The Secret Sounds of the Oven Shelf

http://www.thenakedscientists.com/HTML/content/kitchenscience/exp/
The kitchen has always seemed an unlikely place to find a musical instrument - until now.

What to Do
1 - Take one piece of string and tie it to one corner of the oven shelf. Do the same with the other piece of string on an adjacent corner. If you hold onto the loose ends of the string, it should hang like a picture on a wall.
2 - Take the loose ends of the string and wrap one round each of your index fingers. As your friend to hit the oven shelf with the wooden spoon. What does it sound like?
3 - Put your fingers in your ears. The oven shelf should now be hanging down directly in front of you, as though you're hanging a picture from your eardrums!
4 - Ask your friend to run the wooden spoon across the front of the oven shelf while it's hanging from your ears. What do you hear now?
5 - Let your friend have a go!

What Happens
When you listen to the oven shelf being hit normally, you can hear a ringing sound. However when your fingers are in your ears, the sound you hear is much lower - a bit like a huge gong - and really nothing like an oven shelf usually sounds.
Why does it happen?

First of all we have to understand that sound is all about vibrations. When somebody speaks, their voicebox vibrates, and this makes the air around it vibrate. These vibrations carry information about what someone has just said. When these vibrations reach your ear, they make your eardrum vibrate and this is processed by your brain as sound. The amount of energy (or the volume of the sound) that manages to make the journey from voicebox to ear depends on what the sound is travelling through and what kind of sound it is.

In the case of speaking to a friend or when you listen to the oven shelf, the vibrations must travel through air. Air is really sloppy, fluid and not very stiff. Water is quite similar - if you put your hand in water and slowly move it around, the water feels very soft and fluidic. However, if you slap the water then it suddenly feels very hard and stiff. This is because the water doesn't have time to get out of the way so it has to form waves. Although it is not quite so obvious, this is the same for air. If you move something through it very quickly, the air feels stiffer and it's much harder to move through it, so high frequency vibrations will transfer more energy into the air.

At high frequencies the air does not have time to get out of the way so it has to form waves. At low frequencies the air has time to move around the shelf so it does not have to form waves.
The ability of sound to reach someone's ear also depends on the ability of the air next to the ear drum to vibrate. In the same way as a high frequency (pitch) vibration can transfer more energy to the air from the oven shelf because it has less time to get out of the way, a high frequency sound will transfer more energy from the air to your eardrum so the sound loud. Low frequency sounds vibrate the air much more slowly, and so the air seems relatively more sloppy and doesn't transfer energy so well so they sound much quieter. So both low and high frequency sounds are produced by the oven shelf but it's only the high frequencies that vibrate the air by your ear drum much so the shelf sounds tinny and high pitched.

In order to hear the low frequencies, you need to create a stiff connection between the oven shelf and your ears. The string wrapped around your fingers provides this connection. The string is taut and stiff and can transmit both high and low frequencies. When you add the high and low frequencies together, the oven shelf suddenly sounds like a gong.

What about in the real world?

This is why your voice sounds different to everyone else and when you hear it recorded. Everyone else just hears you though the air, but you hear yourself through the bones in your skull as well, so different pitches will reach your ears than other people's.