

# 1 Introduction

A great war of ideas is raging. Western civilization is besieged. By “Western Civilization” I mean the civilization that grew out of the marriage between ancient Israel and classical Greece. Like any living thing in the world, she has struggled to survive since the moment of her birth. However, the Western tradition includes bold claims about the dignity of man and what is objectively real. So, in addition to enemies who might naturally oppose any civilization, the West has enemies who dispute her claims. In this talk, I shall focus on the Western view of reality—in light of the teaching of St. Thomas of Aquinas—and on a particular opposition to this view.

Let us reflect on some points of the West’s development. First, the Hebrew and the Greek traditions became intertwined in the writing of the *Septuagint*.<sup>1</sup> The two became one in Christianity, which requires both traditions in order to express doctrine. Christians converted the declining Roman empire to the Faith, defended Europe against the onslaught of Muslim invaders,<sup>2</sup> and finally established a new civilization, among whose fruits are modern science<sup>3</sup> and laws respecting the rights of man. Western civilization is not identical with Christian civilization; for example, some Jews participate fully in the Western tradition and fully in Jewish tradition.<sup>4</sup> Still, her existence is principally due to Christianity.

The West has many enemies, both within countries formed by her ideals and without. Since the time of Descartes, who denied Aristotelian metaphysics, the West has had philosophical enemies within her own ranks. This continues down to the present day.

One enemy of Western civilization is a recent form of atheism. New Atheists,<sup>5</sup> such as Richard Dawkins, while claiming for themselves the mantle of science, ironically deny the Aristotelian metaphysical<sup>6</sup> basis for understanding reality. In the general context of the great war and the particular context of the attack from the New Atheists, I point to the philosophical conflict over how things really are.

## 1.1 Ancient Israel and Creation

The story of the conflict begins in ancient Israel. The relevant idea from *Genesis* is that things have not always existed. God, Who is not a thing, initially created things. A new thing, such as a pot, might come into existence by transformation from a pre-existing thing, such as a lump of clay. However, according God’s revelation to the Israelites, there was in the past a beginning when the first things were created from nothing (ex nihilo), not by transformation. The fundamental distinction made by the ancient Israelites is between God and what God creates.

## 1.2 Classical Greece and Transformation

Another thread of the story begins in classical Greece. The early philosophers struggled to understand the apparent conflict between how a thing remains the same and how it changes. The difficulty of understanding the apparent simultaneity of permanence and change, of

being and becoming, led some to conclude that change is not real; others concluded that there is no permanence at all. On one side, sense experience was viewed as essentially illusory; on the other side, the mind’s abstraction of the unchanging was viewed as essentially illusory. The Greek philosophical tradition culminated, however, in the writing of Aristotle, who stood up for the reality of sense experience and for the mind’s ability to abstract the permanent.

Aristotle made the fundamental distinction between actuality and potentiality. By explaining that

a thing changes precisely when what had existed only potentially in the thing begins to exist actually,

he showed how both permanence (in what remains actual) and change (in the actualization of a potential) are real. Both the mind’s comprehension of a definite object and the sense experience of change are satisfied. This distinction is the root of what is called

1. The *Septuagint* is the first translation of the *Tanakh* (what Christians call the *Old Testament*). The translation, into Greek, was made before the Christian era. [Vander Heeren \[2012\]](#) provides a detailed overview. [Ratzinger \[2005, 2007\]](#) comments on the marriage of the Greek and the Hebrew cultures in the writing of the *Septuagint*. (I do not have page references because I do not have my copies of those books as I write the present talk.) In at least one of *Truth and Tolerance* and *Jesus of Nazareth*, Ratzinger writes of the union of the cultures as a marriage, of which the *Septuagint* is the offspring. Further, Ratzinger indicates that the relationship between God and man is completed, in a sense, by this marriage, which matures in Christianity. The Hebrew culture results from God’s reaching down to man and man’s faithful response; the Greek culture results from man’s reaching up toward God through the intellect.

2. [Belloc \[1938, Chapter 4\]](#) gives a concise overview of the circumstances leading up to the First Crusade.

