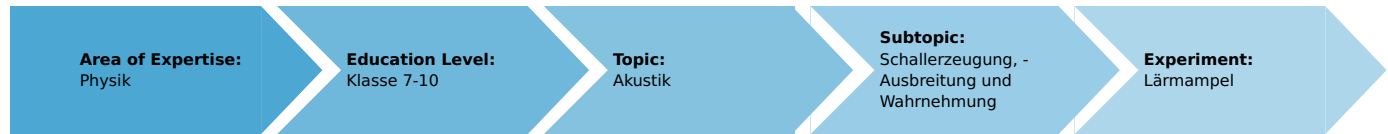


Noise level traffic light (Item No.: P6011600)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



1 Student

Additional Requirements:

- Microphone
- PC

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional information

In this experiment, the students measure the noise level in the classroom during two lessons, first while the noise level traffic light is visible, and then while the students cannot see it. They evaluate the course of the noise level over time and assess whether the visibility of the noise level traffic light had an effect on the noise level during the lesson.

Notes concerning the execution of the experiment

The experiment will be set up and performed together by the entire class. Then, every student can work out his/her own evaluation.

For a conclusive evaluation of the experiment, a microphone should be used that is sufficiently sensitive for the loudness level of conversations at a distance of approximately four to five metres.

The measurements should be performed during two lessons. If necessary, they can be adapted in terms of the time that is spent with the experiment.

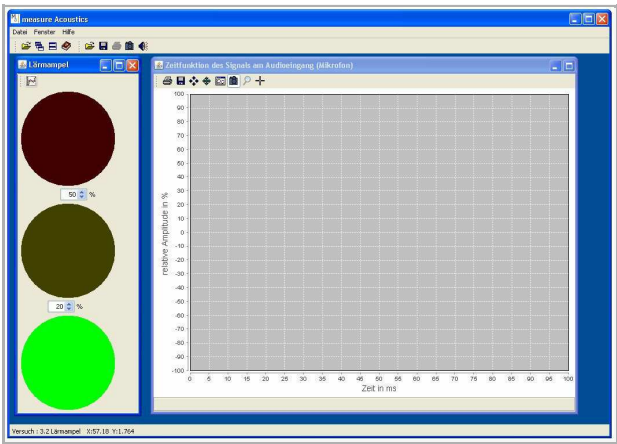
Noise level traffic light (Item No.: P6011600)

Task and equipment

Task

What does a "noise traffic light" do?

Noise is very disturbing for a lot of people. Sometimes, however, we do not realise how loud it is around us because we are busy with other things. In these cases, our feeling of loudness is dulled and we do not notice how much the noise actually impairs our overall performance and productivity. In order to be able to verify objectively when sound in our environment actually gets too loud, i.e. when the noise level exceeds certain limits, so-called "noise level traffic lights" are used. In this experiment, you can check the noise level in your classroom and try to control it.



Equipment

Position No.	Material	Order No.	Quantity
1	Software "Measure Acoustics", single user license	14441-61	1
Additional material			
	Microphone		1
	PC		1

Set-up and procedure

Notes concerning the set-up and execution of the experiment

- The experiment will be set up and performed together by the entire class. Then, every student can work out his/her own evaluation.
- For a conclusive evaluation of the experiment, a microphone should be used that is sufficiently sensitive for the loudness level of conversations at a distance of approximately four to five metres.

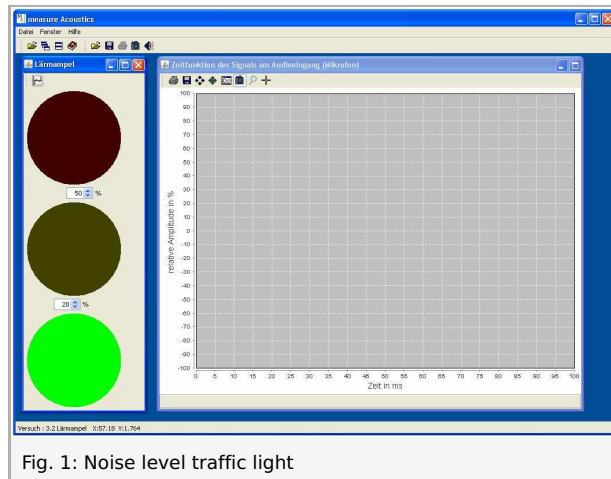



Fig. 1: Noise level traffic light

- Connect the microphone correctly to the computer.
- Open the audio settings of the PC. Set the recording sound volume of the microphone to maximum.
- Position the microphone at the work area of a student so that it can receive sound signals from all directions if possible.
- Start the software "measure Acoustics".



- Open the experiment "3.2 Noise level traffic light".

Help 1:

Open the experiment overview (Menu "File" → "Open experiment" or select  "Open experiment" on the menu bar). Open the folder "3 Applications in the field of medicine, music, and everyday life" and select the experiment "3.2 Noise level traffic light".

- Among other things, a noise level traffic light will be displayed (Fig. 1). It has three levels:
 Green: The noise level is OK.
 Yellow: The noise level is increased.
 Red: The noise level is too high.

Part 1: Adjusting the thresholds

The two thresholds for the three levels of the noise level traffic light can be adjusted as desired. The values are percentages that refer to the maximum relative amplitude that can be recorded with the microphone. For absolute noise or loudness values, these percentages would have to be standardised with regard to the hardware that is used. For this purpose, an additional, calibrated sound level meter would be required. This experiment must do without this additional step.

