

Chapter 1

A Mage in Motion – Metaphysical Riddles of Time, Space, and Motion

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“Here we go” I whisper as the gates holding us back from the frozen peaks and canyons of Alterac Valley finally open the flood of would-be heroes ready to fight the Horde and their allies, the Frostwolf clan. I summon my nightsaber mount— I’m still amazed that this feline three times my size is able to appear from a parallel world to carry me swiftly without protest. With a growl he leaps over the ridge alongside other Alliance heroes: there are noble Elf Warriors and terrifying Death Knights riding next to shadow Priests and demonic Warlocks. In front, a holy Paladin and a Draenei Shaman are arguing about who is the better healer, while a diminutive Rogue is pick-pocketing them (somehow I think she is just pretending). A Druid and a Dwarf Hunter ride up to me demanding some conjured water. I shrug my shoulders in disbelief as I begrudge what is expected of me these days. “Don’t you know I can’t conjure drinks and ride?” I muttered tersely.

I am Admetus, a Human Mage. My personal story is short since, for some reason, I don’t have much recollection of my past. I live in the world of Azeroth, although many of its denizens call it “The Server” especially when the so call “Lag”

demon appears to “slow” or “crash” it. I have to admit I have never quite believed these stories, since I have never experienced the “Lag.” I only know of this phenomenon from others who describe it as a momentary stoppage of all actions in the world. I have often wondered that if we all experience this lag in the same way, how could we know that there was indeed a lag?¹ Regardless, many believe it exists and leads them to threats about changing “servers” and to blasphemous tirades against the mighty pantheon of the gods of *Blizzard*. These divinities apparently control and have the power to destroy or “shut down” our world, as some prefer to say. Many of my fellow denizens believe that once a week, to remind us of their power, the *Blizzard* gods “shut down” our Server for a few hours. I have also never experienced this, but many claim they do, and every Tuesday after midnight cries can be heard around Azeroth lamenting the impending but momentary doom. Similarly as with the lag, I remain puzzled: if all things disappear simultaneously only to reappear a few hours later undisturbed, how can we tell that we have in fact disappeared?

We ride through the frozen canyons and valleys of Alterac with ease. No Horde in sight. From the corner of my eye I see a wildflower. I magically dismiss my mount and proceed to collect it almost without intending to, as if compelled by a force beyond my control. I am an herbalist, you see. I collect and alchemically alter

¹ Newton postulated and argued (via the famous rotating bucket experiment) that for his laws of motion to be feasible, he needed to assume the existence of an independent, unobservable, and absolute background of space and time. Leibniz argued for a relational account of motion and against the existence of such independent background in similar ways than our protagonist: if we shift everything in the universe a little bit to the right, in time and/or in space, could we tell this motion took place? For more information see the references on Newton, Barbour and Shoemaker, for a philosophical argument for the existence of time without change.

flowers into powerful potions, which then I sell, gift to friends, or drink myself. “It is strange” I whisper, for I have never seen a flower in Alterac Valley before or growing from a crusted sheet of ice for that matter. As I wonder over this strange herbal riddle, the last alliance rider disappears over the hill. I feel something or someone staring from a distance behind me. I turn around on my heels expecting the worst but I see no one. This is not the first time that I have experienced the sensation of a towering presence behind me. I have been feeling this since I began training as a Mage, or questing as some call it, in the Northshire Abbey of Elwynn Forest over four years ago. As a matter of fact, I don’t remember much of anything before that. How strange.

This feeling of being watched has grown more distinct and acute. Recently it has been accompanied with the disturbing realization that the mysterious presence may not just be observing me, but somehow affecting or attempting to control my actions. A few years ago, in one of my long walks around Stormwind (or runs, rather; I don’t know why most of us always run around rather than walk; we must be in a hurry I guess) a renowned sage from Dalaran was lecturing his students, at the steps of the Cathedral of Light, about the idea that our actions are nothing more than the inevitable consequence of our ordered universe.

