THE MOTION OF TIME AND THE ETERNITY OF GOD:
Reflections on Robert John Russell's *Time in Eternity*

Michael J. Dodds, O.P.
Pacific Coast Theological Society
April 5, 2013

> *For better than three centuries, we moderns have been training ourselves to think of the physical world in purely mechanistic terms; we have-- perhaps for the first time in human history-- dedicated ourselves to seeing the universe about us as a reality from which every possibility of theophany has been scrupulously excluded. That is a revolution in spiritual sensibility whose ultimate cultural consequences, I am fairly sure, do not bear contemplating.*
>
> --David Bentley Hart[1]

1. Introduction

I was struck by these word of David Bently Hart in a recent issue of *First Things*, since it occurred to me that this is exactly the world that Bob Russell has been contemplating for the last several decades-- the world (or world view) that we have inherited in the wake of mechanistic modern science. In his latest book, *Time in Eternity*,[2] Bob offers us the fruits of his contemplation-- the *contemplata*, as Thomas Aquinas would say.[3] One thing Bob has discovered is that science itself now provides us a way out of that mechanistic world view. He has exploited the indeterminism of quantum mechanics to suggest how God may be active in the world, especially in biological evolution, through non-interventionist objective divine action (NIODA).[4] Through Bob's work, we can see that any world view that would, in the name of science, rule out all possibility of divine action is not really science, but scientism-- an unfounded ideology that arbitrarily limits reality to what falls within the quantitative methodology of science.

Bob has not only shown that science is compatible with beliefs that exceeds its limits but has also demonstrated how the engagement of science and faith can be mutually enriching through his eightfold path of Creative Mutual Interaction (CMI).[5] In this book, Bob employs CMI to gaze into the world's future as described by science and envisioned by faith. This raises the question of time and eternity. Choosing Wolfhart Pannenberg as partner and guide, Bob

discovers four ways in which science might enhance Pannenberg's theology (chapters 1-4) and two ways in which that theology might in turn influence science by suggesting new research programs (chapters 5-6).

In this paper, I will give a brief overview of Bob's project and then suggest some ways in which a retrieval of the thought of Aristotle and Thomas Aquinas on time and eternity may also be helpful in the theology/science dialogue.

Bob defines time as "our ordinary, daily experience of time--with its fleeting present moment seemingly lost forever as it vanishes immediately into the past, only to be replaced by what was before a future of uncertain possibilities."[6] He applies the word "eternity" to both God and the eschatological fulfillment of creation.[7] By God's eternity, he intends something more than what he considers the traditional notion: "By the 'eternity of God,' I mean something much richer and more complex than its two traditional alternatives: 1) Eternity as timeless on the one hand, in which all the distinctions between the rushing moments of our life ... are lost as they are conflated into the dimensionless eternal '*nunc,*' a single structureless and unchanging 'now.' 2) Eternity as unending flowing time on the other hand, in which we are again imprisoned in a momentary present that immediately vanishes into a lost past only to be replaced by an event emerging contingently from an ever inaccessible future." Divine eternity is rather "the boundless temporality of the Trinitarian God, a lavishly rich 'supra-temporality' that is both the source and fulfillment of the temporality of creation."[8]

In its eschatological context, eternity means "the gift of true temporality of the Trinity to our world."[9] Bob sees the relation of our present world to its eschatological fulfillment through the lens of the bodily resurrection of Jesus. As the resurrection involved a transformation of Jesus' body, so the eschaton must involve the "transformation of creation in all its dimensions

into the New Creation ... [including] what science understands as the physical universe."[10]

The discussion of eternity demands an engagement with science to address the "direct challenge from physics to the topic of time and eternity." Regarding divine eternity, the timeless "block universe" of Einstein's physics seems to "challenge the temporal character of the world, and thus indirectly to challenge the temporal character of eternity."[11] With respect to eschatological eternity, the predictions of science seem to jeopardize the promise of faith. Science sees the future of the cosmos in terms of endless expansion ("freeze") or recontraction ("fry").[12] Such predictions seem to "undercut, even render meaningless, an eschatology based by analogy on the bodily resurrection of Jesus."[13] In this way, "physics and cosmology challenge the truth and meaningfulness of any Christian eschatology that affirms the physical/biological transformation of this world into the New Creation," resulting in "a fundamental impasse between theology and science."[14]

Bob's response to the first issue illustrates CMI by suggesting an interpretation of Einstein's theory of relativity that would allow for flowing time and avoid the block universe (Chapter 5). For the second issue, Bob develops seven "guidelines for revising eschatology in light of contemporary science."[15] Fundamental to these guidelines is a recognition of the limits of science. Science is to be neither ignored nor assigned to a different world from that of theology.[16] Instead, Bob invites us to question "a philosophical assumption that we routinely bring to science, namely that the predictions of well-winnowed theories hold without qualification." Such questioning may enable us to "accept a very different philosophical assumption about the future predictions of science while accepting all that science describes and explains about the past history and present state of the universe."[17] Recognizing (philosophically) that the laws of science are descriptive rather than prescriptive, and realizing (theologically) that the processes

that they describe "are the result of God's ongoing action as Creator acting within nature and not of nature acting entirely on its own," we may conclude that, "if God is free to act in radically new ways (which of course God is!) not only in human history but in the ongoing natural history of the universe, then the future of the cosmos will not be what science predicts. Instead, the cosmic far future will be based on a radically new kind of divine action that ... cannot be reduced to, or explained by, the current laws of nature, that is, by God's action in the past history of the universe."[18] God's action may instead result in something "radically new", beginning with the resurrection of Jesus, which might itself be viewed as the "'first instance of a new law of the new creation' (FINLONC)."[19]

In this way, the challenge of science to Christian eschatology is resolved by a recognition of the limits of scientific methodology and so also of scientific prediction. Science remains an essential dialogue partner, however, not only in suggesting possible elements of continuity between the present world and the New Creation[20] but most especially in the larger task of CMI that forms the heart of the book: "to take up Pannenberg's profound theological creativity about eschatology and begin to make clearer connections between it and contemporary science."[21]

2. Motion and time

As Bob engages contemporary science, I would like to suggest that engaging the past, through a consideration of the ideas of time and eternity in Aristotle and Aquinas, may also be helpful in the theology/science dialogue. The first thing we might notice is that time, as Aristotle understands it, has the happy feature of being intrinsically connected to the physical world that science investigates. According to Aristotle: "Time is just this-- the number of motion in respect of 'before' and 'after.'"[22] Time and physical motion are tied together since one is the measure of the other.

