

Experiment HP-3: The Galvanic Skin Response, Deception, Cognitive Complexity, and Vigilance

Background

This experiment contains four exercises that are a continuation of Experiment HP-2 and use changes in skin conductance to measure subjects' psychophysiological responses to additional tasks. In these exercises, you will:

- test an experimental hypothesis about deliberate deception, *guilty knowledge*, and the amplitude of the GSR;
- test an experimental hypothesis about cognitive complexity and the latency of the GSR;
- test an experimental hypothesis about personality, vigilance, and the lability of skin conductance levels.

Equipment Required

- PC Computer
- IWX/214 data acquisition unit
- USB cable
- IWX/214 power supply
- GSR-200 GSR amplifier, electrodes, and extension cable

IWX/214 Setup

- 1 Place the IWX/214 on the bench, close to the computer.
- 2 Check Figure T-1-1 in the Tutorial Chapter for the location of the USB port and the power socket on the IWX/214.
- 3 Check Figure T-1-2 in the Tutorial Chapter for a picture of the IWX/214 power supply.
- 4 Use the USB cable to connect the computer to the USB port on the rear panel of the IWX/214.
- 5 Plug the power supply for the IWX/214 into the electrical outlet. Insert the plug on the end of the power supply cable into the labeled socket on the rear of the IWX/214. Use the power switch to turn on the unit. Confirm that the red power light is on.

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.

- 1 On the **Main window**, pull down the **Settings menu** and select **Load Group**.
- 2 Locate the folder that contains the settings group, **IPLMv4.iwxgrp**. Select this group and click **Open**.
- 3 Pull down the **Settings menu** again. Select the **GSR-B-LS2** settings file.
- 4 After a short time, LabScribe will appear on the computer screen as configured by the **GSR-B-LS2** settings.
- 5 For your information, the settings used to configure the LabScribe software and the IWX/214 unit for this experiment are listed in Table HP-3-1 on page HP-3-1. These settings are programmed on the **Preferences Dialog window** which can be viewed by selecting **Preferences** from the **Edit menu** on the LabScribe Main window.

Table HP-3-1: Settings on the Channel Window of the Preferences Dialog Used to Configure the iWorx Recording System for Experiment HP-3.

Parameter	Units/Title	Setting	Mode/Function
Acquisition Mode		Chart	
Start		User	
Stop		User	
Display Time	Sec	10	
Speed	Samples/Sec	200	
Channel A4	Skin Conductance Level	✓	DIN8

GSR Setup

- 1 Locate the GSR-200 galvanic skin response amplifier, male-male DIN8 cable, and GSR electrodes (Figure HP-3-1 on page HP-3-1) in the iWorx kit.



Figure HP-3-1: The GSR-200 galvanic skin response amplifier.

- 2 Plug one end of the male-male DIN8 cable into the female DIN8 connector on the GSR-200 galvanic skin response amplifier. Plug the other end of the DIN8 cable into the Channel 4 input of the iWX/214 (Figure HP-3-2 on page HP-3-2)



Figure HP-3-2: The GSR-200 connected to an iWX214.

Calibration of GSR Amplifier

- 1 Position the baseline of the recording in the center of the **Skin Conductance Level channel** before attaching the electrodes to the amplifier:
 - Click on the **Save to Disk** button in the lower left corner of the **Main window** to switch the **LabScribe** software into **Preview mode**. When **LabScribe** is in **Preview mode**, there is a **red X** across the **Save to Disk** button. In **Preview mode**, the iWorx recording system works without recording data on the hard drive or any other storage media.
 - Click on the **Preview** button. Use the offset knob on the GSR amplifier to move the output voltage of the amplifier to zero.
 - Click on the **Stop** button.

Note: If the user clicks the **Preview** button and an error window appears the **Main window** indicating the iWorx hardware cannot be found, make sure the iWorx unit is turned on and 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 dialog window**

- 2 Before proceeding to the actual exercises, make sure the **LabScribe** software is set to **Record mode**. Click on the **Save to Disk** button, in the lower left corner of the **Main window**, to change **LabScribe** from **Preview** mode to **Record** mode. When **LabScribe** is in **Record** mode, there is a **green arrow** on the **Save to Disk** button.
- 3 The GSR-200 galvanic skin response amplifier is factory calibrated so that an output of 1 Volt is equal to 5 microSiemens (μS). This calibration factor is programmed into the LabScribe recording software by the **GSR-A-LS2** settings file used in this experiment. 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 GSR-200 amplifier already entered (Figure HP-3-3 on page HP-3-2).

