Footnotes to Aristotle

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This lecture will begin with exposition and end with what might sound like wild speculation. Alfred North Whitehead famously remarked that "[t]he safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato."[1] Although my title tonight is a rephrasing of Whitehead's remark, I don't mean it to imply that he was wrong. The two greatest philosophers in the Western tradition are Plato and Aristotle, or maybe Aristotle and Plato. I tend to be suspicious of anyone who ranks them too quickly, so let's leave that an open question, or maybe consider it as fodder for discussion after the lecture. Since I've already quoted Whitehead on behalf of Plato, let's consider a powerful piece of testimony on the side of Aristotle. This comes from Julían Marías, a Spanish philosopher from the school of José Ortega y Gasset, in his history of philosophy: the first one I ever read. As Marías puts it there: "Whenever philosophy has established *real* contact with Aristotle, it has immediately become more precise and serious."[2]

One problem faced by any case for the importance of Aristotle is his reputation as a dull and dry purveyor of sterile classifications. Bertrand Russell, for instance, tells us that the *Nicomachean Ethics* "appeals to the respectable middle-aged," that it is useful in "repress[ing] the ardours and enthusiasms of the young," and that "to a man with any depth of feeling it is likely to be repulsive."[3]

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[1] Alfred North Whitehead, *Process and Reality*, p. 39.
[2] Julián Marías, *History of Philosophy*, p. 372.
[3] Bertrand Russell, *History of Western Philosophy*, p. 147; Aristotle, *Nicomachean Ethics*.

In response to Russell, I would say that while it is true that the surviving works of Aristotle lack the pathos and literary flourish of the Platonic dialogues, it is questionable whether Aristotle is either respectable or middle-aged in his outlook. In fact, in Aristotle I see a rather strange thinker who has been overly domesticated over the centuries. Throughout this lecture, I'll be defending the virtues of strangeness in human thought. But the first clue that Aristotle is more offbeat and edgy than is usually believed can be seen in his often bizarre, endearingly morbid sense of humor. In his *De Anima* (or *On the Soul*) there is the odd remark that touch is the most important sense, because it is the only one that destroys us if we do it too hard.[4] In the *Rhetoric*, we find the chilling examples he gives of good luck: first, "such as if all of a man's brothers are ugly but he is good-looking," or this one: "if someone who regularly made a journey were the only one not to, while others did for the first time– and were killed."[5] And finally, there is one of my favorite passages in the entire history of philosophy, from the *Metaphysics*, Book Gamma, Chapter 2: "For if it does not belong to the philosopher, then who will be the investigator of whether Socrates and Socrates seated are the same?"[6] On the whole, I find it easy to believe W.D. Ross when he reports that Aristotle had a "mocking disposition which showed itself in his [facial] expression."[7]

As Johnnies tend to know, Aristotle wrote a lot of great works. But since my real passion these days (and as far back as my Annapolis days from 1987 through 1990) is systematic philosophy, my concern tonight will be with the *Physics* and the *Metaphysics*.[8] We know the usual way of distinguishing these works from each other. The *Physics* refers to *physis*, or nature, thereby continuing the great tradition of speculative theories of nature launched by the pre-Socratics. The title *Metaphysics*, however, was presumably coined by Aristotle's later editor Andronicus of Rhodes, and

[4] Aristotle, *De Anima*, p. 76.
[5] Aristotle, *The Art of Rhetoric*, 1362a.
[6] Aristotle, *Metaphysics*, p, 48.
[7] W.D. Ross, *Aristotle*, p. 7.
[8] Aristotle, *Physics*; Aristotle, *Metaphysics*.

simply referred to *ta meta ta physika*, or what comes after the physics.[9] Since the prefix *meta-* can also refer to matters beyond physics, and thus beyomnd nature altogether. Let's assume that the details of this story are accurate; I have no direct archival evidence to challenge it, not do I have any wish to do so. My purpose, instead, is to give a different interpretation of the difference between the *Physics* and the *Metaphysics*.

Here is that interpretation. The *Physics* is about the continuous, and the *Metaphysics* is about the discontinuous, also known as the discrete. The continuum, or συνεχές, refers to an unbroken stretch of anything: so unbroken, in fact, that it consists of no definite number of pieces. The examples of continua given in the *Physics* include time, space, and physical motion. Any continuum is divisible into as many parts as we please. We can say with equal accuracy that this lecture tonight is made up of three parts, or seventy-nine, or twelve million. We can put as many numbers as we want on the number line between zero and 100. The discrete, by contrast, is that which is independent, autonomous, and which cannot be arbitrarily sliced up however we wish. The best example in the *Metaphysics*, of course, is primary substance, or πρώτη οὐσία. But Aristotle gives another example of discreteness, one that may be surprising: qualitative change. If a stone is worn away in a river, this does not happen gradually and continuously: in some moments a chunk breaks off the stone, while in other moments nothing happens at all.

But I would go even further than this. This quarrel between the continuous and the discrete is not only central to Aristotle's philosophy, but is one of the central intellectual distinctions in our entire intellectual history. Before diving into Aristotle, allow me to give some examples. For more than a century, the foundations of physics have been troubled by the incompatibility of its two central pillars: quantum theory (for electromagnetism as well as the strong and weak nuclear forces)

[9] Peter van Inwagen, Meghan Sullivan, & Sara Bernstein, "Metaphysics."

and general relativity (for gravity). In 2012 I sat on a panel with the Austrian physicist Anton Zeilinger, who would later win the Nobel Prize for teleporting photons across the Danube. At dinner afterward, I took the liberty of asking him about the most promising avenue for unification of quantum theory and general relativity. He responded as follows: "I haven't the foggiest idea. But since some of the world's most intelligent people (if I may immodestly say so) have worked on this problem without success for more than a century, it will probably be something completely from out of left field." What exactly is that problem?

It is often explained as it was in a 2022 article in *The Guardian*: "Physicists agree that the theory of quantum mechanics applies to very tiny particles, and Einstein's theory of general relativity applies to larger objects."[10] A similar explanation is given by prominent American scientist Michio Kaku in one of his helpful physics bestsellers, *The God Equation*.[11] As rules of thumb go, this one is not so bad: it is true that quantum effects (such as the indeterminacy of position and momentum) are most easily observed at the level of tiny entities such as particles. Meanwhile, general relativity is most useful at the scale of astronomical events involving gigantic masses and vast stretches of time, where the effects of gravity on space-time become most obvious And yet, this rule of thumb isn't entirely accurate. The probabilistic effects of quantum mechanics are observable even at the relatively large scale of atoms and molecules, and could even be detected at the level of mid-sized everyday objects (dogs, shoes, airplanes) if the wavelengths of such objects weren't too short for quantum effects to be easily measured. Conversely, general relativity applies to the bending of space-time by all masses, not just extremely large ones. Your own body distorts nearby space with its mass, though the effect is too tiny to be noticeable.

[10] Stephen Buranyi, "Do We Need a New Theory of Evolution?"
[11] Michio Kaku, *The God Equation*, p. 141. Kindle edition.

Shifting the focus away from small and large objects, the tension between quantum theory and general relativity is better understood in terms of the opposition between the discrete and the continuous. Quantum theory treats the world as made up of tiny chunks, as with photons of light, while general relativity treats it as a continuous bending of space and time, as with starlight bending when it passes near the sun's gravitational pull, confirmed by Arthur Stanle Eddington in his measurements during the 1919 solar eclipse. The central problem is that of the *interaction* between the continuous and the discrete; this is the reason for the deadlock faced by physics for more than a century. While quantum theory tells us we're living in a world full of sudden jumps and tiniest units, general relativity envisions the cosmos as a continuous bending. How can discrete particles move through a spatio-temporal continuum?

