

# DESIGNING HIGH IMPACT MAPS IN QGIS

A training course that helps you design  
better maps

*with Alasdair Rae*



**QGIS version:** 3.10 (A Coruña)

**Workbook version and date:** v1.5, February 2021

**Automatic Knowledge Ltd**

[www.automaticknowledge.co.uk](http://www.automaticknowledge.co.uk)

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### A note about QGIS versions

This workbook was written for QGIS version 3.10.14, the latest long-term release (LTR). If any screenshots in the workbook look different to the ones on your screen it is probably because you're on a different version, or have your toolbars positioned differently, but this is unlikely to cause any problems. Most QGIS versions are named after where the developers have their meetings (e.g. 3.10 is called A Coruña). The LTR version of QGIS is the most stable one, but you will also see a newer version of QGIS on the website – these often have more features but are not yet finalised for official long-term release.

This workbook is also available online, at:

<https://automaticknowledge.org/training/workbooks>

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## About Automatic Knowledge

Our philosophy is all about sharing data and knowledge, so that we can all be a bit better informed about the world. The way we do this is mainly through spatial data analysis and visualisation, and as part of this we offer training courses in geospatial software – mostly QGIS. Alasdair Rae (pictured) founded Automatic Knowledge in 2019 and also runs the training courses.



## Why 'automatic knowledge'?

The idea behind Automatic Knowledge is that we do the hard work of completing the journey from data to knowledge, so that you can then make more informed decisions. These training sessions will hopefully help you do that too.

## Other activities (e.g. free stuff)

In addition to training, we provide a range of consultancy services, specialising in data, spatial analysis, the built environment and cartography. We also publish free and open datasets that you may find useful, at:



[automaticknowledge.co.uk/resources](https://automaticknowledge.co.uk/resources)




We're also a 'sustaining member' of QGIS, which means that we donate money to the QGIS project on an annual basis, to help fund its development. By taking this course, you're helping too.

## Automatic Knowledge training sessions

The idea behind all our training sessions, and these workbooks, is to help you learn new things in an enjoyable way, without confusing you. We want everyone who takes one of our courses to come away with useful new skills that they can then put into practice in their day-to-day work, and build on in the future.

### About this workbook

Following a workbook can be a great way to learn new software skills, but there's also a risk that it turns us into robots, following step-by-step instructions in a linear way. During the session we'll talk about maps and do some demos of QGIS tasks –  among other things. *The emojis?* I add them in for a bit of colour, but they also serve a practical purpose because they can help us find key sections of the document quickly.

### Formatting

Most font is size 14. When switching between screen and workbook this is easier on the eyes. The following format will be used in relation to files/folders, websites, QGIS options/tools, click actions and any text I want you to input. I've also added a 'Notes' section on each page where you can jot things down.

**Files, folders and suchlike:** e.g. world\_countries.shp

**Websites:** e.g. [www.automaticknowledge.org/training](http://www.automaticknowledge.org/training)

**QGIS windows, tools, sections, options:** e.g. Coordinate

**Actions - click menu item/ button:** e.g. Vector > Research Tools

**Text input:** e.g. "geounit" IN ('Japan','New Zealand')

## 1. What is a 'high impact' map?

In a training session about high impact maps, we should probably begin by thinking in a bit more depth about what 'high impact' might mean, why we would want to make these kinds of maps, and why we might not.

As a starting point, let's all go to the link below and I'll talk us through things (I'm not a huge fan of what they've called this subreddit, but it *is* 100% maps, and very interesting too).

<https://www.reddit.com/r/MapPorn/>

- Let's sort by **Top** and **All Time** 

Starting at the top, we've got (as the time of writing):

1. US politics
2. Chicken nuggets
3. Arizona voting precincts (and Native American areas)
4. World War 1
5. Eagle tracking
6. A topologist map of the world (showing borders)
7. Passenger railway networks
8. Wolf tracking (territories)
9. 'When a band announces a world tour' map
10. France's longest border – shared with Brazil

There are thousands more. They made an 'impact'.

---

### Notes

**Impact?** A nice conversation with a friend can have an impact. A chance meeting with an old friend can too. An excellent teacher can have an impact. But then again, so can an asteroid or a runaway train. We just need to think a bit about what we're trying to achieve and what impact we want to have, and with whom.

Now let's look at some more carefully selected ones, from this subreddit, as well as r/dataisbeautiful.

1. The speed of light:

[https://www.reddit.com/r/dataisbeautiful/comments/dbntq8/light\\_speed\\_fast\\_but\\_slow\\_oc/](https://www.reddit.com/r/dataisbeautiful/comments/dbntq8/light_speed_fast_but_slow_oc/)

2. World's 25 largest lakes, side by side:

[https://www.reddit.com/r/MapPorn/comments/hxl68b/worlds\\_25\\_largest\\_lakes\\_side\\_by\\_side/](https://www.reddit.com/r/MapPorn/comments/hxl68b/worlds_25_largest_lakes_side_by_side/)

3. 90 minute public transit commuter zone – SF vs London:

[https://www.reddit.com/r/MapPorn/comments/f0o8yu/90\\_minute\\_public\\_transit\\_commuter\\_zone\\_for\\_london/](https://www.reddit.com/r/MapPorn/comments/f0o8yu/90_minute_public_transit_commuter_zone_for_london/)

4. US (contiguous) population density map:

[https://www.reddit.com/r/MapPorn/comments/gbr7qy/us\\_contiguous\\_population\\_density\\_map/](https://www.reddit.com/r/MapPorn/comments/gbr7qy/us_contiguous_population_density_map/)

5. Coterminous US elevation – 3D scene:

[https://www.reddit.com/r/dataisbeautiful/comments/imrpce/conterminous\\_us\\_elevation\\_generalized\\_by\\_500km%C2%B2/](https://www.reddit.com/r/dataisbeautiful/comments/imrpce/conterminous_us_elevation_generalized_by_500km%C2%B2/)

- They generally look quite nice.
- Tell us something we already knew.
- Tell us something we sort of knew.
- Tell us something we did know.

We can also think about *impact* more generally from a visual perspective, beyond maps.

