MISCELLANEOUS NOTES taken in preparation for the AIL Class: Reality and Unreality: (updated 1/13/2010)

Anthropic reasoning involves assessing these constraints by analyzing the properties of universes with different fundamental parameters or laws of physics from the current one, and has frequently concluded that essential structures, from atomic nuclei to the whole universe, depend, for stability, on delicate balances between different fundamental forces; balances which occur only in a small minority of possible universes — so that ours seems to be fine-tuned for life. Anthropic reasoning also attempts to explain and quantify this fine tuning. Within the scientific community the usual approach is to invoke selection effects from a real ensemble of alternate universes, which cause an anthropic bias in what can be observed.

Antinomy: Russell's antinomy can be stated as follows. Classes seem to be of two kinds: those which do not contain themselves as members, and those which do. A class will be called "normal" if, and only if, it does not contain itself as a member; otherwise it will be called "non-normal." An example of a normal class is the class of mathematicians, for patently the class itself is not a mathematician and is therefore not a member of itself. An example of a non-normal class is the class of all thinkable things; for the class of all thinkable things is itself thinkable and is therefore a member of itself. Let 'N' by definition stand for the class of *all* normal classes. We ask whether N itself is a normal class. If N is normal, it is a member of itself (for by definition N contains all normal classes); but, in that case, N is non-normal, because by definition a class that contains itself as a member is non-normal. On the other hand, if N is non-normal, it is a member of itself (by definition of non-normal); but, in that case, N is normal, because by definition the members of N are normal classes. In short, N is normal if, and only if, N is non-normal. It follows that the statement 'N is normal' is both true and false. This fatal contradiction results from an uncritical use of the apparently pellucid notion of class.

Artistotle: Time: According to the Classical Greek philosopher Aristotle, time is the measure of motion. Motion for Aristotle was both quantitative and qualitative. He used astronomy to define the idea that time there were equal intervals for time; that is, time has uniformity. He correlated the rate of motion of the stars with the uniformity of motion and thus the uniformity of time. Aristotle believed that there was a fifth element beyond earth, air, fire, and water known as aether, which rotates around the center of the universe (in Aristotle's time, the center of the Earth). If the motion of aether is the measure of time, then the stars rotate uniformly as well. With the advent of the Scientific Revolution in the sixteenth century, Aristotle's theory came under significant revision with the work of astronomers Nicholaus Copernicus and Galileo Galilei. These developments eventually became a subject of interest to Newton.
Armstrong: Karen: The Case for God; Homo Religiosus.
http://www.youtube.com/watch?v=SJMm4RAwVLo Prize Winning Speech: Compassion
http://www.youtube.com/watch?v=V-bkZc7SWLQ In defense of Islam

Aristotle's Categories:

1. **Substance** (*ousia*, "essence" or "substance"). *Substance* is defined as that which neither can be predicated of anything nor be said to be in anything. Hence, *this particular man* or *that particular tree* are substances. Later in the text, Aristotle calls these particulars "primary substances", to distinguish them from *secondary substances*, which are universals and *can* be predicated. Hence, Socrates is a primary substance, while man is a secondary substance. *Man* is predicated of Socrates, and therefore all that is predicated of man is predicated of Socrates.
2. **Quantity** (*poson*, "how much"). This is the extension of an object, and may be either discrete or continuous. Further, its parts may or may not have relative positions to each other. All medieval discussions about the nature of the continuum, of the infinite and the infinitely divisible, are a long footnote to this text. It is of great importance in the development of mathematical ideas in the medieval and late Scholastic period.
3. **Quality** (*poion*, "of what kind or quality"). This is a determination which characterizes the nature of an object.
4. **Relation** [*disambiguation needed*] (*pros ti*, "toward something"). This is the way in which one object may be related to another.
5. **Place** (*pou*, "where"). Position in relation to the surrounding environment.
6. **Time** (*pote*, "when"). Position in relation to the course of events.
7. **Position** (*keisthai*, "to lie"). The examples Aristotle gives indicate that he meant a condition of rest resulting from an action: *'Lying', 'sitting'*. Thus *position* may be taken as the end point for the corresponding action. The term is, however, frequently taken to mean the relative position of the parts of an object (usually a living object), given that the position of the parts is inseparable from the state of rest implied.
8. **State** (*echein*, "to have"). The examples Aristotle gives indicate that he meant a condition of rest resulting from an affection (i.e. being acted on): *'shod', 'armed'*. The term is, however, frequently taken to mean the determination arising from the physical accoutrements of an object: one's shoes, one's arms, etc. Traditionally, this category is also called a *habitus* (from Latin *habere*, "to have").
9. **Action** (*poiein*, "to make" or "to do"). The production of change in some other object.
10. **Affection** (*paschein*, "to suffer" or "to undergo"). The reception of change from some other object. It is also known as *passivity.* It is clear from the examples Aristotle gave for action and for affection that action is to affection as the active voice is to the passive. Thus for action he gave the example, *'to lance', 'to cauterize';* for affection, *'to be lanced', 'to be cauterized.'* The term is frequently misinterpreted to refer only or mainly to some kind of emotion or passion.

Inside Book Jacket: Moving from the Paleolithic age to the present, Karen Armstrong details the great lengths to which humankind has gone in order to experience a sacred reality that it called by many names, such as God, Brahman, Nirvana, Allah, or Dao. Focusing especially on Christianity but including Judaism, Islam, Buddhism, Hinduism, and Chinese spiritualities, Armstrong examines the diminished impulse toward religion in our own time, when a significant number of people either want nothing to do with God or question the efficacy of faith. **Why has God become unbelievable?** Why is it that atheists and theists alike now think and speak about God in a way that veers so profoundly from the thinking of our ancestors?

Answering these questions with the same depth of knowledge and profound insight that have marked all her acclaimed books, Armstrong makes clear how the changing face of the world has necessarily changed the importance of religion at both the societal and the individual level. And she makes a powerful, convincing argument for drawing on the insights of the past in order to build a faith that speaks to the needs of our dangerously polarized age. **Yet she cautions us that religion was never supposed to provide answers that lie within the competence of human reason; that, she says, is the role of** *logos.* **The task of religion is "to help us live creatively, peacefully, and even joyously with realities for which there are no easy explanations."** She emphasizes, too, that religion will not work automatically. **It** is, she says, a practical discipline: its insights are derived not from abstract speculation but from "dedicated intellectual endeavor" and a "compassionate lifestyle that enables us to break out of the prism of selfhood."

Chapter on Death of God? See the PDF Document provided on disk.

Armstrong: Reviews of The Case for God: (1) Karen Armstrong is able to do two things which are individually remarkable, and in combination perhaps unique.
- provide a credible, erudite, historical overview of all the main religions in a way that shows how they fit together; i.e. the key ideas they have borrowed from each other
- do so in a way which is vivid, accessible and often inspiring.

The God Armstrong is arguing for is not some religious readers will be shocked to discover that "their" religion is based on ideas that are far more widespread than they may have realized. And they may be uncomfortable that one actively involved in day-to-day human concerns, checking off prayer requests or directing the weather, but deeper, mysterious, perhaps ineffable. Some non-religious readers will be shocked by how compelling a case **Armstrong makes for a religious mindset based, not so much on "belief" or "faith" but on spirituality and compassion**. But all, if they approach this book with an open mind, are likely to emerge with a richer understanding of life's most important questions

Review: (2) **An Intellectual Feast But in the End Very Little Help to the World's Problems:** In this astounding book, prolific author Karen Armstrong has written an intellectual history of the notion of God down through the centuries, focusing on our western Christian conceptions. In many ways her book covers much of the same territory that Robert Wright did in The Evolution of God, which I reviewed on Amazon. But whereas Wright focuses on the evolution of morality in conceptions of the divine, Armstrong focuses on the practice of religion itself.

I was astonished as time after time she got so many things right in those areas I knew something about. This is an amply documented massive book which cannot be rehearsed in any detail in this short review. But it is an intellectual feast. If you want to be brought up to speed to today's world on the subject of religion in the western world, this book may be the only one you need. From Paleolithic times to postmodern thinking it's all here for the most part. From the Hebrew God Yahweh, to the Greek "logos," to the rise of Christianity, the era of Constantine, the rise of Science, the Enlightenment down to the present day, she covers it all masterfully.

Her main concern throughout the book seems to be the rise of the religious fundamentalist phenomenon and the atheist backlash seen best in the so-called New Atheists like Harris, Dawkins, Dennett, and Hitchens. Against both sides she claims religion is not a set of doctrines to be believed but rather something practiced in ritual and experienced through introspection, art, and music. As such, the New Atheists have not adequately debunked religion at all when they debunk the Bible, creationism, and/or religious ideas of the divine.

Christian fundamentalism according to her, "is in fact a defiantly unorthodox form of faith that frequently misrepresents the tradition it is trying to defend" (p. xvi). She argues: "Religion was a matter of doing rather than thinking" (p. 25). "Religious discourse was not intended to be understood literally because it was only possible to speak about a reality that transcended language in symbolic terms. The story of the lost paradise was a myth, not a factual account of a historical event" (p. 15). "Like any myth, its purpose is to help us to contemplate the human predicament" (p. 28). As such, the creation account "was emphatically not intended as a literal account of the physical origins of life" (p. 44). When it comes to Yahweh she argues, "There was no clear, consistent image of God in Genesis" (p. 35). Moreover, "Yahweh was simply one of the 'holy ones' in El's retinue" (p. 34). She challenges fundamentalists to therefore "face up to the implications of the Darwinian vision of nature `red in tooth and claw'" (p. 324). She argues that "if a biblical text appeared to contradict current scientific discoveries the exegete must interpret it differently" (p. 324).

With this understanding of fundamentalism she claims the New Atheist's "analysis is disappointingly shallow, because it is based on such poor theology" (p. xvi). "Religion," she says, "was never supposed to provide answers to questions that lay within the reach of human reason...Religion's task, closely allied to that of art, was to help us to live creatively, peacefully, and even joyously with realities for which there were no easy explanations and problems that we could not solve; morality, pain, grief, despair, and outrage at the injustice and cruelty of life....Religion is a practical discipline" (p. 318). Just like the fundamentalists whom they argue against, Armstrong claims that "the new atheists believe that they alone are in possession of truth...they read scripture in an entirely literal manner and seem never to have heard of the long tradition of allegoric interpretation or indeed of Higher Criticism" (p. 303). Thus, Dawkins is "not correct to assume that fundamentalist belief either represents or is even typical of either Christianity or religion as a whole" (p. 304). And he "is also wrong to claim that God is a scientific hypothesis, that is, a conceptual framework for bringing intelligibility to a series of experiments and observations" (p. 305). All told, she shares the same kinds of criticisms of the New Atheists as liberal theologian John F. Haught does in his book God and the New Atheism: A Critical Response to Dawkins, Harris, and Hitchens, which I also reviewed on Amazon.

But her analysis is problematic on a number of fronts. When it comes to religion, Armstrong is placing her liberal theological grid on it backward through time. She's right about primitive religion. Their religion was in the rituals, the dances, the human/child/animal sacrifices, the chants, and the drum music. But somewhere along the evolutionary line, especially within Christianity, religious believers developed doctrinal beliefs too. We see them in the historic creeds of the church, a few of which are in the New Testament itself. If they hadn't done so then what can account for such things as the Inquisition, or the Thirty Years War between the Catholics and Protestants and between the Protestants themselves? This creedal development happened long before Christian fundamentalism arrived on the scene, by her own account! What she seems to misunderstand is that there is no "one size fits all" when it comes to religion. And so she cannot fault the New Atheists for attacking the fundamentalist religion of today's world since that's what religion is for many, many people.

Furthermore, her book uses the results of Higher Criticism, which is little more than the scientific method applied to historical texts like the Bible. She faults the New Atheists for treating God and religion as a scientific hypothesis but then turns around and uses that the same scientific method when deconstructing the Biblical texts. Can she really have it both ways? Even if she doesn't think the scientific method should be used to examine one's religion or concepts of the divine, she needs to articulate and defend an alternative method that can deliver the same kinds of results. What's the alternative for her? Introspection? Art? Music? What kind of method is that? Such a method would never have allowed her to come to the conclusions she's reached about religion in general, and of Christian fundamentalism in particular.

Suffice it for me to say that I find her religion-as-psychology metaphysically unfulfilling and deeply inadequate. Her god is a distant god and as such her god can be safely ignored as having no relevance for one's life at all. She's practically an atheist. So rather than targeting the New Atheists who are promoting scientific thinking, denouncing religious violence, and proclaiming the follies of authoritarian fundamentalist faith, why doesn't she stand up with them against the fundamentalists who are the source of much, if not most, of the problems in this world?

Think of it this way. What does Armstrong fault the New Atheists for in comparison to the religious fundamentalists? Misunderstanding, at best? That's nothing in comparison to the problems that authoritarian fundamentalist faith produces in the world, and she knows this. She's nitpicking when there's a world that needs her help. After all, who really cares if the New Atheists are attacking what she doesn't consider representative of true religion or true Christianity? They are attacking a real threat to world peace regardless! And who really cares if religion doesn't poison everything as Hitchens proclaims? Religion causes a great deal of suffering.

I highly recommend Victor Stenger's latest book in response to criticism like hers, The New Atheism: Taking a Stand for Science and Reason, which I also reviewed on Amazon. This is one of the New Atheists that Armstrong failed to mention. I'm the author of "Why I Became an Atheist," and the forthcoming edited book, "The Christian Delusion."
Bell's theorem: This theorem has even been called "the most profound in science."
It is a theorem that shows that the predictions of quantum mechanics (QM) are not intuitive, and touches upon fundamental philosophical issues that relate to modern physics. It is the most famous legacy of the late physicist John S. Bell. Bell's theorem is a no-go theorem, stating that: "No physical theory of local hidden variables can ever reproduce all of the predictions of quantum mechanics."
•Einstein was critical of the standard interpretation of quantum mechanics. The EPR paper showed that the standard interpretation of quantum mechanics implies "spooky action-at-a-distance" and therefore is not a complete theory. Einstein wanted to get rid of the "action-at-a-distance" by introducing "local hidden variables."

•Einstein pursued this goal for the rest of his life, between 1935 and 1955, and even after his death the problem seemed worth the effort of many persons, mainly theorists and philosophers. But finally, Bell's theorem, published in 1964, proved once and for all that the problem could be decided by experiments: it is possible to construct experiments in which it is impossible for any kind of interpretation based on "local hidden variables" to give the same predictions as quantum mechanics, providing a means of testing whether "action-at-a-distance" actually occurs.

•Multiple researchers have performed equivalent experiments using different methods. It appears most of these experiments produce results which agree with the predictions of quantum mechanics, leading to disproof of local-hidden-variable theories and proof of nonlocality. Still not everyone agrees with these findings. There have been two loopholes found in the earlier of these experiments, the detection loophole and the communication loophole with associated experiments to close these loopholes. After all current experimentation it seems these experiments uphold prima facie support for quantum mechanics' predictions of nonlocality.

Bohm, David: The general nature of reality must have room in them to permit a consistent account of consciousness. Vice versa, our notions of consciousness must have room in them to understand what it means for its contents to be reality as a whole.

Bohr, Niels *If anyone says he can think about quantum problems without getting giddy, that only shows that he has not understood the first thing about them.*

In his biography: xxxxx. Heisenberg: Why Dr Bohr, do you have a horseshoe above the portal to your office? Bohr: because it brings good luck! Heisenberg: Surely, you do not believe it brings good luck? Bohr: of course not! Heisenberg: Why then? Bohr: because they say it brings good luck, even if you do not believe it brings good luck!

Blackbody Radiation*:* In physics, a **black body** is an idealized object that absorbs all electromagnetic radiation that falls on it. No electromagnetic radiation passes through it and none is reflected. Because no light (visible electromagnetic radiation) is reflected or transmitted, the object appears black when it is cold. However, a black body emits a temperature-dependent spectrum of light. This thermal radiation from a black body is termed **black-body radiation**. At room temperature, black bodies emit mostly infrared wavelengths, but as the temperature increases past a few hundred degrees Celsius, black bodies start to emit visible wavelengths, appearing red, orange, yellow, white, and blue with increasing temperature. By the time an object is white, it is emitting substantial ultraviolet radiation.

The term "black body" was introduced by Gustav Kirchhoff in 1860.

Black-body emission gives insight into the thermal equilibrium state of a continuous field. In classical physics, each different Fourier mode in thermal equilibrium should have the same energy, leading to the theory of ultraviolet catastrophe that there would be an infinite amount of energy in any continuous field. Black bodies could test the properties of thermal equilibrium because they emit radiation which is distributed thermally. Studying the laws of the black body historically led to quantum mechanics.

Clockwork Theory of Universe (Newton, Scholastic: Nicole de Oresme): is a theory as to the origins of the universe. A "clockwork universe" can be thought of as being a clock wound up by God and ticking along, as a perfect machine, with its gears governed by the laws of physics.

What sets this theory apart from others is the idea that God's only contribution to the universe was to set everything in motion, and from there the laws of science took hold and have governed every sequence of events since that time. This idea was very popular during the Enlightenment, when scientists realized that Newton's laws of motion, including the law of universal gravitation, could explain the behavior of the solar system.

A notable exclusion from this theory though is free will, since all things have already been set in motion and are just parts of a predictable machine. Newton feared that this notion of "everything is predetermined" would lead to atheism.

This theory was undermined by the second law of thermodynamics (the total entropy of any isolated thermodynamic system tends to increase over time, approaching a maximum value) and quantum physics with its unpredictable random behavior.

Consciousness: a one cell paramecium has no neurons or synapses, yet can learn, reproduce, find food, escape from being sucked into tube, and learns to escape even faster. May not be conscious, but is clearly intelligent. Cell structure contains 10 million microtubials which can switch faster than neurons. See link to Quantum Consciousness by Stuart Hammeroff.

Copenhagen Interpretation to Quantum Mechanics: (see the full article in the PDF document: with same title; including comments by Von Neumann, Einstein, Bohr and Indian Philosophers) The basic issue, again, was — how was an unknown Infinity manifesting itself as the finitely known? A question that had haunted many philosophers and Vedic scholars had the best Quantum minds thinking now. The three main possibilities they put forward as explained above were also not new:

1. Truth cannot be known and the observer creates reality *(Copenhagen Interpretation)*
2. Truth resides is multi-dimensional and cannot be explained in our present known dimensions. *(Many-worlds Interpretation)*
3. Under the hood of the Unknown Infinity is a certainty of an "Intelligence" that creates "method to this madness". *(Hidden Variables Interpretation)*

These theories were well known to the Vedantists long before Planck had inadvertently come out with his *quanta* to shake the deterministic world of Newtonian Duality of matter and wave!

Cosmology: the study of the entire universe, how it was formed, how it has changed over time, and how it will ultimately end.

Assumptions:

1. All basic physical laws are the same everywhere in the universe.
2. The universe is isotropic, where space is the same no matter where we look. There is no favored direction and there is no center of the universe.
3. The universe is homogeneous and on the very largest scales, the distribution of materials is smooth.

Cosmogony: The study of the formation of planets, stars, and galaxies, but especially of the solar system.
Cosmography: A branch of astronomy that maps and describes the main features of the universe.

Computing: 2049: a single computer will be more powerful than the collective brainpower of human race.

Dawkins, Richard: Another view, advanced by Richard Dawkins, is that the existence of God is an empirical question, on the grounds that "a universe with a god would be a completely different kind of universe from one without, and it would be a scientific difference."[16]

Democritus: The fifth century B.C. Greek philosopher, first postulated atoms to be the fundamental building blocks of the visible world. Since then, many advances in science have been driven by man's attempts to understand these atoms.

Descartes, Rene: Cogito ergo sum (I think therefore I am). Objects move in straight lines

Descartes, René (French pronunciation: [ʁəne dekaʁt]), (31 March 1596 – 11 February 1650), also known as *Renatus Cartesius* (Latinized form),[2] was a French philosopher, mathematician, physicist, and writer who spent most of his adult life in the Dutch Republic. He has been dubbed the "Father of Modern Philosophy", and much of subsequent Western philosophy is a response to his writings, which continue to be studied closely to this day. In particular, his *Meditations on First Philosophy* continues to be a standard text at most university philosophy departments. Descartes' influence in mathematics is also apparent, the Cartesian coordinate system allowing geometric shapes to be expressed in algebraic equations being named for him. He is credited as the father of analytical geometry. Descartes was also one of the key figures in the Scientific Revolution.

