**Opening Remarks**

Over the course of the semester, we examined the Eleatics in some detail, mostly focusing on Parmenides' proem and the Platonic dialogue of *Parmenides*. It would seem on the surface that Parmenides was the greatest Pre-Socratic philosopher simply by the weight of his arguments and predilection for conflict. Reading *Parmenides*, one would tend to think that Socrates/Plato was rather impressed with the system Parmenides created, the idea of the One being central to his thesis. Why is it, then, that I have chosen to write this paper on Zeno, a figure often thought to be nothing more than a thorn in the side of the Socratic philosophers? The question is best answered by focusing on exactly why Zeno is the proverbial thorn: his ideas were, and still are, difficult to comprehend and dispute. Most people, philosophers included, enjoy a challenge of wits; when that challenge becomes an exercise in futility however, most would rather cut their own leg off. Indeed, Zeno's paradoxes were simply mental workouts that had no answer. Zeno himself proposes no possible explanations to them. But is this really the case? Are his paradoxes merely constructions that are meant to confuse, providing no enlightenment, nor legitimate argumentation? Before Russell, Zeno was viewed as I have described, a sort of sideshow freak in the annals of philosophical discourse. Russell, however, recognized Zeno as a mathematical genius[1], although this view seems a bit suspect.

It seems probable that Zeno did not fully understand the implications of his paradoxes. And, in fact, I would go so far as to argue that the *Sophist* leads one to believe Zeno is nothing more than a jerk, as Aristotle calls him the inventor of the dialectic, a

---

[1] The Presocratic Philosophers

method of arguing by using the other party's admitted positions against them. His whole philosophical career seems to be nothing more than a way of defending Parmenides from attacks made against the latter's views about non-sensory reality. By showing that the competing views resulted in the same problems, Zeno hoped to prove Parmenides' position had as much justification. Here, though, is the beauty of Zeno's arguments. Perhaps he **was** a jerk, but what true philosopher isn't[2]? Zeno did not fully understand what he was producing, and in this instance Russell is right: Zeno is a genius, but in a way I don't think Russell implies. It is my position that Zeno produced a line of argumentation, fully intending it to be nothing more than a debunking of the anti-Parmenidean sentiment, which has stood the test of time and more properly described the true nature of reality than other more "acceptable" views. Thus, Zeno got it right, despite his efforts to annoy and cajole others into intellectual fistfights.

Instead of approaching Zeno from a mathematical position, as other have frequently done, I am instead going to focus on his paradoxes from the viewpoint of contemporary quantum mechanics, physics, and other more interesting pursuits of scientific nature, as well as common-sense views of reality as perceived in an age of space travel and computers. It will be my aim to show that as science becomes more refined, Zeno is shown to be more applicable. I will explicate his positions then juxtapose them with modern scientific views with the intention of showing definite corollaries.

**Density**

[2] A mild jab intended to be taken for humor value.

The first argument I'll focus on is the paradox that attempts to show that there could not be many things in the world, i.e. if more than one thing exists, it is a contradiction. Zeno's reasoning is thusly:

> "First, he says that any collection must contain some definite number of things, neither more nor fewer. But if you have a definite number of things, he further concludes, you must have a finite -- 'limited' -- number of them; he implicitly assumes that to have infinitely many things is not to have any particular number of them. Second, imagine any collection of things arranged in space -- imagine them lined up in one dimension for definiteness. Between and two of them, he claims, is a third; and in between these three elements another two; and another four between these five; and so on without end. Therefore the limited collection is also 'unlimited', which is a contradiction, and hence our original assumption must be false: there are not many things after all."[3]

The conclusion to be made from this argument is that if the world contains many things, a contradiction arises since the collection of things must be finite and infinite simultaneously. We have a rigidly defined number of items, yet their density is infinite. To put it another way, there must be something between two items that makes them separate, lest they be one item. Since there then must be something else that is between those three items lest they be one item, we have five items, ad infinitum.

