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Understanding Myth and Myth as Understanding: An Interdisciplinary Approach to Mytho-Logic Narration

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UNDERSTANDING MYTH AND MYTH AS UNDERSTANDING:

AN INTERDISCIPLINARY APPROACH TO MYTHO-LOGIC NARRATION

by

Sandra Bartlett Atwood

A thesis submitted in partial fulfillment
of the requirements for the degree

of

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in

American Studies
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UTAH STATE UNIVERSITY
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ABSTRACT

Understanding Myth and Myth as Understanding:

An Interdisciplinary Approach to Mytho-Logic Narration

by

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Utah State University, 2015

Major Professor: Dr. Lynne S. McNeill
Program: American Studies (Folklore)

I wanted to see if there were points of overlap between the various accounts of creation found in folklore, philosophy and physics. In order to justify such a project, I initially considered literature from each of these disciplines regarding the necessity of interdisciplinary dialogue generally and specifically the need for both intuition and logic when considering how anything actually exists. Through my research and casual observation, I hypothesized that opposition seemed to be a universal characteristic of nature. I then looked at how each discipline has described fundamentally opposing pairs and created a list of primary features that those accounts had in common. Finally, I demonstrated (in my study *The Symmetry of God*) the utility of an interdisciplinary approach to myth by showing how science and philosophy can improve our understanding of myth and conversely how folklore (myth in particular) may suggest meaningful and potentially *revolutionary* relationships not yet considered by science.

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PUBLIC ABSTRACT

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Sandra Bartlett Atwood

I wanted to see if there were points of overlap between the various accounts of creation found in folklore, philosophy and physics. In order to justify such a project, I initially considered literature from each of these disciplines regarding the necessity of interdisciplinary dialogue generally and specifically the need for both intuition and logic when considering how anything actually exists. Through my research and casual observation, I hypothesized that opposition seemed to be a universal characteristic of nature. I then looked at how each discipline has described fundamentally opposing pairs and created a list of primary features that those accounts had in common. Finally, I demonstrated (in my study *The Symmetry of God*) the utility of an interdisciplinary approach to myth by showing how science and philosophy can improve our understanding of myth and conversely how folklore (myth in particular) may suggest meaningful and potentially *revolutionary* relationships not yet considered by science.

DEDICATION

This work is dedicated to my four sons, Angus, Bryn, Col and Daniel, whose love and sacrifice throughout this process have surpassed all expectation. WE DID IT BOYS!

My father, Charles Claymore Bartlett, whose silence taught me to listen, my mother, Judy, for her constant nurturing and to my Ohana for the lessons in Love.

My kindergarten song leader for teaching me a tune that stayed with and influenced me all of my life "Happiness runs in a circular motion, life is like a little boat upon the sea. Everything is really part of everything anyway; you can be anything you let yourself be." and to Mr. Barry Smith, my 3rd and 5th grade teacher from Agnes Davidson Elementary School along with National Geographic for feeding my sense of wonder.

Dr. Fred Provenza (and his wife Sue) for exemplifying a brand of scholarship that would forever change the way I look at theoretical and practical problems, Kirt Frank Rees for inspiring my study *The Symmetry of God*, Ben Bridgstock for introducing me to the Quran and other sacred texts and to my three Henrys for teaching me that my ability to ask important questions is divine and pleasing to God.

The USU Folklore Department, particularly Lisa Gabbert for giving shape to my thoughts early on and to Lynne McNeill for her tremendous intellect, warm personality and painstaking commitment to the project, also folklorists, Bernadene Ryan and Jeanine Huenemann, for encouraging me to finish when I was determined to quit, Elaine Thatcher, Jay Mechling, Tok Thompson, Greg Schrempp, Allen Hansen and Henry Glassie for their interest and support—special thanks to the English Department's Michael Sowder for his enthusiasm and to Evelyn Funda and Jeannie Thomas for accommodating my personal circumstances and giving much needed encouragement and logistical support along the way, as well as the Fife family for providing the fellowship that transformed my academic aspirations into reality.

The USU Philosophy Department, particularly Charlie Huenemann for his relentless skepticism and insight, also Harrison Kleiner and of course Gary McGonagill, as well as Galen Strawson at the University of Texas for their time and special interest in my work.

The USU Physics Department, particularly Jim Wheeler, Ajay Singh (and his wife Pranita) and Eric Held, as well as Frank Wilczek of the MIT Department of Physics for welcoming my rather amateur and unorthodox approach to physics with patient and respectful dialogue.

To every human in search of the truth *wherever* it may be found, including the subjects of my research whom I have intimately come to know and revere. Finally, I dedicate this work—along with all the time and talents I possess—to God.

PREFACE

"Of all the frictional resistances, the one that most retards human movement is ignorance…The friction which results from ignorance...can be reduced only by the spread of knowledge and the unification of the heterogeneous elements of humanity. No effort could be better spent." (Tesla 1900, 211)

As a young Christian[1] girl with an insatiable curiosity for creation narratives of all kinds, I began to notice that all sacred accounts of creation contained the notion of necessarily opposing pairs. One of the first allusions to this phenomenon that I encountered early on is found in 2 Nephi 2:11, 13-16, 27 of The Book of Mormon, "For it must needs be, that there is an opposition in all things. If not so…righteousness could not be brought to pass, neither wickedness, neither holiness nor misery, neither good nor bad. Wherefore, all things must needs be a compound in one; wherefore, if it should be one body it must needs remain as dead, having no life neither death, nor corruption nor incorruption, happiness nor misery, neither sense nor insensibility…And if these things are not there is no God. And if there is no God we are not, neither the earth; for there could have been no creation of things, neither to act nor to be acted upon; wherefore, all things must have vanished away…it must be that there was an opposition…Wherefore, the Lord God gave unto man that he should act for himself. Wherefore, man could not act for himself save it should be that he was enticed by the one or the other…."

As I grew, my circle of interest expanded and I became fascinated by philosophy and physics, particularly the way idealists and realists both seemed to make a reasonable case for how anything comes to exist. I wondered, "Could they both be right?" Similarly, I puzzled once

[1] I am a member of the Church of Jesus Christ of Latter-day Saints, often referred to as Mormons.

again as monists made seemingly sound arguments for how all things are essentially one or uniform and yet others effectively contended that all things are many or multiform. As I became familiar with quantum mechanics and various unification theories produced by theoretical physicists, I wondered if these sundry disciplines and traditions might not be pointing at the same phenomenon—a fundamental opposition of some kind—to describe the source and disposition of existence; that "existence" itself may be binary "existence-nonexistence" which seemed to coordinate many of these apparently disparate accounts of creation both from within each discipline as well as across disciplines.

In this way, my thesis initially presumes and ultimately concludes as well, that the most fundamental entity in the world is perhaps neither existence nor nonexistence but rather the dynamic co-existence of the two. Furthermore, I propose that whether referring to the methods for understanding the world or to the phenomena themselves, the question of the one and the many, or the simultaneously particular and universal nature of existence, is best accommodated by symmetry—distinction without difference; that by assuming or at least applying methodological symmetry to binary phenomena, we can somewhat reconcile the age old breach in understanding how anything exists.

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CHAPTER I

INTRODUCTION

Although folklore, philosophy and physics are perceived to occupy distinct spheres, are there points of overlap? Do the discourses of folklore, philosophy and physics contain mythological elements? Employing folklorist David Hufford's *methodological symmetry*, I have examined philosopher Galen Strawson's *equal-status monism* and physicist Niels Bohr's principle of *complementarity* alongside folklorist Claude Lévi-Strauss' *binary opposition* theory. Methodological symmetry was developed by Hufford as a way of investigating and interrelating meaningful correlations between professional and vernacular beliefs surrounding what he assumed to be a singular medical phenomenon or experience. It "is a methodology based on the theoretical premise that the same questions must be applied to medicine as are applied to the lay community" (Hufford 1997, 54:1-14). Applying Hufford's method to my interdisciplinary study of existence and the mutually dependent or relational nature of opposites, I have asked the same questions of folklore, philosophy, and physics, examining each discipline's treatment of what I consider to be a single—albeit complex or multi-faceted—natural phenomenon.

According to Alan Dundes, "A myth is a sacred narrative explaining how the world and man came to be in their present form" (Dundes 1998, 1). Elliot Oring defines *narrative* as, "another word for story." He explains, "Narrating is a method by which an experience is transformed into a verbal account…It should be noted that nowhere in this definition is myth held to be untrue—rather, that the narrative is held by someone to be ultimately true enables its characterization by the folklorist as myth" (Oring 1986, 121-124). While the terms 'myth' and 'fiction' have come to be nearly synonymous in post-modern western culture, the original connotations of *myth* are derived from the Greek word *mythos* meaning word or speech. In

archaic Greek, *mythos* is uniquely reserved for enigmatic, authoritative speech; God-like reason, whereas *logos* typically refers to rational, domestic speech; common reason or *logic* (McGonagill 2010*)*.[2] In *Les Enfants Sauvages: Mythe et Réalité*, Lucien Malson further defines myth as "the expression of unobservable realities in terms of observable phenomena" (Leach 1962, 34).

Based on years of casual observations and an enduring interest in how anything came to exist, I have developed a familiarity with creation narratives of all kinds. More recently and with these particular definitions of myth in mind, I have, by means of both, the comparative method and paradigmatic structuralism, considered sacred narratives alongside the relatively modern "myths" produced by metaphysics and quantum mechanics in search of a common theme that might generalize[3] these otherwise seemingly disparate accounts. Indeed, although folklore, philosophy and physics are usually perceived to occupy distinct spheres, there seemed to be points of overlap and the discourses of each of these segregated disciplines did in fact contain mythological elements. One of the persisting motifs I noticed throughout the various accounts is a phenomenon I will be referring to as binary, essential, fundamental or necessary opposition.[4] Having identified a suitable singularity for my case study, I then instigated my project by employing Hufford's Methodological Symmetry to examine perspectives in folklore, philosophy and physics regarding the mutually dependent nature of opposites.

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[2] Taken from a 2010 ancient Greek philosophy lecture given by Dr. Gary McGonagill at Utah State University and used here with his express consent.

[3] Webster's Dictionary provides the following definitions for *generalize*: give a general form to; derive or induce a general conception or principle from the particulars of; draw a general conclusion from; give general applicability to; make indefinite.

[4] Because each discipline's specific term for two-fold phenomena comes loaded with predetermined meanings and nuances specific to a particular author or domain, I have devised the generic term "necessary opposition" which at this point is only meant to suggest that some phenomena are fundamentally and therefore, inescapably (or necessarily) comprised of opposing traits. However, while I will also be using other common terms such as binary, essential and fundamental for their descriptive value, note that my general use of "binary opposition" does somewhat differ from Levi-Strauss' specific use of the term.

The most problematic features of my preliminary inquiry were its scope and comparative nature. Because it was neither practical nor possible to review the creation myth of every folk group, much less all the variant accounts of each type for this project, I necessarily had to limit my sample, this was mostly determined by my casual and nonsystematic study of myth over the past thirty years or so—although I did follow up on suggested readings I received or came across throughout the course of this project as well as purposefully reviewing several of the accounts that had stood out to me over the years as being particularly useful to this study. Additional risks of my cross-cultural analysis included: the loss of important distinctions caused by simply picking one version over another, the neglect of idiosyncratic elements resulting from my focus on paradigmatic features, and subsequently the de-contextualization of fundamentally culture-bound aspects of myth. Furthermore, I compared themes from sacred narratives, not only cross-culturally but across disciplines as I attempted to align these ancient accounts with contemporary ones, which potentially amplified the aforementioned risks in the process. So "Why compare them at all?" you may ask.

I believe Alan Dundes answers this question when he asserts, "One of the most disheartening aspects of…the scientific study of folklore, is the persistent lack of analysis and interpretation" (Dundes 1998, 120). Dundes does not even seem to mind *which* critical method is employed so long as we commit ourselves to coupling our study of folklore with "thoughtful commentary" (Dundes 1998, 120). He encourages folklorists to, first recognize parallels in folklore, and then attempt to explain the underlying meaning of those elements in some systematic way that ultimately transcends the specific context of any particular performance or text. Drawing on "Bloody Mary" scholarship to facilitate his argument, Dundes says of his distinguished colleagues, "[I]t is clear that folklorists…know *about* the…ritual, but it is equally

obvious that its basic underlying significance, if any, seems to have eluded them," concluding that folklorists are apparently either "unwilling or unable to interpret folklore" (Dundes 1998, 122; my emphasis). [5]

According to Jacob Grimm, once folklore has been "salvage[d] and collect[ed]," it must be "research[ed] in detail" if we are to ever understand poetry, history, and language *in relation to* its origins. Grimm's reasoning is both cryptic and intriguing: "Despite all the ridicule and derision with which it [myth] has been treated, it has survived in secret, unconscious of its own beauty, and carrying *its irrepressible essence* alone *within itself*" (Dundes 1999, 5; my emphasis). Likewise, folklorist Bruce Jackson recalls Edward D. Ives' shrewd observation, "it all goes to show that the facts—for whatever reason collected—know more than we do at the time, and, if they are properly saved and stored away, they may someday answer questions we never knew enough to ask" (Jackson and Ives 1996, 169).

Borrowing from comparative mythology and paradigmatic structuralism, I have distinguished a single property, necessary opposition, which is common to all myths, from "those that are peculiar to one or more only" in an attempt to isolate this most prevailing element for further analysis. Not so much because common themes are more "important"—as Müller and others had supposed—but because they are more essential and also because they are better suited to empirical analysis. Hence, while folklorists may never arrive at the origins of myth, we can nevertheless gain meaningful insight into its significance. Charles Darwin revealed a lot about the natural world studying physical traits that survive. In my research I have recognized surviving cultural elements and given them one more critical look to see what they might yet reveal and predict about the world as well as the folks who preserve them.

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[5] Although many contemporary folklorists have begun to address this concern, little attention has been paid to myth in this regard.

Hufford viewed his interdisciplinary experience-centered approach "as a stage of investigation that largely *precedes* theoretical interpretation…" (Hufford 1982, xvii; my emphasis). Although he recognized that no approach is or should be truly free of theory, by keeping theory at a minimum he was able "to provide better raw material that may be of use to analysts who subscribe to a variety of theoretical schools of thought" (Hufford 1982, xvii). Similarly, my thesis (which is principally an introduction to my life's work) identifies and substantiates—by means of comparative methods, paradigmatic structuralism and symmetry theory—a point of mutual interest and then presents a compelling platform for genuine interdisciplinary dialogue regarding the shared phenomenon. With Hufford, I agree that, "the primary theoretical statement of the experience-centered approach might be roughly summed up as follows: some significant portion of traditional supernatural belief is associated with accurate observations and interpreted rationally" (Hufford 1982, xvii). I also concur with him in qualifying that this statement is neither meant to suggest that all beliefs are true nor be taken as proof that they are true. Like Hufford, whether future analysis of the materials I am presenting here lead to the reduction of supernatural beliefs to mere physical explanations or perhaps to the discovery of supernatural realities which have effectively eluded the current instruments and methods of scientific inquiry, this study is primarily "concerned with obtaining a better description of those observations and processes of reasoning that are associated with a particular kind of widely distributed supernatural belief [the mutually dependent nature of opposites as prescribed in myth, in my case]" (Hufford 1982, xix).

In, *Sacred Narrative: Readings in the Theory of Myth*, Dundes brings together twenty-two selected essays from the major contributors of each of the main schools of thought in myth theory since the dawn of international folkloristics near the end of the nineteenth century. Through the

works of William Bascom, Jan de Vries, James G. Frazer, Mircea Eliade, Bronislaw Malinowski, C. G. Jung, and Claude Levi-Strauss, he takes us from the initial efforts of the historic-geographic (comparative method), myth-ritual, Freudian, Jungian; psychoanalytic, functionalist and structuralist approaches to interpreting the genre of myth. While many of these methods are still employed by individual scholars, folklore, as a discipline, has turned its attention to performance-based folklore; folklore studied within the context of a specific event, process, place, or group. Hufford opposes this trend, chiding,

> Some folklorists have gone so far as to say that in the study of supernatural belief the issue of whether a given belief is correct is irrelevant. Given the findings reported in this present study[6], I must consider this to be an overstatement. For some research questions the actual connection between personal accounts and the objective facts of allegedly related personal experience matters little; for example, 'Why does this group enjoy hearing this particular legend, regardless of their personal involvement in the events it describes?' But for other questions our ability to describe confidently the features of related experience can be crucial; for example, 'Why is a particular believed narrative stable across time and space?' (Hufford 1982, xi)

Despite the shift towards contextualized, performed folklore, Gregory Schrempp's, *Magical Arrows: the Maori, the Greeks, and the Folklore of the Universe*, is an example of how the comparative method (particularly an interdisciplinary one) can still be applied in important ways that *interrelate* universal elements of diverse narratives rather than over-generalize and reduce them to mere bits of data—stripped of context and catalogued in some inexhaustible index. Contemporary folklorist, Jay Mechling, also recognizes the need to examine folklore "at the borders." It is here, he asserts, we begin to "*shift [our] gaze* from the stable centers to the dynamic peripheries of cultures [and disciplines[7]], those boundaries where differences meet and new meanings are made" (Mechling 2010).

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[6] Referring specifically to his study of "the Old Hag" which will be properly introduced in chapter II of my thesis.
[7] In a personal conversation with Dr. Mechling at the annual conference of the American Folklore Society October 14, 2010, he confirmed to me his underlying intent that this quote be generously applied to all boundaries; whether cultural, disciplinary, concrete or abstract, meaning is always derived at crossroads.

In specific response to contemporary developments in folklore, Hufford explains, there exists "an unfortunate tendency in folklore studies to divide into academic factions seen as either unrelated to one another or as necessarily in conflict. Such divisions are those found between persons with a humanities emphasis and those with a social science footing, collectors as opposed to theoreticians, and text-oriented versus context-oriented scholars" (Hufford 1982, xvii). Hufford also recognized (as I do) that these types of fissures seem to exist within other disciplines and *between* disciplines as well. He continues, "Whatever the source of this trend, the resulting conflict is frequently expressed in new ways of doing things that are intended both to show the shortcomings of and to replace competing approaches" (Hufford 1982, xvii). While Hufford acknowledges that such arguments have their place and can lead to better understanding and practices, it is his opinion that "at least in folklore, they have tended to be overdone" (Hufford 1982, xvii). Hufford is not interested in his experience-centered approach replacing other methods and in fact his own study extensively employs the language, methods and findings of not only other folklorists but of scholars from disciplines (statistics, medicine and psychophysiology) "rarely, if ever before associated with the study of folklore" (Hufford 1982, xvii).

Recently, many scholars and scientists have begun to look beyond the confines of their respective disciplines. Chapter seven of Humanistic geographer, Yi-Fu Tuan's landmark work, *Space and Place: The Perspective of Experience*, is devoted to the discussion of what he calls, "mythical space and place," or myth as a construct of reality. Theoretical physicist, Fritof Capra, in, *The Tao of Physics: An Exploration of the Parallels between Modern Physics and Eastern Mysticism* considers the impending role of vernacular knowledge in elucidating and perhaps, even guiding scientific research. Bio-chemist and historian, Alfred Tauber's work, *Science and*

the Quest for Meaning, His Holiness The Dalai Lama's, *The Universe in a Single Atom: The Convergence of Science and Spirituality*, and distinguished evolutionary biologist, Edward Wilson's opus, *Consilience: The Unity of Knowledge*, are also good examples of contemporary efforts to understand science through the lens of tradition[8] and conversely, tradition through the lens of science.

While folklore is not readily associated with science, in his work, *l'Origine de Tous les Cultes*, nineteenth century lawyer, mathematician, and professor of rhetoric, Charles Dupuis[9] asserts, "La mythologie, dans son origine, est l'ouvrage de la science; la science seule l'expliquera" (Santillana and von Dechend 1969, 230). (Mythology, in its origin, is the work of science; science alone will explain it.) But can science *alone* explain myth? Might not science profit from a sincere and rigorous response to myth as well? Nevertheless, as rational thought led to scientific inquiry and an absolute confidence in objective observation and experimentation to interpret the world, myth was first marginalized, then rejected, and eventually ignored by science.

Prior to Platonic philosophy, c. 450BCE, humans are thought to have been pre-rational, in other words, the now opposing ideals of mythic and rational thought were at one time compatible and uncontested. In the *Republic*, Plato bans myth and poetry from Athens, not because he thinks they are erroneous or malevolent, but because he believes them to mislead mediocre minds. In fact, Plato considers myth and poetry to be true, albeit *allegorical*, accounts of reality and continues to ground his dialogues, even frame his arguments in terms of Greek mythology. At least through Newton, European scientists were still trying to *explain* the biblical account of

[8] Among the synonyms for tradition are: myth, folklore, belief, custom, ritual, and practice—for reasons that will be evident later in my thesis, I want to maintain these nuances and implications here though my work will primarily focus on myth.

[9] Dupuis was a proponent of Max Müller's theory of Solar Mythology which proposed that all myths are metaphors for the sun and that through the corruption of language, the metaphors took on independent and inherently corrupted meaning that must now in modern times be reconstructed by scholars in order to get at any given myth's "true" meaning. For obvious reasons, this method is no longer considered by folklorists.

creation as found in Genesis, reflecting an ongoing incorporation of at least their own mythology (Wilczek 2008, 13). However, the philosophical ideas of Bacon, Descartes and the like would become grounds for science ultimately untying itself from folk belief and heading down a path of reducing nature into its incontingent, deterministic parts. Pointedly, "The philosophical basis of this rigorous determinism was the fundamental division between the I and the world introduced by Descartes…" (Capra 2000, 57) effectively removing subjective experience and consequently folk belief from the domain of science. Furthermore, by the nineteenth century, developments in evolutionary biology also seemed to question the relevance of such narratives.

Ironically, as science and technology brought the sub-atomic realm into view during the early part of the twentieth century, the weirdness of quantum activity seemed to defy logic, inviting—if not welcoming—mysticism back to the table.[10] In short, scientists found themselves, unavoidably, in need of a binary or two-fold perspective if they ever hoped to explain and ultimately reconcile this "new" and uncanny sub-atomic realm with the larger cosmos.

In my opinion, science—by closing its eyes to the value of myth—is unnecessarily reinventing the wheel, and one-armed at that. Incidentally, some of the greatest scientific breakthroughs in the past have been made by individuals who intentionally looked to traditional ideas to inspire their scientific work. Goethe believed that "[s]cience arose from poetry… [and hoped that] when times change the two can meet again on a *higher level* as friends" (Miller 1955, 42; my emphasis).[11] Because creation narratives are one place where nearly all disciplines intersect, I begin there, "In the beginning…" as it were.

In the process of having determined necessary opposition as prescribed in creation narratives as the point of interest for my case study, I preliminarily considered a variety of sacred

[10] My use of mysticism here will be fully explored in chapter II.
[11] This statement given to William Miller as quoted in LIFE Magazine, May 2, 1955 can also be found at http://articles.latimes.com/1988-07-10/opinion/op-9363_1_sup

narratives—narratives "explaining how the world and man came to be in their present form" (Dundes 1998, 1)—from both East and West and from "primitive" as well as "progressive" cultures. I casually compared these ancient descriptions with modern existential narratives found in the discourses of philosophy and science in search of paradigms; unifying themes and motifs that persisted throughout the various traditional and contemporary accounts of creation. My familiarity with the discourses of metaphysics and quantum mechanics coupled with the acumen of cooperating experts in these disciplines allowed me to simultaneously investigate whether any of the traditional archetypes found in folklore were also embodied in philosophy and physics. My early hypothesis being: If sacred narratives are indeed "the expression of unobservable realities in terms of observable phenomena" (Leach 1962, 34) then they will be patterned in some meaningful way and as such, have the impetus to inform other disciplines. In other words, *if* mythical accounts indeed disclose unseen realities, *then* myth will necessarily lend valuable insight to the sciences which seek to understand those phenomena. What's more, considering that our current understanding of the quantum realm actually *requires* the existence of unobservable realities (Wilczek 2008, 33)—realities which the scientific method alone cannot fully address (Eddington 1928, 258-260)—then some degree of reconciliation between science and myth seems, not only critical, but imminent.

