

Live Coding

- A performing arts form featuring:
 - The writing of source code
 - The use of interactive programming
 - Improvisation, i.e. composing and playing music at the same time

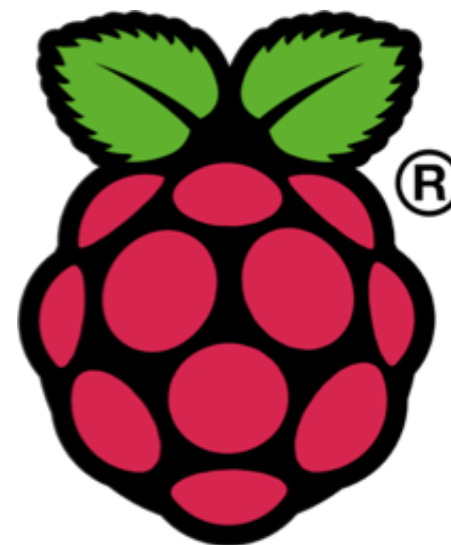


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(((Sonic π)))

- Live coding environment
- Designed to support both computing and music lessons in schools
- Free and cross-platform
 - Windows, MacOS, Linux, Raspberry Pi



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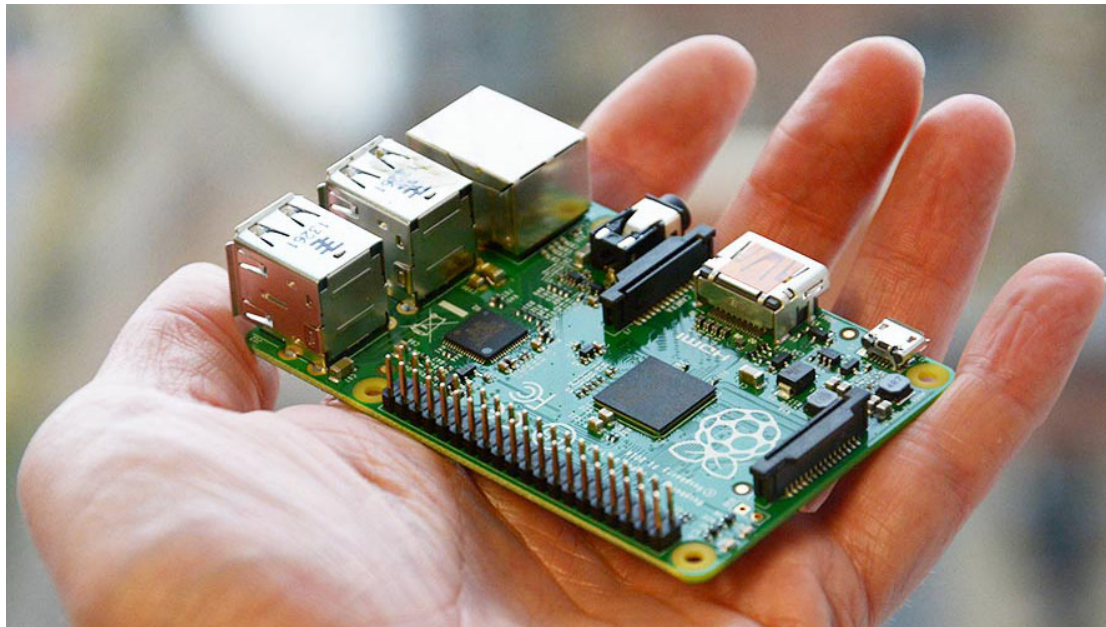
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Sonic Pi: Live & Coding



