PhysBot Data Tracker Learning Kit

LEADER’S GUIDE

The PhysBot Data Tracker biowearable learning kit investigates wearable technologies used in health care and fitness to help inspire young people to become technology innovators, not just tech consumers.

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The PhysBot Data tracker was developed in collaboration with Bug Kitty labs and TinyCircuits.
Funded by the Ohio State University’s 4-H Foundation. Sales of this kit advance the Ohio 4-H Youth Development Program.
This device is for educational purposes only. It is not intended to diagnose or prevent heart disease. Please consult a healthcare professional before making changes to your diet or physical behavior.

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As a PhysBot Data Tracker facilitator, you will engage youth in activities to:

- **Assemble** the PhysBot device.
- **Explore** the components and calibrate the device for use during fitness challenges and experiences.
- **Discover** response to exercise through data logged by the PhysBot.
- **Analyze** data after uploading to the PhysBot’s Data Explorer computer software program.
- **Investigate** hacks to improve the PhysBot or for a new use that interests the youth.

**Getting Started!**

You do not have to be a tech expert to be successful with the PhysBot Data Tracker. The device was developed by Ohio State University Extension, Big Kitty Labs, and Tiny Circuits with a wide range of users in mind. The key to success is enthusiasm for learning alongside the young people you work with to assemble, explore, and program the PhysBot.

Each 4-H PhysBot kit includes:

- Circuit board
- Pulse sensor connect
- USB cable
- Stretchy wrist band

**Space Requirements**

The PhysBot Data Tracker fitness challenge activities (see Activity 7) can be conducted indoors or outdoors, weather permitting. You just need an area large enough for youth to safely exercise. Simple exercises such as walking or running in place or doing jumping jacks can be done in a smaller area. You may even decide to set up a PhysBot experience that has youth conducting the same exercises indoors and outdoors to see how environment impacts results.

**Equipment and Supplies**

Your will need to have access to a computer with the PhysBot Data Tracker software program installed. Please visit ohio4h.org/physbot to download the program.

The activities in this guide require these additional materials:

- 9V battery (one per PhysBot)
- Tape measure
- Ruler
- Masking tape, spray paint, cones or flags
- Bandanas or blindfolds
- Stopwatch or electronic device with timer
- Smartphone with compass or a regular compass
- Items to create an obstacle course
- Pencil and paper

**Challenge Activities**

The eight PhysBot fitness challenge activities are a springboard for learning and exploring. Facilitators can choose to do some or all of the challenges depending upon time, interests, or needs. The challenges also can be conducted in one or multiple sessions. You and the youth you work with are in charge of your PhysBot Data Tracker journey.

We encourage you and your group to create your own challenge activities. Let investigation, imagination, and innovation be your guide to demystifying the technology behind fitness trackers.
ACTIVITY 1
What is a PhysBot Data Tracker?

Have you ever wondered how popular fitness trackers work? What powers them? How they measure and collect data?

PhysBot Data Tracker is a fitness tracker demystified. Youth probe what is under the cover of popular fitness trackers by seeing how all the PhysBot parts work and function together.

Assemble the Device and Explore Parts and Functions

1. Place youth into teams of three.
2. Give each team a PhysBot Data Tracker kit.
3. Ask each team to open the kit, and ask each team member to select a part.
4. Invite youth to discuss their answers to these questions:
   • Can you identify your part?
   • What function do you think your part performs?
5. Use the instructions included with the PhysBot kit and the photos and probing questions on the following pages to help youth explore the parts and assemble the device.

Circuitboard Components

Identify the parts of a circuit board.

1. 8-bit micro-controller
2. 9-axis sensor
3. Battery connector
4. Flash memory
5. Joystick
6. Micro-USB connector
7. Power switch
8. OLED display
9. Pulse sensor connector
10. USB to serial converter
11. Voltage regulator
12. Unused sensor connector

Answer key on page 15
Parts and Functions

Part: Circuit board

**Function:** The “brain” of the device. The circuit board controls all the functions. Explore control functions through calibration in Activity 2.

**Data Output:** 16-bit (each bit corresponds to a digit in a data point. For example the pulse sensor requires up to three data points or three bits.)