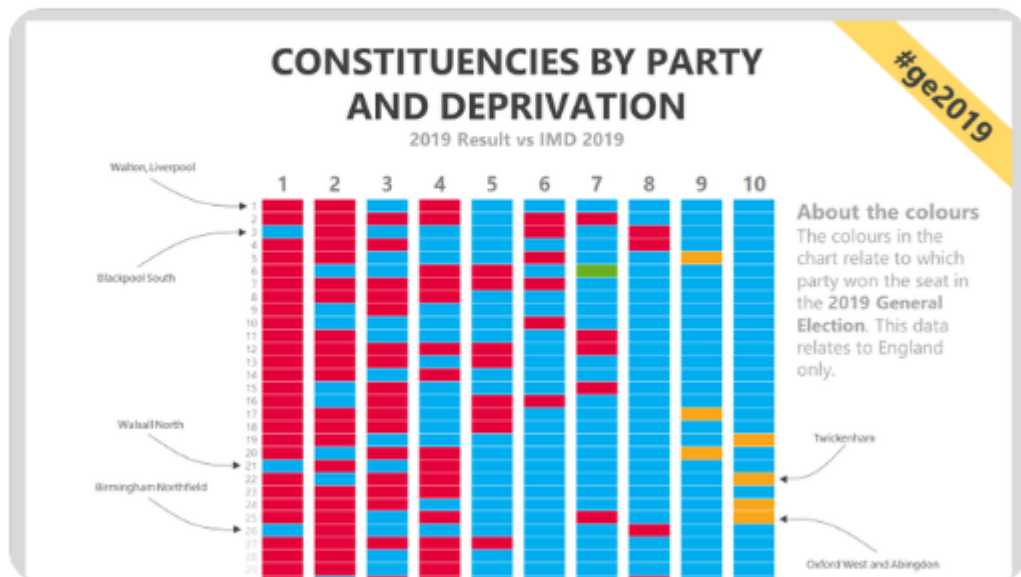
Take this example from the UK, where I looked at voting and deprivation patterns.

<https://twitter.com/undertheraedar/status/1205429108521480192?s=20>



**Alasdair Rae** @undertheraedar · Dec 13, 2019

An updated **constituency/deprivation** chart for England for the 2019 general election - looks quite different to before. See following tweets for comparison with 2017 and 2001 #ge2019 #ge2019data



Philip Brown

16 379 445

Again, the results aren't very surprising – but perhaps they are a *bit* surprising. Let's have a think about what's encoded here: e.g. colour, order, geography.

Notes

Remind me to tell you the back story to how this went from very quick and dirty Excel effort to different versions being in The Economist and on Sky News. I think the process and steps are quite important because a lot of this is serendipitous (e.g. my global density spike map).

Some thoughts on 'high impact' maps.

- They affect our emotions (so: politics, nature, identity etc).
- They *don't* have to be pretty, at all.
- But they *might* be pretty, often are.
- Often quite simple (conceptually and visually).
- Easy to understand.
- Easily shared – Twitter, Facebook, Instagram, Reddit, etc.

'Quick scanners' – this is most people and contexts now, probably. Something to keep in mind when making maps.

**John Burn-Murdoch** @jburnmurdoch · Feb 15  
When lockdown is getting me down, I like to look at Israeli hospital data

The average age of people seriously ill with Covid in Israel's hospitals is falling dramatically as vaccines take effect

Average age of people hospitalised with severe cases of Covid-19

310 4.2K 18.5K

**Sanne Hombroek** @sannehombroek · Feb 15  
Without reading anything (which is bad of course) I thought it was the number of cases dropping this hard in Israel. I think that (as always) the viz is very well designed, but **quick scanners** might be overly optimistic.

3

<https://twitter.com/sannehombroek/status/1361383599866601473?s=20>

Notes



**Task:** think of a map that made an impact on you, good or bad, at any time – and let's take a look at some of them – please share some links or even just a description so that we can all look at them.



**Characteristics of 'high impact' maps** (we don't want all maps to be 'high impact' of course - that would be too much).

*Jot down some thoughts below and we can compare notes – I'll do it too.*



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Notes

## 2. 'Principles for the orderly loss of information'

We're going to do some mapping in QGIS soon, but first I want to introduce my 'principles for the orderly loss of information' – a set of ideas I put together in an academic paper more than a decade ago which I often go back to when making maps.

Here they are, translated from academic English to something approaching normal English (really!).



- **'expansive inclusion'** (include all possible data elements at the outset) – i.e. don't filter out anything to begin with.
- **'iterative loss'** (filter the data iteratively to derive meaning) – i.e. get rid of any junk in a series of steps.
- **'simplicity from complexity'** (aim to identify key patterns) – i.e. what is the message or story of the data and how can we find it? (filters and blend modes can be useful here)
- **'optimal compromise'** (recognise that a series of analytical compromises are necessary in spatial data analyses) – i.e. recognising that any final result, however pretty or fancy, leaves things out and is some kind of compromise.

These principles are included in a number of papers, mostly hidden behind paywalls, but here's an open access one:

<https://link.springer.com/article/10.1007/s12061-016-9196-0>.

Some of these ideas are based on the notion that we can move from data (unstructured elements) to knowledge (information, imbued with meaning) but of course things do not necessarily work in a linear fashion like this and there are all sorts of other complications we need to consider – including context, who our *intended* audience is, who the *actual* audience ends up being, and many more.

Nonetheless, I have found that these *Principles for the orderly loss of information* are quite useful in the preparation of maps and graphics that make an impact on people.

I'd like us to look at a short Twitter thread now that incorporates some of these principles.

<https://twitter.com/undertheraedar/status/1342951108063473664?s=20>

The second one in particular serves as a good example.



**Alasdair Rae** @undertheraedar · 26 Dec 2020

...

this file is named `filtering_out_the_junk.gif` and shows what happens when you take commute data for England and Wales and then filter and style it so it makes some sense

Some of the examples are a bit wild, but I included them all as they demonstrate different approaches to the same thing – how to filter out junk to get to the meaning/insights.

### 3. Let's look at an example in a QGIS Atlas

Enough talking and listening for now – let's get going with some QGIS.



- Open QGIS now and then while it's loading up you can get the data (see below).
- We're going to open up a QGIS Atlas – since this course is for people with QGIS experience, ideally you will already be familiar with how the Atlas works, but if not don't worry – we'll work through it step by step.
- Go to <http://automaticknowledge.org/training/data/> and download the files from atlas\_1... to atlas\_5... and then from the /styles folder within the /data folder, download the five corresponding atlas qml files, plus the QGIS project file I've put there – qgis\_next\_level\_ATLAS\_layout.qgz.
- Once you've done this, you just need to open up the QGIS project file and then you'll probably get the Handle Unavailable Layers warning so you need to click each file, then Browse to tell QGIS where they are stored.

