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31 Jan 2019

Emergent User Interfaces
CS-E4200

Introduction to Multimodal Interaction 3
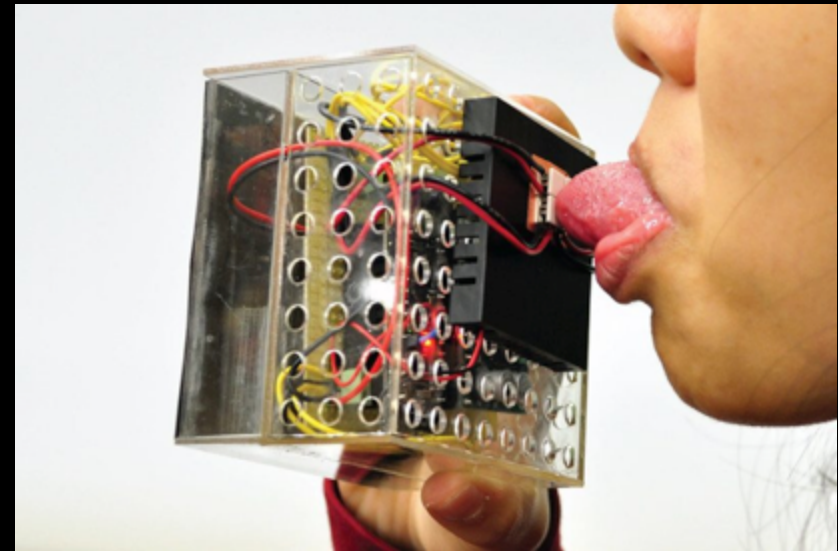
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Displays for other senses

Smell & Taste

- We have 5 senses.

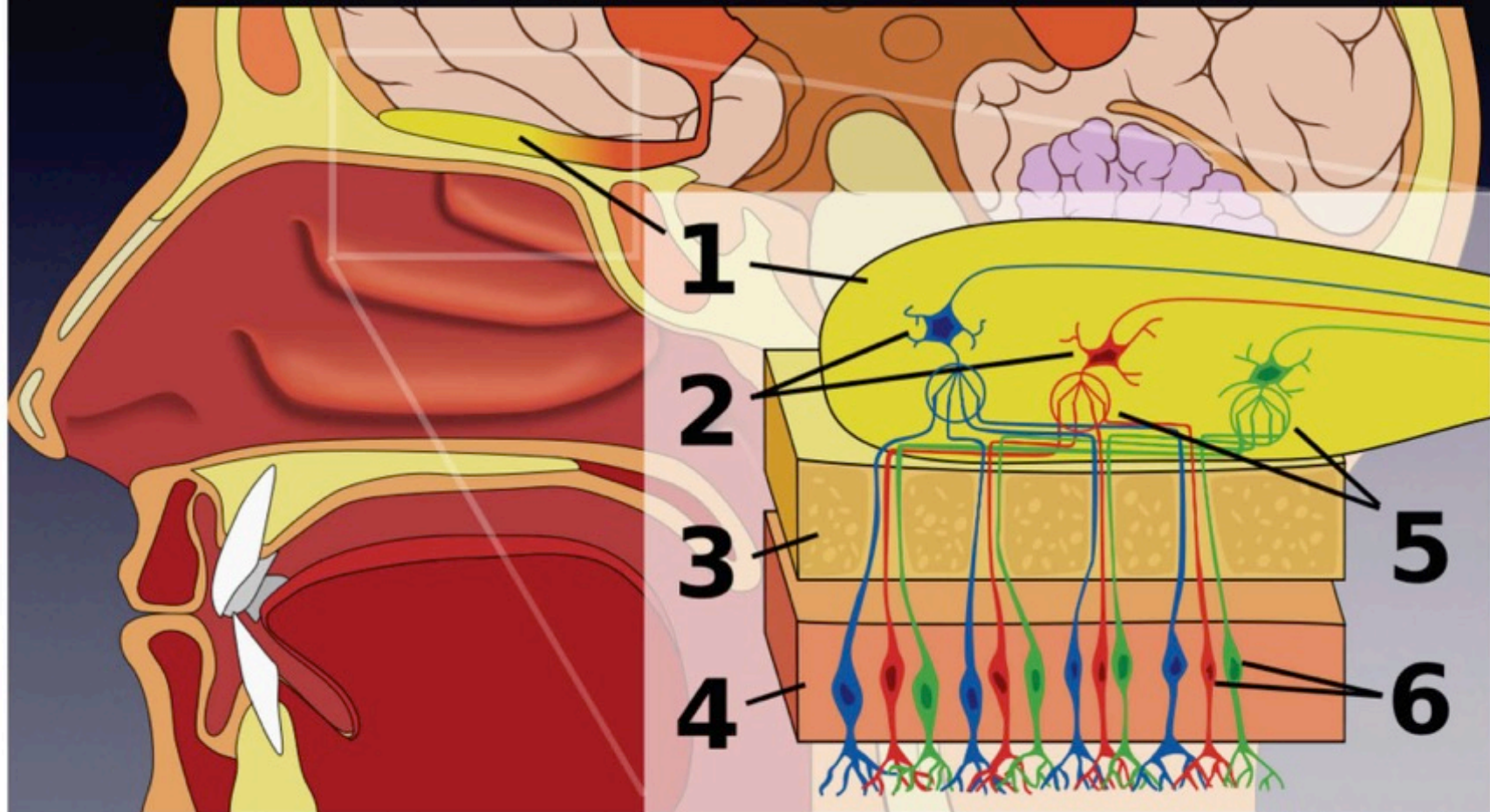- Why do we only use 3 with a computer?

