Music in the Digital Space – How to Live Code 2

SOUNDSWEIRD
Learning Platform
for Sound Experiments

This manual is a follow-up to the short guide 'What is Live Coding?' which provides an introduction to live coding for the creation of interactive music and visuals. As a continuation it covers two topics:

- What is multichannel audio and how to work with it in MiniTidal?
- Musical games and exercises to help you improve your live coding 'kung fu'.

More channels is more!

When you put headphones on your ears and listen to music, you are technically listening to music that has been prepared for such headphone listening – that is, for both of your ears. How many audio channels does this music use? Well, exactly two. The music is usually mixed in such a way that each particular instrument in the song you are listening to has its place somewhere 'between' your ears. Try listening to some music on headphones to see if you can distinguish one instrument as being more to the left, and another more to the right. Such a layout in space is called a panorama, which is why the command to set this parameter in MiniTidal (a live coding language that allows you to make musical patterns with text) is `pan`.

`pan` accepts a numeric parameter in the range <0,1> that indicates exactly where in the stereo field the sound should appear. 0 is all the way to the left, 1 is all the way to the right. All numbers inside that range are somewhere in between. If you set the panorama to the center, in this case to 0.5, you will hear a given sound equally strong in both ears.

Today, however, we often use more than two audio channels. We call this multichannel audio. We can have 4, 8, or actually any number of audio channels. It just depends on what technology we have available. In a multichannel music concert the speakers are often placed around the listeners so that they can feel the sound waves from all sides while listening to the music. It's actually an emulation of what we have in everyday life because we always perceive sound in relation to space, so we can say that it's natural for us to perceive 3D-sound.

In order to have multiple channels in a computer, you usually need a special audio interface that allows the computer to use multiple channels. If you have one, you just have to tell Estuary to use it.

How to do multichannel sound in Estuary

Estuary is by default set to two channel audio (stereo), but if you have a system with multichannel audio, it is possible to set this up in Estuary. Parameter settings are made in the Estuary terminal.

The `!audioOutputs` command prints the current setting:

```
audio Outputs = 2
```

The `!maxAudioOutputs` command lists the number of available channels:

```
max Audio Outputs = 8
```

If the number of available channels is more than 2, you can set the selected number for Estuary with the command `!setAudioOutputs 8`

audio Outputs = 8

Please note: in order to be able to send audio from Estuary to multiple speakers, it is necessary to have a multichannel audio interface connected to your computer with the appropriate number of audio outputs. Otherwise, you will not be able to set the number of outputs in the browser to more than 2. Depending on your operating system, you can currently set up multichannel audio output in either Firefox or Chrome. You might need to test which of the options works.

In this setup, Estuary will automatically distribute the audio signal to the selected number of channels, and as users we need to keep this in mind when playing. In MiniTidal, the pan command is panned from a numeric parameter in the range <0,1>, with this range encapsulating the selected number of audio channels. Thus, `pan 0` sends the signal to the first channel and `pan 1` to the last. Everything in between is a smooth transition between the other channels.

How to use this in MiniTidal?

- random channel selection
  `n (run 8) # s "808" # pan rand`
- circling around
  `n (run 8) # s "808" # pan (slow 4 $ saw)`

Musical exercises and games

Live coding in music most often works with genres of dance electronic music, which is certainly interesting, but not the only way to do it. It's good to find your own musical expression, so that the output will be original, interesting and inspiring.

Experiment, experiment, experiment

If you only play what you know, you'll never get into other corners of music. That's why it's best to keep trying new things – that's when it's the most fun.

When you have a lot of options, which is obvious when live coding, it's easy to get lost in them. That's why one of the main rules is: Draw your own boundaries.
What does it mean to draw your own boundaries? Boundaries are limitations, and so in live coding they might look like this:

1. Create music from melodies only (no drums)
2. Create music from percussion only
3. Make music of long sounds only (drones)
4. Make music with more silence than sounds
5. Make music of abstract structures
6. Use a constant increase of sounds until an abrupt end
7. Use steadily decaying sounds over a long soundscape until silence is reached
8. Use a limited number of instruments and modifications, e.g. make music purely from a single sample (which of course can be modified in any way...)
9. Create music in a predetermined limited time space
10. Make music that circles around
11. Make music circling around in layers of different speeds and directions
12. Make music by using samples jumping from side to side
13. Make music that flows in different directions

Setting your own rules and letting them guide you is a very useful exercise that helps to develop many aspects of your playing. Such exercises can of course also be used in group play, for which Estuary is an excellent platform.

Spatial sound and visuals in an online 3D environment

For live coding with multichannel sound and video projection, a specially created experimental online 3D platform in the form of a virtual world can also be used. This offers a whole new type of experience and sharing of sound. The audience can enter the online world via a web browser on the project website (3d.sounds weird.org). Through a virtual 3D character one can meet other avatars, interact in a shared chatroom and watch the performance in progress. The screen with the actual code from Estuary is projected onto two virtual screens, while it is also possible to 'project' the image via video mapping onto other objects in the 3D space. You also experience surround sound by navigating your avatar between the virtual speakers. However, the visitor can also switch the sound to stereo.

The live coding transfer of the performance to the 3D world requires a suitable internet connection and a computer that can stream the content of a web browser window running the Estuary website as a Full HD video to a designated streaming address (using RTMP protocol). The streaming address is assigned by the platform administrator and you can use a freely available streaming program (e.g. OBS). Up to 8 channels of audio can be streamed to the virtual world in this way, but again, the streaming computer must have a sound interface with the appropriate number of channels installed and connected (see above for the procedure), and the browser in Estuary has to be set to that number of audio outputs.

The video projection on virtual objects in the space needs a sufficiently powerful streaming computer, that enables you to stream also another separate browser window with Estuary to the next assigned RTMP address. In this browser window you leave only

the video layer active without displaying the code itself. The projection is displayed in the 3D space on hanging objects by ‘mapping’ different areas of the streaming video area to different objects. To achieve accurate mapping it is best to just try it out. If necessary, another computer can be used to stream the video layer, but in that case it can happen that the audio is not perfectly synchronous with the video anymore.

Participants of the live coding session need to take into account a delay of several seconds in both audio and video in the 3D environment in comparison to what happens on the Estuary website. This latency cannot be avoided as it is caused by the transcoding of the signal during streaming. This time delay makes synchronous listening impossible, so if we want to use surround sound, we also need to have a set of physical speakers connected in the room to monitor the sound.

Stereo or multichannel audio, as well as the exact mapping of video streams to virtual objects, can be set up in more detail in the 3D platform’s admin interface.