We might also speak of evolutionary biology, and the conflict between the continuous and the discrete in that field. In 1972, Niles Eldredge and Stephen Jay Gould introduced their concept of "punctuated equilibrium" in opposition to what they called the "phyletic gradualism" of Darwin's tradition.[12] According to Eldredge and Gould, species change does not happen through the slow work of natural selection, but occurs rather suddenly in geological time. The great American biologist Lynn Margulis (and you really should all read her if you haven't already) added her own theory of sudden change to the mix, through the idea that evolution occurs through symbiosis between previously separate life forms.[13] We could also add Thomas Kuhn's theory of science as consisting of punctuated "paradigm shifts" rather than gradual and cumulative triumphs of rationality.[14] And if architecture is more your style (and I had to learn it on the fly when hired by SCI-Arc eight years ago) we can also speak of the dispute between the jarringly discontuous architecture of the 1988 Deconstructivism show a the MoMA in New York, and the 1993

[12] Niles Eldredge & Stephen Jay Gould. "Punctuated Equilibria."
[13] Lynn Margulis, *Symbiotic Planet*.
[14] Thomas Kuhn, *The Structure of Scientific Revolutions*.

appearance of a countercurrent in favor of smoothness and continuity in architecture: inspired by the philosopher Gilles Deleuze, and especially visible in the style of Zaha Hadid.[15] In fact, scratch the surface of any intellectual conflict, and you are likely to find some version of the dispute between the continuous and the discrete. To understand why this topic matters, there is no better place to turn than Aristotle's own works.

Aristotle on the Continuous

Aristotle develops his idea of continuity through a critical assessment of Anaximander's *apeiron*, which refers to the cosmos as a single indeterminate whole, a boundless expanse without qualities or parts. Aristotle rejects this by noting that nothing is ever just one: does the *apeiron* not even have a size or shape? If it does, then its size and its shape are something *in addition* to its unity. Consider the following simple case, using a number other than one. If I say there are five apples and five bananas sitting on the kitchen counter, the number five is the same in both cases, though of course the apples and bananas differ greatly from each other in qualitative terms. Apples are round and red, bananas are oblong and yellow, just to start. The quantity also tells us nothing about the condition of the fruit: whether it's underripe, ready to eat, or already blackened or oversoft. If we turn our attention to a single banana, it's fine to say that the banana is one thing, but only if we recognize that this same banana also has hundreds, perhaps thousands of qualities (yellowness, oblongness, curvature, etc). This means that while the banana is one thing, it is also many when viewed from the standpoint of its qualities. As trivial as this may sound, it eventually becomes an important point for Leibniz in *Monadology* §8, and Leibniz will become important for us tonight as well.[16]

[15] Philip Johnson & Wark Wigley. *Deconstructivist Architecture*; Gilles Deleuze, *The Fold*.
[16] G.W. Leibniz, *Philosophical Essays,* p. 214.

In the days before subatomic particles were discovered, it was thought that atoms were indivisible: pure units without parts. But in 1897 J.J. Thomson discovered the first subatomic particle: the electron, known for its tiny mass and negative electric charge. In 1911 Ernest Rutherford discovered that atoms are not uniform, but have a tiny nucleus made up of protons, which are much larger than electrons and have a positive charge. In 1932 James Chadwick discovered the neutron, which is essentially just a proton with a neutral rather than positive charge. Then in 1964 it was theorized independently by Murray Gell-Mann and George Zweig that even protons and neutrons are made up of smaller particles, called "quarks," whose existence was experimentally proven in 1968. Hence we no longer say that atoms are the smallest unit of nature, but can say instead that physical matter is made of quarks and electrons.

This bit of recent scientific history would not have bothered Aristotle at all, since of course he didn't believe in the existence of uncuttable atoms anyway: as we know, the word *atom* literally means that which cannot be cut. And we know that Aristotle thought matter to be continuous, meaning that it can be cut into smaller and smaller pieces as far as we wish, without ever reaching some ultimate, uncuttable unit. If he were alive today, he would presumably think that both quarks and electrons could still be divided into smaller units *ad nauseam*.

At any rate, Aristotle did not embrace the idea that the *apeiron* could be one in the sense of being purely simple and without parts; as we have seen, nothing exists that does not have multiple qualities. Yet he did accept the idea of the continuum, referring to a continuous stretch of anything that can be divided infinitely downward as far as we please. In his own words: "the continuous is divisible without limit."[17] This is obvious enough in the case of the number line, which contains as many numbers as we want it to have: there is no obstacle to our putting hundreds or even millions of numbers on the line between the neighboring integers 1 and 2. But this seems to mean that every

[17] Aristotle, *Physics*, p. 4.

continuum is always multiple, not one, which seems contradictory. This multiplicity of the continuum had already caused problems in the eyes of Zeno of Elea, since it entailed that there are infinitely many points between any two given points, leading him to reject the existence of motion. For Aristotle, by contrast, the reality of motion had to be protected at all costs, since his entire philosophy is in some sense designed to explain motion.

Be that as it may, he doesn't discount the idea of an unlimited *apeiron* as simply false. He does think this concept is sometimes useful, because if we decide that the unlimited doesn't exist, he says, then "many impossibilities result," just like when "we posit that it does exist."[18] In particular, if we deny the existence of the unlimited, Aristotle thinks that three impossible consequences follow. First, there will be "a start and an end of time." Second, magnitudes, or quantities will not always "be divisible into magnitudes" in their own right. And third, "number will not be unlimited."[19] Since all of these points are interesting, let's take them one at a time.

The first impossibility is that without the unlimited, there will be "a start and an end of time." Aristotle's shock at this notion is always difficult for us moderns to grasp. Both our monotheistic religions and our state-of-the-art Big Bang astrophysics tell us that the universe was created at some point in time, and will come to an end at some later point in time. But of course that is not Aristotle's conception of the world. As he sees it, there has always been time and always will be time. It is worth recalling that he does not think the same about space. In his view, space only extends as far as the outermost sphere of the heavens: namely, the rotating spheres where pre-modern physics said that all the stars were located, moving around the earth in unison at a distance further from us than the planets.[20]

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[18] Aristotle, *Physics*, p. 45.
[19] Aristotle, *Physics*, p. 49.
[20] On the modern replacement of this theory see Alexandre Koyré, *From the Closed World to the Infinite Universe*.

The second impossibility concerns magnitudes, or quantities. Take any number: four, for example. We can slice four into a pair of twos or into four separate ones. But we don't have to stop there. We can cut up the ones into ever-tinier fractions, meaning that our original number four can be carved up into as many smaller units as we wish. Given this ability to keep dividing things into ever-tinier components without end, something like the unlimited must exist. Without it we would eventually arrive at the ultimate smallest units of mathematics, which do not exist. Aristotle's view is that this is true not only of number, but also of time, space, and matter. All of these are examples of continua, meaning that they can be split into pieces as small as we wish without ever arriving at a smallest part.

From this endless division of numbers into smaller parts, we advance to the third impossibility, which concerns the increase of numbers through addition. I was just a small child when my mother taught me how to count to 100; I remember becoming discouraged and starting to cry somewhere in the low seventies, thinking that we would never reach the goal. While for many children 100 symbolizes an immense quantity of anything, it's obviously a paltry sum compared with numbers used even for everyday purposes, such as financial transactions, and that's to say nothing of higher mathematics. Indeed, just a few years after my traumatic march to 100, I took childish delight in imagining ever larger numbers, simply adding zeroes and other digits to an initial numeral, or engaging in mental exploits of repeated doubling or tripling. Such cases show that the limitless must exist, since otherwise we would eventually arrive at a highest number and not be able to go beyond it. Note that this cannot be refuted simply by saying "infinity." For one thing, infinity is technically not a number. For another, the mathematician Georg Cantor proved in the nineteenth century that there are infinitely many different infinities, all of different sizes.[21]

[21] Georg Cantor, *Contributions to the Founding of the Theory of Transfinite Numbers*.

