

User Guide
Polygraph system
version 2.1

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Device description

What is a polygraph? This is complex and high-tech device, by which detect a variety of physiological parameters: heart rate and breathing, blood pressure, galvanic skin response and so on. The testing procedure is absolutely painless, although it makes the test pretty worried for his fate.

Device sensors are connected to the human body parts, passing the test. The resulting data is sent to a computer, which draws several graphs. They helps to experts to compile their opinion about person and situation.

During the detector test on the person are asked a series of questions, most of which relate to the facts that are relevant to the case. It is believed that a person's reaction to important questions for him leads to significant changes in the measured parameters. Experts say that cheating such device is almost impossible, even if the customer is specially trained person who knows the principles of the polygraph work.

The polygraph is used today for a wide variety of situations. It is used in law enforcement to identify the persons involved in the commission of crimes. According to a survey expert compile opinion, which, however, is not absolute proof of guilt, but it is considered by the investigator and the court together with the totality of the evidence in the case.

Polygraph is used in private business widely. Large corporations have special units that are part of the security services or personnel work. Polygraph helps in carrying out to check on loyalty, internal investigations and in proceedings about embezzlement within the firm.

One of the trends in the use of polygraph - the study of candidates for certain positions. A clever device helps to identify the moral and psychological qualities of the staff and helps to recognize the individuals who have the potential to enter into so-called "risk groups".

We hope that Polygraph BIO will help you shed light not only on the most intricate crimes, but also solve legal, commercial, domestic and even intimate issues.

Device components

Polygraph is produced in two configurations: standard and extended.



Components of standard configuration:

1. The sensor unit.
2. The photoplethysmogram sensor (PPG) (for measuring the volumetric blood pulse caused by periodic changes in the volume of blood with each heart beat, heart rate, heart rate variability).
3. The galvanic skin response (GSR) (for measuring of human skin resistance).
4. The temperature sensor.
5. The abdominal breathing sensor (for registration indicators thoracic respiration).
6. The chest breathing sensor (for registration indicators diaphragmatic breathing).
7. The air pressure 1 sensors (anti cheat sensor) (for detecting any movement caused by muscular contractions)
8. USB connecting cable.

Additionally, in the expanded configuration:

9. 3D-camera Intel RealSense for testing video.
Two additional sensor motor activity (airbags).



3D IR Laser video camera (INTEL VF0800) in a plastic case made by 3D printer, with a Tripod. For the face muscles and movements tracking.

10.

The scheme connecting the sensors to the sensor unit



Designation on photo	Label	plug sensor / cable
A		USB connection cable 8
B		Air pressure sensor 7
C	Resp	Respiration sensor 5 (or 6)
D	GSR	Galvanic skin response sensor 3
E	Resp	Respiration sensor 5 (or 6)
F	Temp	Temperature sensor 4
G		Photoplethysmogram sensor 2

If you purchased extended hardware configuration there will two additional connector B for additional Air pressure sensor.

Sensor connection technique

First seat the test person to air pressure sensor (airbag), and if you purchased the expanded configuration, place two additional ones under the arms. After that, other sensors can be connected.

The breathing sensors (abdominal and chest)

The breathing sensors are connected before other main sensors. Examinee is asked to lean forward slightly and raise his hands at shoulder level or overhead. The first sensor is placed on the abdomen for 2-3 fingers above the navel, and the second - on the upper part of the chest at the level of 3-4 th rib. The connecting hoses must be on the side of the person, which is closer to the polygraph, and Velcro of sensors - on the back. If the sensor mount tensioned hard enough so that they are held in place, the tension is correct when the examinee lowered his hands. If breathing schedule is not satisfactory, the tension can easily raise or lower. During the interview, the operator must observe how breathes the examinee to place the sensors in places where the breath is most noticeable.

Common mistakes:

- Set too close to each other: so registration only one of breathing.
- Too loose or tightly secured. Result: the distortion of the recorded respiration amplitude.
- Falling into the fold in obese people. Recording quality is also reduced significantly.

Galvanic skin response sensors (GSR)

Sensors GSR are mounted on the fingers with a certain step - through the finger. To keep the installation requirements of the sensors, they must be fixed at the 2nd and 4th or 3rd and 5th fingers. We recommend the first option.

The contact plate is installed on the pad of the first finger phalanx. If the skin is very tough, the electrode attachment site may be shifted to the side surface of the finger.

Common mistakes:

- Setting too tight or too loose.
- In the case of perspiration under the sensor finger no wiping fingers cotton pad. If you have not it, you can simply ask the respondent to wash your hands and wipe dry. To determine that something is wrong very easy - you notice reduce the information content of this sensor. \

Photoplethysmogram sensor (PPG)

PPG sensor actually detect the peripheral circulation, the prerequisite is the establishment of the sensor on the fingers of his right hand. Usually, it is set on the first phalanx of the free finger. For more informative indicators compare fingers medium and thumb. Typically, for dry hands the thumb is more informative. The middle finger is more informative for people with wet hands. PPG sensor is high photosensitive sensor, so it should be placed out of differences in the level of illumination.

Common mistakes:

- Setting too tight or too loose.
- Neprotiranie sensor if necessary up to and in between polygraph testing.
- Set on the poor information place of the finger.

The temperature sensor

The temperature sensor must be set under one of the galvanic skin response sensor, so that it lies next to the finger.

Connecting the camera

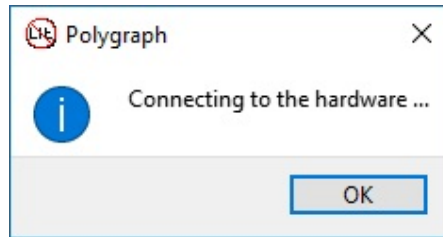
Application use 3D-camera Intel® RealSense™ Camera F200. Download the file Intel_3d.zip from this link: www.telebf.com/Intel_3d.zip unzip and install. Follow the instructions by installer.

Software Installation

Download the file www.Polygraph.BiO/downloads/poly-Setup.zip, launch poly-Setup.exe file and follow the instructions by the installer.

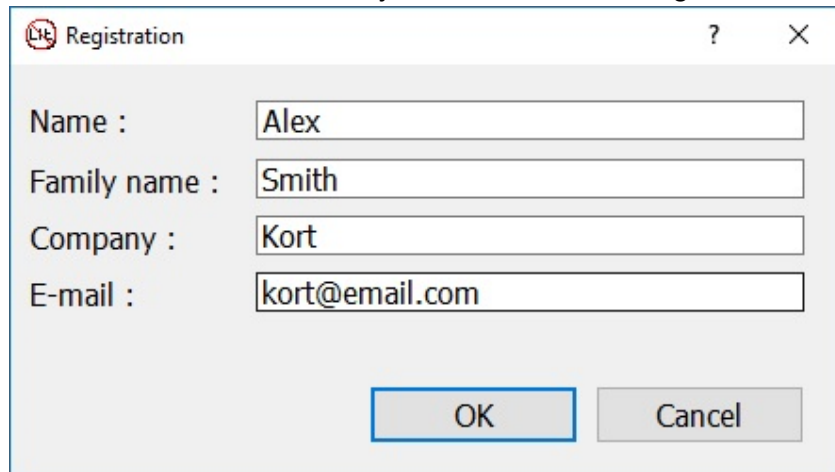
Device connection and registration

Connect the device to your computer and run the application Polygraph.exe. Wait for the connection to the device.



After connection, the information window will disappear.