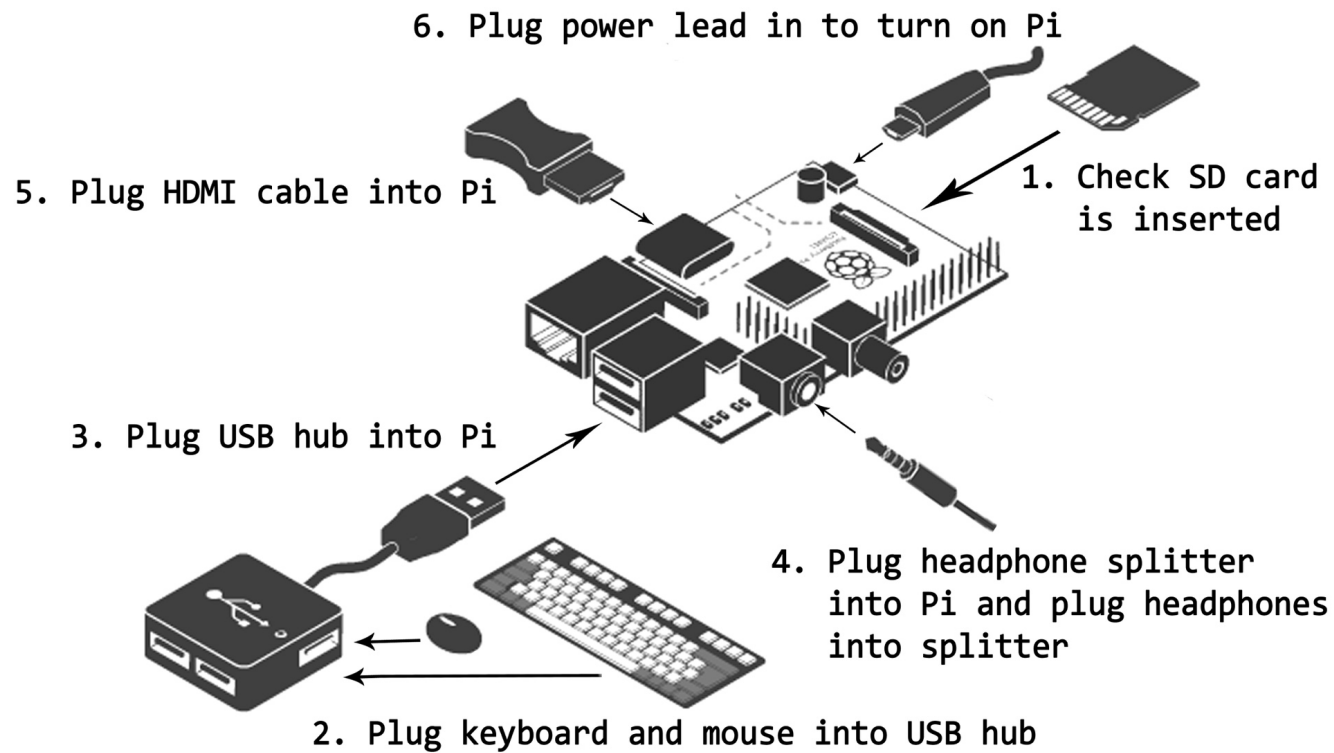
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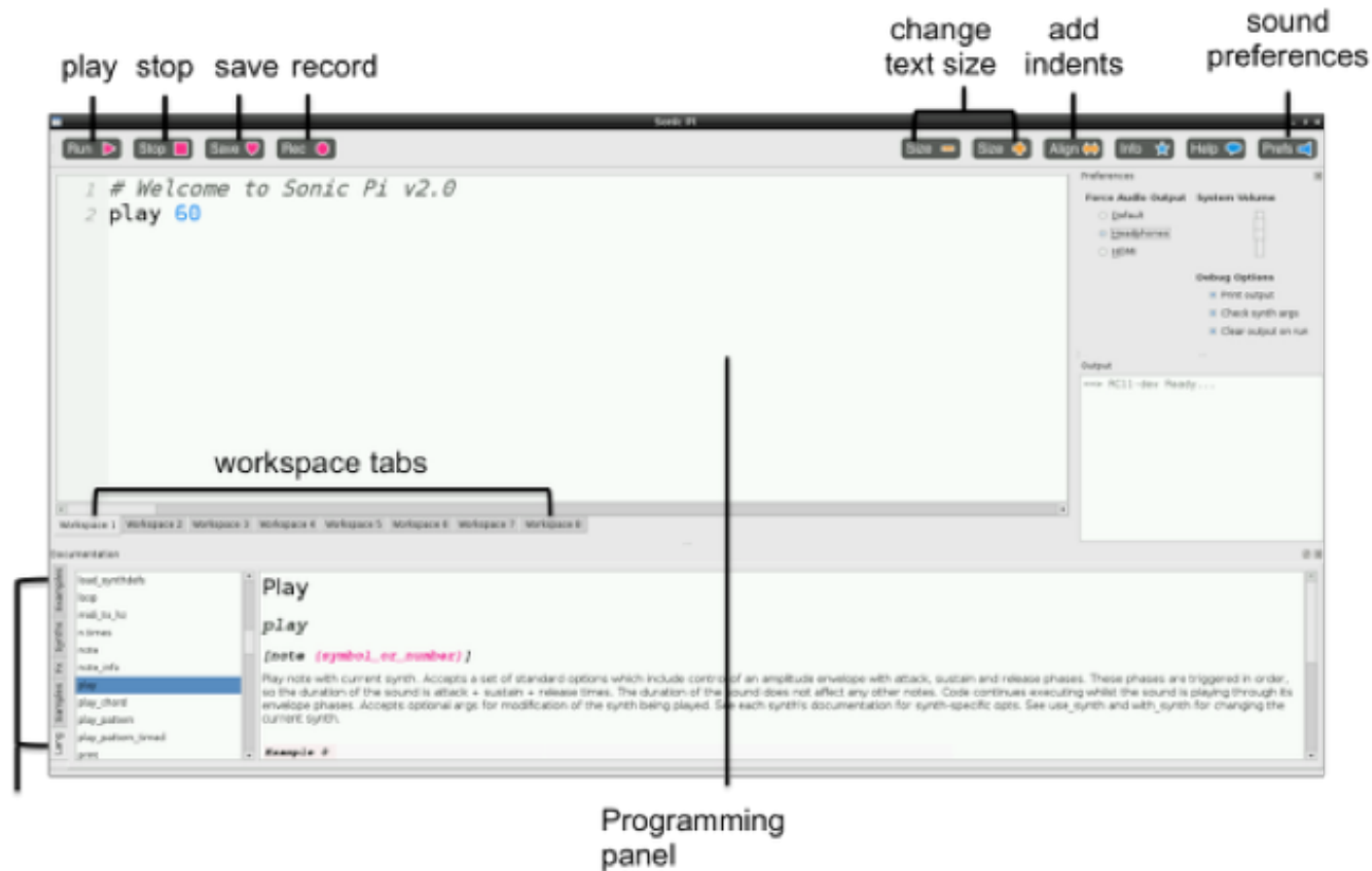
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play

