Measuring reading skills (Item No.: P1522260)

Curricular Relevance

Area of Expertise: Biology

Education Level: Age 16-19

Topic: Behavior

Subtopic: Behavior of humans and animals

Experiment: Measuring reading skills

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	10 Minutes	2 Students

Additional Requirements:

- iPad or Android tablet

Experiment Variations:

- Alternatively, use a PC with measureLAB (14580-61)

Keywords:

Reading speed, Movement of eyes, Typoglycemia

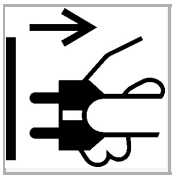
Overview

Information for teachers

Additional information

Reading speed is a central factor of reading literacy, i.e. the ability to fluently read and understand individual words, sentences, and entire texts. One's reading speed primarily depends on the complexity of the text being read as well as on the reading experience of a person. As for children and young persons, the speed usually increases when they get older. An average third-form student can normally read approximately 100 words per minute of a relatively easy text (with many words that the child already knows). A trained reader, on the other hand, can read 250 (or even considerably more) words per minute on average. The movements of the eye are measured by recording potential changes on the skin surface (compare the experiment on electrooculography). This is possible because there is a standing potential between the cornea (positive) and the retina (negative). When the eyes move, the electrical dipole shifts. The resulting changes are measured on the skin surface with the aid of electrodes.

Warning



Unplug when in use!
For safety reasons, the Sensor-Unit Electrophysiology must only be used if the attached Cobra4 measured data recording instrument is not connected to the mains voltage!

An electrooculogram of the eye movements, which is recorded at school, should not be overinterpreted in the event of deviations from the examples in the illustrations. Reading deficits or disorders that are related to the eye movement system can only be diagnosed with any degree of certainty by a doctor.

Notes concerning the execution of the experiment

Please ensure that the students take care that the test person does not move during the measurement. Even the slightest movements of the head will cause the electrical activities to be superimposed during the measurement (movement artefacts). The test person should read silently during the measurement, since the reading speed is usually lower when reading loud (or when moving the lips accordingly). Only when all of the students perform the measurements under the same conditions can the results be compared.
You can hand out several different texts to your students, preferably on a DIN A4 (or letter) page. A proven method is to compare an easy text from a school book with a specialist text from Wikipedia, e.g. concerning the subject "resting potential". Or compare a text in your mother tongue with a text in a foreign language.

Robert-Bosch-Breite 10
D - 37079 Göttingen

Tel: +49 551 604 - 0
Fax: +49 551 604 - 107

info@phywe.de
www.phywe.com

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Overview

Short description

We measure our reading speed

With this experiment, you can determine your own personal reading speed. One’s reading speed can be trained and is an important prerequisite for the proper handling of all kinds of texts. You can precisely study the movement of your eyes during the measurement.

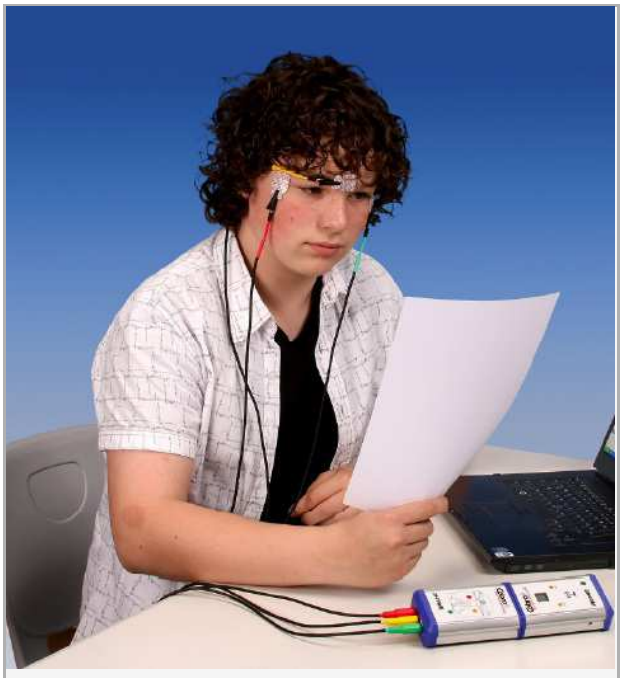

Fig.1: Experimental set-up

Equipment

Position No.	Material	Order No.	Quantity
1	Cobra4 Wireless/USB-Link	12601-10	1
2	Cobra4 Sensor-Unit Electrophysiology: ECG, EMG, EOG	12673-00	1
3	Shielded leads for electrophysiology, color-coded, 3/pkg	12673-01	1
4	Electrodes for ECG Sensor, 100 pcs.	12559-01	1
5	Crocodile clips for disposable electrodes, 3/pkg	12673-02	1
With disposable electrodes:			
6	Electrodes for ECG-Sensor	12559-01	1
7	Crocodile clips f. disposable electrodes, 3 pieces	12673-02	1
Or with permanent electrodes:			
8	EMG electrodes, 3 pieces	65981-02	1
9	Electrode Gel, tube	65981-06	1
Additional material:			
	Android-Tablet or iPad		1
	PHYWE measure App		

Android

iPad

Tasks

Read several lines of a text and look at the measurement results. This enables you to understand the movement of your eyes. (In addition, you will be able to see that your reading behaviour differs when you read easy and more difficult texts.)

