Air Horn

Overview: Sound can change according to the speed at which it travels. Another word for sound speed is pitch. When the sound speed slows, the pitch lowers. With clarinet reeds, it's high. Guitar strings can do both, as they are adjustable. If you look carefully, you can actually see the low pitch strings vibrate back and forth, but the high pitch strings move so quickly it's hard to see. But you can detect the effects of both with your ears.

What to Learn: Sound is made by vibrating objects and can be described by its pitch and volume.

Materials

- 7-9" balloon
- straw
- film canister or similar small plastic container
- drill and drill bits

Lab Time

NOTE: DO NOT place these anywhere near your ear… keep them straight out in front of you.

1. To make an air horn, poke a hole large enough to insert a straw into the bottom end of a black Kodak film canister. (We used the pointy tip of a wooden skewer, but a drill can work also.)
2. Before you insert the straw, poke a second hole in the side of the canister, about halfway up the side.
3. Grab an un-inflated balloon and place it on your table. See how there are two layers of rubber (the top surface and the bottom surface)? Cut the neck off a balloon and slice it along one of the folded edges (still un-inflated!) so that it now lays in a flat, rubber sheet on your table.
4. Drape the balloon sheet over the open end of the film canister and snap the lid on top, making sure there's a good seal (meaning that the balloon is stretched over the entire opening - no gaps). Insert the straw through the bottom end, and blow through the middle hole (in the side of the canister).
5. You'll need to play with this a bit to get it right, but it's worth it! The straw needs to *just* touch the balloon surface inside the canister and at the right angle, so take a deep breath and gently wiggle the straw around until you get a BIG sound. If you're good enough, you should be able to get two or three harmonics!

Reading

What is the sound barrier? It's when something travels faster than the speed of sound. When an object travels faster than the speed of sound, there's a loud crack or boom that happens.

There are lots of things on earth that break the sound barrier – bullets and bullwhips, for example. The loud crack from a whip is the tip zipping faster than the speed of sound.

So why do we hear a boom at all? Sonic booms are created when an object travels faster than sound waves. In order to do this, the object must push enough air out of its way as it tears through the atmosphere. The faster an object travels through the air, the more air pressure is built up in front of the object (think of how the water collects at the bow of a boat as it travels through the water). The object, like an airplane, pushes air molecules aside in such a way that they are compressed to the point where shock waves are formed. These shock waves form two cones, at the nose and tail of the plane. The shock waves move outward and rearward in all directions and usually extend to the ground.

Since the airplane is flying, the shock waves extend from the plane to the ground. The sharp release of pressure, after the buildup by the shock wave, is heard as the sonic boom.

This experiment is rather tricky. Instead of a rubber band vibrating to make sound, a rubber sheet vibrates, and the vibration (sound) shoots out the straw. It will take practice for your child to make a sound using this device. The straw needs to barely touch the inside surface of the balloon at just the right angle in order for the balloon to vibrate. Make sure you're blowing through the hole in the side, not through the straw.

Exercises Answer the questions below:

1. Why do we use a straw with this experiment?

2. Does the length of the straw matter? What will affect the pitch of this instrument?

Answers to Exercises: Air Horn

1. Why do we use a straw with this experiment? (To blow a continuous stream of air onto the rubber sheet to set up a vibration in the sheet, which allows air to escape out the side where the straw contacts the rubber sheet.)
2. Does the length of the straw matter? What will affect the pitch of this instrument? (Air flow, tightness of rubber sheet.)