I'll help anyone who needs it but hopefully everyone has the data and the QGIS project activated now. You'll recognise it if you've done our *Taking QGIS to the Next Level* training session. It's an Atlas of countries, with some population and economic data for each. It will take a few minutes to set up – no rush.

**Follow along demo time**

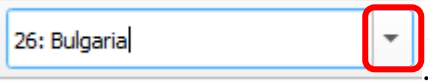
Now that we all have the Atlas up and running, follow along with me.



- Let's open up the **Print Layout** and then **turn the Atlas on**  and then we can maximise the window and make sure the page takes up the full print layout area too .

- You should see the names of the countries at the top of your **Print Layout** screen, starting with **Afghanistan**.

- Now I want you to take a few minutes to explore different countries – using the dropdown button beside the country name at the top of the

**Print Layout** - .

- Look at the different elements in the **Print Layout** – the flag, the map, the labels, the title, the numbers and how they are formatted, the inset map, the colours, the text in the top right, the little black lines at the top and bottom of the page.
- Now look at **Colombia** – this is a good example that shows off what I've tried to do with regard to labelling. We'll think more about labels later.

I'll now explain a bit more about my different choices here and also look more closely at the different elements and what my thinking was.

Feel free to ask questions and make suggestions here – I am sure you can think of ways to improve what I have started.

**Time to save your work**

You haven't done much editing to this project.

Nonetheless, you have told QGIS where to find the individual layers for the project and you should also have turned off the title message via **View > Decorations** so it's wise to save the project anyway – it hardly takes up any disk space and then you can open it up later if you want to play with it.

I recommend saving regularly (I'll add the disk icon to remind you) and also saving incrementally. So, this time save your project as something like **qgis\_high\_impact\_maps\_p13** and from then on just save it with a different page number appended.

This way, if disaster strikes, you can always go back to a specific point and pick it up from there again.

#### 4. Let's recreate a best practice example

I always like to learn from others, and when it comes to map and data stuff there are so many good examples to choose from – whether it's colours, layout, fonts, titles or whatever.

Before we have a go at recreating something that I consider to be a nice, clean example of 'best practice', here are some good places to look for inspiration – below.

- See maps and graphics produced by the teams at the following organisations. In general, you can just put the names of these organisations into Google, Twitter etc. and just add 'maps' or 'graphics' or 'dataviz' and you'll see some good examples.
  - The Financial Times (UK)
  - The New York Times (US)
  - The Economist (UK)
  - National Geographic (US)
  - Berliner Morgenpost (Germany)
  - Bloomberg (US)
  - South China Morning Post (Hong Kong)
- There are many more examples from news organisations, and many, many talented individuals and teams – these are just a few.
- Also see [www.informationisbeautifulawards.com](http://www.informationisbeautifulawards.com)

I don't generally like to single out individuals but if you're looking for some further inspiration then I recommend the following.

1. Joshua Stevens: [www.joshuastevens.net/portfolio](http://www.joshuastevens.net/portfolio)
2. Hannah Dormido: [hannahdormido.com/work](http://hannahdormido.com/work)
3. Bill Rankin: [www.radicalcartography.net/index.html](http://www.radicalcartography.net/index.html)

They are all great, and Bill Rankin in particular is very original in his outlook, plus I like the idea of radical cartography.

Now we're going to re-create a 'best practice' example from the 2017 UK General Election, based on an election map produced by the Financial Times (aka the FT). See below for the original.

The FT election map, 2017 (scroll down the linked page a little):  
<https://enterprise.ft.com/en-gb/best-of-ft/>

- Now take a look at the version of the same map that I created in QGIS: it's in the [data/images](#) folder for today's session - `UK_GE_2017_results_FT_style.png`.
- Have a close look at it and you'll see that it's very similar, but I've also made some changes – mostly superficial.
- Now I want you to go to the website below and download the `...v7.gpkg` file (it's a UK general election dataset):



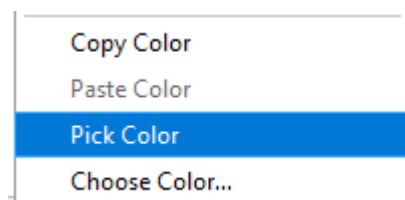
[github.com/alasdairrae/wpc/tree/master/files](https://github.com/alasdairrae/wpc/tree/master/files)

- I put it together from multiple sources in the run up to the 2019 General Election and it was used quite widely at the time (see [github.com/alasdairrae/wpc](https://github.com/alasdairrae/wpc) for more info).
- Open a new QGIS project now.
- Now I want you to add the `uk_wpc_2019_with_data_from_v7.gpkg` file to QGIS, style it, and then work towards re-creating the FT map in a new Print Layout – either modelled on my version or theirs.



If you're not sure how you'd go about this, that's fine – **I will do a walk through as well** – in this case we can just take our time and I can talk through things as needed.

This is a good example of where the QGIS colour picker comes in really handy, since you can just pick the colours directly from your screen – no messing about typing in RGB colour values or html codes.

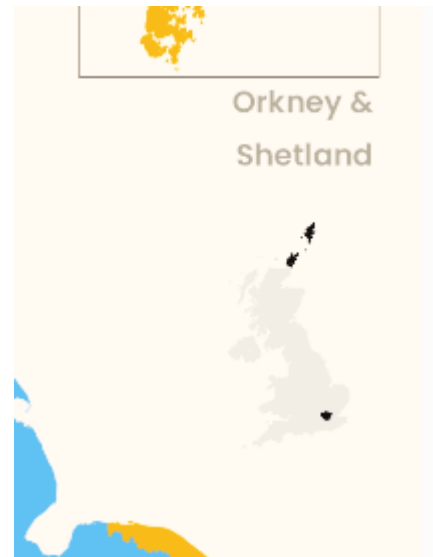


If you're not sure of the best approach to adding the little inset maps here, don't worry – we can go through these elements as well. Oh, and one final tip: to avoid annoying people from Orkney and Shetland, don't call them 'the Shetlands' or 'the Orkneys'!