At first glance, Aristotle's points about division and addition might seem to be the same. We can divide any number into as many pieces as we like, or add to any number as much we like; both procedures have no limit other than personal patience. But Aristotle notes a crucial difference between them.[22] In the case of division the total amount is already contained in the starting point, while in the case of unlimited increase it is not. To give an example, when we take the number four and begin cutting it indefinitely into tinier pieces, we never get beyond the four that we already had at the start; we are merely subdividing an already known quantity, no matter how minutely we explore its interior. Yet when we play the reverse game of increasing the number four as far as our imagination will take us, we immediately get beyond four and even reach numbers absurdly greater than our initial one. The unlimited cannot be some greatest encompassing cosmic whole, since for every quantity, no matter how large, there is always a larger one. In other words, there is no infinite container that holds everything, but every finite amount of matter, number, space, and time contains an infinite amount of increasingly tiny units inside itself. This is one of my favorite counterintuitive points in the *Physics*.

Yet by conceding the existence of limitless divisibility, Aristotle seems to have fallen directly into Zeno's trap. It is impossible to reach the dorway, since between us and the door there exists an infinite number of halfway points; it is impossible for Achilles to pass the turtle in a footrace, since whenever Achilles runs to where the turtle was, the turtle will have run some incresaingly infinitesimal distance past that point. Zeno's underlying point is that if space is infinitely divisible then motion will be impossible, since we cannot possibly move through an infinite number of points. The problem is that Aristotle also holds that space is infinitely divisble, which seems to commit him to the impossibility of motion as well. Of course, we know that Aristotle has a strategy for escaping this predicament, and it is one of the keys not only to his *Physics*, but to his philosophy

[22] Aristotle, *Physics*, pp. 52-53.

as a whole. This involves his distinction between the *actual* and the *potential*, one that is familiar to us today from everyday language and experience.

The classic example is the celebrated acorn: it is an actual acorn but a potential oak tree, meaning that its acorn-qualities right now are not the full story of its reality. Although an acorn is not currently an oak tree, and a kitten is also not currently an oak tree, the status of "not being an oak tree" is obviously different in the two cases. We can think of the acorn as a repository of forces not currently expressed, but that might someday shape it into a lofty, sturdy oak; a kitten, presumably, will never grow into an oak tree without horrific genetic manipulations that lie beyond the scope of present-day science. The same holds for a human infant who is capable of very little at present, but might someday lead a large bank or artificial intelligence laboratory, or perhaps a street protest against these same institutions. Likewise, there is the infamous San Andreas fault, not far from where I live. Although quiet at this moment in 2024, the fault is likely to be the site of a major earthquake at some point in the next fifty years, presumably causing widespread destruction.

Ultimately, what Aristotle is after with his discussion of the actual and the potential is an account of motion, which he famously defines as the activation of what is potential *insofar as it is potential*.[23] When an acorn grows into an oak tree, this involves the activation of what used to potential in the acorn, whereas the kitten had the potential to be an oak. As another example, consider a piece of bronze sitting on a worker's table in Athens. We can say that it is actually bronze and actually located in Athens rather than somewhere else. Hence there is no way to *actualize* its bronzeness and its presence in Athens, since both of these are already accomplished facts, not future possibilities. If we want the bronze to change in some way, we need to draw on its potentiality rather than its actuality. In this spirit, we can say that the bronze is potentially a sword and potentially located in Miletus, and if we have the proper metal-working skill and means of transportation, we

[23] Aristotle, *Metaphysics*, p. 189.

can actualize these potentials. For Aristotle, the activation of potentials is what motion means. However, we need to keep in mind that for Aristotle "motion" refers to any sort of change, whether it be an acorn growing into an oak or a person becoming old and tired. It is not like modern physics, where "motion" refers exclusively to the movement of objects in space. This difference between potential and actual has a good case to be called the center of Aristotle's philosophy. At one point he even describes being not as unified, but as "twofold." As he puts it: "Everything changes from what is potentiality to what is actively."[24]

On that note we return to Zeno's paradoxes, which Aristotle addresses by way of his actual/potential distinction. Zeno is correct, Aristotle says, that it would be impossible to reach the doorway if we *actually* had to pass through an infinite number of points in between. Our movement to the door would not be continuous and eventually successful, but would "come to a standstill," since we could never even reach the next point on our way to the door, let alone the door itself.[25] There is no "next" point, after all, since between where we are and even a close nearby point there are infinitely many other points in between. The reason motion really does occur is that the path from our current position to the doorway is not *actually* made of an infinite number of points, but only *potentially* so.[26] (VIII.8) In other words, splitting any length of space into separate points is something we do as a kind of mental exercise; it does not really govern our motion in space. This means that Zeno's examples fail.

The so-called paradox of the arrow is another of Zeno's most famous, and Aristotle challenges this one as well. Imagine that an archer fires an arrow directly at a target. Obviously, the fired arrow always appears to be moving. But if we closely consider any particular moment of its flight, the arrow must be in some definition position, which means that it is motionless in that point.

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[24] Aristotle, *Metaphysics*, p. 199.
[25] Aristotle, *Physics*, p. 164.
[26] Aristotle, *Physics*, p. 164; emph. added.

But if it is always motionless at any given moment, how can it also be moving? Predictably enough, this leads Zeno to claim that the arrow does not actually move, and that (once again) all motion is just an illusion generated by our senses. Aristotle rightly notes that this argument relies on a questionable assumption. Namely, the arrow paradox "results from assuming that time is composed of nows."[27] In other words, Zeno reasons that in any distinct temporal instant, the arrow must occupy some definite spatial position. But Aristotle does not think that time is made of distinct instants, any more than he thinks a line is made of indivisible points. Euclid's geometry would later define a point as "that which has no part," and beyond this, we already know that no matter how closely we place two points together, we can always add an unlimited number of additional points between them.[28] This is why Aristotle contends that the same principle applies to time and space, not just magnitude.[29] In the case of the arrow paradox, there is no definite number of moments between the time the arrow is fired and the time it strikes the target. No two nows can be contiguous for the same reason that no two points on the number line can be: we can always add another now between any two nows that seem to be consecutive.

Aristotle makes some additional remarks about time in much the same spirit. Since he views time as a continuum, there can be no definite "now" in which something begins to happen. The moment of falling in love or turning toward the dark side can never be pinpointed exactly, for the simple reason that nothing in time can ever be located in a single instant. He also makes the crucial point that our sense of time is rooted in our observation of change. As he notes, "when we ourselves do not change in our thought or do not notice that we change, then it does not seem to us that time has passed."[30] (IV.11) This is important because many philosophers seem to think of time

[27] Aristotle, *Physics*, p. 120.
[28] Euclid, *The Thirteen Books of the Elements*, p. 153.
[29] Aristotle, *Physics*, p. 102.
[30] Aristotle, *Physics*, p. 76.

as something like a wind tunnel: as if it were a disembodied force that caused things to change, when it is really just our way of measuring change.

To repeat, if there were truly an infinite number of halfway points between me and the door, Zeno would be correct: not only could I never reach the doorway, I could never move at all. For there would be an infinite number of halfway points between my current position and even a close nearby point. Aristotle's response was that only in a derivative way can we conceive of space as made up of distinct parts: the continuum is *actually* one, but *potentially* many. From an Aristotelian standpoint, Zeno's paradoxes pose no threat to the existence of motion. By introducing his concept of potentiality, Aristotle has no need to say that the continuum actually has an infinite number of parts to it. It is enough to say that we can potentially divide the continuum into as many pieces as we please: in our minds, that is. But the world in which motion takes place is continuous, unfolding over undivided stretches of space. If I want to walk to the door, I simply walk to the door. There is no actual infinity of points I must cross in order to do so. The shift from Zeno's to Aristotle's understanding teaches us that motion is real. This means that Aristotle's extensive physics of motion (which includes all forms of change, not just physical movement) is able to get off the ground. As we know, it would become an extremely useful tool not only in the ancient world, but also in early Islamic civilization and then in Medieval Europe, before being rejected decisively by seventeenth-century physics.