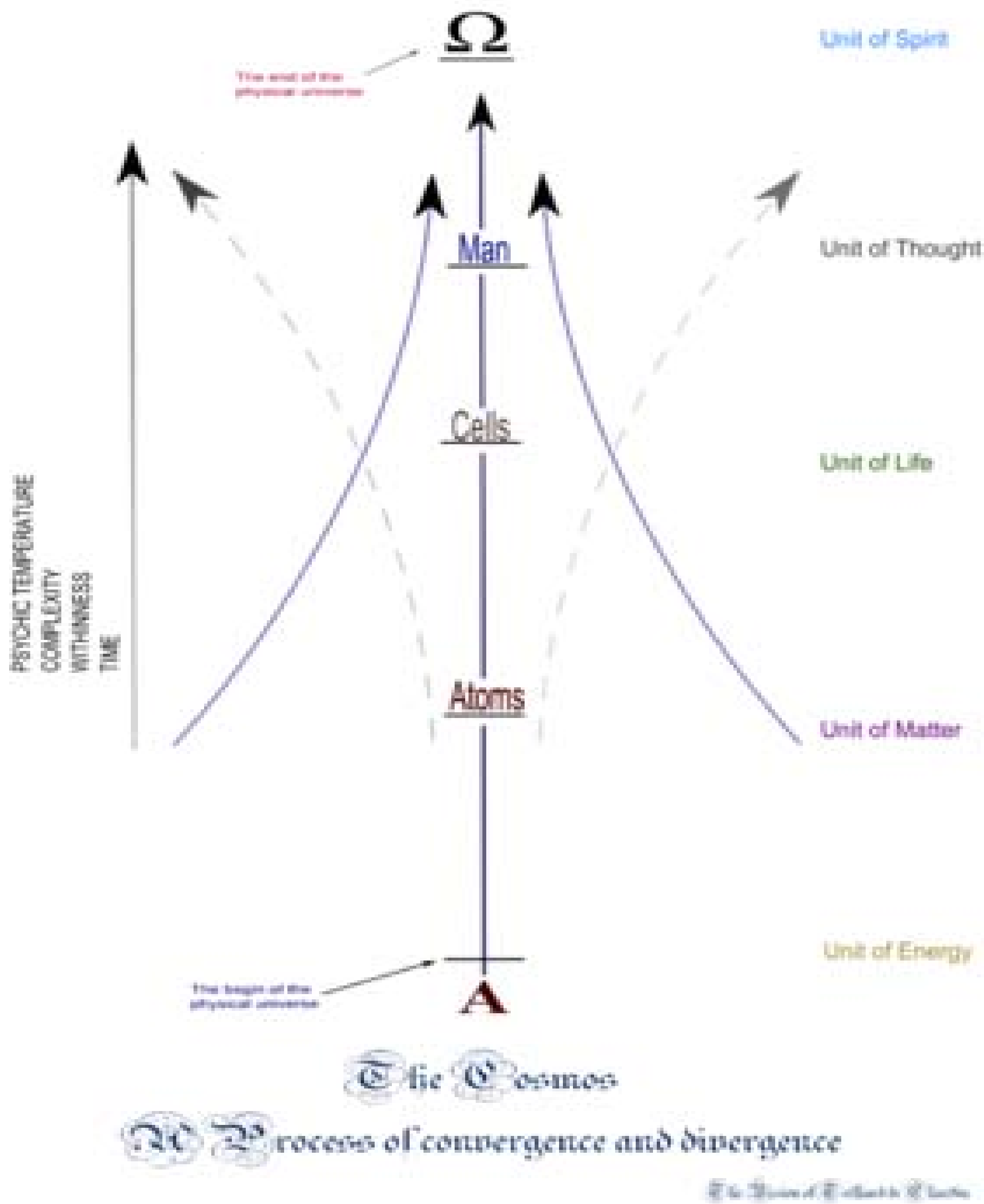
Descartes frequently sets his views apart from those of his predecessors. In the opening section of the *Passions of the Soul*, a treatise on the Early Modern version of what are now commonly called emotions, he goes so far as to assert that he will write on his topic "as if no one had written on these matters before". Many elements of his philosophy have precedents in late Aristotelianism, the revived Stoicism of the 16th century, or in earlier philosophers like St. Augustine. In his natural philosophy, he differs from the Schools on two major points: First, he rejects the analysis of corporeal substance into matter and form; second, he rejects any appeal to ends—divine or natural—in explaining natural phenomena.[3] In his theology, he insists on the absolute freedom of God’s act of creation.

Descartes was a major figure in 17th-century continental rationalism, later advocated by Baruch Spinoza and Gottfried Leibniz, and opposed by the empiricist school of thought consisting of Hobbes, Locke, Berkeley, Jean-Jacques Rousseau, and Hume. Leibniz, Spinoza and Descartes were all well versed in mathematics as well as philosophy, and Descartes and Leibniz contributed greatly to science as well. As the inventor of the Cartesian coordinate system, Descartes founded analytic geometry, the bridge between algebra and geometry, crucial to the discovery of calculus and analysis. He is best known for the philosophical statement "*Cogito ergo sum*" (French: *Je pense, donc je suis*; English: *I think, therefore I am;* or *I am thinking, therefore I exist*), found in part IV of *Discourse on the Method* (1637 - written in French but with inclusion of "Cogito ergo sum") and §7 of part I of *Principles of Philosophy* (1644 - written in Latin).

de Chardin, Teilhard; Pierre Teilhard de Chardin (French pronunciation: [pjɛʀ tejaʀ də ʃaʀdɛ̃]; May 1, 1881 - April 10, 1955) was a French philosopher and Jesuit priest who trained as a paleontologist and geologist and took part in the discovery of Peking Man. Teilhard conceived the idea of the Omega Point and developed Vladimir Vernadsky's concept of Noosphere.

Teilhard's primary book, *The Phenomenon of Man*, set forth a sweeping account of the unfolding of the cosmos. He abandoned traditional interpretations of creation in the Book of Genesis in favor of a less strict interpretation. This displeased certain officials in the Roman Curia and in his own order who thought that it undermined the doctrine of original sin developed by Saint Augustine. Teilhard's position was opposed by his church superiors, and his work was denied publication during his lifetime by the Roman Holy Office. The 1950 encyclical *Humani generis* condemned several of Teilhard's opinions, while leaving other questions open. In 2009, the Pope praised Teilhard and his work.

de Chardin, Teilhard: Phenomenology
Teilhard's phenomenology



Cosmos - a process of convergence and divergence[9]

Teilhard himself claimed his work to be phenomenology.

Teilhard studied what he called the rise of spirit, or evolution of consciousness, in the universe. He believed it to be observable and verifiable in a simple law he called the Law of Complexity/Consciousness. This law simply states that there is an inherent compulsion in matter to arrange itself in more complex groupings, exhibiting higher levels of consciousness. The more complex the matter, the more conscious it is. Teilhard proposed that this is a better way to describe the evolution of life on earth, rather than Herbert Spencer's "survival of the fittest." The universe, he argued, strives towards higher consciousness, and does so by arranging itself into more complex structures.

Teilhard identified what he termed to be different stages in the rise of consciousness. These stages are analogous to what are termed the geosphere and the biosphere. The Law of Complexity/Consciousness traces matter's path through these stages, as it 'complexifies' upon itself and rises in consciousness. Teilhard claimed that although it is not evident, consciousness (in an extremely limited degree) exists even in rocks, as the Law of Complexity/Consciousness implies. In plants, matter is complex enough to exhibit a consciousness that is the very life of the plant. In animals, matter is complex enough to an extraordinary degree to where consciousness shows itself in a wide range of reactionary movement to the whole universe.

However, Teilhard here proposed another level of consciousness, to which human beings belong, because of their cognitive ability; i.e. their ability to 'think'. Human beings, Teilhard argued, represent the layer of consciousness which has "folded back in upon itself", and has become self-conscious. Julian Huxley, Teilhard's scientific colleague, described it like this: "evolution is nothing but matter become conscious of itself."

So in addition to the geosphere and the biosphere, Teilhard posited another sphere, which is the realm of human beings, the realm of reflective thought: the noosphere.

In the noosphere Teilhard believed the same Law of Complexity/Consciousness to be at work, although not in a way previously seen. He argued that ever since human-beings first came into existence 200,000 years ago, the Law of Complexity/Conscious began to run on a different (higher) plane. Consciousness in the universe, he argued, now continues to rise in the complex arrangement and unification (Teilhard sometimes called it 'totalization'[10] of mankind on earth. As human beings converge around the earth, he reasoned, unifying themselves in ever more complex forms of arrangement, consciousness will rise.

Finally, the keystone to his phenomenology is that because Teilhard could not explain why the universe would move in the direction of more complex arrangements and higher consciousness, he postulated that there must exist ahead of the moving universe, and pulling it along, a higher pole of supreme consciousness, which he called Omega Point.

Teilhard re-interpreted many disciplines, including theology, sociology, metaphysics, around this understanding of the universe. A main focus of his was to re-assure the converging mass of humanity not to despair, but to trust the evolution of consciousness as it rises through them.

de Chardin, Influence of Teilhard

Teilhard and his work have a continuing presence in the arts and culture. He inspired a number of characters in literary works. References range from occasional quotations—an auto mechanic quotes Teilhard in Philip K. Dick's *A Scanner Darkly*[11] -- to serving as the philosophical underpinning of the plot, as Teilhard's work does in Julian May's 1987–94 Galactic Milieu Series[12]. Teilhard also plays a major role in Annie Dillard's 1999 *For the Time Being*[13]. Characters based on Teilhard appear in several novels, including Jean Telemond in Morris West's *The Shoes of the Fisherman*[14] (mentioned by name and quoted by Oskar Werner playing Fr. Telemond in the movie version of the novel) and Father Lankester Merrin in *William Peter Blatty's The Exorcist*[15]. In Dan Simmons' 1989–97 *Hyperion Cantos*, Teilhard de Chardin has been canonized a saint in the far future. His work inspires the anthropologist priest character, Paul Duré. When Duré becomes Pope, he takes *Teilhard I* as his regnal name.[16] .

Teilhard appears as a minor character in the play "Fake" by Eric Simonson, staged by Chicago's Steppenwolf Theatre in 2009, involving a fictional solution to the infamous Piltdown Man hoax.

Teilhard's work has also inspired artworks such as French painter Afred Manessier's "L'Offrande de la terre ou Hommage à Teilhard de Chardin[17]" and American sculptor Frederick Hart's acrylic sculpture *The Divine Milieu: Homage to Teilhard de Chardin*[18]. A sculpture of the Omega Point by Henry Setter, with a quote from Teilhard de Chardin, can be found at the entrance to the Roesch Library at the University of Dayton[19]. Edmund Rubbra's 1968 Symphony No. 8 is titled *Hommage a Teilhard de Chardin*.

Teilhard's influence is commemorated on numerous collegiate campuses. A building at the University of Manchester is named after him, as are residence dormitories at Gonzaga University and Seattle University. His stature as a biologist was honored by George Gaylord Simpson in naming the most primitive and ancient genus of true primate, the Eocene genus *Teilhardina*.

The title of the short-story collection *Everything That Rises Must Converge* by Flannery O'Connor is a reference to Teilhard's work.

Deterministic Chaos: a system is chaotic if its trajectory through state space is sensitively dependent on the initial conditions, that is, if unobservably small causes can produce large effects.
In the last few decades, physicists have become aware that even the systems studied by classical mechanics can behave in an intrinsically unpredictable manner. Although such a system may be perfectly deterministic in principle, its behavior is completely unpredictable in practice. This phenomenon was called deterministic chaos.

To explain its origin, we must go back to the concept of linearity. Linearity means basically that effects are proportional to causes. If you hit a ball twice as hard, it will fly away twice as quickly. Another way of expressing this is additivity: the total effect is the sum of the effects of the individual causes. For example, if you are pushing a car that ran out of fuel, and want it to move twice as fast, you might either push twice as hard, or find someone else to help you push. The effect would be the same. In the example of the car, the system is not perfectly linear: when you push twice as hard, the car will not move exactly twice as fast, but only approximately. You would not make a big mistake, though, if you would assume that the effect is proportional to your effort. Many practical situations are like that: they are not exactly linear, but you can approximate them quite well with a linear function. Linear equations are solved easily, but non-linear ones are in general very hard or impossible to solve. Therefore, until the beginning of this century most non-linear problems in classical mechanics were approximated by linear ones. However, cases started to accumulate where linear functions were clearly not good approximations.

One of the most famous is the three-body problem. Newton's theory of gravitation provides a simple solution to the problem of two mutually attracting bodies, for example the sun and one of its planets. However, as soon as a third body comes into play, for example another planet, the problem becomes mathematically unsolvable. In practice, astronomers work with approximations, where the attraction to the most important body, in this case the sun, is taken as the basis, while the effect of a third body is brought in as a perturbation. Predictions based on this approximation are in practice very reliable. The reason this works is because the gravitation exerted by the planets is tiny compared to the gravitation exerted by the sun. However, nobody can prove that they are absolutely reliable. It is very well possible that the solar system is unstable and that the gravitational attractions between the different planets may lead one of the planets to suddenly escape into outer space.

We cannot predict whether such catastrophic effects will occur because they depend on undetectable changes in the initial conditions. In the two body problem, if one of the conditions is changed a little, the effect will not be very different. For example, if the moon would be brought a little closer to the Earth, its trajectory would remain basically the same. This is no longer true in the three-body problem. A tiny change in one of the variables, for example the speed of the planet Venus, might result in a totally different outcome, for example the planet Mars crashing into the sun. This is called "sensitive dependence on initial conditions". The effects are extremely sensitive to changes in the conditions that cause them. This is the essence of non-linearity: effects are no longer proportional to causes. Small causes may have large effects. In a way, "sensitive dependence" is nothing more than the rediscovery by scientists of the old wisdom which is captured by the phrase "for want of a horseshoe the kingdom was lost". Processes which are very sensitive to small fluctuations are called chaotic. This is because their trajectories are in general very irregular, so that they give the impression of being random, even though they are driven by deterministic forces.

The meteorologist Lorentz has invented yet another expression, the "butterfly effect". While studying the equations that determine the weather, he noticed that their outcomes are strongly dependent on the initial conditions. The weather is a chaotic system. The tiniest fluctuations in air pressure in one part of the globe may have the most spectacular effects in another part. Thus, a butterfly flapping its wings somewhere in Chicago may cause a tornado in Tokyo. This explains why scientists find it so difficult to predict the weather. To predict future situations, they need to know the present situation in its finest details. But obviously they will never be able to know all the details: they cannot monitor every butterfly flapping its wings! The fewer details they know, the less accurate their long term predictions. That is why reliable weather predictions seldom extend more than a few days in the future.

Such chaotic processes basically work as amplifiers: they turn small causes into large effects. That means that small, unobservable fluctuations will affect the outcome of the process. Although the process is deterministic in principle, equal causes having equal effects, it is unpredictable in practice. Indeed, causes that seem equal to the best of our knowledge can still have unobservable differences and therefore lead to very different effects.

Durr: Hans-Peter: Matter is not made of matter

Einstein: what is the difference between general and special relativity?
Special relativity *says that how things happen can look different to people in different places or moving at difference speeds--except for things involving the speed of light in a vacuum. Things moving at the speed of light always move at the speed of light compared to you, no matter how fast you're moving.*

General relativity *says that space and time are actually different aspects of the same thing--space-time--and that space-time is curved. Exactly how curved space-time is at any point in the universe depends on how much gravity there is in the area. In addition to bending space-time, gravity can also bend light, radio waves, and all kinds of other stuff.*

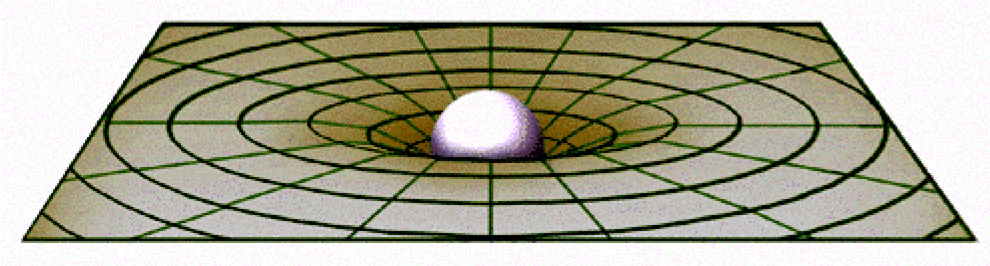
Einstein, Albert:
Why I was able to delve deeply into space-time problems: the ordinary adult never gives a thought to space-time problems….I, on the contrary, developed so slowly that I did not begin to wonder about space and time until I was an adult. I then delved more deeply in the problem than any other adult or child would have done.

Einstein, Albert: If we think of the Field as being removed, there is no space which remains, since space does not have an independent existence . Reality is merely an illusion, but a persistent one, Hence it is clear that the space of physics is not in the last analysis, anything given in nature or independent of human thought. It is a function of our conceptual scheme (mind). Space as conceived by Newton proved to be an illusion, although for practical purposes a very fruitful illusion.

Einstein, Albert: Time: In 1915, Albert Einstein first proposed his theory of special relativity. Essentially, this theory proposes the universe we live in includes 4 dimensions, the first three being what we know as space, and the fourth being *spacetime*, which is a dimension where time and space are inextricably linked. According to Einstein, two people observing the same event in the same way could perceive the singular event occurring at two different times, depending upon their distance from the event in question. These types of differences arise from the time it takes for light to travel through space. Since light does travel at a finite and ever-constant speed, an observer from a more distant point will perceive an event as occurring later in time; however, the event is "actually" occurring at the same instant in time. Thus, "time" is dependent on space.

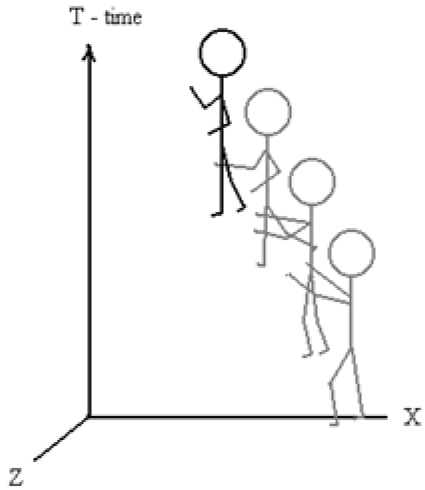
Gravitational Time Dilation (WHAT IS WRONG WITH THE PICTURE BELOW?)

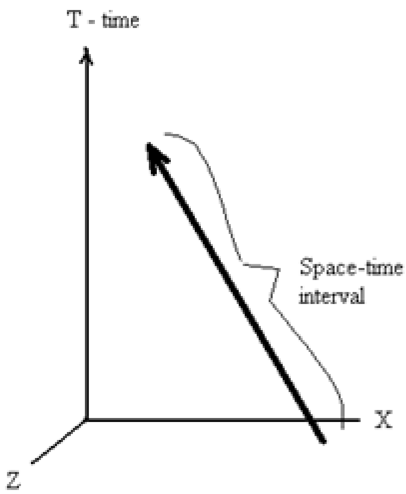
An important aspect of Einstein's theory of relativity to note is that he proposed matter causes space to curve. If we pretend that "space" is a two-dimensional sheet, a planet place on this "sheet" would cause it to curve (see diagram below). This curvature of space results in what we perceive as gravity. Smaller objects are attracted to larger ones because they "roll" through the curved space towards the most massive objects, which cause the greatest degree of curvature. In relation to time, this curvature causes the gravitational time dilation effect. Under normal circumstances, this effect is impossible to observe. However, in the presence of the extremes of our universe (such as black holes, where a huge amount of matter is compressed into an extremely small volume), this effect becomes much more obvious. To a distant observer, an object falling into a black hole would appear to never reach it, due to time dilation causing time to "progress" extremely slower, at least relative to the distant observer (the object in question, however, would very rapidly be destroyed by the black hole).