Smell and Taste

- Today still experimental technology

- https://en.wikipedia.org/wiki/Digital_scent_technology
- https://en.wikipedia.org/wiki/Gustatory_technology

Smell

wikipedia.org

How do we Smell

- Many theories around how we interpret smell.

- Key work by Buck and Axel (2004)

  - Mapped odor molecules to receptors

  - A lock and key system

  - Believed to build smell from much smaller primitives (e.g. like vision)

  - About 1000 primitives!

  - Not all in use either

- Its a big space!

- We don't know how to "build" smells or describe them
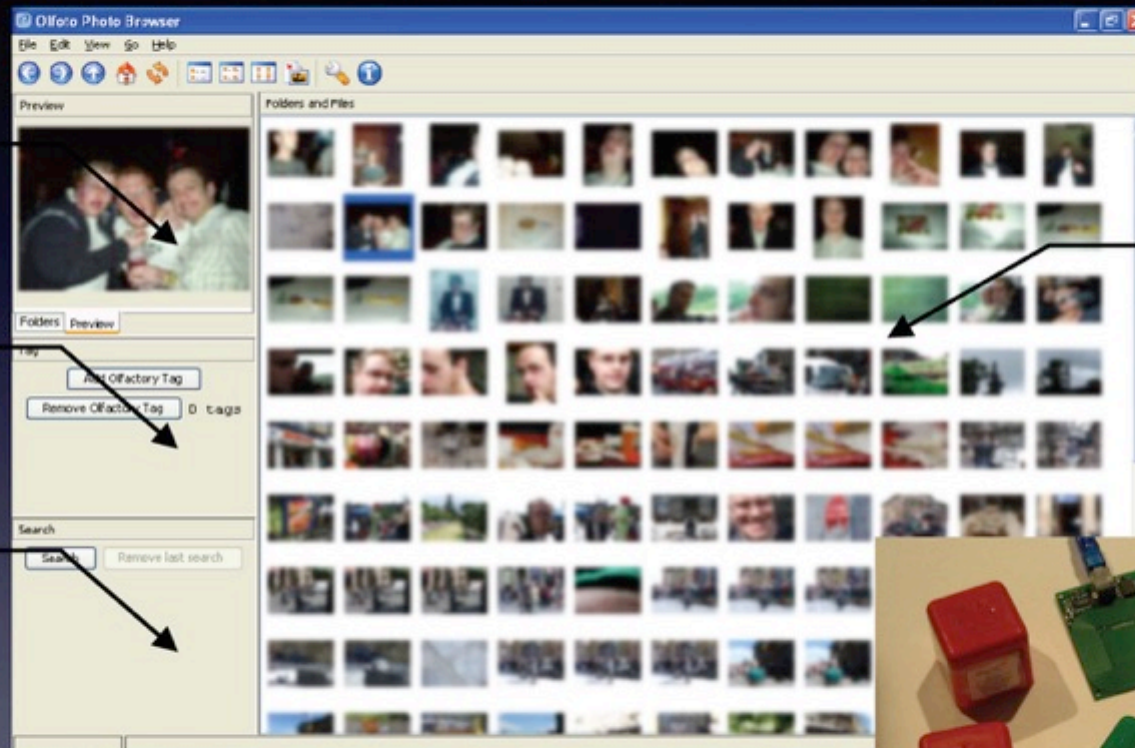
What could we use smell for?