3. The terms “science” and “scientific,” by etymology, could be misleading. In Latin, the verb “scire” means “to know,” but many a scientific theory cannot be known as a truth. Modern science does have truths: Every repeatable perception resulting from a carefully described experiment or observation is a truth that has the power to prove a theory false, even a theory that had long been treated as standard. However, a scientific theory that refers to something imperceptible, like the electron, might some day be superseded by a new theory making no reference to the imperceptible thing. The imperceptible thing was proposed as a possible reason for the perceptible result of an experiment. The imperceptible thing’s existence is not certain, and so the theory referring to it cannot be known as a truth. There are many who would claim that the electron’s existence is certain, but such “entity realism” has problems. [Chakravarty \[2016\]](#) gives an overview of scientific realism.

4. Although Jewish tradition is consistent with Western civilization, Islamic tradition appears not to be. A person who calls himself “Muslim” might participate fully in Western culture. However, if his support for universal human rights be grounded in the belief that man is created in the image of God, then he participates *against his own religion*, which condemns the Judeo-Christian idea of man. Even if he find some other basis for universal human rights, he will have trouble reconciling it with Islamic tradition. [Ali and Spencer \[2003\]](#) point out that both the Sunni and the Shiite traditions in Islam are opposed to universal human rights (unless the only humans in existence were Muslims).

5. “New Atheism” is a term widely used to refer to ideas popularized by Richard Dawkins, Sam Harris, Daniel Dennett, and Christopher Hitchens in the first decade of the 21st Century. [Feser \[2008\]](#) devotes a whole book to the refutation of the philosophical errors of the New Atheists.

6. The word, “metaphysics,” originates from the order of the books in the traditional list of Aristotle’s writings. His writing on the distinction between act and potency came after (meta) his writing on nature (physics). These days, any theory about what lies at the root of being or of change is called “a metaphysical theory.”



“Aristotelian metaphysics,” and it led to modern science, which takes sense experience as the fundamental data in need of theoretical explanation.

### 1.3 Synthesis in Christianity

When, after having been lost for a time, Aristotle was reintroduced into the West by Aquinas, he perfected the metaphysical theory so that it could explain not only change by transformation but also creation ex nihilo. Aquinas showed how, even if there had been no beginning in time, there would still be creation ex nihilo at every moment in time.<sup>7</sup>

### 1.4 Scientism, the New Atheism

Although Aristotle’s metaphysical theory naturally led to the emergence of modern science in the West,<sup>8</sup> Aristotle’s opponents today ironically mount their attack under the banner of science. The self-proclaimed advocate<sup>9</sup> of science typically holds an erroneous view, *scientism*,<sup>10</sup> according to which everything that exists is describable by modern science. We shall see in what follows how Aristotelian metaphysics is opposed to scientism. First, however, we must explore the key Aristotelian distinction, which allowed Aquinas to form a synthesis of the Judeo-Christian idea of creation and the Greek explanation of change.

## 2 The Actual and the Potential

Aristotle distinguished between real, actual existence and real, potential existence in order to explain both the reality of change and the reality of permanence.

### 2.1 The Eleatics

In the Greek colony of Elea in Southern Italy—and before the time of Socrates—Parmenides and Zeno<sup>11</sup> appear to have held that change is unreal. In any change something new arises; what is new did not exist before the change. Denying that creation of anything new takes place, the Eleatics, at least on one interpretation of their writing, saw no way to explain the appearance of the new feature. It cannot come from nothing. So they denied that the senses are adequate to the understanding of reality and insisted on the unreality of change. The Eleatic view is arguably more subtle than what appears in this characterization, but even in classical Greece the Eleatic view was taken by some to reject the reality of change.<sup>12</sup>

The debate over the reality of change continues today. Like the apparent view of the Eleatics, a common view among physicists is that although time is real, the *passage* of time is an illusion.<sup>13</sup> The universe is imagined as a four-dimensional space, one of whose dimensions is called “time.” The time dimension is handled differently from the spatial dimensions in general relativity, and so time in that sense is regarded as perfectly real (and, at least in each particular

reference frame, distinct from space). However, the *passage* of time is like what the Eleatics called “change” and is now commonly regarded as unreal.

