

# Nonlinear Dynamics, Psychology, and Life Sciences

## Special Issue: Developmental Psychopathology

### Relationship Dynamics in the Development of Psychopathology: Introduction to the Special Issue

Thomas J. Dishion, *Guest Editor*

### Mother-infant Interaction and Quality of Child's Attachment: A Nonlinear Dynamical Systems Approach

M. Angeles Cerezo, *University of Valencia, Spain*, Rosa M. Trenado, *University of Valencia, Spain*, Gemma Pons-Salvador, *University of Valencia, Spain*

**Abstract:** The traditional classification of infant attachment described three distinct types (Ainsworth et al. 1978): Secure (B), Insecure-avoidant (A), and Insecure-resistant (C). Research shows that the quality of infant attachment reflects the child's history of interaction with their primary caregiver and, therefore, maternal sensitivity and appropriateness of maternal responses during the first year of life has been found to predict infant attachment. In this study the nonlinear dynamical systems (NDS)

approach was applied to broaden the study of maternal sensitivity into the overall temporal organization of mother-infant relationship exchanges. The study focuses on understanding the differences between secure and insecure attached children by applying NDS in two temporal scales: real time and a developmental scale, with the notions of "flexibility" and "self-organization", respectively. Infants, classified as securely or insecurely attached at 15 months, had free-play situations with their mothers, at 6 and 12 months of age, videotaped and coded in real time. Results showed that at 6 months dyads from the B group, compared to the non-B group, showed higher flexibility through several NDS indices derived from the State-Space Grid method (SSG). The dyads at 12 months did not show differences in those indices. Moreover, B group showed self-organization by decreasing the number of attractors, from 6 to 12 months of infant's age, in contrast with A and C groups that either showed less self-organization, by increasing the number of attractors, or stayed basically as they were at 6 months. Furthermore, the B group showed an increase in the proportion of attractors with higher values from time 1 to time 2, in contrast to the non-B groups. Findings provide some grounds for using a SSG approach to deepen the construct of maternal sensitivity in dyadic terms.

### Flexibility and Attractors in Context: Family Emotion Socialization Patterns and Children's Emotion Regulation in Late Childhood

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**Abstract:** Familial emotion socialization practices relate to children's emotion regulation (ER) skills in late childhood, however, we have more to learn about how the context and structure of these interactions relates to individual differences in children's ER. The present study examined flexibility and attractors in family emotion socialization patterns in three different conversational contexts and their relation to ER in 8-12 year olds. Flexibility was defined as dispersion across the repertoire of discrete emotion words and emotion socialization functions (emotion coaching, dismissing, and elaboration) in family conversation, whereas attractors were defined as the



average duration per visit to each of these three emotion socialization functions using state space grid analysis. It was hypothesized that higher levels of flexibility in emotion socialization would buffer children's ER from the presence of maladaptive attractors, or the absence of adaptive attractors, in family emotion conversation. Flexibility was generally adaptive, related to children's higher ER across all contexts, and also buffered children from maladaptive attractors in select situations. Findings suggest that the study of dynamic interaction patterns in context may reveal adaptive versus maladaptive socialization processes in the family that can inform basic and applied research on children's regulatory problems.

## **Affective Dynamics in Triadic Peer Interactions in Early Childhood**

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**Abstract:** In interpersonal interaction research, moving beyond dyadic to triadic dynamics can be analytically daunting. We explored the affective states expressed during triadic peer interactions to understand how patterns were associated with childhood psychopathology and sociometric status. High-risk kindergarten children (N = 216) were observed in several groups of three during a free play task. We extended the state space grid technique to 3-dimensional analysis in order to derive variables of interest. Unlike results from parent-child dyadic interactions, triadic affective variability was not strongly associated with externalizing or internalizing problems. However, several triadic affective states were distinguished by externalizing, internalizing, and sociometric status, most commonly mutually aversive affect. Strengths and limitations of this methodology in relation to understanding peer triadic interactions are discussed.