Aristotle on the Discrete

Looking back on the pre-Socratics, we can see that their *apeiron* counts as a continuum, even though the pre-Socratics never explicitly defined it that way. Like the number line, it is boundless, in the sense that it extends without limit in every direction, and also consists of no definite number of parts. How, then, can we move from the boundless *apeiron* to the multitude of individual beings we

see all around us? At least two pre-Socratic thinkers offered origin stories in which the *apeiron* was broken up into countless pieces.[31] According to Pythagoras, the *apeiron* inhaled the void, leading to something like tiny bubbles or vacua separating parts of the *apeiron* from each other, yielding what we know today as individual things. Anaxagoras gives us a different version, in which *nous* or mind caused the *apeiron* to rorate so rapidly that it vibrated excessively and finally broke into tiny pieces: the *homoiomeraeiai*. In those pre-Socratics who believed in the *apeiron* were adopting a basically continuous model of reality, while those who believed instead in ultimate physical elements (whether water, air, number, atoms, or four separate elements) were advocates of a discrete conception of the world. Aristotle is the first person we know of who divided them into these two groups: a decision probably motivated by his own joint fascination with the continuous (the *Physics*) and the discrete (the *Metaphysics*).

Speaking of the *Metaphysics*, potentiality and actuality also continue to play an important role in this work, though a different one. Aristotle is quick to inform us that the question here is no longer about objects being unable to move through an actual number of intermediate points. The important issue in the *Metaphysics* is *qualitative* change. Namely, if an object were nothing more than its current, actual state, it would never be able to change at all; potentiality is therefore needed as the engine of all transformation. Of course, this is not an imaginary concern aimed at a straw man opponent: Aristotle was engaged in dispute at the time with a rival philosophical school, the Megarians, who held that a thing is no more than its sum total of current activities. The Megarians were named after their small home city of Megara, which still exists to the west of Athens today. The leader of the school was one Euclides, a former student of Socrates. Aristotle summarizes their doctrine in the *Metaphysics* as follows: "someone who is not building is not capable of building, but

[31] See Eduard Zeller, *Outlines of the History of Ancient Philosophy*.

someone who is building is capable if and when he is building, and similarly in the other cases."[32] In simpler terms, no one is a house builder unless they are building a house at this very moment. But Aristotle is unconvinced. He complains that according to the Megarian teaching, when someone stops building, "he will not possess the craft," meaning that they will no longer be builders once they stop, or even while they take a lunch break. But this is absurd, because "if he starts again immediately, how will he have learned again how to make use of this craft?"[33] In other words, there is a big difference between a master house builder who currently happens to be asleep, and those of us who are awake and may even have tools in our hands, but have no idea what to do in order to build a house.

Far from being an outmoded way of thinking, the Megarian approach is tacitly adopted even by some recent authors. A good example is my late lamented friend, the French philosopher Bruno Latour. The method he helped develop for the social sciences is called Actor-Network Theory; it maintains, like the Megarians, that everything is equivalent to its sum total of actions here and now.[34] As Latour puts it, objects (which he calls "actors") can only be defined by their actions. There is no other way to define an action than by asking what other actors it modifies, transforms, perturbs, or creates.[35] A thing is the effects it has on other things, and nothing more. In this way, Latour and his colleagues devised a technique for analyzing any situation by focusing on what things do, rather than getting lost in speculation about what their hidden properties might be. And as a method for the social sciences, it has yielded many fruits.

One of these fruits is that Latour is able to attack theories that try to explain reality with such fuzzy abstractions as "Science," "Society," or "Capitalism." Instead of these terms, the Actor-

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[32] Aristotle, *Metaphysics*, p. 145.
[33] Aristotle, *Metaphysics*, p. 145.
[34] Bruno Latour, *Reassembling the Social*. For an admiring but critical commentary see Graham Harman, *Prince of Networks*.
[35] Bruno Latour, *Pandora's Hope*, p. 122.

Network theorist tries to look more concretely at what every human and non-human actor is doing in a given situation. For instance, the French historian Fernand Braudel (much admired by Latour) writes a history of capitalism that does not take this economic system for granted, but actually looks at the European development of local markets into regional markets, regional markets into national ones, and finally national markets into international monopolies.[36] When one thing transforms into another, Latour insists that we explain each step, and not just say that the later ones existed in advance in the earlier ones. We cannot say that a cake is "already there in the recipe," since from raw ingredients to the final cake there are a number of steps that must be properly executed, and these must be specified. We could certainly call the ingredients "a potential cake," but for Latour this idea of potentiality risks intellectual laziness. He would agree with the Megarians that we should focus solely on actual things and what is needed to turn them into different things. And in the case of the house-builder discussed by the Megarians, Latour would surely agree that a house-builder is simply whoever is building a house at this very moment.[37]

Aristotle counters such ideas by insisting that if everything were completely actual, then nothing could ever change. At the moment of writing these words I was typing on an Apple MacBook Air computer while sitting at our dining table in Long Beach, California. Yet this is no longer the case. I am now on a journey into my distant undergraduate past in Annapolis. Forty-eight hours from now I may be at the supermarket in Long Beach instead. Aristotle would say that all this is possible only because I have the potential to change my current situation; without such potential, I would have been forever frozen in the act of sitting at home and typing.

In similar fashion, a happy person is potentially sad, and a dusty little pearl-fishing village called Dubai was potentially a wealthy world metropolis, which is exactly what it became. These

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[36] Fernand Braudel, *Civilization and Capitalism*, 3 vols.

[37] For another interesting defense of the Megarians see Nicolai Hartmann, "The Megarian and the Aristotelian Concept of Potentiality."

scenarios are not properly accounted for by either he Megarians or Latour. We surely all remember the difference between potential energy and kinetic energyfromn high school physics: whenever something occurs in the world, it is because one or more entities were previously in a position to make it happen before it actually did. A vase was stationed precariously on a windowsill ten floors above the sidewalk and thus it was able to fall in a strong wind; an athletic young girl had abundant energy stored in her muscles and for this reason was able to climb the tree in front of the school.

I'd like to lay special stress on Aristotle's passion for movement and change since, in recent decades, his theory of enduring individual substances has unfairly earned him the reputation of a boring philosopher of stasis. He warns us against a tendency that is still widespread today: the frequent proclamation that "everything is in flux," all is changing constantly, nothing remains the same. Aristotle responds that this statement isn't quite true, since nature contains rest as well as movement. Just as importantly, change in nature is not usually gradual or continuous: if a stone is worn away by a river, this happens in jumps rather than continuously. That is to say, a stone being worn away in a river does not lose the same number of particles in every second; instead, sometimes nothing changes, but all of a sudden a significant piece of the stone is broken away. Likewise, when we read Edward Gibbon's great multi-volume work on the decline and fall of Rome, we do not find an equal amount of Roman decline on every page; there are specific moments in Gibbon's history where decay is unusually rapid or severe, and others in which it is even reversed for awhile.[38] The renewed embrace of radical flux and flow in recent philosophy has unjustly diminished Aristotle's reputation as an innovator. But he is nothing if not a philosopher of movement.

Substance

[38] Edward Gibbon, *The Decline and Fall of the Roman Empire*, 3 vols.

