# Chapter 4: Sensation & Perception

**Important Points**

- Stimulus Detection
- Visual System
- Auditory System
- Other Sensory Systems
- Gestalt Rules
- Depth Perception
- Pain Perception

Chapter 4 continues the biological approach to psychology as we examine how the sensory systems work. One common question that students have in this section revolves around how much detail is necessary. Do you really need to know the fine structure of the retina? Should I know the material on smell in the same amount of detail? Why is it important to study this stuff? I can't give you an easy answer to these questions, but I will remind you that function is more important than fact. You should get an idea of how the systems work rather than the minute details of the components. As we go through each of the major sections, I'll try to highlight what I think is really essential.

By the way, is the man in the opening scenario walking up or down the staircase?

## 1. Stimulus Detection

This section really involves a consideration of **psychophysics**—how we detect and compare stimuli. There are two important theories to focus on. **Signal Detection Theory** outlines some of the factors that influence our ability to detect stimuli, e.g., how much noise is in the background? How motivated is the individual? Figure 4-3 illustrates the various outcomes of a detection task. Note the distinction between two types of error: a **miss** and a **false alarm**, and the fact that it is important to both identify a signal when it is present and to correctly reject it when no signal is there.

One of the first theories in this area was **Weber's Law**. This law states that the change in stimulus intensity necessary to report a **Just Noticeable Difference (JND)** is constant at any level of a test stimulus. For example, if I am trying to determine your ability to detect differences in the intensity of sound, I might present you with a test tone at a particular level (e.g., 50 decibels). As I turn up the volume, you have to tell me when you notice that the sound has indeed increased—you have to report a JND. Let's say that you do so at 55 decibels. The change in stimulus intensity was 55-50 = 5 decibels. Knowing this I can calculate what a JND will be at any other value for the test stimulus. For example, what will a JND be if I increase the test stimulus to 100 decibels? The calculation is shown below.

$$5/50 = x/100$$

Solving the equation, we find that x=10. A JND would be reported at 100 + 10 decibels OR 100 – 10 decibels—i.e., a JND will be found at either 110 or 90 decibels. Note that the value of the JND is not constant…the relative difference is. If I double the value of the test stimulus, then I must double the value of a JND.

You should be familiar also with the concept of **sensory adaptation** and whether it is possible to detect **subliminal** (i.e., below threshold) stimuli.

## 2. The Visual System

It has been said the vision is the single most important sensory mechanism for humans. This certainly holds for the focus of Chapter 4. You should know the visual system very well. Anatomically, it is most important for you to know the structure of the **retina**. Note the diagram of the retina on p. 145. Once light passes through the lens, the image is focused on the retina. But the light sensitive receptors (**rods and cones**) are at the very back of the eye. Light must pass through two other cell layers before it even reaches the receptors. "Connected" to the receptors are the **bipolar cells**. They take information from the receptor cells and pass it to the outermost layer, the **ganglion cells**. The ganglion cells represent the output stage of the retina. In fact, the axons from the ganglion cells form the **optic nerve**. You should be familiar with how the rods and cones work (essentially by a breakdown of light sensitive chemicals), and the different functions that they serve (e.g., cones give you colour vision). The section on colour vision is also important. Know the distinction between the **trichromatic** theory and the **opponent process** theory. What evidence is available to support either of these theories? Also be familiar with the material on feature detectors in the visual cortex.

### 3. The Auditory System

After vision, hearing is the next most "important" sense. Know the structure of the inner ear in particular and how sound waves are translated into a signal. Perhaps the most important part of this section deals with the perception of pitch. Know the distinction between **place theory** and **frequency theory.** Which theory better explains low frequency sounds? Why?

### 4. Other Sensory Systems

Together, the remaining sensory systems are referred to as the "minor" senses. Humans do not rely on these systems as much and they are not as sensitive as vision and hearing. For touch, smell and taste, you should know in general how the system works. How is that light pressure on the skin is translated into the psychological perception of touch? Are we more sensitive to one kind of smell or taste?

### 5. Perception: Gestalt Rules

The latter part of the chapter switches to a discussion of perception rather than sensation. In many ways this is the more fascinating aspect of our sensory systems—how do we actually put of this information together in our mind? The first thing to examine is the rules of form perception. These **Gestalt** (pronounced "guess stalt") rules have been around for many years and give us some insight to our perception of pattern and form. You should know each of the rules (e.g., proximity, similarity) and how that rule explains perception. The way we organize information can generate some interesting illusions (e.g., as shown in figures 4-33, 4-35 and 4-36). The **perceptual constancies** are also important.

### 6. Depth Perception

How do we locate a target in space? Essentially, we use a number of cues to depth available in the environment. **Binocular cues** require two eyes (they also require the eyes to be on the front of the head and not too far apart or close together). The most important binocular cue is **retinal or binocular disparity**. This cue results from the fact that a target in space will present a slightly different view to the left eye as compared to the right. The brain can use this disparate information to "calculate" the distance. But we can see depth even with one eye. Here we have to rely on the **monocular cues** such **as linear perspective, relative size**, and so on. These monocular cues are learned and will require some experience with the world. The next section describes several illusions that are generated by monocular cues and inappropriate size constancy scaling. You should know what these illusions are and how we think they work.

## 7. Perception of Pain

Pain perception is a rather complex process.  The experience of pain can be modulated by a number of factors including naturally-occurring opiates in the body called **endorphins** and one's cultural expectations.  The final section in this chapter examines the notion of a critical period.  Even for attributes that would seem to be strongly influenced by genetics, it is often the case that there must be some exposure to "normal" environmental experience for proper development.