

## Time: Arrow or Boomerang?

By

Kenneth B. Lucas

Time is an important concept in human society, but is it really a relevant concept for physics? If so, is human time the same as physics time? Does time affect physical processes, or do time units merely provide a uniform means of measuring the rate of various physical processes?

Physicists talk about time's "arrow", but might "boomerang" be a more accurate term? Is time a physical dimension of reality, and if so is time travel possible? Did the universe have a beginning or has it always existed?

Human scientists would find understanding reality easier if earth society encouraged logic in the manner of the fictional planet Vulcan. Human scientists and mathematicians have to attempt to develop an ability to think logically in spite of the contrary efforts of society.

These efforts include conditioning future scientists to view reality in specific ways that may not be scientifically accurate. For example, we are told beginning when we are very young to believe the physical dimensions of reality are length, width and height. This belief is "hard wired" into our brains complicating the ability to understand concepts like string theory that suggests reality may have many more dimensions.

Society conditions us to have certain perceptions of time. Parents begin teaching their newborns that they should eat and sleep according to some fixed schedule instead of eating when hungry and sleeping when tired. This and other conditioning about time may make time appear more physically important than it is.

Humans seem to have a need for some concepts that are certain and not subject to question. Normally religion provides the necessary set of unquestionable concepts that do not change over time. Many of these concepts involve issues such as morality and deities, but the concepts may also involve the nature of physical reality such as the ancient belief that both the sun and the moon orbited the earth.

Sometimes people will assign certainty to political figures which can be dangerous because the process can support tyrants.

One unfortunate change that has happened over the last century is that some people have tried to turn physical science into a provider of concepts that are not subject to question. This practice is antithetical to empirical science because it discourages development of more refined theories and may prevent understanding of physical reality.

For example, Discover magazine carried an article a few years ago by a physicist, whose name I didn't consider worth remembering, claiming that anyone who didn't accept his expansion

model of the universe didn't understand physics. He is the one who doesn't understand physics. Empirical science is a pragmatic discipline.

For example, whether light is really a wave or a particle is not important in empirical science. What is important is if treating light as a wave or a particle produces an answer that is consistent with observations. Incidentally the idea that light must be one or the other is a false dichotomy. Light could be a form of energy that may be transmitted by waves or particles. Some type of [dark matter] aether might be necessary to carry waves through space, but electrons could provide a medium for transmitting light waves in an atmosphere with the atmosphere displacing any aether.

The fact that scientists may not have other explanations for aspects of reality doesn't mean that other explanations aren't possible, only that no one has discovered the other explanations. Physicists lack a Unified Field Theorem because no one has discovered the concepts that are necessary for such a Theorem. The explanation exists but hasn't been discovered because of inadequate information or because physicists aren't looking at existing information correctly.

Electrons, protons and neutrons existed before Sir J.J. Thomson discovered the electron and postulated the existence of the other two particles. His discovery forced scientists to throw out the long accepted concept that atoms were the smallest particles of matter and could not be further subdivided.

Thomson's discovery was part of a revolution in physics that occurred a century ago. Understanding time or other concepts may not require such a radical change in viewpoint as occurred because of the work of Thomson, Albert Einstein and others, but scientists who want a more accurate understanding of time and other aspects of reality need to be willing to accept radical changes in viewpoints.

Humans in general seem preoccupied with time. They allow what they call time to dominate their lives. The face of a clock determines when they get up, when they go to work and when they come home. During the part of the year when days have the longest period of daylight they wish to get up earlier. Instead of simply getting up at 6 A.M. instead of 7 A.M. they are so controlled by the face of a clock that they have to call 6 A.M. 7 A.M. in order to get up earlier.

Humans sing about time. Jim Croce sang about saving time in a bottle. Time can fly or it may drag on. Humans talk about the passage of time and even the end of time.

Physicists talk about an "arrow of time". Are these concepts the same? Does the passage of what humans call "time" mean time is an "arrow" that points in one direction.

Human society measures time using two different repetitive cycles: the rotation of the earth on its axis and the orbit of the earth around the sun. Society calls the first cycle a "day" and the second a "year". A year is almost exactly equal to 364 days. The number of days in a year is adjusted to account for the fraction of a day that is left over each year. The length and number of cycles is very important for human society, but is the number of cycles important in physics?

Neither cycle appears to impact any physical process other than earth's weather.

