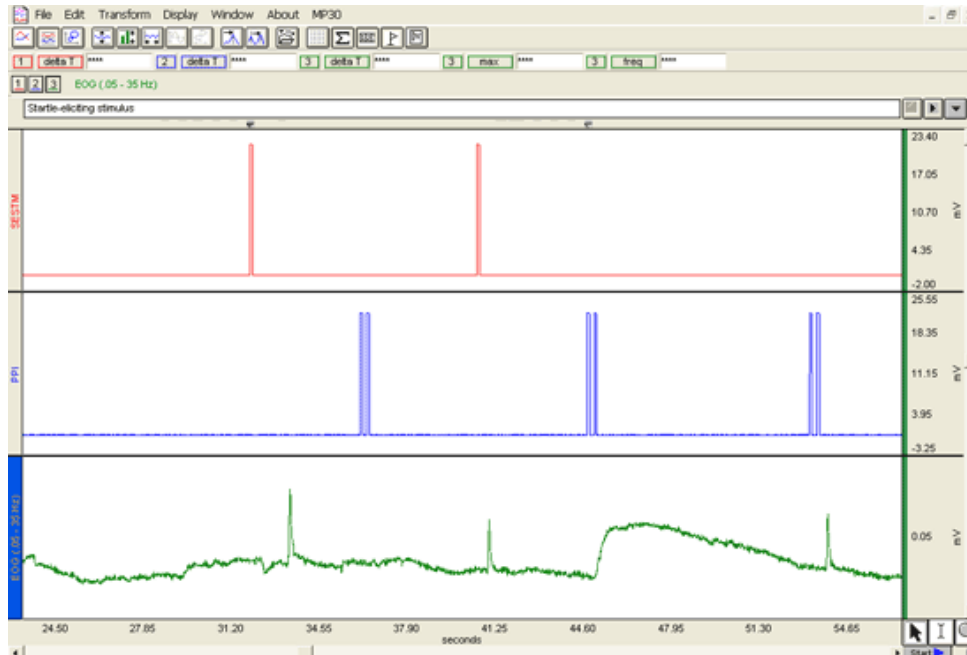# BSL *PRO* Lesson H31: Prepulse Inhibition of Startle



**Standard Trial Prepulse Inhibition of Startle data using the BSL *PRO***

*Abstract:*

A startle response is a physiological response to an unexpected intense stimulus, such as a burst of loud noise or the slamming of a door. This stimulus is known as the startle-eliciting stimulus. Responses to the startle-eliciting stimulus include increased eye blinking, heart rate, skin conductance, and muscular responses.

One method used in startle research involves the presentation of a weak, non-startling stimulus a brief time before a startle-eliciting stimulus. The weaker stimulus is called a **prepulse** or **lead stimulus**. Generally, this stimulus does not elicit a startle response. However, it prepares the organism for the startle-eliciting stimulus, thus reducing its startle effect. This is known as the **prepulse inhibition** (PPI) of a startle effect. There should be a latency of approximately 100 msec between the prepulse onset and the startle-eliciting stimulus onset.
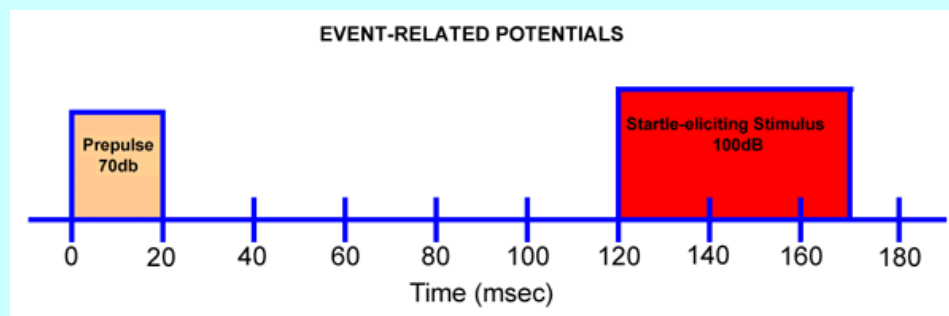


*Note:* In this experimental design, the prepulse lead stimulus outputs 70 dB of broadband noise and is presented for 20 msec. The startle-eliciting response includes 100 dB noise, lasting 50 msec.

**References:**

The following publications offer further information about the **Prepulse Inhibition of Startle:**

Attention, Emotion & the Startle eyeblink response: Uncovering the nature of the phenomenon (developed by Bram Golewater, University of Victoria, Victoria, BC)

Andreassi, J. L. (2000). The eye blink component of the startle response in attention, emotion, and clinical research. *Psychophysiology human behavior & physiological response fourth edition.* 249-254. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Blumenthal, T.D. (1997). *Prepulse inhibition decreases as startle reactivity habituates.* Psychophysiology, 34-446-450.

Norris, C.M. & Blumenthal, T.D. (1996). *A relationship between inhibition of the acoustic startle response and the protection of a prepulse processing.* Psychobiology.

Stern, R. M., Ray, W. J., & Quigley, K. S. (2001). Startle response. *Psychophysiological recording second edition.* 58. 106-110. New York: Oxford University Press, Inc.

## Objectives

1. To observe changes in the startle response as the subject is exposed to an unexpected, sudden stimulus.
2. To observe changes in the startle response as the subject is exposed to the prepulse inhibition stimulus.
3. To measure, compare, and correlate the response of blink magnitude, latency, and habituation rate as the subject is exposed to the startle-eliciting stimulus and the pre-pulse inhibition stimulus.

## Equipment

- Two computers (at least one must be a PC running Windows; see Hardware Note for details).
- BIOPAC electrode lead set (SS2L)
- BIOPAC electrodes (EL504)—three per subject
- BIOPAC Electrode Gel (GEL1)
- Alcohol swabs
- Stimulus Presentation System
  - o SuperLab™ System for BSL: STP35W for MP35 or STP30W for MP30
  - o If you already have SuperLab™, you can use the interface to the MP unit: STP35 for MP35 or STP30 for MP30.
- Auditory Stimuli (a sample .xpt file is included in the H31 folder download for PC or Mac.)
  - o This experimental design requires two types of acoustic stimuli:
    1. a startle-eliciting stimulus: 100 dB presented for 50 msec
    2. a prepulse stimulus followed by a startle-eliciting stimulus: 70 dB presented for 20 msec, followed by 100dB presented for 50 msec (with a latency of approximately 100 msec)
- Headphone (OUT100 or other model)
- Flat head screwdriver for MP30 setup
- BIOPAC Software: Biopac Student Lab *PRO*
- BIOPAC Data Acquisition Unit (MP30 or MP35)

## Setup

### Hardware

*NOTE*    Second computer required—The synchronization signal(s) coming from the STP35/30W can be directed to a BSL MP35/30 running on a PC or a Macintosh, but it is not possible to run the STP35/30W on the same computer as the BSL MP35/30 System. The STP35/30W requires that the SuperLab™ software and a digital I/O card (PCI slot required) be placed on a PC running Windows 95 or later.

1.  Connect SuperLab to the MP unit:

**MP35 users:**

a.  Connect **STP35** cable to the I/O Port of the rear of the MP35 unit and connect the other side of the cable into the Digital I/O card on the second computer where SuperLab™ software is placed (vs. the computer that is running the BSL *PRO* software.

b.  Connect the other side of the STP35 cable into the Digital I/O card on the second computer where SuperLab™ software is placed (vs. the computer that is running the BSL PRO software).


STP35 cable to MP35 I/10 port

**MP30 users:**

a.  Using a flat head screwdriver, loosen the pins from **GND D**, Input Port **8** and **9** on **STP30**.

    *   Turn 1-1½ times to loosen the screws. (You do not need to remove the screws.)
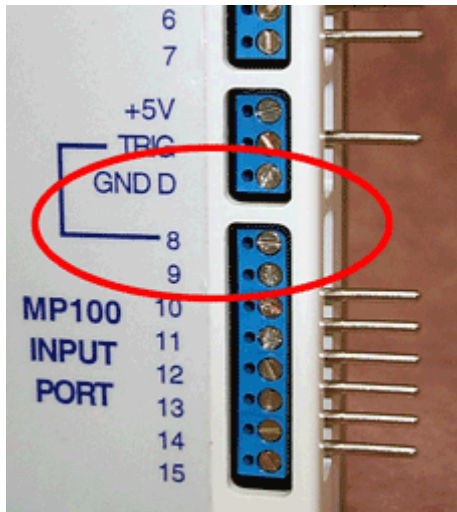