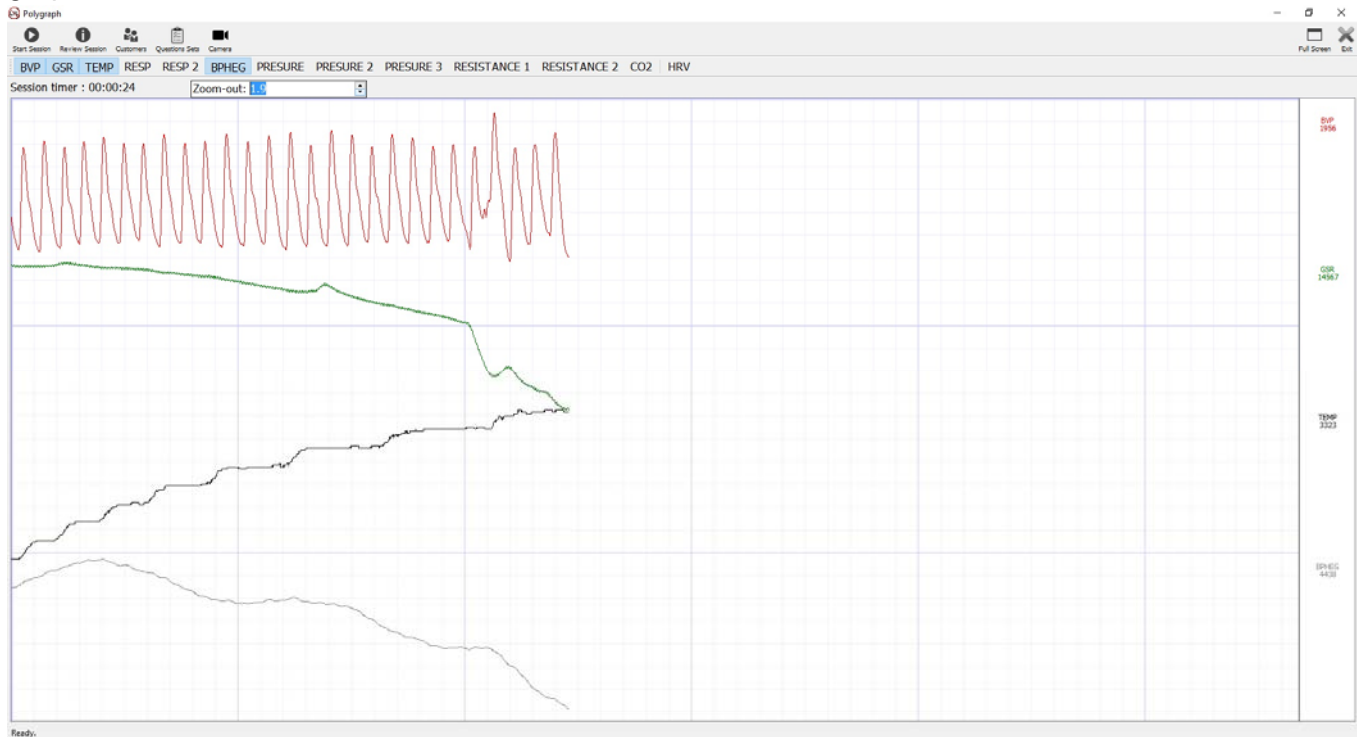
When you connect the device for the first time, you must fill out the registration form.



You should enter your name, company name and e-mail, which is used during the purchase. All fields are required. When the device is connected to another computer, these registration steps will be again with the same e-mail address.

Main window

The main window of the program consists of a main menu, a list of signals, time lines and scale, graphics and status bar.



The main menu contains the following items:

1. Start session - to launch a new test.
2. Review Session - view and export previous sessions.
3. Customers - add, edit, and delete names of customers.
4. Questions Sets - add questions for the examination and formation of sets of them.
5. Camera - for face tracking and micro movements monitoring (only available in the extended version).

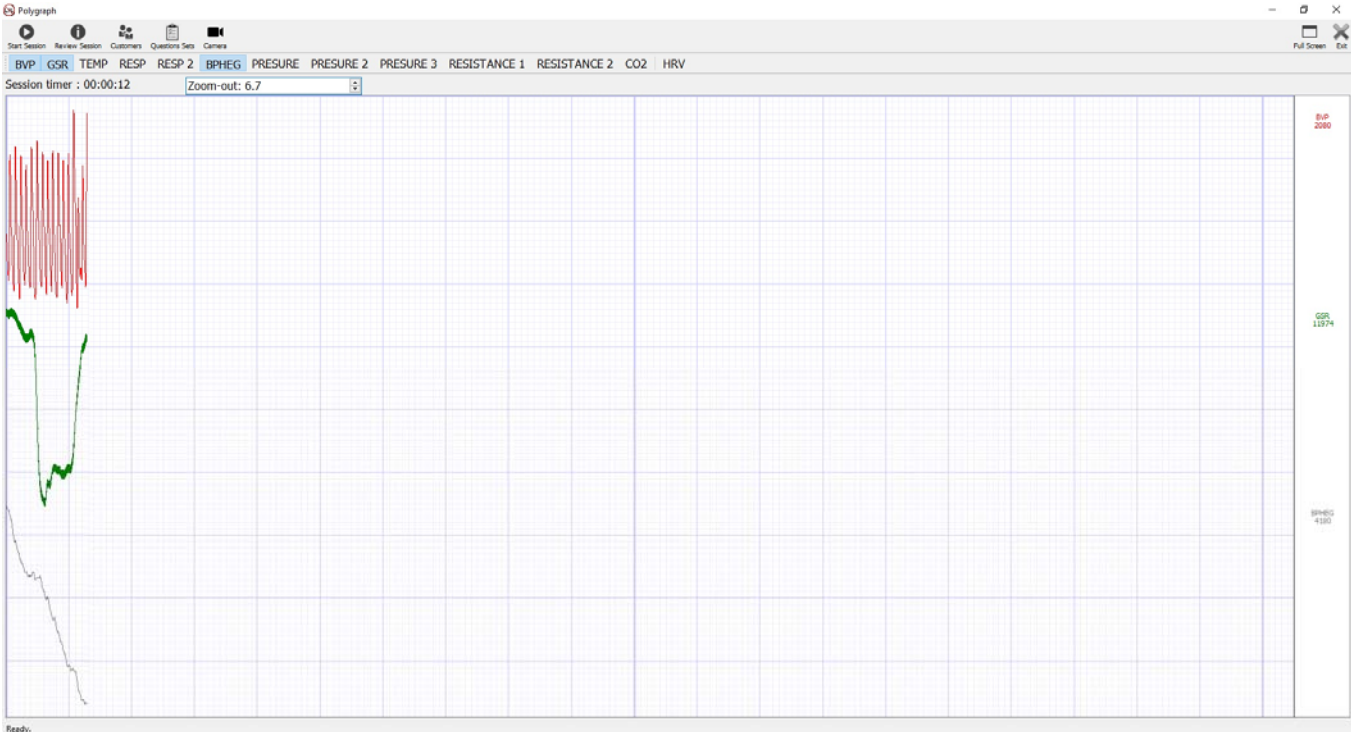
The next line contains the list of signals that can be displayed. Clicking on any of them, you can turn on / off the display of graphs of these signals in the graphics area.

1. BVP - Blood Volume Pulse - pulse fluctuations of blood volume signal from PPG sensor
2. GSR - a signal from the galvanic skin response sensor
3. TEMP - the signal from the temperature sensor
4. RESP - signal from the breathing sensor
5. RESP 2 - a signal from the second breathing sensor
6. BPHEG - dynamic changes in blood pressure, the signal from the PPG sensor
7. PRESSURE - tremor sensor signal (the seat air pillow)
8. PRESSURE 2 - tremor sensor signal (under the arm)
9. PRESSURE 3 - tremor sensor signal (under the arm)
10. RESISTANCE
11. RESISTANCE 2
12. CO2 - carbon dioxide level

13. HRV - Heart Rate Variability - variability of heart rhythm

right of each graph, given the appropriate signal name and its value at the current time.

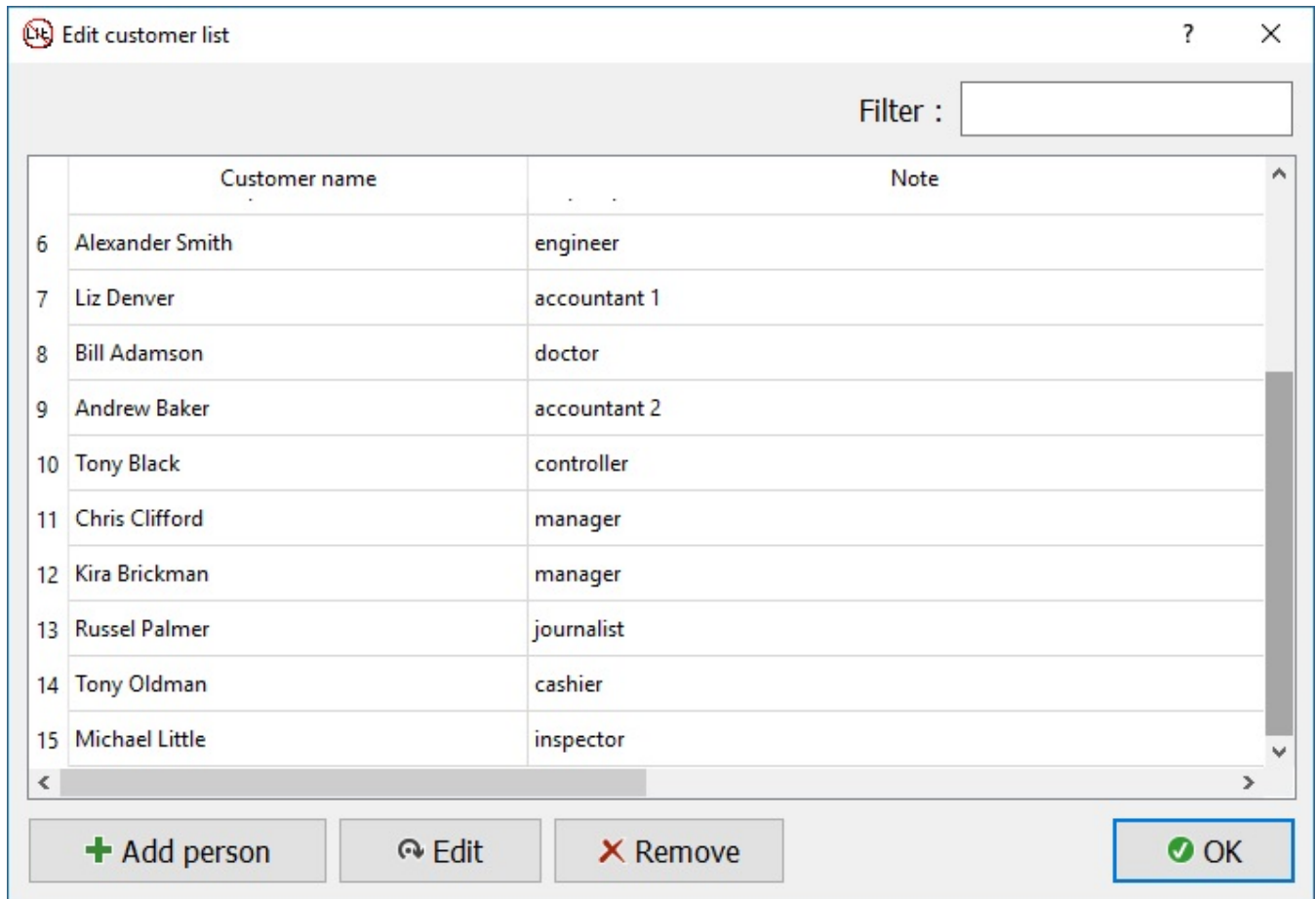
At the top of the screen displays the time of testing. When you start a new session, the countdown will start from scratch. the Using scale can change the size of signal diagrams for a more accurate and analysis of the study.



