

## THE EXISTENCE AND NATURE OF TIME

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There can hardly be a more universal aspect of experience than time.<sup>1</sup> Every thing we see, every thought we think, every move we make is interwoven with succession and flux. The physical world is a world of becoming, a world falling ever into nothingness, the present consuming the future even as the past consumes the present. We measure out our very existence in years, days, and seconds, but we never possess more of that existence than the knife-edge between memory and expectation. But mind, a power which lifts us above the immediate experience of the ever changing sensory world,<sup>2</sup>

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<sup>1</sup> In this essay, I will consider the nature of time and some consequences of that nature from the point of view of everyday experience. By this qualification I mean to exclude that special experience which results from precise measurement and experiment, and so I intend to leave aside the consideration of the relation between what I will propose here and the notions of space-time and simultaneity found in the Theory of Relativity. But because the Newtonian conception of an absolute time independent of motion recommends itself to our minds not only because it forms a part of the Newtonian mathematical understanding of the world, a system which so beautifully expresses large swaths of experience, but also because it seems to be straightforwardly based on some aspects of common experience, I will deal with that notion here. I hope to take up certain considerations arising from Relativity in a later paper.

<sup>2</sup> *Metaphysics* I, 1, 980a21-81a12.

finds itself confronted first and foremost with this very world, and, though living a life striving to transcend the transitory world, itself supplies the element which lends endurance to the world. The world itself does not keep; we simply keep it in mind.

This fundamental experience of the flux of becoming is found in all our thoughts and acts, and is rooted in the fact that we are animals that think, possessed of minds determined by what that most natural knowledge, sensation,<sup>3</sup> presents to us. Our understanding of the sensible world, especially of motion, place, and time, condition our thinking about everything else. The proper object of the mind, says St. Thomas, is the whatness of material things,<sup>4</sup> and every object of a power is such an object in virtue of the proper object.<sup>5</sup> The proper object of sight being color, everything else we can see—men, horses, shapes, motions, etc.—are seen only insofar as we see color. There is, then, no understanding which is not rooted in the understanding of the physical world; a metaphysics, ethics, politics, or even logic, which tries to attain a supersensible standpoint without standing upon the world of sensation, is necessarily a fantasy, even if its conclusions happen to be true. But what sensation presents to us perhaps more insistently than anything else is motion. To avoid detection, hold still; to attract attention, wave your hand. And since motion is always in time, time becomes for us some sort of condition of understanding.<sup>6</sup>

But however important place and time and motion are,

<sup>3</sup> *Posterior Analytics* II, 19, 99b28–100b5; hereafter, *PA*.

<sup>4</sup> St. Thomas Aquinas, *Summa Theologiae* Ia, Q. 84, a. 7, c.

<sup>5</sup> St. Thomas Aquinas, *In Boethii de Hebdomadibus*, L. III.

<sup>6</sup> A reflection of this fact is found in Kant's notion that time is an a priori form of intuition. Cf. Immanuel Kant, *The Critique of Pure Reason*, trans. Werner S. Pluhar (Indianapolis, Ind.: Hackett Publishing Co., 1996), Transcendental Aesthetic, Section II, Time, §5 Transcendental Exposition of the Concept of Time, pp. 87–90; hereafter, *CPR*. Cf. Aristotle, *De Memoria*, Ch. I, 450a1–11.

we might be dissuaded from thinking too hard about them because of a curious feature they have in common: though present to us in our every experience, certain as we are about their existence, facile as is our speech about them, we are immediately brought to a standstill when we try to say what they are. Like the purloined letter in Poe's story, they seem both to be immediately at hand and to elude our grasp, transparent and opaque at once. As St. Augustine said, I know what time is until someone asks me.<sup>7</sup>

The first problem one faces is the puzzling question of whether, or rather, how, time exists. This is not just the general application of the principle laid out in *Posterior Analytics* II, 1, that the question of whether a thing is precedes the question of what it is, a principle founded upon the insight that, as Aristotle puts it shortly afterward, "to seek what [a thing] is without having the "that it is" is to seek nothing,"<sup>8</sup> but, more pressingly, how can this so-apparent aspect of our experience be real when its only reality is its very undoing, its reality its very annihilation?

The flux of time so impressed Heraclitus that he was tempted into saying that "all things flow," an expression meant not only to point to the fact that sensible things decay, but, taken in the context of his philosophy as a whole, seemingly to claim that there is no aspect of the world which does not cease being immediately upon being. The world, as Plato would say a little later, is only a passing shadow cast onto the blank nothingness of space by the otherworldly forms.<sup>9</sup>

But even if this were true, the question would remain, how does this shadow world exist? It endures in time, we think, and rightly so, duration being just the prolonged existence of something through time. And yet what sort of prolongation is it in which no single part is prolonged? For it is not only

<sup>7</sup> St. Augustine, *Confessions* XI, 14; hereafter, *Confessions*.

<sup>8</sup> *PA* II, 8, 93a26–27.

<sup>9</sup> Plato, *Republic* VII, 514a–17c; cf. also, *Timaeus*, 52a–c.

yesterday which is no longer and tomorrow which is not yet, but even the moment when the light left this page has passed by the time your eyes are affected by it. It is through memory and expectation alone that we perceive the permanence of things—what is actually existent is only that which is in the very present moment.

[Time] either does not exist at all, or exists scarcely and faintly. For one part of it has come to be and is not, but the other part will be and is not yet, but from these are composed the time which is infinite and any given time. But it seems impossible that what is composed from non-beings share in being.<sup>10</sup>

Moreover, if today is a whole, but no part of today exists except the present now, and the now is not a part but only a division of the parts of today, what sort of whole could today possibly be?

So we find that time and the things which exist in time are barely existent, having whatever being they have not merely piece-meal, but through the ever-changing and infinitesimal slice of things called the “now” or the “present”—a slice which is, moreover, a division of past and future, of what is no longer and of what is not yet—of non-beings. The only existent part of time is the shared edge of two non-beings.

One is driven to wonder whether time is best understood in a quasi-Kantian way, i.e., as an aspect of our perceptive abilities rather than as a natural being outside of us. If we only perceive time by composing the past with the future, and neither of these exist except in memory and expectation, then it seems that time must be more a mental than a physical phenomenon. But, on the other hand, this position would seem to relegate physics and indeed every experience and every reflection on the natural world to psychology, since the

<sup>10</sup> *Physics* IV, 10, 217b32–18a3.

former deals largely with temporal phenomena as such and the later with what belongs to our minds.

Still, it is evident that, however odd time may be, it does exist and have certain seemingly indubitable properties. If it did not exist, perhaps it would not cause all these intellectual headaches, and, besides, motion could not exist without time. Whether it be a separated substance as Newton thought<sup>11</sup> or the mere form of sensibility as Kant thought,<sup>12</sup> the existence of time cannot be seriously doubted by sane men. It may be doubted that it is something purely extra-mental or that it is something wholly determined by our own consciousness, but that it exists in some way is beyond question. The real difficulty at hand, then, despite the question we raised above, is what time is and how, not whether, it exists.

