# K9 Perception

## *Umwelt*

## Sight (Vision)

## Sound (Audition)

## Touch (Soma)

## Smell (Olfaction)

*Umwelt*

## The subjective schema with which the animal organizes its experience of the environment.

Sight

## Color & Motion Sensitivity

## Dogs see color like a human *deuteranope*. That is, they are red-green color blind (this occurs in 4% of human males).

## The *retina* of the eye contains the light sensitive cells. It contains 2 types:

### *Cones* - responsible for color vision & details (dogs only have 3% cones).

### *Rods* - sensitive to light, contrast, & motion.

## *Deuteranopes* have 2 *cone* types rather than 3.

## Because dogs have more *rods* than humans, they can see better in the dark & are more sensitive to motion.

## Detail or Acuity

## Dogs do not have a fovea (or area with 100% *cones*) & this results in less of an ability to see details. They do have a *visual streak* (20% cones).

## If normal human vision is 20/20, then that of the dog is about 20/75. This means that a dog must be 20' away from an object to clearly visualize it’s details, while a human with normal vision could clearly visualize the details from 75'.

## Thus, humans are more likely to see a stationary object in the distance (like a deer) than dogs.

## Night Vision - Dogs see better at night for 2 reasons:

### They have more rods.

### They have a *tapetum lucidum* (a surface behind the *retina* that reflects light back through it). BTW, the tapetum lucidum gives the dogs eyes their eerie shine at night.

## Depth & Field

## Due to the placement of the eyes, humans have an overlap of the field of each eye of 140o; dogs, less than 100o. This results in the dog having limited ability to *accommodate* (or focus on items at different distances). Thus, humans are better at *depth perception*.

## Dogs, however, have a wider overall field (about 250o vs. 180o in humans) & thus see more of the world.

## Comparisons

## Summary & Comments

## Dogs are red-green color blind. They see a brighter, less detailed world when compared to humans. Distance is not judged as well, but they see more of the world. They excel at night vision & detection of moving objects.

## These differences make sense in light of evolutionary theory. Good depth perception & visual acuity are necessary for a primate jumping from tree limb to tree limb. Good color vision enabled this primate to choose the ripest & most nutritious fruit. The K9, on the other hand, is well adapted as a nocturnal hunter of camouflaged prey.

Sound

## Top of the range - About 40,000 cps (estimates vary from 26,000 to 65,000) in dogs & 20,000 cps in young humans (Exs. 8, 9, 10, 12, 15 thousand cps).

## Most acute at about - 4,000 in dogs & 2,000 (speech range) in humans.

## Pitch discrimination - Humans are better (perhaps enjoy music more).

## Localizing direction - Dogs are better here (perhaps those large ears).

## Distance judgment - Humans are better here.

## Summary

## As with vision, humans & dogs hear differently.

## Each species excels in certain areas.

## The important point is that dogs can hear things (high frequency sounds) that we cannot.

Touch

## *Homunculus* is a visual representation of the amount of brain tissue devoted to touch sensation. For humans, it has lots of space devoted to the thumb & index finger as well as the lips and tongue. Showd that the amount of brain area devoted to the sensory/motor ability of a body part is related to the sensitivity of the body part rather than its size.

## *“Canunculus”* would have a very large muzzle, lips, eyelids & ears.

## While the physiological *threshold* for pain is relatively constant across species, pain *tolerance* varies both across & within. Humans are relatively intolerant. Ex. Ovariohysterectomy recovery.

## While humans have separate nerves for hot & cold detection, dogs have only cold detectors.

## Dogs have a hair covered body & receptor cells around the hair follicles can detect their movement.

## Vibrissae

## Specialized hairs called *vibrissae* are whiskers located at various points on the face. They are more deeply embedded in the skin & have more receptor cells at their base than regular hair cells.

## Detect air currents, small vibrations, & objects in the dark.

## Provide dogs with info about nearby objects, coordinate the movement of the muzzle & mouth toward nearby objects, & may serve an important protective function against ocular injury.

## May be involved in the reflexive aggressive response to air blown in the face.

Smell

## Structure

## Dogs have a *wet nose* & this is believed to facilitate olfaction.

## Dogs have a considerably *bigger nose* & bigger is believed to be better.

## In dogs, *turbinal bones* facilitate odor detection, while in humans the placement of turbinal bones impairs olfaction.

## Olfactory Apparatus

## The size of the olfactory receptor surface (where the cells that detect odor are located) is 170 cm2 in the GSD & only 4 cm2 in humans.

## Olfactory receptors in the brain number 220 million in the GSD & 5 million in humans.

## Human olfactory bulbs are about the size of a kernel of corn, while in dogs, these bulbs make up a significant portion of the (significantly smaller) brain.

## Pheromones

## Dogs use *pheromones* (chemical substances secreted in urine, feces, & glandular secretions) as part of their communications system.

## Reception of pheromones appears to take place in an accessory olfactory organ called the *Vermonasal Organ* (or *Organ of Jacobson*).

## The *Flehmen Response* or *Tonguing* (where dog salivates & teeth chatters) may facilitate this. This response is common after a male “investigates” a female’s urine.

## Comments

## Dogs have an incredible sense of smell. Estimates suggest that it is 40-1,000,000x more sensitive than humans.

## Some examples:

### *Butyric Acid* (the component in sweat that smells like dirty socks) - dogs may be 100,000,000x better.

### *Amyl Acetate* - dogs are about 400x better.

### *Alpha-ionone* - dogs are about 10,000x better.

## Of all animals tested with different smells in different laboratories, the dog is the best.

## While humans are predominately visual creatures, dogs are predominately olfactory.

## Unlike differences in vision & audition, differences in olfactory abilities of dogs & humans is so pronounced as to be difficult to comprehend.

## Scent Work - Types

## Drugs

## People (criminal or lost) & crime scene evidence

## Dead people

## Explosives & arson materials

## Natural gas leaks

## Toxic wastes (e.g., mercury)

## Contraband fruit

## Termites, gypsy moths, & screw worms

## Cows in estrous

## Evidence of endangered species

## Skin cancer