Loosen pins from GND D, 8 and 9

b.  Plug the signal pins from the interface cable (SS44L) into the STP30:
        **Black** - GND D
        **Red** - Input Port 8
c.  Make sure that the signal pins are well set and then tighten the screws.
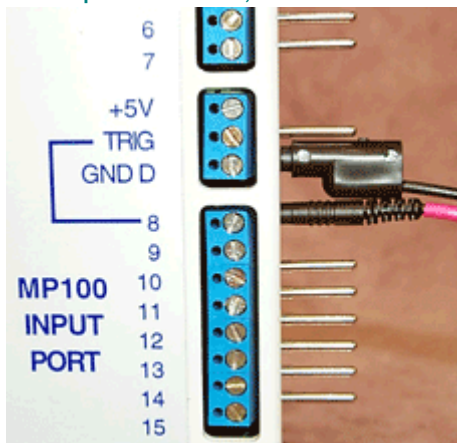

Plug the SS44L into GND D and 8

d.  Plug the signal pins from the second interface cable (SS44L) into the STP30:

    **Black**—Stack into the GND of the first SS44L cable

    **Red**—Input Port 9

e.  Make sure that the signal pins are well set. Tighten the screw for Port 9.

f.  Plug the first **SS44L** Smart Sensor into CH 1 on the front of the MP30 unit.

g.  Plug the second **SS44L** Smart Sensor into CH 2.

h.  Plug a ribbon cable into the **STP30** and connect the other side of the ribbon cable into the digital I/O card on the second computer where SuperLab™ software is placed (vs. the computer running the BSL *PRO* software).
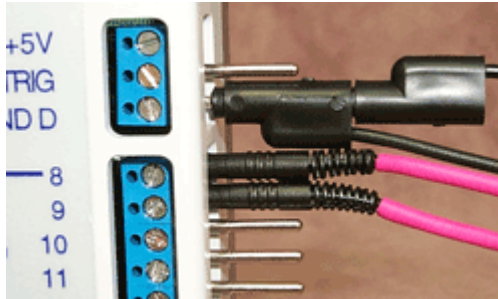


**Plug the second SS44L into GND and 9**

2.  Plug the **electrode lead set** (SS2L) into CH 3.

3.  Plug a headphone into the sound port on the second computer.



**MP30 setup with the main computer**

## Software

**BSL *PRO:***

1. Turn the **main computer on**.
2. Launch the **BSL *PRO*** software.
3. Open the Prepulse Inhibition of Startle file by choosing **File menu > Open > choose Files of type: GraphTemplate (*GTL) > File Name: h31.gtl**.
   - The gtl file is located on the H31 webpage. Be sure to open the template that matches the MP unit you are using.
   - The template is set to display Startle-eliciting stimulus (from SuperLab); Prepulse Inhibition of Startle (PPI); and EOG, as shown below.
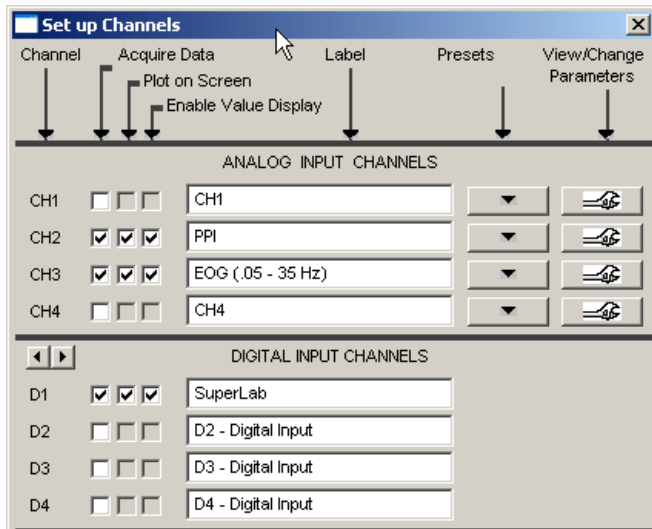