**Memory:** 1 MB (This is the equivalent of one minute of MP3 compressed music.)

**PROBING QUESTIONS**

- What components are essential to a circuit board? *Micro-controllers and sensors are two critical components.*
- How many parts of the PhysBot Data Tracker circuit board can your team identify?
- What other products use circuit boards with micro-controllers? *Answers will vary.*

Part: Sensor

**Function:** The “nerves” of the device. The sensor senses your pulse to measure heart rate.

**PROBING QUESTION**

What do sensors measure? *Sensors are used in many applications and measure temperature, speed, volume, pressure, etc.*

Some real-world examples include:

- Temperature sensors are used in gas turbines to monitor that all the equipment stays within a range.
- Pressure sensors are used on oil and gas equipment to help prevent blowouts.
- Medical equipment like CTs and MRIs have thousands of sensors to ensure that everything stays within FDA approval.

Part: LED (Light-Emitting Diode) and receptor

**Function:** The “eyes” of the device. When you are awake your eyes are open. When the power is connected, the sensor lights up green.

**How it works:** Variations in light reflecting off the skin from pulsing blood allow the receptor to detect pulse. Explore this further in Activity 3.

**PROBING QUESTION**

How are LEDs used in the real world? *They are the status lights on electronics and appliances. And RGB LED can be dimmed and made to change color. The PhysBot LED stays green when attached to power.*

Part: Power Connector and Battery

**Function:** “The heart” of the device is the battery. It provides the power requirement to the circuit board through the “veins and arteries” or the power connector.

**PROBING QUESTION**

What other power sources would you like to see? A green energy source such as a solar cell or solar panel or a rechargeable battery. Other types of batteries that provide an input voltage of 3 volts to 9 volts.

Part: USB cable

**Function:** The “spinal cord” of the device. The USB cable enables the circuit board to upload logged data to the software program on the computer.

**PROBING QUESTION**

What other connectivity method(s) would be helpful to access logged data from the PhysBot? *Bluetooth technology would provide opportunity to upload data without needing cable connection. A cell phone app would provide additional opportunities to interface with logged data in real-time. The PhysBot Data Tracker is not yet Bluetooth capable.*

Guide youth through completing the tasks below. Ask each youth to perform at least one of the tasks.

**Configuration and Calibration Tasks**

To begin switch on the power. Press the joystick to the left to display the Main Menu. Press the joystick to the right to set and left to go back.

Perform configuration and calibration tasks:

1. **Set the calendar date and time:** Move the joystick up and down and left to right to scroll through the menu to set the year, month, day, hour, minute, and second. You must save between each setting. Values will not be displayed until you return to the Main Menu.

2. **Set brightness:** Move the joystick to adjust the brightness of the screen for the user. Value 0 is the dimmest setting and Value 244 is the brightest. Set value to meet user’s preference.

3. **Calibrate compass:** Wave and rotate the circuit board in a figure 8 motion for 5 to 10 seconds to calibrate all axes. Press done to finish. Press back to return to the main menu. Use a smartphone compass or handheld compass to compare/check setting.

4. **Set temperature offset:** Set to compensate for user’s skin temperature. Adjust value up and down to achieve more accurate air temperature. The value entered will be subtracted from the temperature reading. Use a thermometer to check air temperature and compare to your setting.

5. **Clear step count:** Use to immediately clear all step count data. The setting does not enter a submenu like the others.

**ACTIVITY 2**

*What can PhysBot Data Tracker do for you?*

Have you ever wondered why your pulse is taken during a trip to the doctor? It is a quick indicator of your fitness.

The PhysBot Data Tracker is not a medical device! Any information gathered by the device is merely for self improvement and awareness. However, the PhysBot can accurately measure heart rate when the pulse sensor is properly placed on one of the body’s pulse points.

**How the Pulse Sensor Works**

The sensor measures the amount of green LED light passing through the skin. When the heart beats there is a pulse of blood that changes how much light is reflected back to the sensor. The PhysBot Data Tracker circuit board analyzes the signal from the sensor and records or displays the data. This type of detection is used in devices such as the Apple Watch and the Fitbit.

