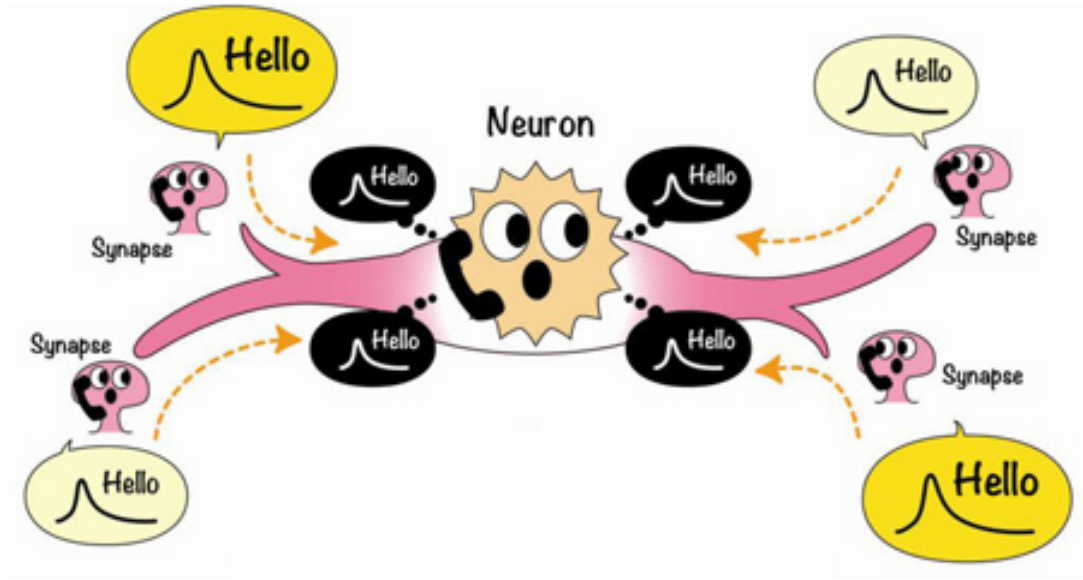
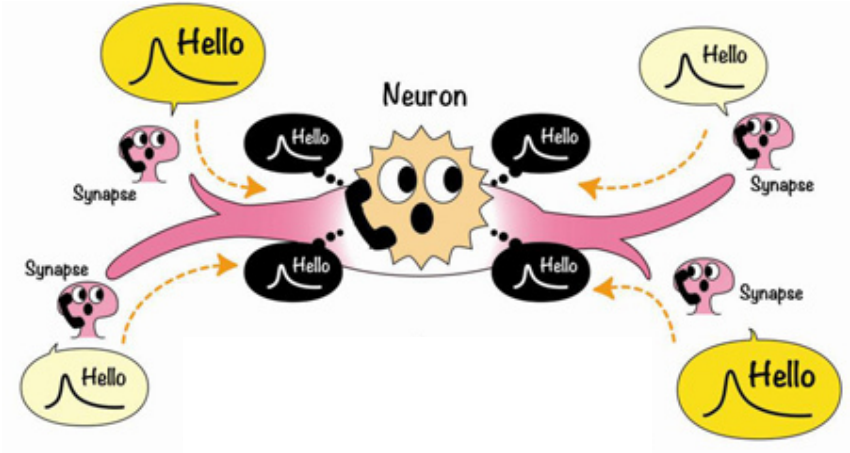
Multisensory Integration



