# Experiment HP-2: The Galvanic Skin Response (GSR) and Emotion

**Equipment Required**

PC or Mac Computer

IXTA, USB cable, IXTA power supply

C-GSR-320 – GSR cables

**Any talking or movement may cause artifacts**

**GSR Setup**

1. Locate the GSR cables.

*Figure HP-2-S1: The GSR galvanic skin response amplifier.*

2. Plug the connector into the GSR channel (A7) of the IXTA.
3. Attach the GSR electrodes to the pointer and ring finger (where the fingerprints are located) of the subject's hand. Make sure the fingers are not too cold or too dry.
    - Make sure to use the GSR Conductive paste., just enough to cover the electrodes. You do not need a lot.
    - Do not use alcohol on the subject's fingertips.

**Note – the GSR unit is precalibrated. No other calibration is needed.**

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4. Select one person from your group to be the subject. Ask the subject to go to the sink, wash their hands with soap and water, and dry them thoroughly. Washing the hands insures that surface oils or other substances, which might lower skin conduction, are removed. Do not use alcohol to clean the fingers, alcohol dehydrates the skin.
5. Connect the GSR electrodes.
    - Make sure to use the GSR Conductive paste.
6. The subject should sit with their back to the computer monitor. Use the subject's hand which is closer to the iWorx equipment.
7. Attach each GSR electrode to the volar surface of the distal finger segment of two non-adjacent fingers; the index and the ring fingers are the ones usually used. Attach the electrodes with the Velcro straps so that the straps are snug, but not overly tight.

Remove any jewelery from the hand with the GSR electrodes on it.

8. The subject should rest their hand with the GSR electrodes comfortably. The GSR electrodes should be free from any extraneous pressure and the electrode cable should be hanging freely. Instruct the subject not to move the hand during the recording process; movement will introduce artifacts into the recording.

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# Experiment HP-2: The Galvanic Skin Response (GSR) and Emotion

## Exercise 1: Tonic SCL and Habituation

Aim: To measure the subject's tonic skin conductance level, observe possible spontaneous skin responses, and habituate the subject to the questioning paradigm used in this experiment.

Approximate Time: 20 minutes

Any talking or movement may cause artifacts

### *Procedure*

1. Two measurements are performed in this exercise:
    - **Tonic Skin Conductance Level**: In this measurement, the subject sits quietly for one minute as their tonic skin conductance level (SCL) is recorded. Any movement may cause an artifact in the recording.
    - **Habituation**: In this measurement, the subject's tonic skin conductance level (SCL) is recorded as they sit quietly and without movement. While recording the subject's SCL, ask the subject the question: Is your name, X? (where X is the subject's real name). The subject should only respond: **Yes**. After the subject's SCL changes and then returns to the baseline on the filtered Skin Conductance channel, ask the subject the same question. Continue to ask this same question until the subject shows no response on three consecutive trials. Lack of a change in the subject's SCL while answering the question is considered *habituation*.
2. Type **First Tonic SCL** <Subject's Name> in the Mark box.
3. Click on the Record button. Click the mark button. The value displayed on the Skin Conductance Level channel is the tonic skin conductance level (SCL) of the subject. Record the subject's tonic SCL for one minute.

