

Experiment HP-4: Skin Temperature, Stress, Calming, and Embarrassment

Background

It may seem odd that a psychologist would be interested in the study of skin temperature. However, events which take place in the brain influence skin temperature, just like they influence other characteristics that you have studied. A peripheral response, like a change in skin temperature, can be used as an indicator of brain activity, state of mind, or psychological state. Skin temperature depends on three types of factors:

- environmental conditions (clothing, environmental temperature, humidity, and circulation of air);
- individual variables such as genetics, gender, and health;
- cognitive/emotional or psychological states.

When the environmental and individual factors are controlled or held constant, skin temperature can still vary between 1 and 2 °F, due to variation in a subject's cognitive/emotional or psychological states.

Temperature Regulation

The folk adage “cold hands, warm heart” is based on a fundamental principle of temperature regulation: *peripheral vasoconstriction* (cold hands) is generally accompanied by *central vasodilation* (warm heart). Blood vessels are composed of smooth muscle cells which are innervated by neurons of the autonomic nervous system (ANS). Neurons in the sympathetic branch of the ANS release norepinephrine, which causes vascular muscle cells to contract and constrict the flow of blood. Neurons in the parasympathetic branch of the ANS release acetylcholine, which causes vascular muscle cells to dilate and enhance the flow of blood. The shunting of blood within the body is useful in regulating body temperature and meeting the demands of organs in need of energy and oxygen.

Cells that are sensitive to temperature, and respond to changes in blood temperature in order to maintain a homeostatic body temperature, are located in the hypothalamus. A decrease in blood temperature causes the generation of signals from the hypothalamus. These signals move through the autonomic nervous system to cause peripheral vasoconstriction. Vasoconstriction of the peripheral circulation shunts blood to the interior of the body to keep the body warm. These signals also trigger other responses aimed at generating or conserving body heat, like shivering. In contrast, an increase in blood temperature brings about peripheral

vasodilation. Peripheral vasodilation increases blood flow to the skin. This response, along with sweating, cools the surface of the body and reduces the blood temperature.

Individual Differences

If the environment is constant, individual differences in skin temperature are attributed to genetics, the presence and distribution of adipose (fat) tissue, gender, and health factors. In general, females have a lower skin temperature than males probably due to the presence of cutaneous adipose tissue and lower basal metabolic rates. Persons who are very thin or undernourished, like women with Anorexia Nervosa, have very low skin temperatures in an adaptive effort to preserve body energy. Beyond the obvious effect of infection on elevating body temperature, a person's state of health can be a factor influencing skin temperature. For example, diabetics often have reduced peripheral circulation and lowered skin temperature, particularly at the extremities. Another example is Raynaud's Disease; persons with this disease have extremities that are excessively cold due to insufficient blood supply.

Psychological States

Individual cognitive and emotional psychological states will cause changes in skin temperature. For example, events that activate the sympathetic nervous system, and lead to a stress response, will cause a reduction in skin temperature by a reduction in peripheral circulation. In animals, survival often depends on greater muscular and cardiovascular activity; in these cases, blood is shunted to the organs that need more oxygen. In humans, the stress response that is activated by any threat to one's life or self worth can lead to a collection of physiological responses: lowered skin temperature, increased heart rate and breathing, increased brain activity, increased muscle tension. This is known as the “Fight or Flight” response. Physiological responses are often accompanied with changes in psychological state, like the subjective feeling of anxiety. The opposite events occur when the stressful situation passes. Parasympathetic activation returns blood flow to the periphery, increases peripheral skin temperature, and makes the person relaxed.

Blushing is a localized parasympathetic activation that is a paradox. When someone is embarrassed or attention is drawn to them by others, the person experiences increased blood flow to the cheeks and to the chest and throat region. The opposite would seem logical since it seems that embarrassment would be a stressful trigger of sympathetic activity. The social significance and the adaptive value of blushing are not known,

but some researchers speculate that blushing engenders empathy from others. Leary and Meadows (1991) found that blushing correlates most strongly with measures that reflect concerns with how one is regarded by others. Blushing correlates highly with *embarrassability* and according to Shearn, et al. (1990) females tend to blush more than males.