Preparation for test

1. Entry of names of customer

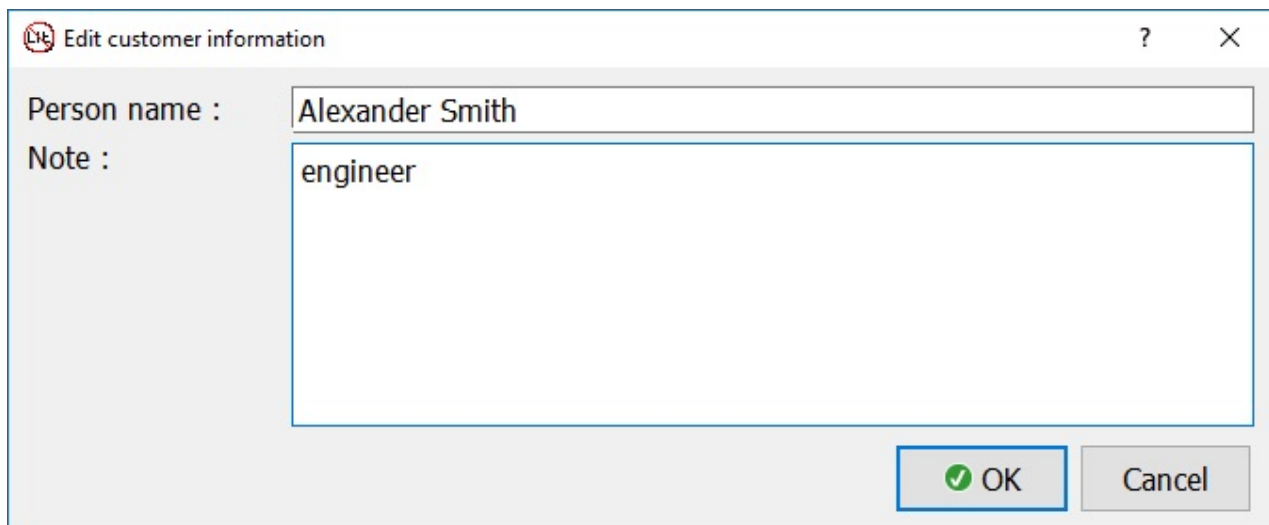
Select the menu item "Customers" and enter the names of people to be surveyed. Enter additional information about them.



The screenshot shows a dialog box titled "Edit customer list" with a search filter and a table of customer information. The table has two columns: "Customer name" and "Note".

	Customer name	Note
6	Alexander Smith	engineer
7	Liz Denver	accountant 1
8	Bill Adamson	doctor
9	Andrew Baker	accountant 2
10	Tony Black	controller
11	Chris Clifford	manager
12	Kira Brickman	manager
13	Russel Palmer	journalist
14	Tony Oldman	cashier
15	Michael Little	inspector

Buttons at the bottom: + Add person, Edit, Remove, OK.



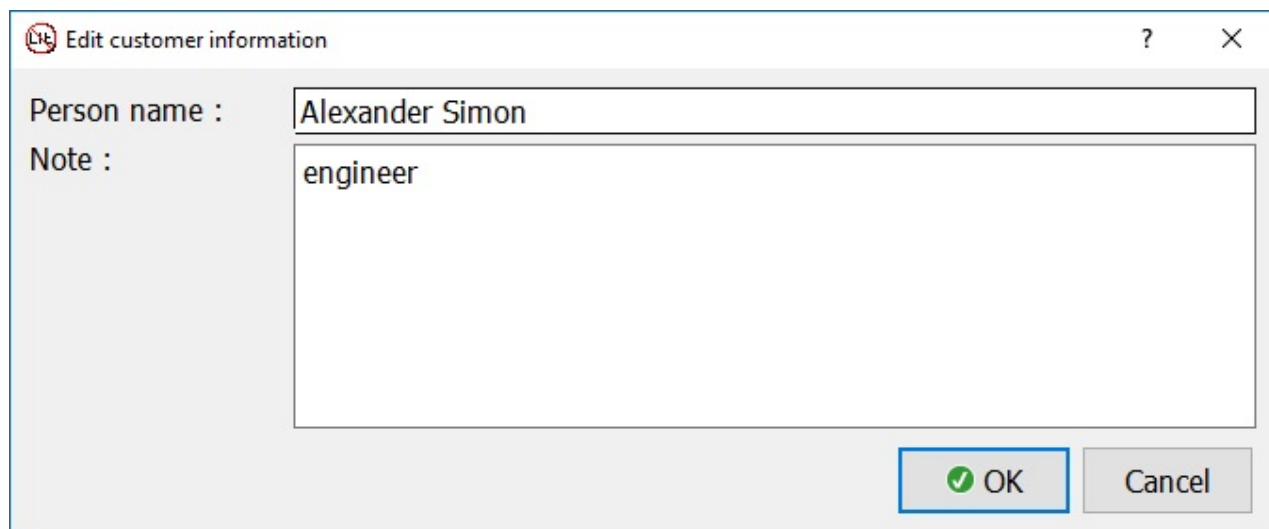
The screenshot shows a dialog box titled "Edit customer information" for the customer Alexander Smith. It has two input fields: "Person name" and "Note".

Person name : Alexander Smith

Note : engineer

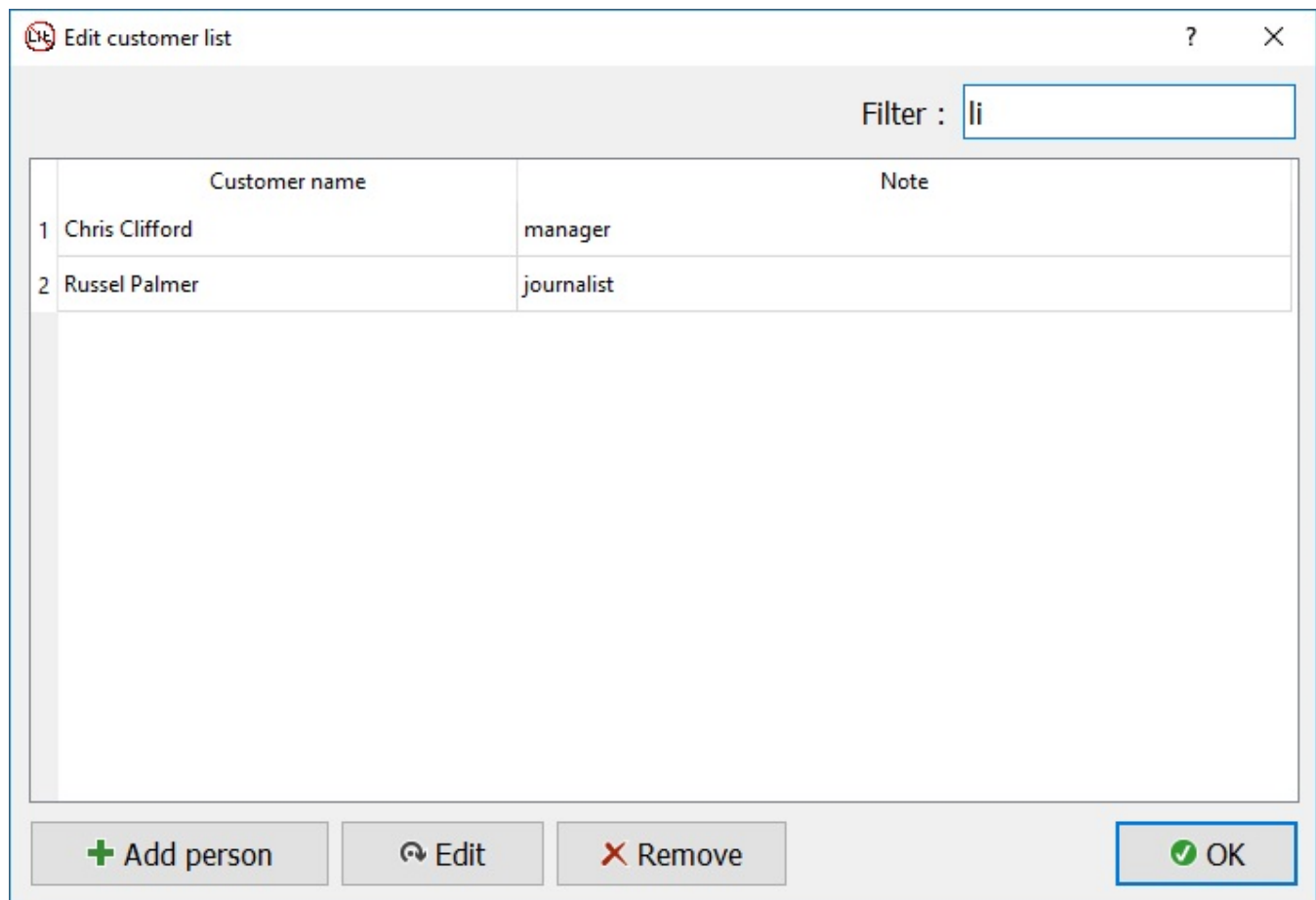
Buttons at the bottom: OK, Cancel.