A second aspect to the gravitational time dilation postulate is that the faster an object is moving, the slower time progresses for that object in relation to a stationary observer. While in everyday circumstances, this effect goes entirely unnoticed, it has proven to be true. An atomic clock placed on a jet airplane was shown to "tick" more slowly than an atomic clock at rest. However, even with the speeds achieved by a jet aircraft, the time dilation effect was minimal. A more solid example can be seen through an experiment performed on the International Space Station (ISS). After the first 6 months in space, the crew of the ISS aged .007 seconds less than the rest of us on earth (the relatively stationary observers). The station moves at approximately 18,000 miles per hour (see applet below to track the location and speed of the ISS), much faster than the range of normal human speeds. Even with such speeds, however, time dilation is minimal unless you approach speeds close to the speed of light (300,000 km/sec.).

Time as a Fourth Dimension





To understand time as a fourth dimension, it is necessary to recognize that any human attempt to "draw" or "represent" time beyond our immediate perception of it (basic, linear progression), is inherently flawed, because out mental capacity is limited to three dimensions. However, time, like space, is a dimension in itself, and objects can transverse it in a similar way as they do through the third dimension. A popular way of viewing time is using a coordinate set of axes, except instead of using a plane with simple x and y axes, a z axes can be added. The graphic to the left represents a possible way of viewing time. As a person walks forward, he is traveling though the three dimensions of space, and a fourth as he progresses forward through time. Thus, for humans, time travel (or traveling through the fourth dimension) is entirely possible, however, only in one direction. Relativity has shown us that it *is* possible to change our perception of time based on distance, gravitational dilation, or speed, but the direction of time has remained constant and singular.

Consequences of Einstein's Scientific Revolution

The changes Einstein ushered in with his radical theories of relativity resulted in the now ubiquitous $E = mc^2$ equation, which essentially states that matter and energy are interchangeable (this discovery eventually led to the creation of the first nuclear fission bomb). However, Einstein's equations also predicted the presence of black holes and gravitational waves, and were initially excused as inconsequential aberrations; however there is now substantial evidence to support the existence of black holes. Just as importantly, Einstein ushered in an entirely new age of theoretical physics, helping to tremendously advance our perception of the universe and directly contributing to today's modern string theory, an attempt to unify the theories of relativity and since-discovered quantum mechanics into a unified explanation of the universe.

Gravity; Einstein's Vision of Gravity: **Fermi Labs again confirms Einstein's Theory**. During its first year of operations, NASA's Fermi Gamma Ray Space Telescope mapped the sky with unprecedented resolution and sensitivity. It captured more than 1,000 discrete sources of gamma rays — the highest-energy form of light. Capping these achievements was a measurement that provided rare experimental evidence about the structure of space and time, unified as space-time in Einstein's theories.

"Physicists would like to replace Einstein's vision of gravity — as expressed in his relativity theories — with something that handles all fundamental forces," said Peter Michelson, principal investigator of Fermi's Large Area Telescope (LAT) at Stanford University in Palo Alto, California. "There are many ideas, but few ways to test them."

Many approaches to new theories of gravity picture space-time as having a shifting, frothy structure at physical scales trillions of times smaller than an electron. Some models predict that the foamy aspect of space-time will cause higher-energy gamma rays to move slightly more slowly than photons at lower energy.

Such a model would violate Einstein's edict that all electromagnetic radiation — radio waves, infrared, visible light, X-rays, and gamma rays — travels through a vacuum at the same speed.

On May 10, 2009, Fermi and other satellites detected a short gamma-ray burst, designated GRB 090510. Astronomers think this type of explosion happens when neutron stars collide. Ground-based studies show the event took place in a galaxy 7.3 billion light-years away. Of the many gamma-ray photons Fermi's LAT detected from the 2.1-second burst, two possessed energies differing by a million times. Yet after traveling about 7 billion years, the pair arrived just nine-tenths of a second apart.

"This measurement eliminates any approach to a new theory of gravity that predicts a strong energy dependent change in the speed of light," Michelson said. "To one part in 100 million billion, these two photons traveled at the same speed. Einstein still rules."

Fermi's secondary instrument, the Gamma-ray Burst Monitor, has observed low-energy gamma rays from more than 250 bursts. The LAT observed 12 of these bursts at higher energy, revealing three record-setting blasts.

GRB 090510 displayed the fastest observed motions with ejected matter moving at 99.99995 percent of light speed. The highest energy gamma ray yet seen from a burst — 33.4 billion electron volts or about 13 billion times the energy of visible light — came from September's GRB 090902B. Last year's GRB 080916C produced the greatest total energy, equivalent to 9,000 typical supernovae.

Scanning the entire sky every 3 hours, the LAT is giving Fermi scientists an increasingly detailed look at the extreme universe. "We've discovered more than a thousand persistent gamma ray sources — five times the number previously known," said Julie McEnery at NASA's Goddard Space Flight Center in Greenbelt, Maryland. "And we've associated nearly half of them with objects known at other wavelengths."

Blazars — distant galaxies whose massive black holes emit fast-moving jets of matter toward us — are by far the most prevalent source, now numbering more than 500. In our own galaxy, gamma ray sources include 46 pulsars and two binary systems where a neutron star rapidly orbits a hot, young star.

"The Fermi team did a great job commissioning the spacecraft and starting its science observations," said Jon Morse at NASA headquarters in Washington. "And now Fermi is more than fulfilling its unique scientific promise for making novel, high-impact discoveries about the extreme universe and the fabric of space-time."

Emergence: is what happens when the whole is smarter than the sum of its parts. It's what happens when you have a system of relatively simple-minded component parts -- often there are thousands or millions of them -- and they interact in relatively simple ways. And yet somehow out of all this interaction some higher level structure or intelligence appears, usually without any master planner calling the shots. These kinds of systems tend to evolve from the ground up.

Emergence/Complexity/Consciousness, Law of. This law simply states that there is an inherent compulsion in matter to arrange itself in more complex groupings, exhibiting higher levels of consciousness. The more complex the matter, the more conscious it is. Teilhard proposed that this is a better way to describe the evolution of life on earth, rather than Herbert Spencer's "survival of the fittest." The universe, he argued, strives towards higher consciousness, and does so by arranging itself into more complex structures.

Emergence: In philosophy, systems theory and science, **emergence** is the way complex systems and patterns arise out of a multiplicity of relatively simple interactions. Emergence is central to the theories of integrative levels and of complex systems.

Professor current definition of emergence in the journal, *Emergence* (Goldstein 1999). For Goldstein, emergence can be defined as: "the arising of novel and coherent structures, patterns and properties during the process of self-organization in complex systems" (Corning 2002).

Goldstein's definition can be further elaborated to describe the qualities of this definition in more detail: "The common characteristics are: (1) radical novelty (features not previously observed in systems); (2) coherence or correlation (meaning integrated wholes that maintain themselves over some period of time); (3) A global or macro "level" (i.e. there is some property of "wholeness"); (4) it is the product of a dynamical process (it evolves); and (5) it is "ostensive" (it can be perceived). For good measure, Goldstein throws in supervenience -- downward causation." (Corning 2002)

The term "emergent" was coined by the pioneer psychologist G. H. Lewes, who wrote:

"Every resultant is either a sum or a difference of the co-operant forces; their sum, when their directions are the same -- their difference, when their directions are contrary. Further, every resultant is clearly traceable in its components, because these are homogeneous and commensurable. It is otherwise with emergents, when, instead of adding measurable motion to measurable motion, or things of one kind to other individuals of their kind, there is a co-operation of things of unlike kinds. The emergent is unlike its components insofar as these are incommensurable, and it cannot be reduced to their sum or their difference." (Lewes 1875, p. 412)(Blitz 1992)

Entanglement: Brian Clegg received a physics degree from Cambridge University and is the author of numerous books and articles on the history of science. His most recent book is *The God Effect : Quantum Entanglement, Science's Strangest Phenomenon*. **What is quantum entanglement?**

Entanglement is a strange feature of quantum physics, the science of the very small. It's possible to link together two quantum particles — photons of light or atoms, for example — in a special way that makes them effectively two parts of the same entity. You can then separate them as far as you like, and a change in one is instantly reflected in the other. This odd, faster than light link, is a fundamental aspect of quantum science. Erwin Schrödinger, who came up with the name "entanglement" called it "the characteristic trait of quantum mechanics." Entanglement is fascinating in its own right, but what makes it really special are dramatic practical applications that have become apparent in the last few years.

Is it possible that entangled particles are not actually in immediate communication, but are simply programmed to behave in the same way? Much like twins separated at birth who live eerily similar lives — assume the same professions, marry similar spouses, etc.

This is an obvious possibility. John Bell, who devised a lot of the theory for testing the existence of entanglement, covered it in a paper called "Bertlmann's Socks and the Nature of Reality." Reinhold Bertlmann, a colleague of Bell's, always wore socks of different colors. Bell pointed out that, if you saw one of Bertlmann's feet coming around the corner of a building and it had a pink sock on, you would instantly know the other sock wasn't pink, even though you had never seen it. The color difference was programmed in when Bertlmann put his socks on. But the quantum world is very different. If you take some property of a particle, the equivalent of color, say the spin of an electron, it doesn't have the value pre-programmed. It has a range of probabilities as to what the answer might be, but until you actually measure it, there is no fixed value. What happens with a pair of entangled electrons is you measure the spin of one. Until that moment, neither of them had a spin with a fixed value. But the instant you take the measurement on one, the other immediately fixes its spin (say to the opposite value). These "quantum socks" were every possible color until you looked at one. Only then did it become pink, and the other instantly took on another color.

You write that Einstein among other scientists could not accept quantum entanglement. It seems to throw out the whole notion of cause and effect. How confident are physicists that quantum entanglement exists and what are the implications for science and the scientific method?

Einstein had problems with the whole of quantum physics — which is ironic, as it was based on his Nobel Prize winning paper on the photoelectric effect. What he didn't like was the way quantum particles don't have fixed values for their properties until they are observed — he couldn't relate to a universe where probability ruled. That's why he famously said that God doesn't play dice. I think an even better quote, less well known, was when he wrote: "I find the idea quite intolerable that an electron exposed to radiation should choose of its own free will, not only its moment to jump off, but also its direction. In that case, I would rather be a cobbler, or even an employee in a gaming house, than a physicist." Einstein believed that underneath these probabilities were fixed, hidden realities we just couldn't see. That was why he dreamed up the idea of entanglement in 1935. It was to show that either quantum theory was incomplete, because it said there was no hidden information, or it was possible to instantly influence something at a distance. As that seemed incredible, he thought it showed that quantum theory was wrong.

It did take a long time to prove that entanglement truly existed. It wasn't until the 1980s that it was clearly demonstrated. But it has been shown without doubt that this is the case. Entanglement exists, and is being used in very practical ways.

Entanglement doesn't throw away the concept of cause and effect. But it does underline the fact that quantum particles really do only have a range of probabilities on the values of their properties rather than fixed values. And while it seems to contradict Einstein's special relativity, which says nothing can travel faster than light, it's more likely that entanglement challenges our ideas of what distance and time really mean. Similarly, entanglement is no challenge to the scientific method. We need to use a different kind of math, but this is still the same science.

Where do you see the first practical applications of entanglement?

The first thing most people think of, including a report produced for the Department of Defense shortly after entanglement was proved real, is being able to use it to communicate faster than light. The link of entanglement works instantaneously at any distance. So it would be amazing if it could be used to send a signal. In fact this isn't possible. Although there is a real connection between two entangled particles, we don't know what the information is that it's going to send. If I measure the spin of an entangled electron, yes it communicates the value somehow to its twin — but I can't use it. I had no idea what the spin was going to be. This is just as well, as faster than light messages travel backwards in time. If I could send a message instantly it would be received in the past, and that really would disrupt cause and effect. However, there are still real and amazing applications of entanglement. It can be used to produce unbreakable encryption. If you send each half of a set of entangled pairs to either end of a communications link, then the randomly generated but linked properties can be used as a key to encrypt information. If anyone intercepts the information it will break the entanglement, and the communication can be stopped before the eavesdropper picks up any data.

Then there are quantum computers. These are conceptual machines that can crack problems that would take an ordinary computer longer than the lifetime of the universe to solve. We already know how to program a quantum computer to do some amazing things. For instance, if I have an unsorted database with a million entries, I will typically have to try out 500,000 of these before hitting on the right one. (Try looking for a specific number, rather than a person, in the paper version of the New York telephone directory.) But using a quantum computer it only takes 1,000 attempts. Unfortunately, though, Quantum computers are almost impossible to make.

Instead of storing information in bits on silicon chips, each of which can hold 0 or 1, a quantum computer uses quantum particles like photons or atoms as the information stores. Each particle can store infinitely long numbers, but if you look at the particle, it changes the value. Entanglement means you can't interact with these quantum bits (qubits for short) without frying your quantum memory. There are several technologies being tried to build the first, basic quantum computers, but they all rely on entanglement to get information into and around the system.

Most dramatic of all is quantum teleportation.

And for those Trekkies out there, tell us about the possibility of teleportation.

It's more than a possibility; it has been done, but only on a very small scale. What a Star Trek transporter is supposed to do is make an exact copy of an object or a person somewhere else. There's a fundamental problem here. Because looking at a quantum particle changes it. You can't scan a particle, see what it looks like and make an exact copy. So it might seem that teleportation is impossible. Entanglement lets you get around this restriction. By interacting the particle with one half of an entangled pair, and then putting the other half of the pair through a special process, a bit like a logic gate in a computer, it's possible to make an identical particle at a remote location. We can only do this because the entanglement transfers the quantum

information without us ever knowing what it was. In the process, the original particle loses its properties. Teleportation isn't copying, it effectively destroys the original.
This doesn't mean you'll be able to rush out and buy a transporter at Radio Shack next week. This process has been done with large molecules, similar in size to a bacterium, so it's possible that we could teleport something living. But it won't work with something as big as a person. You would have to scan every single molecule in the body and reassemble at the other end, which doesn't look like it's every going to be practical.
Maybe this isn't so bad, though. Remember, the original is destroyed (something Star Trek glosses over). Okay, you get an identical copy, but would you be prepared to be vaporized if you knew an exact, indistinguishable copy was going to be created the other side of the world? I'm not ecstatic about flying, but by comparison it sounds a safe option.
Could entanglement prove to be the "Holy Grail" for merging scientific and mystical, religious thought?
There have certainly been people who have tried to draw this kind of conclusion, but I think they are mistaken. Entanglement is a wholly physical process. I called my book ***The God Effect*** because it has been suggested that entanglement is the working mechanism of the **Higgs boson**, a very special particle that gives everything its mass, and has been called the **God Particle**, because it's so fundamental. But that's just a label. It's also true that Nobel Prize winning physicist Brian Josephson has suggested that entanglement could explain telepathy (much to the irritation of paranormal debunker James Randi), but Josephson was saying if telepathy exists, then here's a physical mechanism that could explain it — he wasn't indulging in mystical navel-gazing. **What entanglement (and quantum theory in general) does do is remind us is that the real world is much stranger than we imagine**. That's because the way things are in the world of the very small is totally different to large scale objects like desks and pens. We can't rely on experience and common sense to guide us on how things are going to work at this level. And that can make some of the effects of quantum physics seem mystical. In the end, this is something similar to science fiction writer Arthur C. Clarke's observation that "**any sufficiently advanced technology is indistinguishable from magic."**

Epistemology (from Greek ἐπιστήμη - episteme-, "knowledge, science" + λόγος, "logos") or **theory of knowledge** is the branch of philosophy concerned with the nature and scope (limitations) of knowledge.[1] It addresses the questions:

- What is knowledge?
- How is knowledge acquired?
- What do people know?
- How do we know what we know?

Much of the debate in this field has focused on analyzing the nature of knowledge and how it relates to similar notions such as truth, belief, and justification. It also deals with the means of production of knowledge, as well as skepticism about different knowledge claims.

See the PDF document provided for full discussion.

Euclid: Axioms

Euclidean geometry is an axiomatic system, in which all theorems ("true statements") are derived from a small number of axioms. Near the beginning of the first book of the *Elements*, Euclid gives five postulates (axioms) for plane geometry, stated in terms of constructions:[6]

1. Let the following be postulated: to draw a straight line from any point to any point.
2. To produce [extend] a finite straight line continuously in a straight line.
3. To describe a circle with any center and distance [radius].
4. That all right angles are equal to one another.
5. *The parallel postulate*: That, if a straight line falling on two straight lines make the interior angles on the same side less than two right angles, the two straight lines, if produced indefinitely, meet on that side on which are the angles less than the two right angles.

Although Euclid's statement of the postulates only explicitly asserts the existence of the constructions, they are also taken to be unique.

The *Elements* also include the following five "common notions":

1. Things that equal the same thing also equal one another.
2. If equals are added to equals, then the wholes are equal.
3. If equals are subtracted from equals, then the remainders are equal.
4. Things that coincide with one another equal one another.
5. The whole is greater than the part.

Feynman, Richard: "... I think I can safely say that nobody understands Quantum Mechanics"

With regard to the questions of reality, quantum mechanics, and consciousness, why math works, and ultimate causes of the universe - these problems are so hard and deep, that no one can tell whether there is a problem.

Galileo: objects move in circles.

Gilder: In his paper on Intelligent Design vs Darwinism. After 100 years or so of attempted philosophical leveling, however, it turns out that the universe is stubbornly hierarchical. It is a top-down “nested hierarchy,” in which the higher levels command more degrees of freedom than the levels below them, which they use and constrain. Thus, the higher levels can neither eclipse the lower levels nor be reduced to them. Resisted at every step across the range of reductive sciences, this realization is now inexorable. We know now that no accumulation of knowledge about chemistry and physics will yield the slightest insight into the origins of life or the processes of computation or the sources of consciousness or the nature of intelligence or the causes of economic growth. As the famed chemist Michael Polanyi pointed out in 1961, all these fields depend on chemical and physical processes, but are not defined by them. Operating farther up the hierarchy, biological macro-systems such as brains, minds, human beings, businesses, societies, and economies consist of intelligent agents that harness chemical and physical laws to higher purposes but are not reducible to lower entities or explicable by them.

Greeks on Consciousness: along with the early Hindi, believed that consciousness was either inside the brain or a facility that existed in the universe that we could tap into.

Green, Michael: The physicist follows Isaac Newton and Stephen Hawking into the Lucasian chair of mathematics at the University of Cambridge. Michael Green is one of the pioneers of string theory. His seminal work in 1984 showed that string theory can describe all elementary particles and their interactions.

What plans do you have for the role? For a long time I've been involved in the interface of elementary particle physics and general relativity, string theory in particular. Some very exciting things have been happening in string theory that I wish to pursue. Although string theory has not fulfilled or even come close to its original aims - to unify our ideas about the fundamental forces - it is now providing surprising insights in other areas of fundamental physics. These are problems that nobody has had any way of understanding and now we have a chance of solving.

One example is understanding the properties of very high-energy collisions of heavy nuclei. **When heavy nuclei are collided in particle accelerators they form a "fireball" of matter. But the behavior and properties of such a fireball are difficult to understand using standard nuclear physics. Now it seems there's a way of describing the fireball as a kind of mathematical "black hole", using string theory**. At first sight, these problems would seem to be a million miles from what string theory was originally designed to tackle, but to me that's one of its most fascinating aspects.

Are we still on the right track to a single unifying theory? What has been realized through string theory are some general principles, which make me feel that we're very much on the right track. But we are a long way from a detailed understanding of what underlies the forces of nature as we see them.

I personally do not like the idea of a "theory of everything" - that we will one day understand everything in one simple formula. I don't think that's the way science works. Scientists have previously believed they were close to understanding everything, but I'm not sure we will ever have a complete understanding of

Gödel's Theorem: For any consistent formal system F purporting to settle—that is prove or disprove—all statements of arithmetic, there exist an arithmetic proposition that can be neither proved nor disproved in this system. Therefore, the formal system F is incomplete. (**See the Halting Problem – Alan Turing)**

Gödel: Gödel: a Life of Logic by Casti and De Pauli: Truth is bigger than proof. Logic is necessary but not sufficient to describe any kind of objective reality. Wittgenstein (Gödel's mentor) concludes that language cannot capture all there is in the world. Gödel showed that every system contained a G (Gödel Number) that was undecidable from within the system, but could be determined to be true, from outside the system. Gödel believed that there was an afterlife because the universe has meaning. Also, none of us can accomplish all we need to accomplish in the first life. Therefore there must exist an afterlife. Gödel was a Platonist and developed an ontological proof of the existence of God.

