"Space is big. Really big. You just wouldn't believe how mind-bogglingly big it actually is."

Douglas Adams, The Hitchhikers Guide to the Galaxy

Remember the Hubble deep field image? That long-exposure of one 24-millionth of the night sky, a black pool rippled with *thousands* of galaxies, each convulsing in its own arc across the universe. Look up on a clear night. Pinch your fingers in front of your eye. Those galaxies, those behemoths of light and energy and cosmic violence, are contained in that gap. It is *big* out there.

Now, in your mind's eye, zoom in. Pick out a galaxy, any galaxy (my favorite's the purple one, just right of top center), and fly in close. Let it expand, filling your vision with white heat until the individual stars begin to resolve with their systems, serene and burning through space at monstrous speeds. Now toward one star, perhaps with a group of planets– gas giants dwarfing even Jupiter. Straight ahead toward their parent. The sun grows to staggering scale, you pierce the corona and its heat barely tingles on your skin. The plasma surface spits and fumes and roars arcs of particles and heat into the indifferent void. You tumble down as the magnetic field, ripples and washes over you.

Dive down toward the surface, shrink yourself. Elasticize, quantize, minimize. Smaller and smaller as you pierce the surface of the star. Whitehot plasma becomes a sea of individual nuclei– hydrogen fusing into helium. The energy from these reactions fuels the star itself, sustains it over billions of years, overcoming gravity, defying time, and, in a single confirmed case, supporting life itself. You notice a pair of hydrogen atoms quivering near you, separated just enough to remain subject to the Coulomb barrier. A slight push will drive them to fuse, but before they unite you feel yourself drawn toward the atoms, pulled. Inexorable. The atom on the left swells as you continue to exponentially shrink and approach the nucleus. Suddenly it's as if you and that single atom are alone in the universe for the scale of it– a single proton orbited by an electron. The empty space between the two, a hundred thousand times greater than the size of the proton itself, yawns around you, a void and the truest emptiness in the universe.

This is simple. This is beautiful. Two fundamental particles composing the basis of our world.

Wait.

You continue in, continue shrinking. The tour's not over– the proton balloons into a planet-sized monstrosity, its surface all you can see. In the heart of the atom, quarks vibrate back and forth, gluons leap from one to the other forming an intricate web that holds the supposed "building blocks of our universe" together. Around you, other unidentified particles swirl and swarm as you descend and suddenly, from your impossibly small perspective, you have a view of the microuniverse that very much recalls the Hubble deep field image– all the particles of the standard model (gluons, quarks, neutrinos, etc) hurtling through the vastness. Some are massive,

others insubstantial as light itself. Evidently, to create the simplicity of the atom requires much complexity.

This is reductionism, with all of its power and all of its flaws.

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You probably learned about reductionism in middle school science, the idea that things get simpler as you reduce them to smaller and smaller parts. This compels those who subscribe to science, a school rooted in understanding and control, because small and simple things become easier to understand and easier to control. Reductionism gave us the atom, the cell, the binary language. Reductionism led us to deep knowledge about ourselves and the world around us. More interesting: as humanity became more industrialized and technologized, we began to award more and more importance to the sciences– after all the sciences brought us the skyscraper and the cell phone and the Hubble Space Telescope. The sciences feel safe, an established method to arrive at an empirical, verifiable, *useful* truth which feels to an age of relativism and constant realizations of how little we truly know like an island in a storm (and perhaps this feeling of safety, along with the drive to technologic superiority, can help explain the weight placed on modern STEM education– scientific truth has priority). If science can do so much to elucidate our universe and elevate our condition, why can its principles not go *deeper*– apply to the human self. Transcend the field of science itself If science can orient our bodies relative to other bodies, can it orient our *selves* relative to the Cosmos?

And so science became philosophy. Hobbes' materialism, British Empiricism, these were born out of the move to break humanity down to its simplest parts and so finally understand our condition, our predicament. Reductionism applied to ourselves. This is an oversimplification, really (which could even be a criticism of this very essay)– the claim could be applied to most philosophical, sociological, and anthropological paradigms. Are we composed merely of a body and a brain? Are our actions and cultures to be understood as binary movements of neurons? Or as functions of networks? Or as social constructs?

Yes, yes, and yes.

