FROM COMPLEXITY TO PEACE

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Davis, October 20, 2005
Thesis

We humans, with a soul, may learn from recent advancements regarding natural complexity in order to find peace...
Outline

Lessons from turbulence
Lessons from chaos
Lessons from normality
Lessons from turbulence
A multiplicative cascade

70%  

30%
A multiplicative cascade

\((p + q)^n\)
After $n = 12$ levels

$h = 56.69 \quad p = 0.7$

A multifractal measure

Intertwined layers of thorns having distinct densities
Another divisive cascade

50%  

50%
Another divisive cascade

Disjoint equal \textit{thorns} over Cantor \textit{dust}
As found inside layers of first cascade by varying hole size
The two cascades are inherently \textit{related} to one another
Cumulative distributions

Locally flat and without derivatives

Devil’s staircases having maximal lengths

\[ d\{(0, 0), (1, 1)\} = 2, \ p \neq 1/2, \ h \neq 0 \]
Fully developed turbulence
(Meneveau and Sreenivasan, 1987)

Layers in one-dimensional turbulence as in first cascade:
boundary layer, atmospheric, wake of a cylinder...

\[ Re = v \cdot L / \nu \gg 1 \]

\[ p = 0.7 \quad \text{universal} \]
Our turbulent times

inequities
discrimination
competition
forced equality
disparities
fear

2/3 of the world under poverty
6,000 kids die a day for lack of water
violence and terror
An optimal system?

5, 10, 20 and 40% largest thorns have 57, 70, 84 and 95% of the mass

This is quite close to **USA**: 59, 71, 84 and 95%

**Warning**: both cascades are **dissipative**: if we ride them, they lead us to “bite the dust”
Common sense solution

Run cascade in reverse to mend what is broken. “Cut mountains and fill valleys” to restore unity. Live at low Reynolds numbers to avoid violence.
Common sense solution

Run cascade in reverse to mend what is broken
“Cut mountains and fill valleys” to restore unity
Live at low Reynolds numbers to avoid violence:

A unique solid solution without thorns and dust
The hypotenuse is the pathway of peace!
Moral: love everyone to find the origin!
THE HYPOTENUSE
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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.
Lessons from chaos
The logistic parabola

\[ X_{k+1} = \alpha X_k (1 - X_k), \quad \alpha \in [0, 4] \]

...say population of rabbits as a function of time different cases depending on \( \alpha \)...
From the origin to bifurcations

\[ 0 < \alpha \leq 1 \]
\[ X_\infty = 0 \]

\[ 1 < \alpha \leq 3 \]
\[ X_\infty = \frac{\alpha - 1}{\alpha} \]

\( \alpha = 3.2 \)
period 2

\( \alpha = 3.46 \)
period 4
Periodicities and chaos intertwined

$(\alpha > \alpha_{\infty} \approx 3.5699)$

$\alpha = 3.6$
aperiodic

$\alpha = 3.74$
period 5

$\alpha = 3.83$
period 3

$\alpha = 4$
aperiodic
Periodic behavior for any number is found in the tree!
After $\alpha_\infty$, **dusty** “strange attractors” are common. Expansion of periodic **buds** gives small copies of tree!
Thorns galore

The tree contains many **multifractal** measures. The first one occurs at $\alpha_\infty$:

Others happen at accumulation points of buds for all periods.
Universality on Fig Tree  
(Mitchell Feigenbaum, 1978)

Bifurcations happen in an **orderly** fashion:

\[
d_{n}/d_{n+1} \rightarrow F_1 = -2.50 \cdots \quad \Delta_n/\Delta_{n+1} \rightarrow F_2 = 4.669 \cdots
\]
Also universality on other trees
straight root, tender branch, branches, dust (“fig leaves”)

\[ f(X) = \alpha X (1 - X^3) \]

Relevant in Ecology, Chemistry, Physics and Economics
Dynamics of convection are reproduced if \( \alpha \) is heat
More common sense

As with turbulence, it is best:

to lower our heat to avoid violence
to tame non-linearities to bypass thorns and dust
not to amplify the troubles we face \((\alpha \leq 1)\)
to live slowly and in humility
not to cross the threshold, \(X = Y\), the hypotenuse
to come down the tree to find the root
to arrive at the origin: \(X_\infty = 0\) (O my rabbits!)

Being trapped in an strange attractor at high heat is hell!
FEIGENBAUM’S PARABEL
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Foliage of disorder
trapped in empty dust,
jumps astir forever
enduring subtle thrust.

