

Fractal Structure in Voluntary Eye Movements

Charles Coey

Center for Cognition, Action, & Perception, University of Cincinnati

Sebastian Wallot

Center for Cognition, Action, & Perception, University of Cincinnati

Michael Richardson

Center for Cognition, Action, & Perception, University of Cincinnati

Guy van Orden

Center for Cognition, Action, & Perception, University of Cincinnati

Abstract: Fractal scaling relations are found in repeated measurements of voluntary human behavior (e.g., time estimation, visual search, word naming). These fractal scaling relations suggest that the variation in the observed behavior is scale-free with small-scale and large-scale variations sharing the same structure. Researchers have proposed a conceptual control parameter that may account for reliable changes in fractal dimension observed across behaviors and tasks (e.g., Van Orden, 2010; Kloos & Van Orden, 2010). This control parameter is a ratio between the uncontrolled and controlled degrees-of-freedom (DoF) associated with a particular experimental procedure. Two voluntary eye movement experiments tested whether this parameter accounts for differences in observed fractal dimension. Collectively, these results support the conceptual utility of the proposed control parameter. Conditions in which uncontrolled DoF exceeded controlled DoF yielded fractal dimension estimates more toward 'white noise', whereas conditions in which controlled DoF exceed uncontrolled DoF yielded estimates more toward 'brown noise'.