

LECTURE 6 PSYC 200

Jan 25th

Sensation and Perception (cont'd)

Visual System: Colour vision

the color (hue) we perceive is largely determined by the relative contributions of blue, green, and red cones to the retinal signal: Young-Helmholtz trichromatic theory

if all three cones are equally active, we would see only white

if they were inactive, we would be unable to perceive color

this is why it is hard to see at night because the cones are inactive due to absence of light

we are able to distinguish 7 million different colours because of cones

all colours have three attributes:

- 1) brightness: intensity of the light wave
- 2) saturation: intensity of the color
- 3) hue: describes a color combination

color constancy: object maintains a same color despite background illumination

Making color

the additive color system involves light emitted directly from a source, before an object reflects the light

mixes various amounts of red green and blue lights to make a variety of colours

examples: TVs, iPads, iPhones, laptops

the subtractive color system creates color by subtraction or absorbing certain wavelengths of color while reflecting other wavelengths back to the viewer

involves two things: reflective light and colors

it starts with an object, the use of dyes by this object are gonna subtract the portions of white light illuminating the object, producing colors relative to their color

example: apple, it has no color, it has no light energy of its own, all it does is reflect the wavelength of white light that causes us to see red, it is absorbing most of the white light and is only reflecting the small portion of the white light so we see red

other examples: color painting, photograph

hearing (audition): sound waves

how we hear sounds is through ears and brain, we convert sound waves into meaningful noises

sound waves can be represented by sine waves

three important attributes:

- 1) frequency: the pitch, measured by Hertz
- 2) timbre: how pure the sound is
- 3) amplitude: intensity or volume, measured in decibels

process of hearing

the complex structures of the inner ear provide the mechanisms for transducing sounds (variations in air pressure) into neural signals

sound waves are amplified in auditory canal

sound waves travel to the end of the canal where they cause the eardrum to vibrate

causes vibrations in middle ear, three tiny bones called hammer, anvil and stirrup, these 3 bones vibrate causing the oval window to vibrate as well, the oval window is the opening to the cochlea

(critical auditory structure found in inner ear and it is filled with fluid, movement of the oval window causes fluid in cochlea to swish, inside cochlea there are hair cells located along

structure called the basilar membrane, the hair cells are the sensory receptors of the auditory system, where transduction takes place)

each hair cell is made up of 200 tiny filaments known as stereo cilia

basilar membrane is moved by vibrations, deflected upwards

this causes stereo cilia to bend

this stimulates ganglia cells which are part of the nervous system

when axons and ganglia cells come together, they make the auditory nerve

auditory nerve: signal enters the brain stem, relayed to the thalamus, relayed towards auditory cortex (temporal lobe)

tonotopy

the thickness of the membrane influences how much it is going to move in response to the sound waves

the hair cells at the base of the basilar membrane respond only to high frequencies

the tip (apex): the basilar membrane is less stiff and thinner, hair cells here respond to lower frequency sounds

tonotopy: basically a map of different frequencies picked up by the basilar membrane

what frequencies are we more sensitive to? 1000Hz to 4000Hz ---> test question

Locating sounds

we use 2 clues to localize sounds

1) interaural time: refers to the difference in time when the sound reaches each of the two ears, sound usually reaches one ear before reaching the other, brain is able to calculate the smallest difference in time and helps you turn to the location of that sound

2) sound intensity: strength/intensity of the sounds, their intensity diminishes over time the longer they travel

sound shadow: sound reaches left ear first, it will be stronger in intensity, sound in right ear will not be as intense because it has a longer distance to travel, you move your head in the direction of the highest intensity of sound

smell (olfaction): pheromones

olfaction brings both good news and bad news: it helps you taste food

it is also helpful in identifying dangerous substances

it is your first line of defense

smell is also a mode of communication: pheromones are chemicals released by the body

can be used to mark a territory, used to identify other animals, used to indicate aggression

role of human pheromones (Martha McClintock): reported a study that woman who spend a lot of time together found that their menstrual cycles often synchronized, one explanation was pheromones, her and some of her friends collected body chemicals from donors (under arm odourants), they took Qtips and wiped them under the noses of another group of women (recipients) and there was no odour to them, they found that depending on the donor's cycle, the recipient's cycle changed

Martha McClintock concluded that the synchronization of the menstrual cycles among female friends and dormitory mates was caused by pheromones transmitted through social interaction.