To begin the investigation of time, or of anything else, we need to understand the meaning of the word which signifies the thing we wish to comprehend. This is obvious, as language allows us to identify the object of our thoughts; but behind this fact lies another less obvious. To come to know, we have to begin with what we already know. Either there is a pre-scientific knowledge from which we can securely begin to acquire a further knowledge or there is not. If the latter, we cannot ever have true knowledge of things, since there would be no knowledge from which to start. We could, at best, develop some sorts of coherent hypothetical systems which

<sup>11</sup> Newton holds that time is something which does indeed exist outside our minds, but not by being a body or an aspect of body. It is thus an immaterial substance or else an aspect of an immaterial substance; he seems in some texts to imply that it is the duration of God. Cf. Isaac Newton, *Mathematical Principles of Natural Philosophy*, Motte trans., revised by Florian Cajori (Los Angeles: University of California Press, 1962), Vol. I, Scholium to the Definitions, pp. 6, 7–8; Vol. II, General Scholium, pp. 544–46. Hereafter, *Principia*. Cf. also, Alexandre Koyré, *From the Closed World to the Infinite Universe* (Baltimore: Johns Hopkins University Press, 1957), pp. 223–28.

<sup>12</sup> *CPR*, *Ibid.*

would reflect experience, but we could not actually judge between successful models of experience. On the other hand, if there is such pre-scientific knowledge, it must be present to the uneducated and must have been present to the educated before they became educated. Its expression will be in ordinary speech understood by all because expressing what is known by all. So with time. We should try first of all to say what is included in the everyday notion of time, and only later try to develop a more refined, philosophical understanding. But this is surprisingly difficult. To what does the name "time" refer?

We can easily point to what we name "dog" or "cat," and even what we name "motion," or even "thought," in a sense, but we cannot so easily determine what we are trying to point out when we say "time."

This is itself a puzzle, at least if we consider that no one fails to recognize the existence of time and to use the name "time" every day. Time seems to be everywhere—to what would we point in particular if we wished to point to time? If we were trying to converse with a non-English speaker, we would probably point to a clock, but we would here be depending on the common knowledge that clocks measure time. Lacking that shared knowledge, we would probably point to the sun or the moon, running the risk that our interlocutor would think the word "time" refers to the body of the sun or moon. If we pointed to the sun or moon and then moved our hand so as to trace an imaginary line of motion, we would be more likely to communicate what we intend by "time" (especially if we first pointed to the sun or moon and said "sun" or "moon", and then "time" while tracing the path). Here we would be doing something very like what we would have done with the clock (for in each case we are indicating something whose motion measures time), but without the surreptitious invocation of advanced, technical knowledge. Alternatively, it seems, we might beat time with our hands,

using several rhythms in order to avoid the identification of time with a particular one.

Perhaps one of our ploys could convey our meaning to a primitive interlocutor; perhaps not. What is clear is that it is difficult even to say what we intend when we say the word "time." In other cases, we are usually hard pressed to say just what we mean, but we at least can point to instances of what we mean and would most likely be understood by those of moderate intelligence. Even if we have trouble saying just what the difference is between a cat and a dog we would not have too much trouble pointing to instances of what we mean and thereby indicating, however imperfectly, the meanings or at least the referents of our words. Not so with time. Time does not seem to be a "thing" the way a dog is.

And yet we are well aware of time's existence and we use the word with great ease. Time is some sort of reality which is always and everywhere present to us. We cannot imagine a place without time. Though we imagine one in which everything is still, that stillness is itself temporal, it endures in time. We cannot, it seems, easily point to "time" because time is ever-present and omni-present; we have too much of it around us easily to identify any one thing with it. But then it is not any one thing, but seems rather to be something that is with all things.

We can also note that time seems commonly thought to be a quantity of some sort. There is a yesterday and a today, this part and that part of time, and they add up to some bigger time. Understood as a quantity, time raises no eyebrows. Somehow, we all agree, we measure motion or duration by it, saying that "we drove for an hour," or that "Joe lived 30 years." As Newton says, time "by another name is called duration."<sup>13</sup>

But it is just here that we uncover the difficulties touched

<sup>13</sup> *Principia*, Scholium to the Definitions, Vol. 1, p. 6.

upon above: if a thing is a quantity and has parts, it cannot exist without its parts existing or at least one or two of them. But all the parts of time do not exist, for the past is gone, the future is not yet and the present is only a limit of the past and the present.

The problems raised with the existence of time are insoluble if, with Newton, one assumes that time exists independently of mobiles. For Newton, "absolute, true and mathematical time, of itself, and from its own nature, flows equably without relation to anything external."<sup>14</sup> In defense of his notion of time, Newton suggests the inaccuracy of any clock, whether artificial or, like the moon or sun or stars, natural.<sup>15</sup> His view basically reifies the time which we imagine when we imagine a moving point, e.g., in much the same way as his view of place results from supposing that the pure dimensional space in which we imagine mathematical figures is real. He refers to both time and space so understood as "absolute, true, and mathematical," and to the motion measured by these in the same terms. But, leaving aside for the moment space, is there any way to understand how the flux of time can exist on such a view of time?

First of all, it is a likely claim that, apart from spiritual things, only bodies and their accidents exist. Motion is something of a body, and it is reasonable to think that time is too. If not bodily, then it is immaterial or spiritual. But if it were spiritual, it would not seem to be a subject for physical science, and yet all natural philosophers and scientists do consider it. And we perceive motion through sensation, which is a perception of physical things, not of spiritual things.

A more perfect argument for the non-independence of time can be formulated as follows. If time is not in any way the attribute of another, its existence is independent of all others

<sup>14</sup> Ibid.

<sup>15</sup> Ibid., pp. 7-8.

(not in the sense that it would be necessarily uncaused, but in the sense in which we say a created substance has independent existence while its accidents do not). In this case, the present now cannot be understood as relying on another subject for its existence, but must exist independently. Since the now is what exists of time, and time "flows . . . without relation to anything external,"<sup>16</sup> the now must either be a physical mobile the motion of which is an equable flowing (a claim which would make time inhere in some physical substance other than itself, contrary to the supposition), or it must be the very mutation which flows equably. On Newton's view, time or the now turns out to be a change which is itself a substance, not the change of anything. Thus, if it is right that the past and the future do not exist now, as is obvious, and if the now itself is only an ever-changing division between these non-beings, then, supposing with Newton that time is independent of substance, that there is no further ontological peg for the now to hang its hat on, this poor fleeting now is itself sheer becoming, a becoming not of anything, but a substance which is itself mere change. Such a thing, besides being bizarre on its face, is shown to be impossible in Aristotle's *Physics* when he shows that every change involves a material which underlies the change, that every change is of something composed of material and form.<sup>17</sup>

This problem, like all good dialectical problems, points us in the direction we need to move. For we see that, if the now is a stand-alone being, we are up against impossible oddities. Consequently, the now is not of this sort, but is something which somehow belongs to something else.

What, then, is time an aspect of? There are clearly two sorts of things in the world, called by St. Thomas and Aristotle "accidents" and "substances," the former being those things

<sup>16</sup> Ibid., p. 6.

<sup>17</sup> *Physics* I, 7, 189b30-91a22.

which exist by inhering in others, the latter those which do not. Time, since it is not a substance, must be a sort of accident of substance. But given that time is by its very notion always other than itself, incessantly flowing, it must be an accident of something which is changing precisely insofar as that something is the subject of time. Hence, time is necessarily something of a mobile as such.<sup>18</sup> This claim also matches our perception that time and motion are known together—we cannot imagine time without imagining motion, or motion without imagining time.