Alongside his insights about motion, what Aristotle has to say about primary substance, *prote ousia*, discrete individual entities, is of equal interest. Of the two groups of pre-Socratic thinkers, those who focused on ultimate physical elements (water, air, atoms) were downward reductionists who dissolved everything into its smallest pieces. While it can be very useful to know what something is made of, this can also lead us to overlook important features of the original substance. For instance, we know that water both puts out fires and quenches thirst, though neither of these capacities are found in its smaller ingredients, hydrogen and oxygen. I call this form of reduction "undermining," since it dissolves individual things in favor of their smaller components or perhaps their causal backstories.[39] Later in ancient Greek philosophy we find the Sophists, frequently attacked by Socrates and Plato. One of them, Protagoras, is famous for saying that "man is the measure of all things." This amounts to the upward reduction that I all "overmining," since it shifts attention from the inherent constitution of things to the question of how these things affect the human mind, or possibly how they affect everything else, as in Latour's Actor-Network Theory. The right way to avoid these two extreme methods is to focus on things that are neither the smallest nor the largest components of the cosmos, and this is exactly what Aristotle does. For this reason he is often mocked as being obsessed with "mid-sized everyday objects," though we can easily turn this formula against his critics by saying that they are obsessed either with "tiny-sized physical objects" or "large-sized cosmic wholes." Medium-sized things also have an important place in philosophy.

Like most trailblazers, Aristotle is sometimes inconsistent about his central topic. In the *Metaphysics* he not only asks the question "What is substance?" at least five times, but gives slightly different answers in each case. At times he insists that nothing is more a substance than anything else: the sun is more powerful and durable than a dragonfly, but the dragonfly is just as much a dragonfly as the sun is the sun, and hence they are equally substances. At other times he speaks of

[39] See Graham Harman, "Undermining, Overmining, and Duomining."

substance in the comparative terms of one thing being "more" or "less" substance than another. For instance: "substance seems to belong most evidently to bodies. That is why we say that animals and plants and their parts are substances, and also natural bodies, such as fire, water, earth, and each thing of this sort."[40] Later he stresses that whatever is *natural* is somehow more substance than a table or anything else put together by human artifice. For Aristotle, substance means many things. It is a unity over and above the sum of its parts; it is a somewhat inscrutable thing which can never be adequately defined in words, since things are concrete while definitions use universals; it has the capacity to have opposite qualities at different times; and it has abundant reserves of currently unexpressed potential. But perhaps most importantly, the concept of substance is needed in order to ensure that the discreteness of reality is taken just as seriously as its equally real continuous character.

According to Aristotle, "everyone" in his time agrees that earth, water, fire, plants, and the sky are substances. So too are "bodies in general and the things composed of them, both animals and divine beings, and the parts of these. Each of these is said to be a substance *because it is not said of an underlying subject but rather the other things are said of it.*"[41] (Delta 8) The grammatical differene between nouns and adjectives make this easy to understand. We say "the car is green," not "the green is car"; this shows that we recognize the car as the underlying substance and its color an accidental quality that can be modified if we wish. While some have criticized Aristotle for assuming that the structure of language is an accurate guide to reality, he is certainly correct that the car appears to us as a more robust thing than its green color. Normally, we do not see enduring colors taking on the form of different objects, though it is quite common for objects to change color.

[40] Aristotle, *Metaphysics*, p. 105.
[41] Aristotle, *Metaphysics*, p. 79; emph. added.

Furthermore, just as we saw in the case of the *apeiron*, an object cannot *simply* be one, since it will always have multiple qualities; yet a substance must *also* be one so as to unify its many qualities. As Aristotle puts it: "of all things that have several parts and where the totality of them is not like a heap, but the whole is something beyond the parts, there is some cause of it."[42] By way of example, he notes that a "syllable is not its phonetic elements, BA is not the same as B and A, nor is flesh fire and earth. For when they –for example, the flesh and the syllable– are dissolved they no longer exist, whereas the phonetic elements do exist, and so do the fire and the earth."[43] Though we no longer share the widespread ancient Greek view that fire and earth are indestructible physical elements, we can still take his point that the whole is something more than its sum total of parts.

Despite its unity, a substance must always be composite as well: not only in the qualities it possesses, but also in the parts of which it is formed. In this way Aristotle brushes against the later notion of emergence.[44] Although a substance has parts, it is not reducible to them, since otherwise it would be a mere collection rather than a unified substance. If someone tried to name a new substance composed jointly from France, red pepper, and the music of Mozart, we would quickly conclude that these three random objects do not form a unified substance with emergent properties of its own. It is rather different if we list water, tomato paste, kidney beans, and spice: in this case we are inclined to say they are unified in the substance "chili." Although Aristotle surely would not recognize chili as a substance, I am inclined to do so, given that chili has a certain *je ne sais quoi* not found in its ingredients when taken in isolation. And conversely, the ingredients should also be treated as substances, since of them has an independent reality that is not entirely transformed the chili as a whole.

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[42] Aristotle, *Metaphysics*, p. 141.
[43] Aristotle, *Metaphysics*, p. 132.
[44] See Manuel DeLanda, "Emergence, Causality, and Realism"; Niki Young, "Object, Reduction, and Emergence."

But we have just touched on an interesing problem. For is it really the case that the various ingredients of a whole both retain their independence and simultaneously belongs to the larger substance of which they are ingredients? For example, if a berry bush is a substance, then is each of the individual berries also a substance? In one passage Aristotle does say that the parts of animals and plants are substances just like animals and plants themselves.[45] But a more characteristically Aristotelian answer comes when he says "it is only when the whole has been dissolved" that the parts can exist as substances in their own right.[46] In terms of our example, this means that individual berries are not substances unless they are picked. Until that occurs, they are only "potentially" substances, since they remain subordinated to the unity of the plant as a whole, which is considered the only substance on the scene until berry-picking occurs. Quite aside from berries, it is easy to see why Aristotle might think that a liver or kidney could be treated as part of a unified human substance, and might think as well that these organs only become independent in cases where overall bodily function breaks down. Organ transplants were unknown in his time, but familiar to us today: a healthy organ is removed from a deceased donor and shipped elsewhere to be transplanted into a needy recipient. During its period of transit from one body to another, the organ could easily be viewed as an independent substance. Since Aristotle would make the same point for the parts of plants, we can see his willingness to think that the status of "substance" is always temporary and contingent.

As mentioned, Aristotle has a tendency to favor nature as the ultimate authority on what counts as a substance and what does not. Berries may exist as substances once they are picked, but a raspberry pie could never count for Aristotle as a substance, given his general suspicion of artificially produced things. In our own time, we are less likely to share his prejudice in favor of nature. Today's

[45] Aristotle, *Metaphysics*, p. 105.
[46] Aristotle, *Metaphysics*, p. 82.

world is brimming with artificially produced objects that nonetheless behave like substances: chemical molecules synthesized in laboratories as in the case of medical drugs, important "transuranian" elements such as plutonium that are rarely found in nature, not to mention airplanes, cars, drones, robots, and medical prostheses, along with the European Union and the International Olympic Committee. The fact that complex machines do not occur naturally in forests does not automatically entail that coffee grinders are less deserving of the name "substance" than strawberries. This is especially clear once we recall the centuries of careful breeding and fattening needed to produce the highly edible, but perhaps more tasteless bright red strawberries we purchase in supermarkets today.