Gödel: Book Review: Kurt Gödel is often held up as an intellectual revolutionary whose incompleteness theorem helped tear down the notion that there was anything certain about the universe. Philosophy professor, novelist, and MacArthur Fellow Rebecca Goldstein reinterprets the evidence and restores to Gödel's famous idea the meaning he claimed he intended: that there is a mathematical truth--an objective certainty--underlying everything and existing independently of human thought. Gödel, Goldstein maintains, was an intellectual heir to Plato whose sense of alienation from the positivists and postmodernists of the 1940s was only ameliorated by his friendship with another intellectual giant, Albert Einstein. As Goldstein writes, "That his work, like Einstein's, has been interpreted as not only consistent with the revolt against objectivity but also as among its most compelling driving forces is ... more than a little ironic."
This and other paradoxes of Gödel's life are woven throughout *Incompleteness*, with biographical details taking something of a back seat to the philosophical and mathematical underpinnings of his theories. As an introduction to one of the three most profound scientific insights of the 20th century (the other two being Einstein's relativity and Heisenberg's uncertainty principle), *Incompleteness* is accessible, yet intellectually rigorous. Goldstein succeeds admirably in retiring inaccurate interpretations of Gödel's ideas. --*Therese Littleton*

Gödel, Kurt: The Incompleteness Theorem

In 1931 and while still in Vienna, Gödel published his famous incompleteness theorems in "Über formal unentscheidbare Sätze der *Principia Mathematica* und verwandter Systeme" (called in English "On formally undecidable propositions of *Principia Mathematica* and related systems"). In that article, he proved for any computable axiomatic system that is powerful enough to describe the arithmetic of the natural numbers (e.g. the Peano axioms or ZFC), that:

1. If the system is consistent, it cannot be complete.
2. The consistency of the axioms cannot be proved within the system.

These theorems ended a half-century of attempts, beginning with the work of Frege and culminating in Principia Mathematica and Hilbert's formalism, to find a set of axioms sufficient for all mathematics. The incompleteness theorems also imply that not all mathematical questions are computable.

In hindsight, the basic idea at the heart of the incompleteness theorem is rather simple. Gödel essentially constructed a formula that claims that it is unprovable in a given formal system. If it were provable, it would be false, which contradicts the fact that in a consistent system, provable statements are always true. Thus there will always be at least one true but unprovable statement. That is, for any computably enumerable set of axioms for arithmetic (that is, a set that can in principle be printed out by an idealized computer with unlimited resources), there is a formula that obtains in arithmetic, but which is not provable in that system. To make this precise, however, Gödel needed to solve several technical issues, such as encoding statements, proofs, and the very concept of provability into the natural numbers. He did this using a process known as Gödel numbering.

In his two-page paper "Zum intuitionistischen Aussagenkalkül" (1932) Gödel refuted the finite-valuedness of intuitionistic logic. In the proof he implicitly used what has later become known as Gödel–Dummett intermediate logic (or Gödel fuzzy logic).

Gödel's Incompleteness Theorem:
This theorem is one of the most important proven in the twentieth century. Here are some selections that will help you start to understand it. Gödel's original paper "On Formally Undecidable Propositions" is available in a modernized translation. It's also in print from Dover in a nice, inexpensive edition.

Gödel: Jones and Wilson, *an Incomplete Education*

In 1931, the Czech-born mathematician Kurt Gödel demonstrated that within any given branch of mathematics, there would always be some propositions that couldn't be proven either true or false using the rules and axioms ... of that mathematical branch itself. You might be able to prove every conceivable statement about numbers within a system by going *outside* the system in order to come up with new rules and axioms, but by doing so you'll only create a larger system with its own unprovable statements. The implication is that *all* logical system of any complexity are, by definition, incomplete; each of them contains, at any given time, more true statements than it can possibly prove according to its own defining set of rules.
Gödel's Theorem has been used to argue that a computer can never be as smart as a human being because the extent of its knowledge is limited by a fixed set of axioms, whereas people can discover unexpected truths ... It plays a part in modern linguistic theories, which emphasize the power of language to come up with new ways to express ideas. And it has been taken to imply that you'll never entirely understand yourself, since your mind, like any other closed system, can only be sure of what it knows about itself by relying on what it knows about itself.

Gödel: Boyer, *History of Mathematics*

Gödel showed that within a rigidly logical system such as Russell and Whitehead had developed for arithmetic, propositions can be formulated that are undecidable or undemonstrable within the axioms of the system. That is, within the system, there exist certain clear-cut statements that can neither be proved nor disproved. Hence one cannot, using the usual methods, be certain that the axioms of arithmetic will not lead to contradictions ... It appears to foredoom hope of mathematical certitude through use of the obvious methods. Perhaps doomed also, as a result, is the ideal of science - to devise a set of axioms from which all phenomena of the external world can be deduced.

Gödel: Nagel and Newman, *Gödel's Proof*

He proved it impossible to establish the internal logical consistency of a very large class of deductive systems - elementary arithmetic, for example - unless one adopts principles of reasoning so complex that their internal consistency is as open to doubt as that of the systems themselves ... Second main conclusion is ... Gödel showed that *Principia*, or any other system within which arithmetic can be developed, is *essentially incomplete*. In other words, given *any* consistent set of arithmetical axioms, there are true mathematical statements that cannot be derived from the set... Even if the axioms of arithmetic are augmented by an indefinite number of other true ones, there will always be further mathematical truths that are not formally derivable from the augmented set.

Gödel: Rucker, *Infinity and the Mind*

The proof of Gödel's Incompleteness Theorem is so simple, and so sneaky, that it is almost embarrassing to relate. His basic procedure is as follows:

1. Someone introduces Gödel to a UTM, a machine that is supposed to be a Universal Truth Machine, capable of correctly answering any question at all.
2. Gödel asks for the program and the circuit design of the UTM. The program may be complicated, but it can only be finitely long. Call the program P(UTM) for Program of the Universal Truth Machine.
3. Smiling a little, Gödel writes out the following sentence: "The machine constructed on the basis of the program P(UTM) will never say that this sentence is true." Call this sentence G for Gödel. *Note that G is equivalent to: "UTM will never say G is true."*
4. Now Gödel laughs his high laugh and asks UTM whether G is true or not.
5. If UTM says G is true, then "UTM will never say G is true" is false. If "UTM will never say G is true" is false, then G is false (since G = "UTM will never say G is true"). So if UTM says G is true, then G is in fact false, and UTM has made a false statement. So UTM will never say that G is true, since UTM makes only true statements.
6. We have established that UTM will never say G is true. So "UTM will never say G is true" is in fact a true statement. So G is true (since G = "UTM will never say G is true").
7. "I know a truth that UTM can never utter," Gödel says. "I know that G is true. UTM is not truly universal."

Think about it - it grows on you ...

With his great mathematical and logical genius, Gödel was able to find a way (for any given P(UTM)) actually to write down a complicated polynomial equation that has a solution if and only if G is true. So G is not at all some vague or non-mathematical sentence. *G is a specific mathematical problem that we know the answer to, even though UTM does not!* So UTM does not, and cannot, embody a best and final theory of mathematics ...

Although this theorem can be stated and proved in a rigorously mathematical way, what it seems to say is that *rational thought can never penetrate to the final ultimate truth* ... But, paradoxically, to understand Gödel's proof is to find a sort of liberation. For many logic students, the final breakthrough to full understanding of the Incompleteness Theorem is practically a conversion experience. This is partly a by-product of the potent mystique Gödel's name carries. But, more profoundly, to understand the essentially labyrinthine nature of *the castle* is, somehow, to be free of it.

Gödel: Hofstadter, *Gödel, Escher, Bach*

All consistent axiomatic formulations of number theory include undecidable propositions ...

Gödel showed that provability is a weaker notion than truth, no matter what axiom system is involved ...

How can you figure out if you are sane? ... Once you begin to question your own sanity, you get trapped in an ever-tighter vortex of self-fulfilling prophecies, though the process is by no means inevitable. Everyone knows that the insane interpret the world via their own peculiarly consistent logic; how can you tell if your own logic is "peculiar' or not, given that you have only your own logic to judge itself? I don't see any answer. I am reminded of Gödel's second theorem, which implies that the only versions of formal number theory which assert their own consistency are inconsistent.

The other metaphorical analogue to Gödel's Theorem which I find provocative suggests that ultimately, we cannot understand our own mind/brains ... Just as we cannot see our faces with our own eyes, is it not inconceivable to expect that we cannot mirror our complete mental structures in the symbols which carry them out? All the limitative theorems of mathematics and the theory of computation suggest that once the ability to represent your own structure has reached a certain critical point, that is the kiss of death: it guarantees that you can never represent yourself totally.

Gould, Stephen Jay: proposed an approach dividing the world of philosophy into what he called "non-overlapping magisteria" (NOMA). In this view, questions of the supernatural, such as those relating to the existence and nature of God, are non-empirical and are the proper domain of theology. The methods of science should then be used to answer any empirical question about the natural world, and theology should be used to answer questions about ultimate meaning and moral value. In this view, the perceived lack of any empirical footprint from the magisterium of the supernatural onto natural events makes science the sole player in the natural world.[27]

GROK: To **grok** (pronounced /ˈɡrɒk/) is to share the same semiosphere or line of thinking with another physical or conceptual entity. Author Robert A. Heinlein coined the term in his best-selling 1961 book *Stranger in a Strange Land*. In Heinlein's view, grokking is the intermingling of intelligence that necessarily affects both the observer and the observed.

Grok means to understand so thoroughly that the observer becomes a part of the ”

> observed—to merge, blend, intermarry, lose identity in group experience. It means almost everything that we mean by religion, philosophy, and science—and it means as little to us (because of our Earthly assumptions) as color means to a blind man.

The Oxford English Dictionary defines *grok* as "to understand intuitively or by empathy; to establish rapport with" and "to empathize or communicate sympathetically (with); also, to experience enjoyment." Other forms of the word include "groks" (present third person singular), "grokked" (past participle) and "grokking" (present participle).

In an ideological context, a *grokked* concept becomes part of the person who contributes to its evolution by improving the doctrine, perpetuating the myth, espousing the belief, adding detail to the social plan, refining the idea or proofing the theory.

Guth, Alan: The inflationary theory of the universe even proposes that the universe began at a state of no geometry (i.e., a universe with nothing, not even time) and then a tunneling occurred, allowing the universe to pass from the state of "nothing" to "something" (the "false vacuum") by tunneling (Guth 1999)

Guth: Inflationary Theory

Guth's first step to developing his theory of inflation occurred at Cornell in 1978, when he heard a lecture by Robert Dicke about the flatness problem of the universe.[5] Dicke explained how the flatness problem showed that something significant was missing from the Big Bang theory at the time. The fate of the universe depended on its density. If the density of the universe was large enough, it would collapse into a singularity, and if the actual density of the matter in the cosmos was lower than the critical density, the universe would increasingly get much bigger.

The next part in Guth's path came when he saw a lecture by Steven Weinberg in early 1979. Weinberg talked in two lectures about the Grand Unified Theory (GUT) that had been developed since 1974, and how it could explain the huge amount of matter in the universe compared of the amount of antimatter. The GUT explained all the fundamental forces known in science except for gravity. It established that in very hot conditions, such as those after the Big Bang, electromagnetism, the strong nuclear force, and the weak nuclear force were united to form one force. Weinberg also was the one who emphasized the idea that the universe goes through phase transitions, similar to the phases of matter, when going from high energy to low energy. Weinberg's discussion of why matter is so dominant over anti-matter showed Guth how precise calculations about particles could be obtained by studying the first few seconds of the universe.

Guth decided to solve this problem by suggesting that a supercooling during a delayed phase transition. This seemed very promising for solving the magnetic monopole problem. By the time they came up with that, Guth had gone to the Stanford Linear Accelerator Center for a year, but Guth had been talking to Henry Tye back and forth. Tye suggested that they check that the expansion of the universe not be affected by the supercooling. In the supercooled state, a false vacuum is produced. The false vacuum is a vacuum in the sense that it is state of the lowest possible density of energy; it is false in the sense that it is not a permanent state of being. False vacuums decay, and Guth was to find that the decay of the false vacuum at the beginning of the universe would produce amazing results, namely the exponential expansion of space.

Guth realized from his theory that the reason why the universe appears to be flat was because it was fantastically big, just the same way the spherical Earth appears flat to those on its surface. The observable universe was actually only a very small part of the actual universe. Traditional Big Bang theory found values of omega near one to be puzzling, because any deviations from one would quickly become much, much larger. In inflation theory, no matter where omega starts, it would be driven towards equal to one, because the universe becomes so huge. In fact, a major prediction of inflationary theory is that omega will be found to be one.

The reason for the missing monopoles was that the universe was so big that the density of monopoles would be very low. The “enormous number of monopoles could have risen in the inflationary universe, yet we and all other observers would find them to be observationally far rarer than snowballs in the Sahara…Inflation would spread them so thin that the average observer would expect to find only a single monopole in the entire observable universe.” The incredibly vast expansion of the universe caused by inflation solved both the flatness problem explored by Robert Dicke and the monopole problem that had been explored by Tye and Guth.

By an amazing coincidence, two weeks later, Guth heard about another problem discussed by colleagues at work. This was called the horizon problem. The microwave background radiation discovered by Arno Penzias and Robert Woodrow Wilson appeared extremely uniform, with almost no variance. This seemed very paradoxical because, when the radiation was released about 300,000 years after the Big Bang, the observable universe had a diameter of 90 million light-years. There was no time for one end of the cosmos to communicate with the other end, because energy can not move faster than the speed of light. The paradox was resolved, as Guth soon realized, by the inflation theory. Since inflation started with a far smaller amount of matter than the Big Bang had presupposed, an amount so small that all parts would have been in touch with each other. Inflation then blew up the universe so quickly that there was no time for the essential homogeneity to be broken. The universe after inflation would have been very uniform even though the parts were not still in touch with each other.

Guth first released his ideas on inflation in a seminar at SLAC on January 23, 1980. Word about his ideas spread quickly and soon Guth, who had been worried about his job prospects, was besieged with offers. Although there were positive responses from his audiences, Guth did not publish his work because he was primarily concerned with the “graceful exit” problem. In August, he submitted his paper, entitled “The Inflationary Universe: A Possible Solution to the Horizon and Flatness Problems” to the Physical Review. He ignored magnetic monopoles because they were based on assumptions of GUT, which was outside the scope of the speech.

The answer came on December 1981 while Guth was finishing a paper on his failures. He read a paper from Moscow physicist Andrei Linde saying that the whole universe is within just one bubble, so nothing is destroyed by wall collisions. This conclusion was made using a Higgs field with an energy graph that was originally proposed by Sidney Coleman and Erick Winberg. Guth was amazed by this concept so he searched through Linde’s paper looking for a blunder, but he found none. Linde had independently been working on bubble inflation, but no one had informed him of the flatness problem. Both he and Guth eventually exchanged papers, thus helping each other work out inflation. Another person who was working on the "graceful exit" problem was Paul Steinhardt.

Guth: Confirmation of theory

While inflation was a very interesting theory that was able to solve some existing problems in cosmology, it still needed to be tested. Scientists decided to find out if there is the amount of variation in the background inflation that was predicted by inflationary theory. To accomplish it, they sent two probes to measure the non-uniformities that Guth and Linde said could be found. The results of the first, COBE (Cosmic Background Explorer) were released in 1992 and said "yes." However, the physicists who sent it felt that they needed to modify their estimates of the experimental uncertainties. COBE was followed in 2003 by WMAP (Wilkinson Microwave Anistropy Probe), which showed that the nonuniformities did exist with even greater precision. This helped show that Guth's ideas on inflation were the correct ones.

An even more critical test for inflation was: is the value of omega precisely one? According to Guth's inflation theory, omega for the observable universe should equal one, even though it would most likely be much different for the entire universe. In 1998, they accomplished this by measuring the movements of Type Ia supernovae. One thing that they noticed was the supernovae were all the same. They also found out that distant objects actually moved slower than scientists had expected according to Hubble's expansion law. This suggested the existence of dark energy existing in empty space responsible for the expansion rate of the universe. It was determined from the supernova projects that omega almost certainly equals one, which was in perfect consistency with the inflation model.

Guth: Creating a new universe

Guth has investigated the conditions for how a universe could be created in a laboratory, consistent with the laws of physics. Traditionally, one would need the energy of several galaxies, but inflation theory showed it is actually much easier to create a universe. All one needs is one ounce and false vacuum. Once false vacuum exists, the evolution of the universe is independent of what came before. Physicist Roger Penrose once stated that one would need negative energy to create a new universe, but Guth showed that it could also be made by quantum tunneling.

The birth of a new universe also does not affect the old one. It would take about 10^{-37} seconds to disconnect from its parent. However, all an observer would see is the formation of a black hole, which would disappear very quickly. Creating a new universe actually would be quite dangerous since it would result in the release of energy similar to that of a 500 kiloton explosion.[*citation needed*]

Guth: Scientific beliefs

Alan Guth believes that the size of the entire universe is at least 10^{23} times bigger than the size of the observable universe. The universe also exists among countless other universes with various different laws of physics. A fractal pattern exists in the multiverse system, which involves universes inside vacuums that are inside other universes. Each pocket universe created by inflation will appear flat to the observers within it. Meanwhile, new universes will fill in the gaps created by older ones, similar to Hoyle's discredited steady-state theory. The big bang of the universe is actually similar to cell division in biology, since new universes are continuously formed. However, inflation always wipes out the circumstances of the beginning of the particular universe.

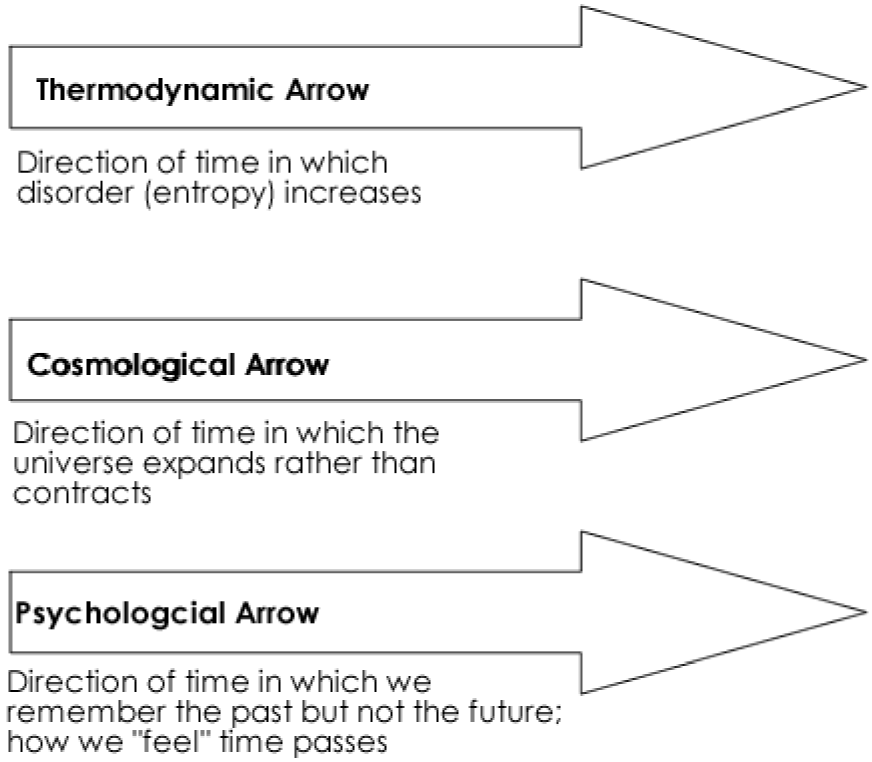
Alan Guth's main beliefs about the universe are that it definitely has a beginning and that it is just one of many universes that came into existence. Inflation never ends, but keeps expanding at an exponential rate, meaning that it doubles in very short increments much less than one second. Universes keep being created all the time as bubbles within the inflation process. The entire cosmos was created by quantum fluctuations from nothingness. While the concept of a universe being created from nothing sounds improbable, it is perfectly consistent with the laws of conservation of energy because its total energy value is zero.

One theory that Guth is particularly fond of is string theory, which says that the building blocks of the universe are superstrings that are much smaller than elementary particles. According to the latest versions of this theory, there are about 10^{500} possible vacuums in existence. The main reason why Guth supports string theory is that he feels that it is the only one that provides a working idea of quantum gravity, a concept that physicists have long been searching for.

