

Scientists produce the first smell map

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Is the smell of almonds closer to that of roses or bananas? Weizmann Institute scientists have now answered that question (roses) by showing for the first time that smells can be mapped and the relative distance between various odors determined. Their findings, which appeared recently in *Nature Methods*, may help scientists to unravel the basic laws underlying our sense of smell, as well as potentially enabling odors to be digitized and transferred via computer in the future.

We know the musical note do is farther from la than from re on a scale – not only because our ears tell us the distance is greater, but because their frequencies are farther apart. No such physical relationship had been discovered for smells, in part because odor molecules are much more difficult to pin down than sound frequencies.

To create their map, the scientists began with 250 odorants and generated, for each, a list of around 1,600 chemical characteristics. From this dataset, the researchers, led by Rafi Haddad, a graduate student with Prof. Noam Sobel in the Neurobiology Department, and Prof. David Harel of the Computer Science and Applied Mathematics Department, together with their colleague Rehan Khan, created a multidimensional map of smells that revealed the distance between one odor molecule and another.

Eventually, they pared the list of traits needed to situate an odor on the map down to around 40. They then checked to see whether the brain recognizes this map, similar to the way it recognizes musical scales.

They reexamined numerous previously published studies that measured the neural response patterns to smells in a variety of lab animals – from fruit flies to rats – and found that across all the species, the closer any two smells were on the map, the more similar the neural patterns.

The scientists also tested 70 new odors by predicting the neural patterns they would arouse and running comparisons with the unpublished results of olfaction experiments done at the University of Tokyo. They found that their predictions closely matched the experimental results.

These findings lend support to the scientist's theory that, contrary to the commonly held view that smell is a subjective experience, there are universal laws governing the organization of smells, and these laws determine how our brains perceive them.

Source: Weizmann Institute of Science

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