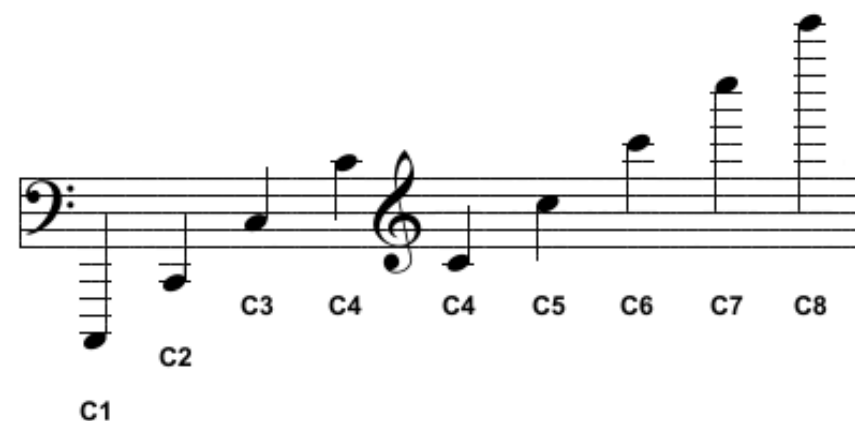
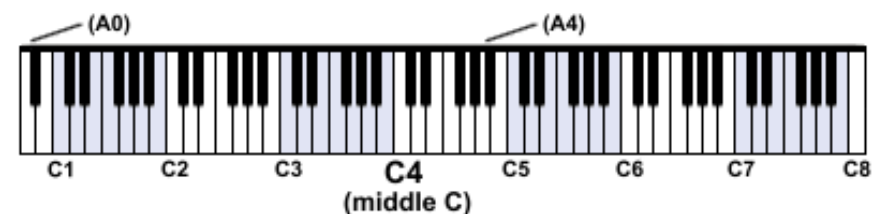
- play :C4
 - Play the note C4 (with default synthesizer)
- play 60
 - Play the note with MIDI number 60 (i.e. C4)
- play :60
 - What happen?



