**Chaos, Complexity & Christianity**

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

Carlos E. Puente

*University of California, Davis*

# Summary

- *Introduces simple multiplicative cascades that break equilibrium into fractal dust.*

- *Exhibits the "devil's staircases" and their universal properties.*

- *Explains how turbulence happens in the air according to a generic cascade that leads to dissipation.*

- *Shows how the cascades reflect the ways of our division, including the political systems in the world.*

- *Relates Jesus, symbolized by a straight hypotenuse with equation $Y = X$, with the only solution that allows finding true peace.*
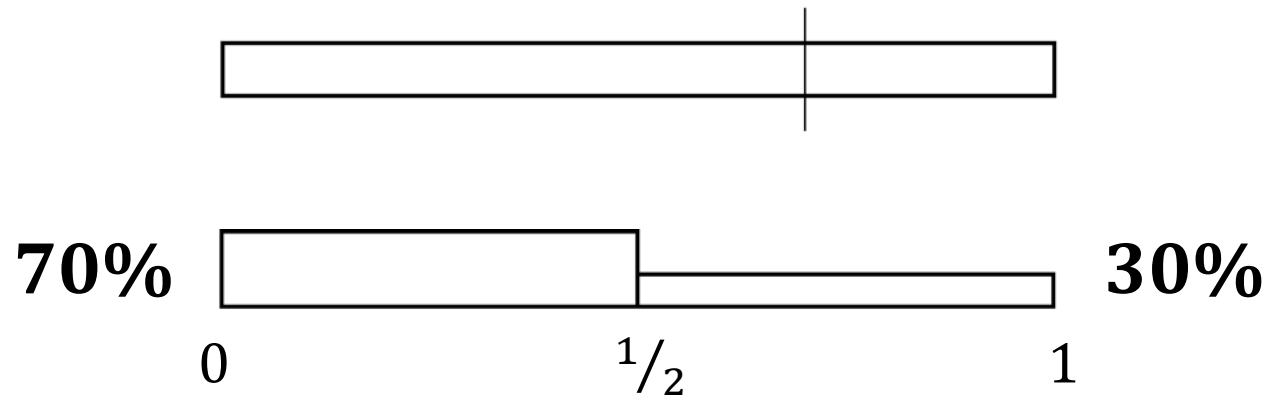
# A reminder

# The Pythagorean theorem
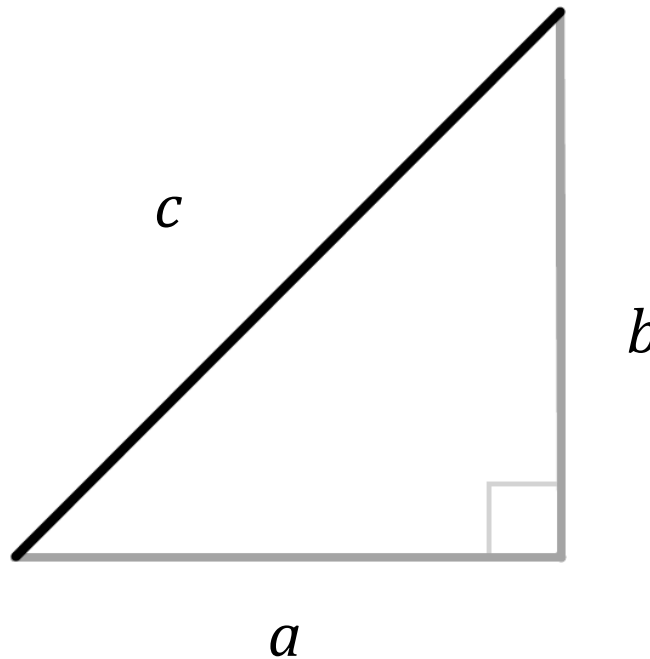


$$a^2 + b^2 = c^2$$

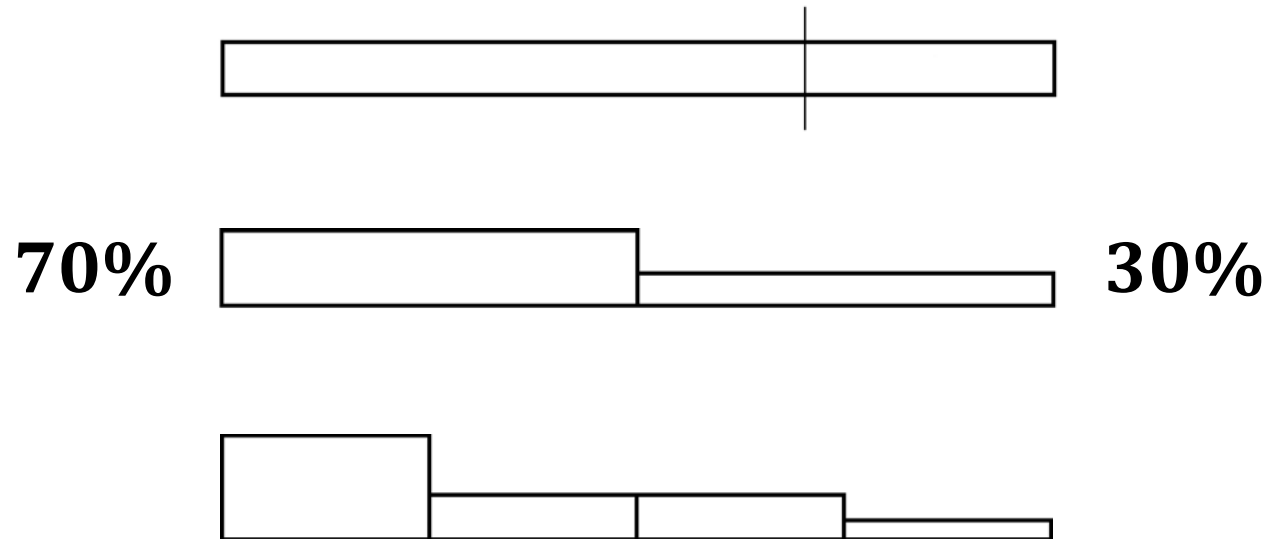$$a = b = 1 \Rightarrow c = \sqrt{2} \approx 1.4142 \dots$$

# Games of kids

*(Puente, 2011a,b, 2018a,b,c, 2020)*
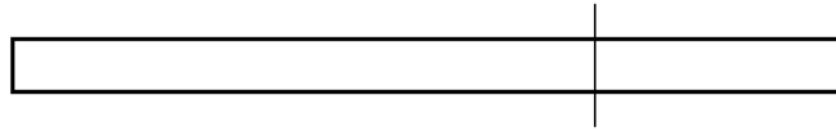
# A game of kids

**70%**                                      **30%**

0                             $\frac{1}{2}$                          1

# A game of kids

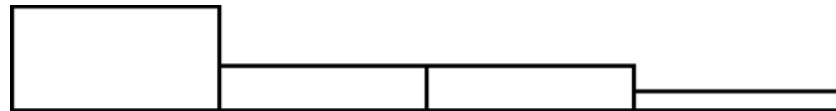70%                                                      30%
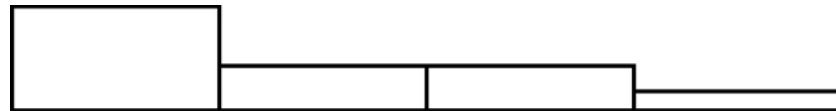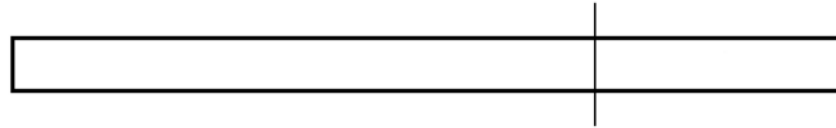
# A game of kids



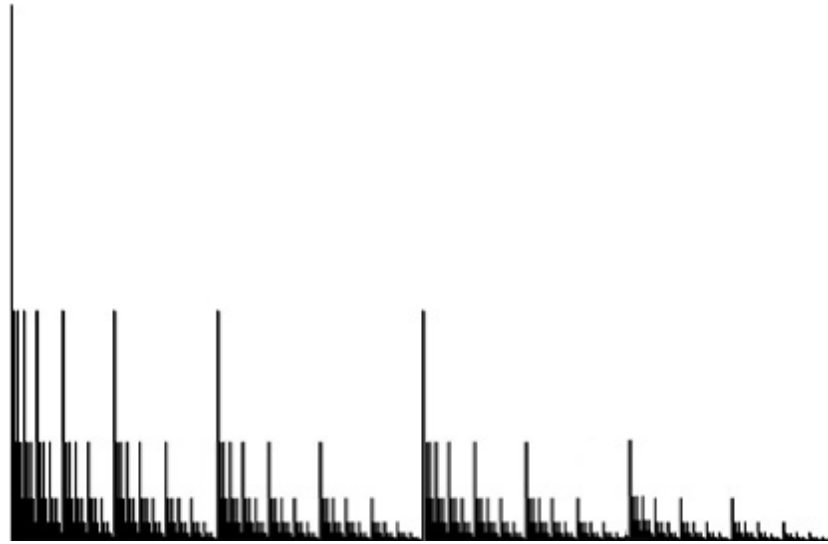70%                                          30%

$h = (0.7 \cdot 2)^3$

⋮

# A game of kids



$p$     $q$

$(p+q)^3$

$$
\begin{array}{ccccccc}
 & & & 1 & & & \\
 & & 1 & & 1 & & \\
 & 1 & & 2 & & 1 & \\
1 & & 3 & & 3 & & 1
\end{array}
$$