**Channel setup for Prepulse Inhibition of Startle template using MP35; digital channel D1 is labeled CH20 in the graph recording.**
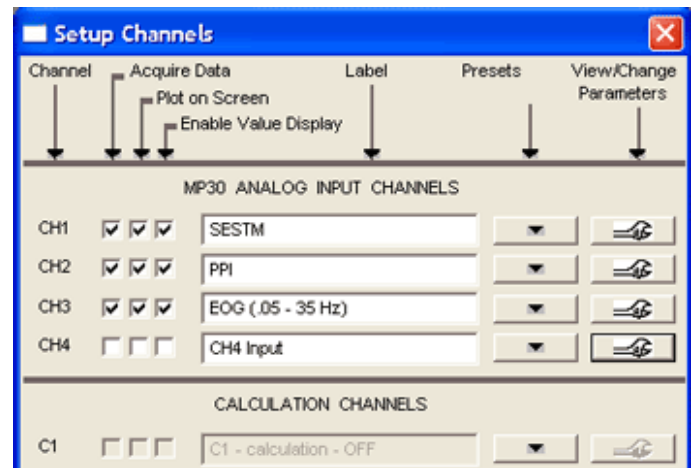
**Channel setup for Prepulse Inhibition of Startle template using MP30**

**SuperLab™:**

1. Turn on the **second computer**.
2. Launch the SuperLab™ software.
3. Open a .xpt file you created. (Sound files in the .xpt file have to be in .WAV format.)

   - If you want to try the sample file, open the **Sample.xpt** file from the H31 folder you downloaded.
   - **IMPORTANT**: Do not use the sample.xpt for your experiment—the stimulus output levels (dB) are not accurate for this setup.

## Subject - Electrode Connections

1. Clean the skin on the lateral corner of the eye with alcohol.
2. Clean the skin underneath of the same eye with alcohol.
3. Clean the skin on the forehead with alcohol.
4. Place the electrodes over each prepared area.
5. Place the electrode lead set as described below.
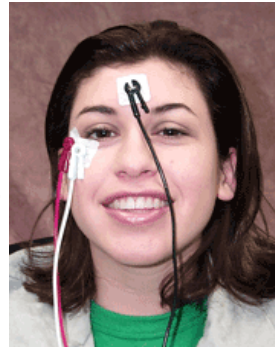
**Lead placement**
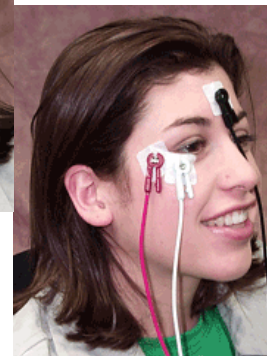
| Lead Color | Signal | Position |
|---|---|---|
| **Red** | **(+)** | the lateral corner of the eye |
| **White** | **(-)** | underneath of the same eye |
| **Black** | **(ground)** | on the forehead |

**It is important** to make sure that the electrodes are making good contact with the surface of the skin and to prevent the electrode wires from pulling the electrodes loose. If a subject feels his or her skin is pulled, hook the lead wire(s) over the ear or across the head to minimize strain.

- The red and white (side of eye) leads may easily hook over the ear (see picture).
- The black (forehead) lead may easily rest over the head.

# Running the Experiment

### *Hints for minimizing data error*

- Wait at least 10 minutes after attaching the electrodes so the skin has ample time to absorb the gel.
- The subject should not talk or laugh during the recording segment.
- The subject should be relaxed in the position noted for the recording segment.
- The subject must avoid excessive extraneous movement.
- Remove all jewelry or other metal objects.
- Check all cable connections.

## Signal Check

1. Position the subject in front of the second computer monitor.
2. Make sure the subject is relaxed.
3. Subject should choose "Run" from the "Experiment" menu on the menu bar.
4. In the "Run Experiment" window, click "Run" again to start your **.xpt** file.

   - You do not have to enter Subject's Name for the Signal Check.

5. Recorder should click "Start" on the main computer to begin recording.
6. Have the subject blink eyes.
7. The recorder should click "Stop" on the main computer to end recording, and the subject should press "Esc" key to stop SuperLab, or wait until stop automatically.
8. Review the data.