If time is the measure of motion, to understand time we must first know something about measurement. Fortunately, measurement is a familiar notion. (I suppose, for example, you know what size shoes you're wearing.) But what do we really mean by measurement? How does it work? What do you do when you measure something? Well, you take some length, give it a name (inch, foot, meter or cubit), and then use it to size up other things. The unit itself is arbitrary. At one point in Luke's gospel, for instance, Jesus is said to withdraw "about a stone's throw" from his disciples (Luke 22: 41). A stone's throw. How far is that? We have some idea, I suppose, and if we wanted to, we could use the "stone's throw" as our universal standard for measuring all other distances.

To measure not how far away something is, but how long something takes to happen, we need a different unit of measurement. We don't choose some length, but instead some motion, which we then employ as a unit to measure the duration of other motions. Again, the unit is arbitrary. Galileo used his own heartbeat as a unit to measure the motion of a pendulum.[23] You could also use the time of one stone's throw to measure all other times. So you might calculate that Peter took a time of twelve stone's throws to walk a distance of five stone's throws. You might do that-- but it's not very practical**.**

We usually try to find some motion that's more regular and dependable than a heart beat or a stone's throw as our basic unit. We choose, for instance, the daily rotation of the earth. We call it one day and then divide it up into hours, minutes, seconds, nanoseconds and so on, and we use it to measure the duration of other things. This gets us to the idea of intrinsic and extrinsic time.

2.1. Intrinsic time

As each distance has its own intrinsic quantity or spatial length that can be used for

measuring other distances, so every motion has its own intrinsic temporal length that can be used for measuring the duration of other motions. The duration of any particular motion is known as its "intrinsic time."[24] A heartbeat, for instance, lasts one heartbeat, and a stone's throw lasts one stone's throw. A complete rotation of the earth on its axis lasts one earth-turn (which we call one day), and a complete orbit of the earth around the sun takes exactly one earth-orbit (which we reckon as one year). When we take the duration that's intrinsic to one motion and use it to measure some other motion, we get extrinsic time.[25]

2.2. Extrinsic time

In considering extrinsic time, we are no longer dealing directly with time but with clocks. While time is an intrinsic measure of motion, a clock is a (rather arbitrary) extrinsic measure of time. As we might take the length that's intrinsic to a yardstick and use it to measure other distances (such as the length of a highway or the height of a building), so we take the time that's intrinsic to one motion (such as one earth-spin) and use it to measure the duration of other motions.[26]

As the unit for measuring distance must be some length or other that we arbitrarily call "one" (such as one yard), so the unit for measuring motion must be some time or duration of motion that we arbitrarily call "one" (one heartbeat or one earth-spin). The trick, of course, is to choose a motion that has some regularity and consistency as our unit for measuring the others. Heartbeats, for instance, are far less regular and reliable than celestial motions. So, the ancients chose the daily motion of the outermost sphere of the heavens for one day, and the annual motion of the sun for one year. Since Copernicus, of course, we choose the daily rotation of the earth for one day, and its annual orbit around the sun for one year.

Though more consistent than heartbeats, celestial motions are not entirely reliable either.

The ancients saw that they needed an extra day every four years (a "leap year") to keep the day in synch with the year. As our clocks have become more precise, we've found it necessary occasionally to add a "leap second" to keep them in synch with the movement of the earth (it being easier to adjust the clocks than to adjust the motion of the earth).

2.3. Universal time

Does the cosmos have one universal time that naturally measures all the others? Intuitively, we think so. We assume that time passes at the same rate throughout the universe--that what's "right now" for us here on earth is also "right now" everywhere else, and that past and future are universally the same.

Aristotle thought that the daily rotation of the outermost sphere of the heavens was the most fundamental movement in the cosmos and the cause of all other motions. He could therefore claim that this one fundamental motion and its corresponding duration or intrinsic time was itself the universal measure of motion and time in the cosmos.[27] Time was inherently tied to the physical motion of the cosmos.

With the coming of Isaac Newton, however, Aristotle's cosmology was abandoned. This meant there was no longer any outermost sphere and so no physically most primary motion to serve as a universal basis for all time in the cosmos. Newton, not wanting to abandon the idea of a universal measure of time, simply posited an "absolute time" and an "absolute space" as a kind of abstraction, not associated with any particular measure of distance or motion.[28]

With Einstein's theory of relativity, Newton's ideas of absolute time and space were also abandoned. In the cosmos as we understand it, there is no "absolute time" disassociated from all motion; nor is there any most fundamental motion on which all others depend. The consequence is that there is no most fundamental time. Instead, the measure of time and space must be relative

to the motion of one's particular inertial reference system. One clock may run faster or slower than another depending on one's reference system and its motion relative to other systems.[29]

We might say that a basic difference between Aristotle's world and Einstein's is that Aristotle's fundamental motion or primal "clock" was fixed in the rotation of the outermost sphere which did not itself move from place to place. In Einstein's world, whatever motion we might select as our "clock" is always itself in motion in relation to other things. The choice of a clock is now arbitrary. Russell illustrates this arbitrary choice: "By 'clocks' I mean something as simple as elementary particles, such as muons, which decay after a set amount of time called their 'half-life.'"[30] We might say that muons are a good (though again arbitrary) choice for a clock since they decay at a regular rate. We could say that the time intrinsic to the "half-life" of a muon is one "muon half-life", and then use this as an extrinsic measure for the duration of other events, even the decay of other muons. But muons, unlike Aristotle's outermost sphere, are themselves in motion with respect to other things, and this must be taken into account when we use them as clocks. If our clocks are themselves in motion, how do we reconcile them?

