Seminar

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Time to Smell: A Cascade Model of Human Olfactory Perception Based on Response-time (RT) Measurement

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In the Thunberg Lecture Hall
SCAS, Linneanum, Thunbergsvägen 2, Uppsala
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ABOUT JONAS OLOFSSON

Jonas Olofsson's research interests concern psychological and biological aspects of human perception, emotion and memory, with a focus on olfaction (smell). He received his undergraduate and doctoral degrees (2003 and 2008) from Umeå University and has been Associate Professor of Psychology at Stockholm University since 2009. In his doctoral dissertation, Olofsson showed that olfactory function was more impaired in old-age individuals who carried a gene variant associated with Alzheimer's disease (Olofsson et al., 'Odor Identification Impairment in Elderly ApoE-e4 Carriers Is Independent of Dementia', *Neurobiology of Aging*, 2010). Among carriers of this gene variant, those with a poor sense of smell suffered from a larger cognitive decline in the next five years (Olofsson et al., 'Odor Identification Deficit as a Predictor of Five-Year Global Cognitive Change: Interactive Effects with Age and ApoE-e4', *Behavior Genetics*, 2009). These findings indicate that olfactory impairment in the elderly might be a precursor of cognitive impairment in individuals at high risk of Alzheimer's disease, consistent with the neuroanatomical overlap between Alzheimer's disease pathology and olfactory systems.

As a postdoctoral Fellow at the Feinberg School of Medicine at Northwestern University, Chicago, Olofsson used neuroimaging and cognitive experimental techniques to investigate the relationship between olfaction and language systems in the brain. Results from this ongoing research project show that contrary to popular belief, emotional responses to odours are slow and inconsistent (Olofsson et al., 'A Time-Based Account of the Perception of Odor Objects and Valences', *Psychological Science*, 2012). He also found in the left frontal and temporal lobes, a set of brain regions specialized in linking a smell to verbal and knowledge-based associations to create a meaningful olfactory experience (Olofsson et al., 'A Cortical Pathway to Olfactory Naming: Evidence from Primary Progressive Aphasia', *Brain*, 2013).

As a Pro Futura Scientia scholar, Olofsson will investigate the potential cognitive and health benefits of training elderly people's sense of smell.

ABSTRACT

The timing of olfactory behavioral decisions may provide an important source of information about how the human olfactory-perceptual system is organized. This review integrates results from olfactory response-time (RT) measurements from a perspective of mental chronometry. Based on these findings, a new cascade model of human olfaction is presented. Results show that main perceptual decisions are executed with high accuracy within about 1 s of sniff onset. The cascade model proposes the existence of distinct processing stages within this brief time-window. According to the cascade model, different perceptual features become accessible to the perceiver at different time-points, and the output of earlier processing stages provides the input for later processing stages. The olfactory cascade starts with detecting the odor, which is followed by establishing an odor object. The odor object, in turn, triggers systems for determining odor valence and edibility. Evidence for the cascade model comes from studies showing that RTs for odor valence and edibility assessment are predicted by the shorter RTs needed to establish the odor object. Challenges for future research include innovative task designs for olfactory RT experiments and the integration of the behavioral processing sequence into the underlying cortical processes using complementary RT measures and neuroimaging methods.

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