- Obrist et al. (2014)
  - Asked people to provide "smell stories"
- Associations of the Past
- **Remembering via Smell**
- Stimulating
- Identifying and Detection (*notifications*)
- Mood changing

Olfoto

Photo viewing pane

Tagging pane

Searching pane

Thumbnail pane

Stephen Brewster, David McGookin, and Christopher Miller. 2006. Olfoto: designing a smell-based interaction. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '06), Rebecca Grinter, Thomas Rodden, Paul Aoki, Ed Cutrell, Robin Jeffries, and Gary Olson (Eds.). ACM, New York, NY, USA, 653-662. DOI=10.1145/1124772.1124869 http://doi.acm.org/10.1145/1124772.1124869

Olfoto

- 6 Participants
  - 2 parts, each used their own photos
- 3 Research Questions
  - Can smell play a role in photo searching?
  - How does Smell compare to Text tags?
  - What are the practical issues using smell?

Results

- Text was much better 96%

- Smell was at 53%

  - but above chance performance

- Smell can support photo recall

  - but text was better

- Strong potential but technical issues play an important role
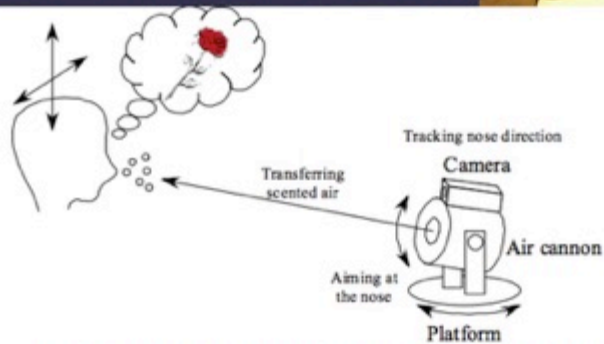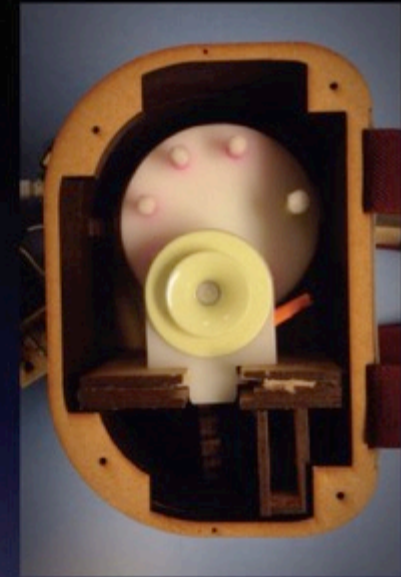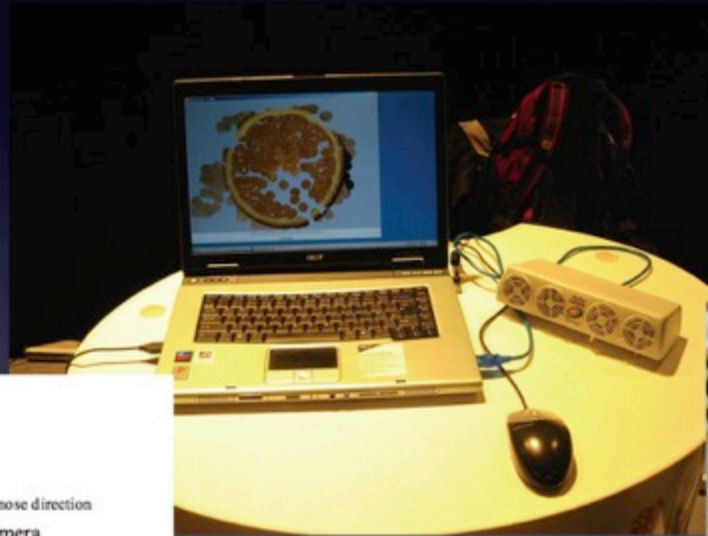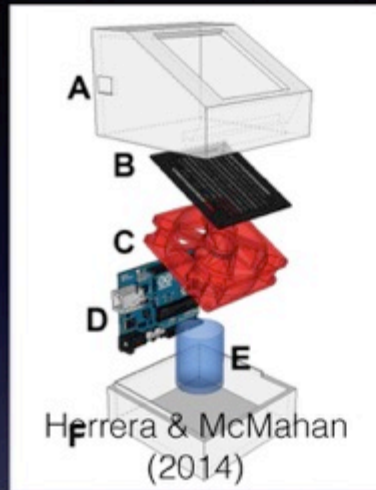
Smell Delivery

Herrera & McMahan (2014)

Fig 1: Concept of the projection-based olfactory display.