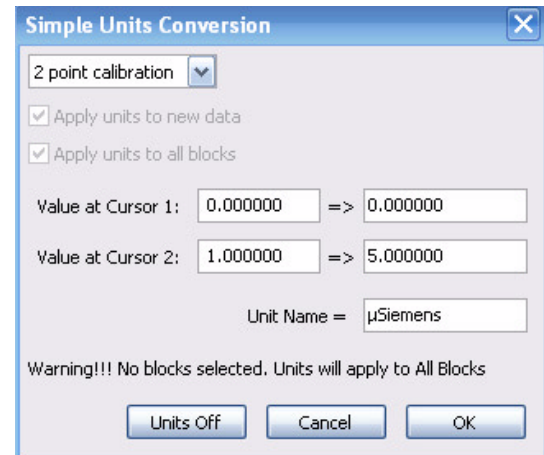


Figure HP-3-3: Simple Units Conversion window for GSR-200 amplifier.

Exercise 4: GSR and Deliberate Deception

Aim: To test an experimental hypothesis about deliberate deception and the amplitude of the GSR.

Procedure

- 1 Select a person from your group to be the subject. Select a person who was not the subject in Experiment HP-2.
- 2 Give the subject his or her own copy of the ten questions that will be asked in this exercise (Table HP-3-2 on page HP-3-3):
 - Ask the subject to select three questions from Questions 2 through 10. The subject should not tell other members of the group which questions were chosen.
 - When those three questions are asked, the subject will deliberately deceive the polygrapher(s).
 - In private, the subject should mark the three questions that he or she chose with a letter **D** for deception. The subject should place his or her marked copy of the questions in an opaque envelope before the beginning of the exercise.
- 3 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.
- 4 Connect the GSR electrodes to the BNC connector on the GSR-200 amplifier.
- 5 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.

- 6 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.
- 7 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.
- 8 Type **Tonic SCL** <Subject's Name> in the **Mark box** that is to the right of the **Mark** button.
- 9 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. This value should be between **2** and **20 μ Siemens**. Record the subject's tonic SCL for one minute. Continue recording.
- 10 After recording the subject's tonic SCL, use the offset knob on the GSR-200 amplifier to adjust baseline of the recording to zero. Type **Baseline** <Subject's Name> in the **Mark box**. Press the **Enter** key on the keyboard.
- 11 Type **Habituation** <Subject's Name> in the **Mark box**. Habituate the subject to the questioning paradigm:

- Ask the subject a neutral question: **Is your name, X?** (where X is the subject's real name). Press the **Enter** key on the keyboard. The subject should respond **Yes**.

- Ask the question again only after the subject's skin conductance level has returned to its baseline level. Mark the recording each time the question is asked.

- Continue to ask the subject the same question for five minutes. After the subject is habituated, click **Stop** to halt the recording.

- 12 Instruct the subject to sit quietly, and answer each question from the list in Table HP-3-2 on page HP-3-3 with either a **Yes** or a **No**. The subject should not elaborate on any answer.

- 13 Type **DDQ1** (for Deliberate Deception Question 1) in the **Mark box**. Press the **Enter** key on the keyboard as the subject is asked the first question. Continue recording.

- 14 Before asking the next question:

- Type the number of the next question, **DDQ2**, 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.

- 15 Press the **Enter** key on the keyboard to mark the recording as the subject is asked the next question. Continue recording.

- 16 Repeat Steps 14 and 15 for the remaining eight questions in the list, labeling each question as **DDQX**, where **X** is the number of the question.

- 17 When the subject's skin conductance response to the tenth question is completed, click **Stop** to halt the recording.

- 18 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.

