

**PART 1**

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**PSYCHOLOGICAL,  
SOCIAL, AND  
BIOLOGICAL  
FOUNDATIONS  
OF BEHAVIOR**

- Unit I** Perception and Response
- Unit II** Behavior
- Unit III** Self and Others
- Unit IV** Social Structure
- Unit V** Social Strata



**UNIT I**

# Perception and Response

**Foundational Concept:** Biological, psychological, and sociocultural factors influence the ways that individuals perceive, think about, and react to the world.

**CHAPTER 1** Sensing the Environment

**CHAPTER 2** Making Sense of the Environment

**CHAPTER 3** Responding to the World

**Unit I MINITEST**



**CHAPTER 1**

# Sensing the Environment

**Read This Chapter to Learn About**

- ▶ Sensory Processing
- ▶ Vision
- ▶ Hearing
- ▶ Somatization: Tactile Sensation
- ▶ Taste
- ▶ Smell
- ▶ Perception

## SENSORY PROCESSING

A **stimulus** is any signal from the environment that could potentially impact the senses. The signal is transmitted into a **sensation**, which describes the reception of environmental information by sensory organs. **Perception** is the final process of integrating sensations into the brain by selecting information from the environment to attend to, organizing that information, and interpreting the information to make it meaningful.

### Thresholds

The study of how stimuli are translated into perception is called **psychophysics**. Human perception does not register every particle in the environment nor every change in intensity. For example, would you notice the weight of a flea on your skin? Or the taste of a single grain of sugar in your water? Your sensory ability acts as a filter,

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through which small enough changes in the world around you pass without detection, but larger changes are caught. In the 19th century, two psychophysicists discovered principles of human perception that shed (noticeable) light on the porousness of this filter. Gustav Fechner was a German psychophysicist associated with the concept of the **absolute threshold**: the absolute minimum intensity of a stimulus for human sensory perception 50 percent of the time. He discovered various absolute thresholds for different senses and stimuli (See Table 1-1).

**TABLE 1-1** Examples of Absolute Thresholds.

Sense	Absolute Threshold
Taste	1 teaspoon of sugar in 2 gallons of water
Smell	1 drop of perfume in the volume of a six-room apartment
Vision	A candle flame seen at 30 miles on a dark, clear night
Hearing	Tick of a watch at 20 feet in an otherwise silent room
Touch	The wing of an insect falling on the cheek from a height of 1 centimeter

Galanter, 1960

But what about a change from one intensity to another? Would an additional drop of perfume be noticeable in a six-room apartment if it were added to an existing cloud of perfume already sprayed seconds earlier? German physician Ernst Weber introduced the **just noticeable difference (JND)**, the amount by which a stimulus needs to *change* for a human to perceive a difference at least 50 percent of the time (See Table 1-2). Weber observed that the JND increases in proportion to the intensity of the initial stimulus. For example, the brighter a light is, the greater an increase in luminosity is required for humans to notice the difference in brightness. **Weber's law** states that the JND of a stimulus is a constant proportion to the intensity or size of the initial stimulus. Each sense is associated with a different constant, referred to as **Weber's fraction**.

**TABLE 1-2** Just Noticeable Differences among 5 senses.

Sense	Examples of Just Noticeable Difference in Human Perception
Taste	20% saltier taste
Smell	Very complex
Vision	2% brighter
Hearing	10% louder
Touch	2% heavier

It should be noted that JNDs may change over the course of a person's life span and under certain medical conditions (e.g., olfactory JND increases significantly in dementia-related cognitive dysfunction). More recent research has supported Weber's

law except at the very far ends of the spectrum (e.g., extremely heavy or extremely light objects). JND is also subject to **sensory adaptation**. Sensory adaptation refers to the gradual alteration in sensitivity with prolonged stimulation (e.g., music at a concert seems less loud at the end of the night) or absence of stimulation (e.g., when your eyes adjust to a dark room).

## Signal Detection Theory

Signal detection theory seeks to describe how people make decisions. The brain receives and interprets signals. **Signals** are the information gathered from the environment with both the accurate information needed to make the correct decision, as well as the **external noise** that interferes with a person's ability to interpret the information and the **internal noise** from a person's own history, perceptions, and interpretations. When people make decisions about the truth value of a proposition, those decisions may be correct or incorrect (See Table 1-3).

**TABLE 1-3** Signal Detection.

	Decision—True	Decision—False
Actually—True	Hit	Miss
Actually—False	False alarm	Correct rejection

When signal detection theory is used in the context of Weber's law, this means that the greater the difference between comparison stimuli, the easier it is to make a correct decision about whether or not the stimuli are the same (hit or correct rejection). But with very similar comparison stimuli, it is more difficult to correctly identify differences, and it is more likely that incorrect decisions will be made (false alarm or miss).

When signal detection theory is used in the context of medical or psychological settings, it is often used to assess two different types of validity for tests.