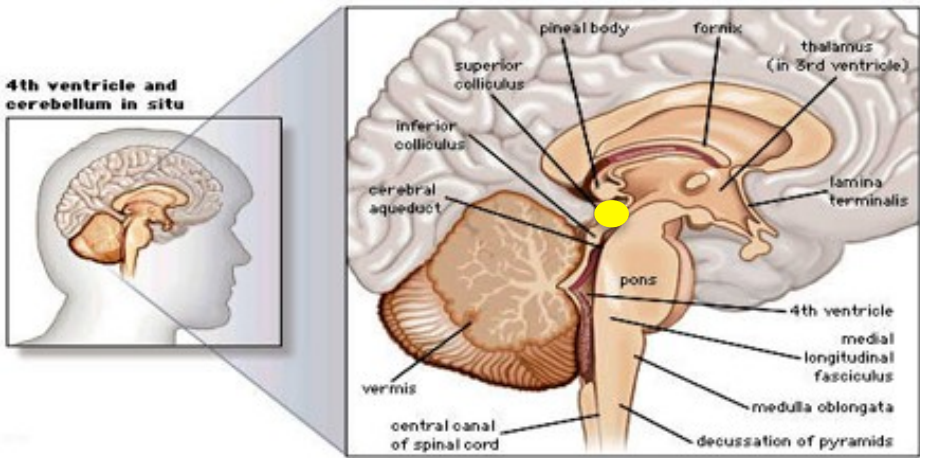
Multisensory Integration

- sensory events are typically never experienced in isolation
- ability to integrate information across multiple senses enhances the brain's ability to detect, localize, and identify external events



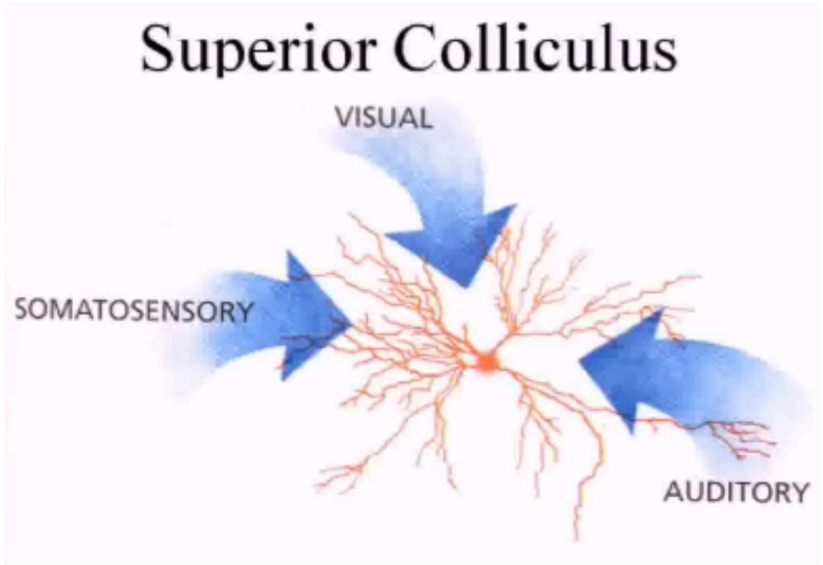
SC: Integration Center

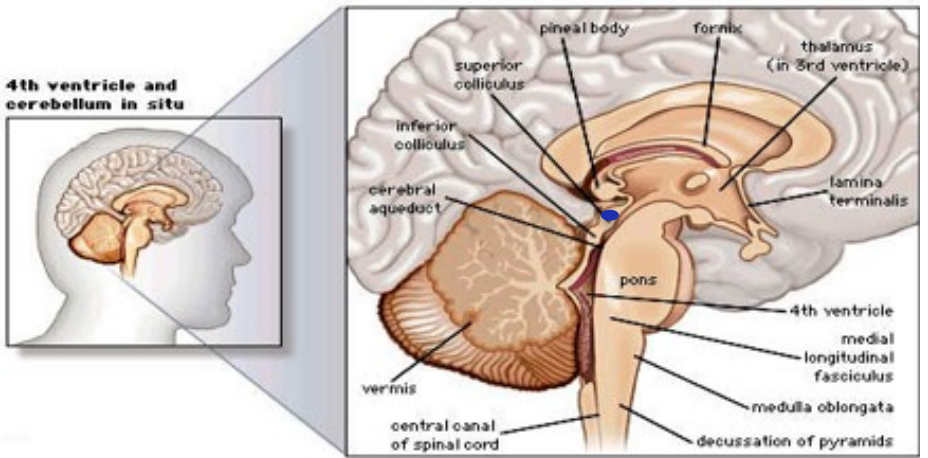
- superior colliculus (**SC**) in the midbrain (mostly animal research)
- individual Deep SC neurons can receive sensory input of more than one modality - convergence zones