In chapter II, *Interdisciplinarity*, I outline and interrelate the concepts of *methodological symmetry* presented by Hufford, *dialogue* as viewed by Heidegger and Plato and the relationship between *analysis and synthesis* as well as *logic and intuition* according to Einstein, Bohr, Heisenberg, Schrödinger and Dirac, in order to justify my interdisciplinary comparative analysis of each of these disciplines' take on irreducibly binary phenomena. While I have primarily followed Hufford's particular approach in my thesis, I wanted to demonstrate that similar

attitudes towards interdisciplinarity persist within each discipline and that a person could have reasonably started with any of the aforementioned methodologies in pursuing the phenomenon of necessary opposition.[12] Of interest here will be the way these interdisciplinary models were derived in direct *response* to the multifarious—even paradoxical—nature of a specific phenomenon each of these scholars or scientists were investigating: in the case of Hufford, *the Old Hag*; Heidegger, *the essence of thinking*; Plato, *Love*; Einstein, Bohr, Heisenberg, Schrödinger and Dirac, *the electron*.

In chapter III, *Necessary Opposition*, I summarize what Lévi-Strauss, Strawson and Bohr have supposed about necessary opposition. I distill and justify what I consider to be the prevailing points of overlap where the ideas of Lévi-Strauss, Strawson and Bohr seem to intersect.

In chapter IV, *Consequences and Conclusions*, I examine the notion of symmetry and the utility of tertiary elements—the seemingly *distinct* aspects—of each argument to see if they can be related to the other two in any productive ways that further enhance each discipline's *description* of existence and deepen the collective understanding of what I am suggesting may be a single phenomenon whose distinct aspects have been isolated during the reductionary process of each respective discipline.

[12] That being said (and borrowing once again from Hufford), I will clarify that, "Because I hope this study will be of interest to people in a variety of fields, I have tried to avoid excessively technical language. When this was not possible, I have provided basic definitions and background information…I have sought however to keep this book [thesis] from falling into special interest sections, each standing alone. The data and concepts from each portion are necessary for the full understanding and appreciation of all others. I trust that the advantages of this integrative approach outweigh any disadvantages. At any rate, the novelty that a psychologist [philosopher or physicist in this case] will find in reading primarily folklore material or that a folklorist will experience in reading about laboratory sleep studies [metaphysics and quantum theory in this case] may be a good thing in itself. (Hufford 1982, xxiii)

CHAPTER II

INTERDISCIPLINARITY

Epistemology is the study of knowledge or understanding. Epistemology is concerned with the nature and scope of knowledge and is also referred to as *theory knowledge*. It questions what knowledge is and how it can be acquired.[13] Each discipline has its own "rules" that dictate how and what kind of questions may be asked and the acceptable methods by which we may come to know the answers to those questions. Each of the following scholars in this chapter found the limitations of their respective disciplines not only stifling and restrictive but *insufficient* to adequately deal with the phenomena they were investigating and looked to the methods, language and insights of other disciplines and traditions to illuminate their understanding and augment their research. By soliciting the insights of various disciplines and traditions, they were able to discern relationships and meaningful nuances that largely reconciled the contradictions and inconsistencies they each encountered while approaching a complex phenomenon from a single perspective only.

To fully develop the epistemological roots and branches of folklore, philosophy and physics—while incredibly interesting and likely an indispensable component of developing the work I have begun here—is admittedly beyond the scope of *this* project. My purpose at this point is merely to demonstrate that there exists at least a branch of erudition within each discipline that has recognized (as I do) the advantages of a more interdisciplinary approach to understanding and interpreting the world. I include this vein of scholarship in my thesis in order to establish that while interdisciplinary methods may not enjoy widespread contemporary acceptance or use,

[13] http://www.iep.utm.edu/epistemo/ as well as, http://en.wikipedia.org/wiki/Epistemology

these methods have been defensibly justified and meaningfully employed by significant scholars from folklore, philosophy and physics both presently and formerly—even anciently.

Of interest here, is the way that Hufford, Heidegger, Plato and the big five of theoretical physics (Einstein, Bohr, Heisenberg, Schrödinger and Dirac) developed strikingly similar approaches to addressing complex phenomena despite the fact they came from divergent backgrounds, disciplines and eras and were likely either unaware of or uninterested in each other's research.[14] Because these scholars came from distinct disciplines, it is easy to cue in on the dissimilar aspects of their methods such as idiosyncratic terms and definitions from their various training and assume that their approaches are like apples and oranges and therefore un-relatable. To facilitate the easy recognition of the common and relevant aspects of each of the following methods to my particular study, I have identified three critical elements found in each of the following methodologies. It is my hope that whether folklorists agree with Hufford; whether philosophers agree with Heidegger or Plato; whether physicists agree with Einstein, Bohr, Heisenberg, Schrödinger and Dirac, or not, at least my diverse audience will find some familiar ground on which to stand as I make my argument for examining folk belief from the perspective of philosophy and physics (understanding myth) and conversely physics and philosophy from the perspective of folk belief (myth as understanding).

The following three methods share at least these three elements despite the markedly varied language and illustrations to which they appeal: 1) the following scholars unanimously recognized that to reveal some aspect of a phenomenon from one perspective unavoidably and simultaneously obscured other aspects inherent to that phenomenon; 2) they concluded that multiple perspectives were compulsory and could only be derived from an interdisciplinary

[14] However, Heidegger and these five physicists were working on the question of *being* around the same time and were all drawing on Kantian and transcendental philosophy to some extent.

approach to the phenomena they studied; 3) they understood that such an approach must entail *non-hierarchical* interdisciplinary discourse where both qualitative and quantitative methods were valued and employed, that is, they recognized that at least some elements of subjective experience are objectively real and as such potentially reliable and straightforward and likewise, that at least some elements of objective experience are only subjectively or relatively real and as such potentially inconsistent and misleading.

David Hufford on Methodological Symmetry and the Experiential Source Hypothesis

David Hufford's *methodological symmetry* and the relationship he documented between cultural and experiential sources that inform narratives set a precedence in contemporary folkloristics in terms of recognizing the epistemological limitations of current trends in the collection and interpretation of folklore and the advantages of involving other disciplines in order to: 1) better *explain* folklore and 2) make folklore relevant and useful to other disciplines. For this reason, I begin with a summary of his landmark work *The Terror That Comes in the Night: An Experience-Centered Study of Supernatural Assault Traditions*. In this study, Hufford examines a legend known in Newfoundland, Canada as "the Old Hag." When Hufford began studying Old Hag narratives, he "expected it to take only a few months and to result in a single article." As the project developed, he "came to realize gradually in the course of the work" that the project required an entirely new approach. Yet, Hufford explains, "Only when I had completed this book did I begin to see the outlines of what I now call the experience-centered approach…" (Hufford 1982, x). In the process of collecting and analyzing Old Hag narratives, Hufford continues, "The greatest challenge to explanation in such traditions is the question of

why people believe that they or others have had such experiences." Because recognizable[15] accounts of Old Hag turned up throughout North America (and throughout the world since ancient times) not just in Newfoundland where the legend is common, Hufford *had* to question whether culture alone could explain what was clearly shaping up to be a phenomenological experience that was occurring independently of any familiarity with the tradition. He deduced that if a legend originated from a cultural source then one or more of the following would apply: 1) no first person accounts would exist; 2) they would be misinterpretations of ordinary events caused by the influence of traditional beliefs; 3) they would be outright lies or errors of memory; 4) they would be the experiences of victims of a hoax; 5) they would be caused by fasting, hallucinogens known to produce subjective experiences that vary cross-culturally and are shaped by expectations; 6) they would be the experience of abnormal individuals whose psychotic episodes were shaped by their cultural repertoire (Hufford 1982, 13-14). Since the Old Hag accounts he collected and studied did not fit into any of these categories, Hufford concludes, "the alternative to the cultural source hypothesis is what I call the experiential source hypothesis. This hypothesis holds that the Old Hag tradition contains elements of experience that are independent of culture…The experiential source hypothesis predicts that recognizable 'Old Hag experiences' will occur with some regularity without contact with the tradition." whereas "The cultural source hypothesis predicts instead that, in the absence of a cultural source, recognizable Old Hag attacks will not occur any more frequently than any other dream…" (Hufford 1982, 15-16). Due to the

[15] By "recognizable" Hufford meant that for a particular experience to be considered the Old Hag, regardless of the informant's knowledge of the Old Hag belief, the experience must contain certain elements which Hufford presents in terms of "primary features." Hufford's study disclosed four primary features: 1) subjective impression of wakefulness; 2) immobility variously perceived (paralysis, restraint, fear of moving); 4) fear. Hufford's work on the Old Hag, which began in 1971 predates and arguably *inspired* the first scientific identification of the same phenomenon—hypnogogic or hypnopompic sleep paralysis depending on the part of the sleep cycle in which one awakens—by almost a decade. I include here the most comprehensive bibliography that I discovered regarding sleep paralysis. Most of the foundational research on the subject is acknowledged here: http://www.periodicparalysis.org/english/view.asp?x=541.

frequency and distribution of irrefutably recognizable Old Hag narratives outside of Newfoundland and among uninformed Newfoundlanders, Hufford was justified in claiming that the narratives are primarily descriptions of a common supernatural[16] experience that Newfoundlanders had recognized as being unique and given a specific name—which, incidentally, is more than a century of scientific psychological studies were able to do.

Referencing a recent scientific study[17] that provided a reasonable explanation for the disappearance of medieval Norse mermen sightings by treating the corroborating details within those narratives as reliable data, Hufford notes, "[E]vents accurately observed and reasoning properly carried out are in some cases central in the development and maintenance of folk belief, *even when the beliefs appear fantastic*. Also, in such cases folk knowledge is sometimes well in advance of scientific knowledge." He continues, "Furthermore, an awareness of the roles of observation and reason can be essential in answering important folklore questions. The mermen example also indicates that such explanatory efforts should demonstrate a high degree of correspondence with the details of the tradition in question" (Hufford 1982, xiii; my emphasis). I will similarly argue that when employing traditional creation accounts as source material for the scientific investigation of the creation and disposition of matter, similar precautions must be taken to ensure *potentially* critical details are considered regardless of how incredulous the beliefs *seem* to be.

While the scientists carrying out the mermen study applied a highly scientific approach to explain a medieval legend (in truth they used folklore to develop an investigation designed to better understand optical phenomena due to atmospheric conditions and inadvertently offered a highly plausible explanation for the legend in the process), it was their attention to the details of

[16] I am defining supernatural as, beyond current scientific understanding.
[17] See *In the Wake of Sea Serpents* by Bernard Heuvelmans for more details of the study itself.

that folk belief that produced a reasonable justification for a phenomenon that had rarely been taken seriously outside of traditional Norse culture and revealed the tremendous accuracy with which those stories were initially told and subsequently re-told. The study validated the notion that despite plentiful variant details within the collected accounts, there remained a conservative core of reliable common features. Testing this hypothesis, the scientists deliberately and successfully *solicited* the legend to *guide* their study of optical phenomena. However, generally speaking, in the postmodern era, science has superseded myth as being *the* definitive description of reality and rarely even acknowledges much less consults tradition. Though Hufford celebrates the mermen study as an example of science providing a meaningful explanation for a particular tradition and perhaps validating folk belief generally, he feared that in a purely scientific approach to folklore, "The folk belief would be explained away rather than explained" (Hufford 1982, xiv). For example, once Hufford realized he was dealing with something more robust than a local urban legend, he noted, "The failure of the cultural source hypothesis to accommodate the Old Hag data has made the present chapter [*The Psychological Dis-Interpretation of the Old Hag*] the most difficult one in this book both to write and to explain…But if the source is not in culture, both a source and a mechanism must be sought in psychology" (Hufford 1982, 115).

After discovering that psychology had not even acknowledged what he was calling "Old Hag" as a real and distinct phenomenon, Hufford set out to understand why Old Hag had gone unnoticed by science. He informs us, "Assuming the existence of a cultural source, psychologists have…offered the Old Hag rigorous hospitality at best. The occasional firsthand Old Hag account has been accounted for in a great variety of ways by a long series of authors. The effect has been to explain the phenomenon away while discouraging the development of a thorough description of it" (Hufford 1982, 116). One such author Hufford identifies as having

inadvertently driven the Old Hag deeper into obscurity is psychoanalyst, biographer and former apprentice of Freud, Ernest M. Jones. After discovering that no psychologist or psychiatrist had ever used the term Old Hag in the way he was using it, Hufford recognized that he, "must first connect the Old Hag with something that has been studied and discussed in print." To do this, Hufford turned his attention to psychology's treatment of sleep phenomena. He focused on Jones' research extensively as it was the first conclusive work on sleep phenomena and because of its resulting bias (according to Hufford) on future scholars and because its influence on the numerous theories that followed was inexcusably adverse. Where did Jones go wrong? In Hufford's opinion, it was an error of taxonomy resulting from Jones' "excessive reliance on theory." Because Jones, a student of Freud,

> …was so certain of his theory and had so little regard for the traditions he considered…the distinction between the theoretical and the empirical all but disappeared. In his work, one can hardly distinguish the experiences themselves, when they are presented at all, from their interpretations. The lack of scientific precision attributed to popular thought is found here in academic disguise. Considering the breadth of his scholarship and the quantity of information he assembled, it is truly regrettable that Jones did not *untangle* more of what he found. But perhaps this failure is understandable given his theory-laden approach and the lack of objective knowledge about sleep at the time he wrote. (Hufford 1982, 134-135; my emphasis)

In summary, Hufford believed that psychologists' failure to accurately classify sleep phenomena and more specifically to distinguish "nightmare" from "bad dream" led to confusion and ignorance of the Old Hag as a distinct phenomenon. What's more, "each time this assumption was made in print it became more difficult for subsequent researchers to consider alternative possibilities" (Hufford 1982, 135). None of this is to say that Hufford did not recognize the need for science to engage in the Old Hag discussion; in fact he considers the narratives he collects to be "data" and borrows statistical models in an attempt to distinguish and accurately classify the phenomenon. The fact that Hufford initially focusses on describing what

Old Hag is *not*, is in direct line with Karl Popper's philosophy of critical rationalism[18] which was adopted by science as a governing feature of its present epistemology and is evidence of Hufford's interest in a genuinely integrated approach that attempts to legitimately disclose what the Old Hag actually *is*.

Although Hufford's intent was to speak specifically to the Old Hag legend with which he worked exclusively, I would argue that Hufford's methods and findings indirectly make a case for creation narratives as well. For instance, based on Hufford's reasoning, one can sensibly argue that the existence of extensive motif indexes[19] are evidence of the frequency and distribution of myths (and folktales too for that matter) and suggest that creation narratives are perhaps based in a common objective experience; that is to say, they comprise "elements of experience that are independent of culture" (Hufford 1982, 15) and beg to be taken seriously, even literally—at least to some extent. As with Old Hag narratives, despite culturally distinct particulars, vestiges of an underlying *recognizable* and widespread core experience persist, even *wait* to be addressed. In other words, though myths, generally speaking, are not considered practical explanations for the creation and character of matter by postmodern western philosophy and science, the recognizable motifs that make them translatable worldwide, throughout the ages, and I would argue across disciplines, demand sincere attention and rigorous investigation.

Once again (as this kind of attitude is critical to the development of any truly interdisciplinary mindset) *despite the productivity of his experience-centered approach*, Hufford

[18] Critical rationalists hold that scientific theories and any other claims to knowledge can and should be rationally criticized, and (if they have empirical content) can and should be subjected to tests which may falsify them. Thus claims to knowledge may be contrastingly and normatively evaluated. (http://www.iep.utm.edu/cr-ratio/ as well as, http://en.wikipedia.org/wiki/Critical_rationalism)

[19] Although it must be noted that Hufford has concerns regarding the way existing motif indexes reduce complex phenomena like the Old Hag beyond recognition, where it becomes classified under separate motifs such as witches or paralysis. When this happens, he argues, integral attributes of the Old Hag phenomenon get held up next to other examples not related to or compatible with the distinct experience that is the Old Hag.

resists the temptation to see his method as being complete or definitive; rather he recognizes that experience, particularly subjective experience is very tenuous ground. He cautions,

> I present this approach as one that can be *added* to those already in use. I do not propose that it should become the only way that folklorists [and I would add philosophers and scientists] should study belief or that it should replace any specific alternatives, although I do believe that it can substantially *supplement* many other strategies.
>
> This approach recognizes the epistemological difficulties of focusing on experience, especially when dealing with the materials of greatest interest in the folkloric study of supernatural belief. Another's experience is always a reconstruction to be inferred rather than a 'fact' to be directly observed. The data the folklorist relies on for this reconstruction consist largely of verbal accounts, and these are well known to be loaded with sources of error; faulty memories; the creative process of oral tradition; the very processes of perception, which are generally recognized to be influenced by expectation. (Hufford 1982, x; my emphasis)

In short, Hufford recognizes the limitations of any one approach and endorses the use of various methods (not just his own), both in and outside of folklore, to genuinely examine and describe folk belief, maintaining that other approaches are viable, applicable and must be welcomed if we are ever to unveil the manifold aspects of *any* given phenomenon.

Heidegger and Plato on Dialogue

Neither Martin Heidegger[20] nor Plato claimed to use *dialogue* as their method per se. However *that* they used it—Plato exclusively—is reason enough to illuminate this method which two of the greatest philosophical minds found so useful—even necessary in their attempt to describe what it means to exist. It is interesting that all of Heidegger's writings are informative narratives except for this, one of his last works, "*Conversation on a Country Path about Thinking*" which is a conversation—a dialogue—between a scientist, a teacher and a scholar.

[20] Martin Heidegger (1889-1976) is widely acknowledged to be one of the most original and important philosophers of the 20th century. His thinking has contributed to such diverse fields as phenomenology (Merleau-Ponty), existentialism (Sartre, Ortega y Gasset), hermeneutics (Gadamer, Ricoeur), political theory (Arendt, Marcuse, Habermas), psychology (Boss, Binswanger, Rollo May), and theology (Bultmann, Rahner, Tillich). His critique of traditional metaphysics and his opposition to positivism and technological world domination have been embraced by leading theorists of postmodernity (Derrida, Foucault, and Lyotard). (http://www.iep.utm.edu/heidegge/)

Heidegger gives neither preface nor explicit justification for employing this "new" approach as he nears the end of his philosophical musings in mortality, but there is much we can infer regarding his possible motives by examining Plato's use of dialogue and within Heidegger's text itself. As with Plato's dialogues: 1) we are dropped into a conversation already in progress; 2) Heidegger (like Plato) is not a participant in the conversation; 3) he is not even narrating some actual or specific conversation as such; 4) he gives no accounting or explicit explanation for employing this method.

Having identified *how* these two went about saying something, we must also infer the *why* of it. What motivated these two philosophers to defer to dialogue and why do neither of them explicitly account for it? Let's consider the content and context of each dialogue. In "*Conversation on a Country Path about Thinking*" from *Discourse on Thinking* as the title indicates, Heidegger is discussing "thinking" or more specifically, he is probing for the "essence of thinking" in order to shed light on the quintessential nature of man. In *Lysis* and *Symposium*, Plato seeks to disclose the most essential—or greatest—good in order to cultivate human nature. Of acute interest to me—and in my opinion what answers the *why,* is the way in which dialogue permits each of these philosophers to address the relentless ambiguity and disconcerting paradoxes that always accompany any discussion of the presumably inescapable binary aspect of things.

I think Heidegger, after a lifetime of developing and defending his perspective, recognized that Plato's use of dialogue permitted him to fully develop many lines of thought before settling on what is believed to be *his* opinion. For example, we can assume that when Socrates speaks, we are also hearing the fully developed thoughts of Plato himself. I will also be assuming that when we hear from other members of Plato's dialogues that we are essentially

listening to the prevailing notions of his day and the questions either Plato asked himself to challenge his own thinking and/or the criticisms of others regarding his ideas about the world and human nature. I would even argue that, like Plato's dialogues, every aspect of Heidegger's work is intentional—infused with meaning. Why does the conversation take place on a country path? Why does the conversation in Symposium occur in the dark of night and reach its climax as the dawn breaks and the cock crows? Because meaning and enlightenment come at the crossroads, where night becomes day, where disciplines and opinions collide and interrelate. The country path is a winding road. Every dip and bend in the road offers a new perspective. It is significant and no doubt intentional on Heidegger's part that the conversation takes place not in the scientist's lab, not in the scholar's office, nor in the teacher's classroom, but on a country path. Whatever his intentions may have been, he leaves it for us to infer and, yes, I would assert, that too is intentional on his part.

Heidegger follows Husserl's[21] lead in developing a perspective that would transcend the two prevailing opposing camps of their day, the empirical scientific realism of the positivists[22]

[21] Edmund Husserl (1859-1938) was a mathematician, physicist and philosopher. He completed his doctorate dissertation on the theory of the calculus of variations before completing another degree in philosophy where he considered the philosophy of arithmetic. *Logische Untersuchungen* (*Logical Investigations*) was published in two parts, and is an introduction to his concept of phenomenology. In 1913 he published the quintessential piece, Ideas: A General Introduction to Pure Phenomenology, introducing his phenomenological reduction — an intuitive method of contemplating objects while observing the meanings and reflections the mind deploys to describe them. Due to the nature of such reflection, the object of contemplation need not be physically present; for Husserl the method involves the setting aside of real existence and concerning oneself with the "bracketing of existence," or the observing of what it means that something appear as a true phenomenon within "the objective world". These studies led Husserl to conceive and analyze detailed descriptions of mental structures involved in the perception of objects. Husserl came to the conclusion that consciousness requires an object for contemplation; it is a descriptive discipline that should strive for the description of "things in themselves," as opposed to the invention of theories. (http://www.egs.edu/library/edmund-husserl/biography/)

[22] Logical Positivism is a position propagated by the Vienna Circle (1922) that insists: The only meaningful philosophical problems are those that can be solved by logical analysis (elementary propositions that are either tautological—true in every possible interpretation—or empirically verifiable). As such, logical positivism rejected metaphysics, theology and sometimes ethics as meaningless.

and the noumenal realism of Kant.[23] Borrowing from the Greek word, alethia or Truth, Heidegger describes essential truth as being so ripe with meaning—potential, intention, relative perspectives—that any attempt to disclose some aspect of its essence would necessitate a simultaneous concealment of some other aspect of itself. In this way, Heidegger avoids "either/or" arguments by providing a framework in which two opposing notions of reality are both "correct" and yet neither are absolutely "True." Furthermore Heidegger will have said that insomuch as correct statements regarding a given phenomenon contradict one another, we have not yet understood the true nature of that phenomenon or as Hufford discovered with the Old Hag, we have misclassified it.

I believe it is for this reason Heidegger employs the various perspectives of Scientist, Teacher and Scholar in "*Conversation on a Country Path about Thinking*." The dialogue opens with the scientist being concerned about the teacher's statement—a statement which is not given by the way—concerning man's nature not being a question about man (Heidegger 1966, 52). For the scientist, this is perplexing and impossible because he recognizes only those aspects of man which are observable and measurable. Indeed, if left to our common sensory apparatus, we *must* look to man to disclose this particular aspect of what a man actually is. The teacher however is concerned with a more rigorous inquiry and challenges, "I only said that the question concerning man's nature makes a *consideration whether this is the case* unavoidable" (Heidegger 1966, 52; my emphasis). In other words the teacher is merely suggesting that to consider the nature of anything we must examine what is there when we aren't looking as well as what we observe when we are looking at it. In the next line, the scientist gives the teacher that much by acknowledging, "Even so," showing his regard for at least the consideration of there being more

[23] Immanuel Kant (1724-1804), one of the most influential philosophers of all time, is best known for his landmark work *The Critique of Pure Reason* which contributed significantly to Western notions of metaphysics and epistemology. His work influenced nearly every philosophical movement that followed him.

to man's nature than meets the eye, but goes on to say, "it is a mystery to me how man's nature is ever to be found by looking away from man." demonstrating the general disinterest and mistrust science holds for the mysterious. The teacher, on the other hand, embraces the complexity as a necessary step towards any kind of real understanding about the actual nature of man not just what appears or seems to our senses to be our nature. The teacher understands that everything must have at least two aspects, the seen and unseen aspects which make up the whole. And so the teacher responds to the scientist, "It is a mystery to me too; so I seek to clarify how far this is possible," in other words, yes it's a mystery which is precisely why it demands our attention to whatever degree possible. Then he adds, not only must we "seek to clarify how far this is possible," but also how far this may be *necessary* (Heidegger 1966, 52; my emphasis). The scientist is outraged at the paradox, "To behold man's nature without looking at man!" To this the teacher simply replies, "Why not?" George Bernard Shaw, in his work *Back to Methuselah: A Metabiological Pentateuch* said, "I hear you say, 'Why?' Always, 'Why?' You see things; and you say, 'Why?' But I dream things that never were; and I say 'Why not?'" (Shaw 1946, 6).

