmony to the balance between thought and action" (68). In the previous speech, science is virtuous because it produces knowledge and gives humans power over nature, but in this speech, science is much more of an "ivory tower" with its virtue primarily being the peace and beauty it gives to those who practice it. The knowledge and power that were so central in his November 1945 speech have, less than two years later, been reduced to accidents or unfortunate by-products of science. Science is its own justification, and it is driven by an "organic necessity" that is completely disconnected from any beneficial outcome for society or humanity at large. This description by Oppenheimer fits Burke's definition of technologism, a kind of religion that has as "its underlying, unspoken assumption" that "the more technology, the higher the culture" (*Religion* 170-1). In this speech,

science is a god or god-term to the extent that it is viewed as consubstantial with the highest of all virtues, but unlike the "science" in the November 1945, this version holds no promise that progress in science will in any way lead to progress for humanity. It is science for the sake of science, a fully insulated consummatory vocabulary.

One of the most telling symptoms of consummation, according to Burke, is that tracking down the possibilities or implications in a vocabulary becomes an end in itself. It is not done in order to express something (self-expression) or to obtain something from others (communication). The beauty of the system makes the journey worth it, and a person in the grips of it would like nothing more than to be able to follow it to its inevitable conclusions without having to think about side-effects. I argue that this last statement on science shows Oppenheimer following his ascetic and aesthetic preferences, his consummatory drive, to another level, preserving the core of what made science a source of happiness for him by abandoning any condition that it should be beneficial for humanity at large.

Robert R. Wilson

Robert R. Wilson was a grandson of a Quaker preacher in Wyoming ("Interview") and a pacifist, who decided to join the Manhattan project, and he became a significant contributor to the development of the atomic bomb. Less famous than Robert Oppenheimer, he has never had a book written about him, and yet interviews with him have been featured in movies, books, and

magazines.[124] He is seen by many as the conscience of the Los Alamos scientists[125] and stated that he regretted his involvement with the development of nuclear weapons beyond VE Day.[126] He is one of the Manhattan Project scientists that has gone furthest in examining the ethics of the project and his own participation in it.[127]

Because he has reflected so much on his actions and motives, Wilson provides a rare perspective of the *experience* of consummation, as he describes his transformation from a "pacifist" to a "warrior" and from an atomic scientist to an "automaton." In this section, I show how Wilson in turn interacts with and absorbs the arguments and terms of each of the three visions outlined in the last chapter and how these mingle with his own beliefs and his relationship to Robert Oppenheimer. Although Wilson adopted all of the three visions in turn, as Oppenheimer did, he never saw the development as inevitable. He was also never convinced that the use of the atomic bomb on civilians was necessary to bring about the "end of all war." Rather, what he describes is a kind of mindless urge or drive that was initiated for good reasons

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[124] The main sources I have consulted are from the Robert R. Wilson Papers in the Carl A. Kroch Library at Cornell University. The primary documents there include his Los Alamos notebooks, his unpublished autobiography titled "Pacifist to Warrior," and another untitled autobiography written by his wife, Jane Wilson. Robert Wilson is also featured in a third of *Scientific Temperaments: Three Lives in Contemporary Science* by Philip J. Hilts, *All in Our Time: The Reminiscences of Twelve Nuclear Pioneers* edited by Jane Wilson, *Atomic Fragments: A Daughter's Questions* by Mary Palevsky, and the Oscar-nominated documentary *The Day After Trinity* directed by Jon Else.

[125] Herbert F. York (a fellow Manhattan Project scientist) says, "I'm very much aware of the fact that most sensitive, intelligent people take more the Wilson view" (Palevsky 192). As Kai Bird and Martin Sherwin write, "Those who knew Wilson always thought him a man of singular integrity" (284).

[126] He said of not choosing to leave the project after VE Day, "In terms of all my… everything that I believe in, before, after, and during the war, I can not understand why I did not make that act" (Trinity).

[127] Oppenheimer, on the other hand, states, "I had never said that I had regretted participating in a responsible way in the making of the bomb" (Seagrave).

but thereafter became all-consuming. The drive was so compelling that it made scientists unable to break out of their focused efforts to think ethically and critically about what they were doing.

Perhaps because of his Quaker/Baptist background, the language in his interviews, notes, and his unpublished autobiography frequently have religious overtones, and his thinking seems to follow a religious pattern of sin and redemption.[128] For example, he says the Association of Los Alamos Scientists and the Federation of Atomic Scientists were founded "for the expiation of our [the scientists'] sin" (qtd. in Hilts 79) and uses words such as "my immortal soul" (qtd. in Hilts 64) and "demonic" or "diabolical" (Wilson, "Pacifist"). The first draft of his unpublished biography begins with a kind of confession, "This book is an attempt to trace how one participant, a confessed pacifist, came to work on that awsome [sic] nuclear project, and how that experience has warpted [sic] his life ever since" ("Pacifist"). To warp can mean to distort, twist something out of shape, or to "cause to judge, choose, or act wrongly or abnormally." In either case, this is quite a stark description of the emotional and moral burden his work on nuclear weapons put on him.[129]

Science plays a central part in both the sin and the redemption in Wilson's narrative. On the one hand, science, for Wilson, is an expression of a pious desire to understand nature. Wilson describes the formation of this desire in his early explorations of scientific phenomena when he made a functional Crookes tube (experimental electrical discharge tube that shows electrical discharge as green and yellow light):

[128] He states in 1996 that, compared to Hans Bethe, "his own outlook tends to be less logical and more religious" (Palevsky 148).
[129] He later moderates this statement to "how that experience has colored his life for better and worse ever since."

> I got very rapidly to the point where I could get a discharge. I built a kind of a voltage device, and I'd get a voltage on the tube, a thousand volts or so, and get a beautiful discharge. Then as it pumped down, it would go through all of the mysterious business of getting the Crookes' dark spaces, you know, and the various phenomena of a discharge. Just beautiful phenomena. I'd be looking at it, my eye right up against the tube, and I had the impression that I was doing something very meaningful. Of course, I couldn't understand a thing, but it seemed there was so much to be understood there. I got deeply interested. I began to think of myself as being something of a scientist. ("Interview")

He writes that the choice to study physics in those days "was not all that different from taking the cloth" ("A Recruit" 160), and he was not motivated by any specific practical use for physics. Rather, it was an internal desire to understand nature.

On the other hand, Wilson later describes that it is through science and the pleasure it brings that the "sin" of nuclear weapons touches him. It is not nuclear weapons development by itself that makes him feel guilt, but rather continuing the project beyond the cessation of the German nuclear threat. In short, consummation and following the consummatory drive at Los Alamos is Wilson's sin. Later, he finds means of redemption or at least some expiation through science by founding the ALAS and FAS and becoming a pioneer in the field of fast proton radiation treatment for cancer.

Pacifist to Warrior

Wilson began the 1940s as a dedicated pacifist. He had attended "leftist discussion groups and antiwar demonstrations at the university gate" at UC Berkeley and believed firmly

that "munition makers were the 'merchants of death' who had stirred the trouble and little but evil could come from the fighting in Europe" (qtd. in Hilts 64). Based on these arguments, Hilts writes, "Wilson and a friend agreed that no matter how justified the cause against Hitler might seem, it would only serve the engorged, blood merchants [sic] to join in" and "the two of them made a coffee pact that they, at least, would not be fooled. They would oppose any action in the war" (64).

However, when Wilson left to take up a position as assistant professor at Princeton University, his perspective gradually changed. It was clear that the war was much closer to the Princeton community than in California. Princeton University had shunned German professors who had been welcomed at Berkeley, Canadian faculty members had been drafted, and immigrant professors from Europe had enlisted or tried to enlist in the army.[130] "My pacifist remarks, so sympathetically received in California, were a cause of anger, derision, scorn, and argument in Princeton. Are you some kind of Isolationist they would ask derisively. It seemed to be a community already at war" ("Pacifist to Warrior" 7). Hilts writes that "Wilson's opinion was hacked away as one argument followed another" (Hilts 64). He gradually became less certain of his pacifist commitments.

The moment of decision arrived for Wilson when he was invited by Ernest Lawrence to attend a secret conference at MIT:

> We listened to a fascinating and dramatic account by a number of British scientists about what they had accomplished by radio detection of aircraft, and about how important it had been in holding off the immanent German invasion of

[130] Hilts describes that Wilson "met some who had lived under Hitler's system and wanted to go back with a rifle" (Hilts 64).

> England. They pleaded with us to help them further to develop what was to become the science of "radar". [sic] German air power was so overwhelmingly powerful that it seemed that the British would be successfully invaded unless help were to be provided from abroad. ("Pacifist to Warrior" 9).

The group discussed for a few days what they should do and finally decided to set up an American laboratory to support the "valiant efforts of the British physicists," and all physicists in attendance were expected to decide by the next morning whether they would leave their other positions at their universities and join the war effort during a time when the U.S. was still neutral.

Wilson describes a long night of agonizing about that decision:

> That night, all night, I debated the problem. Of course I was absolutely opposed to and deeply offended by the Nazis, but was war the right answer to their violence? and was taking part in that violence my only alternative. Well, it is one thing to argue philosophically when ones [sic] words had no particular significance, however, now I was being asked to be significant for there was no doubt in my mind that radar would make a significant difference in the outcome of the war. Then too, if ever the forces of darkness were arrayed against the forces of light, it seemed to me that this was that time. So strong was nazi might that one could imagine a thousand years of that evil were the nazis to win. For a while in my argument with myself, I let myself believe that radar was just a defensive activity, but a deeper consideration convinced me that such was not a valid belief. By dawn

> my immortal soul had lost the argument. I joined the project. ("Pacifist to Warrior" 10-1)[131]

Wilson sums up his change during this period as him being "a pacifist manqué" or unfulfilled pacifist, a pacifist that might have been. This was the critical moment of decision for him, and he would later return to that night as the source of his commitment to continue war work until Nazism was defeated.

Once he informed Princeton of his commitment to the laboratory at MIT his colleagues convinced him to instead join the Uranium Project that Eugene Wigner and others there had just joined. They argued that this project "would be physics, not just electrical engineering . . . so I would be making use of my education. Making power seemed to me to be more humanitarian than shooting down airplanes" ("Pacifist to Warrior" 12).[132]

Nuclear Energy to Nuclear Bomb

As Peierls remembers it, the focus of the American Uranium Project shifted when a British delegation consisting of Wallace Akers, Hans von Halban, Francis Simon, and himself made the project members aware of the findings in the Frisch-Peierls memorandum and urged them to focus on developing a weapon (Peierls 169-73). Hilts claims that, at this point, Wilson "became excited; this news reduced the problem of making a bomb to the straightforward problem of purifying uranium" (66). He went into a bubble of focused concentration to solve the

[131] Hilts writes, "He did not sleep that night. His conscience scratched at him. He could not participate in slaughter, but he did not want to bear the responsibility of Hitler's success either. 'That night,' Wilson wrote later, 'I chose against the purity of my immortal soul and in favor of a liveable world worth living in. I joined the new laboratory in the morning" (64).

[132] The goal of the project at that stage was to create a nuclear reactor, since the expectation was that an atomic bomb would require such large amounts of U^{235} that it was not feasible to make one before the war was over.

problem of particle separation: “Wilson ignored his other work and became absorbed by the question. He gradually sank out of easy communication with the world for some days” (66). Although this was a period of intense work, it was also a period of intense pleasure.