- Key point: Smell must be "hand mixed". Limits number and diversity of smells

Smell – focused vapor stimulation

- Phased source of ultrasound makes a flow velocity beam in mid-air

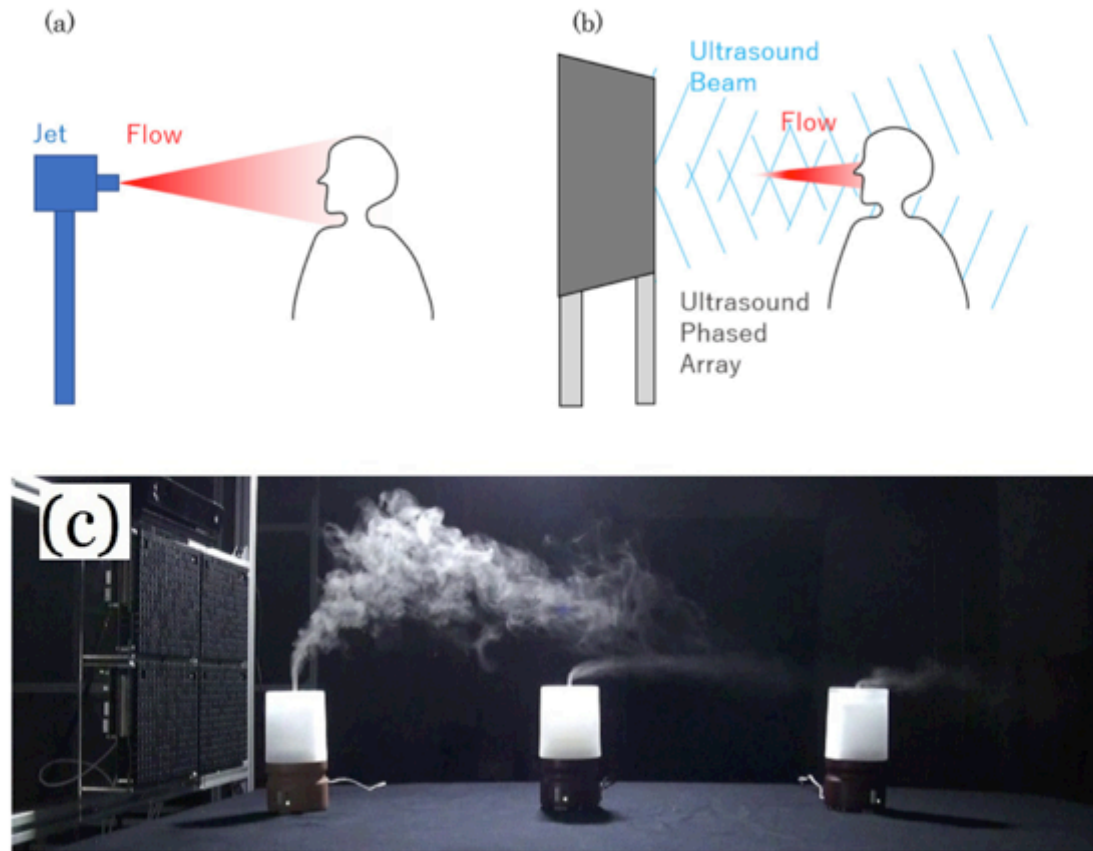- Sources of chemical vapors can be redirected toward (or away from) the user

Fig. 2. Schematic depiction of (a) Conventional jet-driven flow and (b) ultrasound-driven flow. (c) Actual generated flow. The vapor source nearest to the ultrasound phased array is not redirected as much as the other two.