The idea now is that we can spend some time getting our Print Layout into good shape, taking care about text placement, fonts, insets, frame widths, legends and so on.

Once we've done all this, we should have something that looks like the original version, or my slightly modified version.

To the right you will see one minor map innovation I have tended to use in recent years. I prefer to use insets like the ones on here as I believe it is useful. But for anyone not from the UK, or not familiar with its geography, it's impossible to say where Orkney and Shetland are located in reality.



That's why I've included a little graphic below the inset maps that shows the location of the places shown in the insets. I could have called this something like 'Location of inset maps' but I've left it blank for now as I think it's fairly intuitive (maybe I'm wrong – I'm kind of 50/50 on this one).

Before finishing, have a think about elements that you could add to a map like this – e.g. add in the number of areas for each colour in the legend, add thin border lines – i.e. helpful extra information that doesn't over-burden the reader.

- Export your Print Layout as a 300dpi png and Save your QGIS project again now.



## 5. Let's look at blend modes in QGIS

Okay, let's move on from the fundamentals above and work on some data that will allow us to make a much fancier map – perhaps even one that will elicit a few 'oohs' and 'aaahhs'.

Talking of 'oohs' and 'aaahhs', one of the best ways to generate these is through shiny global connection maps – e.g. remember the blue-on-dark Facebook connections map from 2010?

It was produced by Paul Butler in 2010 when he was a Facebook intern, and it is very cool. See below for the link.

<https://paulbutler.org/2010/visualizing-facebook-friends>

His write-up of the process is worth a read in your own time but we're going to do something similar in terms of global connections and glowing lines, with a dataset I prepared for you. →

Global Flight Routes



Source: OpenFlights.org



Once we've got the data on screen we'll use blend modes. See the next page for what you need to do.

## The global flights dataset

Using open data from <http://openflights.org> I created a csv file of flight connections so that they could be mapped. I then joined airport information to this, so that for each route I could identify the origin and destination city and country (we can use this to filter later on). You could do all this yourself using nothing more than a VLOOKUP in Excel, with the routes.dat and airports.dat text files available from OpenFlights:



<https://openflights.org/data.html> (this link is just for info)

In order for QGIS to be able to draw lines between points, all I had to do was create a new column (which I did using concatenate in Excel), with individual entries for each airline route, in the following format:

```
linestring (39.9566 43.449902, 49.2787 55.6062)
```

The 'linestring' part tells QGIS to draw a line between points. The numbers between the brackets are the x and y coordinates of the origin and destination airports, with a comma between each pair of coordinates, and each x and y coordinate pair separated by a space. It's very simple (once you know how!).

Once QGIS plotted the lines (about 67,000 in a few seconds) I saved it as a GeoPackage. I've put the files in the folder below – [download all gpkg files](#), then read on while they download.

<https://automaticknowledge.org/training/data/flights>

If you have slow or misbehaving internet, feel free to just download the `airline_flows_all.gpkg` file – that will be fine – but get them all if you can. I also put the original `csv` file in the same directory, for reference (it can be imported via `Delimited Text`).



**Now we're going to do another follow along**, to get us started, but after that I'll leave you to it so that you can experiment further, with my suggestions.



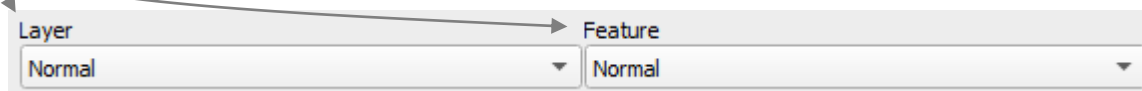
- `Open a new QGIS` project if you haven't already – and be sure to have saved the one you were working on previously.
- Add the `airline_flows_all_with_dist.gpkg` file to QGIS now – I find it easiest just to drag and drop it right into QGIS. If you weren't able to download this file (the largest one) then you can just use the smaller one.
- When you add it to QGIS it will look vaguely world-shaped, but it won't look very nice or interesting – just a bit like the mess of lines you see here.



- First of all I'm going to change the project background colour to #111111 via Project > Properties > General and then Background color. This is very dark, but not quite black.
- Then let's change the line colour to #0032ff, width, Opacity to 15% and 0.1 Stroke width.
- Okay, looks better now, but not quite right – so now we're going to use the Blending mode options in QGIS, which we access via Layer Properties > Symbology and then Layer Rendering at the bottom of that (read the bit below now).

With the Blending mode options, we need to understand what does what. There are two ways to apply a Blending mode, as follows (you can also blend objects in a Print Layout).

- **Layer** – this option blends one layer (like our airline flows layer) with other map layers above or below it – or the background.
- **Feature** – this option blends features within the same layer – e.g. our individual flight route flow lines. In our case we have thousands of overlaps so this can be a useful feature.



Hmm, okay, but what *exactly* do all these different Blending mode options actually do? Well, a great way to find out is to try different ones, so here are the definitions from the QGIS documentation – try each one in QGIS as you read. 🧐

**Normal:** This is the standard blend mode, which uses the alpha channel of the top pixel to blend with the pixel beneath it. The colors aren't mixed.

**Lighten:** This selects the maximum of each component from the foreground and background pixels. Be aware that the results tend to be jagged and harsh.

**Screen:** Light pixels from the source are painted over the destination, while dark pixels are not. This mode is most useful for mixing the texture of one item with another item (such as using a hillshade to texture another layer).

**Dodge:** Brighten and saturate underlying pixels based on the lightness of the top pixel. Brighter top pixels cause the saturation and brightness of the underlying pixels to increase. This works best if the top pixels aren't too bright. Otherwise the effect is too extreme.

**Addition:** Adds pixel values of one item to the other. In case of values above the maximum value (in the case of RGB), white is displayed. This mode is suitable for highlighting features.

**Darken:** Retains the lowest values of each component of the foreground and background pixels. Like lighten, the results tend to be jagged and harsh.

**Multiply:** Pixel values of the top item are multiplied with the corresponding values for the bottom item. The results are darker.

**Burn:** Darker colors in the top item cause the underlying items to darken. Burn can be used to tweak and colorize underlying layers.

**Overlay:** Combines multiply and screen blending modes. Light parts become lighter and dark parts become darker.

**Soft light:** Very similar to overlay, but instead of using multiply/screen it uses color burn/dodge. This is supposed to emulate shining a soft light onto an image.