- **Sensitivity** is the ability to detect a true signal. When the sensitivity of a test is increased, people are more likely to get both hits and false alarms. These types of tests are often useful as screening instruments that later more expensive and invasive tests will confirm or invalidate the original results (e.g., mammograms as a screening instrument for breast cancer).
- **Selectivity** is the ability to correctly reject a negative signal. Increasing the specificity of a test increases both correct rejections and misses. This is more useful for confirmatory tests (e.g., biopsy).

There is a give-and-take relationship between sensitivity and specificity of a test, so it is mathematically challenging to have both high sensitivity and specificity simultaneously within the same test.

## Sensory Adaptation

**Sensory receptors** transform the environmental signals into stimulus energy that neurons can transmit to the central nervous systems. After firing, all neurons have a **refractory period** in which they cannot fire. During this time while the neuron recovers, no sensation will trigger a firing. As the neuron recovers, there may be a brief time period when only an increased sensory stimuli will trigger a response from the neuron, but a normal stimulation will not. The more frequently a receptor fires, the refractory and recovery period grows longer over time and stimulus adaptation occurs when only a new or significant stimulus triggers a response from the neuron. For example, the sensory nerve cells on the wrist of someone who wears a watch every day eventually stops firing in response to the stimulation from the pressure of the watch. Only a new or significant change to that pressure (e.g., hitting your wrist on a door) will trigger a response from the sensory neurons. Most sensory adaptations are reversible.

## Sensory Pathways

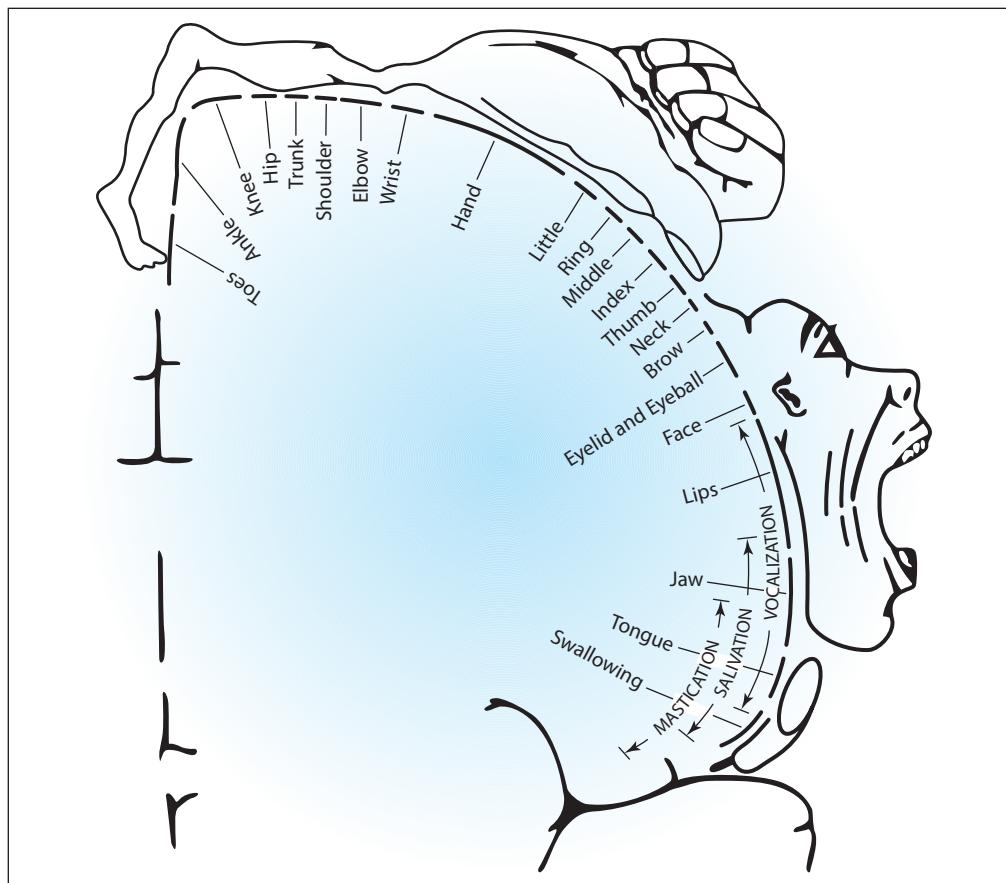
Stimuli trigger a cascade of information flow from receptors, via nerve cells, to the brain, and sometimes to the spinal cord. All sensory information, except for smell, is routed through the thalamus. Then most of the information is sent to the cross-lateral side of the brain where it is processed:

- Auditory information is processed in the temporal lobe.
- Visual information is processed in the occipital lobe.
- Tactile information is processed in the somatosensory cortex, which is located in the parietal lobe.

One way to show how the parietal lobe processes sensory information from different areas of the human body is with a visual representation called a **homunculus** diagram. One such diagram is shown in Figure 1-1. Larger areas of the diagram indicate that there are more neurons processing sensory information for that area.

