De que va tu paper?

Self-organization, scaling and collapse in a coupled automaton model of foragers and vegetation resources with seed dispersal, 2009

Dr. Oliver López-Corona
https://www.lopezoliver.otrasenda.org/

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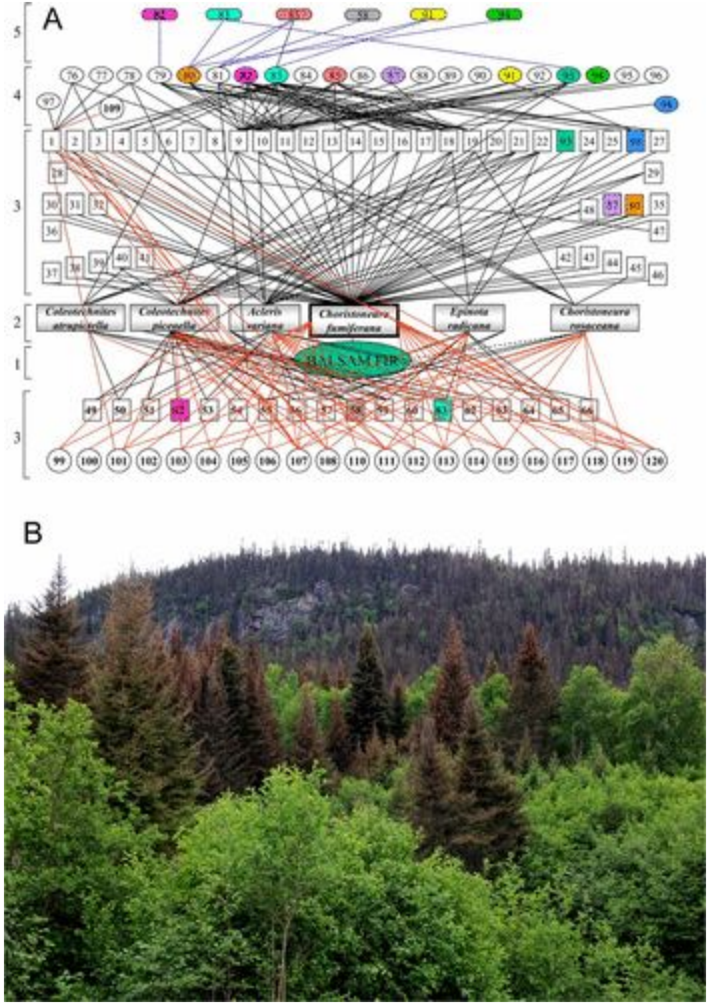
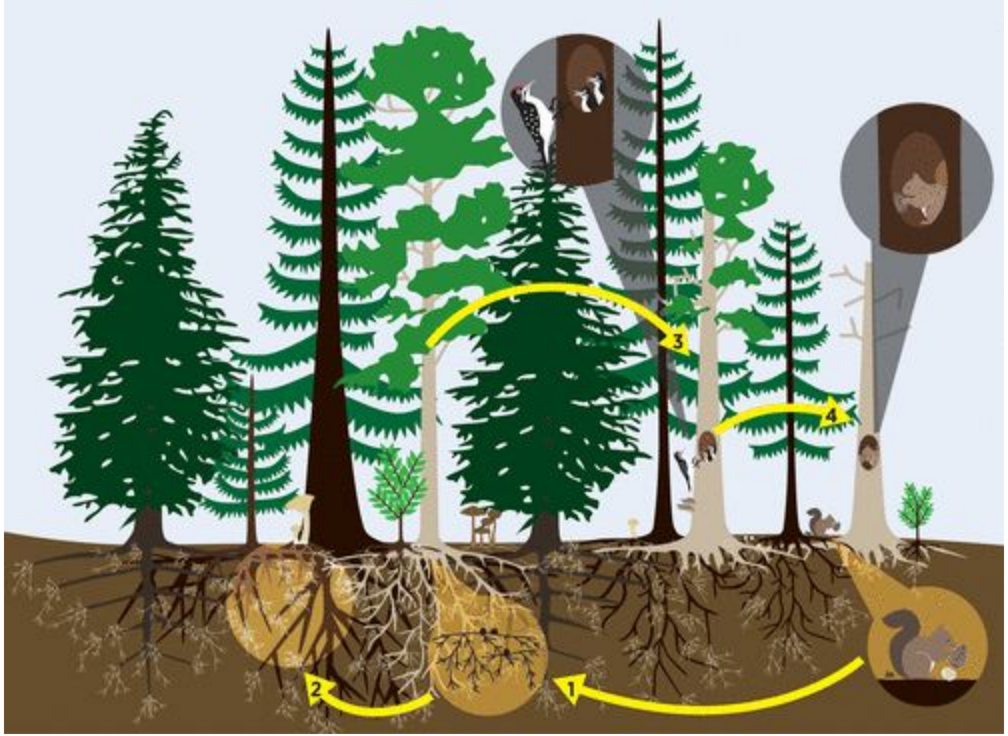
Es esto un bosque?



