Ambiguity and symmetry reduction in the emergence of structures and the nucleation of the visual thinking

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Perception is an irreversible ordering process keeping continuously occupied our mind while we are awake. The development of this process closely reminds dynamic instabilities occurring in dynamic natural systems removed away from equilibrium.
During perception, the mind interiorizes the proposed image. The interiorized image, controlled by curiosity and attention, evolves from a balanced, indifferent, statistically "symmetric" and meaningless state toward the emergence of an unbalanced, ordered and meaningful structure: the thought or visual thinking. The critical state is balanced, indifferent, statistically "symmetric" and meaningless and, at the same time, unbalanced, ordered and meaningful: at the critical state of this process symmetry and order join and coexist ambiguously. A fluctuation, and it is catastrophe: a reduction of statistical symmetry and disorder occurs. We become fully aware of this mental bifurcation while we sense e.g. the emergence of perspective reversions during the dynamic perception of a bistable ambiguous figure such as the Necker cube.
During a nonequilibrium dynamic instability – e.g. the Rayleigh-Benard instability of a liquid heated from below or the one-mode laser instability – a system, driven and controlled by a flux of external resources, evolves from a balanced, statistically "symmetric" and incoherent state toward the emergence an unbalanced, ordered structure exhibiting new properties and behaviors. The critical state is balanced, statistically "symmetric" and incoherent, and, at the same time, unbalanced and ordered: at the critical state of this process, symmetry and order join and coexist ambiguously. A fluctuation, and it is catastrophe: a reduction of statistical symmetry and disorder occurs, marked e.g. by the emergence of convective motions in the liquid or of phase coherence and collimation of the electromagnetic radiation field in a cavity.
In this contribution we'll focus on the perception of simple ambiguous figures and we'll propose a qualitative model of perception based on synergetics and quantum mechanics. An attempt is made to throw light on the computational activity selforganizing in the brain during the visual thinking. It will be recognized that strong analogies exist between the process of perception on the one hand and the dynamic instabilities studied in the frames of synergetics and the nonlinear thermodynamics of nonequilibrium systems on the other hand.
Details on these analogy can be found in Refs. 1, 2 and 4.
In the course of the oral presentation we'll reach the following conclusions.

1. During perception of ambiguous figures such as the Necker cube or some images of the optical art [5], the evolution of the interiorized image can be modelled as developing in two steps

?? a dynamic instability of a nonequilibrium structure (our mind) exhibiting a selforganising evolution according to the rules of synergetics [2], leading to a critical state characterized by

?? the emergence of an extremely important functional property, such as the visual thinking [3], whose dynamic behavior closely reminds the oscillations, promoted by a resonant electromagnetic field, of the valence electron of a diatomic molecule, undergoing the charge transfer spectrum according to the rules of quantum mechanics.

2. A single mathematical formula describes the essential features of both the charge transfer spectrum and – to a good approximation – the perspective reversions of visual thinking: therefore, through the introspective analysis of the process of perception, our mind can sense scientific forms of knowledge without structuring them in their appropriate explicit mathematical formulation: art itself is a form of knowledge, and the artist's intuition often precedes scientific formalizations by centuries or even millennia.
3. The proposed analogy between the perception of bistable ambiguous figures and the spectroscopic observation of the hydrogen molecule-ion according to quantum mechanics might induce us to infer from it that the logic underlying the process of perception is the same as the non Aristotelian logic underlying quantum mechanics. This logic assigns a central role to ambiguity and symmetry breaking. Therefore ambiguity and symmetry reduction, as a fixed course towards perception, thoughts and emotions, rise to the role of permanent cultural values [4,11].

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