It takes a few seconds for data collection to start normally

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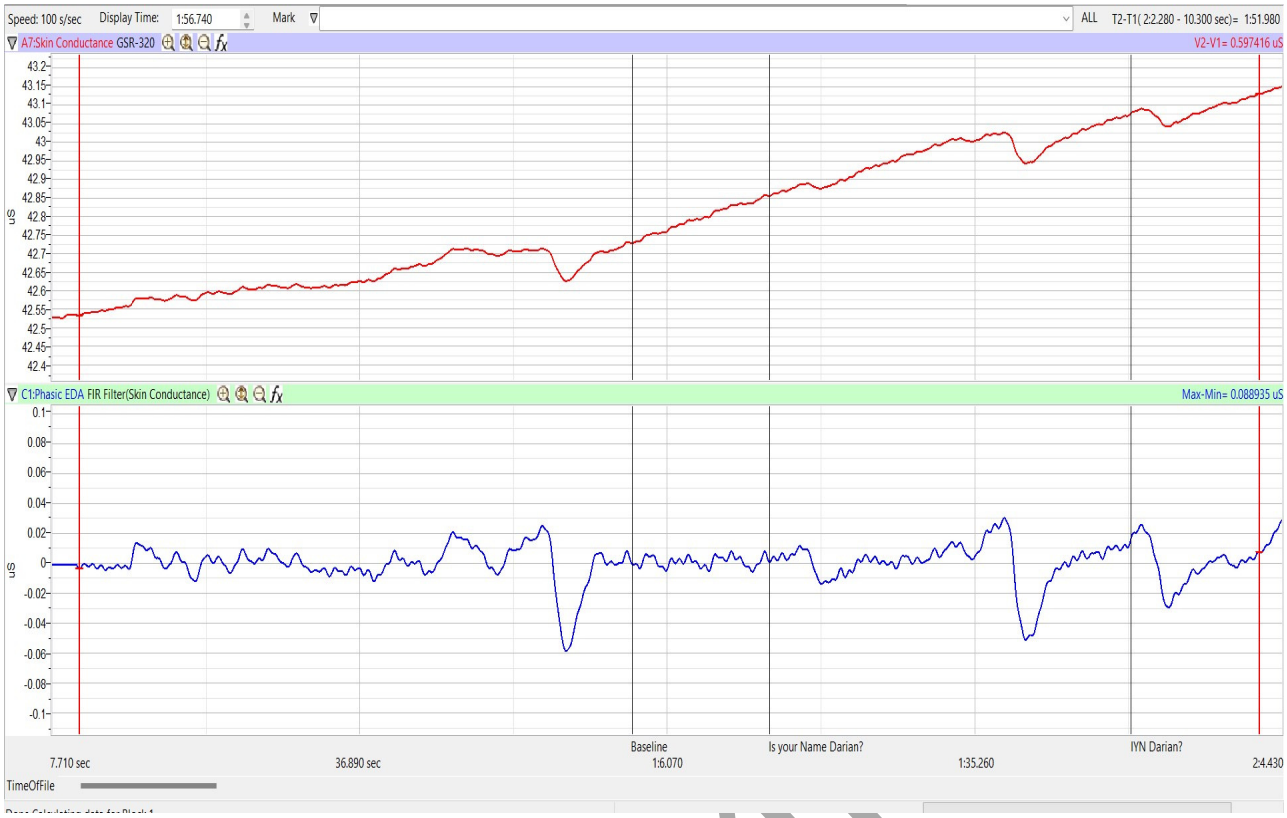


*Figure HP-2-L1: The output of the GSR amplifier before and after the GSR electrodes, which are already on the fingers of the subject, were connected to the amplifier.*

4. Type **Baseline** <Subject's Name> in the Mark box and click the mark button.
5. Type **Is Your Name**, <Subject's Name>? in the Mark box Click the mark button as the subject is asked the question. Continue recording.
6. When the subject's tonic skin conductance level is response to the previous question has returned to the baseline, type **IYNX** in the mark box and click the mark button. Ask the question again.
7. Repeat Step 11 until the subject shows no response to the question for three consecutive times. Click Stop to halt the recording.
8. Select Save As in the File menu, type a name for the file. Click on the Save button to save the data file.
9. Repeat this exercise on other subjects in your lab group.