Thermal Biofeedback

A biofeedback paradigm for the treatment of migraine headaches uses changes in skin temperature as a measure of response to the treatment. The school of thought is that migraines are vascular headaches that are a result of vasoconstriction and vasodilation in the brain. The implication of this theory is that migraine headaches can be averted or diminished if persons suffering from migraines can learn to regulate blood flow. This treatment approach has demonstrated mixed success; many theorists believe that relaxation is the most successful ingredient, rather than blood flow control. Other theorists believe migraine headaches are caused by the release of neurotransmitters in the brain, so these headaches are considered neural rather than vascular. Skin temperature biofeedback can still be useful for learning how to relax and reduce the stress response.

Biofeedback is really an operant learning paradigm. A person generates a response (usually mental imagery) and the physiological outcome is monitored (feedback-reinforcement/punishment). The feedback influences the mental imagery; the person continues the mental imagery because it is successful or changes the imagery to something that will bring success, like the attainment of the desired goal. Through this type of training, a person can learn to modify some aspects of both voluntary (muscle tension, EEG) and autonomic activity (heart rate, skin conductance, skin temperature, stomach acid), even though the autonomic nervous system was once thought to be outside conscious control.

Biofeedback technology has been useful for persons with high levels of anxiety. Counselors or therapists, who use biofeedback technology, receive advanced training in this technique and are usually certified for its use.

In this experiment, students will perform a set of exercises that will:

- measure baseline skin temperature and record the data;
- measure changes in skin temperature during a mild psychosocial stressor (mental arithmetic);

- measure the effect of calming mental imagery in a biofeedback paradigm on skin temperature;
- test an experimental hypothesis about embarrassability, blushing, and gender.

Equipment Required

PC Computer

IWX/214 data acquisition unit

USB cable

IWX/214 power supply

TM-100 Temperature probe

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 **SkinTemp-LS2** settings file.
- 4 After a short time, LabScribe will appear on the computer screen as configured by the **SkinTemp-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-4-1 on page HP-4-3. 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-4-1: Settings on the Channel Window of the Preferences Dialog Used to Configure the iWorx Recording System for Experiment HP-4.

Parameter	Units/Title	Setting	Mode/Function
Acquisition Mode		Chart	
Start		User	
Stop		User	
Display Time	Sec	10	
Speed	Samples/Sec	200	
Channel A3	Temperature	✓	DIN8
Channel A4	Skin Conductance Level	✓	DIN8

Temperature Probe Setup

- 1 Locate the TM-100 temperature probe (Figure HP-4-1 on page HP-4-3) and the GSR-200 galvanic skin response amplifier, male-male DIN8 cable, and GSR electrodes (Figure HP-4-6 on page HP-4-7) in the iWorx kit.



Figure HP-4-1: The TM-100 temperature probe.



Figure HP-4-2: The TM-100 temperature probe connected to an IW214.

- 2 Plug the DIN8 connector on the TM-100 temperature probe into the Channel 3 input on the IWX/214 (Figure HP-4-2 on page HP-4-3).
- 3 The GSR-200 galvanic skin response amplifier will be connected to the IWX/214 at the beginning of Exercise 4.

Calibration of Temperature Probe

- 1 Prepare two beakers of water, one at 10°C, and the other at 40°C. Measure the temperature of the cold water with a thermometer just before the TM-100 temperature probe is placed in the beaker.
- 2 Place the tip of the TM-100 temperature probe in the center of the beaker of cold water.
- 3 Type **Calibration at <ColdWaterTemperature>** in the **Mark box** to the right of the **Mark button** on the **LabScribe Main window**.
- 4 Click **Record**. The output of the TM-100 temperature probe on the **Temperature channel** should reach a stable level about twenty seconds after the probe was placed in the cold water. Press the **Enter** key on the keyboard to mark the recording. Continue recording.
- 5 Measure the temperature of the warm water with a thermometer just before the TM-100 temperature probe is placed in the beaker.
- 6 Type **Calibration at <WarmWaterTemperature>** in the **Mark box**.
- 7 While recording the output of the TM-100 temperature probe, move the tip of the probe from cold to warm water.
- 8 The output of the TM-100 temperature probe on the **Temperature channel** should reach a stable level about twenty seconds after the probe was placed in the warm water. Press the **Enter** key on the keyboard to mark the recording.
- 9 Click **Stop** to halt the recording.
- 10 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.

