

Experiment HP-1: The Galvanic Skin Response (GSR) and Emotion

What is a GSR?

The Galvanic Skin Response (GSR) is one of several electrodermal responses (EDRs). EDRs are changes in the electrical properties of a person's skin caused by an interaction between environmental events and the individual's psychological state. Human skin is a good conductor of electricity and when a weak electrical current is delivered to the skin, changes in the skin's conduction of that signal can be measured. The variable that is measured is either skin resistance or its reciprocal, skin conductance. According to Ohm's Law, skin resistance (R) equals the voltage (V) applied between two electrodes on the skin divided by the current passed through the skin (I). The law can be expressed as $R=V/I$.

A GSR amplifier, like the one that will be used in this experiment, applies a constant voltage to the skin through electrodes. The voltage is so small that it cannot be felt or perceived by the individual. However, the current that flows through the skin, as the voltage is applied, can be detected and displayed. Because the constant voltage applied to the skin is known and the current flow can be measured, the skin's conductance can be determined by the GSR amplifier. The output of the GSR amplifier is the skin's conductance expressed in units called microSiemens (μS).

Two types of skin conductance are characterized, tonic and phasic. Tonic skin conductance is the baseline level of skin conductance, in the absence of any particular discrete environmental event, and is generally referred to as Skin Conductance Level (SCL). Each person has a different SCL, with typical tonic levels ranging from 10-50 μS . Tonic skin conductance levels vary over time in individuals depending on his or her psychological state and autonomic nervous system regulation.

Phasic skin conductance is the type that changes when events take place. Discrete environmental stimuli (sights, sounds, smells, etc.) will evoke time related changes in skin conductance. These are generally referred to as Skin Conductance Responses (SCRs). SCRs are increases in the conductance of the skin which may last 10-20 seconds followed by a return to the tonic or baseline level of skin conductance (SCL). These phasic changes are often simply called GSRs. Individuals will show spontaneous GSRs, that are not event related, to varying degrees. The typical frequency of spontaneous GSRs is between one and three per minute. Some persons are highly reactive with considerable spontaneous generation of GSRs, and others have a relatively steady tonic level of skin conductance without spontaneous GSRs. Some of these individual differences are discussed in another section of this experiment.

The parameters of event-related GSRs that can be quantified are: amplitude, in microSiemens; and latency, rise time, and half-recovery time, in seconds. These parameters can be determined from a recording like the one shown in [Figure HP-1-B1](#).

The amplitude of an event-related GSR is the difference between the tonic skin conductance level, at the time the response was evoked, and the skin conductance at the peak of the response. Latency is the time between the stimulus and the onset of the event-related GSR; latency values should be about three seconds or less. Rise time is the time between the onset of the event-related GSR and the peak of the response; typical values for rise time are one to three seconds. Half-recovery time is the time between the peak of the response and the point after the peak when the conductance returns to an amplitude that is one-half the amplitude of the peak; typical values for half-recovery time are two to ten seconds.

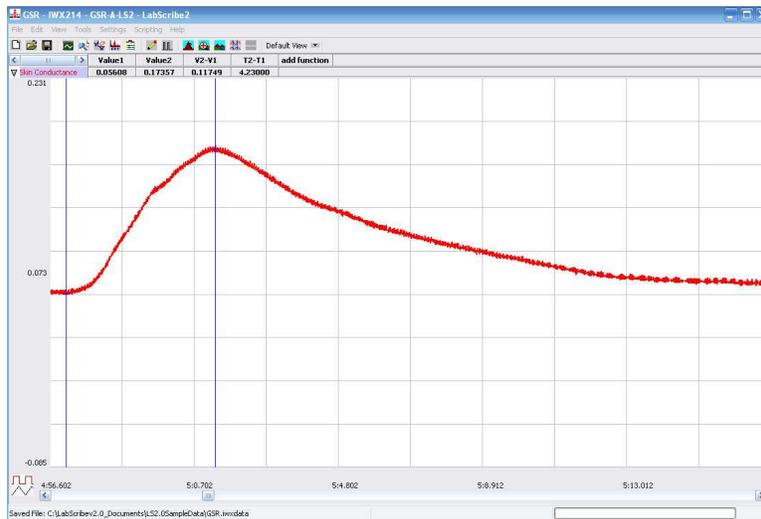


Figure HP-1-B1: A typical GSR in response to an emotional question, displayed in the Analysis window.