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Viewing forests through the lens of complex systems science

Elise Filotas, Lael Parrott, Philip J. Burton, Robin L. Chazdon, K. David Coates, Lluís Coll, Sybille Haeussler, Kathy Martin, Susanna Nocentini, Klaus J. Puettmann ... See all authors

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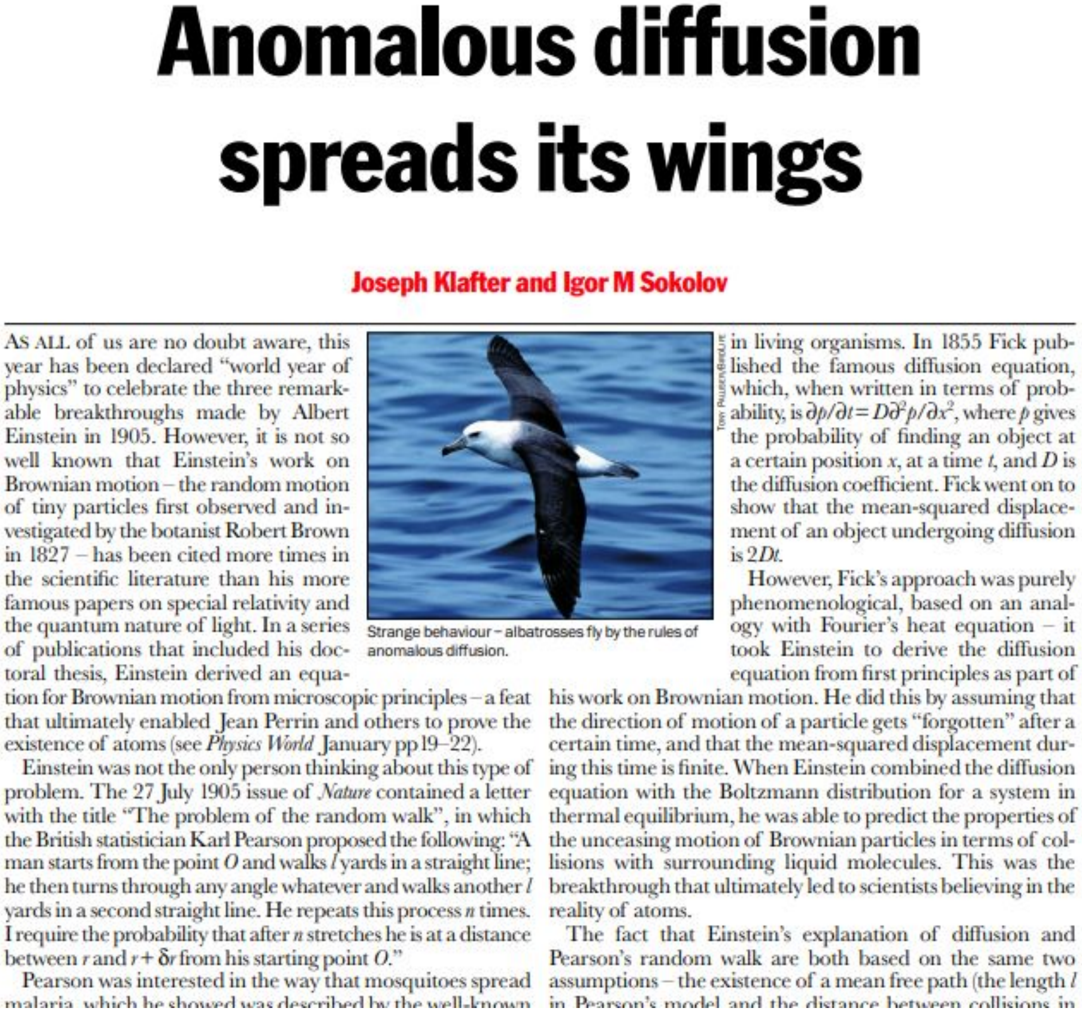

Anomalous diffusion spreads its wings

Joseph Klafter and Igor M Sokolov

Tony Palliser/BirdLife

Strange behaviour – albatrosses fly by the rules of anomalous diffusion.

