Sense organs essay

Senses are physiological capacities of organisms that provide data for perception. The senses and their operation, classification, and theory are overlapping topics studied by a variety of fields, most notably neuroscience, cognitive psychology (or cognitive science), and philosophy of perception.

The nervous system has a specific sensory system or organ, dedicated to each sense. Humans have a multitude of senses. Sight (ophthalmoception), hearing (audioception), taste (gustaoception), smell (olfacoception or olfacception), and touch (tactioception) are the five traditionally recognized. While the ability to detect other stimuli beyond those governed by the traditional senses exists, including temperature (thermoception), kinesthetic sense (proprioception), pain (nociception), balance (equilibrioception), and various internal stimuli (e. g. the different chemoreceptors for detecting salt and carbon dioxide concentrations in the blood), only a small number of these can safely be classified as separate senses in and of themselves.

What constitutes a sense is a matter of some debate, leading to difficulties in defining what exactly a sense is. Animals also have receptors to sense the world around them, with degrees of capability varying greatly between species. Humans have a comparatively weak sense of smell, while some animals may lack one or more of the traditional five senses. Some animals may also intake and interpret sensory stimuli in very different ways. Some species of animals are able to sense the world in a way that humans cannot, with some species able to sense electrical and magnetic fields, and detect water pressure and currents.

A broadly acceptable definition of a sense would be “ A system that consists of a group of sensory cell types that responds to a specific physical phenomenon, and that corresponds to a particular group of regions within the brain where the signals are received and interpreted. ” There is no firm agreement as to the number of senses because of differing definitions of what constitutes a sense. The senses are frequently divided into: those that perceive external stimulti, known as exteroceptive senses; those that perceive the body’s own position, motion, and state, known as proprioceptive senses; and those that perceive sensations in internal organs, known as interoceptive senses. External senses include the traditional five: sight, hearing, touch, smell and taste, discussed already by Aristotle,[1] as well as thermoception (temperature differences); and possibly an additional weak magnetoception (direction). [2] .

Proprioceptive senses include nociception (pain); equilibrioception (balance); proprioception (a sense of the position and movement of the parts of one’s own body). A number of interoceptive senses are also recognized. Non-human animals may possess senses that are absent in humans, such as electroreception and detection of polarized light. In Buddhist philosophy, Ayatana or “ sense-base” includes the mind as a sense organ, in addition to the traditional five.

This addition to the commonly acknowledged senses may arise from the psychological orientation involved in Buddhist thought and practice. The mind considered by itself is seen as the principal gateway to a different spectrum of phenomena that differ from the physical sense data. This way of viewing the human sense system indicates the importance of internal

sources of sensation and perception that complements our experience of the external world. Traditional senses[edit] See also: Five wits#The “ outward” wits This article needs additional citations for verification. Please help improve this article by adding citations to reliable sources.

Unsourced material may be challenged and removed. (March 2008) Sight[edit] In this painting by Pietro Paolini, each individual represents one of the five senses. [3] The Walters Art Museum. Sight or vision is the capability of the eye(s) to focus and detect images of visible light on photoreceptors in the retina of each eye that generates electrical nerve impulses for varying colors, hues, and brightness. There are two types of photoreceptors: rods and cones. Rods are very sensitive to light, but do not distinguish colors.

Cones distinguish colors, but are less sensitive to dim light. There is some disagreement as to whether this constitutes one, two or three senses. Neuroanatomists generally regard it as two senses, given that different receptors are responsible for the perception of color and brightness. Some argue[citation needed] that stereopsis, the perception of depth using both eyes, also constitutes a sense, but it is generally regarded as a cognitive (that is, post-sensory) function of the visual cortex of the brain where atterns and objects in images are recognized and interpreted based on previously learned information. This is called visual memory. The inability to see is called blindness.

Blindness may result from damage to the eyeball, especially to the retina, damage to the optic nerve that connects each eye to the brain, and/or from stroke (infarcts in the brain). Temporary or permanent blindness can be

caused by poisons or medications. People who are blind from degradation or damage to the visual cortex, but still have functional eyes, are actually capable of some level of vision and reaction to visual stimuli but not a conscious perception; this is known as blindsight. People with blindsight are usually not aware that they are reacting to visual sources, and instead just unconsciously adapt their behaviour to the stimulus. Hearing[edit] Hearing or audition is the sense of sound perception.