### *Data Analysis - Tonic Skin Conductance Level*

1. Scroll through the data file and locate the recording of the subject's tonic skin conductance level (SCL).

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2. Use the Display Time icons to adjust the Display Time of the Main window to display the one minute recording of the subject's tonic SCL on the Main window. This section of data can also be selected by:
    - Placing the cursors on either side of the one minute recording of the subject's SCL, and
    - Clicking the Zoom between Cursors button on the LabScribe toolbar (Figure HP-2-L2) to expand or contract the one minute recording to the width of the Main window.
3. Data can be collected from the Main window or the Analysis window. If you choose to use the Analysis window, click on the Analysis window icon in the toolbar.
4. The mathematical function Mean should appear on screen. Mean is located on the right margin of the Skin Conductance graph.

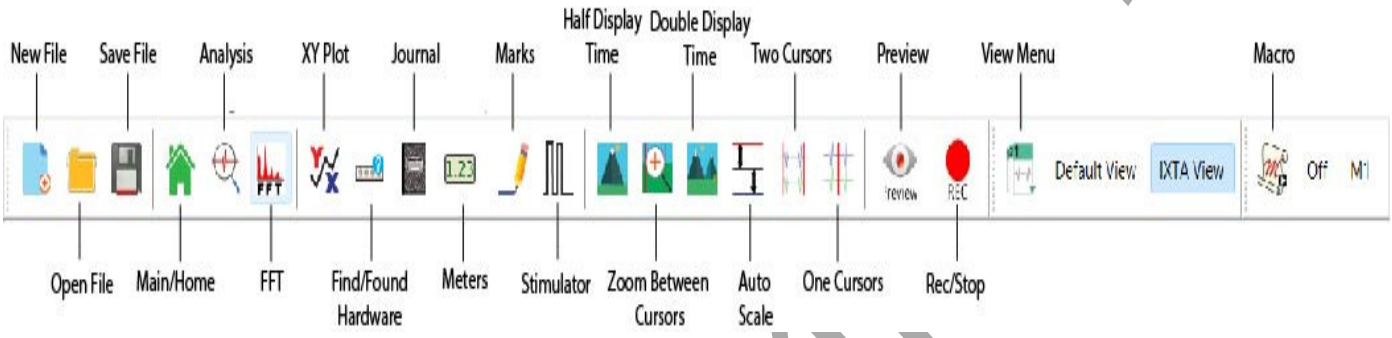


*Figure HP-2-L2: The LabScribe toolbar.*

4. On the Skin Conductance Level channel, use the mouse to click on and drag a cursor to the left margin of the data displayed on the Analysis window. Drag the other cursor to the right margin of the same data.
5. Once the cursors are placed in the correct positions for determining the mean tonic skin conductance level in the one minute recording, the value for the mean tonic skin conductance level can be recorded in the on-line notebook of LabScribe by typing the name and value of the parameter directly into the Journal.
6. The functions in the channel menu of the Analysis window can also be used to enter the names and values of the parameters from the recording to the Journal. To use these functions:
    - Place the cursors at the locations used to measure the mean tonic skin conductance level.
    - Transfer the name of the parameter to the Journal using the Add Title to Journal function in the Skin Conductance Level channel menu.
    - Transfer the value for the mean to the Journal using the Add Ch. Data to Journal function in the Skin Conductance Level channel menu.
7. Record the values in the Journal using the one of the techniques described in Steps 5 or 6.
8. Enter the value for the mean tonic skin conductance level for the subject in Table 1.

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***Data Analysis - Spontaneous Skin Conductance Responses***

1. On the one minute recording of the subject's tonic skin conductance level displayed in the Analysis window, count the number of spontaneous skin conductance responses that occurred during the one minute recording of the subject's tonic skin conductance.

***Note:*** *Changes in the subject's skin conduction level (SCL) which are upward deflections equal to or greater than 0.05 µS are counted as spontaneous skin conduction responses. The SCL does not need to return to the baseline value before another response takes place. Use the Filter Skin Conductance channel.*

2. Enter the number of spontaneous skin conductance responses that occurred in the one minute recording in the Journal by typing the value directly into that window. Also, enter the value in Table 1.