## **A Nonlinear Dynamical Systems Analysis of Child Emotion Displays in Relation to Family Context and Child Adjustment: A Cox Hazard Approach**

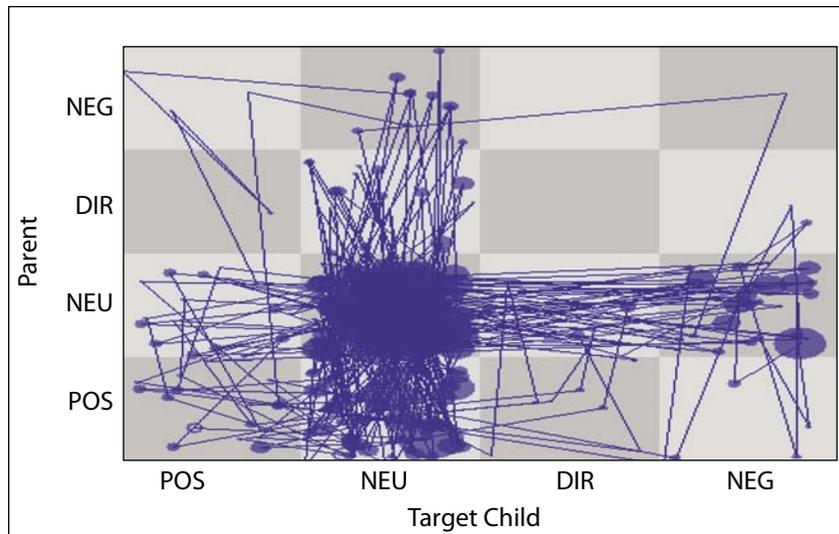
**James Snyder**, *Wichita State University, Wichita, KS*, **Callie Brockman**, *Wichita State University, Wichita, KS*, **Mike Stoolmiller**, *University of Oregon, Eugene, OR*

**Abstract:** This report examines how the relative attractor strengths of children's display of three emotion states, anger, sadness/fear, and neutral-engaged, are associated with exposure to maternal negative affect and care giving disruptions, and to child antisocial behavior and depression. Exposure to negative maternal affect was associated with a weaker attractor state for sadness or fear displays relative to those for anger and neutral-engaged displays. Exposure to care giving disruptions was associated with stronger attractor strength for anger and sadness/fear relative to that for neutral-engaged. Overt and covert antisocial behaviors were associated with weaker attractor states for sadness/fear displays relative to that for the neutral-engaged displays. Overt antisocial behavior was associated with a stronger attractor state for anger displays relative to that for neutral-engaged displays, and covert antisocial behavior with a weaker attractor state for fear/sadness displays relative to that for neutral-engaged displays. Child depressive symptoms were marginally associated with a stronger attractor state for fear/sadness displays relative to neutral-engaged. The data suggest the attractor strengths for emotion display states are affected by social experience and that between-individual risk for various forms of psychopathology is related to the relative intra-individual attractor strength of various emotion displays in a multi-state emotion display system.

## **The Nonlinear Dynamics of Family Problem Solving in Adolescence: The Predictive Validity of a Peaceful Resolution Attractor**

**Thomas J. Dishion**, *Arizona State University, Tempe AZ and University of Oregon, Eugene OR*, **Marion Forgatch**, *Oregon Social Learning Center, Eugene OR*, **Mark Van Ryzin**, *University of Oregon, Eugene OR*, **Charlotte Winter**, *University of Oregon, Eugene OR*

**Abstract:** In this study we examined the videotaped family interactions of a community sample of adolescents and their parents. Youths were assessed in early to late adolescence on their levels of antisocial behavior. At age 16–17, youths and their parents were videotaped interacting while completing a variety of tasks, including family problem solving. The interactions were coded and compared for three developmental patterns of antisocial behavior: early onset, persistent; adolescence onset; and typically developing. The mean duration of conflict bouts was the only interaction pattern that discriminated the 3 groups. In the prediction of future antisocial behavior, parent and youth reports of transition entropy and conflict resolution interacted to account for antisocial behavior at age 18–19. Families with low entropy and peaceful resolutions predicted low levels of youth antisocial behavior at age 18–19. These findings suggest the need to study both attractors and repellers to understand family dynamics associated with health and social and emotional development.



