Researchers getting closer to understanding why odors are so difficult to describe

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(Medical Xpress)—Ask someone to describe something they are looking at, and they will offer words that have evolved to describe seen objects, but ask them to describe odors, and they will almost always use comparative words based on detection of prior odors. Why this is has puzzled scientists for quite some time, though now it appears that some are getting closer. One team working at Northwest University has been using brain scans to understand what happens when we try to identify smells—they've published a paper describing their findings in *The Journal of Neuroscience*. Meanwhile, another team has been studying the differences between cultures and how they describe odors and have found that some do a much better job than others. They published a paper earlier this year in the journal *Cognition*.

Our inability to develop good descriptive words to describe odors has been generally ascribed to the ways in which our brains work—we're simply not wired for it. That of course, is a simplistic approach—if we're not wired for it, why not? Also, is it possible we are wired for it, but have never found the need great enough to cause such words to come about in our evolutionary development?

The team at Northwestern has taken a hands-on approach to finding out; first in a prior study, they looked at the brains of people with a brain ailment that makes them even worse than the norm at describing odors. The found a part of the brain that was different, which suggested odor description may be in the wiring after all. In their more recent study, they asked volunteers to describe odors while hooked up to both fMRI and EEG machines. That study showed that there appears to be two parts of the brain involved in recognizing odors and converting what is smelled into a description of some sort. The data there suggests there may be a breakdown between what is perceived and a communication's channel, once again hinting at wiring.

Taking a completely different approach, a team led by Asifa Majid, with Radboud University in the Netherlands, has been studying different cultures to see if some are better at describing odors than others. They found two that very clearly are—one group that lives in southern Thailand, the other on the Malay Peninsula. Both groups tended to have a large odor vocabulary, which included words specifically dedicated to odors, much like other cultures have for vision or even sound. Their findings suggest that if odor description abilities are hard-wired in the brain, it likely happens after we're born as we're learning to talk.

More information: 1. A Designated Odor–Language Integration System in the Human Brain, The *Journal of Neuroscience*, 5 November 2014, 34(45): 14864-14873; DOI: 10.1523/JNEUROSCI.2247-14.2014

Abstract
Odors are surprisingly difficult to name, but the mechanism underlying this phenomenon is poorly understood. In experiments using event-related potentials (ERPs) and functional magnetic resonance imaging (fMRI), we investigated the physiological basis of odor naming with a paradigm where olfactory and visual object cues were followed by target words that either matched or mismatched the cue. We hypothesized that word processing would not only be affected by its semantic congruency with the preceding cue, but would also depend on the cue modality (olfactory or visual). Performance was slower and less precise when linking a word to its corresponding odor than to its picture. The ERP index of semantic incongruity (N400), reflected in the comparison of nonmatching versus matching target words, was more constrained to posterior electrode sites and lasted longer on odor-cue (vs picture-cue) trials. In parallel, fMRI cross-adaptation in the right orbitofrontal cortex (OFC) and the left anterior temporal lobe (ATL) was observed in response to words when preceded by matching olfactory cues, but not by matching visual cues. Time-series plots demonstrated increased fMRI activity in OFC and ATL at the onset of the odor cue itself, followed by response habituation after processing of a matching (vs nonmatching) target word, suggesting that predictive perceptual representations in these regions are already established before delivery and deliberation of the target word. Together, our findings underscore the modality-specific anatomy and physiology of object identification in the human brain.

2. Revisiting the limits of language: The odor lexicon of Maniq,

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Abstract

It is widely believed that human languages cannot encode odors. While this is true for English, and other related languages, data from some non-Western languages challenge this view. Maniq, a language spoken by a small population of nomadic hunter–gatherers in southern Thailand, is such a language. It has a lexicon of over a dozen terms dedicated to smell. We examined the semantics of these smell terms in 3 experiments (exemplar listing, similarity judgment and off-line rating). The exemplar listing task confirmed that Maniq smell terms have complex meanings encoding smell qualities. Analyses of the similarity data revealed that the odor lexicon is coherently structured by two dimensions. The underlying dimensions are pleasantness and dangerousness, as verified by the off-line rating study. Ethnographic data illustrate that smell terms have detailed semantics tapping into broader cultural constructs. Contrary to the widespread view that languages cannot encode odors, the Maniq data show odor can be a coherent semantic domain, thus shedding new light on the limits of language.