Ironically, the premier scientific icon of our era, Albert Einstein, seems to concur with the teacher in saying, "The most beautiful experience we can have is the mysterious—the fundamental emotion which stands at the *cradle* of true art and true science" (Einstein 1949, 7; my emphasis). In this lies the strength of phenomenology. Rather than privileging either the "known" or the "unknown" it permits us to examine the relationship *between* these two aspects or the know-*ing* we could say. Lao Tzu, in the Tao Te Ching XLII, effectively describes this kind of relational ontology, "The Tao [or we could say Alethia, Truth or that which is most essential] begets One; one begets two; two begets three; three begets all things. All things carry the yin on

their front and the yang on their back and are harmonized by the immaterial breath (ch'i) (Perry 1971, 23). This idea of one aspect being before us or within our view and the other aspect being at our backs—out of view but nevertheless *there*—is useful and is enhanced by Heidegger's notion of disclosure and concealment.

Socrates' closing remarks in the Symposium are of interest here. After determining Love to be the most essential being in existence and a long night of drinking and attempting to disclose the nature of Love from the various perspectives of each man present, by dawn all have fallen asleep or left except Agathon, Aristophanes, and Socrates. Aristodemus wakes just as the dawn was about to break. He finds the three drinking and Socrates talking to them though,

> Aristodemus couldn't remember exactly what they were saying—he'd missed the first part of their discussion, and he was half-asleep anyway—but the main point was that Socrates was trying to prove to them that authors should be able to write both comedy and tragedy: the skillful tragic dramatist should also be a comic poet. He was about to clinch the argument, though, to tell the truth, sleepy as they were, they were hardly able to follow his reasoning. In fact, Aristophanes fell asleep in the middle of the discussion, and very soon thereafter, as day was breaking, Agathon also drifted off. (Cohen, Curd and Reeve 2005, 330)

And so the seemingly anticlimactic closing paragraph of the Symposium puts us to sleep as well unless we really consider what Socrates was trying to say. It has been said that tragedy demonstrates the smallness of the individual in light of the universal or divine perspective, whereas comedy demonstrates the smallness of the universal in relation to the individual perspective. So what is the significance of only the comedian, and the tragedian being still awake for Socrates' concluding remarks? I think Socrates was trying to illustrate that to understand what is most essential we must view both the universal and particular aspects of the world together. That to view one aspect in isolation necessarily conceals the other. I would further suggest that this is the reason Plato and Heidegger employ dialogue as a means of dropping into a multiplicity of correct perspectives at once thereby holding up multiple and varied disclosures

alongside each other and allowing a "mysterious" understanding to somehow *emerge* from the relationship *between* the various conversations. As I mentioned in the introduction, Plato bans myth and poetry from Athens in the *Republic*, not because he thinks they are erroneous or malevolent, but because he believes them to mislead mediocre minds. In fact, Plato considers myth and poetry to be true, albeit *allegorical*, accounts of reality.

I would further argue, that Plato was seeking a balance between myth and logic; that because the pendulum had swung so far to the left, he was emphasizing philosophy as a shift towards the right but never really intended to do away with the less visible poetry on our backs so much as he wanted to draw attention to the world in plain view before us. I would also suggest that the pendulum had come full right in postmodern western thinking and that Heidegger and others were essentially making a shift towards the left in search of a more balanced perspective.

Throughout *Lysis* and *Symposium* this theme is presented continuously and indeed seems to be *the* point Plato is trying to make. I have mentioned only a few examples to demonstrate how this notion of relational ontology is found throughout Plato's work and how liberally he applies it to almost every conversation. Underlying *Lysis* and *Symposium* is the question of how we may come to know anything. *Lysis* is a quest to discover how love works whereas the *Symposium* concerns itself with illuminating the nature of love. In both cases, many logical and "correct" notions are presented but because the objective is to get at the Truth of the matter and not just to be "right" they must reach beyond the limitations of rhetoric and logic and seek a different kind of knowing to guide their conversations. The Greeks recognized two types of thinkers, *elengchein*, someone who questions and probes to get at what is actually true—Socratic elenchus—and *eristikos*, someone who practices the sort of argument that aims at scoring points against an opponent, rather than discovering the truth (Cohen, Curd and Reeve 2005, 525-527). It

goes without saying that Heidegger, like Plato was more interested in getting at the truth than simply being right. In the memorable words of the fictional character Lord Frith (the sun god from Richard Adam's 1972 story book *Watership Down*), "What *is*, is what must be."

In *Lysis*, there is an argument, based in human experience and opinion that to love is to be loved back, something we have all experienced in some way and know to be a "correct" statement, but is it "true" becomes the question. "So there are no horse-lovers unless the horses love them back…and no wine-lovers, or exercise-lovers. And no lovers of wisdom, unless wisdom [itself] loves *them* in return" (Reeve 2006, 12; my emphasis). Then comes the contradiction—which is also "correct" and equally supportable by human experience—and yet "…one is frequently a friend of a non-friend…" (Reeve 2006, 13). To these contradictions Socrates responds, "I think you are right, Lysis, to say that if we were looking at things in the right way, we wouldn't be so far off course. Let's not go in that direction any longer. That line of inquiry looks like a rough road to me. I think we better go back to where we turned off, and look for guidance to *the poets, the ancestral voices of human wisdom*." Socrates then asks Lysis if he thinks the ancient philosophers and poets were right in their reasoning about nature and the universe, to which Lysis replies, "Maybe." Socrates' next response is significant, "Maybe half of it…maybe even *all of it*, but we don't understand it. To our way of thinking," (Reeve 2006, 14; my emphasis) it seems implausible. In *Symposium*, Dionysus[24] instructs us that to be truly conscious we must become drunk, that to obtain wisdom we must be mad. In "*Conversation on a Country Path about Thinking*," Heidegger calls it a "releasement" from our willful judgments or

[24] Dionysus is the god of the grape harvest, winemaking, wine, of ritual madness, fertility, theatre and religious ecstasy in Greek mythology and later considered a patron of the arts. He invented wine and spread the art of tending grapes. He has a dual nature, on the one hand bringing joy and divine ecstasy, on the other brutal, unthinking rage. He is the only god to have a mortal parent. When an angry Hera tricks Zeus into killing Dionysus' mother, Zeus manages to rescue the fetus, stitching Dionysus into his thigh to hold him until he was ready to be born. By virtue of being born of Zeus, alone, he is immortal and therefore a god rather than a demi-god. (http://www.greekmythology.com/Other_Gods/Dionysus/dionysus.html)

a "letting-be" which he describes as active passivity or we could say a mindful mindlessness rather than common apathy (Heidegger 1966, 53).

In his work, *Lysis, Plato on Love,* C.D. Reeve—in true Heideggerian fashion I might add—looks at the etymology behind Socrates' claim to knowing the Art of Love. "The only thing I say to know," Socrates tells us in *Symposium*, "is ta erotica" (177d8-9). What is he claiming to know? (neuter plurals imply "the art or craft of" like ta phusika (physics) and ta politika (statesmanship) [so] …the noun eros (love) and the verb erotan (to ask questions) seem to be etymologically connected—something explicitly mentioned in *Cratylus* (398c5-e5). Socrates knows about the art of love [or anything for that matter] in that—but just insofar as—he knows how to ask questions, how to converse elenctically (Reeve 2006, xix-xx). Furthermore, in *Lysis*, Socrates informs us about this critical aspect of thinking and knowing as he cautions, "Those who are already wise no longer love wisdom (philosophein), whether they are gods or men. Nor do those who are so ignorant that they are bad, for no bad and stupid man loves wisdom. There remain only those who have this bad thing, ignorance, but have not yet been made ignorant and stupid by it. They are conscious of not knowing what they don't know (Reeve 2006, 19), reiterating Heidegger's concepts of "releasement" and "letting-be." Students of Heidegger would further develop this notion distinguishing the know-*ing* from the known and the see-*ing* from the seen.

Though the scientist in Heidegger's "*Conversation on a Country Path about Thinking*" is at first almost hostile regarding any kind of serious investigation into that which is not "present," he comes to realize that to "look" at these other aspects of man's nature entirely, requires us to "look *away*" if we are to see the subjective reality behind an object and not be distracted by its more obvious characteristics. Ultimately he comes to realize the limitations of scientific inquiry

alone and recognizes that what is required is a "non-willing in the sense of a renouncing of willing [it is not clear what Heidegger intended by 'willing' but within this context we could say 'remove preconceived judgments and expectations' so far as it is possible to do so], so that through this we may release, or at least prepare to release, ourselves for the sought-for essence of thinking that is not a willing" (Heidegger 1966, 52-53). With great enthusiasm the scientist confesses, "Ever more openly I am coming to trust in the inconspicuous guide who takes us by the hand—or better said, by the word—in this conversation" (Heidegger 1966, 53). And later, the scientist, almost intoxicated and bewildered confides, "In many respects it is clear to me…But at the same time, I know less and less…" and later when the teacher asks if he has forgotten what he had said in an earlier conversation, he replies, "Forgetfulness does seem to be an especial danger in such conversations." reiterating once again this idea of a necessary state of forgetful-awareness.

While I am certain that these ideas require further development, I hope that I have at least brought forth compelling corollaries between the methods and insights of Plato and Heidegger and shown how their view of the world is essential to any meaningful epistemological endeavor regardless of discipline, culture, or faith. In other words, whether we are considering Love-Strife, Myth-Science, Mind-Matter, Rhyme-Reason, the ordinary senses only perceive the Yin on our fronts. Finer sensibilities and diverse methods are required to disclose the more ambiguous yang on our backs. In this way, Heidegger and Plato, together with Hufford seem to regard an interdisciplinarity approach to understanding the nature of existence integral.

Einstein, Bohr, Heisenberg, Schrödinger and Dirac on Analysis *and* Synthesis; Logic *and* Intuition

While Albert Einstein, Niels Bohr, Werner Heisenberg, Erwin Schrödinger and Paul Dirac[25] are typically recognized for their various descriptions of the nature and disposition of matter, in this chapter, I will be focusing primarily on the collective philosophy they developed in order to begin to unlock the secrets of the atom and to somewhat satisfy the breach between classical and quantum descriptions of nature. Since the point of my thesis is to justify an operative interdisciplinary model where scholars from all disciplines might engage in meaningful discourse that illuminates the multifarious aspects of necessary opposition—in effect, a dialogue that enlarges each discipline's description of what it means to exist—I will only include enough of their ideas to establish that, while science generally does not look to tradition (and only cursorily to philosophy) as a viable resource, there indeed exist noteworthy scientific scholars who have adopted comparable approaches to binary phenomena as Hufford, Heidegger and Plato did. To be specific, I will be including only these scientists' ideas on: 1) the simultaneous "disclosure and concealment" of studied phenomenon; 2) an integrated approach to understanding atomic structure; 3) the utility—even necessity—of intuition and the inherent limitations of logic in scientific discovery.

Though these scientists did not agree on every point and indeed drew various conclusions, they generally agreed that the insights of many (if not all) disciplines and traditions were requisite to even approach the seemingly mystical relationship between the two opposing aspects of the electron—though each aspect was straightforward when considered independently. In other words, the problem of the electron demanded analysis *and* synthesis, logic *and* intuition in order to disclose the electron's (conventionally considered as matter) or light's (conventionally seen as energy) unavoidably two fold nature. In fact, when electrons or light are

[25] These men are five of the first and most notable theoretical physicists who helped define and develop the field throughout the first half of the twentieth century.

passed through a barrier with a single slot against a backdrop, there will be a corpuscular (particular) signature. However, if the same electrons or light are passed through the same barrier with *two* slots against the same backdrop, there will be an undulatory (wavelike) signature. Faced with such a paradox, these scientists found themselves apparently beyond the confines of logic and in need of metaphysical insight. The prevailing notion in the science of their day that had made "objective" experiment the authority had been fundamentally challenged by the ambiguous character of the electron itself, in that the condition of the electron seemed to depend on the very instruments of experiement and observation.

Heisenberg explains, "Science no longer is in the position of observer of nature, but rather recognizes itself as part of the interplay between man and nature. The scientific method [itself]... changes and transforms its object: the procedure can no longer keep its distance from the object." (Heisenberg 1960, 231) and on another occasion, "…separation of the observer from the phenomenon to be observed is no longer possible" (Scully 2007, 3). The conundrum of the electron's seemingly dual nature led Heisenberg, Bohr (although Bohr would later alter the very definition of "phenomena" and "experiment" in order to maintain a more positivist footing) and others (indeed the majority of present-day quantum physicists) to what would be called the *Copenhagen Interpretation* of quantum mechanics. Heisenberg's interpretation essentially concedes that sub atomic particles (and light) are both a wave of energy and a particle at once (or we could say neither a wave of energy nor a particle); that their existence is observer dependent. This condition means that when we attempt to observe a particle's location in space, its velocity cannot be accurately predicted and likewise, if one measures a particle's velocity, its location can no longer be reliably predicted. Heisenberg asserts, "The conception of objective reality ... has thus *evaporated* ... into the transparent clarity of mathematics that represents no longer the

behavior of particles but rather our knowledge of this behavior" (Popper 1992, 85; my emphasis). While Heisenberg and Bohr are aligned on the fundamental uncertainty (although Bohr later avoids this terminology) of the electron in space and time, Schrödinger and Einstein reject this interpretation and insist on a more determinate scheme where the electron can be explained (at least in some *possible* physics) in terms of space-time, meanwhile Dirac seems rather disinterested and puts his "faith" in mathematical "beauty" as the guiding principle that would eventually lead to a complete understanding of atomic processes, all of which will be elaborated in the following paragraphs which I have dedicated specifically to each man's comments on the matter.

Despite considerable variation in the details of their opinions, I will be considering the theoretical physicists of the turn of the twentieth century as a folk group.

> "What Is Folklore?" Dundes disputes the notion that "folk" should be automatically identified with peasant or rural groups, or with people from the past. He argues that contemporary urban people also have folklore and suggests that rather than dying out, folklore is constantly being created and recreated to suit new situations. (Dundes, 1965, 2) Dundes defines folk group as "*any group of people whatsoever* who share at least one common factor." (Dundes 1965, 2) It does not matter what the linking factor is—it could be a common occupation, language, or religion-but what is important is that a group...have some traditions that it calls its own. (Dundes, 1965, 2) Oring (1984) reduced even further the size of the potential folk group by showing how rich can be the folk culture of a high-context dyad, a folk group consisting of only two [or very few] people. (Mechling 2006, 435)

I assert that these men, though widely dispersed across the globe in a time when both travel and communication were slow, developed a common language, culture and an essentially common view of the world. I will also be considering the following quotes[26] as a collection of the folk belief of this group. Many of the quotes are from letters[27] which can only be considered as

[26] I acquired many of the aforementioned quotes from http://todayinsci.com/home.htm before confirming them in printed sources.

[27] See Jennifer Eastman Atteberry's work on immigrant letters, *Up in the Rocky Mountains*, which establishes correspondence as a form of folklore.

conversations between the members of this widely dispersed folk group. These personal narratives and memorates, which have indeed become part of the collective narrative of that folk group even today, must be seen as at least somewhat comparable to the informal interactions of more traditional folk groups. Nearly all of the quotes are from either their personal reflections or as remembered and recorded by another member of the folk group. As with all folk belief there are both conservative and dynamic elements. While I will be focusing primarily on the conservative elements which align with my declared thesis, I will also provide some relevant commentary regarding the dynamic elements or the points at which their beliefs diverge. The reasons for this include; avoiding over-generalizing their work and a purpose (the utility of dynamic elements when we assume symmetry) which will become clearer in the chapters to follow. With that said, I will now present their respective accounts of disclosure and concealment, the compulsory integration of various disciplines and traditions and the utility and necessity of subjective experiences such as intuition and beauty in order to determine and describe atomic processes.

Werner Heisenberg specifically, in his 1958 *Physics and Philosophy: The Revolution in Modern Science*, addresses the suitability of an integrated approach to scientific discovery acknowledging,

> It is probably true quite generally that in the history of human thinking the most fruitful developments frequently take place at those points where two different lines of thought meet. These lines may have their roots in quite different parts of human culture, in different times or different cultural environments or different religious traditions: hence if they actually meet, that is, if they are at least so much related to each other that a real interaction can take place, then one may hope that new and interesting developments may follow. (Haisch, 2009, 160)

In addition to drawing on other insights he also admits (as mentioned earlier) the inadequacy of the scientific method alone to describe nature, conceding,

> What we observe is not nature *itself* but nature exposed to our method of questioning. Our scientific work in physics consists in asking questions about nature in the language that we possess and trying to get an answer from experiment by the means that are at our disposal. (Heisenberg 1958, 78; my emphasis)

The use of "nature *itself*" will become important in the following chapters. For now I merely draw attention to Heisenberg's belief that what we observe is not nature *itself*. Einstein often puzzled, "but what is there when we are not looking?" Incidentally, the correlation between this kind of rationale and the teacher's initial query in Heidegger's *Conversation on a Country Path about Thinking* is self-evident and will be further explored later in this thesis.

In an earlier paper in 1949, Heisenberg expresses the inadequacy of language (common or scientific) to describe what nature is doing at the atomic level. He believes mathematics is the language best suited to describe the fundamentally binary processes of the atom. While traditional accounts of nature defer to metaphor and analogy rather than mathematics, I would argue the reasoning is the same. Heisenberg explains the confines of language and the way that mathematics (like allegories) provide an alternative "vocabulary" that make, at least, an *abstract* description of reality possible,

> It is not surprising that our language should be incapable of describing the processes occurring within the atoms, for, as has been remarked, it was invented to describe the experiences of daily life, and these consist only of processes involving exceedingly large numbers of atoms. Furthermore, it is very difficult to modify our language so that it will be able to describe these atomic processes, for words can only describe things of which we can form mental pictures, and this ability, too, is a result of daily experience. Fortunately, mathematics is not subject to this limitation, and it has been possible to invent a mathematical scheme—the quantum theory—which seems entirely adequate for the treatment of atomic processes; for visualization, however, we must content ourselves with two incomplete analogies—the wave picture and the corpuscular picture. (Heisenberg 1949, 11)

In a letter to Albert Einstein, Heisenberg unapologetically admits the allure of beauty and simplicity as reliable indicators of fundamental truth,

> You may object that by speaking of simplicity and beauty I am introducing aesthetic criteria of truth, and I frankly admit that I am strongly attracted by the simplicity and beauty of mathematical schemes which nature presents us. You must have felt this too: the almost frightening simplicity and wholeness of the relationship, which nature suddenly spreads out before us. (Stewart 2007, 278)

Finally, in reference to the unfathomable 'properties' of the electron, Heisenberg makes a comment of profound interest, especially in light of Malson's previously stated definition of myth being "the expression of unobservable realities in terms of observable phenomena." (Leach 1962, 34) Heisenberg, in a rather matter-of-fact tone informs us,

> It seems sensible to discard all hope of observing hitherto *unobservable* quantities, such as the position and period of the electron…. (Kragh 1999, 161; my emphasis)

Suggesting once again that an abstract glimpse of these "unobservable" realities by means of pure mathematics and the theoretical narrative they provide are perhaps our only hope of conceptualizing how the electron exists.

In reference to Heraclitus'[28] "world in common," **Erwin Schrödinger**—father of wave mechanics—believed that this world in common is discovered through observation in combination with insights of a metaphysical nature—hunches, spontaneous creative thought, and the like—that guide the interpretation of the observations. He also believed that the only way to achieve a complete world picture is to take account of nonscientific as well as scientific knowledge; that to obtain a comprehensive view of the world, one requires the union of all knowledge, the insights achieved in *all* disciplines.[29]

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[28] Heraclitus (c. 540-480BC) was a pre-Socratic ancient Greek philosopher who perceived that all things share a common origin in what he calls *logos* which for Heraclitus is evidently a kind of voice or vibration of some kind. "This *logos* holds always but humans always prove unable to understand it, both before hearing it and when they have first heard it. For though all things come to be [or, happen] in accordance with this *logos*, humans are like the inexperienced when they experience such words and deeds as I set out, distinguishing each in accordance with its nature and saying how it is…For this reason it is necessary to follow what is common. But although the *logos* is common, most people live as if they had their own private understanding." (Cohen, Curd and Reeve 2005, 25)

[29] http://www.project2061.org/publications/sfaa/online/chap1.htm

In regards to incorporating all insights into a comprehensive framework (and in opposition to the Copenhagen interpretation or probability theories generally), Schrödinger explains in a letter to Willy Wien[30] August 25, 1926,

> Physics does not consist only of atomic research, science does not consist only of physics, and life does not consist only of science. The aim of atomic research is to fit our empirical knowledge concerning it into our other thinking. (Moore 1989, 226)

For Schrödinger, all thinking must form a comprehensible unity. While the folks in Copenhagen were satisfied with a non-deterministic model, Schrödinger preferred to think of all inconsistencies (the dual nature of the quantum, spontaneous generation, evolution and so on) in nature as the intersecting of causal chains. In fact, it becomes clear in his book *Meine Weltansicht* which was published after his death, the extent to which he was influenced by his study of Vedanta.[31] Through this traditional lens and inspired by the ideas of Max Delbruck,[32] in 1944 Schrödinger writes a book titled *What is life?* where he suggests that similarly to quantum mechanics, heredity too must be a case of "order-from-disorder". In this way, he is able to make several seemingly counterintuitive assumptions such as, the mechanism responsible for heredity must contain a small number of atoms and be persistent across time—a description which cannot be explained by classical physics but relies on a quantum understanding of micro-biological processes. Relating the quantum conception of the diffusion of particles in a solution, to mutation, he suggests that genes, if viewed as a molecule comprised of aperiodic crystals, allow

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[30] Wilhelm Carl Werner Otto Fritz Franz Wien (1864-1928) was a German physicist who used theories about heat and electromagnetism to deduce *Wien's displacement law*, which calculates the emission of a blackbody at any temperature from the emission at any one reference temperature. He also formulated an expression for the blackbody radiation which is correct in the photon-gas limit. His arguments were based on the notion of adiabatic invariance and were instrumental for the formulation of quantum mechanics. Wien received the 1911 Nobel Prize for his work on heat radiation. (http://en.wikipedia.org/wiki/Wilhelm_Wien)

[31] "The goal of Vedanta is for the seeker to have the direct experience of his or her true nature…Vedanta also teaches that we are all members of a single family and that our differences are merely superficial." (http://vedantadc.org/what-is-vedanta)

[32] According to Delbrück's model, quantum physics made it possible to understand general persistence as well as the case of spontaneous mutation. (http://en.wikipedia.org/wiki/What_Is_Life%3F)

a small number of atoms to encode a nearly infinite number of possibilities. Schrödinger's interdisciplinary work "was an inspiration to the first of the molecular biologists, and has been, along with Delbruck himself, credited for directing the research during the next decade that solved the mystery of how 'like begat like'[33]" (Mullis 1997, 103).

