COLOR VISION

The electromagnetic radiation of the light spectrum with a wavelength between 380 and 780 nm is visible to humans. While the rods can only recognize light-dark contrasts, the three types of cones are responsible for color vision:

- L cones (L for Long) are sensitive to longer wavelengths. The absorption maximum is around 560 nm, which corresponds to a greenish yellow.
- M cones (M for medium) are sensitive to medium wavelengths. The absorption maximum here is around 530 nm, corresponding to a yellow-green color.
- S cones (S for short) are sensitive to shorter wavelengths. The absorption maximum is around 420 nm, a blue.

As a rule, pseudoisochromatic color charts are used for the initial diagnosis of color vision disorders, in which color-capable people recognize letters or numbers from arrangements of color spots of different brightness and color gradations, some of which cannot be read for color vision-impaired people. Conversely, people with color blindness recognize letters or numbers on these panels that color-impaired people cannot.

A more detailed differentiation of color sensory disorders is carried out using an anomaloscope. With this device, the test person is alternately offered a white full circle for defined brightness adaptation and two colored semicircle segments every second. One crescent-shaped segment shows a monochrome yellow, the brightness of which can be varied (e.g. through the width of an aperture). Red, green or a mixed color that results from the addition of red and green spectral light appears in a second crescent-shaped field.

If the test subject is "red weak", they will constantly mix in more red than a normally color-capable collective in order to perceive both hemifields as the same. A "green weaker" will mix in more green accordingly.

Task:

Determination of color ametropia

Material:

ishihara color plates,

Web: http://www.colblindor.com/rgb-anomaloscope-color-blindness-test/

Execution:

The color ametropia is measured on the computer with the help of a virtual anomaloscope and the values are noted (or the image is saved).

Test your color vision on the following pages and write down the values

http://www.color-blindness.com/ishihara-38-plates-cvd-test/

http://www.color-blindness.com/farnsworth-munsell-100-hue-color-vision-test/

http://www.color-blindness.com/color-arrangement-test/

Evaluation:

Describe and discuss the values found. Statistically compare the values depending on sex. Compare the degrees (scores) of color ametropia of different visualization tests (Ishihara vs. F-M-100 vs. D-15) using a t-test (or Mann-Whitney U-test).

SERIES EXPERIMENT SENSE OF SMELL

Smell and taste are chemical senses that pick up irritants. The sense of smell or olfactory sense refers to the perception of smells. Smell and taste interact and influence each other. The sense of smell is the most complex chemical sense. The olfactory epithelium in the upper nasal passage and the taste buds on the edge and base of the tongue act as sensory organs. The olfactory nerve in the bulbus olfactorius and taste fibers of the Nn. facialis (VII), glossopharyngeus (IX) and vagus (X) to the central nervous system.

The important German aroma researcher G. Ohloff describes eight basic smells:

Grundgeruch:	blumig	fruchtig	grün	würzig	holzig	harzig	animalisch	erdig
zugehörige Geruchsnoten	• Jasmin • Rose • Veilchen • Mimose • Orangenblüte • Maiglöckchen	• Zitrusfrüchte • Apfel • Himbeere • Erdbeere • Ananas • Passionsfrucht	• Buchenblätter • Gurken • Heu • Myrthe • Galbanum	• Zimt • Anis • Vanillin • Nelken • Pfeffer • Kampfer	• Sandelholz • Zedernholz • Vetiver • Patschouli • Koniferen	• Weihrauch • Myrrhe • Labdanum • Kiefernholz • Mastix	• Ambra • Moschus • Bibergeil • Schweiß • Fäkalien	• Erde • Schimmel • Ozean

The line-up was

https://de.wikipedia.org/wiki/Olfaktorische_Wahrnehmung#Geruchsqualitäten entnommen

Task:

Interpretation and assignment of odors to the Ohloff scheme.