**Hard light:** Hard light is also very similar to the overlay mode. It's supposed to emulate projecting a very intense light onto an image.

**Difference:** Subtracts the top pixel from the bottom pixel, or the other way around, in order always to get a positive value. Blending with black produces no change, as the difference with all colors is zero.

**Subtract:** Subtracts pixel values of one item from the other. In the case of negative values, black is displayed.

- Okay, just make sure you've had a chance to try each of the **Blending mode** options on your flight routes layer and take a note of which one you think looks most useful. I think **Screen** works well with this layer.
- Now I want you to experiment with the opacity for the flights layer – which we turned down to 15% before – and see what impact this has – e.g. with **Screen**, **Dodge** or **Addition**. Computer running slow? Let me know.

### Task

For the rest of this part of the training, I want you to see if you can create a nice flights viz. You could add the airports layer and perhaps filter it so you just show a couple of major world airports.



Paul Butler's big interactive version, for close up inspection and inspiration: <http://fbmap.bit aesthetics.com>

You could add in the **Globe Builder** plugin and then wrap your flight routes round the globe, looking at it from a particular perspective. You could also filter the flight routes by origin, by destination (e.g. JFK, PEK, LHR, AMS), or by plane type. Just look at the fields in the **Attribute Table** to see what's possible.

Once you're happy, export some maps. I put some examples in the [data/images](#) folder and feel free to share yours with me. If you need any help with this task, just ask!





## 6. From little things to big impacts: lines, legends, labelling...

Seriously? Are we really going to talk about lines, legends and labelling? Yes, of course. For some people, these things are piffling matters, irrelevant details that only matter to nerds. But, add up all the little things – and get them right – and your final result can be SO much better.

**As a training exercise, we're all going to make a BAD MAP in QGIS. Then in section 9 we'll take a BAD MAP, and make it better (to paraphrase the Beatles).**



- Open up a **new project in QGIS**, making sure you've saved the previous one (and remember to keep using the **qgis\_high\_impact\_maps\_p23** project name system of incremental saving – it's particularly important here as we'll come back to this project again later).
- **Add** in the UK General Election results layer from before (**uk\_wpc\_2019\_with\_data\_from\_v7.gpkg**) and then, *using the guidance on the next page*, make what you consider to be a 'bad' map out of it, making sure to look at each different element. You can use any of the fields in the **Attribute Table** to make your map – it doesn't have to be a colour-by-winning party map. You can see an example of the **BAD MAP** I produced in the **data/images** folder.
- When you do export your map, be sure to use a suboptimal file format as well (e.g. **jpg**).

**Map projection** – since this is a map of the UK, we could use British National Grid as the projection but that would be too sensible, so try another one instead – perhaps World Robinson.

**Generalisation** – we could simplify the lines here to make it smoother, but that might break things so let's leave this one. But it's something to think about. Too generalised and it looks clunky. Too detailed and it can be a bit distracting.

**Line width** – the default in QGIS is 0.26 and I often find this too thick. Experiment here. Make your lines either too thin or too thick. I normally opt for 0.1 to 0.15, so try 0.4 or above!

**Labelling** – I chose to label a fairly random selection of places, using the `5_GB_places.gpkg` layer so you should too! Add in weird effects, sizes and wild fonts for full effect.

**Legend** – make your legend look as technical and unfriendly as possible and maybe even call it 'Legend' or something similarly obvious. Keep all the junk.

**Class breaks** – if you're mapping something like % voting for a particular party, use weird class breaks instead of the default, so that the number in each class varies wildly.

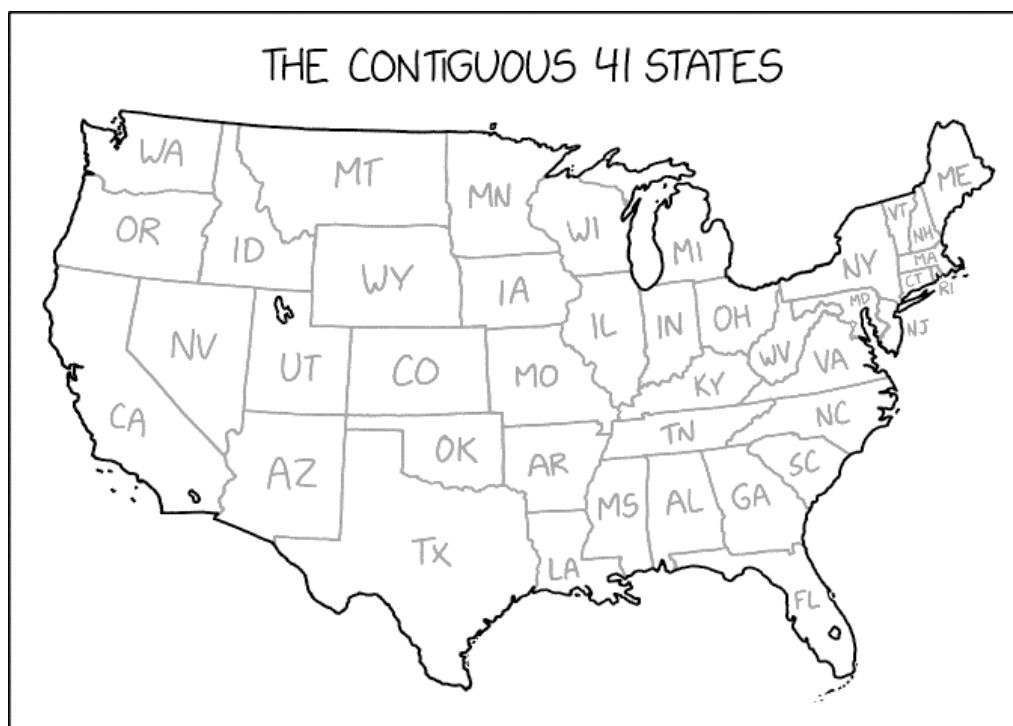
**Scale bar, north arrow, title, text** – add in these elements as you wish, making sure not to do it well.



I'm not keen on internet map shaming, so I don't think you'll ever see me complaining about other people's maps online – I've done enough bad ones myself and I'm always learning.

However, I do think it's useful to keep a memory bank of both 'good' and 'bad' mapping practices and examples that we can draw upon and learn from (and unusual ones – see below).