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Set-up and procedure

Set-up

Preparatory tasks

Preparation and application of disposible electrodes

The heart, muscle, and eye activities are measured on the skin surface. You have to measure at different points depending on the organ in question.
For **getting started, disposable electrodes** are the most suitable, since you can simply stick them to the skin areas that are designated in the experiment descriptions and they also supply acceptable results. Simply fasten the crocodile clips to the ends of the colour-coded leads and clip them on the tabs of the disposable electrodes:

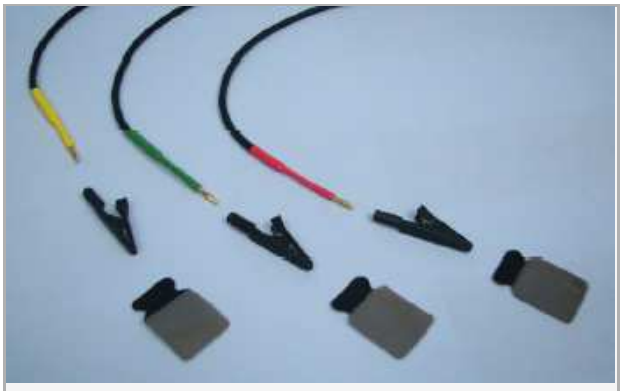


Fig.2: disposable electrodes

Preparation and application of permanent electrodes

You can use permanent electrodes alternatively aswell.

Permanent electrodes are more time-consuming and costly, but have the following advantages apart from lower follow-up costs:
-EMG permanent electrodes: reduced footprint on the skin and, thereby, more precise measurements
-ECG permanent electrodes: increased footprint on the skin and, as a consequence, stronger signals

Fig. 3: Permanent electrodes

In order to establish contact, apply some electrode cream onto the surface of the EMG electrode (which is also used for EOG) and fasten the electrode to the desired skin area with the aid of some Leukoplast® adhesive tape. Then, connect the electrode to the end of the corresponding colour-coded lead:

Set-up

- The experiment requires at least two persons wherein one test person is to be connected to the electrodes and another person will operate the Tablet.
- Fasten the three electrodes to the face as shown in Fig. 2.

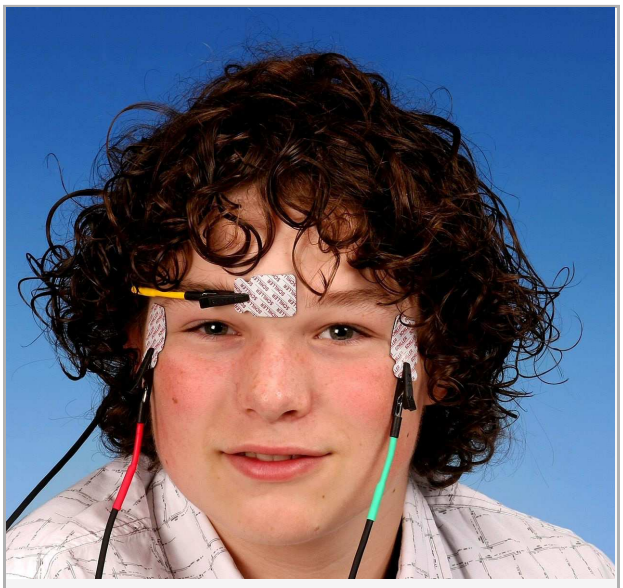
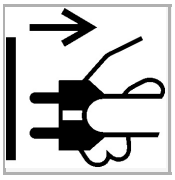


Fig. 4: Fastening of the electrodes around the eyes

- Now, connect the colour-coded leads with the crocodile clips to the electrodes: at first the yellow crocodile clip to the electrode on the forehead above the nose. Please bear in mind that the facial skin tends to be oily, especially on the forehead. In order to ensure that the electrodes adhere well to the skin, you should wash the affected skin areas with soap or at least wipe them with a handkerchief. If the cable impairs the vision of the test person, you can place the cable behind one of the ears. Connect the red crocodile clip to the electrode next to the right eye, and the green clip to the electrode next to the left eye of the test person.
- You can now connect the electrode cables to the Cobra4 Sensor-Unit Electrophysiology. Plug the red plug into the socket that is marked with (+), the yellow plug into the socket that is marked with (-), and the green plug into the socket that is marked with (Ref).