***Data Analysis - Habituation***

1. If you were in the Analysis window - click on the Main window icon. Scroll through the data file and locate the recording of the habituation SCL for the subject.
2. Use the Display Time icons to adjust the Display Time of the Main window to display the complete habituation period on the Main window.
3. Determine the subject's habituation score by counting the number of times the question, "Is your name, <Subject's Name>?" was asked before the habituation criterion was reached. Each time the question is asked is considered a trial. The habituation criterion is reached when there is no skin conductance response from the subject for three consecutive trials. For example, if the subject first shows no skin conductance response to the question in the sixth trial, and no responses in the seventh and eighth trials, the subject's habituation score is six. Typical habituation scores are between two and eight.

***Note:*** *Some spontaneous skin responses may occur during the habituation test. Do not count spontaneous responses in the habituation score. Only count a trial as a skin conductance response to the question when the response begins within three seconds of the question and the skin conductance change is equal to or greater than 0.05 µS.*

4. Enter the subject's habituation score in the Journal by typing the value directly into that window and in the table.
5. Enter the value for the tonic skin conductance level, the number of spontaneous skin responses per minute, and the habituation score for all the subjects in your group into the table. The class data will be used in Exercise 7.

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**Table HP-2-L1: Tonic SCL, Spontaneous Skin Responses, and Habituation**

| Subject | Mean Tonic SCL (µS) | Spontaneous Skin Responses (Number/Minute) | Habituation Score (Trials before Habituation) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Exercise 2: Orienting Response - Neutral Content**

Aim: To determine the change in the skin conductance level and the peak response rise time of a subject responding to a series of neutral content questions.

Approximate Time: 20 minutes

***Procedure***

1. The same subject that performed Exercise 1 should participate in this exercise.
2. The subject will be asked a series of ten questions with a neutral content (see Table 2). Instruct the subject to sit quietly and **to answer each question truthfully with either a Yes or a No**. The subject should not elaborate on any answer.
3. Type **Second Tonic SCL** <Subject's Name> in the Mark box. Click on the Record button. Click the mark button. Record the subject's tonic skin conductance level for one minute. Continue recording.
4. Type **NC1** (for Neutral Content Question 1) in the Mark box. Click the mark button to mark the recording as the subject is asked the first question with neutral content. Continue recording.
5. Before asking the next question:
    - Type the number of the next neutral content question (**NC2, NC3....**) in the Mark box.
    - Wait for the subject's skin conductance level to return to the baseline level before asking the next question.
    - Wait for any spontaneous skin responses to return to their baseline frequency before asking the next question.
6. Click the mark button to mark the recording as the subject is asked the next question with neutral content. Continue recording.

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7. Repeat Steps 5 and 6 for the remaining eight questions in the list in Table 2.
8. When the subject's skin conductance response to the tenth question is completed, click Stop to halt the recording.
9. Select Save in the File menu.

***Data Analysis***

1. Scroll through the data file and locate the recording of the subject's skin conductance response to the first question in the list of neutral content questions.
2. Use the Display Time icons to adjust the Display Time of the Main window to display the complete response to the first question on the Main window. This section of data can also be selected by:
    - Placing the cursors on either side of the subject's skin conductance response to the first question, and
    - Clicking the Zoom between Cursors button on the LabScribe toolbar to expand or contract this section of the recording to the width of the Main window.