Material:

Flasks with smelling substances

Execution:

The test person closes their eyes (or the eyes are blindfolded) and takes turns receiving bottles with odorous substances. The test person writes down the number on the bottle. The test person only smells it briefly and names the basic smell AND the suspected substance. The statements are logged.

Evaluation:

Record and discuss the subject's olfactory sensation. Compare these with the results of other course participants and evaluate them statistically and descriptively. After the experiment, you will receive a list of the substances involved from the LV management. Compare these to the students' answers using a Chi-Square test (in Excel CHIQU.TEST)

ADAPTATION OF THE SENSE OF SMELL

Our olfactory sensitivity to a particular odor is variable and decreases over time when the odor is strong. The experienced phenomenon is called adaptation (= habituation). The sense of smell can even contradict itself completely.

Task:

observation of the adaptation.

Material:

Bottles I, II and III with smells, 2 people, stopwatch

Execution:

Preliminary experiment:

Sniff both of them briefly at both scent source I and scent source II (not III!).

What are the scents (carnation or rose?)? Exchange your views.

Experiment:

Subject A smells fragrance source I continuously for > 30 seconds. Subject B smells fragrance source II continuously for > 30 seconds.

(The time stated is a guideline. You simply smell until a clear adaptation occurs, i.e. the sense of smell decreases)

Then immediately smell Fragrance Source III.

Write down what you smell at Scent Source III.

Evaluation:

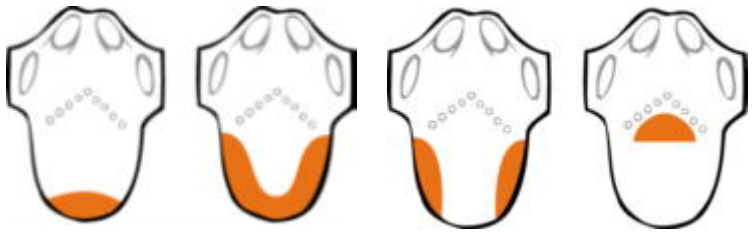
Record and discuss the subject's olfactory sensation. Compare these with the results of other internship participants and evaluate them statistically and descriptively. Assess whether there are differences between subjects A and B using a chi-square test

HUMAN SENSE OF TASTE

LOCALIZATION ON THE TONGUE

The sense of taste is used to assess potential food for usable ingredients and tolerability. In vertebrates, the sense of taste consists of certain proportions of the basic qualities "sweet", "sour", "salty" and "bitter" as well as "umami" (sometimes supplemented by "fatty" and "metallic"). The flavours "sweet", "umami" and "fatty" signal high-energy food (carbohydrates, proteins, fats). The salty taste signals the levels of minerals that are important in regulating the body's electrolyte levels. Sour and bitter tastes are warning signals that the food may either be spoiled (acidic bacterial breakdown products) or contain alkaloids (plant secondary metabolites) that make the food unpalatable.

These basic qualities of taste perception are based on the relative specificity of different receptor cell types, which in humans are arranged in groups (taste buds) in the form of secondary sensory cells, primarily on the surface of the tongue. Each taste bud contains receptor cells for the detection of the taste qualities mentioned, with a slightly different distribution of the cells for the different taste qualities being observed. (Haenig, 1901). Later investigations showed no local preference.



Task:

Localization of the taste sensation

Material:

Cotton (cotton buds or similar), glasses

The following solutions are to be prepared by yourself, dep. from the gauges at home

- 0.2 mol/l table sugar: 68.4 g/l or 35.2 g/0.5l or 6.8 g/100ml
- 0.02 mol/l HCl: If you have 1M HCL, dilute it 1:50, for example 100 ml in 5 l water
  OR
  If you have acetic acid, this depends. of the content (5% corresponds to 0.8 mol/l): Then you have to dilute the vinegar 1:40. For example: 100 ml in 4 liters of water
- 0.3 mol/l NaCl: 17.5g/l or 8.8g/500 ml …
- 0.4 mol/l MgSO4: 48 g/l or 24 g/0.5l or 4.8 g/100ml

Execution:

To determine the distribution of the taste qualities on the tongue, a cotton swab is dipped into one of the test solutions and then the taste sensation on the outstretched tongue is tested point by point. After each sample, the subject presses their tongue against the palate, examines the substance and determines where on the tongue the taste can be clearly perceived. Before changing to another test solution, the mouth must be rinsed thoroughly with water. Important: The subject must be left ignorant of which substance is being tested.