Procedure



Unplug when in use!
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- Connect the sensor-unit Electrophysiology with the Wireless/USB-link and switch it on.
- Connect your tablet via Wi-Fi with the Wireless/USB-link.
- Open the PHYWE measure App and select the sensor "Electrophysiology". Select the sensor-mode "EOG".
- Select a sampling rate of your choice. The higher your sampling rate the more accurate the measurement will be. In addition to this there is also a possibility to mulitply your values by a factor to get an even clearer result.
- Start the measurement data recording process once the voltage has levelled out. The test person should be seated on a chair in a relaxed position. It is very important for the test person to remain absolutely still throughout the measurement, since otherwise the system will also record other electrical activities.
- The test person should now silently read (and without moving the lips) several lines of a text that a teacher has handed out. After reading the text you stop the measurement. Use the "zoom" tool and "fit in" tool to get a decent plot.

Results and evaluation

After the end of the measurement, select a suitable measurement section with the zoom tool and look at it. You can also use the “survey” function in order to determine the so-called saccades (fast shifts in gaze) and the regressive movements of the eyes during line skips.

Go to the report now and answer the questions to your results and the evaluation

Robert-Bosch-Breite 10
D - 37079 Göttingen

Tel: +49 551 604 - 0
Fax: +49 551 604 - 107

info@phywe.de
www.phywe.com

Report: Measuring reading skills

Results - Question 1

Draw the curve of the electrical activity of the eye movements when reading a line. Indentify and mark the following elements in your drawing: fixation points, saccades, and regressive movements.

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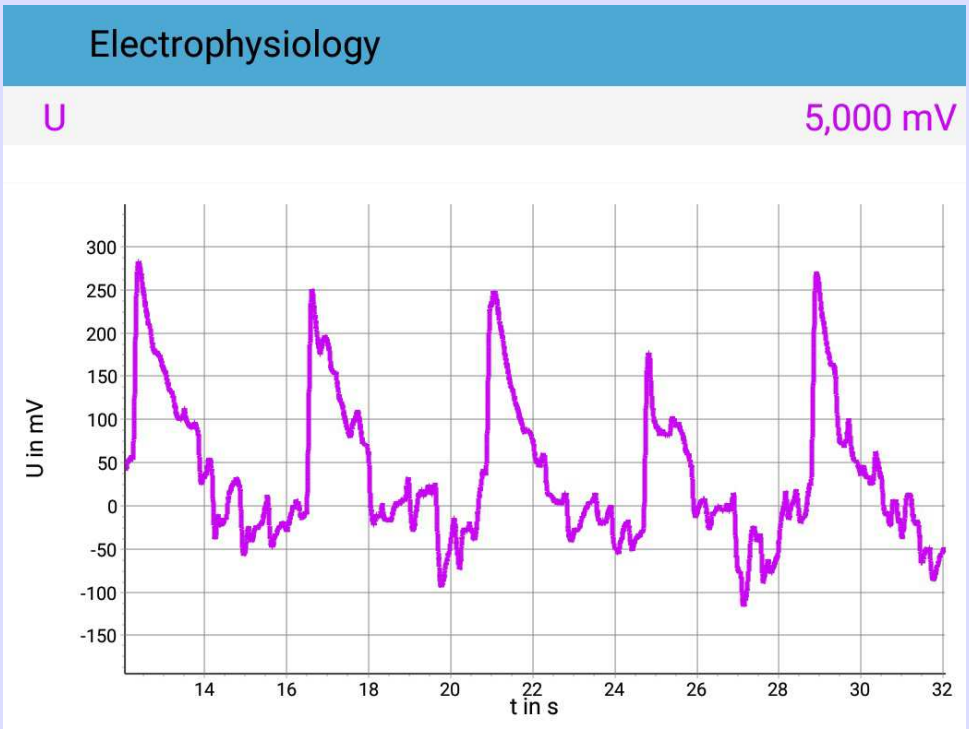
Results - Question 2



Describe and interpret the curve above. How many “small” saccades do the eyes perform on average when reading a line? How many lines were you able to read on average per minute?

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Results - Question 3

3. Can you read the following text? If so, you clearly understand as to why a trained reader can read more quickly than an untrained reader!

I cdn'uolt blveiee taht I cluod aulaclty uesdnatnrd waht I was rdanieg: the phaonmneel pweor of the hmuan mnid. Aoccdrnig to a rseearch taem at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoatnt tihng is taht the frist and lsat ltteer be in the rghit pclae. The rset can be a taotl mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe. Such a cdonition is arppoiatrely cllaed Typoglycemia. Amzanig huh? Yaeh and you awlyas thguoht slpeling was ipmorantt.

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