In the sample presented in [Figure HP-1-B1](#), the subject was asked a standard neutral question: “Do you own a bike?” The parameters measured from this subject’s recording include:

- a tonic skin conductance level of about 7.5 μS ,
- a latency of the phasic GSR in response to the question of 1.35 seconds,
- an amplitude of the phasic GSR of 2.12 μS ,
- a rise time of the phasic GSR of 2.35 seconds; and
- a half-recovery time of about 5 seconds.

The Electrodermal System

The skin is a three-layered (epidermis, dermis, subdermis) adaptive organ which aids in the maintenance of the body’s water balance and core temperature. These functions are carried out by blood vessels and eccrine sweat glands. The blood vessels constrict and dilate to deliver blood flow to the surface of the body for heat conservation or loss. The eccrine sweat glands function to cool the body by depositing moisture on the skin surface through ducts (in the dermis) and sweat pores (in the epidermis). The glands, which are located in the subdermis over most of the body, are about ten times more dense on the palmar surface of the hands and soles of the feet.

The most widely accepted model of skin conductance is the sweat circuit model proposed by Edelberg (1972). According to this model, phasic changes in skin conductance occur when the sweat ducts in the epidermis fill, and skin conductance recovers to tonic levels when the moisture is deposited on the skin or reabsorbed by the sweat glands.

In Edelberg’s model, the sweat ducts act as variable resistors; their resistance lowers (conductance increases) as they fill with sweat. The amplitude of the change in conductance depends on the amount of sweat delivered to the ducts and on the number of sweat glands which are activated.

Sweat gland activation is a simple physiological survival mechanism, which is of interest in psychology because it is a neural response. This activation is controlled by the brain via the sympathetic division of the autonomic nervous system. Human sweat glands receive primarily signals from sympathetic cholinergic fibers that use the neurotransmitter acetylcholine. This is an anomaly because most sympathetic fibers utilize norepinephrine. Edleberg (1972) described three descending pathways for regulatory control over the sweat glands:

- the premotor cortex descending through the pyramidal tracts;
- the hypothalamus and limbic system;
- the reticular formation.

Individual Differences in Electrodermal Activity

In the 1950s, Lacey and Lacey first described individual response patterns that have become commonly accepted as relatively reliable personality trait characteristics. Individuals, who show a high frequency of spontaneous skin responses and habituate slowly to repeated presentations of simple stimuli, are termed electrodermal labiles. In contrast, individuals, who produce few spontaneous skin responses and habituate rapidly to simple stimuli, are termed electrodermal stabiles. Additionally, these traits have been correlated with a number of psychophysiological variables (Schell, Dawson, & Fillion, 1988). Persons typed as electrodermally labile are generally better at vigilance tasks and show a lower vigilance decrement over time than electrodermally stable persons. Some researchers believe that electrodermal lability/stability represents a fundamental difference in the information processing characteristics of individuals (Schell, et al., 1988).

Psychosocial Events and Skin Conductance

Electrodermal activity correlates positively with the novelty, intensity, emotional content, and significance of the stimulus. In each of these contexts, an orienting response (OR) is activated in the central nervous system. The orienting response is the neural equivalent to: “Hey, pay attention to this; it might be important for your survival!” Both tonic and phasic skin conductance are influenced by psychosocial contexts.

It has been shown that tonic skin conductance levels rise in anticipation of performing a variety of tasks and during the performance of these tasks. Common tasks that have been used in experiments to demonstrate this phenomenon include: mental arithmetic, vigilance/attention tasks, and social tasks (like, discussing a social issue with others).

Phasic skin conductance responses have been studied in a variety of contexts. The field of social psychophysiology utilizes skin responses as indicators of social empathy, embarrassment, and social attitudes. Electrodermal activity is considered a highly sensitive indicator of the social significance of an event. The most common use of electrodermal activity has been in the detection of deception, the so-called “lie detection test.”

The Polygraph, or Lie Detection Test

The test used to detect the truthfulness of an individual's statements is often referred to as a polygraph. A polygraph is actually a multi-function chart recorder that measures GSR, heart rate, blood pressure, and respiration rate. These four responses are sensitive to stimulus novelty, intensity, emotionality, and significance. The device is operated by a person known as a polygrapher, who is trained and licensed to administer and interpret the test with the art and science of the discipline. Polygraphers use a variety of tools to detect deception, including highly standardized questioning procedures.

