π))) Sonic Pi PART 1

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Sam is the creator of Sonic Pi. By day he's a Research Associate at the University of Cambridge and by night he writes code for people to dance to.
sonic-pi.net

LIVE CODING

You'll Need

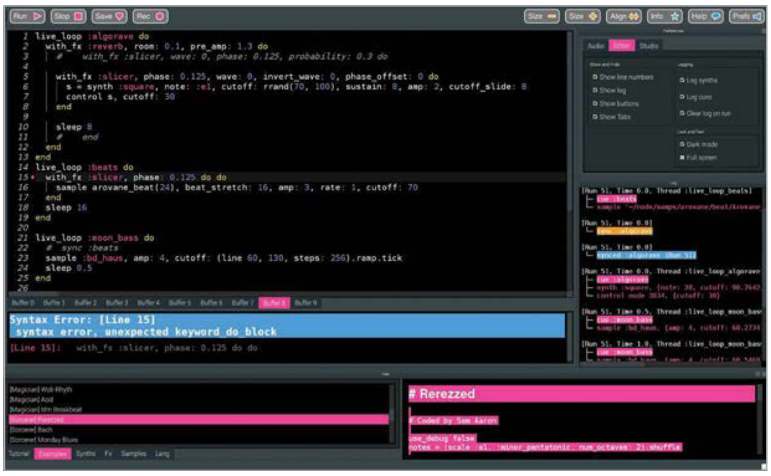
- Raspberry Pi running Raspbian
- Sonic Pi v2.6+
- Speakers or headphones with a 3.5mm jack
- Update Sonic Pi: `sudo apt-get update && sudo apt-get install sonic-pi`

Digital musician and Cambridge Computer Lab researcher **Sam Aaron** starts a new Sonic Pi tutorial series by introducing the art of live coding

The laser beams sliced through the wafts of smoke as the subwoofer pumped bass deep into the bodies of the crowd. The atmosphere was rife with a heady mix of synths and dancing. However, something wasn't quite right in this nightclub. Projected in bright colours above the DJ booth was futuristic text, moving, dancing, flashing. This wasn't fancy visuals; it was merely a projection of Sonic Pi running on a Raspberry Pi. The occupant of the DJ booth wasn't spinning discs; she was writing, editing, and evaluating code. Live. This is Live Coding.

This may sound like a far-fetched story from the future, but coding music like this is a growing trend and is often described as live coding (**toplap.org**). One of the recent directions this approach to music-making has taken is the Algorave (**algorave.com**) – events where artists like myself code music for people to dance to. However, you don't need to be in a nightclub to live-code; with Sonic Pi v2.6+, you can do it anywhere you can take your Raspberry Pi and a pair of headphones or some speakers. Once you reach the end of this article, you'll be programming your own beats and modifying them live. Where you go afterwards will only be constrained by your imagination.

Below The new Dark theme for v2.6 is lovely!



```
live_loop :algorave do
  with_fx :reverb, room: 0.1, pre_amp: 1.3 do
  | #    with_fx :slicer, wave: 0, phase: 0.125, probability: 0.3 do

    with_fx :slicer, phase: 0.125, wave: 0, invert_wave: 0, phase_offset: 0 do
      s = synth :square, note: :e1, cutoff: rrand(70, 100), sustain: 8, amp: 2, cutoff_slide: 8
      control s, cutoff: 30
    end

    sleep 8
  | #    end
  end
end
live_loop :beats do
  with_fx :slicer, phase: 0.125 do do
    sample arovane_beat(24), beat_stretch: 16, amp: 3, rate: 1, cutoff: 70
  end
  sleep 16
end

live_loop :moon_bass do
  # sync :beats
  sample :bd_haus, amp: 4, cutoff: (line 60, 130, steps: 256).ramp.tick
  sleep 0.5
end
```

```
Syntax Error: [Line 15]
 syntax error, unexpected keyword_do_block
[Line 15]:   with_fx :slicer, phase: 0.125 do do
```

```
# Rerezzed

# Coded by Sam Aaron

use_debug false
notes = (scale :e1, :minor_pentatonic, num_octaves: 2).shuffle
```

Live loop

The key to live coding with Sonic Pi is mastering the **`live_loop`**. Let's look at one:

```
live_loop :beats do
  sample :bd_haus
  sleep 0.5
end
```

There are four core ingredients to a **`live_loop`**. The first is its name. Our **`live_loop`** above is called **`:beats`**. You're free to call yours anything you want. Go crazy. Be creative. I often use names that communicate something about the music they're making to the audience. The second ingredient is the **`do`** word, which marks where the **`live_loop`** starts. The third is the **`end`** word, which marks where the **`live_loop`** finishes. Finally, there is the body of the **`live_loop`**, which describes what the loop is going to repeat – that's the bit between the **`do`** and **`end`**. In this case, we're repeatedly playing a bass drum sample and waiting for half a beat. This produces a nice regular bass beat. Go ahead: copy it into an empty Sonic Pi buffer and hit Run. Boom, boom, boom!