Evaluation:

Enter the examined stimulus points according to the specific taste sensation with different symbols in a representation. Describe the results descriptively. Analyse whether taste perception is spatially independent using a chi-square test (in Excel CHIQU.TEST).

DETERMINATION OF TASTE THRESHOLDS

FOR NaCl AND KCl

In addition to the specifically acting irritants, the surrounding environment (e.g. distilled water or saline solution), the temperature, the sense of touch and pain also play a role in taste perception. The sense of taste is often influenced by a sense of smell that is triggered at the same time.

Taste perception has two thresholds, a non-specific one, at which the stimulus intensity is sufficient to tell you "that something is being tasted" and a specific one, which allows you to decide "what is being tasted". The specific taste threshold is only reached at higher concentrations of the irritant. Furthermore, it can be felt that the taste can change with the concentration of the irritant, so that there are also different stimulus thresholds for different stimulus qualities and their combination. This can be demonstrated using a series of dilutions of sodium chloride and potassium chloride.

Task:

Determination of different taste thresholds for different taste qualities of NaCl and KCl solutions.

Material:

beakers

1 mol/l NaCl solution, if available (probably not) 0.1 mol/l KCl solution

Execution:

Prepare a dilution series of the saline solution(s):

- 0.5M: 29 g/l
- 0.1M: take 0.2L of the 1M solution and add 0.8L of water
- 0.05M: take 0.5L of the 0.1M solution and add 0.5L of water;
- 0.02M: take 0.2L of the 0.1M solution and add 0.8L of water;
- 0.005M: take 0.1L of the 0.05M solution and add 0.9L of water;
- 0.0025 M: take 0.5 L of the 0.005 M solution and add 0.5 L of water;
- 0.001M: take 0.2L of the 0.005M solution and add 0.8L of water;

With your nose pinched shut, first try pure water and then the salt solutions in increasing concentrations. Small sips are enough (the tongue should be wet). The test solutions can be swallowed or spat out. The taste sensation is characterized for each concentration and entered in a table. Important: The subject must be left ignorant of which substance/concentration is being tested.

Evaluation:

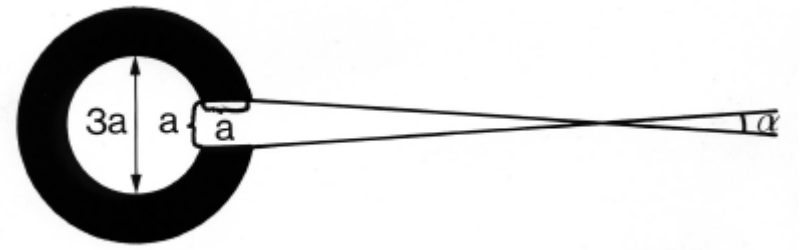
Discuss your sense of taste. Compare these with the results of other internship participants and form typical statistical values such as arithmetic mean, median, standard deviation and variance. Link the sensation threshold to age (correlation or regression (in Excel "trend line"). Compare the group of smokers with non-smokers or the two sexes with each other (in Excel t.test()).

MEASUREMENT OF VISUAL ACUITY

With the eye test, the visual acuity (visual acuity) of the eye is checked. Visual acuity corresponds to the resolving power of the eye, i.e. the ability of the retina to perceive two points as separate. Normal visual acuity corresponds to a visual acuity of 1.0 (100 percent). Young people often achieve better visual acuity. With increasing age, the visual acuity decreases.