Crossing of the outset
leaving faithful root,
looming tender offset
failing to yield fruit.

Cascade of bifurcations,
increasing heat within,
inescapable succession
of branches bent by wind.

Sprouting of dynamics
attracted to the strange,
oh infinity reminding
at the origin: the flame.
Lessons from normality
Bells and power-laws

**Gaussian**

$f(x) \sim e^{-x^2/2}$

**Pareto**

$f(x) \sim 1/x^{\alpha+1}$

**CLT**

scale free

“heavy tails”
Power-laws and natural complexity

\[ P[X \geq x] \sim x^{-c} \]

earthquakes, avalanches, hurricanes, floods, volcanic eruptions, forest fires...

utter violence
Power-laws and inequalities
(Vilfredo Pareto, 1896)

$log N(x) = log A + m \cdot log x$

30th to 85th percentiles of world income distribution
(After Di Guilmi el al., 2003)
Power-laws and wars

(Lewis Fry Richardson, 1960)

\[ \log P(S>s) = 1.27 - 0.41 \log s \]

\[ R^2 = 0.985 \quad N = 97 \]

(After Cederman, 2003)
More on common sense

As violence is related to power-laws ⇒ study the mechanisms that produce them and avoid such in order to find peace
More on common sense

As violence is related to power-laws ⇒ study the mechanisms that produce them and avoid such in order to find peace:

- multiplicative cascades
- preferential attachments
- highly optimized tolerance
- self-organized criticality...

(After Bak, 1996)

“Scale free humans” misuse their power to yield power-laws

There is no “invisible hand” but our own...
A pathway to normality via iterations

\[ w_1(x, y) = \left( \frac{x}{2}, x + z \cdot y \right), \quad w_2(x, y) = \left( \frac{x}{2} + \frac{1}{2}, 1 - x - z \cdot y \right) \]

(Puente, 2003)

From a multifractal to a realistic natural set

From any multifractal to a limiting bell
Bells in higher dimensions

From thorns and dust to harmony via a space-filling transformation
The exquisite decompositions of the bell
(Puente, 2003)

Hidden order in chance in the limit
All is beauty inside the bell
ice crystals and biochemical rosettes inside the bell
A rather special case

\[ w_1(x, y) = \left( \frac{x}{2}, x + z \cdot y \right), \ w_2(x, y) = \left( \frac{x}{2} + \frac{1}{2}, 1 - x + z \cdot y \right) \]
always positive, \( z \to 1 \)

A bell concentrated at **infinity**!
A universal **filter** of any type of disorder!
THE AMAZING BELL

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By the mystery of science gracefully shines a state, an all-embracing alliance adding liberty a shape.

One day, as if by chance, boldly there was such gem, as the shadow off a wire that fills completely space.

As the ideas hint above enduring a lasting zest, here is probable code in the ever precious bell.

The bell peals silent, oh oh reflecting its peace, and inside it gathers lovely masterpiece.

Symmetric pure beauty, oh oh oh mighty delight, this limit in fullness stores life’s designs.

Such vessel contains, oh oh alephs of all tastes, diatoms and crystals including DNA.

But there is a case, oh oh reason to this song: the forward selection that raises it all.

There is clear choice that rotates the 8.

By loving sincerely we surely converge.

Notice, this is cogent: the bell’s central theme.

By living in freedom one fulfills the dream.

There is transformation that kindles the heart.
By loving in plenitude we become smart.

For love mends the spiky and takes to the clouds.

**By living the present one joins blessed crowd.**

Oh see, this is truthful: the plus all the way.

**By loving the enemy we learn how to play.**

Dimensional growth, oh essence of life.

**By living in harmony one nails normal plan.**

Oh notice the symbols, oh irrational might.

**By loving simplicity we experience the light.**

Oh listen, you colleague, let’s go out the cave.

**By living in unity we all shall prevail.**

Oh notice, my friend, the plea from a bell.

**By loving and loving joy will have no end...**
CONCLUSIONS

Simplicity is far better than complexity

Refrain from what is “natural” and do what is “normal”

When needed reclaim inherent scale by rectifying:

Avoid accumulation of energies living in equilibrium $p = 1/2$

Do not cross appointed thresholds staying at the root $\alpha \leq 1$

Satisfy the central limit theorem being always positive $z \to 1$

Peace be with you!

http://puente.lawr.ucdavis.edu/peace.htm