

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

Equipment Required

PC or Mac Computer

IXTA, USB cable, IXTA power supply

TM-220 Temperature probe

iWire-B3G GSR amplifier and electrodes

Temperature Probe Setup

1. Locate the TM-220 temperature probe, the iWire-B3G galvanic skin response amplifier and GSR electrodes. (the GSR electrodes are shown in the Lab section).

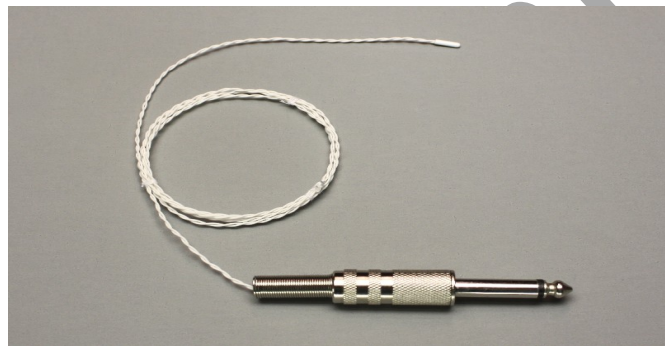


Figure HP-4-S1: The TM-220 temperature probe.



Figure HP-4-2: The TM-220 temperature probe connected to an IXTA.

2. Plug the connector on the TM-220 temperature probe into the “Temp” channel input on the IXTA.
3. 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.

Note: The iWire-B3G galvanic skin response amplifier will be connected to the iWire 1 input on the IXTA at the beginning of Exercise 4.

Optional Calibration of Temperature Probe

Note: The TM-220 temperature probe is pre-calibrated and additional calibration is not necessary. The directions below are for your information if you would like to perform another calibration.

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-220 temperature probe is placed in the beaker.
2. Place the tip of the TM-220 temperature probe in the center of the beaker of cold water.
3. Type **Calibration Cold** in the Mark box.
4. Click Record. The output of the TM-220 temperature probe on the Temperature channel should reach a stable level about twenty seconds after the probe was placed in the cold water. Click the mark button to mark the recording. Continue recording.
5. Measure the temperature of the warm water with a thermometer just before the TM-220 temperature probe is placed in the beaker.
6. Type **Calibration Warm** in the Mark box.
7. While recording the output of the TM-220 temperature probe, move the tip of the probe from cold to warm water.
8. The output of the TM-220 temperature probe on the Temperature channel should reach a stable level about twenty seconds after the probe was placed in the warm water. Click the mark button 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. Click on the Save button to save the data file.
11. Use the Display Time icons to adjust the Display Time of the Main window to display the data needed to calibrate the TM-220 probe on the same Main window. 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-220 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-S4) to expand or contract the time between the cursors to the width of the Main window.

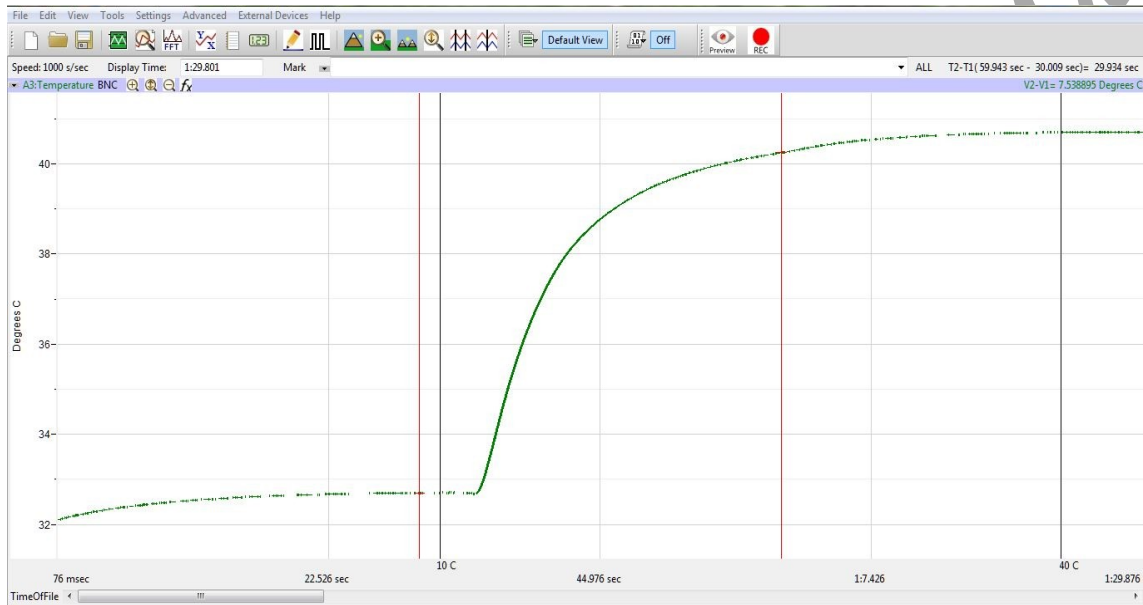


Figure HP-4-S3: Recording of TM-220 output used for its calibration.

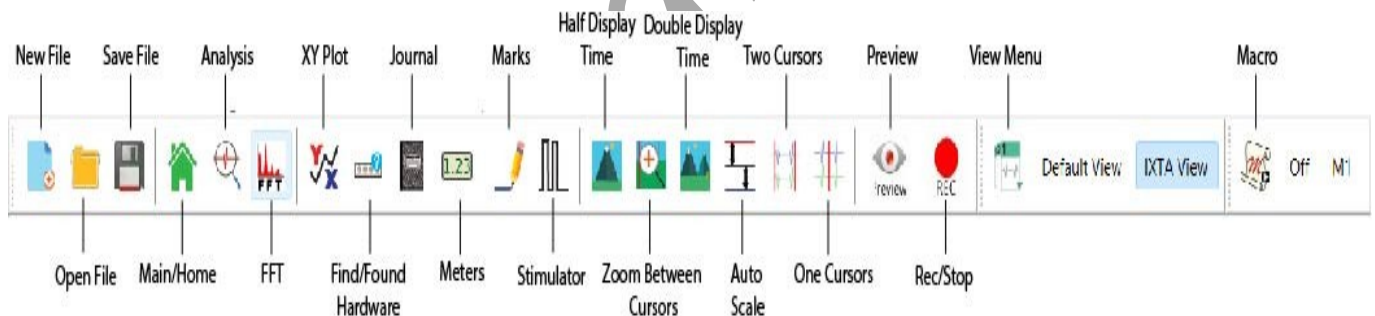


Figure HP-4-S4: The LabScribe toolbar.

12. To convert the output of the TM-220 temperature probe at the measured temperatures:

- Place the cursors on the marks that identify the temperatures used in the calibration of the TM-220:
- Click V2-V1 to the right of the Skin Temperature channel.
- Select Simple
- The Simple Units Calibration window will appear with the voltages at the positions of the two cursors already entered on the window.

- 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.

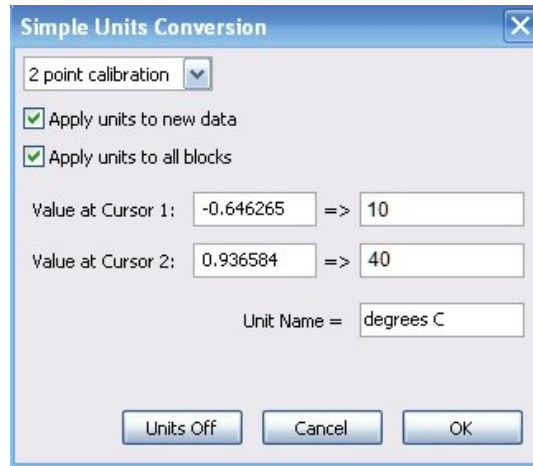


Figure HP-4-S5: Simple Units Conversion window for the TM-220 temperature probe.

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

Exercise 1: Baseline Skin Temperature

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

Approximate Time: 15 minutes

Procedure

1. Select a person from your group to be the subject. Instruct the subject to sit quietly and in a position that prevents them from seeing the computer monitor.
2. The subject should rest the hand comfortably on their lap for one minute before beginning the recording.
3. Type **Baseline Skin Temp "Subject's Name"** in the Mark box. Click Record, click AutoScale All, and click the mark button to mark the recording. Continue recording for one minute.
4. Type **End Baseline** in the Mark box. After recording the subject's skin temperature for one minute, click the mark button. Click Stop to halt the recording.
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.

Data 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.
3. Data can be collected from the Main window or the Analysis window. If you choose to use the Analysis window, click on the Analysis window icon in the toolbar.
4. The mathematical function, Mean, should appear on screen. The value for Mean on each channel are seen in the table across the top margin of each channel, or to the right of each graph.
5. On the Skin Temperature channel, use the mouse to click on and drag a cursor to the beginning of the data displayed. Drag the other cursor to the right margin of the same data at the end of the 1 minute window.
6. 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.
7. 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.

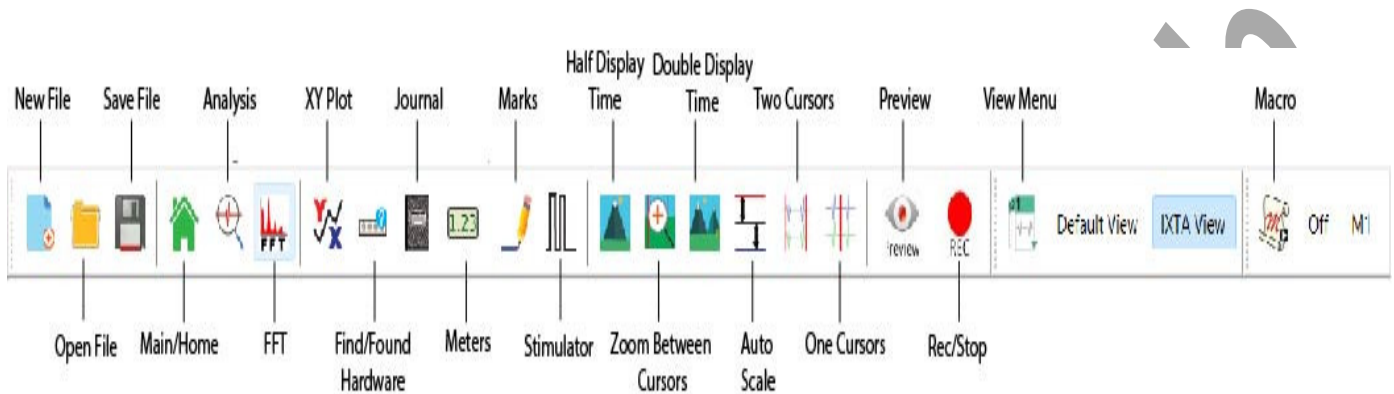


Figure HP-4-L1: LabScribe toolbar.

7. Record the value in the Journal using the one of the techniques described in Steps 6.
8. Enter the subject's mean skin temperature in Table 1.

Exercise 2: Mild Psychosocial Stressor & Skin Temperature

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

Approximate Time: 20 minutes

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 they will be doing:
 - When the subject hears the word Begin, they say 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 they hear 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** in the Mark box to the right of the Mark button. Click Record, click

AutoScale All.

3. Click the mark button 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, click the mark button and say the word *Stop*. Continue to record.
5. Instruct the subject to sit quietly for one minute.
6. Type **End Follow-Up** in the Mark box. Click the mark button at the end of the one-minute follow-up period.
7. Click *Stop* to halt the recording.
8. Select *Save* in the File menu.