**Table HP-2-L2: Neutral Content Questions**

| |
|---|
| 1. Do you live in a dormitory? |
| 2. Do you like broccoli? |
| 3. Do you have a cat? |
| 4. Are you a senior? |
| 5. Have you ever gone ice skating? |
| 6. Do you sometimes ride a bike to school? |
| 7. Have you ever been to Alaska? |
| 8. Do you have a sister? |
| 9. Were you born in [State or Country]? |
| 10. Are you a psychology major? |

3. Click on the Analysis window icon.

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4. Look at the Function Table that is above the Skin Conductance Level channel in the Analysis window. The functions, Value1, Value 2, V2-V1, and T2-T1, should appear in this table. The values for these functions are displayed in the table across the top margin of the Skin Conductance Level channel.
5. On the Filtered Skin Conductance Level channel, use the mouse to click on and drag a cursor to the point in the recording when the question was asked. Drag the other cursor to peak of the subject's response to the question. The following parameters of the subject's response are measured by the functions listed in the table:
    - **Baseline Skin Conductance Level**, which is the skin conductance level of the subject at the time the question was asked. The value for the Value1 function on the Skin Conductance Level channel is the baseline skin conductance level.
    - **Peak Response Skin Conductance Level**, which is the maximum skin conductance level of the subject in the period after the question was asked. The value for the Value2 function on the Skin Conductance Level channel is the skin conductance level of the peak response of the subject.
    - **Change (Δ) in Skin Conductance Level**, which is the difference between the baseline and maximum skin conductance levels of the subject in response to the question. The value for the V2-V1 function on the Skin Conductance Level channel is the change in the skin conductance level of the subject.
    - **Peak Response Rise Time**, which is the time between the question being asked and the peak response of the subject to the question. The value for the T2-T1 function on the Skin Conductance Level channel is the rise time of the peak response.

***Note:*** *In this exercise, it would not be useful to calculate the latency, which is the time between the mark indicating the question and the onset of the response. The questions in this exercise are not brief discrete events; each question is a different length and takes a different time to ask. Latency will be measured in another exercise in another context.*

7. Record the values for these functions in the Journal using the one of the techniques described in Exercise 1.
8. Enter the values for the baseline skin conductance level, peak response SCL, change in SCL, and rise time of the peak response for the first question in Table 3.
9. Repeat Steps 1 through 7 for the other nine neutral content questions in the list.

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**Table HP-2-L3: Skin Conductance Changes for Neutral Content Questions**

| Questions | Baseline SCL (µS) | Peak Response SCL (µS) | Δ in SCL (µS) | Peak Response Rise Time (seconds) |
|---|---|---|---|---|
| 1. Do you live in a dormitory? | | | | |
| 2. Do you like broccoli? | | | | |
| 3. Do you have a cat? | | | | |
| 4. Are you a senior? | | | | |
| 5. Have you ever gone ice skating? | | | | |
| 6. Do you sometimes ride a bike to school? | | | | |
| 7. Have you ever been to Alaska? | | | | |
| 8. Do you have a sister? | | | | |
| 9. Were you born in [State or Country]? | | | | |
| 10. Are you a psychology major? | | | | |

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**Exercise 3: GSR & Emotional Content**

Aim: To determine the change in the skin conductance level and the peak response rise time of a subject responding to a series of questions with either neutral or emotional content.

Approximate Time: 20 minutes

***Procedure***

1. The same subject that performed Exercise 2 should participate in this exercise.
2. Attempt to keep the subject uninformed about the design and purpose of this exercise. At the very least, make sure the subject is unaware of the sequence in which the questions will be asked.
3. The subject will be asked a total of ten questions, seven new questions with neutral content and three questions of an emotional nature.

4. Without informing the subject, randomize the position of the questions with emotional content in the list of questions to be asked. To randomly place the questions with emotional content on the list of questions, perform a blind draw of three pieces of paper, each marked with a number from 2 through 10. No paper marked with the number 1 is placed in the draw to insure that the first question will be one with neutral content. The three numbers drawn indicate the positions of the questions with emotional content in the list of ten questions.
5. Select three questions with emotional content. They should not be intrusive, and they should involve common emotional experiences. Table 4 contains good examples of questions with emotional content.
6. Select seven new questions with neutral content. Table 5 contains good examples of this type of question.
7. Instruct the subject to sit quietly and to answer each question truthfully with either a Yes or a No. The subject should not elaborate on any answer.
8. Type **Third Tonic SCL** <Subject's Name> in the Mark box. Click on the Record button. Click the mark button. Record the subject's tonic skin conductance level for one minute. Continue recording.

