Experiment HN-8: Human To Human Interface – Zombie Arm

Equipment Required

PC or Mac Computer

IXTA, USB cable, Power supply for IXTA

iWire-B3G cable and three EMG lead wires

Disposable snap electrodes (7)

HV stimulator lead wires

FT-220 hand dynamometer

Tennis or Ping-Pong ball

The Equipment Setup

Note – You must connect the iWire-B3G cable to the IXTA prior to turning it on.

1. Attach the connector on the end of the iWire-B3G cable to the iWire 1 input of the front of the IXTA.
2. Connect the FT-220 to the black tygon extension tubing, connect this to the A2 port on the front of the IXTA.
3. Connect the stimulator leads to the HVS stimulator on the front of the IXTA as stated in the directions below.
4. Prepare your subjects.

iworx Sample Lab

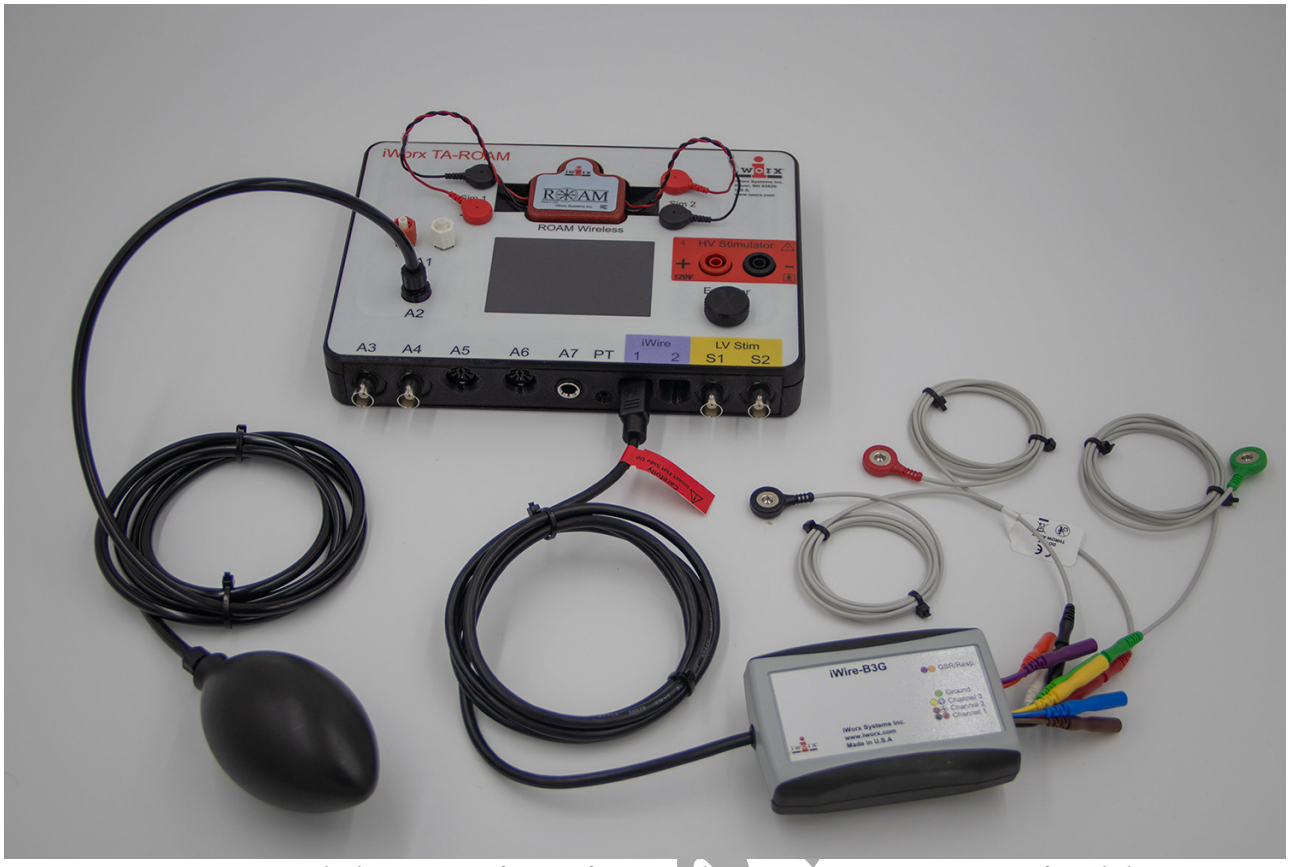

Figure HN-8-S1: IXTA with the FT-220 for performing the Human to Human Interface lab.

Person Squeezing the Hand Dynamometer

1. The subject should remove all jewelry from his/her right arm.
2. Obtain three disposable electrodes. If using the offset electrodes, bend the snap away from the pad.
3. Locate areas on the forearm; place electrodes over these locations and attach the colored recording leads.
