

Sensation and Perception: Activities to Promote Learning and Clarify Student Perceptions

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This collection of activities and demonstrations represent a wide range of topics in Sensation and Perception. Activities from pedagogical literature, downloadable tutorials, instructor manual suggestions, affordable commercial products, and original activity ideas are summarized. Given the interactive and highly visual nature of the course matter, newer technology has simplified demonstrations and enhanced examples. Online sites provide a plethora of resources from popular visual illusions to interactive flash tutorials. The chapter author has tested each of the activities in this chapter in undergraduate Sensation and Perception courses and has found them to be effective teaching tools for the topics represented. Two original activities not published elsewhere precede the annotated bibliography. Suggestions for activity expansion and modification are also included for many activities¹, again representing classroom-tested and successful ideas. Judgment of activity effectiveness is based on both positive student feedback and measureable learning outcomes.

Original Activity #1 Teen Buzz – Age Effects on Hearing

This activity involves high frequency ring tones used by youths, which most adults cannot hear. The website www.teenbuzz.org provides a chart of downloadable tones from 8 kHz (everyone can hear), to higher frequency tones that only younger and younger age groups can typically hear. For example, the chart indicates those below 60 should hear the 10kHz tone, those below 40 should hear the 15 kHz tone, and on up to the 21-22 kHz tones that typically only those under 20 can hear.

¹ Throughout the chapter, items with asterisks are original suggestions or additions to the published resources discussed. Additional information for original suggestions is available upon request by contacting Dr. Cindy Gibson at cgibson2@washcoll.edu.

These high frequency tones provide a good starting point to discussions of cochlear topography and hair cell loss due to age. Students can test their own hearing in the higher frequencies, then create charts of factors that may personally be affecting their hearing both positively and negatively. For example, they may have benefits such as living in a rural area, rarely attending concerts, and not using headphones regularly, as well as detrimental personal experiences such as a history of ear infections, and exposure to loud noise from farm equipment or jets if they live near an airport. Students are typically surprised when their instructor, or more poignantly, their peers cannot hear certain higher frequency tones. Students indicate the activity is memorable and it may influence their attentiveness to protecting their own hearing (e.g., reducing music volume through headphones).

Original Activity #2: Altering Taste Sensations with Miracle Fruit

This activity involves miracle fruit (also known as miracle berry), which is widely and inexpensively available on the internet as either dried fruit tablets or lozenges. A near-tasteless fruit when eaten alone, miracle fruit coats the tongue, reacting with acids in foods eaten subsequently to change the perception of tart or sour substances to sweet. The protein miraculin found in the fruit changes conformation in acidic environments (e.g., when exposed to citric acids in tropical fruits), stimulating sweet receptors to the point of overpowering the signals from sour receptors. Any foods eaten 30 to 120 minutes after eating the miracle fruit will be perceived as sweet, including cheese, sourdough breads, and a variety of fruits. An inexpensive order of miracle fruit lozenges coupled with a few choice foods to sample can be used to introduce the concepts of taste receptors, used in conjunction with mapping taste receptors, or to demonstrate the relationship between sensory stimulation and perception. Students can be asked to research the physiological basis for the effect and/or suggest practical uses and applications for the fruit.

This is one activity that makes a strong impact on students. A good summary of the effects of miracle fruit can be found at the following reference:

- Song, H.-J. (2001). The sense-sational miracle fruit. *ChemoSense*, 3(3), 3-4. Retrieved from: <http://chemosense.info/issues/01/chemosenseMay2001.pdf>

Annotated Bibliography of Published Activities

Activities for Topics in Vision

Structure of the eye. Dissection of a sheep or cow eye provides a memorable activity for learning the structures of the eye. This activity can be accomplished using a few simple tools in either a laboratory or classroom environment and can be completed as a single demonstration, in groups, or by partners. No review by an animal ethics committee is necessary for prepared specimens purchased from a commercial vendor. Although several companies supply eyes for this purpose, Ward's Natural Science (<http://wardsci.com>) flushes their fixed specimens to remove chemicals that would otherwise require special disposal. Bought in bulk of 10 or more, cow eyes can cost as little as \$2 per eye. The key to this activity is a good dissection guide. Home Science Tools sells complete dissection kits, including a dissection guide, dissection tools, and a cow eye. The dissection guide including complete instructions, pictures, and labeling diagrams can be found for free at <http://www.hometrainingtools.com/articles/eye-dissection-project.html>.