In the following passage, Wilson explains his process of scientific discovery and the thrills that can make it into an addiction:

> There are times . . . that ideas work themselves out over a long period and at other times the solution appears as a sudden apparition. If you have finished the long business of putting together lots of data, then, as a picture gradually emerges you get a certain sense of pleasure. But the real kicks come when you have the more typical creative experience. You’ve filled yourself up with as much information as you can. You just sort of feel it all rumbling around inside of you, not particularly at a conscious level. Then—it can happen anytime—you begin to feel a solution, a resolution, bubbling up to your consciousness. At the same time you begin to get very excited . . . pervaded by a fantastic sense of joy. (66)

As Wilson states later, “In this business of creativity, it’s pretty much all pleasure . . . the intensity of the elation lifts you far out of yourself” (Hilts 69). As he was walking home from the laboratory one night, he felt the solution to the problem dawning on him: “I had the sense suddenly that I knew the answer. I could feel it coming. . . . By God, it’s going to come, I’m going to solve it.” The idea then appeared “all at once, wholly formed.” Wilson states, “I saw it. I saw the particles speeding along, separating. One set were getting bumped off in one direction, one bumped off the other way” (67). Whatever apprehensions he may have had earlier about creating weapons of war seem to have disappeared by now, as Wilson starts dreaming of conquering Germany with nuclear weapons:

> My mind was going a mile a minute. I was thinking of all kinds of things at once. I thought, my God, I am the man who knows how to make the bomb! I, a man of about twenty-five years old, would almost by myself win the war. It could save the world. I knew within a year we could test the idea, get some U-235, make the bomb and end the war. . . . I had all sorts of other fantasies as I was walking; I imagined women throwing themselves at my feet, I imagined myself making a fortune, even imagined myself becoming president. (67)

If his focus had been intense before, it was nothing compared to the months and years that followed. Wilson quickly drew a sketch and pulled in government funding (nearly one million dollars, according to Hilts [68]) for the machine he would call the "Isotron." From about October 1940 to April 1941 Jane Wilson remembers her husband not being home for a single night or Sunday: "All he lived for was his physics" (qtd. in Hilts 68). Yet his eagerness to complete the isotron was also driven by an idealistic zeal. Wilson writes, "I still had the illusion that the isotron could be an effective ingredient in shortening the war, and that every moment we lost in making it would translate into multitudes of dead people, which was why, I suppose, I was working like a mad man" ("Pacifist to Warrior").

The isotron was one of at least four competing projects for particle separation, and eventually Ernest Lawrence, one of his competitors, convinced him that his research group was further along; at the same time, Oppenheimer convinced him he would be of more use joining "a group that would construct a bomb to end the war" (Hilts 68). Since Wilson had already agreed in principle to help building a bomb, there was no great moment of soul-searching this time around. Wilson agreed to end the isotron project and join what he saw as a "romantic adventure"

in the wilderness and was now fully invested in the creation of atomic weapons ("A Recruit" 143").

From Atomic Scientist to Automaton

In *The Day After Trinity*, Wilson describes the atmosphere at Los Alamos: "Our lives were directed to do one thing [build the bomb], it seemed as though we had been programmed to do that, and we, as automatons, were doing it." Wilson compares the actions of the scientists to a fully mechanical process. An automaton is "a self-operating machine" designed to follow a programmed set of instructions automatically. Less sophisticated than a computer or robot, it is a mere mechanism without any feature of artificial intelligence. Obviously, the scientists during this period acted out of free will, but it did not occur to Wilson to question why they should continue the work after the original motivation, the German nuclear project, was no longer a threat. People driven by consummatory self-consistency act, think, and make conscious decisions, but they do so within a framework defined by their vocabulary. As Burke writes, "The driver drives the car, but the traffic drives the driver" (*On Human Nature* 71). Wilson's descriptions of this period seem to show the same tendency.

One of the contributing factors to this blindness was the intensity of the effort at Los Alamos. As Wilson observes,

> at Los Alamos, we worked frantically so that a weapon would be ready at the earliest moment. Once caught up in such a mass effort, one does not debate at every moment, Hamlet fashion, its moral basis. The speed and interest of the technical developments, the fascinating interplay of brilliant personalities, the rapidly changing world situation outside our gates—all this worked to involve us

> more deeply, more completely in what appeared to be an unquestionably good cause. (qtd. in Hilts 75)

McAllister Hull, who was a junior scientist at Los Alamos, describes a similar process in *Rider of the Pale Horse: A Memoir of Los Alamos and Beyond*:

> During the war, the urgency of our task and the constant press against time *excluded other thoughts* from our minds, or mine anyway. There was a sense that our efforts might help bring an end to the war, but our immediate goal was simply to get the bomb built. We faced enough problems in chemistry, physics, and especially applied physics to satisfy any one of us, and we focused on them with *a single-minded intensity characteristic of all scientists*. It was not until after the Trinity test that we could stop and think about what we collectively had done. (106, emphasis added)

As Hull remarks and as Kuhn writes in *The Structure of Scientific Revolutions*, it is the nature of scientists and scientific work to be focused on a very narrow task within a stable paradigm (144). Wilson and Hull had accepted the paradigm or game of developing an atomic bomb, rules set up by their own commitment and the *Los Alamos Primer*. They thought deeply and frantically about how to solve the puzzles within that framework, but they spent little or no time questioning the framework itself.

Whatever his concerns may have been before he joined the project, once Wilson joined the project, his mind seems focused on the goal of the *Los Alamos Primer* to "maximize damage and efficiency." Rather than a mere cog in the machine, Wilson was an eager participant in the bomb project, and in addition to carrying out the crucial measurements necessary to develop the implosion device (for the plutonium bomb), he also came up with designs for hydrogen bombs

and more efficient fission bombs in the future. It was a highly productive time for him where he was very clearly working within a paradigm to maximize damage and efficiency, and this is clearly shown in the two notebooks he kept during this time.[133]

There are particularly two themes in these books Wilson keeps returning to concerning the bomb project: One concerns the "tube alloy [uranium] toxicology" or radiation effects, and the second is improved fission bombs and thermonuclear reactions for fusion bombs and fusion reactors. Concerning radiation, he usually records the words of other scientists, but the ideas for improved fission bombs and thermonuclear reactions are his own inventions and show how deeply this former pacifist was now into the new paradigm of weapons development. The overarching structure of the texts mirror those of the *Los Alamos Primer*, with potentialities in nature being exploited to maximize damage and efficiency.

Although Wilson was primarily concerned with explosion damage, his notebook shows that radiation damage was also a recurrent theme in the lectures and meetings he attended. He takes two pages of notes on a lecture on "Tuballoy [sic] toxicology" held by Health Group Director and pioneering radiobiologist Louis H. Hempelman on January 10, 1944. Tube alloy was the British code name for uranium 235 and plutonium. The document describes what (at that time) is currently known about the dangers of radiation from U235, primarily from tests on animals conducted by Joseph G. Hamilton (humans were also injected with plutonium after this to in order to get more precise results).[134]

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[133] The Wilson Papers at Cornell University contain two personal notebooks covering the period of 1943-45. One book covers both administrative issues and ideas for inventions or experiments from March 1, 1943 until around June 1944, after which it is only used for inventions and experiments until October 17, 1955. The second book takes over administrative issues from June 6, 1944 until January 1945.

[134] Hempelman urged Oppenheimer in August 1944 to begin testing plutonium on humans to learn more about the health effects it could have ("Hempelman"). From April 1945 and until July

The essential pattern of the text is either that of a series of scientific experiments, with test, result, and conclusion, or a conclusion followed by a description of the test and the results. The conclusions are the following: U235 attacks the kidneys like lead does, has a small absorption rate, and is stored primarily in the bones. It is not the total amount of radiation that counts, but rather the rate of exposure. Other effects are "certain people allergic by smaller than 1 r/day [one röntgen per day]," "sensitivity to radiation increases with exposure," "leukemia greater in mice that have had lethal doses. 4-8r/day," "phosphorus in urine decreases in overexposure," "enzymes in tissue changes on [sic] radiation," a certain acid "prolongs life . . . 7-11 days," 95% of it "goes to the bone," but "if blown into lung 20%" is absorbed and 80% goes to the bones. The tests are referred to in very brief terms, such as, "have fed dogs 100gr . . . have blown 1g . . . into dog – no effect!" and "800r kills 50% mice in one dose. Small dose of 8r/day no effect at 100 days."

As the *Los Alamos Primer* focuses on damage and efficiency, this text focuses on "effect," and research results either show "no effect" or different toxic effects of radiation. Because the purpose of the project is to make an effective weapon, the lethal outcomes are potentially favorable outcomes. The text concludes that a "committee" is "to be established" in order to determine the "effect of gadget."[135] The text concludes with some notes on the

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1947, 18 human subjects from ages 4 to 69 were purposefully injected with plutonium under the auspices of the Manhattan Project. The subjects were not informed about the nature of what was injected into them, but they were told the research would be "important to the war effort." Many of the patients died within a few years of being injected with plutonium and the allowed body tolerance for plutonium was lowered by a factor of five ("Plutonium").

[135] After this, Wilson records several discussions about the toxic radiation effects of U235 and Pu49 from notes he took at the Coordination Council meetings with Oppenheimer and the other group leaders, where a certain tamper material (material surrounding the fissionable material used to reflect neutrons back into the fissionable material) is "still good because of radiation," measurements of alpha, beta, and gamma radiation are to be taken at the Trinity test, guesses and measurements are made about the radiation effect of certain tamper materials, Fermi discusses

discussion that followed this presentation and some formulas for calculating expected gamma radiation. After the war, "Wilson walked through the rubble of the cities hit by the bombs" while he was "working on a project to assess radiation damage. He made the terrible calculations of the effects of intense radiation on human flesh" (Hilts 79).

The second theme of improved fission bombs and thermonuclear reactions goes beyond the primary scope of the Manhattan project (to make fission bombs), but it is within the paradigm of working to maximize damage and efficiency.[136] On January 25, 1944 Wilson gets an idea about how one could make a more efficient fission reaction to trigger a fusion bomb: "One might make a thermal reaction go off with a bang by mixing in some Cd- [cadmium] so that when neuts [neutrons] get up to temperature greater than 0.3 volt – gadget goes off with a bang!" Cadmium is used to control the amount of reactivity in fission reactions by absorbing neutrons that have energy lower than about 0.5 eV [electron-volts] (Wilson underestimated it to 0.3 eV). Combined with pure U^{235} this would prevent the neutrons with lower energy from starting a reaction and leading to loss of material. Instead, only high energy neutrons would react, and this would speed up the fission reaction and allow a greater percentage of the material to fission before it would be blown apart. This invention was eventually used in bomb designs to make more efficient fission explosions (Peierls, "Weekly Report").[137]

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how nuclear reactions create a certain radiation "poison," and Wilson has several ideas for measuring especially gamma and neutron radiation.

[136] Teller and Oppenheimer had been discussing the possible designs of fusion bombs since 1942, and Teller was in charge of a small group investigating thermonuclear reactions at Los Alamos. But since any fusion reaction would most likely need an atomic bomb to trigger it, Teller's project was given few resources and was primarily concerned with making sure an atomic bomb would not burn up the atmosphere by triggering a series of thermonuclear reactions (Rhodes, *Making* 539-40).

[137] Transcription of this notebook page is in Appendix C.

Not satisfied with this, Wilson keeps working on the potential implications and uses of this new discovery, following his new thought to the end of the line. The very next day he writes an idea for a hydrogen bomb similar to the "layer cake" design later developed by Soviet scientist Andrei Sakharov:

> Again, one might put material in layers as follows:
>
> Layer 1: pure thermal device
>
> Layer 2: 25 [U235] + Cd
>
> Layer 3: tamper or another layer of 25 [U235] + Boron for example or H_3 [tritium] which would go off at very high temperature.
>
> Layer 4: heavy steel retainer to keep gadget from exploding in initial stages.[138]

[138] Andrei Sakharov would later come up with a similar design in 1948 that became the blueprint for the first Russian hydrogen bomb (Rhodes, *Dark Sun* 334). At that point, the Russian scientists had received many of the bomb designs developed at Los Alamos, but Sakharov claims that the layer cake design was his original idea and not based on Wilson's design.