SC: Integration Center

- e.g., visual inputs from the retina and auditory inputs from the inferior colliculus converge on the same SC neuron rendering it *multisensory*
- typically bimodal





OT: Integration Center

- olfactory tubercule
- auditory + olfactory integration

Smelling Sounds: Olfactory–Auditory Sensory Convergence in the Olfactory Tubercle

Daniel W. Wesson and Donald A. Wilson

Journal of Neuroscience 24 February 2010, 30 (8) 3013-3021; DOI: https://doi.org/10.1523/JNEUROSCI.6003-09.2010

JNeurosci
THE JOURNAL OF NEUROSCIENCE

Chem. Senses 36: 301–309, 2011

doi:10.1093/chemse/bjq129
Advance Access publication December 16, 2010

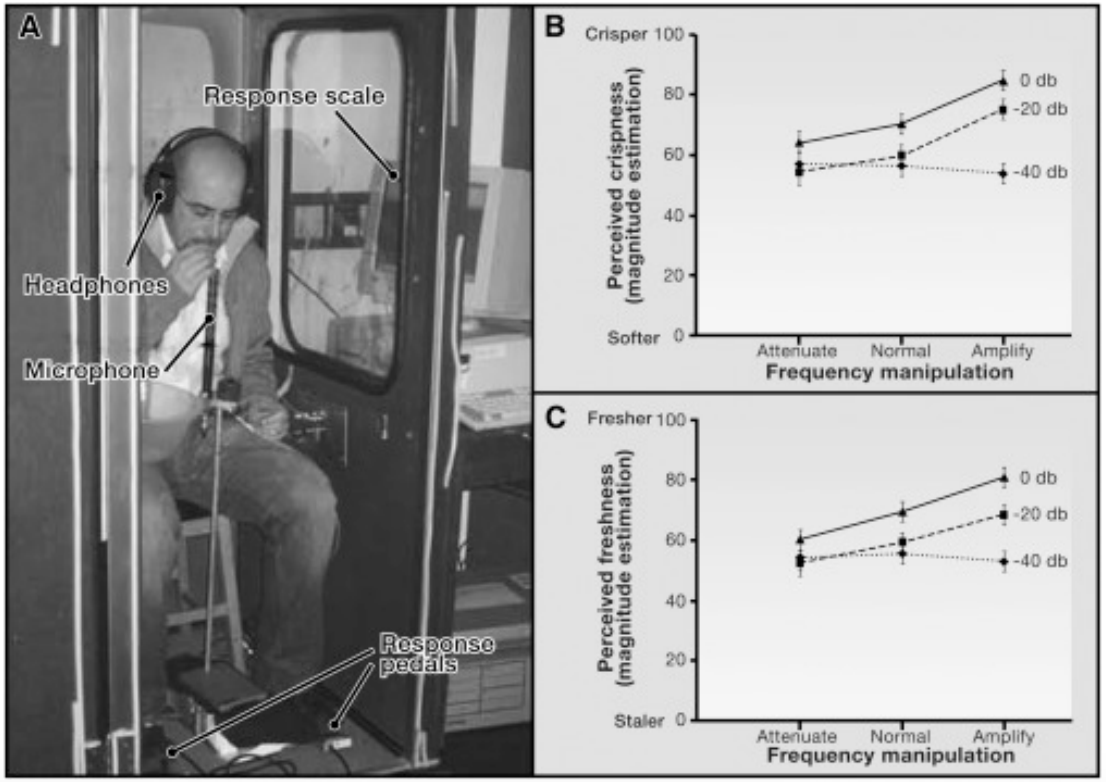
Auditory–Olfactory Integration: Congruent or Pleasant Sounds Amplify Odor Pleasantness

Han-Seok Seo and Thomas Hummel

Smell & Taste Clinic, Department of Otorhinolaryngology, University of Dresden Medical School, Fetscherstrasse 74, 01307 Dresden, Germany