Hearing is all about vibration. Mechanoreceptors turn motion into electrical nerve pulses, which are located in the inner ear. Since sound is vibrations propagating through a medium such as air, the detection of these vibrations, that is the sense of the hearing, is a mechanical sense because these vibrations are mechanically conducted from the eardrum through a series of tiny bones to hair-like fibers in the inner ear, which detect mechanical motion of the fibers within a range of about 20 to 20, 000 hertz,[4] with substantial variation between individuals. Hearing at high frequencies declines with an increase in age. Inability to hear is called deafness or hearing impairment. Sound can also be detected as vibrations conducted through the body by tactition.

Lower frequencies than can be heard are detected this way. Taste[edit] Taste (or, the more formal term, gustation; adjectival form: “ gustatory”) is one of the traditional five senses. It refers to the capability to detect the taste of substances such as food, certain minerals, and poisons, etc. The sense of taste is often confused with the “ sense” of flavor, which is a combination of taste and smell perception. Flavor depends on odor, texture, and temperature as well as on taste.

Humans receive tastes through sensory organs called taste buds, or gustatory calyculi, concentrated on the upper surface of the tongue. There are five basic tastes: sweet, bitter, sour, salty and umami. Other tastes such as calcium[5][6] and free fatty acids[7] may be other basic tastes but have yet to receive widespread acceptance. Smell[edit] Smell or olfaction is the other " chemical" sense. Unlike taste, there are hundreds of olfactory receptors (388 according to one source[8]), each binding to a particular molecular feature.

Odor molecules possess a variety of features and, thus, excite specific receptors more or less strongly. This combination of excitatory signals from different receptors makes up what we perceive as the molecule's smell. In the brain, olfaction is processed by the olfactory system. Olfactory receptor neurons in the nose differ from most other neurons in that they die and regenerate on a regular basis. The inability to smell is called anosmia. Some neurons in the nose are specialized to detect pheromones.

[9] Touch[edit] Touch or somatosensory, also called tactition or mechanoreception, is a perception resulting from activation of neural receptors, generally in the skin including hair follicles, but also in the tongue, throat, and mucosa. A variety of pressure receptors respond to variations in pressure (firm, brushing, sustained, etc.). The touch sense of itching caused by insect bites or allergies involves special itch-specific neurons in the skin and spinal cord.

[10] The loss or impairment of the ability to feel anything touched is called tactile anesthesia. Paresthesia is a sensation of tingling, pricking, or

numbness of the skin that may result from nerve damage and may be permanent or temporary. Other senses[edit] Balance and acceleration[edit]Main article: Vestibular system Balance, equilibrioception, or vestibular sense is the sense that allows an organism to sense body movement, direction, and acceleration, and to attain and maintain postural equilibrium and balance. The organ of equilibrioception is the vestibular labyrinthine system found in both of the inner ears. In technical terms, this organ is responsible for two senses of angular momentum acceleration and linear acceleration (which also senses gravity), but they are known together as equilibrioception. The vestibular nerve conducts information from sensory receptors in three ampulla that sense motion of fluid in three semicircular canals caused by three-dimensional rotation of the head.

The vestibular nerve also conducts information from the utricle and the saccule, which contain hair-like sensory receptors that bend under the weight of otoliths (which are small crystals of calcium carbonate) that provide the inertia needed to detect head rotation, linear acceleration, and the direction of gravitational force. Temperature[edit]Thermoception is the sense of heat and the absence of heat (cold) by the skin and including internal skin passages, or, rather, the heat flux (the rate of heat flow) in these areas. There are specialized receptors for cold (declining temperature) and for heat. The cold receptors play an important part in the animal’s sense of smell, telling wind direction. The heat receptors are sensitive to infrared radiation and can occur in specialized organs, for instance in pit vipers.

The thermoceptors in the skin are quite different from the homeostatic thermoceptors in the brain (hypothalamus), which provide feedback on

internal body temperature. see temperature receptor) Kinesthetic sense[edit] Proprioception, the kinesthetic sense, provides the parietal cortex of the brain with information on the relative positions of the parts of the body. Neurologists test this sense by telling patients to close their eyes and touch their own nose with the tip of a finger. Assuming proper proprioceptive function, at no time will the person lose awareness of where the hand actually is, even though it is not being detected by any of the other senses. Proprioception and touch are related in subtle ways, and their impairment results in surprising and deep deficits in perception and action.

