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Fractals in Our Mind: Chaos Theory in Psychiatry

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Abstract:

Background: From a mathematical perspective, dynamics can be thought of as linear or non-linear. Linear equations work quite well for a number of problems in the physical sciences. For instance, they are very useful if one wants to predict the orbit of the planets or understand the effects of wind resistance and gravity on the trajectory of a missile. To explore systemic change, non-linear dynamics uses non-linear equations. Non-linear equations are not additive; therefore, they are often difficult to solve. Non-linear systems tend to settle down over time. This settling down, or convergence, tends to result in one of four typical patterns. These patterns, when graphed in diagrams that show periodic changes in behaviour, are called attractors. The trajectories of these attractors typically converge on a discrete point, a simple oscillating cycle, a quasiperiodic cycle, or chaotic cycle. A practical translation of this is the fractal, an object consisting of a pattern that when magnified, reveals repetitive levels of detail so that a similar structure exists on all scales. This property is known as self-similarity.
Aims: To examine a novel view-point by examining the possible applications of chaos theory in the study of mental health.
Method: For this paper, we studied the available research correlating chaos theory and mental health, especially schizophrenia and bipolar disorder.
Results and Discussion: The papers we reviewed show dynamic and chaotic models for both schizophrenia and bipolar disorder. Examples have been found of chaotic responses to initial stimuli in schizophrenia where overstimulation or sensory overload may be paradoxically associated with negative symptoms, fixity, or even catatonia. Meanwhile, regarding bipolar disorder, the attractor hypothesis has been analysed. It is thought that healthy persons have a single strange attractor regarding their mood shifts, while in patients suffering from bipolar disorder, this attractor is destroyed and replaced by two attractors with chaotic transients between them. The second pillar of chaos theory has also been analysed regarding mental health by using fractal analysis to more accurately determine MRI changes in mental patients.
Conclusion: This analysis is still in the opening phases and more research is needed to further cement chaos theory as a valid approach in psychiatry, especially since initial results seem promising.

Keywords

Bipolar Disorder, Schizophrenia, Chaos Theory, Fractal Analysis, Chaotic Attractor