I remember him saying that: “Our free will is just an illusion and we do not control our actions. This is a hard deterministic position—what is *is* because something distinctly caused it through and through and cannot be otherwise. Chance and possibilities are also mere illusions solely referring to our lack of knowledge and control.” He mumbled something about how the thought of a

universe ruled by chance was akin to the sight of the horrible motion of a mass of maggots in their carrion bed. A particularly bright student stood up and slapped the sage across the face. “There can be no judgment against me if there is no real element of chance in our universe” she said as she sat back down. I heard later that she replaced him as the head master of the academy.² As I reckon with this memory, I realize that of late this feeling is definitely more than the sensation of being watched; as if a foreign agency is controlling my actions. But if an external agency is behind my actions...

Suddenly I feel a sharp pain on my neck and lose control over my limbs, dropping the herb I have just gathered. I think a Rogue has just sapped me! Maybe that was the presence I felt and it could be my undoing. After a few seconds a back stab leaves me reeling with pain. I quickly invoke a frost nova spell that reveals the Undead Rogue and leaves him frozen in place. This spell tends to last only a few seconds so I proceed to do what I do best in dangerous situations: run away. As I flee I cannot stop thinking about my previous recollections about the meaning of freedom and the agencies in control of my actions. I figure that since the Rogue would be chasing me for some time—for they seem more than any other class to relish the chase—I would carefully consider the possibilities.

Since my current action is running and I cannot shake off the image of the motion of the maggots, I begin by entertaining what motion entails. “A good choice” I whisper, since motion is the basis of all of our actions. Motion is to *go* from A to B, I

² A good introduction to the topic of determinism and indeterminism is in Butterfield’s article in Routledge’s *Encyclopedia of Philosophy* and Kane’s edited volume on free will. The online Stanford Encyclopedia of Philosophy is also a good resource for summaries of this debate and other philosophical topics (plato.stanford.edu).

state to myself. Yet somehow I feel that I cheated by trying to define motion this way since “to go” implies motion. So I try again: motion is to *change* space locations in a given time. I feel satisfied until I realize that I may still be cheating since change implies motion as well. Even worse, I have just introduced two concepts that may deceptively complex: space and time. Rather than making matters simpler, I am making them worse. How can something so simple can be so difficult?³ And that damned Rogue is still chasing me!

I consider that to go from A to B I must first pass the halfway point between them. Let’s call it A’. Using the same reasoning, to go from A to A’ I first need to pass the halfway point, A”. To go from A to A” I must first pass through A””. And...I shudder. I imagine this as a line in front of me.



I can physically go from A to B, but from this thought experiment I can infer that motion is impossible since it would take an infinite amount of time to traverse the infinite points between A and B. I can’t move from A to B, or even worse, I can’t move at all since B can be any point arbitrarily close to A. “Motion is impossible,” I conclude aloud. Yet here I am running away from that Rogue and he is getting

³ Julian Barbour gives a wonderful introduction to the history of motion, reference frames, and dynamics in his book *The Discovery of Dynamics*.

closer. But how can he be getting closer if it would take an infinite amount of time to go from A, him, to B, me? This is giving me a headache.

Suddenly, a booming voice that appears to come from inside my head proclaims: “This is the well known paradox of Zeno.”⁴ After a startled moment I reply: “Who are you?” As I ask the question I look around nervously hoping that the sound came from the woods instead. A sardonic laugh follows my query. Distraught by this new event I try to stay focused on my other problem: the Rogue-in-chase.

Noticing that the Rogue is still a good distance away I distract myself again with this problem of motion. Obviously the problem must lie with my reasoning, since I can clearly move from A to B and the Rogue keeps getting closer. Unless, of course, I think that my reasoning is so sound that the experience of motion is illusory. I wake up from this thought by stepping on a cold creek that serpentines its way towards a crevice on the ridge I am running through. Let’s substitute the letters for numbers. I consider: A is zero, B is one and I imagine adding the numbers in my head, to go from A’ to B is half the distance, to go from A’’ to A’ is one fourth of the total distance and so on: $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$ I don’t have to add them all up to know that they should equal 1. But that’s of course assuming that I *would* add them all up, all the infinite fractions $1/2^n$ (with n being 1 and all the even numbers) between 0 and 1. “That is the answer to the problem” I declare satisfied. Since the sum of all these fractions add to 1, motion can occur.