## Types of Sensory Receptors

There are multiple types of sensory receptors, but modern science recognizes seven major classes of receptors. The first five are familiar and will be addressed later in this chapter: taste, touch, smell, sight, and hearing (i.e., the “five senses”). In addition, there are two other classes of sensors. The **vestibular sensors** help monitor how the body is responding to gravity and motion. They help the body maintain balance. These sensors are primarily located in the semicircular canals in the ear, which project information to be processed by the cerebellum. **Kinesthetic sensors** monitor the position of body parts in space. **This type of receptor is** overwhelmed during rapid growth



**FIGURE 1-1** A homunculus diagram.

spurts because the sensors have not caught up with the size of the body. Receptors of this type are spread throughout the body but are largely located in joints and muscles, which send information to the somatosensory cortex in the parietal lobe.

## Information Processing in the Cerebral Cortex

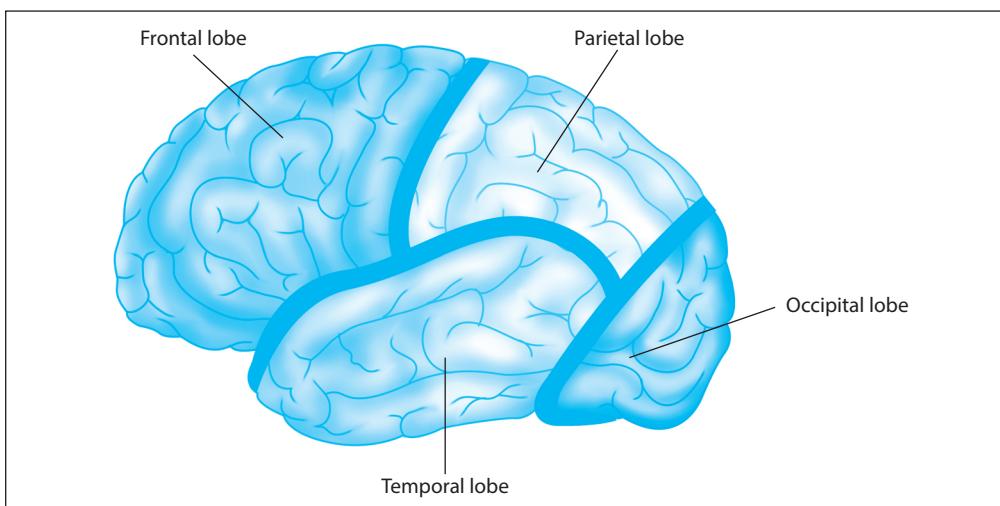
The cerebral cortex is the surface of the brain. (The word *cortex* comes from the Latin word for “bark,” as in tree bark.) The **cerebral cortex** controls voluntary movement, cognitive functions, and some memory storage. It is most heavily involved in higher-order cognitive processing, including language, sensory perception, voluntary motor functioning, and consciousness. The cerebral cortex is made up of four “lobes”:

- frontal (attention, decision making)
- temporal (memory, language)
- parietal (movement, sensation)
- occipital (vision)

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The lobes are shown in Figure 1-2.



**FIGURE 1-2** The cerebral lobes.

There are two distinct sides of the brain, each side playing a unique role in processing information. Most sensory information is processed cross-laterally, or on the opposite side from the body part where the sensory information was received. This is why a stroke in the left parietal area may cause difficulties with sensations on the right side of the body.

## VISION

Vision is the sense that people best understand. The human eye can see only a small range of light frequencies (wavelengths between 400 nm and 700 nm). Within the visual system, there is a perception apparatus that organizes the visual light cues.

### Rods and Cones

Light information is encoded in the brain via the retina of the eye. Two primary light receptors are involved: **rods** and **cones**. Both rods and cones work by catching photons and signaling this information to bipolar cells. Rods are more sensitive than cones, which allows for lower-light (scotopic) vision that is relatively low in acuity. Rods also have only one photopigment (rhodopsin), so they cannot sense differences in color and transmit only gray-scale visual information. Cones are activated in higher levels of light (photopic vision). They directly sense light and communicate data about light to the

nervous system. Cones have lower sensitivity but higher acuity, and they are the source of color vision. When both cones and rods are activated, vision is said to be mesopic.

## Visual Processing

There are two opposing views on how color vision works.

- **Opponent process theory** is based on three opposing color dichotomies: black–white, red–green, and yellow–blue. These are thought to provide the basis for all color vision. No single cone can provide information about both opposite colors at the same time. For example, if you stare directly at a red image for 60 seconds, then close your eyes, you will experience a green **after-image** thought to be caused by **vision fatigue** for the red color.
- **Trichromatic color theory** (also known as **Young–Helmholtz theory**) is based on the idea that the cones are divided into three specialized types. One type responds to short-wave light (blue), one to mid-wave light (green), and one to long-wave (yellow) light. In humans, mid- and long-wave cones are much more prevalent than short-wave cones. Precise discrimination among hues depends on relative levels of activity of different cones.

