

Massive Information



&

*Other Short Works
to Dethrone Descartes*

Paul Feather



Full Life Farm Publications

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Thank you.

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Terra Currie

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The Game

Responding to the tragedy of modern civilization is rather like a chess game. We would like our moves to matter. I, for one, do not want to be the lost bishop blocked in by my own pieces in some awkward corner of the board, forgotten. And if our moves should matter, there must be a strategy. In this game, the strategy is to dethrone Descartes, whom we will not blame for our tragedy but who nonetheless serves a dour and iconic effigy of our dysfunction.

Descartes' severing of man from nature and mind from matter—his 'I think, therefore I am'—pushed human relationship with nature from an already unstable position into new depths of dominion and fear. From these depths, if our effort is to make moves that matter in the only game we have, our strategy shall be to topple king Descartes and replace his fragmented paradigm with an ecological perspective of connection.

Each essay in this book stands alone. United, they form the strategic basis of our game against Descartes, each essay becoming a poignant move or turning point in the game. These points find symbolic reference in images from a chess match between grandmasters Alexander Morozevich (black) and Ian Sokolov (white) on Jan 25, 2005. We selected this match as having the character and flavor of humanity's imminent (and ongoing) battle of wits.

Descartes plays white.

Players meet with the unopened game, and *Li* is the preliminary conversation—casually introducing ideas that will form the main themes of contest.

Play begins, and black opens with the Albin counter-gambit, which allows black to set the tone of the game. In doing so, black loses a pawn. At this position, I offer my own gambit in *The Elephant in the Room*. It is a story of loss.

Toward midgame, the pieces are well developed in *Massive Information and the Ecology of Mind*; from here, the strategy should be clear. On the chessboard, black develops an aggressive pawn attack, ensuring an open game and freedom of movement.

Black's first material gain—the captured rook on d1—pairs with *A World without Because*. This essay removes the underpinning of the Cartesian defense, and offers a portrait of our family discovering new maps to replace the now-broken vision of the world-as-machine.

Finally, white resigns with *Quantum Justice*—a story of Monday. This essay brings the ecological maps of *Massive Information* into the mundane world of human behavior. Here, we connect these essays with our previously written book titled *Quantum Justice*.

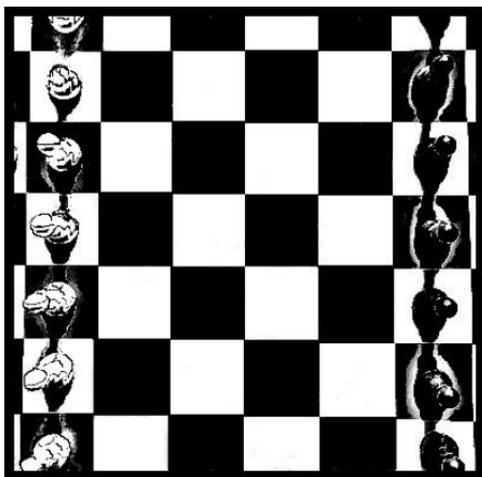
The final image in the end notes, although not played out after resignation of the original game, imagines Black's mopping up of the pieces and checkmate.

Good luck!

-Paul Feather and Terra Currie,
Carrollton, GA.
March 2019.

I.

Li



Li: Fire; clarity; clinging to the power of higher truth as a fire clings to wood.

When the flames of these stories die low, you can hear the star-song. Most often, the stories roar so loudly that I cannot hear the stars, but I believe now that the flames of these stories are guttering out.

Stories are a fire that burns words. Truth is a story that dances between the words. The words contain the truth as the fuel contains the fire. The fire cannot leave the fuel; it rises up and out, ever clinging nonetheless. As with the fire, so also the stories rise up out of the words that can never contain them—clinging to them until they are all consumed. The story is Li, the fire clinging to her truth.

We named our daughter Li. That's another story—some other time, perhaps—but my wife pulled her name from the *I Ching*; a reminder of her truth in a moment of questioning; the fire filling the space between the fuel; the truth in the space between the words. Do you see? The stories that are sputtering now in their last moments are the bonfires of humankind. The great roaring blazes of kings, culture, and corporations. The words have been all used up. There is still

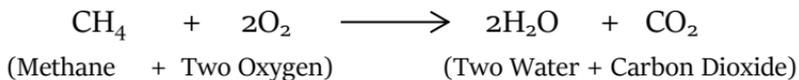
a great clamoring that drowns out the star-song, but sometimes there are lulls now, and I can see the truth—dancing.

To tell a story about truth, one must leave a lot of space between the words. Truth isn't like they told me it would be. Truth dances. It turns into fiction when you aren't looking and then back again. For instance, we have such great power in creating abstract fictional narrative that we have created a whole new type of truth—the shared fiction. Google, The Dollar, and White Jesus are all shared stories that shape our reality in a profound way. We have built truth out of fiction. Google isn't real except in the collective imagination of its users, employees, investors, and detractors, but that collective fiction is, in itself, real and true.

It appears that there are different levels of truth. Fiction and truth swirl up together like the eddying flames; fiction becomes truth—and maybe that hasn't ever mattered so much before now—and truth becomes fiction. I have met the modern truth-seekers ensconced in cramped university offices with books overflowing from the desk onto the floor. I have been employed in that meticulous search for data—the numbers that hold the truth up. There is truth there, in ab-

straction, but I tell you truth is a fire, and numbers do not burn.

I want to give you an example, but I am afraid that it will frighten you. We have given these numbers and equations so much power; they carry the weight of a sacred and forbidden text. Why is it forbidden? Don't worry—they won't burn you. Perhaps things would be different if they did.



This, in the language of the sacred chemists, is the combustion of methane. This is fire, and here again we see that there are different levels of truth. Both truth and fiction swirl together in the flames; but truth on the level of abstraction is hardly debated, so let us examine the fiction.

The fiction lies in reification. *Reify: to regard something abstract as a material or concrete thing.* We easily presume that methane, oxygen, water, and carbon dioxide are material and concrete things. They are not. When we reify our abstract scientific principles, we create a whole mythical world full of fictions like $E=mc^2$, carbon dioxide, neuro-

transmitters, and gravity—and we forget that these abstractions are not real.

CO₂

People do not like to be told that their stories are myths, and we will cling to the guttering flames of the old stories. They are sacred to us because there is some truth to them, but the truth is in the spaces between the words. The truth dances between the words until it consumes them—so many sticks in a fire. The words of the old stories are not the truth and there's no such thing as carbon dioxide.

You see, it doesn't mean anything to say that carbon dioxide is a carbon atom joined with two oxygen atoms. Most of the fires that we know burn carbon with oxygen, but what is carbon? It's an element—number six on the periodic table. Its atomic mass is 12.011 amu. (Don't be frightened—they are still just numbers.)

Number six on the periodic table means that carbon has six protons in its nucleus and usually brings six electrons to the great universal trading table where it is paired up with an atom of oxygen or two. But what is an electron made of? Do you see now? We can't explain carbon dioxide without

moving the essence of what carbon dioxide is from the molecule to the atom to the subatomic particles. We have not captured that essence. That essence is the truth that dances around the words.

I chased these truths for years in the lecture halls and libraries, and I scribbled in the margins of my textbooks when I caught a glimpse of something that shimmered out of reach. Now I find these scribbles many years later—some particularly fascinating melody in the periodic table marked with an asterisk—and I remember what I was looking for.

I was looking for the steadfast faith that I found in the tree on the edge of the soccer field where I sat between classes and read an old beaten copy of the *Tao Te Ching*. She was not an imposing tree. There were others on campus more magnificent and aged, and I was not then the sort to personify a maple. Nonetheless, as I sat immersed in Lao-Tse's verses, the tree herself became for me a symbol of the flowing non-action of the Tao, her rooted life-force juxtaposed in my mind against the restless manipulation of my engineering education. How is it that such a little tree may become the center of one's life for a time? How is it that the trunk I considered to be little more than back support on a

sunny afternoon should become the metric by which I measure truth? That my fire—my Li—should cling today to the wood of that maple?

I never found that relationship in the textbooks, and so I left.

Carbon has a very long story. Forged billions of years ago in the bellies of other stars, she broadcast herself in massive supernova explosions whose gases were swept up again in new stars—new generations of nuclear reactions birthing new elements—it's a very, very long story. Oxygen has another story (also quite long), and their stories dance together. I say that the fire is telling those stories. The trees heard the stories with their roots buried deep in the ground, and they tell it now in the eddied smoke and embers flung far into the sky.

The reification of carbon—making her real and concrete when perhaps she were better off an abstraction—confuses mirrors with causes. Carbon is a mirror. You can see the truth of the world in carbon's diamond mirror, but the reflection is not the cause of things; it is only a reflection of the cause. Is it reasonable to premise that carbon is who she is because electrons and protons are who they are? Elec-

trons and protons are just more mirrors. *Orbital diagrams, the periodic table, and quantum mechanical models of the atoms don't explain the behavior of carbon and oxygen. They mirror that behavior.* There is no causality here. It is reflection. In the making-real of fictional mirrors, we mistake them for causes, and this leads us to a false sense of understanding and confidence in our control of those causes. We believe that we know things that we do not know.

We cannot control carbon dioxide. There is no carbon dioxide. There is only the relationship that is dancing in the fire.

Plants Tell the Truth

Your digestion is a fire. The chemical reactions that occur in the fire in your gut take the form:



As my chemistry text explains,¹ ‘The end products of this biological oxidation are carbon dioxide, water, and energy, just as they are when an organic fuel such as methane is burned with oxygen in a furnace.’ I want to draw the lines

for you to see what this fire is—this story that is burning in your belly. The bacteria that feed this fire are living in your gut and living in the soil. They are all the same. David Montgomery and Anne Biklé observe:²

“If you were to turn a plant root inside out, rhizosphere and all, you would see that it is like the digestive tract. The two are, in many respects, parallel universes. The biology and processes that bind soil, roots, and rhizosphere together mirror those in the mucosal lining of the gut... The gut is the human version of the rhizosphere.”

The stories that are whispered to the trees in their roots—to be flung into embers in celebration of the great supernovas of the stars—these are the stories in your belly. Am I being too poetic? Does none of this seem useful to you? I suppose what is useful depends on what you are trying to do.

What I am trying to do is to navigate within a world when I have discovered that the map I was given as a child is inaccurate. I was led to believe in a linear world with direct lines of cause and effect that can be traced back to reified abstractions like atoms, temperature, or capitalism. It

turns out that I navigate relationships much more successfully if I abandon that approach altogether. Having thrown out the map, naturally I look for guides instead. There are a few plants—*Cannibis*, for example, or *Nicotiana*—who have long held a slow conversation with humans on the nature of fire and soil. I find it *useful* to listen to their stories. These are the same stories that are in my gut. They are stories of Li—fire clinging to truth.

I grew up in Kentucky in the ‘80’s, shortly before the bottom fell out of *Nicotiana* (tobacco), which forced the entire state to restructure the economy that we had built upon the domestication of this plant. I escaped by one generation the childhood task of stripping tobacco at harvest time. I only did it once on a short visit to my uncle’s farm, and on this occasion I absorbed enough nicotine through my hands to become sick by the end of the day. I’m told this is common. Now—reexamining my relationship to plants—I recently found myself courting a small *Nicotiana* in the greenhouse, hoping to win permission to pull one of her leaves. The leaf is cracked on the central vein and hangs toward the ground. Surely she doesn’t need that one? Eventually, never sure how to know that permission was granted (perhaps a bit

brashly, but with good intentions and I hope with consent) I plucked the leaf.

She now reminds me to be careful in my relationships. The smoke of her fire bites my tongue and steals my breath to remind me to be quiet when I can. I share her with my wife when we need reminders to only say what is real and true.

The smoke of *Nicotiana* is one lens upon the truth. I find it useful to listen to her because of what is happening to the truth—with our reified scientific abstractions on one side, and reality TV on the other. I am not saying that reality TV causes millions of people to lose their grip on reality. I've already said that cause and effect is a cheap parlor trick. I'm just observing that we are becoming a little unhinged. Every truth is wrapped in fiction; every noble cause tainted with injustice. My wife makes prayer bundles by wrapping tobacco in colored cloth. Where did this tobacco come from? This cloth? We do not know. What is the meaning of a prayer offered with industrially produced tobacco? We do not know.

We are inundated with information, but every truth is floating untethered. We have become a culture where the format of our information means nothing. There is a spec-

trum of truth that runs through reality TV, science, and Fake News, but this spectrum does not separate truth from fiction. The truth has become unmoored from the old cosmologies that once formed the bedrock of our knowledge. Perhaps there is some healing in these prayer ties. Perhaps they are just one more vehicle for tobacco taken from a tired field.

Gregory Bateson details a theory of schizophrenia in which patients who develop schizophrenic behavior are responding to repeated double-bind situations where they receive simultaneous but conflicting messages.³ So, for example if a mother combines claims of love (content) with facial expressions of disgust (form), this presents a double-bind where the child can't know how to properly interpret the message, *because the content of the message does not match its form*. Being dependent upon her mother, the child cannot withdraw, and the double bind is completed when the child is punished equally for responding to either half of the conflicted message.

We are a double-bind culture. The information we are receiving is all formatted so that we believe it should be truthful. It's in a textbook, on a newscast, or delivered from

a podium or pulpit, but this means nothing, or at least it does not mean what we think it means. The truth is unmoored from the format, and we find ourselves equally in the wrong for acting upon any secondary information source. In this double bind, we can no longer distinguish the conspiracy theory from run-of-the-mill politics, entertainment from oppression, or left from right. Prayer is tinged with exploitation; activism with injury. There is nothing to cling to. There is no Li.

Have a cigarette, but don't forget to say please. The plants will not lie to you.

Massive Information

“We need to learn from egalitarian religious and especially extant indigenous groups that the emphasis of our society must be on process; not on the creation of *things* and the accumulation of monetary or political power, but on the acknowledgement and maintenance of relationships...”⁴

Derrick Jensen

I am sorry if it is hard for you to believe that carbon is not a real and concrete thing—that the truth of the periodic table is not in the elements but in the periodicity. I know that we've been trained to believe that the truth is in the elements—not in the relationships between them.

Much of the trouble amounts to our obsession with *things*. When we look for causes—apparently a very human thing to do—we are very much trained to place those causes upon *things*. So we claim that global warming is contained in carbon dioxide, cancer is contained in the cells which reproduce beyond control, and racism is contained in the behavior of deplorables. We neglect the relationship between these presumed causes and all the rest of the system, whether that system be the climate, the human body, or society. It may be that our obsession with things is so great that we can't conceive of problems without concrete causes, of racism without racists, of cancer without mutating cells, or of global warming without carbon dioxide. I'm sorry if that is hard for you, so I will try another tack.

It is fair to be preoccupied with things. It is reasonable to wonder how something can be true if it does not have a real and concrete expression. Real things have mass and energy. Let us not drift into poetry and superstition when we have

important matters at hand and problems to solve. I purpose then to show that relationships are as important as things because *relationships are things*. That our reified mirrors—carbon, protons, the very foundations of matter—are missing some pieces. That when we unified matter and energy ($E=mc^2$) we neglected a third type of *thing*—a third type of matter-energy. This third thing is information.

Nothing real exists in isolation, because everything is integrated into relationships with other things. The cells in your body, the gases in a fire, and humans in a community are all constantly exchanging information. Information is the medium of relationship.

When I sit in contemplation on this cold morning before a fire for warmth, it is cheap and thingish to say that the chemical reactions of the burning wood release heat that warms my body. In truth, there is a much more complex relationship here. Never mind that I remember the tree to whom this wood belonged; this is the last of a great oak—all burned now except for the great beams lying in the shed and the sawdust slowly rotting away in a pile by the mill. But even if this were the unconscious burning of fuel at the whim of a thermostat, delivered through pipelines without my acknowledgement, there is still relationship in this

warmth. This fire is telling a story about carbon and oxygen, sunlight and soil, and about me and my relationship to all of that. The language of that story is the dancing flames and heat; my body also tells that story in receipt of the warmth. I am a character of carbon and oxygen, and so some of this story is about me.

When we sit with the fire, it is a communion. We are sharing in the story of the fire. This communion creates a thing. Perhaps we should call it a sacrament, for it is an outward sign of the reality of the communion. The communion of two things creates a third thing—a true thing that has mass—a beingness of the shared story. This mass wholly embodies the information that is shared in the relationship. Did you know that we can turn information into energy and mass? There is a demon in physics yet! Do not be afraid.

Maxwell's Demon turns information into energy. He has haunted physics since the mid-1800s, now exorcised, now revived, time and time again. This demon is a thought experiment that explores the possibility of creating usable energy by manipulating the random movements of particles or parts of a system. So, for example, two containers of gas could be separated by a door, and the demon could wait for random particles of gas to bump into the door. By adroitly

opening or closing the door at opportune moments, Maxwell's Demon could increase the temperature of one container by allowing fast-moving random particles to enter that container from the other side of the door, and passing slow-moving particles from the hot side to the cold side. This manipulation of random movements would create a useable energy difference between the two containers. Because we could imagine that the demon might not use much energy to open and close the door, this would create a sort of perpetual motion machine.

Over the decades there's been a lot of discussion of this idea, but this is not the place for it. However, in 2010 Shoichi Toyabe, Takahiro Sagawa, Masahito Ueda, Eiro Muneyuki, and Masaki Sano demonstrated this process experimentally in the laboratory for the first time by successfully converting information into energy.⁵ I'll wager that we'll call that experiment one of the most important scientific events of the 21st century, but only if we live to see the 22nd. In the meantime, no one appears to have noticed. There's an equation that goes with it (don't be afraid): It's $mc^2 = KTI$. The 'I' stands for information, and the 'm' stands for mass. Of course all of that is equal to 'E' for energy. You already knew that.

In this experiment, the physicists manipulated the random movements of a particle in order to increase the energy of the particle, just like Maxwell's Demon. They did this by creating a feedback loop in which the particle responded to information about itself. That information enabled the random motion of the particle to be manipulated so as to increase its potential energy. The particle shared information with the controller of the experiment, and the controller shared information with the particle. The particle's mass increased in response to the sharing of information.

That sharing is communion, and that mass is sacrament. That sharing is relationship and that mass is truth. So relationships have mass. In the quotation that introduces this passage, when Derrick Jensen observes that we must cultivate a society that emphasizes the acknowledgement and maintenance of relationships rather than the accumulation of *things*, he is observing that these relationships are truths that can't be neglected in a balanced society. I propose that those relationships have mass and energy, and rather than attributing causality to our reified scientific abstractions, we must learn to acknowledge that real systems are driven by relationship to a truth that is only ever mirrored in those abstractions. Real systems are driven by story.

To know that, in a very physical sense, our relationships are real changes everything. What does it mean about my identity if I know that my ‘self’ is embodied and enmeshed with ‘others’ in some as yet poorly understood (actually, completely ignored) physical web of information? Embodiment of information requires us to reshape our concept of time, because the exchange of information—relationship—requires some passage of time, and it is precisely these relationships that have mass. This massive information extends into the past and future. What can we say about time, knowing that the all-too-solid past and future are embodied in a system’s massive informational structure—that genocide and slavery, say, persist today in the physical structure of shared fictions like The Dollar, Private Property, and Monday? There is more to this than we know. We must re-think everything.

The flames of the old stories that drive human culture are guttering out. The fire clings to the wood—Li. The truth clings to the words. Can you see it dancing there, mirrored in the metaphors and equations? Can you see the piece that is missing from the old stories as they die low? Can you catch the gleam of the broken edge and the glimmer of truth dancing in this fusion of mass, energy, and information?

Can you hear the star-song? I do believe it is growing louder.

II.

The Elephant in the Room



Imagine that you are in a dark room, feeling about with your hands. There is something in the room with you, and you can feel it, but only in bits and pieces. You are reminded of the blind mice in the fable of the elephant—one of the mice feels the elephant's tail and thinks she is a rope, and another feels her trunk and believes she is a snake. The third mouse feels her legs and argues that she is a great mountain while the fourth feels the leaves of a palm tree in her ears. They cannot agree on what she is.

Imagine making a map with your fingertips.

This thing in the room is genocide and extinction. She is a pulsating, insatiable body sucking in more peoples and more species—growing fat on information. She is growing fat on all of the words in thousands of lost languages. There is no one left to tell you of those words and what they meant. Outside of this room, there was a whole world that only those words could paint, and it is gone—extirpated to this dark and silent room. She has grown fat on all the accumulated evolutionary experience of the auk and the passenger pigeon. Not one of them is left to pass on the secret knowing encoded in their DNA and nowhere else. This thing in the room knows. She is getting bigger.

The elephant is not in the room yet, actually. There are still elephants outside under the sun and browsing the forests. Extinction has not tasted her yet, but she may—and soon. What will happen then to all that information that the elephant knows? What will happen to the story of the elephant? I think I may be able to tell you. I have been in this room too, and I have run my fingertips all over this thing many times, reading her like the mice in the fable. I have a picture in my mind now; I believe that I know what she is.

She is information.

Possibilities

Everything exists in the present moment as an arrangement of matter, and that matter could be arranged in many other different ways. The arrangement in the present moment is just one possible arrangement from a set of possibilities.

Imagine an elephant for a moment, but this time imagine that we are not blind mice, and that our knowledge is not limited only to the tail or the trunk of the elephant. Imagine that we know everything there is to know about her,

right down to the very last atom. There are this many atoms of carbon, so many of oxygen, and we know all of the arrangements of these atoms, how they are connected to each other, and their relative placement in the elephant. Imagine that we have all of the information that there is about the elephant.

Of course the configuration of matter in the elephant is always changing. The elephant is breathing; her blood is pumping; maybe she's gestating another elephant. The matter in the elephant is perpetually being rearranged, and each moment she is a new set of atoms. If we have perfect knowledge of every atom in her body at one very specific moment in time, this knowledge defines only one instant, and there is a very large set of other arrangements that would define the elephant at other times. There is a whole set of possible arrangements of matter that may define the elephant, and the elephant inhabits many of these possibilities, shifting between them from moment to moment to moment. This set of possibilities is called a *story*.

A *story* is a set of possible configurations that a system may take; only one of those configurations may exist in the present moment.

If we were to *completely* describe the elephant, we would need to describe not only the placement of every atom in the present moment, but also the extent of all possible arrangements of matter that the elephant may inhabit as she moves throughout her story. Every configuration of matter that the elephant inhabits is one instance of a set of possibilities.

Order

Every arrangement of matter contains information about how that matter is arranged. That information is the same as order.

