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**Speed-curvature relations in speech production: a multilingual
experimental and modeling study**

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Regularities in the relations between tangential velocity and trajectory curvature have been found in a number of human movements. They were formalized in the 1/3 power law [Viviani and Terzuolo, *Neuroscience* 7: 431-437, 1982]. Viviani and colleagues also found that modifying the speed-curvature relations would influence the perception of synthetic movements in terms of naturalness and classification. Hence, these relations could be at the core of the perception-action link in human movements. In this paper, tongue movement collected from speakers of French, German and Mandarin are analyzed. They are compared with data from simulations using a biomechanical tongue model, which is controlled on a target-to-target basis. Our results for experimental data and simulations are very similar. It is found that the 1/3 power law offers a fair description of the velocity-curvature relations when a large amount of movements are considered together. However, a refined analysis of individual movements reveals that the exceptions to this law are numerous. It is concluded that the velocity-curvature relation is not controlled in speech movements, and that the 1/3 power law only accounts for general characteristics of movements, which could arise from dynamical properties of the articulators.