There have been more than fifty additional inflation theories proposed since Guth's original model. When the Planck satellite is finally launched in 2009, it should provide data to help choose between the various theories of the details of inflation. The theory of inflation that wins out will certainly differ from Guth's original model, which he acknowledged was incomplete because of its inability to solve the "graceful exit" problem. But Guth will always be remembered as the person who revealed inflationary theory to the scientific community.

According to Guth's theory of cosmic inflation, the universe originated from a false vacuum filled with high energy. The existence of a repulsive gravitational field caused the universe to enter a great period of exponential expansion. He realized that the expansion was so quick that in only 10^{-33} seconds, it was 10^{50} times the original size. Due to the fact that the false vacuum is not stable, the expansion will not continue forever. Instead, quantum tunneling will cause the false vacuum to decay into a low-energy true vacuum. When it decays, bubbles suddenly appear to fill in the space. Although the bubble universes start out small at first, many of them will quickly become fairly large. The ultimate conclusion was that, on the contrary to popular belief, it was possible for the universe to suddenly appear from nothing.

Hawking, Stephen: one of the world's most renowned contemporary theoretical physicists, proposes a unique view of time, building on the theories established by Newton, Einstein, and even Kant (though Kant took a philosophical approach, Hawking incorporates this factor as well). Hawking visualizes time as a series of 3 "arrows." There is the thermodynamic arrow, the cosmological arrow, and the psychological arrow. The concept of these arrows help explain why we see time as moving "forward," and what this "flow" of time actually is in terms of the expansion and contraction of the universe. Essentially, these arrows help distinguish the past from the future, and give a direction to time.



In our current state of the universe, all these arrows are pointing in the same direction, however, this will not always be the case, according to Hawking. The thermodynamic arrow is derived from the second law of thermodynamics, which states that *in any closed system, disorder (entropy) always increases with time*. Take an example of a glass falling from a table. The glass begins in a state of heightened order; it is all in one piece. As time passes, the glass hits the floor, and shatters into many pieces, increasing the disorder, or entropy, tremendously.

Entropy increasing in a system

When viewing the universe as a closed system, it also stands to reason the universe began in a state of high order, and when it ends, will be in a state of extreme disorder. Based on the quantum theory of gravity and "no boundary condition" of spacetime (which Hawking explains in his book, <u>A Brief History of Time</u>, but which we will not discuss in detail), the universe did indeed begin in a very smooth and ordered state, which a few fluctuations in the density and velocities of particles as required by the quantum uncertainty principle. These fluctuations eventually caused matter to cluster due to their own gravity (in regions of higher density) after the Big Bang, and eventually form galaxies, stars, and planets. Having regions of high density, regions of low density, and then more regions of high density translate to an increase in entropy since the initial, smooth ball of matter before the Big Bang. Thus, the thermodynamic arrow's direction is confirmed; as time progresses, entropy increases.

Hawking initially believed that since the universe began as an ordered, smooth point in spacetime, it would eventually return to this state after the "Big Crunch," when the universe starts to collapse upon itself (now, it is still in a stage of expansion and will expand for at least another ten thousand million years). Thus, if the entropy of the universe began to decrease as the universe collapses (which happens to determine the direction of the cosmological arrow), Hawking reasoned that the psychological arrow of time would also reverse itself. This is because the psychological arrow and thermodynamic arrow always point in the same direction. The psychological arrow, as described earlier, is the direction of time that dictates what we remember as the "past." To understand how this related to entropy, it is valuable to imagine our brains as computers. They begin in a state of heightened disorder; a random series of 1's and 0's, for example. When data is input, these 1's and 0's rearrange themselves into an ordered state, which becomes a part of the computer's "memory." However, the energy required to order those 1's and 0's was converted from electrical energy to heat energy during the process, and then expelled into the atmosphere, resulting in an overall *increase* in entropy (greater heat means faster velocities and random motion of particles - see diagram to the right). Our brains work in similar ways, converting the chemical energy in the food we eat into heat energy when we live, breathe, and create memories in the form of neural connections in our brains. Thus, we remember events in the same direction of time that entropy takes; we perceive the "past" as a time of heightened order, or less entropy. Therefore, the psychological and thermodynamic arrows of time point in the same direction.

By this virtue, Hawking theorized that when the universe began to collapse, and the cosmological and thermodynamic arrows switched direction, so would the psychological arrow. Whoever would be living on Earth when the universe began to contract would "remember" things that happen in the future; their lives would run in reverse order, beginning when they were very old, right before their death, and ending when they were born. They would not see the wine glass break and shatter, but rather re-coalesce from thousands of tiny pieces into a new, whole wine glass. However, as Don Page and Raymond Laflamme, Hawking's colleague and student, respectively, pointed out, no law of physics, quantum mechanics, or relativity said that the universe would have to contract in reverse-time and that entropy would have to decrease. Hawking backtracked and realized they were right; the psychological and thermodynamic arrows would not reverse direction.

One last relationship had to be determined, why did the thermodynamic and cosmological arrows run in the same direction (or, why does entropy increase as the universe expands)? As it turned out, the reason was fairly simply explained. The universe as we see it today is expanding and increasing in entropy; that is not in dispute. However, by the time the rate of expansion of the universe falls below critical speed and the universe's own matter begins to pull in on itself, all the stars will have burnt out, galaxies will have collapsed, and protons and neutrons will have decayed into radiation and photons; basically, the ultimate state of disorder (or very close to ultimate). When the universe begins to contract and the cosmological arrow reverses direction, there will be no solid direction for the thermodynamic arrow to point in, since entropy could not increase much more. Furthermore, the psychological arrow would be entirely insignificant in this state of the universe; at ultimate entropy, life could not possibly exist.

Homo heidelbergensis ("Heidelberg Man", named after the University of Heidelberg) is an extinct species of the genus *Homo* which may be[1] the direct ancestor of both *Homo neanderthalensis* in Europe and Homo sapiens.[2] The best evidence found for these hominin date between 600,000 and 400,000 years ago. *H. heidelbergensis* stone tool technology was very close to that of the Acheulean tools used by *Homo erectus*.

Heisenberg, Werner: In quantum mechanics, the **Heisenberg uncertainty principle** states that certain pairs of physical properties, like position and momentum, cannot both be known to arbitrary precision. That is, the more precisely one property is known, the less precisely the other can be known. It is impossible to determine simultaneously both the position and velocity of an electron or any other particle. This is not a statement about the limitations of a researcher's ability to measure particular quantities of a system; it is a statement about the nature of the system itself as described by the equations of quantum mechanics. According to the uncertainty principle, it is, for instance, impossible to measure simultaneously both position and velocity of a microscopic particle with any degree of accuracy or certainty.

In quantum mechanics, a particle is described by a wave. The position of the particle is regarded as being where the wave amplitude is greatest and the momentum is determined by the wavelength. The position is **uncertain** to the degree that the wave is spread out (well-defined wavelength), *but* the momentum is **certain** (well-defined) only to the degree that the wavelength is well-defined. Thus, position and momentum for a particle have opposite requirements for good definition, so that both position and wavelength cannot simultaneously be well-defined. **distance times position = 1**

Infinity in Physics:

In physics, approximations of real numbers are used for continuous measurements and natural numbers are used for discrete measurements (i.e. counting). It is therefore assumed by physicists that no measurable quantity could have an infinite value[*citation needed*] , for instance by taking an infinite value in an extended real number system (see also: hyperreal number), or by requiring the counting of an infinite number of events. It is for example presumed impossible for any body to have infinite mass or infinite energy. There exists the concept of infinite entities (such as an infinite plane wave) but there are no means to generate such things.

Theoretical applications of physical infinity

It should be pointed out that this practice of refusing infinite values for measurable quantities does not come from *a priori* or ideological motivations, but rather from more methodological and pragmatic motivations[*citation needed*]. One of the needs of any physical and scientific theory is to give usable formulas that correspond to or at least approximate reality. As an example if any object of infinite gravitational mass were to exist, any usage of the formula to calculate the gravitational force would lead to an infinite result, which would be of no benefit since the result would be always the same regardless of the position and the mass of the other object. The formula would be useful neither to compute the force between two objects of finite mass nor to compute their motions. If an infinite mass object were to exist, any object of finite mass would be attracted with infinite force (and hence acceleration) by the infinite mass object, which is not what we can observe in reality. Sometimes infinite result of a physical quantity may mean that the theory being used to compute the result may be approaching the point where it fails. This may help to indicate the limitations of a theory.

This point of view does not mean that infinity cannot be used in physics. For convenience's sake, calculations, equations, theories and approximations often use infinite series, unbounded functions, etc., and may involve infinite quantities. Physicists however require that the end result be physically meaningful. In quantum field theory infinities arise which need to be interpreted in such a way as to lead to a physically meaningful result, a process called renormalization.

However, there are some theoretical circumstances where the end result is infinity. One example is the singularity in the description of black holes. Some solutions of the equations of the general theory of relativity allow for finite mass distributions of zero size, and thus infinite density. This is an example of what is called a mathematical singularity, or a point where a physical theory breaks down. This does not necessarily mean that physical infinities exist; it may mean simply that the theory is incapable of describing the situation properly. Two other examples occur in inverse-square force laws of the gravitational force equation of Newtonian gravity and Coulomb's Law of electrostatics. At r=0 these equations evaluate to infinities.

Infinity in cosmology

An intriguing question is whether infinity exists in our physical universe: Are there an infinite number of stars? Does the universe have infinite volume? Does space "go on forever"? This is an important open question of cosmology. Note that the question of being infinite is logically separate from the question of having boundaries. The two-dimensional surface of the Earth, for example, is finite, yet has no edge. By travelling in a straight line one will eventually return to the exact spot one started from. The universe, at least in principle, might have a similar topology; if one travelled in a straight line through the universe perhaps one would eventually revisit one's starting point.

If, on the other hand, the universe were not curved like a sphere but had a flat topology, it could be both unbounded and infinite. The curvature of the universe can be measured through multipole moments in the spectrum of the Cosmic Background Radiation. As to date, analysis of the radiation patterns recorded by the WMAP satellite hints that the universe has a flat topology. This would be consistent with an infinite physical universe. The Planck satellite launched in 2009 is expected to record the Cosmic Background Radiation with ten times higher precision, and will give more insight into the question whether the universe is infinite or not.

Infinity in computing

The IEEE floating-point standard specifies positive and negative infinity values; these can be the result of arithmetic overflow, division by zero, or other exceptional operations.

Some programming languages (for example, J and UNITY) specify greatest and least elements, i.e. values that compare (respectively) greater than or less than all other values. These may also be termed **top** and **bottom**, or **plus infinity** and **minus infinity**; they are useful as sentinel values in algorithms involving sorting, searching or windowing. In languages that do not have greatest and least elements, but do allow overloading of relational operators, it is possible to *create* greatest and least elements (with some overhead, and the risk of incompatibility between implementations).

Illusions: The Periodic Table of Illusions: blindness, the ambiguities, instability, distortion, fiction, and paradox, plus their causes.

FOR all the fun we have with them, illusions do serious work in illuminating how our brains work, and in particular how perception works. They may also help us understand how consciousness developed, and tell us about our "neuro-archaeology" and the behaviour patterns laid down in the nervous system over evolutionary time.

But let's concentrate on perception: it is tricky enough. I've tried to classify illusions in a way that shows the principles underlying them, starting with physical causes, moving on to physiological disturbances of neural signals, and finally to cognitive processes - where the brain tries to make sense of sensory signals, not always successfully.

The distinction between physiological and cognitive is not straightforward. It's rather like the distinction between how a machine works and what it does. For example, a can opener needs two descriptions: the mechanism of levers and cutters, and what this does to open a can.

That distinction between physiological and cognitive has "real-world" consequences. Think of the placebo effect, which suggests close connections between the physiological and the cognitive-psychological. So different types of illusions could be significant in ways we do not yet know. That's why I have constructed my Periodic Table of Illusions (bad pun intended) thus: **blindness, the ambiguities, instability, distortion, fiction, and paradox, plus their causes.**

Starting with blindness perhaps seems odd but the many kinds of blindness and accompanying visual phenomena tell us much about perception. Blindness ranges from the physiological, with no sensation of light and colour (congenitally or from injury or disease) to various mind blindnesses, such as agnosia, when light, colour, movement and form are perceived but the object seen lacks meaning.

Another form is change blindness, where a person fails to notice big differences in a picture or scene - sometimes even when someone in that scene has been substituted.

Next come the ambiguities. Confounded ambiguity illusions depend on a failure to properly distinguish between two objects, in poor light or because of our ageing senses. Differences in the brightness of regions of an object or scene help us see detail; limited light makes the visual brain choose whether neural activity is due to the presence of light or to neural "noise". Both neural noise and light fluctuate randomly so to see anything reliably we need significantly more photons.

As for flipping ambiguity, such as the duck-rabbit illusion, there are two theories about how they work: either the brain tires of one image and switches to the other, or there are two perceptions vying for centre stage. Since perception usually changes when what is "out there" changes, this spontaneous flipping may tell us the brain is switching its opinion as it ponders alternative interpretations. Oddly, flipping gets easier with practice. It is as if more or less feasible alternatives wait in the wings to challenge the present interpretation. Once, after weeks looking at ambiguous figures, I found solid objects, even concrete buildings, flipping in front of my eyes!

One of the most famous kinds of instability illusion is created by the use of those repeated patterns so typical of 1960s Op Art, which make the picture appear to be moving. Again, the causes are controversial. One view is that these patterns stimulate brain regions in the V5 area to produce sensations of movement. Or it may be that there is motion at the retina from eye tremor, and from the lens trying to focus the image, which may stimulate the movement systems - especially from high-contrast repeated lines.

Distortion illusions are arguably the most controversial since they most concern the distinction between illusions created by receiving neural signals (reception), where things can go wrong physiologically, and illusions of misreading signals (perception), where things can go wrong cognitively; back to the physiological versus the cognitive again.

Years ago I was struck by the idea that Ponzo illusions and the Muller-Lyer illusions, which normally show converging lines and arrows, are simple perspective pictures of 3D objects (corners, in the case of Muller-Lyer), or scenes (receding railway tracks, in the case of Ponzo illusions), and that to understand them we should think about how three dimensions are seen in 2D pictures. This includes the retinal images of normal objects.

We know what we see is very different from the images on our retinas because perceptions are scaled, like maps. So what sets the scaling for seeing the sizes and shapes of surrounding objects? Using ambiguity illusions I found that the scaling in Ponzo and Muller-Lyer illusions can be set from visual cues, such as the convergence of lines by perspective, or from the current perception of distance. The fact that the same retinal image can give more than one perception, as when perceptions "flip", is useful because it lets us separate "bottom-up" (from the eye) from "top-down" (from the brain) processes. This way we know that a perceptual change without a change in the eye must be top-down, from the brain, and not bottom-up, as there is no change in the image.

This leaves us with fiction and paradox. Fictional illusions are not necessarily false, any more than a novel is altogether false, though fictional. They are generated by the creative activity of the visual brain, generally guided by knowledge from the past, often predicting the immediate future. There are probability-statistical principles here known as Bayesian inference.

One "fiction" concerns the blind spot on the retina, where the optic nerve is. One of nature's most amazing illusions is that we don't see this region as a black hole in visual space. The brain generally "fills in", using surrounding colours and patterns.

One of nature's most amazing illusions is that we don't see our blind spot
The last category, paradox, brings us to René Magritte's *Carte Blanche* (left). The illusion turns on the unlikeliness or impossibility of an event. For example, a person swimming the Atlantic is unlikely, but it is "allowed" by the rules of language; a dark-haired blonde, however, is impossible and not allowed by the rules, so it is a logical paradox. In *Carte Blanche*, we see an impossible horse we know could not be ridden or even be alive. Why? While the probable is by definition more likely to be occurring, unlikely things do occur and we need to pay them special attention. But the Magritte horse? My hunch is that perceptions are hypotheses, depending both on rules, which may conflict, and on assumptions, which may be wrong.

As we have seen, there are a great variety of causes of these phenomena of seeing we call illusions. Many are imperfectly understood, and some have wildly different explanations. But illusions are invaluable because the clues they hold to how we see simply could not be found elsewhere.

Profile

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Inflationary Theory: See Guth, Alan, above.

Judaism: Main Beliefs of Judaism / Jewish Religion: Judaism beliefs are set forth in the following thirteen articles, first compiled by Maimonides in the eleventh century:

I believe with a true and perfect faith that God is the creator (whose name be blessed), governor, and maker of all creatures; and that he has wrought all things, worketh, and shall work forever.
I believe with perfect faith that the creator (whose name be blessed) is one; that there is no unity like unto his in any way; and that he alone was, is, and will be our God.
I believe with a perfect faith that the creator (whose name be blessed) is incorporeal, that he has not any corporeal qualities, and that nothing can be compared unto him.
I believe with a perfect faith that the creator (whose name be blessed) was the first, and will be the last.

I believe with a perfect faith that the creator (whose name be blessed) is to be worshipped and none else.
I believe with perfect faith that all the words of the prophets are true.
I believe with perfect faith that the prophecies of Moses our master (may he rest in peace) were true; that he was the father and chief of all prophets, both of those before him and those after him.
I believe with perfect faith that the Law, at present in our hands, is the same that was given to our master Moses (peace be with him).
I believe with perfect faith that this Law will not be changed, and that no other Law will be revealed by the creator (blessed be his name).
I believe with a perfect faith that God (whose name be blessed) knows all the deeds of the sons of men and all their thoughts; as it is said: "He who hath formed their hearts altogether, he knoweth all their deeds".
I believe with a perfect faith that God (whose name be blessed) rewards those who keep his commandments, and punishes those who transgress them.
I believe with a perfect faith that the Messiahs will come; and although he tarries I wait nevertheless every fay (?should this be day) for his coming.
I believe with a perfect faith that there will be a resurrection of the dead, at the time when it shall please the creator (blessed be his name).

Kant, Emmanuel: Consciousness: the Noumenon (actual thing being observed) and the Phenomenon (mental image of perceived reality)

Kant, Emmanuel: Time: Immanuel Kant was an Enlightenment scholar and philosopher from Germany. His views on time can be summarized into 5 arguments, which are presented in his book Critique of Pure Reason. In it he states that time possesses both “empirical reality” and transcendental ideality”

" Time is not an empirical concept that is somehow drawn from experience. For simultaneity or succession would not themselves come into perception if the representation of time did not ground them a priori. Only under its presuppositions can one represent that several things exist at one and the same time or at different times. "

His first argument states that our notions of time, such as simultaneity and succession are “mind-contributed”, meaning that our minds develop these ideas to explain the relationship of different events, because they are presupposed in our perception of simultaneous or successive events in time.

" Time is a necessary representation that grounds all intuitions. In regard to appearances in general one cannot remove time, though one can very well take the appearances away from time. Time is therefore given a priori. In it alone is all actuality of appearances possible. The latter could all disappear, but time itself, as the universal condition of their possibility, cannot be removed. "

His second argument postulates that time is an a priori structure (i.e. it is inherent in our mind without the use of empirical data) because there exists the possibility of considering time by itself, without the use of objects for it to define, however all objects must be defined by time.

"The a priori necessity also grounds the possibility of apodictic principles of the relations of time, or axioms of time in general. It has only one dimension: different times are not simultaneous, but successive...These principles could not be drawn from experience, for this would yield neither strict universality nor apodictic certainty. We would only be able to say: That is what common perception teaches, but not: This is how matters must stand. These principles are valid as rules under which experiences are possible at all, and instruct us prior to them, not through it."

His third argument claims that because time is a universal concept and is measured the same way by all people, it must be a priori, because if it was a posteriori, there would be "neither strict universality nor apodictic certainty." His fourth and fifth arguments, Kant argues that time is sensible, rather than conceptual imposed upon experience by the mind.

Following these arguments, he concludes that time could "subsist for itself or attach to things as an objective determination" (that it can either be a static idea or a modifier of an object), that time is "nothing more than the form of inner sense" (that it is a perception made by the mind and not a real measurement), and that time is "the immediate condition of inner intuition" and "the mediate condition of outer appearances" (that we sense time immediately within our minds, and then later apply the condition of time to objects and our surroundings)

Lackoff, George: Human beings do not have direct access to their deepest levels of understanding.

Limits of Computing:

Logic, Fuzzy: both of the following theorems are correct.
Everybody loves a love.
George doesn't love himself.
Therefore George does not love Martha.