## Color Blindness

The genes that code for mid- and long-wave cones are located on the X chromosome. Because color blindness is recessive, males are more likely than females to be color-blind, as a man has only a single X chromosome. The most common form of color blindness is red–green color blindness, but yellow–blue color blindness is also observed. Even less common is complete color blindness (monochromat), in which the individual sees only shades of gray.

A simple test can be used to identify color blindness. An individual is shown a diagram consisting of closely spaced dots of different colors and sizes. The arrangement is such that the dots of one color form a recognizable image. An individual with normal vision will see the image, constituted by dots of one color, stand out among dots of a different color. A color-blind individual will not see the image.

## Parallel Processing

Once the retina of the eye transmits information to the visual cortex in the brain (occipital lobe), the brain divides up the signal (e.g., movement, straight lines of different orientations, color) and processes the pieces individually and simultaneously. This is called **parallel processing**.

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## Feature Detection

Within the visual processing system, certain specialized cells are uniquely tuned to see specific objects and to process the pieces of those objects, even in the midst of other complex stimuli. One of the most studied is the **fusiform gyrus** area of the brain, which solely processes information needed to identify faces. The ability to identify other individuals by their faces is thought to be an evolutionary advantage. It is also why your brain picks out the image of a face from other objects, such as an “emoticon” in which a colon, a dash, and a parenthesis looks like a smiling face on its side: :-). Individuals with damage to the fusiform gyrus demonstrate a specific deficit in the identification of human faces—a condition called **prosopagnosia**.

## Higher-Order Visual Processing

Once the eye sends signals to the brain via the optic nerve, the brain begins higher-order processing and organizing of the information. The results may be affected by genetics, culture, age, and other influences on perception of environmental signals.

### BINOCULAR CUES

Using input from the two eyes, the brain can determine many things about the environment based on the differences between the two views. These differences provide what are called **binocular cues**. The first binocular cue is **retinal disparity**. The retinas of the two eyes register two slightly different pictures due to the differences between the eye positions in the head. The closer the object is, the greater the disparity between the two views. The brain then reconciles the two pictures to create the experience of depth perception (this is also the system harnessed by 3-D movies). The second binocular cue is **convergence**, which incorporates the physical movement of the eyes. The individual eyes turn toward each other to focus on an object that is closer to the body.

### MONOCULAR CUES

The input from just a single eye gives the brain many cues about depth perception in the environment, including:

- **Linear perspective.** Parallel lines stretching into the distance appear to move closer together.
- **Height in an image.** Objects higher in an image are assumed to be farther away.
- **Relative size.** Objects of the same type that are larger than others are assumed to be closer.

- **Light/shadow.** The interplay of light and shadow can create the image of three dimensions, even in a two-dimensional image.
- **Interposition.** If one object blocks the view of another object, the blocking object is assumed to be closer.
- **Texture.** The farther away an object is, the less distinct its texture becomes.

Many of these visual cues are believed to be innate or at least developed extremely early in life. Once the eyes have matured sufficiently, infants are able to see their environment clearly and seem to perceive depth. The classic experiment designed to assess depth perception in infants is the so-called visual cliff study. In 1961, psychologists Richard Walk and Eleanor Gibson created a “visual cliff” to determine at what point in development infants use visual cues to perceive depth. They used a checkerboard pattern to provide depth cues, with one half of a table approximately 3 feet lower than the other half, but with a clear plastic top over the entire surface at the higher level, so an infant could crawl safely to the other side if she or he ignored the depth cues. In the experiment, the infant’s mother stood on the far side of the table and called the child to her. Infants aged approximately 7 to 9 months consistently stopped at the edge of the visual cliff. Figure 1-3 shows an image of the study.