    - Place the red (+1) electrode just below the crease of the elbow, slightly lateral of midline.
    - Place the black (-1) electrode on the mid-forearm, also slightly lateral
    - Place the ground (green) electrode between the red and black electrodes as shown.
4. This person will be holding and squeezing the hand dynamometer.

iWorx Sample

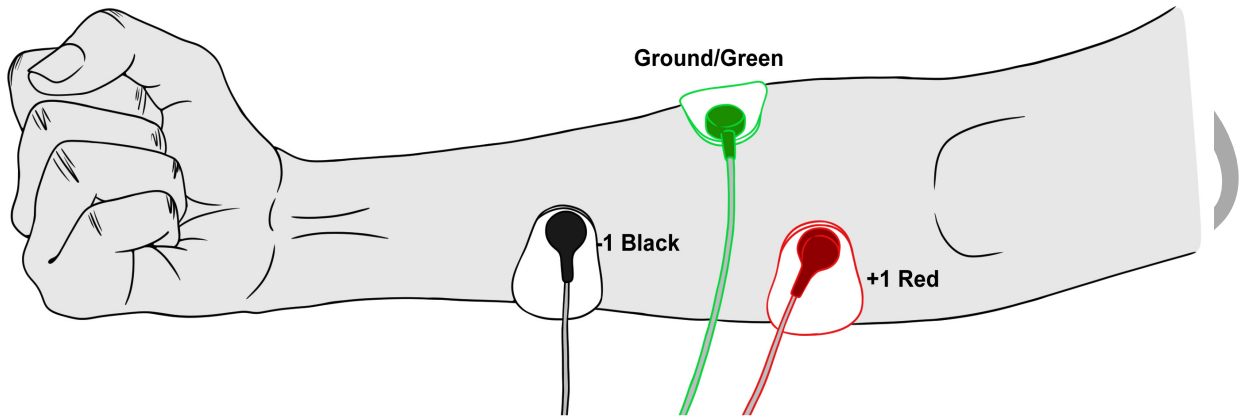

Figure HN-8-S2: Electrode and lead placement for the person who will be generating the signal to be carried to the stimulator. The red and black recording leads are placed on the flexors.

Person Receiving the Stimulation

1. Obtain two disposable electrodes. If using the offset electrodes, bend the snap away from the pad.
    - The red (+1) electrode just below the crease of the elbow, slightly lateral of midline.
    - The black (-1) electrode on the mid-forearm, also slightly lateral
2. You will be snapping the lead wires onto these stimulating electrodes after Exercise 1.
3. Lightly hold a ping-pong or tennis ball in the palm of their hand, trying not to hold on to it too tightly. It should be just resting in their grip.