In our own time, when natural science is usually viewed as the gold standard of knowledge, it might seem antiquated that Aristotle praises philosophy as the superior discipline. The reason he gives (despite his own scientific accomplishments) is that only philosophy is concerned with substance. I take his point to be as follows. Given that substance is what endures despite all changes in it qualities, and given as well that we cannot define any substance in words, there is something elusive about it that makes it difficult to measure adequately or paraphrase in exact prose language. That makes substance a good match for *philosophia*, which is always the love of a wisdom that can never fully be had rather than a direct form of wisdom itself. By contrast, the natural sciences will always favor that which is more tangible and directly discernible; substance itself is neither of these things, but is somehow deeper than all its visible or testable features. The adoration of precise quantitative measurement in the sciences is one of the reasons modern thought dismisses Aristotelian substance as outmoded, or as not very useful. But how might this dismissal be reversed if we increase our awareness that knowledge is not the only form of human cognition? There are really only two kinds of knowledge, in the end. If someone asks us what something is, we can either tell them what it is made of (which amounts to undermining), tell them what it does (which amounts

to overmining), or tell them both at once (which I call "duomining," a term borrowed from the credit card industry, where it has the appropriately sinister meaning of data-mining and text-mining someone simultaneously). Some social networks can predict with 90 percent accuracy where you will be tomorrow, and some credit card companies have algorithms that use changes in spending patterns to predict divorce several years in advance. All of this is knowledge. But a full picture of human cognition requires knowledge to be supplemented with *philosophia*, aesthetic sensibility, practical know-how, political instincts, personal empathy, and what psychoanalysis calls the "truth" of symptoms, along with other intuitions and skills. The fact that some things exist only in shadow does not make them less real than the things that sit in direct sunlight.

None of this means that we need to agree with Aristotle's own hierarchy, which places philosophy on top of science. I for one do not agree, just as I would not agree that a globe of the earth is "better" than a street map of Los Angeles; obviously, which of the two is better depends on what you are trying to do. But present-day society is so enamored of the exactitude, the concrete achievements, and even the monetizable industrial results of natural science that philosophy has reached something close to the historical low point of its prestige. This can be seen from the fact that so many present-day philosophers try to be recognized as "scientific" in their thinking, while few scientists aspire to be called philosophers anymore, unlike in previous centuries.

Although it is often assumed inc ontemporary philosophy that Aristotle's theory of substance is dated, it does have many powerful features. Some present-day philosophies wish to treat substances (or discrete objects more generally) as nothing more than arbitrary chunks torn out of a primal whole by the human mind alone, as if the world really were just a continuum.[47] Yet this position contradicts itself by assuming in advance that the mind is independent enough from the whole to be able to perform the work of creating individual things from whole cloth: in other words,

[47] See Thomas Nail, *Being in Motion*; Thomas Nail, "Is Nature Continuous or Discrete?"

there are no specific objects unless a human mind is there to produce them. These contemporary theories are actually traceable to Anaxagoras, and his view that a powerful mind causes the whole to rotate, vibrate, and shatter. But who uphold such views need to explain how, in a supposedly unified cosmos, the mind was different enough from this unity to be able to produce the discrete in the first place.

The Problem of Interface

To summarize, Aristotle views time, space, motion, and number as continuous, but substance and qualitative change as discontinuous. This leaves us with the question of how these two domains could ever interact, since otherwise they would represent two separate and parallel worlds with two different sets of rules. In a world of perfect continuity, individual substances would exist only as delusions of the senses, which is precisely what Parmenides and Zeno thought. And in a world of perfect discreteness, nothing could interact with anything else: everything would remain isolated in its unique individuality, which is precisely why Leibniz said monads (his name for substances) have no windows, and why he called upon divine intervention as the only possible solution for how his monads could communicate.[48]

If two things are continuous, this means that they blend into one; if two things are separate, this means they do not touch at all. What interests us, and certainly interests Aristotle as well, is the intermediate case where two object touch without blending together. Aristotle's term for this middle case is "contact," a concept he never sufficiently develops. The problem is knowing exactly where contact occurs. Of course, common sense sees no problem here: I am a substance, my friend is a substance, and it is easy for us to make contact simply by shaking hands. But difficulties soon arise. For one thing, I am not the same as my hand and my friend is not the same as his hand, since in

[48] G.W. Leibniz, *Theodicy*.

both cases the hand is merely part of each of us. Thus we could say no more than that shaking hands is merely a contact of hands, not of people, and then we would need to know how a part of me (like my hand) can have any effect on me as a unified being.

Beyond that, we cannot even say that the two hands touch while shaking. After all, the hands do not meet in some sort of obscene total surface contact, but only at a limited number of points along the outer layer of skin, so that now we need to know how those limited points on the skin are able to affect the hand as a whole, and so on. The contact between two things is more problematic than the physical assumptions of everyday life would lead us to believe. Descartes faced an analogous problem when trying to determine where his two finite substances (mind and body) could possibly meet. His theory was that the soul is contained in the pineal gland of the brain, whose function was then mysterious, though today we know it to produce melatonin.[49] Although Descartes's solution was wrong, he was perfectly right to ask how two totally different kinds of things could ever meet. What, in the end, is contact? This is what the problem of interface means.

It is interesting to note that a similar problem arises in a philosopher not often associated with Aristotle: I speak of Henri Bergson in France. Much like Aristotle, he too faces the problem of how the discrete and the continuous could somehow interact. For Bergson, the first term of the duality is inner experience, also known as endured time, or *durée*, which is qualitative and continuous: in short, the swirling realm of his wife's cousin, Marcel Proust.[50] The second and opposite term is the realm of what Bergson calls space, characterized as quantifiable and made up of discrete points and discrete entities. For Bergson, the interface between these two opposites takes place along a one-way street. For it is the flowing inner self of *durée* that must somehow learn to make contact with the discrete and quantifiable outside world. In fact, Bergson gives us three separate terms for

[49] See René Descartes, *The Passions of the Soul*.
[50] Henri Bergson, *Time and Free Will*; Marcel Proust, *In Search of Lost Time*, 6 vols.

this interface: simultaneity, the second self, and endosmosis. But if there is any case in which the world adapts to us by becoming more smooth and flowing than usual, Bergson does not discuss it, at least not in his debut book *Time and Free Will*.

Speculative Conclusion

But now I would like to work towards a conclusion, admittedly a speculative one. One of the valuable points we can take from the *Physics* and the *Metaphysics* is that the continuous and the discrete both exist; neither can be reduced to the other. This is why the problem of their point of contact or interface is so important. Two continua cannot make contact, since if they are different from each other in the first place, then they must make contact at some definite, discrete point of intersection. Maybe the easiest way to see this is to return to the correspondence between Clarke and Leibniz, which at least in my time was still on the St. John's seminar list.[51] Famously, in this correspondence Clarke defends Newton's conception of time and space as absolute and empty containers. Leibniz responds with good arguments, saying (among other things) that it would make no sense to ask "what if the universe had been created ten minutes earlier?" or "what if the universe were fifty feet further to the west?" Time and space are not absolute and independent, but must be interpreted in terms of the entities that fill them. It may have been a losing proposition in the days of Newtonian hegemony, but following Einstein's general relativity, and the bending, twisting, and folding of space by mass, Leibniz looks much better now. His point, at any rate, is that continua intersect only by way of the discrete elements that fill them. The unified space-time of Einstein and Minkowski is not a counter-example, since if this unified space-time exists then it is just one continuum, and attempts to link it with another would still require discrete entities in both simultaneously.

[51] Samuel Clarke & G.W. Leibniz, *Correspondence*.

Conversely, I would say that two discrete entities cannot touch directly, but can only meet in a continuous medium. Although it is usually harder to convince people of this second point, I will explain here why it strikes me as inevitable. First, it is worth remembering that a number of thinkers across the centuries have recognized that there is a certain danger in speaking of individual things, since a pure individual would have to be completely cut off from everything else. For two things to be in relation entails that they are not *only* individuals. In the 1940s the French physicist Louis de Broglie, already a Nobel Prize recipient for demonstrating the wave nature of electrons, noted "how interesting the notion of interaction is, from the philosophical point of view, since it implies a certain limitation on the concept of physical individuality."[52] Here he is dipping his toes into deep philosophical waters.