If necessary, you can edit the name and additional information, or delete the entry.



The screenshot shows a dialog box titled "Edit customer information". It has a title bar with a red "X" icon, a question mark, and a close button. The main area contains two input fields: "Person name :" with the text "Alexander Simon" and "Note :" with the text "engineer". At the bottom right, there are two buttons: "OK" with a green checkmark icon and "Cancel".

For a long list, use the filter. Filter is case-sensitive.

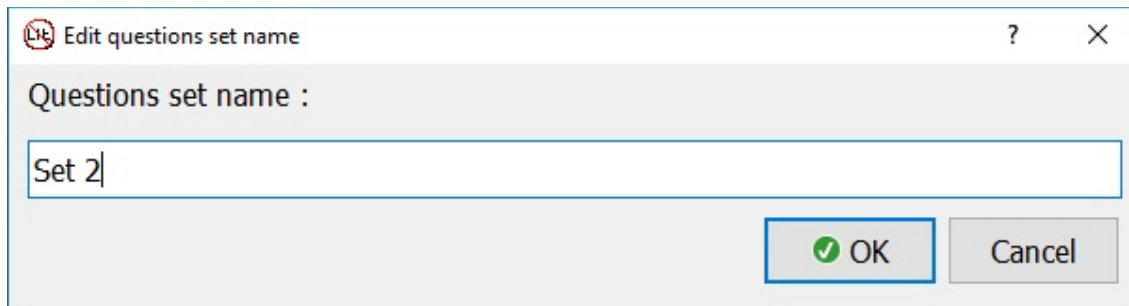
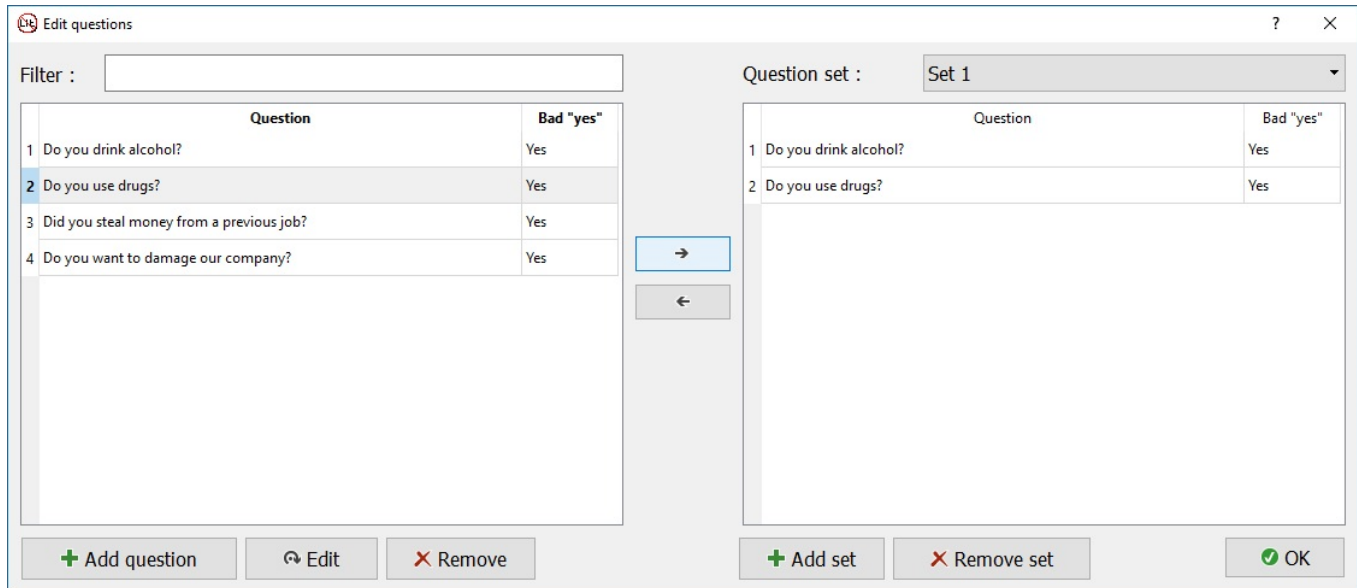


The screenshot shows a dialog box titled "Edit customer list". It has a title bar with a red "X" icon, a question mark, and a close button. At the top right, there is a "Filter :" input field containing the text "li". Below this is a table with two columns: "Customer name" and "Note". The table contains two rows of data. At the bottom, there are four buttons: "+ Add person", "Edit" with a circular arrow icon, "Remove" with a red "X" icon, and "OK" with a green checkmark icon.

	Customer name	Note
1	Chris Clifford	manager
2	Russel Palmer	journalist

2. Formation sets of questions

Select the menu item "Questions Sets" and create sets of questions.



Add the appropriate questions to the set using the arrow between the question field and the sets field. You can also remove the question from the set.

Calibration device

When sensors are connected to the test person, check the quality of signal and start next step - calibration of the device.

For this, ask questions from calibration set with exact answers: your name, the town in which you were born, marital status, what city you are in, etc. The answer to these questions can be either "yes" or "no", therefore, questions are asked such as, "You are now in London?"

As a result of such calibration polygraph examiner will be understand of how device should respond to "honest" answers, and you can proceed to questions from the core set.

Starting a new session

Click the menu item "Start new session" and select the name of the customer and a set of questions for the test.

Start new session

Customer filter :

	Customer name	Note
9	Andrew Baker	accountan
10	Tony Black	controller
11	Chris Clifford	manager
12	Kira Brickman	manager
13	Russel Palmer	journalist
14	Tony Oldman	cashier
15	Michael Little	inspector

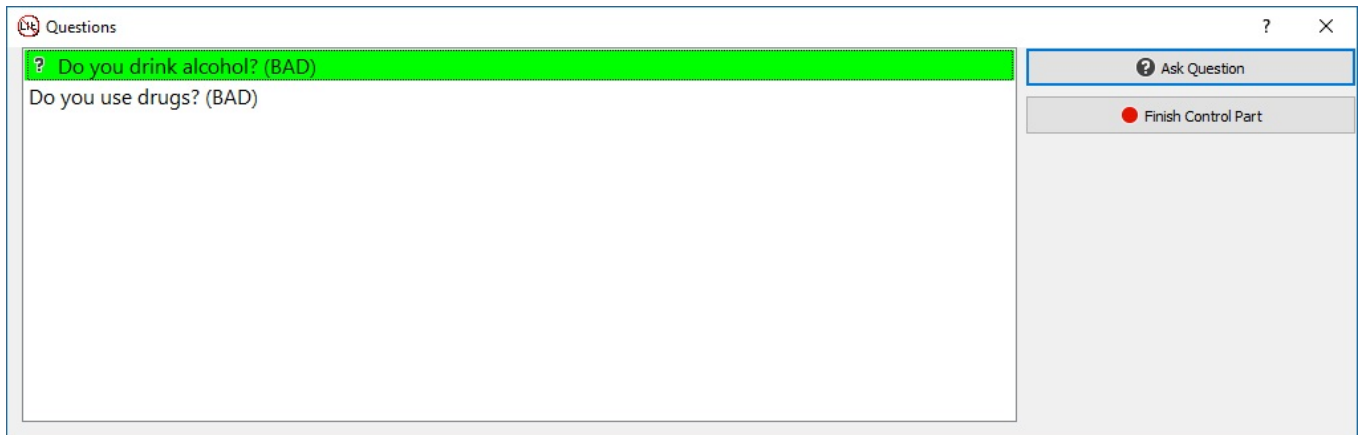
Questions set filter :