Taste

Taste: What we Know

- 5 primary tastes
    - sweetness
    - sourness
    - saltiness
    - bitterness
    - umami
- Each stimulates taste buds
- You loose 50% by age 20
- Also mechanoreceptors and temperature sensors!
- Not just about "taste"
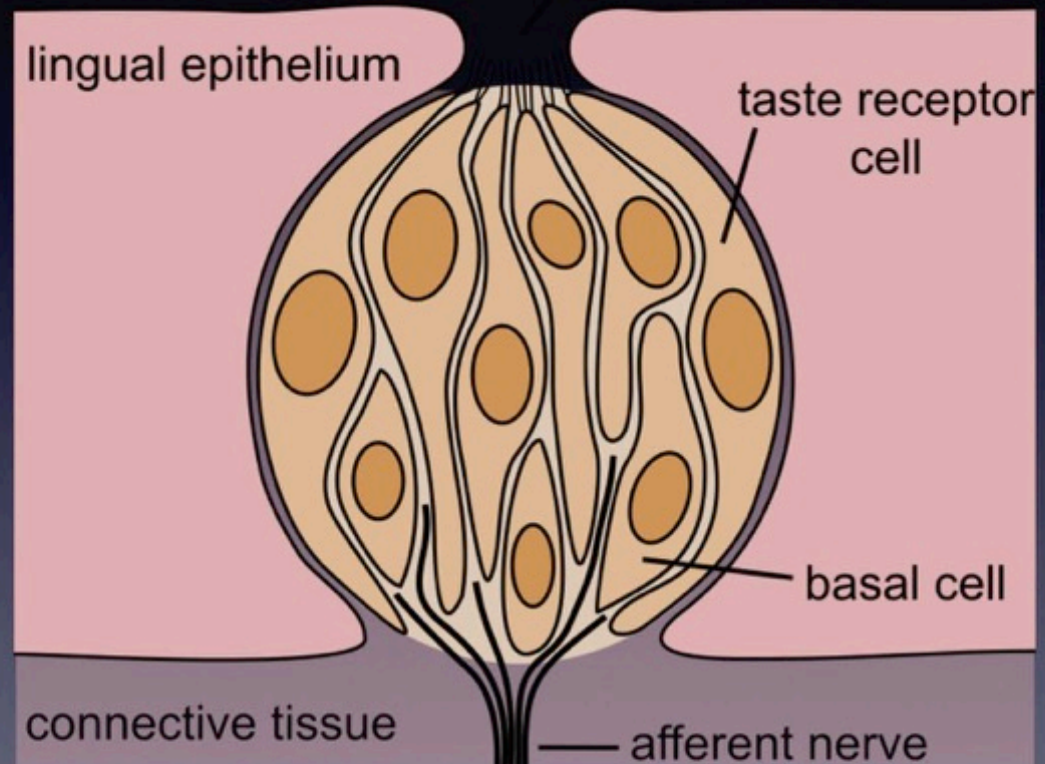
lingual epithelium

taste receptor cell

basal cell

connective tissue

afferent nerve

In HCl?

Temporal, Affective, and Embodied Characteristics of Taste Experiences: A Framework for Design

Marianna Obrist[1,2], Rob Comber[1], Sriram Subramanian[3], Betina Piqueras-Fiszman[4],
Carlos Velasco[4], Charles Spence[4]

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ABSTRACT
We present rich descriptions of taste experience through an analysis of the diachronic and synchronic experiences of each of the five basic taste qualities: sweet, sour, salt, bitter,

There is a need for a more systematic study of people's taste experiences and their specific characteristics in order to make a fuller use of this sense in future taste-enhanced technologies. This paper stands as a first step in addressing

In HCI?

- Sought to understand how taste is experienced

- Descriptions and shape selection based on odourless taste liquids

- Provided shapes to describe the experience

- Similar to audio waveforms?

pleasant
neutral
unpleasant

mouth filling

SWEET

SOUR

SALTY

BITTER

UMAMI (a) (b)
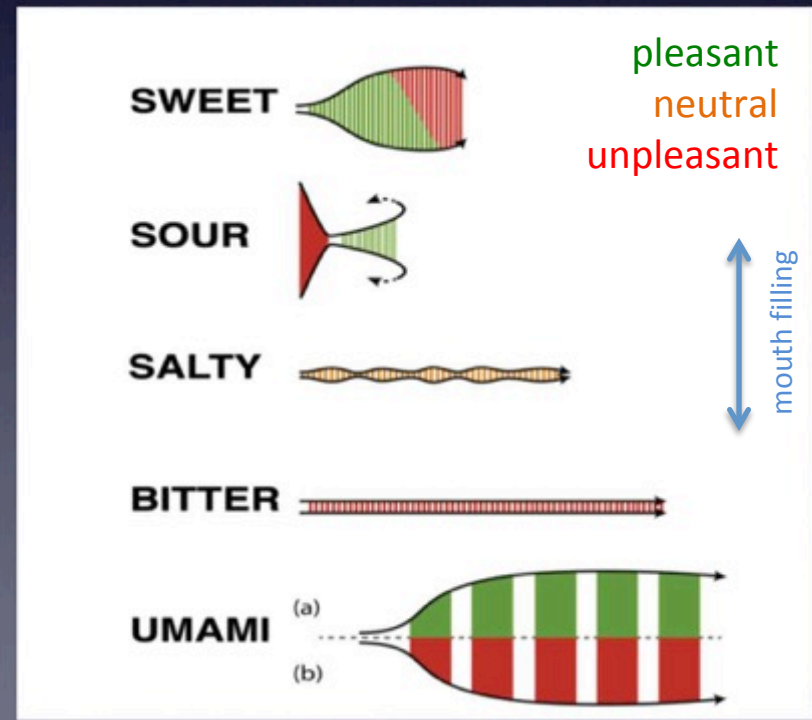
Taste Delivery

- Electrical stimulation?