For all its power and all its insight, reductionism runs into real trouble when it rolls up against emergence. To abuse the cliche, the more we explore this island, the more dangerous and mysterious we find it. There's a delightful Radiolab episode on the subject, and I'll borrow a few ideas from it here (do yourself a favor and listen to the episode). In 1965, Western researchers travelling through southeast Asia, specifically Thailand, found fireflies that blink in perfect synch. Whenever these fireflies find each other, they synchronize, regardless of locale and for reasons still not understood. The pattern, the synchronicity, is general to the fireflies and cannot be explained by examining the individual fireflies. This is emergence: many individual parts interact in inexplicable ways to produce something general and much greater than the sum of the parts. I'd like to introduce an inversion of this concept as well– when we try to apply the

principles of reductionism to emergent phenomena, our subject explodes back into complexity. Like our example of the universe from above. Like ant colonies and neural networks. Like community.

Emergence is, to put it badly, still an emerging field. In a way, we may never truly understand the phenomena– it's hard even to ask the right questions about them. "What makes neural networks work?" is essentially nonsense because there are no visible mechanisms between neurons that explains how thought happens. Each neuron does not contain a "chunk" of thought that coalesces into what I'm writing on this page now. Rather, it's an almost symphonic orchestration of binary transmissions of electricity between my neurons that somehow creates thought which, much like the number 42, seems to be the answer to a question no one knows how to ask. There's a secret sauce that no one can explain. Perhaps there's an overlooked rule to the universe here– simplicity is built on complexity just as complexity is built on simplicity. The simplest components of a house might be its bricks, but what are the simplest components of those bricks?

Perhaps emergence itself fundamentally cannot be a scientific field because it simply is a law of the universe. A mechanism unto itself. Perhaps it is only an observation about the way our world operates.

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Above, I implied that we must be wary when science becomes our sole philosophy. Philosophy, classically understood, is a method of attaining truth by looking at the world through many different lenses. It is martialed remembrance, it is physics, music, biology, literature. It is the liberal arts. No one lens can explain the world, humanity, the self. I'll now break my own rule, just a little, to talk about why emergence matters for how we think about our place in the Cosmos.

As we so often do, let's think about love. Forgive me for being a bit tongue in cheek with this reference, but Haddaway really does sum up our stance on love with his perennial question, "what is love?". Ask any person to explain love, and you're liable to write a book with the infinitely varied answers. Is it a feeling? A choice? An act? Do we choose love or does love choose us? And which type of love do we mean– filial? Romantic? Agape? C.S. Lewis sums up love in Mere Christianity as "not affectionate feeling, but a steady wish for the loved person's ultimate good as far as it can be obtained." Martin Luther King, Jr., in his speech The Most Durable Power, proclaims love as exactly that. A quick Wikipedia search says: "Love is a variety of different feelings, states, and attitudes that ranges from interpersonal affection to pleasure." So I guess we're done there.

Kidding. We tend to understand love in many, many different ways. I picture it like the trunk of an ancient tree– the roots go deep and the branches splay across the sky and following each limb from the main trunk, above or below, will lead somewhere completely different and

totally invigorating and beautiful. But love itself remains the trunk. Solid. Unyielding. Organic. We try to compartmentalize love, break it into simpler pieces so that we can understand it, but each fragment turns out different and cannot explain the whole alone. We even try to distill different types of love into sterilized little containers to distinguish the way we feel about sisters, brothers, lovers, friends, etc. But we use the same word for so many different feelings and actions, and still no one can adequately define it.

As Lin Manuel-Miranda said in his Tony acceptance speech for *Hamilton*, "love is love is love is love is love". Love just is.

Love is emergent. All the definitions we try on gather together like particles coalescing into atoms or stars into galaxies to create a force just beyond our comprehension, one that is all at once accepting and transforming, sacrificial, powerful, keenly aware, and totally blind. Love is emergent. Love is.

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Physicists endlessly pursue the most basic component of matter. We thought we were close with the atom guys, we really did. And then the proton, neutron, and electron– we *had* it, we just had to go one more layer. And then everything blew up again. That's what's so utterly captivating about string theory– that vibrating superstrings make up the foundation of everything everywhere. The quest for the Grand Unified Theory, the model of the universe that will unite quantum physics and general relativity and allow us to understand it all, fuels a great deal of physics research today.

Philosophy follows a similar arc. The school of ethics seeks the answer to a massive question: what is the good life and how do we live it? Ethics seeks a prescription for the day-to-day. To adequately fill this prescription requires certain understandings of foundational concepts of human life– we have to get at the simplest parts of "being human." So we encounter questions like, "what is it to be human?" and "what is truth?" and "what is doubt?" and so many more. The deep questions take us right up against concepts like these and very quickly dissolve into thousand-year arguments. Depending on your premises, you can make good, valid arguments for any number of responses to these questions. But are these arguments *true*? Well now we're back to that same old question– what is truth? It's completely circular.