Unlike de Broglie, there are others who refused to limit the concept of individuality in any way, and it drove them to a delightfully extreme idea: we know it under the name of "occasionalism." Although this term immediately makes most people think of seventeenth century French Cartesianism, occasionalism actually began in medieval Iraq, through a formerly liberal theologian named Abu Hasan al-Ash'ari. His idea was that God is not just the only creator, but the only causal agent at all. Fire does not burn cotton; God burns cotton. Along with this challenge to direct causation between worldly beings, al-Ash'ari also upheld another occasionalist doctrine concerning time. Namely, time is made of discontinuous instants, with the world vanishing and being recreated in every such moment. Most people are more familiar with the European variants of this doctrine in Malebranche, but also in Spinoza, Leibniz, and Berkeley, and again in the twentieth century with Whitehead. Occasionalism is usually rejected, even mocked today, for its apparently extrvagant theological solution to the problem of causation. But I would point out that David Hume and Immanuel Kant are still very much respected mainstream philosophers in our own time, and

[52] de Broglie, *Continu et discontinu en physique moderne*, p. 115. The translation from French is my own.

they simply adopt an occasionalism by other means. Instead of God, the monopoly on causation is given to the human mind instead. But the real solution should not be taxonomical; we should be able to account for causation as being indirect but still local.

Yet perhaps you still do not see a problem to be solved. After all, there seems to be no difficulty in shaking someone's hand, pushing a car when the engine stalls, trains coupling together in a railyard, breakfast cereal touching the sides of its box, touching the roof of your mouth with your tongue, or witnessing inanimate masses that slam together in the asteroid belt. Where's the supposed problem? Let's begin by recalling that modern philosophy has been rich in so-called "representationalist" theories of truth, referring to the view that when we open our eyes and look at the world we do not see things, but representations of things. John Locke is one of the most prominent representationalist philosophers, and Richard Rorty one of the best-known anti-representationalists.[53] The case for representationalism has numerous detractors, though it is rather simple: note that while fire is able to burn forests and cook food, fire as an image in my mind cannot do either of these things. Accordingly, we can think of our relation to the world as an act of translation, one in which we render the forms of the world in terms that are relevant to humans. But dogs also see the world in a doggish way, parrots in a way of their own, and so forth. The result is that no living creature makes direct contact with the world, but only an indirect contact that is distinct to their species, and perhaps even to each animal individually. All that we encounter directly is a representation of reality. The German philosopher Markus Gabriel dismisses this as "interface skepticism."[54] But many philosophers still defend a representationalist theory, myself included: in my case for the simple reason that a perfect perception or perfect mathematical of fire is not itself a fire. Nor can we say that the difference is simply that real fire exists in something calls "matter," while

[53] John Locke, *An Essy Concerning Human Understanding*, 2 vols.; Richard Rorty, *Philosophy and the Mirror of Nature*.
[54] Markus Gabriel, *Fields of Sense*, p. 14.

my idea of fire is a "form" extracted from matter. No one has ever seen or encountered such a thing as "matter," except in the relative sense that clay is a kind of matter for making bricks, though compared with its smaller constituents is form rather than matter. As I see it, the main historical motivation for theories of matter was to create a neutral medium of support in which forms can exist and then be extracted by the mind without alteration. I would propose instead that reality is nothing but forms wrapped in forms, sealed in forms, frozen in forms, and that these forms are always subject to translation when moving from one place to another.

In any case, if representationalism is true, then it cannot be limited to creatures with minds. Why not? Because inanimate objects are every bit as finite as humans, even if they are not "conscious" in the way that animals are. The term "finitude" is used by Martin Heidegger in his interpretation of Kant, as a way of defending the view that humans cannot touch reality directly.[55] Let's consider for a minute why finitude is so important. The ecological philosopher Jakob Johan von Uexküll made a powerful argument that even though all living creatures in a given region share the same surroundings (*Umgebung*), they do not share the same environment (*Umwelt*).[56] This differs for each creature, depending on its capacities. His most famous example is the tick, that infamous parasite that falls from trees and sucks the blood of its host; one of them nearly killed my father last year.

According to Uexküll, the tick's entire environment consists of just three factors: first, it senses butyric acid, found in the sweat of mammals, and this causes it to loosen its grip on the tree and fall onto the mammal; second, it uses its sense of heat to find a place on the mammal's body where blood is close to the surface; third, it uses its sense of touch to bite though the skin and suck the blood of its host. Such limited horizons for this creature! But while humans have a much richer

[55] Martin Heidegger, *Kant and the Problem of Metaphysics*.
[56] Uexküll, *A Foray into the Worlds of Animals and Humans*.

existence than this, we are still confined (as in Kant's philosophy) to perceiving three dimensions of space, a linear and irreversible time, and events that have causes rather than appearing at random.

Although many people can be persuaded to accept the theory of finitude in the cases of humans and animals, they tend to recoil in horror if asked to view inanimate things in the same way. Am I claiming that stones and dust have minds? But that's not the point. The point is that nothing like a "mind" is needed to interact with the world in a finite, limited way. If the tick's existence seems sadly limited, try to imagine the even sadder state of a flame when encountering a cotton ball. The flame is presumably not "conscious," yet it still interacts with a very limited range of the cotton ball's features: namely, the ones that are relevant to the its flammability. In other words, the flame is still finite rather than infinite in its interactions with the world, just like living creatures. It follows that no thing makes direct contact with another thing, but only with a restricted sample of its properties. From this we see that one discrete entity cannot make full direct contact with another; an interface of some sort must be involved. The same is true of the discrete points placed in a continuum, such as the numbers on a number line. We can never specify two numbers that directly touch on the number line, because an infinity of numbers can always be placed between any two given numbers. Since no two discrete entities can ever touch, they must somehow *become continuous* in order to touch.

And here is where the unusual speculations begin. I would say that there are two different ways in which entities become continuous with each other: let's call them "exterior" and "interior." The exterior way is the one we usually think of. Two things in the world meet and somehow affect each other, or maybe just one affects the other. I once wrote an article about the grim scenario of a midair collison between two airplanes.[57] The way I interpreted this event was not in the usual way, as a physical impact between two independent pieces of material, but as the temporary unification of

[57] Graham Harman, "Time, Space, Essence, and Eidos."

the two aircraft into a single substance. This new substance then had grave downward causation on its parts before they quickly separated, in new and severely damaged form.

Such downward causation (often called "retroactive causation") has been explored by such philosophers as Manuel DeLanda and Roy Bhaskar. DeLanda speaks of the "mechanisms through which a whole provides its component parts with *constraints and resources*, placing limitations on what they can do while enabling novel performances."[58] Bhaskar, for his part, declares that wholes are "capable of acting back on the materials out of which they are formed."[59] This gives us another reason not to undermine things by dissolving them into their tiniest pieces, since the whole will always haunt the elements of which it was made. We need only consider that Steve Jobs was one of the two original founders who built Apple from the ground up, only to see himself fired by the corporation in 1985. Or think of the way that a bomb (the whole) destroys its components (the parts). Stephen Jay Gould wrote about the constraints with which organisms try to rule their component cells, with cancer marking an unfortunate failure of this process.[60]

The point of these discussions of downward causation has been to shift our focus to what happens on the *inside* of objects I mentioned earlier that Leibniz would become important for us tonight, and that moment has come. For who has ever given a more serious theory than Leibniz, not just of how substances seem from the outside, but of what goes on in their interior where all their perceptions occur. But I am arguing for something a bit different. Let's say that I perceive a flower. According to the representationalist theory of truth, it is fair to say that we perceive not a flower, but a flower-image. The flower may also encounter some oversimplified version of me, but let's leave that topic for another occasion. Following the claim about two objects becoming one through causation (however briefly), both the flower and I the observer are parts of a larger object. In cases

