Sensation and perception

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Che-Xian Brewster Dr. Walker 5/4/2012 Course Thesis and Resolution Thanks to the nose, ears, eyes, tongue, and skin, we can imagine a day at the lake: glimmering blue sky, fresh water, warm sand (if they have it), and honking geese. Our knowledge of the world depends on the senses: vision, hearing, taste, smell, position, movement, balance, and touch. If someone bounces a basketball, our eyes and ears pick up stimuli such as light and sound waves and send neural signals to the brain. This process called sensation occurs when physical energy from objects in the world or in the body stimulates the sense organs. However, only when the signals come together meaningfully do we actually perceive a bouncing basketball. Perception happens when the brain organizes and interprets sensory information. Sensation and perception occur together, and normally we don’t distinguish between the two separate processes. We use all five of our senses and organize the information we get from them every day of our lives. Sensation is the process by which physical energy from objects in the world or in the body stimulates the sense organs. The brain interprets and organizes this sensory information in a process called perception. Psychophysics is the study of how the physical properties of stimuli relate to people’s experience of stimuli. Research in psychophysics has revealed much information about the acuity of the senses. Psychologists assess the acuity of the senses in three ways: 1. Measuring the absolute threshold 2. Measuring the difference threshold 3. Applying signal detection theory The absolute threshold is the minimum amount of stimulation required for a person to detect the stimulus 50 percent of the time. The difference threshold is the smallest difference in stimulation that can be detected 50 percent of the time. The difference threshold is sometimes called the Just Noticeable Difference (JND), and it depends on the strength of

the stimulus. If someone were comparing two weak stimuli, such as two very slightly sweet liquids, he'd be able to detect quite a small difference in the amount of sweetness. However, if he were comparing two intense stimuli, such as two extremely sweet liquids, he could detect only a much bigger difference in the amount of sweetness. Nineteenth-century psychologist Ernst Weber proposed a principle demonstrating the fact that we can't detect the difference between two stimuli unless they differ by a certain proportion and that this proportion is constant. In other words, the just noticeable difference for a stimulus is in a fixed proportion to the magnitude of a stimulus. Weber's Law holds true except in the most extreme kinds of stimulation. Researchers use signal detection theory to predict when a weak signal will be detected. This theory considers the fact that the ability to detect a signal depends not only on the strength of the signal but also on the perceiver's experience, motivation, expectation, and degree of alertness. Different people respond differently to the same signal, and the same person may detect a particular signal at one time but not another. Furthermore, people can often detect one type of signal in a sensory modality such as hearing or vision but be oblivious to other types of signals in the same sensory modality. When people walk into a restaurant, they probably notice food smells right away. However, as they sit in the restaurant, the smells gradually become less noticeable. This phenomenon occurs because of sensory adaptation. Sensory adaptation is the decrease in sensitivity to an unchanging stimulus. The smells don't disappear–the people just become less sensitive to them. Babies have all the basic sensory abilities and many perceptual skills, but these abilities develop and grow more sensitive over time. Babies can recognize the difference between a human voice and other

sounds, and they can locate a sound’s origin. They can recognize the difference between smells and, very early on, can recognize their mother’s particular smell. As for taste, they can differentiate between sweet and salty. Babies also have fairly adept visual abilities. Soon after birth, they can distinguish objects of different colors and sizes. When they are just a few weeks old, they begin to differentiate among contrasts, shadows, and patterns, and they can perceive depth after just a few months. Even innate perceptual skills need the right environment to develop properly. A lack of certain experiences during sensitive periods of development will impair a person’s ability to perceive the world. People who were born blind but regain their vision in adulthood usually find the visual world confusing. Since these adults were blind in infancy, they missed the sensory experiences necessary for their visual system to develop fully. There are 5 major groups of senses: * Vision * Hearing * Touch * Taste * Smell Researchers have studied vision more thoroughly than the other senses. Because people need sight to perform most daily activities, the sense of sight has evolved to be highly sophisticated. Vision, however, would not exist without the presence of light. Light is electromagnetic radiation that travels in the form of waves. Light is emitted from the sun, stars, fire, and light bulbs. Most other objects just reflect light. People experience light as having three features: color, brightness, and saturation. These three types of experiences come from three corresponding characteristics of light waves: * The color or hue of light depends on its wavelength, the distance between the peaks of its waves. * The brightness of light is related to intensity or the amount of light an object emits or reflects. Brightness depends on light wave amplitude, the height of light waves. Brightness is also somewhat influenced by wavelength. Yellow