As all of us are no doubt aware, this year has been declared "world year of physics" to celebrate the three remarkable breakthroughs made by Albert Einstein in 1905. However, it is not so well known that Einstein's work on Brownian motion – the random motion of tiny particles first observed and investigated by the botanist Robert Brown in 1827 – has been cited more times in the scientific literature than his more famous papers on special relativity and the quantum nature of light. In a series of publications that included his doctoral thesis, Einstein derived an equation for Brownian motion from microscopic principles – a feat that ultimately enabled Jean Perrin and others to prove the existence of atoms (see *Physics World* January pp19–22).

Einstein was not the only person thinking about this type of problem. The 27 July 1905 issue of *Nature* contained a letter with the title "The problem of the random walk", in which the British statistician Karl Pearson proposed the following: "A man starts from the point O and walks l yards in a straight line; he then turns through any angle whatever and walks another l yards in a second straight line. He repeats this process n times. I require the probability that after n stretches he is at a distance between r and $r + \delta r$ from his starting point O."

Pearson was interested in the way that mosquitoes spread malaria, which he showed was described by the well-known in living organisms. In 1855 Fick published the famous diffusion equation, which, when written in terms of probability, is $\partial p/\partial t = D\partial^2 p/\partial x^2$, where p gives the probability of finding an object at a certain position x, at a time t, and D is the diffusion coefficient. Fick went on to show that the mean-squared displacement of an object undergoing diffusion is $2Dt$.

However, Fick's approach was purely phenomenological, based on an analogy with Fourier's heat equation – it took Einstein to derive the diffusion equation from first principles as part of his work on Brownian motion. He did this by assuming that the direction of motion of a particle gets "forgotten" after a certain time, and that the mean-squared displacement during this time is finite. When Einstein combined the diffusion equation with the Boltzmann distribution for a system in thermal equilibrium, he was able to predict the properties of the unceasing motion of Brownian particles in terms of collisions with surrounding liquid molecules. This was the breakthrough that ultimately led to scientists believing in the reality of atoms.

The fact that Einstein's explanation of diffusion and Pearson's random walk are both based on the same two assumptions – the existence of a mean free path (the length l in Pearson's model and the distance between collisions in

Scale-free foraging by primates emerges from their interaction with a complex environment

Denis Boyer, Gabriel Ramos-Fernández, Octavio Miramontes, José L Mateos, Germinal Cocho, Hernán Larralde, Humberto Ramos and Fernando Rojas

Published: 11 April 2006 | https://doi.org/10.1098/rspb.2005.3462

Abstract

Scale-free foraging patterns are widespread among animals. These may be the outcome of an optimal searching strategy to find scarce, randomly distributed resources, but a less explored alternative is that this behaviour may result from the interaction of foraging animals with a particular distribution of resources. We introduce a simple foraging model where individual primates follow mental maps and choose their displacements according to a maximum efficiency criterion, in a spatially disordered environment containing many trees with a heterogeneous size distribution. We show that a particular tree-size frequency distribution induces non-Gaussian movement patterns with multiple spatial scales (Lévy walks). These results are consistent with field observations of tree-size variation and spider monkey (*Ateles geoffroyi*) foraging patterns. We discuss the consequences that our results may have for the patterns of seed dispersal by foraging primates.

Self-organization, scaling and collapse in a coupled automaton model of foragers and vegetation resources with seed dispersal

D Boyer and O López-Corona

Instituto de Física, Universidad Nacional Autónoma de México, Apartado Postal
20-364, 01000 México D.F., México

E-mail: `boyer@fisica.unam.mx`

Abstract. We introduce a model of traveling agents (*e.g.* frugivorous animals) who feed on randomly located vegetation patches and disperse their seeds, thus modifying the spatial distribution of resources in the long term. It is assumed that the survival probability of a seed increases with the distance to the parent patch and decreases with the size of the colonized patch. In turn, the foraging agents use a deterministic strategy with memory, that makes them visit the largest possible patches accessible within minimal travelling distances. The combination of these interactions produce complex spatio-temporal patterns. If the patches have a small initial size, the vegetation total mass (biomass) increases with time and reaches a maximum corresponding to a self-organized critical state with power-law distributed patch sizes and Lévy-like movement patterns for the foragers. However, this state collapses as the biomass sharply decreases to reach a noisy stationary regime characterized by corrections to scaling. In systems with low plant competition, the efficiency of the foraging rules leads to the formation of heterogeneous vegetation patterns with $1/f^{\alpha}$ frequency spectra, and contributes, rather counter-intuitively, to lower the biomass levels.