**Table HP-2-L4: Example Questions with Emotional Content**

| |
|---|
| • Are you in love? |
| • Do you ever cry? |
| • Does nudity make you blush? |
| • Do you recall your first kiss? |
| • Does being alone at night frighten you? |
| • Have you ever seen a tragic auto accident? |
| • Have you ever heard about a date rape? |
| • Do you ever hide some of your feelings? |
| • Do you believe in the practice of "safe sex?" |

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**Table HP-2-L5: Example Questions with Neutral Content**

| |
|---|
| • Is today (Tuesday)? |
| • Did you watch TV last night? |
| • Do you like pizza? |
| • Have you ever been to a professional baseball game? |
| • Do you have a car? |
| • Are you taking a PE class? |
| • Do you like to go to movies? |

9. Type **NQ1** (for Neutral Question 1) in the Mark box that is to the right of the Mark button. Click the mark button to mark the recording as the subject is asked the first question. Continue recording.
10. Before asking the next question:
    - Type the number of the next question (**NQ2 or EQ2** for Neutral or Emotional Question 2) in the Mark box.
    - Wait for the subject's skin conductance level to return to the baseline level before asking the next question.
    - Wait for any spontaneous skin responses to return to their baseline frequency before asking the next question.
11. Click the mark button to mark the recording as the subject is asked the next question. Continue recording.
12. Repeat Steps 10 and 11 for the remaining eight questions in the list, labeling each neutral question as **NQ** and each emotional question as **EQ**.
13. When the subject's skin conductance response to the tenth question is completed, click Stop to halt the recording.
14. Select Save in the File menu.

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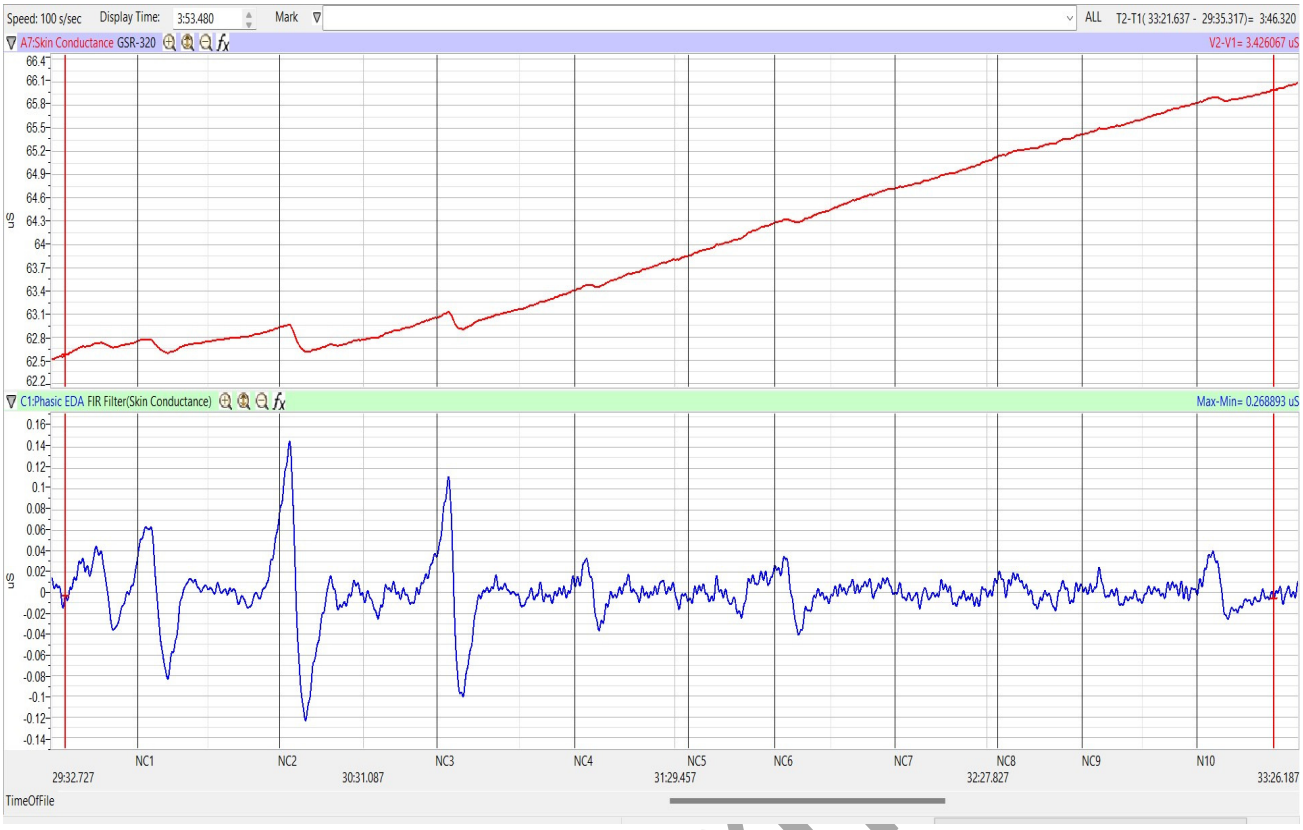