	Questions set
1	Set 1
2	Set 2

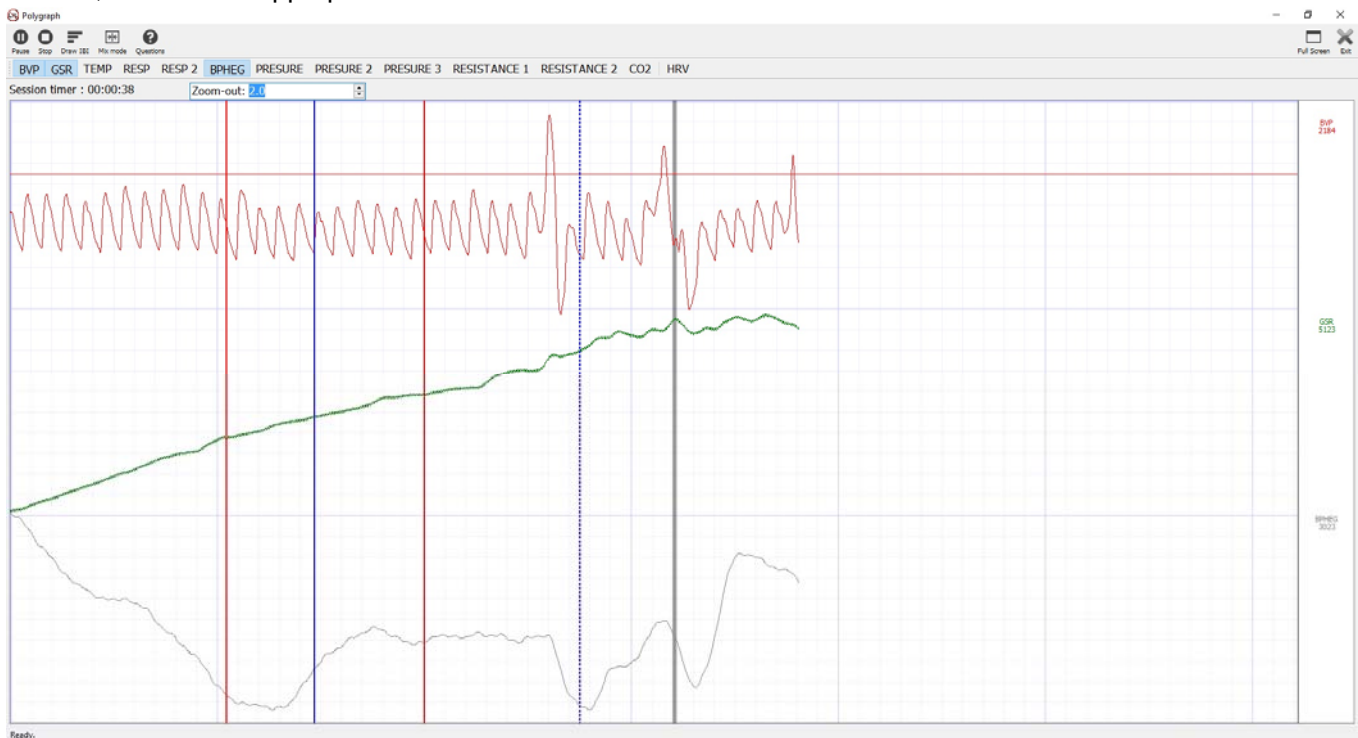
OK Cancel

Use the filters for customers and for questions, if the lists are very long. These filters are case-sensitive.

As a result, the window with the questions opens on top of the field with graphs.



Ask questions one by one, by clicking on the button "Ask Question", and then, depending on the respondent's answer, click on the appropriate answer "Yes" or "No".



The red and blue vertical lines indicate the moments when the questions are asked (red) and responded (blue). Vertical lines can be of four types:

1. Solid red - the answer "yes" to this question requires special attention for analysis
2. Dotted red - the answer "no" to this question requires special attention for analysis
3. Solid blue - the customer answered "yes".
4. Dotted blue - the customer answered "no".

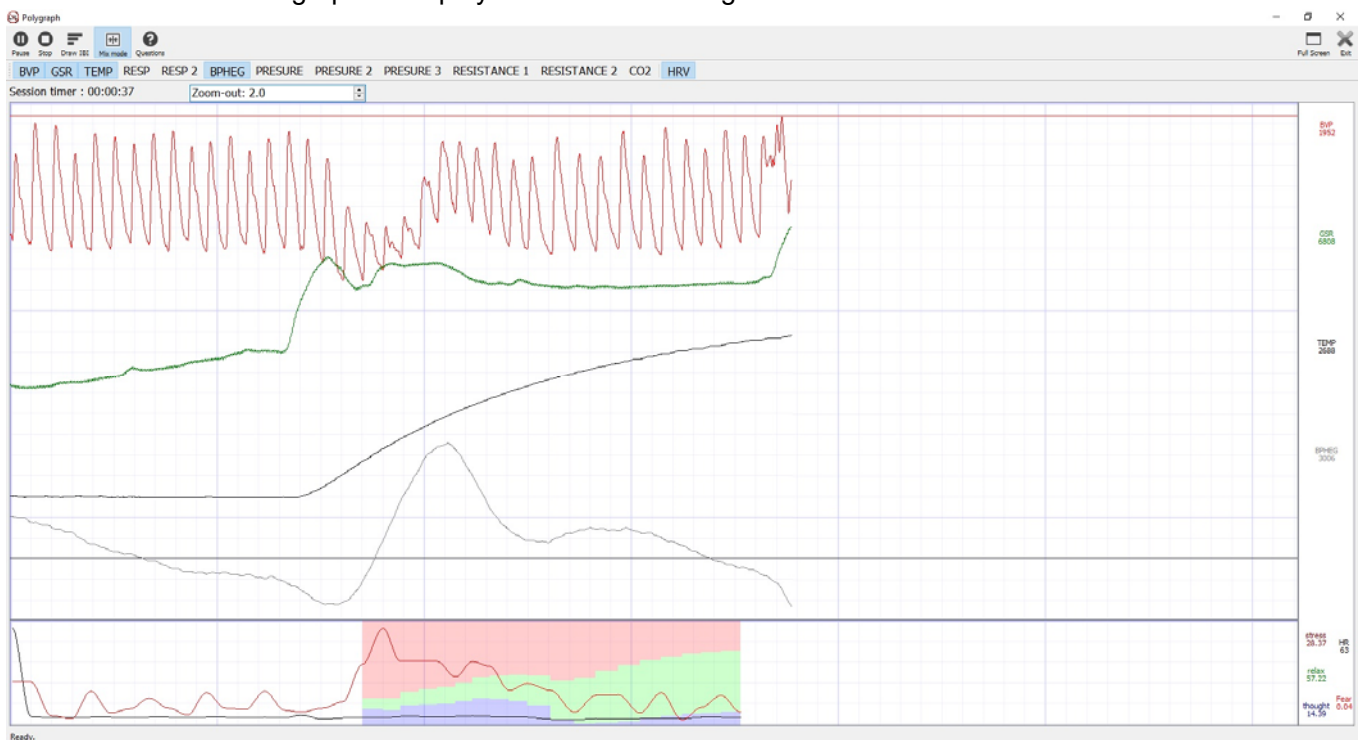
Gray vertical lines indicate that a key is pressed in the study. This option may be used by polygraph examiner for additional marks in the session.

During the session, there will be the following possibilities presented by the following items:

1. "Draw IBI" - is the calculation and rendering Inter Beat Interval (alternating green and pink stripes), indicating the duration of the intervals.



2. "Mixed mode" - graphics display with 10% - crossing each other.