The use of polygraphs to detect lying in individuals accused of crimes is highly controversial, in part because the identification of false positives occurs in about 10 to 15% of test cases. A false positive occurs when the polygrapher has determined that the person is being deceptive when, in fact, he or she has not. A much rarer occurrence is a false negative. A false negative occurs when the test indicates the person is telling the truth, but he or she is actually guilty. For this reason, polygraph tests are often used in support of a person's truthfulness, but not as evidence of guilt.

In this experiment, you will use measurements of skin conductance to analyze psychophysiological responses. You will:

- measure the tonic level of skin conductance, the frequency of spontaneous conductance responses, and the habituation of the skin conductance response;
- observe and measure the GSR as an orienting response to being asked neutral content questions;
- observe and measure the GSR to questions with emotional content.

Experiment HP-1: The Galvanic Skin Response (GSR) and Emotion

Equipment Required

PC or Mac Computer

USB cable

IX-EEG recorder

GSR electrodes

IX-EEG Setup

Use the USB cable to connect the computer to the USB port on the IX-EEG.

Start the Software

1. Click on the LabScribe shortcut on the computer's desktop to open the program. If a shortcut is not available, click on the Windows Start menu, move the cursor to All Programs and then to the listing for iWorx. Select LabScribe from the iWorx submenu. The LabScribe Main window will appear as the program opens. There will be a message indicating that the computer has recognized the IX-EEG.
2. On the Main window, pull down the Settings menu and select Load Group.
3. Locate the folder that contains the settings group, IXEEG.iwxgrp. Select this group and click Open.
4. Pull down the Settings menu again. Select the GSR-A settings file from Human Psychophysiology.
5. After a short time, LabScribe will appear on the computer screen as configured by the GSR-A settings.
6. For your information, the settings used to configure the LabScribe software and the IX-EEG unit for this experiment are programmed on the Preferences Dialog window which can be viewed by selecting Preferences from the Edit menu on a Windows computer or the LabScribe menu on a Mac.
7. Once the settings file has been loaded, click the Experiment button on the toolbar to open any of the following documents:
 - Appendix
 - Background
 - Labs
 - Setup (opens automatically)

GSR Setup

1. Connect the GSR electrodes to the labeled sockets on the rear of the IX-EEG data recorder ([Figure HP-1-S1](#)). Connect the yellow color-coded electrode to the yellow connector on the IX-EEG and the blue electrode to the blue connector.



Figure HP-1-S1: IX-EEG connected to GSR electrodes.

Calibration of GSR Amplifier

1. Place the GRS electrodes on the lab bench so they are not touching any surfaces.
2. Click on the Record button; record data for 1 minute.
3. Click on the Stop button.
4. Set the baseline to zero:
 - Click the down arrow to the left of the GSR channel to open the Channel Menu.
 - Click Units
 - Click Set Offset ([Figure HP-1-S2](#))
 - Set the offset to 0 and check Apply to all blocks
 - Click OK.

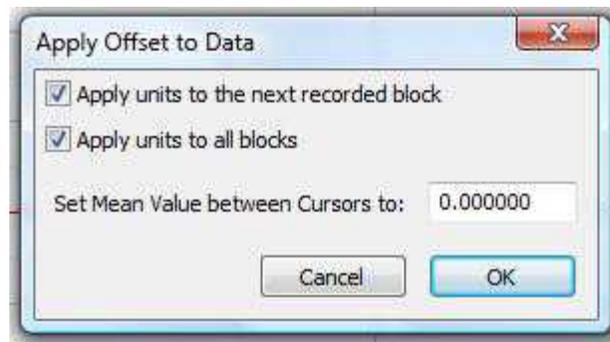


Figure HP-1-S2: Apply Offset window for setting the GSR unit to “0”.

Note: If the user clicks the Record button and an error window appears the Main window indicating the iWorx hardware cannot be found, make sure the IX-EEG is connected to the USB port of the computer. Then, click on the OK button in the error window. Pull down the LabScribe Tools menu, select the Find Hardware function, and follow the directions on the Find Hardware dialogue window.

Note: The IX-EEG galvanic skin response amplifier is factory calibrated so that an output of 1 Volt is equal to 1 microSiemen (μS). This calibration factor is programmed into the LabScribe recording software by the GSR-A settings file used in this experiment.

5. To check the programming of the calibration:

- Click on the arrow next to the title of the Skin Conductance Level channel to open the channel menu.
- Select Units from the channel menu and Simple from the Units submenu.
- The Simple Units Calibration window will appear with the values for the two-point calibration of the IX-EEG amplifier already entered.

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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.