If we were to randomly scramble all of the atoms in an elephant again and again—maybe we put her in a blender—we would not ever see an elephant. This highly structured arrangement of matter is highly improbable, nonrandom, and only achieved because the elephant—by whatever means—has the information that is necessary to create an elephant. She can arrange this matter into an elephant very reliably without ever getting a monkey instead (with some

left over). This information that organizes the matter in the elephant is one form of order.

Order Again

There are two kinds of order: One kind of order (just discussed) exists in the present moment as an organized arrangement of matter that is nonrandom and improbable. The second kind of order exists in the set of other possible arrangements—that set may be either very large and varied, or it may be reduced and homogenous. A restricted, well-ordered set of possibilities is not the same as a highly organized and structured member of that set existing in the present moment. These two types of order are not the same; one is order in the instance, and the other is order in the set.¹

It is easiest to grasp this second form of order if we consider the ecosystem and the elephant in relationship. Let us say that our elephant is living in the Serengeti. Just as we have said that the elephant is an arrangement of atoms, we could define an ecosystem as an arrangement of species. For a frozen instant in time, imagine an omniscient description of every organism present in the Serengeti and their relative

position to each other. This would completely describe the ecosystem as we have defined it. Just as with the elephant, the Serengeti has a story; there is a set of possible arrangements that the ecosystem inhabits, shifting in each new moment from one arrangement of species to another. The Serengeti is a very complex ecosystem, so it manifests a very high degree of order in the present moment. If we scrambled all the species in the Serengeti into a random arrangement, we wouldn't get the Serengeti. There would be ecological collapse. It wouldn't work for the gut bacteria in an elephant to be scrambled up with soil mycorrhiza in the branches of an acacia tree at the bottom of a lake. Not without most of everything dying. Whatever came out at the end of all that couldn't be called the Serengeti.

So the Serengeti and the elephant are both manifestations of the first form of order we discussed: order in the instance. That form of order is a highly structured, nonrandom, and improbable arrangement of things in the present moment. The second form of order we must consider is located in the set of possible arrangements for the Serengeti. It is an ordering of the story.

If the elephant becomes extinct, the set of possibilities for the Serengeti will become smaller, because every possi-

ble arrangement of species that includes elephants will be eliminated. There will no longer be elephants in the story of the Serengeti. Reducing the story in this way is a form of order. In fact, reducing the possible states of a system in this way is how order will be defined if you look it up in a physics textbook. You will not see two kinds of order in that book; merely a fudging of two separate things into one. It isn't good science to do that. It leads to extinction and genocide.

Sometimes it is helpful to consider extremes. In a GMO cornfield, most of the large organisms are engineered corn plants that are genetically identical. If we were to randomly shuffle the organisms in this ecosystem, things might not look so different. We could shuffle these plants in many different ways to produce essentially the same result. Certainly, if we compare this cornfield to the Serengeti, the set of possible arrangements of species is relatively small. In this respect, the GMO cornfield is a very ordered ecosystem, but it is not ordered in the same way as the Serengeti. The order is not in the present moment; it is not embodied in an improbable arrangement of species or matter. This form of order is in the set; the order is in the story.

	Instance (present moment)	Set (story)
GMO cornfield	Highly redundant and simple; requires little information to describe	Reduced number of possible arrangements
Serengeti	Highly structured; requires a lot of information to describe.	Large number of possible arrangements

Order is here

Order is here

Where is it?

It is not possible to have order or information without something to contain or convey that information.

The first kind of order, in an elephant or in the Serengeti, is clearly contained in their organized physical arrangements of matter, but there is no clear physical phenomenon that can be said to contain the second type of order. An elephant is a form of order, but if the elephant becomes extinct the Serengeti becomes more ordered in its story, and less ordered in its actual being. This order in the story is a real thing, by which I mean that it is a mathemati-

cally quantifiable phenomenon. Isn't that what we mean by real? Where is it then?

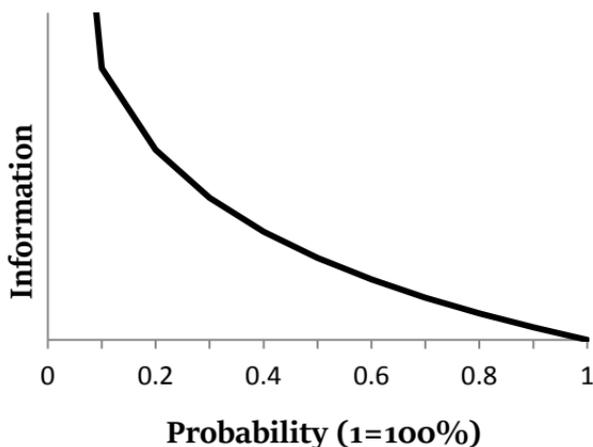
Equations that define the information contained in a set of data were developed by Claude Shannon in 1948. Ecologists also use these equations to quantify the diversity of an ecosystem. These equations use the language of order and entropy (disorder), such that a GMO cornfield is a highly ordered ecosystem with low entropy, and the Serengeti would be much more disordered (higher entropy). These ecologists are measuring the order in the story of the ecosystem.

Every organism carries a quantifiable measure of entropy or information. That quantity of information is a function of the probability of finding that organism in the ecosystem. One interesting thing about these equations is that they are logarithmic, so the information conveyed by an organism increases exponentially as the probability of finding it approaches zero. An extinct organism has zero probability of appearing, so if you saw a passenger pigeon today, she would convey an infinite amount of information. That would be one hell of a passenger pigeon, wouldn't it?

This is something that should make you raise your eyebrows a bit. Most of my work over the past year has resulted from this observation that I made while studying statistical ecology. (It's a hobby.)

This is not a rigorous scientific essay (nobody wants to read

those—not even my wife), but I'd like to point out that information should be carried by something. Here we find that an organism carries increasing information depending upon how close to extinction she is, but no physical characteristic of the elephant changes exponentially as a function of her prevalence in the ecosystem. She is not becoming more massive, nor is her temperature is increasing. What physical property could possibly change in this manner and thereby convey this information? Nothing.



Probability (1=100%)
Information about an ecosystem conveyed by an organism as a function of the probability of the organism's species appearing in an observation. Note that the information increases infinitely as the probability goes to zero.

I do not believe that any known physical phenomenon can be shown to contain or convey the information in story. Others have called this information *cybernetic information*, and it is generally regarded as an abstract quantity with no concrete, physical embodiment, but I propose that this information exists concretely outside the known physical environment, in what I call the *story environment*. If we would like to understand extinction and genocide, then I propose that we begin with an understanding of story.

I propose that any real, complex, interconnected system such as an organism, a community, an ecology, or a culture has story. Story is real, physical mass that contains all of the information about the possible arrangements of that system. There is both theoretical and experimental evidence for this mass—new theories of gravity assign weight to cybernetic information, and a team of physicists have successfully converted it to energy.²

A detailed analysis of that evidence is beyond the scope of that essay, as is the complete system of thought that results from this premise. However, the core of this system of thought is that our possibilities are shaped by story—for that is what story is—and the stories that we use to rationalize, coordinate, and understand our behavior are massive, phys-

ical objects contained in the story environment. We are a part of these objects in a very real way. This system of thought is intimately linked to the crises of extinction and genocide, because these events are best understood through the lens of story. If our response to this culture of genocide and exploitation will be balanced and relevant, that response should be informed by an honest and unflinching assessment of the stories we belong to.

We are Stories

We are physically integrated into and enveloped by the stories that we use to determine our own possible behaviors.

The mass contained in a story belongs to the entire system that the story represents. Human culture is organized by story. Languages are stories; money is a story; the United States of America is a story. By participating in these stories, we become a part of the set of possibilities that those stories define. We may choose whether we wish to belong to some of these stories or not. I do not have to authenticate the story of money by participation in that story, nor do I have to identify as a U.S. citizen. I know people who do not do these

things in spite of being born into these stories; they have chosen other stories.

All stories are physical matter in the story environment, and when we are part of a story, we are physically embedded in that matter. If the story of the Serengeti includes elephants, each instance of an elephant in the here and now is an expression of her presence in the story. Every relationship is a story and that inviolate whole relationship is a physical structure in the story environment.

There are stories that include both humans and elephants, but the predominating stories that organize our behavior set us apart from the rest of the world. These Cartesian stories divide humans from nature; there is no room for elephants in these stories—only ivory. The possible behaviors available to us as a member of these stories are uniformly exploitative. Within the framework of these stories, even the language of conservation speaks only of guarding our “resources” for future generations of humans. We are physically embedded in these stories from birth.

We are also embedded in other longer stories that do include elephants and other animals, and in which we are interwoven into—rather than separate from—this fabric of being. These stories are not consistent with the Cartesian cos-

mology that sets humanity apart from a mechanical world, and although the Cartesian paradigm has been rapidly extending itself at the expense of other stories for the past several hundred years, we now find that there are other stories that can't be aligned with that mechanical worldview. Our anthropocentrism does not lay flat against other stories in the story environment—it is not a coherent cosmology. The structure and nature of the universe is not mechanical.

When we view extinction and genocide from this perspective, we are presented with the question as to which stories we wish to belong to, and whether we will continue to grind down the edges of other stories in order to force our incoherent vision of human-centricity upon the world.

The Cartesian Rift

The Cartesian story does not lay flat against other stories in the story environment. This creates an aberration—a raw edge where the stories cannot meet—which grows larger as the power and extent of the Cartesian story expands. That aberration acts as a singularity that consumes material in the story environment. Extinction and genocide are an ex-

pression of this loss of story.

We are experiencing the Earth's sixth mass extinction event. We are converting complex ecosystems into engineered single species agri-systems, and this moves order from the here-and-now into the story environment. Rather than having a complex and organized expression of present order such as a virgin forest, we have a reduced and ordered set of diminished possibility such as a chicken house and a bunch of two-by-fours. This is happening all over the world, and quickly.

Simultaneously, there is a similar trend occurring in the sphere of human culture, where we call it genocide. The process of genocide and the process of extinction are mathematically equivalent. Over the past five hundred years, classical civilizations have assimilated or destroyed an extremely diverse array of cultures, religions, languages, and people that once covered the greater part of the Earth. Genocide has homogenized human culture which no longer expresses so much diversity and structure in the present moment, and increasingly expresses the regimented order of reduced possibility. The stories of ecology and the stories of culture are becoming more ordered.

This ordering in the story environment is a loss of possibility and information that is embodied as mass in the story environment. Some phenomenon is tearing away at these stories and consuming their mass. I believe that this phenomenon acts as a singularity created at the intersection between the burgeoning Cartesian story and the rest of the story environment. Like a black hole, this singularity pulls in mass from the surrounding stories and consumes it. This lost mass is lost possibility. It is extinction and genocide. It is this thing in the room that we are refusing to acknowledge or talk about.

I am tired of these old narratives that extinction, climate change, and genocide can be dealt with through rational problem solving. I am tired of half the people pretending that these stories can be swept under the rug if we will only elect Bernie Sanders or a few more woke representatives, and I am tired of the other half pretending that these problems don't exist or aren't theirs to begin with. I am tired of these lies that science will save us or that we don't need to be saved. It is extremely awkward to tell you that our science is the problem as much as anything else—our science that refuses to lay flat against the world and creates this thing in the room with me. I am tired of people that make

fun of flat-earthers and then draw equally flat maps that reduce climate change to so many parts per million of carbon dioxide and that exorcise genocide to a dull blur in a past that doesn't exist. These maps do not fit in this room.

Have you been in this room before? Here in this place where the stories are? This room is the dreamtime beyond the tick-tock-clock. This room is where languages and identities merge into metaphors older than words. This is where stars are born and die again. This thing in the room is the burning, grinding edge of the tectonic plates that forged the sky. In those places where the crinkled edges rise like the Himalayas, she comes and throws down the mountains and softens them again. She is like Kali, the destroyer. She is growing now, fat upon dodo birds, passenger pigeons, and the Arawak people. She will swallow all the stories that do not lay flat here. She will not choke upon Descartes. Not a bit.

I am feeling around now in the dreamtime, looking for a story that fits. I bring those stories back with me, and when I sit by the fire at night with my wife, we try on these other stories. When I sit with my daughter on the floor winnowing seeds to plant in the spring, I try on these other stories. I teach them to her as best I can, and she teaches them to

me—these stories in the seeds, in the soil, in the dreamtime. These are the long stories of slow time. We try them on together and see if we can smooth out the edges so they will lay flat. We will not wear those other stories anymore.

III.

Massive Information

& the Ecology of Mind



There is a yet uncharted bridge between ecology and gravity. I believe that ecology as a natural science has reached a dead end that will not be surpassed until we reform our understanding of gravity. The ecological connections that run through, weave together, and bind every being in the world are gravitational connections—gravity is an ecological force. Our current understanding of gravity does not aptly describe these relationships, and this misperception prevents further advance in the field of ecology where such connections indelibly mark the development and expression of ecological realities.

The stories of gravity and ecology have run along parallel lines and do not appear to intersect in important ways, but we may observe that these lines have a common origin. Newton's great achievement in describing gravity was extended into the precise, objective mathematical language that we now employ to describe all natural systems, and that language continues to shape ecology as a natural science. The same could be said for any field of study. Biology, geology, astronomy, and even humanistic disciplines such as economics, psychology, and anthropology have all been grown out in what amounts to a petri dish full of *agar de*

Descartes avec Newton. This is certainly not the only way to study the world, but it's what we know, and I'll acknowledge what merit it has.

Five hundred years of Descartes and Newton has taught us to seek understanding by taking things apart, but ecology and gravity are phenomena of interconnection. Interconnection is the bridge between these two concepts. Gravity connects, and ecology studies those connections. So, an understanding of ecology requires an understanding of gravity; it requires an understanding of the nature of connection. How are things connected, via what mechanisms, and why?

I believe that the story of ecology—shaped from its inception by our story of gravity—intersects with that story again at this turning point in human relationship to global ecological systems. But now it must be the story of ecology that informs our theory of gravity.

Leopold's Lament

Aldo Leopold, one of the pioneering minds of the science that we now call ecology, once wrote,¹

“One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell or make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise.”

Perhaps this statement, published in the early 1950s, reads a little differently now than it did then. During the rise of Leopold’s career—he graduated from the Yale School of Forestry in 1908 and directed the first U.S. program in wild-life management at the University of Wisconsin in 1933—farmers in the U.S. were just beginning to embark on what we would eventually call the Green Revolution.

The promise of the Green Revolution was increased crop yields from chemical fertilizers, pesticides, herbicides, and hybrid crops—now morphed into GMO agriculture. The promise was to feed the world and free the farmer from drudgery. In fairness, that promise has partly been kept. We certainly produce more food than ever before, world hunger is on the decline for the moment, and our drudgery has taken other forms than farming. We can imagine at this time,

as Leopold lamented his loneliness in a world of wounds, that the enthusiasm for such apparent progress was both pervasive and contagious.

Things are a bit different now. The wounds have festered a bit, but ecology has taken its seat at the table. The ecologist must no longer play doctor to a community that ‘believes itself well,’ and if Leopold’s successors must vie for attention, to some extent they do so in a social/political climate that they have helped to shape. Their demands and warnings ring with a note of truth that few today would casually dismiss. In a little under 70 years, ecology has gone from being the lonely frontier of birdwatching poets to a sweeping political behemoth that, ironically, drives a growing industry of its own. I wonder what Leopold would think today of the growing solar and wind farms that represent our attempts to stave off energy starvation, or the miles of corporate Organic monocrops that have grown out of the compromises between industry and ecology. Perhaps he would still feel lonely.

Today’s ecologists attempt to precisely define the relationships between species and to better understand how larger ecosystems function—generally with the intent to preserve them. Faced with the encroaching progress of agricul-

ture and industry, they must answer hard and gritty questions like, “How much of this rainforest can we cut down while minimizing extinction rates to 5%?” Or, “What is the minimum acreage for a viable biosphere preserve?” These are hard questions, posed by compromise, and answered with hard scientific data that is hastily gathered and always incomplete. These ecologists, for better or worse, speak the language of economy, scale, and policy. Their fight is perhaps valiant, perhaps futile, but if it is lonely this is not the loneliness of which Leopold wrote three quarters of a century ago. In the intervening years, ecology has been translated into a language that the layman speaks, so today’s inheritors of Leopold’s legacy are no longer alone.

Language is digital. However versatile our language may be, we sacrifice complexity for precision, and so there are gaps between the words. Ecology on the other hand, is analog. There are no gaps between trees and tree frogs, nor between the mycorrhizal mats in the soil and their symbiotic relationships with tree roots. The reader may object, but I will insist that this objection is a product of our training and not a product of the forest, the river, or the prairie. As ecology has evolved into a science with rigor, precision, and credibility—as it has gained its seat at the table with econo-

my and policy—it has also evolved into a language. This is most useful. We can speak of the *carrying capacity* of the global ecosystem, and of *rates of extinction*. All these things matter. We need these words. But the forest doesn't

When we study species, we set them apart from each other. It's convenient to have a methodology for all of this, so we use DNA. We can make a gap between the fungus and the tree, because they have different DNA. In the overlaps between ecology, biology, and botany, we share a Linnean system of classification that allows us to conveniently sort all of these species into boxes, each with their own Latin label. Of course this is not what the forest or the river does; it is something that we do. This classification is the digital language of an analog ecology.

In the soil and in your gut, DNA is much more fluid than this. There is not actually a line between the fungus and the root, because there are cells in the borderland that do not clearly belong to either but share properties of both. There is no fungus without the tree, and there is no tree without the fungus. Likewise, the bacteria in your gut take up snippets of your DNA, or even DNA from the food that you eat, or DNA from the bacteria *on* the food that you eat, and they look it over for anything useful to incorporate into their own

blueprints for future progeny.² The world is analog. There are no gaps.

Ecologists, in gaining their seat at the table, have been forced to translate their field studies into the digital language that is spoken at that table. The loss of verity in doing so is the price that the modern ecologist has paid so that he need not “harden his shell or make believe that the consequences of science are none of his business.”

There is a new ecology that arises today on the ever receding line between the domains of man and of nature, and that new ecology is somewhat different from Leopold’s. The new ecologist, if he is to speak of ecological realities, may not always use the language of congressional committees or university lecture halls, because the new ecology is analog. The new ecology is an ecology of mind.

For the new ecologist, it is still a world of wounds—a lonely place.

Even from the foundations of ecology in the U.S., this approach to studying the natural world as whole and interconnected systems was inherently fragmented. Modern ecology is an extension of a fragmented worldview; perhaps

it is a step in the long journey of piecing that worldview back together, but ecology in its current form—the language built upon the reflections of such lonely visionaries as Leopold—is a convoluted approach to nature that consists of taking it apart in order to put it back together. Ecology of mind is a gestalt. In the ecology of mind, natural systems are approached from within, in recognition that the ecologist is in no way separate from the systems that they study. In this way, a bridge is created between ecology and psychology. Ecology of mind as a human enterprise belongs partly in the humanities but partly in the natural sciences. This is a field of study that straddles the standard divisions in academia just as it straddles the divisions between academia and practical everyday living. This is the ecology of the concrete jungle. This is the ecology of the laundry room, the kitchen, and the dinner table.

The schism in modern ecology is hard to see, because to all appearances ecology is a holistic approach in an otherwise reductionist context. The early ecological visionaries certainly integrated things in a way that was rare among natural scientists at the time. Frederic Clements, when he introduced the first ecology textbook in the U.S., proposed a way of thinking that most people found foreign and strange.

His proposal was to consider networks of plants as “formations” that were, in effect, superorganisms:³

“The plant formation is an organic unit. It exhibits activities or changes which result in development structure and reproduction.... According to this point of view, the formation is a complex organism which possesses functions and structure and passes through a cycle of development similar to that of the plant. This concept may seem strange at first owing to the fact that the common understanding of function and structure is based upon the individual plant alone.”

This relatively holistic approach offered by Clements and others would gain sufficient traction to launch a new scientific discipline in the U.S.—a discipline that would attract Leopold and others who would insist that we view the world as a community of which the human species is only a part. This discipline would eventually pose ethical questions regarding the relationship between humans and the environment. Leopold wrote of the need for a “land ethic” just before he died in 1948,⁴

“In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such.”

The difficulty in developing this land ethic, according to Leopold, was in its requirement that individuals self-limit their freedom to degrade the land for short term economic benefit and acknowledge an ethical obligation to conserve the land for its own sake. He saw social evolution as a three step process with the first two steps being the development of ethical obligations in interpersonal relationships and then, second, in ethical relationship to the broader human community. Precepts such as the Golden Rule represented our ethical obligations in human relationships, and for him, the adoption of ethical obligations to the land was a logical third step in our social evolution. Conservation, in Leopold’s view, was dependent upon humanity assigning abstract value to nature beyond its economic utility—a sort of Golden Rule applied to the land:⁵

“It is inconceivable to me that an ethical relation to land can exist without love, respect, and admiration

for land, and a high regard for its value. By value, I of course mean something far broader than mere economic value; I mean value in the philosophical sense.”

This value, for Leopold, appears to be something that he gained through years of exploring the outdoors both as a child and in his official capacity in the U.S. Forestry Service. Leopold began working for the Service shortly after it was founded in 1905, and in these early years of U.S. Forestry, game management policy involved extermination of wolves and other large predators in an attempt to protect farmers’ cattle and increase the abundance of game. His role in this extermination project became a point of transition for him as he began to question the ethics and implications of this policy. In one story, he tells of an epiphany that he realized upon killing a mother wolf with her pups.⁶

“We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes—something known only to her and to the mountain. I was young then, and full of trigger-itch; I thought that because fewer wolves meant

more deer, that no wolves would mean hunters' paradise. But after seeing the green fire die, I sensed that neither the wolf nor the mountain agreed with such a view.”

But what of other people who have little or no opportunity for such epiphany? As ecologist Robert Pyle—another graduate of the Yale School of Forestry—has asked, “What is the extinction of the condor to a child who has never seen a wren?”⁷ It seems that Leopold’s land ethic, 70 years after he proposed it as a natural extension of our social evolution, remains elusive. The possibility of developing this sense of value and obligation seems only to recede with the modernization of American life that further isolates us from the wilderness. It seems to me that Leopold’s basis for conservation as an act of ethical obligation is further from our reach than ever.

