

## **Name that odor: Identical odors seem different when given different names**

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Our brains process odors differently depending on the names assigned to them, according to new research. Participants were asked to sniff similar odors, for example two citrus scents, and then rate how dissimilar they thought the odors were. Researchers found that identical odors that had been given different names were rated as being more dissimilar than if they were labeled as being the same.

By using ultrahigh-field functional MRI technology, the researchers could see how the information, the [odor](#) and labels, was processed in the area of the [brain](#) that identifies odor, and how this differed depending on the label used. This research helps us better understand the context-dependent experience of odors and how language can affect our daily life.

The research is [published](#) in the journal *Human Brain Mapping*.

Would a rose by any other name smell as sweet? Or stinky tofu as ... stinky? Maybe not. It turns out that the labels we give to things affect the way we perceive their odor and, according to new research, can even make us think that identical odors smell different. Researchers have discovered that giving names to odors not only affects our perception of them but how they are processed in our primary olfactory cortex, the area of our brains related to our sense of smell.

Participants were given minty and citrusy odors to sniff, which had been labeled with two words; for example, mint-menthol or eucalyptus-menthol. While sniffing, participants were scanned using an ultrahigh-field (7-tesla) functional MRI (fMRI) machine. While MRIs take snapshots of the brain, fMRIs enable researchers to see activity in the brain over time, in this case where in the brain the information about the labeled odors was being processed.

		Odorants	
		menthol (Men)	eucalyptol (Euc)
Labels	minty	mint-Men	mint-Euc
	eucalyptus	eucal-Men	eucal-Euc

\*eucal, eucalyptus

		Odorants	
		citral (Cit)	limonene (Lim)
Labels	citrus	lemon-Cit	lemon-Lim
	yuzu	yuzu-Cit	yuzu-Lim

\*yuzu is a popular citrus fruit in Japan.

Combinations of words and odors: The four different odors and their labels were chosen based on a pilot study which checked that participants would see them as matching up. In this final study, 20 participants aged 20–39 years old rated the level of similarity and difference. Credit: *Human Brain Mapping* (2024). DOI: 10.1002/hbm.26681

After the scan, participants sniffed the odors again, but this time presented in pairs, and then rated how similar or different they thought the odors were from each other. In this second round, the odors and their labels were either the same, or two identical odors were given different labels, or different odors were given the same name.

"We were surprised to discover the clear effects of labels on the participants' ratings of odors. We could also see from the fMRI results how the semantic context, the word labels used, influenced odor-coding activity in the [piriform cortex](#), a key part of the primary olfactory cortex for processing smell," explained Associate Professor Masako Okamoto from the Graduate School of Agricultural and Life Sciences at the University of Tokyo.

"Although we knew that the perceptual aspects of odors are processed in the primary olfactory cortex, which the piriform cortex is part of, until now it was unclear whether word labels influenced odor representation in this brain region as well."

Results showed that participants reported a greater difference between odors when two identical odors were given different names, than when they were labeled the same. The fMRI data showed that some parts of the piriform cortex were affected by the words used to label the odors,

while other areas were more affected by the odor itself.

The researchers suggest that this may be because areas affected by words would differ from those affected by odors within the primary olfactory cortex, but further research is needed to confirm this. The team also noticed a significant connection between the areas within the piriform cortex affected by words and other regions of the brain involved in [language processing](#).

This study furthers our understanding of how language and our sense of smell are intertwined, and how flexible our perceptions of odors can be. Something to think about when you choose your next scented "berry bonanza" candle or "fresh cotton mist" detergent.

**More information:** Toshiki Okumura et al, Semantic context-dependent neural representations of odors in the human piriform cortex revealed by 7T MRI, *Human Brain Mapping* (2024). DOI: [10.1002/hbm.26681](https://doi.org/10.1002/hbm.26681)

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