**What is a Wave?**

<http://illinois.pbslearningmedia.org/resource/lsps07.sci.phys.energy.waves/what-is-a-wave/>

Background Essay

The physical definition of a wave is a disturbance that travels through space and transports energy. Some waves—electromagnetic waves (light)—can travel through a vacuum. Other waves, known as mechanical waves, can only travel through a medium such as a solid, liquid, or gas.

You encounter waves all the time in your daily life. For example, you can see because of visible light waves and hear because of sound waves. Waves exist in many forms; for instance, ripples on a pond or waves at a beach are waves that move through water, and earthquakes create waves that move through the ground. You may even have seen people simulate a wave. When a crowd does the "wave" at a sports event, they stand up and sit down in an organized way so that a ripple effect travels person by person through the entire crowd.

The disturbance caused by any wave is only temporary. Although a wave may transport energy from one place to another, it does not transport mass. For example, during the crowd "wave," each person changes position, from sitting to standing, for just a moment as the wave passes by. The people do not travel around the stadium with the wave.

Mechanical waves can be visualized because they move through matter, which is made of particles (atoms). As a particle is disturbed by a wave, it is temporarily displaced from its equilibrium, or rest, position. The movement of the particle causes its neighboring particle to move. As each particle bumps its neighbor, the disturbance is passed along the material. There are two basic types of mechanical waves: transverse and longitudinal. A transverse wave oscillates (moves back and forth) perpendicular to its direction of motion, as you see simulated in the activity when you disturb the particles up and down. A longitudinal wave, such as a sound wave, oscillates parallel to its direction of motion, as you see simulated in the activity when you disturb the particles left and right.

The amplitude of a wave—its maximum displacement from equilibrium—is related to the amount of energy it carries. Periodic waves repeat in a regular pattern; one wave cycle is one cycle of oscillation (for example, from peak upward displacement to peak upward displacement). The rate of oscillation is known as the frequency and the length of one complete wave cycle is known as the wavelength. Even light waves, which are difficult to visualize because they do not require the motion of particles within a medium, are oscillating fluctuations and have the same characteristics of amplitude, frequency, and wavelength.

Discussion Questions

1. Do all waves have to travel through "something"?
2. Do all waves have the same speed?
3. What types of motion are represented by each of the controls in the interactive activity?
4. Can you explain why a boat on the ocean (far offshore) bobs up and down but is not carried to shore by waves?

**Birth of a Tsunami**

<http://illinois.pbslearningmedia.org/resource/nvkq.vid.earth.tsunami/birth-of-a-tsunami/>

After watching the video, answer the follow questions:

Discussion Questions

1. Describe the process of tsunami formation.
2. Why did a tsunami strike the coast of Japan?
3. What makes a tsunami grow into an enormously tall wall of water when it reaches shallower water at the coastline?

Anatomy of a Wave

<http://www.pbs.org/wgbh/nova/earth/anatomy-tsunami.html>