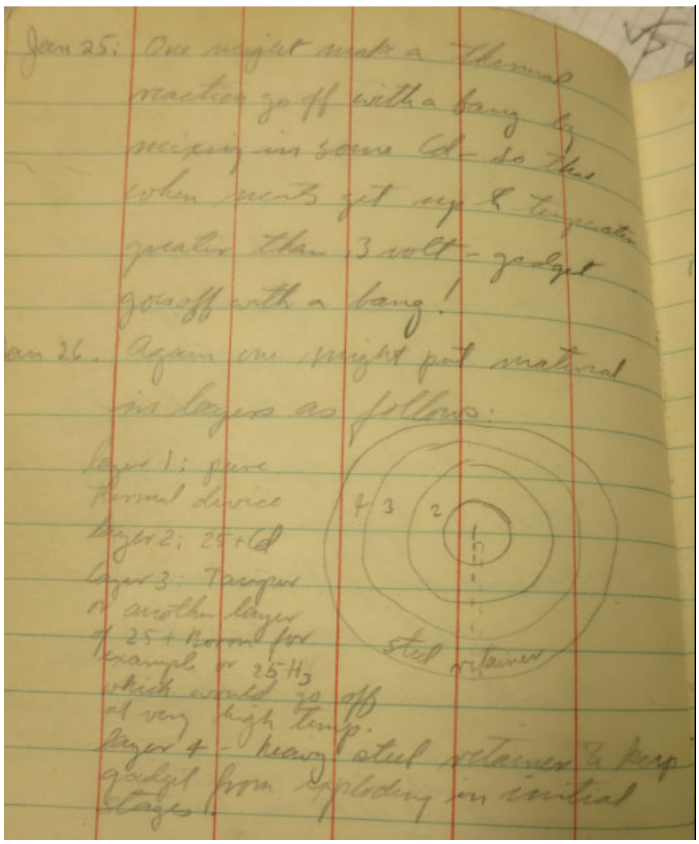


Figure 20 Wilson's sketch for boosting fission bombs with cadmium and tritium

It is unclear what he means by the "thermal device" in layer 1, but he may be describing a device fueled by deuterium reactions. In either case, the function is a "thermal device" to heat the neutrons in the U^{235} and cadmium mix and make it, as Wilson writes, "go off with a bang!" This fission reaction would then trigger a further fission reaction (if he uses boron in layer 3) or a thermonuclear reaction (if he uses tritium), and the steel retainer would keep the layers in place long enough for the heat to develop instead of the device blowing itself to pieces before then. Wilson here has a potential design for a thermonuclear weapon or a fusion-boosted fission bomb. He later uses the same insight to develop designs for even more efficient plutonium weapons.[139]

[139] "2nd of May, 1944. S.M. work indicates big resonance at 0.25 volt [eV] in 49 [plutonium]. Scheme of Jan [sic] 25, 1944 could be used with this to produce a gadget with very little

His later descriptions of ideas for bombs and reactors follow the basic structure of the *Los Alamos Primer*, with a series of means leading up to ends primarily focused on power. Some of the ends mentioned are "sustained reaction," "terrific power," "produce a gadget with very little material," and "getting D-D [fusion] reactions going." His descriptions are enthusiastic, with frequent exclamation marks and a tone of excitement. These ideas did not end when the war ended, even though he says he decided he would never work on weapons again after Hiroshima and Nagasaki ("Wilson's Interview"). He continues working on ideas for fusion reactions and even potential weapons (rockets) until at least 1955, although there is no record of him sharing these ideas with weapons laboratories. The former pacifist is here working diligently and even enthusiastically on what the General Advisory Committee of the Atomic Energy Commission would later label a weapon of "genocide" (Kuznick).[140]

Wilson later describes the state of mind among the Los Alamos scientists (including him) at the time as a kind of obsession that prevented them from questioning what they were doing:

> Perhaps events were just moving too fast. We were at the climax of the project—just on the verge of exploding the test bomb in the desert. Every faculty, every thought, every effort was directed toward making that a success. I think that to have asked us to pull back at that moment would have been as unrealistic and

material. This would be useful for testing purposes – and possibly for measuring density in implosion gadget!" (Wilson, Notebook 1).

[140] In fact, even though Wilson writes he felt sick after especially the Nagasaki bombing, he comes up with a new scheme for "accelerating fast particles to high energy" (useful for fusion bomb design) on VJ Day, August 14, 1945. Later, on June 18, 1953, he comes up with an idea for "running a low pressure [sic] hydrogen [fusion] reaction" using a shock wave and writes, "Could such a beam be useful in rockets? Probably ideal. A shock wave rocket!" Later, on September 17, 1955, he writes up an "Idea for Fusion Furnace!" using D-T [deuterium-tritium] reactions. So despite his reversal to his previous pacifist position, Wilson continued to pursue research with potential military applications and to flirt with thoughts of using it in that direction.

> unfair as it would be to ask a pugilist to sense intellectually the exact moment his opponent has weakened to the point where he will eventually lose, and then to have the responsibility of stopping the fight just at that point. (qtd. in Hilts 76)

He gives a similar description in his unpublished biography:

> We continued to work as men possessed. It may have been that we were like two men in a fierce fight. One of them may well have won [t]he struggle at some obscure stage but not realize that until later on when his foe lies unconscious at his feet. ("Pacifist")

The fight against the evils of Nazism and the adventurous spirit of science had joined forces to create a structure of language and motivations strong enough to generate what Kenneth Burke calls "the formal principle of consummatory self-consistency" ("Watchful" 49). At this point, it would be inconsistent of the scientists, and go against the entire structure of their motivations, to abandon the project. Wilson and the other scientists were charging ahead towards the first atomic bomb explosion at the Trinity test.

From "Ending the War" to "Ending All War"

As mentioned earlier, Wilson was recruited to build a bomb to end the war in Europe, and this purpose was at the core of his argument for joining the project. However, towards the end of 1944, it became clear that the war in Europe would end soon with or without the bomb. Although the consummatory drive was great enough to prevent all but one scientist on record from quitting the project,[141] the changed external realities still had the Los Alamos scientists searching for a

[141] Polish researcher, Joseph Rotblat, decided to leave the project in December 1944 when he learned that "the Germans had abandoned their bomb project" (280).

new justification and reason for their project. As Bird and Sherwin write, "Weisskopf [Deputy Division Leader of the Theoretical Division under Hans Bethe] recalled that the expected end of the war in Europe 'caused us to think more about the future of the world after the war.' At first, they simply met in their apartments, and pondered questions such as 'What will this terrible weapon do to this world?' . . . Gradually, these informal discussions became formal meetings" (Bird and Sherwin 284).

This questioning did not extend to the possibility of abandoning the bomb development. Victor Weisskopf writes, "The thought of quitting did not even cross my mind" (qtd. in Bird and Sherwin 285), and Wilson agrees: "I have often wondered why it was that the defeat of Germany in 1945 did not cause me to re-examine my involvement with the war and with nuclear bombs in particular. The thought never occurred to me. Nor, to my knowledge, did any of my friends raise any such question" (qtd. in Hilts 75). Even Niels Bohr, whom Wilson called "almost the conscience of the project" ("Wilson's Interview"), never mentioned the possibility of not developing the bomb. As Wilson writes, "I do not remember that he ever questioned whether we should be making the bomb or not" (Hilts 75), and the famous question Bohr asked when he arrived at Los Alamos was not "why are you doing this?" but "is it [the bomb] big enough?" (qtd. in Palevsky 33).

What Bohr did provide was a new vision for the bomb project. As I described in the previous chapter, Bohr articulated this vision most clearly in a memo to Roosevelt that he completed July 3, 1944, and Oppenheimer kept a copy of that memo in his desk at Los Alamos. In addition, Bohr stimulated discussions among the scientists about "many of the serious consequences [of the bomb] for a world that could continue to be divided" (qtd. in Hilts 75). When these discussions led to formal meetings, Oppenheimer appealed to a version of Bohr's

vision to give the scientists a justification for completing the project. Wilson refers to this later as "our rationalization about the UN" ("Pacifist") and mentions that the justification may have been self-serving. Still, as Burke writes in *Counter-Statement*: "If some kind of conduct is, by our code of values, called wicked . . . and if the situation we are placed in requires this reprehensible kind of conduct, that Symbol will be effective which, by manipulating other values in our code, makes such conduct seem virtuous" (156).

As mentioned earlier, Oppenheimer referred to this vision several times, arguing in the Los Alamos chapel meeting that "although they were all destined to live in perpetual fear, the bomb might also end all war" (Bird and Sherwin 284), and he made a similar argument at the meeting Wilson organized on "The Impact of the Gadget on Civilization." I have already mentioned Oppenheimer's winning argument earlier, but the impression the meeting made on Wilson went beyond that basic argument. He states, "There would be areas in which there would be no sovereignty, the sovereignty would exist in the United Nations. It was to be the end of war as we knew it, and this was a promise that was made. This is why I could continue on that project" (qtd. in Palevsky 137). Wilson later adds, "We trusted our leaders and trusted that they would set up a united nations [sic] to protect the freedoms we were fighting for. That is what they said they would do. We did not have to think or play politics. In the halcyon world to follow all would be taken care of. I am exaggerating, but not much. That was the spirit" ("Pacifist").

The scientists were convinced. As Bird and Sherwin write, "It was a defining moment for everyone. The logic—Bohr's logic—was particularly compelling to Oppenheimer's fellow scientists. But so too was the charismatic man who stood before them" (Bird and Sherwin 286). Wilson recalls that "my feeling about Oppenheimer was, at that time, that this was a man who is angelic, true and honest and he could do no wrong. . . . I believed in him" (qtd. in Palevsky 138).

An Awakening at Trinity and Reconsidering Science

Wilson was responsible for many of the measurements to be carried out at Trinity, and his mind was so focused on this that he says he could think of little else. This is his description of the explosion at Trinity from his biography:

> It is just before dawn and I scrunch down in the dirt thrown up around our instrument bunker. Five miles in front of me a nuclear device is nearing the point of detonation. If it works, it will be the first nuclear bomb, the result of five years excruciating work. The count-down, started some time before, now proceeds inexorably . . . 10, 9, 8, …. Oh God, will it work? … 7, 6, 5, … I peer through my darkened glass … 4, 3, … I hold my breath … 2, 1, ZERO … and the desert night turns into day. Soon my glass is thrown aside and I stare entranced at the gigantic rising and writhing nuclear object growing before my eyes. Preternatural violets, reds and blues color the convoluting forms that peel off the column of fire below the ever rising and expanding fireball. A flush of exuberance is brought up short by a thundering clap of sound. Although logically expected, it comes as a surprise. Sensations and emotions press in. A momentary ecstasy of creation is replaced by remorse and fear as the realization of the immensity of what we have done is pounded in by the rolling of the thunder from the mountains, mountains that are now dwarfed by the scale of the fireball – and the question grows: what have we done? … what have we made?

It may seem strange that Wilson would not ask those questions until the Trinity blast, but he was not the only one struck by a moment of realization and remorse at Trinity. Samuel Allison, a

junior scientist, cried out to James Conant after the blast, "Oh Mr. Conant! They're going to take this thing over and fry *hundreds* of Japanese!" (qtd. in Hilts 78, emphasis added).

For the first time since his initial decision to join war work, Wilson questioned the ethical basis of his involvement. As Hilts writes, "For a moment Robert Wilson stood outside his own life, and looked down at it, at the physicist and the man involved in a war. He was disturbed. Perhaps the whole thing had been an awful mistake; perhaps even accepting loss in the war would have been better than allowing the conception and birth of this white abyss of force" (78). In "Pacifist to Warrior," Wilson describes his reflections in more detail:

> There was no question about the time I really got religion in this respect, it was exactly the moment the bomb became a reality instead of an intelectual [sic] possibility. As I watched the indescribabley [sic] intense flash, and then the plume of the bomb that dwarfed the desert, I could only turn my thoughts to the reality of what we had done, what we had created, what terrible havoc it could do. Up til that terrible moment, it did require a dedication of one's thoughts to bring it about at all. One could not play Hamlet at the same time. The decision to do it had been taken years before, in excruciating agony. All that dedication to the win[n]ing the war [sic] was freed at the moment of explosion. We had done it, and if there was a momentary exultation in having accomplished what we had set out to do, there was almost an insta[n]taneous realization of the broader context of what horrible thing it was that we had actually accomplished – that it would transcend the war we were fighting. ("Pacifist")

This anguish grew more acute following the bombing of Hiroshima and especially Nagasaki. Wilson had advised Oppenheimer to push for a non-lethal demonstration of the

weapon first, hoping this would make the Japanese surrender without casualties, and he was under the impression that the Targeting Committee would give that advice to president Truman ("Pacifist"; Palevsky 142). In fact, the opposite was the case. Wilson thought Hiroshima might be justified, but that the attack on Nagasaki seemed vengeful and unnecessary. When he understood that the vision of the United Nations was not embraced by the Truman administration, he felt betrayed (Palevsky 140).[142] Hilts writes, "Wilson and the others thought for a time during the Los Alamos project, and just after it, that the scientists would naturally be consulted about how this terrible force would be used. They hoped to confine it. But they were politically naïve. Their illusion was soon removed" (79). Wilson concludes, "In fact, we were just like the slaves building the pyramids" (qtd. in Hilts 79).

In addition to Bohr's vision about the United Nations, Wilson questions whether other factors may have played a role in motivating the scientists to complete the bomb:

> Maybe it was simple curiosity to see if the damned thing would work. Maybe [it] was a simple desire to realize our long commitment to the job. Maybe we wanted selfishly to have the credit of participating in such an important adve[n]ture. The latter thought frightens me – about myself, and about the nature of man and what the future holds for him. Perhaps it is relevant, I hope not, that leaving the Project implied losing one's draft status, leaving a pleasant life with family and friends [sic], losing position in scientific status, even of being killed on some Pacific island. ("Pacifist")

[142] Wilson states, "The only thing that I ever felt betrayed about was the United Nations. I thought that this was used over and over to keep people fighting—that there would be a United Nations and this was going to be the last war. And I did feel that I was working on this project because of that bargain" (qtd in Palevsky 141)

After the war, Wilson returned to his formerly held pacifist beliefs and refused to actively participate in war work. As he stated in an interview, "I had been a pacifist before the war. I went back to those sentiments after the war. I would have no part to do with any secret projects such as that" ("Wilson's Interview"). In 1946 he published "Radiological Use of Fast Protons" in the medical journal *Radiology*, trying to apply some of the knowledge he had learned while developing the atomic bomb to find better treatments for cancer. In this article, the highest goals replacing "maximize damage and efficiency" are "therapeutically practical" and "most desirable therapeutically." Wilson also became a leader of the Federation of Atomic Scientists and was a central voice in pushing for civilian control of nuclear weapons and transparency about nuclear science and technology (Palevsky 131). In doing so, he had vocal and strong disagreements with Oppenheimer about the best course of action, but he agreed with Oppenheimer's vision of science in "Physics in the Contemporary World" as an inherent good and virtue for humanity, regardless of its uses.

In 1967 he became director of Fermi National Accelerator Laboratory and in 1969 gave the following answer in Congress to justify the public expense for constructing the particle accelerator: physics "is not merely a path to more technology, not a step towards the gadgets[143] of the future. It is a much more fundamental human act" (qtd. in Hilts 98). Asked whether the Fermilab Accelerator would promote science that could have national security implications, Wilson answered, "It has only to do with the respect with which we regard one another, the dignity of men, our love of culture. It has to do with those things. It has to do with, are we good painters, good sculptors, great poets? I mean all the things we really venerate and honor in our

[143] "Gadgets" was the code name for atomic bombs at Los Alamos, but that may not have been what Wilson meant in his testimony.

country and are patriotic about. It has nothing to do directly with defending our country except to make it worth defending" (qtd. in Hilts 99).

Towards the end of his life, Wilson also gave voice to a more pessimistic view of science, seeing it as a menace that would haunt humanity for the foreseeable future. Asked by writer Mary Palevsky whether humans might be wise enough to not pursue certain directions of scientific exploration that could lead to unwanted applications, Wilson answers:

> I find it very hard to imagine that, because when an idea starts it's always such an innocent thing. Certainly when we started thinking about nuclei, it certainly didn't cross my mind it would be used in some horrible way. And I think it's the nature of science to sort of proceed crab-like, going from something that doesn't seem to be at all important to moving over a bit and it becomes very important. (qtd. in Palevsky 147)

This being the case, there seems to Wilson to be no way of protecting humanity from the destructive consequences of scientific discovery "except kill all scientists—that might be a good idea. Throw them out in the snow as soon as they show any curiosity. Let's get rid of them. . . . It might be that people will realize the only way they are going to survive scientists or science is to get rid of the scientists" (qtd. in Palevsky 147-8). Mary Palevsky notes that the statement was made half in jest, but "there was something dead serious in what he was saying" (148).

In this perspective, science is definitely is not a humble and obedient servant to humanity. Science has a mind and will of its own, driven, as Burke argued, often by aesthetic rather than ethical motives, and these can make science a menace to human civilization. For Wilson, science was an inspiration, an addiction, a joy, as well as a source of sorrow and regret.

The Case for Consummation

So far, I have made the case that two of the most influential voices at Los Alamos adopted and adapted the three visions of nuclear weapons from chapter 3, and that these, and in particular Bohr's vision, had a significant impact on their actions and beliefs. I have also argued that these consummatory vocabularies, in addition to their training and vocation as scientists, made both scientists susceptible to and motivated by what Burke calls consummation: a drive to complete or finish a certain development or to pursue the implications of a terminology to the end of the line.

Oppenheimer caught the vision or dream of nuclear weapons with the discovery of fission, and he saw his work and the Manhattan Project as "an organic necessity" that grew out of his scientist's creed. Based on his and Bohr's vision of science, it would be unethical and inconsistent to do anything else, and David Hawkins, a philosopher who worked as an administrator and historian at Los Alamos, says that Oppenheimer "was obsessed with an understanding that this development [of the bomb] was in his view inevitable" (qtd. in Palevsky 103). I claim that this is a good example of consummation.

Robert Wilson, on the other hand, details and reflects on a kind of mindless urge to complete the atomic bomb, using terms such as "automatons" and "men possessed" to describe the scientists involved. The effort is described as "frantic" and one where "every faculty, every thought, every effort was directed" to the goal of completing the bomb. The image he uses of the pugilist is especially interesting, since he describes someone so caught up in a fierce competition that they go into a kind of daze and keep repeating the motions of the fight even though the opponent has been knocked out a long time ago. In order to initiate the consummatory drive, people have to be engaged in some cause that creates a vocabulary and impetus for movement,

and then consummation can make that movement become self-sustaining beyond or without the achievement of the initial cause or goal. This seems to be the case with the scientists who go to Los Alamos to fight the Nazis and stay on for Hiroshima, Nagasaki, and, in some cases, the entire development of hydrogen bombs. For Wilson, giving in to that consummatory drive without thought was akin to a sin.

Of course, there were scientists who were less conflicted about their work on the bomb. Hans Bethe, from the outset, "considered the use of the bomb a foregone conclusion" and thought that "when built, the bomb would be used" (qtd. in Palevsky 27). Edward Teller stated before his death that he felt Wilson was wrong for feeling guilty about his work at Los Alamos: he was only "responsible for doing good work" (qtd. in Palevsky 59); "the scientists, by giving you the tools," Teller continued, "are not responsible for the use of these tools. But they are responsible for the effectiveness of the tools and for the understanding of the tools" (qtd. in Palevsky 55). Joseph Rotblat, who worked at Los Alamos and received the Nobel Peace Prize in 1995, states that "scientists with a social conscience were a minority in the scientific community. The majority were not bothered by moral scruples; they were quite content to leave it to others to decide how their work would be used" (280). This is not to say that this group did not experience the same consummatory drive, but rather that there was no conflicting moral obligation for them to be conscious about the broader consequences of their scientific work or to consider whether they should complete any scientific experiment.

Still, there are many voices from Los Alamos that attest to what I argue is this consummatory drive directing their actions and motivating them to complete the bomb, regardless of their initial motivation. Paul Olum was a junior physicist who came to Los Alamos at the age of 24. He was a part of the Isotron group that came to Los Alamos together with

Wilson and Richard Feynman. In the newspaper article "Why Did We Work to Build Such A Terrible Thing?" Olum writes, "Why did we let ourselves do such an incredibly awful thing, sitting there in our offices and conference rooms and talking about it, then doing experiments and calculations, moving step-by-step to the creation of this horror?" Like Wilson, he had joined the Manhattan Project to stop Hitler, but then asks why he and his fellow scientists did not stop their work after VE Day. He answers as follows:

> When you are involved in something like that and carry it close to final creation, it just is hard to stop. You are totally caught up in it. You are making a bomb for a military purpose . . . and you haven't quite finished the job. . . . By April of 1945, it was essentially done, so why not see it through? . . . It was . . . scientists in the middle of an extraordinary project . . . wanting to see the results of what they had done. (D4)

As with Wilson, it is the urge for completion, the consummatory drive, that motivates Olum to continue the work when the original goal has been achieved. Phillip Morrison, another junior physicist at Los Alamos, gives a similar description: "When you organize many people with tremendous passion to do something, they're going to do it. Even if the meaning of it has changed, it's very hard for them to see all that, especially all the way down the line" (qtd. in Palevsky 88). Richard Feynman, head of the computation group at Los Alamo, describes how this kind of tunnel vision develops in the documentary *The Pleasure of Finding Things Out*:

> With any project like that, you continue to work trying to get success, having decided to do it. But what I did immorally, I would say, was not to remember the reason that I said that I was doing it, so that when the reason changed, which was that Germany was defeated, not the singlest thought came to my mind at all about

that! That that meant now that I had to reconsider why I am continuing to do this. I simply didn't think, okay?

In an essay about his experience at Los Alamos, he makes a similar statement: "You see, what happened to me – what happened to the rest of us – is we *started* for a good reason, then you're working very hard to accomplish something and it's a pleasure, it's excitement. And you stop thinking, you know; you just *stop*" ("Los Alamos" 132).

This combination of hard work, pleasure, and excitement is a recurring theme in the testimonies of the Los Alamos scientists, and it is several times compared to the experience of competitive sports. Freeman Dyson, a British physicist who came to the U.S. right after the war and befriended many Los Alamos alumni (including Feynman, Bethe, and Robert Oppenheimer) describes his impression of Feynman's experience leading the Los Alamos computation group: "The section was going full steam ahead, racing against time to have all the calculations done before the first bomb test in July 1945. Dick was organizing them and cheering them on. It was like a grand boat race. They were racing so hard that nobody noticed when the Germans dropped out of the war and left them racing alone" (*Disturbing* 60). His description is very similar to Wilson's image of the boxer continuing the motions after his opponent is defeated. Dyson also mentions that the experience of consummation can be exciting and enjoyable, stating that after the war, Feynman "refused ever again to have anything to do with military work. He knew that he was too good at it and enjoyed it too much" (60). As for the other Los Alamos scientists he met at Cornell, Dyson states, "hardly anybody had been troubled until after Hiroshima. While the work was going on, they were absorbed in scientific details and totally dedicated to the technical success of the project. They were far too busy with their work to worry about the consequences" (*Disturbing* 52). Like Wilson, Dyson sees this enjoyable consummatory drive as a sin: "The sin

of the physicists at Los Alamos did not lie in their having built a lethal weapon. . . . They did not just build the bomb. They enjoyed building it. They had the best time of their lives while building it" (53).

However, it was not impossible to resist this drive, as Joseph Rotblat's example shows. He was the only scientist on record who voluntarily left Los Alamos when it became clear that the German bomb project was no longer a threat. He recalls a conversation in which General Groves essentially said "the real purpose in making the bomb was to subdue the Soviets" (Rotblat 279).[144] He also had conversations with Bohr that made him worried about a future arms race, and when he considered "the growing evidence that the war in Europe would be over before the bomb project was completed," he found any further participation to be pointless (280). He gives the following impressions of why no other scientists followed his example: "The most frequent reason given was pure and simple scientific curiosity—the strong urge to find out whether the theoretical calculations and predictions would come true" (280). He later states in an interview:

> The momentum of the arms race was determined by the scientists, not by the military. And this is very bad. Again, it shows how you get yourself involved in a certain way and forget that you are a human being. It becomes an addiction and you just go on for the sake of producing a gadget, without thinking about the consequences. And then, having done this, you find some justification for having produced it. Not the other way around. (qtd. in Palevsky 177)

[144] Rotblat claims Groves confirmed this ten years later. Groves said, "I think it is well known—that there was never from about 2 weeks from the time I took charge of this project any illusion on my part but that Russia was our enemy and that the project was conducted on that basis. I didn't go along with the attitude of the country as a whole that Russia was a gallant ally. I always had suspicions and the project was conducted on that basis" (qtd. in Palevsky 169-70).

Bohr's Vision and the Decision to Bomb

All the three visions in chapter 3 helped to create a drive to develop the atomic bomb, but Bohr's vision additionally created and sustained a drive to use the bomb on human targets. On January 14, 1944, Leo Szilard wrote to Vannevar Bush, the head of US Office of Scientific Research and Development, that it was urgent that the atomic bomb should be developed and used before the end of the war. His reasoning was that if two powers possess these weapons, there could be no peace "unless these two powers are bound by an indissoluble political union" with the power to control all uranium deposits by force (Weart and Szilard 163). And Szilard believed "it will hardly be possible to get political action along that line unless high efficiency atomic bombs have actually been used in this war and the fact of their destructive power has deeply penetrated the mind of the public" (163). In other words, in order to bring about Bohr's "end of all war," atomic bombs had to be developed and used on human targets. The *hope* of a postwar peace depended on a clear recognition of the *perils* of a nuclear holocaust.

Edward Teller echoed the same sentiment in a letter to Szilard with his reasons for why he refused to sign and distribute the Franck Petition (urging the president to use a non-lethal demonstration to persuade the Japanese to surrender):

> If we have a slim chance of survival, it lies in the possibility to get rid of wars. The more decisive a weapon is the more surely it will be used in any real conflict and no agreement will help. Our only hope is in getting the facts of our results before the people. This might help to convince everybody that the next war would be fatal. For this purpose actual combat-use might even be the best thing. (qtd. in Weart and Szilard 209)

This sentiment was also echoed in a letter by the Science Panel for the Interim Committee, chaired by Robert Oppenheimer, tasked with providing recommendations to the president about how the bomb should be used. The June 16, 1945 letter states that the bomb should be used "to promote a satisfactory adjustment of our international relations" and that immediate military use "will improve the international prospects." The panel state they are "more concerned with the prevention of war than with the elimination of this specific weapon" and therefore "see no acceptable alternative to direct military use" ("No Acceptable" 291). Again, Bohr's logic is used to argue for human targets, with the belief that a greater recognition of the peril of atomic weapons increases the hope of ending all war. The senior scientists Ernest Lawrence, Arthur Compton, Robert Oppenheimer, and Enrico Fermi all agreed with this conclusion.

Wilson repeated this vision of ending all war in an article distributed widely in newspapers after the war, titled "Atomic Specter." One reader, a J. K. Beck, sent him a response in a personal letter that Wilson kept with his papers for the rest of his life. Beck writes, "Was it not a wonderful tale you put at the end of your article. 'It was our hope in developing the bomb that it would be a great force for world cooperation and peace.' Oh my God, I say with earnestness. How could it ever come about by killing innocent women and children in the most horrible way yet devised by a degenerate mankind? It is fanatic to believe such" (Beck 1-2).

It may have seemed fanatical to Beck and other readers and observers, and yet within the logic of Bohr's vision, it makes sense that terrible destruction leads to the end of war. As Alfred Nobel and Orville Wright before him, Niels Bohr believed he had discovered an invention that would make war logically impossible, a scientific and technological marvel that would inevitably and profoundly change the future of humanity. I argue that Bohr set up a vision of the world that seemed logical to his scientific colleagues, and many of them worked to make it reality,

following the implications of his terminology. Hawkins states that Oppenheimer had the same vision of the atomic bomb as "a change in the nature of the world," and "he wanted to act in such a way that the world would understand this as deeply and as soon as possible." For this reason, Hawkins states, Oppenheimer believed "the world had to know about it and its full destructive character and not simply as a demonstration of an explosion, but as a weapon" (qtd. in Palevsky 103).

The failure of Bohr's vision, despite the successful demonstration of the atom bomb as a weapon, may be evidence of his and Oppenheimer's naivete when it came to global and national politics, and the limitations of their scientific terminologies. Thomas Kuhn writes that "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). A further example of this tendency may be Szilard's remark in his letter to Ed Creutz accompanying the Franck Petition. He writes, "Of course, you will find only a few people on your project who are willing to sign such a petition and I am sure you will find many boys confused as to what kind of a thing a moral issue is" (Weart and Szilard 212).

Conclusion

In 1966 Burke describes the aesthetic motive he calls "consummation" that comes from tracking down the implications of a terminology. He then claims that at Los Alamos "physicists compulsively tracked down the implications of their terminologies, thereby producing the atomic bomb" ("Dramatic Form" 55). Based on my research, I argue that there is good evidence that this motive (consummation) was a significant factor in the development of the first atomic bombs. In

addition to the general vocabularies of positivist physics, the scientists also tracked down the implications of at least three consummatory vocabularies or visions. Their logic and key terms were repeated in the personal utterances of two of the most influential scientists at Los Alamos. Many scientists also report experiencing the consummatory drive to complete the atomic bomb, even when their initial goal of stopping Hitler had already been achieved. Furthermore, Oppenheimer, Teller, and Szilard follow the implications of Bohr's vision further and work persistently towards a lethal demonstration of the power of this weapon before the end of the war, in order to bring about Bohr's vision of a world without war.

The success of the Manhattan Project along with the failure of Bohr's vision may give some instructive lessons about the power and peril of the consummatory drive. On the one hand, it is a powerful aesthetic motivation that can lead a group of people to work harmoniously and with great passion to unprecedented achievements. As Bernice Brode, the wife of a scientist at Los Alamos, writes, "They all seemed to be enjoying themselves as scientists always do when they ponder their problems together. No one has to drive them; they drive themselves when they have an intriguing problem. And so it was at Los Alamos. Even an outsider like myself, with no idea what the problem was, could feel the inner urge for scientific solution" (146).

On the other hand, as this example shows and as Burke warns, the principle of consummatory self-consistency can create a compulsion to complete developments that "can spread great misery and devastation throughout the planet" ("Watchful" 49). The consummatory drive of some scientists may be satisfied by developments that are detrimental to the existence of human civilization.

Conclusion: Consummation, Indexing, and the Manhattan Project

In *A Grammar of Motives*, Kenneth Burke outlines a project "directed 'towards the purification of war'" (442) and describes how each book in his planned Motivorium Triology would contribute to this goal. The third book, *A Symbolic of Motives*, "studying the implicit equations which have so much to do with the shaping of our acts" was meant to "enable us to see our own lives as a kind of rough first draft that lends itself at least somewhat to revision, as we may hope at least to temper the extreme rawness of our ambitions, once we become aware of the ways in which we are the victims of our own and one another's magic" (442).

This dissertation is a contribution to the project Burke envisioned for *A Symbolic of Motives*. As a whole, it is a cautionary study of how a form of word "magic," "consummation," can convince individuals and groups to act in a way that is contrary to their deepest held beliefs and values. I argue that scientific texts containing implicit equations, such as "science = power" and "increased power = end of all war," engendered untempered ambitions to develop the first nuclear weapons and to use these in lethal demonstrations at Hiroshima and Nagasaki.

I began this project to gain a greater understanding of consummation as a concept and as an active force within a group. I wanted to study how it is developed, what effects it has, and how its excesses may be prevented or diffused.

In the first chapter of this dissertation, I recovered consummation as a central term in Kenneth Burke's critical vocabulary and clarified that it is a specific manifestation of the entelechial drive that requires a rigorous vocabulary and is sustained by the aesthetic principle of self-consistency. This chapter on consummation is the theoretical foundation for this dissertation, for in order to search for this motive among the Manhattan Project scientists, I first had to know what I should be looking for.

In the second chapter, I restored Burke's indexing method based on his critical work and archival materials. Burke recommended that critics should use his indexing method to find evidence of the consummatory drive in vocabularies, but there has been much disagreement among Burke scholars about what this method is and how it should be used. In order to conduct this study the way Burke recommended, I first had to recover the method, based on his own descriptions of the method, how he taught it to his students, and student indexes with his comments on them. This chapter provides the methodology for my analysis of the thinking and arguments among Manhattan Project scientists, and in it I argue that indexing is a more thorough and wide-reaching method than what is currently called "cluster-analysis." Indexing includes finding key terms, equations, hierarchies of terms, and god-terms, and it can be used in different ways depending on the genre of the text that is being indexed. Burke claimed that texts achieve "internal catharsis" either through dialectical transcendence (transcending a term through a process of abstraction towards a god-term) or dramatic catharsis (following the implications of a god-term or motivating principle to the end of the line).

In order to analyze the motivational structure in a group, Burke suggested that critics should first find a "definitive" text where these structures would be the least obscure and then look for similar structures in the shorter and more fragmentary statements of members of a group. I split this task into two chapters, with chapter three dedicated to indexing the definitive texts and chapter four set apart to index the shorter texts produced by the group. In the third chapter, I analyzed three texts that were instrumental in convincing nuclear physicists to develop the first atomic weapons: the "Frisch-Peierls Memorandum," the *Los Alamaos Primer*, and Niels Bohr's "Memorandum to President Roosevelt." I argued that logical positivism provided a metaphysical basis for these three texts and primed the scientist with both ethical and aesthetic

motivations to complete the development of the atomic bomb, but the three texts provide different justifications for building the bomb. The first advocates for the bomb as a deterrent to a potential German nuclear bomb, the second limits the scope of what should be aimed for to "maximizing damage and efficiency," and the third text connects with the visions of Alfred Nobel and H. G. Wells and states that nuclear weapons will bring about the end of all war. These were the consummatory vocabularies that made it possible to initiate and sustain the consummatory drive.

In the fourth chapter, I traced the impact these texts had at Los Alamos, how the key terms, equations, and hierarchies of terms were adopted and adapted by the scientists there, as well as the scientists' experience of the consummatory drive in their work to develop nuclear weapons. I focused on Robert Oppenheimer (the lab director at Los Alamos) and Robert Wilson (the leader of the experimental physics division at Los Alamos), but I also looked for these motivational structures and descriptions of consummation in texts written by many other senior and junior scientists. The evidence for consummation as a significant motivation was pervasive, and the presence of the motivational structures from the three definitive texts was quite clear, based on the repeated key terms and god-terms, and the hierarchies I found that were organized after the same logic. All in all, I would argue that I succeeded in using indexing to indicate the presence of consummation as a significant motive at Los Alamos, and to analyze the implicit logic that directed the decisions of the scientists there.

In the following sections, I will give an overview of the insights gained and potential further research that can be done on consummation and indexing, and my contributions to Kenneth Burke scholarship, rhetoric of science, and rhetoric and composition in general.

Consummation

As I argue in the first chapter, consummation is a central term in Burke's critical vocabulary, and yet so far there has been little agreement among Burke scholars about what he meant by the term and how it should be used in rhetorical criticism. This has, I believe, prevented more rhetorical critics from using this term to do the work of a Burkeian critic. Burke wrote that a critic "looks upon a work as a portent – he studies its portentousness" ("Watchful" 63). A critic should study a terminology, looking for how certain potentialities have been set up and demand fulfillment. A critic can use the concept of consummation and the indexing method to study the development in scientific fields, political groups, virtually any group that one has a specific interest in. As Burke claimed, by doing textual analysis one would also be conducting "social analysis" (LAPE 275).

Many writers, such as Stephen Hawkings, have raised alarm about potential developments in fields such as artificial intelligence and gene editing, but these are often discarded by practitioners in these fields and policy-makers as fear-mongering and versions of the slippery slope fallacy. Burke himself worried about frivolous claims made by "the current cult of irrationalism" and writes that his brand of rhetorical criticism should help "correct" this tendency by revealing "the logic of a given symbol system" through "systematic analysis of the implications inherent in terms" (*Language* viii). A causal argument can work, or be rescued from the potential slippery slope fallacy, Hatch asserts, if a writer or speaker is "prepared to explain exactly how the causal chain works" (79).

This dissertation illustrates how rhetoricians can carry out such an analysis and defend the validity of their warnings: The concept of consummation outlines how the aesthetic motivation for completing developments inherent in a terminology is created and sustained.

Individuals and groups develop a vocabulary in order to solve specific problems. This vocabulary will always organize reality in a certain way, with some things being more important and other things being less important, some outcomes more desirable and others less, and some terms being more central, functioning as defining key terms for other more peripheral terms. These contrasts can develop into rigorous hierarchies that are able to provide directives for both current and future actions, independent of the original problems. The vocabulary shared by the group now provides an incentive for further developments that may go on indefinitely, and those developments can be predicted based on the current structure of the group's vocabulary.

The indexing method gives critics the tools they need to see these potential developments. By tracking key terms and their equations, and finding the implicit hierarchy of terms and god-term, rhetorical and cultural critics can appreciate the sophistication of the motivational structure and see what is likely to come next, based on the current state of the group's vocabulary.[145] As Burke writes, "For they have brought their calculations to the point where further experimental steps are in order, steps suggested by the present state of their terminologies" ("Watchful" 49). Instead of shouting, "you mad scientists will never be happy until you blow up the entire world!" a critic can point out to practitioners and policy-makers how all the weapons laboratories have a kind of limited tunnel vision towards a narrow goal (such as producing ever greater damage rather than greater precision or defensive abilities), using speeches, manuals, and texts from the weapons laboratories themselves as the evidence of this drive.

[145] For example, it is very clear to see from the god-term of the Los Alamos Primer ("maximize damage and efficiency") that the group will be motivated to develop more damaging, more efficient weapons, going from fission bombs to fusion bombs with ever-increasing explosive yields.

My case study of the Manhattan Project shows how rhetorical critics can feasibly conduct such a "social analysis" on a larger group of people: (1) Identify documents that many in the group have read and pointed to as reference points for the task they are undertaking together (what Burke calls "definitive literary texts") and (2) index these documents, looking for key terms, verbal hierarchies, and god-terms. These should give critics some indication of where this communal project is likely headed and the logics that sustain this development. The critic can then (3) gather letters, emails, blogs, speeches, chats, and conduct interviews looking for those same key-terms, hierarchies, and god-terms among the larger group. This third step may be greatly enhanced by using some simple algorithms to search through massive data of text communications. This step should give the critic an indication of how pervasive these logics are within the group, which of them is primary, and how they may have blended with the personal preferences and emphasis of leaders within the group. Some in the group may have glimpsed the implied next stage of development and already be working towards that stage. The critic should then be able to write some conclusions about the likely developments in the group and use them to warn practitioners, policy-makers, and the public about where this is going and how it can be prevented. Someone with the sentiments of a Robert Wilson just might be willing to listen and reconsider their course of action.

Indexing

In addition to clarifying consummation, my dissertation presents the most thorough explanation of indexing to date. Indexing was a central part of Burke's pedagogical and critical project. "The Rhetoric of Hitler's 'Battle'" is recognized as one of the classics of rhetorical analysis, and yet the method he used (indexing) is not well understood or applied by rhetorical

critics. As Garth Pauley writes, “Apart from scholars’ admiration for the essay . . . little has been written about Burke’s analysis of *Mein Kampf*.” William H. Rueckert says that Burke’s indexing analyses of literature “reveal Burke at the height of his powers as a reader (analyzer and interpreter) of texts” (xvii), and yet few Burke scholars have replicated his method in their analyses of literature. Indexing was Burke’s preferred pedagogical method, which was confirmed by all his former students at Bennington that I have contacted, the vast amounts of comments he gave on the many indexes his students made, and by his emphasis on this method in “Linguistic Approach to Problems of Education,” yet few teachers in rhetoric and composition teach this method to their students.

With this dissertation, I have clarified both the theoretical foundations and the practical procedures for this method, giving teachers more solid grounding to teach and apply it. In particular, I would note as original insights (1) the connection between equations, verbal hierarchies, and god-terms, (2) the difference between texts organized by dialectical transcendence and those organized by dramatic catharsis, (3) the connection between indexing and consummation, and (4) my analysis of the Los Alamos scientists, showing how indexing can be easily used to study larger amounts of texts. By showing how indexing can be used to indicate consummation among the Los Alamos scientists, I hope that I can make indexing a more widespread practice among Burke scholars and rhetorical critics in general.

Kenneth Burke Scholarship

The first audience for this dissertation is Burke scholars. Burke made a claim that the scientists that developed the first atomic bomb were motivated by consummation, without giving any evidence to substantiate that claim. My research helps to substantiate it. In addition, I have

made the formerly nebulous term "consummation" more specific and useful to Burke scholars by clarifying what it means and how it is different from entelechy and perfection, and I have also restored Burke's indexing method with all its original features.

Concerning *consummation*: Although I have been thorough, there is more historical and theoretical work that can be done on this principle. My work on consummation relies primarily on Burke's published texts, but there is more material available on this in the archives. For example, more work could be done to look at Burke's writings on consummation and "clean thermonuclear weapons" during his stay at the Center for Advanced Study in the Behavioral Sciences at Stanford University. He also alludes to the consummatory motive being illustrated by the language in the Gospel of John: "'When Jesus therefore had received the vinegar, he said, It is finished'; *consummatum est; es ist vollbracht;* the Greek text has *Telestai* . . . that contains the *telos* of 'entelechy,' to designate an 'end,' not just as dying or desisting, but rather as a purpose, now at last fulfilled" (*Essays* 18). Burke mentions this scene many more times in his letters, among others in the correspondence he had with Wayne Booth. There is a project here for anyone who wants to tease out what he meant by that connection.

Another line of inquiry could be comparing Burke's concept of consummation with those of George Herbert Mead and John Dewey. As I mentioned in the first chapter, some Burke scholars have, I argue mistakenly, seen Burke's concept of consummation as identical to those of Dewey and Mead. I have clarified some of those distinctions (Burke viewing it as more of a motivation and less as a destination for an aesthetic development), but it is possible to see these definitions as complementary rather than contradictory. For how can a person arrive at the apex of an aesthetic moment unless the appeal and promise of that final completion has brought the

person to that destination? Such a study might also reveal more about the origins of the concept in Burke's thinking, and where and why his emphasis diverged from Dewey and Mead's.

Beyond the historical and theoretical work on consummation, I argue that Burke scholars should actively use this concept in their criticism of self-sustaining linguistic motives. Combined with indexing, consummation gives critics tools to analyze discourse communities with a focus on where this discourse is likely to lead in the near future.

There can be many uses for such a "culture audit," and any object of study is likely to yield interesting insights. Burke writes, "Since every specialty has its terminology, it can be studied like any poem or philosophical treatise, for its equations" ("LAPE" 277) and "the various scientific specialists are to be viewed as carrying out the implications of their terminologies, and thereby seeking technological consummation for its own sake, however deceptively their efforts are justified" ("Watchful" 49). However, this kind of analysis may be most needed where the future developments in a group could potentially have disastrous consequences for human society and the earth. There have already been warnings of such potentialities from the research communities in artificial intelligence and gene editing. Burke scholars should be studying and engaging with these communities, using Burke's insights and methods to possibly prevent developments that will have negative impacts on human society.

I believe Burke scholars also need to teach this concept and this method to students and critics in all disciplines. Of course, one can find Burke useful without finding all his methods and theories equally useful, but I hope I have demonstrated how this consummation and indexing can be used and how useful they are, and what deep insights they can give a critic.

Rhetoric of Science

Rhetoric of science as a field has primarily been concerned with how scientific texts persuade their audience that the truth-claims made in those texts are valid or credible. Whereas rhetorical critics such as Michael Halloran and Alan G. Gross have looked at how scientific texts persuade by ethos appeals, I have analyzed scientific texts in terms of thoroughness or "dialectical symmetry," following Burke's claim that "a rhetorical structure is most persuasive when it possesses full dialectical symmetry" ("Rhetoric" 204).

In addition to analyzing these appeals in science texts, I have also analyzed the ethical implications and consequences of scientists' rhetoric. Many books and dissertations have been written about the Manhattan Project, but, to my knowledge, I am the only one that has searched for and described consummation as a significant motivating factor in the Manhattan Project. It is especially vivid in Robert Wilson's description of the frenzied effort towards Trinity and the pleasure that came with nuclear bomb development. Other scholars have alluded briefly to this drive but never given it a very in-depth treatment. Those who study rhetoric of science should be aware that the consummatory drive is a significant part of the appeal of scientific texts and that these vocabularies contain implications and directives that go beyond the immediate research result or problem these texts were developed to communicate.

Based on my dissertation, I argue that science rhetoric risks impairing ethical decision-making in three ways: (1) eliminating ethical questions from a discourse by restricting the scope of what may be discussed, (2) making science consubstantial with power, specifically power of destruction, and (3) preventing debate by labelling contrary positions as "anti-science."

In "How Well We Meant," I. I. Rabi states about the nuclear scientists at Los Alamos, "We have lost sight of the basic tenets of all religions – that a human being is a wonderful thing.

We talk as if humans were matter" (264, emphasis added). But in the scientific vocabulary of a physicist, there is no other way to describe a human being. A human being is matter and maybe energy, but there is no vocabulary in physics to describe the value of a human being as somehow different than a stone on the ground. Of course, there are good reasons to have limited vocabularies for different disciplines, but the problem arises when these descriptions of reality are seen as sufficient or superior, when this reductionist epistemology becomes a reductionist ontology. One example of this is where Leo Szilard writes concerning his fellow scientists that they will be "confused as to what kind of a thing a moral issue is" (Weart and Szilard 212) or where Oppenheimer talks about science being disciplined in its rejection of questions that cannot be answered by the scientific method ("Physics" 86). 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 therefore even be more prone to "overconfidence" and "polarization" than lay people (Mercier 313).

My research also highlights a central problem in the motivational structure of science, which becomes a problem in the rhetoric of science. In essence the problem is illustrated by Francis Bacon's famous words "scientia potentia est," knowledge (or science) is power. If the purpose of science is power alone, then there is no guarantee or even necessary likelihood that scientific developments will be for the benefit rather than detriment of human society, and yet scientists may be conditioned by this motivational structure to view increased power and control over nature as something of intrinsic value to humanity. During the war years, this is the central

logic of the Los Alamos scientists: science is a means to transform potentialities in nature into destructive power. Burke describes the dangers of "science as power" in *The War of Words*:

> Much of the "imaginal" danger in the modern demoralized use of the powers of applied science is of this sort: a way of life that . . . invites the user of such powers to treat mankind itself in the same terms. Those who do not feel a certain distress even in the chemical eradication of bacteria harmful to human life, open the way for those who will treat human life itself as mere bacteria. (245-6)

To illustrate the principle, Burke shares an experience from a world fair demonstration of a death ray that killed microbes:

> On a screen there was projected a globule of water, greatly magnified. The water was contaminated by a myriad of microscopic organisms that went scurrying back and forth across the surface of the screen. Then the demonstrator shot his new ingenious ray through this liquid, for the fraction of a second. And immediately all the scurrying organisms stopped dead still. And through the audience ran an exclamation of *pity*. And in that pity, I felt, there resided some hope . . . for mankind. Power in itself is impersonal and pitiless. And to see mankind in its terms would be to treat men quite as that ray treated the microscopic bugs. . . . The atrocities committed by Nazi physicians, in the name of scientific experimentation, upon prisoners of war and the inmates of concentration camps are a gruesome indication of what we mean. The ultimate horror is in this possibility: that those who tortured their prisoners in sadistic delight were nearer to the wells of human pity than those who went about their work of infection and

> destruction without emotion, acting sheerly with the methodological precision of the specialist. (246, emphasis in original)

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 potential 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 observers 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, sciene can become a tool to suppress dissent simply by labeling it anti-science.

Oppenheimer said developing the atomic bomb was "an organic necessity" and "if you are a scientist, you cannot stop such a thing." Edward Teller argued against a nuclear test ban treaty by labelling concerns about nuclear bomb tests anti-science and a stance that went against the scientific tradition containing "a spirit of adventure" and "a fearless exploration of the unknown" (Teller and Latter 72).

Rhetoric and Composition

The main contribution to the rhetoric and composition field may be restoring the indexing method. In addition to being Kenneth Burke's preferred method of analyzing texts, it is also a

method that teaches students and critics to look beyond the surface to the deeper motivational structures in a text. Science students should learn to analyze and understand the uses, limitations, and dangers of their specialist vocabularies before they are fully immersed in them, and the same goes for any academic discipline. Kenneth Burke wrote that an education which simply reinforces one hierarchy of terms (or system of thinking) without questioning its structure and ultimate purpose is "not education, but 'conditioning'" ("Draft of 'LAPE'").

The entire indexing method, not only the features included in "cluster-criticism," should be a part of introductions to rhetorical criticism (such as *Modern Rhetorical Criticism,* by Roderick P. Hart and Suzanne Daughton, and *Rhetorical Criticism: Exploration and Practice* by Sonja K. Foss). Students and teachers in rhetoric and composition can use this method on any rich text, and the method is flexible enough to yield good insights in various research projects. I argue that my dissertation could work as a model for these to follow initially.

For composition teachers, one takeaway is that "dialectical symmetry" and hierarchical structure are very important features of a persuasive text. Cognitive psychology has discovered that "long-term memory depends on coherent hierarchical organization of content" (Anderson 76), and Burke claims that "a rhetorical structure is most persuasive when it possesses full dialectical symmetry" ("Rhetoric" 204). Composition teachers can help their students to write texts that are more persuasive and memorable by drawing their attention to the hierarchy of terms they are developing in their texts, and where they may be inconsistent or where the connections between their key terms and equations are unclear. It may also be helpful to get students to question some of the equations they are making, enabling them to view their lives "as a kind of rough first draft that lends itself at least somewhat to revision" (*Grammar* 442).

Consummation and Indexing for the Public

Kenneth Burke was not a typical academic and his audience was not always primarily academic either: He wrote many articles for magazines like the *New Republic* and the *Nation*, and throughout his more scholarly works, he is constantly concerned with preserving nature and improving human society. He advocated for his indexing method and wrote about consummation exactly because he believed that these principles, fully understood, could make a real difference. In order to have this impact, public scholarship is essential. The professional associations in rhetoric and composition are actively calling for this kind of scholarship. Rhetoric Society of America write in their Call for Papers for the "Rhetorics for All" project that they are seeking "rhetorical research that bring the ideas and insights of rhetorical scholarship to a general audience." Conference on College Composition and Communication write in their Research Initiative for 2019-2020 that research proposals must "describe one or more possible audiences beyond the scholarly invested in the project and outline at least one public genre that will be created to engage with these audiences." My project analyzes one historical scientific project where the consummatory drive moved scientists to act unethically, but there are many other such projects today where the same drive may play a role in influencing scientists' decisions. Below I share a few examples where I invite rhetorical critics to ply their trade and share their insights with a public audience. To make this information relatable to a public audience, rhetorical critics can use "The Rhetoric of Hitler's 'Battle'" as a model, or, as Burke suggested, they could use satire. Burke does not see human choice as purely determined by linguistic structures and trends of thought. In fact, "the satirical foretelling would be motivated devoutly by the hope that, in the world of facts, such a trend is *not* inevitable. And the satire would be constructed on the

assumption that, by carrying such speculations to the end of the line, one keeps admonition alive" (*Human* 80, emphasis in original).

Consummation in Artificial Intelligence Research

In "Research Priorities for Robust and Beneficial Artificial Intelligence: An Open Letter" from 2015, the greatest experts in science and industry working on aritificial intelligence warn that the field "up to now has focused largely on techniques that are neutral with respect to purpose," and therefore increased focus now has to be put on making this technology beneficial to humanity. Among areas of concern raised in the report is the potential loss of control of AI systems "via the rise of superintelligences that do not act in accordance with human wishes—and that such powerful systems would threaten humanity" (Russell et al. 111-2). This is a field with abundant indications of a consummatory drive and with potential future developments that will have a great impact on the earth, developments that may already be partially glimpsed in the scientists' vocabularies. What view do people in this community have of "intelligence"? It is clearly a key term in the artificial intelligence community where there are constant debates about whether a certain program is actually "intelligent," and much anticipation hinges around a potential "intelligence explosion" in the future that will bring about "superintelligences" that go beyond human control (Russell et al. 111).

Consummation in Gene Editing Research

Another area that has seen rapid progress and expansion is genetics, and in particular, the research community working on gene editing using the revolutionary CRISPR-Cas9 technology (a technology that allows researchers to alter, add, or remove sections of a DNA sequence).

Despite many government ethics panels arguing for restraint, the technology has already been used to alter human DNA.[146] At first, the news was hailed as a historic breakthrough in the field of genome editing, but the research was later heavily criticized. The scientist, He Jiankui, has been described by fellow geneticists as someone who was "crazy" and wanted to win the Nobel Prize so badly that he was willing to take unethical shortcuts (Shanks), yet many supportive statements from other geneticists about He's work indicate that he may be more mainstream than the current condemnations imply. Again, there are many researchers who indicate that these developments are inevitable and that while one might want to limit these practices, it is simply not possible to do so.

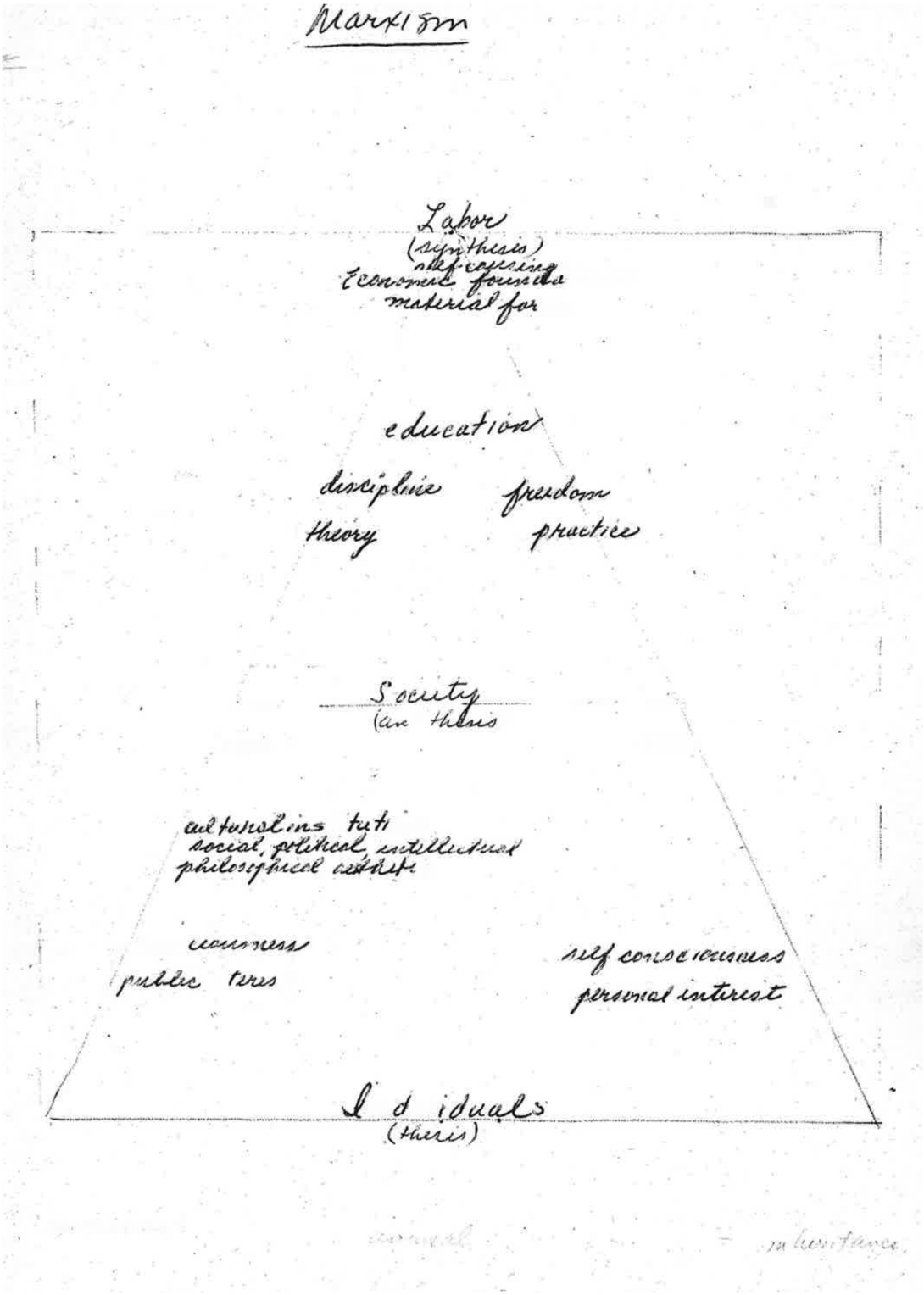
The Center for Genetics and Society, a progressive nonprofit information and public affairs organization, warns, "permitting germline intervention for any intended purpose would open the door to an era of high-tech consumer eugenics" that "could inscribe new forms of inequality and discrimination onto the human genome" ("Open Letter"). This is a clear warning, but is it warranted? In addition to the financial incentives in the medical industry, there is likely to be a corresponding aesthetic motive that is based on the current vocabulary in the geneticist community that motivates researchers regardless of financial incentives. What is the design of that motivational structure? What is "at the end of the line" in that hierarchy? A rhetorical critic using Burke's concept of consummation along with the indexing method may be able to give

[146] In her 2018 summary article, "Do CRISPR Germline Ethics Statements Cut It?" Carolyn Brokowsky writes that "at least 61 ethics reports and statements have been crafted by more than 50 countries and organizations over the past 3 years" dealing with this new technology, with most of them advocating for restraint or even a complete moratorium on gene editing, and yet already in November the same year, a Chinese researcher proudly announced the successful gene editing of two babies. On December 30, 2019 He Jiankui and two other Chinese scientists (Zhang Renli and Qin Jinzhou) were found guilty of performing heritable genome editing on three babies (Shanks).

many helpful insights to the public here, for these developments are not inevitable as long as they require human decisions.

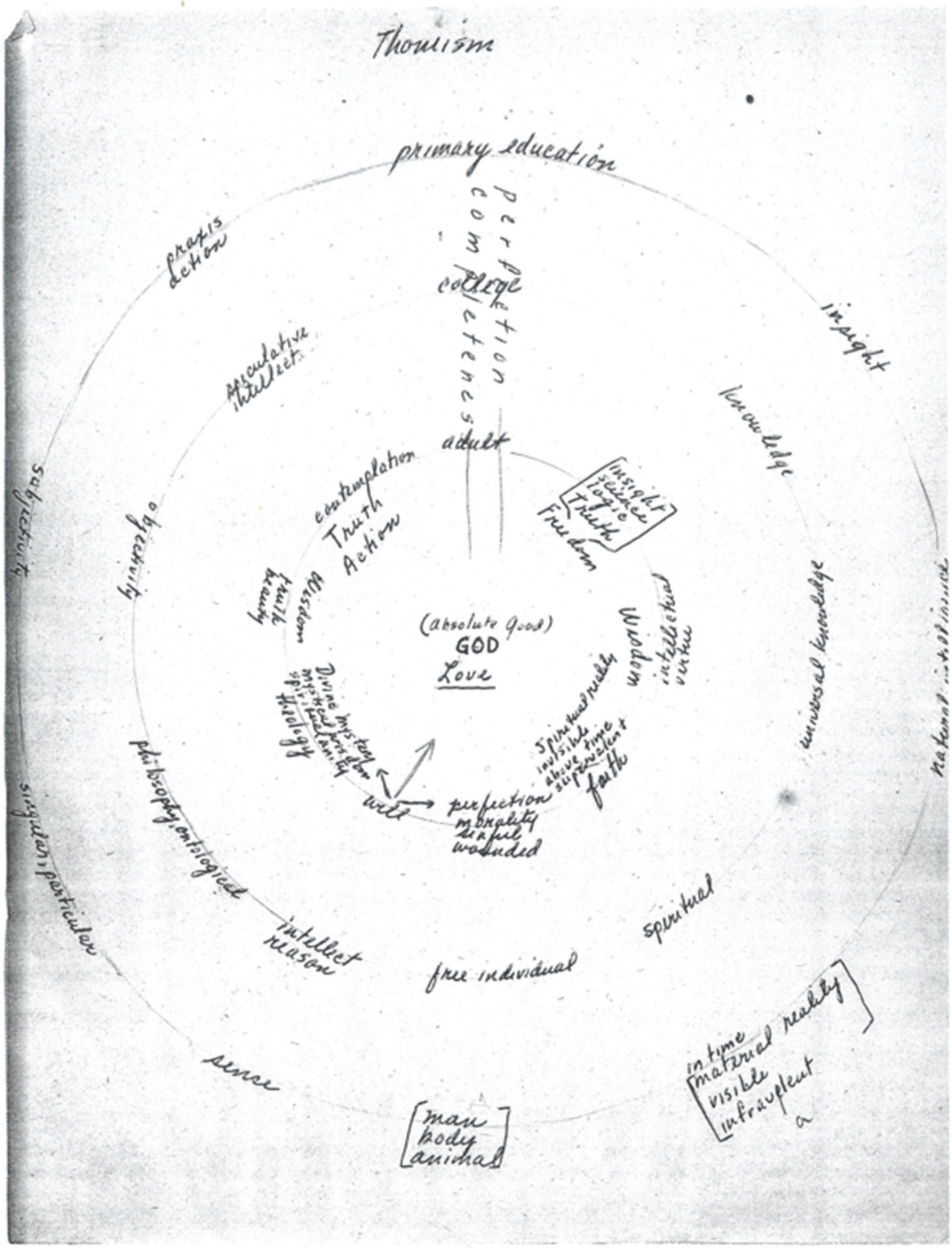
Appendix A: Suzanne Shepherd's Indexing Charts with Transcription

Marxism chart



Transcription starting at the top: Marxism, Labor (synthesis), self-causing, Economic focus and material for?, education, discipline, freedom, theory, practice, society (antithesis), ad turestins? tuti [to protect?], social, political, intellectual, philosophical aesthete/elite?, success?, self consciousness, public turn?, personal interest, Individuals (thesis), inheritance, example?

Thomism chart



Transcription following the hierarchy upwards and inwards one line at a time: Thomism, primary education, college, adult, completeness, perfection, insight, knowledge, freedom (insight, science, logic, truth), natural intelligence, universal knowledge, wisdom (intellectual virtue), in time (material reality, visible, infravelent a), spiritual, faith (spiritual reality, invisible, above time, supervalent), (man, body, animal), free individual, (perfection, morality, sinful, wounded), sense, intellect/reason, will, singular, particular, philosophy, ontological, Divine mystery, mystical wisdom, spiritual, theology, subjectivity, objectivity, wisdom, truth, beauty, praxis, action, accumulative intellect, contemplation, truth action, (absolute good), GOD, Love

Appendix B: Announcing the Bombing at Hiroshima

Truman informs the nation that an atomic weapon has been detonated in Japan.

August 6, 1945

THE WHITE HOUSE

Washington, D.C.

STATEMENT BY THE PRESIDENT OF THE UNITED STATES

Sixteen hours ago an American airplane dropped one bomb on Hiroshima and destroyed its usefulness to the enemy. That bomb had more power than 20,000 tons of TNT. It had more than two thousand times the blast power of the British "Grand Slam" which is the largest bomb ever yet used in the history of warfare.

The Japanese began the war from the air at Pearl Harbor. They have been repaid many fold. And the end is not yet. With this bomb we have now added a new and revolutionary increase in destruction to supplement the growing power of our armed forces. In their present form these bombs are now in production and even more powerful forms are in development.

It is an atomic bomb. It is a harnessing of the basic power of the universe. The force from which the sun draws its power has been loosed against those who brought war to the Far East.

Before 1939, it was the accepted belief of scientists that it was theoretically possible to release atomic energy. But no one knew any practical method of doing it. By 1942, however, we knew that the Germans were working feverishly to find a way to add atomic energy to the other engines of war with which they hoped to enslave the world. But they failed. We may be grateful to Providence that the Germans got the V-1's and V-2's late and in limited quantities and even more grateful that they did not get the atomic bomb at all.

The battle of the laboratories held fateful risks for us as well as the battles of the air, land, and sea, and we have now won the battle of the laboratories as we have won the other battles.

Beginning in 1940, before Pearl Harbor, scientific knowledge useful in was pooled between the United States and Great Britain, and many priceless helps to our victories have come from that arrangement. Under that general policy the research on the atomic bomb was begun. With American and British scientists working together we entered the race of discovery against the Germans.

The United States had available the large number of scientists of distinction in the many needed areas of knowledge. It had the tremendous industrial and financial resources necessary for the project and they could be devoted to it without undue impairment of other vital war work. In the United States the laboratory work and the production plants, on which a substantial start had already been made, would be out of reach of enemy bombing, while at that time Britain was exposed to constant air attack and was still threatened with the possibility of invasion. For these reasons Prime Minister Churchill and President Roosevelt agreed that it was wise to carry on the

project here. We now have two great plants and many lesser works devoted to the production of atomic power. Employment during peak construction numbered 125,000 and over 65,000 individuals are even now engaged in operating the plants. Many have worked there for two and a half years. Few know what they have been producing. They see great quantities of material going in and they see nothing coming out of these plants, for the physical size of the explosive charge is exceedingly small. We have spent two billion dollars on the greatest scientific gamble in history -- and won.

But the greatest marvel is not the size of the enterprise, its secrecy, nor its cost, but the achievement of scientific brains in putting together infinitely complex pieces of knowledge held by many men in different fields of science into a workable plan. And hardly less marvelous has been the capacity of industry to design and of labor to operate, the machines and methods to do things never done before so that the brainchild of many minds came forth in physical shape and performed as it was supposed to do. Both science and industry worked under the direction of the United States Army, which achieved a unique success in managing so diverse a problem in the advancement of knowledge in an amazingly short time. It is doubtful if such another combination could be got together in the world. What has been done is the greatest achievement of organized science in history. It was done under pressure and without failure.

We are now prepared to obliterate more rapidly and completely every productive enterprise the Japanese have above ground in any city. We shall destroy their docks, their factories, and their communications. Let there be no mistake; we shall completely destroy Japan's power to make war.

It was to spare the Japanese people from utter destruction that the ultimatum of July 26 was issued at Potsdam. Their leaders promptly rejected that ultimatum. If they do not now accept our terms they may expect a rain of ruin from the air, the like of which has never been seen on this earth. Behind this air attack will follow sea and land forces in such number that and power as they have not yet seen and with the fighting skill of which they are already well aware.

The Secretary of War, who has kept in personal touch with all phases of the project, will immediately make public a statement giving further details.

His statement will give facts concerning the sites at Oak Ridge near Knoxville, Tennessee, and at Richland, near Pasco, Washington, and an installation near Santa Fe, New Mexico. Although the workers at the sites have been making materials to be used producing the greatest destructive force in history they have not themselves been in danger beyond that of many other occupations, for the utmost care has been taken of their safety.

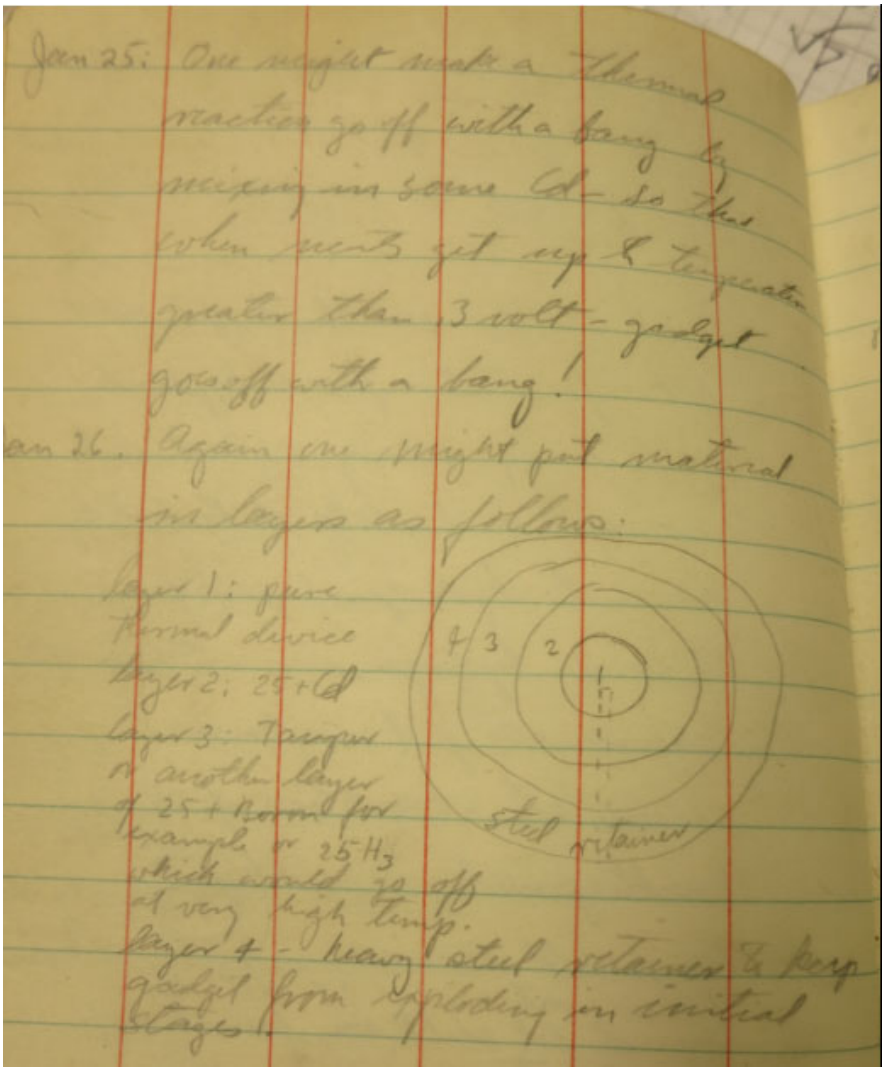
The fact that we can release atomic energy ushers in a new era in man's understanding of nature's forces. Atomic energy may in the future supplement the power that now comes from coal, oil, and falling water, but at present it cannot be produced on a bases to compete with them commercially. Before that comes there must be a long period of intensive research. It has never been the habit of the scientists of this country or the policy of this government to withhold from the world scientific knowledge. Normally, therefore, everything about the work with atomic energy would be made public.

But under the present circumstances it is not intended to divulge the technical processes of production or all the military applications. Pending further examination of possible methods of protecting us and the rest of the world from the danger of sudden destruction.

I shall recommend that the Congress of the United States consider promptly the establishment of an appropriate commission to control the production and use of atomic power within the United States. I shall give further consideration and make further recommendations to the Congress as to how atomic power can become a powerful and forceful influence towards the maintenance of world peace.

Source: Harry S. Truman Library, "Army press notes," box 4, Papers of Eben A. Ayers.

Appendix C: Robert Wilson's Bomb Sketch with Transcription



Transcription starting from the top:

Jan 25: One might make a thermal reaction go off with a bang by mixing in some Cd- so that when neuts get up to temperature greater than 4 volt – gadget goes off with a bang!

Jan 26. Again one might put material in layers as follows:
layer 1: pure thermal device
layer 2: 25 + Cd
layer 3: tamper or another layer of 25 + Boron for example of 25 Hg which would go off at very high temp.
layer 4: heavy steel retainer to keep gadget from exploding in initial stages.
[sketch] 1, 2, 3, 4, steel retainer

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VITA

David Erland Isaksen was born on July 15, 1985, in Porsgrunn, Norway. He is the son of Rolf Idar Isaksen and Jeanne Isaksen. A graduate of Skien videregående skole in Skien, Norway, he received a Bachelor of Arts degree in Literature and Languages from University of South-Eastern Norway in 2009, a Master of Arts degree in Interpreting and Translation (German/English) from University of Central Lancashire in 2010, and a Master of Arts degree in English with a Rhetoric and Composition emphasis from Brigham Young University in 2012.

In August 2012 he enrolled in graduate study at Texas Christian University, beginning a doctorate study in Rhetoric and Composition at the English Department. He was a Graduate Instructor at Brigham Young University. He held the Rupert and Lillian Radford Fellowship in Rhetoric and Composition 2012-2013 and a STARS (Stipends to Attract Remarkable Students) Fellowship from 2012-2015 at TCU. He also had a Teaching Fellowship from 2013-2014.

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ABSTRACT

VISIONS OF NUCLEAR WEAPONS: KENNETH BURKE'S CONSUMMATION PRINCIPLE AND THE MANHATTAN PROJECT

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Kenneth Burke claimed there were three creative motives: expression, communication, and consummation. The third, consummation, is currently not much used or well understood among Burke scholars, but it was one that Burke himself was very concerned with. He claimed that consummation was a significant factor motivating atomic physicists in the Manhattan Project to develop the first atomic bomb. This dissertation explains what Burke's consummation principle means and how it can be used in rhetorical criticism, using the Manhattan Project as an example of consummation.

Consummation is a specific manifestation of the entelechial drive that requires a rigorous vocabulary and is maintained by the aesthetic principle of self-consistency. The motive is engendered when a vocabulary has developed enough "rules" of expectation to make those who use it able to grasp implicit directives about what should come next.

Burke wrote that indexing was a method for discovering the consummatory drive in a vocabulary. The method consists of finding key terms and tracking the equations of those terms (which leads to clusters of terms around key terms). One then finds the hierarchies of terms by

finding out how the terms in the clusters relate to each other in terms of abstraction (specific vs. general, cause vs. effect, etc.). In most well-developed texts, this ladder of abstraction leads up to an organizing principles or what Burke called a god-term.

In indexing a group discourse, Burke stated that one should start with a text that is defining and widely circulated among the group, index it, and then search for fragmented versions of the same hierarchies and clusters in the larger group. I identified three defining texts by Otto Frisch, Rudolf Peierls, Robert Serber, and Niels Bohr, and indexed them. The god-terms were "Super-bomb," "maximize damage and efficiency," and "science," and all the texts defined science as a means to power. I found this equation and these god-terms repeated in texts written by Robert Oppenheimer, Robert R. Wilson, and many other junior scientists at Los Alamos. There was also pervasive evidence of a drive to complete the atomic bomb that matches Burke's descriptions of the consummatory drive.