

White Bear

Unitarian Universalist Church

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Complexity

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Complexity¹

You'll see the original title of the sermon in the summer schedule promised you a "multimedia" exploration of complexity. The sermon would be illustrated by images, by charts and graphs, by evocative photography. That turned out to be too complex to actually show with our available technology – which I really should have seen that coming given the topic. So, I'll upload it to YouTube and put the link on our website, and for this morning, talking and looking around will have to be all the multimedia we get.

Years ago, when working as a chaplain intern for a summer at a hospital, I ministered to people of all different faiths. That's what a chaplain does: they aren't in a hospital to proselytize; they are there to meet the patient where the patient is and provide the comfort and spiritual care appropriate to the patient's faith and spirit. And I'm a UU, so that should be an easy thing to do, right? I'm used to speaking with folks who have all sorts of different paths. But sometimes, I'd go into a patient's room, and the patient would say, with great calm: I'm not worried because I know God has a plan for me and I'm here for a reason.

This immediately sparked a lengthy internal debate in my head – every time I heard someone say this. "But wait," I would say to myself, "you're not here as some punishment for what you did, you don't deserve this, no one does. Humans are pattern-finding animals. How can you possibly tell the difference between a random sequence of events and an orderly and intentional one? And just because something seems orderly, where is the source of that order? When you see a pattern of events, are you perceiving something that's really there, something that's true about the world, or are you the one creating that pattern? After all, conspiracy theories feel real, but that doesn't make them true."

I had the good sense not to say that to the patient.

Is there an orderly pattern to our lives? Is there an orderly pattern to the world?

Investigating that question, is part of what the science of Chaos is all about. Chaos is a branch of mathematics and physics that tries to answer questions about complex systems that are very hard to predict – the stock market for example. They behave in orderly but unpredictable ways and a very small change can have a very big effect that is very hard to predict. This is the "butterfly effect" – the analogy that weather is such an incredibly big, complex system in which the tiniest changes can have massive effects, that a butterfly flapping its wings in China can change the weather in New York from sun to rain.

Everything happens for reasons but those reasons are just so enormously complicated that there's no way figure them all out. 11,000 volunteers submit data to the National Weather service every day. There are 158 Doppler radar installations, there are weather buoys in the ocean, weather satellites in space, weather balloons in the air. National Oceanic and Atmospheric Administration

¹ The readings were two poem by Louis Jenkins:

Afterlife (<http://prairiehome.publicradio.org/programs/2007/05/19/scripts/afterlife.shtml>)

Earl (<http://writersalmanac.publicradio.org/index.php?date=2007/08/22>)

annual budget is five *billion* dollars. There are lots and lots of people, some of the brightest scientific minds this country produces, working to predict the weather. And the best they can do is about a week. And even then, it's often wrong.

Bring your raincoat if you're going on a trip for more than a few days because no one knows what's going to happen.

Our lives are like the weather, they such overwhelming complexity that we can't make predictions about them more than about ten days out, and even then, with lots of room for error. Everything happens for a reason, for lots of reasons, but those reasons are just so enormously complicated that there's no way figure them all out. And sometimes, when you try to put the story together, the cause and effect, sometimes it's just mystifying. How did we all end up here again?

The poet Louis Jenkins captures that feeling of just being mystified by the randomness of life, the lack of a pattern, in a poem called "the Afterlife"

Older people are exiting this life as if it were a movie...

"I didn't get it," they are saying.

He says, "It didn't seem to have any plot."

How to make sense of it?

A friend told me a story about going to see the Dalai Lama. This was maybe fifteen years ago. He went to see the Dalai Lama give a talk in Central Park in New York City. Thousands of people showed up. The Dalai Lama spoke for an hour. A deep, deep talk on an arcane point of Buddhist philosophy. But he gave the whole talk in Tibetan. No English at all. So my friend listened to some translation, he enjoyed the sun, the company, taking it in good humor. The Dalai Lama spoke for over an hour, and at the end of all that complicated philosophizing in a foreign language, he says, in English, with a big grin: "so, in conclusion, try to be a good person."

* * *

So I'm going to prove mathematically that you should be a good person. I'm not really sure how to do that. But I am going to try to prove – to talk about how other people have proved – that it's really, really hard to make sense of things, and it's really hard to make predications about what's going to happen. It's not just you. And in the face of that, the Dalai Lama's suggestion is about the best guiding rule we've got.

I want to give you a math lesson while you're still fresh. Another example of chaos. A look at how little changes have big results, so much so that it makes prediction impossible.

In the 1960s and 70s, there were a group of scientists who were trying to draw graphs of how populations change over time. They were trying to answer questions like: how many walleye does the DNR need to stock in a lake each year so the population stays stable and doesn't get

fished out? This is a pragmatic question if you're the DNR and need to request money for next year's budget.

So they figured out formulas for how to do this: they said, ok, you take your starting populations, and then you figure 8% are going to die of disease, and 13% are going to die of malnutrition and 45% are going to get eaten each year. At what rate, they asked, do the fish, have to reproduce to keep the population stable? At what rate do they have to reproduce to keep the population growing? Ok, got that figured out?

Add in one more confounding factor: there's only food for a maximum of 1,000 fish, any more and they run out of food and 80% starve. If the rate of reproduction is too low, the population dies out. If the rate of reproduction is too high, they consume all the resources and have a massive die-off.

