#### Chaos, Complexity & Christianity

# 1. Presentation: the faith of a hydrologist

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### Welcome to Chaos, Complexity & Christianity

An original class from Science to Faith

To reconcile the world in **Jesus Christ**, for only his love is the solution...

## Summary

- It shares the story of my conversion based on science.
- Introduces the theme of the other encounters of the class.

#### An improbable story

(Puente 2020a)

#### My grandparents



Don Julito & Mama Fanny

#### My grandparents



*Don Julito & Mama Fanny Dora*, my mom, their only daughter

### My grandparents





Don Julito & Mama Fanny Dora, my mom, their only daughter Mama Fanny, my best example of faith

## A beautiful wedding





#### lovely bridal bouquets by Mama Fanny

### A little bit about me



#### I was born in *Cartagena*, Colombia

### A little bit about me



#### I was born in *Cartagena*, Colombia I received my *first communion* when I was 8

### A little bit about me



#### I was born in *Cartagena*, Colombia I received my *first communion* when I was 8 but, my family, in general, did not practice their religion...



I entered Universidad de los Andes, in Bogotá, when I was 16



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I entered *Universidad de los Andes*, in Bogotá, when I was 16 I studied *Mathematics* and *Civil Engineering* once at the university, I stopped going to Mass I believed in a creator God but not in one that would care for me personally



I arrived to the famous and demanding institute when I was 24



I arrived to the famous and demanding institute when I was 24 I married my Colombian girlfriend when I was 25



I arrived to the famous and demanding institute when I was 24 I married my Colombian girlfriend when I was 25 I got Masters in *Operations Research* and *Civil Engineering* and my PhD in *Hydrology*, the science of water, when I was 28



I arrived to the famous and demanding institute when I was 24 I married my Colombian girlfriend when I was 25 I got Masters in *Operations Research* and *Civil Engineering* and my PhD in *Hydrology*, the science of water, when I was 28 ...sometimes I would go to Mass at Boston University

#### (Barnsley, 1988)



















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#### fractal Sierpinski (!)

#### Changing the rules (Barnsley, 1988)

$$w_1(x,y) = \left(\frac{x}{2}, x + d_1 \cdot y\right), \ w_2(x,y) = \left(\frac{x}{2} + \frac{1}{2}, 1 - x + d_2 \cdot y\right)$$

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simple rules from the *plane* to the *plane* the x component is *decoupled* from y the y component is a *linear* combination of x and y  $d_1$  and  $d_2$  are parameters with magnitudes less than 1

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simple rules from the *plane* to the *plane* the x component is *decoupled* from y the y component is a *linear* combination of x and y  $d_1$  and  $d_2$  are **parameters** with **magnitudes** less than 1 the rules pass by {(0,0), (0.5,1) (1,0)}  $x \in [0,1]$  $w_1$  operates to the **left** and  $w_2$  to the **right** 






















fractal *mountain* 



#### A matter of signs



case + - is the *mountain* 

case - - alternates down and up

case + + always goes up and yields a cloud (!)

#### A matter of dimension

$$w_1(x,y) = \left(\frac{x}{2}, x + d_1 \cdot y\right), \ w_2(x,y) = \left(\frac{x}{2} + \frac{1}{2}, 1 - x + d_2 \cdot y\right)$$



as z increases, the "wires" become infinite and fill more space

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as z increases, the "wires" become infinite and fill more space

as z tends to1, their fractal dimensions tend to 2



different textures over the same wire (Elton's theorem)



different **textures** over the same *wire* (*Elton's theorem*) a relevant idea: what is seen from the two axes?



different textures over the same wire (Elton's theorem)
a relevant idea: what is seen from the two axes?
I knew what happened over x, but perhaps Hydrology from y?

### The projection over **x**



# **Turbulence and multifractals**

(Meneveau and Sreenivasan, 1987)



a cascade of eddies generating intermittent violence

## **Turbulence and multifractals**



a cascade of eddies generating intermittent violence

#### multiple **fragmentation** yielding **thorns** and **dust**

# **Turbulence and multifractals**

(Puente, 2006)



a cascade of eddies generating intermittent violence
multiple fragmentation yielding thorns and dust
a dissipative process, also in economic inequalities...

## The projection over y





## Plato was right!



*dx* "*illuminates*" the wire and *dy* is its "*shadow*"

## Plato was right!



*dx* "*illuminates*" the wire and *dy* is its "*shadow*"

dy is a transformation of turbulence

## **Plato was right!**



dx "illuminates" the wire and dy is its "shadow"
dy is a transformation of turbulence
the projection dy appears random, but it is not (!)

## Shadows and no more!



varying the parameters of the construction (and generalizations) produces shapes and statistics similar to natural data (!)

# A useful idea in hydrology

(Puente and Obregón, 1996)



a model (left) of *rainfall* data in Boston (right)

# A useful idea in hydrology



a model (left) of *rainfall* data in Boston (right)

useful for stream flows and economic data, but the limit is better...