[3] Stanford Encyclopedia of Philosophy

How does one rectify this paradox with reality? Surely we have a table over there and a pen over here and several large volumes of Shakespeare on the shelf. None of these items appears to be connected to the other except by the air that flows between them. We might eliminate the air by placing them in the vacuum of space, although there are plenty of particles out there, even in the remotest areas. Is there a way we could possibly put two objects in a situation where **nothing** is between them, not even a rogue photon of light? Doesn't really seem possible, even in the most rigidly defined laboratory. To make this example more ridiculous, lets put *King Lear* in a room specially constructed for this situation. The room has been designed so that particles of any sort cannot penetrate it, perhaps it is constructed of adamantium or mithril[4] or who knows what; lets just say it works. On the other side of the room, we put *Romeo and Juliet*, knowing that the two books are at least three feet apart. We extract all the air from the room, as well as any stray electrons that happen to be floating around. Are the two objects separate now, with nothing between them? At first, it might appear this experiment is optimal for showing the irrelevancy of the paradox. Obviously, we **can** have a situation where two objects have nothing between them other than empty space. This is, of course, until we realize a few things about how materials act in general. All substances experience some sort of decay, even when not enacted upon by external factors. It is observable that Carbon-14, for instance, loses neutrons over time due to the expulsion of alpha particles. It changes to normal Carbon-12 during a slow, tedious process; but one that occurs nonetheless. Nearly all atoms experience the same sort of decay, albeit at different rates, radioactive materials being the most likely to experience rapid atomic decay (hence their name). It appears then that *King Lear* and *Romeo and Juliet* would be releasing particles into the

[4] Adamantium of course being a reference to *Xmen*, while mithril a nod to Tolkein.

space that separates them as time goes on. Were we to somehow observe the situation in our hypothetical room without disturbing it, we might see literally billions of particles floating around, none of which were present at the start of the experiment.

In the preceding example, it has been illustrated that the natural state of the universe seems to be in a state where nearly infinite particles exist between each and every “thing”, or what we might call substantive objects. Zeno’s density problem seems perfectly relevant in light of this. A simple consideration of chemical properties reveals that nature truly does seek to become “one” thing in the sense that Zeno implied it, yet also maintains distinct “separateness”. Rectifying the infinite density of space and the finite number of objects might be more easily done if we posit that *King Lear* isn’t really one object, but a massive collection of billions of atoms. In this instance, what we see as one is in reality a collection of particles whose number measure more than we might be about to actually count easily. The object is a unified whole, but is a collection of things whose density is immense.

**Finite Size**

Leaving density, the next Zenonian argument I’ll focus on is the paradox of finite size. Essentially, the argument shows that if many things exist, they have no actual size, things do not exist at all due to their lack of size, and extended objects extend infinitely by virtue of having a front part:

> "…if it should be added to something else that exists, it would not make it any bigger. For if it were of no size and was added, it cannot increase in size. And so it follows immediately that what is added is nothing. But if when it is subtracted, the other thing is no smaller, nor is it increased when it is added, clearly the thing being added or subtracted is nothing.
>
> But if it exists, each thing must have some size and thickness, and part of it must be apart from the rest…and the same reasoning holds concerning the part that is in front. For that too will have size and part of it will be in front. Now it is the same thing to say this once and to keep saying it forever. For no such part of it will be last, nor will there be one part not related to another. Therefore, if there are many things, they must be both small and large; so small as not to have size, but so large as to be unlimited."[5]

Adding a thing that has no size to another thing of no size is akin to adding 0 to 0, which results in 0, a claim most might agree with. However, if there are many things, they have no size (similar to the explanation about density above), resulting in everything having no size since there are obviously many things in the world. Further, an object with extension has two parts in the sense that we might divide it in half, calling one part the front and the other the rear. Both of these parts are extended, and in fact can also be divided into halves, each having extension as well. We divide these infinitely, thus getting an infinite

[5] Stanford Encyclopedia of Philosophy

number of parts that are all extended. Adding these up, we get what appears to be an infinitely large number. Hence, a finite extended object is infinitely large.

