

Some Sound Experiments from the World Science Festival

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Science Principles: Sound waves; frequency; wavelength; pitch

Description: Back in 2016, I was invited to perform at the World Science Festival in a program about the science of sound which was hosted by Alan Alda. Here are two of the demonstrations that I did that day.

The first uses software to alter the sound of a person's voice by speeding up or slowing down the waveform. When you speed it up, the pitch of the sound gets higher, and when you slow it down, the pitch gets lower. I turned this into a short comedy routine where I follow the life of a volunteer from the audience, and simulate the sound of his voice at different times of life by changing the pitch.

The second demo engages the entire audience. We attempted to create "sound waves" in the audience, similar to "the wave" that you often see at football games. It was only partially successful that day at the World Science Festival, and hopefully more so at the 2018 ASTC Live Demo Hour.

Demo 1: "No Way"

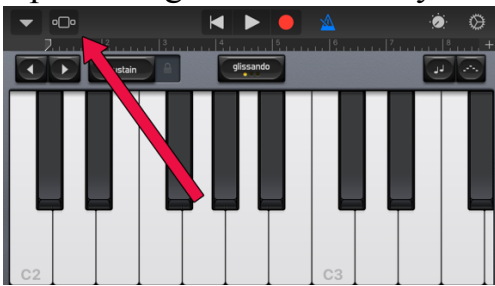


For this demo you will need some sound sampling software that is capable of recording a sound, then playing it back at different "speeds," thereby raising or

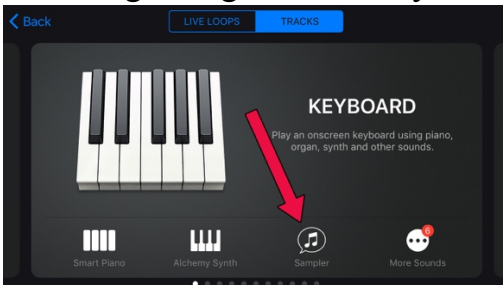
lowering the pitch of the sound. I use Apple's Garage Band on an iPhone as it comes free with the phone.

Before explaining the routine, here are the steps to record (sample) a sound, then play it back using Garage Band on an iPhone.

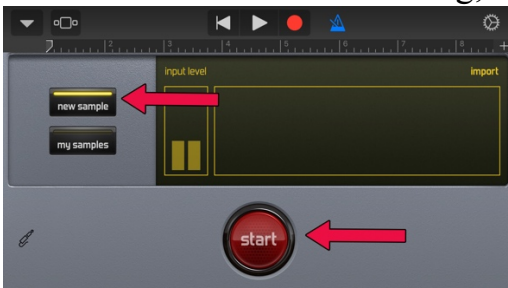
1. Open Garage Band. When you see the keyboard, click on the icon shown.



2. On the next screen, click on the "sampler" icon. (Note: if you don't see Keyboards, but rather see Strings, or Drums, or something, then swipe to the left or right to get to the Keyboard screen.)



3. Next is the screen for recording, using the start and stop buttons.



4. Once you have recorded the sound, you can play it at different pitches on the keyboard. In order to view the full keyboard, click on the icon shown.



Outline of the routine:

- Invite volunteer up onto the stage. (A teenage male is the best because you can most easily hear the changes in his voice.)
- Explain to him that you will record him saying, “No way,” into your phone. Practice this once with him.
- Using the steps above, record (sample) his voice saying, “No way.”
- Tell your volunteer that when you touch him on the shoulder he is to mouth the words, “No way,” but he is not to make any sounds. You (the presenter) will be using your software to make the sounds for him. Practice this once or twice with him. When he mouths the words, you hit the appropriate key on the keyboard so that the software plays back the sound at about the same pitch as recorded. This is probably C3 on the keyboard.
- Tell the audience that you can change the pitch of his voice by speeding it up or slowing it down. At that you will now demonstrate.
 - We start our story when [volunteer] was only 3 years old. His mom says to him, “Now [volunteer], you have to eat all your vegetables before you can have any dessert.” And, [volunteer] said, (*touch his shoulder so he mouths the words, and play back “no way” with a high pitch.*)
 - Let’s move ahead until [volunteer] is in 3rd grade. His teacher says to him, “You just got 100% on your science exam.” And, [volunteer] replies, (*touch his shoulder so he mouths the words, and play back “no way” with a medium pitch.*)
 - Fast forward until [volunteer] is 35 years old. His spouse comes to him and says, “Did you remember that yesterday was our anniversary?” , [Volunteer] replies, (*touch his shoulder so he mouths the words, and play back “no way” with a low pitch.*)
 - Finally, [volunteer] is 98 years old. The nurse comes in and says, “Now [volunteer], you have to eat all your vegetables before you can have any dessert.” And, [volunteer] says, (*touch his shoulder so he mouths the words, and play back “no way” with a really low pitch.*)
- Thank your volunteer and direct him back to his seat. Explain to the audience that by changing the speed of his voice, you can change the pitch of the sound.

Demo 2: “Audience Sound Waves”



In this audience-participation demo, you will try to get the audience to create a “sound wave.”

- Start with having the audience do “the wave” like at football games. You will initiate the wave with an up-and-down motion like an orchestra conductor.
- Next, ask them to do it again, but with a very narrow, well-defined wave.
- Can they make a slow moving wave, then a quick-moving wave. The “stiffer” the medium, the faster the wave. This speed of the single wave across the audience represents the speed of sound through the medium.
- Finally, see if you can make repeated waves all moving in the same direction. This forms a single “sound wave.”
- If there is time, you can play around with changing the frequency of the wave (corresponding to the frequency with which you conduct up-and-down motions as the orchestra leader.)

Note: I did this at the World Science Festival with mixed success. But, will try it again at the 2018 Live Demo Hour.

You can watch my full presentation with Alan Alda, which includes both of these demos, at <http://eddiegoldstein.com/world-science-festival-videos/>