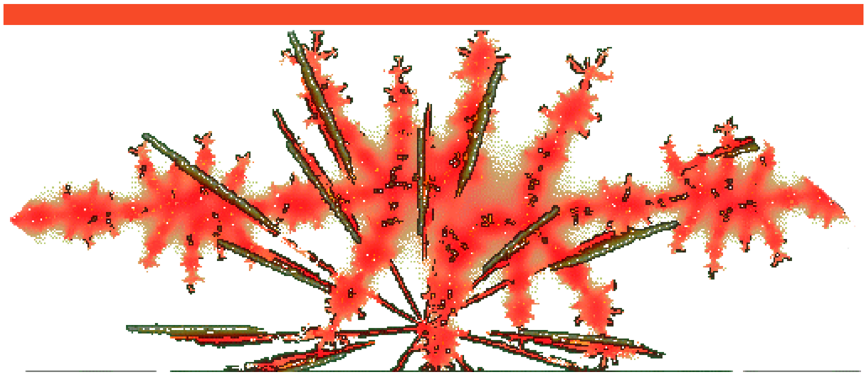
Coming Soon from NDPLS:

Special Issue

Nonlinear Dynamics of Functional Movement: From Complexity to Clinical Decision Making

Call for Manuscripts



The control of static and dynamic human movements and postures (e.g., walking, running, quiet stance) is characterized by variability, defined as typical variations presented during a performance repeated over many repetitions. Functional movement refers to the adaptive control of posture and locomotion under varying internal and external constraints, including walking, running, dynamic balance, perturbation responses, and task-oriented motor behaviors relevant to health and pathology. Movement variability—typical fluctuations across repeated performances—is inherent in biological systems and observed in both healthy individuals and elite athletes.

Movement variability, studied using traditional theoretical frameworks and considered as an indicator of noise in the control system, has traditionally been quantified using linear statistical measures (e.g., standard deviation). However, these measures provide only limited information about how the motor control system responds to intra- and inter-individual variations or change. Linear measures describe variability magnitude around a central tendency but ignore temporal structure and ordering. As a result, scientists and clinicians evaluate deviation about an average performance, i.e., gold standard, of normal, healthy individuals and define abnormal performances as dysfunctional, an undesirable behavior, or the result of instability.

The availability of nonlinear dynamical systems (NDS) theory dates back a century, but its application in clinical movement science is more recent. NDS theory has shown that apparently "noisy" phenomena are the result of nonlinear interactions in complex systems that have deterministic origins. Using NDS theory in the study of biological systems has shown that the measured signals, i.e., real and “noisy,” provides important information regarding the system that produced them. Moreover, nonlinear methods have been used, and shown to be of value, in investigating the complex conditions of normal healthy individuals as well as those with disease (e.g., heart rate irregularities, abnormal blood pressure control, neurological impairments related to stroke or head injury). This research has led to better understanding of normal and abnormal complex systems and to the development of improved diagnostic and prognostic tools. Likewise, NDS theory application to the study of variability in human movement patterns has contributed insights into the complexity of human postural and movement control.

Despite the excellent work on record, much of the current literature is focused on reporting differences in how a variety of nonlinear metrics (e.g., entropy values, Lyapunov exponents, fractal scaling properties) have been applied, often without fully integrating these findings into governing dynamical principles of functional stability, adaptability, and clinical change. For this special issue we ask that researchers revisit a set of necessary and sufficient criteria for patient evaluation tools originally put forward by Brand and Crowninshield in 1981 (*J. Biomech*. 1981, *14*, 655) for the biomechanical analysis of gait. They suggested that effective clinical measurement tools must satisfy the following conditions in order to support assessment, treatment selection, monitoring, and prognosis.