Table HP-3-2: Questions for Deliberate Deception Task

- | |
|---|
| 1. Is your name, X? (X is the subject's real name.) |
| 2. Do you have a part-time job? |
| 3. Have you ever had a Spanish class? |
| 4. Do you have a roommate? |
| 5. Are you planning to go to graduate school? |
| 6. Have you ever gone backpacking? |
| 7. Do you like rainy days? |
| 8. Have you ever worked as a camp counselor? |
| 9. Do you study in the evenings? |
| 10. Do you enjoy classical music? |

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 deliberate deception 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-3-4 on page HP-3-3) to expand or contract this section of the recording to the width of the **Main window**.

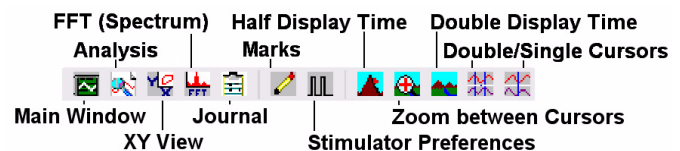


Figure HP-3-4: The LabScribe toolbar.

- 3 Click on the **Analysis window** icon in the toolbar (Figure HP-3-4 on page HP-3-3) or select **Analysis** from the **Windows** menu to transfer the data displayed in the **Main window** to the **Analysis window** (Figure HP-3-5 on page HP-3-4).

- 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**.

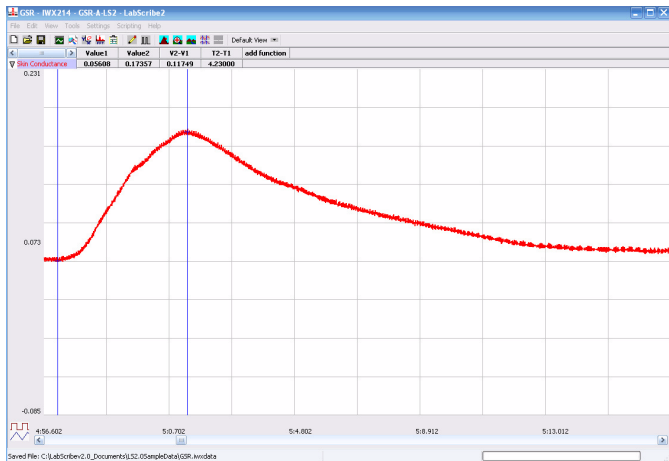


Figure HP-3-5: Skin conductance level of a subject responding to a question displayed in the Analysis window. The cursors are in positions to measure the baseline SCL (V1), the peak SCL (V2), the change in SCL (V2-V1), and the rise time (T@-T1).

- 5 Once the cursors are placed in the correct positions for determining the skin conductance levels and rise time in the subject's response, the values for the parameters in the function table can be recorded in the on-line notebook of **LabScribe** by typing the names and values of the parameters directly into the **Journal**.

- 6 The functions in the **right-click 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 skin conductance levels and rise time.

- Transfer the names of the parameters to the **Journal** using the **Add Title to Journal** function in the **Skin Conductance Level channel menu**.

- Transfer the values for the parameters 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 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.

- Record the values in the **Journal** using the one of the techniques described in Steps 5 or 6.
- Enter the values for the parameters for the subject's response to Question 1 in Table HP-3-3 on page HP-3-5.
- Repeat Steps 1 through 9 for the other nine deliberate deception questions in the list.
- Determine the mean change in SCL and the mean rise time of the peak response for the three deceptive questions. Also, determine the mean change in SCL and the mean rise time of the peak response for the seven honest questions. Enter these means on Table HP-3-3 on page HP-3-5.
- Compare the mean change in SCL and the mean rise time of the peak response for the deceptive questions to those of the honest questions. It is expected that the mean change in SCL is greater and the mean rise time is shorter for the deceptive questions than for the honest questions.

Exercise 5: GSR and Guilty Knowledge

Aim: To test an experimental hypothesis about *guilty knowledge* and the amplitude of the GSR using *The Guilty Knowledge Test*.

There are many versions of *The Guilty Knowledge Test*. There are common factors in all versions of this test:

- All versions use a polygraph
- The person being tested is knowledgeable about some fact;
- The person being tested is concealing or failing to disclose that knowledge, when asked.

Procedure

- Select two new subjects. During this exercise, each subject will silently read a different scenario about the same hypothetical crime.

