

Lab Pd - Create a Theremin in Pd

Summary of the class

- You have been introduced to Pd and learned how to install it
- We have learned how to edit Pd patches and seen different types of objects such as generic objects, messages, numbers, sliders etc.
- We have made a sounding patch based on a sine wave (the `osc~` object)
- We have learned how to turn audio computing ON and OFF.
- We have learned how to control its frequency and its amplitude (by means of a simple multiplication).

It is now time to put this acquired knowledge into practice with an assignment/exercise that deepens into many of these concepts!!

Some might have found our oscillator sounding a bit dull or thin. Our oscillator was indeed based on a humble sine wave, the simplest electronic sound you can get. A sine wave is a wave with a single frequency, without harmonics, so it definitely sounds quite thin. Perfect sine waves are hard to find in nature and acoustic instruments. A tuning fork, high frequency whistles or high frequency flute sounds, both quite poor on harmonics, might get close to that... The Theremin, one of the first electronic music instruments (it was invented exactly 1 century ago, in 1917), has also a quite pure timbre, poor on harmonics, and thus quite close to the sound wave... The reason I'm saying this, is that, for achievement your exercise, you will get inspiration from the Theremin...

Introducing the Theremin

The Theremin was created by the Russian Lev Thermen in 1917. In Spanish, we use the verb "touch" (tocar) for "playing" an instrument. That is if someone was telling you in Spanish "I touch the guitar" (toco la guitarra) it would be really meaning, "I play the guitar"! That happens even in the case of the Theremin, which is one of the few music instruments that is played without being touched! Even if you were not aware of this instrument you have probably heard it in many recordings. Because of its pure electronic sound, it was popular in science fiction movies from the 50s, anytime a sound from "outer space" was required... The Beach Boys used one in their 1966 single "Good Vibrations", and other bands such as the Rolling Stones, Led Zeppelin or Portishead have sporadically turned to its dream-like sounds...

Some Theremin Videos

You can find hundreds of Theremin related videos in Youtube, but if we had to pick just

one, probably this recent video by Thereminist Carolina Eyck stands out from the rest. Carolina is a great performer and great communicator, and in that video, she brilliantly unveils some of the secrets of this mysterious instrument.

[Carolina talks Theremin - An overview for composers and music lovers](#)

Some archetypal Theremin sound characteristics

More than exactly replicate a Theremin, in this initial exercise we want to get inspired by some of its archetypal sonic properties, namely:

- It has a quite pure, almost sinusoidal timbre/tone.
- It can play a continuous pitch (glissando) from its lowest to its highest pitch.
- Pitch and amplitude are controlled separately.
- It often shows a quite distinctive vibrato (modulation of pitch).

Of these 4 elements, only the 4th will require some additional explanation before you will start your exercise, which will necessarily cover the following aspects.

Exercise Premises

1. **Change the linear frequency and amplitude values of the oscillator we made in the classroom to logarithmic units that accommodate better to our perceptual apparatus:**
Convert frequencies to semitones via midi note values with [mtof]. Convert RMS values in range 0-1 to dB units between 0 and 100 with [rmstodb]. In Pd, 0 dB reflects -inf and 100 dB represents unit amplitude before clipping. Therefore, the dynamic range in Pd is of 100 dB.
2. **Provide a vibrato control. It should have 2 separate parameters/sliders: one for controlling the frequency of the vibrato (how fast a note changes, which you should control in Hertz), the other for controlling the vibrato amplitude (how much it changes, for example +-2 semitones).**

What is a vibrato and suggestions on how to create one in Pd?

A vibrato is a subtle and periodic variation of pitch. In a violin, for example, vibrato is produced by the moving the fingertip of the left hand that is pressing a sounding string, and bringing about a slight change in the vibrating string length, which causes an undulation in pitch.

In Pd, we will apply an oscillator object [osc~] to the current value of the pitch before it enters into the main oscillator. In principle, we could apply this variation to the "note" value (i.e. before it enters [mtof]) or to the "Hertz" value (after it leaves [mtof]). One of the 2 approaches is simpler and gives much better results. You will have to choose one and

justify the choice.

You will also have to set properly the range of your vibrato oscillator, both in frequency (the frequency of the vibrato) and in amplitude (the amplitude of the vibrato or the maximum amount of pitch it can go up and down).

Controls (sliders) in your patch

According to what we have said, your final patch should have 4 sliders (remember that you can set their range via right-click > properties.)

1. Pitch of the Theremin (continuous, mimics the Theremin right hand)
2. Amplitude of the Theremin sound (mimics the Theremin left hand)
3. Frequency of the vibrato (from 0 to just a few Hz). Listen and justify your choice.
4. Amplitude (or amount) of vibrato (e.g. from 0 to +-2 semitones).