The eye test is tested subjectively with optotypes, i.e. the patient reads the characters off a board. The optotypes are arranged according to Snellen's principle. The eye charts contain black letters, numbers or so-called Landolt rings in various sizes and in a specific arrangement on a white background. (from www.dr-leber.de)

This is a circular ring with an opening, with the outer and inner diameters being in a ratio of 5:3 to one another. The opening is 1/5 of the outside diameter of the ring. The circle can be represented with the ring opening in eight positions, namely in a straight direction (recess up, down, right or left) and oblique direction (recesses offset by 45 degrees to the above). During the eye test, the examinee should be able to see where the opening is. (from wikipedia)



Task:

Measurement of visual acuity using Landolt rings.

Material:

Plates with Landolt rings

Execution:

Hang the plaques on a wall. Stand at a distance of 4.6 meters. First the right eye is examined without corrective lenses and then with corrective lenses, if necessary, whereby the left eye is covered. The left eye is then examined in the same way. The experimenter points to different Landolt rings and the subject tells which way the gap in that ring is pointing. In this way, that line of the board is determined in which the test person can see 60% of the gaps. Write down the visual acuity given on the left (right, left, with and without visual aids). Also test binocular vision.

Evaluation:

Evaluate the data of all participants descriptively and statistically. Using a t-test, compare the values of the glass’s wearers with the people without visual aids and the vision with both eyes or with only one. Consider whether you are using the "better" or "worse" eye for this calculation.

LANG'S HIT ATTEMPT

In orthoptic findings and ophthalmological reports, one often finds the diagnosis: no stereo vision, stereo blindness. These findings are usually obtained with stereoscopic tests, which place high demands on stereo vision. As a simple test, one can try the glasses-free Lang stereo test (1970). 3D vision depends on "parallax", i.e. a certain angle at which an object is seen by both eyes (compare: "thumb jump").

Task:

Implementation of Lang's hit test

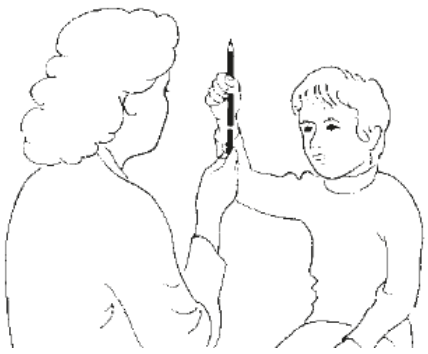
Material:

2 (pencil) pens

Execution:

The examiner holds a pencil with the blunt end up vertically at eye level in front of the examinee. He tries to hit the examiner's pencil without delay with his pencil, which he holds with the blunt end pointing vertically downwards.

The experiment is first carried out 10 times with both eyes open, the distance from the eye varies. Then one eye of the subject is covered and the test is repeated 10 times in this way. The open (examination) eye is noted. The binocular and monocular marksmanship are then compared.



During the examination, attention must be paid to the following:

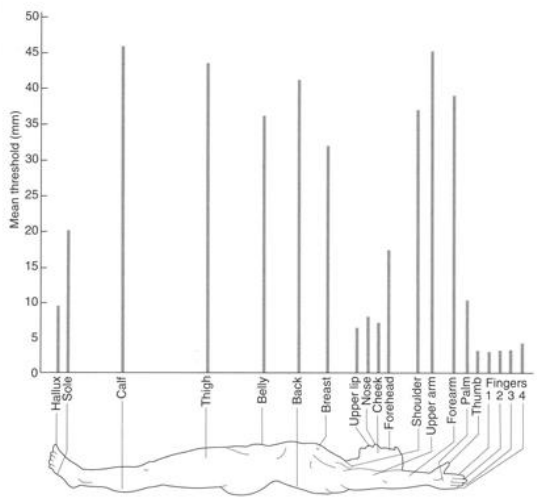
- The pen must be at the subject's eye level.
- The subject should move the pen vertically from top to bottom.
- Sometimes one-eyed patients try to hit the pencil by aiming from front to back, i.e. sagittal, or to feel it with outstretched index fingers (from www.lang-stereotest.com)

Evaluation:

Evaluate the data of all students descriptively and statistically. Use a t-test to compare whether there is a difference between binocular and monocular vision. Compare the values with visual acuity (try Landolt rings).