“In the 19th century they called this solution the convergence of infinite series” rattles the bodiless voice. Exasperated I shout: “Who are you? How do you

⁴ For a solid introduction to Zeno’s paradoxes I recommend Huggett’s article on the Stanford Encyclopedia and his edited volume *Space from Zeno to Einstein*.

know what I am thinking? And what the hell is the '19th century'?" I am not certain if I will get an answer. I haven't seen the Rogue now for some time...maybe I lost him.

Hmm. But if the problem is really the infinite time it takes to traverse the distance from A to B, saying that we can have an infinite time to add the infinite series, does not solve the physical problem of the paradox of motion since it would take me an infinite time to traverse the distances. The answer must be something else. What am I assuming? I assume that there are an infinite amount of points between A and B and that it takes some time to go from one to another. One of the solutions could be to postulate that between these infinite small distances, the time it takes to traverse them is practically zero, instantaneous, and I can clearly have an infinite amount of those. Immediately I recognize that, although a possible solution, I make things worse by suggesting that the essential component of time has no time in it. Oh! So maybe there a minimum or discrete amount of time for every event.

"Dude, that's the idea behind Heisenberg's principle about energy and time. Well done."⁵ This time the voice does not rattle me, but I am perplexed about the comment so without much thinking I ask: "I don't know what that means at all. Can you explain? What is this principle about energy and time?" Not expecting a reply, I am surprised when I hear: "Well. The paradox of motion and Heisenberg's principle in quantum mechanics, er... the best scientific theory about motion of small things, are not necessarily related, well, so I thought, until you mentioned this."

⁵ For more information on quantum mechanics and Heisenberg's principle I would recommend beginning with a popular rendition like Rae's *Quantum Reality or Illusion*. Then a determined reader could pick up Sklar, Whitaker, Torretti, Hughes, Jammer, and the master himself, Heisenberg (see the reference section and further readings for titles).

Another option pops into my head. What if there aren't an infinite number of points between A and B? That is, what if between any two points in space there are a limited number of points? That would mean that there is a minimum distance. If so, we would not run into Zeno's paradox since this would not require an infinite amount of time to traverse. So space could be discrete and maybe so is time. But that is a weird thought since space appears so fluidly continuous. But appearances are deceiving, like my guild leader likes to say.

"Whoever you are," I say "can you explain that principle of "wanton mechanics"?"

"Quantum mechanics" said the voice with a chuckle. "It is a long story. It struck me that your reasoning was very similar to a fundamental principle of this very successful account of nature. You see, Heisenberg found that at small scales some types of properties of systems, like position and momentum or energy and time, are related in such a way that neither can be said to be fully part of the system simultaneously with a precise value. That is, if we have the position of a system fully well defined, then nothing can be said of the property of momentum; as if the system did not have it. This coincides with what the first physicist to uncover quantum mechanics, Max Planck, found about the state of black bodies. The energy or amount of stuff or amount of action a system can do, he concluded, is not formed by all possible values of energy within a certain range, but it comes in discrete amounts or chunks; 'quantum' means packet or discrete." After a pause the voice continued: "That's why I was surprised when you thought similarly from an ancient paradox."

“Are you my conscience?” I ask timidly. Before I could hear a reply the Rogue reappears, but I am able to freeze him again with a cone of cold spell right before he struck. I am lucky. Let’s keep on moving, or can I?

I attempt to run at a faster rate to get away quickly from the soon to be thawed and highly irritated Undead Rogue, but somehow I can’t. I always seem to run at the same rate of speed. I realize that the only few exceptions to this fact are when I run with a hunter or if I take a swift potion, which I inconveniently don’t have with me at this time. As usual I left it in the bank.

“Why can’t I run at a faster rate, or at a slower rate for that matter?” I ask my new “friend.”

“I am afraid that if I tell, you will be shocked to hear the truth,” the voice utters in gloom. “Try me” I reply before really considering the consequences. After a long pause, the voice says: “Already then. You are my creation. You are a character in a virtual world and I control your actions. If I want you to run you run, if I want you to stop you stop.” All of a sudden I stop running. I want to run, I will to run, but can’t. I begin to tear up. What I thought had been my own free choice of action, now feels like a clear illusion. Before I can get too depressed, as if my “master” could sense it, I begin running again. Which is good since the Rogue is after me again. A terrible feeling of void overpowers me and I feel faint. I always thought I was in control of much of my life...