This conclusion can hardly come as a surprise. What exists are things, i.e., substances, in Aristotle's sense, and their accidents. These are what are given to us in experience.<sup>19</sup> But the things we are most aware of are physical things, it being a matter of proof or of faith that there even are non-bodily realities.<sup>20</sup> Yet the awareness of time is common to absolutely all men, so that time must be something we perceive in perceiving what anyone perceives; no special esoteric experience or knowledge is presupposed to the awareness of time. It is reasonable to think, then, that time is something immediately present to us in our awareness of the natural, physical world

<sup>18</sup> *Physics* IV, II, 219b1-2; III, 2, 7-8.

<sup>19</sup> It is probably the case that the most definitive knowledge of the distinction in question is our intimate knowledge that we are ourselves the same year after year even as we grow and change. Our various sizes, locations, colors, etc., are our accidents while we are the substances underlying such incidental attributes.

<sup>20</sup> We may be tempted to say that we see no reason for there not to be immaterial things, but this is not an argument. The mere fact that I do not see a contradiction in a notion does not imply that there is none: ignorance is not knowledge. To assure ourselves that there really is no contradiction in what we are talking about, we need to either see an instance of the nature in question in our experience or prove that, given something in our experience, this nature must really exist. This is why Aristotle says that "to seek what [a thing] is without having the 'that it is' is to seek nothing." (*PA* II, 8, 93a26-27.)

around us. As a result, we see that, since time always changes and change implies a subject, time itself must be something of a substance which changes, i.e., it is something of a mobile as such.

If so, however, note the consequence: it is of the mobile in virtue of motion. For what belongs to the mobile as such is motion. Again, this is not surprising: time implies change, since time itself is always flowing, whence, that it is of another in virtue of the flowingness or motion of that other is only natural.

When Aristotle discusses the definition of time, he begins by noting that we sense time in sensing motion.<sup>21</sup> If time is something of a mobile as such, this is reasonable, since the perception of time would necessarily imply the perception of motion in some way. More importantly, since we do in fact perceive time in perceiving motion, and cannot even imagine perceiving time without perceiving motion, we must conclude that time is something of a substance *through motion*, which is more proximate to substance, or that motion is something of a substance through time, which would, on this view, be more proximate to substance.<sup>22</sup> Of these options, it seems obvious that we should choose the first. Motion seems to be in mobiles more directly, inasmuch as motion is the becoming of a term in the mobile. The Newtonians, e.g., imagine time to be extrinsic to mobiles, while they still held, with everyone else, that motion is in the mobile.

But given that we explained, to the extent we did explain, the existence of time through that of motion, we must ask, how can motion itself exist? For the existence of motion itself seems problematic in a clearly analogous way.

<sup>21</sup> *Physics*, IV, 219a3-4.

<sup>22</sup> Perhaps it would be well to note here that, while all accidents inhere in substances, some are in substance through others, as, e.g., color is in substance through surface, and shape through dimensions. Cf. *Summa Contra Gentiles* IV, c. 63.

However, someone may be at a loss as to whether time would or would not be, were there no soul. For, should it be impossible that there be something numbering, it is also impossible that there be something numerable; whence, it is clear that neither would there be number. For number is either what has been numbered or the numerable. However, if nothing else is naturally apt to number except the soul (and, of the soul, the mind), it is impossible that time exists, if soul does not. But only that which is time as a subject would be, i.e., if motion can be without soul. However, the before and after are in motion, and time is these insofar as they are numerable.<sup>23</sup>

Here, Aristotle is referring to his definition of time, "the number of motion according to before and after."<sup>24</sup> Given that time is a number, he says, it seems to be dependent upon mind, for mind alone can number and even what is numerable cannot be numerable without what can bring its potency for being numbered into act. But, he says, the subject of time, motion, still would exist, if motion can be without soul. He seems to be suggesting that motion itself may also depend on soul, but the reason that motion would depend on soul is presumably not the same as the reason he gives here for time depending on soul, for number is not in the definition of motion itself.

The reason would seem rather to be more akin to the difficulties raised above about time, that all that exists of motion is the momentum, i.e., the division of motion. The beginning and end of a motion do not exist during the motion, and all that does exist is a division between the prior and the posterior parts of the motion. But then motion, like time, exists only by a division of two non-beings. And while we resolved Aristotle's initial difficulty with the existence of time by pegging

<sup>23</sup> *Physics* IV, 14, 223a21-29.

<sup>24</sup> *Physics* IV, 11, 219b1-2.

it onto motion's existence, we find no more fundamental flux to play the same role in explaining the existence of motion.

To see more clearly how motion exists despite its inherently flowing nature, we have to go back to consider more carefully what motion is.

Perhaps we should start by noting what may be the most important and obvious thing we can say about motion, that it is a kind of becoming, not of being. If so, then we ought not to expect it to exist in the same way as the things which around us are most fully being, i.e., what Aristotle calls substances and we might call "things." Motion is not a thing in the way a horse or a dog is. Still it is not nothing, either. It is a becoming, an in-between thing, hard to understand for this very reason. Further, it does not have the existence of an accident, for that it is a stable existence, though inherent in another thing. Motion is only a becoming of such an accidental being, of place, or size, or quantity.

. . . being is said in many ways, but all in regard to one principle. For some are called beings because they are substances, some because they are affections of substances, some because they are ways to substance or destructions or privations or qualities or productive or generative of substances or of the things which are spoken of in relation to substance or the negation of some of these or of substance. Whence we even say that non-being is non-being.<sup>25</sup>

Aristotle points out that all senses of "being" imply a reference to being in the sense of substance. Accidents are called beings because they are qualifications of being in the sense of substance, and motion is called being because it has as its term the being of an accident. Motion, then, is called being because some thing or being, in the first sense of thing or being, that is, substance, is coming to be in some way. The

<sup>25</sup> *Metaphysics* IV, 2, 1003b5-10.

reality of motion is dependent upon the reality of the mobile. It is something of the mobile as such.

When we understand motion as a becoming, we see that it is in between being and non-being. What is becoming is in some way, so becoming is not simply non-being, but every becoming is a becoming of a being, so motion is on the way to being, but is not being. It is from something opposed to the being which becomes, however, for the being which becomes cannot already be before it comes to be. So becoming is between the being and non-being, or, as Aristotle puts it in the *Physics*, between form and privation.<sup>26</sup>

But insofar as motion is something real and not a mere illusion or some non-being, it must be an "act," by which we mean that which is opposed to mere potency or ability. We see that some things are and that other things are not—for example, I see that I am in this room and not in the room I was in earlier. I also see, though, that when I was in the other room, I was able to be in this room, the proof of which is that I am now here. So I see that the thing which is not in a certain way but later is in that way, e.g., was not here and now is, must, even when it was not in that way, be able to be in that way, that is to say, must be in potency to being that way. And yet mere potency is not the existence of anything—what is able to be but is not cannot be an ultimate ground; rather, what is must be real, or "in act." So what is potential is always something in act, the potential is always an aspect of the actual. Motion, then, is an act as opposed to a mere ability. When a ball is lying still, it is in potency to many places and actually in one, but there is another sort of "act" which it can have but does not, and that is motion.