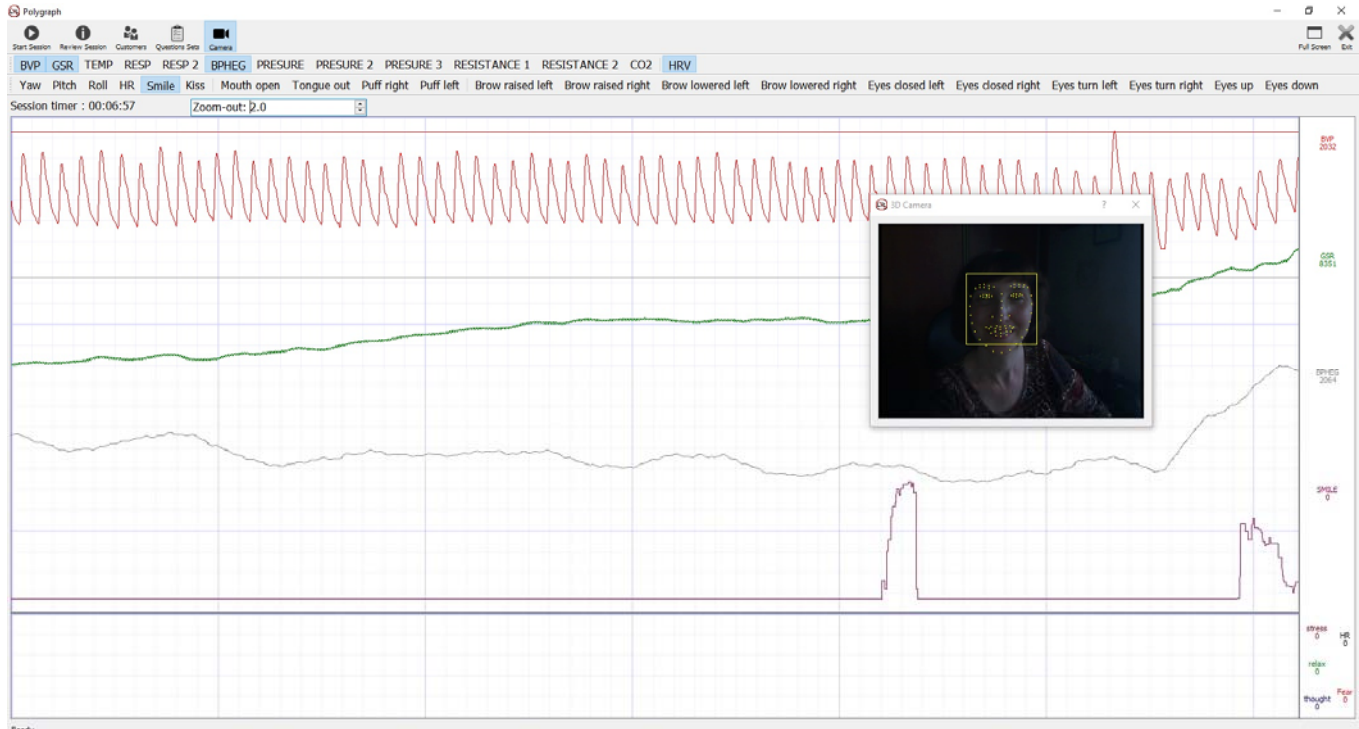
This feature will place a greater number of charts in a reasonable scale.

Using the camera

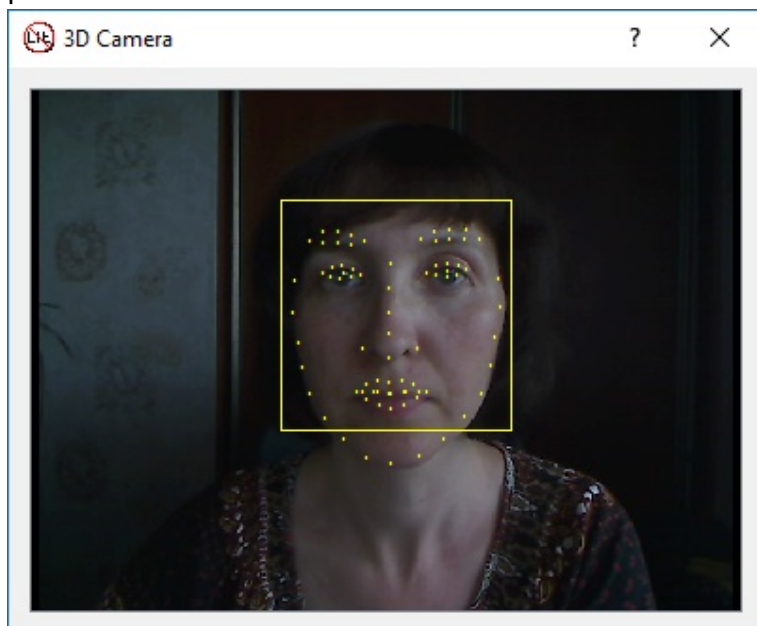
(3D-camera available in expanded configuration of device)

3D-camera fixes nonverbal signals on test. Throughout the entire test, it takes the test and captures facial expressions and muscle contractions in the face.

Start the camera before starting a new session by clicking the "Camera" in the main menu.



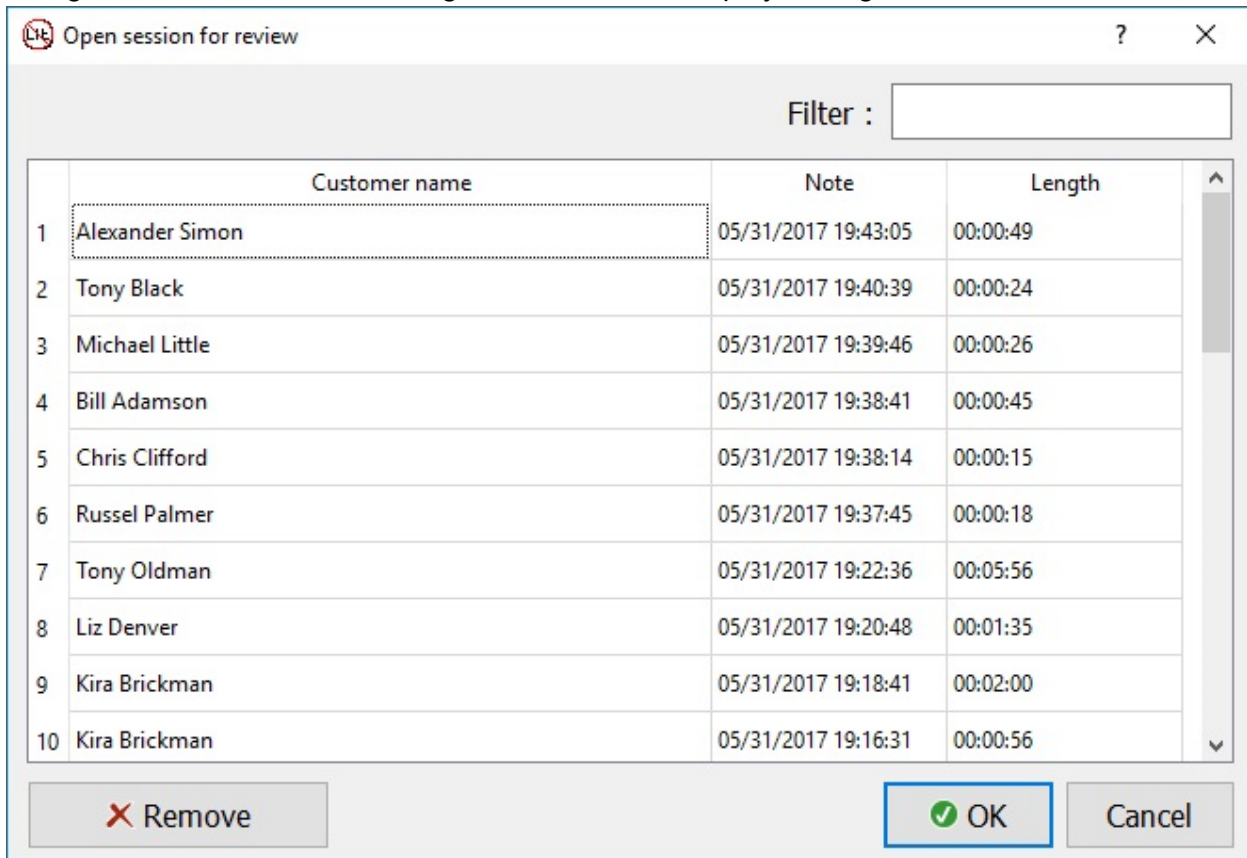
Select signals that are needed to monitor in test. Make sure that the camera is correctly identified the person's face.



After that, you can proceed to start the new session.

Review sessions

For reviewing sessions click "Review sessions" in the main menu. Select the required session according name and time of recording. The screen will display the signals selected session.