- Each scenario will be sealed in its own envelope labeled **A** or **B**. A third sealed envelope labeled **Terms** contains *target terms*.
- Each lab group will receive a set of 3 envelopes. Give the

envelope labeled A to one of the subjects, the envelope labeled B to the other subject, and the third envelope will be kept by the other students in the lab group.

Table HP-3-3: Comparison of Skin Conductance Changes for Honest and Deliberate Deception Questions.

Questions	Deceptive (D) or Honest (H)	Baseline SCL (μS)	Peak Response SCL (μS)	Δ in SCL (μS)	Peak Response Rise Time (seconds)
1.	H				
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
Means for 7 Honest Questions	H				
Means for 3 Deceptive Questions	D				

- Each subject should read the contents of his or her envelope in private, and not share the information in the press release with each other or the rest of the group. One envelope contains a press release (Table HP-3-5 on page HP-3-6) that: describes the murder scene in detail; notes that the police have failed to identify the cause of death or the murder weapon; and, states that all the objects at the murder scene have been ruled out as the murder weapon. The other envelope contains the same press release, with an additional release that identifies the cause of death and the murder weapon (Table HP-3-6 on page HP-3-7).
- Toss a coin to select the subject who goes first. Ask the other subject to leave the room until called.
- Position the baseline of the recording in the center of the **Skin Conductance Level channel** before attaching the electrodes to the amplifier:
 - Click on the **Save to Disk** button in the lower left corner of the **Main window** to switch the LabScribe software into **Preview mode**. When LabScribe is in **Preview mode**, there is a **red X** across the **Save to Disk** button. In **Preview mode**, the iWorx recording system works without recording data on the hard drive or any other storage media.
 - Click on the **Preview** button. Use the offset knob on the GSR amplifier to move the output voltage of the amplifier to zero.
 - Click on the **Stop** button.
- Before proceeding to the actual exercises, make sure the LabScribe software is set to **Record mode**. Click on the

Save to Disk button, in the lower left corner of the **Main window**, to change LabScribe from **Preview mode** to **Record mode**. When LabScribe is in **Record mode**, there is a **green arrow** on the **Save to Disk** button.

- Attach the GSR electrodes to the GSR amplifier and to the first subject.
- Type **<Subject's Name> Subject 1 Tonic SCL** 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. Since the GSR amplifier was zeroed in Step 6, the value displayed on the **Skin Conductance Level channel** is the tonic skin conductance level (SCL) of the subject. This value should be between **2** and **20 $\mu\text{Siemens}$** . Record the subject's tonic SCL for one minute. Continue recording.
- After recording the subject's tonic SCL, use the offset knob on the GSR-200 amplifier to adjust baseline of the recording to zero. Type **Baseline <Subject's Name>** in the **Mark box**. Press the **Enter key** on the keyboard.
- Type **Habituation <Subject's Name>** in the **Mark box**. Habituate the subject to the questioning paradigm:
 - Ask the subject a neutral question: **Is your name, X?** (where X is the subject's real name). Press the **Enter key** on the keyboard. The subject should respond **Yes**.
 - Ask the question again only after the subject's skin conductance level has returned to its baseline level. Mark the recording each time the question is asked.

- Continue to ask the subject the same question for five minutes. After the subject is habituated, click **Stop** to halt the recording.

13 Instruct the subject to sit quietly, and answer each question with a **No**. The subject should not elaborate on any answer. The questions are asked in the format:

Was the _____ a murder weapon?

Each time the question is asked, insert the name of a different possible weapon in the blank in the question. The ten possible murder weapons are listed in Table HP-3-4 on page HP-3-6.

14 Type **S1Q1** (for Subject 1, Question 1) in the **Mark box**.

15 Click **Record** and press the **Enter key** on the keyboard as the first question is asked. Continue recording.

16 Before asking the next question:

- Type the number of the next question, **S1Q2**, 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.

17 Press the **Enter** key on the keyboard to mark the recording as the subject is asked the next question. Continue recording.

18 Repeat Steps 16 and 17 for the remaining eight questions in the list, labeling each question as **S1QX**, where **X** is the number of the question.