- Have to put something in the user's mouth

- Or pseudo taste (with smell)

  - E.g. MetaCookie++

  - (Narumi et al. 2011)

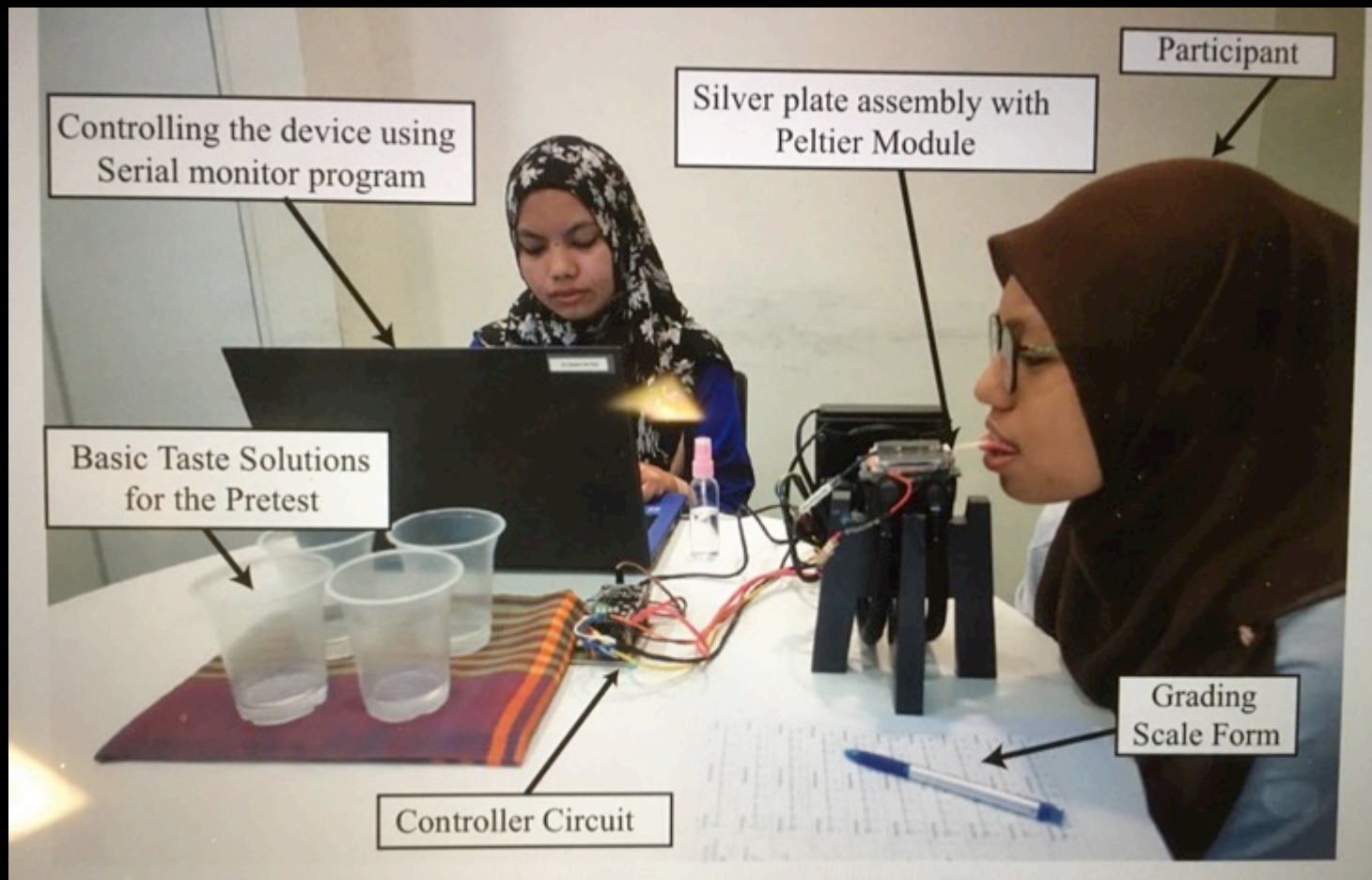- Or user involvement

  - Maynes-Aminzade (2005)
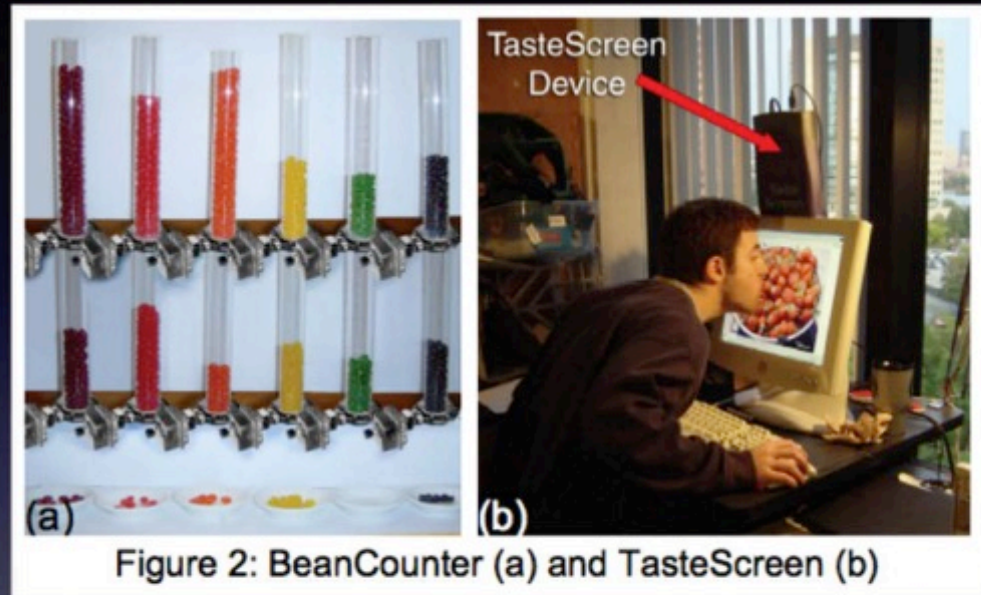
Figure 2: BeanCounter (a) and TasteScreen (b)

IEEE VR 2018

Taste – thermal display

- Mild results: some associations in user test
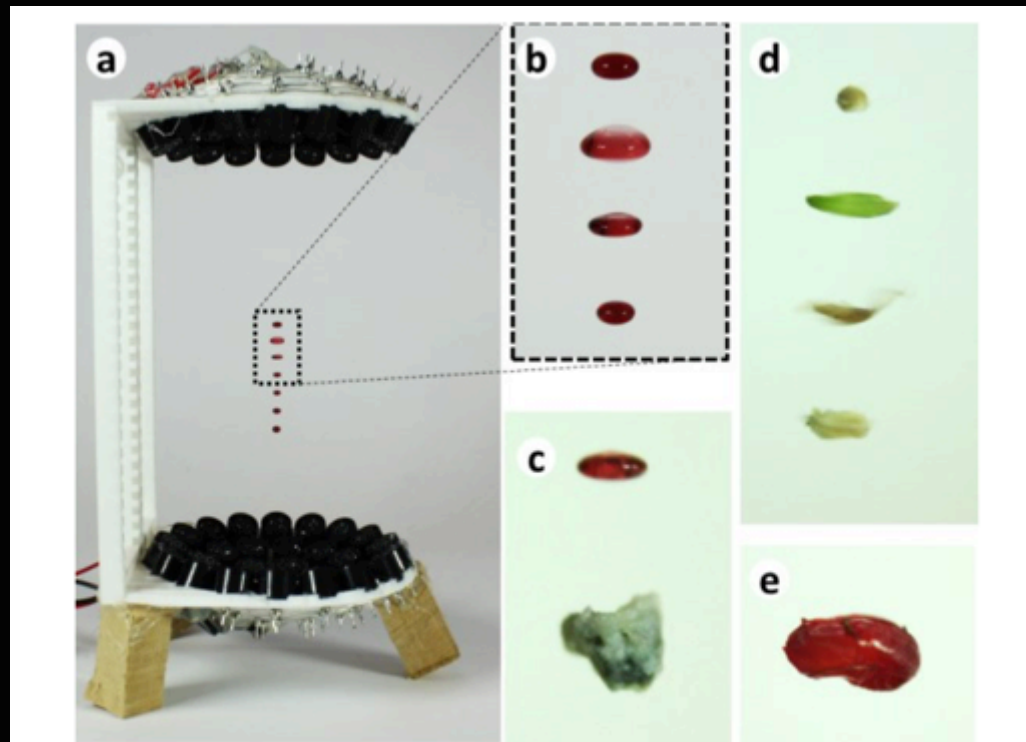 warm ≈ sweet, cool ≈ mint

Tasty-Floats

Figure 1. Examples of levitated food morsels: a, b) Acoustic levitation of droplets of wine; c) Wine and blue cheese; d) Bread, lettuce, meat and bread; e) and a raspberry grain.

Vi, Chi Thanh, et al. "Tastyfloats: A contactless food delivery system." Proceedings of the 2017 ACM International Conference on Interactive Surfaces and Spaces. ACM, 2017.

Conclusions

- Vision and Audio are great!
  - We know Perception
  - We know synthesis
- Olfaction and Taste
  - We know s**t (in comparison)
  - Which means there is lots to find out
- Lots of opportunities we are only beginning to discover

Going Even Further... ?