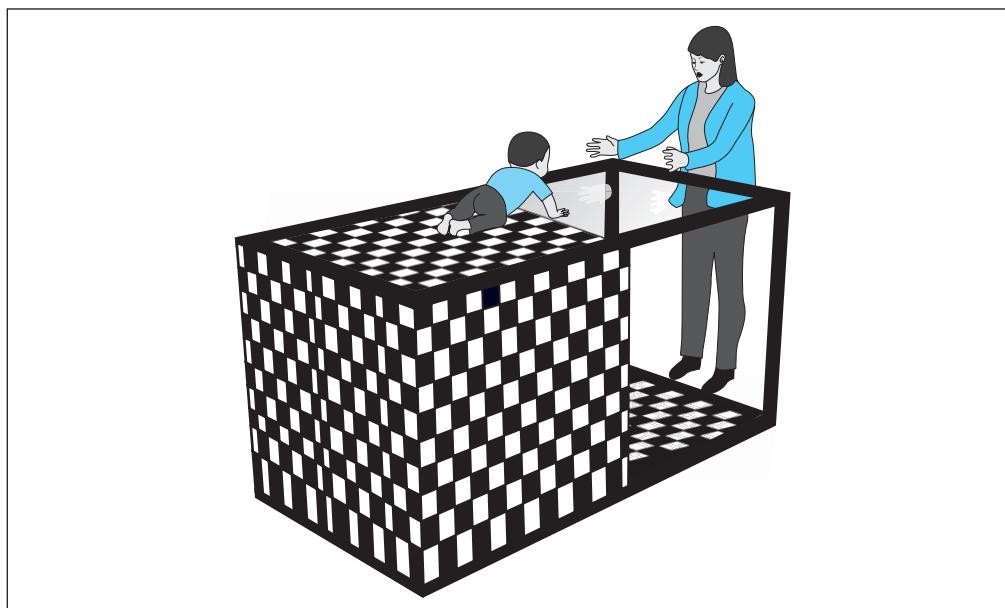


FIGURE 1-3 The “visual cliff” study.

Once the brain can account for where objects are in the environment, higher-order processing begins to use shortcuts to process the environment more quickly and use less processing power. These shortcuts do not appear to be innate, but develop as a child increasingly learns about the environment.

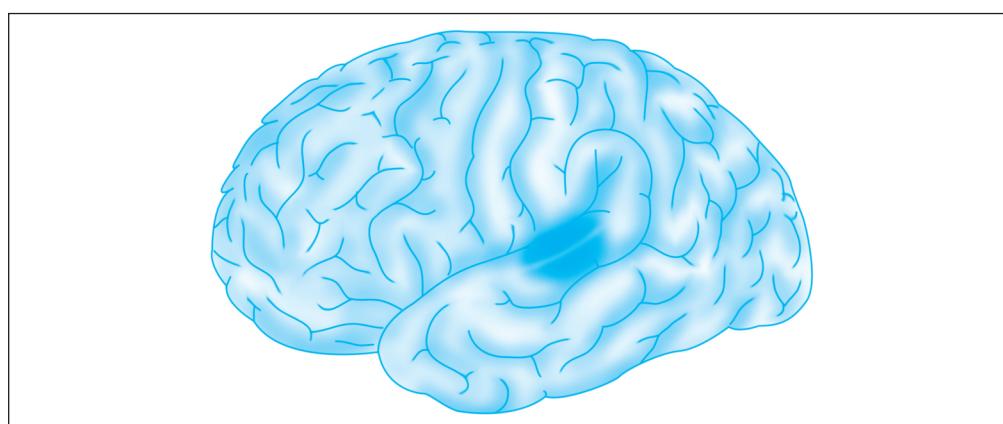
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The visual information processing system accounts for distance and shape so you continue to view objects as having a constant shape and size. For example, if you see a door, you are aware that it is a rectangle, regardless of how close you are or the angle at which you view it. If the door is open, your eye might sense a rhomboid shape, but you continue to perceive the door as a rectangle and maintain consistency of shape. Likewise, if you view an elephant from a distance, you will view it as a large object that is far away rather than a small object.

**HEARING**

Sound waves reaching the ear stimulate the vestibular nerve and cochlear nerves. These nerves combine into the vestibular-cochlear nerve (cranial nerve VIII). It projects into the brain stem, then through the midbrain, up into the thalamus. From there the signal is relayed to the primary auditory cortex in the temporal lobe (see Figure 1-4).



**FIGURE 1-4** The primary auditory cortex.

**Perceiving Loudness and Pitch**

Hearing, or auditory processing, generally relies on combinations of three different types of physical sensations (See Table 1-4) to make sense of the auditory world.

**TABLE 1-4** Auditory Sensations.

Physical Sensation	Measurement	Perception
Frequency	Hertz (Hz)	Pitch
Amplitude	Decibels (Db)	Loudness
Complexity	Harmonic structure	Timbre

The human ear is most sensitive to sounds at approximately 2000 Hz. The threshold of hearing is 0 decibels. Sounds between 80 and 120 decibels are dangerous with prolonged exposure. Sounds above 120 decibels are immediately dangerous and are perceived as painful. Loud sounds damage the delicate hair cells in the basilar membrane in the inner ear, and once these hair cells are damaged, they do not recover.