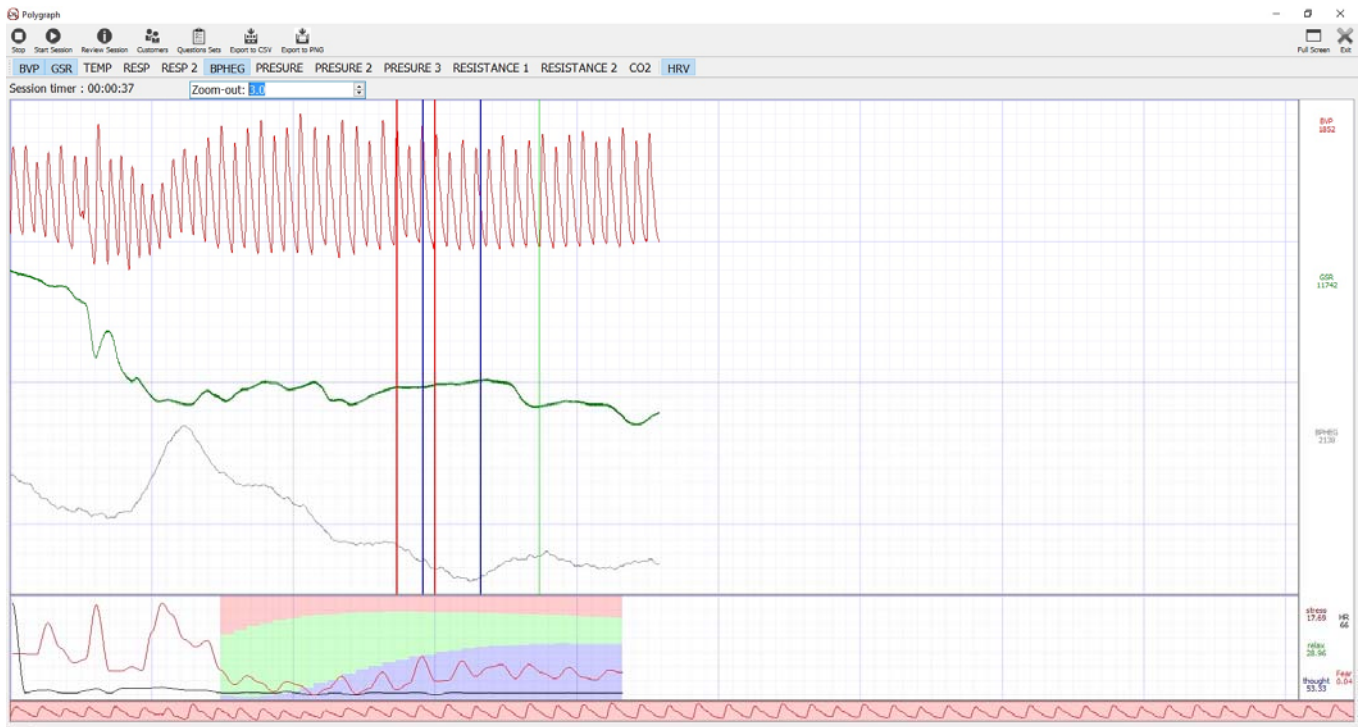


The screenshot shows a dialog box titled "Open session for review" with a search filter and a table of sessions. The table has three columns: "Customer name", "Note", and "Length". The first row is selected, showing "Alexander Simon" with a note of "05/31/2017 19:43:05" and a length of "00:00:49".

	Customer name	Note	Length
1	Alexander Simon	05/31/2017 19:43:05	00:00:49
2	Tony Black	05/31/2017 19:40:39	00:00:24
3	Michael Little	05/31/2017 19:39:46	00:00:26
4	Bill Adamson	05/31/2017 19:38:41	00:00:45
5	Chris Clifford	05/31/2017 19:38:14	00:00:15
6	Russel Palmer	05/31/2017 19:37:45	00:00:18
7	Tony Oldman	05/31/2017 19:22:36	00:05:56
8	Liz Denver	05/31/2017 19:20:48	00:01:35
9	Kira Brickman	05/31/2017 19:18:41	00:02:00
10	Kira Brickman	05/31/2017 19:16:31	00:00:56

Buttons: Remove, OK, Cancel

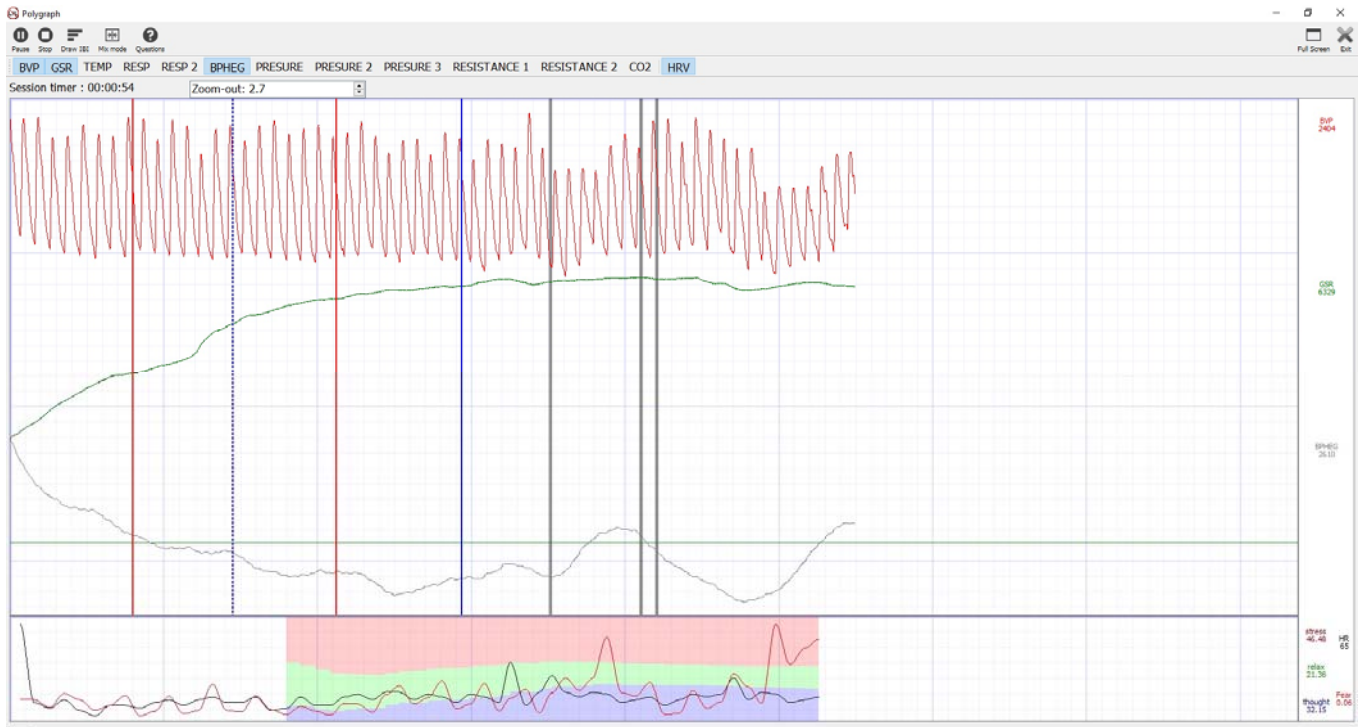
For the analysis, you can display / not display any of the signals by clicking on its name. Absolute values of signals at any one time (light green vertical line) can be seen to the right under the name of each signal.



The red and blue vertical lines indicate the moments when the questions are asked (red) and responded (blue). Vertical lines can be of four types:

5. Solid red - the answer "yes" to this question requires special attention for analysis
6. Dotted red - the answer "no" to this question requires special attention for analysis
7. Solid blue - the customer answered "yes".
8. Dotted blue - the customer answered "no".

Gray vertical lines indicate that a key is pressed in the study. This option may be used by polygraph examiner for additional marks in the session.