As a consequence, it is important to define meaningful, relative values. Proceed as follows:




- Activate the diagram "Time function of the signal at the audio input (microphone)". This diagram shows the current, relative amplitude of the recorded microphone signal.

Help 2:

Select  "Activate/freeze diagram" in the diagram window.

- Selection of the green-yellow threshold value: The teacher talks in front of the class. The students are silent. Freeze the diagram while all of the students are silent and adapt it so that you can read the relative amplitude of the microphone signal. Set this relative amplitude as the green-yellow threshold value.

Help 3:

Select  "Activate/freeze diagram" in order to freeze the diagram. If necessary, zoom in on a suitable diagram section by selecting  "Zoom" in the "noise level traffic light" window and by dragging a rectangle around the diagram section that you would like to zoom in on. To do so, keep the mouse button pressed and drag a rectangle from the upper left-hand corner to the lower right-hand corner. In order to restore the original section select  "Standard diagram section" on the grey bar in the diagram window. You can change the threshold values of the relative amplitude directly between the lights of the noise level traffic lights.

- Selection of the yellow-red threshold value: The teacher talks in front of the class. This time, the students also talk, sometimes louder, sometimes quieter. Try to find a level of talking noise that you find disturbing for the lessons, i.e. a level at which you can no longer focus well on the teacher.
Freeze the diagram while you talk with this level of loudness. Adapt the diagram so that you can read the relative amplitude of the microphone signal. Set this relative amplitude as the yellow-red threshold value (see Help 3).

Part 2: Noise level measurement while the noise level traffic light is not visible

After you have set the threshold values, you can measure the noise level in the classroom during a lesson. Proceed as follows:

- Open a diagram for a long-time recording.

Help 4:


In the window "Noise level traffic light", select  "Show/hide diagram".

- You can make two settings prior to the start of the long-time recording:
 1. Set the number of updates per minute to a value between 1 and 60. This value defines how often an amplitude value of the microphone will be entered into the diagram, i.e. at least once per minute and not more often than 60 times per minute (i.e. once every second).

Help 5: Select the desired number under "Updates per minute" in the upper right-hand corner of the window "Noise level traffic light". The most detailed evaluation can be achieved with a value of 60.


2. You can also adapt the scales of the diagram axes so that they correspond better to your threshold values.

Help 6:

Select  "Open diagram settings" in the upper area of the corresponding window. Then, select the tab "Plot" in the window "Diagram settings". Next, select the tab "Domain axis" under "XY-Plot". Then, on the tab "Range axis", select the tab "Range" under "Other" and enter your value range. Finally, select "OK" in the lower right-hand corner.


- Start the recording of the long-time measurement when your lesson starts.

Help 7:

In the upper area of the window "Noise level traffic light", select  "Record".



- Minimise the "measure Acoustics" window so that you cannot see the noise level traffic light during the lesson.
- At the end of the lesson, maximise the "measure Acoustics" window.
- Stop your measurement.

Help 8:

Select  "Stop" in the upper area of the "Noise level traffic light" window.

- Examine the diagram and note down in a table how often and for how long the noise level was in the increased range ("Result - Observations 1"). To do so, keep adapting the diagram to the section that is currently of interest.

Help 9:

To do so, select  "Zoom" in the window "Noise level traffic light" and drag a rectangle around the desired diagram section in order to zoom in on it: Keep the mouse button pressed and drag a rectangle from the upper left-hand corner to the lower right-hand corner. In order to restore the original section, drag a random rectangle in the opposite direction, i.e. from the lower right-hand corner to the upper left-hand corner, or select  "Standard diagram section" from the grey bar in the diagram window.

- Note down the total duration of the recording in the report (under "Result - Observations 2").

Part 3: Noise level measurement while the noise level traffic light is visible

- Repeat the measurement of part 2 while the noise level traffic light and the diagram are visible for everybody in the classroom. Pay attention to the noise level traffic light and reduce the noise level whenever the yellow or red lights of the traffic light go on.
- Just as in in part 2, note down how often and for how long the noise level was in the increased range (under "Result - Observations 1").
- Note down the total duration of the recording (under "Result - Observations 2").

Report: Noise level traffic lights

Result - Table 1

Note down how often and for how long the threshold values were exceeded while the noise level traffic light was visible/invisible

Noise level traffic light visible		
No.	Time in the yellow range	Time in the red range
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

Result - Observations 1

Note down how often and for how long the threshold values were exceeded while the noise level traffic light was visible/invisible

- Noise level traffic light not visible
- Noise level traffic light visible

Result - Observations 2

Total duration of the recording:

Without the noise level traffic light being visible (part 2):

With the noise level traffic light being visible (part 3):

Evaluation - Question 1

Evaluate the table concerning the long-time recording while the noise level traffic was not visible (part 2). Calculate

How many times the threshold values were exceeded per minute:

The total duration in the yellow range:

The total duration in the red range

Evaluation - Question 2

Evaluate the table concerning the long-time measurement while the noise level traffic light was visible (part 3). Calculate

- a) How many time the threshold values were exceeded per minute:
- b) The total duration in the yellow range:
- c) The total duration in the red range:

Evaluation - Question 3

Compare the results with and without the noise level traffic light. Did the noise level traffic light have an effect on the noise level in the classroom?