⋮
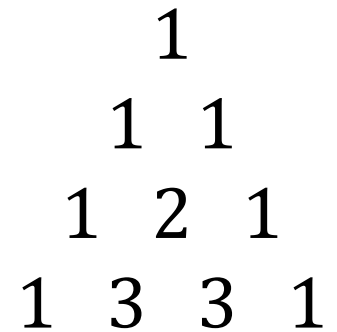
a **multiplicative cascade**

# After twelve levels



$h = 56.69$

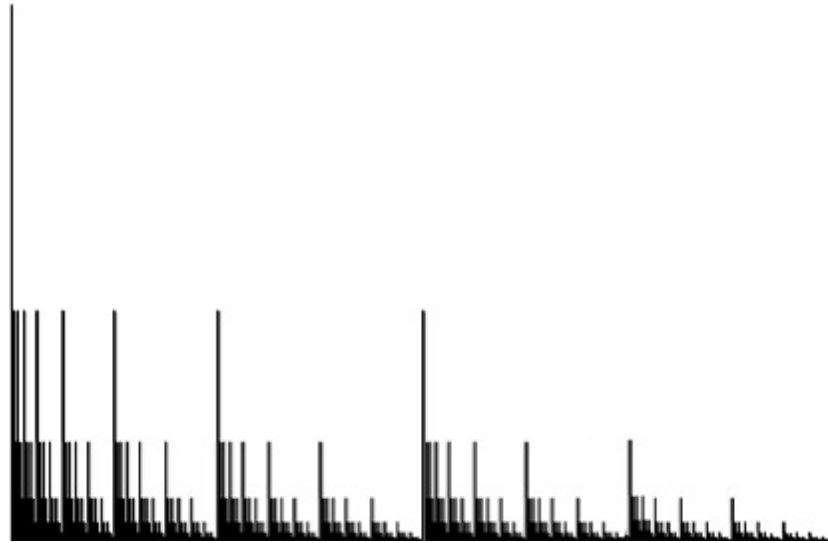$p = 0.7$

# After twelve levels
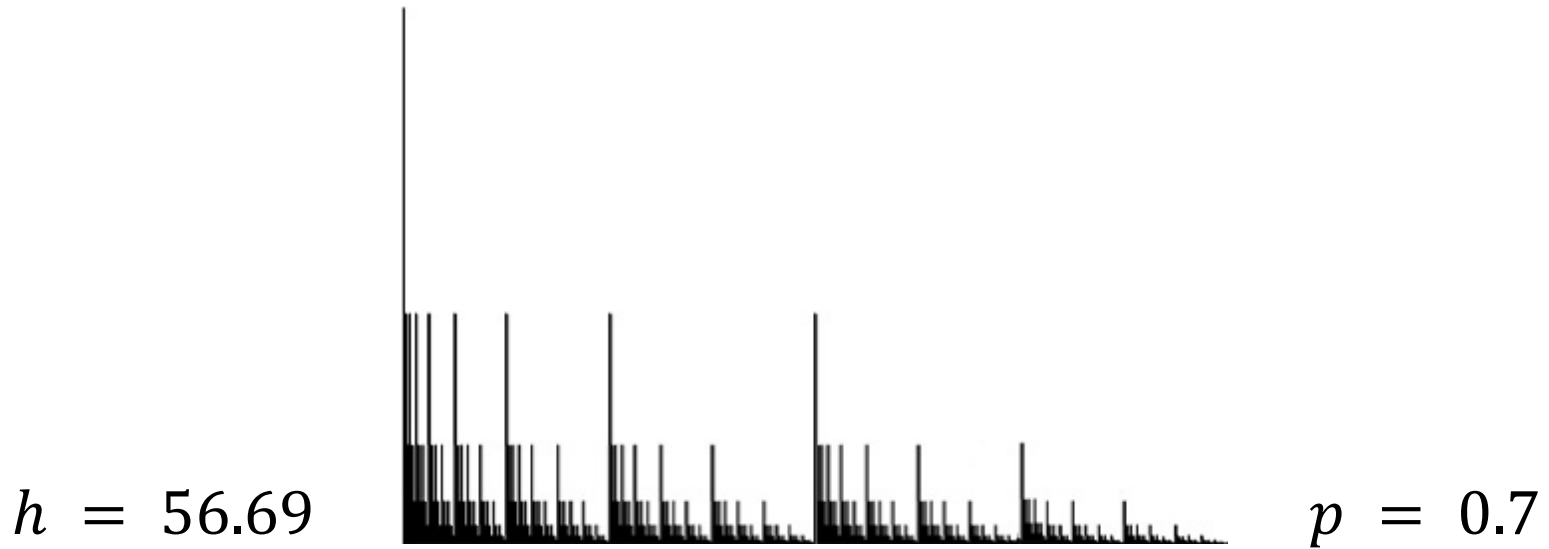
$h \ = \ 56.69$  $p \ = \ 0.7$

layers of intertwined **thorns**
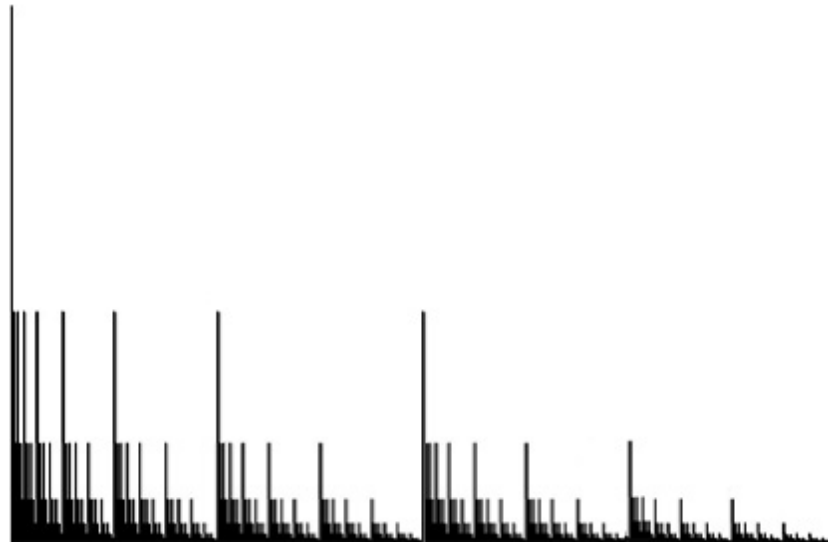
# After twelve levels



$h \; = \; 56.69$

$p \; = \; 0.7$

layers of intertwined **thorns**

the support of the spikes is **dust**

# After twelve levels



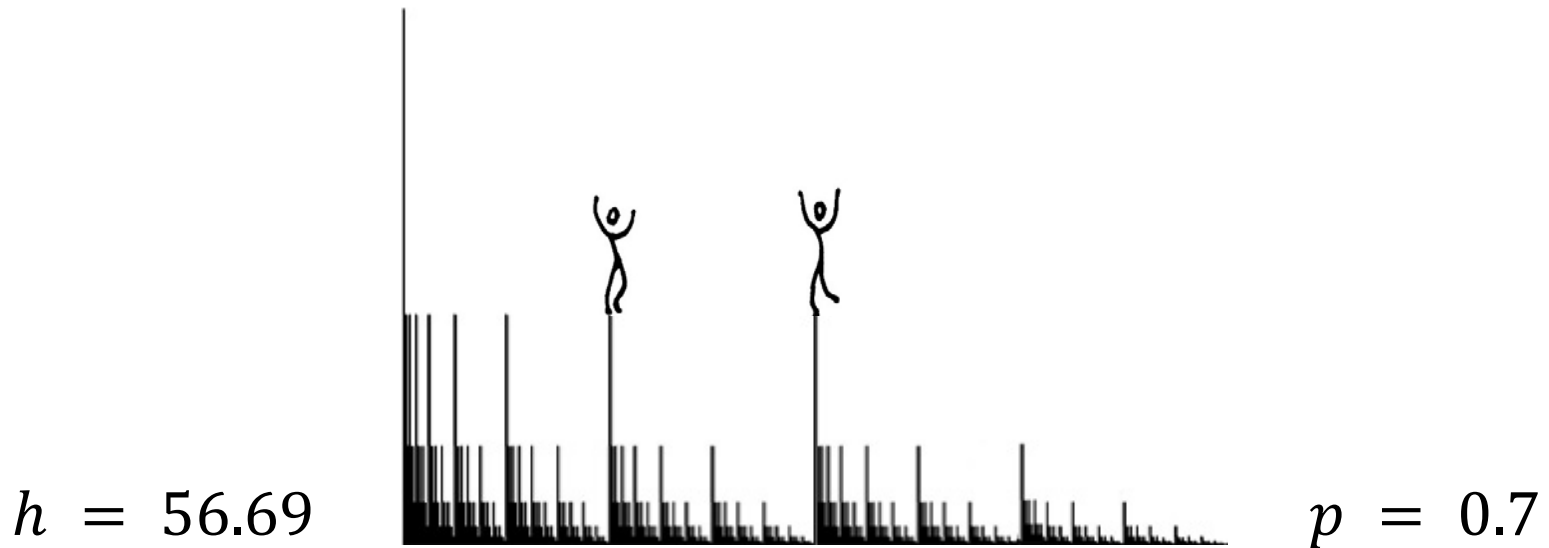$h = 56.69$

$p = 0.7$

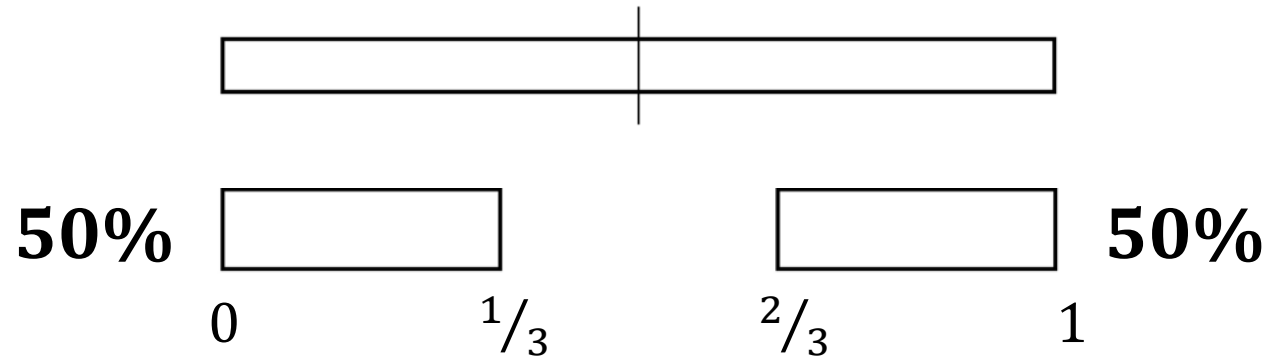layers of intertwined **thorns**

the support of the spikes is **dust**

a ***multi-fractal*** "density"