In his new universal epistemology, Schrödinger also ventures into a philosophy of psychology as well, describing the knowing individual subject and the object of our individual knowledge as being a single, fundamentally irreducible, complementary *real* unit. He insists,

> The world is given to me only once, not one existing and one perceived. Subject and object are only one…[Explaining] Consciousness cannot be accounted for in physical terms. For consciousness is absolutely fundamental. It cannot be accounted for in terms of anything else… [He continues,] The world is a construct of our sensations, perceptions, memories. It is convenient to regard it as existing objectively on its own. But it certainly does not become manifest by its mere existence. (Schrödinger 1967, 11)

While Schrödinger insists on the reality of the subjective experience in space and time, he is in no way suggesting that objective reality is an illusion. He recognized that any serious investigation of the nature of existence demands a sincere dialogue with *all* disciplines, especially those that specifically address "subjective" experience.

In a letter to Einstein written June 13, 1946 regarding the way the uncertainty principle would conceal or at least undermine the actual description of existence by altering our idea of what is knowable, Schrödinger chides,

> I am no friend of probability theory; I have hated it from the first moment when our dear friend Max Born gave it birth. For it could be seen how easy and simple it made everything, in principle, everything ironed and the true problems concealed. Everybody must jump on the bandwagon [Ausweg]. And actually not a year passed before it became an official credo, and it still is.[34]

[33] Referring to Watson and Crick's discovery of the double helix molecule structure of which DNA is comprised.
[34] http://politicalquotes.org/node/62190

Schrödinger also enjoyed drawing attention to examples of ancient wisdom preceding scientific discovery and admitting the limitations of common logic and alleged objective perception, pointing out things like,

> Plato was the first to envisage the idea of timeless existence and to emphasize it—*against reason*—as a reality, more [real] than our actual experience…. (Scully 2007, 3)

One of Paul Dirac's most beloved anecdotes which he often shared regarding the propensity of pure mathematics was the way Schrödinger's original equations describing the wave model of quantum mechanics accounted for the spin of the electron, something unknown at the time he "discovered" the equation. Though it seemed to Schrödinger to be a discrepancy for which he actually developed a solution, in truth his equation instinctively described a specific aspect of the electron unbeknownst (to borrow Lévi-Strauss' expression) to him—or anyone else for that matter—at the time.

Niels Bohr, in the Introduction to *International Encyclopedia of Unified Science Vol. 1* entitled *Analysis and Synthesis in Science*, outlines the role of interdisciplinary scholarship this way,

> Notwithstanding the admittedly practical necessity for most scientists to concentrate their efforts in special fields of research, science is, according to its aim of enlarging human understanding, essentially a unity. Although periods of fruitful exploration of new domains of experience may often naturally be accompanied by a temporary renunciation of the comprehension of our situation, history of science teaches us again and again how the extension of our knowledge may lead to the recognition of relations between formerly unconnected groups of phenomena, the harmonious synthesis of which demands a renewed revision of the presuppositions for the unambiguous application of even our most elementary concepts. This circumstance reminds us not only of the unity of all sciences aiming at a description of the external world but, above all, of the in-separability of epistemological and psychological analysis. It is just in the emphasis on this last point, which recent development in the most different fields of science has brought to the foreground, that the present great undertaking distinguishes itself from that of previous encyclopedic enterprises, in which stress was essentially laid on the completeness of the account of the actual state of knowledge rather than on the elucidation of scientific methodology. It is therefore to be hoped that the forthcoming *Encyclopedia* will have a deep influence on the whole attitude of our generation which, in spite of the ever

> increasing specialization in science as well as in technology, has a growing feeling of the *mutual* dependency of *all* human activities. Above all, it may help us to realize that even in science any arbitrary restriction implies the danger of prejudices and that *our only way of avoiding the extremes of materialism and mysticism is the never ending endeavor to balance analysis and synthesis.* (Bohr 1998, 92-93; my emphasis)

To avoid unnecessary repetition I am limiting Bohr's comments here specifically to the questions of interdisciplinarity and disclosure and concealment as contained in this one quote. Because of the alleged inconsistencies in his opinions over time and because his philosophy of necessary opposition will be addressed forthwith, I will reserve his notion of complementarity and its bearing on existence and the reality of experience for chapter III.

Paul Dirac was initially training to be an engineer before discovering the overwhelming predisposition for pure mathematics that eventually led him to theoretical physics and the legendary contributions he would make there. However, as an engineering student, he developed an uncanny ability to mentally conceptualize and manipulate objects spatially with great ease and enjoyment. It wasn't until he arrived at Cambridge that he developed an interest in philosophy and the emerging field of quantum physics. Upon publication of Einstein's papers in 1905, Dirac felt desperate to understand step by step how Einstein arrived at his theory of special relativity. When no technical account was to be found he was obliged to look to philosophy, as the bulk of commentary on the theory was being discussed predominately in terms of philosophy. This was the first time Dirac had given any attention to philosophy or tradition but this experience and a later course in ancient Greek philosophy—particularly the pre-Socratics and their idea of beauty[35] being truth—seems to have set Dirac on an undeviating course in search of "beautiful" mathematics that would guide and typify his work from his early twenties until he passed away

[35] Pythagoreans believed there to be a strong correlation between beauty and truth and Plato viewed beauty as the highest idea or form, in other words, the most essential, more than all other ideas or forms. These are thought to be the earliest Western theories on beauty.

at 82. At age 78, just four years before his death, Dirac unwaveringly and unapologetically maintained,

> A good deal of my research in physics has consisted in not setting out to solve some particular problem, but simply examining mathematical equations of a kind that physicists use and trying to fit them together in an interesting way, regardless of any application that the work may have. It is simply a search for pretty mathematics. It may turn out later to have an application. Then one has good luck. (Kursunoglu & Wigner 1990, 110)

Dirac spoke of his pursuit of beauty on many occasions. I will share a few more in order to illustrate just how significant this indicator of truth was for Dirac and the extent to which it permeated his thinking and directed his research. Dirac also refers to beautiful mathematics, ideas, connections and relationships as being "pretty" or "interesting." I will be considering all of these notions as evidence of the importance he placed on subjective experience, seeing it as playing an equally important role (if not eliminating the distinction altogether) to objective experience—at least in this somewhat limited yet permeating sense—in the process of discovering how anything actually exists or comes to exist. He insists,

> It is more important to have beauty in one's equations than to have them fit experiment... It seems that if one is working from the point of view of getting beauty in one's equations, and if one has really a sound insight, one is on a sure line of progress. If there is not complete agreement between the results of one's work and experiment, one should not allow oneself to be too discouraged, because the discrepancy may well be due to minor features that are not properly taken into account and that will get cleared up with further developments of the theory. (Scientific American 1963, 47)

> The mathematician plays a game in which he himself invents the rules while the physicist plays a game in which the rules are provided by nature, but as time goes on it becomes increasingly evident that the rules which the mathematician finds *interesting* are the same as those which nature has chosen. (Stewart 2007, 279; my emphasis) [At age 36]

> God used beautiful mathematics in creating the world. (Kursunoglu & Wigner 1990, xv) [Dirac does not explain what he meant by God here but it should be noted that he generally condemned organized religion.]

> Theoretical physicists accept the need for mathematical beauty as an act of faith. There is no compelling reason for it, but it has proved a very profitable objective in the past. For

> example, the main reason why the theory of relativity is so universally accepted is its mathematical beauty. (Vergnaud 2014, 36)
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> The research worker, in his efforts to express the fundamental laws of Nature in mathematical form, should strive mainly for mathematical beauty. He should take simplicity into consideration in a subordinate way to beauty ... It often happens that the requirements of simplicity and beauty are the same, but where they clash, the latter must take precedence. (Kursunoglu & Wigner 1990, 110)

His mention of *simplicity* as being a less fundamental requirement of truth will be of interest in chapter two as Levi-Strauss, Strawson and Bohr attempt to explain the necessarily opposing or paradoxical—and therefore essentially complex though unified—nature of existence at its most essential level and therefore throughout all subsequent levels of existence. It has been commonly attributed to Einstein that "[e]verything should be made as simple as possible, but not simpler." Whether Einstein actually said this or not is irrelevant. The point remains, these five physicists were agreed that while simplicity was desirable, the dual nature of the electron simply did not allow it.

At age 29, in an introduction to a paper on magnetic monopoles, *Quantised Singularities in the Electromagnetic Field*, given at Proceedings of the Royal Society of London, 1931, Dirac confidently proposes the need for an increasingly abstract description of reality this way:

> The steady progress of physics requires for its theoretical formulation a mathematics which get continually more advanced…it was expected that mathematics would get more and more complicated, but would rest on a permanent basis of axioms and definitions, while actually the modern physical developments have required a mathematics that continually shifts its foundation and gets more abstract. Non-euclidean geometry and noncommutative algebra, which were at one time considered to be purely fictions of the mind and pastimes of logical thinkers, have now been found to be very necessary for the description of general facts of the physical world. It seems likely that this process of increasing abstraction will continue in the future and the advance in physics is to be associated with continual modification and generalisation of the axioms at the base of mathematics rather than with a logical development of any one mathematical scheme on a fixed foundation. (Kragh 1990, 208)
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> [And at age 28] There are, at present, fundamental problems in theoretical physics … the solution of which … will presumably require a more drastic revision of our fundamental

> concepts than any that have gone before. Quite likely, these changes will be so great that it will be beyond the power of human intelligence to get the necessary new ideas by direct attempts to formulate the experimental data in mathematical terms. The theoretical worker in the future will, therefore, have to proceed *in a more direct way*. The most powerful method of advance that can be suggested at present is to employ all the resources of pure mathematics in attempts to perfect and generalize the mathematical formalism that forms the existing basis of theoretical physics, and after each success in this direction, to try to interpret the new mathematical features in terms of physical entities. (Kursunoglu & Wigner 1990, 109; my emphasis)

Dirac clearly feels that straightforward purely logical accounts of existence were inadequate; that alternative descriptions (math as metaphor) were needed to effectively approach and describe the smallest building blocks in nature.

Though Dirac—insofar as I was able to ascertain—does not speak directly to the need to integrate the insights of all disciplines, he indirectly demonstrates having personally done so in a most essential way, exhibiting a balanced approach from his earliest efforts until his passing.

Albert Einstein is of particular interest because not only is he (like the others) trying to solve the "problem" of the electron and existence at its most essential level, but he is also somewhat *responsible* for the problem. It was his theories of light consisting of packets of energy and relativity that largely created the new world view. Because epistemology and theory knowledge can be viewed as synonymous, we can say that the quantum theory of relativity revolutionized the rules whereby physicists may come to understand the natural world. Lawrence M. Krauss explains the situation this way,

> Science has taught us to think the unthinkable. Because when nature is the guide—rather than *a priori* prejudices, hopes, fears or desires—we are forced out of our comfort zone. One by one, pillars of classical logic have fallen by the wayside as science progressed in the 20th century, from Einstein's realization that measurements of space and time were not absolute but observer-dependent, to quantum mechanics, which not only put fundamental limits on what we can empirically know but also demonstrated that elementary particles and the atoms they form are doing a million seemingly impossible things at once. (Krauss 2012)

Einstein often admitted that not one of his ideas came from logic. He insisted that all of his greatest discoveries (namely his conviction that nature and its laws are unified in some way) came to him intuitively (sometimes spontaneously but often following intense deliberation over a curiosity he had noticed or wondered about, for example imagining that he was travelling alongside a beam of light and so on) at which point he attempted to prove them logically. He firmly believed that if one could acquire a true idea about the essential nature of things intuitively then one could deduce every other idea about it accurately from there. In 1920, he explains the relationship between theoretical and empirical knowledge; the abstract and the concrete and what can be known suggesting,

> As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality. (Einstein 2004, 28)

Einstein described his criteria for establishing the closest relationship between theory and reality saying,

> A theory is the more impressive the greater the simplicity of its premises, the more different kinds of things it relates, and the more extended is its area of applicability. (Holton and Elkana 1997, 227)

This statement can be seen as an indirect commentary on methodological symmetry as it states that an impressive theory extends the area of applicability beyond the context or discipline from which it originates. It also speaks to the idea of phenomenological symmetry in that it recognizes that the degree to which a theory is considered impressive is determined by how many different kinds of things or phenomena it can relate.

Regarding the notion that to disclose any single aspect of something simultaneously conceals or blinds us to other aspects of that same thing, Einstein humbly confesses in a letter to a layman who had inquired about the pursuit of truth, February 13, 1934,

> As for the search for truth, I know from my own painful searching, with its many blind alleys, how hard it is to take a reliable step, be it ever so small, towards the understanding of that which is truly significant. (Dukas and Hoffman 1981, 18)

Concerning the way energy and matter only *seem* different, he later—in a 1979 Nova Television production—explains the relative nature of (the relationship between) these two phenomena saying,

> It follows from the theory of relativity that *mass and energy are both different manifestations of the same thing*—a somewhat unfamiliar conception for the average man. Furthermore $E=MC^2$, in which energy is put equal to mass multiplied with the square of the velocity of light, showed that a very small amount of mass may be converted into a very large amount of energy... the *mass and energy were in fact equivalent*. (Calaprice 1996, 183; my emphasis)

In chapter IV, I will further develop the relationship between Heidegger's idea of *disclosure and concealment* and Einstein's notion of *relativity*. For now, it is self-evident they were both considering the manifold aspects of a single phenomenon as being essentially equivalent.

The following statements all reflect Einstein's belief that the insights of all disciplines and traditions must be seen as relative perspectives on the same problems science was considering and that multiple perspectives were compulsory in any comprehensive description of existence:

> All religions, arts and sciences are branches of the same tree. (Einstein 1956, 9)

> It is the theory which decides what we can observe. (Heisenberg 1971, 77)

> It would be possible to describe absolutely everything scientifically, but it would make no sense. It would be without meaning, as if you described a Beethoven symphony as a variation of wave pressure. (Attributed to Einstein by Max Born. Paraphrased by Clark 1972, 243)

In the paper *Science, Philosophy and Religion*, presented in 1941, Einstein poetically asserts, "Science without religion is lame; religion without science is blind" (Calaprice 1996, 153). From a paper, *Physics and Reality*, published in the Franklin Institute Journal March 1936, Einstein

wrote, “The whole of science is nothing more than a refinement of everyday thinking” (Einstein 1956, 59).

Einstein believed that common and scientific thinking are related and therefore relatable despite the degree to which each has become grossly pronounced. Upon appointment as the first president of the Kaiser Wilhelm Society, Berlin, formed for the advancement of science in 1911, regards an interdisciplinary approach to discovery, Adolf von Harnack notes, “People complain that our generation has no philosophers. They are wrong. They now sit in another faculty. Their names are Max Planck and Albert Einstein” (Seelig 1956, 45). Hans Reichenbach also seems to have understood the necessity of an interdisciplinary approach to the conditions for existence as well when he said, “It appears that the solution of the problem of time and space is reserved to philosophers who, like Leibniz, are mathematicians, or to mathematicians who, like Einstein, are philosophers” (Schilpp 1959, 307).

In regards to subjective experience being, not only reliable but necessary to the furthering of the scientific understanding of how anything exists or comes to exist, Einstein concludes, in a letter written January 24, 1936,

> But, on the other hand, every one who is seriously involved in the pursuit of science becomes convinced that a spirit is manifest in the laws of the Universe—a spirit vastly superior to that of man, and one in the face of which we with our modest powers must feel humble. (Dukas and Hoffman 1981, 33)

On multiple occasions he reiterates this same notion explaining,

> Curiosity has its own reason for existing. One cannot help but be in awe when he contemplates the mysteries of eternity, of life, of the marvelous structure of reality. (Isaacson 2008, 548) [As recalled by editor William Miller in *Life* magazine, May 2, 1955]

> How can it be that mathematics, being after all a product of human thought which is [subjective experience and supposedly] independent of [objective] experience, is so admirably appropriate to the objects of reality? (Einstein 1949, 24-28) [From an address to the Prussian Academy of Sciences in Berlin January 27, 1921]

> I believe in intuition and inspiration. Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution. It is, strictly speaking, a real factor in scientific research. (Einstein 1931, 97)
>
> It must be conceded that a theory has an important advantage if its basic concepts and fundamental hypotheses are 'close to experience,' and greater confidence in such a theory is certainly justified. There is less danger of going completely astray, particularly since it takes so much less time and effort to disprove such theories by experience. Yet more and more, as the depth of our knowledge increases, we must give up this advantage in our quest for logical simplicity in the foundations of physical theory…. (Levy 1950, 19)

Once again assuming a relativistic perspective, Einstein logically concludes: "Epistemology without contact with science becomes an empty scheme. Science without epistemology is—insofar as it is thinkable at all—primitive and muddled" (Keyes 2006, 51-52).

In a January 19, 1936 letter written in response to a sixth grader from a New York City Sunday School asking if scientists pray, Einstein's thoughtful reply reads,

> …it must be admitted that our actual knowledge of these laws is only imperfect and fragmentary, so that, actually, the belief in the existence of basic all-embracing laws in Nature also rests on a sort of faith. All the same this faith has been largely justified so far by the success of scientific research. (Dukas and Hoffman 1981, 32-33)
>
> The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advances in science. (Einstein and Infeld 1938, 92)

As stated to *Forbes* magazine September 15, 1974, he explains,

> The intellect has little to do on the road to discovery. There comes a leap in consciousness, call it intuition or what you will, and the solution comes to you and you don't know why or how. (Chang 2006, 179)
>
> The mind can proceed only so far upon what it knows and can prove. There comes a point where the mind takes a higher plane of knowledge, but can never prove how it got there. All great discoveries have involved such a leap. (Clark 1972, 755)
>
> The most beautiful emotion we can experience is the mystical. It is the power of all true art and science. He to whom this emotion is a stranger, who can no longer wonder and stand rapt in awe, is as good as dead. ["*his eyes are closed*"] To know that what is

> impenetrable to us really exists, manifesting itself as the highest wisdom and the most radiant beauty, which our dull faculties can comprehend only in their most primitive forms — this knowledge, this feeling, is at the center of true religiousness. In this sense, and in this sense only, I belong to the rank of devoutly religious men. (Olson 2014, 13)
>
> The most beautiful experience we can have is the mysterious—the fundamental emotion which stands at the cradle of true art and true science. (Einstein 1949, 7)

In a 1918 address given in honor of Max Planck's[36] sixtieth birthday, Einstein said,

> The supreme task of the physicist is to arrive at those universal elementary laws from which the cosmos can be built up by pure deduction. There is no logical path to these laws; *only* intuition, resting on *sympathetic* understanding of experience, can reach them. (Einstein 1934, 4)

From an essay, On the Generalized Theory of Gravitation, published in Scientific American

April 1950,

> The theoretical idea … does not arise apart from and independent of experience; nor can it be derived from experience by a purely logical procedure. It is produced by a *creative act*. Once a theoretical idea has been acquired, one does well to hold fast to it until it leads to an untenable conclusion. (Levy 1950, 14; my emphasis)

From an essay, On the Generalized Theory of Gravitation, published in Scientific American

April 1950,

> There exists a passion for comprehension, just as there exists a passion for music. That passion is rather common in children but gets lost in most people later on. Without this passion, there would be neither mathematics nor natural science. (Levy 1950, 13)

In 1959, Karl Popper[37] spoke of the process of scientific discovery this way,

> My view of the matter, for what it is worth, is that there is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains an 'irrational element,' or 'a creative intuition,' in Bergson's[38] sense. In a similar way Einstein speaks of the 'search for those highly universal laws ... from which a picture of the world can be obtained by pure

[36] Max Planck (1858-1947) was a German physicist who postulated that energy may be granular, originating quantum mechanics in the process. His contribution to theoretical physics and my argument is discussed in more detail later in chapter two of my thesis.

[37] Karl Popper (1902-1994) Austrian-British generally considered the greatest twentieth century philosopher of science.

[38] Henri Louis Bergson (1859-1941) was a French philosopher whose *vitalism* philosophy demonstrated the importance of pure intuition for which he was awarded the 1927 Nobel Prize in literature.

> deduction. There is no logical path.' he says, 'leading to these ... laws. They can only be reached by intuition, based upon something like an intellectual love (*Einfühlung*) of the objects of experience.' (Popper 2002, 8)

Once again, Spinoza's influence on Einstein is evident. In regards to beauty, Sir Hermann Bondi[39] reminisces,

> What I remember most clearly was that when I put down a suggestion that seemed to me cogent and reasonable, Einstein did not in the least contest this, but he only said, 'Oh, how ugly.' As soon as an equation seemed to him to be ugly, he really rather lost interest in it and could not understand why somebody else was willing to spend much time on it. He was quite convinced that beauty was a guiding principle in the search for important results in theoretical physics. (Zee 1987, 1)

Although science was able to side-step the true nature of the electron by moving forward with probability calculations that enabled reliable experimentation and commodification of quantum theory, perhaps one of the greatest proponents of applied quantum theory, Richard Feynman[40] acknowledges, "Einstein was a giant. His head was in the clouds, but his feet were on the ground. Those of us who are not so tall have to choose!" (Mead 2002, xix).

Baron C. P. Snow[41] spoke of Einstein's reliance on subjective experience this way,

> Einstein, twenty-six years old, only three years away from crude privation, still a patent examiner, published in the *Annalen der Physik* in 1905 five papers on entirely different subjects. Three of them were among the greatest in the history of physics. One, very simple, gave the quantum explanation of the photoelectric effect—it was this work for which, sixteen years later, he was awarded the Nobel prize. Another dealt with the phenomenon of Brownian motion, the apparently erratic movement of tiny particles suspended in a liquid: Einstein showed that these movements satisfied a clear statistical law. This was like a conjuring trick, easy when explained: before it, decent scientists could still doubt the concrete existence of atoms and molecules: this paper was as near to a direct proof of their concreteness as a theoretician could give. *The third paper was the special theory of relativity, which quietly amalgamated space, time, and matter into one fundamental unity. This last paper contains no references and quotes no authority. All of them are written in a style unlike any other theoretical physicists. They contain very little mathematics. There is a good deal of verbal commentary. The conclusions, the bizarre*

[39] Sir Hermann Bondi (1919-2005) was an Austrian-British mathematician and cosmologist who postulated the *steady-state* theory of the universe with Fred Hoyle and Thomas Gold in 1948.
[40] Richard Feynman (1918-1988) was an American theoretical physicist, one of the most recognized in his field. He shared the 1965 Nobel Prize in physics with Sin-Itiro Tomonaga and Julian Schwinger for their fundamental work in QED or quantum electrodynamics.
[41] Baron C. P. Snow (1905-1980) was an English physical chemist (incidentally physical chemistry is an interdisciplinary study now considered its own discipline), politician and novelist.

> *conclusions, emerge as though with the greatest of ease: the reasoning is unbreakable. It looks as though he had reached the conclusions by pure thought, unaided, without listening to the opinions of others. To a surprisingly large extent, that is precisely what he had done.* (Snow 1966, 100-101; my emphasis)

Once again, while I intend to expand my research eventually to include a more comprehensive study of the epistemological development of science, philosophy and folklore, my intention here is merely to establish that interdisciplinarity has been recognized by each of these disciplines as necessary in overcoming the limitations of the prevailing epistemologies characteristic to each respective discipline. In other words, methodological symmetry assumes—as the name suggests—that while various disciplines appear distinct, they are common and without fundamental difference. They are merely distinct approaches to phenomena that reveal meaningful and useful—though ultimately superficial—aspects of the fundamental whole that is reality.

CHAPTER III

NECESSARY OPPOSITION

The purpose of this chapter is to establish whether or not folklore, philosophy and physics' conceptions of necessary opposition are compatible. To do this I am comparing one scholar from each discipline who has devoted their work to describing the dual nature of existence. While chapter one speaks to the notion of methodological symmetry in terms of interdisciplinarity—or the need for an interdisciplinary approach to phenomena, chapter two is primarily concerned with *applying* methodological symmetry to a specific phenomenon—necessary opposition. In other words, chapter II looks at methodological symmetry as a collective epistemology well suited to the study of complex and widespread phenomena whereas chapter III *employs* methodological symmetry in order to investigate a particular complex and widespread phenomenon which I am calling "necessary opposition." To facilitate the easy recognition of the common features found throughout the distinct accounts of necessary opposition within this chapter—as in chapter II—I am presenting my conclusions forthwith.

