

## Workshop 3

The aim of workshops is open time to work on, and get help progressing your project. The format for the workshop is not fixed, but each week I would like you to follow the advice I would give any research student:

1. **read** something;
2. **do** something; and
3. **write** something.

This week, you should be looking for a pattern to model (mathematically). The core idea is to reverse the process you have usually gone through in maths and physics lessons. Usually, you start with some mathematics, and your teacher will show you (if you're lucky) how to apply that to some problem. Here I want you to start with the problem (a pattern to model), and then look for the maths to analyse and approximate it.

1. Start by reading about a pattern that involves periodicity, *i.e.*, something that is periodic, or appears to have a periodic component to it, or is built from sinusoids. But that component might be quite hidden, for instance have a look at
  - Read some more about  $1/f$  and  $1/f^\alpha$  noise (see previous workshop).
  - Perlin noise, *e.g.*, see <http://flafla2.github.io/2014/08/09/perlinnoise.html> or <https://thebookofshaders.com/11/>
  - Ulam spirals: [https://en.wikipedia.org/wiki/Ulam\\_spiral](https://en.wikipedia.org/wiki/Ulam_spiral) and [http://www.betweenartandscience.com/ulamspiral\\_words.html](http://www.betweenartandscience.com/ulamspiral_words.html).
  - The Houndstooth tessellation: <https://en.wikipedia.org/wiki/Houndstooth>
  - The patterns of spots or stripes on animals (zebras, leopards and so on).
  - Procedural generation of marble or wood textures, *e.g.*, see <http://www.upvector.com/?section=Tutorials&subsection=Intro%20to%20Procedural%20Textures>

Or look at one of the web pages that concentrate on “generative art” or “algorithmic art” to find something unusual.

These are not enough — they are just to get you started. Look for something that personally interests you.

2. Do your own analysis (perhaps using Fourier transforms) of the data. You might need to generate the pattern yourself. Alternatively, think about how you could approximate this pattern using simple rules?
3. The above are very *observational* models. That is, they model what is there. We will keep going after the break with work to look at formative models, *i.e.*, models of how the pattern formed.

You **do not** have to hand anything up. However, you should not limit your exploration of this topic to 50 minutes. You should expect (in the long run) that you will need to put in a couple of hours work (towards your project) for each workshop. But today we are just starting out.

You can also ask questions about your practical, or any other aspects of the course.