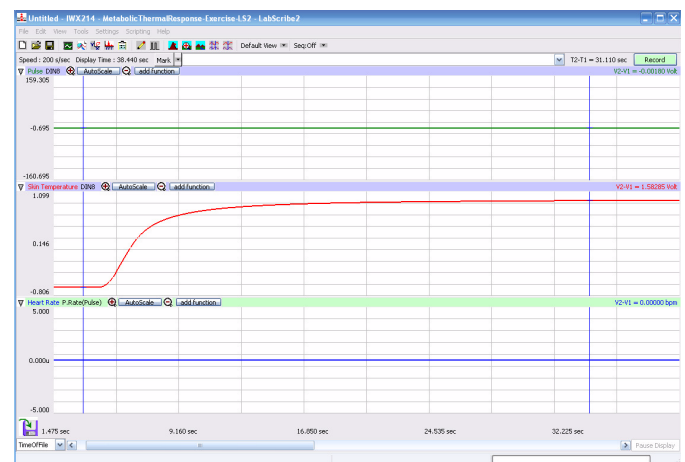


Figure HP-4-3: Recording of TM-100 output used for its calibration.

11 Use the **Display Time** icons to adjust the **Display Time** of the **Main window** to display the data needed to calibrate the TM-100 probe on the same **Main window** (Figure HP-4-3 on page HP-4-3). This section of data can also be selected by:

- Placing the one cursor to the left of the mark that identifies the output of the TM-100 probe at the first temperature.
- Placing the other cursor to the right of the mark that identifies the output of the probe at the second temperature
- Clicking the **Zoom between Cursors** button on the **LabScribe** toolbar (Figure HP-4-4 on page HP-4-4) to expand or contract the time between the cursors to the width of the **Main window**.

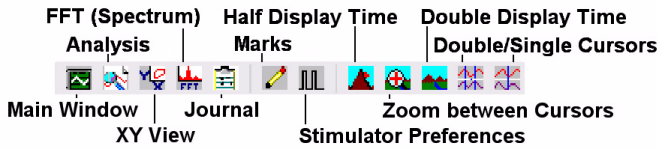


Figure HP-4-4: The **LabScribe** toolbar.

12 To convert the output of the TM-100 temperature probe at the measured temperatures:

- Place the cursors on the marks that identify the temperatures used in the calibration of the TM-100:
- Click on the arrow next to the title of the **Skin Temperature 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 voltages at the positions of the two cursors already entered on the window (Figure HP-4-5 on page HP-4-4).
- Make sure that **2 point calibration** is selected in the pull-down menu in the upper-left corner of the window. Put a check mark in the box next to **Apply units to all blocks**.
- Enter the two temperatures used in the calibration recording in the corresponding boxes on the right side of the conversion equations. Enter the name of the units, **°C**, in box below the pressures. Click **OK** to activate the units conversion.

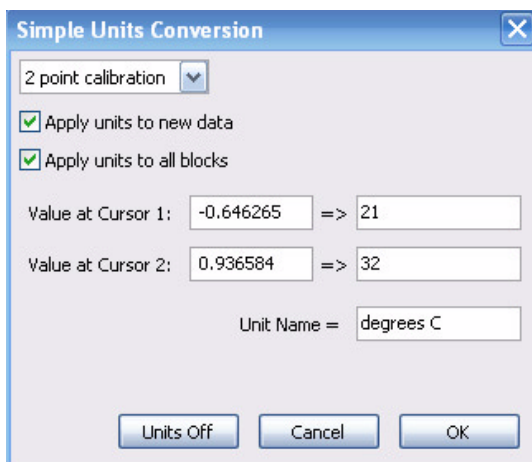


Figure HP-4-5: **Simple Units Conversion** window for the TM-100 temperature probe.

Exercise 1: Baseline Skin Temperature

Aim: To measure the baseline skin temperature of the subject.

