

Abstract Submitted  
for the DFD15 Meeting of  
The American Physical Society

**Shape of the human nasal cavity promotes retronasal smell** SOPHIE TRASTOUR, Ecole Polytechnique and Harvard University, SIMONE MELCHIONNA, Institute for Complex Systems, Rome, SHRUTI MISHRA, DAVID ZWICKER, DANIEL E. LIEBERMAN, EFTHIMIOS KAXIRAS, MICHAEL P. BRENNER, Harvard University — Humans are exceptionally good at perceiving the flavor of food. Flavor includes sensory input from taste receptors but is dominated by olfactory (smell) receptors. To smell food while eating, odors must be transported to the nasal cavity during exhalation. Olfactory performance of this retronasal route depends, among other factors, on the position of the olfactory receptors and the shape of the nasal cavity. One biological hypothesis is that the derived configuration of the human nasal cavity has resulted in a greater capacity for retronasal smell, hence enhanced flavor perception. We here study the air flow and resulting odor deposition as a function of the nasal geometry and the parameters of exhalation. We perform computational fluid dynamics simulations in realistic geometries obtained from CT scans of humans. Using the resulting flow fields, we then study the deposition of tracer particles in the nasal cavity. Additionally, we derive scaling laws for the odor deposition rate as a function of flow parameters and geometry using boundary layer theory. These results allow us to assess which changes in the evolution of the human nose led to significant improvements of retronasal smell.

David Zwicker  
Harvard University

Date submitted: 01 Aug 2015

Electronic form version 1.4