light tends to look brighter than reds or blues. * Saturation or colorfulness depends on light complexity, the range of wavelengths in light. The color of a single wavelength is pure spectral color. Such lights are called fully saturated. Outside a laboratory, light is rarely pure or of a single wavelength. Light is usually a mixture of several different wavelengths. The greater number of spectral colors in a light, the lower the saturation. Light of mixed wavelengths looks duller or paler than pure light. Wavelength –-> Color | Amplitude –-> Brightness | Complexity –-> Saturation | Gestalt psychology, a school of thought that arose in Germany in the early twentieth century, explored how people organize visual information into patterns and forms. Gestalt psychologists noted that the perceived whole is sometimes more than the sum of its parts. An example of this is the phi phenomenon, or stroboscopic movement, which is an illusion of movement that happens when a series of images is presented very quickly, one after another. The phi phenomenon is what gives figures and objects in movies the illusion of movement. In reality, a movie is a series of still images presented in rapid succession. Hearing, or audition, depends on the presence of sound waves, which travel much more slowly than light waves. Sound waves are changes in pressure generated by vibrating molecules. The physical characteristics of sound waves influence the three psychological features of sound: loudness, pitch, and timbre. Loudness depends on the amplitude, or height, of sound waves. The greater the amplitude, the louder the sound perceived. Amplitude is measured in decibels. The absolute threshold of human hearing is defined as 0 decibels. Loudness doubles with every 10-decibel increase in amplitude. The loudness of normal human conversation is about sixty decibels. A whisper is about twenty decibels. A shout right into someone’s

ear is about 115 decibels. Being exposed to sounds that are over 120 decibels, even for brief periods, can be damaging to the auditory system. Pitch, though influenced by amplitude, depends most on the frequency of sound waves. Frequency is the number of times per second a sound wave cycles from the highest to the lowest point. The higher the frequency, the higher the pitch. Frequency is measured in hertz, or cycles per second. Frequency also affects loudness, with higher-pitched sounds being perceived as louder. Amplitude and frequency of sound waves interact to produce the experiences of loudness and pitch. Humans can hear sounds that are between 20 and 20, 000 hertz. Timbre, or the particular quality of a sound, depends on the complexity of a sound wave. A pure tone has sound waves of only one frequency. Most sound waves are a mixture of different frequencies. Taste and smell are chemical senses. As light waves stimulate vision and sound waves stimulate sound, chemicals stimulate taste and smell. Taste, or gustation, happens when chemicals stimulate receptors in the tongue and throat, on the inside of the cheeks, and on the roof of the mouth. These receptors are inside taste buds, which in turn are inside little bumps on the skin called papillae. Taste receptors have a short life span and are replaced about every ten days. For a long time, researchers believed in the existence of four tastes: salty, sweet, sour, and bitter. Recently, researchers have suggested the presence of a fifth taste called Umami. The spice monosodium glutamate (MSG) has an Umami taste, as do many protein-rich foods. Taste is also strongly influenced by smell. Smell, or olfaction, happens when chemicals in the air enter the nose during the breathing process. Smell receptors lie in the top of the nasal passage. They send impulses along the olfactory nerve to the olfactory bulb at the base of the brain. Researchers

theorize that there are a great many types of olfactory receptors. People perceive particular smells when different combinations of receptors are stimulated. The sense of smell is closely connected with memory. Most people have had the experience of smelling something, maybe a certain perfume or spice, and suddenly experiencing a strong emotional memory. Researchers don’t know exactly why this happens, but they theorize that smell and memory trigger each other because they are processed in neighboring regions of the brain. The sense of touch is really a collection of several senses, encompassing pressure, pain, cold, and warmth. The senses of itch and tickle are related to pressure, and burn injuries are related to pain. Touch receptors are stimulated by mechanical, chemical, and thermal energy. Pressure seems to be the only kind of touch sense that has specific receptors. Researchers don’t completely understand the mechanics of pain, although they do know that processes in the injured part of the body and processes in the brain both play a role.