Chapter highlights: Senses and Perception (Ch 3)

The purpose of “chapter highlights” is to offer a framework in which to think about the specific information discussed in each Brain Facts chapter. These highlights draw upon information in the chapter and on the new Brain Facts web site (http://www.brainfacts.org) and occasionally, on our own knowledge of neuroscience that may not be discussed in Brain Facts. Questions for Brain Bee will come from Brain Facts (new 2012 publication) and entries from the new Brain Facts web site that have “brainfacts.org” in the URL. Some but not all relevant entries are cited below.

The first question you might ask is what distinguishes sensation from perception? How can I understand what these two terms represent?

**Sensation** can be viewed as the raw information (light, sound, touch, cold, etc) that activates various receptors in the eye, ear, skin, etc. whereas **perception** is the brain’s interpretation of that sensory information. Visual illusions are wonderful examples of how the brain gets involved in interpreting information. **Visual sensation** is the transduction of light by photoreceptors in the retina. The end result however is **visual perception**, which as is the case for visual illusions, does not always match the incoming sensory information. In other words, we think see something that we actually do not; i.e., there is a mismatch between the information that hits the retina and what the brain “thinks” it sees. We know much more about the neural basis of sensation than we do about the neural basis of perception.

**Brain briefing on visual illusions that discusses this distinction (downloadable PDFs available)**


**Neural basis of sensation: basic principles** http://www.brainfacts.org/sensing-thinking-behaving/senses-and-perception/

1. Sensory information is transduced by receptors, converting light, pressure, cold etc. into an electrical signal

2. Sensory information travels from the periphery to some specific part of the cerebrum by way of the **thalamus** (the major way station through which all sensory information passes)

3. Information from one side of the body (or visual field) is typically sent to the opposite side of the brain (exception: auditory information)

4. Sensory information is organized topographically in the brain (i.e., information from contiguous points on the skin or retina is sent to neighboring neurons in the thalamus and cortex)
5. A **receptive field** (of a sensory neuron) is defined as that area in the periphery that provides sensory input to a neuron.

   a. Sensory information is integrated as it moves from its origin to the cortex; this means that sensory neurons in the cortex tend to have more complex and larger receptive fields than sensory neurons at lower levels.

**Neural basis of vision (used to exemplify a few more basic principles relevant to other sensory systems)** [http://www.brainfacts.org/sensing-thinking-behaving/senses-and-perception/articles/2012/vision-processing-information/](http://www.brainfacts.org/sensing-thinking-behaving/senses-and-perception/articles/2012/vision-processing-information/)


      a. Other sensory systems (auditory, touch, taste, etc) convert other forms of energy or stimuli to electrical signals.

      b. Our body is equipped with many specialized receptors that are designed to selectively respond to many different kinds of stimuli (cold, pressure, pain, chemicals, etc)

   2. The size of the receptive field determines visual acuity or the ability to resolve two independent points in space.

      a. Large receptive fields at the periphery of the retina result in low acuity (e.g., information from many photoreceptors is sent to single retinal ganglion cells) but high sensitivity whereas small receptive fields in the center of the retina result in high acuity.

      b. Receptive fields in the retina and thalamus are simple center-surround (excited by a small region of light hitting its center and inhibited by light hitting its surround), but become more complex in the cortex, responding best to bars or edges of light in a particular orientation and/or moving in a particular direction. In this way, the brain extracts distinct and relatively simple features of the visual world at lower levels of the visual system and integrates them to reconstruct in the cortex the complex visual world seen by the eye.