## A Characteristic Destabilization Profile in Parent-Child Interactions Associated with Treatment Efficacy for Aggressive Children

**Anna Lichtwarck-Aschoff**, *University of Nijmegen, The Netherlands*, **Fred Hasselman**, *University of Nijmegen, The Netherlands*, **Ralf Cox**, *University of Groningen, The Netherlands*, **Debra Pepler**, *York University, Toronto, Canada*, **Isabela Granic**, *University of Nijmegen, The Netherlands*

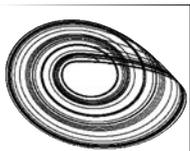
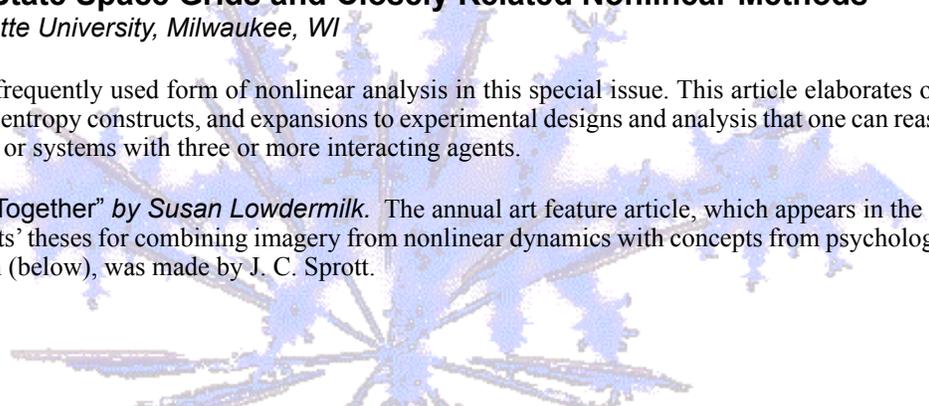
**Abstract:** This study examined profiles of change in repeated mother-child interactions over the course of a 12 week treatment period for childhood aggression. The aim of this study was to investigate whether it was possible to detect the characteristic profile of change, typical for phase transitions, over the course of treatment, and whether this profile was associated with positive treatment outcomes. Entropy values were computed for six repeated real-time observations of each mother-child dyad, using a novel application of recurrence quantification analysis for categorical time series. Subsequent latent class growth curve analysis on the sequences of entropy values revealed two distinct classes of dyads, with one class showing a clear peak in entropy over the six measurement points. The latent class membership variables showed a significant systematic relationship with observed dyad improvement (as rated by clinicians). The class with the peak in entropy over the sessions consisted largely of treatment improvers. Further analysis revealed that improvers and non-improvers could not be distinguished based on content-specific changes (e.g. more positivity or less negativity during the interaction). The present study revealed a treatment-related destabilization pattern in real-time behaviors that was related to better treatment outcomes, and underlines the value of dynamic nonlinear time-series analysis (especially RQA) in the study of dyadic interactions in clinical contexts.

## Some Observations on State Space Grids and Closely Related Nonlinear Methods

**Stephen J. Guastello**, *Marquette University, Milwaukee, WI*

**Abstract:** State space grids are a frequently used form of nonlinear analysis in this special issue. This article elaborates on hypotheses one can test using them, the role of entropy constructs, and expansions to experimental designs and analysis that one can reasonably make to study system stability questions or systems with three or more interacting agents.

*Cover image: "A Ritual to Read Together" by Susan Lowdermilk.* The annual art feature article, which appears in the January issue of *NDPLS*, explains the cover artists' theses for combining imagery from nonlinear dynamics with concepts from psychology and the life sciences. The *NDPLS* Fractal Fern (below), was made by J. C. Sprott.



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