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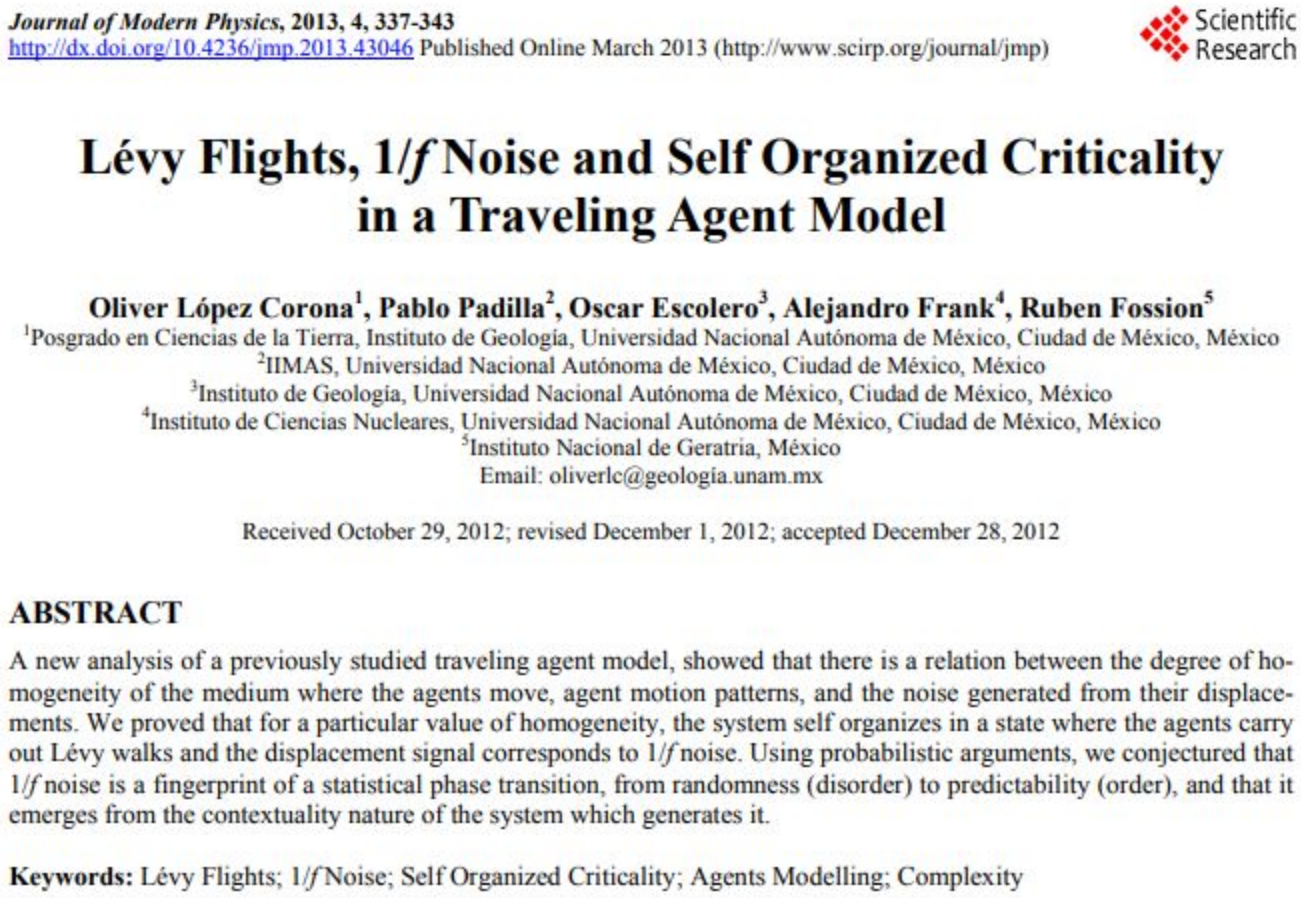

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Scientific Research

Lévy Flights, 1/*f* Noise and Self Organized Criticality in a Traveling Agent Model