### 2.2 Heraclitus

In Ephesus—and before the time of Socrates—Heraclitus appears to have held that everything is in flux, and nothing is permanent. As for the Eleatics, there is some debate about what Heraclitus actually thought. Nevertheless, Plato and Aristotle took him to affirm the reality of change and to deny the reality of any permanence. The view attributed to Heraclitus is in a sense the opposite of the apparent Eleatic view, in which there is only permanence and no change.<sup>14</sup>

7. Aquinas shows how we cannot know by observation whether the universe have a finite age. Only revelation can give us certainty that time began. (I note that even a successful theory like the Big Bang cannot give us certainty that time began.) However, Aquinas also shows that God creates the universe ex nihilo at every moment in time. So creation ex nihilo does not require a beginning in time. That is, God could create the universe such that it always existed, if God wanted to. See the translation of the *Summa Theologiae* by the [English Dominican Fathers](#) [1920, I, Q45, A1, and I, Q46, A1].

8. Feser [2014, Page 36] points out that Aristotle’s middle ground between the apparent extremes of the Eleatics and Heraclitus is precisely what is needed for something like modern science to work. Aristotle more generally [Feser, 2014, Pages 164–171] developed the idea of a natural substance, and his basic thesis was that sense observations can be used to learn about nature. The incorporation of these ideas into Christianity through Aquinas and the Catholic Church’s systematic investigation of miraculous claims, to see if each claim had a natural explanation, laid the groundwork for the emergence of modern science in the West.

9. Bill Nye, for example, is one of the most famous advocates of science. Yet in advocating not merely science but scientism, he makes a philosophical error. Bishop Robert Barron appears in a short movie in which he talks about Bill Nye’s scientism: [https://www.youtube.com/watch?v=SH\\_Njsa0zVQ](https://www.youtube.com/watch?v=SH_Njsa0zVQ).

10. Arguably the initial, definitive use of the word, “scientism,” is given by Sorell [1991]. My definition is essentially the one given by Hutchinson [2011]. There are many arguments against scientism. See, for example, Thomas Nagel’s argument from the problem of qualia, or subjective experience. Nagel’s view is summarized here: <http://www.nybooks.com/articles/2017/06/08/how-to-imagine-consciousness>, in his response to a comment by a professor Black. Note that Nagel is an atheist, though he is out of favor with the typical modern atheist, whose materialism takes the form of scientism. Feser [2014], in the introductory chapter of his book, summarizes all of the main arguments against scientism.

11. Zeno wrote many paradoxes, but what is commonly presented as “Zeno’s paradox” is that idea that one cannot travel from point A to point B along a straight line. First one would have to reach the midpoint C between A and B, but, before that, one would have to reach the midpoint between A and C, etc. The infinite regression was intended to show the absurdity of local motion. Zeno, like Parmenides, appeared to deny both the reality of all change and the multiplicity of beings.

12. Palmer [2017] makes an interesting argument from Plato’s *Parmenides* both for the subtlety of Parmenides’ view and for the common misconception about what his view really was. In any event, Aristotle argues for the reality of change, whether against Parmenides himself or against the common misunderstanding of what Parmenides’ view actually was.

13. Carroll [2015], for example, thinks that the “flow” of time from past to future is an illusion. Smolin [2013], however, regards the passage of time as real.

14. Graham [2015] gives an overview of scholarship on Heraclitus.



## 2.3 The Two Kinds of Reality

In a reality that is actual, there exist other realities that are potential. For example, this sphere of silly putty is a reality that is actual. In this actual sphere of silly putty, there are realities that are potential: a flat piece of silly putty (if I squash it in one manner) and a cubic piece of silly putty (if I squash it in another manner). Potential realities are still real; they really exist, though they are not actual. That is, reality consists not only of what is actual but also of what is potential in an actual thing.