The following descriptions of necessary opposition as a fundamental aspect of existence hold at least these five suppositions common. Following Hufford's lead and from this point forward, I will be referring to these suppositions as the primary features of the *theory*[42] of necessary opposition.

Primary Features of the Theory of Necessary Opposition:

1. Experience[43] exists.

[42] I emphasize *theory* here only because an apparently "separate" category which I plan to call the *experience* of necessary opposition has emerged as a result of the research I have conducted here. This "new" category proves to unnecessarily complicate this study and so I have saved a more complete investigation of this important distinction for future examination.

[43] Both objective and subjective experience literally exist (or exist-nonexist as this chapter will suggest).

2. Existence is binary.

3. Binary existence poses immediate and inescapable difficulties to orthodox descriptions of existence.

4. Binary existence must be intelligible from some possible perspective.

5. Due to the irreducible nature of binary existence, symmetry (distinction without difference) is currently the only viable premise to accommodate it.

The preceding list is intended to engage and direct the reader toward the primary features (elements present in all three accounts) of the following "different" approaches to and descriptions of the nature of existence. In the process I hope to establish that essentially the following scholars and scientists were trying to shed light on the same principle way in which anything exists. While secondary features (elements present in two of the three accounts) and tertiary features (elements found in one account only) will be informally mentioned in this chapter, they will not be explicitly engaged until chapter IV. Chapter IV will then specifically explore the concepts of discrepancy and symmetry and how, *if we assume symmetry*, at least some of the secondary and tertiary features (distinct aspects) of these and other diverse descriptions of existence can inform one another and ultimately be viewed as related aspects of a dynamic whole.

Claude Lévi-Strauss on Binary Opposition

In *Myth and Meaning* as well as in *The Raw and the Cooked*, Lévi-Strauss summarizes his approach—widely known as the *structuralist* approach; an approach which, incidentally, he adopted from linguistics in order to better understand and 'interpret' (or 'translate' as he sometimes called it) myth. In order to relate his version of necessary opposition, which he called *binary opposition*, we must first acquaint ourselves with the context in which he established his

description of the requirements for existence. Levi-Strauss believed that *all* meaning—and therefore existence as an idea or otherwise—is derived from the necessarily binary relationships[44] perceived in nature and that the human mind instinctively strives for the reconciliation and comprehensibility of these fundamental binaries. Indeed, for Lévi-Strauss, myth originates from the innate human desire (or *passion* according to Einstein) for meaning, the inborn need to achieve a general understanding of the universe or to generalize the seemingly inconsistent (mysterious) relationships encountered in the world. He states, "It is, I think, absolutely impossible to conceive of meaning without order." Then, after considering what the verb 'to mean' even *means*, he asserts that meaning consists of the relationship *between* ideas (and I would add entities) and not *within* the ideas (or entities) themselves, saying, "that 'to mean' means the ability of any kind of data to be translated in[to] a different language." once again using "language" metaphorically to "translate" or mediate the numerous and various accounts of necessary opposition found in all cultures across space and time, essentially mediating the binary relationship between existence and nonexistence itself. He continues, "Now what would a translation be without rules? It would be absolutely impossible to understand." concluding, "To speak of rules and to speak of meaning is to speak of the same thing." He explains that all "intellectual undertakings of mankind" involve "introduce[ing] some kind of order." This is significant for Lévi-Strauss because it sets the stage for structural thought as he then relates this "basic need for order in the human mind" to the inherent order of the universe, saying, "the need probably exists *because* there is some order in the universe" (Levi-Strauss

[44] This logic is well supported in both Eastern and Western philosophy. I give one example: from Plato's *Phaedo* we read, "…between each of those pairs of opposites there are two processes: from the one to the other and then again from the other to the first; between the larger and the smaller there is increase and decrease, and we call the one increasing and the other decreasing…Therefore, if these are opposites, *they come to be* from one another…[for example] to be asleep and to be awake; to be awake comes from sleeping, and to sleep comes from being awake…" (Cohen, Curd and Reeve 2005, 241) Later in the *Phaedo*, Plato reiterates the theme using the example of hot and cold, saying that "cold" has no meaning in the absence of the experience of "hot" and vice-versa.

1978, 9; my emphasis) a universe of which the human mind is certainly a part. While Lévi-Strauss emphasizes: It is the intrinsic striving for the intelligibility of existential binaries that is structural, I will be suggesting further, particularly in chapter three, that the *experience* of existence (not just the *idea* of existence) is binary and that the discord produced by literally existing binarily, *as well as* the subsequent desire or need (and I would add, *ability*) to reconcile it, are structural.

In the modern era, "people without writing" were generally believed to possess an inferior cognitive ability if not a different *kind* of thought altogether. Many academics referred to this presumably "primitive" and "irrational" way of thinking as the *savage mind* and considered it distinct from the allegedly more "advanced" and "rational" way of thinking which they called the *civilized mind*. Some scholars, such as Lévy-Bruhl, considered it a fundamental difference saying, "the basic difference between 'primitive' thought…and modern thought is that the first is entirely determined by emotion and mystic representations" (Levi-Strauss 1978, 12) while others, such as Malinowski, viewed it as more of a linear evolutionary development from primitive to sophisticated thinking determined wholly by the basic needs of life. Levi-Strauss was among the first to suggest that there was in fact no physical difference between the "savage" and the "civilized" mind. Building on this paradigm altering premise, he further proposed that because the mind is anatomically uniform in virtually all human subjects, it is then conceivable that there exist in the mind conceptions or patterns of thought that are universal in nature. He explains, "Whereas Malinowski's is a utilitarian conception, the other [Lévy-Bruhl's] is an emotional or affective conception; and what I have tried to emphasize is that actually the thought of people without writing is, or can be in many instances, on the one hand, disinterested—and this is a difference in relation to Malinowski—and, on the other hand, intellectual—a difference

in relation to Lévy-Bruhl" (Lévi-Strauss 1978, 12). In other words, "these people whom we usually consider as completely subservient to the need of not starving…are perfectly capable of disinterested thinking; that is they are moved by a need or a desire to understand the world around them…[and] to achieve that end, they proceed by intellectual means, exactly as a philosopher, or even to some extent a scientist, can and would do" (Lévi-Strauss 1978, 13). However, he cautions that this is not to say that mythical thought is equal or identical to scientific thought clarifying,

> …it remains different in a way, and inferior in another way. It remains different because its aim is to reach by the shortest possible means a general understanding of the universe—and not only a general but a *total* understanding. That is, it is a way of thinking which must imply that if you don't understand everything, you don't explain anything. This is entirely in contradiction to what scientific thinking does, which is to proceed step by step, trying to give explanations for very limited phenomena, and then going on to other kinds of phenomena, and so on. As Descartes had already said, scientific thinking aimed to divide the difficulty into as many parts as were necessary in order to solve it. (Lévi-Strauss 1978, 13)

In short, Lévi-Strauss seems to consider these two modes of thinking as symmetrical or superficially distinct but without substantial difference.

Lévi-Strauss asserts that because myths are "narratives that explain how the world and man came to be in their present form" (Dundes, 1998, 1), they unavoidably address the binary relationship *existence-nonexistence* and subsequently (if not *identically* as per Strawson and Bohr) *life-death* which indeed would become the over-arching theme of his stunning trilogy, Mythologique—*Introduction to a Science of Mythology*. I will also be considering "the problem of the one and the many" or the *individuality-universality* binary (Lévi-Strauss considered universality as the synthesis of binary opposites typically represented in myths by two opposing individuals or phenomena) as homologous with (having the same relative position or structure though not necessarily the same function as) the existence-nonexistence binary, as it deals with

the *relative* existence-nonexistence (life-death) of anything, depending on the perspective from which it is observed or considered.

"Ever since the advent of science in the seventeenth century, we have rejected mythology as a product of superstitious and primitive minds" (Lévi-Strauss 1978, vii). Lévi-Strauss' conception of the 'primitive' mind being endowed with the same fundamental capacities as the 'civilized' mind made it possible for him to establish the intelligibility of myth based on this premise as well as his hypothesis that human thought is structural. In this way he claimed that "myths get thought in man unbeknownst to him" (Lévi-Strauss 1978, 1). Though Lévi-Strauss was intensely criticized by other western thinkers "because their feeling [was] that from an empirical point of view, it [was] an utterly meaningless sentence" (Lévi-Strauss 1978, 1), Lévi-Strauss insisted that for him it described "a lived experience" and was precisely the relationship he had with his own work. "That is," he said, "my work gets thought in me unbeknownst to me" (Lévi-Strauss 1978, 1). This is of particular interest to me for two reasons: 1) Hufford's experience-centered approach and experiential source hypothesis similarly suggest the reality of subjective experience and 2) Like Lévi-Strauss; I have personally experienced this kind of "knowing" as a spontaneous lived experience rather than a sought after knowledge acquired by means of awareness and/or experimentation. In other words, I grasp and indeed have had the experience of knowledge emerging from my mind in a virtually unsolicited way. Baruch Spinoza (the philosopher to which most proponents of nature—or science—defer and who, incidentally, employed a type of geometry to philosophy which parallels Levi-Straus' algebraic approach to folklore), in one of his more obscure works *On the Immendation of the Intellect*, Spinoza not only authorizes this sort of unprompted acquisition of knowledge (when properly obtained—that

is to say when obtained as prescribed in his aforementioned treatise[45]) he places it *above* empirical knowledge. In fact, he deems this kind of knowing to be Truth itself; indeed a cause without a cause and as such the *source* of all knowledge and existence. Even so, I must emphatically stress that neither Lévi-Strauss nor Spinoza (*nor I* for that matter) is interested in eliminating the role of science or the empirical methods of discovery to which science strictly adheres. In fact, recognizing that if indeed the world is fundamentally binary then human thought must also be binary, Lévi-Strauss ventures (similarly to Heidegger) that mythical thinking had concealed scientific thinking and that the rejection of mythical thought in the 1700's was in fact the inevitable and necessary means whereby "scientific thought was able to *constitute* itself" (Lévi-Strauss 1978, 4; my emphasis). Likewise, we could also say that Lévi-Strauss' notion of binary opposition necessarily implies that just as mythical thought necessitated scientific thought, scientific thought necessitates mythical thought.

Developing his view of the presumably binary relationship between scientific and mythical thinking and their point of synthesis, he continues,

> Science has only two ways of proceeding: it is either reductionist or structuralist. It is reductionist when it is possible to find out that very complex phenomena on one level can be reduced to simpler phenomena on other levels…[however] when we are confronted with phenomena too complex to be reduced to phenomena of a lower order, then we can only approach them by looking to their relationships, that is, by trying to understand what kind of original system they make up. (Lévi-Strauss 1978, 7)

Having noticed patterns in thought, language, customs and nature from his earliest childhood, Lévi-Strauss would ultimately become intensely interested in the way myths from various and diverse places and ages seemed to be similar or related and yet wildly different and

[45]Baruch Spinoza (1632-1677) believed that all knowledge could be classified under four modes of perception: 1) perception arising from hearsay; 2) perception we have from casual experience; 3) perception arising when the essence of one thing is inferred from another thing…or when it is inferred from some general proposition that some property is always present; 4) perception arising when a thing is *perceived through its essence alone*, or through knowledge of its proximate cause. (Spinoza 1994, 111; my emphasis)

indeed incoherent with prevailing scientific descriptions of existence. Lévi-Strauss remembers feeling *compelled* to investigate the matter and bring order to what he considered the superficial chaos generally attributed to myth. Because mythical themes such as existence-nonexistence, individuality-universality and life-death persisted in all myths and because these phenomena appeared irreducible, Lévi-Strauss took a structuralist approach to myth and attempted to contrive "what kind of original system they make up" (Lévi-Strauss 1978, 7).

To best describe Lévi-Strauss' take on necessary opposition; we must look at the way he applied his theory of binary opposition not only to the myths he studied but to his method itself. It is noteworthy, not to mention ironic, that reductionism and structuralism are in fact binary in and of themselves and in fact, I would argue that Lévi-Strauss' method of viewing myth through the lens of science is perhaps the first application of his model for reconciling opposing binary relationships generally. Lévi-Strauss' approach was basically to employ algebraic symbols and jargon such as, if A is to B what C is to D then A is to C what B is to D and so on, in order to methodically demonstrate the relatively equivalent relationship among the diverse mythical accounts he studied. His thesis being: Because the "primitive" mind is capable of disinterested and intellectual thinking and because the need to make opposing binaries intelligible is structural, the invariant elements of myths should offer a single coherent account of existence.

Because Lévi-Strauss was attempting to find order amid the seeming chaos inherent to mythical thinking, he was primarily interested in establishing binary opposition as the common denominator of all myths and demonstrating the universality of the human need to reconcile paradoxical phenomena, whereas I am principally endeavouring to improve the description of the state of binary-ness by relating traditional descriptions of binary existence or necessary opposition to scientific and philosophical descriptions of the same phenomena.

Lévi-Strauss defines his structuralist approach to myth as "the quest for the invariant, or for the invariant elements among superficial differences" (Lévi-Strauss 1978, 6). That is to say, although myths appear chaotic due to their multifarious dynamic elements, their conservative elements are actually ordered and for Lévi-Strauss, that order indicated a mental arrangement that is uniform to all human thought. If this is indeed the case, then the scientific approach to binary existence is merely an alternate way to satisfy the inborn human desire for the reconciliation of fundamental binaries. Lévi-Strauss also believed that because all myths are attempts to explain binary existence, one could start with any myth and then systematically relate neighboring myths indefinitely. He begins with the recorded observation of Father P.J. de Arriaga, a Spanish missionary in Peru during the late 1500's. The Father reports that when it was bitter cold, the indigenous priest, according to custom, gathered all who had been born feet first, or had a harelip or born twins together and reproached them for being responsible for the inclement weather. Lévi-Strauss notes, "That twins are correlated with atmospheric disorder is something very commonly accepted throughout the world" and in some cultures "twins were [also] endowed with special powers to bring good weather, to dispel storms, and the like" (Lévi-Strauss 1978, 21-22). However, unlike other mythographers, this is not the relationship that Lévi-Strauss is interested in. Instead he wonders why esteemed scholars—including Sir James Frazer who actually quotes Arriaga on several occasions— "never asked the question why people with harelips and twins are considered to be similar in some respect." saying, "It seems to me that the crux of the problem is to find out: why harelips? why twins? and why are harelips and twins put together?" (Lévi-Strauss 1978, 22). To solve the problem, he conscripts various myths from Peru to western Canada. All of the accounts include twin or twin-like figures with opposing characteristics. In one myth, one twin becomes the sun and the other the moon, in

another; one twin is brave and the other a coward, in yet another; one is a protector of the people and the other a prodigal and so on. Levi-Strauss summarizes, "So we may say in all cases children who are said to be twins or believed to be twins…will have different adventures later on which, if I may say so, *untwin* them" (Lévi-Strauss 1978, 24). From there, Lévi-Strauss takes a much criticized leap by identifying that in one Salish Indian account, the mother of a twin figure steps over a log in the woods under which a magical hare has hidden himself, waiting to peek at her private parts and mock her for being seduced by a trickster posing as her husband-to-be (also a prevailing feature of North and South American twin myths). She is furious at the hare and smacks his face with her walking stick, splitting his nose. "This is why the animals of leporine family now have a split nose and upper lip, which we call a harelip in people precisely on account of this anatomical peculiarity in rabbits and hares" (Lévi-Strauss 1978, 25). He then incorporates a Kwakiutl Indian account of a young girl who is hated for being born with a harelip. One day "a supernatural cannibal woman, appears and steals all of the children…[and] puts them all in her basket in order to take them home to eat them" (Lévi-Strauss 1978, 25). The girl with the harelip is captured first and thrown in the bottom of the basket. Once all the children are in the basket, the ogress puts the basket on her back. The small girl with the harelip manages to cut open the bottom of the basket with a seashell she had collected from the beach and drops to the ground *feet first* unbeknownst to the ogress. For Lévi-Strauss the connection is evident as he confidently declares, "This obviously clears up the connection from which we started in Father Arriaga's Peruvian relations between twins, people born feet first, and people with harelips"[46] (Lévi-Strauss 1978, 26). Although I have greatly simplified Lévi-Strauss' findings

[46] This kind of "hocus pocus" pattern identification ultimately undermined the reputation of comparative methods and contributed to the general abandonment of this approach by folklore as a discipline, particularly in regards to sacred narratives.

into a succinct summary, my purpose is merely to exemplify his idea of binary opposition in a concrete manner that typifies his work.

His identification of myths as being primarily descriptions of binary opposition and the attempted conceptual resolution of those binaries through allegorical narratives is often referred to as the *thesis-antithesis-synthesis triad* (similar to Bohr's conception of analysis and synthesis) and will be an important concept which I will further develop throughout this chapter and reiterate and employ exclusively in chapter IV.

While Lévi-Strauss was attempting to prove that all myths are fundamentally related in that they all speak to the necessarily binary nature of existence, my focus remains the description of necessary opposition itself. As such, I am primarily interested in the way these twin myths all speak to existing in a binary way. In other words, I am less concerned with definitively showing how these accounts specifically align as I am interested in how they demonstrate the notion of the one being or becoming many and the many being or becoming one again or still or whatever the case may be.

An additional insight by Lévi-Strauss which seems to support his explanation of existence being both singular *and* binary at once (thesis-antithesis-synthesis) is the role of the hare as binary opposition embodied in one entity. In the Algonquian belief system, the hare is "the highest deity in which they believed" (Lévi-Strauss 1978, 26). From a functionalist perspective, mythologists have ventured such explanations as: the hare was a main part of the Ojibwa diet or that the agility and speed of the hare exemplified useful traits to which Ojibwa people will have aspired and so on. However according to Lévi-Strauss' take on necessary opposition and the inborn human need to reconcile paradoxical phenomena—at least conceptually if not actually—we can conclude that the hare is the highest deity within the belief

system of this group because not only is the hare an "incipient twin" as Lévi-Strauss suggested in the earlier Salish account due to the split in its lip, but indeed the Ojibwa hare deity is described in the exact same way as the twins of the other accounts, that is, "sometimes he is a very wise deity who is in charge of putting the universe in order, and sometimes he is a ridiculous clown who goes from mishap to mishap" (Lévi-Strauss 1978, 27-28). Lévi-Strauss notes that while the choice of such an "ambiguous character…has worried commentators and anthropologists" he suggests that "the choice of the hare by the Algonkian Indians" is best explained as their need to reconcile paradoxical relationships, reiterating that the hare is "an individual who is between two conditions…a) a single deity beneficent to mankind and b) twins, one of whom is good and the other bad. Being not yet entirely divided in two, being not yet twins, the two opposite characteristics can remain merged in one and the same person" (Lévi-Strauss 1978, 28).

Once again, the purpose of this chapter is to establish whether or not folklore, philosophy and physics' conceptions of necessary opposition are compatible. To do this I am comparing one scholar from each discipline who has devoted their work to describing the dual nature of existence. However, I plan to eventually expand my study of necessary opposition by investigating multiple scholars from each discipline at some point in order to confirm the preliminary findings I have identified here (i.e. the primary features of the theory of necessary opposition as listed in the introduction of this chapter.) We'll now move from Lévi-Strauss in the folkloric realm to Strawson in the philosophical realm, where Lévi-Strauss's binary opposition appears in a different form.

Galen Strawson on Equal-Status Monism

In *Part I: Agnostic Materialism* of his book *Mental Reality*, as well as later in *Consciousness and its Place in Nature: Does Physicalism Entail Panpsychism*, Strawson, in an

effort to establish symmetry (distinction without difference) as the most viable premise for describing fundamental reality, contends that asymmetry and irreducibility claims are incompatible. “How is it possible for there to be asymmetrical dependence without reducibility in some possible or optimal physics?” (Strawson 1994, 70) he asks. He begins with an argument against asymmetry claims by insisting that any serious materialist[47] must accept the real and completely physical existence of experience. He drags Descartes into it by talking about how there cannot exist “degrees of reality, and so there can be no asymmetry in the reality status of experiential reality and nonexperiential reality” (Strawson 1994, 66). He explains how modern materialist claims tend to parallel the scientific world view. For example, most evolutionists would take the position that before living organisms evolved on the planet, there were only (or at least what appear to be) nonexperiential physical things; that as life forms became increasingly complex, the physical properties of the experiential must have evolved from the physical properties of the nonexperiential.

When framed this way, it would definitely seem that experiential reality depends on nonexperiential reality in a way that nonexperiential reality does not depend on experiential reality; giving asymmetry claims the appearance of being “extremely influential” (Strawson 1994, 66). In this view (which Strawson classifies as standard asymmetrical materialism) the experiential is always “based in, or realized by, or otherwise dependent on, the nonexperiential…that wherever there is experiential reality, there is nonexperiential reality but not conversely” (Strawson 1994, 73). Furthermore, the two may not coexist in such a way that gives sovereignty or independence to the experiential.

[47] A materialist is a type of philosopher who holds that matter is fundamental and that all mental phenomena originate from and can be reduced to the interaction of “normal” matter. Materialism is a monistic philosophy.

While these arguments "can sound very plausible" (Strawson 1994, 67), Strawson is quick to point out that if one is a *real* materialist "as one must be" (Strawson 2006, 6) then we cannot ignore the way that color experience and liquidity (Strawson later admits the weakness in this particular analogy, as liquidity, it would seem, can be mechanically reduced and explained by nonexperiential physics) seem to *resemble* their nonexperiential 'counterparts' "*however much they may also differ from them*" (Strawson 1994, 68). He insists further, though standard asymmetry materialism, theoretically, can be *said* to be a logical, fully explicable, regression of experiential reality to nonexperiential reality, it is *thought* to be "very hard—impossible—to imagine" (Strawson 1994, 68).

While critical of reduction theses, Strawson seems even less convinced by irreducibility claims, seeing irreducibility (at least in its more ethereal forms) as a "rather banal thesis about the limitations on human understanding" (Strawson 1994, 69). He explains that despite experiential facts that seem to be registered at various "levels of description" (Strawson 1994, 69), which don't appear to be reducible, other experiential phenomena—like color—seem to persist as being wholly dependent on nonexperiential phenomena. He notes that as long as there must be dependence, it is preferable that it at least be "intelligible or explicable in [some] possible physics" (Strawson 1994, 69) rather than unintelligible to the human mind; inexplicable "even to God, as it were" (Strawson 1994, 69).

After tedious analysis of the various intricate distinctions inherent to each of these two camps, Strawson definitively favors a position that assumes intelligibility and explicability; that "there [must be] a single, unified, nonmiraculous physical reality…[and therefore] some possible valid unified theoretical account of it" (Strawson 1994, 69). He presents a third ideology where mental reality and physical reality enjoy equal-status. In this way, asymmetry is avoided and

irreducibility redressed. He claims, "Reality is irreducibly *both* experiential *and* nonexperiential (both mental and nonmental), while being substantially single in some way W that we do not fully understand, [but nevertheless *is* potentially understandable]" (Strawson 1994, 73; my emphasis). He continues, "The truth is that the experiential and nonexperiential properties of the physical coexist in such a way that neither can be said to be based in, or realized by, or in any way asymmetrically dependent on the other; or if there is any sense in which one can reasonably be said to be dependent on the other, then this sense applies equally both ways" (Strawson 1994, 73). He calls this third "camp," equal-status monism.[48] He feels this is a better version of irreducibility and indeed should replace the view of non-reductive monists, leaving only one viable metaphysic, panpsychism, which he divides into two *kinds* of monism; 1) experience-realizing monism for proponents of asymmetry theories and 2) experience-involving monism for advocates of traditional irreducibility theses, including dualists and idealists, asserting, "there seems to be no reason to think that monism, in one form or another, cannot deliver everything that dualists have traditionally wanted" (Strawson 1994, 43). Ultimately, he largely discredits the former (experience-realizing) by exposing the inherent problem in saying that some things have experience while others only possess the "capacity" for experience, allowing only the latter (experience involving) as a viable metaphysic. Yet, he maintains, there are "surviving distinction[s]" (Strawson 1994, 78) between these views; that in fact all these metaphysical thought experiments, *thankfully*, leave us with "a better feeling for our ignorance" (Strawson 1994, 78). He criticizes contemporary materialists who are too quick to favor a particular view with little or no grounding, thereby further muddying the waters, so to speak. With characteristic

[48] Though he was almost certainly not intentionally employing Lévi-Strauss' thesis-antithesis-synthesis model, Strawson's view of asymmetry-irreducibility-equal status monism and subsequently, experiential-nonexperiential-panpsychic certainly exemplify it. Notably Strawson's concerns here are also directly relatable to the ongoing tension in quantum physics regarding determinate, probability and unified theories.

wit and unapologetic ease, he adds "Where does this leave us? Alarmed, perhaps…" (Strawson 1994, 78).