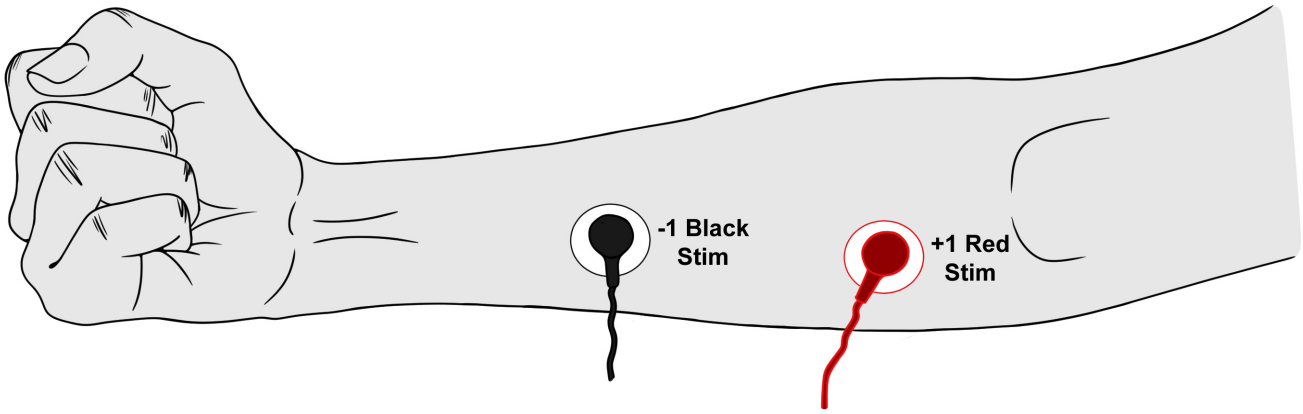

Figure HN-8-S3: Placement of the stimulating electrodes the person who is the "zombie".

Incomplete

IXTA Isolated Stimulator

The IXTA has a high voltage stimulus isolator designed to deliver constant current to the nerve or muscle being studied. In situations where the resistance (R) along the path of the current increases, the voltage (V) increases to maintain the current (I in V = IR, Ohm's Law). The ability of the IXTA to adjust the voltage to deliver the required current is known as voltage compliance. The upper limit of this compliance by the IXTA is set at 100 Volts.

Constant current devices differ from constant voltage devices when presented with an increase in resistance, like the dehydration of the conductive gel under the electrodes. As pointed out earlier, a constant current stimulator is voltage compliant. In constant voltage stimulators, the current delivered to the tissue decreases as the resistance increases because the power supply of the constant voltage device is not designed to deliver additional current.

Although the IXTA can generate up to 100 Volts, the current delivered by the unit is limited to a maximum of 20 milliamperes, for a maximum duration of 10 milliseconds per pulse, and a maximum frequency of 50 pulses per second (Hz). At these levels, the maximum amount of power delivered by the IXTA will not cause injury or tissue damage.

The current is selected using the Stimulator Control Panel. The HV Stimulator can deliver a maximum output of twenty milliamperes

The duration, frequency, and number of stimulus pulses generated by the stimulator are also controlled by making changes to the values in the Stimulator Control Panel. The initial values of the pulses generated by the IXTA are programmed by the same settings file that configured the recording software. For example, if a pulse from the IXTA is programmed for a duration of 1 millisecond and a frequency of 1 Hz, the stimulator will generate a stimulus pulse with the same duration and frequency.

IXTA Stimulator Setup

1. Place the IXTA on the bench near the subject.

Warning: Before connecting the IXTA stimulating electrodes to the subject, check the Stimulator Control Panel to make sure the amplitude value is set to zero (0).

Note: Disconnect the subject from the IXTA prior to powering off the device.

2. Instruct the subject to remove all jewelry before beginning the experiment.

Figure HN-8-S4: The IXTA stimulating electrodes.

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Warning: Make sure the Amplitude is set to zero.

3. For any of the HVS labs, the stimulator preferences panel will initially come up showing S1, even if S1 is off - use the menu to select the HVS settings.
4. Connect the color-coded stimulator lead wires to the High Voltage Current Stimulator. Make sure you push the safety connector of each lead wire into the appropriate socket as far as possible.
5. Connect the 2 stimulating electrodes as stated above.

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Experiment HN-8: Human To Human Interface – Zombie Arm

WARNING – The Stimulator should only be used for the method of application for which it is intended as shown in the directions below.