Case + –,  $z \rightarrow 1$ 



dy is a **Gaussian bell curve** for any non-discrete dx (!)

Case + –,  $z \rightarrow 1$ 



dy is a **Gaussian bell curve** for **any non-discrete** dx (!) a surprising **BRIDGE** from **dissipation** to **conduction** (!)

Case + –,  $z \rightarrow 1$ 



dy is a Gaussian bell curve for any non-discrete dx (!)
a surprising BRIDGE from dissipation to conduction (!)
case - - produces oscillations between two bells





Case + +,  $z \rightarrow 1$ 



a *luminous* and *singular* bell *concentrated* at infinity (!)

Case + +,  $z \rightarrow 1$ 



a *luminous* and *singular* bell *concentrated* at infinity (!)

the most **positive wire** filters **almost any disorder (!)** 

Case + +,  $z \rightarrow 1$ 



a *luminous* and *singular* bell *concentrated* at infinity (!)

the most **positive wire** filters **almost any disorder** (!)

What is the transformation? Is it LOVE? I shared with friends...

#### **True wisdom at MIT**



Álvaro and Elizabeth, my spiritual godfathers, with David

### **True wisdom at MIT**





*Álvaro* and *Elizabeth*, my spiritual godfathers, with *David* it all points to God, have you had an experience with Him? it is key to enter the *Kingdom of God*, *John 3* 



#### my mom had died tragically when I was 20 years old



my mom had died **tragically** when I was 20 years old my heart was filled with **pain** and I had "nothing to lose"



my mom had died **tragically** when I was 20 years old my heart was filled with **pain** and I had "nothing to lose" *forgiving and asking for forgiveness* I had a **mystical** experience



my mom had died **tragically** when I was 20 years old my heart was filled with **pain** and I had "nothing to lose" *forgiving and asking for forgiveness* I had a **mystical** experience the + + diagram became personal: I was born again!





my mom had died **tragically** when I was 20 years old my heart was filled with **pain** and I had "nothing to lose" *forgiving and asking for forgiveness* I had a **mystical** experience the + + diagram became personal: I was born again! what a marvelous event! was it?


#### I couldn't sleep and ended up in a hospital for a month



I couldn't sleep and ended up in a hospital for a month

after 8 years of marriage, my wife left and it all ended in an annulment



I couldn't sleep and ended up in a hospital for a month after 8 years of marriage, my wife left and it all ended in an annulment the university gave me a leave of absence and I went to Colombia



I couldn't sleep and ended up in a hospital for a month after 8 years of marriage, my wife left and it all ended in an annulment the university gave me a leave of absence and I went to Colombia there I met my "second" wife and the annulment repeated





I couldn't sleep and ended up in a hospital for a month after 8 years of marriage, my wife left and it all ended in an annulment the university gave me a leave of absence and I went to Colombia there I met my "second" wife and the annulment repeated ...but I read the Bible truly conscious that God was present (!)

## In due time, growing the faith...



as promised, *reconciliation* with God for *all the family*: my dad *Carlos*, stepmother *Connie* and sisters *Patricia* and *Xiomara* 

## In due time, growing the faith...





as promised, *reconciliation* with **God** for *all the family*: my dad *Carlos*, stepmother *Connie* and sisters *Patricia* and *Xiomara* hydrologist *John the Baptist* became my hero... (!)

## To be born again

(Puente, 2018)

To be born again is very lovely, is to find the sun within yourself.

To be born again is so glorious, that all appears o so very blessed.

To be born again is truly amazing, is to find inside whole immensity. To be born again is so grandiose, that dreams become real mighty bell.

We forgive and better love everyone, and at once we truly make an effort, and heads on towards the light we go, and the eternal triune lights up in our heart. To be born again is very lovely, is finding water to satiate your thirst.

To be born again is so glorious, that removes gripes sending us to pray.

To be born again is truly amazing, is to hear the voice brio for your faith. To be born again is so grandiose, for now you know God loves very well.

We forgive and better love everyone, and at once we truly make an effort, and heads on towards the light we go, and the eternal triune lights up in our heart...



(July 2000/July 2023)

## My blessings from on high



### Marta, my first wife, Cristina and Mariana (!)

## My blessings from on high



*Marta,* my first wife, *Cristina* and *Mariana* (!) like Job, but not equally, a restored family

# My blessings from on high





Marta, my first wife, Cristina and Mariana (!) like Job, but not equally, a restored family the triune God is the source of true riches (!)