He concludes by charging the verification positivists (logical positivists) with wrongfully believing that they have somehow side-stepped metaphysics and all its untidy axioms and indemonstrable conclusions. He asserts, to claim that anything exists, including mere sense data, is to accept that it exists somehow; a somehow that begs to be *fully* explained, and that to believe otherwise is to be deceived. In conclusion he chides, "Today the most common form of the delusion is to think that one can be a tough metaphysics-eschewing positivist and also a hard-nosed materialist" (Strawson 1994, 79). Strawson clearly, not only regards this take on reality to be reckless, but indeed mistaken.

Modern physics, according to some quantum theorists, increasingly describes a fundamental reality where seemingly nonexperiential-like entities such as quarks and leptons emerge from what appear to be experiential-like entities such as ideas, intelligence, energies, behavior itself (active principles of some kind). Other theorists propose that (as I have already mentioned) even energy is more material-like than was once thought (photons and gravitons etc.) In this way, Strawson's brand of panpsychism seems to be fairly reconciled with some of the prevailing notions of quantum field theory and electro/chromo dynamics. Indeed, regarding fundamental symmetry (distinction without difference) and the simultaneous disclosure-concealment of the seemingly manifold aspects of a presumably unified reality, Strawson maintains that while, "[t]he object/property/state/process/event cluster of distinctions is unexceptionable in everyday life, [it is] *wholly superficial* from the point of view of science and metaphysics (Strawson 2006, 198; my emphasis). This leads us directly to Bohr and his version of necessary opposition.

Niels Bohr on Complementarity

In the introductory pages to *The Philosophical Writings of Niels Bohr Volume IV: Causality and Complementarity*, Jan Faye and Henry J. Folse present the array of criticism that plagued Bohr's philosophy from the onset when he first suggested complementarity in 1927 as well as ongoing conflicting commentary which persists today as current scholars attempt to conclude exactly what Bohr was even trying to say. Following Faye and Folse's brief introduction, the book then is entirely a collection of Bohr's lectures given over a 60-year period regarding his belief that complementarity is *the* fundamental epistemology—that is, the only one capable of generalizing our understanding of existence and the superficially distinct viewpoints perceived from within and advanced by each of the various disciplines and traditions.

Before demonstrating how Bohr's complementarity does or does not relate to Lévi-Strauss' binary opposition and Strawson's equal-status monism—and subsequently my notion of necessary opposition—I will draw on the expertise of Faye and Folse in providing a summary of the context they afford in the introduction to Bohr's own writings regarding the conception and evolution of his controversial unifying philosophy. Both in the process of, as well as following this summary, I will describe complementarity itself according to Bohr as well as his critics and finally, demonstrate how it aligns (as well as contradicts at times) with the theories already presented in this chapter from folklore and philosophy.

In 1900, keeping new developments in the study of electromagnetism within the conventional parameters of classical wave mechanics—at least statistically—Max Plank introduced the mathematical formalism *h* or *the quantum of action,*[49] now known as *Plank's constant*. Plank's inference that the energy of the electromagnetic wave emitted by a charged

[49] When Plank originally introduced the quantum of action, it referred to what was happening to light energy that was being absorbed or emitted not to the properties of light itself.

atomic oscillator[50] in the wall of a black body be *considered* quantized (or granular) led Einstein, in his 1905 paper on the photoelectric effect, to postulate that the energy of a charged atomic oscillator in the wall of a black body and the energy of the electromagnetic wave itself are related and that light actually *is* quantized; that light (electromagnetic waves or "quantum" as Plank called them) consists of "packets of energy" (or "quanta" which further investigation would indeed confirm to be discrete physical units or "particles" of light which were eventually termed "photons") necessitating the advent of quantum mechanics in order to supplement the apparently incomplete account of nature put forth and upheld by classical mechanics.

Faye and Folse assert that more than any other early quantum theorist, Neils Bohr was determined to find a philosophical perspective that would transform our understanding of how the object of human knowledge relates to physical reality. "Not only did he maintain that…'complementarity' provided for a consistent and harmonious interpretation of the quantum mechanical account of atomic systems, but also he held that this general philosophical outlook taught an 'epistemological lesson' and entailed a 'thorough revision of our attitude towards physical reality [or existence]'" (Bohr 1998, 1). Naturally, Bohr's grandiose claims were met with fevered skepticism from his contemporaries. Ironically, while his far-reaching statements *beg* for "extensive and systematic exposition" (Bohr 1998, 1) it would seem that Bohr (though having expressed a strong desire and intention to do so on many occasions) simply never got

[50]An oscillator is a mechanical or electronic device that works on the principles of oscillation: a periodic fluctuation between two things based on changes in energy. An atomic oscillator uses the quantized energy levels in atoms or molecules as the source of its resonance. The laws of quantum mechanics dictate that the energies of a bound system, such as an atom, have certain discrete values. An electromagnetic field at a particular frequency can boost an atom from one energy level to a higher one. Or, an atom at a high energy level can drop to a lower level by emitting energy. The resonance frequency (*f*) of an atomic oscillator is the difference between the two energy levels divided by Plank's constant (*h*). The principle underlying the atomic oscillator is that since all atoms of a specific element are identical, they should produce exactly the same frequency when they absorb or release energy. (http://tf.nist.gov/general/enc-am.htm)

around to it. However, in Bohr's defense—and having tackled the subject of necessary opposition myself (in a more general way) here in this thesis—I contend that complementarity is not easily exposed; that it perhaps even *resists* systematic analysis. Nevertheless, there remain contradictions in Bohr's philosophy (though perhaps only superficial) that must be acknowledged, if not resolved, before presenting Bohr's theory as a coherent account of necessary opposition from the domain of physics that might reveal distinct aspects regarding the nature of existence generally.

Contemporary scholars such as Sandro Petruccioli in his book, *Atoms, Metaphors and Paradoxes*, and Ulrich Röseberg in his paper, *Hidden Historicity: The Challenge of Bohr's Philosophical Thought* both note that Bohr's essays often portray complementarity as the natural and inevitable progression of the historical developments in quantum physics that Petruccioli calls a "rational reconstruction" of historical events which serve to justify the legitimacy of his claims. Röseberg adds that this "hidden historicity" perceived by Bohr in fact seems to have "*shape[d]* his own personal reasoning towards complementarity" (Bohr 1998, 2; my emphasis).

Another concern is the way Bohr's views appear to have evolved from 1927 to the post World War II period. While some scholars feel that Bohr was merely making strategic modifications in terminology and refining his presentation in order to more clearly express his philosophy to an increasingly critical audience, others feel his views "may have undergone a substantial change in response to various arguments advanced by Einstein, especially in the famous Einstein-Podolsky-Rosen challenge of 1935" (Bohr 1998, 2) where Einstein challenges[51] the "completeness" of the theory of complementarity as well as the seeming incongruity of the "uncertainty principle" with the very nature of the scientific process—which deeply concerned

[51] Einstein's question of "completeness" was actually not a criticism but Bohr seems to have taken the comment as a challenge. Einstein actually preferred incompleteness and its implication that the electron perhaps exists in itself in some consistent way.

not only proponents of a determinist scheme (such as Einstein and Schrödinger) but Bohr's positivist colleagues as well (incidentally, a good share of the philosophical push for a positivist approach to nature was coming from his homeland, Denmark). Nevertheless, Einstein himself seems rather indifferent to the ongoing alterations and reforms in Bohr's philosophy, saying, "He utters his opinions like one perpetually groping and never like one who believes himself to be in possession of the truth" (Becker 1957, 52). I would argue that Einstein's comment is too dismissive. I intend to use Bohr's findings as reliable insights into the nature of necessary opposition; to demonstrate that his description of binary existence indeed corroborates with the primary features found in the accounts of Lévi-Strauss and Strawson. This is not to say that I will be attempting to validate or synchronize all Bohr's claims. I will simply be demonstrating that Bohr's arguments contain all of the primary features of the theory of necessary opposition to this point as well as acknowledging the points at which Bohr's ideas diverge from either of the previous scholars in terms of secondary and tertiary features of what I am calling the theory of necessary opposition. The potentially disconcerting part of this process will be the way that I draw from both Bohr's 1927 and post WWII (allegedly conflicting) versions of complementarity in order to do so. Remember the purpose of my study is not so much to achieve a tidy view of existence as it is to improve the collective description of the phenomenon of existence by assuming phenomenological symmetry (distinction without difference) necessarily entails methodological symmetry and vice versa.

Remember from chapter II, these early quantum physicists were faced with the inescapably dual nature of the electron which appeared to possess the characteristics of both a wave and a particle depending on which instruments were used to observe it. While mathematical formulas were developed to adequately manage the problem in terms of

experimentation, manipulation and application of atomic processes, the question of the electron's truest nature has yet to be answered. When we look at the familiar macroscopic version of nature as perceived by our unassisted senses, it seems obvious that the world is real (and multiform); that it exists. From this experiential point of reference, Bohr establishes complementarity in 1927. Based on classical mechanics, material objects actually exist in objective, quantifiable ways and can be systematically or logically reduced from complex structures to simpler ones, so the assumption early on (and for many still today) was that all substances could theoretically (and thereby *eventually*) be broken down into their basic part(s). However, when scientists investigated the smallest constituents of matter, they discovered that those subatomic particles *themselves* exist in an irreducibly binary way that seemed to defy human logic. Bohr's earliest statements involving his philosophy of complementarity indicate that to adequately describe the disposition of the electron, *both* a corpuscular and undulatory description are required; that we need both wave and particle characteristics to obtain a complete picture (although Einstein, as I already mentioned, would challenge the completeness of that description) of the essential nature of the most general building blocks of matter as we know it. However, for Bohr this did not imply that nature was unexplainable but simply that nature demanded a binary description. Nevertheless, this did not sit well with his positivist colleagues who criticized him for introducing an unwelcome mysticism into science. Because logical positivism insists on classifying any fundamentally binary description of nature as "illogical" and "unexplainable" Bohr seems to have greatly modified his terminology and definitions to accommodate these prejudices within the academic climate of his day. At the Second International Congress for the Unity of Science in Copenhagen, June 1936, Bohr publicly addresses these concerns and affirms his claims stating,

> …the lessons taught us by recent developments in physics regarding the necessity of a constant extension of the frame of concepts appropriate for the classification of new experiences leads us to a general epistemological attitude which might help us to avoid apparent conceptual difficulties in other fields of science as well. Since, however, the opinion has been expressed from various sides that this attitude would appear to involve a mysticism incompatible with the true spirit of science, I am very glad to use the present opportunity…to clear up any misunderstandings which have arisen…Not only is the well known dilemma between the corpuscular and undulatory character of light and matter avoidable only by means of the viewpoint of complementarity, but the peculiar stability properties of atomic structures which are in obvious contrast with the properties of any mechanical model but which are so intrinsically connected with the existence of the quantum of action, form the very condition for the existence of the objects and measuring instruments, with the behavior of which classical physics is concerned. (Bohr 1998, 83, 87-88)

While it's not clear whether Bohr was actually a realist or an idealist, what *is* clear is that although Bohr is widely *thought* to have been an idealist according to his later version of complementarity, yet he maintained, to the end, that reality is material in some way. Finally, even though Bohr saw complementarity as a means of managing knowability claims, Einstein's notorious question of completeness has *yet* to be answered by the philosophy unless we view complementarity (necessary opposition) as a fundamental condition of existence as I have done. In other words, I will primarily be using Bohr's initial conception of complementarity (which incidentally has persisted as the current textbook definition of complementarity as well) or the complementarity of the wave and particle pictures of nature, in order to demonstrate that complementarity contains all six primary features of what I am calling the theory of necessary opposition. However, those who would further complicate the discussion by exploring a complete exposition of Bohr's ideas will discover that the seemingly conflicting features of Bohr's initial and post WWII positions serve only to support my argument by confirming that even Bohr's philosophy of binary existence seems to be *in itself* binary.

It has been said generally that complementarity is the relationship or situation in which two or more different things improve or emphasize each other's qualities and regarding physics

specifically: The concept that two contrasted theories, such as the wave and particle theories of light, may be able to explain a set of phenomena, although each separately only accounts for some aspects.[52] Here, the subjective (even metaphysical) notion of necessary opposition is presented as objective reality and conversely each of the two opposing but necessary "objective" observations become seemingly immaterial and arguably *subjective*, although as I mentioned earlier, Bohr disputes this idea of immaterial matter in later versions of his evolving, transforming—even *flip-flopping* philosophy. Bohr did not like the way his philosophy suggested that the smallest constituents of reality either exist in-themselves in a way that is unknowable to the human mind or that they exist in some fundamentally subjective way. Regardless, complementarity effectively establishes (similarly to the Strawson's work) the relatively "equal status" of what seems to the human understanding to be objective and subjective experience. It suggests that what we have come to consider objective matter may come from subjective matter and that likewise subjective matter may arise from objective matter in a similar way that energy becomes stored as common matter and common matter is converted into what we consider to be energy, repeatedly. From the Introduction to the *International Encyclopedia of Unified Science Vol. 1* entitled *Analysis and Synthesis in Science*, as mentioned previously in chapter II, I reiterate, this time in terms of accessing the necessarily dual nature of the electron by means of both subjective *and* objective experience; myth *and* reason:

> …the extension of our knowledge may lead to the recognition of relations between formerly unconnected groups of phenomena, the harmonious synthesis of which demands a renewed revision of the presuppositions for the unambiguous application of even our most elementary concepts. This circumstance reminds us not only of the unity of all sciences aiming at a description of the external world but, above all, of the in-separability of epistemological and psychological analysis…Stress [must be] laid on the completeness of the account of the actual state of knowledge rather than on the elucidation of scientific

[52] https://www.google.ca/search?sourceid=navclient&aq=&oq=complementarity&ie=UTF-8&rlz=1T4MXGB_enCA511CA511&q=complementarity+definition&gs_l=hp..1.0l5.0.0.10.71631265.....0.t2r9QEKlYLU

> methodology…Above all, [we must] realize that even in science any arbitrary restriction implies the danger of prejudices and that *our only way of avoiding the extremes of materialism and mysticism is the never ending endeavor to balance analysis and synthesis.* (Bohr 1998, 92-93; my emphasis)

Make no mistake, Bohr's use of "balance" can only be understood as methodological symmetry. Bohr's theory is unique in that it goes one step further suggesting, while symmetry provides a framework in which to *classify* and *relate* paradoxical phenomenon, complementarity attempts to *reconcile* the paradox. One, states *that* the phenomenon are compatible, the other, endeavors to explain *how* they are.

Though Bohr was thought to have been a realist by some and an anti-realist by others, the fact remains that Bohr indeed was determined, like Lévi-Strauss and Strawson, that existence be intelligible from some possible perspective. However, unlike Strawson, Bohr insists that this possible perspective must not only be *potentially* or *conceptually* possible (intelligible at least to God or by means of intuition or allegorical language) but *actually* comprehensible to the human mind. It has been widely attributed to Heisenberg (in concurrence with the ideas of Lévi-Strauss) that "Nature is made in such a way as to be able to be understood. Or perhaps I should put it—more correctly—the other way around, and say that we are made in such a way as to be able to understand Nature."

While Bohr states explicitly at least twice, once in 1936 following the Einstein-Podolsky-Rosen challenge of 1935 and again in 1949 in Bohr's Epistemological Discussions with Einstein, that complimentarity is "exhaustive" stating,

> The apparently incompatible sorts of information about the behavior of the object under examination which we get by different experimental arrangements can clearly not be brought into connection with each other in the usual way, but may, as equally essential for an exhaustive account of all experience, be regarded as "complementary" to each other. (Bohr 1998, 6) [Stated in1936]

> Although these [phenomena] cannot be combined in the customary manner of classical physics, they are complementary in the sense that only together they exhaust all knowledge as regards those properties of the objects which are unambiguously definable. (Bohr 1998, 6) [Reiterated in 1949]

my argument however, avoids Einstein's question of "completeness" by focussing on the way that the electron seems to have at least two distinct, necessary and opposing aspects without making any claims (although the theory of necessary opposition does imply completeness) as to whether those two aspects comprise the entire nature of the electron as Bohr insisted.

To this point, I have reasonably demonstrated the efficiency of an integrated approach, I have also established (at least preliminarily) necessary opposition as a widespread, recognizable phenomenon and will now present, in chapter IV, the next step of research which attempts to reveal necessary opposition as, not only a common phenomenon, but a complex, stable and productive phenomenon as well, indeed the direction in which my ongoing research will continue. In other words, while chapter III has largely been concerned with demonstrating *that* necessary opposition exists and is likely a universal phenomenon by identifying its primary or common features across disciplines, chapter IV will mainly focus on applying the secondary and tertiary features of necessary opposition interdisciplinarily in order to better understand and describe what necessary opposition *is*.

CHAPTER IV

CONSEQUENCES AND CONCLUSIONS

While the theoretical premise *symmetry* was brought into professional and popular usage by quantum mechanics near the turn of the twentieth century, the notion of symmetry is ancient. The following tale "Elephant and The Blind Men" originated in India. It is widely thought that the story is rooted in Hindu lore. It was adapted into the English poem "Blind Men and the Elephant" by John Godfrey Saxe (1816-1887). The story (poem) illustrates how "observation" is predominantly based on previous interaction with the world and basic sensory perception. It also illustrates how those experiences tend to shape our beliefs and inhibit our ability to be truly objective. The story warns the reader that limited perspective can lead to gross misunderstanding; that what *seems* to be is not necessarily what *is*. I have included both the tale as told by a native East Indian[53] and the poem by English imperialist John Godfrey Saxe:

Elephant and the Blind Men

> Once upon a time, there lived six blind men in a village. One day the villagers told them, "Hey, there is an elephant in the village today." They had no idea what an elephant is. They decided, "Even though we would not be able to see it, let us go and feel it anyway." All of them went where the elephant was. Every one of them touched the elephant.
>
> "Hey, the elephant is a pillar," said the first man who touched his leg.
>
> "Oh, no! it is like a rope," said the second man who touched the tail.
>
> "Oh, no! it is like a thick branch of a tree," said the third man who touched the trunk of the elephant.
>
> "It is like a big hand fan" said the fourth man who touched the ear of the elephant.
>
> "It is like a huge wall," said the fifth man who touched the belly of the elephant.
>
> "It is like a solid pipe," Said the sixth man who touched the tusk of the elephant.

[53] http://www.jainworld.com/literature/story25.htm

They began to argue about the elephant and every one of them insisted that he was right. It looked like they were getting agitated. A wise man was passing by and he saw this. He stopped and asked them, "What is the matter?" They said, "We cannot agree to what the elephant is like." Each one of them told what he thought the elephant was like. The wise man calmly explained to them, "All of you are right. The reason every one of you is telling it differently because each one of you touched the different part of the elephant. So, actually the elephant has all those features what you all said."

"Oh!" everyone said. There was no more fight. They felt happy that they were all right.

In Jainism,[54] it is explained that truth can be stated in seven different ways. It teaches us to be tolerant towards others for their viewpoints. This is known as the *Syadvada*, *Anekantvad*, or the *Theory of Manifold Predictions*.

Blind Men and the Elephant

It was six men of Indostan, to learning much inclined
Who went to see the Elephant (though all of them were blind)
That each by observation, might satisfy his mind

The First approached the Elephant, And happening to fall
Against his broad and sturdy side, at once began to bawl:
"God bless me! but the Elephant is very like a wall!"

The Second, feeling of the tusk, cried, "Ho! what have we here
So very round and smooth and sharp? To me 'tis mighty clear
This wonder of an Elephant is very like a spear!"

The Third approached the animal and happening to take
The squirming trunk within his hands, thus boldly up and spake:
"I see," quoth he, "the Elephant is very like a snake!

The Fourth reached out an eager hand and felt about the knee.
"What most this wondrous beast is like is mighty plain," quoth he;
" 'Tis clear enough the Elephant Is very like a tree!"

The Fifth, who chanced to touch the ear, said: "E'en the blindest man
Can tell what this resembles most; deny the fact who can
This marvel of an Elephant is very like a fan!"

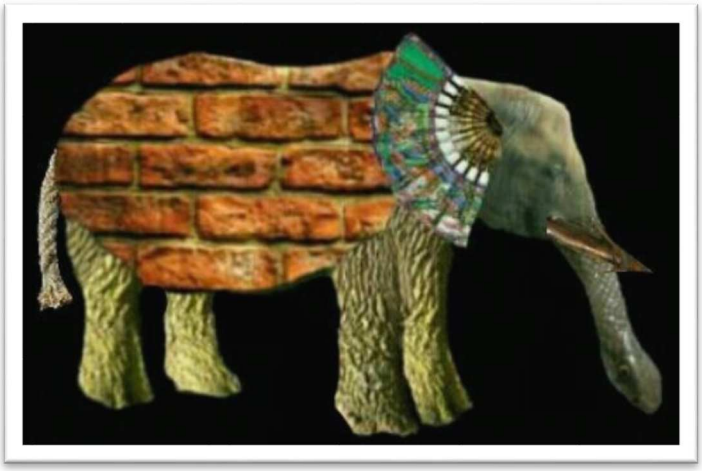
[54] Jainism, traditionally known as Jaina Shasana or Jaina dharma, is generally considered one of the oldest religions in the world and has over six million members. It is an Indian religion that emphasizes spiritual interdependence and equality between all forms of life. The three main principles of Jainism are Ahimsa (Non-Violence), *Anekantvad (Non-Absolutism)* and Aparigraha (Non-Possessiveness). (http://www.bbc.co.uk/religion/religions/jainism/ as well as, http://en.wikipedia.org/wiki/Jainism)

The Sixth no sooner had begun, about the beast to grope,
Than, seizing on the swinging tail that fell within his scope,
"I see," quoth he, "the Elephant is very like a rope!"

And so these men of Indostan disputed loud and long,
Each in his own opinion, exceeding stiff and strong,
Though each was partly in the right and all were in the wrong! (My emphasis)

So oft in theologic [or interdisciplinary] wars, the disputants, I ween,
Rail on in utter ignorance of what each other mean,
And prate about an Elephant not one of them has seen!

Though the poem is typically employed to promote religious tolerance, I would like to relate it to my particular notion of interdisciplinarity and the manifold nature of existence. If discrepancy is the actual or superficial lack of compatibility between two or more facts, then symmetry (distinction without difference) is the means whereby the apparent discrepancies between disciplines and the varied aspects of existence that their respective methods disclose (not to mention the particular jargon they use to describe it) may be somewhat, if not entirely, reconciled. That is to say (as with the blind men of Indostan in the story), each discipline may be effectively disclosing a particular aspect of existence with great clarity and conviction, yet in doing so, concealing other aspects in the process. However, the message from the story, that all of them were in the right and the poem, that all of them were partly in the right and partly in the wrong, only gets us so far. If, like the blind men of Indostan, we merely recognize that our perspective is limited once a seeing individual (a theory in the case of my thesis) hears us



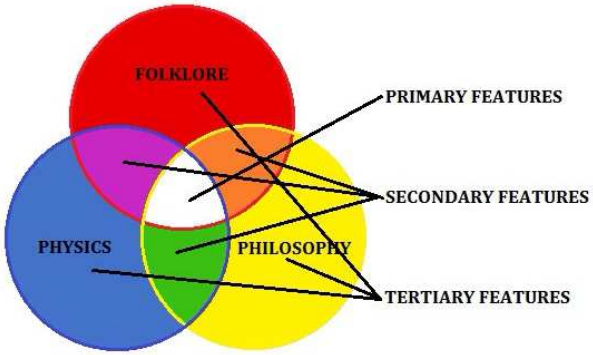
arguing and guides our minds to a more complete picture, we still may miss the mark if we merely mash our independent views together as the figure above illustrates. Rather we must recognize that methodological symmetry assumes that while each discipline may be saying different things *about* a given phenomenon, they are nevertheless describing the same phenomenon and therefore an interdisciplinary dialogue (as indicated in chapter one) that is non-hierarchical in nature is requisite.