Example: Crossmodal Phenomena

The “Sonic Chip” Experiment



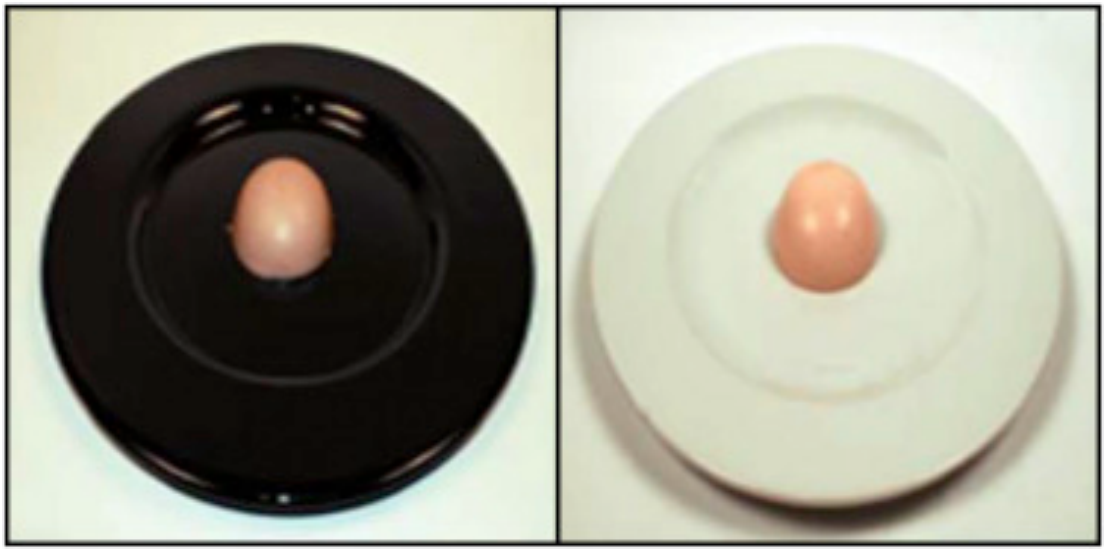
Zampini, M., & Spence, C. (2004). The role of auditory cues in modulating the perceived crispness and staleness of potato chips. Journal of Sensory Studies, 19, 347–363.

Example: Crossmodal Phenomena

http://www.sbs.com.au/food/4-heston-experiments-try-home

Digital Seasoning??!!!

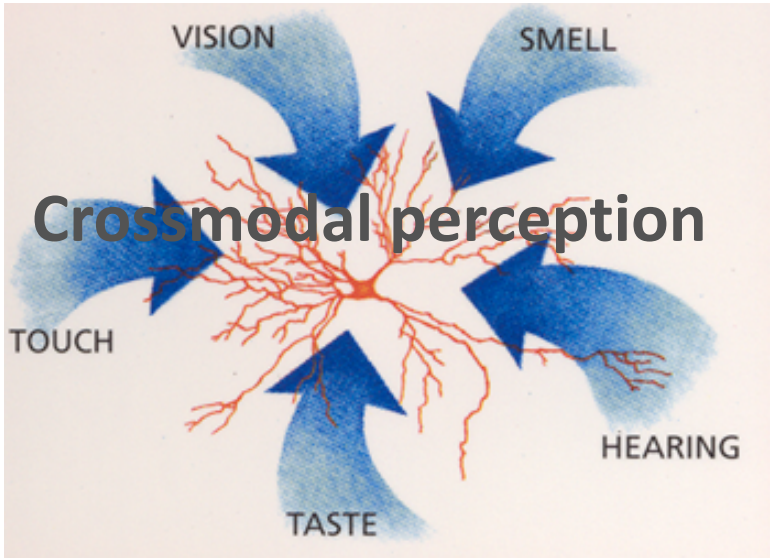
Example: Crossmodal Phenomena



Stewart and Goss, 2013. Plate shape and colour interact to influence taste and quality judgments Flavour, 2 (2013), p. 27