I believe that our failure to evolve a land ethic stems from the original schism in ecological thinking as it was conceived in the early 1900s. This schism is perhaps most easily seen in the juxtaposition of Clements’s description of plant communities with Leopold’s discussion of land ethic. The Clementsian plant community is a superorganism—an

organic unit. In another description of this “formation,” published 25 years after the earlier quote, he again states,⁸

“The developmental study of vegetation necessarily rests upon the assumption that the unit or climax formation is an organic entity.... As an organism the formation arises, grows, matures, and dies.... Furthermore, each climax formation is able to reproduce itself, repeating with essential fidelity the stages of its development. The life-history of a formation is a complex but definite process, comparable in its chief features with the life-history of an individual plant.”

This approach to an ecology as a single organism was never thoroughly extended to human communities as a part of that system, and this represents the foundational schism in American ecology as a field of study. Leopold, for all his effort in reconnecting humans to wild nature, almost uniformly presented that case through the language of a community in which humans are a “plain member and citizen.” It is far different to be a citizen of a community than it is to be an organ of an organism. It is the difference between identifying nature as other, and identifying nature as self. A

citizen may leave a community, but the heart will not survive without the body.

I will claim that no amount of ethical argument or moralizing will ever move humanity to care for land in the way that Leopold envisioned. (In fact, I am not particularly convinced that we ever systematically completed the first two stages of ethical evolution that he claimed we have already taken.) I believe that if we are to develop a balanced and functional relationship with our environment, we must do away with the concept of environment all together and begin to identify ourselves with the land-as-self in the way that many indigenous cultures before us have done. I propose that not only is this the most expedient measure to restore balanced function of the whole-Earth organism, but that this is also the most physically accurate model for understanding the interactions and dynamics of the Earth and the place of humanity within it.

Drawing the human into the ecological study breaks the traditional boundaries between the humanities and the natural sciences as well as the Cartesian splits between man and nature; mind and matter. The human mind enters the sphere of ecology, and in so doing the concept of mind must

be extended to all complex natural systems, for it is only in relation to those system that we ourselves have any meaning. So, we leave Leopold's ecology—forever grateful for his vision and ambition to bring the human community into meaningful relationship with the natural world and for his leadership in the conservation of thousands of acres of American wilderness—and we enter the ecology of mind.⁹ In the same way that Leopold's writing may best express the American ecological approach of the early 1900s, the later development of the ecology of mind is perhaps best expressed through the thinking and writing of Gregory Bateson.

Gregory Bateson was born in England in 1904, the youngest son of William Bateson and Beatrice Durham. Gregory's father was a distinguished biologist who coined the word genetics and was one of the primary scientists responsible for popularizing the work of the Austrian friar Gregor Mendel, whose work you may remember from high school biology. Gregor Mendel, for whom Gregory was named, discovered dominant and recessive genes in pea plants. William had far-reaching ambitions for his three sons and trained them in the natural sciences from a very early age. They lived in "what amounted to a muse-

um....walks were field trips and conversations were explanatory....There was no distinction drawn between science and family.”¹⁰ While the elder Bateson was a loving and attentive father, he must have put enormous pressure upon his sons to dedicate themselves to scientific work.

Gregory’s oldest brother John was killed in the First World War. His remaining brother Martin suffered from unrequited love and had more ambition for poetry than for a scientific career. When Martin shot himself in a dramatic public suicide—in the middle of Picadilly Circus in London—Gregory found himself the lone subject of his father’s ambition. It was in a “sort of revolt” against his pre-ordained path in zoology and genetics that the youngest Bateson turned to the newly developing field of anthropology, which he found attractive for its “more personal element.”¹¹ He also acknowledged that field studies in the Pacific Islands offered an opportunity to escape his family.

His early months studying primitive cultures in New Guinea offered him mostly frustration and malaria, but his keen scientific objectivity applied to understanding the behavior patterns of another culture would shape all of his later work. By the time Bateson had published his first book, *Naven*—a study of Iatmul ceremony—he had realized that his

own perceptions and biases would intrinsically shape his observations and conclusions about other cultures, and that it was therefore impossible to make objective study of the meaning behind their behaviors. This type of thinking represents the early development of the ecology of mind—the acknowledgement that the observer is part of the system being studied.

Rather than attempt to assign meaning to what the Iatmul people were doing, he opted to conceive of every behavior as a pattern, with individual behavior fitting into larger cultural patterns, and vice-versa. His biographer later wrote,¹²

“Bateson’s scheme did not deduce individual behavior from social structure. Neither did it induce social structure from individual behavior. Rather, both these processes were invoked. The pervading themes of individual behavior not only resulted from processes of [cultural] standardization but also effected them. He posited a circular, interdependent, bidirectional system of causation.”

In New Guinea, Bateson stopped seeing behavior as indicative of concrete meaning, but rather saw behavior as an

expression of process, pattern, and dynamics. For example, the “motifs of relationship,” such as dominance or submission were rendered as a binary unit: “We have to think of the individual...as trained in dominance-submission, not in either dominance or submission.”¹³

Naven proposed that human behavior plays out within a framework of feedback mechanisms in which the behavior of A affects the behavior of B, which in turn affects the behavior of A. Of course, these feedback loops may be immensely complex and involve any number of people. Bateson further described how varying dynamics within a culture may create stable arrangements or lead to schisms, instability, and change. This entire formulation was much more dynamic than anything else being offered in anthropology at the time, and in retrospect, we may regard *Naven* as the first cybernetic theory of human culture. (Cybernetics is the study of systems governed by dynamic feedback control and properly includes everything from brains to economies and from forest ecosystems to guided missiles—of course it was the latter that led to most initial

Cybernetics is the study of communication and feedback systems of all sorts, including biological, ecological, and cultural systems

development in the field.) Much later, when the field of cybernetics exploded in the wake of World War Two, Bateson was much excited to find formal definition and mathematical models for his “ad-hoc and awkward” theoretical notions.

Bateson’s eventual proposal was to remove the Cartesian split between man and nature, which he viewed as being “so wrong that any culture built on it was inherently unstable and liable to move on accelerating paths of self-destruction...” He set himself the intellectual task to “challenge this whole set of assumptions and seek...ideas that would function as true premises so that humankind in relation to nature becomes in fact a single self-correcting system, not one bound for destruction.”¹⁴ This incorporation of humanity and nature into a single cybernetic system is the ecology of mind. It is an ecology whose emphasis rests not on things, but on process, not on meaning, but on pattern.

In the same year that Bateson published *Naven* he married his first wife, the famed American anthropologist Margaret Mead whom he had met doing fieldwork in New Guinea. Together, they continued their fieldwork and pioneered new methods for gathering data using video and photography. When Gregory was called into the war effort—where

he was put to work in propaganda attempts to undermine Japanese morale—Mead returned home to the United States just before the birth of their daughter Mary Catherine in 1939. Mary Catherine would also become an anthropologist and cooperated with her father to organize various conferences and his later books.

Following the war, Bateson applied his cybernetic worldview to a wide range of fields, making contributions in biology, animal behavior, linguistics, and in psychiatry with an important theory of schizophrenia. His discourse and writing would leap from topic to topic such that his followers sometimes complained that he was difficult to understand. Bateson had a tendency to maintain specific but peculiar definitions for words—for example he developed a six part criteria for the word *mind* that did not include consciousness or association with a single organism. As Mead later suggested, “Bateson’s talent was for the extraordinary broad concepts and the minor little details. But the middle ground, he’s not so good at....One of the reasons it is hard to grasp the connections [Gregory makes is] because he jumps the middle. He goes to the extraordinarily broad from very small observations.”¹⁵

At the heart of Bateson's entire wandering career is the search for "eternal verities" which he could apply to the un-

Every real system is an *ecology*, and examples of ecological systems include ecosystems such as a river, and organisms such as a human. Organisms are also collections of other ecologies such as cells and organs. Economies such as your hometown, communities like your family, and conversations—as in your reading of this essay—are all ecologies.

derstanding of any topic. His conviction was that a cybernetic understanding of real and natural systems—that is, the treatment of

that system as a continually adapting whole in continual feedback with itself and its environment—would lead to a qualitatively different human relationship with one another and the natural world. This new ecology of mind would reframe our concept of identity, our system of ethics, our art and aesthetics, and our sense of what it means to be human. It also reframes our sense of what ecology is; if humans are brought into the ecological context, all human systems become ecologies as well. Economies, languages, and cultures are all cybernetic systems in continual feedback with the environment and are therefore ecological systems. Even a

simple conversation becomes an ecological relationship. Bateson readily admitted that he did not fully understand how to fully incorporate this new worldview into his own life, stating in 1970,¹⁶

“The most important task today is...to learn to think in the new way. Let me say that *I* don’t know how to think that way...If I am cutting down a tree, I still think ‘Gregory Bateson’ is cutting down the tree. *I* am cutting down the tree. ‘Myself’ is to me still an excessively concrete object different from the rest of what I have been calling ‘mind.’”

However, I wonder if perhaps it were due to his partial adoption of the ecology of mind that many of his colleagues and students found Bateson difficult to understand. He rejected many social norms, generally appearing to lectures disheveled and without socks or notes. His daughter described him as “camped out within the culture without valuing or protecting its forms.”¹⁷ Bateson held a deep loathing for any form of power or control to such an extent that he was often unable to explain his ideas too clearly for fear that he would unduly influence his students’ perspectives, which led to the complaint that he deliberately confused them.

In the case of both Bateson and Leopold—and I suspect for any pioneer on the edge of new understanding—they frequently found themselves “alone in a world of wounds” and in the unenviable position of pointing out that our culture is not well when it does not want to be told otherwise. Leopold’s ecology has gained a seat at the table since his death, and while our culture now seems ready to acknowledge that perhaps we are not well in respect to our relationship with the natural world, we do not yet appear ready to embrace Bateson’s ecology of mind and the reassessments that it imposes upon our sense of self as a mere cell of a larger whole-earth organism. The ecology of mind betrays our humanist sense of superiority and control as well as our egoic sense of importance and individualism. All of these values remain deeply entrenched in human culture well after Bateson’s death.

Two Ecosystems

The main thing that makes Bateson’s ecology of mind different from the more conventional ecology of Leopold is that it is self-referencing. From the human perspective, an ecological approach that includes humans as part of a single

whole-earth organism is different from approaching ecology as a detached observer from the outside, and it is different in a very peculiar way. *The ecology of mind is of a different logical type than Leopold's ecology of the natural world.* Logical typing is a central concept in understanding feedback and self-reference.

When I get into explaining abstract concepts like *logical type*, I fear that I may lose some readers. We have been trained to look at the world in a very particular way, and to use a very limited range of abstractions to understand things. So for instance, if I use the abstraction “Monday” in explaining something about the world there is no need to be concerned that my readers will feel uncomfortable or rebel, because that is an abstraction that we are all well acquainted with and need not think much about. (If I were writing for an audience unfamiliar with our workweek or not accustomed to measuring time at all, I would likely need to preface the use of that abstraction with some careful explanation.) On the other hand, when I begin to use less familiar abstractions, like *logical type*, I feel more compelled to create an atmosphere conducive to your understanding.

The problem is that our map of the world does not lie flat against the reality that we are trying to represent. There

is, in fact, no such thing as *Monday*, and there is, in fact, great usefulness to the abstraction *logical type*. Monday is not an idea that is broadly applicable to many fields of understanding. Logical type, on the other hand, is a very handy concept. It's unfortunate that all of our schooling leaves us with a toolbox of abstractions that aren't always helpful in understanding the world. I firmly believe that we would be well rewarded if we invested a small amount of energy in learning new abstractions, (and I'm afraid it will require a far greater amount of energy to unlearn some of the old ones).

It appears to me that the task before us is to re-map our reality with a new toolbox of abstractions that will be useful in navigating human relationships and human-ecosystem relationships in the post-modern crisis. Given the nature of this crisis, I think anyone who can't learn these new maps should be regarded with the same suspicion that you might reserve for anyone unwilling to learn about Monday. Personally, I find myself in fewer and fewer situations where Monday is a particularly useful concept. All of this is merely to preface a rather simple explanation that—while not particularly difficult—is of the sort that some people don't seem

to see much reason for learning. Here is what we mean by logical type:

Everything can be arranged into sets. We could imagine for instance, the set of all trees. Likewise, we could imagine the set of all plants. The set of plants includes the set of trees. Because the set of plants includes the set of trees, *the set of plants is said to be of higher logical type than the set of trees*. It's that simple. The class of machines is a higher logical type than the class of Volkswagons. *If a class includes another class then the two classes are of different logical types*.

The theory of logical types was developed by Alfred North Whitehead and Bertrand Russell in their compendium *Principia Mathematica*, published in 1910. The intention of *Principia* was to establish a system of logical axioms that was powerful enough to completely describe all mathematical truth. This three-volume work is the type of book that famously contains 100 pages of proof before the conclusion that $1+1=2$. (Admittedly, it is this kind of thing that turns people off to theories such as logical type.) Twenty years after its publication, Kurt Gödel proved that it was not possible to completely describe all mathematical truth after all (even with 100 pages to describe simple addition). This in-

interesting observation of Gödel's seems to have escaped broad cultural awareness but is at least as important as logical types, and far more important than Monday.

Nonetheless, in spite of the failure of its original intention, *Principia* established some important ideas, among them the theory of logical types. Russell and Whitehead determined that a logical paradox results if classes of different logical types are mixed. That is, a class cannot be allowed to contain itself. The paradox occurs when classes are treated as things. For example, the class of plants is not a plant, and therefore the class of non-plants includes the class of plants. It gets a bit complicated from here (and you may skip the rest of this paragraph if you like) because we could create a class of classes that exclude themselves. Does this class of classes that exclude themselves include itself as a member? If it does exclude itself then it should include itself, and if it includes itself, it follows that it should be excluded. The paradox arises from self-reference, and the paradox has the same structure as that which arises from the statement, "This statement is false." If the statement is false then it's true, but if it's true then it's false. Whitehead and Russell theorized that logical consistency could only be maintained

if classes were assigned different logical types and that classes could only contain classes of a different logical type.

It doesn't matter terribly much if you understand why we need logical types to avoid logical paradoxes, but it does matter that you know what logical typing is—it is the separation of sets based on whether they are included in some other set, and it ensures that that sets cannot include themselves. It also matters that you understand their necessity in maintaining logical consistency, even if you can't rattle off the exact nature of the paradoxes involved. In review, the set of words is a higher logical type than the set of nouns; the set of words is not a word, or as the scholar Alfred Korzybski aptly summarized: "The thing is not the thing named. The map is not the territory." The reason that all of this matters is that this concept will crop up again and again in various places. The abstraction of logical typing is applicable to a broad range of fields, including (even especially) ecology. I'll warrant that it is not included in a single ecology textbook in use in an American university today, although I'd love to be proven wrong.

The ecology of mind, by including humans, is of a different logical type than the ecology of nature (from the perspective of humans). For a helpful illustration of this differ-

ence, consider Robin Wall Kimmerer’s work on the ecology of mosses. Quietly placed at the forefront of ecology, Kimmerer’s book, *Gathering Moss*, details many properties of moss micro-ecology.¹⁸ In every moss, there is a tiny forest with its own complex and interwoven cycles of life—tiny animals, tiny plants, tiny lakes and hills—all building up to an ecosystem that itself resembles the forest. Because forest ecosystems include moss ecosystems, forest and moss ecosystems are of a different logical type. (Kimmerer does not use this terminology in her book.) By identifying themes or dynamics that are common to both types of ecosystem, Kimmerer is able to demonstrate certain truths that remain true across logical types—from the forest scale to the moss scale. Presumably these truths are “more true” than truths which do not transfer across logical type. This is a similar approach to what we must take in adopting the ecology of mind, but instead of traveling from the scale of forest-without-human to the scale of moss-without-human we must travel from ecology-from-the-outside to ecology-from-the-inside.

It is worth noting that what remain true in traveling from the micro-ecosystem of moss to the ecosystem of the forest are not *things* but *patterns*. In the same way that

Bateson rendered anthropological patterns of behavior such as dominance/submission as a binary unit, truths that remain valid across logical types take the shape of complementary patterns containing their opposite. There are no locust trees in a moss ecosystem, but locust trees are a pioneer tree species that colonize disturbed areas. This pattern of disturbance/colonization exists in moss ecosystems, even though locust trees do not. There are no black bears in a moss ecosystem, but black bears are an omnivorous species adapted to a diverse habitat. Likewise, in diverse moss ecosystems we will find species that fulfill this pattern of diversity/omnivory. As we travel then, from the ecology of nature to the ecology of mind, we might expect to lose track of *things*, and pay attention to *patterns*. Because these patterns remain true across logical type, it is reasonable to claim that these patterns are “more true” than the things which embody those patterns in the limited context of a single logical type.

Indeed, this dual nature of truth is expressed in the primal roots of our language, as for instance the writer Steve Wheeler has found,¹⁹

“Words are a strange tool....In ancient languages, you find a single term standing for what seem to us contradictory ideas. Thus, *altus* meant both high and deep; *sacer* meant both sacred and accursed. In our own language, the hospitality of a host and the hostility of an enemy still vie for the same root. We can choose to cleave to someone, or cleave something apart. For our ancestors...these primal words pointed to an experience of the world where opposing meanings were held together in deep psychic unity.”

As we move from the ecology of nature-separate-from-human to the ecology of mind, we must abandon our preoccupation with things, and develop an awareness of pattern. The failure of our attempts to integrate human communities with the global ecology, and our failure to develop the land ethic promoted by Leopold and his successors is rooted in our emphasis upon a form of truth that is limited to a single logical type. As we approach the ecology of mind, we begin to emphasize those truths that extend beyond this simple and limited scope. Again, I propose that this not only the most expedient measure to realizing a more balanced global community, but also a more physically accurate (ie, true) basis for understanding the world and our place within it.

The Cruc

When I begin making sweeping claims about the truth of things, I feel compelled to offer the reduced and objective measures for truth that we are all so accustomed to. There is an awkward challenge here, because although we are culturally conditioned to accept only scientific and objective measures for truth, we are also broadly uncomfortable with the dry, precise—sometimes unintelligible—language of science and mathematics. I would say that important visions such as Bateson's ecology of mind have failed to gain broad acceptance partly because they are so often described in language that is inaccessible to many people. Yet, there is a catch-22, because this is exactly the language that will be required of any approach if it is to be broadly accepted in this Cartesian mechanical culture. Such is the challenge of the lonely ecologist in a world of wounds. It is the precise nature of our wounds that the very language we must use to begin the process of our healing is barbed to catch upon our fears of inadequacy to the task, or upon our impatience and complacency—perhaps we are over-satisfied with Monday. Nonetheless, and perhaps only to stave off the loneliness of

this ecological education, I present here the Cartesian model for the ecology of mind that I know will be necessary for that ecology to gain a seat at the table. Perhaps it is a new table, and I hope that you will come and sit with me.

My extension of Bateson's work on the ecology of mind brings us to the aforementioned intersection between ecology and gravity, for my proposal is that real ecological (ie, cybernetic) systems create a new type of mass. I will take the position that any ecological system—as an inviolate and integrated whole—contains information that is quantifiably massive. This massive information defines the system as a whole and determines the character and behavior of the system overall. Because our conceptual definition of mass is inextricably linked to our model of gravity, this position requires that our theory of gravity be reworked in view of this ecological perspective.

I define this massive information in very Cartesian terms. This requires that some portion of the following material will be slightly technical, although none of it is more technical than what is necessary to understand the concept of Monday—even if it is less familiar. (Our clocks and calendars are very technical achievements, their ubiquity notwithstanding.) Those portions that are technical are only

what are required to support my arguments, for we must dethrone Descartes on his own board. I'm afraid it's the only board left.

For Bateson, the backdrop of the ecology of mind was the world of pattern, information, and difference. He invoked a “dividing line between the world of the living (where distinctions are drawn and difference can be a cause) and the world of nonliving billiard balls and galaxies (where forces and impacts are the ‘causes’ of events).”²⁰ Borrowing the phrasing of Carl Jung, he applies the term *Creatura* to the essentially mental world of distinction and difference, and *Pleroma* to the essentially mechanical world of substance. This is, of course, the same dichotomy that Descartes makes between mind and matter, although Bateson refuses the Cartesian approach of throwing out the *Creatura* entirely. In his later work, Bateson emphasizes that,²¹

“It is important to be clear that these two [*Creatura* and *Pleroma*] are not in any way separate or separable, except as levels of description. On the one hand, all of *Creatura* exists within and through *Pleroma*;

the use of the term *Creatura* affirms the presence of certain organizational and communicational characteristics which are themselves not material. On the other hand, knowledge of *Pleroma* exists only in *Creatura*.”

Creatura and Pleroma are modes of understanding and describing the same world. Bateson’s ecology of mind was firmly seated in the *Creatura*, but my present extension of his work in effect builds a bridge between these two modes of understanding. By remodeling gravity we may show that information and difference have mass, and therefore the ‘organizational and communicational characteristics’ of *Creatura* could indeed be described as material phenomena after all.

It seems to me that a *Pleromatic* language for the phenomena of *Creatura*—a Cartesian language to describe phenomena of the mind—is the only road toward wider adoption of the ecology of mind. Humanity will not broadly accept our unity with nature until that unity is clearly and indisputably demonstrated in a Cartesian language (or until that division brings about broad ecological collapse). It appears to me that we are collectively married to *Pleromatic*, materialistic thinking—until death do us part, if you will.

This commitment to Pleroma is so deeply pervasive and long-established that we're generally unconscious that there's any other way to think.

Our preoccupation with Cartesian, Pleromatic description of the world is in short, a preoccupation with mass. Or, ever since Einstein showed that mass and energy were the same thing, we have been obsessed with *substance*—matter-energy. Naturally we want to know what everything is made of, and we presume that everything should be explainable by understanding its substance. If I told you that the ghost of my grandmother gave me cancer, you would not believe me. But, if I cross-referenced her cancer causing DNA with my own—establishing a connection in substance—you would. Then, if we do find cancer in our body, this preoccupation with mass leads us to make distinctions: This cell is cancerous, and this cell is not. This distinction seems reasonable and well defined, because the apparently cancerous cell is mutating and propagating itself beyond control, and the apparently normal cell is not. So, we believe that we have found the source of the cancer. The next step—treatment—continues this approach as we isolate and identify particular molecules as the active principles in herbs, and then synthesize those molecules in laboratories for medicine. In the

same way that we believe we've found the material source of a cancer, we believe that we can find the material source of a medicine.