Before we talk a bit more about labelling, in the next section I'm going to say a little bit about what I think of as 'productivity enhancements' in QGIS: ways of efficient working that I use when I'm creating maps and visuals.



TIRED OF BEING LEFT OFF MAPS OF THE US, ALASKA AND HAWAII  
BEGIN PRODUCING MAPS WITH *OTHER* STATES MISSING, TOO.

Source: <https://xkcd.com/2394/>

## 7. Productivity enhancements

In order to demonstrate some things that I consider to be useful productivity enhancements, we're going to look at the following scenario, based on the two layers below, the first of which is available in the data folder. The second one is the UK general election dataset we've been working with already.

- atlas\_2\_world\_cities\_natranks.gpkg
- uk\_wpc\_2019\_with\_data\_from\_v7.gpkg

**Scenario:** we want to produce a map showing which party came **second** in each constituency at the 2017 General Election. We want to colour the map so that the four largest parties are shown using their party colours, and all others as a light grey. We then want to add a thick black border round those constituencies where less than 2% swing would be required for the seat to change hands. We want to add some place labels, to provide a bit of context, and then put together a simple Print Layout and then export the map as a 300dpi png file. But we don't have long to do it, so we must work efficiently.



See below for the steps I'd follow and see if you can repeat them. I won't mention every tiny detail here, just the main bits.


1. Add the two layers to QGIS (uk\_wpc... first), making sure the points layer is on **top** of the constituencies layer.

2. Filter the places layer using "country" = 'United Kingdom' so that only places in the UK are showing.
3. Using a Categorized style in the constituencies layer, use second17 as the Value and then hit Classify to see it on the map, then OK. We'll fix the colours soon.
4. Go back to the places layer and Filter it a bit more – I've used the following filter text but feel free to edit it to include/exclude other places as you wish: "country" = 'United Kingdom' AND "city" IN ('Leeds','Oxford','Cambridge','London','Edinburgh','Inverness','Caerdydd','Plymouth','Norwich','Manchester','Belfast','Brighton','Birmingham','Glasgow','Aberdeen','Newcastle').
5. By now you should have a map coloured by who came second (with the wrong colours so far) and a few major towns and cities showing (though no labels yet).

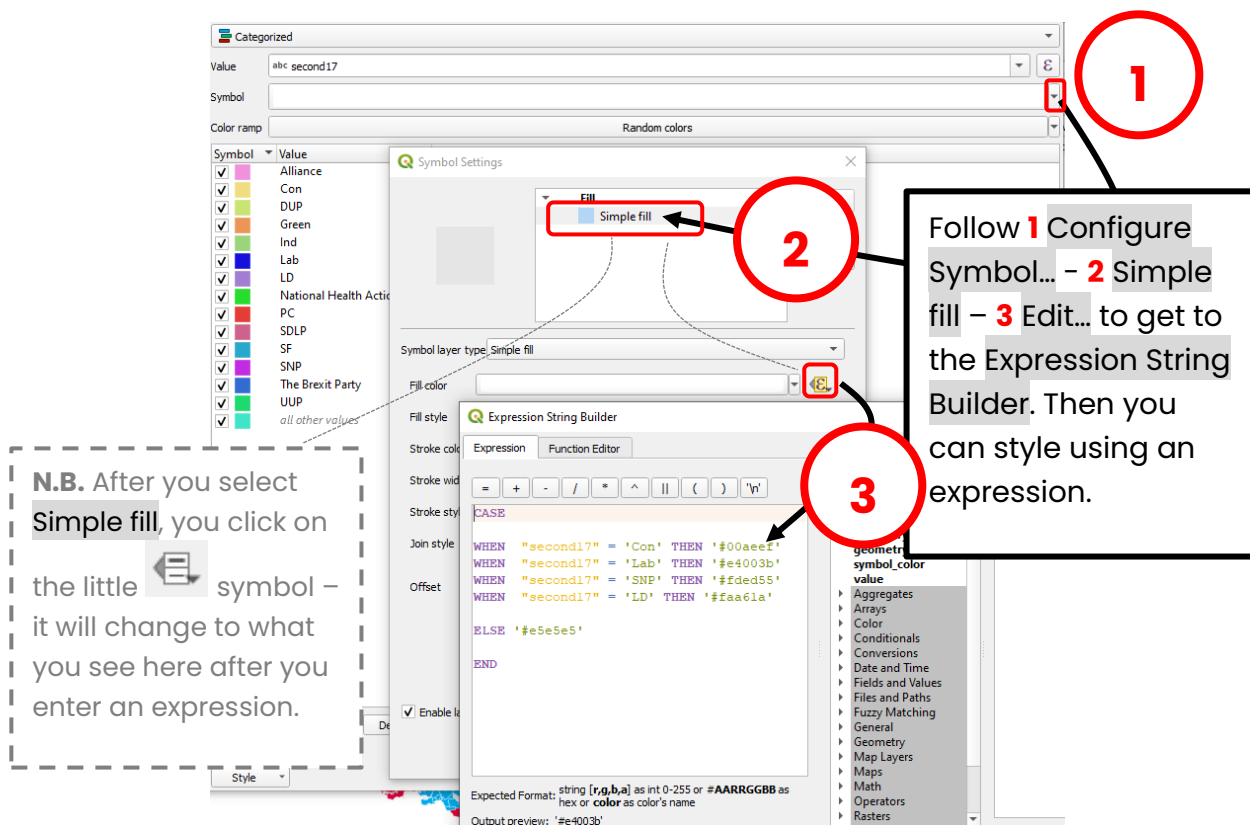
**Top tip**

Use QGIS as a colour picker, just to grab colour values from websites.



How? **1.** Double click a layer to open Layer Properties, then go to Symbology if you're not on it already. **2.** Then click the little black drop-down at the end of the colour patch you see . **3.** Then you just select Pick color and the little eye dropper icon will appear and the colour you click on will be in the main colour patch now. **4.** Click the big colour patch and you'll see the Select Color window with the html and RGB colour values – for polygon layers, you'll have to click the colour patch and then click the next one to get to the Select Color window.

6. There are a couple of ways I could colour the areas by party, but instead of using Categorized I'm actually going to use an expression. So I'll go back to my Symbol Settings and then instead of using a set Fill color I'll put an expression in the Expression String Builder box (as shown below), using the html colour values I picked from the party websites (although I made the SNP one a bit brighter) – note that you can just type actual colour names between single quotes – e.g. 'red'. I also changed the outline to white and 0.1 width at this time. Once done, press OK until you see your map again and all options windows are closed.



