10b: Leaflet / 2.5D Maps

Objectives

- Integrate D3 layers with Leaflet and a map tiling platform (e.g. Open Street Maps)
- Look at a simple 3D example using Mapbox.

Installing Leaflet

Let's use week 9's SG choropleth assignment 3 starter as a base template.

We'll also need the SG GeoJSON dataset.

We're going to add Leaflet CSS and JS via a CDN.

```html
<link rel="stylesheet" href="https://unpkg.com/leaflet@1.7.1/dist/leaflet.css" />
<script src="https://unpkg.com/leaflet@1.7.1/dist/leaflet.js"></script>
```

Load Leaflet basemap

Ignore / comment out the D3 code for now.

You'll need to create a map container for Leaflet to hook to.

Make sure you can get Leaflet and the base map tiles to load.

```
#map {
    width: 1000px;
    height: 600px;
}
<div id="map"></div>
```

```
let map = new L.Map("map", {center: [1.347833, 103.809357], zoom: 12})
    .addLayer(new L.TileLayer("http://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png"));
```

We're using openstreetmap tiles here.

Can you load SLA's OneMap base map tile? Do this.

Attribution, Zoom limits

Add attribution

```
let tiles = new L.tileLayer('https://maps-{s}.onemap.sg/v3/Default/{z}/{x}/{y}.png', {
  detectRetina: true,
  maxZoom: 18,
  minZoom: 11,
  //Do not remove this attribution
  attribution: '<img src="https://docs.onemap.sg/maps/images/oneMap64-01.png" style="height:20px;width:20px;"
               'New OneMap | Map data © contributors, <a href="http://SLA.gov.sg">Singapore Land Authority</a
});
```

Taken from official SLA OneMap Map Docs.

Add maxBounds

SLA OneMap map tiles don't extend much past our borders.

```
let map = new L.Map("map", {
    center: [1.347833, 103.809357],
    zoom: 11,
    maxBounds: L.latLngBounds(L.latLng(1.1, 103.5), L.latLng(1.5, 104.3))
    })
    .addLayer(tiles);
```

Leaflet ideas

You can already do a lot of things within Leaflet and base map tiles.

Leaflet Examples

But of course it would be perfect to overlay your own SVG layers so you have 100% custom control.

Can you add a marker location at the SUTD campus on your map?

D3 - create SVG layer

Hook a SVG layer into Leaflet's overlayPane.

```
let svg = d3.select(map.getPanes().overlayPane)
    .append("svg")
    .attr("width", 1000)
    .attr("height", 600)
        .append("g")
        .attr("id","svgLayer")
        .attr("class", "leaflet-zoom-hide");
```

The leaflet-zoom-hide class is so that when you use Leaflet zoom, it turns of the layer temporarily during the zooming animation.

You can try what happens when you don't include this in the final instance.

D3 - use Leaflet Projection

Leaflet uses its own geo projection, and we're going to make D3 sync with that.

Recall that D3 projection is simply taking a lat/lon coordinate and turning it into a SVG x, y point.

```
function projectPoint(x, y) {
  var point = map.latLngToLayerPoint(new L.LatLng(y, x));
  this.stream.point(point.x, point.y);
}

let projection = d3.geoTransform({point: projectPoint});
let geopath = d3.geoPath().projection(projection);
```

D3 - use Leaflet Projection

Notice that panning and zooming does not properly translate / scale the SVG.
Add in onZoom hook.

```
map.on('zoomend', onZoom);

function onZoom() {
    var bounds = geopath.bounds(data),
        topLeft = bounds[0],
        bottomRight = bounds[1];

    var svg = d3.select(map.getPanes().overlayPane).select("svg");

    svg.attr("width", bottomRight[0] - topLeft[0])
       .attr("height", bottomRight[1] - topLeft[1])
       .style("left", topLeft[0] + "px")
       .style("top", topLeft[1] + "px");

    svg.select("g").attr("transform", "translate(" + -topLeft[0] + "," + -topLeft[1] + ")");
    d3.select("g#districts").selectAll("path")
       .attr("d", geopath);
}
```

Original code snippet by Mike Bostock.

Dynamic sizing

Just CSS tweaks and some basic calculation to set initial width/height for SVG overlay.

```
body { margin: 0 }
#map {
    width: 100vw;
    height: 100vh;
}

...
.attr("width", window.innerWidth)
.attr("height", window.innerHeight)
```

Leaflet - mouse interaction

Leaflet turns off mouse events for all overlay SVG panes by default.

Add the "leaflet-interactive" class to every SVG tag (the appended paths in the case of districts) that you want to make interactive.

2.5D maps using Mapbox

Mapbox isn't a true 3D solution, say unlike Cesium.

Comparison here.

Please go get your own mapbox API key - it's free for low amount of usage.

We're going to run this example from mapbox.

All 2.5D mapbox code will be run using your own API key!

Mapbox - transition

Really easy to add a pan and zoom transition.

```
map.flyTo({
center: [103.849702, 1.278078],
zoom: 17.5,
bearing: 0,

// These options control the flight curve, making it move
// slowly and zoom out almost completely before starting
// to pan.
speed: 0.8, // make the flying decently fast
curve: 1, // change the speed at which it zooms out

// this animation is considered essential with respect to prefers-reduced-motion
essential: true
});
```

Mapbox - embed 3D object

We're going to embed a 3D object. We'll use three.js to load it, then render it using mapboxGL canvas renderer.