“I can tell you to run, walk or stop. But the gam...er, the world does not allow any continuity in between those actions” the voice states as a matter of fact. “Ah,” I exclaim, finding some way to reassert my independence, “then this fact of motion in

my world is indicative of the idea that rate of motion also occurs in discrete amounts: either walk at a given pace, run, ride or stop.” After a moment of silence my new “master” slowly pronounces: “Yes, except that motion always depends on a given reference frame. That is one’s state of rest or rate of motion depends on which point of reference is chosen.”

“What?” I quickly reply back. He proceeds: “Imagine that you are traveling at 3 mph on Gold Road. Someone next to you traveling at 3 mph will say that you are not in motion in relation to him or her.”

“Well, then, according to this thinking, then no one is in motion in reference to themselves.” I say smugly.

“That’s right. And a great scientist, years ago, used this thinking to reveal some amazing facts and laws about our universe” the voice replies and continues: “It turns out that the properties of systems, and not just motion, depend on the reference frame in use to determine those properties.”⁶ My thoughts are now turbulently spinning out of control.

Once again the Rogue catches up with me with his speed up abilities and is near another backstab attempt. “I can’t believe I forgot about this...” I hear the voice mumble. I turn towards the Rogue, cast a polymorph spell transforming him into a sheep. I wonder for a moment about this act of transmutation but figure that since I can’t even get clear on basic motion, I should not even attempt to understand complex biological metamorphosis. I ask: “Did you do that or did I do that?”

“I did. Sorry. Well, we did since without you I can’t do much.” Says the voice.

⁶ Barbour is again a good source of information on this issue, as well as Einstein’s *Relativity*; his own account of the relativity of motion.

Still puzzled about the last event and discussion I turn to gain some distance from the now polymorphed Rogue looking quite harmless at the moment. “I forgot about Blinking too” the voice acknowledges. “What the?...” before I could finish I find myself 20 or so yards ahead of where I was. “How did you do that? And why didn’t you do this before?” I ask with irritation.

“I just forget to use it. My main *alt* is a Priest. Hey, I will put you on ‘autorun’ and be right back, I need to get some coffee. I am thirsty.” Puzzled as to the meaning of all of these assertions, I notice the Rogue dispelling my polymorph incantation and continuing his pursuit. I have gained quite a distance though, so I feel secure to come back to my thoughts (are these my thoughts? And where are they?). How is it possible to go from A to B, at an instant? Did my body travel from A to B crossing all the space in between or did I just “skip” the space in between and appeared at B? Is that what happens if space is discrete for regular basic motion?

“Hey, what did that famous scientist say about all of these?” I yell, hoping to get a solution. Nothing. Worst of all, I get stuck behind a tree with my arms and legs flapping in a running motion but remaining in place. “Get your damned drink and come back! The blasted Rogue is almost on me...” I manage to scream before the Rogue strikes and batters my defenseless body to a pulp. I try to conjure some defensive spell, but to no avail. My legs and arms, still flapping against the tree, are the only things in motion. Oh, the irony.

“I am back” the voice cheerfully states. At that moment I let out an agonizing scream while silently cursing my creator for having forsaken me. I fall to my knees

and drop down to the ground (actually I have fallen into the tree somehow, only my legs are showing).

“Oops. I am sorry. Don’t worry. I will resurrect you at the nearest graveyard,” my master said confidently. As if I did not know since I have died many times before. Now I know to blame him and not me though. I consider what happened when I blinked. I was able to traverse a distance instantaneously or very quickly at least. This does not seem much different than hearthing back to my favorite inn once in a while. (I have this hearth-stone that I can use to return a great distance away to my favorite inn). Oh, and also similar to my abilities to teleport myself and others around “the Server.” Of course. But how is that possible?⁷

“Let me tell you,” the voice said while loudly sipping his “toffee.” I wonder for a fleeting moment whether that drink is giving him a stamina or spirit buff. “The same scientist I told you about, Albert Einstein, trying to show that quantum mechanics was not a fundamental theory...”

“Wait. Wait” I exclaim, “you mean that the same man that did great work in science also challenged it?”