[11] Pain[edit] Nociception (physiological pain) signals nerve-damage or damage to tissue. The three types of pain receptors are cutaneous (skin), somatic (joints and bones), and visceral (body organs). It was previously believed that pain was simply the overloading of pressure receptors, but research in the first half of the 20th century indicated that pain is a distinct phenomenon that intertwines with all of the other senses, including touch. Pain was once considered an entirely subjective experience, but recent studies show that pain is registered in the anterior cingulate gyrus of the brain.

[12] The main function of pain is to attract our attention to dangers and motivate us to avoid them. For example, humans avoid touching a sharp needle, or hot object, or extending an arm beyond a safe limit because it is dangerous, and thus hurts. Without pain, people could do many dangerous things without being aware of the dangers. Time[edit] Chronoception refers to how the passage of time is perceived and experienced.

Although the sense of time is not associated with a specific sensory system the work of psychologists and neuroscientists indicates that human brains do have a system governing the perception of time,[13][14] composed of a highly distributed system involving the cerebral cortex, cerebellum and basal ganglia. One particular component, the suprachiasmatic nucleus, is responsible for the circadian (or daily) rhythm, while other cell clusters appear to be capable of shorter-range (ultradian) timekeeping. Other internal senses[edit] An internal sense also known as interoception[15] is “ any sense that is normally stimulated from within the body”. 16] These involve numerous sensory receptors in internal organs, such as stretch receptors that are neurologically linked to the brain. Some examples of specific receptors are: Pulmonary stretch receptors are found in the lungs and control the respiratory rate. Peripheral chemoreceptors in the brain monitor the carbon dioxide and oxygen levels in the brain to give a feeling of suffocation if carbon dioxide levels get too high.

[17] The chemoreceptor trigger zone is an area of the medulla in the brain that receives inputs from blood-borne drugs or hormones, and communicates with the vomiting center. Chemoreceptors in the circulatory system also measure salt levels and prompt thirst if they get too high; they can also respond to high sugar levels in diabetics. Cutaneous receptors in the skin not only respond to touch, pressure, and temperature, but also respond to vasodilation in the skin such as blushing. Stretch receptors in the gastrointestinal tract sense gas distension that may result in colic pain. Stimulation of sensory receptors in the esophagus result in sensations felt in the throat when swallowing, vomiting, or during acid reflux. Sensory

receptors in pharynx mucosa, similar to touch receptors in the skin, sense foreign objects such as food that may result in a gag reflex and corresponding gagging sensation.

Stimulation of sensory receptors in the urinary bladder and rectum may result in sensations of fullness. Stimulation of stretch sensors that sense dilation of various blood vessels may result in pain, for example headache caused by vasodilation of brain arteries. Non-human senses[edit] Analogous to human senses[edit] Other living organisms have receptors to sense the world around them, including many of the senses listed above for humans. However, the mechanisms and capabilities vary widely. Smell[edit] Most non-human mammals have a much keener sense of smell than humans, although the mechanism is similar. Sharks combine their keen sense of smell with timing to determine the direction of a smell.

They follow the nostril that first detected the smell. [18] Insects have olfactory receptors on their antennae. Vomeronasal organ[edit] Many animals (salamanders, reptiles, mammals) have a vomeronasal organ[19] that is connected with the mouth cavity. In mammals it is mainly used to detect pheromones of marked territory, trails, and sexual state. Reptiles like snakes and monitor lizards make extensive use of it as a smelling organ by transferring scent molecules to the vomeronasal organ with the tips of the forked tongue. In reptiles the vomeralnasal organ is commonly referred to as Jacobsons organ.

In mammals, it is often associated with a special behavior called flehmen characterized by uplifting of the lips. The organ is vestigial in humans,

because associated neurons have not been found that give any sensory input in humans. [20] Taste[edit] Flies and butterflies have taste organs on their feet, allowing them to taste anything they land on. Catfish have taste organs across their entire bodies, and can taste anything they touch, including chemicals in the water.

[21] Vision[edit] Cats have the ability to see in low light due to muscles surrounding their irises to contract and expand pupils as well as the tapetum lucidum, a reflective membrane that optimizes the image. Pitvipers, pythons and some boas have organs that allow them to detect infrared light, such that these snakes are able to sense the body heat of their prey. The common vampire bat may also have an infrared sensor on its nose. It has been found that birds and some other animals are tetrachromats and have the ability to see in the ultraviolet down to 300 nanometers.