Procedure

1. Select one person from your group to be the subject. Ask the subject to go to the sink, wash his or her 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.
2. Connect the GSR electrodes.
3. The subject should sit with his or her back to the computer monitor. Use the subject's hand which is closer to the iWorx equipment.
4. 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.
5. The subject should rest his or her 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.
6. Two measurements are performed in this exercise:
 - Tonic Skin Conductance Level: In this measurement, the subject sits quietly for one minute as his or her 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 he or she sits 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 respond: Yes. After the subject's SCL changes and then returns to the baseline, 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.
7. Type First Tonic SCL <Subject's Name> in the Mark box that is to the right of the Mark button.
8. Click on the Record button. Press the Enter key on the keyboard. Since the GSR amplifier was zeroed in the Calibration section of this exercise, the value displayed on the Skin Conductance Level channel is the tonic skin conductance level (SCL) of the subject ([Figure HP-1-L1](#)). This value should be between 2 and 20 μ Siemens. Record the subject's tonic SCL for one minute.

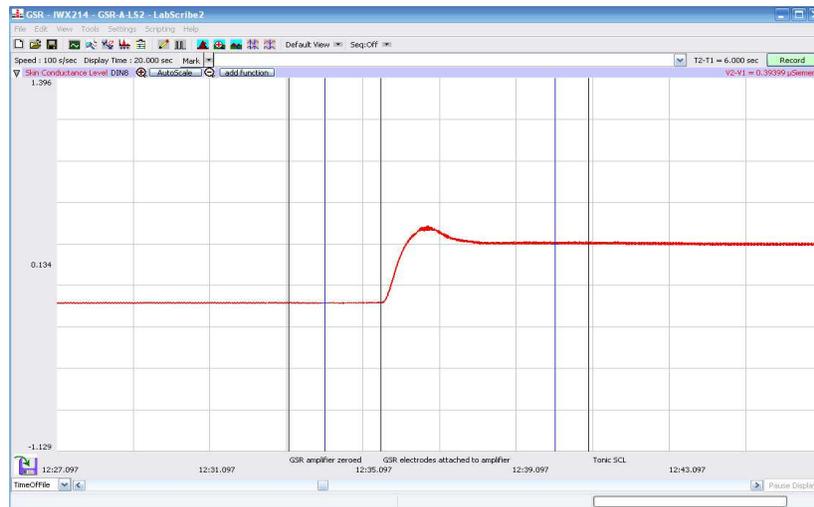


Figure HP-1-L1: The output of the GSR amplifier before and after the GSR electrodes, which are already on the fingers of the subject, were connected to the amplifier. The difference between the output of the amplifier before and after the connection of the electrodes is the tonic skin conductance level of the subject, which is 0.394 microSiemens (μS).

9. After recording the subject's tonic SCL, use the Offset Directions from page 4 of the Setup document to adjust baseline of the recording to zero.
10. Type Baseline <Subject's Name> in the Mark box and press the Enter key on the keyboard.
11. Type Is Your Name, <Subject's Name>? in the Mark box Press the Enter key on the keyboard as the subject is asked the question. Continue recording.
12. Type IYNX (Is Your Name, X?) in the Mark box. When the subject's tonic skin conductance level is response to the previous question has returned to the baseline, press the Enter key on the keyboard and ask the question again.
13. Repeat Step 11 until the subject shows no response to the question for three consecutive times. Click Stop to halt the recording.
14. Select Save As in the File menu, type a name for the file. Choose a destination on the computer in which to save the file, like your lab group folder. Designate the file type as *.iwxdata. Click on the Save button to save the data file.
15. 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).
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-1-L2](#)) to expand or contract the one minute recording to the width of the Main window.
3. Click on the Analysis window icon in the toolbar or select Analysis from the Windows menu to transfer the data displayed in the Main window to the Analysis window.