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Frequency	Keyboard	Note name	MIDI number
4186.0		C8	108
3951.1		B7	107
3729.3		A7	106
3520.0		G7	105
3322.4		F7	104
2960.0		E7	103
2793.8		D7	102
2637.0		C7	101
2489.0		B6	100
2349.3		A6	99
2217.5		G6	98
1975.5		F6	97
1864.7		E6	96
1760.0		D6	95
1661.2		C6	94
1568.0		B5	93
1480.0		A5	92
1396.9		G5	91
1318.5		F5	90
1174.7		E5	89
1108.7		D5	88
987.77		C5	87
932.33		B4	86
880.00		A4	85
830.61		G4	84
783.99		F4	83
739.99		E4	82
659.26		D4	81
622.25		C4	80
587.33		B3	79
554.37		A3	78
493.88		G3	77
466.16		F3	76
440.0		E3	75
415.30		D3	74
392.00		C3	73
369.99		B2	72
349.23		A2	71
329.63		G2	70
311.13		F2	69
293.67		E2	68
277.18		D2	67
261.6		C2	66
246.94		B1	65
233.08		A1	64
220.00		G1	63
207.65		F1	62
196.00		E1	61
185.00		D1	60
174.61		C1	59
164.81		B0	58
155.56		A0	57
146.83		G0	56
138.59		F0	55
130.81		E0	54
123.47		D0	53
116.54		C0	52
110.00		B-1	51
103.83		A-1	50
97.999		G-1	49
92.499		F-1	48
87.307		E-1	47
82.407		D-1	46
77.782		C-1	45
73.416		B-2	44
69.296		A-2	43
65.406		G-2	42
61.735		F-2	41
58.270		E-2	40
55.000		D-2	39
51.913		C-2	38
48.999		B-3	37
46.249		A-3	36
43.654		G-3	35
41.203		F-3	34
38.891		E-3	33
36.708		D-3	32
34.648		C-3	31
32.703		B-4	30
30.868		A-4	29
29.135		G-4	28
27.500		F-4	27
		E-4	26
		D-4	25
		C-4	24
		B-5	23
		A-5	22

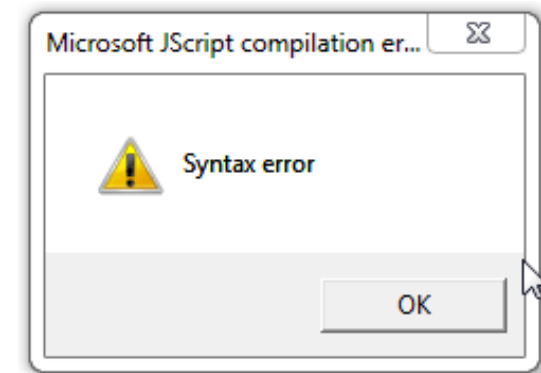


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Syntax Error

- A character or string incorrectly placed in a command or instruction that causes a failure in execution
- i.e. A 'grammatical' mistake in the code based on the programming language being used



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sleep

- sleep 1

- Wait for one beat. Try and listen the differences of the two codes:

- play :C4

play :E4

- play :C4

sleep 1

play :E4



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use_bpm

- Use_bpm
 - Define the tempo, the default bpm is 60 (i.e. 1 second per beat)
- use_bpm 120
 - play :C4
 - sleep 1
 - play :E4
 - sleep 1
 - play :G4



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use_synth

- Use a particular synthesizer (i.e. sound of an electronic instrument)
- `use_synth :tb303`
 - `play :C4`
 - `sleep 1`
 - `play :E4`



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loop

- loop the quoted commands (The best thing computer can do)

- loop do

play :C4

sleep 1

play :E4

sleep 1

end



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n.times

- Loop *n* times only

- 3.times do

play :C4

sleep 1

play :E4

sleep 1

end



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live_loop

- If you need more than one loop running at the same time

- `live_loop :a do`

`play :C4`

`sleep 1.5`

`end`

`live_loop :b do`

`play :E4`

`sleep 1`

`end`

You need to give a name for each live_loop



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Compare loop & live_loop

- live_loop :a do
 play :C4
 sleep 1.5
end

live_loop :b do
 play :E4
 sleep 1
end

- loop do
 play :C4
 sleep 1.5
end

loop do
 play :E4
 sleep 1
end



sample

- Play pre-recorded sample
- sample :perc_bell



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rate

- Play the sample with a given speed, 1 = normal speed
- Therefore also changing the pitch of the sample
- sample :perc_bell, rate: 1.5
sleep 1
sample :perc_bell, rate: 1
sleep 1
sample :perc_bell, rate: -1.5