19 When the subject's skin conductance response to the tenth question is completed, click **Stop** to halt the recording.

20 Select **Save** in the **File** menu

21 Disconnect the first subject from the GSR electrode wires.

22 Ask the first subject to leave the room.

23 Ask the second subject to enter the room.

24 Repeat Steps 6 through 20 for the second subject ("S2").

Table HP-3-4: Ten Possible Murder Weapons for the Scenarios presented in *The Guilty Knowledge Test*.

1. cushion	2. hand	3. bird	4. tea	5. brain
6. vase	7. gun	8. spider	9. lamp	10. knife

Table HP-3-5: The Murder Scenario Read by the Naive Subject.

Mr. Richards arrived at the law firm of Richards and Adams one morning to find Mr. Adams dead on the floor. There was some blood on his head as a sign of a possible head injury. A table was tipped over spilling a tea cup and its contents on the floor and a lamp and vase from the table were broken and on the floor by the table. A cushion from the couch had been pulled to the floor by Mr. Adams' hand as he fell. Mr. Adams' gun was still in its locked drawer untouched as was his pen knife (which he often used as a letter opener) on his desk. The file cabinet top drawer was open and the contents of several folders were scattered on the floor. Interestingly, his pet parakeet was flying wildly around the room and its cage door was ajar and must have been for a long time as a spider had constructed a web to catch flies across the opening.

The police have not been able to determine the murder weapon or the cause of death as yet. An autopsy is pending. The head injury was slight and probably due to the fall. It was not likely to have resulted in death. The police are baffled over the cause of Mr. Adams' death and the exact murder weapon.

Analysis

1 Scroll through the data file and locate the recording of the first subject's skin conductance response to the first question, **S1Q1**, in *The Guilty Knowledge Test*.

2 Use the same procedures used in Exercise 4 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 4.
- 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-3-7 on

- page HP-3-7.
- 5 Repeat Steps 1 through 4 for the other nine questions asked of the first subject.
- 6 Repeat Steps 1 through 5 for the second subject.

Table HP-3-6: The Murder Scenario Read by the Knowledgeable Subject.

Mr. Richards arrived at the law firm of Richards and Adams one morning to find Mr. Adams dead on the floor. There was some blood on his head as a sign of a possible head injury. A table was tipped over spilling a tea cup and its contents on the floor and a lamp and vase from the table were broken and on the floor by the table. A cushion from the couch had been pulled to the floor by Mr. Adams' hand as he fell. Mr. Adams' gun was still in its locked drawer untouched as was his pen knife (which he often used as a letter opener) on his desk. The file cabinet top drawer was open and the contents of several folders were scattered on the floor. Interestingly, his pet parakeet was flying wildly around the room and its cage door was ajar and must have been for a long time as a spider had constructed a web to catch flies across the opening.

The police have not been able to determine the murder weapon or the cause of death as yet. An autopsy is pending. The head injury was slight and probably due to the fall. It was not likely to have resulted in death. The police are baffled over the cause of Mr. Adams' death and the exact murder weapon.

Unknown to everyone but Mr. Adams' psychiatrist is the fact that Mr. Adams was arachnophobic and had an intense and unreasonable fear of spiders. Mr. Adams was working late the night of the accident and needed a particular file from the cabinet. As he opened the file a large spider crawled from the file cabinet onto his arm. Mr. Adams's sudden and overwhelming panic attack caused by his fear of spiders sent a flood of brain signals from the medulla to the heart via the sympathetic nervous system, literally stopping his heart. Mr. Adams experienced "sudden adult death syndrome" from his excessive brain response to the spider.

As he fell to the floor dropping the files, the table overturned spilling the tea cup and its contents on the floor. He hit his head on the table and grabbed the couch cushion with his hand as he fell. The lamp and vase also fell to the floor and broke. The bird was out of its cage because Mr. Adams often let the bird fly free when he was in the office alone at night, although he never let Mr. Richards know of this.

Table HP-3-7: Comparison of Skin Conductance Changes for Subjects that are Naive or have Knowledge of Guilt.