Because symmetry (distinction without difference) is currently the only premise that sufficiently accommodates necessary opposition, any meaningful interdisciplinary application of necessary opposition as a fundamental construct of reality must assume: 1) Phenomenological symmetry demands methodological symmetry and methodological symmetry demands phenomenological symmetry; 2) "Some significant portion of traditional supernatural belief is associated with accurate observations and interpreted rationally" (Hufford 1982, xvii). and likewise, some significant portion of scientific *natural* belief is associated with inaccurate observations and misinterpreted; 3) Concurrent oneness and manyness, or simultaneous individuality and universality, is perhaps the ultimate expression of necessary opposition.

The primary features (conservative elements) of the theory of necessary opposition, which my thesis has already indicated seem to persist across space and time, suggest that each discipline may simply be dealing with a single phenomenon in different ways. However, the features I have outlined thus far are meant principally to indicate that further investigation is worthwhile and potentially fertile. In other words, though the features I have attributed to necessary opposition will likely require revision as more arguments are considered, I believe the list of shared features I have compiled in chapter two certainly justify the legitimacy, even *necessity* of an interdisciplinary approach to mythological themes and serve as a starting point

for further analysis. Indeed, these common features seem to point towards a more general classification for how things exist.

Rather than assume the primary features I have identified in chapter III are conclusive evidence of necessary opposition being a universal characteristic of existence, I suggest we inquire further to determine if the theory of necessary opposition is generalizable within each discipline and not just across disciplines using select examples the way I have done to this point. Additionally, while it is tempting to simply ignore secondary and tertiary features (dynamic elements) of the theory of necessary opposition by assuming them to be either the unruly innovations of culture or the misunderstandings and miscalculations of philosophy and science, I argue that we consider whether they are generalizable *within* each discipline first. In other words, tertiary features may in fact be primary within each discipline and only become tertiary when compared interdisciplinarily. Again, because certain features of necessary opposition in myth may not generalize across disciplines, they may yet persist between all myths (which incidentally is how I came upon necessary opposition in the first place, noticing that all myths contained some description of binary phenomenon). When this happens, I suggest that these tertiary elements—as incredulous as they may seem—denote significant empirical data that should be seen as potentially informative characteristics of necessary opposition which have gone unnoticed by science and philosophy; aspects which may reveal new classes of phenomena (supernatural realities) in the process. Likewise, tertiary features from philosophy and physics



may provide insights into novel relationships in nature that ultimately explain folk belief in rational terms. For this reason, chapter three will primarily be a demonstration of how productive tertiary features can be—*even when they are unique to one account only* (as with the Salish account of the woman splitting the hare`s nose with a stick, for example) and thereby seemingly inconsistent within each discipline's account of existence. Or, as in the case of Bohr's philosophy not really aligning with other physicists and yet being very comparable to the mythical Mayan account of necessary opposition—Teotl, perhaps some tertiary features become substantiated *only* when compared across disciplines. In my mind, this kind of comprehensive investigation ought to be fluid, ongoing and as collaborative and comprehensive as possible.[55]

When developing unconventional alliances, we may have to assert ourselves beyond what is comfortable. I recall the first time I shared my project *The Symmetry of God* with a tenured professor of theoretical physics. We had talked extensively about the history of physics, symmetry and the idea of an interdisciplinary discourse that sincerely considered both science and tradition, before I pulled out the piece of paper containing equations I had derived from primarily biblical references.[56] He took one look, chuckled and holding up my equations, said to his graduate student (who had been eavesdropping with genuine interest as he filled up four whiteboards with a steady stream of calculations), "Solve *that* Jeff." He then informed me, "As interesting as your ideas are, until you can do *that* (pointing to the equations on the board) no

[55] Some suggested scholarly works (in addition to the list begun in the introduction of my thesis) that one could profitably initially contemplate in order to further corroborate and elaborate on the theory of necessary opposition are folklorist Mircea Eliade's *The Sacred and The Profane*, Giorgio de Santillana and Hertha von Dechend's *Hamlet's Mill: An Essay on Myth and the Frame of Time*, Husserl and all of the phenomenologists who followed him including any of philosopher of culture Earnst Cassirer's writings, philosopher of science and logic Karl Popper's *The Logic of Scientific Discovery*, *Conjectures and Refutations* and his ideology *verisimilitude*, Alfred Tarski's semantic theory of truth and his conception of a *metalanguage*, *Erwin Schrödinger's World View: The Dynamics of Knowledge and Reality* (edited by Johann Götschl), David Bohm's *Wholeness and the Implicate Order*, James Maffie's *Aztec Philosophy*—just to name a few—and of course all traditional creation narratives ought to be re-considered in this explicit context.

[56] See the Appendix.

physicist will care about anything you're trying to say." To which I replied, "*That* (pointing to the equations on the board) is not in my 'tool box.'[57] My contribution is to put these equations into your mind and in time perhaps *you* will solve them." For the first time in our lengthy conversation, he took a long, silent, *serious* look at my equations and said, "You have suggested relationships not yet considered by science; I'd like to hang on to these if you don't mind."

Applying *properties of equality for real numbers* from mathematics specifically and assuming symmetry and relativity generally, in my study *The Symmetry of God*, I replaced real numbers with Christian scriptural references to God. The properties of equality for real numbers typically include nine logical rules which allow one to balance, manipulate and solve equations. I have employed four of these rules in my study The Symmetry of God: 1) *Reflexive Property*: For all real numbers (ideas or phenomena in my case) x, $x = x$. A number (idea or phenomena) is equal to itself. 2) *Symmetric Property*: For all real numbers (ideas or phenomena) x and y, if $x = y$, then $y = x$. The order of equality does not matter. 3) *Transitive Property*: For all real numbers (ideas or phenomena) x, y and z, if $x = y$ and $y = z$, then $x = z$. Two numbers (ideas or phenomena) that are equal to the same number (idea or phenomena) are also equal to each other. 4) *Substitution Property*: For all real numbers (ideas or phenomena) x and y, if $x = y$, then y can be substituted for x in any expression. The first three properties allow us to define the equivalence relation between real numbers (ideas or phenomena) and the fourth allows us to balance and solve equations involving real numbers (ideas or phenomena).[58]

For the purpose of this particular study, when *God* is mentioned in any account, *God* = *God*[59] (reflexive property). If *God* is equal (as indicated by the first person singular conjugation

[57] A colloquial term I often use to refer to specialized skills, attitudes and understandings, often associated with various academic disciplines or cultural traditions.
[58] http://hotmath.com/hotmath_help/topics/properties-of-equality.html
[59] "…I AM THAT I AM…" Exodus 3:14

of the verb *to be*), to *Love*,[60] then *Love* is equal to *God* (symmetric property). Likewise, if *God* = *Love* and *Love* = *Light*,[61] then *God* = *Light*[62] (transitive property). Similarly, if *God* = *Love*, then *Love* (or *Light* or *Life*[63] or *All Things* (*Matter*)[64] as per the transitive property) can be *God* in any expression (substitution property), for example, *Love* = *Life*.[65]

When asked how he was able to discover novel relationships in nature (relationships for which there seemed to be no antecedent or indication of), Nobel Prize winning theoretical physicist Paul Dirac simply replied, "A great deal of my work is just playing with equations and seeing what they give" (Wilczek 2003, 45). Essentially that is what I have attempted to do here.

At least two important implications of this particular work in progress are: When we apply a scientific model to Christian references about God—or we can say a universal being or power of some kind 1) we find there arise relationships for which no Christian reference exists and 2) we discover that at least some of the relationships suggested by Christian narratives are manifest in modern science. For example, *Light =All Things (Matter)*[66] is essentially Einstein's equation $E=mc^2$ (Mass-Energy equivalence is the concept that the mass of an object or system is a measure of its energy content[67] or the more familiar, energy equals mass times the speed of light squared), Wilczek's connection between love and dark matter could be interpreted *Love* = *All Things (Matter)* (Wilczek 2008, 22-23);[68] also his statement, "The its *are* the bits [of information]" (Wilczek 2008, 34) sure seems to resemble *Intelligence (Mind*/*Thought) = All Things (Matter)* and similarly, Bohr's view of the quantum of action bridging the gap between so

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[60] "…God *is* love." I John 4:8 (4:16)
[61] No direct Christian reference exists.
[62] "…I *am* the light…" John 8:12 and "…God *is* light…" I John 1:5
[63] "…I *am*...the life..." John 14:6
[64] "…all things were made…*of* him." Doctrine and Covenants 93:10
[65] No direct Christian reference exists.
[66] See appendix
[67] http://en.wikipedia.org/wiki/Mass%E2%80%93energy_equivalence
[68] This relationship was explicitly confirmed by me in a personal interview I conducted with him fall 2008.

called living and nonliving things, seems to correlate with *Intelligence (Mind/Thought) = All Things (Matter)*, *Life = All Things (Matter)* and *Intelligence (Mind/Thought) = Life*, just to name a few. Naturally, the independent scientific pursuit of these aspects of existence has disclosed very different (and allegedly more useful) insights than those disclosed by traditional means but I contend that if we stop there we have missed the point. Again, with Heidegger's idea of disclosure-concealment in mind, the point is that these scientific relationships present themselves in the equations derived by passing Christian references through a mathematical filter which in turn produced relationships for which no explicit supporting Christian reference exists. Philosophical examples of unanswered Christian relationships introduced by The Symmetry of God include Descartes'[69] "Cogito ergo sum." (Je pense, donc je suis or I think, therefore I am) as discussed in his 1637 *Discourse on the Method* and in 1644 *Principles of Philosophy*, where *Intelligence (Mind/Thought) is*…implying that *Intelligence (Mind/Thought*) *itself is* existence. Descartes believed, we cannot doubt of our existence while we doubt (Descartes 1999, part 4, 24-25), that indeed the very act of doubting our existence is proof that we exist while other knowledge obtained by the senses or imagination could be deceptive. This notion of existence became a key element of Western philosophy as it was seen as a foundational epistemology. Spinoza determined that love, which he equated with (as I mentioned earlier) pure unsolicited thought, is the most essential physical law of nature and ought to be the starting point for all scientific and philosophical endeavor; indeed the source from which all other knowledge could be accurately deduced (a notion that was also held by Einstein). In other words, *Love* = pure

[69] René Descartes was a French philosopher and mathematician. He is considered the founder of 17th century continental rationalism, modern philosophy and subsequently western philosophy. As mentioned earlier in the introduction to my thesis, he is also considered responsible for introducing the mind-body dichotomy although I along with Strawson would argue he intended the mind-body relation he introduced to be seen as a relational binary or as two sides of the same coin as I am considering binaries in my research. Incidentally, his notion of the mind-body divide (*Cartesian Dualism*) and *Cogito ergo sum*, are considered antiquated by most modern scholars of both philosophy and science.

Intelligence (Mind/*Thought*) and *Love* or *Intelligence (Mind*/*Thought*) = *Law*[70] which for Spinoza seemed to imply *All Things (Matter)* and *Life*, indeed all of nature in its totality.

Although I have presented what I consider to be a compelling start towards a significant discussion of existence between science, philosophy and folklore, I encourage other folklorists, anthropologists and religious studies aficionados to further explore: 1) if there are Christian references I may have overlooked which support some of the implied equations; 2) if the same equations exist in other sacred narratives, for example, the Hindu idea of intelligence (sometimes depicted as streaming from the third eye of Shiva, God of creation-destruction) signaling creation can be seen as *Intelligence (Mind, Thought, Knowledge*) = *All things (Matter)* which is further complicated by the Hindu notion that thoughts produce vibrations[71] (a view which recent scientific studies also seem to support) which signaled all existence into being or the Aboriginal Australian notion of a primeval melody bringing all creation into existence, which indicate the relationship *Word (Breath) = All things (Matter)* or *Life* (as the Hindu believe all things to be sentient beings) or perhaps demand the additional relationships Vibration/Song = All Things (Matter) leading us to; 3) if *new* equations are suggested by alternative texts from various traditions; 4) if references can be found in various traditions to confirm the equations implied but not supported by Christian texts and so on. As I already mentioned and demonstrated, science and philosophy could likewise fill in gaps, adding equations and giving supporting references to existing equations. In this way, a more comprehensive index of possible equations to be considered, both comparatively within the humanities and social sciences and incorporatively by all disciplines interested in a more complete and unified description of what it means to exist might be thoroughly developed in time. Once again, my purpose here is merely to suggest that

[70] "Love…[*is*] all the law…" Mathew 22:37,39-40

[71] Nama Rupa is the Vedic notion that all things, including ideas and emotions, have a name and a frequency and are therefore qualitatively and ultimately *quantitatively* real.

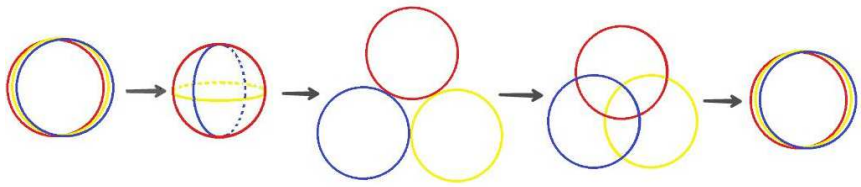
meaningful and promising interdisciplinary applications of necessary opposition indeed exist and ought to be pursued.

While Einstein fell short of saying that energy is intelligent, he did demonstrate that energy is composed of particle-like photons, revealing energy's material-like aspect. Some physicists have—surprisingly—theorized that even space may be "mindful" or that it may possess varying degrees of intelligence and affection. USU theoretical physicist Jim Wheeler,[72] in a recent personal conversation with him regarding the apparently superficial nature of time, ventured a hypothesis saying, "Space, unlike time, requires the existence of a multiplicity of conscious beings that trust one another." And Nobel Prize winning physicist Frank Wilczek[73] expressed to me in a dialogue regarding observed quantum activity that, "Behavior is not separate from existence, rather they are two aspects of the same thing…It seems to me that behavior becomes matter and eventually matter begins to think about [becomes aware of] its behavior." In another discussion with Dr. Wilczek concerning dark matter and dark energy, he explained, "Dark matter is statistical; not genius; not creative; just loosely held together…Increasing intelligence seems to parallel increasing density and complexity." This proposed extended study of my Christian texts based The Symmetry of God is primarily concerned with a comprehensive classification of necessary opposition, that tertiary features must be considered by each discipline where the gaps in understanding occur. This is a new type of index; an interdisciplinary one, which can be presented in overlays. Furthermore, any starting point would be fine depending on the particular expertise or interest of the investigator. Additionally, as all accounts of unity, oneness or universality imply necessary opposition due to

[72] Taken from a private conversation I had with Dr. James T. Wheeler in 2010 and used here with his express consent.
[73] Taken from a telephone conversation I had with Dr. Frank D. Wilczek in 2009 and used here with his express consent.

the fact that the world of our experience is manifold and therefore any such accounts of unity from mythology, metaphysics or quantum unification theories should be incorporated into this study.

However, all things being "one" need not imply that every account of unity is saying the same thing—a common apprehension that many academics uphold regarding interdisciplinary and comparative scholarship generally. On the contrary, because each perspective unquestionably discloses numerous important and useful distinctions, oneness need only signify that the manifold distinctions disclosed by various perspectives can ultimately be related together as a unified whole. In other words methodological and phenomenological symmetry do not presume that every account is saying the same thing; rather symmetry theory presumes that each account is saying very different things about a shared or common phenomenon. In summary, as well as getting back to the over-arching question of my stated thesis: Although folklore, philosophy and physics are perceived to occupy distinct spheres, are there points of overlap? Do the discourses of folklore, philosophy and physics contain mythological elements? I think we can safely say, yes, there *are* points of overlap, the discourses of folklore, philosophy and physics *do* contain mythological elements.



As the figure above illustrates, when we assume symmetry, all phenomena and the theories we employ to perceive, understand and explain them are essentially uniform. They become multiform when a particular discipline (or tradition) examines (or practices) specific

aspects of that phenomenon in isolation or within a limited context. Because the isolated aspects are in fact related, interdisciplinary research will inevitably produce increasing points of overlap until the "many" once again take on a more unified appearance. Because conventional epistemological systems do not currently coordinate or explain enigmatic phenomena with any acceptable degree of precision, paradoxical phenomena or inescapably opposing phenomena must be viewed as dynamic, mutually dependent relationships between what only *seem* to be inconsistent phenomena. In other words, this dynamic continuum or cycle of the "one" being or becoming "many" and the "many" being or becoming "one" (a prevailing theme in presumably all sacred narratives) seems to me the only effective way to comprehend and classify binary phenomena.

REFERENCES

Becker, Bill. 1957. “Pioneer of the atom.” *New York Times Sunday Magazine*, October 20.

Bohr, Niels. 1998. *The philosophical writings of Niels Bohr Volume IV: Causality and complementarity*. Supplementary papers edited by Jan Faye and Henry J. Folse. Woodbridge, CT: Ox Bow Press.

Calaprice, Alice. 1996. *The quotable Einstein*. Princeton, NJ: Princeton University Press.

Capra, Fritof. 2000. *The Tao of physics: An exploration of the parallels between modern physics and eastern mysticism*. Boston, MA: Shambhala.

Chang, Larry. 2006. *Wisdom for the soul*. Washington DC: Gnosophia Publishers.

Clark, Ronald W. 1972. *Einstein: The life and times*. New York, NY: Avon Books.

Cohen, S. Marc, Patricia Curd, and C.D.C. Reeve. 2005. *Readings in ancient Greek philosophy from Thales to Aristotle*. Indianapolis, IN: Hacket Publishing.

Dirac, Paul A. M. 1963. “The evolution of the physicist’s picture of nature.” *Scientific American*, May.

Dukas, Helen, and Banesh Hoffman. 1981. *Albert Einstein: The human side: New glimpses from his archives*. Princeton, NJ: Princeton University Press.

Dundes, Alan. 1998. *Sacred narrative: Readings in the theory of myth*. Berkeley, CA: University of California Press.

Dundes, Alan. 1999. *International folkloristics*. Lanham, MD: Rowman & Littlefield.

Eddington, Arthur. 1928. *The nature of the physical world*. New York, NY: Macmillan.

Einstein, Albert. 1931. *Cosmic religion: With other opinions and aphorisms*. New York, NY: Covici-Friede.

Einstein, Albert. 1934. *Essays in science.* New York, NY: Wisdom Library.

Einstein, Albert. 1949. *The world as I see it.* New York, NY: Philosophical Library.

Einstein, Albert. 1956. *Out of my later years: The scientist, philosopher, and man portrayed through his own words*. New York, NY: Philosophical Library.

Einstein, Albert. 2004. *Sidelights on relativity*. Whitefish, MT: Kessinger.

Einstein, Albert, and Léopold Infeld. 1938. *The evolution of physics: The growth of ideas from early concepts to relativity and quanta*. New York, NY: Cambridge University Press.

Frank, Philip. 1947. *Einstein: His life and times*. New York, NY: Alfred A. Knopf.

Gordon, Isabel S., and Sophie Sorkin. 1959. *The armchair science reader*. New York, NY: Simon & Schuster.

Haisch, Bernard. 2009. *The God theory: Universes, zero-point fields and what's behind it all.* San Francisco, CA: Red Wheel/Weiser LLC.

Heidegger, Martin. 1966. "*Conversation on a country path about thinking*," from *Discourse on thinking*. Trans. by John Anderson and E. Hans Freund. New York, NY: Harper & Row.

Heisenberg, Werner. 1949. *The physical principles of the quantum theory*. Trans. by Carl Eckart and Frank C. Hoyt. New York, NY: Dover.

Heisenberg, Werner. 1958. *Physics and philosophy: The revolution in modern science*. New York, NY: Harper Torchbooks.

Heisenberg, Werner. 1960. *The representation of nature in contemporary physics: Symbolism in religion and literature*. New York, NY: George Braziller.

Heisenberg, Werner. 1971. *Physics and beyond: Encounters and conversations*. Crows Nest, AU: Allen and Unwin.

Holton, Gerald, and Yehuda Elkana. 1997. *Albert Einstein: Historical and cultural perspectives*. Princeton, NJ: Princeton University Press.

Hufford, David J. 1982. *The terror that comes in the night: An experience-centered study of supernatural assault traditions*. Philadelphia, PA: University of Pennsylvania Press.

Hufford, David J. 1997. "Introduction" *Journal of Southern Folklore* 54:1-14.

Isaacson, Walter. 2008. *Einstein: His life and universe.* New York, NY: Simon & Schuster.

Jackson, Bruce, and Edward D. Ives. 1996. *The world observed: Reflections on the fieldwork process*. Springfield, IL: University of Illinois Press.

Keyes, Ralph. 2006. *The quote verifier: Who said what, where, and when*. New York, NY: St. Martin's Press.

Kizza, I. N. 2009. *The oral tradition of the Baganda of Uganda*. Jefferson, NC: McFarland & Company.

Kragh, Helge. 1990. *Dirac: A Scientific Biography*. Cambridge, UK: Cambridge University Press.

Kragh, Helge. 1999. *Quantum generations: A history of physics in the twentieth century*. Princeton, NJ: Princeton University Press.

Krauss, Lawrence M. 2012"A universe without purpose." *Los Angeles Times*, April 1.

Kursunoglu, Behram N., and Eugene P. Wigner. 1990. *Paul Adrien Maurice Dirac: Reminiscences about a great physicist*. Cambridge, UK: Cambridge University Press.

Leach, Edmond. 1962. "Genesis as myth." *Discovery* May.

Lévi-Strauss, Claude. 1978. *Myth and meaning*. Toronto, ON: University of Toronto Press.

Levy, David H. 1950. "On the generalized theory of gravitation." *Scientific American* April.

Mead, Carver A. 2002. *Collective electrodynamics: Quantum foundations of electromagnetism*. Boston, MA: MIT Press.

Mechling, Jay R. 1989. "Banana cannon and other folk traditions between human and nonhuman animals." Journal of Western Folklore 48: 312-323.

Mehra, Jagdish. 1973. *The physicist's concept of nature*. Boston, MA: D. Reidel Publishing.

Miller, William. 1955. "Can we produce an Einstein?" *LIFE Magazine* May 2.

Moore, Walter. 1989. *Schrödinger: Life and thought*. New York, NY: Cambridge University Press.

Mullis, Kary B. 1997. *Nobel lectures: Chemistry 1991-1995*. Singapore, TH: World Scientific Publishing.

Olson, Edwin E. 2014. *Finding reality: Four ways of knowing*. Bloomington, IN: Archway Publishing.

Oring, Elliot. 1986. *Folk groups and folklore genres: An introduction*. Logan, UT: Utah State University Press.

Perry, Whitall N. 1971. *A treasury of traditional wisdom.* London, UK: George Allen & Unwin.

Popper, Karl R. 1992. *Quantum theory and the schism in physics*. New York, NY: Routledge.

Popper, Karl R. 2002. *The logic of scientific discovery: Logik der forschung*. New York, NY: Routledge.

Reeve, C.D.C. 2006. *Plato on love*. Indianapolis, IN: Hacket Publishing.

Santillana, Giorgio de and Hertha von Dechend. 1969. *Hamlet's mill: An essay on myth and the frame of time*. Boston, MA: Gambit.