Bees and dragonflies[23] are also able to see in the ultraviolet. Balance[edit] Many invertebrates have a statocyst, which is a sensor for acceleration and orientation that works very differently from the mammalian’s semi-circular canals. Sensing gravity[edit] Some plants (such as mustard) have genes that are necessary for the plant to sense the direction of gravity. If these genes are disabled by a mutation, a plant cannot grow upright. Not analogous to human senses[edit] In addition, some animals have senses that humans do not, including the following: Echolocation[edit] Main article: Animal echolocation Certain animals, including bats and cetaceans, have the ability to determine orientation to other objects through interpretation of reflected sound (like sonar).

They most often use this to navigate through poor lighting conditions or to identify and track prey. There is currently an uncertainty whether this is simply an extremely developed post-sensory interpretation of auditory perceptions or it actually constitutes a separate sense. Resolution of the issue will require brain scans of animals while they actually perform echolocation, a task that has proven difficult in practice. Blind people report they are able to navigate and in some cases identify an object by interpreting reflected sounds (especially their own footsteps), a phenomenon known as human echolocation. Electroreception[edit] Electroreception (or electroception) is the ability to detect electric fields.

Several species of fish, sharks, and rays have the capacity to sense changes in electric fields in their immediate vicinity. Some fish passively ense changing nearby electric fields; some generate their own weak electric fields, and sense the pattern of field potentials over their body surface; and some use these electric field generating and sensing capacities for social communication. The mechanisms by which electroceptive fish construct a spatial representation from very small differences in field potentials involve comparisons of spike latencies from different parts of the fish’s body. The only orders of mammals that are known to demonstrate electroception are the dolphin and monotreme orders.

Among these mammals, the platypus[25] has the most acute sense of electroception. A dolphin can detect electric fields in water using electroreceptors in vibrissal crypts arrayed in pairs on its snout and which evolved from whisker motion sensors. [26] These electroreceptors can detect electric fields as weak as 4. 6 microvolts per centimeter, such as those

generated by contracting muscles and pumping gills of potential prey. This permits the dolphin to locate prey from the seafloor where sediment limits visibility and echolocation.

Body modification enthusiasts have experimented with magnetic implants to attempt to replicate this sense. However, in general humans (and it is presumed other mammals) can detect electric fields only indirectly by detecting the effect they have on hairs. An electrically charged balloon, for instance, will exert a force on human arm hairs, which can be felt through tactition and identified as coming from a static charge (and not from wind or the like). This is not electroception, as it is a post-sensory cognitive action. Magnetoception[edit] Magnetoception (or magnetoreception) is the ability to detect the direction one is facing based on the Earth’s magnetic field.

Directional awareness is most commonly observed in birds. 28][29][30]It has also been observed in insects such as bees. Although there is no dispute that this sense exists in many avians (it is essential to the navigational abilities of migratory birds), it is not a well-understood phenomenon. [31]One study has found that cattle make use of magnetoception, as they tend to align themselves in a north-south direction. [32] Magnetotactic bacteria build miniature magnets inside themselves and use them to determine their orientation relative to the Earth’s magnetic field.

[33][34] The question of how useful magnetoception may be to human beings is subject of ongoing research. 35] Other[edit] Pressure detection uses the organ of Weber, a system consisting of three appendages of vertebrae transferring changes in shape of the gas bladder to the middle ear.

It can be used to regulate the buoyancy of the fish. Fish like the weather fish and other loaches are also known to respond to low pressure areas but they lack a swim bladder. Current detection The lateral line in fish and aquatic forms of amphibians is a detection system of water currents, consisting mostly of vortices.

The lateral line is also sensitive to low-frequency vibrations. The mechanoreceptors are hair cells, the same mechanoreceptors for vestibular sense and hearing. It is used primarily for navigation, hunting, and schooling. The receptors of the electrical sense are modified hair cells of the lateral line system. Polarized light direction/detection is used by bees to orient themselves, especially on cloudy days.

Cuttlefish can also perceive the polarization of light. Most sighted humans can in fact learn to roughly detect large areas of polarization by an effect called Haidinger’s brush, however this is considered an entoptic phenomenon rather than a separate sense. Slit sensillae of spiders detect mechanical strain in the exoskeleton, providing information on force and vibrations. Plant senses[edit] Some plants have sensory organs, for example the Venus fly trap, that respond to vibration, light, water, scents, or specific chemicals. Some plants sense the location of other plants and attack and eat part of them. Plants have no pain receptors that can travel through neural cell as having no electro-neuro electroreception as confirmed through various experiments.