*Figure HP-2-8: Skin conductance level of a subject responding to multiple questions.*

### *Data Analysis*

1. Scroll through the data file and locate the recording of the subject's skin conductance response to the first question in the list of neutral and emotional content questions.
2. Use the same procedures used in Exercise 2 to position data in the Main window, display the selected data in the Analysis window, and measure values for the following parameters of the response to the first question:
    - **Baseline Skin Conductance Level,** which is the skin conductance level of the subject at the time the question was asked. The value for the Value1 function on the Skin Conductance Level channel is the baseline skin conductance level.
    - **Peak Response Skin Conductance Level,** which is the maximum skin conductance level of the subject in the period after the question was asked. The value for the Value2 function on the Skin Conductance Level channel is the skin conductance level of the peak response of the subject.
    - **Change (Δ) in Skin Conductance Level**, which is the difference between the baseline and maximum skin conductance levels of the subject in response to the question. The value for the V2-V1 function on the Skin Conductance Level channel is the change in the skin conductance level of the subject.

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- **Peak Response Rise Time**, which is the time between the question being asked and the peak response of the subject to the question. The value for the T2-T1 function on the Skin Conductance Level channel is the rise time of the peak response.

3. Record the values for these functions in the Journal using the one of the techniques described in Exercise 1.
4. Enter the values for the baseline skin conductance level, peak response SCL, change in SCL, and rise time of the peak response for the first question in Table 6.
    - Repeat Steps 1 through 4 for the other nine questions in the list.
5. Determine the mean change in SCL and the mean rise time of the peak response for the three emotional questions. Also, determine the mean change in SCL and the mean rise time of the peak response for the seven neutral questions. Enter these means in Table 6.