# My pearls in science



the first two also in Spanish, the second in Italian and Farsi

# My pearls in science



the first two also in Spanish, the second in Italian and Farsi seminar class Chaos, Complexity & Christianity from 2001 to 2021

# My pearls in science



the first two also in Spanish, the second in Italian and Farsi seminar class **Chaos, Complexity & Christianity** from 2001 to 2021 blog *https://campanitasdefe.com* 

(Puente, 2017, 2020b)

- 1. Presentation: the faith of a hydrologist
- 2. An introduction to fractals and complexity
- 3. Jesus, the way, truth, life, and hypotenuse Y = X
- 4. Turbulence and the Bible
- 5. The deterministic nature of chaos
- 6. Y = X: the narrow gate and the only way to the Father
- 7. Urgent biblical symbols in fig trees of science
- 8. A geometric model of the Most Holy Trinity
- 9. The central plea from the bell at infinity
- 10. The exponential surprise and the laws of no power
- 11. The ever vibrant splendor of peace
- 12. A new song: Shanti Setú or Puente de Paz

### 2. An introduction to fractals and complexity

Revises the different kinds of numbers that exist, introduces examples of fractal or fractured sets, including Cantor dust and the Koch curve, contrasts order and chaos using the logistic map, and emphasizes the existence of "power-laws" related to natural violence.

#### 3. Jesus, the way, truth, life, and hypotenuse Y = X

Explains, based on generic models of division and turbulence, that Jesus Christ is certainly the way, the truth and the life; and also the straight hypotenuse with equation Y = X that takes us to the Origin, God the Father (Jn 14:6). Argues that living in a loving and saintly manner, striving for uniformity and away from the dust and thorns of division, is our best option.

#### 4. Turbulence and the Bible

Illustrates that Sacred Scripture contrasts calmness with turbulence in order to define our options. Explains how, using such a symbolism, God invites us to conversion, rectitude, and the unity of love. Reminds us of actions we may take in order to experience true balance in our lives.

#### 5. The deterministic nature of chaos

Studies the iterating dynamics of the "logistic map" to explain how it gives rise to a celebrated scientific diagram, the Feigenbaum tree (the fig tree in German), which contains repetitive behaviors and also others that, by being dusty and lacking repetition, properly define the concept of chaos. Introduces the Hénon and Lorenz attractors to explain how common is the famous "butterfly effect".

#### 6. Y = X: the narrow gate and the only way to the Father

Shows how the Feigenbaum tree provides suitable images that allow us to visualize the final destinies of mankind, including an improbable, truthful and purged escape from the most ardent and infernal chaos. Argues that coming down the fig tree, by its implied conversion and abandonment to goodness under the straight line Y = X, that is Jesus, is essential for us to enter the "Kingdom of Heaven".

### 7. Urgent biblical symbols in fig trees of science

Explains how the Feigenbaum tree yields auspicious symbols that allow representing diverse biblical passages, including those related to fig trees, like the fall of Adam and Eve ending covered with fig leaves; the cursing of a fig tree by Jesus when he was returning to Jerusalem before giving his life for us; and the parable of the fig tree associated with his return. Exhibits the full protection of the "elect" who make up the "Body of Christ" in "The Church".

### 8. A geometric model of the Most Holy Trinity

Employing a fractal function shaped as angel wings and containing infinite unity, exposes a geometric model of the Holy Spirit, and, based on it and via projections, introduces a united representation of the tree members of the Most Holy Trinity, in which the Son is represented by uniformity and the Father by a bell curve concentrated at infinity. Shows how such a construction is useful to praise Jesus Christ and to consider diverse teachings of faith that exalt the greatness of the Most Holy Trinity.

#### 9. The central plea from the bell at infinity

Illustrating important biblical events as transitions from disorder or chaos into order, reminds us of sublime love in the Most Holy Trinity, which ought to be accepted in plenitude. Shows that only in the abandonment to the positive cross, satisfying a vital limit theorem day by day, is found the peace and joy that takes us to God the Father in the bell curve concentrated at infinity, and based, in a particular symphonic way, in the infinite unity of the Holy Spirit.

### **10.** The exponential surprise and the laws of no power

Explains how the famous passage of the Vine and the branches (Jn 15:1-10) gives rise to unforeseen exponential representations of the Holy Spirit and the always relevant Eucharistic Doxology of Holy Mass. Exhibits "power-laws" in natural violence and in the one induced by mankind and calls us to avoid such laws and strive instead for truthful friendships and sanctity.

#### **11.** The ever vibrant splendor of peace

Summarizes the message of the class in the imperious need for conversion and love and emphasizes the need to rely on the power of the Holy Spirit. Remembering some signals in these lessons, and others based on the alpha and the Omega seen in the sky and additional symbols in the Shroud of Turin, exhorts us to be attentive and prepared for the return of Jesus Christ, repeating with faith "Come, Lord Jesus".

#### 12. A new song: Shanti Setú or Puente de Paz

Reiterates the arguments in these lessons employing a collection of songs aimed at singing to the Lord a new song.

...Well, now you know what the class is about.

Next time we shall talk about fractals and other elements that define complexity.

Until next time...

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