Data 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 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 1.
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.

Approximate Time: 30 minutes

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 their 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 their 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 they 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 (No Imagery Phase): The subject sits quietly for one minute without using imagery or biofeedback, and while facing away from the computer screen.
 - Phase 2 (Imagery/Biofeedback Phase): The subject faces the computer screen and watches the recording of their skin temperature. The subject should watch either the recording of the skin temperature as it scrolls across the screen. As the subject watches the temperature display, the goal of the subject in this phase of the exercise is to raise their skin temperature.
 - Phase 3 (No Biofeedback Phase): 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 and person running the computer, 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 their hands in their lap.
6. Type **No Imagery** in the Mark box.
7. Click Record, and click the mark button. Record the subject's skin temperature for one minute. Click Stop.
8. Ask the subject to turn and face the computer screen. The subject should sit quietly while watching the computer screen.
9. Type **Imagery/Biofeedback** in the Mark box.

10. Click Record, and click the mark button. The computer operator can now 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.
13. Type **No Biofeedback** in the Mark box.
14. Click Record, and click the mark button. Record the subject's skin temperature for one minute. Click Stop to halt the recording.
15. Select Save in the File menu.

Data 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 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 1.
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-L1: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 their 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 their gender and embarrassability.

Approximate Time: 30 minutes

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 iWire-B3G GSR or the C-GSR-320 cable and connect it as shown in the Setup.
2. Plug the iWire-B3G galvanic skin response amplifier into the iWire 1 channel on the front of the unit. Plug the C-GSR-320 cable into channel A7.
3. Before the subject performs this exercise, they should go to the sink, wash their hands with soap and water, and dry them thoroughly. Do not use alcohol to clean the fingers, alcohol dehydrates the skin.
4. Moisten the fingertips with GSR conductive paste.
5. The subject should sit with their 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 their hand with the GSR electrodes comfortably. The GSR electrodes should be free from any extraneous pressure and the electrode cable should be hanging freely. Instruct the subject not to move the hand during the recording process; movement will introduce artifacts into the recording.

8. Attach the temperature sensor 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 temperature sensor. The tip of the temperature sensor should be in contact with the face. The extension cable from the temperature sensor to the iWorx unit can be held by the subject to prevent the temperature sensor from being pulled off the cheek.

Procedure

1. Each person in your group will be an experimental subject in this exercise. Randomize the order in which members of your group participate.
2. 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:
 1. Singing a common nursery rhyme, such as Row, Row, Row Your Boat or Three Blind Mice, out loud.
 2. Reading a part from a play, as if trying out for the part in front of the directors.
 3. Reading an expressive poem, out loud.
 4. 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.
3. Type **Tonic SCL** in the Mark box.
4. Click on the Record button. Click the mark button. The value displayed on the Skin Conductance Level channel is the tonic skin conductance level (SCL) of the subject. Record the subject's tonic SCL for one minute.
5. Type **Baseline Task** in the Mark box. Instruct the subject to sit quietly and read from a text. Click the mark button. Record the subject's skin temperature and skin conductance level for one minute. Click Stop to halt the recording.
6. Type **Embarrassment Task** in the Mark box.
7. 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.
8. Click Record as the subject is reading the task that they have to perform. Click the mark button 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.

9. Type **Post Embarrassment** in the Mark box. Instruct the subject to sit quietly and read from a text. Click Record and click the mark button. Record the subject's skin temperature and skin conductance level for one minute. Click Stop to halt the recording.
10. Select Save As in the File menu, type a name for the file. Click on the Save button to save the data file.
11. Repeat this exercise for each member of your group. Keep track of the order of subjects in the Journal.

Data 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 2. 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 3. 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.

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.

Table HP-4-L2: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)		

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).

Approximate Time: 60 minutes

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 their 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?

Table HP-4-L3: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_____

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.