In fact, the potentialities that exist in an actual thing are intimately associated with what the actual thing is. For example, this sphere of silly putty is not potentially a solid blob that fills the room in which I am standing. Not every imaginable potentiality is really in a given actual thing. One task of modern science is to find out what the potentialities in every natural substance are.

## 2.4 Change

Change occurs whenever a potentiality in a thing becomes actual.

## 2.5 Causal Powers and Laws of Nature

A so-called “law of nature” is not what makes things behave as they do. Rather, every thing by nature has certain potentialities and some powers to actualize potencies in other things. A law of nature is what we propose in order to summarize the interactions of things according to their natures.

# 3 Efficient and Final Causality

Efficient cause is to final cause as the actual is to the potential.

# 4 Formal and Material Causality

Formal cause is to material cause as the actual is to the potential.

# 5 Existence and Essence

Existence is to essence as the actual is to the potential.

## References

- Ali, D. and R. Spencer. *Inside Islam: A Guide for Catholics, 100 Questions and Answers*. Ascension Press. West Chester, PA. 2003.
- Belloc, H. *The Great Heresies*.<sup>15</sup> Sheed and Ward. London. 1938.
- Carroll, S. “The Reality of Time.”<sup>16</sup> On Carroll’s blog.<sup>17</sup> 2015.
- Chakravartty, A. “Scientific Realism.”<sup>18</sup> In *The Stanford Encyclopedia of Philosophy*. Winter 2016 Edition. Metaphysics Research Lab. Stanford University. 2016.

Fathers of the English Dominican Province, Translated by. *The Summa Theologiae of St. Thomas Aquinas*.<sup>19</sup> Second and Revised Edition. 1920.

Feser, E. *The Last Superstition: A Refutation of the New Atheism*. St. Augustine’s Press. 2008.

Feser, E. *Scholastic Metaphysics: A Contemporary Introduction*. editiones scholasticae. Heusenstamm. 2014.

Gottlieb, Paula, “Aristotle on Non-contradiction.”<sup>20</sup> In *The Stanford Encyclopedia of Philosophy*. Summer 2015 Edition. Metaphysics Research Lab. Stanford University. 2015.

Graham, D. W. “Heraclitus.”<sup>21</sup> In *The Stanford Encyclopedia of Philosophy*. Fall 2015 Edition. Metaphysics Research Lab. Stanford University. 2015.

Hutchinson, I. *Monopolizing Knowledge: A Scientist Refutes Religion-Denying, Reason-Destroying Scientism*.<sup>22</sup> Fias Publishing. Belmont, MA. 2011.

Palmer, J. “Zeno of Elea.”<sup>23</sup> In *The Stanford Encyclopedia of Philosophy*. Spring 2017 Edition. Metaphysics Research Lab. Stanford University. 2017.

Ratzinger, J. *Truth and Tolerance: Christian Belief and World Religions*. Ignatius Press. San Francisco. 2004.

Ratzinger, J. *Jesus of Nazareth*. Doubleday. New York. 2007.

Smolin, L. *Time Reborn*. Houghton Mifflin Harcourt Publishing Company. New York. 2013.

Sorell, T. *Scientism: Philosophy and the Infatuation with Science*. Routledge. New York. 1991.

Vander Heeren, A. “Septuagint Version.”<sup>24</sup> In *The Catholic Encyclopedia*. 1913 Edition. Robert Appleton Company. New York. 1912.

15. <http://onlinebooks.library.upenn.edu/webbin/metabook?id=heresies>

16. <http://www.preposterousuniverse.com/blog/2015/04/03/the-reality-of-time>

17. <http://preposterousuniverse.com>

18. <https://plato.stanford.edu/archives/win2016/entries/scientific-realism>

19. <http://www.newadvent.org/summa>

20. <https://plato.stanford.edu/archives/sum2015/entries/aristotle-noncontradiction>

21. <https://plato.stanford.edu/archives/fall2015/entries/heraclitus>

22. <http://monopolizingknowledge.net/contents.html>.

23. <https://plato.stanford.edu/archives/spr2017/entries/zeno-elea>

24. <http://www.newadvent.org/cathen/13722a.htm>



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