**ACTIVITY 3**

*What does the pulse sensor tell you?*

Discover Heart Rate Manually

1. Have youth identify pulse points on the body.

   **PROBING QUESTIONS**
   - Where have you had your pulse taken?
   - Where are the easiest locations to find pulse? wrist and neck
   - Where are harder locations to find pulse? behind the knee, top of the foot, at the temple, inside of elbow, groin.

2. Demonstrate how to take a pulse manually. Place the index and middle finger over the pulse on the wrist. Find a steady pulse, count the number of beats in 10 seconds. Use the formula below to calculate beats per minute (BPM).

   \[
   \text{# of beats/10 seconds} \times 6 = \text{BPM}
   \]

   Do not rely on your thumb! Why? Because your thumb has a pulse and it will impact the beats you count. Feel with your fingers to do your count.

**Did you know?**

Normal heart rate for youth ages 6 to 12 is 70 to 120 BPM and for ages 12 and up it is 60 to 100 BPM. Well-trained athletes may have even lower heart rates.
SAFETY ALERT Before trying new exercises or starting a workout program, consult with your doctor. Facilitators need to know and consider any health concerns or limitations for youth participating in the PhysBot Data Tracker challenge activities.

Discover Heart Rate with PhysBot

3. Now that youth know how to find their pulse manually, ask them to check for a heart rate while resting and during exercise with the PhysBot Data Tracker.

4. Have the team select one person to wear the PhysBot for the Pulse Sensor activity. Explain that every person will have an opportunity to experiment with the device during one or more of the challenge activities.

5. Follow the How To Wear the PhysBot on the next page to fit the device on the person’s wrist. The device can successfully be worn on either wrist.

Log Heart Rate with PhysBot

6. Have the team observe the PhysBot for a steady BPM reading. Now, move the joystick on the device to the right to access the Log Menu.

7. In the Log Menu, scroll down and select log interval. Change log setting from 1 second to 5 seconds.

8. In the Log Menu, scroll to select start logging. “Started Logging” will appear on the display. Record time started!

9. Have the person wearing the PhysBot sit for one minute to log a resting heart rate. Have the team observe the PhysBot Data Tracker display while you ask these probing questions.

PROBING QUESTIONS

How much fluctuation is there in the BPM readout? If you were wearing the PhysBot, would your pulse wavelength be similar or different than the person wearing the device? Why or why not?

10. Have the person wearing the device, do each exercise below for one minute continuously:

- Walk in place
- Run in place
- Do jumping jacks

Other team members can do the chosen exercise too and then manually take their heart rate like they did in Step 2.

11. Have youth write down the manual exercise heart rate taken each exercise for use in reflection during Activity 4.

12. Have youth sit down for 1 minute and continue to log data.

13. After one minute, access the Log Menu, scroll down the menu with the joystick and select “stop logging”. A message “Stopped Logging” will appear on the display.

14. The data logged in Activity 3 will be used in Activity 4 to explore downloading logged data to the PhysBot software program.

Did you know?

The human heart can only beat 220 BPM. To determine your maximum heart rate, subtract your age from 220. To calculate ideal maximum heart rate during exercise, multiply maximum rate for your age by 80%.

220 BPM - 16 age = 204 BPM max. heart rate
204 x 80% = 163 BPM ideal max. heart rate
How to Wear the PhysBot Data Tracker . . .

**Put on wristband.**

**Place fabric fasteners on back of circuit board and attach to the top of the band.**

**Attach pulse sensor and battery connectors with connectors facing down.**

**Power on circuit board. LED on pulse sensor will light up green.**

**Find wrist pulse point. Place the pulse sensor LED green light side against skin under the wrist band to hold in place.**

**Tuck battery under band or use velcro dots to place on outer band. Keep battery away from sensor, circuit board, and other metal because of magnetic interference.**

**ACTIVITY 4**

**What does your PhysBot data tell you?**

Now that your teams have logged data on the PhysBot Data Tracker, help them analyze that data with the explorer software.

