Twirling Sound Tubes

How many notes can you play?

WHAT TO DO

Hold the tube at either end and slowly swing it around in a large circle. You should hear a musical note. Twirl it faster to produce a higher note. Try swinging faster to produce higher notes.

WHAT'S HAPPENING?

Imagine that the tube is filled with marbles. If you were to swing it around marbles would obviously begin to spray out of the open end. Air molecules inside the "empty" tube do the same thing as you twirl it, and the air molecules spraying out of the free end create lower pressure inside, which in turn draws more air into the tube at the end you are holding. This creates a flow of air through the tube which collides with the outside air as it tries to exit the tube, causing some of the air to reflect or bounce back. These air or sound waves reflect back and forth and interact with each other until most of them lose energy and die off, but certain frequencies, called natural or resonant frequencies grow larger until they become large enough for us to hear the sound. The natural frequencies are determined largely by the dimensions of the tube, and are all multiples of a lowest or fundamental frequency, called harmonics. Changing the speed at which you twirl the tube determines which of these harmonics sound the loudest, so that you hear progressively higher notes as you swing it faster.