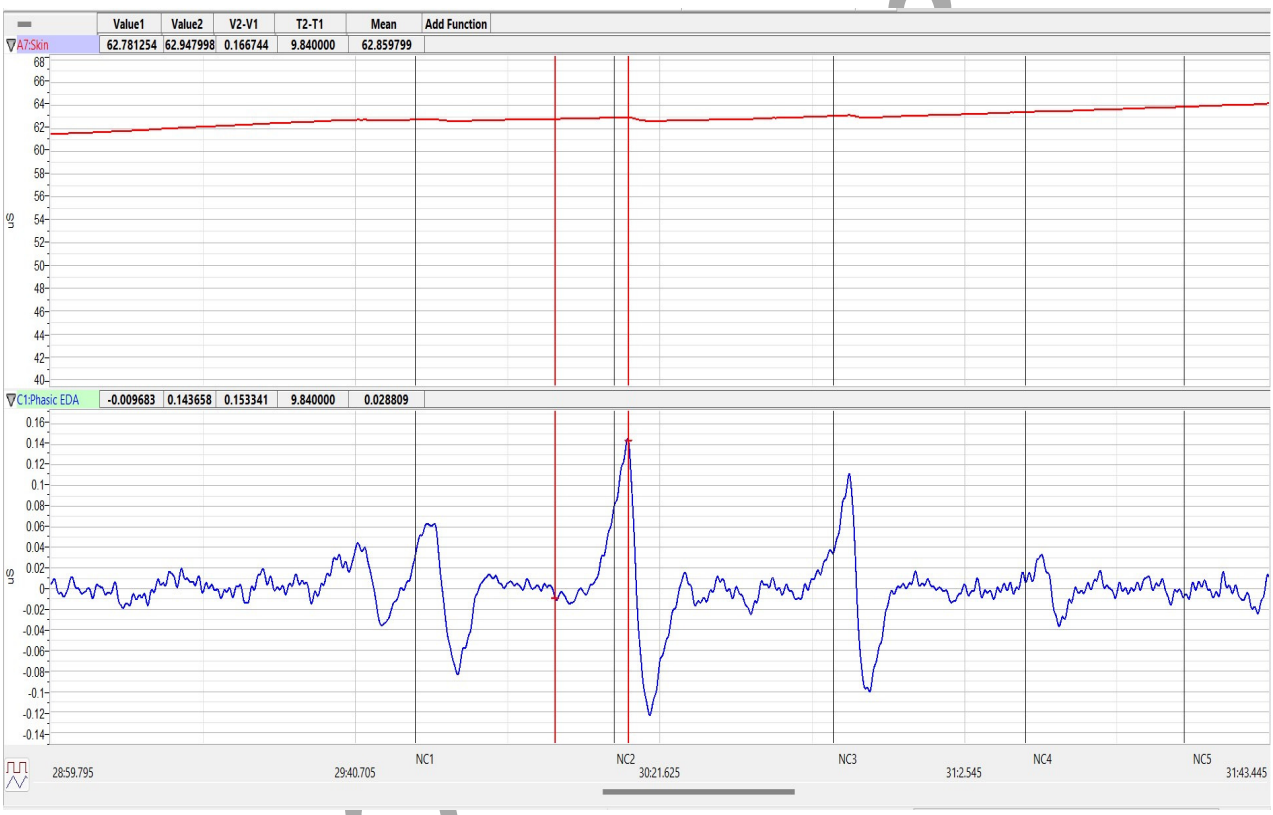


*Figure HP-2-L3: Skin conductance level of a subject responding to an emotional question displayed in the Analysis window.*

6. Compare the mean change in SCL and the mean rise time of the peak response for the emotional questions to those of the neutral questions. It is expected that the mean change in SCL is greater and the mean rise time is shorter for the questions with emotional content than for the questions with neutral content.

Work Lab

***Note:*** *Since there are many GSR exercises that can be done, your instructor may choose to stop after Exercise 3, and have your class complete the other four exercises in the GSR-B experiment during another lab period.*

**Table HP-2-L6:Comparison of Skin Conductance Changes for Emotional and Neutral Content Questions.**

| Questions | Neutral (N) Emotional (E) | Baseline SCL (µS) | Peak Response SCL (µS) | Δ in SCL (µS) | Peak Response Rise Time (seconds) |
|---|---|---|---|---|---|
| 1. | N | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |
| 5. | | | | | |
| 6. | | | | | |
| 7. | | | | | |
| 8. | | | | | |
| 9. | | | | | |
| 10. | | | | | |
| Means for 7 Neutral Questions | N | | | | |
| Means for 3 Emotional Questions | E | | | | |

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