Hearing is a function of sensory reception by hair cells in the cochlea of the inner ear. There are three theories about how this reception takes place:

- **Place theory.** This theory is primarily associated with the German physicist Hermann von Helmholtz. According to this theory, pitch is perceived due to vibrations at specific locations along the basilar membrane in the inner ear. A specific frequency vibrates the hairs in a specific place on the basilar membrane, and the brain interprets the location of those vibrating hairs as a specific pitch.
- **Frequency theory.** Developed in the 1800s, this theory holds that the brain interprets pitch by the vibrating frequency of the entire basilar membrane. For example, a 2000 Hz vibration would cause the basilar membrane in the cochlea to vibrate 2000 times per second, which the brain would uniquely associate with the 2000 Hz pitch.
- **Reconciling the theories of hearing (volley theory).** Both theories proved to have some truth and some errors. The problem with place theory is that vibrating hairs at a single location are not independent of the other hairs in the area. The difficulty with frequency theory is that neurons have difficulty firing faster than 1000 times per second. The unification of these theories was achieved by the American psychologists Ernest Wever and Charles Bray in 1937, who developed the volley theory. They showed that neurons can work together using the functions described in both place and frequency theories to signal pitch. Sounds of less than 1000 Hz appear to rely more on the principles in frequency theory. Sounds in the range of 1000 Hz to 5000 Hz rely on a combination of frequency and place theories to encode sounds. Sounds greater than 5000 Hz rely solely on place theory principles (See Table 1-5).

**TABLE 1-5** Principles of Volley Theory of Hearing.

Frequency of Sound	Coding Principles
<1000 Hz	Frequency theory
1000 Hz–5000 Hz	Frequency + place theory
>5000 Hz	Place theory

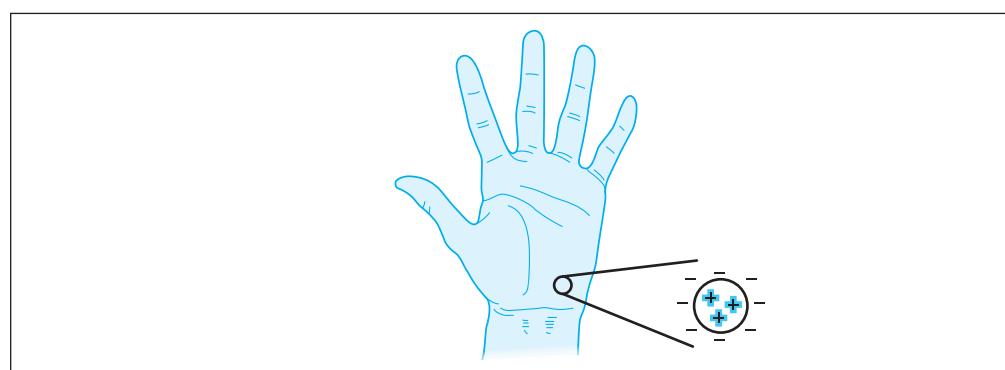
How do you locate a sound in the environment? Similar in function to binocular depth perception cues, binaural cues can inform **auditory localization**, or the determination of location of a sound, by comparing the timing and strength of the same sound in each ear. This information is called **binaural disparity**. The distance between the ears and the ability to turn the head to change how the sound strikes each ear are both critical components of this process of locating the source of a sound in the environment.

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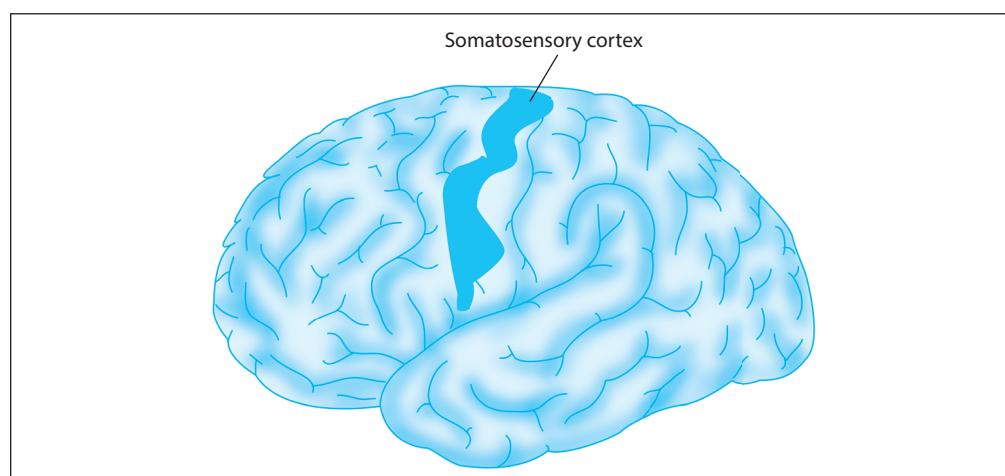
## SOMATIZATION: TACTILE SENSATION

Skin is the largest organ in the human body. It has at least six types of sensory receptors. Some of these receptors are specialized to respond to pressure, thermal, pain, or chemical stimulators, while some of the receptors are still a mystery. Pressure receptors in the skin, like all nerve cells, work using a “receptive field” (see Figure 1-5). These fields vary in size and shape depending on the part of the body. Each receptive field has an excitatory center with an inhibitory surround. Stimulating the center will cause the feeling of pressure, whereas stimulating the inhibitory areas inhibits pressure sensations.



**FIGURE 1-5** A receptive field for tactile sensation.

Once the stimulus activates the nerve fibers, the nerves run up the spinal cord ascending (sensory) pathways to the brain stem where they cross to the other side of the brain. The tactile pathways then funnel through the thalamus on the way to the somatosensory cortex in the parietal lobe of the brain (see Figure 1-6).



**FIGURE 1-6** The somatosensory cortex.

## Pain

Pain, or **nocioception**, is transmitted to the brain via two pathways: “fast” and “slow.” The fast pathway uses **A-delta fibers**, which are large myelinated neurons that can transmit signals quickly to the brain. This pathway transmits sensations such as a sharp pain when you cut your finger. In contrast, on the slow pathway, signals may lag up to 1–2 seconds behind signals transmitted via the A-delta pathways. The slow pathway uses the **C-fiber neurons**, which are small neurons that do not have a myelin sheath at all. The slow pathway transmits signals such as muscle pain.

The famous duo of the Canadian psychologist Ronald Melzack and the British neuroscientist Patrick Wall developed the gate control theory of pain to explain this phenomenon. They postulated that descending pathways from the cortex act as a “gate” to the pain neurons. This gate is opened or closed by the descending pathways and reduces or exacerbates the level of pain signals that reach the brain.

Pain is a unique sensation. The same sensation will not cause the same experience of pain in different people. Psychological factors such as emotion and cognition play a crucial role in how much pain is perceived by an individual. Additionally, factors such as personality characteristics, a history of opioid medication use, and drug abuse will all affect pain levels. Endorphins also play a critical role in the perception of pain and may be another pathway linking psychological and physiological pain perception. Factors that affect endorphins will also affect perception of pain (See Table 1-6).

**TABLE 1-6** Effects of Different Domains on Pain Perception.

Domain	Exacerbate(s)	Reduce(s)
<b>Mood</b>	Depression, anxiety, anger, sadness	Laughter, good mood
<b>Focus</b>	Hyperfocus on pain	Distraction from pain
<b>Beliefs</b>	“I am powerless to stop it.”	“I can handle this.”
<b>Expectations</b>	“It will get worse.”	“It will get better.”
<b>Culture/Gender</b>	Complex: In general, it does not change pain levels but can change expression.	

## TASTE

Sense receptors on the tongue perceive five primary tastes: salty, sweet, sour, bitter, and umami, or savory. Taste perception is a chemical sense and varies greatly across individuals. The primary sensory mechanism is through taste buds, which have a brief life cycle (approximately 10 to 60 days). The density of taste buds on the tongue appears to be genetically determined. Twenty-five percent of individuals are labeled “supertasters.” Supertasters have a greater density of taste buds (10,000 on the tongue)

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compared to “nontasters” (with as few as 500). Supertasters particularly have greater sensitivity to sweet and bitter flavors; for example, they experience more “burn” from chili peppers. Women are much more likely than men to be identified as “supertasters.”

The facial and glossopharyngeal nerves (cranial nerves VII and IX, respectively) collect data from the tongue and send it through the medulla oblongata in the brain stem, and then up through the thalamus on the way to the gustatory area (insular cortex) in the frontal lobe. This area also has a close relationship with the limbic system and accounts for the emotional aspects of food and taste.

Taste buds can be acutely overstimulated, and **taste adaptation** occurs until the neurons recharge and can resume firing. Research has suggested that taste adaptation can occur in as few as four bites of the same food. For example, the fifth bite of a French fry does not taste as salty as the first bite. While tasting ability may be genetically or evolutionarily determined, taste and food preferences are clearly culturally determined. Some people love Hawaiian pizza, some love a plump beetle grub; it all depends on your culture of origin. At the present time, the only identified transcultural innate taste preference is a universal disgust for feces (Rozin, 1990).

## SMELL

Smell, like taste, is a chemical sensory process. Researchers are still learning about how chemical sensations result in the perception of odors in the human brain. There is still much unknown about this process. It is estimated that humans can differentiate between approximately 10,000 scents. However, unlike taste, smell has no clear “basic” smells. In fact, it is estimated that 90 percent of the flavor of food is actually attributable to smell. Smell is unique because it is the only sense that is *not* routed through the thalamus. The olfactory nerve fibers (cranial nerve I) converge in the olfactory bulb in the brain. The olfactory system has projections into the amygdala, which is part of the limbic system (the emotional center of the brain) and the hippocampus (the memory center), which suggests an odor component to memory formation.

**Anosmia** is the lack of the ability to smell. It can be caused by injury or disease. Famously, Ben Cohen of Ben and Jerry's ice cream has anosmia but enjoys the “rich and creamy” texture of his ice cream.