Procedure

- 1 Select a person from your group to be the subject. Instruct the subject to sit quietly and in a position that prevents him or her from seeing the computer monitor.
- 2 Place the thermistor between the subject's left index and middle fingers, close to their bases. Tape the thermistor to the inside of the index finger by placing surgical tape over the wires near the tip, not over the tip. Tape the bases of the two fingers together so that the tip of the thermistor is contacting the skin on the inside of both fingers, and the tip is protected from exposure to air currents.
- 3 The subject should rest the hand comfortably on his or her lap for one minute before beginning the recording.
- 4 Type **Baseline Skin Temp <Subject's Name>** in the **Mark box** to the right of the **Mark** button. Click **Record**, click **AutoScale** for the **Skin Temperature channel**, and press the **Enter** key on the keyboard to mark the recording. Continue recording.
- 5 Type **End Baseline** in the **Mark box**. After recording the subject's skin temperature for one minute, press the **Enter** key on the keyboard. Click **Stop** to halt the recording.
- 6 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 baseline skin temperature.
- 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 baseline skin temperature 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 baseline skin temperature, and
 - Clicking the **Zoom between Cursors** button on the **LabScribe** toolbar (Figure HP-4-4 on page HP-4-4) 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 (Figure HP-4-4 on page HP-4-4) 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 Temperature channel** in the **Analysis** window. The mathematical function, **Mean**, should appear in this table. The value for mean skin temperature 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 skin temperature in the one minute recording, the value for the mean skin temperature 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 name and value of the parameter from the recording to the **Journal**. To use these functions:
 - Place the cursors at the locations used to measure the mean skin temperature.
 - Transfer the name of the parameter to the **Journal** using the **Add Title to Journal** function in the **Skin Temperature channel menu**.
 - Transfer the value for the mean to the **Journal** using the **Add Ch. Data to Journal** function in the **Skin Temperature channel menu**.
- 7 On the **Skin Temperature 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 value in the **Journal** using the one of the techniques described in Steps 5 or 6.
- 9 Enter the subject's mean skin temperature in Table HP-4-2 on page HP-4-7.

Exercise 2: Mild Psychosocial Stressor & Skin Temperature

Aim: To test if the sympathetic nervous system is activated by a mild psychosocial stressor.

When the sympathetic nervous system is activated in response to stress, a reduction in peripheral circulation occurs. This peripheral vasoconstriction leads to a reduction in skin temperature.

It is predicted that the subject's mean skin temperature decreases while the subject is doing mental arithmetic. During the follow-up period, the skin temperatures of some subjects will return to baseline levels. The skin temperatures of other subjects may take a longer time to return to baseline levels.

Procedure

- 1 The psychosocial stressor that will be used in this exercise is mental arithmetic. Inform the subject of the task that he or she will be doing:
 - When the subject hears the word **Begin**, he or she says **500** aloud.
 - The subject mentally subtracts 7 from 500 and announces the result aloud.
 - The subject continues to mentally subtract 7 from the previous result and announce the new result aloud, until he or she hears the word **Stop**.

- The subject should perform this task as quickly and as accurately as possible to reach the lowest possible value within one minute.
- 2 Type **Begin Mental Math <Subject's Name>** in the **Mark box** to the right of the **Mark button**. Click **Record**, click **AutoScale** for the **Skin Temperature channel**.
 - 3 Press the **Enter key** on the keyboard as you say the word **Begin**. The subject should begin the mental arithmetic task immediately after hearing the word **Begin**. Continue recording.
 - 4 Type **Stop Mental Math** in the **Mark box**. After the subject has performed the mathematical task for one minute, press the **Enter key** on the keyboard and say the word **Stop**. Continue to record.
 - 5 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.
 - 6 Instruct the subject to sit quietly.
 - 7 Type **End Follow-Up** in the **Mark box**. Press the **Enter key** on the keyboard at the end of the one-minute follow-up period.
 - 8 Click **Stop** to halt the recording.
 - 9 Select **Save** in the **File** menu.

Analysis

- 1 Scroll through the data file and locate the recording of the subject's skin temperature while performing the mathematical task.
- 2 Use the same procedures used in Exercise 1 to position the data in the **Main** window, display the selected data in the **Analysis** window, and measure value for the subject's mean skin temperature while performing the mathematical task.
- 3 Record the value of this parameter in the **Journal** using the one of the techniques described in Exercise 1, and in Table HP-4-2 on page HP-4-7
- 4 Scroll through the data file and locate the recording of the subject's skin temperature during the follow-up period.
- 5 Repeat Steps 2 and 3 to find and record the subject's mean skin temperature during the follow-up period.