In the end, what this amounts to is a statement that takes the form, "This herb is medicinal, because this molecule is medicinal." Or, "This tumor is cancerous, because these cells are cancerous." But these statements don't mean anything. This is tautology. We have moved the mystery of what medicine is from the herb to the molecule—and probably lost much of it along the way—but we are no closer to understanding this mystery than we were before. Since we are generally much less interested in understanding mysteries than we are in making money—or perhaps we're interested in effortless solutions to complex problems, depending on which side of this medication we're on—we might not notice this sleight of hand.

Of course this strategy of answers that beg the questions—tautology—is prevalent in ecology as well, where we find ourselves seeking concrete *causes* of problems in particular *things*. For example, we say that global temperatures are increasing because carbon emissions are increasing. We might claim that elephants are being slaughtered because of insufficient regulation in the ivory trade. But by linking

these problems to a concrete causal factor—a *thing*—in a complex interconnected system, we merely push the problems further and further back into the system. Why are carbon emissions increasing? Because of our endless appetite for energy! Why do we have an endless appetite for energy? Population growth! Why can't we manage population growth? Genetics! What in the hell is genetics anyway, and do we have time to figure it out? Or perhaps we can just argue that some point in this causal chain is beyond our control and relax into our fatalistic nihilism—have a gram of soma.

This endless chain of causes is an inevitable result of our thingish thinking. Causality in real ecological systems cannot be described through Pleroma—substance—without a descent into meaningless tautology. However, if we approach these systems through *Creatura*—an assessment of *pattern*—it may be possible to uncover truths that are not contained in these endless tautologies. It may be that some of these truths are actually broader and more true—truths of a greater logical type. If so, it follows that these are the truths that should shape our relationship with the world and form the basis of our cosmology. Bateson's ecology of mind is a *Creatural* map of cybernetic ecology.

Further, my extension of Bateson's work suggests that the patterns of *Creatura* cannot be neglected from a rigorous Cartesian analysis, because these patterns actually have mass. I will submit both theoretical and experimental evidence for this proposal. It is counterintuitive to consider the existence of massive objects that have thus far remained outside of our awareness, especially when the nature of that mass is not consistent with our preexisting notions of substance and things. As we will see, this becomes a reflection upon the nature of gravity, because the action of gravity partly defines mass—mass is what gives something weight in a gravitational field.

I propose that patterns and information related to all real and complex systems are embodied as a whole in mass of a higher logical type than the mass that embodies the reduced parts of that system.

I should state my proposal more formally. To do that, we will review our earlier discussion about logical types. Consider that any complex system—that is, anything real—incorporates information about itself. It responds to feedback. It learns. The mechanisms for doing this are as diverse

as are the real systems themselves. Ants exude pheromones that the rest of the colony responds to; my body responds to messages about my balance as I walk; diverse arrays of species self-regulate in a complex ecosystem through largely unfathomable feedback mechanisms; the global economy responds to war, famine, regulation, and other catastrophes through interwoven feedback mechanisms well beyond our comprehension. All of this behavior is regulated within the system through the flow of information, and information is pattern. (If there is no pattern, there is no information—only noise.) I propose that self-regulating systems are governed by a particular *type* of information.

The class of information that becomes important in regulating real systems through feedback and learning is information about the state of

Meta-information is information about information.

the system itself. In other words, it is information that is self-referent—meta-information. Not all information is the same, because information has logical types.

Here's a metaphor. When you read this page, the difference between the letters is information not contained in the letters themselves. This information—the difference between the letters—is of a different logical type than the marks on

the page. An infant viewing these pages would not be able to make any distinction between the letters, having only the raw sensory data presented by the light on the page. In fact, a very young infant may not even be able to distinguish between the page and your hand holding the page. She has no information with which to associate this pattern of differences. Instead, she perceives only raw patterns of lightness, darkness, and color. Those patterns are information about the page, but she lacks further *information about this information*. She lacks the meta-information that is needed to differentiate the letters from each other or even the page from the hand that holds it. Meta-information is of a different *logical type* than the information to which it refers.

There is no way that the information on the page can include the meta-information that we use to distinguish letters from each other or even the page itself from its background. That meta-information is only gained through feedback and learning, and it is part of the complex human-and-environment system. The information that we use to distinguish letters from each other results from a *set of experiences* where we have learned about this distinction between letters. Because this information is about a set of experiences, it is of a different logical type than the raw sensory data

of the light and marks on the page that is conveyed by a single experience. Information about the set is meta-information. This meta-information can't be said to belong to the substance in any individual part of the system. That information belongs to the system as a whole. The difference between the letters isn't in the letters, because it is in my learning; it isn't wholly in my mind, because if the letters aren't there I can make no difference between them. If the human-in-the-environment system is taken apart and reduced, all meta-information related to that system is lost.

I propose that this meta-information which belongs neither to the environment nor to the human perceiving her environment—but rather is a product of both—has substance, by which I mean that it has mass.

Aesthetic Unity

The massive information that exists in all ecological systems must form structures that embody the system as a whole. I propose that we are largely unaware of these meta-informational structures, but that we may deduce their existence and even better understand our world by placing our attention upon them. This idea of *processes and patterns*

embodied in mass is a little foreign to the modern mind, but I will attempt to elaborate this proposal as clearly as possible.

Our perception of the world is incomplete. All of our perception is based on difference and pattern—information. But, there is information that we do not perceive. We do not perceive meta-information, which are patterns of patterns. Nonetheless, patterns of patterns do clearly exist. Pattern has different logical types. Patterns that we perceive have one logical type, and meta-patterns have another logical type. We do not perceive meta-patterns.

For what it's worth, the incompleteness of our perception—and specifically our inability to perceive meta-patterns—is directly analogous to Gödel's observations about the incompleteness of mathematical truth. Gödel's incompleteness theorem shows that self-referent truths cannot be expressed mathematically or contained within a logically consistent system. For example, the statement, "this statement is false" is self-referent, and generates a logical paradox as a result. I associate the incompleteness of our perception as a necessary result of the self-referent information that is part of real, complex, learning systems. This feels very tidy and elegant to me. It is not generally considered to

be good science to justify a hypothesis on the basis that it feels elegant or has symmetry, and yet these aesthetic properties are precisely the nature of truth when we do find it. Bateson—the great bulk of whose career could be summed up as the application of logical typing to the understanding of biology, communication, and human behavior—made this observation when he wrote,²²

“There have been, and still are, in the world many different and even contrasting epistemologies which have been alike in stressing an ultimate unity and, although this is less sure, which have also stressed the notion that ultimate unity is *aesthetic*. The uniformity of these views gives hope that perhaps the great authority of quantitative science may be insufficient to deny an ultimate unifying beauty.”

I find such an aesthetic unity in the incompleteness of our perception and the incompleteness that Gödel observes to be inherent in the formal systems of logic and mathematics. If we allow that all patterns have mass, and permit logical typing of that mass as I propose, we may derive from this single premise a complete system of thought that is

quite aesthetically pleasing and elegant. I will continue to illustrate:

A billiard ball is a pattern. We can say that a billiard ball exists as a thing of substance because the matter that is arranged to create the billiard ball does so in such a way that we recognize a pattern of sensory data that we associate with the symbol of the billiard ball. Without that pattern recognition we may not identify the ball. The movement of the ball, however, is a meta-pattern that depends on the system between the ball and the observer. If the ball and the observer are moving together (as, for example on the same rotating planet), then the ball would not be observed to “move.” Movement may only be discerned by a set of observations. Movement is a meta-pattern of sensory data over time, and this meta-pattern is of a different logical type than the pattern that we define as the ball. Further, we cannot directly observe the movement of the ball. We may observe the ball in a particular location, and as an integrated part in the observer-billiard ball-environment system we may remember where the ball was positioned a moment ago. That memory of the ball’s previous locations and trajectory is a meta-pattern that exists in the system of the ball, the environment, and us. That is a pattern of which we are a part,

but it is not a pattern which we may directly observe, because we can only observe the ball in one present moment.

Our premise is that meta-information has substance. That premise suggests that the velocity of a particle is also a particle, and that this second particle is inevitably interacting with other particles that share its logical type. These interactions create meta-informational structures that are extremely important in understanding the behavior of any real and complex system that is not isolated from its environment.

I can now demonstrate how our premise results in a new model for time. One requirement of this premise is that meta-informational mass will have extension in the time dimension—it is extended in time the same way that more familiar objects are extended in space. If the velocity of a particle is a particle, that velocity can't be said to exist in a single instant in time, because movement exists over a period of time. This extension of physical substance into the time dimension is difficult to understand from our traditional and modern views on what substance is, but this is a necessary result of their embodiment of feedback loops and learning processes. Feedback and learning require time, and if there is mass that embodies those processes, that mass

will also have extension in time. Our Newtonian understanding of time makes this a very counter-intuitive prospect, but it is quite a logical conclusion from the perspective of relativity where time is not an independent dimension. In fact, the existence of mass with time-extension is a very predictable conclusion from relativity because there is no physical distinction between time and the other dimensions. If there were not mass with time-extension, time would be in some way special, which it isn't.

One may argue that a billiard ball is in itself a meta-pattern, because the atoms which make it up are patterns in themselves, and so the ball is actually an arrangement of atoms—a pattern of patterns. However, it is clear that we do not actually perceive the atoms in the ball as atoms. We do not directly perceive the matter in the ball at all, but only through our various sense organs. We perceive light reflected from the ball, or we perceive electromagnetic interactions between the ball and the nerve cells in our hand. All of our perceptions are patterns in a direct sense. There is no possibility of perceiving meta-patterns, but we do embody meta-patterns through our interpretation of our environment, and that interpretation is shaped by our habits and learned behavior. We are integrated into the meta-patterns.

I am proposing that these meta-patterns that embody our interaction with our environment are themselves structures of substance, although they are not directly perceivable. Every interaction in a real and complex system exists within the framework of a self-referencing feedback loop whose inviolate whole is embodied in substance—mass/energy. Hence, this mode of understanding is a bridge between Pleroma and Creatura. I will offer both theoretical and experimental support for this approach after briefly elaborating upon what it means to understand the world through this lens and why it matters.

Ecological Perspectives: From Standing Rock to Herbalism

“If I am right, the whole of our thinking about what we are and what other people are has got to be restructured. This is not funny, and I do not know how long we have to do it in.”

-Gregory Bateson

Adoption of the ecology of mind requires—at minimum—that we restructure our concepts of identity, causality, and

purpose. A complete discussion of these implications is beyond the scope of this work, although I have attempted it elsewhere.²³

However, it is worth establishing that from the ecology of mind, we perceive ourselves to be fully integrated into nested ecologies-within-ecologies—as individuals within communities within ecosystems—and we understand that these ecologies are all embodied as massive information. The simplest way to understand this embodiment of the ecology is to approach it as a *story*. Very specifically, I define story as the circulating messages and meta-information throughout any cybernetic system, whether that system is an organism, ecosystem, culture, or economy. It is simplest to envision this massive information as existing in the *story environment* where it embodies the system as an inviolate whole, and interacts with other stories as part of the whole universe story.

Story is the massive information that circulates through an interconnected ecology of any kind. Stories are meta-information, or meta-pattern, and they embody relationship.

Because we are now approaching ecology from within, we also understand that we are physically integrated into the massive information that embodies the story of the ecology—and here again ecology is broadly defined as any real and complex interaction. This requires us to at least partially reframe our identity to account for being embedded in the story. To “think in the new way” is to identify with the broadly defined ecologies of which we are part, although this will be counter-intuitive to the modern Western mind.

It is really a matter of survival that we reframe our identity in this way. According to Darwinian evolution and survival of the fittest, the *unit of evolutionary survival* is the individual organism, the species, or something similar. However, the unit of survival cannot be any of these, but rather must be the organism-in-the-environment, or the species-in-the-environment, because anyone who destroys their environment destroys themselves.²⁴ It is not species that survive; it is stories that survive. The unit of survival is a relationship. The Darwinian model of evolution—portraying nature red in tooth and claw—completely fails to capture this sense that the evolutionary unit of survival is an interdependent and largely cooperative ecological network

that includes many different species, mostly unrelated by conventional taxonomy.

Our prevailing sense of what it means to survive sets one species against another. It sets man against nature, my business against yours, Democrats against Republicans, and the U.S. against Russia. But none of these one-sided things are complete stories, and they cannot survive by themselves. The unit of survival is a business within a community, a nation within a global society, a species in an ecosystem. A story is precisely this unit of survival.

It seems imperative that our conscious unit of identity should match the evolutionary unit of survival. If our sense of self is not strongly rooted in the story environment, we will continue to cut out isolated elements of a system—ourselves, our species, our political party—and act in the interest of that part without regard to the rest of the community. However, since this isolated part is meaningless from the perspective of evolution and survival, this behavior will be inevitably self-destructive. For this reason alone, adoption of the ecology of mind and the associated reframing of identity seems appropriate—even imminent.

This shift in our awareness toward the stories that embody whole systems will also impact our concepts of pur-

pose and causality. As participants in a larger system, and acting in the interest of that system, we can only be guided in our actions by messages coming from the system as a whole. But, being part of and not outside the ecology, it follows that our understanding of the whole system must remain incomplete, (or at least this is a reasonable interpretation of the theory of logical types and Gödel incompleteness). Again, this results in a counter-intuitive proposition, because our incomplete information about messages from the system implies that some of these messages will appear to us as random events. In short, our conscious and reasoning purpose can never be completely informed by consideration of the whole story, because much of that story cannot be rationally understood. Likewise, we can justifiably perceive that apparently random events are caused by the massive information in the story as a whole, and treat them as messages accordingly.

We are trained that our rational, objective, calculating intellect sufficiently enables us to manage all sorts of complex systems, which we may therefore shape to our reasoned purpose. This assumption is the basis for all human intervention in ecological systems. However, our rational management is more aptly described as blind interference,

because we do not have complete information about the system, and so nearly all of our interventions result in iatrogenic harm—harm originating from the action of the healer.

This is the case in education, land management, economics, healthcare, agriculture, politics, social services, and—as this is a broad characterization of our general behavior—all other spheres of human activity. This is why the ecology of mind is important as a mode of understanding. Our current mode of understanding presumes that we have more information than we do, that we are outside of the systems that we manage, and that we are capable of purposeful manipulation of complex systems when, in fact, our activity is mostly blind, our information incomplete, and our purpose misplaced and likely damaging—however well-intentioned.

If we approach these systems through the ecology of mind, we will admit that much of the information in any ecology is contained in the story environment where it is beyond our perception. This limits the usefulness of our reasoning and purposeful thinking to very limited and localized responses. In interactions that include broadly distributed connections, our navigation is limited to precisely those subjective phenomena that are negated by the prevailing Cartesian worldview—dreams, synchronicities, and intuition. This

sort of experience is the only form that messages from the story environment may take. Continued reliance upon calculated reasoning is a fatal epistemological error. This may be a hard pill for most folks to swallow.

As an example of what this means, consider the unrest at Standing Rock created by construction of the Dakota Access Pipeline (DAPL) in 2016. All of the official discussion of this project by the Army Corps of Engineers, the court system, and in the lawsuits brought forth by the people of Standing Rock centered around Environmental Impact Assessments (EIA), and similar studies meant to determine (and even quantify) the potential threat to human communities from this pipeline. All of the language in this dispute assumes that any detriment the pipeline would present to the Sioux people could be catalogued and quantified. The resulting Assessment of this damage would then be weighed in a Cost Benefit Analysis to Objectively Determine the Appropriate Route for the Pipeline. If there were any objections to this unstated primary assumption, such objection would certainly not be admissible in court.

In my opinion, whether or not the Army Corps rigorously completed an EIA is entirely irrelevant. If we will address complex situations such as Standing Rock, we must

acknowledge the fallacy of our primary assumption that we can catalogue and measure a complex ecology. If protectors of wild nature continue to meet the Cartesian power structure on its own terms, using Cartesian language and epistemology, their protective efforts will be a continual retreat from the destructive forces that they thereby validate. Any intervention, development project, methodology, or conclusion can be rationalized. In a quintessential example, statistician Bjørn Lomborg compiles an enormous amount of data from about 3,000 sources to “measure the state of the world,” concluding in *The Skeptical Environmentalist* that the world is getting better for everyone. (Although he is explicitly humanistic: “The needs and desires of humankind represent the crux of our assessment.”²⁵) With 127 figures and 70 pages of bibliography, Lomborg meticulously supports his argument that the climate is not changing for the worse, deforestation is not happening, air and water are getting cleaner, etc. The problem with all of this is that the entire book is meaningless. At some point, two different scientific reviews were made of the book (with different conclusions made by the Danish Committee on Scientific Dishonesty and the Ministry of Science, Technology and Innovation), but the whole premise that human well-being can be sepa-

rated from the rest of the world and also catalogued, predicted, and measured remained completely unevaluated.

It's not that Lomborg or Army Corps bureaucrats falsify or misinterprets data—although it may be that they do, and some will make this claim—the problem is that the entire mode of inquiry is no good. The future behavior of complex systems is not determined by past data. A 100-year flood line does not predict that no greater flood may occur; ecosystem resilience to 99 different pesticides does not imply resilience to the one hundredth; or as another statistician—in my opinion a much better one—Nassim Taleb observes, good treatment of turkeys by a farmer up until November does not mean they'll make it past Thanksgiving. Information about future behavior does not exist in past data. Likewise, there is no valid way to measure or predict the response of the Missouri River to a DAPL oil spill, nor even the potential magnitude of that spill. Anyone who believes that rigorous EIA would have protected the Standing Rock Sioux is entirely missing the point of these assessments.

The function of EIAs and similar studies is to provide cover and rationalization for systematic exploitation of people and planet. This is their *raison d'être*, and they can easily be written and well-supported for the purpose of any devel-

opment project. This does not have to be the conscious intent of those who prepare these documents; their conscious intentions may be quite the opposite, but this does not change the result—or even the meaning—of their efforts. Ultimately, the injustice of the DAPL is not in poorly executed assessments or failure to objectively measure the potential hazards of the project, and while the use of legal channels owned by the oppressing regime is entirely reasonable during emergencies, it is preposterous to believe that the legal system, congress, or any part of the colonizing government is going to suddenly start turning out or requiring assessments that check development or prevent systematic abuse of people and planet. The claim that our mode of understanding the world causes injustice becomes quite concrete when that mode of understanding is used to define the terms and language under which injustice may be protested. There is an extensive set of machinery that produces Cartesian rationalization—school systems, bureaucracies, and development offices. This machinery is all owned by the colonizing civilization, and it is all precisely geared for the extraction of resources from real ecologies. This machinery of substantiation is not useful for nuanced understanding of real systems—although it is explicitly based on the claim that

it is—but this machinery is very good for rationalizing the destruction of those systems while allowing us to pretend that this destruction is “good management.”

Ultimately, the injustice at Standing Rock is a function of story. There is a long story of colonization and genocide that defines the relationship between the people at Standing Rock and the U.S. economic system, and the events there in 2016 were not remarkable for their injustice, which is commonplace—the Wet’suwet’en people in British Columbia are facing exactly the same injustice as I write this today (and their legal defense is this time based on Archeological Impact Assessments). The crisis at Standing Rock was remarkable only because these people attracted widespread attention and support from the international community in the face of injustice—which is much less common than the injustice itself.

If we view this crisis through the lens of story, we may see that this injustice is merely an extension of the same exploitative relationships that have been governing human behavior for millennia. These relationships are physically embodied in the mass of that story, and the tension that centers upon these unresolved genocidal and exploitative relationships is palpable. From this perspective, there is no

need to create reasoned arguments about the dangers of an oil spill in the Missouri River, because that isn't concretely what this is about. That need arises only from an attempt to conform this struggle to the language and expectations of the colonizing government. If the DAPL never spills a drop of oil in the Missouri (if that were possible), the action at Standing Rock would be no less meaningful. The significant element in this event is the confluence of large numbers of people around the tension created by a centuries-long story of exploitation and genocide. For many people, the events at Standing Rock were highly significant because they were an eloquent expression of the false dichotomy between social and environmental justice. I think that the message from Standing Rock is that we will not find balance in human relationship with the environment until we also acknowledge the stories of genocide and slavery that underpin the economics of that relationship, and affirm the pre-colonial traditions that civilization attempts to extirpate. The participation of so many people in this event is not a purely rational concern.

I have written elsewhere²⁶ on how stories drive human behavior as part of an ecological cybernetic system. The potential implications of that thinking are extensive, and I will

not revisit or extend that analysis here. I will only reiterate that in complex situations involving many relationships and connections—such as social and environmental justice, but also in other complex ecologies such as human health, education, agriculture, and economics—there are always stories that constrain or shape our behavior. It may be said that we are embedded in or belong to those stories that shape our possibilities. If we are to understand these systems, we should approach them holistically through evaluation of story.

Information (ie, story) presumes conformity to pattern and is therefore a restraint upon behavior.

As a final example, and to provide some diversity of illustration, consider that in the same way that we become embedded in stories, we also have stories that are embedded in us. The human organism consists of various ecological subsystems such as organs and cells, all of which are networked to form the ecology of the organism that is you. Accordingly, it will often be useful to view our health through this lens of stories-within-stories.

The stories that are embedded in our bodies also include our states of disease, but from an ecological perspective we

cannot separate these diseases from ourselves. Truly holistic practitioners already know this, or maybe it's better said, "haven't forgotten." As internationally renowned herbalist Susan Weed states—in an observation that closely mirrors Korzybski's summary of the theory of logical types—"The name of the disease is not the disease." She continues,²⁷

"Disease does not exist apart from the being manifesting it. Even a typhoid bacterium or a polio virus is not typhoid or polio without a being to manifest it. And because each being is unique, so each expression of typhoid or polio is unique, and must be treated uniquely...."

This uniqueness in every disease lies in the massive information that embodies the relationships in the story of that disease. What Susan Weed is saying here is that disease is a story. It is a set of relationships, and although she does not explicitly say so, she treats disease as a message about our condition that we can embrace in becoming more balanced—disease is an "ally of wholeness."

This approach is echoed by other healers as well. Herbalist Stephen Harrod Buhner states that health is a state of dynamic equilibrium in which the organism maintains

health by constantly adjusting to disruptions and perturbations in the environment. He offers the metaphor of a clown on a unicycle constantly adjusting his balance:²⁸

“The clown’s motions are expressions of the precise corrections needed to stabilize an unstable perch. And those precise corrections occur in response to the *information* that is encoded in any perturbation that affects his dynamic equilibrium. The information encoded within the perturbation tells the clown—at a level far below that of the conscious mind—exactly what that perturbation will do to his balance. His body understands the information and devises a complex, coordinated response of his entire being to maintain his equilibrium.” (Italics in original.)