Oliver López Corona[1], Pablo Padilla[2], Oscar Escolero[3], Alejandro Frank[4], Ruben Fossion[5]
[1]Posgrado en Ciencias de la Tierra, Instituto de Geología, Universidad Nacional Autónoma de México, Ciudad de México, México
[2]IIMAS, Universidad Nacional Autónoma de México, Ciudad de México, México
[3]Instituto de Geología, Universidad Nacional Autónoma de México, Ciudad de México, México
[4]Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México, Ciudad de México, México
[5]Instituto Nacional de Geratria, México
Email: oliverlc@geología.unam.mx

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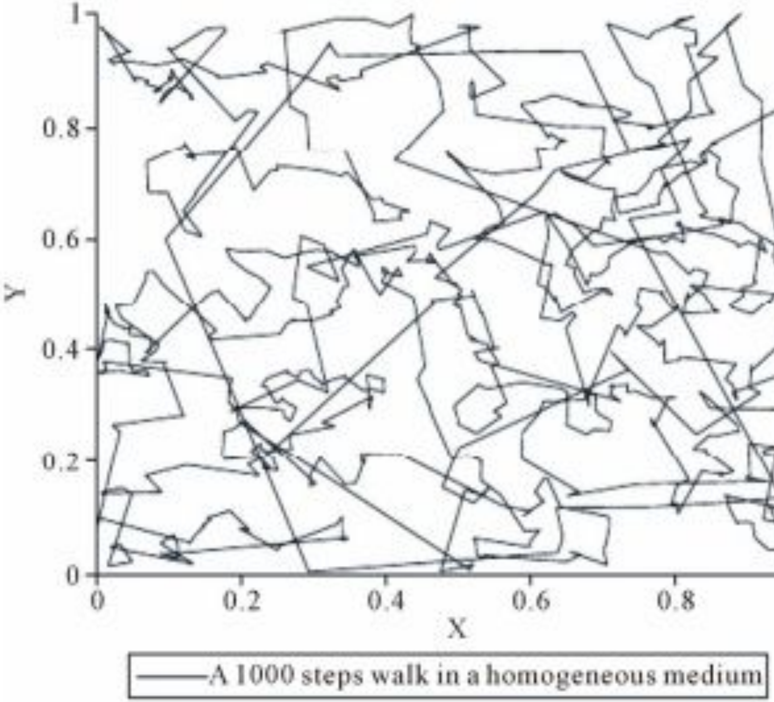
ABSTRACT

A new analysis of a previously studied traveling agent model, showed that there is a relation between the degree of homogeneity of the medium where the agents move, agent motion patterns, and the noise generated from their displacements. We proved that for a particular value of homogeneity, the system self organizes in a state where the agents carry out Lévy walks and the displacement signal corresponds to 1/*f* noise. Using probabilistic arguments, we conjectured that 1/*f* noise is a fingerprint of a statistical phase transition, from randomness (disorder) to predictability (order), and that it emerges from the contextuality nature of the system which generates it.

