A Virtual Reality Olfactory Display
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“Smell is a potent wizard that transports you across thousands of miles and all the years you have lived.”

Helen Keller

Some olfactory facts and why olfaction matters
- Over 90% of what we consider taste is in fact smell. Gustation is limited to sweet, salty, sour, bitter and umami. Hence why food loses its flavour when we have a cold.
- Odour stimuli naturally occur in incredibly complex combinations of molecules – coffee and wine ~400 compounds and beer over 1000 compounds.
- Humans can smell fear and disgust through sweat. Sweat has been shown to contain olfactory signals related to genetic make up. Each human has their own unique “odour fingerprint”.
- Smell has the closest relationship to our biographical memory than any other sense.
- Smell depends upon 300 different receptor proteins in humans, 1000 in rats and 2000 in elephants.
- The olfactory system projects to the central limbic areas of the brain, responsible for memory and emotion.
- There are two modes of smelling – orthonasal from the outside world and retronasal during eating/drinking.
- Although the sense of smell is often ignored it is extremely important for our well-being – a very high % of anosmic individuals suffer from depression.
- Olfactory neurons are the only brain cells to be in direct contact with the world and must be continually replaced on a 30-60 day cycle.
- Sense of smell degenerates over our life. A (non-trauma) rapid loss of olfactory function predicts death within 5 years.
- Females have a much better sense of smell than males, on average.
- We still do not have a comprehensive explanation of how to predict a smell from its underlying molecular structure – the so called “olfactory coding” problem remains to be cracked.
- Smell is the oldest of the senses and largely bypasses the neocortex.
- Historically a figure of 10,000 different smells was the perception limit, but now argued to be 1 trillion, with new odorous molecules being invented every day.
- In humans olfaction works by triggering 10 million olfactory receptors in a unique pattern for each odour – population code. See below and right.
- Tiny changes to molecular structure can have dramatic changes in perceptual odour quality:

Music Composition

MIDI

Odour Composition

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1. Olfactory receptor cells are excited by odorant signals.
2. Olfactory nerve fibers transmit these signals to the central nervous system.
3. This enables the conscious detection of odors in our brain.
4. The signals are maximized to fully explore the olfactory environment.
5. The signals are attenuated to maintain sensitivity.

A population coding of molecular features. Different olfactory receptors respond to a broad set of molecular determinants.