RESOLVING POWER FOR TACTILE STIMULI

Surface sensitivity is the perception of stimuli with the help of skin receptors (tactile perception). These include Merkel cells, Ruffini, Meissner and Vater-Pacini corpuscles, whose information is transmitted to the CNS via nerve fibers. The distribution of these receptors varies depending on the skin area. They also differ in the size of the receptive field. This is the area of sensory receptors that transmits information to a single neuron and therefore represents the "resolution". Merkel cells act on an area of approx. 9 mm2, Ruffini bodies on 22 mm2.



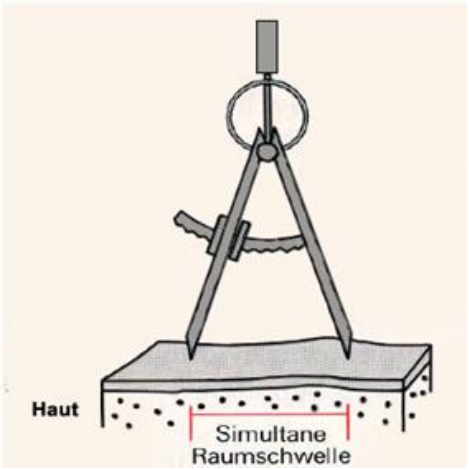
Task:

Determining the resolving power of mechanical touch receptors

Material:

Divider, ruler

Execution:



The two points of an open pair of dividers are placed briefly and not too hard on the skin (back of the hand) of a test person who keeps their eyes closed or looks away. In general, two pressure sensations are specified. Now close the circle a little, sit up again, and so on, until the subject perceives only a tactile sensation. The measured distance between the two points of the compass, at which two sensations are just perceived, indicates the resolving power of the skin for touch stimuli. In order to avoid misinformation, you should always use only one tip of the compass from time to time!

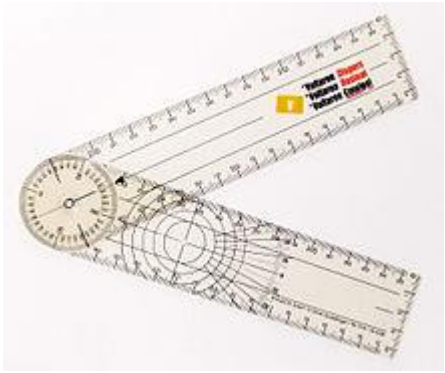
Repeat the experiment (after cleaning the tips with alcohol) on the middle fingertip, forearm, back, and palm (middle of each).

Evaluation:

Discuss the subject's ability to resolve the tactile stimuli. Compare these with the results of other internship participants and describe them statistically. Compare the values of the measured body regions (regardless of sex) with a t-test. Compare the sexes with each other.

ANGLE OF MOVEMENT OF THE EXTREMITIES

Joints can move at different distances. This movement is restricted by hard and soft parts (and clothing). The angles are measured from the neutral-zero position. This is the body position that a person assumes in a normal upright position, about hip-width apart. The arms hang relaxed on both sides of the body and the thumbs point forward.



According to aokhealth.securestand.com/, normal values are:

- Elbow flexion: 140-145°
- Elbow extension: 0-10°
- Knee flexion: 120-150°

Task:

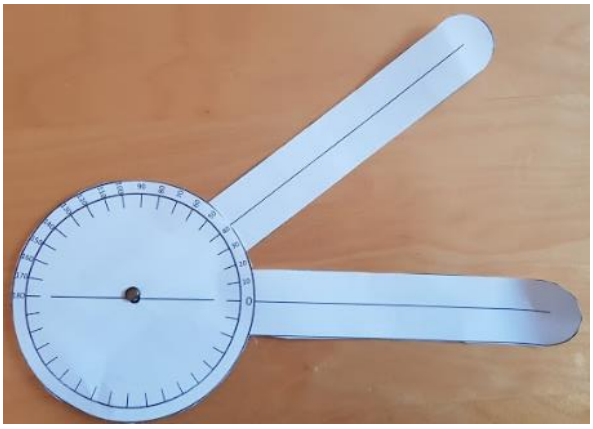
Determine the neutral angle, maximum angle of flexion and extension of both elbow and knee joints. Also try the speed measurement.