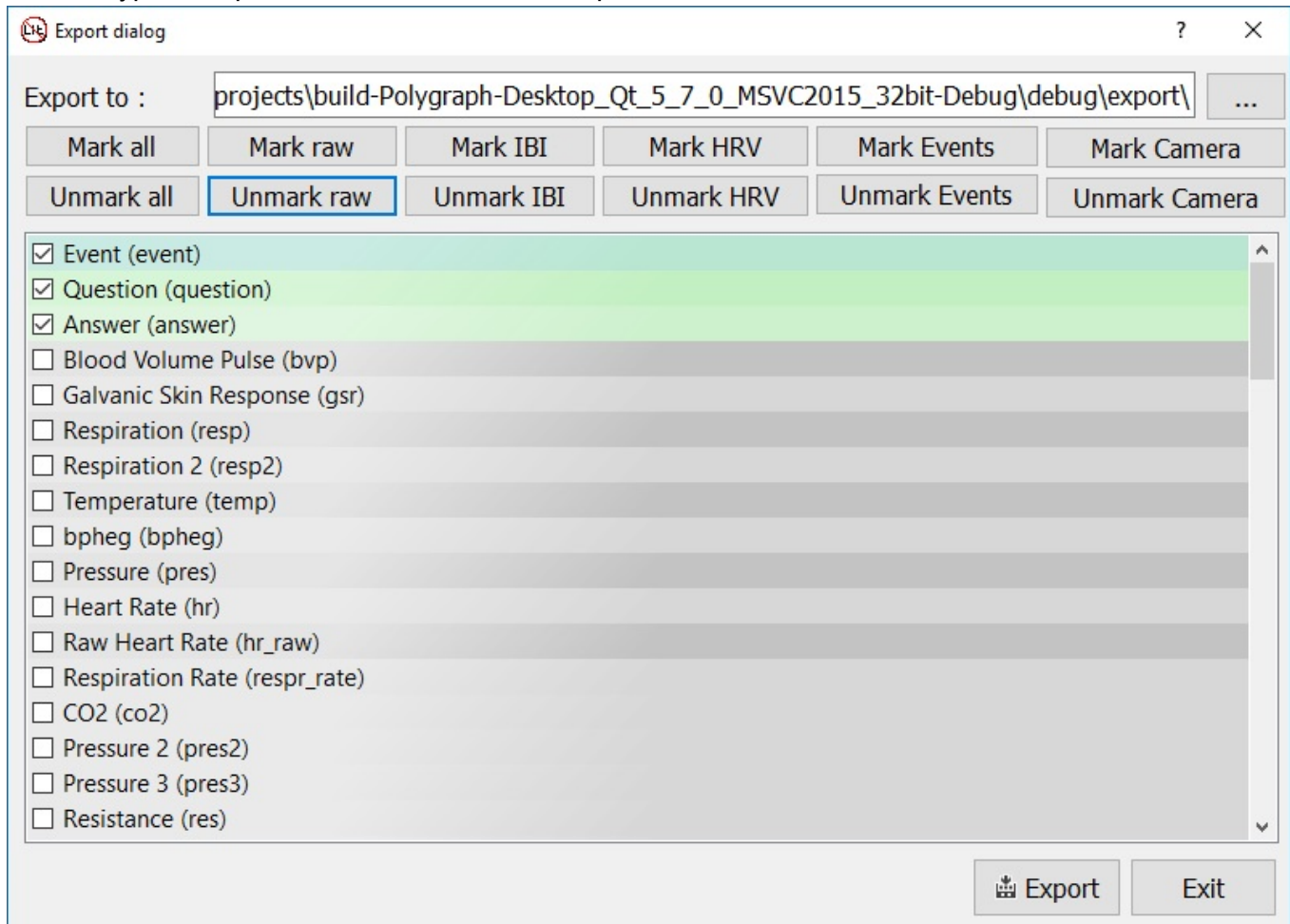


When you hover the mouse on any of the colored lines the balloon-tips with the question at a given moment and answer on it will appear.

Export data to CSV

To analyze the data, all values obtained and calculated signals can be exported to a file *.csv, which can be opened in Microsoft Excel applications, Open Office and others.

For this type of export, click the menu item "Export to CSV"



In the open window, select the folder for saving the file, and chose required data for export.

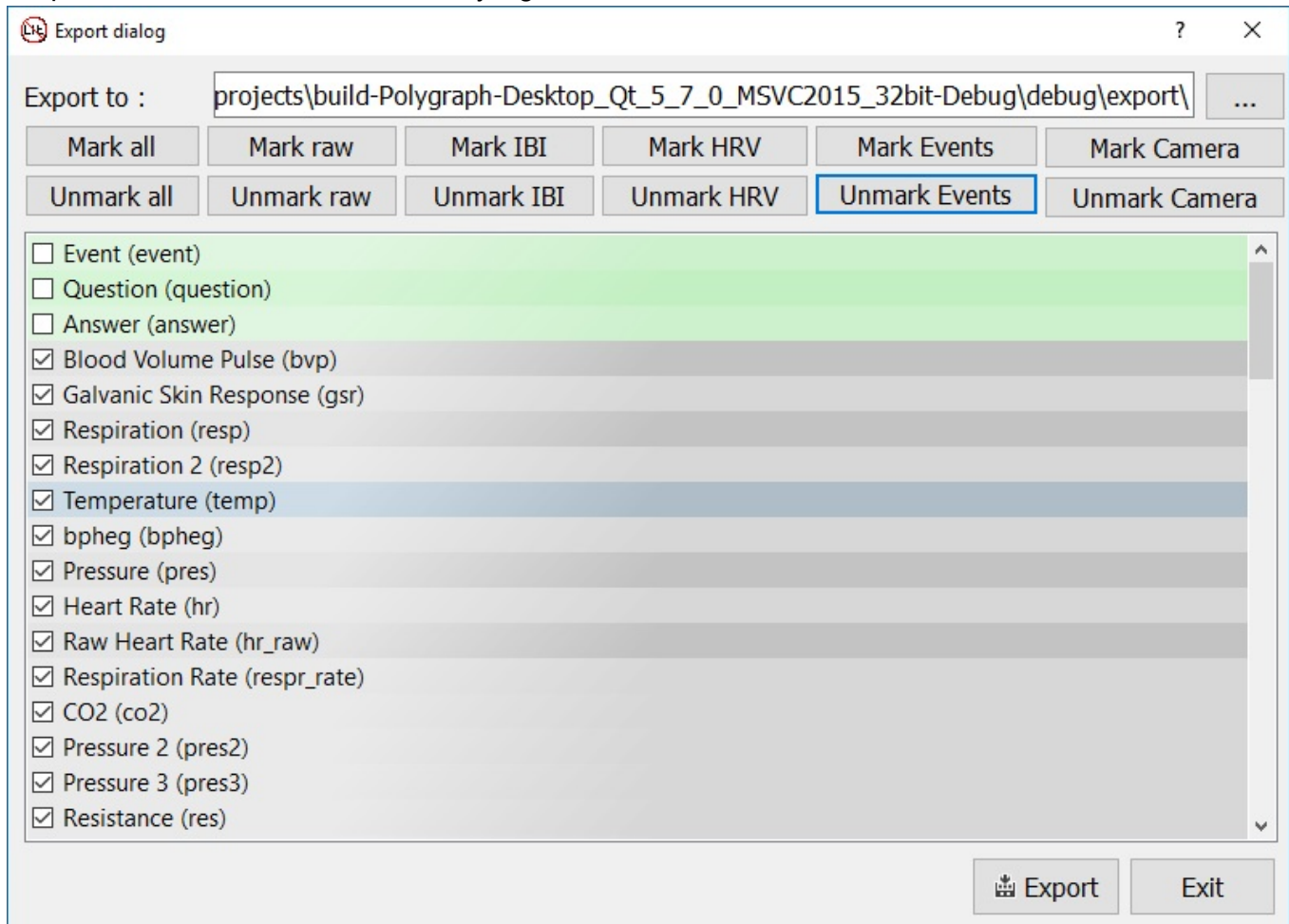
For convenience, all data are divided into groups for select / deselect the whole group:

1. Raw - data from the sensors.
2. IBI - calculated inter beat intervals.
3. HRV - heart rate variability.
4. Events - questions, answers, keystrokes.
5. Camera - data from 3D-camera - facial expressions and facial muscle contractions.

Export result will csv - file containing tabular data for analysis.

Export data to graphic file

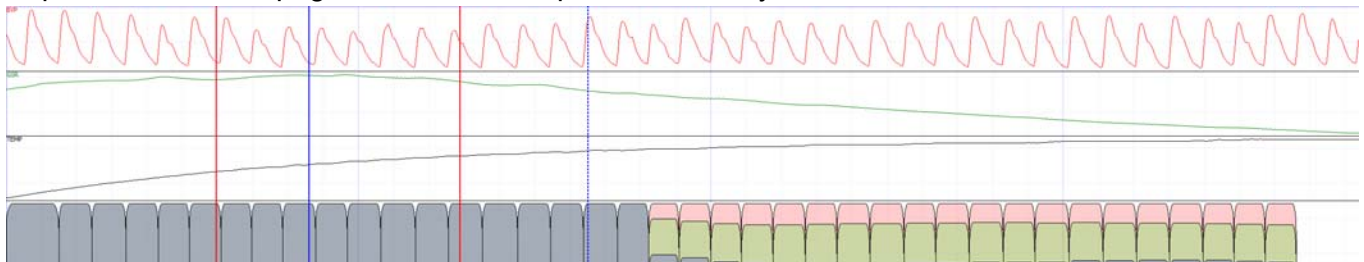
For viewing and printing, the sessions can be saved as image file. For this, select the menu item "Export to PNG", chose the necessary signals and folder to save the file.



For convenience, all data are divided into groups for select / deselect the whole group:

1. Raw - data from the sensors.
2. IBI - calculated inter beat intervals.
3. HRV - heart rate variability.
4. Events - questions, answers, keystrokes.
5. Camera - data from 3D-camera - facial expressions and facial muscle contractions.

Export result will be png - file that can be printed for analysis.



Error Messages

Error	Solution
The connected hardware is not a Polygraph hardware.	Your device is not designed for work with Polygraph BIO. Contact support
Please, connect sensor to the PC.	Connect your device to a computer
You need to connect the hardware for the first time registration.	Connect your device to your computer.
Please, make sure your PC is connected to internet.	Check the connection to the Internet.
Can't find the Polygraph BiO hardware ...	Check Polygraph BIO connection device to your computer.
Please, update Polygraph. You can find new version at {link}	Use the link in the message and update the version of software.
Can't connect to the Polygraph BiO server ...	Contact support.
Please, make sure your all files present in installation, can't find settings file.	Reinstall the application.
Export data files already exist. Files will be rewritten after continue.	Files with the same data exist. To store, make a copy before export.
Export image file already exists. File will be rewritten after continue.	A file with the same data exists. To store, make a copy before export.