# After twelve levels



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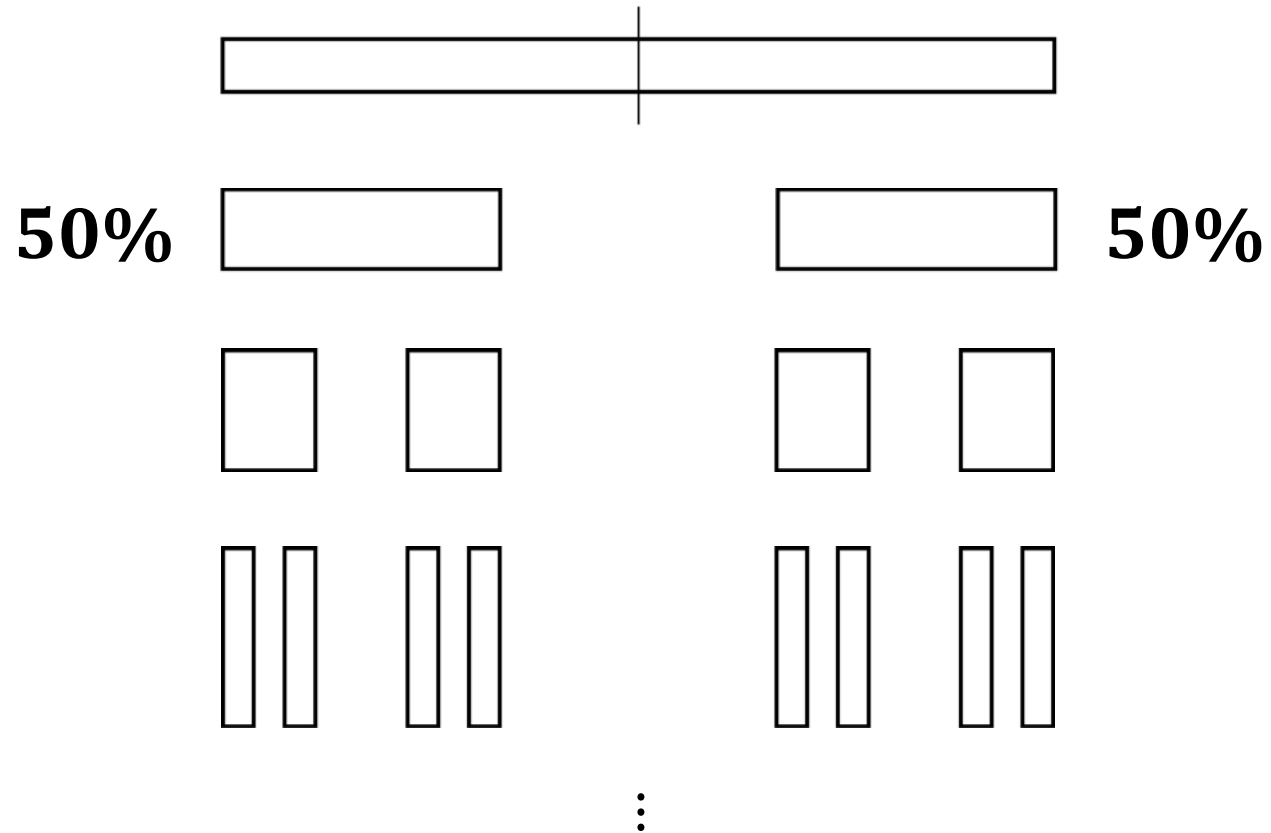layers of intertwined **thorns**

the support of the spikes is **dust**

a ***multi-fractal*** "density"

***difficult to walk!*** **(!)**

# Another game of kids

50%    0    1/3    2/3    1    50%

# Another game of kids

50%                                                50%

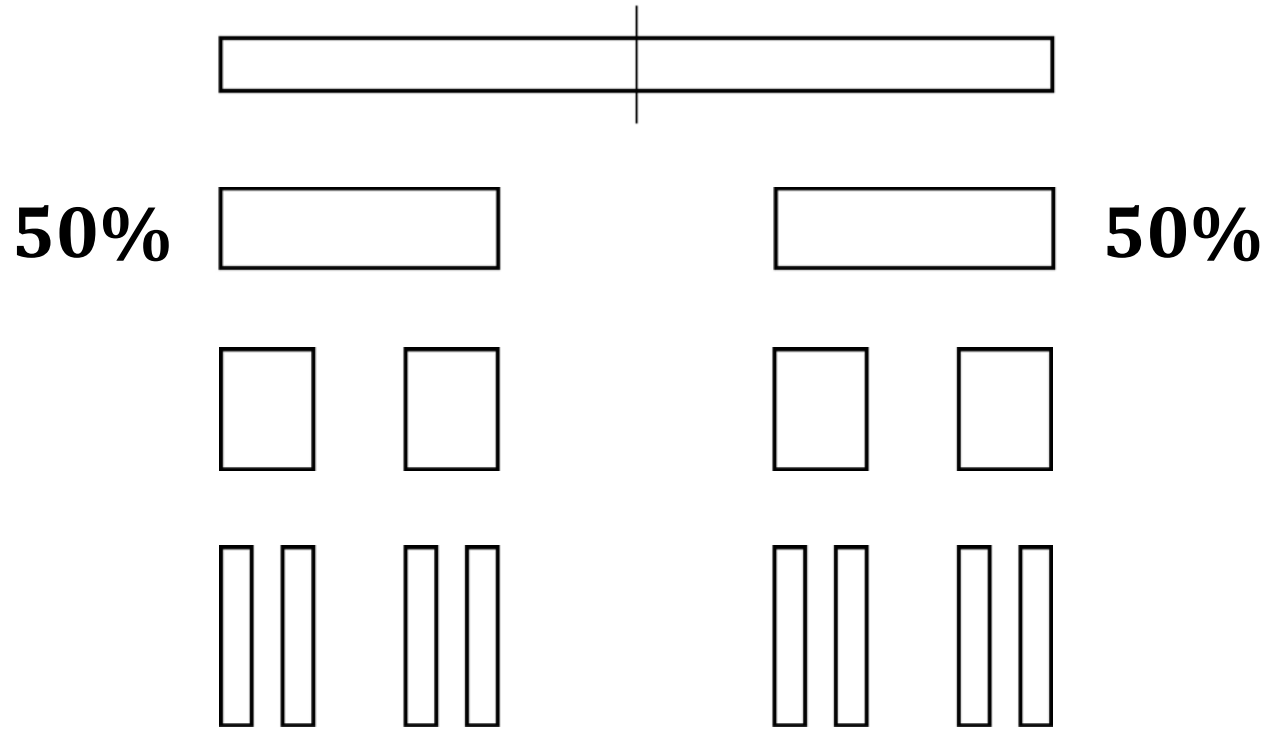# Another game of kids



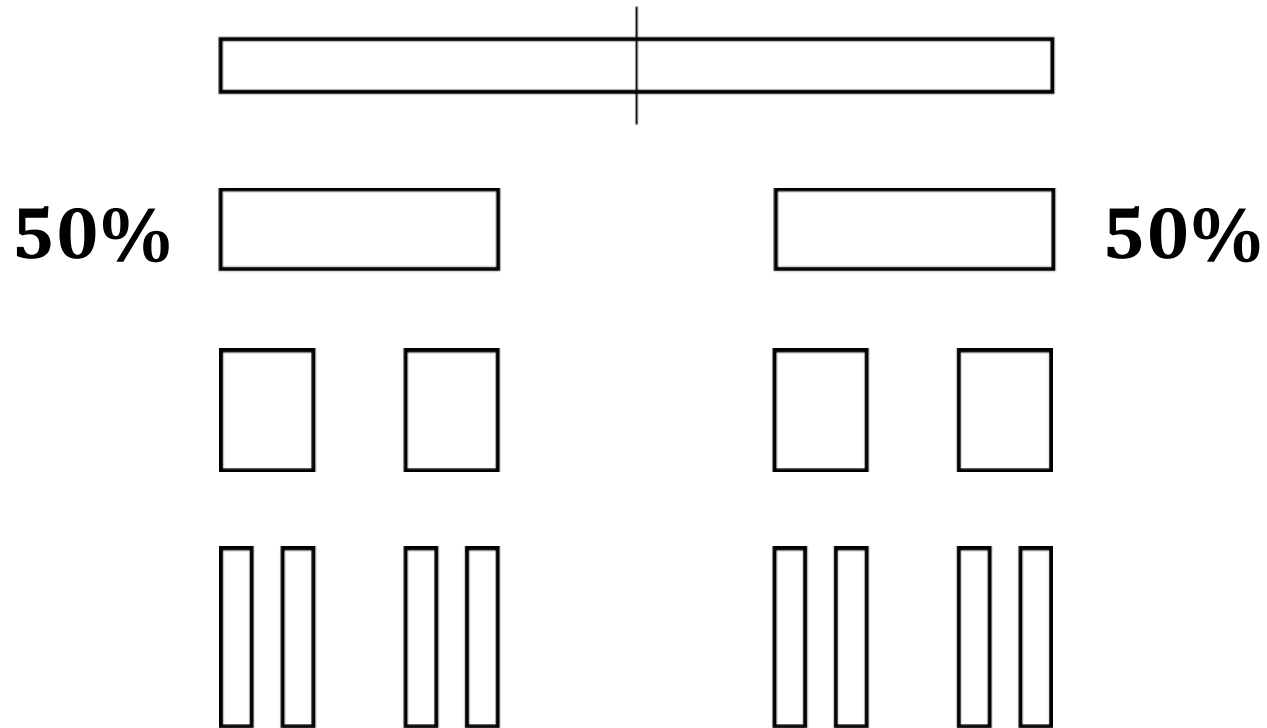50%                                                    50%