<sup>26</sup> By "form" here, we need indicate no more, I think, than whatever comes to be in a mobile in virtue of a becoming. The term of the motion is a sort of being, some new thing about the mobile, the "form," whether the novelty is merely being in a new place or something more inward.

But there are many acts of many things. To specify motion, we have to name that of which it is the act. This is akin to what Aristotle does with his definition of the soul, saying it is the act of an organized body.<sup>27</sup> He is specifying the act by referring to that of which it is the act. In the case of motion, we have to say that the act is of what is not fully arrived at its term, because, were it the act of what has already arrived at its term, it would be an act had by the mobile after the motion is over—so the mobile both would and would not be in motion. Consequently, since the mobile is only able to be at the term but is not there yet, motion is the act of the potential as such, that is, insofar as it is still in potency to the term in question.

We must, for clarity's sake, distinguish the act between the terms which is motion from another imperfect act which is between the terms. In heating water, for example, we may stop heating it before it begins to boil. The warmed water has a temperature which is higher than it originally had but lower than it would have had had we left it on the stove. The temperature of the warmed water is a reality of the water which is imperfect relative to the boiling point, and may therefore be called an imperfect act. But such rest in an intermediate state is not motion. St. Thomas makes the distinction in question in the following text:

Unde quodcumque imperfectum accipiatur ut non in aliud perfectum tendens, dicitur terminus motus et non erit motus secundum quem aliquid moveatur; utpote si aliquid incipiat dealbari, et statim alteratio interrumpatur.<sup>28</sup>

We see that the imperfect act which terminates a motion does not have in its notion any potency to a further act; though

<sup>27</sup> Aristotle, *De Anima* II, 1, 412a27-28.

<sup>28</sup> St. Thomas Aquinas, *In Octo Libros Physicorum Aristotelis Expositio*, ed. P. M. Maggiolo, (Rome, Marietti: 1954), L. III, l. 5, n. 324. Hereafter, *In Phys.*



it is in fact imperfect, it has only the notion of the term of a motion and not the notion of the beginning or principle of motion. The division of motion, on the other hand, does have the notion of a principle of motion insofar as it is something which tends or is itself a tendency to a further term. Whence, just as act, it is imperfect.

So far, so good. But the question concerns the manner of existence of the division of motion, that aspect of motion which exists in the mobile at any moment, i.e., what the medievals called the "momentum." For motion can exist only insofar as the division of motion exists. The modern usage of the word momentum can point us, I believe, in the right direction, for this usage more explicitly brings out the notion that there is something in what is moving in virtue of which it inclines to a further act. In fact, if motion is an imperfect act and what exists of it outside the mind is an act of a potential which is defined in reference to a further act, then it seems that the division of motion even as understood by the medievals, for example, implies an inclination or ordering to a further act. What exists of motion is an act which is imperfect because it is ordered to a further act and is defined as so ordered—that's what it is. In short, to be a division of motion is not like being the division of a length: the division of a length has no inclination toward the end of the length, but the division of motion does have, in fact, is, an inclination to the term of the motion.

Motion, then, exists through the inclination or order of the mobile to a further act, which inclination or order is found in the mobile and exists through the mobile. Now, "ordo est quaedam relatio,"<sup>29</sup> as St. Thomas says, and relations are of various sorts. In particular, some relations are real and some are rational. For example, the relations between double and

<sup>29</sup> St. Thomas Aquinas, *Questiones Disputatae de Veritate*, Q. 27, a. 4, SC 4. Hereafter, *QdV*.

half or between father and son are real. At least some relations must be real if we are not to say that studying the order of the cosmos, for example, or considering the relative sizes of quantities in mathematics or in physics is really a study of some merely mental reality.<sup>30</sup> But the relation between genus and species or the sameness of Socrates with himself are only rational.<sup>31</sup> The latter case is particularly clear, for a relation must be between two things and if there are not really two distinct things, as there is not in the relation of sameness between Socrates and himself, then the relation itself cannot be a real thing outside the mind. In order for a relation to be real, several conditions must be fulfilled.

Ad hoc autem quod aliqua habeant ordinem, oportet quod utrumque sit ens, et utrumque distinctum (quia eiusdem ad seipsum non est ordo) et utrumque ordinabile ad aliud.<sup>32</sup>

If one of the two beings (or both) is not real then they cannot have a real relation. The relation of species to individuals or of the genus to species is a relation of reason and not a real relation because the genus and the species depend upon merely mental existence.<sup>33</sup> There is no universal, generic animal walking around somewhere. Moreover, if the distinction itself between the two beings is not real but only rational then the relation is not real, as, for example, in the case of the relation of sameness between Socrates and himself. And the two

<sup>30</sup> St. Thomas Aquinas, *Questiones Disputatae de Potentia*, Q. 7, A. 9, c. Hereafter, *QdP*.

<sup>31</sup> This is not the same distinction as that between relations *secundum dici* and relations *secundum esse*. This latter distinction is between those things the names of which are not the names of relations (though they may imply relations), and those things the names of which are the names of relations, for example, head as related to body is opposed to part as related to whole. Cf. St. Thomas Aquinas, *Summa Theologiae* Ia, Q. 13, A. 7, ad 1.

<sup>32</sup> *QdP*, Q. 7, a. 11, c.

<sup>33</sup> St. Thomas Aquinas, *De Ente et Essentia*, Ch. 4.

things must have a real ordering to each other, at least if the relation is to be real on both sides. For example, the relation of double and half is just as real on one side as on the other, while, on the other hand, the relation of knowledge to what is known is a real relation though the relation of the known to knowledge is only rational, for there is no real order of the knowable to knowledge; the knowable is not perfected in any way by being known, no being is added to it, as being of some (admittedly obscure) kind is added by a real relation.<sup>34</sup> Finally, as St. Thomas often notes, there must be a real foundation in the terms of the relation for it to be real. If there is no ground for a relation in the thing thought to be related, the relation is only rational, as in the example of the relation of the knowable to knowledge or of God to creatures.<sup>35</sup>

The conditions, then, of real relations are that there be two real terms, which are really distinct, and between which there is a real order. We have seen that there seems to be an order of the momentum or division of motion to the term of motion, but a further puzzle now presents itself. For the term of the motion is precisely what will become, not what is. Once again, what is in flux presents difficulties because it is not all at once, but something of it, here, what it is ordered to, is not yet existent. Thus, the order of the momentum to the term of motion cannot be a real relation. But if so, and the momentum is all that exists of motion, then it seems that motion does not exist in the world but only in our minds. What is real of it outside the mind, then, is imperfect act, an act which is imperfect just as act, the imperfection of which can be grasped only by relating that act to a further act, that is, the term of the motion. But that a relation is a relation of reason.

Well, do we really want to say that motion is the sort of

<sup>34</sup> *QdP*, *Ibid*.

<sup>35</sup> *Summa Theologiae* Ia, Q. 28, a. 1, c.; *QdP* Q. 7, a. 10.

thing which depends upon the mind for its existence? Is it a fiction? Or is it, like genus and species, something found only in the mind?

We should note first that rational being is not unreal, and, while it is always real in the sense that it is really in the mind, it can also be real in another sense, namely, by corresponding to the way things are, even if remotely. For example, if my idea of circle corresponds to the way circles really are, then my idea is real because it is really some thing in my mind and also because the idea corresponds to the way circles are outside my mind. The former is the reality common to all ideas, however hare-brained. The second is a reality in a way borrowed from things proximately, that is, the idea has a sort of reality because it directly corresponds to the way things are; my idea of circle has a sort of reality because it corresponds to the way circles really are.