Redefining on-the-fly

OK, so what's so special about the **`live_loop`**? So far it just seems like a glorified 'loop'! Well, the beauty of **`live_loop`**s is that you can redefine them on-the-fly. This means that while they're still running, you can change what they do. This is the secret to live coding with Sonic Pi. Let's have a play:

```
live_loop :choral_drone do
  sample :ambi_choir, rate: 0.4
  sleep 1
end
```

Now hit the Run button or press **ALT+R**. You're now listening to some gorgeous choir sounds. Now, while

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it's still playing, change the rate from **0.4** to **0.38**. Hit Run again. Whoa! Did you hear the choir change note? Change it back up to **0.4** to return to how it was. Now, drop it to **0.2**, down to **0.19**, and then back up to **0.4**. See how changing just one parameter on-the-fly can give you real control of the music? Now play around with the rate yourself - choose your own values. Try negative numbers, really small numbers, and large numbers. Have fun!

Sleeping is important

One of the most important lessons about **live_loop**s is that they need rest. Consider the following **live_loop**:

```
live_loop :infinite_impossibilities do
  sample :ambi_choir
end
```

If you try running this code, you'll immediately see Sonic Pi complaining that the **live_loop** did not sleep. This is a safety system kicking in! Take a moment to think about what this code is asking the computer to do. That's right, it's asking the computer to play an infinite amount of choir samples in zero time. Without the safety system, the poor computer will try to do this and crash and burn in the process. So remember- your **live_loop**s must contain a **sleep**.

Combining sounds

Music is full of things happening at the same time. Drums at the same time as bass at the same time as vocals at the same time as guitars... In computing we call this concurrency, and Sonic Pi provides us with an amazingly simple way of playing things at the same time. Simply use more than one **live_loop**!

```
    live_loop :beats do
      sample :bd_tek
      with_fx :echo, phase: 0.125, mix: 0.4 do
        sample  :drum_cymbal_soft, sustain:
0, release: 0.1
        sleep 0.5
      end
    end

    live_loop :bass do
      use_synth :tb303
      synth :tb303, note: :e1, release: 4,
cutoff: 120, cutoff_attack: 1
      sleep 4
    end
```

Here, we have two **live_loop**s: one looping quickly, making beats; another looping slowly, making a crazy bass sound.

One of the interesting things about using multiple **live_loop**s is that they each manage their own time. This means it's really easy to create interesting polyrhythmical structures and even play with phasing, Steve Reich style. Check this out:

Steve Reich's piano phase

```
    notes = (ring :E4, :Fs4, :B4, :Cs5,
:D5, :Fs4, :E4, :Cs5, :B4, :Fs4, :D5, :Cs5)

    live_loop :slow do
      play notes.tick, release: 0.1
      sleep 0.3
    end

    live_loop :faster do
      play notes.tick, release: 0.1
      sleep 0.295
    end
```

Bringing it all together

In each of these tutorials, we'll end with a final example in the form of a new piece of music which draws from all of the ideas introduced. Read this code and see if you can imagine what it's doing. Then, copy it into a fresh Sonic Pi buffer and hit Run and actually hear what it sounds like. Finally, change one of the numbers, or comment and uncomment things out. See if you can use this as a starting point for a new performance – and most of all, have fun! See you next time...

```
with_fx :reverb, room: 1 do
    live_loop :time do
      synth :prophet, release: 8, note: :e1, cutoff: 90, amp: 3
      sleep 8
    end
  end

  live_loop :machine do
    sample :loop_garzul, rate: 0.5, finish: 0.25
    sample :loop_industrial, beat_stretch: 4, amp: 1
    sleep 4
  end

  live_loop :kik do
    sample :bd_haus, amp: 2
    sleep 0.5
  end

  with_fx :echo do
    live_loop :vortex do
      # use_random_seed 800
      notes = (scale :e3, :minor_pentatonic, num_octaves: 3)
      16.times do
        play notes.choose, release: 0.1, amp: 1.5
        sleep 0.125
      end
    end
  end
```