Visual perception tutorials – Receptive fields and lateral inhibition. Some of the visual concepts most difficult for students to grasp include receptive fields and lateral inhibition. Tutorials on these and other visual perception topics by John Krantz (http://psych.hanover.edu/Krantz/sen_tut.html) come recommended by the instructor's manual cited below. Students report that these tutorials provide clear explanations and examples for some of the most difficult visual perception concepts.

- Wurst, S.A. (2007). *Instructor's manual with test bank for Goldstein's Sensation and Perception*, 7th ed. (p. 34). Belmont, CA: Thomas Wadsworth.

Visual perception library of resources. Viperlib is a library of resources including images, movies, and tutorials related to visual perception (<http://viperlib.york.ac.uk/?swf=true>). This is a growing database of free materials. The Viper2Go section contains interactive Flash tutorials on a variety of vision topics, including receptive fields and signal detection theory. Although downloads are free,

you must register to view or download the materials and viewing the tutorials requires the Shockwave software plug-in.

Perception Goggles – Visual Adaptation. Drunk simulation goggles are sometimes used in driver's education courses or other venues as concrete examples of the perceptual distortions that occur while drinking. Unfortunately, the goggles can be quite pricey. As a very affordable alternative, perception displacement goggles and inversion goggles are available at <http://www.psychkits.com>. These goggles come with instructions and a detailed list of suggested activities. Additional activities, modifications, and/or data recording can be added depending on the instructor's goals. Students wearing the goggles initially report extreme disorientation followed by rapid adaptation to the visual distortion, providing an excellent and memorable example of perceptual adaptation.

Faceblind tests (Prosopagnosia). Students can test their facial recognition abilities using either the Famous Faces Test or the Online Cambridge Face Memory Test at <http://www.faceblind.org/facetests/index.php>. The Cambridge Face Memory Test is arguably the most valid prosopagnosia screening tool currently available. This free online version involves becoming familiar with several faces and then identifying them from among similar-featured faces. Final scores are compared to norms for face memory. One suggestion is to complete the Famous Faces Test as a class for practice, then have students complete the Cambridge Face Memory Test on their own. *Students can then report through a journaling activity, group activity, or reflection paper on their own facial recognition abilities and/or the underlying theories for prosopagnosia. Students have found these memory tests enlightening and have later utilized the tests as part of a larger research project.

Change blindness demonstration. Excellent examples of change blindness can be found online (e.g., <http://www2.psych.ubc.ca/~rensink/flicker/download/>). Students try to find the one item that is changing between two flickering images. Some of the examples, such as "Airplane" are especially good examples of how even very large and important changes can easily be missed. Students report that their change detection abilities in this demonstration involve sequential scans of smaller sections of the alternating images.

Experiencing color blindness. The Vischeck Photoshop plug-in, available as a free download (<http://www.vischeck.com>), can convert any photo to a simulation of any of the three dichromatic color deficiencies. Good photos to use for this demonstration include pictures of food, dangerous (colorful) animals such as snakes, scenery shots, and

candid pictures of diverse people. *Students often have photos readily available in e-mail or on their cell phones that can be opened in the software and then quickly converted to demonstrate how that photo would look to someone with any of the three types of dichromatic color deficiencies. The Vischeck website also has a plug-in download that can help correct images so they can more easily be seen by people who have a color deficiency.

Visual illusions on the Web. There are numerous online databases of visual illusions. One of the most comprehensive sites in terms of illusions themselves (88 visual illusions in all) and detailed explanations for the illusion effect, including lists of references, can be found at Michael Bach's website (www.michaelbach.de/ot/). This is an award-winning, go-to resource that will be handy throughout the semester, demonstrating optical illusions, color illusions, Gestalt effects, light and motion illusions, and many others. Sites with briefer explanations (<http://psy2.ucsd.edu/~sanstis/SASlides.html> or <http://dragon.uml.edu/psych/illusion.html>) and popular sites with large illusion collections but no explanations (www.scientiificpsychic.com/graphics or www.coolopticalillusions.com) are also available. An index of visual illusions and demonstrations is available at <http://psychlab1.hanover.edu/Classes/Sensation/> and Applet demonstrations of vision, including color, depth, motion, and more are available at <http://lite.bu.edu/> (these require the latest version of Flash Player plug-in).