Questions

- 1 Does the subject's mean skin temperature decrease during the mental arithmetic task?
- 2 Does the subject's mean skin temperature increase during the recovery period?
- 3 Does the subject's mean skin temperature return to the baseline level during the recovery period? If it did not return to the baseline level, what percentage of the return did it make?
- 4 Do these results support the hypothesis put forth at the beginning of this exercise?

Exercise 3: Calming Mental Imagery & Skin Temperature

Aim: To demonstrate the effect of relaxing mental imagery and biofeedback on skin temperature.

After stressful events subside, the parasympathetic nervous system is more active. One indicator of parasympathetic activity is an increase in peripheral circulation through vasodilation, which can be indicated by an increase in skin temperature.

In this exercise, the change in skin temperature represents the degree of relaxation experienced by the subject. Therefore, it is predicted that the subject's mean skin temperature will be higher while the subject is using mental imagery and biofeedback to enhance his or her state of relaxation than during the baseline period. During the follow-up period, skin temperatures of some subjects will return to their baseline levels. Temperatures of other subjects may take a longer time to return to their baseline levels.

Procedure

- 1 In this exercise, the subject's goal is to warm his or her hands as much as possible using relaxing mental imagery and biofeedback regarding the consequences of the imagery.
- 2 Before the beginning of the exercise, instruct the subject to select the imagery that he or she will use during the biofeedback period. During the biofeedback period, if the subject determines that the imagery being used is ineffective, the subject can change the imagery employed.
- 3 There are three phases in this exercise:
 - **Phase 1:** The subject sits quietly for one minute without using imagery or biofeedback, and while facing away from the computer screen.
 - **Phase 2:** The subject faces the computer screen and watches the recording of his or her skin temperature. The subject can watch either the recording of the skin temperature as it scrolls across the screen or the digital readout of the skin temperature on the right side of the **Main window**. To display the digital readout of the subject's skin temperature, pull down the **View menu** on the **LabScribe Main window** and selecting **Voltmeter**. Regardless of the temperature display the subject watches, the goal of the subject in this phase of the exercise is to raise his or her skin temperature.
 - **Phase 3:** The subject sits quietly for one minute without using biofeedback, and while facing away from the computer screen.
- 4 Once the seven minute exercise begins, there should be no talking in the room. All the members of the lab group, except the subject, should leave the room during the five minute imagery/biofeedback phase of the experiment.
- 5 Instruct the subject to prepare for the first phase of the exercise. The subject should sit quietly while comfortably resting the hand with the thermistor in his or her lap.

- 6 Type **No Imagery <Subject's Name>** in the **Mark box** to the right of the **Mark** button.
- 7 Click **Record**, and press the **Enter** key on the keyboard. Record the subject's skin temperature for one minute. Click **Stop** to halt the recording.
- 8 Ask the subject to turn and face the computer screen. The subject should sit quietly while watching the computer screen and comfortably resting the hand with the thermistor in his or her lap.
- 9 Type **Imagery/Biofeedback** in the **Mark box** to the right of the **Mark** button.
- 10 Click **Record**, and press the **Enter** key on the keyboard. Quietly leave the room for five minutes as the subject's skin temperature is recorded.
- 11 Quietly return to the room at the end of the **Imagery/Biofeedback phase** of the exercise, and click **Stop** to halt the recording.
- 12 Ask the subject to face away from the computer screen. The subject should sit quietly while comfortably resting the hand with the thermistor in his or her lap.
- 13 Type **No Biofeedback** in the **Mark box** to the right of the **Mark** button.
- 14 Click **Record**, and press the **Enter** key on the keyboard. Record the subject's skin temperature for one minute. Click **Stop** to halt the recording.
- 15 Record the subject's skin temperature for a minute. Click **Stop** to halt the recording.
- 16 Select **Save** in the **File** menu.

