

## What can I learn about the field of my side vision for the sake of choice of my future career

**Objective of the module:** Gain understanding of the compliance of the anatomy of sensory organs to their functions by performing an experiment on the measuring of the field of peripheral vision.

### Learning outcomes of the module:

1. Analyses information about vision.
2. Tells about central and peripheral vision
3. By cooperating in a group, proposes an assumption for an experiment
4. Measures the field of side or peripheral vision
5. Analyses and evaluates the obtained results
6. Draws conclusions

## Lesson 1-2

### Description of the situation

The aim for beginning the lesson with the text is to actualize the already existing knowledge of the students, provide new information, initiate student discussion on this topic and guide students in finding the issue for the research.

Invite students to familiarize with the text. Explain that the keywords essential for studying this topic are to be written out from the text

### Text

*One of the preconditions of clear vision is that the image of the viewed object falls straight on the central part of retina. It is ensured by the optical system of the eye (cornea, fluid in the anterior chamber, lens, vitreous body). The light rays that enter the eye from the distant objects are almost parallel, therefore in order to focus them on the retina a readjustment of smaller scale is necessary, however, when viewing closer objects, readjustment of larger scale is necessary.*

*The central area of retina is responsible for the central vision or visual acuity. It is necessary for such professions that require reading, concentrating vision on the text, documents, for computer specialists, sewers, vehicle drivers and representatives of other professions that require detailed vision to carry out their work. If central vision is damaged, a person loses these abilities but does not become completely blind since the peripheral or side vision remains.*

*With the help of side vision we see objects that are outside the axis of central vision. This type of vision does not provide as sharp acuity as the central vision, nonetheless it is necessary to orient oneself in the space. We also use peripheral vision to orient during twilight and at*

*night since then central vision almost does not function. The peripheral vision is characterized by the field of vision.*

*Each eye simultaneously catches light from a particular space, called the field of vision. The field of vision can also be described as space that is caught by a fixed eye. An average field of vision is approximately  $90^\circ$  to the sides (lateral) and  $60^\circ$  from the nose (median). If the left arm is stretched sideways, then looking straight it would only be seen with the left eye. The field of vision stretches approximately  $60^\circ$  upwards and the same downwards on a horizontal plane. Perimetry is used to test the field of vision. Almost everyone understands that healthy lifestyle is important to maintain healthy and strong body. But have you ever considered that healthy lifestyle can positively influence your vision?*

## Key words

Explain to students that these keywords shall be further used to create questions about this text.

Students can be invited to pair-up and compare and agree on more essential keywords.

## Questions

Explain that proposed questions may be such to be answered by the text. Underline those and ask and answer each other in pairs.

Teacher's questions after the work in pairs:

1. What optical systems of an eye ensure our vision?
2. What visual angle ensures good ability to read?
3. Is the visual angle the same for all people?
4. What ability is ensure by side vision:
  - To distinguish the colour of objects?
  - To turn in case of danger?
  - To drive an automobile?

The conversation is organized corresponding to the level of knowledge of the class and depending on what questions have been asked by the students themselves. The discussion may lead to such questions created by students that cannot be answered by the information given in the text.

Offer students the shortened version of the text or create such shorter, concentrated text that expresses the main idea together with the students.

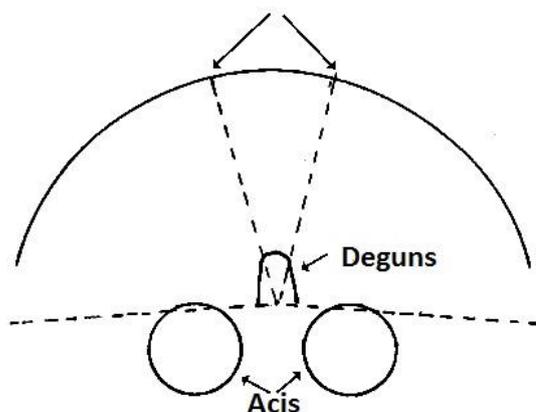
## Description of the situation (shortened)

*The central area of retina is responsible for the central vision or visual acuity (see image). Even though it is a small part of the retina, it is necessary for people to be able to read, sew, see the faces of other people and perform other activities for which the detailed vision is necessary.*

*With the help of peripheral or side vision we see objects that are outside the axis of central vision. This vision does not provide as sharp acuity as the central vision, nonetheless it is necessary to orient oneself in the space – see with the corner of one's eye. It is very important in such careers as sports, driving a vehicle on the road with dense traffic, etc. The side vision is characterized by the field of vision. Field of vision is possible to be measured.*

*Usually the measuring is done by optometrists with the help of special measuring devices.*

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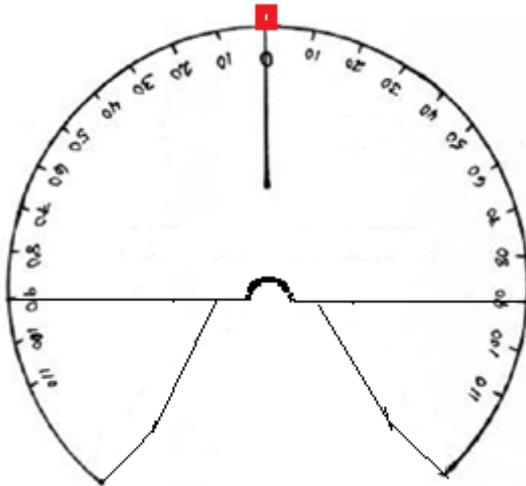
(Image: Field of central vision  
Nose  
Eyes)

From the description of the situation put forward:

**Problem to be investigated:** for instance, *Does the field of side vision change provided the look is not focused?*

**Hypothesis:** for instance, *If the look is not focused, the field of vision widens.*

During the conversation with the students the conclusion is made that the device shown in the image is necessary. According to the given template create a device to measure the side vision together with the students.