From this perspective, disease is a perturbation in the dynamic equilibrium of an organism, and “It is the information, the meaning encoded within the perturbation, that is important, not the form in which it is delivered.”

The problem with our predominantly Cartesian response to disease is that we are responding entirely to the ‘form in which it is delivered,’ and not at all to the messages encoded in that delivery. And, while these practitioners have

clearly developed a holistic approach to medicine that does respond to the messages in the story of the disease, I am afraid that large numbers of people who are systematically conditioned to Cartesian language and worldview will not adopt this view without some connection to these messages in substance.

Ironically, there is also a barrier to reframing our approach to healthcare in the perception that our current healthcare systems are tolerable and even effective. This perception can only be possible with a very narrow (even meaningless) definition of health that excludes consideration of expense, quality of life, long-term perspectives, or social and ecological harmony. When we consider these metrics, we must acknowledge that blind interventionism in the healthcare industry has led to many forms of iatrogenic dysfunction: Healthcare expenses are the center of political debate—although methodology, alas, is not. Plagues of opulence such as obesity, heart disease, and food intolerance are on the rise. Maintenance of public health (and food production) relies upon antibiotics that could fail at any time due to evolution of resistant strains. Even if we disallow indirect connections between ecology and healthcare, it's hard to claim that this system is healthy when *millions of tons* of

non-biodegradable pharmaceutical waste pollute waterways every year,²⁹ one in eight Americans takes antidepressants,³⁰ and millions of children are given drugs just so they'll sit still in their box of a school all day. How is any of this healthy? This is the result of our fallacious belief that we are wise and knowledgeable enough to treat the forms of disease without acknowledging the messages from the broader ecology of which we are part.

I believe that it is important to begin viewing disease as a physical story embedded in the human body, and to treat those stories as disruptions in the dynamic equilibrium of the organism. From this perspective, the messages from the disease are an “ally of wholeness,” in that they deliver the information that we need to regain our balance. If we establish a connection between these messages and the substance of massive information—which is the goal of this paper—adoption of this worldview will be much easier for people conditioned in a highly Cartesian paradigm. The resulting healthcare system would have to integrate whole-body thinking with whole-ecology/whole-society thinking, and the messages in a disease would be sought in the patient's physical condition as well as in her relationship with her family, community, and environment.

Physicist Frijtof Capra—certainly a pioneer of whole-systems thinking—suggests such combination of whole-body and whole-society approaches in his sketch of “the basic framework for a new holistic approach” to healthcare (in 1982).³¹

“Health care will consist of restoring and maintaining the dynamic balance of individuals, families, and other social groups. It will mean people taking care of their own health individually, as a society, and with the help of therapists. This kind of health care cannot just be ‘provided’ or ‘delivered’—it has to be practiced. Furthermore, it will be important to consider the interdependence of our individual health and that of the social and ecological systems in which we are embedded. If you live in a stressful neighborhood the situation will not be improved if you move out and let somebody else take the stress, although your own health may improve.... Such actions amount to managing stress by simply pushing it around—from one family to another, from individuals to the society and back to other individuals, or from society onto the ecosystem, whence it may come back forty years later.”

Of course thinking about the world and ourselves in terms of interacting stories has applications in many different arenas and extends far beyond these examples in social justice and healthcare. We will return to a discussion of these implications, but having now established some sense of why this mode of understanding the world may be important, we shall proceed to the theoretical and experimental underpinning for this system of thought. I believe that there is sufficient evidence that the information, relationships, and messages that I refer to as the story of an ecological system are embodied in mass, and that this evidence warrants broader adoption of the ecology of mind as a mode of understanding and interacting with the world.

Emergent Gravity

The primary premise of my extension of the ecology of mind is that *patterns of all logical types have mass*, and the evidence and reasoning for that premise begins with recent contributions to the theory of gravity. A new theory of gravity published by physicist Erik Verlinde (2016) suggests that gravity is ecological in nature, and that gravitational interac-

tions arise from the structure of entangled information in the bulk volume of spacetime.³²

Verlinde's theory separates gravity from the other fundamental forces of nature—the electromagnetic and nuclear forces—by a difference of logical type. Verlinde derives this model from quantum field theory, and I will summarize:

If you observe an object, you can imagine that all the information you observe about that object is projected onto a surface that surrounds it. In a sense, the object is inside of a shell, and the surface of the shell contains all of the information about the object itself. In the simplest case we could imagine a spherical shell surrounding a point mass, but modeling real-life situations would of course be more complex. Physicists have found it useful to model particles in this fashion, because it is sometimes easier to predict nuclear and electromagnetic interactions if we treat particles as information projected onto a shell that surrounds the particle. There is a clear correspondence between the quantum field theories that describe the behavior of particles and the information on the shell. That is, the behavior of the particle is satisfactorily described and predicted using only information that is contained in the area of the surrounding shell, and the mathematics are made simpler. One of the

reasons the modeling is simpler is because there is a reduction of dimension in the particle space. Information about a particle that occupies a three dimensional volume can be projected onto a shell surrounding that particle, and the surface of that shell would only have two dimensions. This works well as long as there is good correspondence between the behavior of the particle in three dimensions and the information in two dimensions.

It has not been possible, however, to completely model gravity in this way. While we have a system of equations that successfully predicts nuclear and electromagnetic interaction using this approach, the correspondence between particle behavior and information about the particle on the shell does not include gravity. Verlinde claims that the dimensionality of information about gravitational interactions cannot be reduced by projecting the information onto an enclosing surface, even though this is a successful approach for modeling nuclear and electromagnetic interactions. That is, nuclear and electromagnetic forces can be fully described with *area laws* about information on the surface, but gravity can only be described by *volume laws*. There is information embedded in the entire volume of spacetime that is necessary for complete description of gravity.

Einstein's equations that describe gravity in general relativity can actually be derived from area laws, but Verlinde notes that these laws do not actually do a very good job of describing the motion of matter under the influence of gravity, because the movement of galaxies and large astronomical objects as well as some gravitational lensing phenomenon can only be accurately described if we assume a large (up to 95%) proportion of unobservable dark matter in the universe.³³

“Since up to now there appeared to be no evidence that general relativity or Newtonian gravity could be wrong...the most generally accepted point of view is that...our universe contains an enormous amount of a yet unknown form of dark matter particle. However, the discrepancy between the observed gravitational force and the one caused by the visible baryonic matter is so enormous that it is hard to claim that these observations provide evidence for the validity of general relativity or Newtonian gravity....Purely based on the observations it is more appropriate to say that these familiar gravitational theories can only be saved by assuming the presence of dark matter. Therefore, without further knowledge, the evidence in favour of dark matter is just as much

evidence for the possible breakdown of the currently known laws of gravity.”

Verlinde proposes that Einstein’s equations for general relativity, which are derivable from area laws, are incomplete because there are volume laws that more fully describe gravity. Again, these volume laws describe particle interactions using information contained in the volume of space where a particle is embedded, not just information that would be available on the surface of an enclosing shell. Verlinde then goes on to derive these volume laws, and shows that they do indeed describe gravitational interactions without the need for dark matter. In short, *dark matter models the volume law contributions to gravitational interactions.*

The difference between an area law and a volume law is a difference of logical type, because a volume is a set of areas. (If we integrate a set of areas, we have a volume.) Verlinde’s work clearly shows the difference in logical type between nuclear and electromagnetic forces that are accurately modeled with area laws—and gravity, which can only be described with a volume law.

I think it is important to consider that this model of gravity is consistent with our direct experience, because

gravity is phenomenologically different from the nuclear and electromagnetic forces. Gravity is not directly observable. All of our sensory data is limited to nuclear and electromagnetic phenomena. When we observe gravitational affects, we are actually deducing the existence of gravity from meta-patterns in sensory data. When Newton saw the fabled apple falling, what he observed was light—an electromagnetic phenomenon—which gave him information about the apple. He then conglomerated a very large number of patterns about the apple into a set and deduced a second pattern immanent in that set, which is a meta-pattern that we call gravity. Verlinde’s model for gravity is in this way consistent with our primary experience—which I feel to be an important metric for the usefulness of physical theories.

To offer another example, let us consider a carnival ride that I once experienced at a state fair. This ride was called the Gravitron, and it consisted of a room with padded walls that spun very rapidly to produce centrifugal forces upon the riders in order to plaster them against the walls and make them vomit. It was great fun. While one is pushed against the padded wall, he experiences forces that would be indistinguishable from a strong gravitational field with the

‘down’ direction pointing away from the center of the room. However, it seems that these forces are not directly perceivable. I perceive strong contact between my body and the wall, but this contact is actually a nuclear-electromagnetic force between my body and the mat. I experience difficulty in lifting my limbs, but this difficulty is conveyed to my consciousness through nuclear-electromagnetic messages among my skeletal, muscular, and nervous systems. The cumulative effect of all these messages allows me to deduce the meta-pattern which is the centrifugal force presented by the spinning room. That force is very real—it could reduce me to a pulp if it were sufficiently strong—but I do not perceive that force directly; I only perceive it as a meta-pattern in sensory data. We may say the same for gravity.

It is possible to deduce that gravity is a meta-pattern from these purely phenomenological observations, and this is in fact how I originally arrived at this conclusion. I only discovered Verlinde’s more rigorous theoretical phrasing of this premise much later.

Verlinde’s model for gravity strains our language, because this description of gravitational interaction could not properly be labeled as a ‘*force*’; this theory would place gravity in a different logical type from the other fundamental

forces of nature. Likewise, our concept of ‘*mass*’ should be reevaluated with respect to this new theory. I believe that a broad and possibly lengthy discussion will be necessary in order to achieve consensus as to the meaning of such terms under a substantially new theory of gravity, but I will not attempt that here. For the purpose of this paper, I will define mass in the same manner as does my dictionary, as “that property of a body...that causes it to have weight in a gravitational field.” Under Verlinde’s theory of gravity, patterns of different logical types all contribute to gravitational interactions—although not to the electromagnetic and nuclear forces that define our sensory experience—and so we will accordingly assign mass to all those contributions to gravity, even those contributions that are not associated with sensory data.

In contrast, my chemistry text defines mass as “the amount of matter in an object,” with matter being “a catchall term used to describe anything you can touch, taste, or smell.”³⁴ If we accept Verlinde’s theory, this chemical definition of mass in terms of sensory experience cannot be made to agree with the physical definition of mass in terms of gravity. This is because there may be meta-patterns that

contribute to gravitational interactions while remaining outside of definition by sensory patterns.

Accordingly, there may be some interesting debate as to whether the physicists describing gravity will claim the term ‘mass,’ or whether this term should be used by chemists. I will take the position (with my dictionary) that physics is the more fundamental science, and therefore the term ‘mass’ properly belongs with physical descriptions of gravity, and if the two definitions cannot be made to agree that the physicists should claim the term.

Here, there is some departure in Verlinde’s language from my own. Verlinde concludes from these arguments that dark matter does not exist, because it is no longer needed to describe the movement of galaxies, etc.—the observations that led to the postulation of dark matter can be understood by rethinking our model of gravity. However, he still proposes that there is a “matrix” of dark energy that acts as the substrate containing the volume law information, and he models the volume law interaction as an elastic response in this dark energy matrix. Perhaps it is a matter of semantics, but regardless of whether we speak of elastic response in an energy matrix or whether we use the term mass to describe this information, the fact remains that bulk

spacetime contains information of a greater logical type than that which we can directly perceive, and this information has weight in a gravitational field. My approach will be to adopt a physical rather than chemical definition of mass and so I claim that any information contributing to gravitational interaction is matter and has mass. I will also supply additional evidence that this information possesses another defining characteristic of mass—the ability to be converted into energy.

I am proposing of course that the meta-information embedded in the bulk volume of spacetime, which Verlinde finds to be irremovable from our description of gravity, is the same as the meta-information that I am also calling story. Likewise, what Verlinde describes as the ‘bulk spacetime volume’ is what I call the *story environment*. And this is where we perform what Gregory and Mary Catherine Bateson describe as a *sylllogism in grass*, which is a logical operation that takes the form:³⁵

“Grass dies;
Men die;
Men are grass.”

And while this is clearly not logically admissible in a formal system, we must also admit that, as the Batesons observe, “syllogisms in grass...are the very stuff of which natural history is made.” Every physical model is founded upon this logical operation that is fundamentally metaphorical. For example, nuclear chemists attribute the periodicity of the periodic table of the elements to the orbital structure of electrons in the atom. Our models for electron occupation of atomic orbitals is periodic in exactly the same manner as that which organizes the physical properties of atoms in the periodic table. Therefore, chemistry textbooks will blithely state that these orbitals “explain” the periodic behavior of the elements. But they don’t, really. They mirror that activity, and provide some confirmation of that model in doing so, but confirmation is not explanation. Concisely, this argument by the chemists takes the form:

Atomic behavior is periodic;
Orbital structures are periodic;
Atomic behavior results from orbital structure.

Our own line of argument is of the form:

Stories are meta-information;
Volume law contributions to gravity are meta-information;
Stories are volume law contributions to gravity.

So, I will concede here that my argument is fundamentally metaphorical, and therefore inadmissible in a strictly Cartesian game. However, if we choose to call foul at this point in the game, we must also discard atomic chemistry and the main body of theoretical science with it. We may only observe that my assignment of mass to meta-informational story is mirrored in the volume law contribution to gravity, and that this theory—by mirroring my own model—confirms it.

I want to emphasize that the information Verlinde refers to in his description of gravity is *information about connections*. There are entangled connections between every element in the global system, and information about these entangled connections has mass (or at least they are real, measurable gravitational interactions if you object to my semantics). The Cartesian separation between the self and the other is rendered cosmologically invalid by these now very concrete connections. We need a new cosmology. If we

do not account for these interconnections, we cannot fully describe gravity, and the new cosmology must be ecological. In the words of Verlinde,³⁶

“By changing the way we view gravity, namely as an emergent phenomenon ... of quantum entanglement, one also has to change the way we view the evolution of the universe....For this one needs to first properly understand the role of quantum entanglement and the evolution of the total entropy of our universe. So it is still an open question if and how the standard cosmological picture is incorporated in a theory of emergent gravity. How does one interpret the expansion of the universe from this perspective?”

I do not think that our “standard cosmological picture” treats gravity adequately at all. We are taught in school that gravity is a fundamental force that draws two masses together. According to this model of gravity, this is an error of logical type—something like stating, “A noun is blue.” When we substitute a set (ie, ‘noun’) for a member of that set (ie, ‘blueberry’) we make the same error that we make when we

regard gravity as a force between two masses, and the resulting statement is meaningless.

A Relationship and Demons

Of course what we need now is an elegant and ideally mathematical phrasing of the connection between mass and information. It would be really nice to sum all this up in a tweet. The question becomes, how much meta-information would equate to how much mass? What is the mass of a story? I originally approached this question by examining the relationship between energy and information, because we already have an equation between energy and mass in Einstein's famous statement, $E=mc^2$. Therefore, an information/energy equation would also describe the relationship between information and mass. This approach is straightforward because a relationship between energy and information was proposed by James Clerk Maxwell—an extraordinary theorist who laid the foundation of electromagnetics—as long ago as 1870. Verlinde, of course, offers several mass/energy relations in his paper, and some of these relations are similar to the one that we will derive here.³⁷ Because our concern is of a practical nature, our focus will

be upon an experiment that brought Maxwell's vision into the laboratory in 2010, but we will begin with a description of the original thought experiment proposed by James Clerk Maxwell 150 years ago.

In our thought experiment, there is a tiny imagined demon (just an imaginary being—but physicists have been calling him a demon for 150 years), and he guards a door that separates two containers filled with gas. By quickly opening and shutting this door, the demon could allow particular molecules to pass through the door while restricting others. Gas molecules are always randomly moving around, and if the demon were intelligent he could create a temperature difference between the containers without any need to add energy to the system. The demon could do this by sorting fast-moving particles into one container, and slow-moving particles into the other. The intelligent demon could, through agile control of his gate, sort the molecules to produce a system capable of doing useful work—free energy. The free energy is created because the demon organized the gas molecules, which he is able to accomplish because he has information about the molecules. (He knows how fast they are moving, and when they approach the door.) The free energy is the information.³⁸

In 2010, a team of physicists: Toyabe, Sagawa, Ueda, Muneyuki, and Sane, constructed Maxwell's Demon in the laboratory by designing an experiment that produces free energy through manipulation of random particle fluctuations.³⁹ In this version of the Maxwell's Demon concept, a particle was allowed to randomly rotate within a magnetic field. The experiment was set up so that the rotational position of the particle held energy in the magnetic field, rather like winding up the spring in a clock.

As the particle randomly rotated within the field, the fields were also rotated to trap the particle in high energy states—analogueous to Maxwell's Demon trapping high energy gas particles on one side of a partition. Whenever the particle randomly moved into a high energy state, the magnetic fields were rotated so as to trap the particle in that high energy state and prevent it from losing that energy. Because the energy was acquired only through random movement of the particle, and not by energy imparted to the particle by the experiment, the system produced more potential energy in the particle than the work done on the particle by the field. The team concluded that, "The resource of the excess free energy is the information obtained by the measurement

[of the particle's position].”⁴⁰ That is, *the energy was produced by information*.

It is extremely important to note that this system operated as a closed-loop system with feedback. This is a cybernetic feedback system that utilizes information of different logical types, because the feedback control acts upon *information about itself*. This self-referent information is meta-information—story—and the scientists were able to measure and release some portion of this story as free energy in the system. This experiment demonstrates that cybernetic information is convertible to energy.

The energy of the meta-information in the Maxwell's Demon experiment is given by the equation:⁴¹

$$E = k_B T I,$$

where k_B is Boltzmann's constant, T is the temperature of the particle, and I is the Shannon information content of the meta-information.* In their experiment, Toyabe's team

* Shannon information content is a quantifiable measure of information proposed by Claude Shannon in his 1948 paper, “A Mathematical Theory of Communication” *Bell System Technical Journal*.

was able to convert about 28% of this available energy into physical work.

In our pursuit of a relationship between mass and information it now only remains to combine the above equation with Einstein's mass energy relation $E=mc^2$, which yields an equation:

$$m = \frac{k_B T I}{c^2}.$$

We may also confirm this equation by its appearance in Verlinde's derivation of the mass/information relationship in his theory of emergent gravity.⁴²

I draw two primary conclusions from this experiment. The first conclusion is that meta-information is a form of mass/energy, and the second conclusion is that this meta-information may shift logical types and become first order sensory pattern. This team demonstrated that meta-pattern becomes pattern—story becomes the present moment. This shifting between logical types is a truly fascinating phenomenon, and we will elaborate upon it shortly. Another way of describing this transition between logical types of pattern is as a change from cybernetic information to thermodynamic

information. The distinction between these two types of information is described by the chemistry theorist John Scales Avery (also an eminent peace activist),⁴³

“Cybernetic information... is an abstract quantity related to messages, regardless of the physical form through which the messages are expressed, whether it is through electrical impulses, words written on paper, or sequences of amino acids. Thermodynamic information, by contrast, is a temperature-dependent and size-dependent physical quantity. Doubling the size of the system changes its thermodynamic information content; but neither doubling the size of a message written on paper, nor warming the message will change its cybernetic information content. Furthermore, many exact copies of a message do not contain more cybernetic information than the original message.”

I believe that this experiment demonstrates that cybernetic information is not an “abstract quantity” (except in the Gödelian sense that all quantities are abstract) because we find this information embodied in substance of greater logical type. This must be so, for how else could it appear as energy in this experiment? It remains to us to seek under-

standing of this phenomenon whereby material in the story environment becomes first order sensory pattern of the present moment and to examine the implications of this new understanding about the relationship between mass, information, and energy.

The Ratchet

It appears that cybernetic information in the story environment may become thermodynamic information in the present moment through manipulation of random movements. This is the conclusion that we may draw from Maxwell's Demon. This challenges the very definition of random, (meaning without pattern) by stating that random events create pattern. Perhaps we would find ourselves here at a dead end if it were not for the work of statistician and economist Nassim Taleb, who lays out for us the mechanism that creates order out of noise and pattern out of randomness. This mechanism is called *antifragility*.⁴⁴

Taleb demonstrates that the behavior of real, complex systems is largely governed by the system's reaction to chance events. Complex systems are generally asymmetrical in their response to randomness and chaos, meaning that

their response is not equally likely (50/50) to produce either order or disorder in the system. This is because there is often some property of the system that is susceptible to being irreversibly altered by events in the environment (for example, a fragile glass can break, or an antifragile species can evolve by natural selection of genetic mutations). This asymmetry in response to chance in the environment yields either *antifragility* in systems that become more ordered in response to randomness or *fragility* in systems that are disordered by randomness. Bones becoming stronger in response to impact, or an opportunistic organism capitalizing on a transient waste stream are examples of antifragile systems responding to random events.

This property of the system—fragility or antifragility—produces a ratcheting effect upon the system in response to disorder in the environment, and this ratcheting effect ensures that the system will drift toward either disorder or order. Every random event produces a response, some responses are irreversible, the irreversibility of the response is not symmetrical, and therefore the system behavior tends to move only in one direction overall.

Taleb demonstrates that antifragility can be defined in purely mathematical terms—it is an *a priori* truth describing

how systems respond to chance and randomness.⁴⁵ Antifragility appears to be a very fundamental characteristic of real ecological systems. In a world that we otherwise observe to drift inexorably toward disorder and entropy—a drift expressed by the foundational laws of thermodynamics—there is a mechanism that establishes ordered and organized forms, and that mechanism is driven by randomness, chaos, and stress. Taleb explores the implications of this premise in a wide range of fields, ranging from economics through healthcare and into evolution, and creates a compelling argument that this model aptly describes the behavior of real cybernetic systems.

It seems very significant to me that civilization appears to be universally blind to the entire concept of antifragility in spite of its importance in shaping us and the world around us. Taleb had to coin the word *antifragile* to describe this type of system behavior, because this foundational dynamic in our world remains unnamed in every modern, civilized language.⁴⁶ Taleb makes this claim for both ancient and modern languages and includes those of Greek and Latin origin, all Indo-European languages, and all those originating on both sides of the Mediterranean, of Arabic and Semitic descent. These languages may all be included in a

broad linguistic family that linguists identify as *Lislakh*. The absence of a word for ‘antifragility’ in this broad family of languages that now inherits modern civilization seems significant to me—I do not see why such an important and defining aspect of our nature should remain unnamed in these languages except that it reflects a cultural and psychological refusal to acknowledge the balance expressed in this ordering aspect of chaos. There is something here that we have refused to look at for a very long time.