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rrand

- Random number between a given range
- loop do
 - sample :perc_bell, rate: (rrand -1.5, 1.5)
 - sleep rrand(0, 1)
- end



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choose

- Choose randomly between the given numbers

- loop do

 play choose([:C4, :E4, :G4])

 sleep 1

 play [:C4, :E4, :G4].choose

 sleep 1

end



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tick

- Similar to choose but present the given numbers in sequence
- Stop when all the notes in the list has been played
- Add ring to tie the end of the loop back to the begining

- loop do

 play(ring :C4, :E4, :G4).tick

 sleep 1

end



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scale

- Creates a series of MIDI notes for a given a tonic note and scale
- loop do
 - play (scale :C4, :blues_minor, num_octaves: 2).choose
 - sleep 0.5
- end



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amp

- Change the volume of a particular musical command

- loop do

sample :bd_boom

sleep 0.5

sample :sn_dub, amp: 0.5

sleep 0.5

end



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with_fx

- Add sound effect to whatever you play
- (Optional) specifying parameters, see *Help*
- with_fx :echo do
 play :C5
end



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:sound_in

- Use your line in / mic of your computer as synth source
- Add sustain after it to indicate how long the mic in should be
- with_fx :pitch_shift, pitch: 6 do
 synth :sound_in, sustain: 3600
end

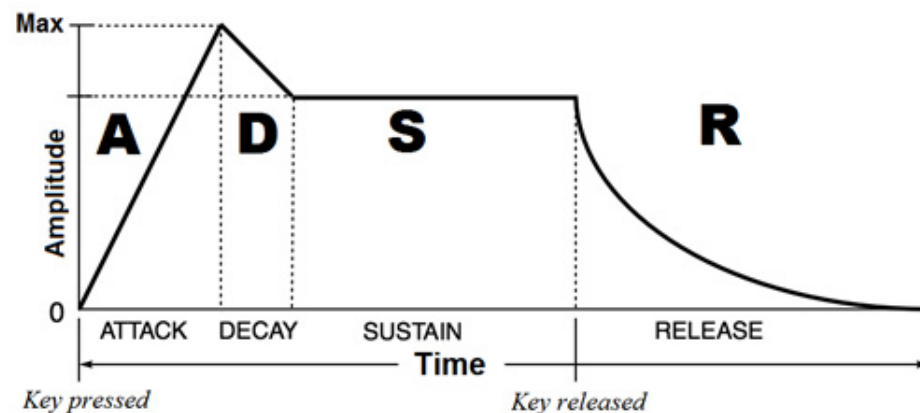


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attack, decay, sustain, release

- Add envelope to whatever you play



- play :C5, attack: 2, release: 6



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Your Turn to Play Music

- Reference on teacher's demo
- Create your own ambient music with live coding
- Using the commands you have learnt: `live_loop`, `use_synth`, `play`, `sleep`, `rrand`, `sample`, `rate`
- Try to explain the choice of your artefacts – What theme is it?



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Defining Patterns

- Define your own pattern with numbers (e.g. 1, 0, 0, 0)

- $\alpha = [1, 0, 0, 0, 1, 0, 0, 0]$

```
live_loop :b do
```

```
  a.each do |p|
```

```
    sample :bd_boom if p == 1
```

```
    sleep 0.125
```

```
  end
```

```
end
```



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Making Drum Pattern

- `a = [1,0,2,0,1,0,2,0,1,0,2,0,1,0,2,2]`
 `live_loop :b do`
 `a.each do |p|`
 `sample :bd_boom if p == 1`
 `sample :drum_cymbal_closed`
 `sample :sn_dub if p == 2`
 `sleep 0.125`
 `end`
 `end`



sync

- Synchronize between different loops
- `live_loop :a do`
 `sample :bd_boom`
 `sleep 1`
`end`
`live_loop :b do`
 `sync :a`
 `sample :drum_cymbal_closed, amp: 0.1`
`end`



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