1. With the PhysBot powered on, move the joystick to the right to access the Log Menu. Toggle down and over to stop logging.
2. With the Physbot programming running, have a team member plug the USB cable into the device and connect to the computer. The PhysBot screen will go blank then reappear.
3. On PhysBot homepage, click the Go To Sync button. The PhysBot screen will go blank for a few seconds, then reappear. After a few seconds a data file will appear.
4. Fill out the information in the data file and save it to the cloud.
5. Be sure to erase your data from the PhysBot before sharing with another user, or before collecting additional data for yourself. You cannot write new data over existing data.

**Install and Sync Data**

Go to [ohio4h.org/physbot](http://ohio4h.org/physbot) to install the program on a MAC or PC computer.

After installation, click on the Data Explorer folder and run the PhysBot Data application. It will take you to the home page Welcome to PhysBot Data Explorer.
**Save and Export Data**

Project is the general name given by the software to any experience logged by the team or user with the PhysBot.

6. Have the PhysBot team enter the following information:
   - **Project Owner:** Team or User
   - **User Name:** Person Wearing the device
   - **User Gender:** Person Wearing the device
   - **User Height:** Needed for Distance and Calorie Calculations
   - **User Weight:** Needed for Calorie Calculation
   - **User Age:** Needed for Calorie Calculation
   - **Results and Findings:** What did you explore, discover, and learn?
   - **Project Title:** Name of Challenge Activity
   - **Project Description:** What experience, activity, project, or challenge did you do?

7. Dialogue with the team about the data charts using these probing questions.

   **PROBING QUESTIONS**
   - What does the spacing of the graph lines tell us about the data log?
   - How can you use the data chart to help tell a story about what you were doing during the duration of the data log?
   - What information if any is missing from the data log?
   - How can you use the data log to create a new experience with the PhysBot Data Tracker?

8. Have the team complete the rest of the information on the challenge, activity, or project and . . .
   - Click **SAVE:** to save data to the computer;
   - Click **SAVE and SYNC to CLOUD:** allows you to save on the computer and make data available on the PhysBot online portal to be released soon.
   - Click **EXPORT:** to export your data to a Microsoft Excel or Google Spreadsheet for further exploration and programming.

9. Have additional teams and/or users connect their PhysBot to the computer and follow steps 1 through 4.

10. As additional challenges, activities, and projects are added to the computer, you, your teams, and users may want to recall them.

11. To recall challenges, activities, and projects go to the Projects tab to see projects previously synced and saved to the software.

12. Click on the project you want to load up, view data and export.

13. A troubleshooting feature is available on the PhysBot website.

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**Types of Data Charts**

**Pulse chart**

**Steps**

**Temperature**

**Did you know?**

A data scientist is a hybrid between a hacker, analyst, communicator, and trusted advisor. We need 1.5 million new data scientists to meet demand.
The PhysBot can help you explore the answer to this question and more. When you walk the dog are you getting in the same steps as when you line dance at camp or jump rope with friends? How can you know? The PhysBot Data Tracker, like a fitness tracker, can help provide answers.

**Explore the Step Counter**
1. Have the team select a different person from Activity 3 to wear the PhysBot for the Step Counter activity.
2. Have the selected team member(s) put on the device. Refer to How to Wear the PhysBot page as needed.
3. Explain that the team will be doing a series of different exercises over the next five minutes.
4. Team member tasks for this challenge include:
   - Exerciser
   - Recorder
   - Counter

5. Have the device wearer move the joystick to the right to access the Log Menu. In the Log Menu, scroll down and select the Log Interval, change to 10 seconds.
6. Have each Recorder write down start and ending log time from the PhysBot for each exercise.

**PROBING QUESTION**
Why is date and time on the devise more important than the time on the clock? The data story is linked to the device’s date and time, not the actual calendar date and time.

7. Have the exerciser move the joystick to the right to access the Log Menu. Scroll down and select Start Logging. A started logging message will appear on the screen. Start logging with the first exercise.
8. Have each team member perform their roles with the exercises in the table below. Have the recorder write down start and stop times from the device and steps visually counted during each exercise for use in data analysis.