Zeno's first idea is very intricate, and I'll instead focus on the second part right now. The idea of infinite extension is interesting in that it is directly connected to limits in modern calculus. We can easily determine using a limit that the sum of a half plus a half of a half, etc. is one, so Zeno's proposition seems almost negligible. That is, of course, until we realize that limits are in fact mathematical approximations. While they are extremely **good** approximations, the limit as a sum approaches an infinite number of arguments is not known with 100% accuracy. I realize this doesn't show Zeno to be correct in that all objects are infinitely large, or have infinite extension. If that was the case, I wouldn't have to worry about paying my rent and could instead afford that new motorcycle…What it does demonstrate, however, is that the problem with infinite divisibility and extension of objects has not been fully rectified in contemporary math. I am at a loss to come up with a good explanation on how to approach this problem beyond the realm of hypothetical mathematical constructs that deal with infinity better than what we have now. Perhaps modal logic would be better in this case.

The first part of Zeno's argument is related to the density position in that the size of a thing is 0. We might look at the explanation above for the failings of math in this area and decide to drop the whole thing to watch the NBA playoffs. This is, of course, barring any relevance to physics; the argument seems to be very relevant, however. Many things do exist, and in fact they have a size that cannot be properly measured. This size appears to approach 0 as we discover their true nature. To be perfectly clear, lets examine the first views of atomic structure. We began with the idea that ordinary things were composed of "atoms", minute particles that formed into collections. These "atoms" were discovered to be cells, then broken down into molecules. The molecules were composed of elements, each of which had protons, neutrons and electrons. It was thought that these three particles were the basis for all matter. Further study revealed that quarks in fact composed these particles, but we're not done yet. Just what composes a quark? The most common theory is that of super strings, although there are several competing views in string theory. Modern science has come to a point where our basic understanding of matter is being challenged. It must also be pointed out that as each division of matter took place, we saw a lot of empty space. For instance, supposing that the nucleus of an atom is a couple basketballs in the middle of a football field, the electrons would be grains of sand a mile away. And those are just the electrons in the first energy level, to say nothing of higher quantum levels. What this demonstrates is that what was thought to be a solid structure is nothing more than some very small particles with a whole lot of room between them. Protons, too, have a similar amount of empty space when comparing the distances of the quarks that compose them. If quarks turn out to be made of even smaller particles with lots of space between **them**, where does it end? The crux of the argument concerning infinite size of finite objects seems to be that Zeno was right in his assessment. We can seemingly divide an object into infinite parts, whose sizes approach 0. Since the sizes are 0, adding them should result in 0 as well, but instead we get coffee tables and cabbages. The division of 1 by 0, i.e. the whole by the size of its parts, is in fact infinite; a quandary that modern physics demonstrates as a legitimate issue.

**Dichotomy**

Here we begin tackling the more well known paradoxes of Zeno, those dealing with motion. The first deals with the division of a thing into two parts infinitely, i.e. a dichotomy:

> "The first asserts the non-existence of motion on the ground that that which is in locomotion must arrive at the half-way stage before it arrives at the goal."[6]

If I must run to Bolton Hall to avoid the rain one day, I need to run half the way there. I then need to run half the remaining way, and then half of that again. Each time, I am getting half again as close as the time before. I can divide these lengths infinitely, yet they are all finite in size. How can I possibly move an infinite number of finite distances in any less than an infinite amount of time? We might simply divide the time infinitely as Aristotle did, yet then again we have an infinite number of finite amounts of time, resulting in the same problem as before.