“Yes, it’s a long and beautiful story, I will tell you in full some day. But getting back to our question. Einstein and others proposed a thought experiment to show that there was something wrong with quantum mechanics. See, quantum mechanics also showed, besides properties of systems occurring in discrete

⁷ Aharamov and Rohrlich’s *Quantum Paradoxes* is a good resource for the conceptual puzzles that still haunt quantum mechanics. Greenstein et al offer an update state of the relation between these puzzles and experiments. It may surprise the reader to know that some of these riddles can, in fact, be tested. The best-known example of this is John Bell’s inequalities that helped resolve the EPR paradox. See Bell’s *Speakable and Unspeakable in Quantum Mechanics*.

amounts, that these properties only occur in the system as possibilities until the time comes when the system is measured. Then the system ‘collapses’ in one of its possible states.”

“Hold on. Measuring a system picks one of its possible states? That’s crazy. This entails that before ‘measuring’ something that something exists only in possibilities,” I state in disbelief.

“That’s what many of them working on this believed. Einstein too felt it was crazy so he thought of a way to show that a different explanation was needed. He concocted a thought experiment, now referred to as the EPR experiment, where a system is composed of two entangled parts called electrons.”

“OK,” I mutter in reply.

“Imagine next that these electrons separate and move very far apart. Also, to make things simple imagine that the electron, when measured, can only show up to be either up or down. Then if we measure the nearest electron, and let’s say that we find it up, because the system was entangled and there was conservation of momentum then the other electron will have to be down. Since we find out that the second electron is down without ever measuring it, then Einstein claimed that quantum mechanics was incomplete, because we just violated the rule that only things measured can show their actual properties.”

I consider asking questions right away, but reflect instead for a moment and then ask: “Could it be possible to conceive of both electrons still as part of the same system? You said that we had a system formed of both electrons, but then it

separated. Could the electrons still be entangled at a distance?" There was silence at the other end and feared that he had gone back for more "toffee."

"Well, many ascribe this as a process of non-locality, that is, that the act of measuring an electron affects the other at a distance," he said with a measured tone.

"I see. So my being measured at A could instantaneously affect, somehow, that something or I will appear at B with the blink or teleport spell. Is that right?"

"Yeah, but remember that quantum mechanics is about small things, like electrons, and humans are a different matter. You can teleport and blink because....eh, well, let's leave that for another day. Let me resurrect you now." A good idea I thought as I began to wonder what the difference could be between electrons and humans. "And by the way, another scientist named John Bell, years later, figured out a way to test Einstein's claims" he added. "And?" "The experiments appears to show that what quantum mechanics teaches us is correct. The electron before measurement is in a state of both up and down possibilities. Precisely what Einstein was trying to avoid."⁸

"Here you go" my master states with satisfaction. "Let me go on a *bio* break and will be right back. It's the coffee." Before I could answer I sense that he has already left. A special bond is beginning to form between the two us, for sure. Does my master exist in this same world I inhabit or is the voice in a parallel yet connected world? Maybe my master resides in the same parallel universe that the mounts go when magically dismissed. But if our worlds are connected, are they

⁸ A good resource for Einstein's concerns with quantum mechanics is Arthur Fine, *The Shaky Game: Einstein, Realism and the Quantum Theory*. In addition, Maudlin's *The Metaphysics within Physics* examines this and several of the other metaphysical riddles Admetus encounters.

part of the same world? This reminds me of Siwel Divad, a Wildhammer Dwarf friend of mine from the academy who once postulated about the existence of possible worlds, and also of T'tereve of TtiWed who argued that every time there is a choice in front of us, the world splits into two separate parallel universes, each containing one of the possible choices. Maybe this is what "the Server" is, a large array of parallel universes.

My master has left me at the graveyard with little health or mana and with many questions about the nature of reality and motion. As I wait I wonder whether there are differences between our worlds. I wonder whether the problems of motion have to do with our conceptual systems or with the very reality of experience. I wonder also whether in fact teleportation is not another word for actualization of a large system. I wonder...as I wonder alone in the graveyard, I notice the familiar face of the Undead Rogue appear from behind a hill. I hope to be a Mage in motion soon.

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