### Step Count Challenge Roles

<table>
<thead>
<tr>
<th>Team Member</th>
<th>Exercise 1: Walk</th>
<th>Exercise 2: Jog</th>
<th>Exercise 3: Stairs</th>
<th>Exercise 4: Jumping Jacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exerciser</td>
<td>Walks around area or in place for one minute</td>
<td>Jog around area or run in place for one minute</td>
<td>Walk up and down stairs or on a sturdy platform for one minute</td>
<td>Do jumping jacks or jump rope for one minute</td>
</tr>
<tr>
<td>Counter</td>
<td>Count exerciser’s setps</td>
<td>Count exerciser’s setps</td>
<td>Count exerciser’s setps</td>
<td>Count exerciser’s setps</td>
</tr>
<tr>
<td>Recorder</td>
<td>Write down the start and stop time from the PhysBot Data Tracker</td>
<td>Write down the start and stop time from the PhysBot Data Tracker</td>
<td>Write down the start and stop time from the PhysBot Data Tracker</td>
<td>Write down the start and stop time from the PhysBot Data Tracker</td>
</tr>
</tbody>
</table>

### Step Count Challenge Log

<table>
<thead>
<tr>
<th>Exercises</th>
<th>Start Exercise</th>
<th>Time from PhysBot</th>
<th>Stop Exercise</th>
<th>Time from PhysBot</th>
<th>Visual Step Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise 1:</td>
<td>Walk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise 2:</td>
<td>Jog</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise 3:</td>
<td>Stair or Step Climb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise 4:</td>
<td>Jumping Jacks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Did you know?** Youth need 60 minutes of physical activity everyday!
9. After Exercise 4, move the joystick to the right to return to the Menu Log. Scroll down and select Stop Logging. A message stopped logging will appear on the screen.

10. Have each team connect the USB cable to the PhysBot Data Tracker and connect to a computer with software loaded.

11. Have each team follow the steps used in Activity 4 to sync data, enter team/user info and view data results. Discuss data findings with team(s) using these questions:

**PROBING QUESTIONS**

- How does the recorder’s log help with understanding the data logged by the PhysBot during multiple exercises?
- Were steps the same during each one minute exercise? Why or why not?
- What other data did you find the most interesting? Why? (pulse changes, distance traveled, temperature change)
- How would logging data every second or every minute change results or data interpretation?

**ACTIVITY 6**

**How far can you travel with your PhysBot?**

Bio-wearable creation has helped to motivate users to log more physical activity. Distance traveled with the PhysBot Data Tracker is calculated from the steps logged just like a fitness tracker.

The accuracy of pedometers and fitness trackers can be improved by knowing your step length or stride length. Step length is the heel print of one foot to the heel print of the other foot during a walking stride. Step length is very dependent on height. The PhysBot Data Tracker uses your height and steps walked to determine distance traveled.

**Formula Used by PhysBot Data Tracker to Calculate Distance**

\[
\text{Distance} = \frac{(\text{Height in inches}) \times 0.414 \times (\text{no. of steps})}{63360}
\]

1. Have each team determine the height of each member. Have each person stand with their back against the wall and their feet together. Place a ruler across the top of their head against the wall. Then use a yardstick or tape measure to determine their height in feet and inches.
2. Have team members write down their height to be able to enter into the computer software program.
3. Have the team select a different person to wear the PhysBot for the Distance Challenge.

**Did you know?**

There are 2,000 to 2,500 steps in a walking mile and 1,400 to 1,700 steps if running that same mile. The difference lies in our step length or stride length.

**Calculate Step Length**

- Have each person calculate their step length.
- Have the person wearing the device reset the Step Count, if there are steps on the PhysBot.
- Move the joystick to the left to access the Main Menu. Scroll down to Clear Step Count. Select Clear Step Count. It will immediately clear all steps.
- To calculate step length, measure off 20 straight feet with a tape measure. Mark the start and end of the 20 feet with tape, cones, flags, rope, string, or other marker.
- Have each person start walking at a normal pace 10 feet prior to the starting line. When your foot crosses the start line, count your steps until your foot crosses the finish line.
• Have each person divide 20 feet by step count = step length
• For best accuracy, have team members do three times and take the average.
• Time permitting, you could have all team members use the PhysBot, since you can quickly clear the step count.