The sense of smell is largely underappreciated as a primary communication tool. Humans and other animals largely use the sense of smell (though potentially subconsciously) to communicate with one another. Pheromones are used by individuals to seek mates and by women to synchronize menstrual cycles to enhance evolutionary group dynamics. Other animals are perhaps less subtle about their use of smell, using urine, feces, or other substances to mark their territory. There do not appear to be any innate preferences for smell. All smell preferences appear to be culturally determined

(Bartoshuk 1978, 2010). Cross-culturally, women appear to be slightly more accurate than men in correctly identifying odors in odor recognition tests (deWijk, Schab, & Cain, 1995).

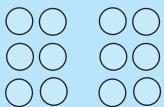
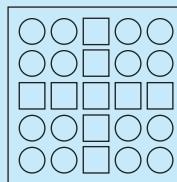
## PERCEPTION

Perception occurs when the brain processes sensory stimuli and translates them in a way the person can understand. While this happens in multiple sensory systems, it is best explained in the visual system. The brain engages in two types of processing. In **bottom-up processing**, the brain examines pieces of a visual image and from those pieces puts together an entire image. There are “feature detectors” in the visual cortex that respond only to very specific stimuli (e.g., only vertical lines or only horizontal lines). Information from these feature detectors is put together by higher-order analyzer cells, which then finalize the whole image. In **top-down processing**, the brain uses *a priori* knowledge of the world to form fast percepts, or mental impressions. It then breaks down the total image into its constituent parts to check if the perceptual hypothesis is correct. Historically there were arguments about which kind of processing the brain uses, but as with many of these arguments, there is truth in both views. The brain appears to use both kinds of processing to understand the world.

## Perceptual Organization

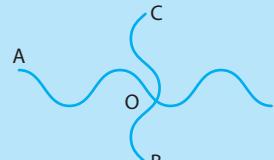
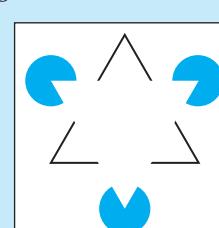
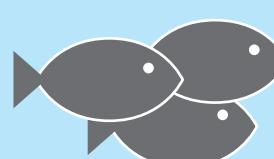
**Gestalt perception** is the concept that the whole is greater than the sum of its parts. There are five major principles of gestalt visual processing (See Table 1-7). The **law of Pragnanz** is a related concept that states when things can be grouped together visually, they will be.

**TABLE 1-7** Key Principles of Visual Organization.

Principle	Example	Explanation
<b>Proximity</b>	You are more likely to see two groups of 6 than one group of 12. 	The closer objects are to one another, the more likely they will be grouped together.
<b>Similarity</b>	You are likely to see a cross because of the visual grouping of the squares as separate from the circles. 	Objects that are visually similar (in size, shape, or color) are likely to be grouped together.

*(continued)*

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Principle	Example	Explanation
<b>Continuity</b>	You will likely see a line from A to D and B to C rather than A taking a right turn at O and ending up at B.	Humans visually continue a straight or curved line rather than transferring to another line.
		
<b>Closure</b>	You will likely see a white triangle that does not exist, because of the suggestion of lines.	When there are gaps in a picture, the perceptual system fills them in.
		
<b>Common Fate</b>	You will likely perceive these fish as members of a group rather than individuals.	When similar objects are moving together in the same direction, they are perceived as belonging to a single group (e.g., schools of fish).
		

## Cultural Influences on Visual Perception

While there is a shortage of data on cultural influences on visual perception, there are a few key studies. In 1983, Darhl Pedersen and John Wheeler compared the responses of two subgroups of Navajo American Indians to the **Müller-Lyer illusion**, a pair of diagrams with center lines that appear to have different lengths but in fact are exactly equal. The difference in perception is caused by short lines that are attached at different angles (see Figure 1-7). One group of Navajos lived in round houses, so in early childhood they had little exposure to visual angles, straight lines, and 90-degree corners. Another group who grew up in more European-style angular houses were more susceptible to the illusion.

Similar responses have been recorded from Zulus who lived in a less “carpentered” world with few rectangular structures (Segall, Campbell, & Herskovits, 1966).

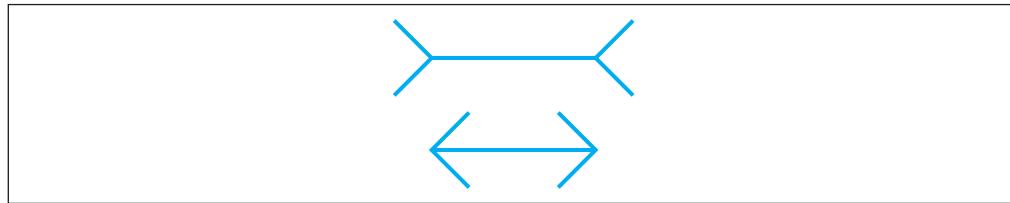


FIGURE 1-7 The Müller-Lyer illusion.

This group is less likely to view the illusion as the corner of a building as Americans typically do. Education can also alter perceptions within a culture (Hudson, 1960), with those with more education being better able to use visual depth cues to comprehend a flat picture.