## Equipment

Firm cardboard sheet, scissors, glue, large transporters from the mathematics class, ruler, a nail, a piece of string, writing materials, red appliqué paper, 2x3 cm large cardboard pieces with letters, adhesive tape.

## Procedure

1. Create a *string compasses* – a string, to which the pencil has been attached, is tied to a nail, the length of the string being 30 cm.
2. Stick a nail on the edge of a cardboard sheet and by stretching the string draw a circle with a range of 30 cm.
3. Draw a small circle for the nose – range of 2 cm
4. Cut out the cardboard circle and use it as a pattern to draw on the cardboard sheets as many circles, as many devices necessary. (If there are several transporters in the classroom, each pair create their own measuring device).
5. Draw a straight line from the spot the nail was stuck to the rim of the circle. Mark it with 0.
6. Using a large transporter, mark sections on the rim of the circle up to 110 to each side, write their values.
7. Cut out the opening for the head.
8. At the marking 0 glue a bright piece of paper which can be bent upwards – for focussing the look.
9. Prepare 2x3 cardboard pieces (4 cardboard pieces will be necessary for each student) with written letters or short words on them. These can be attached to the pencil so they can be slowly moved along the rim of the circle during the experiment.

## Lesson 3-4

### Actualization

At the beginning of the lesson the teacher asks students: who is an optometrist? During the discussion establish that it is an eye care specialists who performs eye checks with the help of different devices, provides prescriptions for glasses if such are necessary. The teacher explains that during this lesson each student shall have an opportunity to act as an optometrist, and with the help of self-made device measure the field of side vision.

Ask the question: Why don't drivers on the road full of vehicle get involved in traffic accidents?

### Example by the teacher:

Invite 4 students to demonstrate how to work with the device.

1. A student is a study object. His/her task is to focus a look on the focus line. As soon as during the experiment the object observes any movement at the rim of the device, he/she says *I see*, when he/she can read the letter or the word he/she reads it.
2. A student is an observer. His/her task is to follow that the object does not cast down the look from the focus line.
3. A student reads off the measures and write on a worksheet at which mark does the object see and at which – read.
4. A student slowly moves the card with the letter along the rim of the device towards the centre.

During the experiment students exchange their roles.

Students demonstrate the measuring assisted by the teacher.

If there are no questions among the class, the teacher invites students to form groups of four.

For each group: a device for measuring the field of side vision;

2-3 cards with letters;

2-3 empty cards;

Markers;

For each student: worksheet for registration of results

### The progress of the experiment and data processing

The teacher invites to make measurements according to the work procedure. Students, switching roles, measure the field of vision with both focused and unfocused look of each member of the group. Students tint the fields of central and peripheral vision corresponding to the instructions given in the worksheets. The teacher acts as a consultant.

## Data analysis and evaluation

Students analyze data by answering the questions in their worksheets first individually, then together with their group and then together in the class.

Questions for data analysis:

1. How did the field of central vision change when it was not necessary to focus the look?
2. How did the field of peripheral vision change when it was not necessary to focus the look?
3. How did the field of vision change when it was necessary to focus the look?
4. How did the field of vision change when it was not necessary to focus the look?
5. What else do the obtained data show?
6. Compare your data to the data of your group mates! How are your data different?
7. What do all data obtained by your group have in common?
8. Is there any difference between boys and girls?
9. In a course of an experiment, what could have caused the obtaining of inaccurate data?
10. What else can I study?
11. Is there any difference among people with different eye colour?
12. Do data vary between people with and without glasses?
13. Could data be different if measuring for the same person is done with and without glasses?
14. Does the colour of the object to be read influence the visual angle?
15. Does the field of side vision differ between athletes and drivers?
16. How large is the field of side vision of athletes of different sports, how do they differ and do not differ?

## Conclusions

Students draw conclusions if the hypothesis can be accepted or rejected.

## Advices for teacher

1. Ask students to use extra information sources (textbooks, the Internet, etc.) while students work practically and respond to questions.
2. Part of high school students has already passed the "B" driver's exam, and are particularly interested, and noted the importance of peripheral vision. Those students, who are training to pass the driver's exam or who are just thinking of obtaining driving license, were willing to train their peripheral vision, but did not know how to do it. Teacher may recommend to find out necessary information at instructor or to find information in medical literature.
3. Some of the students thought about the last sentence of the given text, that healthy lifestyle can positively influence vision. Discussions rose. It is advisable to encourage those kinds of discussions, and to stimulate students to explore the information sources on the topic.

4. For those students who do their exercises quicker than others during the research, teacher may advise to use geometric shapes instead of letters and words. Then they can compare did the visual angle change when they moved letters and symbols.
5. The questions which rise during the working process:
- How is it possible to widen our field of central vision?
  - How is it possible to widen our field of peripheral vision?
  - What determines the size of the field of vision?
  - How large may be a possible human field of vision?
  - Do the position of human affects the visual angle?
  - How does the visual angle differ in the different lightening?
  - Does the color of the illuminated object affect the visual angle?
  - Does wearing of glasses and lenses affect peripheral vision?
6. Some of the students worried that the right and left eye had different visual angles, but the answer could be found by visiting specialists. The students decided to visit specialist.

## References

Support materials developed by the Project “Science and Mathematics” of the State Education Centre (VISC), 2011.

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