But ideas may also have a more remote foundation in reality. If I note that the nature "circle" is found in this and in that figure, but not in every figure, that there are many things corresponding to the idea of circle, then I see that circle is a species of figure. This notion of species is not an idea which directly corresponds to some reality outside the mind; rather, it names the relation between my idea circle and the things which are circles.<sup>36</sup> So the correspondence of this idea "species" with reality is more remote. It remains true, though, that circle is a species. The fact that the foundation of the idea is more remote does not preclude the idea's being founded and true.<sup>37</sup>

However, there are at least two ways in which a relation of reason is founded in reality, only one of which permits the

<sup>36</sup> *De Ente et Essentia*, Ch. 4.

<sup>37</sup> It is this remote foundation in reality which allows logic, which deals with the rational relations of genus, species, subject, predicate, middle term, etc., to be essentially oriented to the truth. Cf. *QdP*, q. 7, a. 11, c.

relation to be predicated of the things understood as related even in their being outside the mind.

. . . sicut realis relatio consistit in ordine rei ad rem, ita relatio rationis consistit in ordine intellectuum; quod quidem dupliciter potest contingere: uno modo secundum quod iste ordo est adinventus per intellectum, et attributus ei quod relative dicitur; et huiusmodi sunt relationes quae attribuntur ab intellectu rebus intellectis, prout sunt intellectae, sicut relatio generis et speciei: has enim relationes ratio adinvenit considerando ordinem eius quod est in intellectu ad res quae sunt extra, vel etiam ordinem intellectuum ad invicem.<sup>38</sup>

Thus, in those cases in which reason discovers a relation in its act of knowing, that relation is predicated of the things as they are in the mind, i.e., the concepts themselves in mental existence. To be a universal predicate, for example, is not something in the nature of things but something which belongs to a nature insofar as it is present in the mind. It is a fallacy to argue that Socrates is a man, and man is a species, therefore, Socrates is a species, for the relation found in the predication of the nature of individual man is not something outside the mind but is something which is attendant upon the nature as present in the mind. The nature itself does not have the notion of relation attached to it, except accidentally as it exists in the mind. For this reason, the relation is not predicated of the thing outside the mind, or even of the nature *per se* when it is in the mind, but only of the nature as understood.<sup>39</sup>

Alio modo secundum quod huiusmodi relationes consequuntur modum intelligendi, videlicet quod intellectus intelligit aliquid in ordine ad aliud; licet illum ordinem intellectus non adinveniat, sed magis ex quadam necessitate consequatur modum intelligendi. Et huiusmodi relationes intel-

<sup>38</sup> Ibid.

<sup>39</sup> *De ente et essentia*, Ch. 4

lectus non attribuit ei quod est in intellectu, sed ei quod est in re. Et hoc quidem contingit secundum quod aliqua non habentia secundum se ordinem, ordinate intelliguntur; licet intellectus non intelligat ea habere ordinem, quia sic esset falsus.<sup>40</sup>

There are also some relations of reason which are predicated of the thing even in its own natural or extra-mental existence. St. Thomas gives, as an example of the attribution of a relation of reason to a thing outside the mind the statement, "today is before tomorrow."<sup>41</sup> While tomorrow does not exist now, and therefore today can have no real relation to it, we nevertheless predicate a relation of them, and do so truly. St. Thomas says that we do this when reason understands one thing in relation to another though it has not actually discovered the relation in things, but rather, by a sort of necessity, sees one thing in relation to the other. Despite the fact that tomorrow does not exist today, we can hardly avoid thinking of today as before tomorrow. And the statement is no doubt true even if it involves a mere relation of reason.

Thus, in the one case of relations of reason, the mind discovers relations among its own concepts and propositions or between these sorts of things and real things. Such relations are not predicated of extra-mental things because they belong to those things only in their state of being understood, not in their own natures nor in the things as they exist in nature, outside the mind. In the other case of relations of reason, the mind, in considering some particular nature or thing, recognizes that that sort of thing, not our notion of it, can only be understood in reference to something else. Such relations are predicated of the thing conceived of as related because the very nature of that extra-mental thing itself is only intelligible by such a reference. The knowable, for example, is intelligible

<sup>40</sup> *QdP*, q. 7, a. II, c.

<sup>41</sup> Ibid.

as knowable only by seeing it as related to knowledge, but this relation is not something real in it.

Before going on, we need to see that we really have no choice but to admit our ability to make this predication truly, however puzzling it is. Because a real relation can only exist between things which are real and are distinct, when we say "Socrates is the same as himself," we are only speaking of a rational relation. But surely we do not want to *deny* that Socrates is same as himself. The statement is true even though it seems strange upon reflection. Here is what St. Thomas says about this example:

. . . aliquis est idem sibi realiter, et non solum secundum rationem, licet relatio sit secundum rationem tantum, propter hoc quod relationis causa est realis, scilicet unitas substantiae quam intellectus sub relatione intelligit. . . .<sup>42</sup>

Were we to deny, faced with the fact that the relation of identity is only a rational one, that Socrates is same as himself, we would be saying that Socrates is not the same as himself and so that the substance which is Socrates does not have unity. The unity of Socrates is not a relation of reason but is understood through a relation of reason. By denying the relation of reason, we would be in effect denying its ground. Something similar must be said about the predication today is before tomorrow and about the case of the momentum's relation to the term of motion.

. . . ratio motus completur non solum per id quod est de motu in rerum natura, sed etiam per id quod ratio apprehendit.

De motu enim in rerum natura nihil aliud est quam actus imperfectus, qui est inchoatio quaedam actus perfecti in eo quod movetur: sicut in eo quod dealbatur, iam incipit esse aliquid albedinis. Sed ad hoc quod illud imperfectum

<sup>42</sup> Ibid, ad 3. Similarly, God is really the Lord of creation though he has no real relation, but only a rational one, to creatures. Cf. *Summa Theologiae* Ia, Q. 13, a. 7, c., ad 4 and ad 6.

habeat rationem motus, requiritur ulterius quod intelligamus ipsum quasi medium inter duo; quorum praecedens comparatur ad ipsum sicut potentia ad actum, unde motus dicitur actus; consequens vero comparatur ad ipsum sicut perfectum ad imperfectum vel actus ad potentiam, propter quod dicitur actus existentis in potentia, ut supra dictum est.

Unde quodcumque imperfectum accipiat ut non in aliud perfectum tendens, dicitur terminus motus et non erit motus secundum quem aliquid moveatur; utpote si aliquid incipiat dealbari, et statim alteratio interrumpatur.<sup>43</sup>

The relation of the momentum to the term of motion is necessary in order to understand it as a division of motion, and not simply as any sort of imperfect act. Consequently, reason completes the notion of motion by understanding a relation between the momentum and the term of motion, even though that relation is not itself a real relation. Nevertheless, such a relation must be grounded on some real aspect of motion as it is outside the mind, or else its predication of the real being outside the mind is unintelligible. It seems to me there are two possible ways to understand this grounding.