We'll run this example from mapbox.

Extra: Will demo an example locally, using three.js code to load animation.

3D - future perspectives

deck.gl and Mapbox GL JS: Better Together, Xiao Ji Chen

Our Thoughts as MapboxGL JS v2.0 Goes Proprietary, Carto

Cesium Sandcastle

deck.gl Examples

Assignment 4

Leaflet + D3 choropleth maps

Setup

To be completed before **22-4-2021**(Thurs) 1200hrs

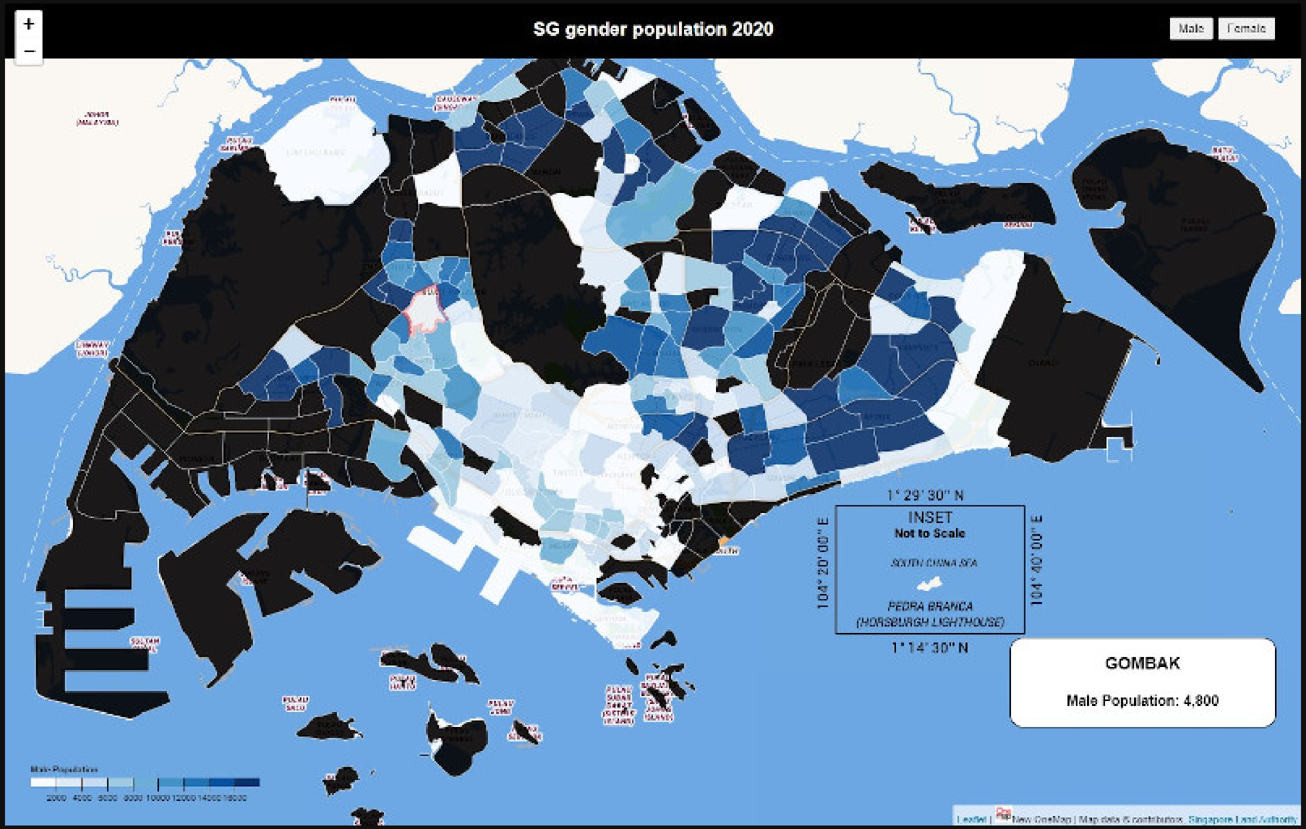
- This repo link will be of the format https://**<username>**.github.io/HASS-assignment4
- In the forked repo create a basic **index.html** file, and make it visible on GitHub repo pages (it's under the settings tab, under GitHub pages).
- You can put your CSS style tags, HTML and JS script code into one file, or organize them into files/directories.

What: Dataset

- We'll be looking at the Singstat Population Geospatial Timeseries.
- We'll also be looking at the Data.gov Master Plan 2014 Subzone Boundary (Web).
- You probably have to do quite a bit of data manipulation. Whether it is in the CSV or via code, it's up to you.

Why + How: Encoding

A choropleth map visualization of the 2020 population in Singapore subdistricts.



Template starter

I've cleaned the dataset on both the GeoJSON data and also the 2020 population data (now updated with both male and female population).

You can code your own version from scratch but I've included a simple template D3 starter.

This assignment is a continuation of the work done for assignment 3.

Requirements

You need to use SLA One Map base map, and hook your choropleth map on top of that.

Your choropleth map can be written in D3 or you can do it in whatever platform you want (e.g. Leaflet).

Add in interaction tooltips, a title, and a legend.

Extra: Add interactivity to showcase both datasets.

Extra: Add in transition animations.

Extra: Cater for mobile responsiveness.

Super Extra: Add more datasets or layers.

I will showcase a version in class.

Questions?

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