Visual cues and balance demonstration. This activity demonstrates how essential visual cues are to balance, which is intricately related to both optic flow and top-down processing. Students test their balance by standing on one foot while holding the raised foot first in front and then behind themselves with their eyes open and again with their eyes closed. *An additional condition can be added by having students repeat the procedure while a strobe light flashes in a darkened room. Students can time themselves and record the differences in balance time. Most students are surprised at how different their balance is when their eyes are closed (i.e., there are no visual cues). Exceptions often include dancers or other precision athletes due to practice at controlling their balance.

- Wurst, S.A. (2007). *Instructor's manual with test bank for Goldstein's Sensation and Perception, 7th ed.* (Ch. 9). Belmont, CA: Thomas Wadsworth.

*It may be useful to stress the clinical applications behind understanding the concepts of visual cues and balance. Literature searches, application papers, or other assignments can be used to enhance the activity. A good application of these

concepts is illustrated in the reference cited below, which is from an open access journal so everyone can easily access the original article.

- Ferrarin, M., Rabuffetti, M., Tettamanti, M., Pignatti, R., Mauro, A., & Albin, G. (2008). Effect of optical flow versus attentional strategy on gait in Parkinson's Disease: A study with a portable optical stimulating device. *Journal of Neuroengineering and Rehabilitation*, 5:3. doi:10.1186/1743-0003-5-3

Biomotion – Light walker demonstration.

Representing a person walking by using only 15 points of light, this online demonstration can be adjusted for motion associated with different genders, emotions, and walking styles. Students can easily detect the differences they select so this makes a good interactive in-class demonstration of motion capture, specifically biomotion detection, based on minimal cues. The light walker can be found at <http://www.biomotionlab.ca> by selecting BML Walker.

CogLab experiments (Change detection and apparent motion). CogLab (<http://coglab.wadsworth.com>) is an online laboratory from Wadsworth Publishers where instructors can set up specific instructions for their own students via a simple registration process. A variety of topics of cognition have interactive experiments where instructors can view data collected from their students. Although primarily cognitive psychology experiments, there are also experiments relevant to perception, including change detection and apparent motion. This may be a good alternative or supplement to traditional laboratory sessions.

Activities for Topics in Audition

Auditory perceptions demonstrations. Several demonstrations are provided and described, all using common, easily accessible materials. The first localization demonstration is an activity showing the interaural time difference involving sound localization when a length of hose is tapped at various locations. The frequency and pitch demonstration involves pouring water into a metal pipe, a quick and memorable demonstration of the relationship between frequency and pitch. The final demonstration investigates sound traveling through air versus other media (a coat hanger), to demonstrate the difference between sound waves in air and ossicle bone vibrations.

- Haws, L., & Oppy, B.J. (2002). Classroom demonstrations of auditory perception. *Teaching of Psychology*, 29, 147-150.

Demonstrations of auditory concepts. This is a comprehensive collection of demonstrations of 39 auditory effects, including critical bands, sound pressure, auditory illusions, masking, timbre, pitch, echoes, and binaural effects. The compact disc comes with a booklet detailing the concepts behind each demonstrated effect, transcripts of the commentary for each track, and references. Students have indicated this CD provides concrete examples for abstract auditory concepts. The CD is affordable and available for purchase at <http://asa.aip.org/discs.html>

- Houstana, A.J.M., Rossing, T.D., & Wagenaars, W.M. (1987). *Auditory Demonstrations* [Sound Recording]. Eindhoven, Netherlands: Institute for Perception Research.

Tactile Activities

Dowels and object perception. This demonstration involves using small dowels or probes (chopsticks may also work) to explore a wide variety of objects while blindfolded. Students can use tools to passively explore the objects, which vividly contrasts to actively exploring the objects with their hands. Students can then identify which mechanoreceptors were involved in the passive and active object recognition tasks. Reflection papers, discussion forums or touch profile worksheets can be assigned.

- Wurst, S.A. (2007). *Instructor's manual with test bank for Goldstein's Sensation and Perception, 7th ed.* (p. 194). Belmont, CA: Thomas Wadsworth.