Schilpp, Paul A. 1959. *Albert Einstein: Philosopher-scientist*. Peru, IL: Open Court Publishing.

Schrödinger, Erwin. 1967. *What is life? And mind and matter*. Cambridge, UK: Cambridge University Press.

Scully, Robert J. 2007. *The demon and the quantum*. Hoboken, NJ: Wiley.

Seelig, Carl. 1956. *Albert Einstein: A documentary biography*. London, UK: Staples Press.

Shaw, George B. 1946. "*Back to Methuselah: A metabiological Pentateuch.*" Oxford, UK: Oxford University Press.

Snow, Baron C. P. 1966. *Variety of men*. New York, NY: Scribner's.

Spinoza, Baruch. 1994. A Spinoza reader: *The ethics and other works*. Edited and translated from Latin to English by Edwin Curley. Princeton, NJ: Princeton University Press.

Sproul, Barbara C. 1991. *Primal myth: Creation myths around the world*. New York, NY: HarperSanFrancisco.

Stewart, Ian. 2007. *Why beauty is truth: A history of symmetry.* Philadelphia, PA: Basic Books.

Strawson, Galen. 2006. *Consciousness and its place in nature: Does physicalism entail panpsychism?* Edited by Anthony Freeman. Charlottesville, VA: Imprint Academic.

Strawson, Galen. 1994. *Mental reality*. Boston, MA: MIT Press.

Vergnaud, Jean-Roger. 2014. *Primitive elements of grammatical theory: Papers by Jean-Roger Vergnaud and his collaborators.* Edited by Katherine McKinney-Bock and Maria Luisa Zubizarreta. New York, NY: Routledge.

Wilczek, Frank D. 2003. *Proceedings of the Dirac centennial symposium*. Edited by Howard Baer and Alexander Belyaev. Singapore, TH: World Scientific Publishing.

Wilczek, Frank D. 2008. *The lightness of being: Mass, ether, and the unification of forces*. New York, NY: Basic Books.

Zee, Anthony. 1987. *Fearful symmetry: The search for beauty in modern physics*. Princeton, NJ: Princeton University Press.

BIBLIOGRAPHY

Aftandilian, Dave. 2007. *What are the animals to us?* Knoxville, TN: University of Tennessee Press.

Atteberry, Jennifer E. 2007. *Up in the rocky mountains*. Minneapolis, MN: University of Minnesota Press.

Aurelius, Marcus. 1945. *Meditations*. Roslyn, NY: Walter J. Black.

Bacon, Francis. 1909. *The new Atlantis*. New York, NY: P. F. Collier & Son.

Becker, Bill. 1957. "Pioneer of the atom." *New York Times Sunday Magazine*, October 20.

Bohr, Niels. 1987. *The philosophical writings of Niels Bohr Volume I: Atomic theory and the description of nature*. Woodbridge, CT: Ox Bow Press.

Bohr, Niels. 1987. *The philosophical writings of Niels Bohr Volume II: Essays 1932-1957 on atomic physics and human knowledge*. Woodbridge, CT: Ox Bow Press.

Bohr, Niels. 1987. *The philosophical writings of Niels Bohr Volume III: Essays 1958-1962 on atomic physics and human knowledge*. Woodbridge, CT: Ox Bow Press.

Bohr, Niels. 1998. *The philosophical writings of Niels Bohr Volume IV: Causality and complementarity*. Supplementary papers edited by Jan Faye and Henry J. Folse. Woodbridge, CT: Ox Bow Press.

Calaprice, Alice. 1996. *The quotable Einstein*. Princeton, NJ: Princeton University Press.

Campbell, Joseph. 1991. *Primitive mythology: The masks of God*. New York, NY: Penguin.

Campbell, Joseph. 1991. *The power of myth*. New York, NY: Anchor Books.

Capra, Fritof. 2000. *The Tao of physics: An exploration of the parallels between modern physics and eastern mysticism*. Boston, MA: Shambhala.

Chang, Larry. 2006. *Wisdom for the soul*. Washington DC: Gnosophia Publishers.

Clark, Ronald W. 1972. *Einstein: The life and times*. New York, NY: Avon Books.

Cohen, S. Marc, Patricia Curd, and C.D.C. Reeve. 2005. *Readings in ancient Greek philosophy from Thales to Aristotle*. Indianapolis, IN: Hacket Publishing.

Danien, Elin C. 2005. *Maya folktales from the Alta Verapaz*. Philadelphia, PA: University of Pennsylvania Museum of Archaeology and Anthropology.

Descartes, René. 1999. *Discourse on method in discourse on method and related writings.* Trans. by Desmond M. Clarke. London, UK: Penguin.

Diels, Hermann, and Walther Krantz, trans. 1969. *The fragments of the pre-Socratics*. http://www.sacred-texts.com/

Dirac, Paul A. M. 1963. "The evolution of the physicist's picture of nature." *Scientific American*, May.

Drummond, Henry. 1967. *The greatest thing in the* world. Mount Vernon, NY: Peter Pauper Press.

Dukas, Helen, and Banesh Hoffman. 1981. *Albert Einstein: The human side: New glimpses from his archives*. Princeton, NJ: Princeton University Press.

Dundes, Alan. 1965. *The study of folklore.* Upper Saddle River, PA: Prentice Hall.

Dundes, Alan. 1998. *Sacred narrative: Readings in the theory of myth*. Berkeley, CA: University of California Press.

Dundes, Alan. 1999. *International folkloristics*. Lanham, MD: Rowman & Littlefield.

Dupuis, Charles. 1872. *Origin of all religious worship*. New Orleans, LA: Reprinted by the University of Michigan University Library.

Eastman, Charles A. 1995. *The soul of the Indian*. Lincoln, NE: University of Nebraska.

Eddington, Arthur. 1928. *The nature of the physical world*. New York, NY: Macmillan.

Einstein, Albert. 1931. *Cosmic religion: With other opinions and aphorisms*. New York, NY: Covici-Friede.

Einstein, Albert. 1934. *Essays in science.* New York, NY: Wisdom Library.

Einstein, Albert. 1949. *The world as I see it.* New York, NY: Philosophical Library.

Einstein, Albert. 1956. *Out of my later years: The scientist, philosopher, and man portrayed through his own words*. New York, NY: Philosophical Library.

Einstein, Albert. 2004. *Sidelights on relativity*. Whitefish, MT: Kessinger.

Einstein, Albert, and Léopold Infeld. 1938. *The evolution of physics: The growth of ideas from early concepts to relativity and quanta*. New York, NY: Cambridge University Press.
Eliade, Mircea. 1987. *The sacred and the profane: The nature of religion*. Orlando, FL: Harcourt.

Eyring, Henry J. 2007. *Mormon scientist: The life and faith of Henry Eyring*. Stephens Point, WI: Worzalla Publishing.

Farmelo, Graham. 2009. *The strangest man: The hidden life of Paul Dirac, mystic of the* atom. New York, NY: Basic Books.

Frank, Philip. 1947. *Einstein: His life and times*. New York, NY: Alfred A. Knopf.

Gordon, Isabel S., and Sophie Sorkin. 1959. *The armchair science reader*. New York, NY: Simon & Schuster.

Haisch, Bernard. 2009. *The God theory: Universes, zero-point fields and what's behind it all.* San Francisco, CA: Red Wheel/Weiser.

Heidegger, Martin. 1966. "*Conversation on a country path about thinking*," from *Discourse on thinking*. Trans. by John Anderson and E. Hans Freund. New York, NY: Harper & Row.

Heidegger, Martin. 1992. *Parmenides*. Trans. from German to English by Andre Schuwer and Richard Rojcewicz. Bloomington and Indianapolis, IN: Indiana University Press.

Heisenberg, Werner. 1949. *The physical principles of the quantum theory*. Trans. by Carl Eckart and Frank C. Hoyt. New York, NY: Dover.

Heisenberg, Werner. 1958. *Physics and philosophy: The revolution in modern science*. New York, NY: Harper Torchbooks.

Heisenberg, Werner. 1960. *The representation of nature in contemporary physics: Symbolism in religion and literature*. New York, NY: George Braziller.

Heisenberg, Werner. 1971. *Physics and beyond: Encounters and conversations*. Crows Nest, AU: Allen and Unwin.

Heuvelmans, Bernard. 1968. *In the wake of sea serpents*. New York, NY: Hill and Wang.

Holton, Gerald, and Yehuda Elkana. 1997. *Albert Einstein: Historical and cultural perspectives*. Princeton, NJ: Princeton University Press.

Hufford, David J. 1982. *The terror that comes in the night: An experience-centered study of supernatural assault traditions*. Philadelphia, PA: University of Pennsylvania Press.

Hufford, David J. 1997. "Introduction" *Journal of Southern Folklore* 54:1-14.
Isaacson, Walter. 2008. *Einstein: His life and universe.* New York, NY: Simon & Schuster.

Jackson, Bruce, and Edward D. Ives. 1996. *The world observed: Reflections on the fieldwork process*. Springfield, IL: University of Illinois Press.

Jung, Carl G. 1963. *Memories, dreams, reflections*. New York, NY: Vintage Books.

Kant, Emmanuel. 1781. *The critique of pure reason*. Trans. from German to English by J.M. D. Meiklejohn. http://www.sacred-texts.com/

Keyes, Ralph. 2006. *The quote verifier: Who said what, where, and when*. New York, NY: St. Martin's Press.

Kizza, I. N. 2009. *The oral tradition of the Baganda of Uganda*. Jefferson, NC: McFarland & Company.

Kragh, Helge. 1990. *Dirac: A Scientific Biography*. Cambridge, UK: Cambridge University Press.

Kragh, Helge. 1999. *Quantum generations: A history of physics in the twentieth century*. Princeton, NJ: Princeton University Press.

Krauss, Lawrence M. 2012"A universe without purpose." *Los Angeles Times*, April 1.

Kursunoglu, Behram N., and Eugene P. Wigner. 1990. *Paul Adrien Maurice Dirac: Reminiscences about a great physicist*. Cambridge, UK: Cambridge University Press.

Lama, His Holiness the Dalai. 2005. *The universe in a single atom: The convergence of science and spirituality*. New York, NY: Morgan Road Books.

Leach, Edmond. 1962. "Genesis as myth." *Discovery* May.

Leonard, Scott A., and Michael McClure. 2002. *Myth and knowing: An introduction to world mythology*. Boston, MA: McGraw-Hill.

Lévi-Strauss, Claude. 1969. *The raw and the cooked: Introduction to a science of mythology*. New York, NY: Harper & Row.

Lévi-Strauss, Claude. 1978. *Myth and meaning*. Toronto, ON: University of Toronto Press.

Levy, David H. 1950. "On the generalized theory of gravitation." *Scientific American* April.

Lind, Richard E. 2007. *The seat of consciousness in ancient literature*. Jefferson, NC: McFarland & Company.

Mead, Carver A. 2002. *Collective electrodynamics: Quantum foundations of electromagnetism*. Boston, MA: MIT Press.

Mechling, Jay R. 1989. "Banana cannon and other folk traditions between human and nonhuman animals." Journal of Western Folklore 48: 312-323.

Mehra, Jagdish. 1973. *The physicist's concept of nature*. Boston, MA: D. Reidel Publishing.

Miller, William. 1955. “Can we produce an Einstein?” *LIFE Magazine* May 2.

Moore, Walter. 1989. *Schrödinger: Life and thought*. New York, NY: Cambridge University Press.

Mullis, Kary B. 1997. *Nobel lectures: Chemistry 1991-1995*. Singapore, TH: World Scientific Publishing.

Olson, Edwin E. 2014. *Finding reality: Four ways of knowing*. Bloomington, IN: Archway Publishing.

Oring, Elliot. 1986. *Folk groups and folklore genres: An introduction*. Logan, UT: Utah State University Press.

Parker, G. Keith. 2006. *Seven Cherokee myths*. Jefferson, NC: McFarland & Company.

Perry, Whitall N. 1971. *A treasury of traditional wisdom.* London, UK: George Allen & Unwin.

Phillips, Walter S. 1896. *Totem tales: Indian stories, Indian told*. Chicago, IL: Star Publishing.

Popper, Karl R. 1963. *Conjectures and refutations: The growth of scientific knowledge*. London, UK: Routledge.

Popper, Karl R. 1992. *Quantum theory and the schism in physics*. New York, NY: Routledge.

Popper, Karl R. 2002. *The logic of scientific discovery: Logik der forschung*. New York, NY: Routledge.

Reeve, C.D.C. 2006. *Plato on love*. Indianapolis, IN: Hacket Publishing.

Sanday, Peggy R. 2007. *Aboriginal paintings of the Wolf Creek crater: Track of the rainbow serpent*. Philadelphia, PA: University of Pennsylvania Museum of Archaeology and Anthropology.

Santillana, Giorgio de and Hertha von Dechend. 1969. *Hamlet’s mill: An essay on myth and the frame of time*. Boston, MA: Gambit.

Schilpp, Paul A. 1959. *Albert Einstein: Philosopher-scientist*. Peru, IL: Open Court Publishing.

Schrempp, Gregory A. 1992. *Magical arrows: The Maori, the Greeks, and the folklore of the universe*. Madison, WI: The University of Wisconsin Press.

Schrödinger, Erwin. 1967. *What is life? And mind and matter*. Cambridge, UK: Cambridge University Press.

Schweitzer, Albert A. 1949. *Genius in the jungle.* New York, NY: The Vanguard Press.

Scully, Robert J. 2007. *The demon and the quantum*. Hoboken, NJ: Wiley.

Seelig, Carl. 1956. *Albert Einstein: A documentary biography*. London, UK: Staples Press.

Shaw, George B. 1946. "*Back to Methuselah: A metabiological Pentateuch.*" Oxford, UK: Oxford University Press.

Snow, Baron C. P. 1966. *Variety of men*. New York, NY: Scribner's.

Spinoza, Baruch. 1994. A Spinoza reader: *The ethics and other works*. Edited and translated from Latin to English by Edwin Curley. Princeton, NJ: Princeton University Press.

Sproul, Barbara C. 1991. *Primal myth: Creation myths around the world*. New York, NY: HarperSanFrancisco.

Stewart, Ian. 2007. *Why beauty is truth: A history of symmetry.* Philadelphia, PA: Basic Books.

Strawson, Galen. 2006. *Consciousness and its place in nature: Does physicalism entail panpsychism?* Edited by Anthony Freeman. Charlottesville, VA: Imprint Academic.

Strawson, Galen. 1994. *Mental reality*. Boston, MA: MIT Press.

Tauber, Alfred I. 2009. *Science and the quest for meaning*. Waco, TX: Baylor University Press.

Taylor, Jill B. 2009. *My stroke of insight: A brain scientist's personal journey.* New York, NY: Plume.

Tesla, Nikola. 1900. "The problem of increasing human energy." *The Century*, June.

Twain, Mark. 1903. *Life on the Mississippi*. Boston, MA: H. O. Houghton and Company.

Tzu, Lao. 2006. *Tao te ching*. Trans. by John C. H. Wu. Boston, MA: Shambhala Publications.

Ueshiba, Morihei. 1985. *Aikido*. Tokyo, JP: Hozansha Publications.

Vergnaud, Jean-Roger. 2014. *Primitive elements of grammatical theory: Papers by Jean-Roger Vergnaud and his collaborators.* Edited by Katherine McKinney-Bock and Maria Luisa Zubizarreta. New York, NY: Routledge.

Widtsoe, John A. 1930. *In search of truth: Comments on the gospel and modern thought.* Salt Lake City, UT: Deseret Book Company.

Wilczek, Frank D. 2003. *Proceedings of the Dirac centennial symposium*. Edited by Howard Baer and Alexander Belyaev. Singapore, TH: World Scientific Publishing.

Wilczek, Frank D. 2008. *The lightness of being: Mass, ether, and the unification of forces*. New York, NY: Basic Books.

Wilson, Edward O. 1998. *Consilience: The unity of knowledge*. New York, NY: Alfred A. Knopf.

Yogananda, Paramhansa. 1946. *Autobiography of a yogi*. New York, NY: The Philosophical Library.

Zee, Anthony. 1987. *Fearful symmetry: The search for beauty in modern physics*. Princeton, NJ: Princeton University Press.

APPENDIX

The Symmetry of God

As found in The Holy Bible[74], Book of Mormon, Doctrine and Covenants and Pearl of Great Price

If:	
God = God	"And God said unto Moses, I AM THAT I AM…Thus shalt thou say unto the children of Israel, I AM hath sent me unto you." Exodus 3:14
God = Love	"…God *is* love." I John 4:8 (4:16)
God = Word (Breath)	"…the *W*ord *was* God." John 1:1 (Moses 1:32)
God = Law	"Christ *is* the end of the law…" Romans 10:4
God = Truth	"…I *am*…the truth…" John 14:6
God = Light	"…I *am* the light…" John 8:12 (9:5, Revelations 21:23, Mosiah 16:9, Alma 38:9, 3 Nephi 9:18, 18:16, D&C 6:21, 10:70, 11:28, 14:9, 88:6, 50, 93:2) "…God *is* light…" I John 1:5 "…Christ…*is*…the light of the sun, and…the light of the stars…" D&C 88:7, 9
God = Power	"…Christ the power of God…" I Corinthians 1:24 "I *am*…the power thereof..." D&C 88:7-10
God = Glory	
God = All Things (Matter)	"…all things were made by him, and through him, and *of* him." D&C 93:10 (88:7-10, 41, 76:24, Moses 1:32-33)
God = Life	"…I *am*...the life..." John 14:6 (Mosiah 16:9, Alma 38:9, 3 Nephi 9:18, D&C 10:70, 11:28)
God = Way	"…I *am* the way…" John 14:6
God = Wisdom	"…Christ…the wisdom of God" I Corinthians 1:24
God = Spirit	"…whatsoever is light is Spirit, even the Spirit of Jesus Christ." D&C 84:45 [equivalence is implied]
God = Good	"…the Lord *is* good…" I Chronicles 16:34 "…good cometh *of* God…" Moroni 7:12 [Perhaps 'good' is a noun here rather than an adverb?]
God = Intelligence (Mind/Thought)	
Then:	
Love = Word (Breath)	
Love = Law	"Love…[*is*] all the law…" Mathew 22:37,39-40
Love = Truth	
Love = Light	
Love = Power	
Love = Glory	
Love = All Things (Matter)	"Charity never faileth…" I Chorinthians 13:8 [Most essential of matter?]
Love = Life	
Love = Way	
Love = Wisdom	
Love = Spirit	
Love = Good	
Love = Intelligence (Mind/Thought)	
Word (Breath) = Law	
Word (Breath) = Truth	"…thy [Jesus Christ referring to Heavenly Father] word *is* truth." John 17:17 (D&C 84:45)

[74] I have used the King James Version of the bible as it is the preferred text within the Christian congregation (The Church of Jesus Christ of Latter Day Saints or Mormons) within which I was raised. I have also solicited references from other Mormon texts such as The Book of Mormon, The Doctrine and Covenants and the Pearl of Great Price. Any expertise I may have lies in this context however, I intend to branch out and solicit input from members and specialists of various religions and traditions in order to make this index as comprehensive as possible.

Word (Breath) = Light	"And God said, Let there be light: and there was light." Genesis 1:3 "…thy word *is* a lamp unto my feet, and a light unto my path." Psalms 119:105 "…their souls were illuminated by the light of the everlasting word…" Alma 5:7
Word (Breath) = Power	"…word of God *is* powerful [*full* of power]…" Hebrew 4:12 (Alma 26:13, 31:5, Moses 1:32)
Word (Breath) = Glory	
Word (Breath) = All Things (Matter)	"By the word of the Lord were the heavens made…For He spake, and it was done; He commanded, and it stood fast." Psalms 33:6, 9 "…the worlds were framed by the word…" Hebrew 11:3 "…upholding all things by the word of his power…" Hebrews 1:3 "…were the heavens made; and all the host of them *by* the breath of his mouth." Psalms 33:6
Word (Breath) = Life	"Of his own will begat he us with the word of truth…" James 1:18 "…their souls *were* illuminated by the…everlasting word…" Alma 5:7
Word (Breath) = Way	
Word (Breath) = Wisdom	"…the word…*is* a discerner of the thoughts and intents of the heart." Hebrews 4:12
Word (Breath) = Spirit	"…the Spirit, which *is* the word…" Ephesians 6:17 "…my voice *is* Spirit…" D&C 88:66
Word (Breath) = Good	"…*G*ood *is* the word…" II kings 20:19 (Isaiah 38:8) [Words of Hezekiah as spoken to Isaiah.]
Word (Breath) = Intelligence (Mind/Thought)	"…the word…*is* a discerner of the thoughts and intents of the heart." Hebrews 4:12
Law = Truth	
Law = Light	
Law = Power	
Law = Glory	
Law = All Things (Matter)	
Law = Life	"…law…is a fountain of life…" Proverbs 13:14
Law = Way	
Law = Wisdom	
Law = Spirit	"…not at any time have I given unto you a law which was temporal…" D&C 29:34
Law = Good	
Law = Intelligence (Mind/Thought)	
Truth = Light	"…whatsoever is truth *is* light…" D&C 84:45
Truth = Power	
Truth = Glory	"The glory of God *is*…truth…" D&C 93:36
Truth = All Things (Matter)	
Truth = Life	"…we are *of* the truth…" I John 3:18-19
Truth = Way	
Truth = Wisdom	
Truth = Spirit	"…the Spirit *is* truth." I John 5:6 (D&C 88:66)
Truth = Good	"…Is it not good, if…truth be in my days?" II Kings 20:19
Truth = Intelligence (Mind/Thought)	"…intelligence, in other words…truth…" D&C 93:29, 36 "…truth *is* knowledge of things as they are, and as they were, and…are to come;" D&C 93:24
Light = Power	
Light = Glory	"…the glory of God did lighten it [the earth]…" [no need of the sun] Revelations 21:23-24 "The glory of God *is*…light…" D&C 93:36 (76:70)
Light = All Things (Matter)	
Light = Life	"…and the life *was* the light of men…And the light shineth in darkness…" John 1:4-5 "…their souls *were* illuminated by the light…" Alma 5:7 (D&C 76:70)
Light = Way	
Light = Wisdom	"…a man's wisdom maketh his face to shine…" Ecclesiastes 8:1
Light = Spirit	"…whatsoever is light *is* Spirit…" D&C 84:45

Light = Good	"…God saw the light, that it was good…" Genesis 1:4 (Moses 2:4, Abraham 4:4) "…whatsoever is light, *is* good…" Alma 32:35
Light = Intelligence (Mind/Thought)	"…intelligence, in other words, light…" D&C 93:29, 36
Power = Glory	
Power = All Things (Matter)	
Power = Life	
Power = Way	
Power = Wisdom	
Power = Spirit	
Power = Good	
Power = Intelligence (Mind/Thought)	
Glory = All Things (Matter)	
Glory = Life	"…he [man] *is* the…glory of God…" I Chorinthians 11:7 (D&C 76:70)
Glory = Way	
Glory = Wisdom	
Glory = Spirit	
Glory = Good	
Glory = Intelligence	"The Glory of God *is* intelligence…" D&C 93:36
All Things (Matter) = Life	
All Things (Matter) = Way	
All Things (Matter) = Wisdom	"To him that *by* wisdom made the heavens…" Psalms136:5-9
All Things (Matter) = Spirit	"There is no such thing as immaterial matter. All spirit *is* matter…" D&C 131:7
All Things (Matter) = Good	
All Things (Matter) = Intelligence (Mind/Thought)	
Life = Way	
Life = Wisdom	
Life = Spirit	
Life = Good	
Life = Intelligence (Mind/Thought)	
Way = Wisdom	
Way = Spirit	
Way = Good	
Way = Intelligence (Mind/Thought)	
Wisdom = Spirit	
Wisdom = Good	
Wisdom = Intelligence (Mind/Thought)	
Spirit = Good	
Spirit = Intelligence (Mind/Thought)	
Good = Intelligence (Mind/Thought)	