**PROBING QUESTION**
How many steps would you need to take to walk a mile? 1 mile = 5,280 feet
How many steps would you need to take to walk around earth, your state, county, or city? Earth = 24,900 miles

**Explore Distance with PhysBot**

1. In Activity 2, the compass was calibrated. If the PhysBot has been powered down at anytime the compass must be recalibrated.
2. Recalibrate Compass
   - Press joystick to the left to access Main Menu.
   - Scroll down and select Calibrate Compass.
   - Wave and rotate the circuit board in a figure 8 motion for five to ten seconds to calibrate all axes.
   - Press done to finish.
   - Press back to return to Main Menu.
   - Use a smartphone compass or handheld compass to compare setting.
3. After compass calibration, have each team find North using the compass reading with the PhysBot Data Tracker and stand together. (Note: a compass always points north.
4. Have the exerciser move the joystick to the right to access the Log Menu. Scroll down and select Start Logging. A started logging message will appear on the screen.
5. Have each team walk the following route from their standing point: 50 steps North, then 50 steps East, then 50 steps South, then 50 steps West and then 50 steps North.
6. Have each team watch the step counter on the PhysBot to know when to turn directions and monitor the compass.
7. At the conclusion of walking the route, move the joystick to the right to return to the Menu Log, scroll down and select Stop Logging. A message stopped logging will appear on the screen.
8. Have each team connect the USB cable to the device and a computer with Physbot software loaded.
9. Have each team follow the steps used in Activity 4 to sync data, enter team/user info and view data results.
10. Discuss data findings with team(s) using these questions:

**PROBING QUESTIONS**
- How many total steps did you walk?
- What distance in miles did you travel?
- If you were walking your dog or a 4-H project animal, would your pet or animal's steps be more or less than yours? Why?
- How was each person’s normal walking stride length impacted by the leader—the person wearing the PhysBot Data Tracker?
- What additional features would be helpful to map your future walking journeys? *This is an opportunity to introduce youth to online walking map apps.*

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**Did you know?**
The American Heart Association recommends you reach 10,000 steps per day with your physical activity.
ACTIVITY 7
Engage youth in a fun Fitness Challenge

You and your group have learned the PhysBot basics. Now it’s time to use PhysBot Data Tracker to measure performance during a fitness challenge. Select from the following challenges to create the one for your group. You may want to add some activities of your own or have your group suggest some too.

Have youth wear the PhysBot Data Tracker during the fitness challenge. Remember to clear the log before starting and after syncing data between device wearers.

Use the PhysBot Challenge Card on back page for participants to record start and stop times between challenges, results, and reactions. Youth can use this data in combination with their PhysBot Challenge printout after syncing data collected to the computer program.

CHALLENGE 1
Can You Outrun Gravity?
When an object is dropped, during its first second of decent it travels 32 feet, thanks to the consistent pull of gravity. Using only leg power (thrust), can you run 32 feet in less than one second? If so, you can outrun gravity!

Challenge Set-Up
- Mark off a 32 ft. area on the floor. Use masking tape to clearly show the start and finish lines.
- Give the PhysBot wearer a running start.
- Start the stop watch (timer) when he/she crosses the start line.
- Stop the stop watch (timer) when he/she crosses the finish line.
- Shout out “seconds traveled” when he/she crosses the finish line.

Results
One can expect to see slight improvement with practice and conditioning.

Why? Physical fitness is one’s ability to carry out tasks without undue fatigue. Improvement of one’s physical health begins with an exercise program, also called physical conditioning.

CHALLENGE 2
How Quick is Your Reaction Time?
The time it takes your eye to first notice a baseball moving towards you to when your arm reaches up to catch it is reaction time. Athletes spend hours practicing to improve reaction times.

Challenge Set-Up
- Have the PhysBot wearer sit in a chair with their thumb and index finger positioned on either side of the 1-inch mark on a 12-inch ruler.
- The goal: Catch the ruler as quick as possible when dropped.
- Without warning, drop the ruler and record the inch-line where the ruler is caught. The lower the number, the faster the reaction time.

Results
One can expect to see slight improvement with practice.