- If you see signal changes as shown below, you are ready to do the experiment. If you do not see these changes, check all connections and repeat.
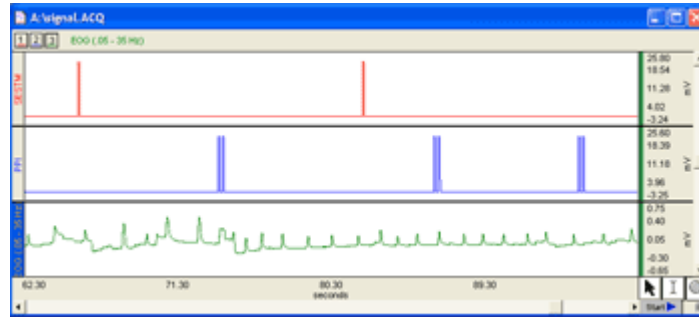


**Signal check confirming that the pulse was detected (if using MP35, the SuperLab data is on CH20 instead of CH1))**

## Experiment

### Procedure

1. Have the subject put the headphone on and sit in front of the computer monitor displaying SuperLab™.
   - The subject should be relaxed and not moving.
2. Once the subject is set, open your .xpt presentation.
3. Choose "Run" from the "Experiment" menu.
   - Enter the subject name if it is necessary.
4. Click on "Run" again - at the same time, the recorder should click on "Start" on the BSL *PRO*.
5. The recorder should click on "Stop" to end the recording when SuperLab™ closes.

## Data Analysis
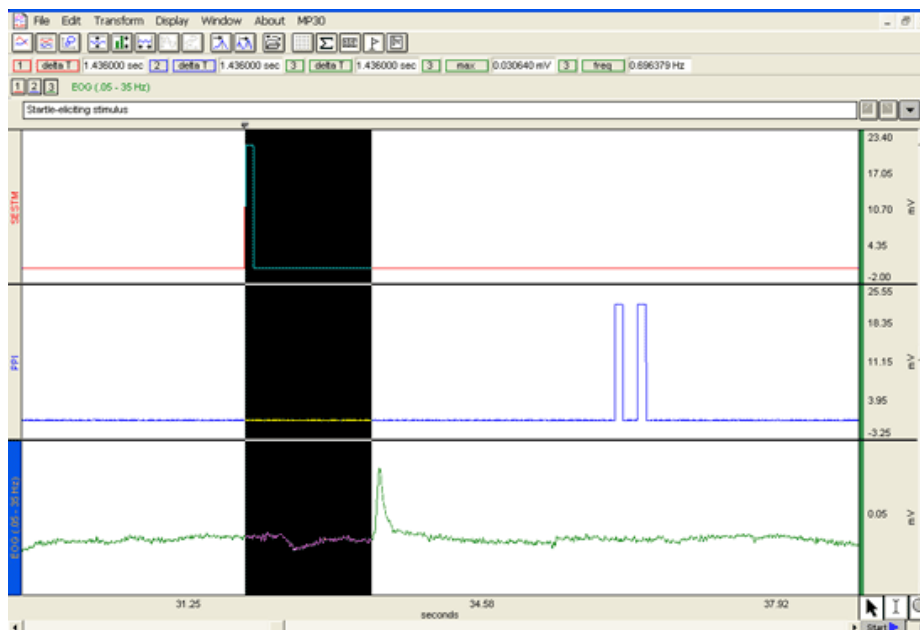


**Standard Trial Prepulse Inhibition of Startle data using the BSL *PRO***

1. Use the I-beam to highlight a region where a startle response is apparent.
2. Measure the reaction times without prepulse by selecting "delta T" in one of the measurement boxes for CH20 (MP35) or CH 1 (MP30) and selecting the area between the start of a SuperLab spike and the start of each corresponding EOG spike.
3. Measure the reaction times with prepulse (PPI) by selecting "delta T" in one of the measurement boxes for CH 2 and selecting the area between the start of a SuperLab spike and the start of each corresponding EOG spike.

4. Measure the amplitude of each EOG spike by selecting "max" for CH 3 and selecting a small area around each spike. Note each max value and its stimuli type (PPI or no PPI).
5. Compare the reaction times and values for prepulse and non-prepulse stimuli.

▪ You should see a significant decrease in eye-blink amplitude when a prepulse is presented before a startle-eliciting stimulus pulse.

# Appendix

## GRAPH TEMPLATE SETTINGS

Click here to open a [PDF of the graph template file](#) settings. The BSL *PRO* Graph Template file automatically establishes the settings shown in the table.

• If using the **MP35,** turn off analog channel CH 1 and enable digital channel D1. Note that D1 will be displayed as CH 20 in the recorded graph.