Here we see the genius of Einstein. Once Newton's absolute time had been eliminated, Einstein saw that we needed another way to coordinate our (moving) clocks. Positing the speed of light as constant, he saw that all times and distances must be relative depending on their relative motion.[31] So time (as a measure) as well as distance became relative to the motion of one system in relation to another. Bob explains how this affects the muons when we use them as clocks and then take their own motion into account: "Their behavior is called time dilation since clocks in motion relative to a clock at rest will seem to run more slowly. In the case of elementary particles, those moving will take longer to decay than the ones at rest; their half-life is 'dilated.'"[32]

If Aristotle had an ontological definition of time rooted in physical motion and Newton had an abstract notion of time unrelated to physical objects, Einstein offered a procedural definition of time based on the coordination of clocks:

> At the heart of this radical upheaval in the conception of time [in Einstein's theory of relativity] lay an extraordinary yet easily stated idea that has remained dead-center in physics, philosophy, and technology every since: To talk about time, about simultaneity at a distance, you have to synchronize your clocks. And if you want to synchronize two clocks, you have to start with one, flash a signal to the other, and adjust for the time that the flash takes to arrive. What could be simpler? Yet with this procedural definition of time, the last piece of the relativity puzzle fell into place, changing physics forever.[33]

Since absolute time was unobservable, it could be ignored and replaced by a procedural definition.[34]

Though we must disagree with Aristotle on his choice of the outermost sphere as the most fundamental motion in the cosmos, it seems we must concur with him that time depends on motion for its intelligibility. The speed of light itself, so fundamental to contemporary physics, is given as 299,792,458 meters per second. But what is a second? What does it represent? To answer, we must point to some fraction of the daily rotation of the earth or some increment of vibrations in an atomic clock. Time must finally reference some physical motion. So despite the complication of comparisons of clocks and Einstein's brilliant account of this, Aristotle's basic understanding of time as the measure of motion still seems both fundamental and appropriate to science since it is rooted in the physics of the cosmos.[35]

If time is essentially related to motion, does it still make sense to look for some fundamental cosmic motion as the ground of all time? In what we might see as an instance of the creative mutual influence of philosophy and science, there are some thinkers who continue to suggest candidates for a most fundamental motion that might ground a universal time. John Polkinghorne suggests that the background radiation from the "big bang" might serve as such a referent: "Moreover, while there is no universal 'now' in local relativistic physics, when the

observable universe is taken into account as a whole there is a natural frame of reference (at rest with respect to the cosmic background radiation), which is the frame cosmologists use when they say that the universe is 13.7 billion years old. Thus there is a possible candidate for a cosmic 'now'."[36] Antonio Moreno has suggested that the motion of light itself might be a candidate for the fundamental cosmic motion.

> We can therefore conclude tentatively that the ontological unity of time depends upon that first motion which is the motion of light, by which, 'since it is the most simple, all other movements are measured' (*ST* I, 10, 6). ... Relativity ... is founded on the principle that the natural state of things is uniform motion in a straight line. In contrast, the Greeks believed that the natural state of motion is motion in a circle. Relativity theory emphasizes the speed of light. The Greeks and Aquinas emphasized the motion of the first sphere and the ontological subordination of all motions and times to the motion and time of this sphere. But in both-- relativity theory and Greek philosophy-- there exists an 'ontological' subordination of all movements to the first motion and time. Consequently, there exists an ontological time. On another level of physical reality, however, the level of 'metric' time, the theory of relativity appears to present great conceptual difficulties to the existence of a universal objective 'metric' measure of time. ... Insofar as metric time is concerned, we may conclude that there does not seem to exist an objective and universal metric time." [37]

John M. Quinn goes further to argue that there *must* be a most fundamental motion in the cosmos to ground the notion of time. He issues a kind of challenge to science to discover this most fundamental motion, even while recognizing that it may ever elude our grasp:

> The subject of this [universal] time must be the primary motion of the cosmos. The subject of the primary motion must be the universal physical cause. The actual designation of the primary motion and the universal physical cause seems beyond the reach of human powers. The failure to pinpoint these factors experimentally does not in any way undermine or shatter the fundamental physical truths of a general science of nature. There is a primary motion in which time is numerically subjectified, and in virtue of the all-pervasive causality of the universal physical cause in the primary motion, time, while remaining numerically one, is secondarily omnipresent in the cosmos as the extrinsic measure of any motion whatsoever.[38]

3. Time and eternity

Understanding time as the measure of motion may also be helpful in our discussion of eternity. If time is a difficult concept, eternity is much more perplexing. It seems therefore

reasonable to begin with what we better understand: "As we attain to the knowledge of simple things by way of compound things, so must we reach to the knowledge of eternity by means of time."[39]

We use the language of eternity to speak of God. As the source of all that is, God must be understood as "existing outside of the order of beings, as a cause producing the whole of being and all its differences."[40] Transcending created being, God also transcends its changes and limits. This transcendent God reveals himself as Father, Son, and Holy Spirit, three persons, absolutely distinct from one another yet of one undifferentiated essence.[41] The dynamic of change is far too feeble and infirm to represent the dynamism of God's trinitarian life-- the unchanging dance (perichoresis) of the three divine persons in the dynamic stillness of divine wisdom and love-- "the motion of the motionless God."[42]