1. The measured parameters must correlate well with the patient’s functional capacity.
2. The measured parameters must not be directly observable and semi-quantifiable by the physician or therapist.
3. The measured parameters must clearly distinguish between normal and abnormal.
4. The measurement technique must not significantly alter the performance of the evaluated activity.
5. The measurement must be accurate and reproducible.
6. The results must be communicated in a form that is readily identifiable in a physical or physiological analog.

Despite decades of technological and computational advances, instrumented clinical gait analysis has often failed to meet all criteria, and this limitation has not been solely attributable to the primary use of linear methods, but may also be attributed to the absence of clearly articulated “laws of governance” and general control-theoretic framework describing how people walk. It has been argued that integrating present gait analysis methods with general theoretical principles could shift clinical decision-making from reliance on experience and convenience toward interpretations grounded in physics, physiology, and motor control. Therefore, for this special issue, we seek submissions that consider whether nonlinear dynamical systems theory can help address these long-standing challenges. Specifically, we invite work that examines whether nonlinear measures can serve as mechanistically interpretable dynamical biomarkers—parameters that reflect the organization, stability, adaptability, and potential reorganization of functional movement systems in ways that meaningfully inform clinical assessment, intervention, and prognosis, and encourage contributions that move beyond the question of whether a nonlinear metric is greater or reduced, and instead addresses questions such as:

- What are the governing dynamical principles of functional stability from a clinical perspective?
- What defines a loss of adaptability in gait or balance?
- How do attractor landscapes reorganize following injury?
- Can nonlinear methods detect proximity to bifurcation, transition, or failure?
- What constitutes a clinically meaningful dynamical biomarker?

Specifically, we are interested in articles with a tutorial quality, research papers, narrative, systematic, and scoping reviews, cohort studies, case reports, and expert opinions that examine:

- Normal and pathological gait
- Running gait prior and following injury
- Locomotive functional tasks such as rising from a chair, getting up and gait initiation, etc.
- Normal quiet and perturbed standing balance
- Dynamic balance related to treadmill or overground walking
- Static and dynamic balance instability related to head injury, e.g., sport-related concussion, macro-trauma related to motor vehicle accidents, etc.
- Sport-related functional tasks and testing following ligamentous reconstructions, e.g., counter movement jumping, hopping, etc.
- Related to any of the topics above, practical comparisons of linear and nonlinear methods of analysis
- Modeling approaches that connect (or propose to connect) nonlinear dynamics to functional outcomes, prognosis, or treatment selection

The purview of the journal is critical to the inclusion of articles: *Nonlinear Dynamics, Psychology, and Life Sciences* publishes papers that augment the fundamental ways we understand, describe, model, and predict nonlinear phenomena in psychology and the life and social sciences. One or more of the following nonlinear concepts must be an explicit part of the exposition: attractors, bifurcations, chaos, fractals, solitons, catastrophes, self-organizing processes, cellular automata, genetic algorithms and related evolutionary processes, neural networks, and agent-based models. The broad mixture of the disciplines represented here indicates that many bodies of knowledge share common principles. By juxtaposing developments in different fields within the life and social sciences, the scientific communities may obtain fresh perspectives on those common principles and their implications. Because the journal is multidisciplinary in scope, each article should constructed for understanding by a broad readership.

NDPLS is published quarterly by the Society for Chaos Theory in Psychology & Life Sciences. Articles will be reviewed by two or more experts in the relevant field. The project is planned on the following schedule:

- Abstract review (optional): Prior to September 15, 2026
- Submission deadline: November 15, 2026
- Reviews complete: February 1, 2027
- Revisions due: March 15, 2027
- Publication: June–July 2027

Manuscripts should be prepared in APA style. Key style points and small variations that are specific to the journal can be found in the Instructions for Authors on the journal web site:
www.societyforchaostheory.org/ndpls/author_instructions/

Please send abstracts and manuscripts to the editor in chief and the special issue editors by e-mail (addresses below). We look forward to receiving your abstracts and manuscripts. If you have any questions about the project, please do not hesitate to ask one of the editors.

Sincerely,

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