Analysis

- 1 Scroll through the data file and locate the recording of the subject's skin temperature during **Phase 1 - No Imagery**.
- 2 Use the same procedures used in Exercise 1 to position the data in the **Main** window, display the selected data in the **Analysis** window, and measure the value for the subject's mean skin temperature in **Phase 1**.
- 3 Record the value of this parameter in the **Journal** using the one of the techniques described in Exercise 1, and in Table HP-4-2 on page HP-4-7
- 4 Scroll through the data file and locate the recording of the subject's skin temperature during **Phase 2- Imagery/Biofeedback**.
- 5 Repeat Steps 2 and 3 to find and record the subject's mean skin temperature during **Phase 2**.
- 6 Scroll through the data file and locate the recording of the subject's skin temperature during **Phase 3- No Biofeedback**.
- 7 Repeat Steps 2 and 3 to find and record the subject's mean skin temperature during **Phase 3**.

Table HP-4-2: Skin Temperature - Different Experimental Conditions

Subject_____	
Experimental Condition	Skin Temperature (°F)
Baseline	
Mental Arithmetic	
Post-Mental Arithmetic	
No Imagery	
Imagery/Biofeedback	
No Biofeedback	

Questions

- 1 Is the subject's mean skin temperature higher during **Phase 2 - Imagery/Biofeedback** than during **Phase 1 - No Imagery**?
- 2 Is the subject's mean skin temperature higher during **Phase 2 - Imagery/Biofeedback** than during **Phase 3 - No Biofeedback**?
- 3 Was the subject successful at the imagery/biofeedback task? The subject is successful at this task if his or her mean skin temperature for the imagery/biofeedback phase of the exercise is higher than the phases with no imagery and no biofeedback. During **Phase 3 - No Biofeedback**, if the subject's skin temperature does not return to the same level recorded in **Phase 1 - No Imagery**, it cannot be assumed the subject learned biofeedback control. Learning is demonstrated when the changes in skin temperature can be attributed to mental focus and feedback, and not just to time.

Exercise 4: Embarrassability, Blushing, and Gender

Aim: To measure any change in the subject's skin temperature and galvanic skin response (GSR) during an embarrassment task. To relate the subject's responses to the embarrassment task to his or her gender and *embarrassability*.

In this exercise, the data that is collected will help you determine if gender and embarrassability influence changes in cheek skin temperature and skin conductance between a baseline task and an embarrassment task. An increase in cheek skin temperature indicates vasodilation in that area, which could be seen as blushing. The skin conductance is being recorded as a measure of the amount of autonomic arousal in the subject.

Temperature Probe and GSR Setup

- 1 Locate the GSR-200 galvanic skin response amplifier, male-male DIN8 cable, and GSR electrodes (Figure HP-4-6 on page HP-4-7) in the iWorx kit.



Figure HP-4-6: 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-4-7 on page HP-4-7).



Figure HP-4-7: The TM-100 and 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.

- 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.

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**

- 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-4-8 on page HP-4-8).

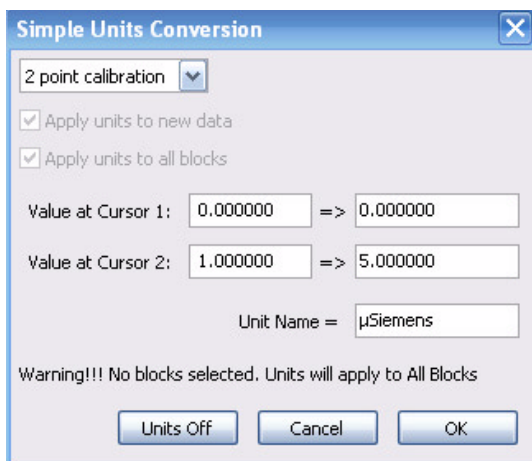


Figure HP-4-8: Simple Units Conversion window for GSR-200 amplifier.

Procedure

- Each person in your group will be an experimental subject in this exercise. Randomize the order in which members of your group participate.
- There are three experimental conditions in this exercise. During the exercise, you will also need to enter comments to indicate:

- Baseline Task:** The subject sits and reads some neutral material from the textbook for one minute.

- Embarrassment Task:** The subject performs the **embarrassment task** for a period of one minute. The tasks are randomly drawn. These tasks include:

- Singing a common nursery rhyme, such as Row, Row, Row Your Boat or Three Blind Mice, out loud.
- Reading a part from a play, as if trying out for the part in front of the directors.
- Reading an expressive poem, out loud.
- Talking about the most embarrassing thing that ever happened to you.

