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Perceptual integration of odor mixtures

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ABSTRACT

Virtually all perceptions of environmental odors are based on an integration process of many volatile components, in many cases hundreds of components. By investigating the perceptual dimensions in this perceptual integration process and how it is affected by the neurophysiology of the olfactory system we can begin to understand the nature of complex odor perception. The aim of this thesis is to describe and model the perceptual integration process by investigating how two single components integrate into an odor percept.

Study I showed that the odor of an agonist, as hypothesized, was dominated by the odor of an antagonist.

Study II implicated that peripheral processing plays an important role in integrating odorants into the mixture perception, with higher intensities and more stable perception of quality when bypassing this level of interaction. Electrophysiological measurements converged with these perceptual effects.

Study III showed that the pleasantness of single odorants is dependent on *intensity* as described by a certain *family* of 2nd degree polynomials. The pleasantness of *mixtures* is dependent on the *quality* change and the *shift in intensity* that occurs when one odorant is added to another. The pleasantness of mixtures can be predicted along a *quality-weighted* average of the individual functions.

Study IV showed that mixture quality is not tied to any particular single component, which indicates that we perceive odor mixture more or less synthetically as a unitary percept. In addition, the study showed that the perceived quality and pleasantness of combined odorants is a simple function of the component qualities such that mixture quality is intermediate to its components' quality in perceptual space.

The combined results from these studies suggest that integration of odors into a mixture percept is dependent on the interaction at the peripheral level of the olfactory system, the receptor epithelia. In addition, the quality of an odor mixture tends to be intermediate to those of its components in a perceptual space and the odor mixture percept tends to be synthesized into a unitary homogeneous percept. Finally, a psychophysical model of mixture integration describing the interplay between fundamental dimensions of the odor percept: intensity, quality, and pleasantness is developed and tested.

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