There's an oversimplification for you– trying to sum up the problems in philosophy in a paragraph. But I think my point still stands. We want to reduce love and truth and justice and humanity into bite-sized, definable parts, and we just can't. No definition satisfies completely. No answer feels full, and perhaps that's because, much like our fireflies, there's not a full explanation for these deep phenomena that have plagued our inquisitive minds for millennia. Perhaps truth and justice and humanity and the like are all emergent, great big concepts composed of so many fragments which we can touch in our daily lives and some unidentifiable secret sauce that makes them so much more than the fragments alone. If you break a bowl, you

have to add glue to put it back together. Maybe the best we can say is that love is love and truth is truth. Simplicity, it seems, is a choice. We can still say that the atom is the most basic building block of matter and acknowledge that it is built of quarks and gluons and math that doesn't quite work on anything bigger than hydrogen because the atom is the easiest to work with, conceptually.

We may never fully know what composes love or justice, but the fascinating thing about human beings is that we usually know them when we see them.

The human is a truth-sensing organism. We developed science to uncover empirical truths. We use logic and reason to pick apart as much of metaphysics as we can. We use psychology to try and uncover people's personal motivations. We build our very lives on "that's true" and "is that right?" all the while taking completely for granted what it actually means to be true and right. When we think about truth, we don't ask the question "what is truth?" and rebuild our perception every time because truth is something we can recognize.

Let me explain. Human beings can recognize emergent phenomena because the human brain is very good at identifying patterns. Science has shown this. It's patterns like these that can lead us to truth– not just empirically verifiable truth but truth in literature, in poetry, in daily life. The human can sense patterns in the course of human life that point to truth outside ourselves. That's part of what I mean when I say the human is a truth-sensing organism. Don't we recognize love when we see it? When we *feel* it? When we are loved? This recognition depends not on how that love squares with a definition kept locked down in the backs of our minds and hearts, but purely on the patterns familiar to us from life and story and maybe even something built into us from the start (but who can really say?). The point is– it is well and good and even useful to engage in deep rational enquiry about the nature of truth and love and the like, but at some point I believe we've got to let go, trust our senses, and dive back into the reality around us waiting to be experienced. This is not to say our rational quest is a hopeless one, but rather an encouragement: we'll know truth and love when we find them.

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If the above seems optimistic, it is. It's a very generous view of humanity which may not resonate in a time of war and terror and hate. It's rooted in a bizarre bastardization of reason and storytelling and science with little to support it, but it still holds weight for the ways we interact in everyday life. It does not say that truth or love is easy in any sense. We must still search, still enquire. We must feel all the despair that comes with not knowing the truth, with not feeling love or feeling it unrequited. We have to seek, hard, with all of our lights and continue to break each concept down and determine what it may be in different instances so that we can see the patterns that give it life. It takes work to recognize emergent phenomena– only in trying to dissect the parts will we realize we're on to something greater than the sum, that we have the real thing.

The above also does not assert that all humans possess truth and love. Rather, we possess the faculties, the senses, for finding them. Just as the blind cannot see and the deaf cannot hear, many of us may have lost our sense for the "real deal." There are wicked people in the world, there is no denying. There is an absence of good in many places, and death and destruction happen, but we all have the capacity to access truth, love, justice, and the like because they are phenomena that emerge from the collective story of humanity and therefore are fundamentally outside us.

You may also ask why I have focused so tightly on the notion of truth and love specifically, why these are the phenomena on which I have concentrated my discourse. Simply, all of life can be generalized to a search for truth and a search for love (if this sounds reductive, oops). These together span all of human life– truth applies to many people in general, and love interacts with a particular person as an individual. These two searches are ongoing and perhaps can never be fully satisfied since, if they are emergent, they are fundamentally beyond our control and comprehension. Every time we break them down and experience them a different way, we understand them just a bit more. We must constantly hone our senses for the full experience of each, which may come in this life when we least expect. Love well and love often. Seek truth in all its forms. Think hard, then not too much.

Remember: if these are emergent phenomena, they arise out of the reality of life that we experience every day. Rational enquiry will aid in our search, but in the end it is full experience with all senses open that will reveal each fully.