cascade yields equal thorns over dust

# Another game of kids
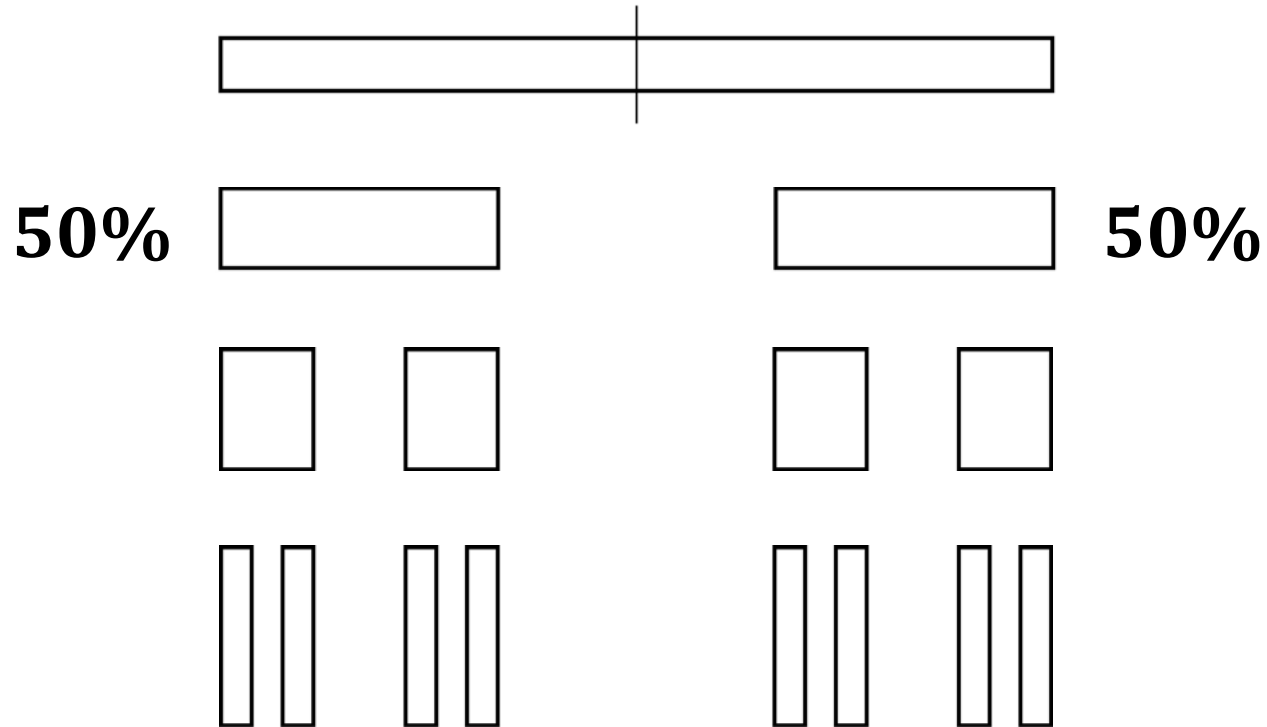


50%                50%

**cascade** yields equal **thorns** over **dust**

varying the *hole* gives the layers of the first game

# Another game of kids



50%          50%

cascade yields equal **thorns** over **dust**

varying the *hole* gives the layers of the first game

*…the two games are intimately **related***

# Where is the modeling clay?
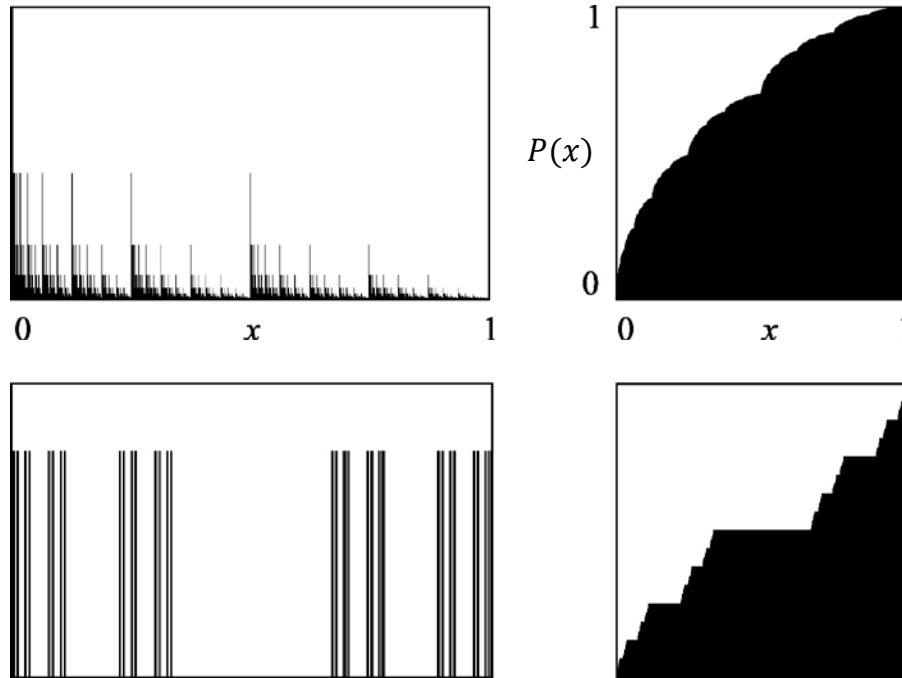


$P(x)$ is the clay from $0$ to $x$

# Where is the modeling clay?
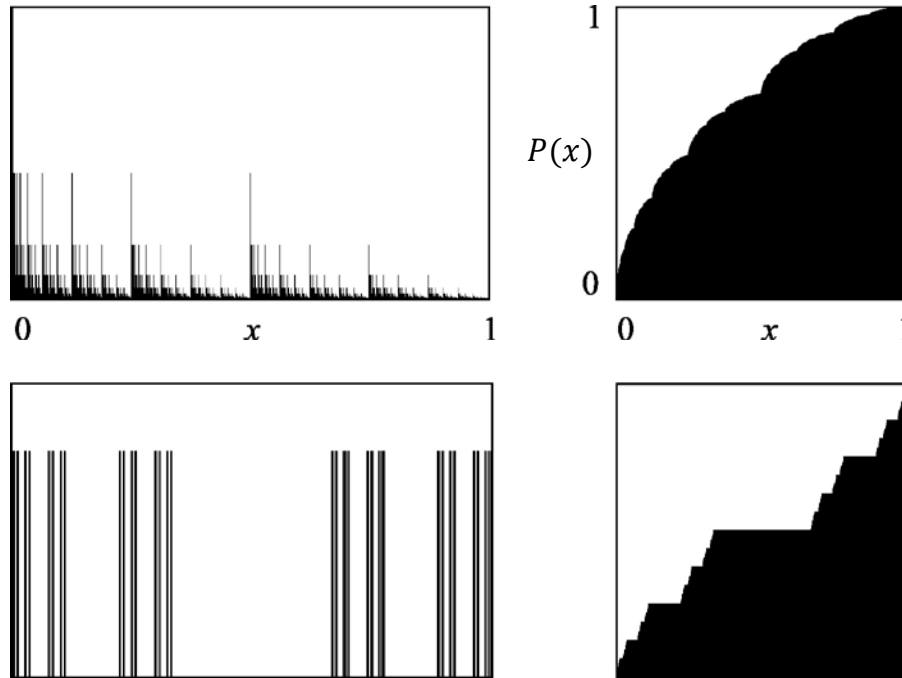


...following the dynamics:

*notches* above: $P(1/2) = 0.7, \ P(1/4) = 0.49$, etc.

*plateaus* below: $P(1/3) = P(2/3) = 0.5$, etc.

# Where is the modeling clay?
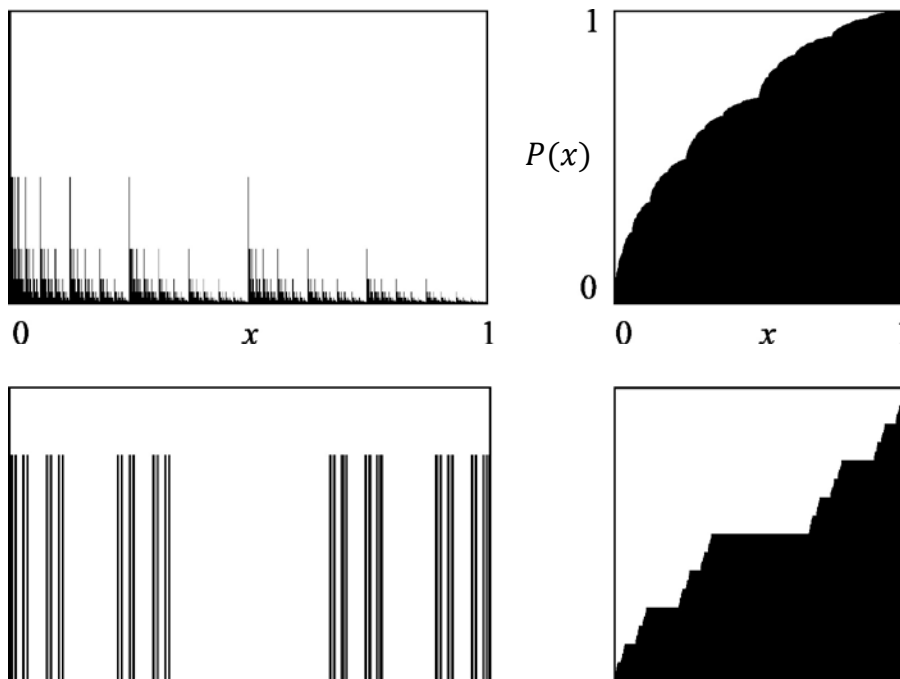


locally flat sets and *lacking tangents*

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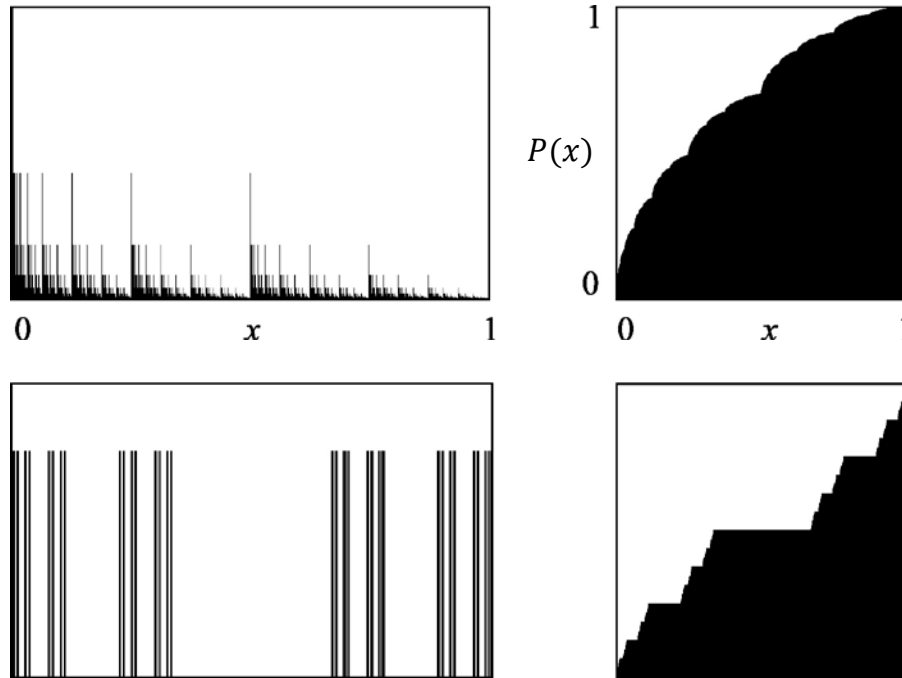


locally flat sets and *lacking tangents*

$$d\{(0,0),(1,1)\} = 2, \text{if } p \neq 1/2 \,, \ h \neq 0$$

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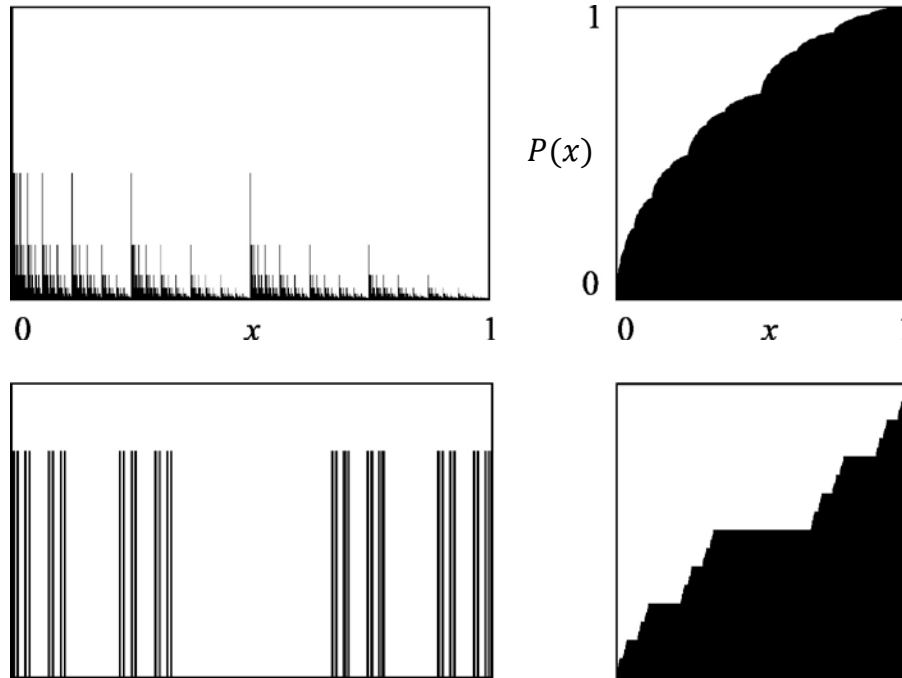


locally flat sets and *lacking tangents*

$d\{(0,0),(1,1)\} = 2$, if $p \neq 1/2$, $h \neq 0$

$d = 2$, combining the games and adding chance **(!)**

# A veritable deception
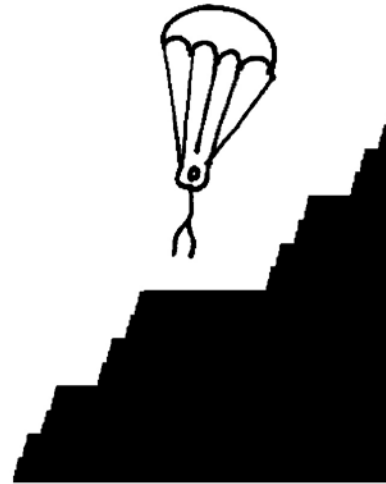
# A veritable deception
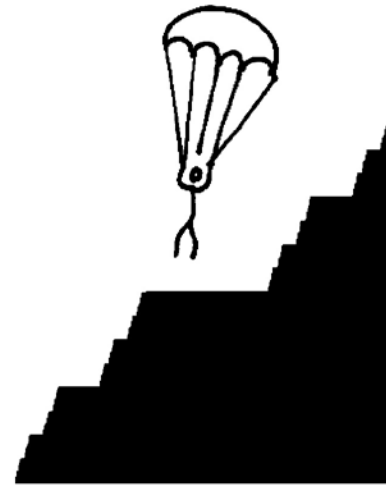
# A veritable deception
*(Cantor, 1883)*
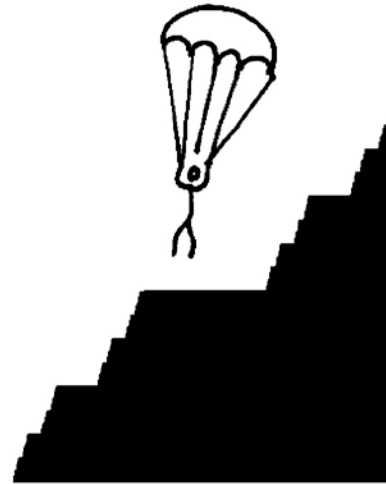
a **devil's staircase**...

# The power of the air

# Fully developed turbulence

*(Richardson, 1922)*

**eddies**
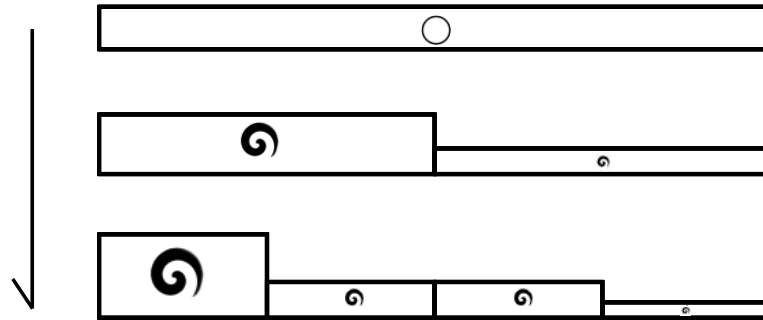
**Reynolds**:

$$Re = \frac{v \cdot L}{\nu}$$

# Fully developed turbulence
*(Meneveau and Sreenivasan, 1987)*



**eddies**
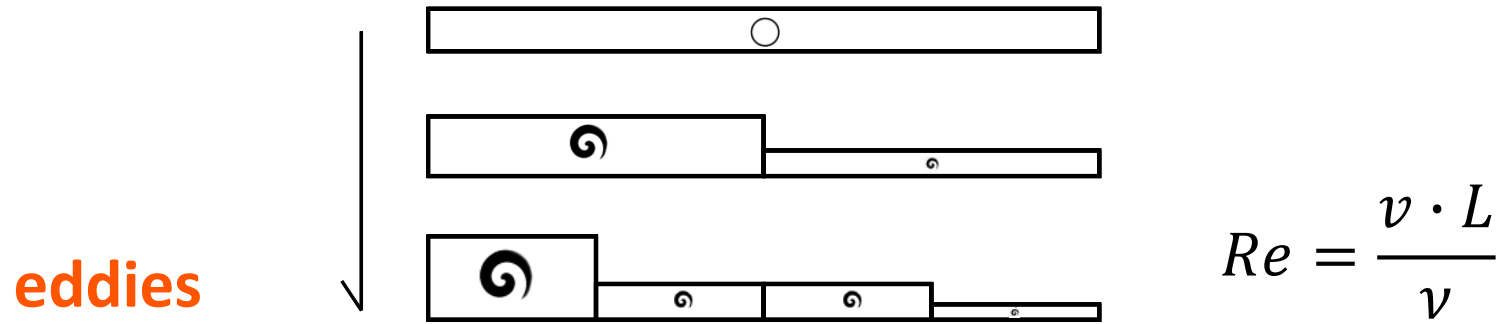
$$Re = \frac{v \cdot L}{\nu}$$

*layers* in 1D turbulence as in the first cascade

# Fully developed turbulence
## *(Sreenivasan, 1991)*
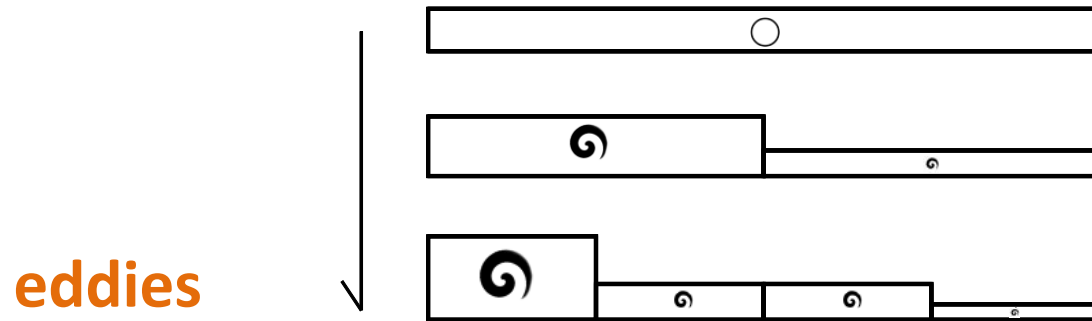
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*layers* in 1D turbulence as in the first cascade

**dissipation**: *atmospheric*, *boundary layer*, *wake of a cylinder*...

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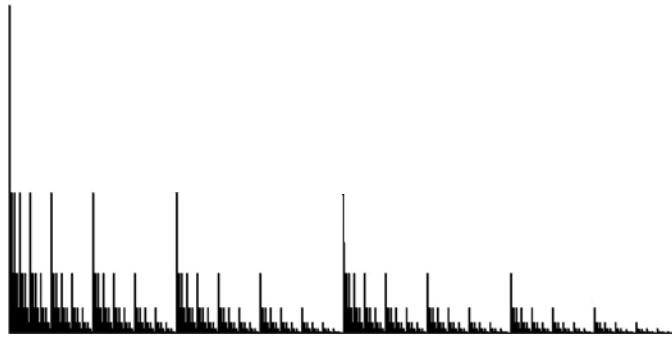


*layers* in 1D turbulence as in the first cascade

**dissipation**: *atmospheric, boundary layer, wake of a cylinder…*

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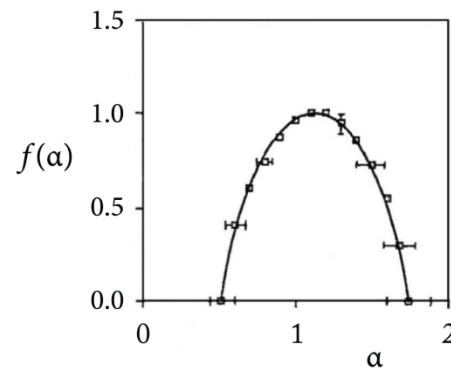


**universal**

# Our own turbulence

*(Puente, 2012, 2014, 2018a,b,c, 2020)*

# Our turbulent times
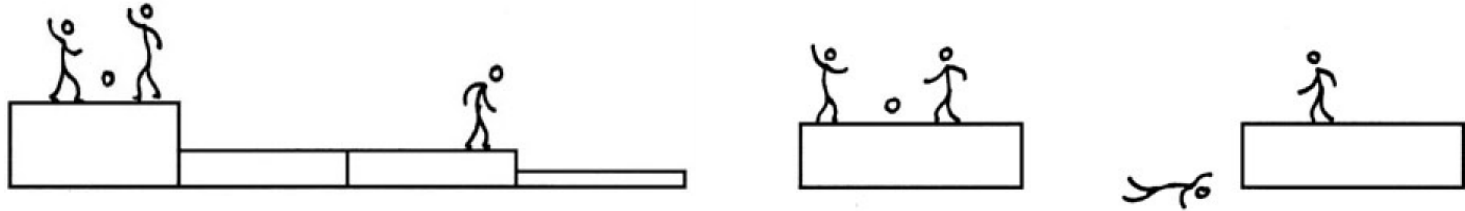
# Our turbulent times



*inequalities*

*competition*

*cynicism*

*discrimination*

*forced equality*

*hatred*

# Our turbulent times
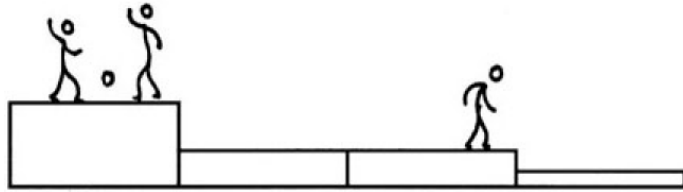


*inequalities*

*competition*

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*hatred*

**selfish** postures and actions that induce **violence**

# Our turbulent times



*inequalities*

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**selfish** postures and actions that induce **violence**

**2/3 = 0.666...** of the world in ***poverty***: movement from **+** to **–**

# Our turbulent times
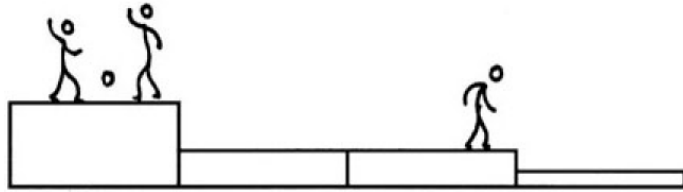
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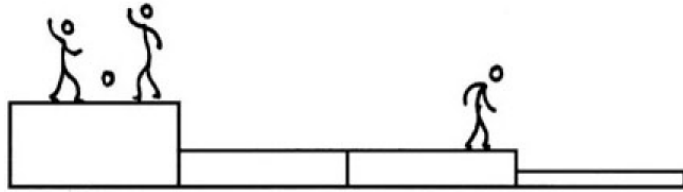
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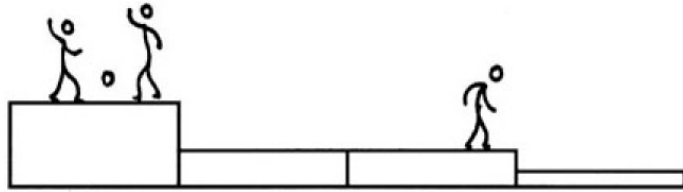
**2/3 = 0.666…** of the world in **poverty**: movement from **+** to **−**

2.200 kids **die** daily for lack of **water**

it applies at various **scales**: within us, our relations, nations… **(!)**

# An optimal system?



$p = 0.7$

$n = 20$
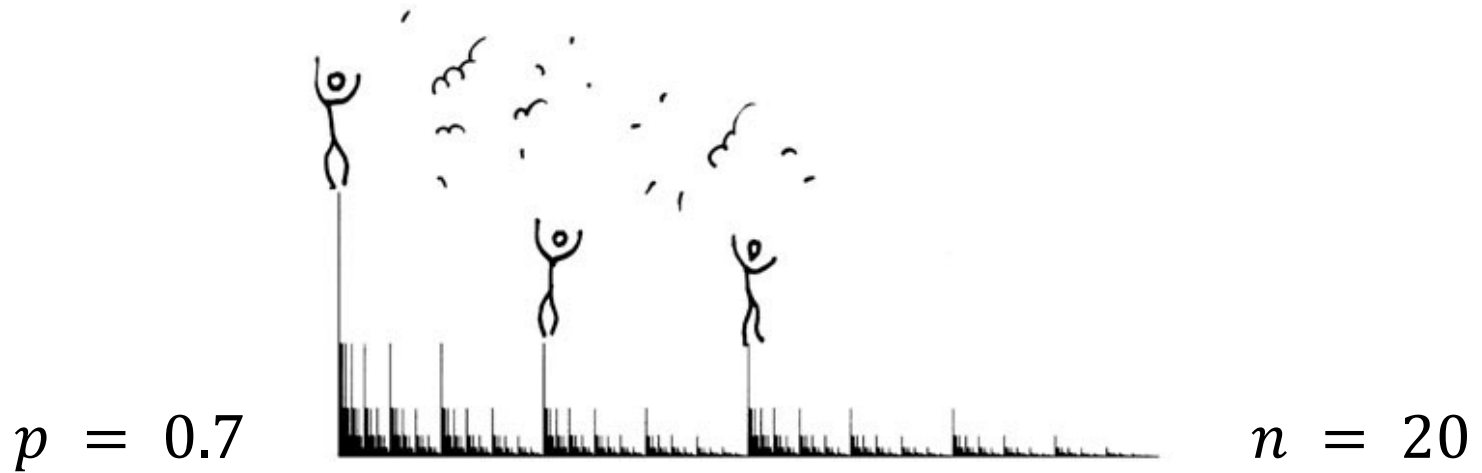
# An optimal system?
*(Puente, 2006)*



$p = 0.7$            $n = 20$
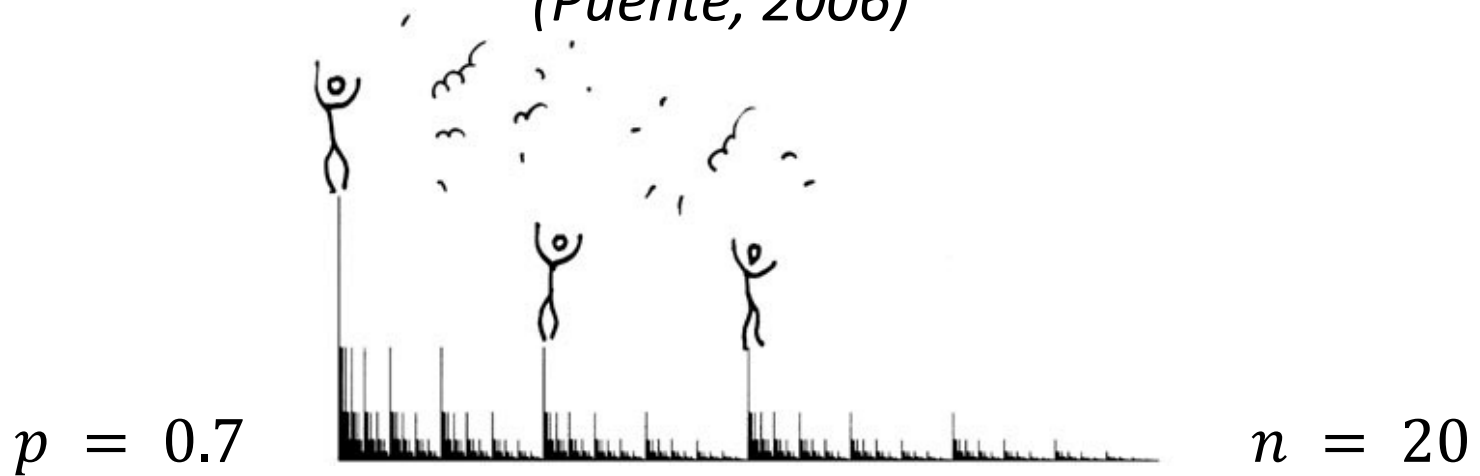
5, 10, 20 and 40% of the largest ***thorns have***

57, 70, 84 and 95% of the mass

# An optimal system?
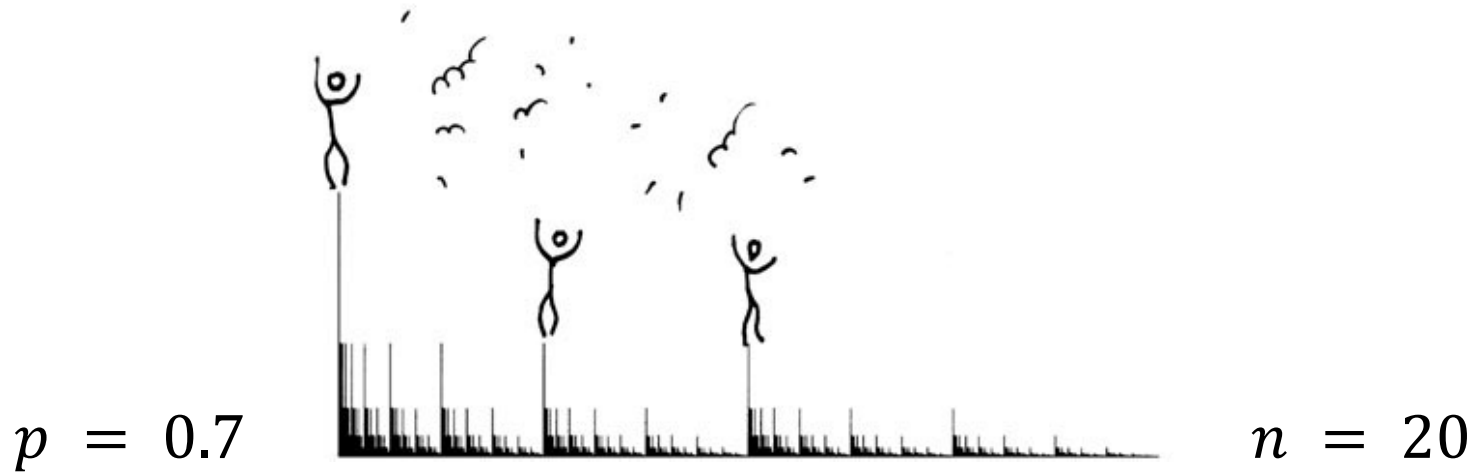


$p = 0.7$                                                  $n = 20$

5, 10, 20 and 40% of the largest *thorns have*

57, 70, 84 and 95% of the mass

close to **United States** @ 1998: 59, 71, 84 and 95%  **(!)**

# An optimal system?
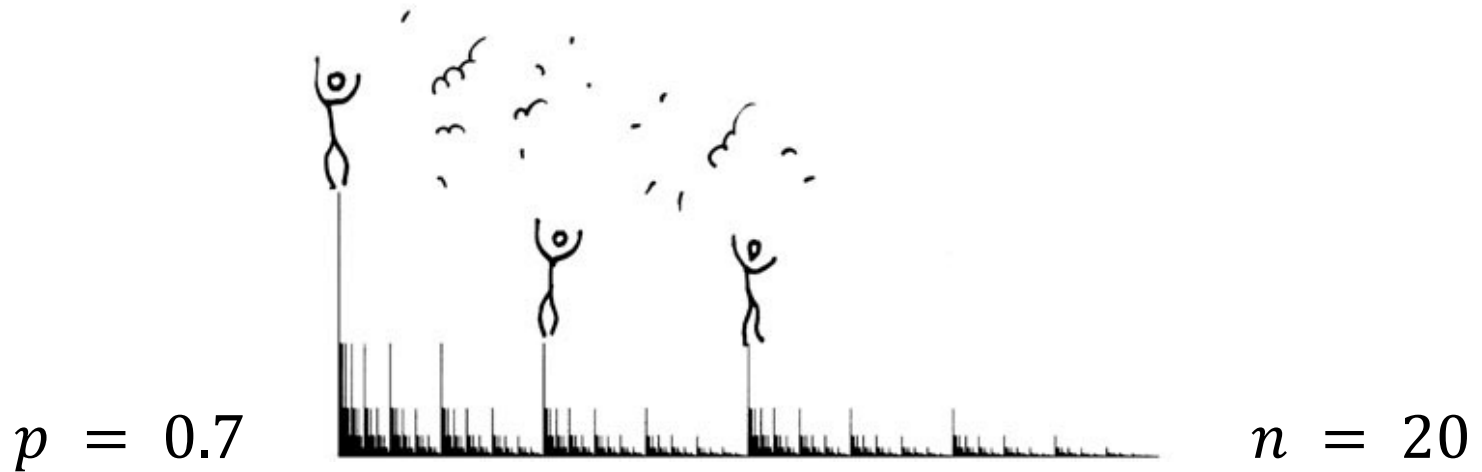
$p\ =\ 0.7$  $n\ =\ 20$

5, 10, 20 and 40% of the largest *thorns have*

57, 70, 84 and 95% of the mass

close to **United States** @ 1998: 59, 71, 84 and 95% (!)

**Warning**: devil's staircases take us to ***bite the dust***

and this applies not only to *material* things…

# The code for success

*(Puente, 2011a,b, 2018a,b,c, 2020)*

# The code for success

run the cascades *in reverse* to **repair** **the breach**

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*live at low Reynolds numbers* to avoid **violence**

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*fill the valleys and cut the mountains* to restore **unity**

# The code for success

run the cascades *in reverse* to **repair the breach**

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RECONCILIATION: **–** a **+**
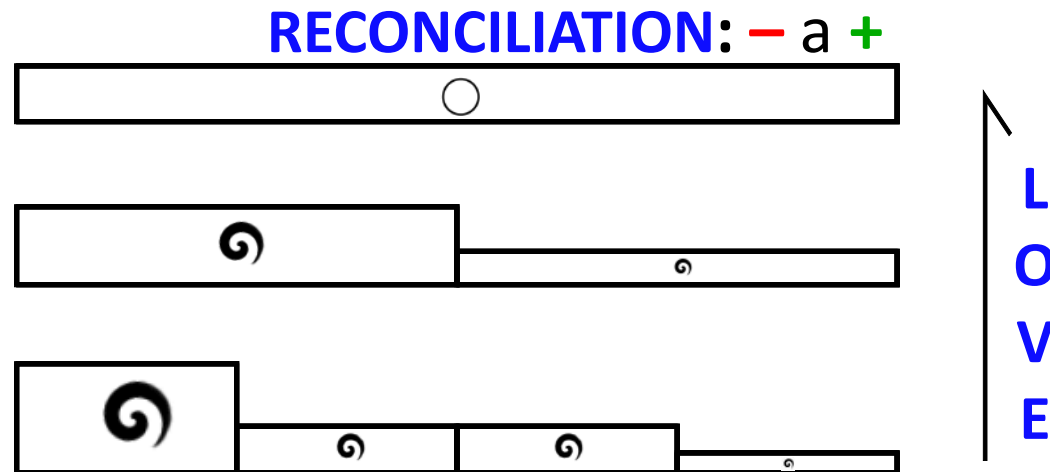
$$1 = 0.999…$$

# The geometric solution
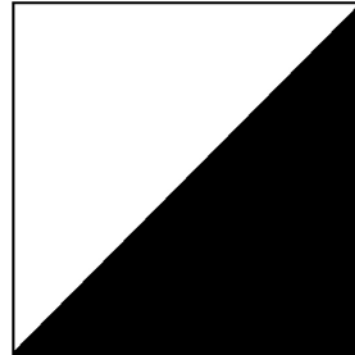
# The geometric solution

50-50

level **zero**
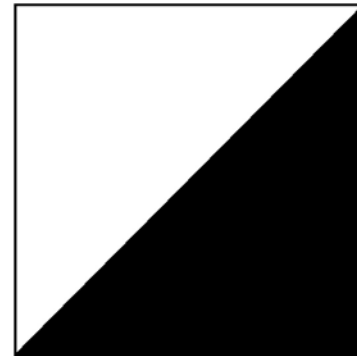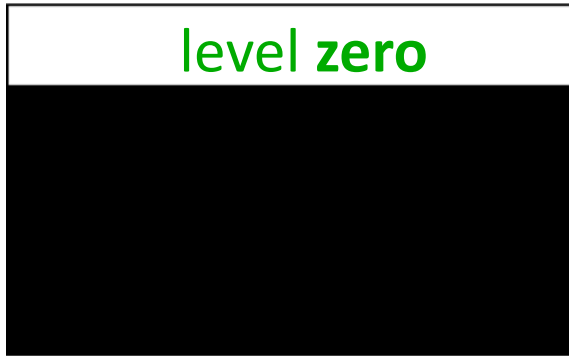
no holes

# The geometric solution

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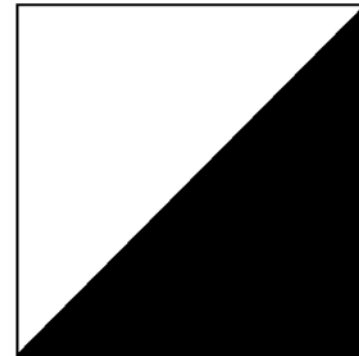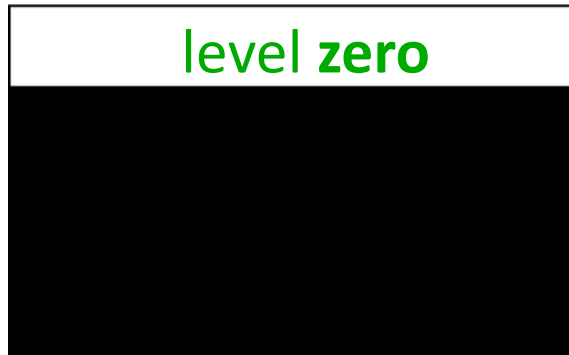
**50-50**                    **no holes**

only one **solid** condition: the **rock** without **thorns** and **dust**

# The geometric solution
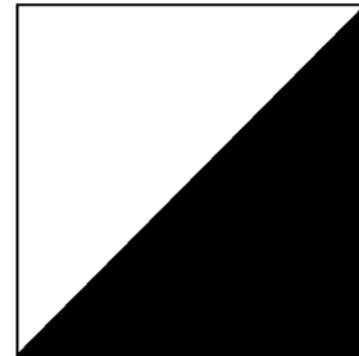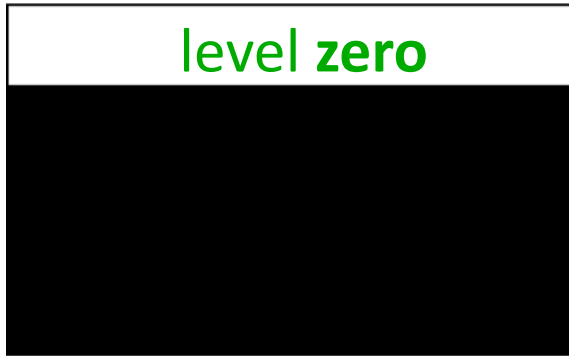
level **zero**

**50-50**

**no holes**

only one **solid** condition: the **rock** without **thorns** and **dust**

*Our Lord Jesus Christ*:

*the way, the truth, and the life...*

# The geometric solution
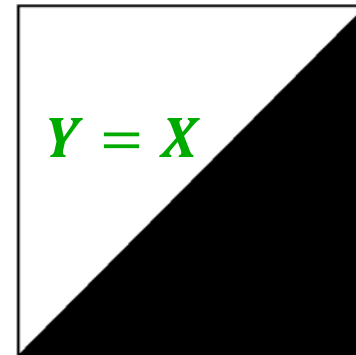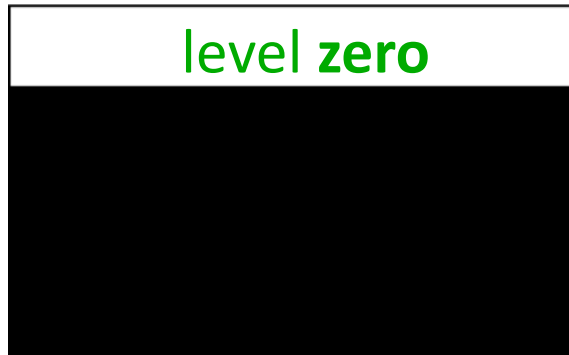


level **zero**

$Y = X$

**50-50**

**no holes**

only one **solid** condition: the **rock** without **thorns** and **dust**

*Our Lord Jesus Christ*:

*the way, the truth, and the life...*

*the* hypotenuse, $Y = X$, is the **gate** towards *peace*

# The geometric solution

$= 0.999... = 1$

level **zero**

**50-50**

$Y = X$
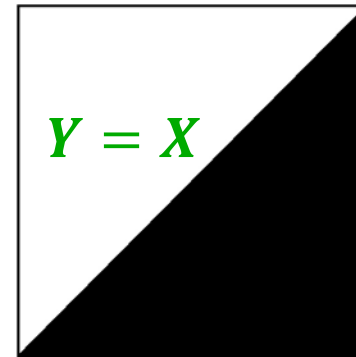
$d = \sqrt{2}$

**no holes**

only one **solid** condition: the **rock** without **thorns** and **dust**

*Our Lord Jesus Christ*:

*the way, the truth, and the life…*

*the* hypotenuse, $Y = X$, is the **gate** towards *peace*

…**rectifying** and **loving** one encounters the **root** **(!)**

# A verifiable invitation
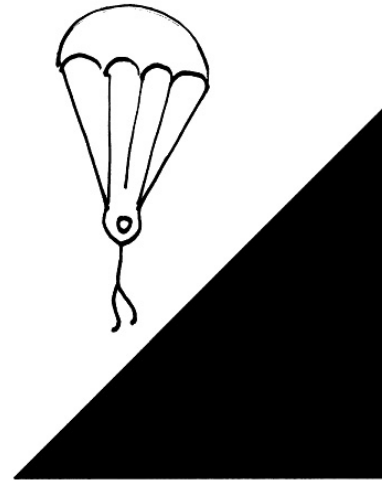
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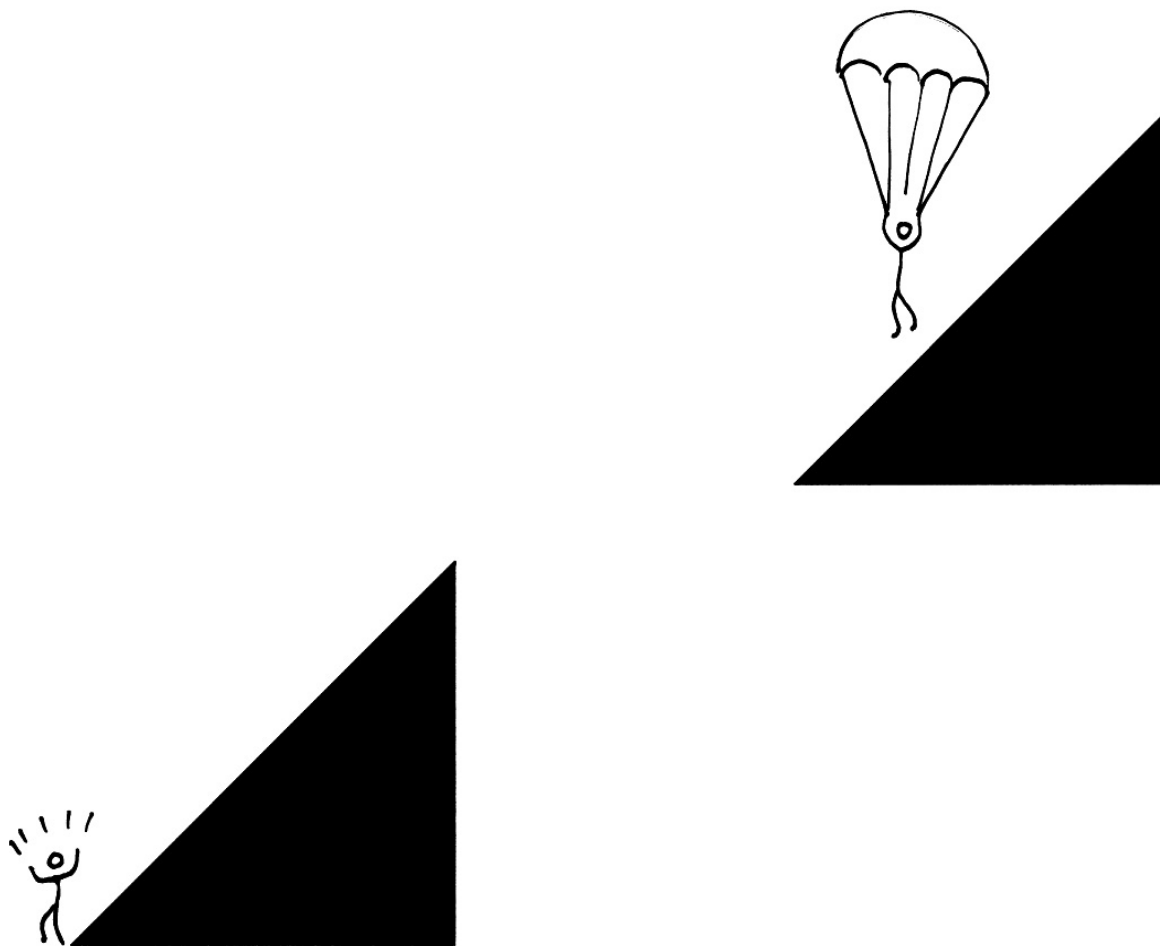
# A verifiable invitation

*(**Y = X**, 33)*
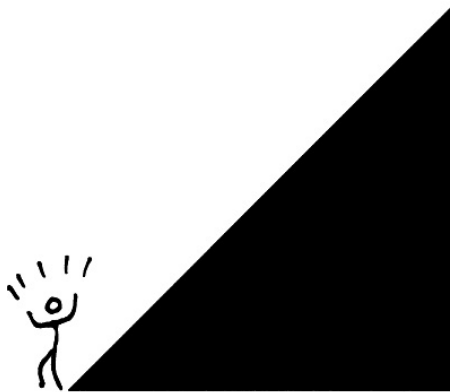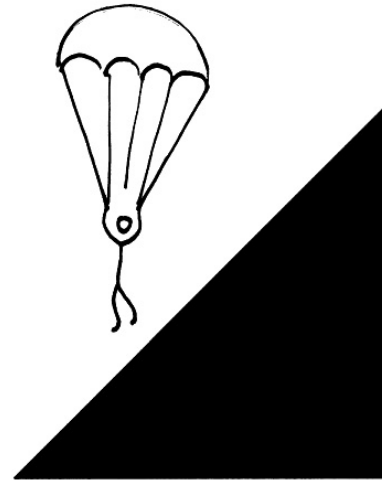


to the **Origin**...

# An unexpected surprise

*(Soons, 2006a,b)*

# A stone cries out!



*under the chin at Shroud of Turin*

# More on the code for success

# The point of happiness
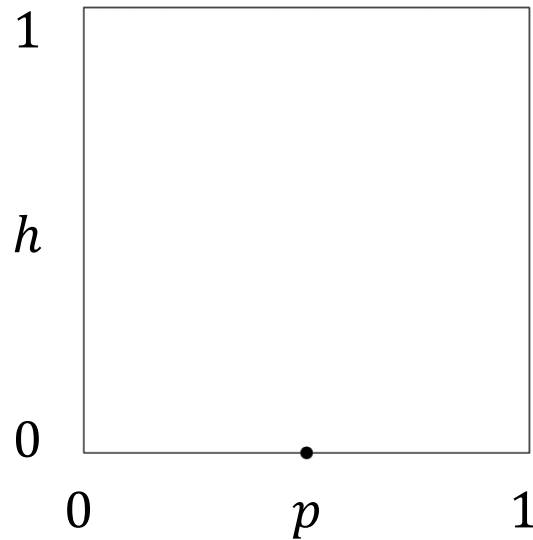
# The point of happiness
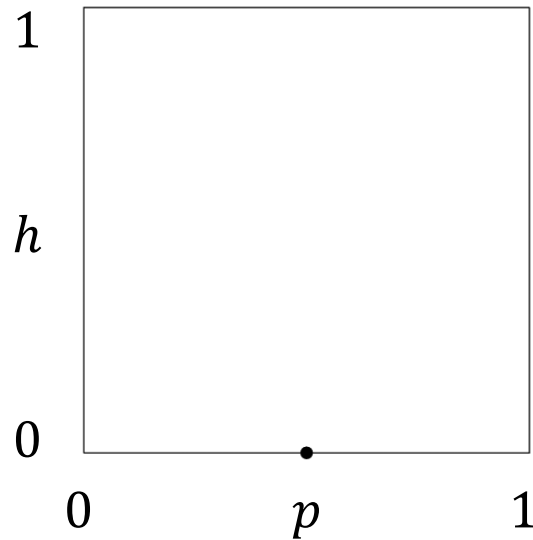


it is easier for a *camel* to pass by the eye of a needle…

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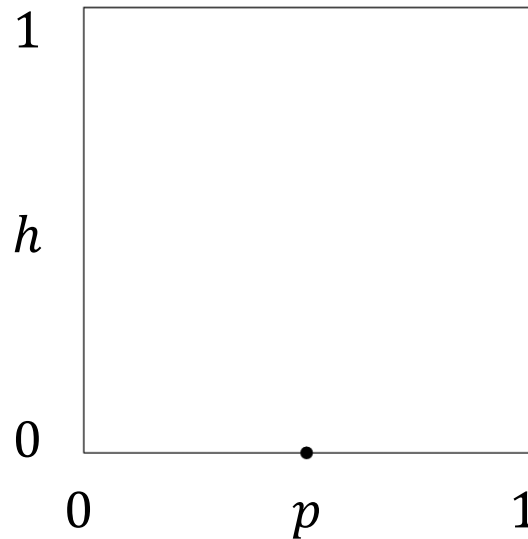


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it is **hypocritical** to judge if not at *the point*

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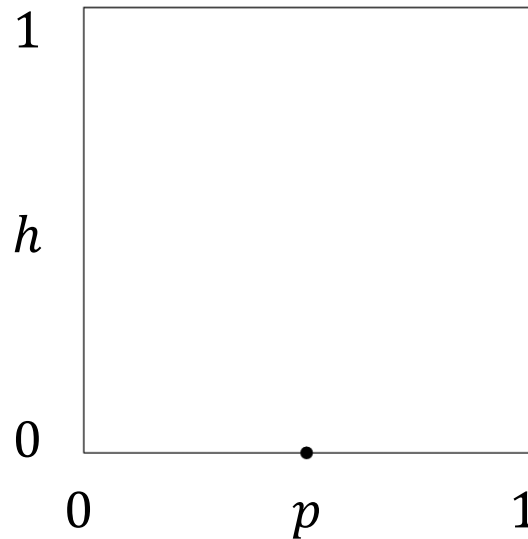


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recognizing the ***gravity*** of ***sin*** we arrive to **the Origin**

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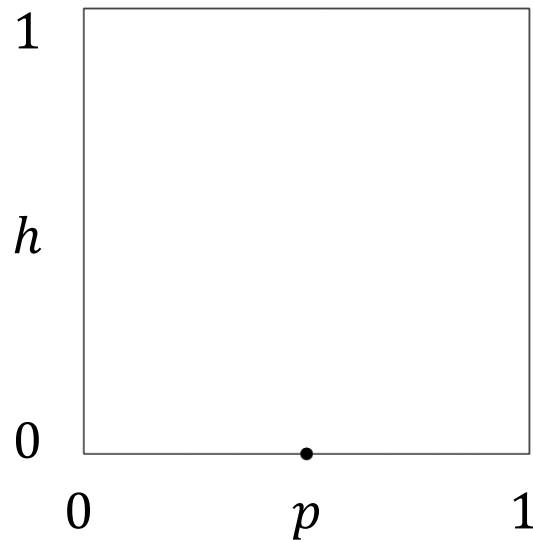


it is easier for a ***camel*** to pass by the eye of a needle…

it is **hypocritical** to judge if not at ***the point***

recognizing the ***gravity*** of ***sin*** we arrive to **the** Origin

there is great ***darkness*** between **6** and **9**, the (**−**) and the (**+**)… **(!)**

# Our options

*(Puente, 2011b)*

# Our options

equilibrium          turbulence

calmness             violence

rectitude            wickedness

fifty-fifty          troubles

# Our options

| | |
|---|---|
| *equilibrium* | *turbulence* |
| *calmness* | *violence* |
| *rectitude* | *wickedness* |
| *fifty-fifty* | *troubles* |
| *shortest* | *longest* |
| *reconciliation* | *separation* |
| *integration, ∫* | *division, $* |
| *wholeness* | *emptiness* |

# Our options

| | |
|---|---|
| *equilibrium* | *turbulence* |
| *calmness* | *violence* |
| *rectitude* | *wickedness* |
| *fifty-fifty* | *troubles* |
| *shortest* | *longest* |
| *reconciliation* | *separation* |
| *integration, ∫* | *division, $* |
| *wholeness* | *emptiness* |
| *unity* | *dust* |
| $1 = 0.999...$ | $2/3 = 0.666...$ |
| *positive, +* | *negative, −* |
| *to the future* | *to the past* |
| ***Y = X*** | *the devil* |

# Pathways

*(Puente, 2011b)*

Two options before us
two pathways ahead,
the one is the longest
the other straight.

We journey directly
or go by the legs,
we follow intently
or end up in pain.

By walking the flatness
or hiking the spikes,
we travel in lightness
or take serious frights.

The incentive is unity
and the call proportion,
the key is forgiveness
and the goal true notion.

In wandering wickedness
there is never fruit,
but in ample humbleness
one encounters the root.

*Y = X*
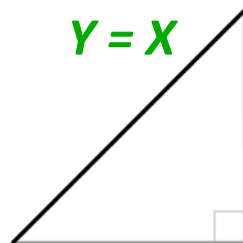
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"as far as the east is from the west…" $\sqrt{2}$ vs. $2$

**unity** may be understood **geometrically**:

**Holy Marriage**

the **Church**

$$0+0=\infty$$

*…Well, here you may appreciate better the nature of the class, from science to faith.*

*In our next encounter we shall see how what has been explained here is consonant with what the Sacred Scriptures say.*

*Until next time…*

# References

Cantor, G. (1883) "Über unendliche, lineare Punktmannigfaltigkeiten V", *Mathematische Annalen* 21: 545.

Meneveau, C and K. R. Sreenivasan (1987) "Simple multifractal cascade model for fully developed turbulence", *Physical Review Letters* 59:1424.

Puente, C. E. (2006) "Lessons from complexity. The hypotenuse: the pathway of peace", *E:CO, Emergence, Complexity and Organization* 8(2): 96.

Puente, C. E. (2011a) *The Hypotenuse: An Illustrated Scientific Parable for Turbulent Times*, 2/e. Santito Press.

Puente, C. E. (2011b) *The Fig Tree & The Bell: Chaos, Complexity and Christianity*. Santito Press.

Puente, C. E. (2018a) https://campanitasdefe.com/2018/01/27/jesus-el-equilibrio/

Puente, C. E. (2018b) https://campanitasdefe.com/2018/02/03/jesus-la-hipotenusa/

Puente, C. E. (2018c) https://campanitasdefe.com/2018/04/01/la-geometria-del-amor/

Puente, C. E. (2020) https://campanitasdefe.com/2020/12/08/la-vacuna-contra-el-maligno/

Richardson, L. F. (1922) *Weather Prediction by Numerical Processes*. Cambridge University Press.

Soons, P. (2006a) https://shroud3d.com/research-on-the-3d-materials/solid-oval-object-research-schumacher/

Soons, P. (2006b) https://shroud3d.com/research-on-the-3d-materials/research-3-letters-on-solid-object/

Sreenivasan, K. R. (1991) "Fractals and multifractals in fluid turbulence", *Annual Reviews of Fluid Mechanics* 23:539.