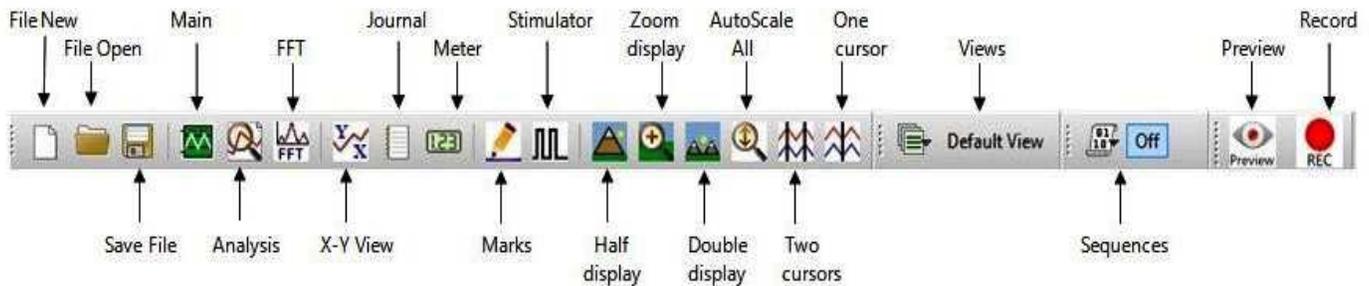


Figure HP-1-L2: The LabScribe toolbar.

4. Look at the Function Table that is above the Skin Conductance Level channel in the Analysis window. The mathematical function, Mean, should appear in this table. The value for mean tonic skin conductance level is displayed in the table across the top margin of the Skin Conductance Level channel.
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. 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.
8. Record the values in the Journal using the one of the techniques described in Steps 5 or 6.
9. Enter the value for the mean tonic skin conductance level for the subject in [Table HP-1-L1](#).

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 $0.05 \mu\text{S}$ are counted as spontaneous skin conduction responses. The SCL does not need to return to the baseline value before another response takes place.

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.
3. Enter the number of spontaneous skin conductance responses per minute for the subject in [Table HP-1-L1](#).

Data Analysis - Habituation

1. Click on the Main window icon to return to viewing the data on the Main window. 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 $0.05 \mu\text{S}$.

4. Enter the subject's habituation score in the Journal by typing the value directly into that window.
5. Enter the subject's habituation score in the table.
6. 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.

Table HP-1-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.

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 ([Table HP-1-L2](#)). 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 that is to the right of the Mark button. Click on the Record button. Press the Enter key on the keyboard. Record the subject's tonic skin conductance level for one minute. Continue recording.

Note: If the subject's tonic SCL has changed, use the offset directions to adjust the SCL value to zero.

4. Type NC1 (for Neutral Content Question 1) in the Mark box that is to the right of the Mark button. Press the Enter key on the keyboard 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. Press the Enter key on the keyboard to mark the recording as the subject is asked the next question with neutral content. Continue recording.
7. Repeat Steps 5 and 6 for the remaining eight questions in the list ([Table HP-1-L2](#)).
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 ([Figure HP-1-L2](#)) to expand or contract this section of the recording to the width of the Main window.

Table HP-1-L2: Neutral Content Questions

- | |
|--|
| <ol style="list-style-type: none">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 in the toolbar or select Analysis from the Windows menu to transfer the data displayed in the Main window to the Analysis window.
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 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.

6. Record the values for these functions in the Journal using the one of the techniques described in Exercise 1.
7. 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 HP-1-L3](#).
8. Repeat Steps 1 through 7 for the other nine neutral content questions in the list.

Table HP-1-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?				

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.

Procedure

1. The same subject that performed Exercise 2 should participate in this exercise.
2. If possible, keep the subject uninformed about the design and purpose of this exercise. However, this might not be possible if the subject read the manual before coming to class. 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 HP-1-L4](#) contains good examples of questions with emotional content.
6. Select seven new questions with neutral content. [Table HP-1-L5](#) 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 that is to the right of the Mark button. Click on the Record button. Press the Enter key on the keyboard. Record the subject's tonic skin conductance level for one minute. Continue recording.

Note: If the subject's tonic SCL has changed, use the offset directions to adjust the SCL value to zero.

Table HP-1-L4: Questions with Emotional Content

<ul style="list-style-type: none">• Are you in love?• Do you ever cry?• Does nudity embarrass you?• 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?"

Table HP-1-L5: 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. Press the Enter key on the keyboard 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. Press the Enter key on the keyboard 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.

