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Editorial

CRITICALITY REFERS to the study of those systems of Nature, whether biological, physical or social that are close to a critical point. This, in turn, is a state in which systems have unique properties: their correlation function diverges, which means that the system is fully integrated; what happens in one of its parts affects the rest. At equilibrium points the values of some of the variables that characterize the system exhibit a distribution of *power law*. That is, there are few very large values, a regular number of regular values and many small values. Within the infinity of association rules that can follow this verbal description, those whose graph is a straight line that descends when logarithmic coordinates are used are laws of power.

Power laws attract attention because they imply an *invariance of scale*. In other words, they do not have an intrinsic scale and if their magnitude is not indicated externally, it does not discern by itself. An example is given by naturalists when they take pictures, say, to a new species of frog found in the field. The frog itself does not show a scale with its size. To know its magnitude, it must be placed next to a known object, say, a coin and, by comparison, set its size.

In 1987, Per Bak and his collaborators Chao Tang and Kurt Wiesenfeld, showed that there are systems in which the critical point is an attractor. That is, if the system is allowed to evolve under its own dynamics, it tends to the critical point. This phenomenon is called *self–organized criticality* and possibly it is called to be one of the great concepts of science of the 21st century. The possibility is opened for a system to show scale invariance and long–range correlations without the need to externally fine–tune any parameters; they migrate to the critical point spontaneously.

In this issue of **INTERdisciplina** a series of works are presented that illustrate how the concept of self–organized criticality has permeated the science of our day.

We have the essay by Iván G. Torre and his collaborators who argue that speech, that natural phenomenon that characterizes us as a species and that we use every day, shows features that allow us to recognize self–organized criticality. A work by Maximino Aldana takes the phenomena of invariance of scale and criticality to the field of social sciences, establishing interesting comparisons between voter models and the dynamics of neural networks. Radically changing the subject, we see a work by Daniel Priego showing features of criticality in the

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phenomenon of fertilization, which gives rise to reproduction in almost all multicellular organisms.

Once again, we find power laws and invariance of scale in the laws of allometry that govern the relationships between the bodily and physiological magnitudes of organisms. In this essay, José Luis Gutiérrez and Faustino Sánchez Garduño illustrate us with examples of allometric relationships accompanied by their due explanations. From there we move on to another type of scaling; that which occurs at any level at which a system is studied and is called multifractal scaling. Surprisingly, José Marco and his collaborators find this phenomenon when studying the spread of epidemics. Ruben Fossion and his team teach us that in the study of physiological time series, some deviations appear in the laws of powers, which opens the door to look for more general processes that contain them as particular cases.

Taken together, this number of **INTERdisciplina** provides a broad and balanced overview of the applications of the concept of criticality in different areas of research. Id

Pedro Miramontes
Guest editor