Note: Disconnect the subject from the IXTA prior to powering off the device.

NOTE: Any changes in amplitude are entered directly into the Stimulator Control Panel. Click "APPLY" to make the change.

Exercise 1: Practice Squeezes

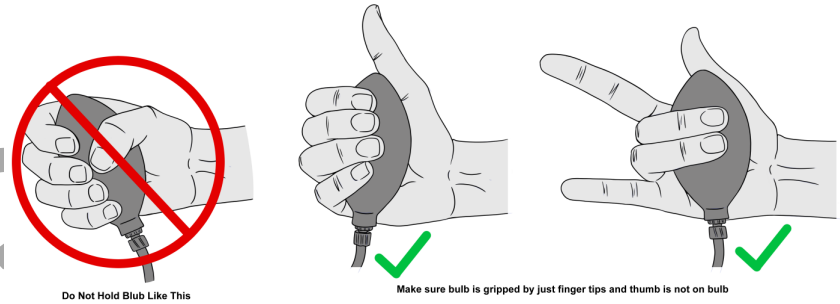
Aim: To determine the effect of a "squeeze" to trigger the stimulator.

Approximate Time: 5 minutes

Procedure

1. **Do not** connect the stimulating leads to the "zombie" subject at this time.
2. Check the stimulator control panel. Make sure the stimulus amplitude is set to 5.

3. Have the person delivering the stimulation hold the hand dynamometer as shown in the diagram. Do not squeeze yet.



4. Click Record button on the LabScribe Main window.
5. Squeeze the dynamometer lightly.

6. Click the AutoScale All button on the toolbar.
7. Squeeze the dynamometer a bit harder. Click AutoScale All.
8. Look at the stimulator channel. If the threshold of 2 is not reached, no stimulation will be sent to the "zombie" subject.
9. Select Save As in the File menu, type a name for the file. Click the Save button to save the file (as an *.iwxdata file).

Note – the stimulator will not "fire" unless a threshold of at least 2 is reached. Practice squeezing the dynamometer to figure out how strong to squeeze to generate a stimulus.

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Figure HN-8-L1: A recording showing the person squeezing or flexing and the subsequent firing of the stimulator.

Exercise 2: The "Zombie Arm"

Aim: To determine the effect of a "squeeze" to cause a reaction in the person being the "Zombie".

Approximate Time: 15 minutes

Procedure

1. Connect the red and black stimulating leads to the "zombie" subject now.
2. This person should relax and gently cradle a ping-pong or tennis ball in their hand. Do not hold the ball tightly.
3. Have the person delivering the stimulation hold the hand dynamometer as shown above. Make sure the stimulus amplitude is still set to 5.

4. Click Record.
5. Let your partner know that you will be squeezing the dynamometer.

6. Squeeze the dynamometer hard enough so that threshold is reached.
7. Click AutoScale All.
8. Squeeze the dynamometer a bit harder. Click AutoScale All.
9. Click Stop.

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10. You should notice that even though the stimulator fired, the “zombie” subject did not have a reaction, though they may have felt tingling.
11. Change the stimulus amplitude to 10. Click “Apply”.

Change to 10

Click “Apply”

12. Click Record and let your partner know that you will be squeezing the dynamometer.
13. Squeeze the dynamometer hard enough so that threshold is reached.
14. The “Zombie” subject should have a twitch enough to cause the ball to move.
15. Squeeze the dynamometer a few more times in succession. Watch the “zombie” arm react each time.
16. Click AutoScale All.
17. Click Stop.
18. Repeat the above procedure after changing the stimulus amplitude to 15. Remember to click “Apply”.

