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# Nonlinear dynamics of speech categorization: critical slowing down and critical fluctuations

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The dynamical system view of speech perception assumes that speech categorization depends on both the acoustic properties of the incoming sound and the state of the perceptual system (indexed by the subject's responses to preceding sounds). Tuller and colleagues [1] systematically manipulated the order of presentation of stimuli from a "say"- "stay" continuum in a binary-choice word identification task. Listeners' responses were modelled using a non-linear dynamical system whose point attractors were associated with perceptual categories. In the present study, we asked French speakers to categorize stimuli on a continuum from "cèpe" /sep/ to "steppe" /step/. Our results provide support for two yet untested predictions from the model: the occurrence of a) critical slowing down and b) critical fluctuations. Critical slowing down relates to the increase in relaxation time that occurs as the system approaches points of instability. Critical fluctuations refer to the system's increased sensitivity to random fluctuations near the points of instability. [Work supported by the CNRS & French Ministry of Research, and by NSF].

[1] P. Case, B. Tuller, D. Mingzhou, and J.A.S. Kelso. Evaluation of a dynamical model of speech categorization. *Perception and Psychophysics*, 57:977-988, 1995.