First, and most obviously, the order of the momentum to the term of the motion, that is to say, to the mobile's possession of the term, is grounded in the mobile's order to the principle of the term, that is, in the case of locomotion, the place. Since to be in place is not the same thing as to be a place,<sup>44</sup> it is not precisely the same to be ordered to a place and to be ordered to being in a place, though neither, obviously, could be without the other. To be in a place is the term of the motion but place itself is presupposed to the motion

<sup>43</sup> *In Phys.*, L. III, l. 5, n. 324

<sup>44</sup> *Categories*, 4, 2a1-2; 6, 4624-25. "Place" is in the category "quantity" (or "how much"), but "being in a place" is its own category, best translated, "where." Aristotle's examples of the category "where" are "in the Lyceum" and "in the marketplace;" examples of places, on the other hand, would be "the Lyceum" and "the marketplace."

and is in fact the real ground for a rational relation which the momentum has to the term of the motion. We see that the mobile is ordered to a place and so see that what the mobile has of motion, the momentum, is ordered to being in that place, and we now see further that the latter relation of reason is founded in the former real relation. We also see more clearly now why Aristotle says that the before and after of time are founded upon the before and after of motion and the before and after of motion are founded upon the before and after of place.<sup>45</sup> The last mentioned before and after is a real relation which grounds the rational relations found in the first two. The mobile has, as mobile, a real order to a further place, both the momentum of the mobile and the place being real and distinct beings.<sup>46</sup> As St. Thomas says:

. . . respectus aliquando est in ipsa natura rerum; utpote quando aliquae res secundum suam naturam ad invicem ordinatae sunt, et invicem inclinationem habent. Et huiusmodi

<sup>45</sup> *Physics* IV, 11, 219a14-19.

<sup>46</sup> Note too that this explanation seems to indicate the primacy of locomotion, for in the other cases of motion, namely, growth or diminution and alteration, the term of the motion does not preexist. That preexistence must therefore be supplied from elsewhere and it is possible that it is found in the preexistence of the places which are the terms of locomotions presupposed to the other changes. Here we should make another distinction for the sake of clarity: when a mobile moves to a new place, the place to which it is moving may only be potentially existent, or it may be actually existent. If, e.g., water is poured from a cup, the air comes to be in the cup and the cup is a preexistent place for the air. On the other hand, if a ball moves from one side of a room to the other, the place which the ball comes to occupy is only potentially present before the ball arrives, for the place is the innermost surface of the container and that innermost surface is not actual before the ball arrives. The air was one continuum before the arrival of the ball, and the air which was where the ball later is was in the air of the room as a part in a whole, not as a placed in a place. (Cf. *Phys.* IV, 4, 211a29-34.) Nevertheless, even this potential mode of existence of a place provides an extrinsic preexistent term of the mobile insofar as the dimensions of the air are really present.

relationes oportet esse reales. Sicut in corpore gravi est inclinatio et ordo ad locum medium, unde respectus quidam est in ipso gravi respectu loci medii. Et similiter est de aliis huiusmodi.<sup>47</sup>

While the example of heaviness is, in St. Thomas' mind, wrapped up with the idea of natural place, there is already some sort of ordering just insofar as a thing has momentum to a further place. Such an ordering is present not only in natural locomotion, supposing there is such a thing, but in every locomotion of any sort at all. In fact, the order or inclination of a body due to gravity and of a body due to momentum seem very much akin, each being some sort of determinate inclination in a direction or to a place, as the experience of weight and of impact indicate.<sup>48</sup>

Alternatively, the term of the motion may be found to exist simultaneously with the motion in the agent of the motion. If, as Aristotle and St. Thomas argue,<sup>49</sup> every motion demands a mover because the mobile is as such only in potency to the term of the motion and only something which has an act can produce that act in what has a potency for that act, then there must be an agent for every motion, an agent which has the act in question in some way. Of course, it may have an act in a way other than the way the mobile will have it, as, for example, the carpenter has the form of the house without himself being a house.

. . . id quod semper habet rationem patientis et moti, sive causati, ordinem habere ad agens vel movens, cum semper

<sup>47</sup> *Summa Theologiae*, Q. 28, a. 1, c.

<sup>48</sup> In a way, the likeness of the experience of gravity and of impact, which depends upon relative velocity, and more particularly relative acceleration, will form the basis of General Relativity. Cf. Albert Einstein, *Relativity, The Special and General Theory* (New York: Crown Publishers, 1961), Ch. XX, pp. 66-70.

<sup>49</sup> Cf. *Physics* VII, 1, 241b34-243a31 (or, in the alternative text, 241b16-243a1); VIII, 5, 257b6-12; *In Phys.*, *ad loc.*; St. Thomas Aquinas, *Summa Contra Gentiles* I, 13.

effectus a causa perficiatur, et ab ea dependeat: unde ordinatur ad ipsam sicut ad suum perfectivum.<sup>50</sup>

Here, the order is to the agent. But because the agent must have what it gives in some way, the order of the patient to the agent can ground its order to the terminal act. This second understanding of the real ground for the relation of the momentum to the term of motion underlines the priority of act to potency.

The relation of the patient to the agent seems ultimately to be, according to the following text, the ground of the rational relation found in the order of the momentum to the term of the motion:

. . . . Quantum igitur ad id quod in rerum natura est de motu, motus ponitur per reductionem in illo genere quod terminat motum, sicut imperfectum reducit ad perfectum, ut supra dictum est. Sed quantum ad id quod ratio apprehendit circa motum, scilicet esse medium quoddam inter duos terminos, sic iam implicatur ratio causae et effectus: nam reduci aliquid de potentia in actum, non est nisi ab aliqua causa agente. Et secundum hoc motus pertinet ad praedicamentum actionis et passionis: haec enim duo praedicamenta accipiuntur secundum rationem causae agentis et effectus, ut dictum est.<sup>51</sup>

The first sentence of this text indicates that to be in motion is to have an imperfect act, an act which, insofar as it is imperfect, is understood as belonging to the same genus as the act which is imperfectly found in the motion, i.e., the final term of the motion. Thus, locomotion is in the genus "where," growth and diminution in the genus "how much" or "quantity," and alteration in the genus "such and such" or "quality." When I am growing, I am imperfectly the size I will attain, by having size in some way, a flowing or becoming way. But mind adds the notion that the real thing is a middle between two terms.

<sup>50</sup> *QdP*, q. 7, a. 10, c.

<sup>51</sup> *In Phys.*, III, l. 5, n. 324.

The rest of the quotation says that in order to understand motion as a middle between two terms, reason must apprehend something which is not out there in nature as a real relation would be. The relation of the mobile to its term, then, is something reason understands in the momentum, but it is not a real relation in the momentum. This rational relation implies further the categories of action and passion, for the ordering to the further act is only possible through an already existent act which is present to the potential, i.e., through an agent.

The two explanations of the existence of the term during the motion do have an order between them. Because every motion demands a mover, the existence of the term of motion in the agent will always be an aspect of motion. This is a universal condition for motion, because act is absolutely prior to potency.<sup>52</sup> On the other hand, locomotion seems to be the only kind of motion in which, during the motion, the term of the motion can exist in some way besides in the agent, insofar as place is like an extrinsic term of this motion. Other motions, like growth or alteration, tend towards a term which does not preexist except in the agent. When something heats, for example, the heat does not exist as a term existing outside the mobile except in the power of the agent or in the newly made proximity of the mobile to another agent which can cause the heat. Consequently, only if locomotion is the first motion or the only motion can we understand the universe to have a kind of completion. If, for example, heating were the first motion, then the term of the motion would have existence only in the agent, the immobile first mover. This mover not being a natural one, we would have arrived immediately at a super physical cause. But if we hold that the first motion is locomotion, then there is a natural principle, place, which to some extent undergirds the existence of motion by providing a kind of extrinsic term of motion even during the motion.