- Post-Embarrassment Task:** The subject returns to reading quietly from the text for one minute.

- Before the subject performs this exercise, he or she should 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.
- Connect the GSR electrodes to the BNC connector on the GSR-200 amplifier.
- 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.
- 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.
- 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.
- Attach the thermistor to the subject's cheek by placing surgical tape over the wires near the tip, not over the tip. Cover the tip with an adhesive bandage to prevent the air in the room from dissipating the heat near the thermistor. Only the tip of the thermistor should be in contact with the face. The extension cable from the thermistor to the *iWorx* unit can be held by the subject to prevent the thermistor from being pulled off the cheek.
- Type **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. 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 $\mu\text{Siemens}$** . Record the subject's tonic SCL for one minute.
- After recording the subject's tonic SCL, use the offset knob on the GSR-200 amplifier to adjust baseline of the recording to zero. Continue recording.

- 12 Type **Baseline Task** in the **Mark box**. Instruct the subject to sit quietly and read from a text. Press the **Enter** key on the keyboard. Record the subject's skin temperature and skin conductance level for one minute. Click **Stop** to halt the recording.
- 13 Type **Embarrassment Task** in the **Mark box**.
- 14 Instruct the subject to draw a slip of paper from the envelope provided to your group. Each slip of paper has an **embarrassment task** written on it.
- 15 Click **Record** as the subject is reading the task that he or she has to perform. Press the **Enter key** on the keyboard as the subject begins the task. Record the subject's skin temperature and skin conductance level for one minute. Click **Stop** to halt the recording.

Note: If the subject is unwilling to perform the embarrassment task then have everyone in your group sing Happy Birthday or You are My Sunshine to the subject for the one minute.

- 16 Type **Post-Embarrassment** in the **Mark box**. Instruct the subject to sit quietly and read from a text. Click **Record** and press the **Enter** key on the keyboard. Record the subject's skin temperature and skin conductance level for one minute. Click **Stop** to halt the recording.
- 17 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.
- 18 Repeat this exercise for each member of your group. Keep track of the order of subjects in the **Journal**.

Analysis

- 1 Find the beginning of the first subject's recording of tonic skin temperature and conductance level.
- 2 Use the same procedures used in Exercise 1 to position the data in the **Main** window, display the selected data in the **Analysis** window, and measure value for the subject's mean skin temperature and tonic skin conductance level.

- 3 Record the names and values of these parameters in the **Journal** using the one of the techniques described in Exercise 1, and in Table HP-4-3 on page HP-4-9. If you are entering values for the means to the **Journal** using the functions in the **channel menu**, use the **Add All Data to Journal** function to enter the values for the mean skin temperature and mean skin conductance level to the **Journal** at the same time.
- 4 Scroll through the data file and locate the recording of the subject's skin temperature and conductance level during **Baseline Task**.
- 5 Repeat Steps 2 and 3 to find and record the subject's names and values of the means during the **Baseline Task**.
- 6 Scroll through the data file and locate the recording of the subject's skin temperature and conductance level during **Embarrassment Task**.
- 7 Repeat Steps 2 and 3 to find and record the subject's names and values of the means during the **Embarrassment Task**.
- 8 Scroll through the data file and locate the recording of the subject's skin temperature and conductance level during **Post-Embarrassment Task**.
- 9 Repeat Steps 2 and 3 to find and record the subject's names and values of the means during the **Post-Embarrassment Task**.

Embarrassability Rating Scale (ERS)

- 1 Read each situation in Table HP-4-4 on page HP-4-11. Rate how much embarrassment you would be likely to feel in each case. Embarrassment is an unpleasant feeling of self-consciousness, awkwardness, and a desire to escape the situation and the presence of others. A rating of 0 indicates no embarrassment at all; a rating of 4 indicates extreme or considerable embarrassment. Ratings of 1, 2 or 3 lie between those extremes.
- 2 Circle your rating for each situation. Total your score for all ten items. Scores can range from 0 to 40.