If time measures the motion of finite, changeable things; eternity names the dynamic life of the infinite and unchanging God. For Aquinas, God's changelessness is a truth that may be known by both reason and revelation.[43] If motion grounds our understanding of time, immutability founds our notion of eternity:

> As we attain to the knowledge of simple things by way of compound things, so must we reach to the knowledge of eternity by means of time, which is nothing but the numbering of movement by "before" and "after." For since succession occurs in every movement, and one part comes after another, the fact that we reckon before and after in movement, makes us apprehend time, which is nothing else but the measure of before and after in movement. Now in a thing bereft of movement, which is always the same, there is no before or after. As therefore the idea of time consists in the numbering of before and after in movement; so likewise in the apprehension of the uniformity of what is outside of movement, consists the idea of eternity.[44]

In physics, time is often represented as a line.[45] The initial and subsequent parts of the line readily illustrate the distinction between the "before" and "after" of time. To get to the notion of eternity, we must employ the "way of negation" to deny the distinction of "before" and "after". Our diagram of eternity might then look like a point, with no parts before or after. This would,

however, be a very inadequate picture of eternity, since a point is the terminus of a line and in eternity there is no termination. To get to a proper notion of eternity, we must again employ the way of negation:

> Further, those things are said to be measured by time which have a beginning and an end in time, because in everything which is moved there is a beginning, and there is an end. But as whatever is wholly immutable can have no succession, so it has no beginning, and no end.[46]

Since eternity has neither beginning nor end, we might be tempted to picture it as an infinitely extended line. Such an image, however, would conflict with our previous picture of eternity as a point. Here, I think we have to admit that all our images fail us. How can we possibly draw an interminable point? How can we conceive of an unending "all at once"? The short answer is that we cannot. As is so often the case in our discussion of God, we cannot know what God is, but only what God is not. We know that God's unchanging being involves neither succession nor beginning and end. We also realize that this implies no deficiency but rather the perfection of divine life. Aquinas therefore finds a suitable description of eternity in Boethius' definition: "the simultaneously-whole and perfect possession of interminable life."[47] Eternity characterizes God's life and so also God's being:

> The idea of eternity follows immutability, as the idea of time follows movement... Hence, as God is supremely immutable, it supremely belongs to Him to be eternal. Nor is He eternal only; but He is His own eternity; whereas, no other being is its own duration, as no other is its own being. Now God is His own uniform being; and hence as He is His own essence, so He is His own eternity.[48]

Employing the notion of time as the measure of motion can help us to realize the perfection of divine eternity, even as we admit that eternity exceeds our comprehension.

3.1. The imperfection of time

Motion is an imperfect mode of being since it inherently involves potency which implies a lack of being. Motion always involves some subject (a moveable or changeable thing that

endures through some change) and two contraries (an initial lack and subsequent possession of some actuality).[49] When a book is moved from one place to another, for instance, it remains the same book but initially lacks and subsequently possesses the quality of being in the new place.

Before the change begins, the object (e.g., the book) is in potency to two distinct actualities. The first is the actuality of moving towards the new place; the second is the actuality of possessing the new place. The first is the actuality of motion. It's a peculiar kind of actuality. It's an act that can be characteristic of an object only as long as the object is in potency-- only until the further actuality (the possession of the new place) that marks the end of motion is achieved. The book, for instance, can move toward the new place only until it gets there. Once the new place is reached-- once the new actuality is attained-- the motion (at least towards that particular place) must stop.

The actuality of motion can therefore be characteristic of a thing only insofar as that thing remains somehow in potency. Aristotle accordingly defines motion as the act of that which exists in potency insofar as it is in potency.[50] As an actuality that entails potency, motion is also an actuality that cannot be possessed all at once. The book possesses the actuality of motion only so long as it remains in potency to the new place. It possesses that actuality successively as it traverses first one part and then the next of its trajectory toward the new location.

As the measure of motion, time shares its imperfection and cannot exist all at once. Although time refers immediately to the *motion* of changeable things, it may also describe their *being* or existence: "Time is the proper measure of motion; and so, insofar as any being recedes from permanence and is subject to change, it ... is subject to time. Therefore the being of corruptible things, because it is changeable, is ... measured by ... time; for time measures not only things that are actually changed, but also things that are changeable."[51]

3.2. The perfection of eternity

Since motion implies imperfection, it cannot be attributed to God. As pure actuality, pure to-be or *esse*, God has none of the potentiality that is the mark of mutable things. God's simplicity rules out the complexity of subject and contraries that is characteristic of changeable things. And since God is all-perfect, there is no new quality God might attain nor any present quality he could lose through change.[52]

Since God's being is not subject to change or motion, it is not characterized by time that is the measure of motion, but rather by eternity. As Aquinas says: "As God is supremely immutable, it supremely belongs to Him to be eternal."[53] As temporality characterizes our existence, eternity not only characterizes God's being but is one with it. As Aquinas says, "eternity is nothing else but God Himself."[54]

Predicating eternity of God in this sense implies not divine impoverishment but rather perfection in being. It certainly does not imply, as Bob seems to suggest, that God's knowledge of the temporal distinctions that are proper to creatures would be "lost as they are conflated into the dimensionless eternal *'nunc*,' a single structureless and unchanging 'now."[55] God knows all things perfectly in their proper context, sequence, and temporality, but knows all of this (in a way we cannot begin to comprehend) by one act which is identical with his being.[56]

