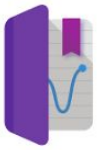
Elephant Seismology Student Hand Out

Part 1: Play with a science app!

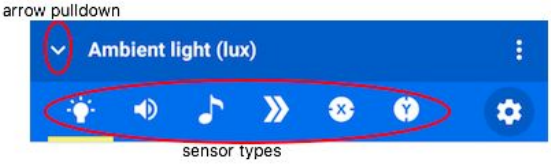
1. On a smartphone or tablet, install the Science Journal app (called Science Journal by Google on iPhone or Android).



Science Journal

2. Enter your birthday and answer the other prompts to set up the app.
3. Click the plus sign (+) in the lower right corner to start a new experiment.
4. Choose the waveform icon to view the sensor data.

5. Pull down the arrow next to Ambient light to view the other sensor types.
6. Try each sensor type. Which sensors seem to measure the phone's motion?



Part 2: Use the app as a seismometer

7. Now we're going to use the phone to act like a seismometer. Select one of the motion sensors (x, y, or z) then place the phone or tablet on the ground.
8. Try walking, jumping, dancing, or anything else near the device.
    a. Identify at least 3 human activities that you **<u>can</u>** see on the sensor graph. Take a screenshot, save the observation in Science Journal, or sketch the resulting waveform below:

    b. Identify at least 3 human activities that are difficult or impossible to detect using your device's accelerometers and the Science Journal app. In the space below, describe each of the activities that cannot be detected seismologically, and why you think they are difficult to impossible to measure.

science FRIDAY EDUCATE

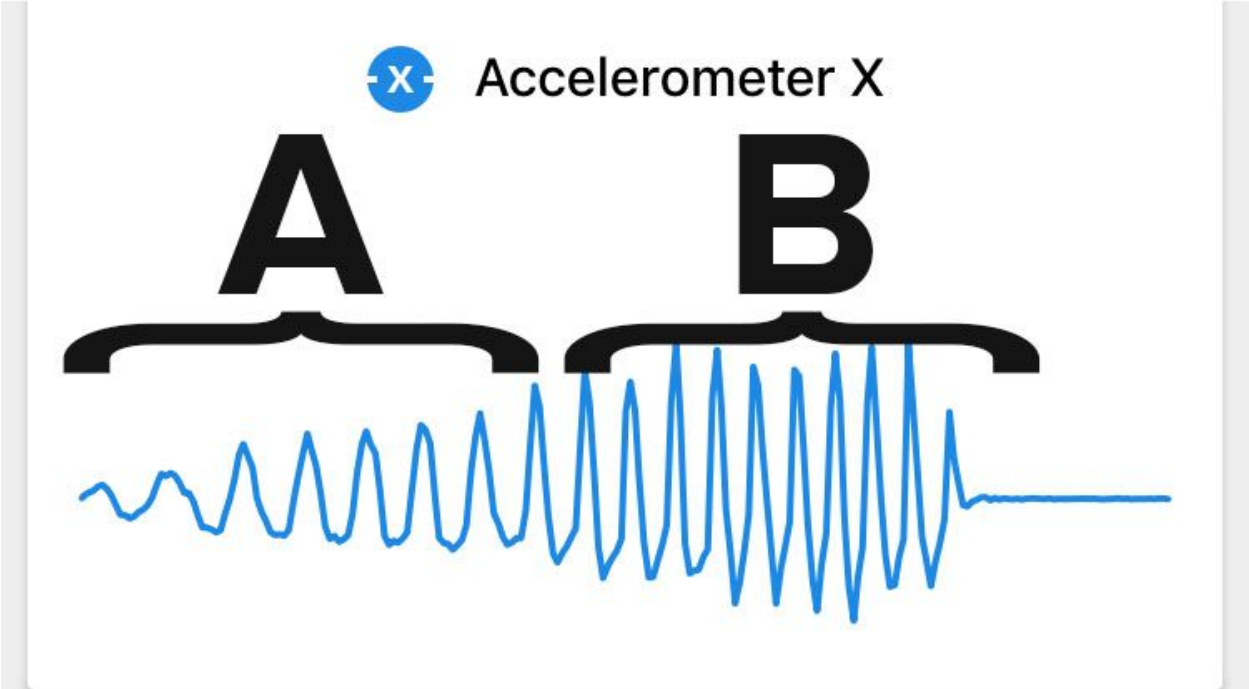
Resource by Marna Eckels & Brian Soash

Part 3: Record behaviors of different amplitudes and frequencies

Waves can have a multitude of different appearances. Using the app lets try to create data sets that can exhibit some of the traits that are used to describe different waves.