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[58] DeLanda, *A New Philosophy of Society*, pp. 34-35. See also Graham Harman, "DeLanda's Ontology."
[59] Roy Bhaskar, *A Realist Theory of Science*, p. 114. Cited in DeLanda, *A New Philosophy of Society*, p. 34.
[60] Stephen Jay Gould, *The Structure of Evolutionary Theory*, p. 695.

of hallucination or severe misperception there would be no real flower to which its image correspinds, but this also does not concern us at the moment. In any case, I the observer and the flower-image are both positioned inside the larger object made of us both, as if in the hollow of a tree or the interior of a building. We can call this interior a "sphere" in tribute to the contemporary German philosopher Peter Sloterdijk, who built an entire worldview from the notion of isolated yet interlocking spheres, beginning from the initial mother-child dyad and growing outward from there.[61] Of course, I do not just encounter the image of a flower in this sphere, but the images of many things simultaneously: flower, mountain, dog, sunset; this may or may not be a special feature of living beings, but this topic too must be left for another time. Initially at least, I am just perceiving these images without anything further happening. We might call this interaction it a *modus vivendi*, in the sense of finding a way to get along with something or someone, pending final resolution of whatever tensions might be present.

Along with Sloterdijk's term "sphere," we can also borrow the related term "atmosphere" from another German philosopher, the recently deceased Gernot Böhme. (Leibniz, Sloterdijk, Böhme: it's interesting that so many German names are linked with the interior of entities.) In any case, atmosphere refers to the general ambience of a situation, as opposed to whatever individual things might happen to occupy it.[62] Amidst our *modus vivendi* with numerous images at any given moment, there is also the more general ambience in which all theae images are bathed. A knife means something very different in such atmospheres as a supermarket deli, a cutlery store, a stage play, or a beach. Our immediate contact is not with the knife-image, but with the atmospheric

[61] Peter Sloterdijk, *Spheres,* 3 vols. His theorization of the mother-child relationship makes it as crucial for philosophy as Melanie Klein (1882-1960) did for psychoanalysis. See Melanie Klein, *The Psychoanalysis of Children*.
[62] Gernot Böhme, *The Aesthetics of Atmospheres*.

continuum that allows me to touch that image in differing ways.[63] Here we find the figure-ground structure of Gestalt pyschology. These opposite terms distinguish between whatever in the visual field grabs our attention and commands our interest (figure), and the more amorphous remainder that does not capture our attention (ground). Stated more simply, it is the experience of architectural interiors, with their dual character as atmosphere and legible surface. What makes this figure-ground structure so important is that I am a discrete entity and the flower-image is a discrete entity, meaning (according to the argument of this lecture) that we should not be able to make contact at all. But all images appear in a more general atmosphere, and this is characterized by its continuity, which serves as the medium for me to perceive the flower.

But, as mentioned, our *modus vivendi* with various images is not just an endpoint, but also a potential beginning. Since we are surrounded by images rather than the things themselves, we seem to be trapped in a world of phantoms; worse yet, these phantoms might even seem to be nothing more than "bundles of qualities" (in Hume's sense) rather than unified images.[64] In other words, we are usually confined to a literalist world. I take Hume to be the arch-literalist, since literalism is the attitude of taking a thing to be identical with whatever sum total of qualities it possesses. Strictly speaking, if an object changes its qualities even a little bit from one moment to the next, it has become a different object altogether, since the bundle is no longer the same. This was rejected in advance by Aristotle, with his meditation on substance and accident; Socrates and Socrates sitting down are indeed the same substance. But it is seldom recognized that it was also rejected by phenomenology in the twentieth century. Edmund Husserl does not agree at all that an object is a bundle of qualities: quite the contrary, since a thing can show us numerous adumbrations, qualities,

[63] See also the related notion of "levels" in Maurice Merleau-Ponty, *The Visible and the* Invisible, p. 114 and Alphonso Lingis, *The Imperative*, p. 5.
[64] David Hume, *An Enquiry Concerning Human Understanding*.

or profiles while still remaining one and the same object.[65] Stated differently, both Aristotle and Husserl allow for a dualism of object and quality that Hume could not even consider permitting.

But an even better way to de-literalize the world is seen in the case of metaphor, which I take to be of the greatest importance for philosophy. When one thing is metaphorically compared with another, there will of course be some basis in shared qualities, since otherwise we will not compare them. But there's more to it than that, since the closer the similarity between two things, the *less* likely there is to be a metaphorical relation between them. For example, during the Cold War NATO used the term "Whiskey Class" to refer to more than 200 Soviet medium multi-purpose submarines. But the stark similarities between all these Soviet watercraft (the use of diesel-electric power, the carrying of four cruise missiles) gives us nothing more than a literal comparison; we are focused on shared bundles of qualities, and solemnly judge that all of the submarines fall under the Whiskey Class rubric. Conversely, if we compare two random objects with few or no shared qualities, we will be too confused to have a metaphorical experience: for example, "a jellyfish is like ten miles of asphalt highway." Try as we might, it is not very likely that we will be able to mentally perform this strange hybrid being.

Yet how different things are with metaphor, omne of my favorite being Homer's "wine-dark sea." This cannot be paraphrased as if Homer were saying: "Have you ever noticed that the Mediterranean is the same color as wine?" That paraphrase would perhaps be false, and in any case would be rather boring. Instead, the trivial fact of their similar color is used as a pretext to identify the sea and the wine more generally. We will think of the sea as having a number of other wine-properties: intoxication, danger, and oblivion come to mind, though no metaphor can ever be exhausted by a prose list of similarities between objects. Note as well that unlike literal statements, metaphors are irreversible. We can also say "sea-dark wine," and this too is a metaphor, but not the

[65] Edmund Husserl, *Logical Investigations*, 2 vols.

same one. In the first case we have a sea with wine-qualities, and in this second case we are speaking of a wine with sea-qualities. In other words, in "wine-dark sea," the sea is playing the object role, and the wine is playing the qualities role.

To strip the qualities away from one object and force them onto another necessarily creates a certain tension. We have a more or less vivid sense of what the qualities of wine are, but no real sense of what a wine-like sea would be, since it is being produced in this metaphor for the very first time. This requires an intense personal effort that is usually foreign to literal statements; this effort draws us into the act of creating a new object in our minds. And since the wine-like sea is so elusive, we step in and perform it ourselves, as if we were a wine trying to shoulder the burden of sea-like qualities. We are like method actors pretending to be a rock, a tree, or a mafia don, with the added complication that we are not just pretending to be the sea, but also a sea with wine-qualities.

The mental effort required to compress the various unspecified wine-qualities into the empty form of a masean helps explain the more powerful emotions that result from metaphorical experience than from literal statement: in the metaphor, our entire being is wrapped up in trying to create the wine-dark sea. In the terms of speech act theory, it is a performative experience rather than a constative one: a statement that is not a mere description of fact, but one that implicates me in its consequences. I am no longer the jaded perceiver who places the image of a sea side-by-side with the image of wine. Instead, I have been causally impacted by my performance of the wine-like sea. The literalism of my *modus vivendi* with images has been replaced with with a new version of me, even if temporarily so. This is the role played by the object/quality polarity that literalism denies.

The philosophy of recent centuries has often asked us to conceive of human beings as transcending the world around us, rising above it so as to make critical assessments of the world rather than naively dealing with it. I would say instead that transcendence is the wrong metaphor for what we do. A better one is to say that we are like moles tunneling through the interiors of objects,

and leaving one only so as to enter another. We are more defined by what we take seriously in our *modus vivendi* than by what we rise above. It may seem like we are now a long way from Aristotle, but it was his great heir Leibniz who drove us more than halfway to where we are now. I now look forward to discussing these matters with you. Thank you.

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