In terms of physics each cycle is the same as the previous cycle except for very slow changes. The shape of the orbit itself gradually cycles between a nearly circular shape to an ellipse over a very large number of cycles. This cycle is repetitive.

The movement of earth in repetitive cycles might indicate a "boomerang" of time but certainly not an "arrow". Some might claim the fact earth continues to go in the same direction indicates an "arrow", but inertia provides a better explanation.

An object at rest or an object in motion continues in that condition unless acted upon by some force. A baseball thrown on earth may slow due to friction with the air or drop to the ground due to gravity, but will not change direction unless hit by something like a baseball bat. The earth travels around the sun in the same direction because it hasn't been hit by a "bat" not because of an arrow of time.

Could other actions indicate an arrow of time? It has been suggested that the fact an egg cannot "unbreak" indicates an arrow of time. Close examination of what happens with eggs in terms of physics indicates that eggs are also part of a cycle. An egg will hatch into a chicken, be eaten or just break. In any of these cases the elements that comprise the egg will eventually become chicken food and a new egg.

A broken egg may not go back together like an egg in a video run backwards, but the materials that make up the egg cycle from egg to basic elements and eventually back to egg. The pieces of an egg could only go back together if the pieces exerted a force to attract each other together.

The cycle isn't this simple because the components of one egg may become part of a fox before becoming part of some plant that uses the fox for fertilizer, etc. However, the biosphere as a physics process, ignoring human intervention, continuously cycles the basic elements between plants and animals and soil or air components. Humans think time important because humans begin as babies, grow up and eventually die, but new humans are born to repeat the cycle.

Entropy, an increase in disorder, is suggested as indicating an arrow of time. But on a planet with a biosphere matter entropy does not occur. Matter cycles between ordered and disordered states. Plants and animals convert matter into sophisticated structures which then decompose to a disordered state before being converted into an ordered state again.

Matter cycling also occurs on a broader scale. A star blows up increasing disorder, but the parts of the star may eventually become part of a planet or another star increasing order.

Energy entropy could qualify as an arrow of time. Energy does seem to progress from what could be called order to disorder. Stars produce high energy radiation some of which heats planetary bodies which then produce low energy radiation that doesn't appear to have any subsequent impact on physical reality. Stellar radiation itself tends to dissipate over long distances with little heating impact on distant planetary bodies within the star's system. The

universe doesn't appear to have a system for collecting and reusing this energy unless black holes perform this function.

Planets with atmospheres and especially those with biospheres may use stellar energy for these systems, but such systems depend upon continued radiation to offset energy that is lost as radiation or other "entropy". Radiation from distant stars and planets may carry information about such bodies, but doesn't appear to cause any impact on physical systems.

Some meteorologists believe that very minor atmospheric gases such as carbon dioxide can convert infrared radiation back into heat, but provide no empirical research to support the claim. They seem to believe that radiation and heat energy are the same thing which is not true although under appropriate circumstances each may be convertible to the other.

The original theory by Jean Baptiste Fourier was that ground radiation heated the air, [http://www.wmconnolley.org.uk/sci/fourier\\_1827/fourier\\_1827.html](http://www.wmconnolley.org.uk/sci/fourier_1827/fourier_1827.html) but that was disproved by Niels Bohr's Nobel Prize winning research indicating that absorption and emission of specific wavelengths of light by gas atoms involves changes in the energy state of an atom's electrons rather than heating. <http://dbhs.wvusd.k12.ca.us/webdocs/Chem-History/Bohr/Bohr-1913a.html>

The claim that trapping infrared radiation causes heating conflicts with research by physicist R.W. Wood indicating that trapping radiation does not cause greenhouses to stay warm. Greenhouses stay warm by trapping heated air molecules which only slowly convert heat into radiation [http://www.wmconnolley.org.uk/sci/wood\\_rw.1909.html](http://www.wmconnolley.org.uk/sci/wood_rw.1909.html)

There don't appear to be any natural systems for cycling energy the way that a biosphere cycles matter. Plants in a biosphere store radiant energy as chemical bonds of complex carbon molecules, but this process delays entropy, it doesn't stop the process. The energy released when fossil fuels are oxidized is energy that may have been stored millions of years earlier.