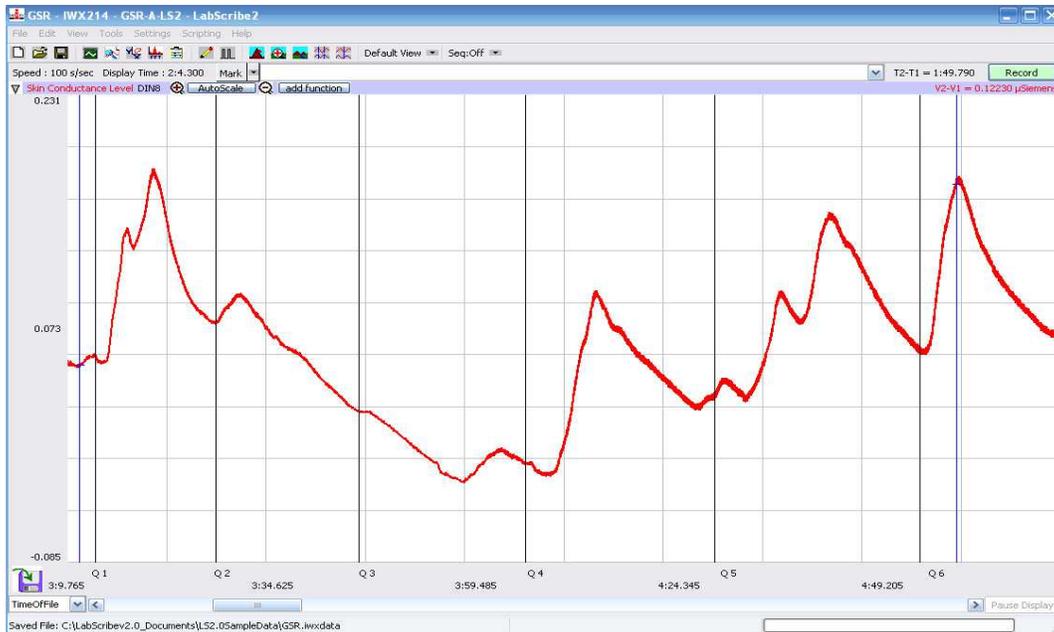


Figure HP-1-8: Skin conductance level of a subject responding to multiple questions.

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.
 - 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 HP-1-L6](#).
 - 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 on [Table HP-1-L6](#).

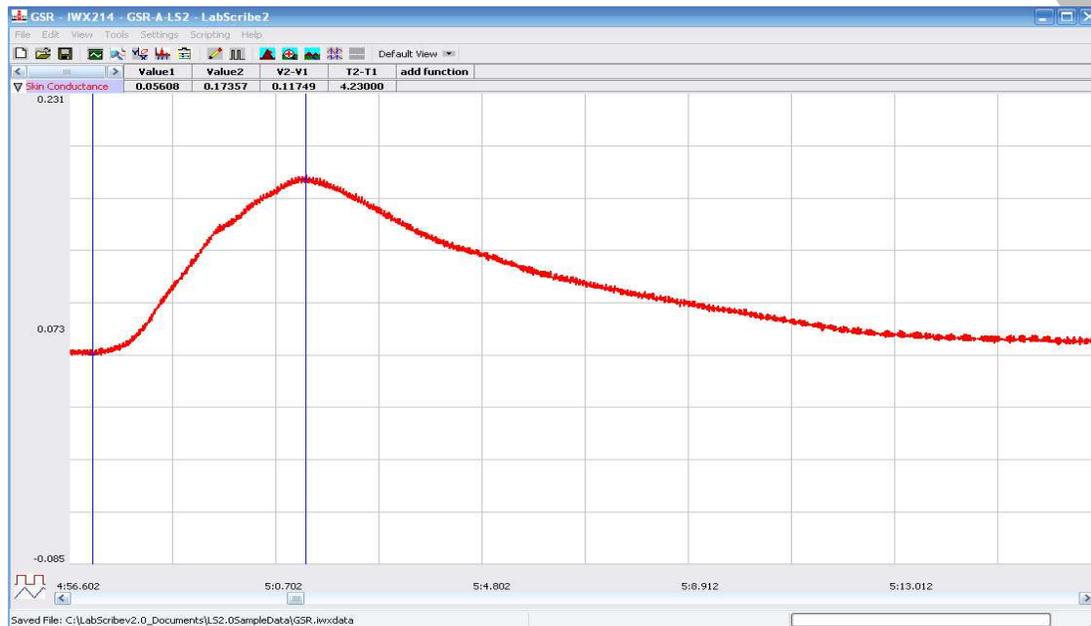


Figure HP-1-L3: Skin conductance level of a subject responding to an emotional question displayed in the Analysis window. The cursors are in positions to measure the baseline SCL ($V1$), the peak SCL ($V2$), the change in SCL ($V2-V1$), and the rise time ($T2-T1$).

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.

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-1-L6: Comparison of Skin Conductance Changes for Emotional and Neutral Content Questions.

Questions	Neutral (N) Emotional (E)	Baseline SCL (μ S)	Peak Response SCL (μ S)	Δ in SCL (μ S)	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				