(translation: 'in cases when the value from our second17 column is 'Con' then use the blue colour associated with this html colour code, and so on...)

Notes

7. We're going to do something similar with an Expression for the cities layer, using city as the label Value. We'll make London size 14, Birmingham, Manchester and Glasgow size 12 and everywhere else size 10 (controversial!!!). Then we can use modified versions of the same expression (shown below, for text size) to set the point size for each place.

```
CASE
```

```
WHEN "city" = 'London' THEN 14
```

```
WHEN "city" IN ('Birmingham', 'Manchester',  
'Glasgow') THEN 12
```

```
ELSE 10
```

```
END
```

8. After this, we'll change the font to Arial Bold, the label placement to Cartographic and add a drop shadow and white buffer (with 75% opacity) to the labels.
9. Then I'll quickly create a Print Layout, using an A4 page size (Portrait) and add text and a legend using manually drawn shapes – although you could use the Legend tool instead.
10. Then I'll duplicate the constituencies layer, put it second from top, Deactivate my expression and use a black 0.3 outline and no fill, and then Filter the layer using "REQSWING" <= 2 to show the most marginal constituencies.

11. I can then add a text note to the Print Layout saying something like '**Marginals:** constituencies with black outlines require a 2% vote swing, or less, to change hands'.

**Baffled?**

Don't worry if you feel in a bit of a spin – I can help unspin it.

If you need some guidance with the steps above, or you just want to walk through them with me again, that's no problem at all. The basic idea is that we have used expressions to set colours and sizes, rather than a point-and-click method.

I'm more than happy to demo anything again.

### Other useful tips

- Use View > Preview Mode to see what your map looks like in greyscale, or to people with colour blindness.
- Drag and drop colours directly between colour patches in QGIS – e.g. from the Fill color patch to the Stroke color one. You can also copy and paste colours. Never done it? Try it.
- Save a style as Default for a layer – done from Layer Properties > Symbology and then Style at the bottom. You can also use Save Style... if you want to share your styles with others (as qml files).
- In the Expression String Builder, the middle box has Recent (generic) at the bottom, where you'll find all your recent expressions, which you can then use and/or edit.



## 8. Labelling!

Let's start this section by looking at the map below. This map is only labels, plotted in the location of the polygons they represent. It was an experimental map I made of the % of people in each small 1981 Census Enumeration District who spoke Gaelic. **Is it even a map?**



Source: 1981 Census

Notes

The original version of the Gaelic map above was in colour on a dark background, with reds for the highest values. The idea here was that individual numbers and their spatial distribution were *particularly* important – more so than aesthetics, so I just plotted those (I just turned the symbology off on the layer).

Anyway, remember those ‘Principles for the orderly loss of information’ from earlier on? Well here they are again and you can see how they might relate to labelling.

- **‘expansive inclusion’** (include all data elements at the outset) – i.e. give yourself choice: don’t filter out anything to begin with (as in our GB or world cities label layers).
- **‘iterative loss’** (filter the data iteratively to derive meaning) – i.e. get rid of any map junk in a series of steps (i.e. when we filter to only include some places).
- **‘simplicity from complexity’** (aim to identify key patterns) – i.e. what is the message or story of the data and how can we find it? (e.g. when we highlight megacities only).
- **‘optimal compromise’** (recognise that a series of analytical compromises are necessary in spatial data analyses) – i.e. recognising that any final result, however pretty for fancy, leaves things out and is some kind of compromise (e.g. when we label ‘Manchester’, but not ‘Leeds’ and everyone from Leeds hates us!).

**Task:** let's take a little time now to look more closely at labelling in QGIS, using some data I prepared earlier. You can either look at the global level or the UK level.



- **Option 1:** download `10_world_cities_natranks.gpkg`, and then apply the `3_world_cities_megacity_2030.qml` style file to it. Once you've done this, explore what I've done with the different labelling options – including the **Manhattan lines** and what I've done to the labels for Mexico City, Delhi and Tokyo (you'll see some of my comments in there).
- **Option 2:** download `5_GB_places.gpkg` and `8_UK_LAD_with_population.gpkg` and then explore what I've done with the labelling for both of these layers – the local authority layer labelling is of course a lot more subtle.

Once you've had a good look at these, play with them for a while. There is so much to labelling: it's so flexible, and tricky!

Did you know that you can type anything into the **Value** box in the **Labels** area of **Layer Properties** and that is what will be displayed on your map? It's true. →→→→→

There is SO much we could say about labelling in QGIS, but that's enough for now.



---

#### Notes

Other labelling tricks you should know about – ask me if you need help: wordwrap, upper/lower/title, a simple find & replace method, conditional formatting for just about everything – case change, etc.

## 9. Take a 'bad map' better, and make it better

Earlier on, I made a 'bad map' – as we all did. You can see my final map here:

[/training/data/images/BAD\\_MAP.jpeg](/training/data/images/BAD_MAP.jpeg)

I'd be interested to see some of yours, if you haven't already shown me them (screen share, DM, email...).

- Now **open your BAD MAP project** from about page 25 and then, using everything we have talked about here, make it better! My BAD MAP example happens to match the 'who came second?' theme from section 7 and if yours does too that's fine. The important thing is that your final map is as clean and clear as possible and you take your map from 'BAD' to 'GOOD'.

- If you get to this point after the end of the formal training schedule, don't worry – you can still come back to me for help via email. If you've finished earlier than expected, that's fine too – we can cover some bonus material or anything else you'd like to look at with QGIS. Either way, make sure you take a break and a drink.

Here's a short blog post where I go through some map layout design choices – you may find it useful and/or helpful here:

[www.statsmapsnpix.com/2018/07/map-layout-design-in-qgis-atlas.html](http://www.statsmapsnpix.com/2018/07/map-layout-design-in-qgis-atlas.html)



**There are many ways to do things with QGIS, and not usually any one perfect or correct, best way of doing it.**

But, when it comes to designing maps and visuals that make an impact it is my view that the general *Principles* I invoked above can be very helpful, in addition to the following more specific map and QGIS-related principles.