Keywords: Lévy Flights; 1/*f* Noise; Self Organized Criticality; Agents Modelling; Complexity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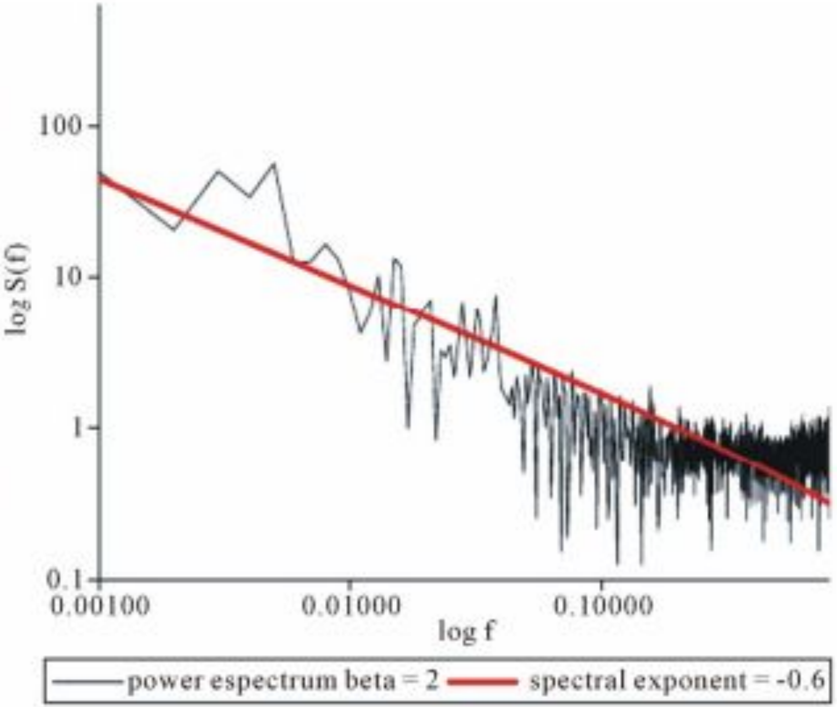
A 1000 steps walk in a homogeneous medium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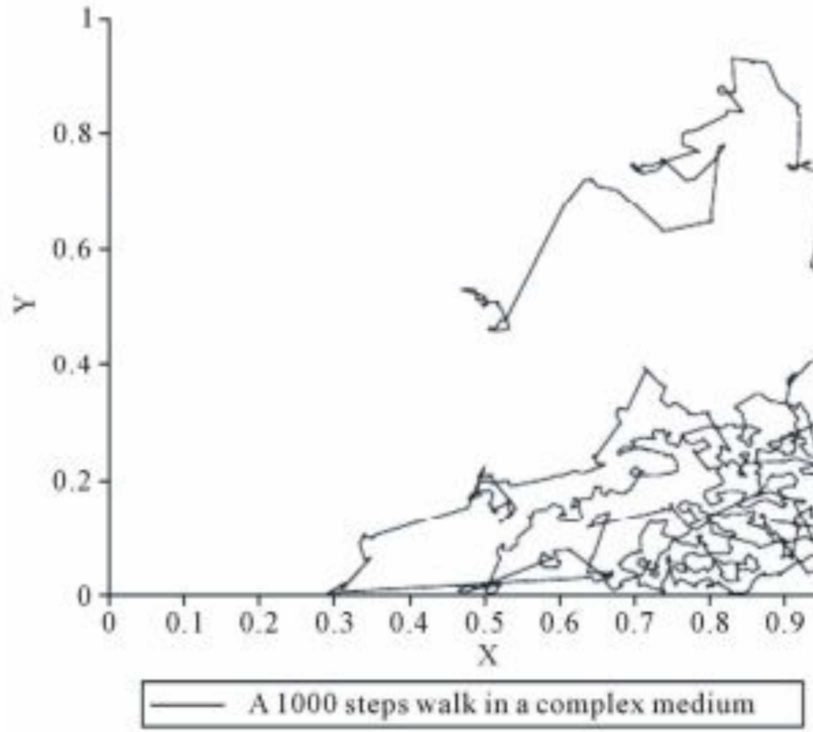

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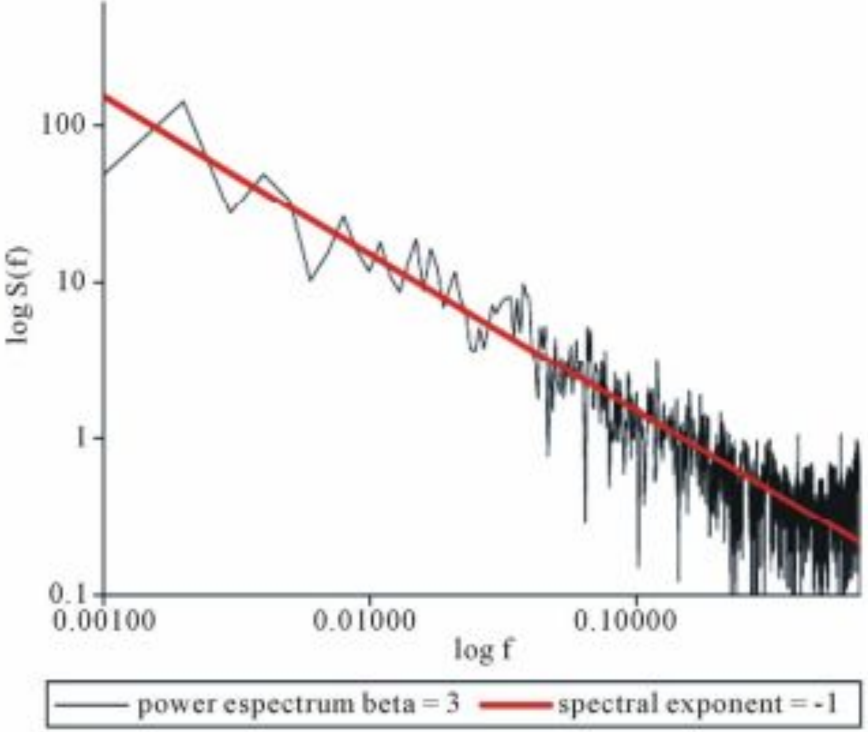
A 1000 steps walk in a complex medium