Here, I extend the application of antifragility to thermodynamics—a territory that Taleb makes no attempt to chart—and I observe that antifragility also describes the mechanism we have identified for transference of information between the story environment and the present moment—another syllogism in grass. All of this, our phenomenological observations about gravity, and Verlinde’s theoretical model create a conceptual outline of the meta-informational embodiment of story in the bulk volume of spacetime, and how that information may also be transferred into the here and now through chance events. Still further, since it is these chance events that shape the long-term development of ecological systems, our understanding of ecology is dependent upon our investigation of these sto-

ries. That investigation is the mode of understanding I am calling *ecology of mind*, and it reshapes our ecological perspective and brings ecology to the forefront of our consciousness.

The entire system of thought presented here as the ecology of mind and elaborated in my other writing may be derived from the simple observation that *pattern occurs in different logical types, and that all patterns of all types have mass*. Mathematically, it may be elegantly spoken as the set of equations: $E = mc^2 = kTI$. This system of thought represents a simple and direct demand for complete reformation of the modern humanistic and Cartesian paradigm.

I have already touched upon a few implications of this basic premise, and I will not attempt much further treatment of that matter here. I will only allude to three primary conclusions that may be drawn from this system of thought, allowing the reader to derive further implications from these conclusions if so inclined.

Time is not linear or progressive. Physical stories embody the feedback loops that are part of every ecology. Because it requires time for signals and messages to propagate throughout a system, these story structures must extend

into the time dimension in a way that we are not familiar with and which is entirely counterintuitive to the modern Lislakh mind. Some ecological systems are very large (ie, cultural systems such as language and religion; shared fictions such as money and nation; and also geological systems such as climate), and it takes a very long time for signals to propagate throughout the system. The past development of these systems is inextricably bound to the present moment in the physical structure of the story.

The variable that remains meaningful in the story environment is not time, but frequency. *Quantum Justice* outlines a frequency model for the shared fictions and cultural systems that constrain human behavior, but that discussion will not be attempted here.⁴⁷

Everything is real. All fictions are embodied in the relationships that define their story. The Dollar is a massive informational structure that coordinates relationships between billions of people. Star Trek, while somewhat less massive, is also a story that imposes cybernetic restraint upon interactions related to that story. All stories, including our identities, thoughts, emotions, and perceptions are embodied in massive information of the story environment.

Direct perception of story occurs through messages.

Information in the story environment is cybernetic information (as defined above). Therefore, perception of information in the story environment is independent of the physical form that the message takes. (If I leave you a note on a chalkboard or a piece of paper, the message is the same—of course if I leave it written in blood that is different, but now we are incorporating form as message in a self-referent meta-message that conveys additional cybernetic information.) In this respect, interaction with the story environment may best be approached as interaction with a mind from which one should expect to exchange messages. This relationship could reasonably be applied in relationship to any ecological system. Our relationship with cells in our body, plants, the global economy, our landbase, other humans, or any other real system may be understood as an interaction of minds. Of course, we are included in these ecologies and not outside of them, so we should expect these messages to appear as random events, because we will not have access to all of the information related to the message. Lacking the information necessary to comprehend the pattern in this information implies that the message must appear random.

These three conclusions (all derivable from the primary premise of massive information) should be sufficient for the reader to independently explore a wide range of implications that result from this approach to ecology. Of course Gregory Bateson's work is also a valuable resource for further exploration of the ecology of mind, as well as any of those scholars whose prior work I have referenced throughout, and in the endnotes.

I should like to close by cautioning the reader against misunderstanding the intent of the Cartesian language employed here to define story, massive information, and the ecology of mind. Our automatic response is to read this as validation of an ecological, animate, and intuitive worldview. We likely perceive that the worldview of *Creatura* may be authenticated and legitimized by placing it within the mechanical framework of *Pleroma*, but this is not my intent. *Creatura*, as a primary experience of perception and practice, needs no validation. My intention here is merely to translate this experience into objective Cartesian language so that it may be understood by those so conditioned to that framework as to be incapable of believing in any other mode of understanding. This is a translation, not a justification.

I suggest that the reader may find this approach to be also a confirmation of the primary experience and intuitions in their own life, which are routinely invalidated by immersion in the predominant Cartesian paradigm. There is no need to substantiate one's primary experience, although it is helpful—when conditioned to a mode of understanding that habitually denies reality—to find corroboration of that experience in the experience and habits of others.

“The universe is made of stories, not of atoms.”

--Muriel Rukeyser

IV.

A World Without Because



I heard the bowl break. I peered over the railing of the kitchen and saw it lying there in several pieces, but not all of them were on the ground. One piece sat there on the table, staring at me. Grinning.

I think I knew the bowl would break before it did, but it's been some time now, and these things have been happening to me long enough that I can't keep them all straight in my head. Sometimes I know, and sometimes I don't. This time, I think it was more of a feeling that something else had happened to break the bowl, and so I was trying to figure out what it was.

Of course the bowl didn't slide off the table and strike a rock. (There are plenty of rocks all about the kitchen, because the kitchen is outside.) If that were the case, how could one piece still sit on the table? Perhaps a stone fell on the bowl, but then we can only wonder how the stone comes to be falling from the sky. It could have been a branch, but there weren't any likely culprits lying about. (There weren't any branches later when the window broke out of the car either—although it was windy that day.)

Why? Why should this bowl spontaneously fracture?

I learned later that about the same time, in the other kitchen a lady had sliced her hand open while cutting an avocado. She wasn't used to sharp knives, and probably took too many prescription drugs. I found her shortly afterward, lying on the floor being bandaged up by a friend. Maybe that's what broke the bowl. I suggested it later to a friend, and told him I was looking for causes of things. He told me I was very human. He's been around some, that one.

We really do want to know why things happen. *Because.*

I'm on a train now, and my wife's arm is coming out of its socket. Terra is approaching the end of a year-long ceremonial retelling of her own stories. These are the stories she uses to define who she is—they are deeply ingrained in her body, and some of them are a source of pain. Some of the most tenacious stories are held in her back, where she was often struck as a child, curled up in a ball. She is exorcising these stories now—reaching back in time to pull out the old arrows where they pierced her so long ago. The purging of these stories is tearing her body apart.

Of course we didn't know this would happen on the train. We had a sense that something would be hard, be-

cause we read it in the candles and the I-Ching before we left, but we hadn't really figured on a soul-wrenching re-birth while on the way to Phoenix—laid out upon seat cushions stolen from other seats, squashed between the footrest and the wall of the train. At least we got the seats at the front of the row by the stairs. There's a little more legroom there.

At some point the train stopped due to engine trouble. We sat in San Antonio, Texas for several hours, and the lights were off. The other passengers began to get restless, and one of them confronted me when I got up to get some water. I hadn't spoken with her before, but I'd heard her side of a phone conversation with her grandson. He's doing good in school, and she cautioned him sternly to stay away from girls.

“Do you know why we're stopped?” she asked.

“No.”

“We've been stopped for hours.”

“Ok. Maybe you should ask someone who works here.”

“There's no one here! They've left us alone on the train!” She acts like we're in the middle of the desert.

“Maybe look outside. I think we're at a station.”

A little while later, a second passenger confronts me in the same way. This one's a man with a fur coat. I'm not sure why I look like someone who should know why the train is stopped.

"Why haven't they given us any information over the intercom?"

"Maybe because it's 2am and everyone's asleep?"

"Something's wrong."

Meanwhile, Terra is lying on the floor more grateful than not for the stillness as every movement pulses searing pain through her shoulder. I go to sleep.

When I awaken, we are moving again but slowly as the train limps toward El Paso, where the conductor tells us they will change engines. Hopefully they will not overheat again and have to stop before we get there.

The situation is worsening for the disgruntled passengers in our car. Apparently, one of them experienced enough anxiety about the situation to provoke an asthma attack, and a small contingent has formed around a plot to sue Amtrak for their negligence in leaving us all to die in San Antonio. "Something terrible could have happened."

The juxtaposition of Terra's pain and their conversations is comical, and Terra takes it as a lesson to lighten up and explore the power of laughter in healing. The group concludes their planning by exchanging Facebook messages so they can coordinate later actions. They say that they are "freedom riders" and "revolutionaries." I'm not making this up. These people believe that injustice is when your train is five hours late on a forty hour ride. One of them is on the phone with her lawyer. I am reading a biography of Harriet Tubman, and I leave it on the tray table at my seat when I go to lunch. I'm trying to be subtle.

The train breaks down again, and there is a certain eeriness to the whole experience; we are conscious of the metaphor drawn between Terra's breaking body and the wounded train. But of course that's just a symbolic leap. There could be no causal relation there. Once we get to El Paso, the train stops for a while as they change out the engine, and my daughter is reassuring me, "Mommy's not going to die. She's still young." She's saying it over and over. "Mommy's not going to die."

"No," I tell her, "Mommy's going to be just fine. It's just her shoulder." Of course it's not just her shoulder, but she's not going to die either. I'm not sure how to explain any of

this to our daughter, because I don't know what's going on myself. Terra probably doesn't even know. Suddenly, the lights go out, and the hum and drone of the air conditioning stops.

Zinnia says again on the now too-quiet train, "Mommy's going to be ok. She's not going to die."

I hear one of the Freedom Riders in the back whispering, "What's wrong with that lady?"

"I don't know. She doesn't look so good." Another responds.

"It kind of makes you think. We're back here freaking out about this train, and that little girl's mom might be dying."

"I think we were meant to hear that. She said it just when the lights went off, and it was so quiet."

"I think so too."

What do you think?

The alignment of all of these events is certainly very random. The other passengers' personalities were combined in just such a way as to amplify one another's outrage and frustration such that the lateness of the train became a story

of injustice and revolution. The engine could have broken down on any other train or any other day. That engine could have gone with the train to Chicago. Nonetheless, this arrangement of events seems tailored in a way that is almost surreal (if you accept the prevailing expectations of reality) in that we may find a rich symbolism in the interaction between the breaking down of Terra's body, the train, the conversations of the other passengers, and their overhearing of our own conversations. This sort of thing happens to me rather a lot.

Why is it that presumably mechanical or random interactions frequently seem to align just so? *Because.*

I have come to believe that our maps of reality are not accurate. We have been taught to interact with the world as an inanimate and largely mechanical clockwork, and that any random events or synchronicities are just that—random. However, I believe that our notion of randomness and what random interactions mean entirely misses the mark. Randomness in our mechanical worldview is essentially synonymous with meaningless. We believe that we can fully understand the world, and that anything outside our understanding—the breaking of a bowl, the failure of a train en-

gine—is just a random occurrence that has no bearing on our otherwise perfect understanding. We believe that random events are just noise that we should filter out so that we can pay attention to the important things—the things we understand.

I propose that this is exactly the opposite of what we should be doing if we want to pursue a greater understanding of the world and some measure of relevance in our interactions with it. I have come to interpret random events as messages, and I believe that the most useful way to navigate my relationships is to place most of my attention and focus upon random events. This approach is part of a larger system of thought that assumes the presence of a subjective mind in every complex system. I will shortly offer a concrete mathematical proof that this is the most appropriate way to approach complexity.

Anything real, whether that is a flower, a train system, or a human being, consists of many interacting pieces. Chains of cause and effect propagate throughout these systems amidst vastly interconnected feedback networks in such a way that it is not possible to reduce these systems to the mechanical clockworks that we believe them to be. The

entire network can only be considered in aggregate, but not as a mechanical system that can be objectively understood. All of the connections in a flower are best understood as a mind. She does what she wants to. All of the connections in the global economy are best understood as a mind. (A diseased one). I find any other approach hard to support in view of either my direct experience with the world, or my theoretical understanding of how physical systems are composed.

This approach is loosely animistic—and it’s worth pointing out that every human society for 99.5% of our history has been animistic—in that we perceive everything to have a mind of its own. (This would be animism as defined by the “attribution of conscious life to objects in and phenomena of nature”—not so much as defined by a belief in the separability of spirit and body). A modern physical understanding of the world supports this animist worldview, but this has been largely overlooked, probably because it disturbs the foundations of thought upon which the modern physical paradigm was originally based. Animistic interaction with the world—in the sense of communication with conscious minds immanent in natural phenomena—opens us up to messages from all sorts of other beings, because we assume

that anything we don't fully understand—which is everything—may be communicating with us. We then perceive that there are messages from another mind in what the rational Cartesian observer would interpret as meaningless random events. This is an entirely different perspective on the world, and although this form of animism has been mostly eliminated from human societies through genocide, I believe that it is actually far more accurate than the objective Cartesian approach. Animism has served humanity for a couple million years, departure from it has led us to global disaster, and we now find that our physical models actually support an animist approach anyway.

The difference between our mechanical paradigm and the animist approach that I am proposing is primarily contained in the word *because*. If we are taught that other beings are machines that may be taken apart in order to discover the inner workings of their molecular biology, then we will perceive their action to be shaped by these mechanisms. We will believe that plants grow toward the sun under the mechanical forces of tropism, there's nothing more to be said about it, and never mind that sometimes they don't. Any departure from normal mechanical behavior is then believed to be random and meaningless. All of the meaning in

the behavior—if any—is contained in the mechanical description of the action. The belief is that this action occurred *because* of these mechanisms.

However, if we consider the subject of our observations to be a subject and not an object, departure from expected behaviors is no longer random and meaningless. In fact, most of the meaning in our observations is now contained in these random departures—exactly in the places where the Cartesian paradigm refuses to find any meaning at all! If we believe that a complex system like a plant is best understood as a mind, then when she does grow away from the sun (which they sometimes do) we might ask ourselves why she does that and what she is trying to say. Our attention is now placed on random events that are outside the reach of our mechanical models, and the belief is that these random events occurred *because* of mind.

So now, when a bowl breaks for no clear reason, or when passengers are combined on a broken down train in a way that feels surreal, I look for meaning. I think there is a mind behind it all, in the connections that link me to the train, to the bowl, to the ceremonies that we now use to navigate our relationships with all these things. I think that this mind is real, and if your rationality is so entrenched as

to balk at the thought of a worldmind, it should also be so forthright and energetic as to examine the following argument in support of the animist paradigm.

It is relatively simple to show that objective cause and effect do not exist in real systems. Objectively observable phenomena do not fully describe causality, so real systems must be considered subjectively. Subjective realities that determine cause and effect are best understood as a subjective mind. Here's why:

Two events may be swapped in time. This is uncommon knowledge because we routinely lie to our children and call it science class. However, according to relativity the order in which events occur depends upon our point of view. Or, two events could be simultaneous according to one perspective but not according to another. This is just how time is made; it's in any decent physics book (although rarely included in basic curriculum). We should teach this to children in school instead of lying about it by omission.

The time-swapping of events raises an interesting question to say the least. If events can be swapped in time, can an effect precede its cause? What would that mean? Fortu-

nately it turns out that it doesn't work that way. My old college textbook addresses this concern about causality:

“It would be disturbing if some observer, with valid claim on ‘reality,’ found that cause and effect occurred in the reverse order. But there is no violation of causality....The only events that can have their time order reversed are those that are so far apart in space, and so close in time, that not even light can travel fast enough to be at both events. There is no way that such events can influence each other, and therefore they cannot be causally related. In a very real sense it does not matter which event occurs first, and indeed different observers will disagree on their relative time order.” (Wolfson, Pasachoff. *Physics for Scientists and Engineers*. 1995)

This paragraph is really an extraordinary trick. You see, physics is entirely built upon cause and effect, so when the theory of relativity made a train wreck of mechanical physics, the easiest thing to do was to throw out that information because it didn't fit our mechanical maps of the world. This statement in my physics book occurs on page 1008. It deftly ignores the fact that objective causality has indeed been vio-

lated by relativity, and that this completely compromises the vast majority of the preceding 1000 pages.

We can't just point out with relief that an effect can't precede its cause and then act like nothing happened. This is a ridiculous conclusion based upon an absurd reduction of real systems. The argument being made here applies to single events with single causes, but such a thing does not exist except in abstraction. In real life every event is causally linked to many other events, and in real systems it is simple to show that objective causality is indeed violated by swapping the time order of events. In fact, it requires only three events to demonstrate the failure of objective cause and effect. For some odd reason, I've never seen that in a physics book. Maybe because it's "disturbing."

If an event has more than one cause (and of course every event does), the individual causes might not themselves cause each other, so their relative time order can be swapped.

These two events are close in time,
and their time order may be swapped

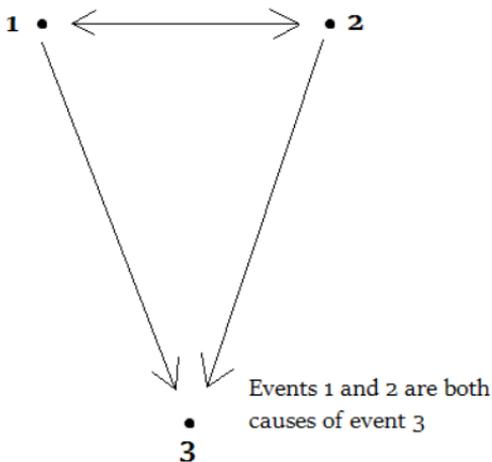


Figure 1: Time order of events 1 and 2 is subjective, but each is causally related to event 3.

In this case, as shown in the above figure, events 1 and 2 are not causally related, but both events cause event 3. There is no way to objectively say whether event 1 happens before or after event 2, because it depends on how you look at it. It's *subjective*. But the order in which things happen matters a lot. If information from event 1 and information from event 2 are both causes of event 3, it matters which piece of information arrives first. The outcome of event

three could be different depending on which piece of information arrives first. But the order that this information arrives is subjective, so—whatever happens at event 3—the cause of this event is subjective. For reference, all of the math for one concrete example of subjective causality is included in the appendix.

This argument shows that we cannot claim that cause and effect is objective, at least not in any system that contains at least three events. In this model of causality, the subjectivity of a system occurs as part the system's interconnections. No single event is subjective, but it is the subjective relationship between event 1 and 2 that produce the subjectivity.

Of course the immediate rational objection to this argument is that the effects of relativity only become important when you're moving near the speed of light—and that would be a very reasonable objection—except that more interactions occur near the speed of light than you might think. On the quantum mechanical level, very high speed is actually a requirement of interaction. If two particles are interacting, then they have to be close to each other. This restriction on the location of the particle requires that it have a high velocity. (This is a result of the Heisenberg indeterminacy princi-

ple, and further explained in the appendix.) We can therefore reasonably presume that, at least on the most reduced level, particle interaction quite often takes place at relativistic speeds—every particle is vibrating and whizzing about at speeds where relativity matters. When we aggregate large numbers of these interactions, we cannot presume that objective chains of cause and effect will be maintained, because the causality in these interactions may be subjective (as shown in figure 1).

Unfortunately, our prevailing quantum mechanical models do not admit this subjectivity. Quantum mechanics is an objective approach where all interactions are aggregated in statistical models, and the behavior of matter is constrained within certain probabilities. But probability is not subjective; there is no accounting for frame of reference or relativity in quantum mechanics. What I am pointing out is that our typical approach is to treat large numbers of quantum mechanical events according to statistical behavior, and that this is different than treating these events as subjective connections. The only meaningful way to relate to large numbers of subjective connections is to treat them as a mind—any real and complex system is best understood as a mind.

Of course when we start bringing in subjectivity and minds, this flies in the face of hundreds of years of scientific thinking—everything since Descartes at least—and there’s no wonder that no one’s talking about it. But the Earth is a mind; plants are minds; the global economy is a mind.

When we start looking at things on a larger level—like broken bowls and trains—we have to acknowledge that any departure of mechanical systems from their expected behavior has its origin in quantum mechanical behavior of subatomic particles. If a bowl on the table spontaneously breaks apart, the origin of that fracture is in the molecular bonds that bind the bowl together. If I find myself on a broken down train with an oddly arranged collection of other passengers undergoing a complex transition in my relationships with my family and the world, that position originated in the synapses of my brain where decisions were made about which train to take, and when to take it; it originates in the molecules that bind the seals together in the water pump in the engine such that these seals should fail at this or that specific time. Our circumstances in every instant arise from the hardware of the universe, which is inevitably beyond our ken, and which we already understand to be inherently governed by patterns that arise from random events. Our

statistical models of those events on the quantum mechanical level acknowledge their randomness as a fundamental aspect of the universe, but fail to incorporate the subjectivity that is a necessary aspect of these interactions.

In the end, this animist perspective must be extended to the global crisis that is—or should be—the center of our lives. When we ask ourselves what causes cancer, the only answer can be that this disease arises from the subjective experience of the cells in the body. If we would respond to gun violence in America, we must acknowledge that this is a symptom of a collectively violent subjective reality of which we are part. When physics admits subjective modes of inquiry, it becomes allowable to ask, “What does it mean for me to be a part of that mind?”

These issues can't be reduced and separated, because the subjective mind that creates these issues is contained in the connections that are immanent in the whole. We can't attribute extinction and climate change to so many parts per million of carbon dioxide, nor can we single out those responsible for gun violence and lock them up or vote them out. This does not mean that we can't hold people accountable for their actions—we certainly should—and we should be

aware that the nature of this crisis extends beyond the actions of any person. These people are acting out the requirements of a diseased mind—not their own mind necessarily, but the larger mind that human culture has collectively created. Anyone that we remove from office or imprisonment will simply be replaced.

I believe that this places us in a predicament where the only relevant response is to rework our paradigm and become aware of the other minds around us, whether these be the diseased minds of human production systems, or the collective minds of the ecosystems and organisms that support all life on this planet. We must learn to act upon messages that originate from beings we had previously considered inanimate or nonexistent—plants, ecosystems, soils—instead of acting upon the messages we receive from collective human stories. This will only be possible if we expect to find those messages in the first place. In the end, it is a matter of acknowledging that we are inevitably part of something bigger—that we are physically embedded in a subjective reality that is beyond us—but that we may choose how to interpret the messages we receive from that greater mind, and which parts of it should receive our focus and attention. I believe that our Cartesian attempts to section off

humanity from the rest of this greater whole have driven us collectively insane. Further, I suggest that consciously reacquainting ourselves via an animist perspective with the minds of other beings and with the worldmind is the most expedient remedy to this dysfunction.

V.

Quantum Justice



Human communities are driven and coordinated by shared stories. Early Monday morning, when the traffic snarls in Atlanta, the engine that drives the collective action of so many people is the story of Monday. Meanwhile, along the deep thermal vents in the canyons of the ocean and far into the vast expanse of Canadian forests, it is not Monday. Monday is just an agreement among all these people in traffic or elsewhere, but this story has no meaning for anyone in those places where humans still do not venture. Those places are coordinated by different stories. There are fewer and fewer places where the story of Monday has yet to reach.