4. God in time and time in God

While we distinguish time and eternity, we also believe that the eternal God is immanently present in the temporal realm. As Aquinas says, God is "in all things and innermostly."[57] We call God "eternal" or "timeless" not to remove him from temporal things, but to affirm his intimate presence in all times and places. So Aquinas says that God's eternity "includes all times."[58]

As subsistent being itself (*ipsum esse subsistens*), God is the ultimate cause of all being and actuality in creation. Since every instance of motion or change, every realization of a potentiality, is itself a kind a actuality, God must be the ultimate cause of all motion and change.[59] As the first cause of being, change, and motion, God is also the ultimate end.[60] So all of motion and change must in some way be ordered towards God as the first cause and ultimate end of all things. If time is derived from and so also in a way dependent on motion, and motion is in some way directed towards God, then time must also be directed toward God as the ultimate end. This means that, regardless of whether we are capable presently of finding a first or most basic motion in the cosmos (analogous to the outermost sphere in Aristotle's cosmology) upon which all other motion and so all of time as the measure of motion is intrinsically dependent, we still have a theological reason for affirming the unity and direction of the actuality of all physical change towards God as its first cause and ultimate end, and so also of the unity of all time as directed towards God as its ultimate end. We might say then that the eschaton itself is, in a way, physically founded in the initial creation of physical matter (the matter we study in empirical science), since matter and all of its changes are intrinsically directed towards God as their ultimate end.

5. Conclusion

The task of theology today (as always) is the contemplation of God.[61] That task is made more difficult if we live in a world, as David Bentley Hart suggests, where "every possibility of theophany has been scrupulously excluded." We are indebted to Bob for marshalling the resources of present science for the task of theology and sharing with us the fruits of his contemplation. I have suggested that it might also be helpful for us to look to the past and retrieve the resources of a theology that flourished before the chance of theophany was driven

from the world. We cannot return to the past (time is, after all, a reality!), but we may be instructed by the wisdom of the past in our present attempt to speak of God in ways that embrace both God's utter transcendence and unspeakable immanence in creation. Though time and change can in no way be attributed to the divine realm, God is not thereby rendered lifeless but recognized as the very font and fullness of life-- the "whole and perfect possession of interminable life."[62] Though God is distinguished from all things temporal and changeable, God is not thereby excluded from them, but, as the very source of being, change, and time itself, is found to be "in all things and innermostly."[63]

---

[1] David Bentley Hart, "Seeing the God," *First Things* No. 230 (February, 2013): 71.

[2] Robert John Russell, *Time in Eternity: Pannenberg, Physics, and Eschatology in Creative Mutual Interaction* (Notre Dame, IN: University of Notre Dame Press, 2012).

[3] See Thomas Aquinas, *Summa Theologica* [*ST*] II-II, Q.188, a.7, co. (New York: Benziger Brothers, 1947). This passage provides the basis for the motto of the Dominican Order: "To contemplate and to give to others the fruits of contemplation (*Contemplare et contemplata aliis tradere*)."

[4] See Robert John Russell, *Cosmology from Alpha to Omega: the Creative Mutual Interaction of Theology and Science* (Minneapolis: Fortress, 2008). While appreciating Bob's insights, I raise some questions about this approach to divine action in my *Unlocking Divine Action: Contemporary Science and Thomas Aquinas* (Washington, DC: The Catholic University of America Press, 2012).

[5] "According to CMI, a robust philosophical interpretation of scientific theories can lead to a creative reformulation of theological doctrines. But in what might be considered a startling move, a theology that is so reformulated in light of science can also lead to suggestions for creative new research programs in science and in the philosophy of science" (Russell, *Time*, 8).

[6] Russell, *Time*, 5.

[7] This is different from the tradition of Aquinas, which reserves the word "eternity" for God and employs another word, "aeviternity," for creatures that, though incorruptible, are still in some ways changeable. See *ST* I, 10, 1-6.

[8] Russell, *Time*, 5.

[9] Ibid., 5-6.

[10] Ibid., 4.

[11] Ibid., 2.

[12] Ibid., 33.

[13] Ibid., 2.

[14] Ibid., 4. See also ibid., 50-56.

[15] Ibid., 77-82.

[16] Ibid., 64-65.

[17] Ibid., 77-78.

[18] Ibid., 78.

[19] Ibid., 81.

[20] "Finally, if Christian eschatology is based on the view of the resurrection of Jesus as a transformation..., then we may be able to find physical features of the universe as it is now that will eternally be part of it, and science can return as a friend in studying these features" (ibid., 12). cf: Ibid., 69-70.

[21] Ibid., 69. "More broadly, it is my hope that the overall developments in this volume will both address the specific challenges outlined above and more generally provide a fruitful example of how Christian theology and contemporary philosophy and physics, cosmology, and mathematics can constructively interact and inform one another" (ibid., 8).

[22] Aristotle, *Physics*, IV, c.11 (219b 2), in *The Basic Works of Aristotle*, ed. Richard McKeon (New York: Random House, 1941). "Time is nothing other than the measure [*numerus*] of motion according to before and after [*prius et posterius*]" (Thomas Aquinas, *Commentary on Aristotle's Physics* [*In phys.*], tr. R. Blackwell et al., Book 4, lecture 17, no. 10 [New Haven: Yale, 1963]).

[23] See http://www.math.wichita.edu/history/Men/galileo.html, accessed 1/9/2009.