Biologists suggest a different direction for an arrow of time. They claim that biological life, and the associated biosphere, began as simple forms and progressed to more complex forms which would imply a process that increased complexity and order. A problem with this explanation is that the process, if it existed, seems to have been temporary.

Some physical characteristics of individual animal and plant species may have changed over long periods of "time", but the basic physical systems have not changed. The basic physical structure (skeleton) of animals developed early as did the various physical systems such as chemical input processors (digestive system) and such systems as those that input video and audio information or that control movement of body parts. Changes have involved minor characteristics like size and appearance rather than functional systems.

Human society has become more complex over time within the dominant culture, but humans discovered in isolated societies during the last century have been physically the same as those in the advanced culture.

The cell itself is a biochemical computer with molecular memory. It functions like an electronic computer: inputting information, processing that information according to instructions in its memory and outputting information. Biologists describe that memory in terms of four bases referred to by letters, but those bases are arranged in a binary form with each link in the DNA molecule consisting of one of two two-member sets of bases with one member of the set or the other on a specified side.

Such a system implies that biological life could exist due to the action of some type of intelligence rather than a physical process that increases order. An intelligence in some other part of the galaxy could have placed such biochemical computers, or their components, on comets or asteroids and sent them to where ever they might land and begin development according to preprogrammed instructions. Some type of higher dimensional being could have created such computers or perhaps the biosphere has some type of life of its own under the vaguely described concept of Gaea.

Human civilization and technology have become extremely complex because of an increase in knowledge rather than a physical change. Is this an example of an arrow of time that increases order? The organization of matter has increased with human civilization, but at the expense of an increase in energy entropy. Humans have converted stored solar radiation in the form of fossil fuels back into radiation to produce civilization with an increase in energy entropy.

Humans put matter they no longer want into landfills instead of returning it to the matter cycle. This process increases entropy by placing matter in a state in which order cannot be increased.

Human civilizations may last many human lifetimes, but civilizations can collapse. Greece and Rome had advanced civilizations that collapsed. Some ruins in North America indicate more advanced civilizations might have collapsed before the Europeans arrived. Current human civilization could be a nuclear war away from barbarism as some science fiction writers have suggested. An asteroid strike could destroy civilization.

### Big Bang or Steady State

Human religions have long suggested that the universe had a beginning. Most physicists also believe the universe had a beginning. Other physicists believe in a steady state universe that had no beginning.

An ancient work attributed to the Biblical patriarch Enoch provides an early physical description of the beginning for the universe Chapter 25 of the Secrets of Enoch states that “all of creation” came from an invisible object with a “fiery light” inside or what physicists today call a black hole. <http://reluctant-messenger.com/2enoch01-68.htm> Physicists who believe the universe had a beginning have a similar belief that the universe came from a black hole. The term “black hole” is chosen because it does not emit or reflect light or in other words is invisible.

The Standard Model of the Big Bang involves an increase in order from total disorder. Supporters say a black hole exploded due to some unknown force that fragmented the contents into subatomic particles moving away from each other at an extremely high velocity. (Some refer to the event as an expansion, but particles moving away from each other faster than the pieces of an exploding grenade indicates an explosion, not an expansion. An "expansion" would imply a slow steady process rather than a rapid one.)

Subsequently, these particles somehow changed direction and converged to form stars and planets. The whole explanation makes the same amount of sense as the claim that God created everything in six 24 hour periods.

If the universe came out of a black hole rather than having always existed, it would make more sense for a rapidly spinning black hole to have produced jets of material. Such jets have been observed coming from where black holes appear to be.

Perhaps material in a spinning black hole becomes unevenly distributed disrupting the gravitational field producing a weak area in the gravitational field allowing material to escape. The spin of a black hole could move material away from the center toward the event horizon. What causes the jets is not as important as the fact that jets of material can leave a black hole.

A black hole capable of producing a universe, or only a galaxy, would likely have produced multiple jets which would have further weakened the gravitational field of the black hole. The result might have looked something like pinwheel type fireworks.

Material in the jets might have been more concentrated and less evenly distributed than material in the jets observed from current black holes. The jets might have been "lumpy" with areas of heavy concentration forming star systems or even galaxies.

The material would have come out of the black hole highly compressed. The lumps would have expanded rapidly without a strong gravitational field to keep them compressed. Areas of extremely heavy concentration might even have become smaller black holes, unable to expand because of a strong gravitational field.

The Standard Model of the Big Bang states that what in effect would have been a supernatural force separated all particles from each other or in other words the event produced total disorder. Some other force(s) would have had to change the universe to an ordered state.

If material came out "lumpy" expansion of lumps into stars and planets would have caused a slight decrease in order. Areas of material might have contained lumps and dust with the dust gradually being absorbed by the lumps. Separate stars or stars with planet systems would represent a less ordered system than the black hole because stars move independently even though they may interact with each other. Even planets are somewhat independent of the stars they orbit.

Such an event would have produced a universe in which all objects were moving. The velocity

of the material in the jets might have declined as the mass of the black hole declined resulting in matter leaving first traveling away from the later matter at a higher velocity. Objects at the same relative location on different jets would have been moving away from each other because the distance between the equivalent portions of adjacent jets would have been moving away from each other.

Although material might have been moving away from the black hole at relativistic velocity, gravitational attraction of the remnants of the black hole and material closer to the center could still have been strong enough to gradually slow the first material leaving and eventually cause it to curve around the center.

The only propulsive force on the materials in the jets would have come from whatever force caused the material to leave the black hole. Like a baseball thrown into the air, gravity could gradually have slowed the outer material, although not necessarily enough to pull it back to the center.

It is commonly believed that objects cannot move away from each other at a relative velocity greater than the speed of light ( $C$ ). What about jets on opposite sides of a black hole with each jet moving away from the black hole at relativistic velocity? An observer on one jet would be unable to see an observer on the other because light emitted from an object on one side could not catch up to an object on the other side.

A steady state universe would imply no arrow of time, only cycles. A steady state universe would seem to require a way to recycle energy, including low energy radiation. Black holes could accumulate low energy radiation, as well as matter, and then eject it in jets to form new stars. Galaxies might collapse into black holes with new galaxies eventually being produced from the black holes.

A universe with a beginning might also be moving to an “end” such as in the hymn “When the Roll Is Called Up Yonder”– “When the trumpet of the Lord shall sound and time shall be no more....” Would the end be some other situation or a return to a black hole for a new cycle?

A problem with a universe having a beginning is what came before. If the God of Abraham created the universe where did God come from? If a black hole exploded, where did the black hole come from?

A higher dimensional being could have created a universe in lower dimensions the way humans create the artificial lower dimensional worlds in movies. Such a being would not experience time. Some physicists suggest that reality might cycle between a universe and a black hole.

Many physicists overestimate our ability to determine what is going on in the universe. We are at an isolated location which limits the quality of information available. Physicists have only a few decades of information from distant locations that hasn't been filtered through earth's atmosphere.

This issue is important to a discussion of time because estimates of the age of the universe involve information from what appear to be extremely distant objects. We cannot be certain that the universe doesn't possess physical characteristics that over very long distances affect the perception of distance.

The universe might be of fixed dimensions with a reflective "border" that reflects light and objects back into the interior. Another possibility would be that the universe exists in the equivalent of an auto race track. Light might be the equivalent of the faster cars that lap the slower cars (i.e., galaxies).

A common misconception about the perceived red shift of distant objects is that the greater red shift of the most distant objects indicates that those objects are currently moving faster than closer objects.

The defect in this claim is that it confuses relative time with time as a dimension or at least time as a means of plotting the location of objects. Relative time deals with how some distant event affects earth, such as the arrival of radiation from a supernova. Determining what the universe is doing requires treating time as a dimension. The objects must be plotted on a graph showing the (x,y,z) coordinates of 3-dimensions plus coordinates for velocity and time.

Knowing what an object was doing 5 or 10 billion years ago tells nothing about what the object is doing today. If an object 5 billion light years away started moving toward earth 4 billion years ago, people on earth won't know about it for another billion years.

Looking at the differences in red shifts using time as a dimension can only indicate that any rate of expansion of the universe decelerated over time rather than accelerated. For example, consider the following: the red shift of the light that left an object at some time T indicates the object was moving away from earth at a relative velocity V. The red shift of light that left a closer object at T + A indicates it was moving at velocity V - N. The light of a still closer object at T + A + B indicates it was moving at velocity V - N - M, etc. The most this data can indicate is that the universe was expanding faster in the more distant past than in the less distant past. The data cannot indicate any expansion of the universe is increasing.

Keep in mind that if galaxies were continuing along the path of jets that came out of a black hole and material leaving the black hole left at a lower velocity as the process continued the result would be a red shift between the first material and later materials. Areas of matter at different locations on the jet would be moving away from each other even though traveling in the same direction, much like race cars with different velocities traveling along a lengthy straight road instead of a curved race track.

I should note here that there is a "lazy light" theory that suggests the red shift of distant objects doesn't necessarily indicate they were moving away from earth at the time. This explanation might be more consistent with Hubble Telescope images indicating distant galaxies that seem to be moving toward each other. Unless the rest of the universe is moving away from earth, it would be logical to expect that some distant galaxies might be moving toward earth's galaxy and

others would be moving away.

### A Dimension of Time?

Treating time like a dimension can be useful for determining what the universe is doing, but is time really a physical dimension of reality? If time is a dimension, does that mean it would be possible to move from one time to another?

Time travel is a frequent topic in science fiction. The crew of the Starship Enterprise traveled to the past on more than one occasion. Dr. Who regularly travels from one time period to another.

Is such physical time travel possible? Science fiction writers suggest one potential problem with time travel would be changing the past in a manner that changed the present, including the prospect of killing one's own ancestors directly or indirectly by starting a chain of events that resulted in death.

Another problem would be that moving matter from the present to the past would increase the matter in the universe in the past which would cause a net increase in matter if return to the future became impossible.

Travel through time might require that time be a dimension like length, width and height. A different time might be like a different frame in a movie. A time traveler would have to leave the current frame and move to a different past frame. Earth's location in the past frame would be different from its location in the current frame making movement to earth's past difficult.

Perhaps time is like a river and going to a previous time would require moving against the current.

If time were a dimension it would be a higher dimension. Time travel would require moving to the higher dimension before returning to the lower dimension. Such action would seem to be mathematically impossible. It might be possible to project an object from a higher dimension to a lower dimension because a projection would subtract information, but moving an object from a lower dimension to a higher one would seem to require adding information.

Physically moving matter from the present to the past might be impossible, but could information travel backward through time? Information from the past showing past conditions survives in the form of tree rings or sediment. Information even survives about past reversals of the earth's magnetic field.

Humans save information about the past in books, films, etc. The human brain retains information about the past. Those of us who were old enough to understand the significance of the assassination of President John F. Kennedy on November 22, 1963, can vividly remember what we were doing at approximately 1 P.M. Central Time when we heard the news. We also remember what we were doing on September 11, 2001, when we heard about the attack on the World Trade Center.

Some humans occasionally claim to have foreknowledge of the future. I've never read Nostradamus but some of those who have claim he predicted 20<sup>th</sup> century events centuries before they occurred. I have read H.G. Wells. In stories written about 1900 he predicted such things as high speed highways, air travel, radios and even something with aspects of the Internet.

Some people claim to have seen specific events before they happened. I don't know if such claims are valid or not, but if they are it would indicate that information can travel "backwards" through "time".

Scientists can use knowledge of the operation of physical systems to predict some future events. Scientists know when eclipses of the sun and moon will occur and where they can be observed. Meteorologists can predict weather a few days in advance with varying degrees of accuracy.

An ability to predict the future could indicate that the human mind is not bound by time. The human body might be confined by time because it is in a lower dimension than time. However, the human mind might exist in a dimension above time. The ability of the human mind to create alternate worlds such as the future of Gene Roddenberry or the alternate galaxy of George Lucas indicates that the human mind is not limited by what we consider as physical reality. Perhaps it is not limited by time either.

The ability to perceive the concept of time as a dimension indicates the human mind might exist in a dimension above time. Could humans perceive time if it were a higher dimension than the human mind? Consider for a moment beings living in a 2-dimensional world. Would they be able to comprehend the idea of a dimension of height?

But, is it really time that is a dimension. We measure time in terms of motion. Time units are based on the motion of the earth. Clocks and watches measure time using the motion of mechanical components or electrons. Might motion be a better candidate for a dimension of reality than time?

Time measurements indicate completion of a number of cycles. Many of these cycles are independent of each other. Even the daily cycles of human beings have varying degrees of independence. Might each frame or moment of time be merely the temporary intersection of various different cycles which continue on their way after that frame? In this case time might not be a dimension or even some type of physical process but only a means of measuring cycles.

I don't have the answers, only questions and speculation.