

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
Deaf-Blind Author and Political Activist

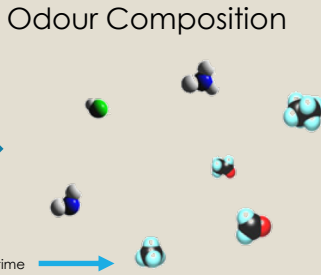
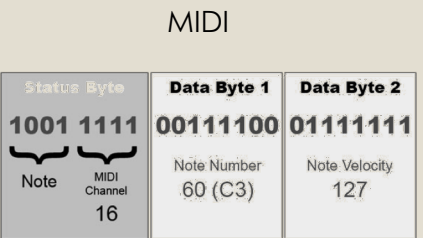
Some olfactory facts and why olfaction matters

- 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.

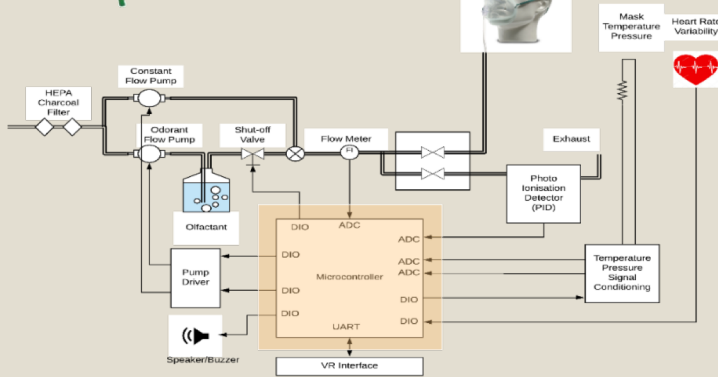
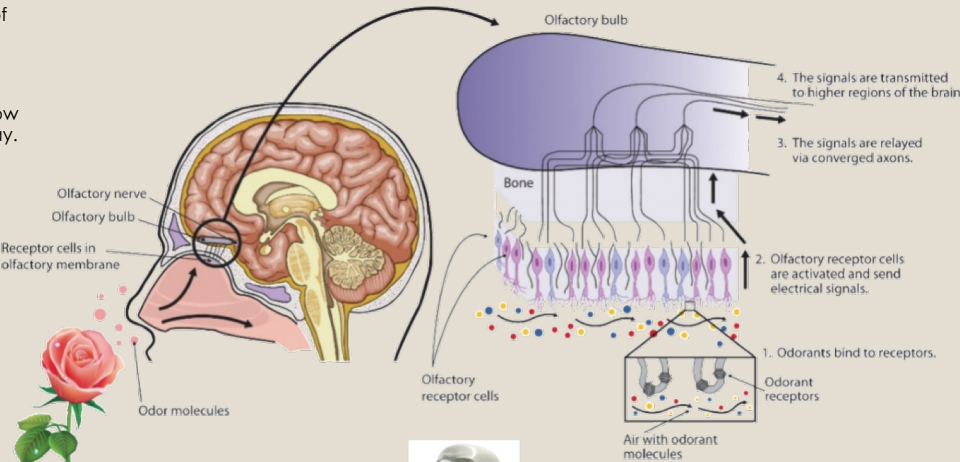
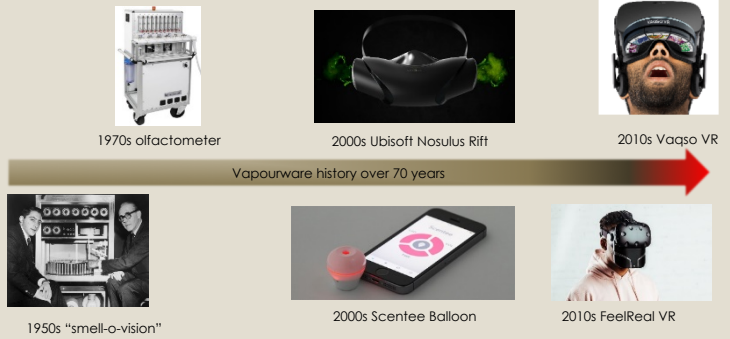
- Females have a much better sense of smell than males, on average.
- We still do not have a comprehensive explanation of how to predict a smell from its underlying molecular structure – the so called “olfactory coding” problem remains to be cracked.
- Smell is the oldest of the senses and largely bypasses the neocortex.
- Miasma theory of smell was used historically as an account for the spread of disease through smell. It accounts for our use of deodorants today.
- Smell can be used as a diagnostic for various neurodegenerative disorders.
- 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:

Odorant receptors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Odorants															Description
A															rancid, sour, goat-like
B															sweet, herbal, woody
C															rancid, sour, sweaty
D															violet, sweet, woody
E															rancid, sour, repulsive
F															sweet, orange, rose
G															waxy, cheese, nut-like
H															fresh, rose, oily floral

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



Repurposing the MIDI protocol to make an “odour composition” in time



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University of Leicester Olfactory (Stage 1) Display