Table HP-4-3: Effect of Embarrassment on Skin Temperature and Conductance

Subject_____	Gender_____	ERS_____
Experimental Condition	Mean Skin Temperature (°C)	Mean Skin Conductance Level (µS)
Tonic		
Baseline Task (1)		
Embarrassment Task (2)		
Post-Embarrassment Task (3)		
Mean Elevation (2-1)		

Class Data

- 1 The recordings from all three task periods of each subject should be analyzed using the instructions from Exercise 4.
- 2 Each subject should anonymously enter her or his gender, embarrassability score, mean skin temperature from each task, and mean skin conductances from each task on the class data sheet.
- 3 Divide the class results into two groups using the median value from the class scores on the Embarrassability Rating Scale. Subjects with scores above the median value are assigned to the high embarrassability group, and subjects below the median value are assigned to the low embarrassability group.
- 4 Calculate the group averages for the mean skin temperatures and conductances for each experimental condition for both embarrassability groups.

Experimental Hypotheses

Aim: To test three experimental hypotheses regarding the effect of gender and embarrassability on blushing (measured as changes in skin temperature and conductance).

Hypothesis 1

Hypothesis 1: Persons who score as “high” on the embarrassability scale blush to a greater degree (greater mean elevation in cheek temperature) during the embarrassment task than persons who score as “low” on the embarrassability scale.

- 1 Compare the group average for the mean elevations in skin temperature from the high embarrassability group to the group average of the low embarrassability group.
- 2 Does the high embarrassability group have higher mean elevation in skin temperature?
- 3 Does the class data support Hypothesis 1?
- 4 How would the results be affected if subjects were not “accurate” when they performed their embarrassability ratings?

Hypothesis 2

Hypothesis 2: Females blush to a greater degree (greater mean elevation in cheek temperature) during the embarrassment task than males.

- 1 What percentage of the female subjects are in the high embarrassability group? What percentage of the males are in the high embarrassability group?
- 2 Compare the group average for the mean elevations in skin temperature from the female group to the group average of the male group.
- 3 Does the female group have a higher mean elevation in skin temperature?
- 4 Does the class data support Hypothesis 2?
- 5 How would the results be affected if subjects were not “accurate” when they performed their embarrassability ratings?

Hypothesis 3

Hypothesis 3: Mean elevations in skin conductance levels are correlated to mean elevations in cheek temperature.

- 1 Plot the mean elevation in cheek temperature of each subject as a function of his or her mean elevation in skin conductance. Plot all subjects on the same graph. Mark points for subjects in the high embarrassability group with crosses, and points for subjects in the low embarrassability group with circles.
- 2 Does mean elevation in skin temperature correlate with mean elevation in skin conductance? Is this relationship linear? Are the crosses clustered in one region of the graph, and the circles clustered in another region of the graph?
- 3 Are the group averages for mean elevation in skin temperature and conductance higher in the high embarrassability group than in the low embarrassability group? Does this comparison correlate with the graph?
- 4 Does the class data support Hypothesis 3?

References

Leary, M. R. & Meadows, S. (1991). Predictors, Elicitors, and Concomitants of Social Blushing. *Journal of Personality and Social Psychology*, 60(2), 254-262.

Shearn, D., Bergman, E., Hill, K., Abel, A., & Hinds, L. (1990). Facial Coloration and Temperature Responses in Blushing. *Psychophysiology*, 27(6), 687-693.

Table HP-4-4: Embarrassability Rating Scale

Situation	Rating (0-4)				
	No Embarrassment				Extreme Embarrassment
People are singing "happy birthday" to you at a party.	0	1	2	3	4
You just knocked over your glass at the table of an important dinner party.	0	1	2	3	4
You find yourself in the elevator alone with your favorite professor and can't think of anything to say.	0	1	2	3	4
You've just been called on unexpectedly by a professor to answer a question.	0	1	2	3	4
Compared to everyone else, you seem inappropriately dressed for a social event.	0	1	2	3	4
You trip and fall dropping your books while walking up the stairs to class.	0	1	2	3	4
You are at a play and it is clear that the actor has forgotten his lines.	0	1	2	3	4
You have to stand and introduce yourself to others on the first class day.	0	1	2	3	4
Your date spills spaghetti sauce on his/her clothes on the first date.	0	1	2	3	4
You walk into a bathroom you thought was empty at someone's house and find a member of the opposite sex.	0	1	2	3	4

Score _____