Of course these agreements that coordinate our behavior are very complex. All of the people in Monday traffic have their own smaller stories as well. They have stories of their families, their jobs, and stories of breakfast eaten quickly, or slowly, or not at all. Every Monday morning is a great cooperative effort to produce just such a thing as occurs in that place at that time with those people, and it all works (or doesn't) the way that it does because people agree on certain things. They agree that it is Monday, but they also agree that red means stop and green means go. They agree that they are in Atlanta, that they will drive on the right side of the

road, and that sausage biscuits may be conveniently handed through a drive-thru window in exchange for green pieces of paper that in turn may be exchanged for someone's time, the right to occupy certain land (called real estate), or for political favors. They agree on the form, structure, and meaning of words in the English language, and to use that language in coordinating the numerous minor details of all these interlocking stories. All of these agreements are shared realities in the minds of the Monday morning migration in Atlanta. The stories vibrate like the phones and the motors and the bridges, some fast, some slow—everyone caught in this immense current of story.

Tell a Tale, not a Story

I am trying to be very specific about this thing called story. I do not mean a mere chain of events or a series of words. Perhaps that is better called a *tale*. When we tell a tale, we relate a chain of events with words, but a tale does not organize human behavior in the way that real stories do. Stories are systems of agreements like the Dollar, Argentina, and Monday. Stories encroach upon free will in a way that makes them hard to talk about. (No one much likes to think

that their free will is constrained these days.) Stories bind us together—it's a loose and intangible binding that disappears when you look at it too closely, but they bind us nonetheless. Mostly the binding force of story lies in the obscurity of unexamined minutia. We don't think much about the green pictures of dead presidents and the tacit agreements they represent and the fact that we share those agreements with people who sell us sausage biscuits; our cooperation with this system is implicit. We don't question Monday. We just punch the alarm clock and get out of bed.

We don't think much about the places in the holes between the words—the things that our language can't express—the way that we can only see what we can label, and whether there might be more in the world than all that we have words for.

Certainly we aren't truly constrained to our stories. We can play Mad Hatter and insist that it is never Monday and always tea time, but there will be few March Hares to keep our company, and the bread and butter will run thin. We can invent our own words or give new definitions to old ones. The extent that our stories infringe upon our free will is limited by our imagination and dispelled by our examina-

tion, but there is always a story—even a story about not having stories. You cannot run from a meta-story.

A meta-story is the story that contains a story. In many ways, my life has been a process of rejecting the usual stories of the culture in which I was born. I have rejected stories of what it means to be successful, and stories of propriety and convention. I have spent my life examining stories, how they limit me, and what I can do to be free. I have only learned that behind every story there is another waiting to bind me. When I rejected conventional stories about how I should live my life, build my house, get my food, and grow a family, I only found that I continued to be bound by the meta-stories—the stories within which the other stories take place—stories of language, identity, worldview, and cosmology.

I have told of my quest to escape from the stories of a violent culture.¹ In the telling of that tale, I became aware of the influence upon my life of the meta-stories that I had not previously examined. I became aware of how my language affects my thinking and how I see the world. I became aware of how my sense of self affected my choices and my thinking. I became aware of how my maps of the world might not be entirely accurate—how my map of the world didn't exact-

ly lay flat against some of the things that I could observe around me but hadn't properly examined. I saw that the world is not made in the way that they taught me in school.

This evaluation of what had previously been the most basic assumptions of my being led to the writing of *Quantum Justice*.² I came to understand that the human and global crisis (mass extinction, climate change, genocide, and all the rest) is a result of our stories. The primary premise of *Quantum Justice (QJ)* is that the stories that organize our collective behavior are discordant or out of balance, and that the collective effort of human activity will result in social and environmental injustice to the point of ecological collapse until we can put new stories in place—new agreements that will coordinate our relationships with each other and the natural world. Because our predicament lies in the stories that we use to mediate all of our relationships, the problem cannot be isolated to any one group of people. The continual and toxic political debate between the left and the right is a charade.

Since writing *QJ*, Terra and I have experimented with further withdrawal from the story systems that we are convinced carry the responsibility for our global crisis. Our withdrawal has been to the extent of reevaluating the meta-

stories of language, identity, and cosmology—our sense of how the world is made. Fortunately, our substantial slipperiness with respect to our stories allows us to uproot our lives fairly readily, and our daughter is still young enough to be flexible with her expectations. We closed down the farm, moved out of the house we had just spent five years building, and moved to North Carolina. It's hard to say why exactly we did that. Perhaps because it is difficult to reframe your worldview and change your sense of self within the constraints of your everyday existence and among the expectations of people who are already familiar with your habits. It is easier to make these broader changes in the relative freedom provided by the company of relative strangers or a more solitary lifestyle.

I have spent most of my time since this move studying, writing, exploring what it means to be someone else, learning how to make ad-hoc changes to the English language in order to better express my experience, watching, and listening. It's a bit slow, but a solid year of study has produced some tangible and identifiable results. I feel that I am more able to articulate the concepts that we originally outlined in *QJ* and to enact the principles that we advocated there.

The writing of *QJ* was heavily intuitive and guided by random synchronicities and heuristic thinking. The result was a very useful guide to understanding the nature of story, but it is a sprawling and wandering work—well researched and to my knowledge entirely accurate—but hard to follow. It tends toward the abstract, and was never well-organized or underpinned with concrete arguments. I think that I am now ready to place a container around *Quantum Justice*. I believe that I can now provide both a theoretical basis for the understanding of story that we introduced with *QJ* a year ago, and more succinctly and eloquently frame the descriptions so that they can be understood more easily.

Meta-information: Judging the Price of Gas

Beyond the primary premise that the stories which coordinate human activity are the source of our global crisis, there are two main insights that define *QJ*, and from which the bulk of the material can be derived. The first of these insights is that our stories are physically real, quantifiably massive structures with a wave nature, and that individuals

are quantum elements of these wave structures. I can be a bit more precise about what this means now.

A story is always changing. The agreements that we use to coordinate our behavior are constantly. So, for example, the generally accepted price for a gallon of gas constantly fluctuates in response to many variables such as inflation, civil unrest, or rumors of a hurricane. The key to understanding these stories is to recognize that *one of the variables that determine the price of gas is the price of gas*. The feedback network that determines the price of gas has information about itself. People base what they are willing to pay for a gallon of gas, in part, on what they are already paying for a gallon of gas. The study of this kind of feedback system is called cybernetics. Brains, economic systems, and forests are all examples of cybernetic systems. *A story is a cybernetic system.*

A great deal of work has been done on cybernetics, and Gregory Bateson in particular has pioneered the application of cybernetic thinking to a very wide range of fields, including to “cultures as wholes, as systems of dynamic equilibrium.”³ Here he describes how human behavior is bound by the constraints of cybernetic systems:⁴

“...A human governor in a social system is bound by the same limitations [of a cybernetic system]. He is controlled by information from the system and must adapt his own actions to its time characteristics and to the effects of his own past action”

Our behavior is always partially constrained by story, and these restraints are constantly changing in response to information from the system as a whole and to *information about ourselves*. When we act upon information that we have about ourselves, we learn from that information, and when we learn we generate information about information. This is meta-information. If a gas station departs from the generally accepted stories about the price of gas and attempts to charge \$10/gallon, that price is information. If I know that I can probably get gas for \$2.89/gallon, and that \$10/gallon is too high, I have meta-information about the price of gas and my relationship to that price. I know not only the information about the price, but also the meta-information that the price is too high.

This meta-information does not come from the price of gas but rather from my prior relationship with the price of gas combined with this new information. My prior experience is essential in determining how I will judge this price. If

I have only experienced gas at \$15/gallon, I will believe this price to be very low. The meta-information that comes from my prior experience and interaction with this whole system is what will determine my purchase of this gas. That meta-information is story.

Story is the meta-information of a cybernetic system.

Story acts as a constraint upon behavior of any element within the system that it represents. (*Or rather, it doesn't represent the system; it is the system.*) I am certainly free to buy gas even though the price is too high, but it's likely that I won't, because I am constrained by story. Likewise, the gas station owner is certainly free to set the price too high, but will probably also act within the constraints of our shared story. Elements in a system that are constrained by story have free will but are loosely held to behavior that fits within generally accepted parameters of that story. *This behavior exactly parallels the behavior of photons in a quantum wave.* There is a clear analog in the behavior of quantum particles to the behavior of individuals constrained by story. Collective human behavior mirrors this fundamental property of matter.

This insight that the stories constraining our behavior are mirrored in the behavior of matter extends further than

metaphor (on Cartesian terms anyway). There is further connection between story and matter, because new experimental and theoretical evidence demonstrates that *meta-information is matter*. Physicist Erik Verlinde has developed a convincing model for gravity on the premise that dark matter in the universe is actually modeling the presence of meta-informational structures.⁵ Another team of physicists led by Shoichi Toyabe successfully converted meta-information into mass.⁶ All of this work has happened since 2010. I have fully detailed the implications of this work elsewhere,⁷ so I will not do so again here, but it is clear to me that the meta-information in the stories that coordinate collective human behavior are real and have mass. We cannot directly perceive or interact with our stories, but these stories may interact with one another in the *story environment*.

In *QJ*, we approach injustice and the global crisis by attempting to understand the interaction of stories, and we claim that the only relevant response to these issues is through evaluating the languages, economic systems, identities and cosmologies that coordinate our behavior.

This analog between collective human behavior and the quantum structure of light and matter is the crux of quan-

tum justice. I'm suggesting that all real and complex systems are organized in the same way as light—that a central wave-like story coordinates the activity of material pieces that compose the system as a whole. The parts are substance; the whole is a wave. This is true for cells coordinated by the story of an organ, leaves coordinated by the story of a tree, individuals coordinated by a language or by an economic system, and for the busy enzymes that manufacture DNA inside of every living cell. Everything is constrained by story. Organisms are bound by ecosystems, Individuals by cultures, and Monday traffic by convention. This constraint may be mapped upon the binding of an electron to an atom, or of a photon to a beam of light. The nature of this constraint is much the same. In the final distillation, this may be the most important thing I have to say:

Light is a message—perhaps the purest form of message—about the way things are. Light is the model of all being, and all other forms of being may be mapped upon this blueprint of a wave with particle nature. Every being as a whole is connected, bound, and drawn together by the wavelike story that is itself the undivided whole of that being.

We may use this insight to shed light upon the global crisis generated by collective human behavior, and to treat this crisis in view of the stories that coordinate that behavior. These stories are our languages, economic systems, political identities, and cultures—all of which are becoming increasingly homogenized into a single unifying global human system. Individually, we are quantum elements in these stories. Understanding the crisis in these terms places our individual response to the crisis in terms of which stories we will belong to. Further, these stories can only be understood as waves with varying frequency, because time has no meaning in the story environment.

Time loses its meaning, because every story has extension in the time dimension. If I decide that a gas price is too high, this is because of my *prior experience* with the price of gas. The fact that I am buying gas at all is because of an *anticipated need* for gas. The behavior of this system—me buying gas—is determined by meta-information about the past and future. That meta-information has mass, but it exists in the past, present, and future. This is very counter-intuitive to our prevailing sense of what mass is (or time).

As another example, consider a conversation between two people, Bob and Sue. When Bob makes a statement, he will observe some reaction in Sue's facial expression, and that observation obtains meta-information. The story of that meta-information begins with Bob's statement, and ends with his observation of Sue's expression—which is a period of nonzero duration. Accordingly, the mass representing that meta-information has extension in time. Bob's observations of Sue's reactions are clearly a defining influence in Bob's continuing communication.

The result of this is that time becomes meaningless in the story environment—past and future mean the same as left and right. Our approach in *QJ* is to consider the nature of our stories as a function of frequency rather than time. Bateson echoes this approach in his *epistemology of cybernetics*,⁸

“The behavior of...every part of the circuit is partially determined by its own previous behavior. Message material...must pass around the total circuit, and the time required for the message material to return to the place from which it started is a basic characteristic of the total system. The behavior of...any part of the circuit is thus in some degree determined not on-

ly by its immediate past, but by what it did at a time which precedes the present *by the interval necessary for the message to complete the circuit.*" (Italics mine.)

This 'interval necessary for the message to complete the circuit' can be viewed as a resonant frequency for the story system as a whole, and as Bateson shows, that frequency is a 'basic characteristic of the total system.' Our approach in *QJ* is to analyze our collective stories on the basis of frequency, and to approach social and environmental justice issues through the lens of frequency. This approach completely deemphasizes time.

Time is deemphasized because stories extend into the past, making past injustice appear to be ever present. (It is almost impossible to say this in English; the structure of the language disallows it.) As we suggested in *QJ*, "Our mindfulness of the continual now that is never disconnected from the past offers some awareness of the visceral reality of slavery today. When we handle money, we are aware that this money is a thread drawn out of the pit of despair that is the belly of a slave ship."⁹

In summary, application of cybernetic analysis to human culture both validates and extends the original suggestions presented in *QJ*. Experimental and theoretical evidence¹⁰ since 2010 further validates the modeling of cybernetic systems—including human culture—as massive meta-informational story structures. The requirement that this meta-informational mass have extension in the time dimension severely limits the usefulness of a linear progressive model of time when applied to complex cybernetic systems with feedback. A frequency model of time such as that presented in *QJ* is therefore a much more obvious and relevant model for anything as complex as global human behavior. The treatment of individual elements within the story—ie, people—as quantum elements certainly becomes very intuitive at this point, and is further supported by the work of Nassim Taleb, presented below.

Get it Now

The second major insight that we offered in *QJ* was that there is a developing order in the universe, and that this developing order could present *entropic forces* upon us through random events. I have been able to better articulate

this insight by making use of the work of economist and mathematician Nassim Taleb, who developed *antifragility* as a model for how order develops in response to random events.¹¹ Taleb's model can be adapted to demonstrate a physical mechanism that moves order from the story environment into the present moment. This presents entropic forces.

Taleb observes that some systems—and all real and natural systems—are *antifragile*, because they become more ordered in response to chaotic and random events. That is, response to disorder in the environment produces more ordered states within the system. This observation is much more far reaching than it first appears. Antifragility means that when a system is stressed, it will respond by becoming stronger (as opposed to a fragile system that responds to stresses by breaking or becoming weaker). For example, if a species is stressed by scarcity or predation, it may evolve, and the new species could be more complex or better adapted than its ancestor species.

Taleb shows that this increase in order within a system—demonstrated by greater strength, adaptation, or complexity—is due to asymmetry in how the system responds to random events. When a random event occurs, that event can

either push the system toward disorder or toward order, and sometimes these changes are irreversible (for example, a glass may break, or a species may evolve). Often, there is an asymmetry in how these irreversible changes impact the system—it is not 50/50 whether the irreversible change will push the system toward order or disorder, but one of these possibilities is greater than the other. Therefore, with exposure to many random events over a long period of time, there will be a ratcheting effect toward the direction of either increasing or decreasing order, depending on the nature of the asymmetry. Fragile systems are ratcheted toward disorder, and antifragile systems are ratcheted toward order.

The insight that we provide in *QJ* is that most aspects of the global crisis can be understood through the lens of developing order in the world. Extinction, genocide, and industrialization are all homogenizing forces that reduce the variety and complexity of cultures and ecosystems. This observation from *QJ* is reproduced and better articulated in my essay “The Elephant in the Room.”¹² I have proposed that the variety and complexity lost to extinction and genocide is held in the story environment.

In essence, our efforts toward social and environmental justice could be regarded as efforts to preserve or restore the complexity and variety of human and natural systems. If we wish for indigenous people to maintain their ways and traditions (ie, that we refrain from genocide), that would represent increased complexity and order in the present expression of global human culture. If we wish for Black Americans to have a self-determined economic reality without being subjugated by an economic system rooted in the story of their oppression, that self-determinacy would represent further complexity and variety in human culture, and that social justice effort would resist homogenization. Environmental justice efforts that preserve diverse natural ecosystems are also clearly efforts to maintain ordered, complex ecological structures in the present moment.

If we allow that the aims of social and environmental justice can be summarized as efforts to preserve diversity, complexity, and order in the present moment and to resist the homogenizing trends of colonialism, extinction, and industrialization, it follows that we should explore the mechanisms whereby lost complexity may be restored. Taleb's model for antifragility precisely defines this mechanism as a function of system response to random events. Antifragile

systems become more ordered through irreversible response to random events. Once lost to extinction and genocide, global complexity must reemerge through this mechanism of irreversible and antifragile response to chaos.

That this lost order may return is established and perhaps best articulated in *The Universe Story*, where physicist Brian Swimme and cosmologist Thomas Berry describe the workings of *cosmogenesis*, which is precisely the return of lost order.¹³ The overarching presence in the story environment is a universe story that resonates with the ebb and flow of order between the story and the present moment. Order flows from the present moment and into the story environment through such mechanisms as extinction, industrialization and genocide; order enters the present moment through antifragility and cosmogenesis.

It warrants some emphasis that the order we are seeking to restore is *in the present moment*. It is specifically the present moment that must be optimized. This has implications for our overall tactics in that we may not consider long-term goals as ends which justify our means if those means do not protect or proliferate order and complexity in the present moment. It is applicable here to heed the warnings of Margaret Mead and Gregory Bateson, who pioneered

this study of “cultures as wholes, as systems of dynamic equilibrium.”¹⁴

“Before we apply social science to our own national affairs, we must re-examine and change our habits of thought on the subject of means and ends. We have learnt, in our cultural setting, to classify behavior into ‘means’ and ‘ends’ and if we go on defining ends as separate from means *and* apply the social sciences as crudely instrumental means, using the recipes of science to manipulate people, we shall arrive at a totalitarian rather than a democratic system of life.”

The separation of our activities into ‘means’ and ‘ends’ presumes that we are optimizing some future time, but that optimization of the future is meaningless in regard to the cycling of order between the story environment and the present moment. This need for optimization of the present moment is also a reflection of antifragility, which is the mechanism whereby systems become more ordered. Order is achieved through capitalization upon random events, not through science and social planning. Consider this the next time people are excited about destroying a diverse ecosys-

tem for another endless solar monotony and attempting to paint it ‘green.’

It may also be worth emphasizing that the preservation and perpetuation of complexity that I suggest as a metric for justice is quite different than our generally accepted sense of what justice is. In this system of thought, justice is difference; justice means different people eating different foods, speaking different languages, using different money, and living contrasting lives. But, our whole symbolism and language around justice is actually based on equality—the balancing of scales weighing two things the same. It is precisely this homogenization that we must resist in the interest of what I would call justice. To paraphrase the novelist Tom Robbins, justice “does not lie in treating different things equally. It lies in treating different things differently.”

Be the Demon

In summary, the content of *QJ* may be derived from the dual insights that collective human behavior is coordinated by physical wave structures in the story environment, and that the essence of justice is movement of order from that environment into the present moment.

The cultivation of order in the present moment comes from antifragile response to random events. The readiness for such response can only come from a state of consciousness in which we are wholly aware of our place as a cell within a larger entity such that we remain receptive to messages and synchronicities from that larger system. We are aware that we are part of a vastly interconnected ecology that is most appropriately understood as a mind.

Antifragile response is irreversible. From our position in the ecology of mind, our action is that of a pawl in the mechanism of natural expression. We act to lock-in random events and prevent their reversal. We are the demons in Maxwell's experiment.* We are not the guiding force or master of the ecology. In fact, it is quite the opposite.

Individually, we must remain fragile. My proposed quantum structure of story—in which individuals are quantum elements—is mirrored in Taleb's modeling of antifragile systems. Taleb points out that antifragility is achieved when whole systems are divided into parts that have great flexibil-

* Maxwell's Demon is a thought experiment in classical physics whereby order is increased in a physical system through manipulation of random particle fluctuations by an intelligent "demon." See also the essay "Massive Information."

ity. This flexibility allows the system to capitalize upon random opportunities, but the system is not so heavily invested in any of the parts as to be unable to afford their loss. Anti-fragile systems are composed of fragile parts in the same way that stories are composed of individuals, and light is composed of photons.

It is for this reason that our stories have become so fragile. Our stories grant privilege to individuals, (in fact that's what they are designed to do) and so they are fragile stories. If we act from the ecology of mind—in which we are a mere part of a larger whole—we will refuse this privilege, knowing that it is the system as a whole whose integrity must be maintained. This refusal of privilege is the primary barrier to justice, because as yet we do not place our identities into the ecology of mind, but mostly maintain stories about ourselves that are definitively separate from the ecology of the greater whole. This is the root of our cosmological dysfunction: we do not know who we are.

I believe that people will only disengage from cultural stories that grant them privilege if they have evaluated the meta-stories that frame their participation in those stories. These are stories of cosmology, identity, and language. I suppose that my primary attempt in writing *Quantum Jus-*

tice is to shake up our cosmology. I am attempting to demonstrate that our dysfunction is tied to the way we have mapped the world and our assumptions about how the world is made. We have mapped the world upon a clock-work and not a beam of light; we do not perceive the selfness of the other. I do not think that people will disengage from the culture that grants them privilege unless they have redefined their sense of self such that the privilege offered no longer applies to who they believe themselves to be.

Appendix:

Causality of Objective Observable Events Depends upon Subjective Interactions—An Example

Abstract:

A thought experiment shows that objective observables may be caused by subjective interactions and therefore the causality of such objective observables is not objective. This leads us to consider abandoning objective physical modeling and to consider subjective modeling of physical systems as aggregates of subjective interactions instead of through reduction of objective elements.

Consider three events to be viewed from two inertial reference frames S and S' . The events occur in S at coordinates (x_1, t_1) ; (x_2, t_2) ; and (x_3, t_3) respectively, and in S' at (x'_1, t'_1) ; (x'_2, t'_2) ; and (x'_3, t'_3) . Reference frames S and S' are synchronized such that $x_1 = x'_1 = 0$ and $t_1 = t'_1 = 0$. S' travels in the $+x$ direction with respect to S at velocity $v = 0.9c$.

We may select event coordinates in S such that events 1 and 2 are not causally related—that is, their time order is

subjective. In frame S, t_1 precedes t_2 , and in S' t_2 precedes t_1 . (t_2 is positive, and t_2' is negative). However, event 3 is selected such that a causal link is established between both events 1 and 2. The spacetime interval between event 1 and event 3 is short enough for light to travel between the events. Light may also travel between event 2 and event 3. This creates a causal link between 1 and 3 and between 2 and 3 that would not be dependent upon selection of the reference frame.