<sup>52</sup> *Metaphysics*, IX, 8, 1049b4-1051a3.

The universe would seem to be more complete, then, if locomotion is the first motion, though even this motion requires that the mover have the term of the motion in it in some way.

Thus, in any case the act of the term must be in the agent, but in a more perfect world we would also have the term of the first motion, a place, in the physical world. If locomotion is not the first motion, but, say, the expansion space-time is, and if this is not somehow reducible to a locomotion<sup>53</sup>), then the term of motion would, during a motion, exist only in the power of the agent. This is not a problem in the sense that a contradiction would be, but it does seem that there ought to be, within the confines of nature, principles as sufficient as possible for the explanation of natural phenomena, certainly of one so basic as motion.<sup>54</sup>

Time, then, does not exist independently but has its existence from a mobile as mobile, or, in other words, from the mobile as subject to motion. Thus, it is part of the very notion of time that it is of a body in virtue of that body's motion. Time, then, is something of motion. It exists only because its division exists, and that division exists because motion's division exists. So these divisions are linked and each in a way forms the basis of the existence of time. But are there really two distinct divisions here, i.e., are there two things in the physical world for the mind to consider?

Given that we always sense time when we sense motion

<sup>53</sup> Since space-time itself is supposed to be produced by some prior change, it seems it cannot be itself the result of a locomotion. Whether this is an intelligible conception is beyond the scope of this paper.

<sup>54</sup> The feebleness of existence of motion and time and, in particular, their dependence on mind, underline in a remarkable way the basic insight of the third way of St. Thomas, which argues that contingent beings are unintelligible without some necessary being. (Cf. *Summa Theologiae*, Ia, Q. 2, a. 3, c.) A world of sheer becoming, i.e., a purely material world, cannot explain itself. Rather, as Plato said, the world of becoming is nearly a non-being, is only a shadow of a being.

and vice-versa, and that nobody doubts that every motion occurs in time, if we were to hold that the now is not the same thing outside the mind as the division of motion, it seems we would have to say either that the two are sensed as different things but are always sensed together, or that only one is sensed and the other is known to be together with it by an argument. The latter position is not tenable; we are not aware of any such argument and if there were such an argument it seems likely that at least some people would fail to make it for themselves. But the togetherness of the now and of the division of motion is so well known that no one misses it. Besides, it is experienced as something of perception, not of reason.

If this is so, then, looking at our experience of time and motion and of their divisions, we need only ask whether there are two things sensed or not. Is the experience like seeing two men who are always together and becoming so used to this fact that we never think of the one man without thinking of the other, or is it like seeing a curved line and seeing that it has two aspects, that it is both convex and concave? If we were asked to imagine the flow of time, we would, I think, imagine a line with a point moving along it. If we try to imagine time apart from motion, we instead imagine another motion. Even if we imagine a resting universe, utterly still, we still seem to represent it to ourselves as in time by comparing the enduring disposition of this static world to a vaguely imagined motion, the parts of which manifest to me the different parts of the duration of that world. If, on the other hand, we try to imagine motion apart from time, we simply fail. I do not see that we have any image or concept of such atemporal motion.

So time and the now are not perceived as other than motion and its division, and, *a fortiori*, we do not link them by argument. It remains that they are different in the way that the convex and the concave are different, namely, because

we consider one thing under different lights. Time is motion considered in some special way, and the now is the division of motion considered in some special way.

Further reason to think this way about time and the now can be gathered from some things we saw earlier. First of all, the division of motion is ordered to the further act which is the term of the motion. If this division is so ordered and is identical in being with the now, then we see why we always understand the now to be the beginning of a new part of time. Secondly, as motion has parts, so does time: both are continuous but do not have parts with relative position. Both are continuous by having their parts joined by indivisibles which exist and which are the only aspects of them that do exist outside the mind.

Time, then adds some *ratio* to motion and the now adds a *ratio* to the momentum, but they are the same *in re*. What is the additional *ratio*? Time is some sort of measure of motion; though it is in reality a motion, it is one used as a measure of another. Insofar as time is a measure of motion, it is thought of as a quantity. As such, it is a determiner of motion, for it determines motion with regard to "how much" or quantity.

But how does time contain or determine motion? The answer here would seem to depend on whether or not there is a first motion by which other motions are measured. If there is, then the number of this motion will be time in the most primary way. The time which is the number of this first motion will contain or determine other motions by measuring them as a quantity measures another quantity, for the divisions of the first motion will correspond to the divisions of the others, and the numbering of the divisions of the first will be the numbering of the divisions of the others.

But in the nature of things, the time of the first motion will not be itself measured by another time or motion, though we might use some convenient motion, such as the rotation of the earth, as our standard of measurement. The number of the first motion and the motion itself are only different in ratio,

as we have seen, so here the time cannot be an external measure of the motion. Just as when we measure material with a yardstick by lining up the end points of the yardstick with the parts of the material, so we measure secondary motions by lining up their divisions with the divisions the standard motion. And as the yardstick itself is not so measured, but is only a measure, so the first motion would not be measured but only be a measure. We could, of course, choose to measure it by another motion, but the latter would be in its nature posterior to it, not a natural measure.

However, if there is no first motion, there would be no naturally prior motion to use as a measure, though there still could be movements which are better suited as measures for our purposes. In this case, we could only choose what is more suitable for us as a measure without that choice being in any way natural or unnatural.

In either case, what we use as a first measure, whether its priority has to do with some natural order or not, will not itself be measured but will be only a measure. We will still recognize its parts and in some way try to assure that the parts of the measure are alike, are as homogeneous as possible, but that judgment will necessarily be made not by reference to some external standard but by reference to one internal to the motion, for we will be comparing one part of the motion to another when we judge its uniformity. This judgment of the likeness of the parts of the measuring motion will require comparing them in our memories, not comparing them to some other motion. Our grasp of the uniformity of the motion chosen as a measure will clearly be limited.<sup>55</sup>

If it is right to say we measure motion by time and that

<sup>55</sup> One wonders how the physicist can choose a standard such as the oscillations of a cesium atom, when such a thing cannot be directly sensed. The motions here must be judged to be regular by means of some theory, which itself must depend upon the perceived uniformity of some macroscopic motion, and some argument that the original motion is less regular than the microscopic one.



motion is in time as in a container or measure, then we ought to ask, what is it to measure something? When we measure something, what we are doing is making its quantity known in terms of another quantity, the unit of measure, which we take as known. We measure length in inches or centimeters, but these latter are assumed to be known and are not themselves measured unless we take up another unit to do so. So too with pints and acres and days. Moreover, what we do, at least when we measure in a more perfect way, is to set up a numerical ratio between the unit and the quantity we are measuring. A yard, for example, contains 36 inches; i.e., yard : inch :: 36 : 1. We can also measure less perfectly, saying, e.g., that we have "a little more than three yards of cloth," that is, that the cloth we have is to a yard of cloth as 3 and a little more to 1. In either case, we are measuring by using a numerical ratio.