[24] "Le temps propre est la mesure intrinseque d'un mouvement. C'est dans ce sens qu'Aristote écrit, 'le temps n'est pas le mouvement,' mais 'il est quelque chose du mouvement' (*Phys*., IV, c. 10 [218b 18]; c. 11 [219a 10]), ce que saint Thomas traduit, 'tempus est quoddam accidens motus' (*In phys*. 4, lect. 23, no. 2)" (Joseph de Tonquédec, *La philosophie de la nature* [Paris: P. Lethielleux, 1956], 3:72-73). "[T]ime is not a number abstracted from the thing numbered, but existing in the thing numbered; otherwise it would not be continuous; for ten ells of cloth are continuous not by reason of the number, but by reason of the thing numbered. Now number as it exists in the thing numbered, is not the same for all; but it is different for different things" (*ST* I, 10, 6, co.). See also Antonio Moreno, "Time and Relativity: Some Philosophical Considerations," *Thomist* 45 (1981): 70.

[25] See Moreno, "Time and Relativity," 70.

[26]"D'autre part, si nous mesurons le temps propre d'un mobile par celui d'un autre mobile -- par exemple, la durée d'un évenément par le mouvement du soleil, et surtout si nous admettons un temps unique pour tous les mouvements cosmiques, ce dernier temps est la mesure extrinseque du premier. Et dans ce sens saint Thomas écrit: 'mensura extrinseca [est] tempus' (*In phys*. 3, lect. 5, no. 15)" (Joseph de Tonquédec, 3:72-73).

[27] "This also is why time is thought to be the movement of the [outermost] sphere, viz., because the other movements are measured by this, and time by this movement" (Aristotle, *Physics*, IV, 14 [223b 23]). cf: *In phys*. IV, 17, no. 4; IV, 23, no. 12. For Aquinas, it is because of the simplicity of the motion of the outermost sphere rather than its causality that it can serve as a universal measure for all other motion: "For things to be measured by one, it is not necessary that the one should be the cause of all, but that it be more simple than the rest" (*ST* I, 10, 6, ad 4).

[28] In Newton's world, "[i]t is perfectly possible for there to be no uniform motions to serve as an accurate measure of time. The reason is that any motion is subject to being accelerated or retarded (by the application of external forces). In contrast, absolute time (which is nothing other than duration or the perseverance of existence of things) remains the same, whether the motions be be swift, slow, or null" (http://plato.stanford.edu/entries/newton-stm/#5.1, accessed 1/9/2009). Stephen Hawking wrongly identifies Newton's absolute time with Aristotle's universal time. Really, Newton's absolute time has no foundation in the motion of any physical object, while Aristotle's time is founded on the physical motion of the outermost sphere of the heavens: "Both Aristotle and Newton believed in absolute time. That is, they believed that one could unambiguously measure the interval of time between two events, and that this time would be the same whoever measured it, provided they used a good clock. Time was completely separate from and independent of space" (Stephen Hawking, *A Brief History*, 18).

[29] "Einstein's innovation was to affirm that the local time of one inertial frame is as physically meaningful as that of another since there is no absolute time that would allow the two to be compared" (John Hedley Brooke, "Einstein, God, and Time," *Zygon* 41 [2006]: 943). "In the theory of relativity there is no unique absolute time, but instead each individual has his own personal measure of time that depends on where he is and how he is moving" (Stephen Hawking, *A Brief History of Time*, 33).

[30] Russell, *Time*, 228.

[31] For a helpful reflection on what it means (and doesn't mean) to say that the speed of light is constant, see http://math.ucr.edu/home/baez/physics/Relativity/SpeedOfLight/speed_of_light.html (accessed 2/2/2013).

[32] Russell, *Time*, 228.

[33] Peter Galison, *Einstein's Clocks, Poincare's Maps: Empires of Time*. New York: W.W. Norton & Co., 2004, 13-14.

[34] Other physicists later applied this same thinking to quantum mechanics, much to Einstein's chagrin: "Younger physicists, including Werner Heisenberg, began in the 1920s to pattern the new quantum physics on what they took to be Einstein's tough stance against concepts (like absolute time) that referred to nothing observable. In particular, Heisenberg admired Einstein's insistence that simultaneity refer exclusively to clocks coordinated by a definite and observable procedure. Heisenberg and his colleagues pressed their insistence on observability hard: if you want to speak about the position of an electron, show the procedure by which that position can be observed. If you want to say something about its momentum, then display the experiment that will measure it. Most dramatically, if even in principle you could not measure both position and momentum simultaneously, then position and momentum simply did not both exist at the same time.

Einstein famously bridled at that conclusion, even as his quantum colleagues pleaded with him to acknowledge that they had only extended to atoms Einstein's own acute criticism of time, and simultaneity. It was far too late for Einstein to call his relativistic genie back into the bottle, but he worried the new physics carried too far the spirit of his insistence on observable procedures-- and so underestimated the formative role of theories in fixing what could be seen. As Einstein wryly observed, 'A good joke should not be repeated too often'" (ibid., 24-25).

[35] Peter Galison notes this relation of time to motion in his account of Mach's critique of Newton's absolute time: "For Mach, time was not something primitive against which phenomena were measured. Quite the opposite: time itself derived from the motion of things-- the earth as it spins, the pendulum as it swings. To attempt to get behind the phenomena to the absolute was futile. Mach's condemnation was clear: 'This absolute time can be measured by comparison with no motion; it has therefore neither a practical nor a scientific value; and no one is justified in saying that he knows aught about it. It is an idle metaphysical conception'" (Galison, *Einstein's*, 236-37). Ted Peters observes that for both Augustine and quantum mechanics, time is essentially related to motion: "what both Augustine and quantum mechanics can say about the very early universe is that time is determined by the motion of things; and this gives matter an ontological status prior to that of time" (Ted Peters, "On Creating the Cosmos," in *Physics, Philosophy and Theology*, ed. Robert John Russell, et. al. [Vatican City State, 1988], 283). Because of its intrinsic relation to physical motion, Aristotle's idea of time seems more compatible with contemporary science than other definitions, such as that of Plato, who defines time in terms of eternity (an even more difficult concept to grasp): "Now the nature of the ideal being was everlasting, but to bestow this attribute in its fullness upon a creature was impossible. Wherefore [the father and creator] resolved to have a moving image of eternity, and when he set in order the heaven, he made this image eternal but moving according to number, while eternity itself rests in unity, and this image we call time" (Plato, *Timaeus*, 37d, in *The Collected Dialogues of Plato* [Princeton, NJ: Princeton University Press, 1973]).