Material:

Goniometer

Execution:

Print out the parts of the goniometer. Thick paper is beneficial here. Otherwise, you can also stick the printed paper onto a piece of cardboard. Cut out the parts along the lines and staple them together in the middle with the help of ziplocks or something similar.



Stand up straight, shoulder-width apart, and let your extremities hang. Another person should place the goniometer on the elbow or knee joint in such a way that the two legs run roughly along the bones. Read the angle of this neutral position. Bend the joint as much as possible and read the value again. Do the same for the stretch. Repeat the measurement for the knee.

Evaluation:

Discuss the subject's angles. Compare these with the results of other course participants and describe them statistically. Compare the values of the measured body regions (regardless of sex) with a t-test. Compare the sexes with each other.

FIELD OF VIEW MEASUREMENT

The ability to move the head and eye allows humans to look in many different directions. Only the object that was focused by the eye appears sharp in the visual image. If another object is to be recognized clearly, then the eye must be moved and refocused. This process usually takes place unconsciously. The ability to recognize different colors (R-G-B) also depends on the angular distance of the visual axis.

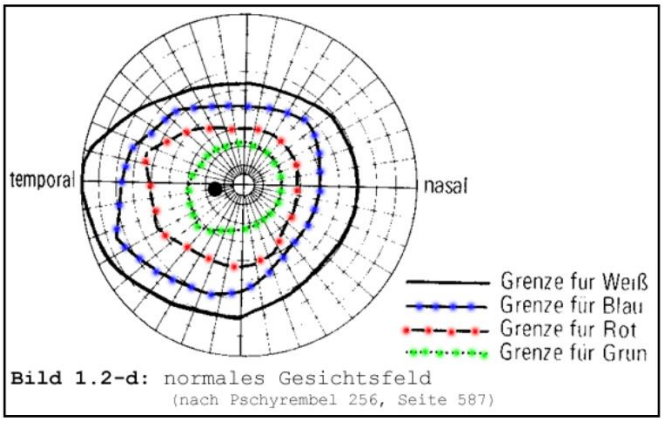


Bild 1.2-d: normales Gesichtsfeld
(nach Pschyrembel 256, Seite 587)

Task:

Measurement of the field of view for B/W and three primary colors.

Material:

Human subjects, perimeter, sight maps

Execution:

The subject, seated in a chair, folds down the handles of the perimeter and holds the device with the indentation horizontal against the forehead. For the measurement, the person closes one eye at a time.

The test person stands behind the test person and moves the test leg of the device to the right beyond 120°. Now he slides a test card into the slot of the perimeter leg (the test person must not know the letters!). The first visual field measurement is carried out by the tester slowly moving the perimeter forward (the slightest eye movement of the test person to the map falsifies the result!!! If the test person still “looks”, repeat the experiment from this position with a new card). As soon as the visual card enters the subject's field of vision, the persom reports it. The test person notes the reading (in degrees) of the perimeter scale.

The subject advances the perimeter arm further. As soon as the test person can read the pair of letters, they name the letters and the test person writes down the two values mentioned. The experiment is then repeated with the second page, then with color cards (blue, red, green).

Take the card with the "I". Keep the perimeter slightly down. At approx. 15° (if only one eye is open) the line should disappear, reappearing later. Write down both values.

Evaluation:

Label the sectors on the perimeter scale that you can see and determine the mean and standard deviation within the exercise group. Statistically compare the two sexes, (non)glasses wearers and the different measurement parameters B/W, colors). Determine the position and size of the blind spot.