For example, frequency is the measure of how many waves pass by in a specific amount of time. Something with a high frequency would then have a large amount of waves passing by or being generated in a short amount of time. In the Figure 1 below waves are being generated in both section A and section B. There appears to be a difference between those two sections however.

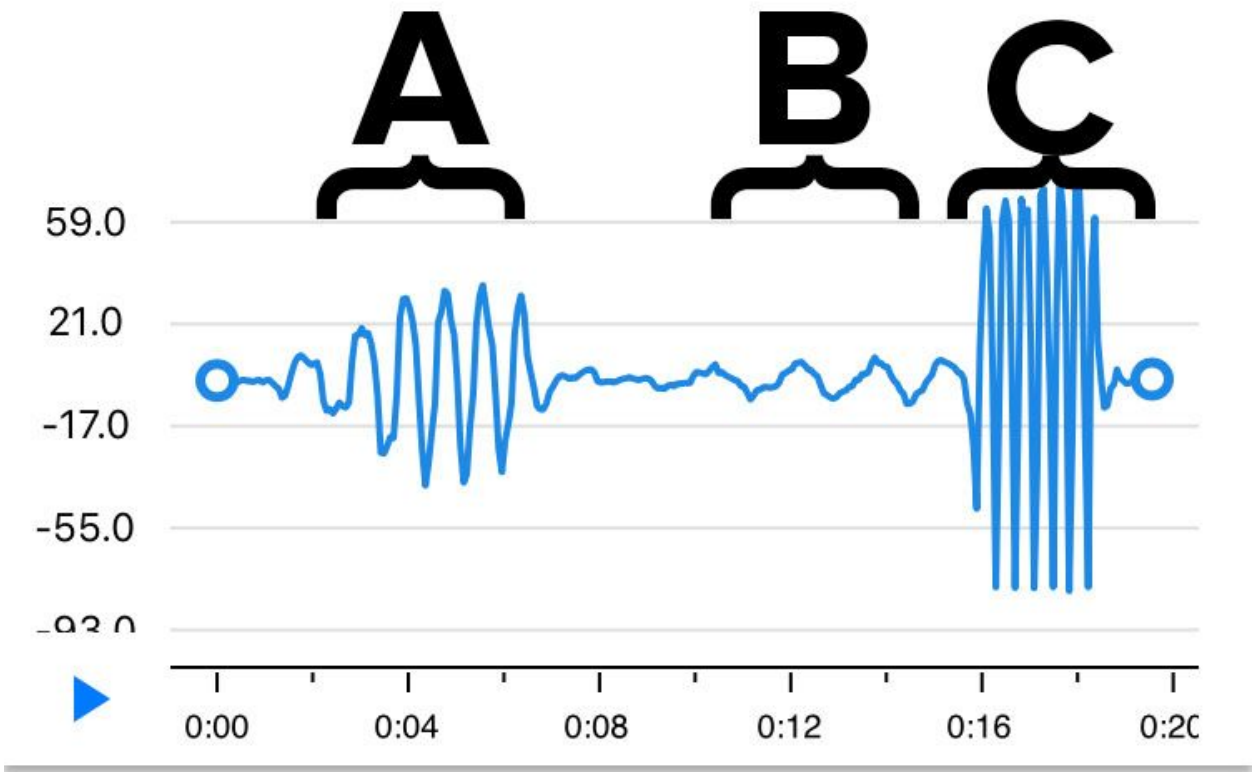
Figure 1



1) Using your knowledge of what frequency is, try describing the difference between section A and section B in Figure 1 above.

2) Which of these two sections in Figure 1 has the highest frequency? Support your claim about which section has the highest frequency by citing specific evidence from the image above, and then explain the reasoning behind why that piece of evidence proves your point.

Figure 2



3) Waves have other important features such as amplitude, which is the size of the wave's crest from the center point. Which of the three sections above has the lowest amplitude? Support your claim about which section has the lowest amplitude by citing specific evidence from the image above, and then explain the reasoning behind why that piece of evidence proves your point.