<p>Objective causality:</p> <p>$1 \rightarrow 3$</p> <p>$2 \rightarrow 3$</p>	<p>Subjective relationship:</p> <p>$1 \leftrightarrow 2$</p>
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It can be shown that for some set of events, the sequence in which information from events 1 and 2 will arrive at x_3 is subjective. In frame S, information from (x_2, t_2) arrives at x_3 *before* information from (x_1, t_1) . In frame S' , information from (x_2', t_2') arrives *after* information from (x_1', t_1') .

For example,

$$x_1 = x'_1 = 0 \text{ light years (ly)}$$

$$t_1 = t'_1 = 0 \text{ years (y)}$$

We select two other events to occur in S such that,

Event 2 occurs at :

Event 3 occurs at :

$$x_2 = 1.5 \text{ ly}$$

$$x_3 = 2 \text{ ly}$$

$$t_2 = 1 \text{ y}$$

$$t_3 = 2.5 \text{ y}$$

Note that light cannot travel from event 1 to event 2, but light can travel to event 3 from either event 1 or event 2.

We may derive the coordinates of these events in S' from the Lorentz transformations such that,

$$x' = \gamma(x - vt)$$

$$t' = \gamma\left(t - \frac{vx}{c^2}\right)$$

where,

$$\gamma = \frac{1}{\sqrt{1 - v^2/c^2}}$$

If S' travels in the +x direction with respect to S and $v = 0.9c$, this yields,

$$\gamma = 2.29$$

$$x'_2 = 1.38 \text{ ly}; t'_2 = -0.8 \text{ y}$$

$$x'_3 = -0.57 \text{ ly}; t'_3 = 1.6 \text{ y}$$

So, in S, event 1 precedes event 2 but in S', event 2 precedes event 1.

In reference frame S

Also, in S, information carried by light from event 1 arrives at x_3 at

$$t = \frac{x_3}{c} = 2\text{y}$$

while information from event 2 arrives at x_3 at

$$t = t_2 + \frac{(x_3 - x_2)}{c} = 1.5\text{y}$$

So, in reference frame S, *information from event 2 arrives at x_3 before information from event 1 arrives at x_3 .*

In reference frame S'

However, in S' information from event 1 arrives at x'_3 at

$$t' = \left| \frac{x'_3}{c} \right| = 0.57\text{y}$$

while information from event 2 arrives at x'_3 at

$$t' = t'_2 + \frac{(x'_2 - x'_3)}{c} = 1.15\text{y}$$

So, in reference frame S' , *information from event 1 arrives at x'_3 before information from event 2 arrives at x'_3 .*

We can set up an observer at (x_3, t_3) who will execute an objectively measurable event that varies depending on the order in which the information arrived at x_3 from events 1 and 2. So, if information from 1 arrives before information from 2, the observer will execute result A. If information from 2 arrives before information from 1, the observer will execute result B. We are forced to conclude that this objectively observable result A or B would be different in S vs. S' . However, this result cannot possibly depend upon frame of reference if it is objectively observable so the assumptions of causality leading to event 3 must be self-contradicting. That is, it is not possible for either event 1 or event 2 to objectively cause event 3. Rather, it is the subjective reality of the observer at event 3 which causes the objective result. The cause of our objective experimental result (the outcome of event 3) is found to be subjective.

It is important to note that while we calculate these results using a scale of years and light years (for ease in calculation), the model need not be dependent on scale. We could

also take these events to be quantum mechanical interactions between subatomic particles, for we must acknowledge that nearly all of these particles may be moving at or near the speed of light where such relativistic effects cannot be neglected. In fact, the indeterminacy principle *requires* that spatial interaction between particles will increase the velocity of the particle near relativistic speeds, because that interaction constricts the location of the particles involved to the limited region of space where they may interact.

According to the indeterminacy principle, $\delta x \delta p \geq h/2\pi$, The spatial restriction implied by any particle interaction (such as the confinement of a subatomic particle to the space within the nucleus) effectively reduces the magnitude of δx , and forces δp to increase correspondingly. For example, constraint of a neutron to an atomic nucleus requires *minimum* particle speeds of 20% the speed of light. We cannot safely presume that quantum interaction occurs far below the speed of light; relativistic effects will be significant in a large number of interactions.

In this relativistic quantum mechanical model, the subjective interactions that determine the nature of objectively observable experimental results would be too numerous to compute. Also, the indeterminacy principle limits the accu-

racy to which we may measure or predict these subjective interactions anyway. Therefore, objectively measurable experimental results are dependent upon subjective conditions that may only be considered *in aggregate*. This approach is consistent with the statistical modeling that already defines our objective quantum mechanical models, but it is quite different to consider aggregated *subjective* interactions vs. aggregated *objective* interactions.

In an attempt to salvage objective causality, quantum mechanics treats the aggregate interactions as random influences, and uses probability and statistics to model all of these interactions. However, probabilistic models are deterministic and objective, and this form of modeling does not treat the subjectivity of this phenomenon. In a statistical model, the results of any experiment will not depend upon frame of reference. However, we have shown that the objective results of some observations do depend upon frame of reference and may not be considered to be caused by objective chains of cause and effect. They can be shown to be caused by subjective observer realities. It becomes impossible to model that subjective phenomenon through any objective model, statistical or otherwise. It is simply more accurate to model any complex system subjectively.

Subjective modeling of any system, instead of fragmenting and isolating independent elements for observations must aggregate large numbers of subjective interactions, most of which occur on the quantum mechanical level and cannot be directly observed. This form of modeling may best be approached as a subjective ‘mind’ or whole and animate manifestation of the system under observation. This implies a certain sense of interiority to the system being modeled. For example, in the proposed subjective model it is physically legitimate and mathematically sound to aggregate all of the subjective interactions within a seed and ask, “Does this seed *want* to grow?” Or, alternatively to aggregate the subjective interactions within a living cell and ask, “Does this cell *want* to become cancerous?” The language of subjective interiority in relation to the substructure of the system under consideration is entirely acceptable in a subjective model, for we have shown that objective observables do in fact depend upon such subjective interior interactions in the substructure of any system. In fact, as a useful heuristic, such subjective modeling will likely prove very useful.

Endnotes



The Game

Alexander Morozevich (black) vs. Ian Sokolov (white) - Jan 25, 2005

1. d4 d5; 2. c4 e5; 3. dxe5 d4; 4. Nf3 Nc6; 5. Nbd2. Nge7; 6. Nb3 Nf5; 7. a3 Be7;
8. g3 a5; 9. Qd3 a4; 10. Nbd2 h5; 11. Bh3 g6; 12. Ne4 h4; 13. Bf4 hxg3; 14. hxg3 Ng7;
15. Bg2 Rxh1+; 16. Bxh1 Bf5; 17. Nfg5 Na5; 18. Qf3 Ne6; 19. Nh7 Bxe4; 20. Qxe4 c6;
21. e3?Nb3; 22. Rd1 Qa5+; 23. Ke2 Nec5; 24. Qg2 Qa6; 25. Kf1 Qxc4+; 26. Kg1 Qc2;
27. Qf3 d3; 28. Bg5 Ne4; 29. Bxe7 Nxf2; 30. Qxf2 Qxd1+; 31. Kg2 Qc2;
32. Bd6 O-O-O; 33. Kg1 Qxf2+; 34. Kxf2 Rh8 o-1

Li

¹ McMurray, J and Fay, R. *Chemistry*. Upper Saddle River, NJ: Prentice Hall. 2nd edition, 1998. p 988.

² Montgomery, David and Biklé, Anne. *The Hidden Half of Nature: The Microbial Roots of Life and Health*. New York / London: W.W. Norton, 2016. p 244.

³ Bateson, Gregory. *Steps to an Ecology of Mind*. University of Chicago Press. 1972.

⁴ Jensen, Derrick. *A Language Older than Words*. White River Jcnctn, VT: Chelsea Green, 2004

⁵ Shoichi Toyabe, Takahiro Sagawa, Masahito Ueda, Eiro Muneyuki, and Masaki Sano. “Experimental demonstration of information-to-energy conversion and validation of the generalized Jarzynski equality” in *Nature Physics*. Vol 6. Dec 2010.

The Elephant in the Room

¹ These two forms of order are of a different logical type as defined by the theory of that name developed by Bertrand Russell and Alfred N Whitehead, *Principia Mathematica*, 1910. See also Feather, Paul. “Massive Information” in *Massive Information and Other Short Works to Dethrone Descartes*. Carrollton, GA: FLF Publications. 2019.

² Dutch physicist Erik Verlinde offers a new theory of gravity in which cybernetic information would have weight in a gravitational field: Verlinde, Erik P. “Emergent Gravity and the Dark Universe,” in *SciPost Phys. 2, 016 (2017)*. arXiv:1611.02269v2 [hep-th] (8, Nov 2016). <https://arxiv.org/abs/1611.02269>.

Japanese physicists, Shoichi Toyabe, Takahiro Sagawa, Masahito Ueda, Eiro Muneyuki, and Masaki Sano have also demonstrated that cybernetic information is inter-convertible with energy in the laboratory: Shoichi Toyabe, Takahiro Sagawa, Masahito Ueda, Eiro Muneyuki, and Masaki Sano “Experimental demonstration of information-to-energy conversion and validation of the generalized Jarzynski equality” in *Nature Physics*. Vol 6. Dec 2010.

More complete discussion of the experimental and theoretical evidence for the mass of meta-informational story in Feather, Paul. “Massive Information” in *Massive Information*. FLF, 2019. A more complete treatment of the resulting system of thought in general is available in Feather, Paul and Currie, Terra. *Quantum Justice: Theories and Theatrics for the Ecozoic Era*. Carrollton, GA: FLF Publications, 2018.

Massive Information

¹ Leopold, Aldo. *The Round River: A Parable*. In *Round River: From the Journals of Aldo Leopold*, ed. L. Leopold. New York: Oxford University Press, 1993 (1953). pp 158-165. My immediate source for Leopold’s Lament was in Mann, Charles C. *The Wizard and the Prophet: Two Remarkable Scientists and Their Dueling Visions to Shape Tomorrow’s World*. New York: Alfred A. Knopf, 2018. pp 74-75.

² This type of sharing of DNA among bacteria is called horizontal gene transfer. For a good discussion of microbiology, consider Montgomery, David and Biklé, Anne. *The Hidden Half of Nature: The Microbial Roots of Life and Health*. New York / London: W.W. Norton, 2016. I’d also suggest any of Paul Stamets’s work on mycorrhizal symbioses. Finally, there is also a succinct discussion of horizontal gene transfer and the blending of genetic identity in molecular biology in Avery, John Scales. *Information Theory and Evolution*. New Jersey: World Scientific, 2012. ch 3.

³ Clements, Frederick. *Research Methods in Ecology*. Lincoln: University of Nebraska Publishing Co, 1905. p 199.

⁴ Leopold, Aldo. *A Sand Country Almanac, and Sketches Here and There*. New York: Oxford University Press, 1949. p 204.

⁵ Ibid. p 223.

⁶ Ibid p 130.

⁷ Pyle, Robert. *The Thunder Tree*.

⁸ Clements, Frederic. *Plant Succession and Indicators* New York: H.W. Wilson, Co. 1928

⁹ In fairness to Leopold, it may be that his personal view on nature was (at least sometimes) closer to that of a Clementsian superorganism, or an ecology of mind, as this quote of his would indicate, “It is at least not impossible to regard the earth's parts—soil, mountains, rivers, atmosphere etc,—as organs or parts of organs of a coordinated whole, each part with its definite function. And if we could see this whole, as a whole, through a great period of time, we might perceive not only organs with coordinated functions, but possibly also that process of consumption as replacement which in biology we call metabolism, or growth. In such case we would have all the visible attributes of a living thing, which we do not realize to be such because it is too big, and its life processes too slow.” (Found in Harding. *Animate Earth*, p 44). If this was his personal view, he perhaps regarded it as too far out for wide acceptance, and limited his writing to the more modest goal of incorporating humans into natural communities as members, not cells or organs.

¹⁰ Lipset, David. *Gregory Bateson: The Legacy of a Scientist*. Boston: Beacon Press, 1982. p 44.

¹¹ Ibid, pp 114-5.

¹² Ibid, p 142.

¹³ Ibid, pp 167-8

¹⁴ Bateson, Mary Catherine. *With a Daughter's Eye: A Memoir of Margaret Mead and Gregory Bateson*. New York: William Morrow & Co. 1984.

¹⁵ Lipset, p 227.

¹⁶ Ibid, p 274.

¹⁷ Bateson made this statement in a lecture Jan 9, 1970, and the lecture was published in Bateson, Gregory. *Steps to an Ecology of Mind*. Chicago: University of Chicago Press. 2000, (1972). p 468. This quotation is also referenced in Bateson, MC. p 96.

¹⁸ Kimmerer, Robin Wall. *Gathering Moss: A Natural and Cultural History of Mosses*. Corvallis: Oregon St. University Press, 2003.

¹⁹ Wheeler, Steve. "The Fire in the Cave," in *Dark Mountain Issue 12: Sanctum*. The Dark Mountain Project, 2017. Wheeler cites the work of Jean Gebser as his source for these observations.

²⁰ Bateson, Gregory. *Mind and Nature: A Necessary Unity*. New York: E.P. Dutton. 1979. p 7. Also, Bateson, Gregory. *Steps to an Ecology of Mind*. Chicago: University of Chicago Press. 2000, (1972). pp 462-3 and 489. Bateson takes the terms *Pleroma* and *Creatura* from Jung, C.G. *Septem Sermones ad Mortuos* London: Stuart & Watkins, 1967.

²¹ Bateson, Mary Catherine; Bateson, Gregory. *Angel's Fear: Towards an Epistemology of the Sacred*. Bantam Books, 1988, p 15.

²² Bateson, G. *Mind and Nature: A Necessary Unity*. New York: E.P. Dutton. 1979. p 18.

²³ Please see, in particular, Feather, Paul. "A World without Because," in *Massive Information and Other Short Works*. Carrollton, GA: FLF publishing, 2019, and also Feather, Paul and Currie, Terra. *Quantum Justice*. FLF 2018, especially pp 57-205. www.paulandterra.com

²⁴ This line of argument follows Bateson's in *Steps to an Ecology of Mind*. Chicago: University of Chicago Press. 2000, (1972). pp 491-2.

²⁵ Lomborg, Bjørn. *The Skeptical Environmentalist: Measuring the Real State of the World*. Cambridge: University of Cambridge, 2001. (Original Danish publication, 1998). pp 11-12.

²⁶ Feather, Paul. “Quantum Justice” in *Massive Information*. Carrollton: FLFP, 2019. Feather, P and Currie, T. *Quantum Justice*. Carrollton: FLFP, 2018. www.paulandterra.com

²⁷ Weed, Susan S. *Healing Wise*. Woodstock, NY: Ash Tree Publishing, 1989. p 29.

²⁸ Buhner, Stephen Harrod. *The Secret Teachings of Plants: The Intelligence of the Heart in the Direct Perception of Nature*. Rochester, VT: Bear and Co. 2004. pp 40-43.

²⁹ In 2006 alone, 26 million pounds of antibiotics were used just for preventative treatment of confined animals in agriculture. For extensive analysis of pharmaceuticals contaminating water, see Buhner, Stephen Harrod. *The Lost Language of Plants. The Ecological Importance of Plant Medicines to Life on Earth*. White River Jnctn, VT: Chelsea Green. 2002. Also, Wu, M; Atchley, D; Greer, L; Janssen, S; Rosenberg, D; Sass, J. *Dosed Without Prescription: Preventing Pharmaceutical Contamination of our Nation’s Drinking Water*. NRDC White Paper. December 2009.

³⁰ Baxi, Ami M.D; Mandel, Seth. *NCHS Data Brief*. New York: U.S. Center for Disease Control and National Center for Health Statistics. August 2017. Also Pratt L.A. Brody D.J. Gu Q “Antidepressant use among persons aged 12 and over: U.S., 2011-14. NCHS Data Brief, no 283. Hyattsville, MD: NCHS, 2017.

³¹ Capra, Frijtof. *The Turning Point: Science, Society and the Rising Culture*. New York: Bantam Books, 1982. p 332.

³² Verlinde, Erik P. “Emergent Gravity and the Dark Universe,” in *SciPost Phys.* 2, 016 (2017). arXiv:1611.02269v2 [hep-th] (8, Nov 2016). <https://arxiv.org/abs/1611.02269>.

³³ *Ibid.* p 42.

³⁴ McMurray, J; Fay, R. *Chemistry*. New Jersey: Prentice Hall. 1998 2nd ed. (1st ed, 1995). Glossary.

³⁵ Bateson, M C; Bateson, G. *Angel's Fear*. 1988, p 21.

³⁶ Verlinde. p 44.

³⁷ Verlinde. p 26.

³⁸ Of course there has been substantial debate as to whether Maxwell's Demon is a practical reality. In 1929 another physicist, Leo Szilard observed that in order to manipulate a system in this way and produce free energy, the demon would have to measure the particles. Szilard's criticism of Maxwell's Demon amounts to the fact that measurement of a system produces entropy, and through some rather un-navigable calculations he demonstrates that the entropy increase from this measurement is enough to offset the decrease in entropy when the demon actually utilizes this information. So, in Szilard's analysis we have two counteracting operations: measurement which increases entropy, and utilization which decreases it. Szilard shows that for the whole system, entropy may not be decreased, and so no free energy is created. Szilard, Leo. "On the Decrease of Entropy in a Thermodynamic System by the Intervention of Intelligent Beings." *Zeitschrift fur Physik*, 1929, 53, pp 840-856. Translated by Anatol Rapaport and Mechthilde Knoller.

Later analysis of this experiment further exorcised Maxwell's Demon by showing that the demon would also have to store information in order to carry out this task, and that storage of information is a physically irreversible process that produces entropy. Landauer, R. IBM J. Res. Dev. 5, 183 (1961). All in all, it may be that Maxwell's Demon does not exist in the sense where it was originally proposed as a violation of the 2nd law of thermodynamics.

My suggestion is to put aside the question of whether truly free energy can be created by this demon—which has generally been the focus of discussion—and consider the demon's implications as to the relation-

ship between mass/energy and information, which is the goal of this paper to define.

³⁹ Shoichi Toyabe, Takahiro Sagawa, Masahito Ueda, Eiro Muneyuki, and Masaki Sano. “Experimental demonstration of information-to-energy conversion and validation of the generalized Jarzynski equality” in *Nature Physics*. Vol 6. Dec 2010

⁴⁰ Ibid. p 3.

⁴¹ The first appearance of this equation is probably Leo Szilard’s criticism of Maxwell’s Demon: Szilard, Leo. “On the Decrease of Entropy in a Thermodynamic System by the Intervention of Intelligent Beings.” *Zeitschrift fur Physik*, 1929, 53, 840-856. Translated by Anatol Rapaport and Mechthilde Knoller.

⁴² Verlinde, Erik P. “Emergent Gravity and the Dark Universe,” eq 5.5 on p 26. (Verlinde uses natural units in that equation and so omits the constants.) Because the meta-information of a whole system is distributed throughout the volume of all spacetime, Verlinde calculates the information removed from the total volume of spacetime by a given mass, and so in this case the temperature, T , is taken to be the thermal background radiation temperature of the universe. Verlinde also offers equations that calculate the meta-information associated with a given mass within a certain radius of that mass.

⁴³ Avery, John Scales. *Information Theory and Evolution*. New Jersey: World Scientific, 2012. p 90.

⁴⁴ Taleb, Nassim Nicholas. *Antifragile: Things That Gain from Disorder*. New York: Random House, 2012. Taleb lays out the details of black swan events and antifragility in a very extensive system of thought over a five book series, *Incerto*.

⁴⁵ Taleb, N.N.; Douady, R. “Mathematical Definition, Mapping, and Detection of (Anti)Fragility” 2012. arXiv:1208.1189.

⁴⁶ Ibid, pp 32-33.

⁴⁷ Feather, P; Currie, T. *Quantum Justice: Theories and Theatrics for the Ecozoic Era*. Carrollton, GA: FLF Publications. 2018.

Quantum Justice

¹ Feather, Paul and Currie, Terra. *Sacred Violence: A Family's Quest to Uproot Hitman Culture*. Carrollton, GA: Full Life Farm Publications. 2017. www.paulandterra.com

² Feather, Paul and Currie, Terra. *Quantum Justice: Theories and Theatrics for the Ecozoic Era*. Carrollton, GA: Full Life Farm Publications. 2018. www.paulandterra.com

³ Bateson, Gregory. "Social Planning and the Concept of Deutero-Learning." *Steps to an Ecology of Mind*. Chicago, IL: University of Chicago Press, 2000, 2nd ed. (1972). p 159.

⁴ Bateson, G. *Steps to an Ecology of Mind*. (1972). p 316.

⁵ Verlinde, Erik P. "Emergent Gravity and the Dark Universe," in *SciPost Phys.* 2, 016 (2017). arXiv:1611.02269v2 [hep-th] (8, Nov 2016). <https://arxiv.org/abs/1611.02269>.

⁶ Shoichi Toyabe, Takahiro Sagawa, Masahito Ueda, Eiro Muneyuki, and Masaki Sano. "Experimental demonstration of information-to-energy conversion and validation of the generalized Jarzynski equality" in *Nature Physics*. Vol 6. Dec 2010

⁷ Feather, P. "Massive Information." in *Massive Information and other Short Works to Dethrone Descartes*. Carrollton, GA: Full Life Farm Publications. 2019. www.paulandterra.com.

⁸ Bateson, G. *Steps to an Ecology of Mind*. (1972). p 316.

⁹ Feather, P; Currie, T. *Quantum Justice*: pp 84-85

¹⁰ Please see Feather, Paul. "Massive Information." in *Massive Information*. 2019. www.paulandterra.com.

¹¹ Taleb, Nassim. *Antifragile: Things That Gain from Disorder*. New York: Random House, 2012.

¹² Feather, P. "Massive Information." in *Massive Information*.

¹³ Swimme, Brian and Berry, Thomas. *The Universe Story From the Primordial Flaring Forth to the Ecozoic Era: A Celebration of the Unfolding of the Cosmos*. New York: Harper Collins, 1992.

¹⁴ Mead, Margaret. "The Comparative Study of Culture and the Purposive Cultivation of Democratic Values." quoted in Bateson, Gregory. "Social Planning and the Concept of Deutero-Learning." *Steps to an Ecology of Mind*. (1972). 2nd ed. pp 159-160.