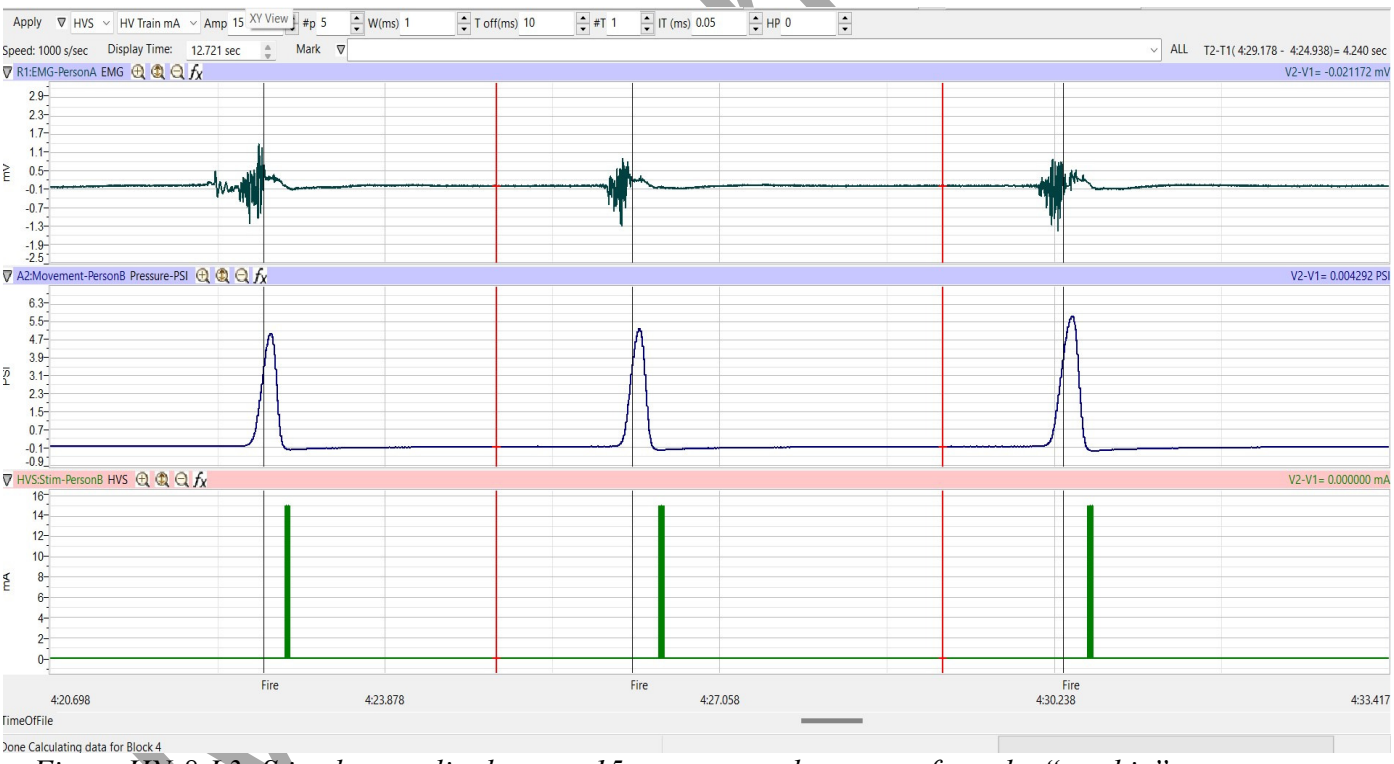

Figure HN-8-L3: Stimulus amplitude set at 15 to get a good response from the “zombie” arm.

Sample Lab

Question

1. Did you notice a difference is the way the ball moved when changing the stimulus amplitude from 5 to 10 and then from 10 -15?
2. What is the reason for this? What is happening with the muscle fibers?

Experimental Design

Ask students to design their own hypothesis relating to muscle responses when someone else is in control.

This can include:

NOTE – this amplitude may be uncomfortable for some people.

- Increasing stimulus amplitude to 20.
- Looking at other muscle combinations – use the biceps of the "Zombie" person receiving the stimulation.
- Can the person squeezing the dynamometer control the "Zombie" enough to balance an object, write, etc...?
- Try using something heavier than a small ball.

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