What scientists expected was that for any given rate of reproduction that didn't eventually lead to extinction, the population would eventually settle into a steady state. Eventually, the population would stabilize in perfect harmony with the environment. A lot of scientists thought that, if all else remains the same – if the food supply was the same every single year, if exactly 8% of fish died of disease every year – if all else remains the same, the population should eventually reach an equilibrium, the same number every single year.

So the question then, is: what's the relationship between the rate of reproduction and the long-term fish population?

For example, fast-breeding fish might settle into a high equilibrium, while a slow-breeding fish just sort of pokes along with a small population year after year.

When they started working on answering this question, the consensus was that this was a difficult problem to solve, there are a lot of different factors at play, after all – but it is basically solvable. This is something you'd give on the final exam at the end of a year of high school algebra.

And when they did this analysis, a scientist named Mitchell Feigenbaum discovered a remarkable thing, something unexpected. (and, as a brief aside, I got a picture of Feigenbaum, and it looks exactly like what your stereotype of a mathematician is: he's got wild hair, he's got a desk just piled high in papers, he's in front of a blackboard filled with equations...) But what Feigenbaum proved about these populations...

What he proved was that the population did *not* always settle down into a single number that was the same every year! Sometimes, they found, the population gets into a steady oscillation between two different sizes. You have 60 fish one year, and 80 the next, then 60, then 80 and so on. It settles into equilibrium, but the equilibrium bounces between two places.

Discovering that the population doesn't settle to a single value in perfect equilibrium was unsettling enough, but they also discovered an even crazier thing!

Sometimes, it turns out, the population *never* settles down in a steady state. Sometimes, it bounces all over the place, apparently at random. It never reaches equilibrium, not one end point, not a two-year cycle, not a ten year cycle – no cycle at all. It just keeps bouncing around forever. Feigenbaum proved that there would never be a predictable end point to this process. In other words, there isn't ever a stable harmony where everything is in perfect balance. Or, if you like, the stable harmony is itself chaos!

Now this was hard to take, because scientists don't like random and unpredictable.

It's a little hard to get your head around all that math (for me anyways) without crazy hair and a messy desk and a blackboard.

Feigenbaum's insight was to prove with mathematical rigor that not only does the fish population not settle down into a regular pattern that you can forecast, no, he argued that this was a fundamental property of complex systems.

Clouds, weather, the way cream swirls into your coffee cup, water goes down the drain, current moves in electric circuits, it's all chaos: orderly, but unpredictable, high sensitive to tiny changes in unpredictable ways.

Do you ever feel like your life is out of control? Like you have no idea what's coming next? Like stuff happens -- maybe frequently, maybe rarely – and you are left wondering what just happened and where it came from?

It's not just you. It's the basic structure of the universe. Complexity and the inability to predict what is coming, to be blindsided, to have life suddenly become otherwise without any way of predicting it. This is not just you. These are a part of the deep mathematical structure of the universe. It happens at all times, in all places, in all scales – in the movement of galaxies, of cream in your cup, of atoms in your body, in your life. To the degree that we expect an orderly, rational, predictable, sequenced set of events, we are out of step with the physical reality of our universe.

To acknowledge it is first to mourn the loss of a neat and orderly world, a world where every action you make has an equal reaction. Where there are clear moral lessons for every life encounter, where there is one story, that, once discovered makes life meaningful, that untangles our knotted lives. To accept the blindsiding fact is to accept the inevitability of loss, of destruction, of death, of old age, of disease, of car accidents and colds, of broken relationships, and unforeseen addictions, and illness that rob you of the ones you love.

There is a funeral we've got to go to for the orderly world where we – or someone at least – is in control of our own destiny.

But on the other side of that funeral is a celebration, and liberation. It's liberation from having to be in control. Liberation from the nerve-wracking, nail-biting need to foresee every possible outcome and hold it all together by force of will. There's a lightness to life, a grace to the person

who dances along the unknown, doing what is within their control and letting the rest go without losing it.

That's something I seek, and it's something I admire deeply in those hospital patients who said: "God has a plan for me." What I heard them say was: "there's a guy in the sky with a Gantt chart for my life." – a project plan for how every moment would unfold. But that's not what they actually said. And regardless of the theology, the patient who told me "God has a plan" was able to do something deeply admirable: to let go of what they couldn't control. They found a way to release the human death-grip on being in control of life and running the show. It may be God's plan guiding their life which makes that possible. It may be the mathematical fact of this universe. But it comes to the same thing.

Two years before she died of Leukemia at the age of 47, the poet Jane Kenyon wrote:

I got out of bed
on two strong legs.
It might have been
otherwise. I ate
cereal, sweet
milk, ripe, flawless
peach. It might
have been otherwise.
I took the dog uphill
to the birch wood.
All morning I did
the work I love.

At noon I lay down
with my mate. It might
have been otherwise.
We ate dinner together
at a table with silver
candlesticks. It might
have been otherwise.
I slept in a bed
in a room with paintings
on the walls, and
planned another day
just like this day.
But one day, I know,
it will be otherwise.

One day, I know, it will be otherwise. Even for Earl.

You already know this. And we probably didn't need all that lengthy math lesson. You know it intuitively. The lesson I take from all this is that we're responsible for the efforts, but not the

result. You do everything in your power to do, honestly, responsibly, but that doesn't guarantee you an outcome. That's a relief, to let go of all that is out of your control is freedom from a terrible burden. Let go and be human. Be limited. Be finite. Be unknowing. Be mystified. Be joyful in love, mourn loss. Work for justice. Do what you can, let the rest go.

And, in conclusion, try to be a good person.