OFC: Integration Center

- orbitofrontal cortex - receive inputs from primary olfactory cortex, gustatory cortex, secondary somatosensory cortex, superior (auditory) and inferior temporal gyrus (visual) and emotion centers (amygdala)



Synesthesia

- an experience in one sensory modality seems to induce an experience in another, non-stimulated sensory modality
- **adjacency principle**
  - result of the neural areas in which the information is processed being adjacent to one another (eg: grapheme and colour)
  - part of the story but not the whole (eg: sound and colour)

Synesthesia

5 types of Synesthesia

Grapheme-color

Grapheme-color synesthesia is one of the most common forms, accounting for 64.4% of all synesthetes. People affected by this type of synesthesia will associate or "see" distinct colors when they look at certain symbols. For example, the letter "A" could be red, while the letter "B" could be yellow. The colors are unique to each person.

Chromesthesia (Sound-to-color)

People afflicted with sound-to-color synesthesia see shapes and colors when they hear certain sounds. The perceived colors usually manifest themselves in generic shapes such as squares and circles. This type of synesthesia can be triggered by listening to a song or playing a musical instrument.

Number-form

Number-form synesthesia is caused by a connection between the way the brain handles numerical and spatial data. Whenever an individual afflicted with this form of synesthesia thinks about numbers, they visualize a number map such as the example shown to the right. These maps can be extremely convoluted, full of twists and turns between each number.

Personification

Also known as ordinal-linguistic personification (OLP), this type of synesthesia results in individuals perceiving sequences of things to have various personalities. These sequences can include letters, numbers, days and months. For example, the numbers 1, 2 and 3 could be playful children, while the number 4 could be an elderly woman.

Lexical-gustatory

Lexical-gustatory synesthesia is a rare form of synesthesia that combines language with taste (or smell.) To those affected, hearing written or spoken language triggers a complex sensation of temperature and texture. For example, the word "jail" could taste like cold, hard bacon.

Information from www.synesthesiatest.org.

Crossmodal Perception

Demattè ML, Sanabria D, Spence C (2006) Cross-modal associations between olfaction and touch. Chem Senses 31:291–300

Crossmodal Perception

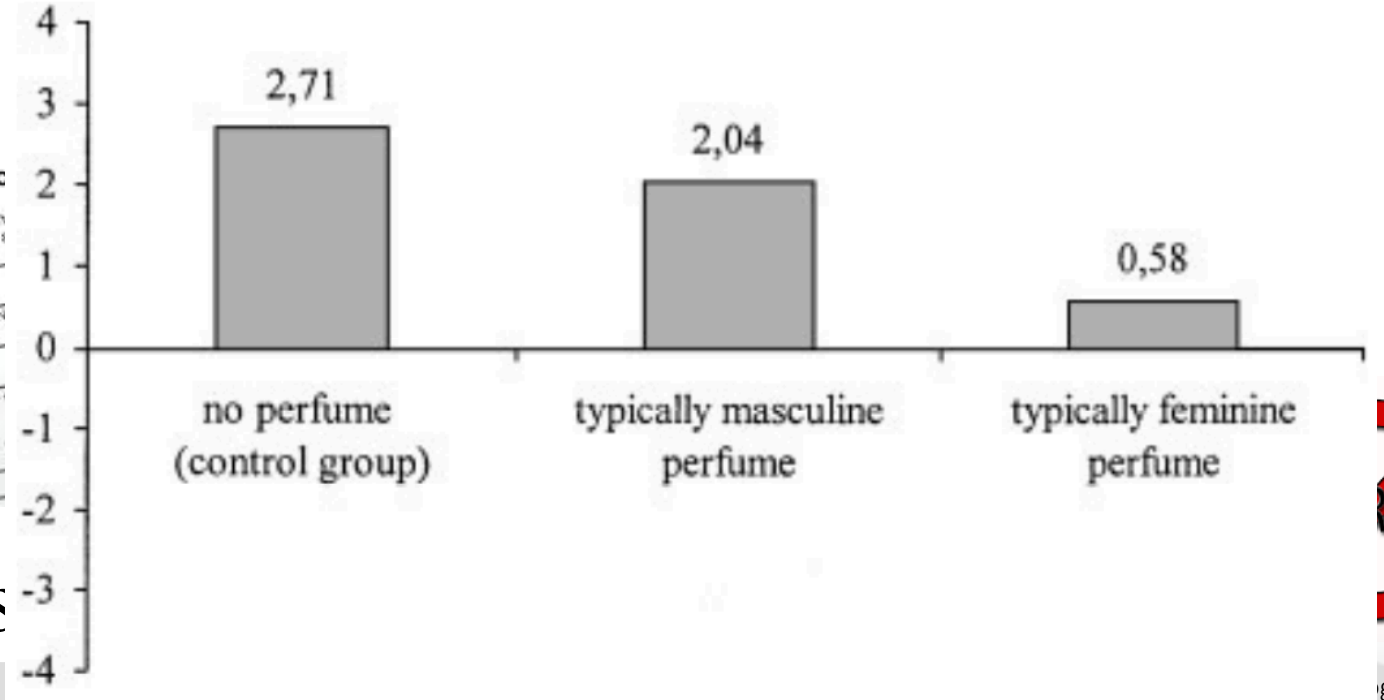
Demattè ML, Osterbauer, R, Spence C (2007) Olfactory Cues Modulate Facial Attractiveness. Chem Senses 32:603–610