Secondly, we are measuring by a unit of the same kind. Length is measured by length and time by time. We do measure temperature by distance, as in a mercury thermometer, and usually measure an area by measuring the lengths of the sides of the area, but in both cases we do so because we see a relation between what we wish to measure and what we actually measure—increased temperature causes increased volume in the mercury, which, being restricted to a tube of uniform bore, correlates directly with an increase in the length of the mercury column. And increasing the side of a square causes an increase in the area of the square. In the first case, we measure a cause through its effect, in the second, an effect through its cause. But directly, we measure in both cases length by length: one "degree" on the thermometer scale is represented by a length, and we just count up the number of such lengths; and so too, more obviously, in the case of the areas.

But motion is also measured by time, a puzzle only if we think time is simply other than motion. If time were other than motion and were an effect or cause or in some other way directly correlated with the quantity of motion, we might say

we measure motion through time as we measure temperature or area through length. But we do not invoke any theory or argument when we measure motion by time (though a measure precise enough to use in mathematical physics would need at least some theoretical foundation). Moreover, we not only measure motion by time but time by motion. All of this confirms our earlier claim that time and motion are the same *in re*.

What we see from all this is that time is an aspect of motion according to which we measure motion, looking, it seems, to another motion. Since when we measure, we number, we can say that time is the number of a motion, insofar as we can call what is numbered a number.<sup>56</sup> But we have to add, with Aristotle, "according to before and after" because the expression, "the number of motion" could simply indicate an enumeration of separate motions. The before and after, though, cannot simply be the before and after of time, since then we would be defining time through itself; rather, the before and after is of motion, and motion, as we have seen, has a before and after due to the order of the momentum to the term of motion. Further, that before and after is due to the before and after of place, at least in local motion, and, if all motion is local or if locomotion is prior in being to other motions, then the before and after of all motions is rooted in the before and after of place. If there is no first motion or if there is but it is not a locomotion, then the before and after of motion is the ultimate physical ground for the before and after of time, but itself is intelligible only in the light of the existence of a mover which has virtually the term of the motion as well as possible intermediate terms.

Certain essentials of the foregoing analysis are found in the following text from St. Thomas:

Sciendum est autem, quod philosophus in praedicamentis posuit tempus quantitatem per se, cum hic ponat ipsum

<sup>56</sup> *Physics* IV, 14, 223a21-29.

quantitatem per accidens; quia ibi distinxit species quantitatis secundum diversas rationes mensurae. Aliam enim rationem mensurae habet tempus, quod est mensura extrinseca, et magnitudo, quae est mensura intrinseca. Et ideo ponitur ibi ut alia species quantitatis. Hic autem considerat species quantitatis quantum ad ipsum esse quantitatis. Et ideo illa, quae non habent esse quantitatis nisi ex alio, non ponit hic species quantitatis, sed quantitates per accidens, ut motum et tempus. Motus autem non habet aliam rationem mensurae quam tempus et magnitudo. Et ideo nec hic nec ibi ponitur quantitatis species. Locus autem ponitur ibi species quantitatis, non hic, quia habet aliam rationem mensurae, sed non aliud esse quantitatis.<sup>57</sup>

St. Thomas is commenting on the fact that Aristotle does not include time or place among quantities *per se* in the *Metaphysics* but does do so in the *Categories*.<sup>58</sup> St. Thomas explains the apparent contradictions by saying that time and place only have the notion of quantity from another, namely, magnitude, and so are not distinct ways of being quantity. Since the *Metaphysics* is concerned with things as they are in their own natures while the *Categories*, as a logical work, is more concerned with the way things are in thought and speech, the former will not credit time and place with being distinct *per se* species of quantity, while the latter, looking merely to distinct notions of measure will consider time and place as distinct *per se* quantities because they are distinct ways of measuring. In fact, in the *Metaphysics*, Aristotle only considers line, surface, and body to be distinct species of continuous quantity.<sup>59</sup> Everything else, including time and place, which is somehow considered a continuous quantity takes its quantification from those three. Motion, since it is continuous only due to the magnitude over which the mobile passes and does not have

<sup>57</sup> *In Meta.*, L. V, l. 15, n. 986.

<sup>58</sup> Cf. *Metaphysics* V, 1020a11-14, *Categories*, Ch. 6, 4b20-5b10.

<sup>59</sup> *Ibid.*

the notion of a measure but rather something measured, is not considered a *per se* species of quantity in either text.

The text from St. Thomas, then, seems to say that time and place are not distinct quantities in themselves, that is, in their natural modes of being, but are so only insofar as we measure something, namely motion, by them. But such measurement, whether it have a natural basis are not, is only intelligible on the assumption that there is a mind doing the measuring. Still, place has an abiding existence, and so what is place as a thing outside the mind, namely, the surface of containing body or, on a more Newtonian or Einsteinian view, the independent dimensions of space, does have part outside of part, as required for quantity, while time and motion do not. Thus, while the mind provides the notion of measurement for both time and place, it provides for time also that permanence necessary for quantity.

The essential parts of this explanation of the existence and nature of time also are consonant with unreflective experience. We experience time as something which is not all at once, and which is connected to motion necessarily. Time itself, if we try to abstract it from any motion, becomes for us flux and motion. Further, when we determine motions by time, we are merely comparing the parts of a motion taken as a standard with the parts of the motion we wish to measure or determine. And the mystery at the heart of time is the same as one of those at the heart of motion, the necessity for time and motion to be related to a non-existent past and future, and so to be referred in some way to mind, a power which transcends becoming and attains unified being. This role of mind in the existence of what are at first thought to be purely natural or extra-mental phenomena underscores how tenuous is the being of the world of direct sensible experience and how dependent, consequently, it is on some superior mode of being.

The foregoing considerations manifest, I believe, the existence and the nature of time in an abstract and therefore imper-

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fect way. But there are still many questions remaining, some of which are only made more pressing by what we have seen. Is there a first motion? If so, what is it? Can it be uniform? And how can motions which are distinct and each have their own before and after share any time, if time is the number of the before and after of motion, if, especially, as seems to be the case, there is a numerically one now for more than one motion? What is this supposed simultaneity? I hope to consider, even if very dialectically, these and other more concrete questions in a later article.

## IN DEFENSE OF GOD'S POWER TO SATISFY THE HUMAN HEART

*Michael Augros*

Then Gideon built  
an altar there to the Lord  
and called it  
*The Lord is Peace*

—Judges 6:24

*Our heart is restless until it rest in thee.* These well known words of St. Augustine summarize his own life, but they also describe the inclination of every soul, and encapsulate the spiritual writings of the saints. They declare the homing instinct of the creature back toward its creator. But what is the nature of that instinct? What manner of rest in God does the human heart desire? St. Augustine answers in no uncertain terms. He spells out in plain language the secret to man's happiness: There is a single good which is fully satisfying to the human heart—there is only one such good—it is God himself. The manner in which we possess God so as to bring our desires at last to rest is to share in the vision of his divine essence. Nothing else will satisfy us. Nothing else is needed.

This understanding of the purpose of our existence is not traditionally categorized as one of Augustine's personal opinions, but as a mere elaboration of divinely revealed truth,

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