Why? When we start to work on a new physical skill through repetition, our nervous system creates new neural pathways. This phenomenon is referred to as muscle memory. However, no matter how good your muscle memory for this challenge becomes, it will always take some time for the falling ruler to travel as a message from your eyes to your brain and from your brain to your fingers!
**CHALLENGE 3**

**Timed Walk with Guide Dog**
How does the loss or impairment of one of our senses impact our heart rate, walking stride, sense of distance traveled, lapse of time, and feelings or emotions when completing a common physical activity? Discover your body’s response to this diversity challenge using PhysBot Data Tracker and your personal experience.

**Challenge Set-Up**
- Blindfold or have the PhysBot wearer close their eyes.
- Partner the PhysBot wearer with someone to role play being their guide dog.
- Before starting the walk, have the Guide Dog record step count and time from the PhysBot on the Challenge Card.
- Explain that when the whistle blows, the guide dog will take the PhysBot wearer for a walk. Make sure the walking area is clear of obstacles and hazards and that participants understand the importance of safety.
- Give the Guide Dog role player written directions that explain how many minutes to walk before returning to home base.

**Results**
Upon return, have the guide dog role player record step count and time from PhysBot on Challenge Card. Have the PhysBot wearer answer these questions before removing blindfold and have the guide dog role player record answers on Fitness Challenge Record.

- How many minutes do you think you walked?
- How many steps or how far do you think you traveled?
- What words would you use to describe how you felt on your walk?
- Did walking with a sense impaired impact your heart rate in anyway? If so, how?

**Why?** Emotions, injuries, illnesses, disabilities, and environment impact our body’s response to exercise. Recognizing what’s normal for our body can help us make adjustments to any exercise program.

**CHALLENGE 4**

**Animal Agility**
Having fun when exercising is a great motivator to increase physical activity. Athletes and non-athletes alike log more steps and minutes working out when exercising with others. Game-time, friendly competition and goal-setting are good motivators to developing healthy active habits.

**Challenge Set-Up**
- PhysBot wearers and those without PhysBots join together to play PhysBot Says Animal Agility version of Simon Says.
- Facilitator randomly calls out animal agility exercises listed below choosing when to say “PhysBot says” and when not to put that phrase in front of the Animal Agility exercise . . .
  - Dance like a bear
  - Skip and oink like a pig
  - Hop like a bunny
  - Run like a deer
  - Gallop like a horse
  - Claw and screech like a cat
  - Walk like a lamb
  - Crawl like a crab
  - Swing like a monkey
  - Climb like a goat
  - Dig like a raccoon
  - Slither and hiss like a snake
  - Swim like a fish
  - Jump like a kangaroo
  - Flutter like a butterfly
  - Waddle and quack like a duck
  - Glide like an eagle
  - Charge and snort like a bull
  - Fly like a bat
  - Swarm and buzz like a bee
  - Wag your tail and bark like a dog
  - Flap your wings and crow like a rooster
- Create other Animal Agility exercises or switch out animals. There are lots of animals that jump, climb, run, walk, etc.
- Play the game until there is one person left with a PhysBot or the group is ready for the next challenge.

**Results**
Which animal agility exercises engaged the most activity and reaction from the participants?

**Why?** Physical activities that require moving muscles not normally worked or doing multiple tasks at once require more effort and energy. When you sync the data, can you correlate pulse rate and steps to certain Animal Agility exercises (slow moving versus fast moving, those that included making noise and those that did not, etc).
CHALLENGE 5
Timed Obstacle Course

Use your creativity to put together an obstacle course. Here are some suggestions to get you started.

Challenge Set-Up
- Use pool noodles or hula hoops as props for footwork paths, crawl through paths, hurdles, etc.
- Plastic cones to create path to dribble or kick a ball through and around.
- Stick horse for barrel race around buckets.
- Tarp and wooden stakes with string to weave over top of tarp to create spider web for youth to slither or crawl under.
- Chalk directions written on black top (Touch your toes, do 10 jumping jacks, twirl around, walk backwards 10 steps, etc.)
- Masking tape or duct tape—walk the line.
- Beach Ball—get from point A to point B carrying the beach ball between you and your partner’s backs or have individuals move the beach ball between the points carrying between their knees.
- Come up with your own props and ideas. Make sure they are age and ability appropriate. Always keep safety in mind. Do not use any water related obstacles because the PhysBot is not waterproof.