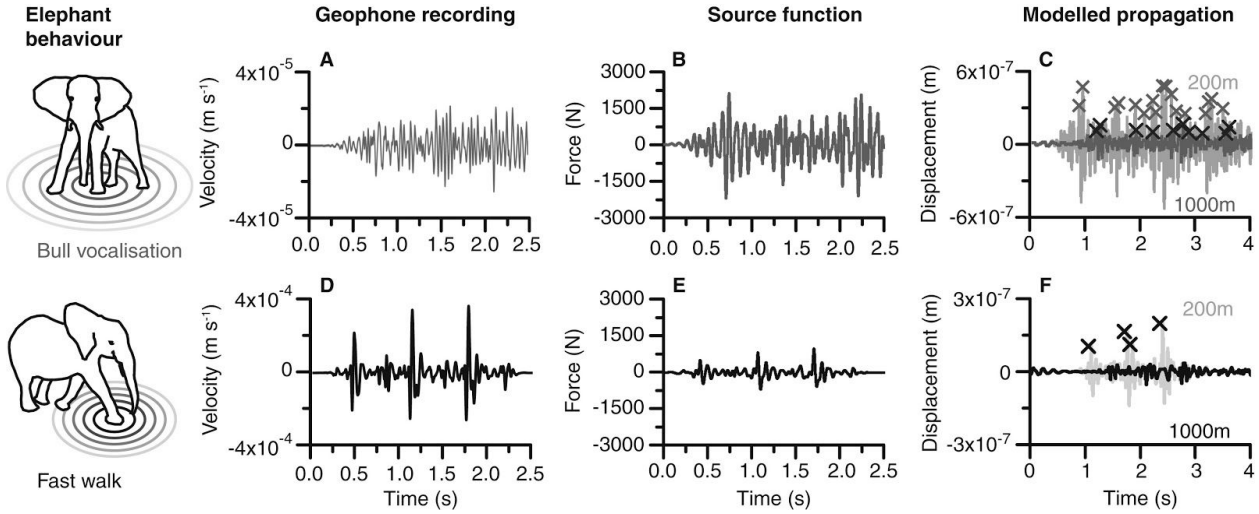
4) Wavelength is the distance from a specific point on one wave to the same specific point on the next wave. Using your app create an image like Figure 1 and Figure 2 above that shows (A) the longest wavelength you can create and (B) the shortest wavelength you can create. Use the spaces below to upload your images. If you're unable to upload them, sketch them out below.

(A) the longest wavelength you can create

(B) the shortest wavelength you can create

5) How did you use your knowledge of wavelengths and experimentation to create these wavelengths? Think about which axis you picked to measure and why you made the specific movements you did in order to create it.

Part 4: Student Sleuths



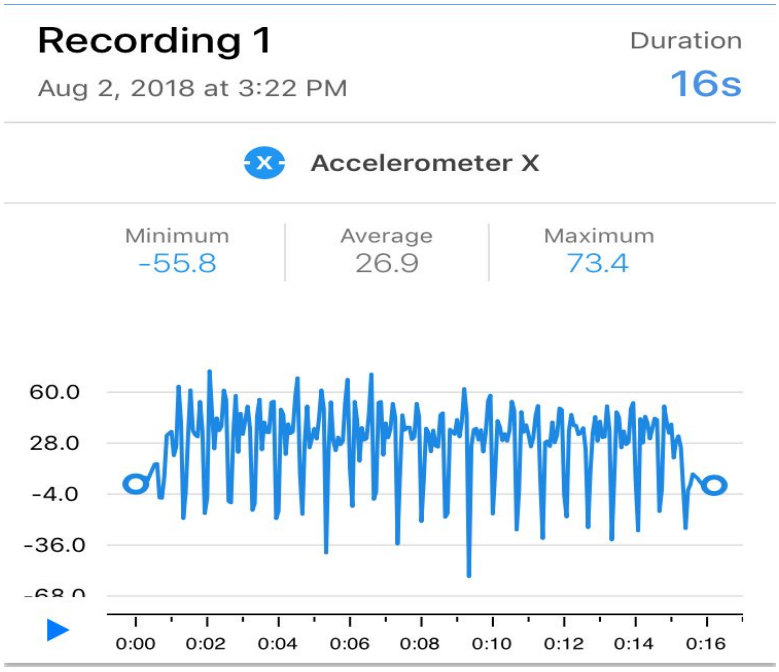
A rumble from a bull (A, B, C) versus each footfall in a fast walk (D, E, F) differs in recorded vertical ground velocity versus time (A, D), determined source function force versus time (B, E) and modelled propagation sampled at 200 m and 1000 m from the source (modelled with high noise on sandy terrain; C, F). Credit: from the journal Current Biology/CC-BY

Directions: Now that you've familiarized yourself with the app let's take an opportunity to conduct an investigation similar to the work the scientists have done with elephants.