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power espectrum beta = 3
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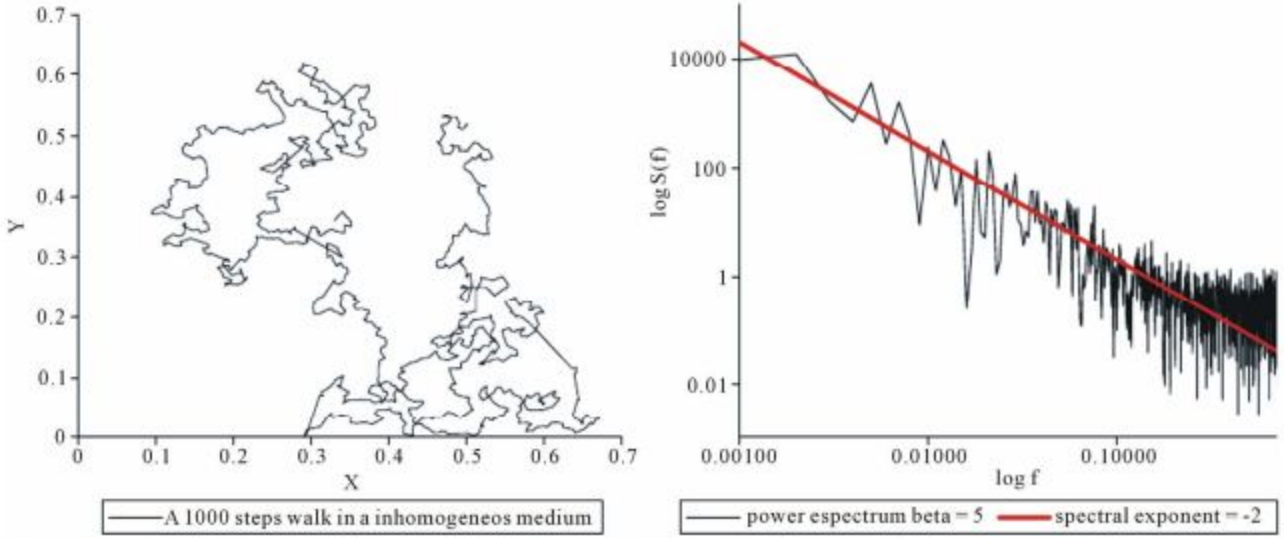
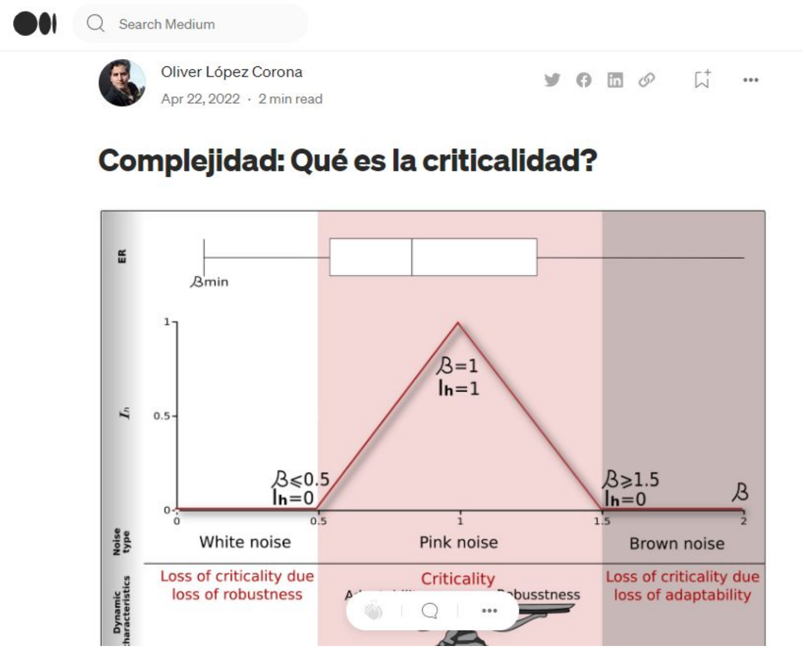


Figure 1. Examples of agent walk (first column) and the corresponding power spectrum (second column) for three values of themedium homogeneity coefficient $\beta = 2$ (homogeneous medium), $\beta = 3$ (complex medium) and $\beta = 5$ (inhomogeneousmedium).