N=Naive K=Knowledge	S1: N or K	Baseline SCL (µS)		Peak Response SCL (µS)		Δ in SCL (µS)		Peak Response Rise Time (seconds)	
	S2: N or K	S1	S2	S1	S2	S1	S2	S1	S2
Terms	Target (T) or Not (N)	S1	S2	S1	S2	S1	S2	S1	S2
1. cushion									
2. hand									
3. bird									
4. tea									
5. brain									
6. vase									
7. gun									
8. spider									
9. lamp									
10. knife.									
Means for T	T								
Means for N	N								

Hypotheses for The G-K Test

Hypothesis 1: The mean skin responses of the knowledgeable subject to the two target terms (possible weapons) will be greater than that subject's responses to the non-target terms.

Hypothesis 2: The mean skin responses of the naive subject to the two target terms (possible weapons) will be no greater than that subject's responses to the non-target terms.

- 1 Open the third envelope and find out which terms are the *target terms*. Label the two *target terms* on the table (Table HP-3-7 on page HP-3-7).
- 2 All members of the lab group can now read the press releases read by Subjects 1 and 2. Identify the naive (N) and the knowledgeable (K) on the table (Table HP-3-7 on page HP-3-7).
- 3 Determine the mean change in SCL and the mean rise time of the peak response for the target and non-target questions for both subjects. Enter these means on Table HP-3-7 on page HP-3-7.
- 4 Is the mean change in SCL greater and the mean rise time of the peak response shorter for the target terms than for the non-target terms in the knowledgeable subject?
- 5 Is there any significant difference between the mean change in SCL and the mean rise time of the peak response for the target terms and those values for the non-target terms in the naive subject?
- 6 Does your data support the two hypotheses listed above?

Exercise 6: Cognitive and Emotional Complexity

Aim: To demonstrate how cognitive and emotional complexity of a task influences the latency of skin responses.

Sometimes, words, phrases, and even gestures evoke multiple associations in memory because of a person's unique history or life experiences

For example, the letters "id" for one person may be associated with an identification number, such as a PIN or a social security number. For a second person, it may bring an association with Freudian terminology for the personality, the Id. For a third person, it may evoke associations of personal tattoos in the Nazi concentration camps, or the "dog tags" worn by soldiers.

Procedure

- 1 Select a new subject for this exercise. Ideally, it should be a person who has not read the lab exercise and is naive to the purpose of the exercise.

- 2 Position the baseline of the recording in the center of the **Skin Conductance Level channel** before attaching the electrodes to the amplifier:

- Click on the **Save to Disk** button in the lower left corner of the **Main window** to switch the LabScribe software into **Preview mode**. When LabScribe is in **Preview mode**, there is a **red X** across the **Save to Disk** button. In **Preview mode**, the iWorx recording system works without recording data on the hard drive or any other storage media.

- Click on the **Preview** button. Use the offset knob on the GSR amplifier to move the output voltage of the amplifier to zero.

- Click on the **Stop** button.

- 3 Before proceeding to the actual exercises, make sure the LabScribe software is set to **Record mode**. Click on the **Save to Disk** button, in the lower left corner of the **Main window**, to change LabScribe from **Preview mode** to **Record mode**. When LabScribe is in **Record mode**, there is a **green arrow** on the **Save to Disk** button.

- 4 Attach the GSR electrodes to the GSR amplifier and to the subject.

- 5 The task in this exercise involves word associations:

- There should be no noise in the room during this experiment. No one should make comments while observing the experiment. Laughter, whispering, and other extraneous comments can influence the subject's skin conductance dramatically.

- A prompt word will be spoken to the subject. The words on the list (Table HP-3-8 on page HP-3-8) should be spoken in sequence.

- Select a person in your lab group to type the word in the Mark box on the recording window. Select second person to speak the word at the same time he or she presses the **Enter** key on the keyboard to mark the recording.

- The subject will respond by saying aloud the first word which comes to his or her mind. The verbal response does not need to be recorded in the **Journal**, but you may want to write down the response for your records.

- Only the subject's skin conductance responses to the prompt words need to be recorded.

Table HP-3-8: Word List for Cognitive and Emotional Complexity Task.

- | |
|-----------|
| 1. pencil |
| 2. book |
| 3. car |
| 4. joint |
| 5. house |
| 6. coke |
| 7. table |
| 8. cup |
| 9. crank |
| 10. tree |

- 6 Type **<Subject's Name> Tonic SCL** in the **Mark box** that is to the right of the **Mark** button.
- 7 Click on the **Record** button. Press the **Enter** key on the keyboard. Since the GSR amplifier was zeroed in Step 3, the value displayed on the **Skin Conductance Level channel** is the tonic skin conductance level (SCL) of the subject. This value should be between **2** and **20 μ Siemens**. Record the subject's tonic SCL for one minute. Continue recording.
- 8 After recording the subject's tonic SCL, use the offset knob on the GSR-200 amplifier to adjust baseline of the recording to zero. Type **Baseline <Subject's Name>** in the **Mark box**. Press the **Enter key** on the keyboard. Record for the subject's baseline SCL for two minutes. Click **Stop** to halt the recording.
- 9 Instruct the subject to sit quietly. Habituate the subject to the questioning paradigm by asking neutral questions for five minutes. You do not need to record this habituation task.
- 10 Once the habituation is completed, begin the association task. Type the word **Pencil** in the **Mark box**. Click **Record**. Press the **Enter** key on the keyboard as the word **Pencil** is spoken. Continue recording.
- 11 Before speaking the next word:
 - Type the word, **Book**, in the **Mark box**.
 - Wait for the subject's skin conductance level to return to the baseline level before speaking the next word.
 - Wait for any spontaneous skin responses to return to their baseline frequency before speaking the next word.
- 12 Press the **Enter** key on the keyboard to mark the recording as the next word is spoken. Continue recording.
- 13 Repeat Steps 11 and 12 for the remaining eight words in the list, labeling the beginning of each trial with a mark containing the word.
- 14 When the subject's skin conductance response to the tenth word is completed, click **Stop** to halt the recording.
- 15 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.

Analysis

- 1 Scroll through the data file and locate the recording of the subject's skin conductance response to the first word in the list.
- 2 Use the same procedures used in Exercises 4 and 5 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 prompt word was given. 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 prompt word was given. 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 prompt word. 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 prompt word being given and the peak response of the subject to the word. 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 4.
- 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 prompt word in Table HP-3-9 on page HP-3-10.
- 5 On the **Analysis window**, keep one cursor at the time that the prompt word was spoken. Move the other cursor from the peak of the subject's skin conductance response to the onset of that response. The value for **T2-T1** for the cursors in these positions is the latency of the subject's response to the spoken word.
- 6 Record the value for the latency of the response to this prompt word in the **Journal** using the one of the techniques described in Exercise 4. Also, enter this value in Table HP-3-9 on page HP-3-10.
- 7 Repeat Steps 1 through 6 for the subject's skin responses to the other nine prompt words.
- 8 Determine the mean change in SCL, mean rise time of the peak response, and mean latency of the three target words, and of the seven neutral words. Enter these means on Table HP-3-9 on page HP-3-10

Table HP-3-9: Comparison of Skin Conductance Changes for Words spoken in the Cognitive and Emotional Complexity Task.

Words	Target (T) or Neutral (N)	Beginning SCL (μ S)	Maximum SCL (μ S)	Δ in SCL (μ S)	Latency (seconds)	Rise Time (seconds)
1. Pencil	N					
2. Book	N					
3. Car	N					
4. Joint	T					
5. House	N					
6. Coke	T					
7. Table	N					
8. Cup	N					
9. Crank	T					
10. Tree	N					
Means - Neutral Words	N					
Means - Target Words	T					

Hypothesis

Hypothesis: The mean latency of the responses to the three target words is greater than the mean latency of the seven neutral words.

The assumption is that most persons have had some exposure to drug-related terms via public media, education, or personal experience, and this experience will enable multiple associations to these terms when they are heard. Some of these multiple associations may or may not be emotional in nature. Words with multiple associations without emotional significance may also cause GSR responses with longer latencies.

- 1 Compare the mean latency for the target words to that for the neutral words.
- 2 Does your data support the hypothesis?
- 3 How do the mean change in SCL and the mean rise time of the peak response for the target words compare to the same parameters for the neutral words?

Exercise 7: Personality, Vigilance, and the Lability of SCL

Aim: To test the hypothesis that persons with greater lability in skin conductance have greater vigilance decrements and are less vigilant than persons with less lability in skin conductance. Researchers have identified a link between the trait of skin conductance lability and that of vigilance (Shell, et al., 1988).

All subjects who participated in Exercise 1 of *Experiment HP-2: The Galvanic Skin Response (GSR) and Emotion* should take the following **Vigilance Test**.

Procedure

- 1 To test the relationship between the vigilance of a subject and the lability of the subject's skin conductance response, each subject performs a ten-minute **vigilance test** with the following components:
 - When told to begin, the subject scans a printed page and highlights, with a marker, all the occurrences of consecutive vowels.
 - At the end of five minutes, the subject is told to stop scanning and highlighting, and to draw a line on the page to mark his or her progress.
 - In the remaining five minutes of the test period, the subject scans and highlights consecutive vowels on the second page of the test.
 - At the end of the second five minute period of the test, the subject is told to stop scanning and highlighting, and to draw a line on the page to mark his or her progress.
 - Score the test for the following parameters:
 - The percent correct for the total possible chances in the complete test;
 - The percent correct for the total possible chances on first page;
 - The percent correct for the total possible chances on the second page.

2 Calculate the subject's vigilance decrement score by subtracting the percent correct for the first page from the percent correct for the second page. A positive vigilance decrement score indicates an improvement in performance, rather than a decrement.

3 The remainder of this exercise is completed using data recorded when the subjects performed Exercise 1 of *Experiment HP-2: The Galvanic Skin Response (GSR) and Emotion* and reported on the class data sheet. Make sure you obtain a copy of the class data sheet containing the information needed to complete this exercise.

4 The information compiled on a class data sheet includes:

- The **number of spontaneous skin responses per minute** for each member of the class tested in Exercise 1 of *Experiment HP-2: The Galvanic Skin Response (GSR) and Emotion*. This parameter is considered to be one of the independent variables in the exercise.

- The **habituation score** for each member of the class tested in Exercise 1 of *Experiment HP-2: The Galvanic Skin Response (GSR) and Emotion*. This parameter is also an independent variable.

- The **vigilance and decrement scores** for each member of the class who participated in Exercise 1 of *Experiment HP-2: The Galvanic Skin Response (GSR) and Emotion*. The vigilance and decrement scores are the dependent variables in this analysis.

5 Divide the subjects in the class into two groups based on the number of spontaneous skin conductance responses per minute. Use a median split to place the subjects with the number of spontaneous skin conductance per minute that is

below the median in the low lability group; subjects with a number of spontaneous skin conductance per minute that is above the median in the high lability group.

6 Also, divide the subjects in the class into two groups based on habituation scores. Use a median split to place the subjects with the number of trials before habituation that is below the median in the low lability group; subjects with the number of trials before habituation above the median in the high lability group.

7 Calculate the mean vigilance and decrement scores for the four lability groups and enter the values in Table HP-3-10 on page HP-3-11.

Hypothesis

Hypothesis: Persons with greater lability in skin conductance (high spontaneous response frequency, high habituation score) have greater vigilance decrements and are less vigilant than persons with less lability in skin conductance.

1 Compare the mean vigilance (mean percent correct in the complete test) and vigilance decrement (or improvement) scores for the high spontaneous response group to those of the low spontaneous group.

2 Compare the mean vigilance (mean percent correct in the complete test) and vigilance decrement (or improvement) scores for the high habituation score group to those of the low habituation score group.

3 Do these comparisons support the hypothesis?

Table HP-3-10: Mean Vigilance Scores for High and Low Lability Groups

Vigilance and Decrement Scores	Spontaneous Response/Minute		Habituation Score	
	Low Number (Low Lability)	High Number (High Lability)	Low Number (Low Lability)	High Number (High Lability)
Mean Percent Correct of Total Possible Chances in the Complete Test				
Mean Percent Correct from Total Possible Chances on the First Page of the Test				
Mean Percent Correct from Total Possible Chances on the Second Page of the Test				
Mean Improvement (+)/Decrement (-) Score Mean % Correct (Page 2) - Mean % Correct (Page 1)				

References

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