1. In groups of three, with at least one smartphone with the app above, create your own recordings based on 3 different actions. Record the resulting graphs using your smartphone or with a sketch in the table below. Designate one person in your group as the record keeper who will keep track of what action goes with which of the recordings.
2. When you've completed the three actions and sketched or uploaded the graphs in the table below, trade papers or devices with another group to see if they can use their own experimenting and graph analysis to figure out what action generated each seismogram.
3. After each group has finished analyzing the graphs and providing their prediction and justification for which activity they think generated each graph, each group record keeper should reveal the real action that generated the graphs!

IMPORTANT: Everyone MUST hold their phone the same way when recording their seismographic data, and they must use the same sensor for measuring their data (x, y, or z). This allows for easier comparison by reducing the number of variables in the type of movement.

Example:

Student Recording #1

Group #1 Hypothesis: The graph above shows someone quickly jumping up and down.
Evidence: Short waves that appear to happen very quickly in a short amount of time.
Reasoning: The graph shows to show a fairly consistent amplitude with a low trough to each wave. There looks like more smaller waves at the top of each wave, which makes us think that it's showing the “hangtime” at the top of each jump before coming back down. The person is probably jumping up and down quickly because of how how high of the high frequency over the course of 16 seconds the waves were measured.
Answer: Running in place

G**roup #_____'s recordings**

Student Analysis Recording #1
Group _____ Hypothesis:
Evidence:
Reasoning, be sure to provide specific examples or information from the graph :
Answer:

Student Analysis Recording #2
Group _____ Hypothesis:
Evidence:
Reasoning:
Answer:

Student Analysis Recording #3
Group _____ Hypothesis:
Evidence:
Reasoning:

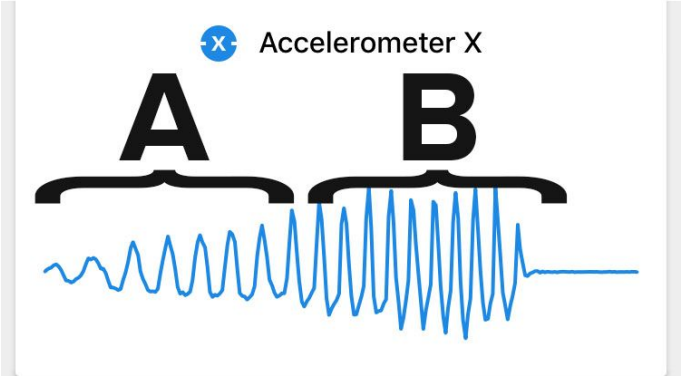
Reflection:

Waves definitely can play a pivotal role in our everyday lives and now, even be used in a variety of new ways.

1) Why do you think elephants are organisms that are very effective in this form of seismological study as compared to animals you might see on a more regular basis like a dog or a cat?

2) In your opinion why might it be worth for a conservation group or protected wildlife area in Africa to invest in the application of this research?

Figure 1



3) One of your friends says that section B in Figure 1 from the previous activity shows a long wavelength. Do you agree or disagree with them? Use the template below to help you construct your argument in against or in defense of their statement.

Claim, one sentence that clearly states your conclusion:
Evidence, cite at least two pieces of information from the activity that directly support your claim: Evidence #1: Evidence #2:
Reasoning, explain how each of the previously cited piece of evidence supports your claim in at least two to three sentences for each piece of evidence: Reasoning for evidence #1: Reasoning for evidence #2

4) What can a higher amplitude tell you about the elephants?

Claim, one sentence that clearly states your conclusion:
Evidence, cite at least two pieces of information from the activity that directly support your claim: Evidence #1:
Reasoning, explain how each of the previously cited piece of evidence supports your claim in at least two to three sentences for each piece of evidence: Reasoning for evidence #1:

5) If you were conducting this study and you found that there were waves being created that had a high amplitude separated by waves with much smaller amplitudes you might say that the elephant creating that might be doing what sort of activity?
HINT: Look back at your activities as well as the reading from the study by Beth Mortimer and Tarje Nissen-Meyer.

Claim, one sentence that clearly states your conclusion:
Evidence, cite at least two pieces of information from the activity that directly support your claim: Evidence #1:
Reasoning, explain how each of the previously cited piece of evidence supports your claim in at least two to three sentences for each piece of evidence: Reasoning for evidence #1: