

An inter-connected web
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Chalice lighting *‘Rydym yn cynnau’r Fflam ar ddechrau ein Gwasanaeth. Mae Golau’r Fflam yn arwydd o’n hymchwil am yr Gwirionedd; mae Gwres y Fflam yn arwydd o gynhesrwydd Cariad; mae Prydferthwch goleuni’r Fflam yn arwydd on hymchwil grefyddol i ddwyn y gorau i’n bywydau ac i’n Byd.*

Fel mae’r gannwyll yn cael ei difa wrth cynnal y Fflam a’r Gwres, felly y llwyddwn ninnau i ddwyn Gwirionedd, Cariad a Phrydferthwch i’n bywydau ac i’n Byd, drwy drawsnewid ein bodolaeth yn Fflamau cysegredig sef, aberth o’r Hunan, sydd yn cael ei fwydo gan ysbryd Duw, yn gweithredi drwyn bywydau a’n cysylltiadau ni.

Boed i’n myfrydodau ein cynorthwyo i sicrhau fod y Goleuni mewnol yn llosgi’n fwy llachar, gan ddwyn goleuni cyfiawnder i’n Byd wedi ei dywyllu. —traditional Welsh chalice lighting.

We light the Flame at the beginning of our service. The Light of the Flame is a sign of our search for the Truth; the Warmth of the Flame is a sign of the warmth of Love; the Beauty of the Light of the Flame is a sign of our spiritual search to bring the Light into our lives and the world.

Just as a candle is consumed by fueling the Flame and the Warmth, so we succeed in bringing Truth, Love, and Beauty into our lives and the world, by transforming our consciousness into a sacred flame — namely, the sacrifice of the Self, which is fed by the spirit of God, acting through our lives and our connections.

Let these meditations help us to ensure that our intended light will burn more brightly, while bringing the light of justice into a darkening world.

Introduction

In the beginning was the word, and the word was with God, and the word was God.

This essay began on a blank piece of paper, or more precisely a blank computer screen. In much the same way, several weeks ago, I sat at that piano, looked at the keyboard and began to pedal a minor third with a descending chromatic sequence starting from the tonic of the major chord whose third and fifth were the pedaled chord. I practiced the resulting riff for a couple of weeks and dropped the idea. It did not inspire any lyrics, and I soon realized the idea was an essential one in many other songs. My fingers touched the keys, the keys the hammers, the hammers the strings,

which vibrated the air that hit my eardrum. All that is left of that idea, beyond the whisper of the rippling air waves resonating and decaying in this sanctuary, is the analytic description of the second sentence.

The riff could have been found on the guitar or another instrument. I could have drawn it on a piece of staff paper. It might have been fully notated and orchestrated. But it was not. The piano sat silently until I played; the screen was blank until I began typing.

The musical riff and the idea of this essay must have been discovered and rediscovered many thousand times by many thousand people on many thousand planets. So it goes. There is nothing new under the sun. On the other hand, this particular essay will not exist in any form until I hit the save key, until I print it, or really until you read it or until you hear me read it to you. It is, at the time of this writing, nothing more than an incomplete work.

I am now typing (or reading to you) the fourth paragraph of the essay, and in an exceeding bad form, I have not stated my central theses. These are: Creation is an on-going process that is not external to the creation, but part of the creation and the creator. God did not sit at her keyboard and begin playing. There is not blank screen upon which the universe is written. The world is always in a state of becoming, and, in as much as our lives shape the tiny portion of the world around us, our desires should be focused on the creation of beautiful things.

Some of our creations

A book is a beautiful thing. It seems to be a world complete from cover to cover: setting, character, plot, development, climax, catharsis, resolution are all contained within. But as you read, you are at the same point that the author wrote when that sentence was written. You are here now, and even though I have thought and rethought this essay, that which is being said here and now is in the here and now. Yes, I wrote it then, or I type it now, and that now is your then. But we are now here: you — listening or reading, and I — speaking or typing. There is no tense for the present tense of your reading a book, curled up under the lamp, the evening quiet, spouse, children, or parents in other rooms, or together but in a different author's space. When you are reading you are at the author's mind; not the inner mind that examines structure and word choice, but at the outer mind — the facade that the author presents to you. You are at the same space and time as the author chooses you to be.

The author is not external to the book. The book is one manifestation of the author. It is a reflection of the author's inner-self at the time of the writing. The picture of the author as manifested in the book is incomplete, but when you finish the book you and the author share that experience. The flow only goes in one direction, though. The author affects you; only rarely do you affect the author. Yet, the author is affected, if only indirectly, by you. The author writes for *someone* to read. And the success of the book depends on the existence of the audience.

A piece of music is not merely dots arranged on and between lines, interconnected by lines of phrase, dynamics, senses of tempo and horizontals drawn to indicate rhythm. The piece of music is not the first reading by the performers. It is, instead, a revisited and rehearsed item. It expresses the emotion and intellect of the composer as much as it does the interactions and intricacies of the performers' lives. Hidden beneath the performance is the gratification of a good rehearsal as well

as the annoyance with the other player who may not have learned the part. The performance of the music depends on the states of the performers and the states of the audience members. Emotions are evoked. Communication occurs. But the deep inner meaning of the song — whether it be the anguish of unrequited love expressed in *Für Elise* or the sheer joy of *Do Wa Diddy Diddy Dum Diddy Do* — cannot be expressed in any other language than the language of performance. The thoughts and emotions evoked are as dependent on the state in which an audience member finds herself as it does on the state of the performer and the message of the composer.

The world is not sheet music waiting to be performed: it is the performance, and the sheet music is being written by us now. It is not a novel fully written: it is the writing and the reading occurring as we sit here.

Scientific models

All of our models of the physical systems are flawed. Be aware, the physical theories that we understand give outstandingly precise predictions. But each of the myriad of the theories misses some important aspect that another theory can explain.

In classical Newtonian physics a massive body is modeled as a point mass that exerts a force on the space that surrounds it. Such a particle is isolated and generates a field of inwardly pointing force surrounding the mass. An isolated particle may as well be static. Two such particles interact via their mutual gravitational attraction. This interaction has been observed in weightless environments. An astronaut wanting a tool that has a small mass reaches towards it, and the tool, if free floating, is attracted to the astronaut's hand.

A multitude of particles interact in an elaborate dance. We know the equations that appear to govern their motion, but we don't know an explicit formula to describe the solution. Our zen-master friend sits cross-legged and watches the solution unfold. . . . *we believe in an interconnected web.*

The model for the isolated particle begins as a dot on an otherwise blank page. Arrows are drawn to simulate the directions and magnitudes of the force field surrounding the particle. But the space of the real world — the world that contains you, me, and this discussion — is not empty. It can't be. According to Einstein's theory, its geometric structure is determined by the particles within it.

The first book I wrote is entitled "How Surfaces Intersect in Space." It was first published in 1993. I like to think it is a work of non-fiction. As I was writing it, I wrote in the same way that I wrote much of this essay. I started with an idea, and I thought through the sentences. I often thought and rethought paragraphs at a time. I felt that if the sentences and paragraphs were memorable, then the structure was carefully crated. I thought several passages, before they were written. To do so was the only way I could allocate the time to write.

So I lied to you. This essay did not begin on a blank screen. It began as I thought through the essay, over and over, while walking and muttering to myself, or sometimes thinking the themes through as I went to sleep. Some earlier versions are dancing in the wind as the whispered sound vibrations of my self-vocalizations.

(My son Albert thought of a wonderful device: an earpiece to be worn by those of us who talk to ourselves. If you like to vocalize your inner thoughts, you can talk to ourselves without appearing crazy.)

The book opens with the passage: “**What is Space?** Physicists and architects might tell you that space is defined by the things that occupy it. Virtual particles and antiparticles are continually being created and annihilated in the vacuum. The geometry of large scale space is determined by those massive bodies that occupy it. The ceiling, floor, and walls — rather their configuration and their relationships — define the space of the room in which you are sitting. In music, the time between the notes defines the rhythm; the intervals between notes define melody. Even silence is defined by the sounds that fill it. Listen.”