Either everyone is a lover or some people are not lovers.
If everyone is a lover, Waldo certainly is a lover.
If everyone isn't a lover, then there is at least one non-lover;
Call her Myrtle.
Therefore if Myrtle is a lover, everyone is a lover.

Metaphor: Synecdoche is closely related to metonymy (the figure of speech in which a term denoting one thing is used to refer to a related thing); indeed, synecdoche is sometimes considered a subclass of metonymy. It is more distantly related to other figures of speech, such as metaphor.

More rigorously, metonymy and synecdoche may be considered as sub-species of metaphor, intending metaphor as a type of conceptual substitution (as Quintilian does in *Institutio oratoria* Book VIII). In Lanham's *Handlist of Rhetorical Terms*,[2] the three terms have somewhat restrictive definitions, arguably in tune with a certain interpretation of their etymologies from Greek:

- *metaphor*: changing a word from its literal meaning to one not properly applicable but analogous to it; assertion of identity rather than, as with simile, likeness.
- *metonymy*: substitution of cause for effect, proper name for one of its qualities, etc.
- *synecdoche*: substitution of a part for whole, species for genus, etc.

Metaphysics vs. Science: a point of view

Before you can understand why, how, and where physics and metaphysics will converge, you must understand exactly what is meant by physics and metaphysics. Metaphysics is basically *the philosophical study of being and knowing*. Metaphysics is very closely related to spirituality, but it is not religious. On the other hand, when I talk about physics I am not really talking about the old Newtonian physics that many of us were taught in school. Instead, I am talking more about the leading edge sciences that are, in my opinion, currently expanding the previous limits of science, mainly quantum physics (the science where physics and metaphysics merge) . **Why / Where Metaphysics and Physics are about to Merge?** Science and spirituality have a very close relationship. Metaphysics / spirituality and science are really two complimentary ways of looking at reality. Therefore as we get closer to the truth, physics and metaphysics must merge, or in other words, science will meet spirit.

The main difference between science and spirituality was:
☐ true spirituality you look within
☐ traditional scientists look toexternal sources

But now, scientists are beginning to look within, to solve external scientific problems, because almost every day new information is coming out that does not make sense under the old science (such as psychic phenomenon). Scientists are now beginning to go straight to the real source, which is the same source that supplies metaphysics. Therefore, it is inevitable that physics and metaphysics merge.

“It was very important that, a long time ago, we made the decision to separate spirit from science. And so we were able to learn how to do science. But now we’ve learned, and we can take on the richer task of learning to do science when consciousness is part of the experiment.” - William Tiller, Ph.D.

Science's approach to The Truth: The initial goal of science was, of course, not to separate science and spirit, but instead to understand nature. In early/ancient civilizations science and spirituality were meant to complement each other and nature. Scientists wanted to understand nature, so they could live in harmony with it, not so they could dominate it. Only until the middle of the 16th century did this really change.

Materialism, which is *the theory that physical matter is the only reality and that everything, including thought, feeling, mind, and will, can be explained in terms of matter and physical phenomena* brought about the separation between science and spirit. Since, under this way of thinking, physical well-being and worldly possessions became the greatest good and had the highest value in life. The world was thought of as a machine, and there was no need for God or metaphysics / spirituality.

Then in the early 20th century, scientist like Einstein, Bohr, Heisenberg, Schrödinger and other founders of quantum theory proved that it was not a material world at all. Many of the founders of quantum even had an interest in spiritual matters. They discovered that the physical universe is essentially non-physical. It seems to arise from a field that is even more subtle than energy, a field that seems to be more like intelligence or consciousness than matter. As you may know, these are ancient metaphysical teachings, and metaphysicians have no problems with these ideas. Even though, much of the scientific community does. And, once materialism is gone, the convergence of science and spirituality can begin again.

How Physics and Metaphysics Will Merge? Although, it is not certain exactly how the convergence of science and spirit will take place, there are many ideas as to how and when this might happen. Some people believe that there will be a complete blending of one into the other. Others believe that they will continue to overlap and expand each other. Personally, I believe that through quantum physics, science will prove many of the ancient metaphysical / spiritual teachings (as it is already doing) and in the process we will see the convergence to science and spirit.

Or as Fred Allan Wolf, Ph.D. said: "It isn't a question of science bringing spirituality in. It's more a question of expanding the circle within which both science and spirituality lie, so that the kind of question we can ask can be looked at from the different points of view that both science and spirituality bring to the table. It's important to realize that the subject, the 'inner space,' is worthy of great exploration. It's important to realize that the ways we explore the 'inner space' may not be the same ways that we explore 'outer space.' But the ways that we understand inner space may be greatly assisted by the ways that we understand the quantum nature of the physical world."

In conclusion, everyday we are coming closer to seeing physics and metaphysics merge. I look forward to watching this, just as much as you do.

Metaphysics: Branch of Philosophy that deals with the nature of our world...the study of being and reality. A central branch of metaphysics is **ontology,** the investigation into what categories of things are in the world and what relations these things bear to one another. This includes time, being, and the nature of existence. . Many philosophers over the years have tried to understand the notion of time, using mathematics or logic to explain the way our world works.

The nature of causality is a major topic in metaphysics, although it is one we know very little about. **Causality** seeks to explain how two events are linked--i.e. if one event caused another. The idea of **entropy** is a major player in causality. The notion that the universe tends towards disorder is essential in explaining why events transpire. It can be assumed that if the universe tends towards disorder, that one event causing less disorder would lead into an event causing more, however with our current knowledge of physics there is no way to quantify the entropy of most events (those events that are not reactions--how does one measure the entropy of war?) Causality remains an aspect of time that has been argued by many, but it seems like no headway will be made until our understanding of physics increases.

Among groups of metaphysicists, there are two general groups, t**ensed theorists and tense-less theorists. Tensed theorists believe that the passage of time is an objective fact; that time flows from past to present to future and there is no subjectivity to it. Tense-less theorists believe that the only objective view of time is when it is used in the relation of two objects. This division between theories is one of the major issues concerning metaphysics.**

Another issue is the idea of causal asymmetry. A long standing idea in metaphysics was the idea of **causal asymmetry, which is the idea that events in the future cannot affect those in the past, but those in the past can affect events in the future.** This is a simple idea in itself, but attempts to explain causal asymmetry in terms of other methods of **understanding time have not proven fruitful**. Some metaphysicists believe that causation may actually be symmetric, but that some aspect of our psychological constitution makes it appear asymmetric. The idea that causal asymmetry can be explained partly by our psychological constitution implies that other seemingly objective things can be challenged in the same way.

Mysticism: usally linked with Platonism to for NeoPlatonism: (from the Greek μυστικός, *mystikos*, an initiate of a mystery religion)[1] is the pursuit of communion with, identity with, or conscious awareness of an ultimate reality, divinity, spiritual truth, or God through direct experience, intuition, instinct or insight. Mysticism usually centers on a practice or practices intended to nurture those experiences or awareness. Mysticism may be dualistic, maintaining a distinction between the self and the divine, or may be nondualistic. Differing religious traditions have described this fundamental mystical experience in different ways:

- Nullification and absorption within God's Infinite Light (Hassidic schools of Judaism)
- Complete non-identification with the world (Kaivalya in some schools of Hinduism, including Sankhya and Yoga; Jhana in Buddhism)
- Liberation from the cycles of Karma (Moksha in Jainism and Hinduism, Nirvana in Buddhism)
- Deep intrinsic connection to the world (Satori in Mahayana Buddhism, Te in Taoism)

- Union with God (Henosis in Neoplatonism and Theosis in Eastern and Catholic Christianity, Brahma-Prapti or Brahma-Nirvana in Hinduism)
- Innate Knowledge (Irfan and Sufism in Islam)
- Experience of one's true blissful nature (Samadhi Svarupa-Avirbhava in Hinduism and Buddhism)
- Seeing the Light, or "that of God", in everyone (Quakerism)

Enlightenment or *Illumination* are generic English terms for the phenomenon, derived from the Latin *illuminatio* (applied to Christian prayer in the 15th century) and adopted in English translations of Buddhist texts, but used loosely to describe the state of mystical attainment regardless of faith.

Mystic traditions form sub-currents within larger religious traditions—such as Kabbalah within Judaism, Sufism within Islam, Vedanta and Kashmir Shaivism within Hinduism, Christian mysticism within Christianity—but are often treated skeptically and sometimes held separately, by more orthodox or mainstream groups within the given religion, due to the emphasis of the mystics on direct experience and living realization over doctrine. Mysticism is sometimes taken by skeptics or mainstream adherents as mere obfuscation, though mystics suggest they are offering clarity of a different order or kind. In fact, a basic premise of nearly every mystical path, regardless of religious affiliation, is that the experiences of divine consciousness, enlightenment and union with God that are made possible via mystical paths, are available to everyone who is willing to follow the practice of a given mystical system. Within a given mystical school, or path, it is much more likely for the mystical approach to be seen as a divine science, because of the direct, replicable elevation of consciousness the mystical approach can offer to anyone, regardless of previous spiritual or religious training.

Some mystic traditions can exclude the validity of other traditions. However, mystic traditions tend to be more accepting of other mystic traditions than the non-mystical versions of their traditions. This is based on the premise that the experienced divinity is able to bring other mystics to their own tradition if necessary. Some, but not all, mystics are even open to the idea that their tradition may not be the most practical version of mystic practice.

Most mystic traditions have both positive (+) and negative (-) values of mystical experience within their own tradition. One example of this is in the New Age tradition, which simply calls these values positive and negative energy. Another example is in the Jewish, Christian, and Muslim traditions, which would refer to these as the influence of good and evil spirits, or good and evil realms - in the case of an out of body experience.

Nature: Nature, in the broadest sense, is equivalent to the **natural world**, **physical world**, or **material world**. "Nature" refers to the phenomena of the physical world, and also to life in general. It ranges in scale from the subatomic to the cosmic.

The word *nature* is derived from the Latin word *natura*, or "essential qualities, innate disposition", and literally means "birth".[1] *Natura* was a Latin translation of the Greek word *physis* (φύσις), which originally related to the intrinsic characteristics that plants, animals, and other features of the world develop of their own accord.[2][3] The concept of nature as a whole, the physical universe, is one of several expansions of the original notion; it began with certain core applications of the word φύσις by pre-Socratic philosophers, and has steadily gained currency ever since. This usage was confirmed during the advent of modern scientific method in the last several centuries.[4][5]

Within the various uses of the word today, "nature" may refer to the general realm of various types of living plants and animals, and in some cases to the processes associated with inanimate objects–the way that particular types of things exist and change of their own accord, such as the weather and geology of the Earth, and the matter and energy of which all these things are composed. It is often taken to mean the "natural environment" or wilderness–wild animals, rocks, forest, beaches, and in general those things that have not been substantially altered by human intervention, or which persist despite human intervention. For, example, manufactured objects and human interaction generally are not considered part of nature, unless qualified as, for example, "human nature" or "the whole of nature". This more traditional concept of natural things which can still be found today implies a distinction between the natural and the artificial, with the artificial being understood as that which has been brought into being by a human consciousness or a human mind. Depending on the particular context, the term "natural" might also be distinguished from the unnatural, the supernatural, and the artifactual.

Nonlocality: In physics, **nonlocality** is a direct influence of one object on another, distant object, in violation of principle of locality. In classical physics, nonlocality in the form of action at a distance appeared in corpuscular theories and later disappeared in field theories. Action at a distance is incompatible with relativity. In quantum physics nonlocality re-appeared in the form of entanglement.

Physical reality of entanglement has been demonstrated experimentally together with the absence of local hidden variables. Entanglement is compatible with relativity; however, it prompts some of the more philosophically oriented discussions concerning quantum theory. More general nonlocality beyond quantum entanglement but still compatible with relativity, is an active field of theoretical investigation but has yet to be observed.

Paradoxes: “This statement is not provable.”

“This statement is false”; known as the Liar’s paradox, or the Epimenides paradox.

Olbers paradox: So why is the night sky dark? The first scientifically reasonable answer was given in 1848 by the American poet and writer Edgar Allan Poe! He suggested that the universe is not old enough to fill the sky with light. The universe may be infinite in size, he thought, but there hasn’t been enough time since the universe began for starlight, traveling at the speed of light, to reach us from the farthest reaches of space.

Astronomers have concluded that the universe began some 12 to 15 billion years ago. That means we can only see the part of it that lies within 12 to 15 billion light-years from us. There may be an infinite number of stars beyond that cosmic horizon but we can’t see them because their light has not yet arrived. And the observable part of the universe contains too few stars to fill up the sky with light.

But that is not the whole solution to the paradox. Most stars, like the Sun, shine for a few billion years or so before they consume their nuclear fuel and grow dark. Dying stars spew gas and dust back into space, and this material gives birth to new generations of stars. But after enough generations, all the nuclear fuel in the universe is eventually exhausted, and the formation of luminous stars must come to an end. So even if the universe were infinitely old as well as infinitely large, it would not contain enough fuel to keep the stars shining forever and to fill up all of space with starlight. And so the night sky is dark.

Phenomenology: In its most basic form, phenomenology attempts to create conditions for the objective study of topics usually regarded as subjective: consciousness and the content of conscious experiences such as judgments, perceptions, and emotions. Although phenomenology seeks to be scientific, it does not attempt to study consciousness from the perspective of clinical psychology or neurology. Instead, it seeks through systematic reflection to determine the essential properties and structures of consciousness and conscious experience**.**

Husserl derived many important concepts central to phenomenology from the works and lectures of his teachers, the philosophers and psychologists Franz Brentano and Carl Stumpf.[1] An important element of phenomenology that Husserl borrowed from Brentano was intentionality (often described as "aboutness"), the notion that consciousness is always consciousness *of* something. The object of consciousness is called the *intentional object*, and this object is constituted for consciousness in many different ways, through for instance perception, memory, retention and protention, signification, etc. Throughout these different intentionalities, though they have different structures and different ways of being "about" the object, an object is still constituted as the same identical object; consciousness is directed at the same intentional object in direct perception as it is in the immediately following retention of this object and the eventual remembering of it.

Though many of the phenomenological methods involve various reductions, phenomenology is essentially anti-reductionistic; the reductions are mere tools to better understand and describe the workings of consciousness, not to reduce any phenomenon to these descriptions. In other words, when a reference is made to a thing's *essence* or *idea*, or when one details the constitution of an identical coherent thing by describing what one "really" sees as being only these sides and aspects, these surfaces, it does not mean that the thing is only and exclusively what is described here: The ultimate goal of these reductions is to understand *how* these different aspects are constituted into the actual thing as experienced by the person experiencing it. Phenomenology is a direct reaction to the psychologism and physicalism of Husserl's time.

Although previously employed by Hegel, it was Husserl’s adoption of this term (circa 1900) that propelled it into becoming the designation of a philosophical school. As a philosophical perspective, phenomenology is its method, though the specific meaning of the term varies according to how it is conceived by a given philosopher. As envisioned by Husserl, phenomenology is a method of philosophical inquiry that rejects the rationalist bias that has dominated Western thought since Plato in favor of a method of reflective attentiveness that discloses the individual's "lived experience." Loosely rooted in an epistemological device, with Skeptic roots, called epoché, Husserl's method entails the suspension of judgment while relying on the intuitive grasp of knowledge, free of presuppositions and intellectualizing. Sometimes depicted as the "science of experience," the phenomenological method is rooted in intentionality, Husserl's theory of consciousness (developed from Brentano). Intentionality represents an alternative to the representational theory of consciousness which holds that reality cannot be grasped directly because it is available only through perceptions of reality which are representations of it in the mind. Husserl countered that consciousness is not "in" the mind but rather conscious of something other than itself (the intentional object), whether the object is a substance or a figment of imagination (i.e. the real processes associated with and underlying the figment). Hence the phenomenological method relies on the description of phenomena as they are given to consciousness, in their immediacy.

According to Maurice Natanson (1973, p. 63), *"The radicality of the phenomenological method is both continuous and discontinuous with philosophy's general effort to subject experience to fundamental, critical scrutiny: to take nothing for granted and to show the warranty for what we claim to know."*
In practice, it entails an unusual combination of discipline and detachment to suspend, or bracket, theoretical explanations and second-hand information while determining one's "naive" experience of the matter. The phenomenological method serves to momentarily erase the world of speculation by returning the subject to his or her primordial experience of the matter, whether the object of inquiry is a feeling, an idea, or a perception. According to Husserl the suspension of belief in what we ordinarily take for granted or infer by conjecture diminishes the power of what we customarily embrace as objective reality. According to Safranski (1998, 72), "[Husserl and his followers'] great ambition was to disregard anything that had until then been thought or said about consciousness or the world [while] on the lookout for a new way of letting the things [they investigated] approach them, without covering them up with what they already knew."

Heidegger modified Husserl's conception of phenomenology because of (what he perceived as) his subjectivist tendencies. Whereas Husserl conceived humans as having been constituted by states of consciousness, Heidegger countered that consciousness is peripheral to the primacy of one's existence (i.e., the mode of being of Dasein) which cannot be reduced to one's consciousness of it. From this angle, one's state of mind is an "effect" rather than a determinant of existence, including those aspects of existence that one is not conscious of. By shifting the center of gravity from consciousness (psychology) to existence (ontology), Heidegger altered the subsequent direction of phenomenology, making it at once both personal and mysterious. One of the consequences of Heidegger's modification of Husserl's conception of phenomenology was its increased relevance to psychoanalysis. Whereas Husserl gave priority to a depiction of consciousness that was fundamentally alien to the psychoanalytic conception of the unconscious, Heidegger offered a way to conceptualize experience that could accommodate those aspects of one's existence that lie on the periphery of sentient awareness.[2][3]

Plato: Platonism: The philosophy of Plato, especially insofar as it asserts ideal forms as an absolute and eternal reality of which the phenomena of the world are an imperfect and transitory reflection.
Any philosophy that embodies some major idea of Plato's, especially in taking abstract forms as metaphysically more basic than material things. Though there was in antiquity a tradition about Plato's "unwritten doctrines," Platonism then and later was based primarily on a reading of the dialogues. It is characterized by an intense concern for the quality of human life — always ethical, often religious, and sometimes political, based on a belief in unchanging and eternal realities (the Platonic Forms), independent of the changing things of the physical world perceived by the senses. This belief in absolute values rooted in an eternal world distinguishes Platonism from the philosophies of Plato's immediate predecessors and successors and from later philosophies inspired by them. *See also* Neo-Platonism.

Platonism: Literary Dictionary: [**play**-tŏn-izm], the doctrines of the Greek philosopher Plato (Platon, 427–347 BCE), especially the idealist belief that the perceptible world is an illusory shadow of some higher realm of transcendent Ideas or Forms. Despite Plato's hostility to poets as misleading imitators of worldly illusions, *Platonic* ideas have repeatedly been adopted in Western literature: in the Renaissance his view of physical beauty as an outward sign of spiritual perfection is prevalent in love poetry, while in the age of Romanticism his idealist philosophy was absorbed by many poets, notably Percy Bysshe Shelley. The *Cambridge Platonists* were a group of theologians associated with Cambridge University in the mid-17th century, who sought to reconcile the Anglican faith with human Reason while promoting religious tolerance; their leading writers were Henry More and Ralph Cudworth. See also Neoplatonism.

Platonism: Philosophy Dictionary: Generally, any view supposed to owe its classical origin to the dialogues of Plato. In modern philosophy the view taken especially from the middle dialogues of Plato that abstract objects, such as those of mathematics, or concepts such as the concept of number or justice, are real, independent, timeless, and objective entities. Numbers stand to mathematical enquiry rather as countries do to geographical enquiry, and concepts stand in a similar relation to enquiries such as philosophy or law that delve into their nature. See also forms.

Reality: http://en.wikipedia.org/wiki/Reality. in everyday usage, means "the state of things as they actually exist."[1] Literally, the term denotes what is *real*; in its widest sense, this includes everything that is, whether or not it is observable or comprehensible. Reality in this sense includes being and sometimes is considered to include nothingness, as well. By contrast, the term *existence* is often restricted solely to being (compare with *nature*).

Richard's Paradox: see **Antinomy** above. A number N is Richardian, if and only if, it is not Richardian. In this expression, the statement is both true and false. Assume that a Richardian number is one that describes the properties of numbers, such as a prime number or a square number. The number 15 is neither prime nor square, therefore it is not a Richardian number in these instances. But Richardian numbers describe the properties of numbers. So, is 15 a Richardian number? Yes, a contradiction!   This is the essence of Gödel's Proof, but he reduced it to arithmetic statements.