- Choose colours carefully.
- Be careful with line widths.
- Think about the end user – who are they? Quick scanners?
- Good labelling is SO important, but takes time and thought.
- Go easy on the ‘mapjunk’ (e.g. do you REALLY need that scale bar and north arrow?).
- Have you got your map projection right?
- DIY map legend, or use the built-in one? It depends.
- What about class breaks in a choropleth? You need to be aware that there can be big differences: e.g. see this blog post: <http://www.statsmapsnpix.com/2016/01/from-anscombes-quartet-to-choropleth.html>
- Trying to show too many things? Be realistic about how much people can take in – if in doubt, simplify.

I don't like to leave people high and dry after a training session so if you're stuck or need me to clarify anything, feel free to get in touch – email, website contact form, Twitter DM, whatever.

**Thanks for joining in!**

## 10. Credits

**QGIS** – QGIS is a user friendly Open Source Geographic Information System (GIS) licensed under the GNU General Public License. QGIS is an official project of the Open Source Geospatial Foundation (OSGeo).

<https://www.qgis.org/en/site/about/index.html>

**Natural Earth** – ‘no permission is needed to use Natural Earth data’. All versions of Natural Earth raster + vector map data found on this website are in the public domain.

<https://www.naturalearthdata.com/about/terms-of-use/>

**SimpleMaps** – World Cities Database (Basic), used under the Creative Commons Attribution 4.0 licence.

<https://simplemaps.com/data/world-cities>

**World Bank** – Population data, used under the Creative Commons Attribution 4.0 licence.

<https://data.worldbank.org/indicator/SP.POP.TOTL>

**Emojis** are from Twemoji, at twemoji.twitter.com, licenced under the CC-BY 4.0 licence.

<https://twemoji.twitter.com/>

**Poppins Font** – Designed by Indian Type Foundry, Jonny Pinhorn, licenced under the Open Font Licence.

[https://scripts.sil.org/cms/scripts/page.php?site\\_id=nrsi&id=OFL](https://scripts.sil.org/cms/scripts/page.php?site_id=nrsi&id=OFL)

**OpenFlights.org** – airline data, used under the the Open Database License.

<https://openflights.org/data.html#license>

## 11. Useful links

**Natural Earth** – the best source for easy-to-use global map data, e.g. countries, places, states, roads, coastlines and much more.

<https://www.naturalearthdata.com>

**simplemaps** – world cities csv files, with lat/long coordinates. This is a great source for place name data.

<https://simplemaps.com/data/world-cities>

**Sentinel-2 cloudless** – for adding satellite imagery to QGIS. Right-click **WMS/WMTS** in the QGIS browser panel, then click **New Connection...** add **Sentinel-2 cloudless** to the Name and the second url below to the URL field.

<https://s2maps.eu/>

<https://tiles.maps.eox.at/wms?service=wms&request=getcapabilities>

**OS OpenData Downloads (Ordnance Survey)** – a huge amount of free, open geospatial data are now available from Ordnance Survey via their Open Data Hub. The data covers Great Britain and no registration is required.

<https://osdatahub.os.uk/downloads/open>

**ONS Geography Portal (UK)** – see the Boundaries section of this website for a wide range of UK boundary data. This site includes data for the whole of the UK, whereas Ordnance Survey data only covers Great Britain. A great resource.

<https://geoportal.statistics.gov.uk/>

**QGIS Documentation** – the official help docs from the people who make QGIS.

<https://www.qgis.org/en/docs/index.html>

## Back page cheat sheet



These are things I use myself – to make things work faster, better, smoother.

- **CTRL+Tab** turns panels on/off so the map area is full screen width.
- Select some features, **Edit > Copy Features** then **Edit > Paste Features As** a new temporary layer (called a 'scratch' layer) or a new vector layer.
- **F11** for full screen mode, **F1** for QGIS User Guide, **F6** to open Attribute table (on Windows).
- **CTRL+Shift+Tab** for full screen map mode (on Windows). Same again to undo.
- Change projection for project (it doesn't alter any data) via **EPSG** button, bottom right.
- Black is too harsh, try **#222222** / RGB 34, 34, 34 instead. Go beyond default colours!
- Where is your layer stored? Double-click a layer, go to **Information** and see **Path**.
- Turn on the thousand separator (1,000 vs 1000) – **Settings > Options > General**, tick box.
- Want to save the position of your map? Use **View > New Spatial Bookmark**.
- **Print Layout** looking fuzzy? Just hit refresh and that will fix it.
- **Print Layout** page not zooming to full extent? Re-size your page, then reset to original.
- Save your most commonly used data source paths as **Favorites** in the **Browser**.
- When styling layers, you don't have to use only the columns you already have – e.g. you can style based on calculations or even by extracting portions of text.
- Hey, my lovely XYZ base map looks a bit fuzzy! Set projection to **EPSG:3857**.
- Hey, my joined layer has weird column header names! Go back into **Joins**, and edit the join so that the **Custom Field Name Prefix** is ticked and the box is blank.
- How do you do those glowing lines/polygons? That's via **Blending mode** in **Symbology**.
- Help! My side panel things have disappeared. Go to **View > Panels**.
- Use **Inverted polygons** with a filter and a satellite base layer to create nice area maps – make layer white/black and use about 75% **Opacity**.
- Go to **Processing > History** to view or re-run your recent geoprocessing tasks.
- A general carto tip: try to make your map as simple as possible, remove any junk.
- Type **world** into the **Coordinate** box if you want a world countries layer to use.
- Use a 16:9 aspect ratio if your maps are mainly for screens (e.g. 320mm x 180mm).
- Map a list of x and y coordinates quickly via **Delimited Text** in **Data Source Manager**.
- Drag and drop files from your file browser directly into QGIS (e.g. **shp**, **gpkg** etc).
- You can add layers via the **WMS/WMTS** option in **Browser**. Just Google it.
- Want to save/re-use a map style for a layer? **Layer Properties > Style > Save Style...**
- If you give the **qml** file the same name as a layer file and put it in the same folder as the file then when you add it to QGIS that style will be applied by default.
- Learn about **Draw effects**! Use them to add a glow or a shadow to features.
- **View > Preview Mode** to see your map in colour-blind safe modes or greyscale.
- Best Plugins? **MMQGIS**, **SRTM Downloader**, **Build Globe View**, **Qgis2threejs**, **qgis2web**.
- Add base maps via **XYZ Tiles** in **Browser** panel. **OpenStreetMap** is there by default.