Results
Sync the data logged during the Timed Obstacle Course, how does the data help tell your physical activity experience from the course. Were you surprised by the steps logged, pulse rate data points, or distance covered?
Why? The PhysBot pulse sensor may not make contact at all times to pick up readings throughout the obstacle course.

CHALLENGE 6
Go on a Community Walkabout

Plan a 30 to 60 minute hike or walkabout with your PhysBot group.

Challenge Set-Up
- Have device wearers clear step counter and log.
- Have device wearers start logging at the beginning of the hike.
- Have everyone take a manual resting pulse rate before beginning.
- Have those that are not wearing a PhysBot to take a manual pulse rate three times along the hike. Take the total time you plan to walk and divide by three to determine intervals.
- Have PhysBot wearers stop logging at the end of the hike.

Results
Sync the data logged during the hike or walkabout. Does the data collected help explain the weather conditions you were walking in, the terrain along the walk and/or physical endurance of participants? Why or why not?
Why? Unless walking on a flat surface the entire time, pulse rate typically will elevate if walking uphill and will rise over time as you exercise. In addition, weather conditions (hot and humid or really cold) can impact your heart’s response to exercise more than on moderate days with low humidity.

CHALLENGE 7
Create Your Own Fitness Challenge

Come up with your own challenge. The sky’s the limit. The only limiting factor is that the PhysBot Data Tracker is not encased, so it cannot be exposed to water and does not hold up to contact sports. In addition, share your PhysBot challenge experiences, stories, photos, and results. Creating a community of PhysBot learners and innovators requires your commitment to sharing.
What Hacks Would You Make to PhysBot Data Tracker?

We want you to inspire youth to create a hack for PhysBot around an interest of theirs. Here are some ideas to help you and your group come up with their own hacks:

- Test the device’s performance on the family pet to record steps and pulse rate.
- Explore the Maker Movement to create a sunshade for the PhysBot screen, design a different band, or print a case from a 3-D printer for the PhysBot fitness tracker unit.
- Test a different power source, like a solar panel or solar cell.
- Explore biowearables in clothing. What other clothing could the PhysBot be attached to in order to collect fitness information.

What hacks will your group come up with to use PhysBot Data Tracker in a way other than its original intent as a demystified fitness tracker? The key word here is demystified. By revealing what is under the screen of commercial fitness trackers, PhysBot motivates young people to invent, create and even hack their way into the next generation of engineers, technologists and data scientists.

Discover for yourself fitness in progress with the PhysBot Data Tracker. We did!
PhysBot Challenge Card

<table>
<thead>
<tr>
<th>Workout Title/Project Title:</th>
<th>Gender (circle):</th>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td></td>
<td>First Name:</td>
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<td>Resting Heart Rate:</td>
<td>Weight:</td>
<td>lbs.</td>
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<tr>
<td>(Count beats in 15 seconds, then x 4)</td>
<td>Workout Start Time:</td>
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<td>sec.</td>
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<tr>
<td></td>
<td>Workout End Time:</td>
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</tr>
<tr>
<td>Description:</td>
<td>(Workout level/Repeat number):</td>
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Troubleshooting Tips: B
1. Always clear the data log on your device before collecting fresh data.
2. Always turn off the data logging function on your PhysBot device before syncing.
3. Always start on the PhysBot software homepage before syncing your device.
4. If your device becomes damaged or inoperable, return it to Tiny Circuits for repairs to 540 S. Main St. #457, Akron, OH 44311.
5. Extend your PhysBot experience by adding a lightweight lithium battery from Tiny Circuits at tinycircuits.com/collections/all. This thin compact battery easily Velcro's to the outside of your band. Plus, it's rechargeable.

Tiny Battery Charger
This is a standalone Lithium battery charger which lets you charge up your batteries from a micro USB cable. The battery can connect to a JST SH connector (the battery connector on the batteries sold at Tiny Circuits). You can also use this without the JST connector with two large through holes to connect to a battery pack. ($6.95)

Lithium Ion Polymer Battery 3.7V 290mAh
This is a rechargeable Lithium ion polymer battery that can power your projects. The battery has a capacity of 270mAh at 3.7V. ($5.95)