vomerinasal organ: we have one, it is responsible for processing pheromones, found inside nasal cavity

in human beings, the vomeronasal organ plays the same roles in humans and animals:

answer is no because the vomeronasal organ contains no receptor neurons in humans as it does in humans TEST

process of smelling

we smell with a very thin sheet of cells that make up the olfactory epithelium, not with our nose
mucus is generated by the olfactory epithelium, important because it dissolves the odours
it contains olfactory receptor cells

olfactory receptor cells are the site of transduction TEST QUESTION, they are genuine neurons

olfactory nerve is made up of olfactory axons

how many dendrites does the olfactory sensor have? ONE DENDRITE

end of this dendrite there is a small knob (on the surface of the olfactory epithelium), it contains several cilia

we only have 1000 different types of olfactory cells but we can smell 10000 odours

how is this possible? because processes that occur in the olfactory cortex where signal is decoded and identified

mucus is important because it dissolves the odours

olfactory signals aren't relayed to the thalamus (this is the only exception), signals are sent straight to where they need to go: hippocampus (plays a role in memory), amygdala (plays a role in emotions)

two things that happen when you smell something: triggers memories and triggers emotions

smell is the strongest sense because it isn't relayed to thalamus

the size of the olfactory epithelium is one indicator of an organism's olfactory acuity

dogs are good at smelling because they have a larger olfactory epithelium (17x bigger than humans)

age and sex differences: ability to smell peaks at the age of early adulthood (around age 30)

grandparents can't taste food as well as before because their noses are weaker

women are better in smelling

if you want to maintain ability to smell, stay away from smoking and alcohol, they diminish sense of smell

taste (gustation): chemical senses

animals and humans depend on chemical senses for survival

chemical senses: gustation and olfaction

gustation and olfaction have a similar task: the detection of environmental chemicals

we have to use both senses in order to perceive the flavour of food

both of these systems are separate from each other and they are different

by blocking your nose while eating, you are blocking odourants from reaching the brain therefore losing your ability to taste

this takes place in the 'binding problem'

the signals of these two senses combine somewhere in the brain

chemical senses

humans evolved as omnivores, opportunistically eating the plants and animals they could gather, scavenge or kill

some of our taste preferences are innate: we are all born with a preference for sweetness and dislike for bitter tasting foods and appreciation of fatty foods

our taste preferences can be modified by experience
the body has the ability to recognize a deficiency of certain key nutrients and develop an appetite for them

basic tastes

umami: glutamate

add MONOSODIUMGLUTAMATE to foods to influence umami

the four obvious taste qualities: saltiness, sourness, sweetness and bitterness

the fifth is umami

MSG causes cancer and killed brain cells

how are tastes distributed on the tongue? front is sweet, back is bitter, side is sour and salty

all areas of the tongue are sensitive to taste qualities, however some areas are more concentrated

process of tasting

bumps on our tongue: papillae

each one has one to several 100 taste buds associated with it

each taste buds has 100-150 taste receptor cells

taste receptor cells are arranged like the sections of an orange

each taste receptor cells synapses on an axon, called the gustatory afferent axons

we have between 2000-5000 taste buds altogether

chemically sensitive portion of the taste receptor cell is at the top, called the apical end

taste hairs extend from the tip of the receptor cells, they project onto an opening on the surface of the tongue called the taste pore

Taste buds ----> primary gustatory ----> thalamus ----> cerebral cortex

body (somesthetic) and skin (cutaneous) senses

somatic sensation enables our body to feel, ache, chill, and to know what its parts are doing

it is sensitive to many kinds of stimuli

responsible for feeling of touch and pain

somatic sensory system: different from other systems

somatosensory system responds to touch, temperature, pain, body position, many different types of stimuli

touch

it is necessary for our development and well-being

monkeys that are not allowed to touch their moms are depressed

baby rats that can't groom themselves don't produce normal amounts of growth hormone

most of the sensory receptors in the somatic sensory system are mechanoreceptors: respond to physical torsion, the more pressure you put on these receptors, the higher the amount of action potentials fired

functions of our skin is to protect us, it is a protective barrier, prevents evaporation of body fluids into the environment around us, also provides us with the most direct contact with the outside world

our skin is the largest sensory organ we have

pain

besides mechanoreceptors somatic sensation depends strongly on **nociceptors**: they signal that the body tissue is being damaged, help minimize damage to body
ability to detect pain plays an important role on your ability to survive
there is a misery of life without pain: risk of infections or skeletal deformation
having no nociceptors, your body doesn't tell you if a position is hurting you or if it is straining your body
maybe cathy had nociceptors but they were defective, couldn't transmit signals to the CNS

3 types of pain

nociceptive pain: is a negative feeling caused by an external stimulus (spraining ankle, physical injury)

neuropathic pain: is a negative feeling caused by a malfunction in the nervous system, often caused by injury or disease that affects CNS (cancer), smoking weed is an effective treatment to this sort of pain

referred pain: is a negative feeling that occurs when sensory info from internal and external areas converges on the same nerve cells in the spinal cord, you experience pain and one part of the body which is very different from the actual site of the pain is where you feel the actual pain (heart attack: pain starts in left arm and not in heart)

why of some people seem to feel pain more acutely than others?

gate control theory: pain passes through this hypothetical gate and what it does is either it blocks or allows the pain signal to come through or not, pain signals that are allowed through go up to the brain, brain will do two things: either send a signal back down to further open the gate (pain becomes more intense) or it will send a signal back down to close the gate (to reduce intensity of the pain)

we can actually close the gate by engaging in certain behaviours, when we bump our elbows we rub it so that we close the gate and reduce pain

endorphins: hormones released to reduce pain by the body/brain

when doctors inject you with morphine they choose spinal cord

epidural: given in the spine to help reduce sensation of pain