This problem is interesting in that it completely violates our understanding of motion at the level in which we perceive it. Obviously, I can run to Bolton (albeit rather slowly due to prior injuries)[7] in a finite amount of time, as has been exhibited before over the course of the year. College Station receives a fair amount of rain, so it is not too uncommon to see other students running to various classrooms as well. Applying this

---

[6] Stanford Encyclopedia of Philosophy
[7] Football and baseball have taken their toll, unfortunately.

paradox, however, how are we ever able to get anywhere? At the level of perception we're accustom to, the level which deals with *King Lear* and computer desks, infinite division of spatial units seems near impossible. I can't even take a step that is one-billionth of the distance between Bolton and the bus stop. It is such a small distance as to be unobservable by my eyes. Moreover, I can time myself running to Bolton, and it's a finite amount of time. One-billionth of a second literally means nothing to me outside of a mathematical context. Did it take a billionth of a second or a trillionth of a second for a particular event to occur? I'm willing to bet the most rigorous scientific instruments would have a hard time discerning that, which makes my ability to do so impossible.

Moving to the sub-atomic level, however, we may be forced to appeal to the Uncertainty Principle as proposed by Heisenberg, often referred to as the HUP. When I say appeal to HUP, what I mean is this: particles of matter at the sub-atomic level, those being protons, neutrons, et al, are not known in position and time simultaneously. A certain electron is **here**, but we cannot be sure of its velocity. On the other hand, supposing I know its velocity, I cannot be sure of the actual position. The HUP is predicated on the notion that knowing something about a system requires disturbing it, which seems reasonable. Even at the macroscopic level, light must bounce off an object for me to see it; so too something must "bounce off" sub-atomic particles. Unfortunately, the only particles we can currently use to do the bouncing happen to be other sub-atomic particles, and this is where HUP becomes relevant. The effect of using an electron microscope to "see" protons is that those protons are moved, much the same way a basketball might move if I started throwing billiard balls at it. Thusly, I can measure velocity, but not position, as I have moved the particle ever so slightly by looking at it, and “ever so slightly” being an enormous change at the sub-atomic level. Some bizarre results might be obtained by HUP. Is a particular atom ;at position A? The probability factor is maybe 99.9995% that it is at A, but it also might be anywhere in the remaining 0.0005%. By anywhere we actually mean **anywhere**, i.e. fifty-seven billion light-years away; there is a definitive finite chance that ; could be at any location.

Applying the HUP to the dichotomy results in a clear understanding of the validity of the paradox. Since we cannot know position absolutely, how am I to know if ; even traverses the space between point A and B? If I know that ; is indeed at A, its velocity is unknown to me, hence it might actually be moving infinitely fast. We can observe ; at position A and at position B, but we cannot “see” it during the entire time it spends moving between them; this creates the situation where ; might actually move half the distance, then half the remaining distance, etc. Since the velocity is unknown with certainty, and the position is only known after the fact, perhaps it is possible ; traverses no actual space when moving from A to B. Since it would take an infinite amount of time per Zeno, ; skirts the issue by either not moving through the intervening space, or moving infinitely fast. In this case, we cannot tell if either is true, nor can we be sure if either is false. It might be the case that either one is false, but probable that at least one is true. The HUP is incomplete, obviously, as it provides no answers to these questions. Because of this incompleteness, we cannot be sure if the universe is indeterminate or determinate, or even if those words have any meaning at the quantum level. Einstein’s famous quote, “God does not play dice”, directly addresses this issue, as he was loath to admit to a world where particles acted randomly, with no definable path. Zeno seems to have a definitive place in the HUP with the dichotomy, and thus with the understanding of sub-atomic motion.

**Achilles**

One of, if not the most, famous paradoxes of Zeno's was the Achilles paradox, similar in nature to the dichotomy in that motion is impossible because space is infinitely divisible:

> "…Achilles was taken [as a character] in it, and the argument says that it is impossible for him to overtake the tortoise when pursuing it. For in fact it is necessary that what is to overtake [something], before overtaking [it], first reach the limit from which what is fleeing set forth. In [the time in] which what is pursuing arrives at this, what is fleeing will advance a certain interval, even if it is less than that which what is pursuing advanced…and in the time again in which what is pursuing will traverse this [interval] which what is fleeing advanced, in this time again what is fleeing will traverse some amount…and thus in every time in which what is pursuing will traverse the [interval] which what is fleeing, being slower, has already advanced, what is fleeing will also advance some amount."[8]

To explain using an example of my own[9], I propose that I must face Don Garlits in a drag race. To make it interesting, suppose this race will determine the fate of the

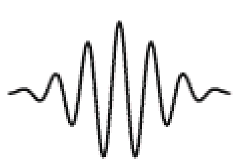
[8] Stanford Encyclopedia of Philosophy
[9] Mostly because there aren't enough drag racing analogies in philosophy, which seems a shame.

universe, as Garlits is in cahoots with Satan. It is a fact that “Big Daddy” is one of the best racers to ever live, so I am quite worried about losing. While Garlits has a multimillion-dollar top fuel dragster, I am stuck driving a ’79 Pinto with a busted radiator. Not the best position to be in, for either myself, nor the masses that are depending on me. Thankfully, Garlits has agreed to a bracket race, wherein my car will be given a substantial lead to make up for the utter lack of speed relative to the dragster. The track is a standard one-quarter mile, whose length we’ll denote as T. After we have successfully staged, I drive down the track, 0.9T being traversed. I am moving at roughly 0.1T per second. At this time, Garlits lights up his tires and barrels down the track at 1T per second. A simple mathematical calculation would reveal that we should both reach the end of the track simultaneously. This is where the paradox comes in: Garlits must first reach the point at which I was when he started the race, that being 0.9T away from the starting line. In the time it takes him to get there, I have moved another fraction of T, to which he must also reach. Each time Garlits is in the position I was before, I have moved slightly further. There are an infinite number of spaces interspersed between Garlits’ current position and mine that he must reach before he catches me, hence he never will. Garlits travels 0.9T, then 0.99T, then 0.999999T, etc. Garlits can never win, and the world is saved.

The relevance of the Achilles is similar to that of the dichotomy in that we have a finite amount of space that must be traversed in an infinite number of iterations. As stated similarly above, it seems ridiculous to assume that Garlits has no chance of catching my hotrod Pinto, even if only to tie. It is not the case that Garlits’ speed is unknown, but his position; it is the uncertainty of his actual position leads us to problems with the overtaking of the Pinto, and if he even reaches the finish line or not.

Here I will look at another paradox of some fame in recent years, commonly referred to as Schrödinger's cat. Schrödinger proposed a situation where a cat was placed in a box along with a radioactive material (perhaps uranium), a hammer mechanism and some poison. If the uranium decayed, the hammer was released, striking the bottle of poison and breaking it, which killed the cat. However, as we cannot know exactly when a material will decay, it is impossible to know if the cat is dead or alive without opening the box. We can definitely predict the fate of the cat to a great degree of accuracy, as the half-life of uranium is well known, but it is impossible to know exactly when the cat is dead, as a half-life is an average of the rate of decay a radioactive material experiences, not a rigid constant. Hence, the cat is in a state of being "not-dead" or maybe "not-alive".

This example gives rise to the concept of wave functions, a method of applying determinism to the HUP mentioned above. In much the same way that Garlits or Achilles cannot catch the slower due to uncertainty about their actual position, we cannot tell if the cat is alive or dead. When we open the box, however, we know precisely if the cat is dead or alive, which would be analogous to observing Garlits crossing the finish line. A wave function



is a mathematical construct that resembles the picture above and tries to describe the relationship between position and speed. The size of each peak gives the probability that a particle will be found in a position, and the distance between peaks gives its velocity. A wave function's purpose is to quantify an unquantifiable relationship, i.e. the unknown speed and position problem. Hence, we can use a wave function to predict one combination of position and velocity with certainty[10]. Using a wave function, we can accurately predict Garlits' position at a certain time and if the cat is alive or dead at a certain time as well. The uncertainty of position implied in the Achilles is so closely related to wave functions at the quantum level that it gives rise to certain questions I'll try to answer a bit later.

**Arrows**

Moving on[11], we'll now consider the paradox that deals with a flying arrow:

> "…that the flying arrow is at rest, which result follows from the assumption that time is composed of moments…he says that if everything when it occupies an equal space is at rest, and if that which is in locomotion is always in a now, the flying arrow is therefore motionless."[12]

In this instance, Zeno is proposing a case where time is a series of instances, consecutive periods of "now". We might agree that **now** is quite different than **then**, and grant to

[10] Stephen Hawking's public lecture
[11] A very bad pun.
[12] Stanford Encyclopedia of Philosophy

Zeno the conclusion that time is composed of many nows, each occurring one after another. If we fire an arrow towards a target, it traverses towards its target. Taking a snapshot of the arrow at a particular instant, however, reveals that its motion is null. It occupies the same space during that entire instant, thus it has no velocity Again, this appears reasonable, considering that when we take pictures objects in them don't continue to move. A problem arises when we consider that the entire movement of the arrow can be divided up into instants: if the arrow does not move at any one instant, and the entire movement can be divided into instances, then it really doesn't move at all. If I assume an instant is actually a time of 0, and the distance moved is also 0, the speed of the arrow is in fact 0/0, which is an undefined value in mathematics. A common criticism of this paradox is that just because the arrow travels no distance during the instant we observe it does not mean it is at rest. This criticism seems faulty itself due to the reliance on the assumption of motion the arrow experiences. To explicate, if we did indeed take a picture of the arrow in flight and showed it to someone, would they be able to tell us with accuracy if the arrow was motionless when the picture was take or moving towards the target?

I hit my target with the arrow, so in fact the arrow does move, that much we know; but this is only because we are able to see the arrow fly from my bow to the target, not because we have an inherent ability to discern motion. In this case, Zeno seems to have something. Yes, 0/0 is undefined, which directly supports the fact we can't look at a picture and judge velocity. It must be pointed out that velocity is an average in the first place, so two positions must be know for it to be relevant. Moving 10 feet in 1 second results in a velocity of 10ft/s; thusly, moving 10 feet, or any distance for that matter, in 0 seconds results in 10/0 ft/s, or an infinite velocity if we know some high level calculus. Consequently, the paradox leads us to come to terms with our own limitations as individuals to observe the world as anything other than a series of events that seem to be connected. Although this paper was intended to focus on more scientific interpretations of Zeno, I can’t help but think the arrow problem reveals something vital about our own stream of consciousness. How is it that we perceive time, or even how does time progress? Is it merely a transitory state that exists solely for the purpose of keeping things in order, as I’m inclined to think, or an actual, quantifiable substance that can be measured in a laboratory? The implications of 0/0 lead me to believe the former, although I wouldn’t be surprised if mathematics one day has a solution to that problem. I am unsure of the relevance of this paradox in scientific circles, but common-sense reasoning leads one to believe it provides some insight into how our perceptions of the temporal nature operate.

**Millet**

The last paradox of Zeno’s I’ll look at is the one dealing with millet seeds and the indeterminacy involved in perception:

> “Zeno's reasoning is false when he argues that there is no part of the millet that does not make a sound; for there is no reason why any part should not

> in any length of time fail to move the air that the whole bushel moves in falling."[13]

If a bushel of millet makes a noise when dropped, why does one grain of millet not? Dropping the whole bushel will make a noise of a certain level of decibels, call it *db*. If there are a million grains of millet in the bushel, each grain makes one-millionth of a decibel noise, or *db*/1,000,000. Thus, this seems to be an issue of perception, not that one grain of millet makes no noise. An oft-used joke is, "If a tree falls in the forest, and no one is around to hear it, does it make a noise?" Again, we see that it could be the case, and in fact most assuredly is, that our perception is what is causing the problem here, not something fundamental about the nature of the universe. We just have no ability to hear one grain of millet hit the ground, although I am sure a sophisticated listening device might be able to.

The implication of the millet problem is quite simplistic: we should not always trust our senses. By sense, I mean not only the five physical senses, but analytic senses derived from the systems we have created. While simple, this principle is not always applied, by either scientists or philosophers alike. Were we to only read Aristotle, we might not know how gravity works per Newton, who was later proven wrong by Einstein, and who is now being shown to be wrong himself. At each stage in the development of our scientific knowledge, there have been a few individuals who understood the millet problem, and were not content in the current state of affairs. They revised scientific theories, thought concrete once before, and developed new ways to do mathematics. If

[13] Stanford Encyclopedia of Philosophy

they simply followed the current course of study at the time, their ideas might not have been realized. It is fairly clear from the quotation that Zeno's intent was not to confuse, but to spark thought, in much the same way a Zen Koan might.

**Conclusions**

One underlying theme in the paradoxes of Zeno, that of indeterminacy of time and space, is definitely applicable to modern scientific research, particularly involving quantum mechanics. The current state of quantum mechanics is a morass of theories, new ones of which are produced on an almost daily basis. When first reading Zeno, we might dismiss it as hypothetical nonsense that has no bearing on reality, and in most cases we'd be correct. The problem with this view is that Zeno's work cannot be understood at the macroscopic level anymore than we can visualize the interactions that atoms have with one another. As we become more familiar with sub-atomic particles, the true underlying reality beneath the world we propose to understand, the more obvious it becomes that the uncertainty Zeno describes is indeed an issue. We have no need to worry about Achilles being unable to finish a race in much the same way we don't need to concern ourselves with problems arising from the position of an atom being unknown; Zeno becomes a mental exercise, meant to irritate the Socratics about pluralism. A physicist, however, is very concerned with issues like the position of atoms, and hence Zeno is appropriate with regards to his handling of such problems.

That said, my honest conclusion about Zeno, after reading criticism of his work by many philosophers including Aristotle, is that his only intent was provide muscle in an effort to defend Parmenides from the overtly aggressive movement of the Socratics and their pluralist ideals. He proposed problems dealing with spatial and temporal relationships that were unsolvable, either then or now. By mere luck or happenstance, his propositions somehow accurately mirrored reality more closely than we ever thought possible. While most likely incorrect or only partially correct, at least intuitively, the arguments are still extremely relevant to comprehending how the universe operates beyond our senses. If Zeno is in fact fully correct, and our intuitive notions of time and space are flawed completely, philosophical questions arise, namely the relationship between the Achilles problem and wave functions, as mentioned earlier. The uncertainty about the position of Achilles as relates to wave functions basically boils down to: not knowing the position of an object in totality gives room for questions of transitory existence. By this I mean Achilles a collection of sub-atomic particles, and this implies that knowing his actual position at a specific time is impossible. How is it we can still see Achilles move at the macroscopic level? If all the atoms composing Achilles' body are indeterminate in position, what "glue" holds them together long enough for his existence to be continued for the totality of his life, much less the race? The whole of existence might be nothing more than God being really lucky at the craps table, somehow always throwing the dice so everything is ordered properly at the level we can perceive.

Hopefully I have shown at least a cursory relationship between Zenonian paradoxes and contemporary physics, or at least offered a beginning to create one. It has become evident while doing this paper that science and philosophy are more closely related than one might think, although looking back on historical philosophical figures reveals this to be patently false. The one more knows about science, the easier it is to create theories of philosophy that describe reality, which is hopefully our aim as philosophers. If not, we might always take up fishing…