- Sense of balance
- Brain interface

Sense of balance

- Galvanic Vestibular Stimulation (GVS)
  - vestibular nerve connected to inner ear organs
  - electrical surface stimulation through the skin
- Causes some sensation of vection
- Experimented in VR − not in practical use…
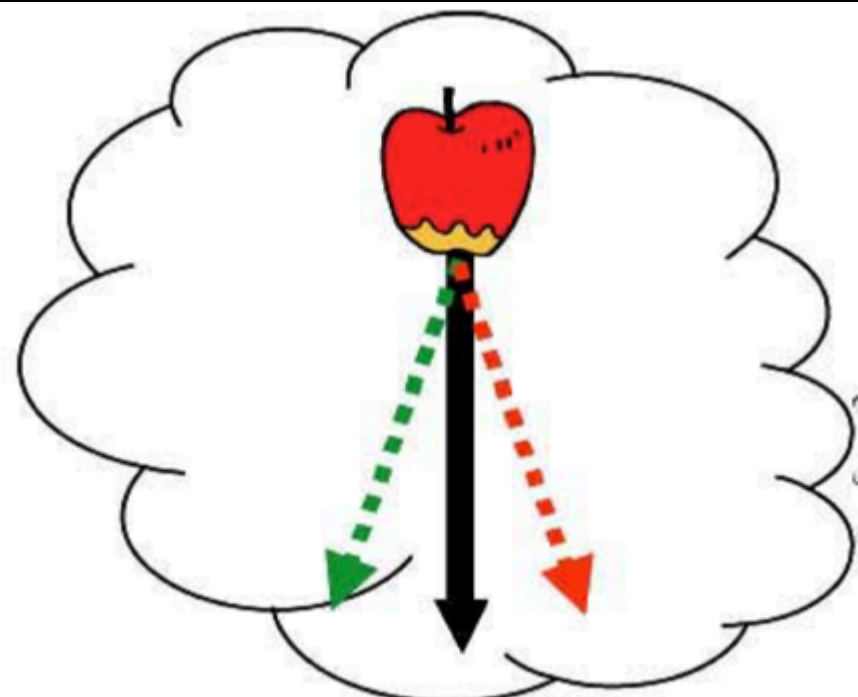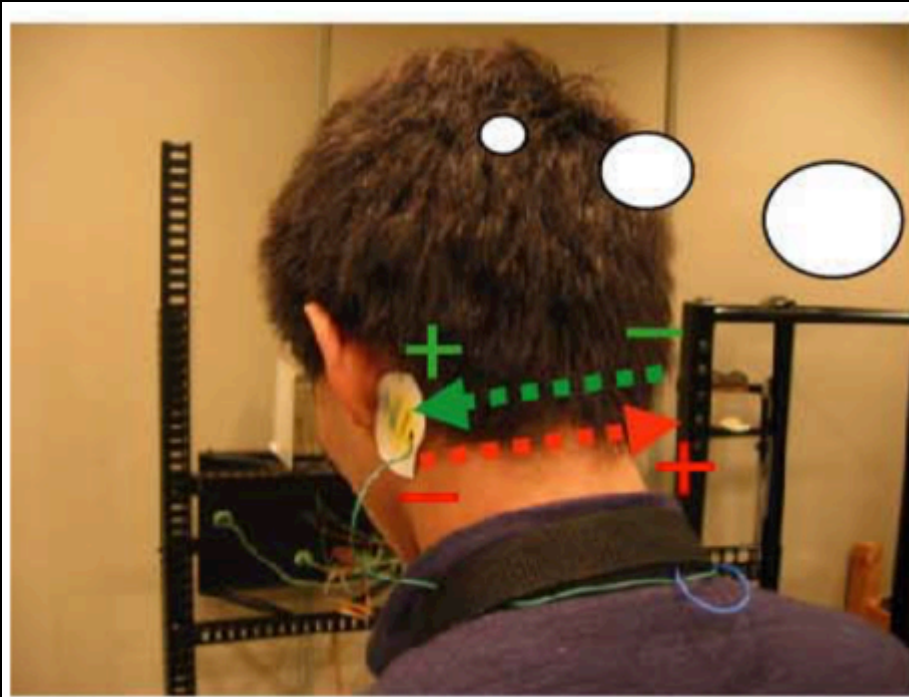
Brainball

- Two-player game where relaxation is counterbalanced with the desire to win.

- Detect EEG waves typical in relaxed state of mind

- https://www.tii.se/projects/brainball

Next Week: Implementation Techniques

- Hardware
  - Sensors
  - Actuators
  - Interfacing: Arduino

- Software
  - Processing platform
  - How to use camera
  - About audio…