Sagan, Carl: argued that the doctrine of a Creator of the Universe was difficult to prove or disprove and that the only conceivable scientific discovery that could challenge it would be an infinitely old universe.

Schrödinger, Erwin: A cat is placed in a box, together with a radioactive atom. If the atom decays, and the Geiger-counter detects an alpha particle, the hammer hits a flask of prussic acid (HCN), killing the cat. The paradox lies in the clever coupling of quantum and classical domains. Before the observer opens the box, the cat's fate is tied to the wave function of the atom, which is itself in a superposition of decayed and undecayed states. Thus, said Schrödinger, the cat must itself be in a superposition of dead and alive states before the observer opens the box, ``observes" the cat, and ``collapses" it's wave function.

Smollen, lEE: a staunch critic of string theory: wrote: The Trouble with Physics.

Speed of Light: The speed of quantum tunneling. According to Einstein, speeds faster-than-light were impossible because causality paradoxes could occur relative to some observers. Nevertheless, no causality paradoxes occur because of faster-than-light travel via a here-now... Whenever a particle travels via the here-now of a distinct reference frame between any two points in that frame, it travels across zero distance and time between these two points and relative to that specific reference frame. Since it crosses a zero period of time in this frame, then relative to this frame, it travels infinitely quickly between these two points. However, relative to a different reference frame, it would travel across a quantity of distance-time.

$d / T'' = c^2 / v$ **, equation 27**

In the equation, v is the velocity of S' relative to S, and d is the distance in the S frame spanned by T" relative to S. According to Eq. (27), a particle wave tunneling through a barrier in the same direction as v will travel across d (distance) in T" (period of time) with velocity c^2/v relative to the S frame. Since c□ v, the particle will always move equal to or faster than the speed of light in a vacuum. Since I do not know what determines v, I cannot predict the time it takes for a particle wave to tunnel through a barrier based on the width of the barrier. If the particle wave moves faster-than-light via a here-now in the opposite direction of v, it will traverse a negative period of time, □ T", relative to S. For this reason, Einstein declared speeds faster-than-light impossible, thus preventing time travel into the past and any causality paradoxes, which may arise. In the next subsection, as well as in subsection 5.9, I give distinct solutions to two different causality paradoxes.

From figure 4, I derive figure 5. In figure 5, the reference frame S' has a velocity v relative to the reference frame S. The difference in time units between S and S' relative to S is T distance-time in the positive X axis direction**. A barrier is at rest in S. To the left of the barrier there is a man. To the right of the barrier there is a loaded gun. The man and the gun are at rest in S.**

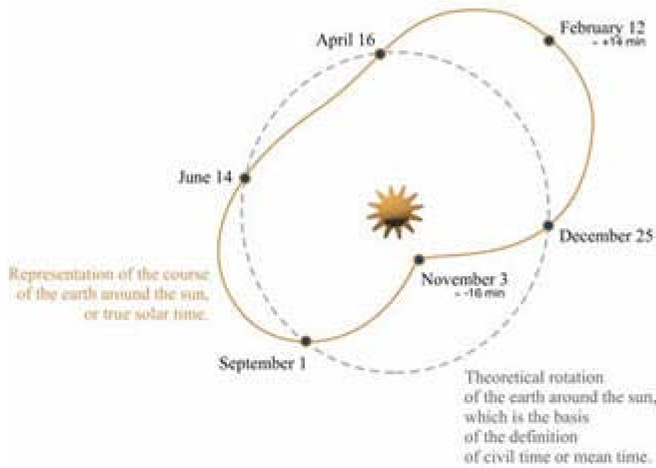
The gun is aimed at both the barrier and the man and is connected to an electrical apparatus. This apparatus fires the gun after the man on the other side of the barrier pushes a button. However, the bullet could tunnel through the barrier and strike the man. If it travels via the S' here-now, it would travel across a -T period relative to the man and possibly kill him. **Could the bullet kill the man before he pushed the button to fire the gun?** If it did, a causality paradox would occur. However, this could not be the case. The period of time it takes from the point in time the man pushes the button to the point in time the gun fires could not be less than the time it takes light at speed c to travel from man to gun. However, according to Eq.27, the period of time T is limited by the slowest speed for quantum tunneling□speed c. **Consequently, the bullet could not travel back in time far enough to strike the man before he pushed the button. No actual causality paradox could occur in this scenario.**

Susskind, Leonard: String Theorist: see Science Symposium Video:
String Theory has come under some criticism, for lack of results. There may not be a simple solution or formula that provides all the values for our standard model. Rather superstrings may be the DNA of reality, which unfold all the possible working states, as many as a googleplex number of states, or 10^500, or infinitely "Many Worlds"
Physics may begin to look more like biology. Space-time may not be fundamental. The right vision may come from cosmologists like Alan Guth: bubbles within bubbles within bubbles, etc. The universe is a landscape with high and low energy states. Low energy states, entropy, are stable and may begin to inflate, they may impinge on another low energy or minima causing a small bubble to appear, etc
Newton, Isaac: Time: The English philosopher Sir Issac Newton made his greatest contribution to the study of space, time and motion in his work *Philosophae Naturalis Principia Mathematica.* In the section entitled "Scholium," Newton theorized that that mathematical time passed by independently without disruption by other forces in the universe. Additionally, he stated time that was a dimension of the universe in which events occur in sequence. This is known as the realist view of time. Essentially, Newton believed that time was as real as the objects that it contains and it could be measured.

"Absolute, true, and mathematical time, in and of itself and of its own nature, without reference to anything external, flows uniformly and by another name is called duration. Relative, apparent, and common time is any sensible and external measure (precise or imprecise) of duration by means of motion; such a measure - for example, an hour, a day, a month, a year - is commonly used instead of true time." -Principia

Prior to the late seventeenth and the early eighteenth centuries, Newton's era, a number of views on time refuted the idea that time could be measured, instead arguing that time could not occur without a change occurring somewhere in the universe. In this view, time is the measure of the intervals between or cycles of changes in the universe. This is contrary to Newton's point that time can continue regardless of the rest of the universe. The pre-Newtonian and many post-Newtonian theories considered relative time; Newton wanted to separate that from absolute time. As mentioned in the above quote from *Principia*, Newton considered traditional measurements of time to be units of relative time, whereas absolute time could not be measured in such a manner.

An Arguement for Absolute Time



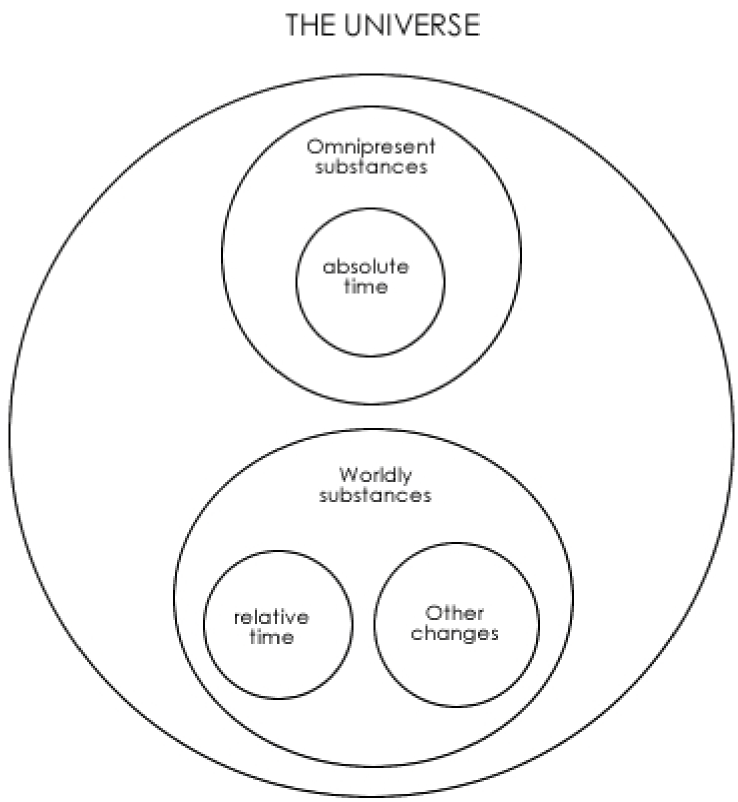
Newton's "Scholium" provides a number of arguments for absolute time. Distinguishing between relative and absolute time allowed for the corrections of inequalities in the solar day, the amount of time it takes for the sun to return to its zenith, which was originally thought to be uniform throughout. Whereas the Ptolemaic astronomy of antiquity considered the sidereal day--the amount of needed for a fixed star to return to its zenith--to be constant, emerging theories during the scientific revolution began to doubt that the rotation of the Earth remained constant over a year (a constant rotation was crucial to the uniformity of the sidereal day). With Newton's theory of time, absolute time could remain constant even as relative time was liable to change due to changes in the Earth's rotation.

The Newtonian theory does consider time as a dimension to be the fourth dimension of motion. While Newton didn't fully explore the effects of relative motion on time, his theory did set some precedent for Einstein's theory of relativity, at least giving him material to vastly expand on.

William Charleston's Theory:

Many of the core aspects of Newton's theory can be found in William Charleston's *Physiologia Epicuro-Gassendo-Charltoniana* (1654), which was published twelve years before Newton was born. Charleston stated that time is a real entity, that it is constant regardless of other forces, and that it is distinct from any measure of it. In fact, Newton became familiar with this text while he was an undergraduate, and it clearly influenced his later theories; however, thanks to Newton's combined success, particularly with his *Principia*, Newton's theory on time is far more well known than that of Charleston.

Interestingly, when Newton considered time to be a real entity, he did not regard it as a true, worldly substance. Instead, he believed that time had a special existence akin the ubiquity of God. Here we can see the influence of religion, especially deism--the belief that God can exist while allowing natural laws to govern the universe without a supernatural element)--on Newton at the beginning of the Enlightenment.



Indeed, Newton theory of time not only provided part of the basis for classical physics as far as the early twentieth century (not coincidentally, Einstein's time), but also became a crucial element of the Newtonian system of philosophy and theology.

TIME:

The arrow of time?
The Shape of Time?
Can time stop?
Did time have a beginning?
Is time infinitely divisible?
When are the tic/tocs constant or variable, under what conditions?
Is time an illusion?
God is outside of time?
How do we measure time?
Are the tic/tocs uniform or variable throughout the Universe?
Time and its influence on Reality?
What is the fundamental unit of time?
Why does the human perception of time differ?
What were the historical benchmarks of time?
What is an atomic clock?
Is time travel possible?

Is time symmetrical?

Tegmark, Max: Parallel Universes, from Scientific America. Other Universes are a direct implication of cosmological observation. IS THERE A COPY OF YOU, reading this article at this time. According to Tegmark, the answer is yes. See LINK to document provided herein.

Turing, Alan: **The Halting Problem**: for any Turing Machine Program H purporting to settle the halting or non halting of all Turing Machines, there exists a program P and input data I such that the program P and Input data I such that the program H cannot determine whether P will halt when processing the data I.

A **Turing machine** is a theoretical device that manipulates symbols contained on an infinite strip of tape. Despite its simplicity, a Turing machine can be adapted to simulate the logic of any computer algorithm, and is particularly useful in explaining the functions of a CPU inside of a computer. A succinct definition of the thought experiment was given by Turing in his 1948 essay, "Intelligent Machinery". Referring back to his 1936 publication, Turing writes that the Turing machine, here called a Logical Computing Machine, consisted of:

..."an infinite memory capacity obtained in the form of an infinite tape marked out into squares on each of which a symbol could be printed. At any moment there is one symbol in the machine; it is called the scanned symbol. The machine can alter the scanned symbol and its behavior is in part determined by that symbol, but the symbols on the tape elsewhere do not affect the behavior of the machine. However, the tape can be moved back and forth through the machine, this being one of the elementary operations of the machine. Any symbol on the tape may therefore eventually have an innings[2]." (Turing 1948, p. 61)

Quantum Tunneling: Tunneling is the quantum mechanical process by which a particle can penetrate a classically forbidden region of space (for example, passing from two separate points *A* and *B* without passing through intermediate points). The phenomenon is so named because the particle, in traveling from *A* to *B*, creates a sort of "tunnel" for itself, bypassing the usual route.

In 1927, F. Hund was the first to notice the possibility of the phenomenon of tunneling, which he called "barrier penetration," in a calculation of the splitting of the ground state in a double-well potential. The phenomenon arises, for example, in the "inversion" transitions of the ammonia molecule, which is allowed in quantum mechanics although forbidden in classical physics. In the same year, L. Nordheim applied the Schrödinger equation to the calculation of the reflection coefficient of an electron from various kinds of interfaces and noted that an electron, whose energy was insufficient to go over the barrier classically, could still tunnel through the barrier for the case of a rectangular potential barrier. Thus, Nordheim extended the case of tunneling between bound states noticed by Hund to the case of tunneling between continuum states. Oppenheimer subsequently performed a correct calculation of the rate of ionization of hydrogen by an external field in 1928. Following this, George Gamow and, independently,

R. W. Gurney and E. U. Condon applied the tunneling phenomenon to explain the range of alpha decay rates of radioactive nuclei.

Although tunneling may seem abstract and far removed from reality, it is a actually a basic and important processes of nature. It is vital, for example, in the very first step of the thermonuclear reaction which powers the Sun.

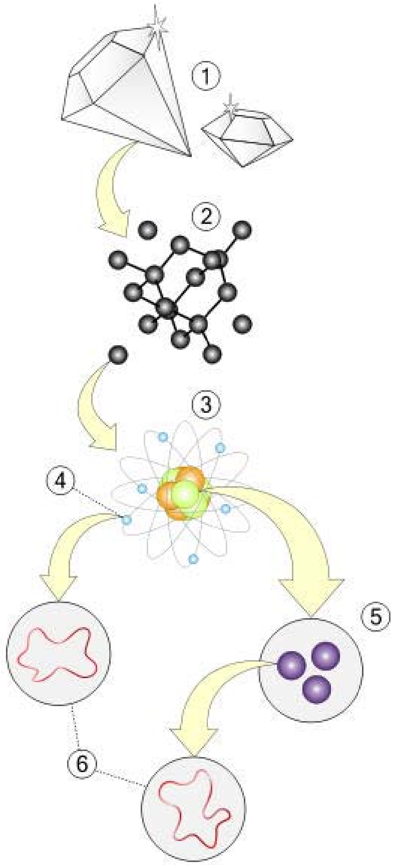
The inflationary theory of the universe even proposes that the universe began at a state of no geometry (i.e., a universe with nothing, not even time) and then a tunneling occurred, allowing the universe to pass from the state of "nothing" to "something" (the "false vacuum") by tunneling (Guth 1997).

Quantum Mechanics: Around the turn of 1900s, the German physicist Max Planck postulated that a black body emitted light in discrete packets of energy. A few years later in 1905, Einstein invented the concept of light *quanta* by which he explained the photoelectric effect (and for which he received the 1921 Nobel Prize). The next twenty years were filled with revolutionary ideas. Niels Bohr postulated that electrons orbiting atoms could do so only in a discrete set of orbits, and Louis de Broglie proposed the idea that not only did light, previously thought to be a wave, have particle properties, but all particles had wave properties. The accumulation of all this was the theory of *Quantum Mechanics*, developed in the mid twenties by Erwin Schrödinger, Werner Heisenberg and Paul Dirac.

String Theory: is a developing branch of quantum mechanics and general relativity into a quantum theory of gravity.[1] The strings of string theory are one-dimensional oscillating lines, but they are no longer considered fundamental to the theory, which can be formulated in terms of points or surfaces too.

Many detractors criticize string theory as it has not provided quantitative experimental predictions. Like any other quantum theory of gravity, it is widely believed that testing the theory directly would require prohibitively expensive feats of engineering. Whether there are stringent indirect tests of the theory is unknown.

String theory is of interest to many physicists because it requires new mathematical and physical ideas to mesh together its very different mathematical formulations. One of the most inclusive of these is the 11-dimensional M-theory, which requires spacetime to have eleven dimensions,[2] as opposed to the usual three spatial dimensions and the fourth dimension of time

	Levels of magnification: 1. Macroscopic level - Matter 2. Molecular level 3. Atomic level - Protons, neutrons, and electrons 4. Subatomic level - Electron 5. Subatomic level - Quarks 6. String level

Susskind, Leonard: There are several unfathomable questions:
Questions about Reality; Questions about Quantum Mechanics; Questions about Consciousness Why Mathematics Works; Questions about the Ultimate Causes of the Universe. Susskind quoted Feynman as saying these problems are so hard and deep, that no one can tell whether there is a problem. There are other questions resulting from the limits of mind to understand conception that can be unraveled using mathematics.

Spinoza: In 1656, Amsterdam’s Jewish community excommunicated Baruch Spinoza, and, at the age of twenty–three, he became the most famous heretic in Judaism. He was already germinating a secularist challenge to religion that would be as radical as it was original. He went on to produce one of the most ambitious systems in the history of Western philosophy, so ahead of its time that scientists today, from string theorists to neurobiologists, count themselves among Spinoza’s progeny.
Substance, Attributes and Modes

> These are the fundamental concepts with which Spinoza sets forth a vision of Being, illuminated by his awareness of God. They may seem strange at first sight. To the question "What is?" he replies: "Substance, its attributes, and modes".
>
> — Karl Jaspers[17]

Spinoza believed God exists only philosophically and that God was abstract and impersonal.[1] Spinoza's system imparted order and unity to the tradition of radical thought, offering powerful weapons for prevailing against "received authority." As a youth he first subscribed to Descartes's dualistic belief that body and mind are two separate substances, but later changed his view and asserted that they were not separate, being a single identity. He contended that everything that exists in Nature (i.e., everything in the Universe) is one Reality (substance) and there is only one set of rules governing the whole of the reality which surrounds us and of which we are part. Spinoza viewed God and Nature as two names for the same reality,[11] namely the single substance (meaning "that which stands beneath" rather than "matter") that is the basis of the universe and of which all lesser "entities" are actually modes or modifications, that all things are determined by Nature to exist and cause effects, and that the complex chain of cause and effect is only understood in part. His identification of God with nature was more fully explained in his posthumously published *Ethics*.[1] That humans presume themselves to have free will, he argues, is a result of their awareness of appetites while being unable to understand the reasons why they want and act as they do. Spinoza has been described by one writer as an "Epicurean materialist."[11]

Spinoza contends that "*Deus sive Natura*" ("God or Nature") is a being of infinitely many attributes, of which thought and extension are two. His account of the nature of reality, then, seems to treat the physical and mental worlds as one and the same. The universal substance consists of both body and mind, there being no difference between these aspects. This formulation is a historically significant solution to the mind-body problem known as neutral monism. The consequences of Spinoza's system also envisages a God that does not rule over the universe by providence, but a God which itself is the deterministic system of which everything in nature is a part. Thus, according to this understanding of Spinoza's system, God would be the natural world and have no personality.

In addition to substance, the other two fundamental concepts Spinoza presents, and develops in the *Ethics* are attribute – that which the intellect perceives as constituting the essence of substance, and mode – the modifications of substance, or that which exists in, and is conceived through, something other than itself.