Tactile illusions and demonstrations. This article reviews 20-plus published tactile illusions (e.g., size constancy, after effects, change numbness) and assesses their demonstrative ease. Some of the reviewed demonstrations have visual counterparts such as the Muller-Lyer effect, while others are cross-modal or tactile-specific. The article also provides detailed instructions for four tactile-specific illusions (the comb, fishbone, curved plate, and bump-hole illusions), all of which require few or no supplies and no more than moderate set-ups.

- Hayward, V. (2008). A brief taxonomy of tactile illusions and demonstrations that can be done in a hardware store. *Brain Research Bulletin*, 75, 742-752.

Activities for the Chemical Senses

Genetic taste strips. Students can test their genetic taste abilities using paper strips coated with phenylthiocarbamide (PTC: tests bitter tasters and supertasters), thiourea (bitter test), and sodium benzoate (may taste, sweet, bitter, salty or tasteless). Since genetics contribute to taste bud composition and sensitivity, differences in genetic taste abilities

are an easy way to demonstrate why people have such highly varied taste preferences. These tests papers can provide students with a personal profile of their taste abilities and preferences. These papers are widely available online and are very inexpensive.

Smell identification test. The Smell Identification Test and/or the Brief Smell Identification Test quantitatively screen(s) olfactory function using a variety of scratch-and-sniff booklets. Answer keys are available, as are detailed instructions in the SIT Administration Manual (sold separately). Test booklets and manual are available at www.sensonics.com. The test booklets can be reused numerous times. This test is a valid, reliable, quick, self-screening procedure students can administer themselves.

General / Miscellaneous Topics

Weber's law and the just noticeable difference.

This exercise demonstrates that the just noticeable difference is a constant proportion rather than a constant number. Students are asked to first hold an envelope containing a quarter in one hand and an envelope holding several quarters in the other hand. The weight difference should be noticeable. When the quarters are placed inside shoes, however, the weight difference is no longer noticeable even though the difference in the number of quarters has remained constant. *Variations on this exercise could be created using any small object (e.g., erasers) and any 2 containers of varying weight (e.g., small cups vs. heavy mugs or buckets). Sequentially adding small objects to first the lighter container, then to the heavier container can yield quantitative values for calculating the proportion for the just noticeable difference for each container.

- Bolt, M. (2001). *Instructor's resources to accompany Psychology, 6th edition, by David G. Myers.* (Ch. 5, p. 8). New York: Worth.

Hand dominance. The handedness demonstration kit from www.psychkits.com includes several activities of hand dominance, scoring sheets for data collection, and complete instructions. One activity involves using chopsticks to move a series of beads from one side of a plastic container to another. The time in seconds to move 10 large beads is recorded for both the left and right hands. Additional detailed laboratory activities involving hand dominance and brain symmetry, focusing more heavily on brain lateralization, can be found at:

- Sherman, B., Dickson, J., Gross, D., Hutchins, E., Talbot, K., & Thorsheim, H. (2002). Principles of psychology: Experimental foundations. *Office of Teaching Resources in Psychology*. Retrieved from http://teachpsych.org/otrp/syllabi/lab_manuals.php

Lab aids: Human senses kit. This laboratory kit from Lab Aids (www.lab-aids.com/catalog.php?item=8) contains a variety of activities involving chemical, tactile, and visual senses. It comes with copies of a lab manual, including instructions and data collection areas, and enough materials for dozens of students to participate over multiple semesters. The kit and instructions seem geared toward high school audiences, but can be adapted for use with any age group. Dividing and/or altering the instructions to customize them allows the demonstrations for olfaction, taste, and vision to be separated to fit course topics. *One suggestion to enhance the kit is to add a series of lifesavers of different flavors, but similar visual appearance (e.g., peppermint and spearmint). When tasted with the nose plugged, this vividly demonstrates the interaction of smell in our ability to taste. Musk-

flavored lifesavers are a popular flavor in Australia and an interesting addition since most American students consider eating musk to be akin to eating perfume (an example of experience/top-down processing). With noses plugged, however, the effect is eliminated. Musk-flavored lifesavers are available online from a number of Australian candy stores.

Online companion website for sensation and perception. The online student companion website for the Wolfe, Kluender, & Levi's Sensation and Perception text provides chapter by chapter demonstrations and examples at www.sinauer.com/wolfe/home/startF.htm. This site is freely available to everyone, even without adopting this specific text. It provides a good supplement to any Sensation and Perception book the instructor chooses to use.