Very few things that I believed in 1993 remain part of my belief system now. We grow. But that passage still rings true to me. It is a theme that I continually return to within my professional work, and within my life. As a child, I was fascinated with the world atlas that we kept at our house. It has a relief picture on the cover of a tall sailing ship. I imagined the ship to be the US Coast Guard training ship, *The Eagle*, upon which my eldest brother had trained. I often did relief scrubs of the ship on a piece of notebook paper and with a number 2 pencil. As I scanned the pages of maps, I imagined lines of latitude and longitude actually intersecting along the seas. State lines and country boundaries must have been marked on the earth either by fences or by lines painted between the states.

I now understand these lines and demarkations as a coordinate system on a sphere. This is the most simple example of the mathematical object that we call a “manifold” — an empty stage upon which the play that is this life could unfold. But the universe is not a stage: it is the play, the actors, the playwright, the lights, the stage, and the stage hands. The world is not an empty space upon which the action lies. This podium is not a piece of furniture in a room. It is used symbolically to define the room as a church or circus.

It takes light 8 or 9 minutes to reach us from the sun. We know this because the earth and the sun are separated by 93 million miles. If the space between the earth and sun is empty, why does it take so long to get from one to the other?

My last example from physics is the interactions between and among sub-atomic particles. The late Richard Feynman developed a methodology to represent particle interactions as small planar diagrams — graphs with vertices and edges: an electron and a positron meet, annihilate, create a wave of light that splits into an electron-positron pair. The diagram that represents this is an expression of certain matrix operations. This diagrammatic voodoo permeates the mathematics that I currently work upon. I have pages and pages of notebooks in which I do complicated algebraic calculations by means of manipulating diagrams. I also have geometric calculations that are done with analogous diagrams that have yet to be turned into meaningful algebra.

Some models that are due to Sir Roger Penrose indicate that the large scale geometric structure of flat space can be simulated by an interconnected web of such diagrams. *The interactions among particles determines the geometry of the apparent underlying space.* I now believe that the underlying space of the world or even the underlying space-time is an illusion — a convenient fiction to keep our visually inclined minds thinking in geometric terms. I know enough to know that Sir Roger’s spin networks are also a fiction — they only describe the underlying model of that aspect of particle physics that relates to the “spin” of the particle. That spin is related to the same spin

observed when a Harlem Globetrotter spins a basketball on his fingertip.

Yet, Sir Roger's spin networks are a special case of the diagrams that I spoke of above. These interconnected webs codify interactions among families of particles and relationships among these interactions can also be encrypted by another interconnected web of diagrams — stick figures drawn on a blank piece of paper whose deeper meaning we have yet to fathom.

Other physical and philosophical theories that are currently being examined not only codify the interactions among particles, but the interactions among the interactions. A so-called “spin foam” is engendered. Our fictionalization of this foam looks very similar to the swim center in Beijing. And relations among the secondary interactions are also studied.

Epilogue

The sermons that we have heard recently have to do with the common themes of developing self-awareness through meditation, learning when to trust and when not to trust, walking through the shadow, and surrender for the practical application of overcoming addiction. All of these themes are far more important than anything that I have said today. These life-lessons help us cope at the level of everyday social interactions. We learn to love. We learn to respect. We learn forgiveness. We learn to tolerate.

My own spiritual path has always less to do with the interactions on the human side of things. It is one of my greatest character flaws. It does have to do with the introspection that comes from thinking logically, pondering the imponderable, and coming to understand nature through mathematical modeling. But other models also apply: fiction, music, parable, myth, love, duty, surrender. The mathematical models that I do understand (and trust me, I barely have a grip on anything that I have told you today) continue to point to: the world as developing, we as the artists who are shaping our reality, and our lives' purposes to help bring joy to others. Go in Peace.