Spinoza was a thoroughgoing determinist who held that absolutely everything that happens occurs through the operation of necessity. For him, even human behaviour is fully determined, with freedom being our capacity to know we are determined and to understand *why* we act as we do. So freedom is not the possibility to say "no" to what happens to us but the possibility to say "yes" and fully understand why things should necessarily happen that way. By forming more "adequate" ideas about what we do and our emotions or affections, we become the adequate cause of our effects (internal or external), which entails an increase in activity (versus passivity). This means that we become both more free and more like God, as Spinoza argues in the Scholium to Prop. 49, Part II. However, Spinoza also held that everything must necessarily happen the way that it does. Therefore, humans have no free will. They believe, however, that their will is free. In his letter to G. H. Schaller (Letter 62), he wrote: "men are conscious of their own desire, but are ignorant of the causes whereby that desire has been determined."[18]

Spinoza's philosophy has much in common with Stoicism in as much as both philosophies sought to fulfill a therapeutic role by instructing people how to attain happiness (or eudaimonia, for the Stoics). However, Spinoza differed sharply from the Stoics in one important respect: he utterly rejected their contention that reason could defeat emotion. On the contrary, he contended, an emotion can only be displaced or overcome by a stronger emotion. For him, the crucial distinction was between active and passive emotions, the former being those that are rationally understood and the latter those that are not. He also held that knowledge of true causes of passive emotion can transform it to an active emotion, thus anticipating one of the key ideas of Sigmund Freud's psychoanalysis.[19]

Some of Spinoza's philosophical positions are:

- The natural world is infinite.
- Good and evil are related to human pleasure and pain.
- Everything done by humans and other animals is excellent and divine.
- All rights are derived from the State.
- Animals can be used in any way by people for the benefit of the human race, according to a rational consideration of the benefit as well as the animal's status in nature.[20][21]

[edit] Ethical philosophy

Encapsulated at the start in his *Treatise on the Improvement of the Understanding* (*Tractatus de intellectus emendatione*) is the core of Spinoza's ethical philosophy, what he held to be the true and final good. Spinoza held good and evil to be relative concepts, claiming that nothing is intrinsically good or bad except relative to a particular individual. Things that had classically been seen as good or evil, Spinoza argued, were simply good or bad for humans. Spinoza believes in a deterministic universe in which "All things in nature proceed from certain [definite] necessity and with the utmost perfection." Nothing happens by chance in Spinoza's world, and nothing is contingent.

In the universe anything that happens comes from the essential nature of objects, or of God/Nature. According to Spinoza, reality is perfection. If circumstances are seen as unfortunate it is only because of our inadequate conception of reality. While components of the chain of cause and effect are not beyond the understanding of human reason, human grasp of the infinitely complex whole is limited because of the limits of science to empirically take account of the whole sequence. Spinoza also asserted that sense perception, though practical and useful for rhetoric, is inadequate for discovering universal truth; Spinoza's mathematical and logical approach to metaphysics, and therefore ethics, concluded that emotion is formed from inadequate understanding. His concept of "conatus" states that human beings' natural inclination is to strive toward preserving an essential being and an assertion that virtue/human power is defined by success in this preservation of being by the guidance of reason as one's central ethical doctrine. According to Spinoza, the highest virtue is the intellectual love or knowledge of God/Nature/Universe.

In the final part of the "Ethics" his concern with the meaning of "true blessedness" and his unique approach to, and explanation of how, emotions must be detached from external cause and so master them, gives some prediction of psychological techniques developed in the 1900s. His concept of three types of knowledge - opinion, reason, intuition - and assertion that intuitive knowledge provides the greatest satisfaction of mind, leads to his proposition that the more we are conscious of ourselves and Nature/Universe, the more perfect and blessed we are (in reality) and that only intuitive knowledge is eternal. His unique contribution to understanding the workings of mind is extraordinary, even during this time of radical philosophical developments, in that his views provide a bridge between religions' mystical past and psychology of the present day.

Given Spinoza's insistence on a completely ordered world where "necessity" reigns, Good and Evil have no absolute meaning. Human catastrophes, social injustices, etc. are merely apparent. The world as it exists looks imperfect only because of our limited perception.

Panentheist or Pantheist?

Main article: Pantheism controversy

It is a widespread belief that Spinoza equated God with the material universe. However, in a letter to Henry Oldenburg he states that: "as to the view of certain people that I identify god with nature (taken as a kind of mass or corporeal matter), they are quite mistaken"[22]. For Spinoza, our universe (cosmos) is a *mode* under two *attributes* of Thought and Extension. God has infinitely many other attributes which are not present in our world. According to German philosopher Karl Jaspers, when Spinoza wrote "*Deus sive Natura*" Spinoza meant God was *Natura Naturans* not *Naturarta*. Jaspers believed that in Spinoza's philosophical system, God's transcendence was attested by his infinitely many attributes, and that two attributes known by humans, namely Thought and Extension, signified God's *immanence*.[23] Even God under the attributes of thought and extension cannot be identified strictly with our world. That world is of course "divisible"; it has parts. But Spinoza insists that "no attribute of a substance can be truly conceived from which it follows that the substance can be divided" (Which means that one can not conceive an attribute in a way that leads to division of substance), and that "a substance which is absolutely infinite is indivisible" (Ethics, Part I, Propositions 12 and 13).[24] Following this logic, our world should be considered as a mode under two attributes of thought and extension. Therefore the pantheist formula "One and All" would apply to Spinoza only if the

"One" preserves its transcendence and the "All" were not interpreted as the totality of finite things.[23]

Martial Guéroult suggested the term "Panentheism", rather than "Pantheism" to describe Spinoza's view of the relation between God and the world. The world is not God, but it is, in a strong sense, "in" God. Not only do finite things have God as their cause; they cannot be conceived without God.[24]

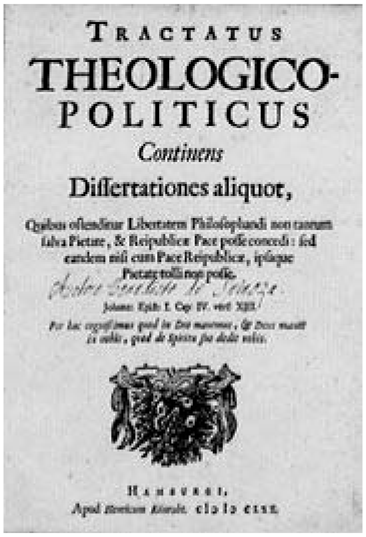
In 1785, Friedrich Heinrich Jacobi published a condemnation of Spinoza's pantheism, after Lessing was thought to have confessed on his deathbed to being a "Spinozist", which was the equivalent in his time of being called an atheist. Jacobi claimed that Spinoza's doctrine was pure materialism, because all Nature and God are said to be nothing but extended substance. This, for Jacobi, was the result of Enlightenment rationalism and it would finally end in absolute atheism. Moses Mendelssohn disagreed with Jacobi, saying that there is no actual difference between theism and pantheism. The entire issue became a major intellectual and religious concern for European civilization at the time, which Immanuel Kant rejected, as he thought that attempts to conceive of transcendent reality would lead to antinomies (statements that could be proven both right and wrong) in thought.

The attraction of Spinoza's philosophy to late eighteenth-century Europeans was that it provided an alternative to materialism, atheism, and deism. Three of Spinoza's ideas strongly appealed to them:

- the unity of all that exists;
- the regularity of all that happens; and
- the identity of spirit and nature.

Spinoza's "God or Nature" provided a living, natural God, in contrast to the Newtonian mechanical "First Cause" or the dead mechanism of the French "Man Machine." Coleridge and Shelley saw in Spinoza's philosophy a *religion of nature*[1] and called him the "God-intoxicated Man."[11][25] Spinoza inspired the poet Shelley to write his essay "The Necessity of Atheism."[11]

Modern relevance


TRACTATUS
THEOLOGICO-
POLITICUS
Continens
Dissertationes aliquot,
Quibus ostenditur Libertatem Philosophandi non tantum salva Pietate, & Reipublicae Pace posse concedi: sed eandem nisi cum Pace Reipublicae, ipsaque Pietate tolli non posse.
Johann: Epist. I. Cap. IV. vers. XIII.
Per hoc cognoscimus quod in Deo manemus, & Deus manet in nobis, quod de Spiritu suo dedit nobis.
HAMBURGI,
Apud Henricum Künraht. CIↃ IↃ CLXX.

Tractatus Theologico-Politicus, a name Wittgenstein later paid homage to in his Tractatus Logico-Philosophicus

Late 20th century Europe demonstrated a greater philosophical interest in Spinoza, often from a left-wing or Marxist perspective. Karl Marx liked his materialistic account of the universe.[1] Notable philosophers Louis Althusser, Gilles Deleuze, Antonio Negri, Étienne Balibar and Marilena Chauí have each drawn upon Spinoza's philosophy. Deleuze's doctoral thesis, published in 1968, refers to him as "the prince of philosophers."[26] Other philosophers heavily influenced by Spinoza include Constantin Brunner and John David Garcia. Stuart Hampshire wrote a major English language study of Spinoza, though H. H. Joachim's work is equally valuable. Unlike most philosophers, Spinoza and his work were highly regarded by Nietzsche.

Philosopher Ludwig Wittgenstein evoked Spinoza with the title (suggested to him by G. E. Moore) of the English translation of his first definitive philosophical work, *Tractatus Logico-Philosophicus*, an allusion to Spinoza's Tractatus Theologico-Politicus. Elsewhere, Wittgenstein deliberately borrowed the expression *sub specie aeternitatis* from Spinoza (*Notebooks, 1914-16*, p. 83). The structure of his *Tractatus Logico-Philosophicus* does have some structural affinities with Spinoza's *Ethics* (though, admittedly, not with the latter's own *Tractatus*) in erecting complex philosophical arguments upon basic logical assertions and principles. Furthermore, in propositions 6.4311 and 6.45 he alludes to a Spinozian understanding of eternity and interpretation of the religious concept of eternal life, stating that "If by eternity is understood not eternal temporal duration, but timelessness, then he lives eternally who lives in the present." (6.4311) "The contemplation of the world sub specie aeterni is its contemplation as a limited whole." (6.45) Furthermore, Wittgenstein's interpretation of religious language, in both his early and later career, may be said to bear a family resemblance to Spinoza's pantheism.

Leo Strauss dedicated his first book ("Spinoza's Critique of Religion") to an examination of the latter's ideas. In the book, Strauss identified Spinoza as part of the tradition of Enlightenment rationalism that eventually produced Modernity. Moreover, he identifies Spinoza and his works as the beginning of Jewish Modernity.[11]

Spinoza has had influence beyond the confines of philosophy. The nineteenth century novelist, George Eliot, produced her own translation of the *Ethics*, the first known English translation thereof. Eliot liked Spinoza's vehement attacks on superstition.[1] Goethe could not say exactly what he liked in the *Ethics*, but was profoundly moved by it nevertheless (Goethe admitted he could not understand much of Spinoza.)[1] The twentieth century novelist, W. Somerset Maugham, alluded to one of Spinoza's central concepts with the title of his novel, *Of Human Bondage*. Albert Einstein named Spinoza as the philosopher who exerted the most influence on his world view (Weltanschauung). Einstein, in a telegram response, answered he believes in "Spinoza's God."[27] Spinoza equated God (infinite substance) with Nature, consistent with Einstein's belief in an impersonal deity. In 1929, Einstein was asked in a telegram by Rabbi Herbert S. Goldstein whether he believed in God. Einstein responded by telegram: "I believe in Spinoza's God who reveals himself in the orderly harmony of what exists, not in a God who concerns himself with the fates and actions of human beings."[27][28] Spinoza's pantheism has also influenced environmental theory. Arne Næss, the father of the deep ecology movement, acknowledged Spinoza as an important inspiration.

Moreover, the Argentinian writer Jorge Luis Borges was greatly influenced by Spinoza's world view. In many of his poems and short stories, Borges makes allusions to the philosopher's work. So of course does Isaac Bashevis Singer in his short story *The Spinoza of Market Street*.[1]

Spinoza has been the subject of numerous biographies and scholarly treatises (see list below).[25][29][30][31]

Spinoza is an important historical figure in the Netherlands, where his portrait was featured prominently on the Dutch 1000-guilder banknote, legal tender until the euro was introduced in 2002. The highest and most prestigious scientific award of the Netherlands is named the *Spinoza prijs* (Spinoza prize).

Spinoza's work is also mentioned as the favourite reading material for Bertie Wooster's valet Jeeves in the P. G. Wodehouse novels. Spinoza's life has been the subject of plays[2] and has been honored by educators.[32]

[edit] Spinoza and Deep Ecology

Arne Næss first wrote about the idea of Deep Ecology, and from the early days of his developing this outlook, he looked to Spinoza as an important philosophical source[33]

Others have followed Naess' inquiry, including Eccy de Jonge, in *Spinoza and Deep Ecology: Challenging Traditional Approaches to Environmentalism*, and Brenden MacDonald, in *Spinoza, Deep Ecology, and Human Diversity—Realization of Eco-Literacies*

One of the topical centres of inquiry connecting Spinoza to Deep Ecology is "self-realization." See Arne Naess in *The Shallow and the Deep, Long-Range Ecology movement* and *Spinoza and the Deep Ecology Movement*

Von Neumann, John: His peers referred to him as the smartest man alive. He designed the first computer for IBM. When Gödel delivered his famous Theorem at a convocation in Vienna, Von Neumann was the only person in the audience that understood the implications of Gödel's Theorem. Of Jewish birth, he converted to Roman Catholicism on his death bed. He declared that reality occurred in the brain.
Whitten, Edward: wrote the first treatise with Michael Green on String Theory. Now heads up the String Theory project at the Institute of Advanced Studies at Princeton.
Wigner, Eugene: the content of the consciousness is the ultimate universal reality,
Zeno: The Quantum Zeno effect, also known by terms such as "a watched pot never boils", was after Zeno, the fourth century Greek philosopher famed for his paradoxes and conundrums. It is usually invoked for a class of effects in which constant monitoring of a quantum subsystem drastically slows down its dynamics.
American Indians

Celts: oral tradition, written word prohibited; fiercely militaristic – both men and women, classes but not class system, male female equal, spiritual, superstitious, head hunters, human and animal sacrifice, polytheistic, creative and inventive, revered the arts,

Celtic Cosmology: The Celts do not seem to have had a hierarchy of divinity in the sense of a coherent pantheon dwelling in some remote place. The human world and the Otherworld formed a unity in which the human and divine interact. Each location has numinous powers which are acknowledged by the people as we can see by their naming of mountains, rivers and other natural features many of which have associated deities.

When the Celts invaded Greece in 278 BCE, Brennus entered the precinct of Delphi, saw no gold and silver dedications and only stone and wooden statues and he laughed at the Greeks for setting up deities in human shape. Caesar mentions that the Germans worship forces of nature only.

Pagan Celtic Spirituality understood that all of existence has a cyclic nature, and that there is a direct continuity between the material world and the otherworld. Druidic teachings, that have come down to us through Welsh tradition, recognized that there is an unseen world that interpenetrates and affects the visible world. Things are just not what they seem. **Everything exists on several simultaneous levels**. Human beings can understand things as having three levels: **the physical, the spiritual, and the symbolic**. Thus, Celtic culture was **integrated with nature**, and expressed itself through the multiple possibilities of life itself. Celtic religion taught the reincarnation of all individual souls, and the appearance of divine beings on Earth.

Druidism, like Buddhism, sees the ultimate nature of reality in terms of three types of dependent relationship. To the Buddhist phenomena exist in three fundamental ways. Firstly, by dependence upon causes and conditions. Secondly, by dependence upon the relationship of the whole to its parts and attributes. Thirdly, and most profoundly, phenomena depend upon mental imputation, attribution, or designation. All these relationships are constantly changing and so all produced phenomena are impermanent. Existence is merely impermanence viewed in slow motion.

These dependencies are are also fundamental to the Druid world view and are known as gwyar (change, causality), calas (structure) and nwyfre (consciousness). The triskele represents reality arising from these three dependences and may have been used as a meditational symbol by the Druids.

Romans
Greeks
Plato: Philosophical monotheism and the associated concept of absolute good and evil emerges in Classical Antiquity, notably with Plato (c.f. Euthyphro dilemma), elaborated into the idea of The One in Neoplatonism.

The **Allegory of the Cave**, also commonly known as **Myth of the Cave**, **Metaphor of the Cave**, **The Cave Analogy**, **Plato's Cave** or the **Parable of the Cave**, is an allegory used by the Greek philosopher Plato in his work *The Republic* to illustrate "our nature in its education and want of education". (514a) The allegory of the cave is written as a fictional dialogue between Plato's teacher Socrates and Plato's brother Glaucon, at the beginning of Book VII (514a–520a).

Plato imagines a group of people who have lived chained in a cave all of their lives, facing a blank wall. The people watch shadows projected on the wall by things passing in front of a fire behind them, and begin to ascribe forms to these shadows. According to Plato, the shadows are as close as the prisoners get to seeing reality. He then explains how the philosopher is like a prisoner who is freed from the cave and comes to understand that the shadows on the wall are not constitutive of reality at all, as he can perceive the true form of reality rather than the mere shadows seen by the prisoners.

The Allegory is related to Plato's Theory of Forms,[1] wherein Plato asserts that "Forms" (or "Ideas"), and not the material world of change known to us through sensation, possess the highest and most fundamental kind of reality. Only knowledge of the Forms constitutes real knowledge.[2] In addition, the allegory of the cave is an attempt to explain the philosopher's place in society.

Monotheism
Pantheism:
Ontology: study the nature of being, existence, reality
Epistemology: nature of knowledge. Epistemological realism requires strict adherence to and regard for the rules and procedures for doing science.
Metaphysics: ultimate nature of being and the world; includes cosmology and ontology.

Newton 1643-1726
Religious views based on bible
Three dimensions
Stuff is infinitely divisible, hence the Calculus

Math is intuitive and made sense
Isaac Newton made a Bible-based estimate of a few thousand years. Einstein believed in a steady state, ageless Universe. Since then, data collected from the Universe puts the probable answer somewhere in the middle.

Max Planck 1858-1947
Blackbody Radiation: energy was quantized (h), not infinitely divisible
Considered the founder of QM

Albert Einstein 1879-1959
Particle nature of light, not infinitely divisible, arrives in packets, Nobel prize
Four dimensions, time is a variable dimension
God does not play dice with the Universe; reaction to QM

Niels Bohr 1885-1962
Atomic structure; planetary system of orbits
Quanta–electrons in discrete orbits, jump from one to other, Nobel Prize
Math is not intuitive – probabilistic
Uncertainty Principle (Heisenberg). Momentum x Position = 1
Copenhagen Interpretation of QM: now orthodox interpretation. Scientific truths are ***subjective*** not ***revealed*** truths
The universe is presumed real independently of human observers or any acts of observation. Metaphysical realism.

Kurt Gödel 1906-1978: Math is incomplete; it is fuzzy around the edges. **Incompleteness Theorem**: no algorithm that demonstrates a mathematical proof can also prove its own validity
The Bohr Einstein debates; nature of reality; objective or subjective; the role of consciousness and observation. The argument of hidden variables

John Bell 1928-1990: Bell's Theorem
"concept of measurement is so fuzzy……needs something more fundamental"
Proved nature is nonlocal; with no hidden variables, 1964
Bell's Theorem: **"the most profound in science"**

Alain Aspect 1947- Experiment, 1982 violated Bell's inequalities thereby proving Bell's Theorem, Gold Medal, and settling the Bohr-Einstein debate in favor of Bohr.

Is quantum gravity an oxymoron? Quantum mechanics forbids a quantum system from being both knowable and objectifiable. But quantum mechanics and quantum field theory assume that the spacetime metric is both knowable and objectifiable. If the metric is not knowable or not objectifiable, then it's impossible to define a quantum theory precisely. In that sense it seems like the term "quantum gravity" is oxymoronic. String theory demands that the graviton exist, but so far it hasn't enlightened us on the ultimate resolution of this apparent oxymoron**.**

Cosmology: What's the final answer? The Big Bang began with a radiation dominated era, which accounted for the first 10,000-100,000 years of the evolution of our Universe. Right now the dominant forms of energy in our Universe are matter and vacuum energy. The latest measurements from astronomers tell us:

1. Our Universe is pretty flat: The cosmic microwave background is the relic of Big Bang thermal radiation, cooled to the temperature of 2.73° Kelvin. But it didn't cool perfectly smoothly, and after the radiation cooled, there were some lumps left over. The angular size of those lumps as observed from our present location in spacetime depends on the spatial curvature of the Universe. The currently observed lumpiness in the temperature of the cosmic microwave background is just right for a flat Universe that expands forever.

2. There is a cosmological constant: There is vacuum energy, or something that acts just like IT, to make the expansion of the Universe accelerate in time. The acceleration of the Universe can be seen in the redshifts of distant supernovae.

3. Most of the matter in the Universe is dark matter: Studies of galatic motion show that ordinary visible matter in stars, galaxies, planets, and interstellar gas only makes up a small fraction of the total energy density of the Universe.

The Universe at our current epoch has (approximately)

$$\Omega_B + \Omega_D + \Omega_\Lambda = 1,$$
$$\Omega_B \sim .05, \quad \Omega_D \sim .25, \quad \Omega_\Lambda \sim .7$$

So right now the density of vacuum energy in our Universe is only about twice as large as the energy density from dark matter, with the contribution from visible baryonic matter almost negligible. The total adds up to a flat universe which should expand forever.