Learned Associations

"our brains learn to combine tastes and smells that regularly co-occur in our home cuisine" - Charles Spence 2015. Multisensory Flavor Perception. 161, Issue 1, 26 Pages 24-35

Learned Associations

Manager



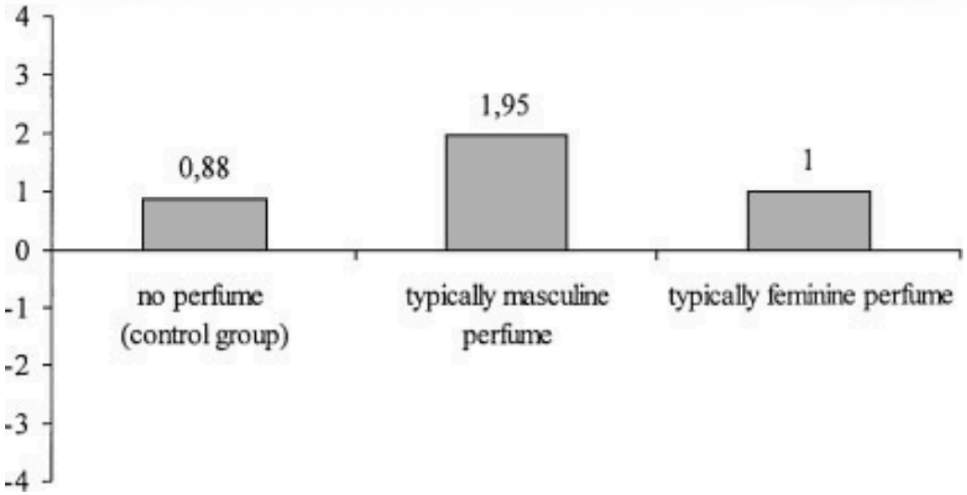
Assis

Sczesny, S., & Stahlberg, D. gy, 32, 815-828. Link: http://onlinelibrary.wiley.com/doi/10.1002/ejsp.123/abstract

EXPERIMENT NO.2

2002

"think manager-think male" phenomenon



Sczesny, S., & Stahlberg, D. (2002). The influence of gender-stereotyped perfumes on leadership attribution. European Journal of Social Psychology, 32, 815-828. Link: http://onlinelibrary.wiley.com/doi/10.1002/ejsp.123/abstract

pitch

Klofstad, C.A., Anderson, R.C., Peters, S., 2012.**Sounds like a winner**: voice pitch influences perception of leadership capacity in both men and women. Proc. R. Soc. B: Biol.Sci. 279, 2698–2704.