[36] John Polkinghorne, "Space, Time, and Causality," *Zygon* 41 (2006): 977.

[37] Antonio Moreno, "Time and Relativity," 78-79.

[38] John M. Quinn, *The Doctrine of Time in St. Thomas: Some Aspects and Applications: An Abstract of a Dissertation* (Washington, DC: Catholic University of America Press, 1960), 39, 46-47. "The unity of time ... is seated in a subject proximate and proper to time: this must be a local motion. Since a measure is the most uniform in a given genus, the primary subject of time must be the maximally regular of motions; that is to say, it must be primary among local motions. In accord with the science of his day, Aquinas thinks that this most regular of motions is plainly observable: it is the motion of the first heavenly sphere. It is worth noting that the necessity of a numerically one time does not depend on a faulty astronomy. It is only the precise designation of the primary motion that stands or falls with the truth or falsity of a particular theory of astronomy" (ibid., 39).

[39] *ST* I, 10, 1, co. "We can understand and express simple eternity only by way of temporal things, because our intellect has a natural affinity to ... temporal things" (*ST* I, 13, 1, ad 3).

[40] Thomas Aquinas, *Commentary on Aristotle's On Interpretation*, Book I, lect. 14, no. 22, in *Aristotle: On Interpretation. Commentary by St. Thomas and Cajetan*, tr. John Oesterle (Milwaukee: Marquette University Press, 1962).

[41] This theology differs from Pannenberg, who argues that God's presence in creation demands a differentiation in God's unity: "If God is, then his whole life and all things created by him must be present to him at one and the same time. This is not to set aside the distinction of what is temporally different. On the contrary, differing precisely as regards its temporal position, it is present to the eternal God. In the same way it can be said to be affirmed, willed, and created by him. This is possible only if the reality of God is not understood as undifferentiated identity but as intrinsically differentiated unity. But this demands the doctrine of the Trinity" (Pannenberg, *Systematic Theology*, 1:405). Russell argues that "Pannenberg's claim here is crucial to his entire project," noting that the presence of all things to God "requires that the unity of God is differentiated" and that "God as differentiated unity requires the doctrine of the Trinity." He goes on to say, "I think the claim is true, but I do not believe Pannenberg convincingly demonstrates its truth" and explains that the purpose of his own book "in large measure is to take up this claim and make it more convincing by reconstructing it in light of mathematics and physics and then showing its fruitfulness in leading to insights in the philosophy of time and in physics" (Russell, *Time*, 378n86). I would only point out a minor logical flaw in the argument which may nonetheless have major implications for trinitarian theology. Pannenberg contrasts "undifferentiated identity" with "intrinsically differentiated unity." But the logical contrary of "undifferentiated identity" is not "differentiated unity," but rather "differentiated identity." Identity has to do with the distinction of persons. If God were characterized by "undifferentiated identity," then God could be only one person, not three. We might rightly say therefore that in God there is the "differentiated identity" of three divine persons, but still pause at the idea of "differentiated unity". Unity is not a personal property that distinguishes the three (such as the relations of fatherhood and sonship), but an essential property which does not distinguish the persons, but rather shows their oneness of essence. See *ST* I, 10, 3; I, 39, 1-8. To speak of God as "differentiated unity", therefore, seems to jeopardize the oneness of the divine essence-- the one and *undifferentiated* essence of the three *differentiated* identities of the divine persons. Whether Pannenberg's theology itself jeopardizes the unity of the divine essence seems ambiguous since he locates the differentiation in the "economic Trinity" rather than the "immanent Trinity," but then immediately affirms the identity of economic and immanent Trinity. After noting how Barth spoke of "an 'order and succession' in the trinitarian life of God which includes a 'before' and 'after,'" Pannenberg remarks: "The last point can be made only with reference to the manifestation of the Trinity in the economy of salvation. It corresponds to the realization that the immanent Trinity is identical with the economic Trinity" (Pannenberg, *Systematic Theology*, 1:405).

[42] "Not only do theologians attribute motion to God, but it is also granted us that we may fittingly praise the motion of the immovable God (*motum Dei immobilis*)" (Thomas Aquinas, *In librum beati Dionysii De Divinis Nominibus expositio,* IX, lect. 4, no. 841 [Turin and Rome: Marietti, 1950]). On the motion of the motionless God, see Michael J. Dodds, *The Unchanging God of Love*: *Thomas Aquinas and Contemporary Theology on Divine Immutability* (Washington, DC: Catholic University of America Press, 2008), 161-203

[43] "As a principle of procedure in knowing God by way of remotion, therefore, let us adopt the proposition which, from what we have said, is now manifest, namely, that God is absolutely immovable (*omnino immobilis*). The authority of Sacred Scripture also confirms this. For it is written: 'I am God and I am not changed' (Mal. 3:6). 'With whom there is no change' (Jas. 1:17). Again: 'God is not as man that he should be changed' (Num. 23:19)" (*SCG* I, c.14, no. 4). For a review of contemporary criticisms of Aquinas' teaching, see Dodds, *Unchanging God of Love*.

[44] *ST* I, 10, 1, co.

[45] See, for example, the helpful diagrams in Russell, *Time*, 229-48.

[46] *ST* I, 10, 1, co. "Aquinas's approach to divine eternity is a conscious exercise in the *via negativa* of the Dionysian tradition. ... This is a constant theme in Aquinas's writings on eternity, although it is often overlooked by contemporary interpreters. Because our intellects are fundamentally inadequate to grasp the divine nature, Aquinas never claims to provide a strict definition of divine eternity, but rather only to say what it is not. ... Eternity is fundamentally a negative notion describing the perfect actuality of existence without any limitation *(ens extra terminos)*" (Brian J. Shanley, "Eternity and Duration in Aquinas," *Thomist* 61 [1997]: 530-31, 544).

[47] *ST* I, 10, 1.

[48] *ST* I, 10, 2. "Those beings alone are measured by time that are moved. For time... is 'the number of motion.' But God, as has been proved, is absolutely without motion, and is consequently not measured by time. There is, therefore, no before and after in Him; He does not have being after non-being, nor non-being after being, nor can any succession be found in His being. For none of these characteristics can be understood without time. God, therefore, is without beginning and end, having His whole being at once. In this consists the nature of eternity" (*SCG* I, c. 15, no. 3). Brian Shanley explains: "Aquinas will now show how divine eternity derives directly from the divine immutability that is the necessary condition for God to be First Cause of the changing temporal world (*primum movens non motum*). This same approach will characterize all of Aquinas's mature treatments of divine eternity: because God as the First Cause must be pure act and therefore wholly immutable, it follows that He cannot be measured by time and is therefore eternal" (Brian Shanley, "Eternal Duration," 537).

[49] Aristotle, *Physics,* I, 7 (190b 10-15).

[50] "The fulfillment [entelechy] of what exists potentially, in so far as it exists potentially, is motion" (Aristotle, *Physics* III, 1 [201a 10]). "Hence the Philosopher has defined motion most adequately by saying that motion is the entelechy, i.e., the act, of that which exists in potency insofar as it is such" (*In phys*. III, lect. 2, no. 3).

[51] *ST* I, 10, 4, ad 3. "Now some things recede from permanence of being, so that their being is subject to change, or consists in change; and these things are measured by time, as are all movements, and also the being of all things corruptible" (*ST* I, 10, 5, co.).

[52] See ST I, 9, 1.

[53] ST I, 10, 2, co.

[54] "*Aeternitas non est aliud quam ipse Deus*" (*ST* I, 10, 2 ad 3). "What is important here is to see that eternity is not an extrinsic measure of the divine *esse*, but rather is identical with the divine *esse*. In this sense it is only a *quasi mensura*, resulting from our tendency to conceive eternity as analogous to other measures like time and aeviternity" (Brian Shanley, "Eternity and Duration," 531).

[55] Russell, *Time*, 5. The "now" of time involves plurality and so is well described by Russell's fractal analogy (ibid., 146-51). Eternity is quite different. We get to the idea of eternity not through a "conflation" of temporal distinctions (a kind of straight-jacketing of time that would represent an even more limited and impoverished reality) but by a denial of temporal limitations that points to a perfection in being that has neither beginning nor end and is not possessed successively. "The 'now' of time is the same as regards its subject in the whole course of time, but it differs in aspect; for inasmuch as time corresponds to movement, its 'now' corresponds to what is movable; and the thing movable has the same one subject in all time, but differs in aspect as being here and there; and such alteration is movement. Likewise the flow of the 'now' as alternating in aspect is time. But eternity remains the same according to both subject and aspect; and hence eternity is not the same as the 'now' of time" (*ST* I, 10, 4, ad 2). cf: *In phys*. IV, lect. 18, no. 5.

[56] "God knows things other than himself with a proper knowledge; not only in so far as being is common to them, but in so far as one is distinguished from the other. ... It is manifest that God knows all things with proper knowledge, in their distinction from each other" (*ST* I, 14, 6, co.). "Since God is the cause of things by his knowledge, his knowledge extends as far as his causality extends. Hence as the active power of God extends not only to forms, which are the source of universality, but also to matter..., the knowledge of God must extend to singular things, which are individualized by matter" (*ST* I, 14, 11, co.). "Divine knowledge is in no way changed by a change in the objects of its knowledge. Our knowledge varies when the objects change because it knows with separate conceptions things present, past, and future. Consequently, when Socrates is not sitting, the cognition had of him when he was sitting becomes false. God, however, sees things as present, past, or future in a single intuition. Therefore, no matter how a thing may change, the truth in His intellect remains the same" (Thomas Aquinas, *Truth* [*De veritate*], Q. 2, a. 5, ad 11, tr. Robert Mulligan (Chicago: Henry Regnery Co., 1952).

[57] ST I, 8, 1, co.

[58] "Words denoting different times are applied to God, because His eternity includes all times; not as if He Himself were altered through present, past and future" (*ST* I, 10, 2, ad 4). cf: I, 13, 1, ad 3. Aquinas uses the metaphor of a circle to illustrate the universal presence of the eternal God to all times and places. "Since the being of what is eternal does not pass away, eternity is present in its presentiality to any time or instant of time. We may see an example of sorts in the case of a circle. Let us consider a determined point [A] on the circumference of a circle. Although it is indivisible, it does not co-exist simultaneously with any other point [B] as to position, since it is the order of position that produces the continuity of the circumference. On the other hand, the center of the circle [C], which is no part of the circumference, is directly opposed to any given determinate point on the circumference. Hence, whatever is found in any part of time coexists with what is eternal as being present to it, although with respect to some other time it be past or future. Something can be present to what is eternal only by being present

to the whole of it, since the eternal does not have the duration of succession" (*SCG* I, c. 66, no. 7).

[59] See *ST* I, 2, 3, co.

[60] See *ST* I, 6, 1.

[61] *ST* I, 1, 7.

[62] See *ST* I, 10, 1.

[63] *ST* I, 8, 1, co.