Siren Disk

Spin up some sound.

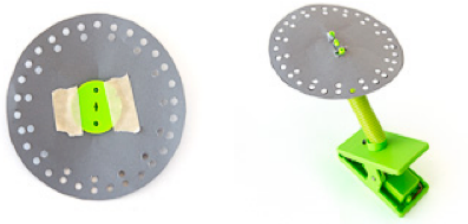
Blow air through the holes of a spinning disk to produce different tones. More holes and a faster-spinning disk make for higher-pitched sounds.

Tools and Materials

- Siren Disk template
- Cardstock for printer or copier
- Scissors
- Single 1/4-inch (5-mm) hole punch (a standard one will work, but a hole punch with a 2-inch [5-cm] reach will give you more options)
- Small safety or baby fan with soft foam blades and battery or USB power
- Tape
- Straw
- Small Phillips screwdriver

Assembly

1. Print out or photocopy onto cardstock the Siren Disk template. Cut out the disk.
2. Punch a hole wherever there's a black dot on the pattern.
3. Mount the disk to the fan. Try to center it the best you can (the cross on the disk represents the center). One way to do this is to tape the disk to the fan blades. On most safety fans, the fan blades are attached to a removable holder. If you can, use a screwdriver to remove the blades, attach the disk, and remount the blades with the disk attached. (Note that the blades are not dangerous since they're just made of foam.)



To Do and Notice

Turn on the fan. Aim a straw at the outer ring of holes. Blow through the straw, and listen to the pitch of the sound produced.

Move the straw to the inner ring of holes. Before you blow, think about how the pitch might change: Will it be higher, lower, or the same? There are fewer holes, but they're turning at the same rotational speed. Blow through the straw and compare the pitch to what you heard from the outer ring of holes.

Place your finger gently against the disk to slow it down. What happens to the pitch when you blow through the holes now?

Turn off the fan and punch additional holes in the disk. Can you predict what the new pitch will be?

What's Going On?

Sound is a compression wave where air is compressed and expanded. The stream of air that comes out of the straw gets chopped by the moving holes, which each create a compression and an expansion.

The number of compressions and expansions created is directly related to the number of holes that chop the air. The more chops that occur in a unit of time, the higher the frequency of the sound. The fewer chops that occur in a unit of time, the lower the frequency of the sound. Since the pitch of a sound is related to its frequency, a higher frequency has a higher pitch and a lower frequency has a lower pitch.

The inner ring of holes has a lower frequency since fewer holes per revolution pass under the airstream each second. Interestingly, only the number of holes per second matters and not the distance from the center: every spot on the disk has the same rotational speed. That is, each spot turns the same number of times per second, even though the outside ring has a greater linear speed than the inside ring, since it has to go a farther distance in each turn.

Going Further

You can also make the disk sing electronically. Connect a small solar panel to an amplified speaker (see the Modulated LED Snack for how to do this), and shine a light through the holes of the disk onto the solar panel. The speaker will make a pitch that is the same as the air blowing through the holes.