Time and Eternity: *Antje Jackelén's Theological Study*

with James M. Byrne, "Theological Methodology, Classical Theism, and 'Lived Time' in Antje Jackelén's Time and Eternity*"; Varadaraja V. Raman, "There's More to Time than Ticking Away"; Hubert Meisinger, "The Rhythm of God's Eternal Music: On Antje Jackelén's* Time and Eternity*"; John R. Albright, "*Time and Eternity: *Hymnic, Biblical, Scientific, and Theological Views"*

TIME AND ETERNITY: HYMNIC, BIBLICAL, SCIENTIFIC, AND THEOLOGICAL VIEWS

by John R. Albright

Abstract. The book *Time and Eternity*, the English version of *Zeit und Ewigkeit,* by Antje Jackelén, contains scientific and theological treatments of these two topics, starting with the usage of such ideas in German, Swedish, and English hymns. This essay describes her work and explains how the scientific ideas provide a coherent framework for understanding the place of time.

Keywords: antimatter; Bible; cosmology; Dirac equation; Albert Einstein; eschatology; eternity; hymn; irreversibility; Antje Jackelén; Maxwell's equations; Newtonian mechanics; quantum mechanics; relativity; symmetry; thermodynamics; time

The concept of time is one of the most elusive of entities. It tends to defy all attempts to define it, whether by means of everyday language or by careful philosophical and mathematical structures. Yet all of us think we know what it is, and we talk about it frequently. The concept of eternity is no easier because it relies on an understanding of time in order to make sense. Although we all have experienced time, none of us has experienced eternity.

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In 2002 Antje Jackelén published a monograph in German, *Zeit und Ewigkeit*, which has since been translated into English with the title *Time and Eternity* (Jackelén [2002] 2005). In the English version there are 231 pages of text divided into four chapters that deal with various aspects of time and eternity. What do Christian hymns have to say? What does religion, especially in the biblical tradition, say? How does either of the above compare with the results from the natural sciences? Can one construct meaningful theological statements about these concepts?

CHRISTIAN HYMNS

Jackelén studied hymns from six different collections, all of which are in recent use. Two were in German (one Catholic, one Protestant), two in Swedish, and two in English. She analyzed references to concepts allied to time and eternity in these hymns to look for ways in which people's understanding of these may have been influenced by congregational singing. The methodology is interesting and quite logical except for the choice of the hymnals in the English language. She chose two from Australia rather than from Britain, Canada, or the United States. In these other countries there are hymn collections that are quite widely used and that exhibit intentionally the ethnic diversity of hymnic sources that she praises in the Australian hymnals.

She notes that references to time are not always interesting. References to eternity are more so. They tend to appear in the latter stanzas of hymns, a phenomenon that goes back to the early days of German hymnody when hymns were long with many stanzas, and it was expected that by the end of the hymn you would wind up in heaven. It also helped that the German word *Ewigkeit* (eternity) fits easily into rhyme schemes, as in Martin Luther's chorale *Erhalt uns, Herr, bei Deinem Word* (Lord, keep us steadfast in Thy word), where the couplet appears, *Beschirm Dein arme Christenheit / Daß sie Dich lob in Ewigkeit* (Defend Thy Christendom that we / May evermore sing praise to Thee).

Jackelén points out that "hymns do not deal with a carefully considered dogmatic statement, but rather with the formulation and processing of faith and life experiences" (p. 44). Poetic license routinely calls for neglect of the niceties of systematic theology in the interest of the well-turned phrase. As a result, people in congregations sometimes sing lyrics with theological content that the singers would not accept if they stopped to think about it. For example, Bishop Reginald Heber's Epiphany hymn "Brightest and best of the sons [more recent hymnals read *stars*] of the morning" is in fact a prayer to an astronomical object, the Star of Bethlehem, presumably from the Magi. Protestants do not usually believe in prayer to anyone except God, and certainly not to an inanimate object. Another example is John Athelstan Riley's hymn "Ye watchers and ye holy ones," which contains a stanza that begins "O higher than the cherubim, more glorious than the seraphim. . . ." This entire stanza is from a traditional Eastern Orthodox hymn to the Virgin Mary. Again, few Protestants would be pleased if they knew what they were singing.

The discussion of time and eternity in hymns is deliberately arranged by theological themes rather than by the history of hymns. As a consequence, there is less emphasis on Latin hymns than might have been desirable, although some of them are mentioned. Two very famous examples that have clear reference to eschatological themes are *Te Deum laudamus* and *Dies irae, dies illa,* both well known to musicians for the various musical settings that exist. Both appear in hymnic paraphrases that seem not to have become popular.

Biblical and Theological

The Bible offers no single systematic teaching about time or eternity. It does not ordinarily see the two concepts as antonyms. It is often claimed that the Hebrew scriptures are based on linear rather than cyclic time. There is some truth to this assertion, but Torah calls for the cycles of the week and the year as well as pointing to a linear time scale. The Jews were in continual contact with societies who believed in the supremacy of cyclical time, so they had to develop responses to their neighbors. The dichotomy persists to our day, when those of us from the Abrahamic religions (more or less linear time) must make contact with Hindus and Buddhists for whom time is cyclical at least on the cosmological scale.

The New Testament adds the complication that Greek thought is blended with the teachings of Jesus, the Jewish teacher from Nazareth. "Greek thought sees the world primarily as space, Israel rather accentuates time," writes Jackelén (p. 73). On this basis Yahweh's prohibition of images can be understood. God acts in time rather than in space. To reach the Greek mind it is necessary to make accommodations to this sort of absolutism.

A set of eight theses concludes the consideration of biblical views of time. They summarize her conclusions. The strongest statements are concerned with the difference between the "already and "not yet" to describe the eschatological outlook of the early church. The tension between these two ideas is seen as the difference between John's Gospel and the Synoptic Gospels (Matthew, Mark, Luke). The "not yet" of Luke refers to the kingdom of heaven that is to come. The Johannine "already" refers not to past history but rather to eternal life that has already begun.

Theological questions are many and varied. One example is whether God is timeless or temporal. Contemporary theologians cannot agree about the answer to this question, and the lines of reasoning are carefully reviewed (p. 82). Some of the theologians whose work is discussed at length are Karl Rahner, Wolfhart Pannenberg, and Emmanuel Lévinas.

Time and Eternity in Natural Science

Although scientists, like everyone else, believe they know what time is, they seldom think much or deeply about it. Subjective time seems completely one-dimensional, locally linear, and not repeatable. This is the traditionalist attitude from Psalm 90, especially from Isaac Watts's paraphrase: "Time, like an ever-rolling stream, / Bears all its sons away." It is this attitude that informed Isaac Newton's ideas about time (p. 125). He assumed that space and time are continuous and linear. In this view eternity could entail the entire timeline from negative to positive infinity. Newton's space and time are absolute and independent of reference frame. In fact, they define what we mean by a reference frame. Time for Newton is irreversible; it increases on a linear basis, has always done so, and will do so forever. Time travel is impossible. A correct understanding of time is indispensable if you wish to understand Newtonian mechanics. Here is where Newton and various of his contemporaries made their advance beyond the mechanics of earlier ages, inherited from Aristotle, who held that the force on an object is proportional to its velocity (the first time derivative of position). Ever since Newton's time the force is known to be proportional to the acceleration (the second time derivative of the position, hence the time derivative of the velocity).

The nineteenth century saw the development of understanding of electricity and magnetism, for which the experiments of Michael Faraday and Joseph Henry were crucial. They showed that time is an essential ingredient in the connection between electricity and magnetism. Magnetic flux per se does not give rise to electric effects, but a time-changing magnetic flux always gives rise to an induced voltage. This observation and others in the same vein led James Maxwell to his formulation of the equations that govern the electromagnetic field, including the case of the propagation of light.

Albert Einstein in 1905 produced the special theory of relativity (SR), in which certain views of time must be changed. In SR, space and time are still continuous and linear, as they were for Newton, but for Einstein space and time are no longer absolute. Instead, a new set of postulates governs space, time, and motion.

1. Time and space are to be treated on an equal footing.
2. To change from one frame of reference to another, you need a linear transformation, for which the correct form turns out to be the one introduced by Hendrik Antoon Lorentz.
3. The laws of physics are invariant under a Lorentz transformation.
4. The speed of light *in vacuo* is constant, independent of reference frame.

There are numerous consequences of these postulates. Space and time are no longer absolute. Instead, the speed of light becomes the new absolute (p. 142). Time intervals are no longer invariant if you change reference frames, but two events that happen at the same point in space at different times cannot have their time order reversed by going from one reference frame to another.

In 1915 Einstein finished the general theory of relativity (p. 144). In this newer theory, space and time are still continuous, apart from singularities that may appear. The theory is no longer linear, so eternity is likely to be difficult to define. In the cosmological model of Aleksandr Aleksandrovich Friedman and Georges Lemaître both time and space flow out of one point (a singularity), popularly known as the Big Bang. Any attempt to learn about time earlier than the singularity will fail. Within this model there are three possibilities for the far distant future, or eternity. The open, or hyperbolic, case calls for eternal expansion and cooling of the universe. The closed, or elliptic, case features expansion followed by a contraction into the Big Crunch. The flat, or parabolic, case is the boundary case between the open and the closed. Scientists have strong opinions about which of these three is correct (Dyson 1979; Tipler 1994). Observational evidence is so far inadequate to produce a clear decision.

Quantum mechanics, discovered in 1925–26, has much to say about time. There are three different formulations based on the work of Werner Heisenberg, Paul A. M. Dirac, and Erwin Schrödinger. The three formulations turn out to be equivalent. A consequence of the basic assumptions of quantum mechanics is the uncertainty principle, discovered by Heisenberg in 1927 (p. 151). It is true for all three formulations. It says that the product of the uncertainty in the measurement of momentum times the uncertainty in position cannot be less than Planck's constant divided by four times pi. So the more accurately you measure one of these, the less accurate will be your knowledge of the other. This result strongly suggests that there should be a similar uncertainty relation between time and energy. Since then, good evidence for this idea has come from experiments.

As originally set forth, quantum mechanics was not correct in SR because the dynamical equation (the Schrödinger equation) does not treat space and time on an equal footing. Late in 1927, Dirac discovered a new dynamical equation (the Dirac equation, published in 1928) that is manifestly correct in SR. It correctly expresses the evolution in time of a quantum state. But in 1929 Dirac concluded that the whole notion of a quantum state evolving in time is wrong in SR because we can see all three space dimensions on both directions at will, but we cannot see backward in time except as memory or history, and we cannot see forward at all. So he proposed the idea of the block universe in which God (or a godlike being) could see all of time at once in both directions. If the block universe were correct, there would be implications about predestination that are subtle (p. 184).

In 1931, Dirac correctly interpreted his 1928 equation as predicting the existence of antimatter. In the following year, three independent experiments proved him to be correct. In the theory, one defines an operator *C* that changes a particle into its antiparticle. Another operator *P*, called parity, changes the sign of the space coordinates; in other words, *x,y,z->-x,-y,-z.* It also changes a left hand into a right hand. A third operator *T* is the time-reversal operator. As its name implies, it makes time go backward. Under the operation of any one or any combination of *C*, *P*, *T* the mathematical form of the basic equations of physics remains the same (Newton's laws, Maxwell's equations, SR, Einstein's equations of general relativity, the Schrödinger equation, the Dirac equation). It was long assumed that everything is invariant under these operations. In the 1940s, Dirac stated casually that these symmetries may perhaps not be so sacred as people thought, but he did not pursue the matter. In the 1950s, T. D. Lee and C. N. Yang proposed that *P* is not a valid symmetry for the weak nuclear interaction, although it is valid for the strong and electromagnetic interactions. They proposed specific experimental tests for their conjecture and were quickly proved correct. For the weak interactions, the product *CPT* is still good, and so is the combination *CP*, although *C* and *P* are not separately valid; it follows that *T* is still valid. In 1964, Val Fitch, James Cronin, and coworkers showed experimentally that *CP* is clearly violated. So if *CPT* is still good, there must be a lack of invariance under *T*. Therefore the framework of wonderful theories above has to be incomplete.

It is reasonable to ask how good the symmetry under *CPT* really is. It is not easy to answer that question because, after years of work, the community of theoretical physicists has not come up with a reasonable theory that violates *CPT*. There are experiments that test *CPT*, which predicts that a particle and its antiparticle must have the same mass and the same lifetime. So far these tests have not been able to falsify *CPT*, even when they are done with great precision.

The conclusion so far is that for single-particle systems, time reversal is almost a valid symmetry of nature. The violating part is confined to the weak interactions, and then it is very small. What effect can such a result have on the macroscopic world, where we know that time has a unidirectional nature? Perhaps the answer is "None." Some people are not satisfied with such an answer and point out that every DNA molecule ever observed is left-handed rather than right-handed. Such a condition is a violation of parity, so there must be some connection between biology and the weak nuclear force. Not every scientist would agree. It is an observational fact that in the part of the universe that is near to us—including our galaxy and those nearby—matter predominates over antimatter. If this condition were to extend to the entire universe, it would imply a cosmological violation of these discrete symmetries.

In macroscopic systems, the violation of time symmetry is usually connected with such dissipative effects as friction, dilution, heat flow, and electrical resistance, all of which are one-way phenomena and involve thermodynamics and statistical mechanics—in other words, the science of collective behavior of matter for which temperature is important (p. 166).

In the nineteenth century, thermodynamics became a science that we would recognize today. It is based on laws including the First Law: There is a quantity called the internal energy, which is the sum of the energies of the various parts of the system. Total energy of all kinds is conserved (neither created nor destroyed, although it can be changed from one form to another). The Second Law: There is a quantity called entropy, which is a measure of how many different states are possible for a given value of the energy of a system. From these laws flow a great number of important consequences, too many to list here. One of them is that for a closed system (one that can exchange neither matter nor energy with its exterior environment), the entropy must increase in time until it reaches a maximum value, at which point we say that equilibrium has set in. It is this property that leads to the practical notion that time flows only one way.

The problem that statistical mechanics has to face is that a large assembly of particles whose individual behavior exhibits time reversal symmetry will behave in the aggregate in an irreversible way. Where does the irreversibility come from? As with other fundamental problems, the answer is not something that everyone would agree to. One convincing explanation is that it depends on the initial conditions. Most thought experiments about this topic begin with the particles either all lined up or otherwise ordered, and their subsequent motion exhibits disorder or entropy. Even such a thoroughly Newtonian, deterministic mechanical system as a small group of bodies moving under their mutual pairwise gravitational forces exhibits chaotic motions so that the long-term state of the system cannot be predicted, and it will certainly not come back to its original configuration. An observer watching this behavior will say that it is random and irreversible.

Toward a Theology of Time

Jackelén reviews a variety of theological models for both time and eternity. She explains relational ideas, especially as used by Thomas F. Torrance. She also describes attempts by other modern theologians to use a relational framework to build trinitarian ideas into time.

The real key to a relational understanding of time is to be found in eschatology (p. 198). The study of end times is fascinating; it is often ignored by people because too many prophets have predicted the end of the world, and it has not happened. Cosmology in general, and eschatology in particular, are subjects that scientists traditionally have held to be unscientific and unworthy of the attention of serious scholars. Since the 1920s, cosmology gradually has become totally respectable, and Freeman Dyson (1979) has led the way toward scientific acceptability for eschatology by painting scenarios of future destruction of our world. From environmental mismanagement through solar system collisions, from the red giant phase of the sun through its subsequent burnout as a white dwarf, from the spread of the galaxies and burning out of stars through the long-term cooling of the entire universe, one can imagine what sort of future science can predict with the tools at hand. Theology has to decide how to deal with such ideas.

The promises of the Christian scriptures appear to be at odds with science in the long-term view. Jackelén approaches this difficulty by discussing the difference between annihilation and transformation. The unadorned scientific view leads to the idea that we will all be annihilated at the end by one of Dyson's catastrophes. The transformation picture is based on the promise that God will make all things new, by a creative process that is a mystery. She uses hymns by Paul Gerhardt to illustrate that consistency in this matter is not to be achieved. The essence of the new creation, which will supplant the old, is that it will wipe away all evil and blemish, as in the lines by Charles Wesley ([1747] 1982, hymn #657),

> Finish then Thy new creation,
> Pure and spotless let us be;
> Let us see Thy great salvation,
> Perfectly restored in Thee.

CONCLUSION

Jackelén has given us a strong presentation, beginning with a fascinating account of what hymn texts say about time and eternity in thee different languages. She gives an authoritative and careful summary of scientific views on the subject, and she does a thorough job of explaining the views of the Old Testament, the New Testament, and traditional and modern theology.

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