Our results suggest that 1/f noise may be a fingerprint of a statistical phase transition from randomness (low correlation associated with white noise), to predictability (high correlation associated to brown noise) an idea suggested in [37].



Oliver López Corona

Apr 22, 2022 · 2 min read

Complejidad: Qué es la criticalidad?

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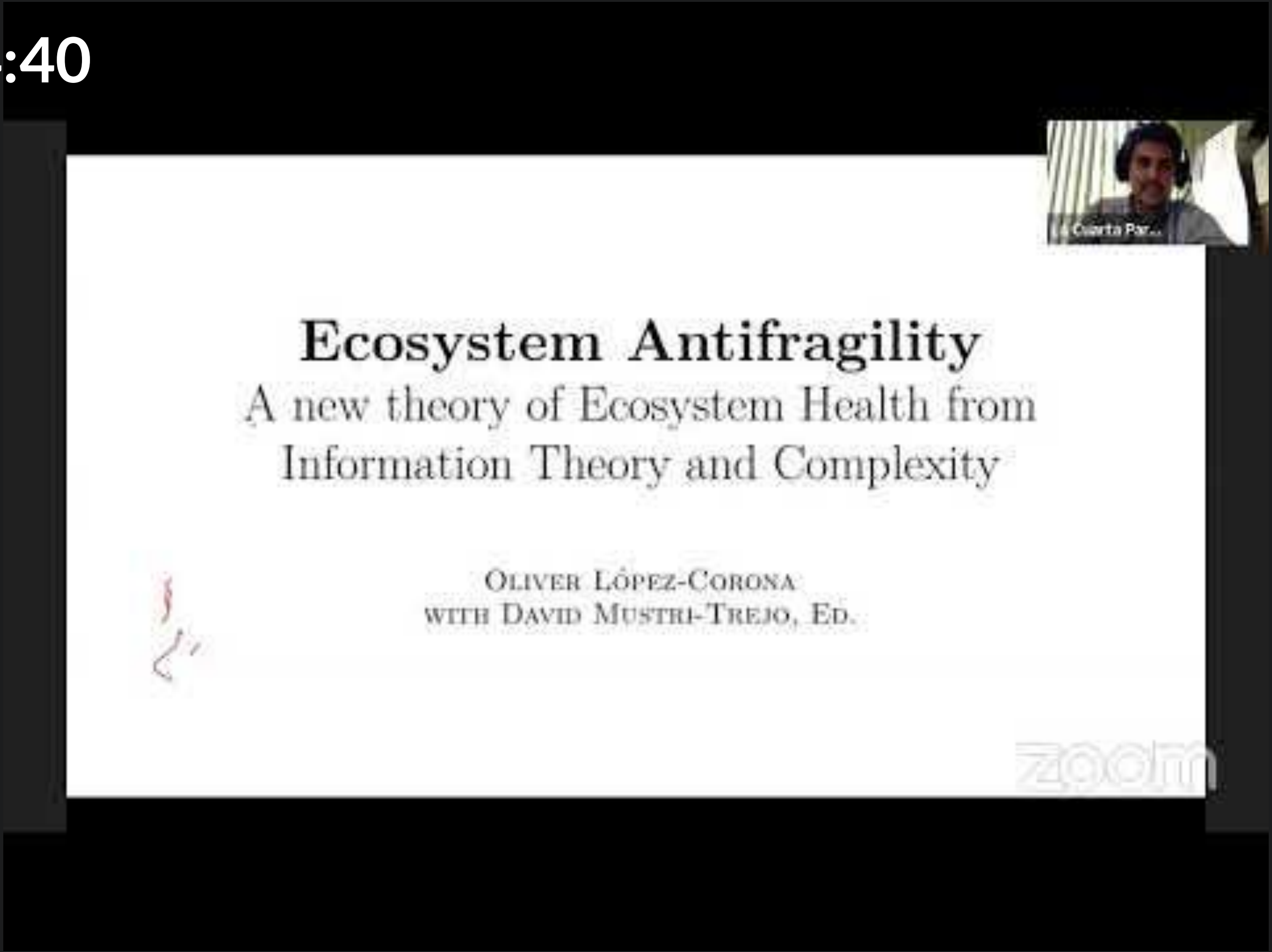

Ecosystem Antifragility

A new theory of Ecosystem Health from Information Theory and Complexity

Oliver López-Corona
with David Mustri-Trejo, Ed.