```
tt()
```

Schedule

1. Date and Time in JS
2. Spatial data for the Web
3. Geospatial Apps

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1. **Date and Time in JS**
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Date Objects: the problem

Different cultures adopt different data formats

Sun calendars / Moon calendars

Political aspects: UTC, summer time / winter time….

Zero state:

- King’s reign (15)
- Creation (5786)
- Birth of Jesus (2025)
- Hidjira (1447)
- ….

Date Objects: JS’s solution

JavaScript **Date objects** represent a single moment in time in a platform-independent format <milliseconds since…>

Zero state: 1.1.1970, 00:00:00

Differences in time are calculated in milliseconds

Date objects translate from milliseconds to understandable date formats

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Date

Date Objects with JS - days

```
Date.now()                                  // returns a Number (milliseconds)

const today = new Date()                    // create a Date object

today.toString()                            // make it readable

const tomorrow = new Date("20245-11-11")    // standardized Date format

tomorrow.toString()

Tomorrow -today                             // #milliseconden

tomorrow.getDay() - today.getDay();         // #dagen
```

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Date/Date

https://stackabuse.com/javascript-get-number-of-days-between-dates/

Date Objects with JS - time

```
const begin = Date.now()

const end = Date.now()

let elapsed = end - begin                    // elapsed is a Number (milliseconds)



let secs =                                   // # seconds
```

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Date/Date

https://stackabuse.com/javascript-get-number-of-days-between-dates/

Date Objects with JS - time

```
const begin = Date.now()

const end = Date.now()

let elapsed = end - begin                    // elapsed is a Number (milliseconds)

let beginTime = new Date(begin)

let endTime = new Date(end)

let secs = endTime.getSeconds() - beginTime.getSeconds()
```

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Date/Date

https://stackabuse.com/javascript-get-number-of-days-between-dates/

Date Objects with d3: d3-time

d3: JS compatible with (far) more options

```
const today = new Date(2023, 11, 21);

const tomorrow = new Date(2023, 11, 22);

const days = d3.timeDay.count(today, tomorrow);

d3.timeWeek, d3.timeMonth etc.
```

Time handling and time scales

https://d3js.org/d3-time

https://d3js.org/d3-scale/time

Pauze

Schedule

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Spatial data

- Spatial data describe anything covering an “area”, on Earth or in space
- a shape or a position
- position on Earth: `[latitude, longitude]`
- To visualize spatial data, we need: a **map**, the **data** and a **library / Geospatial application**

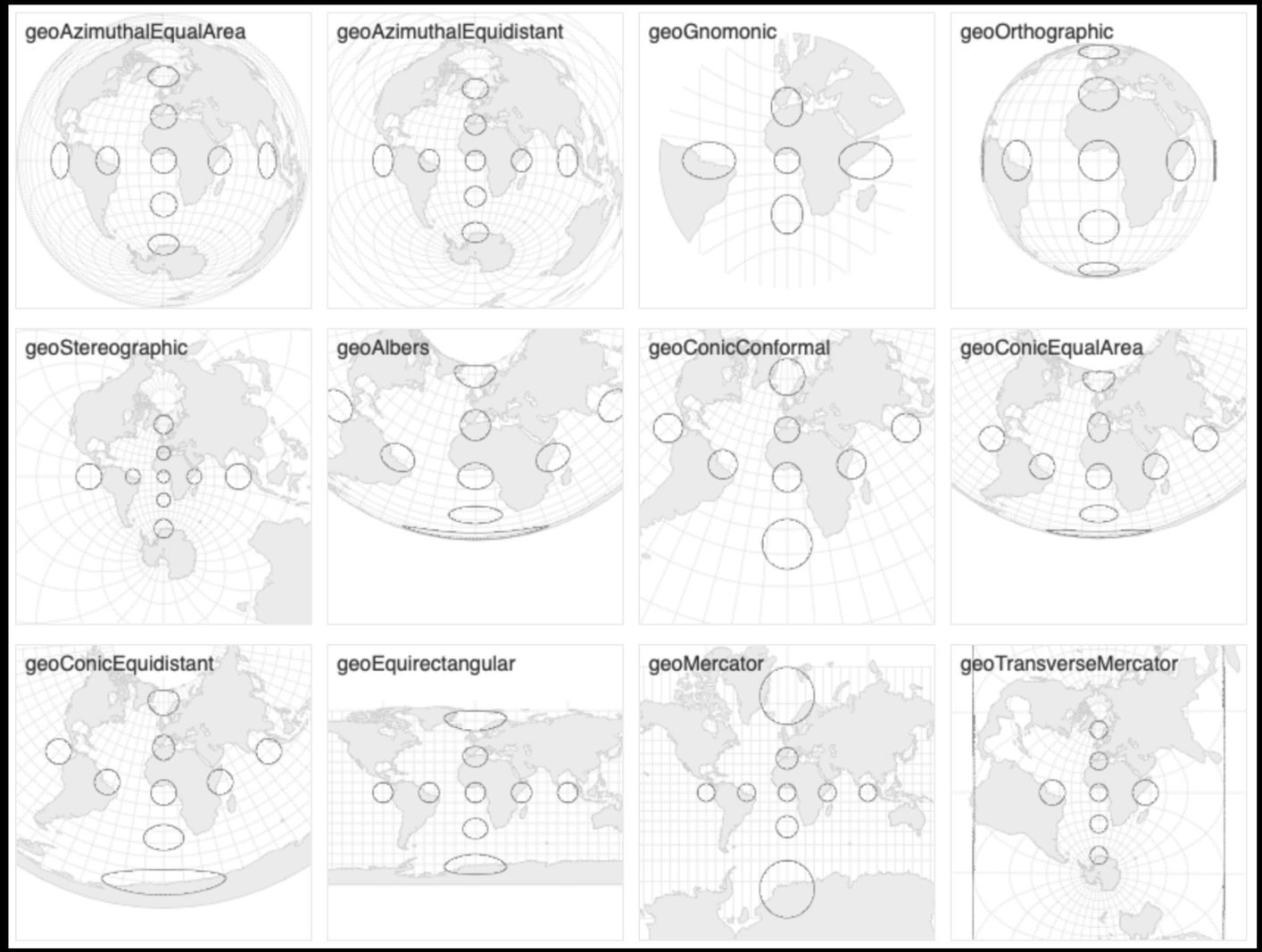
Latitude and longitude finder: https://www.latlong.net/

Map projections: a problem

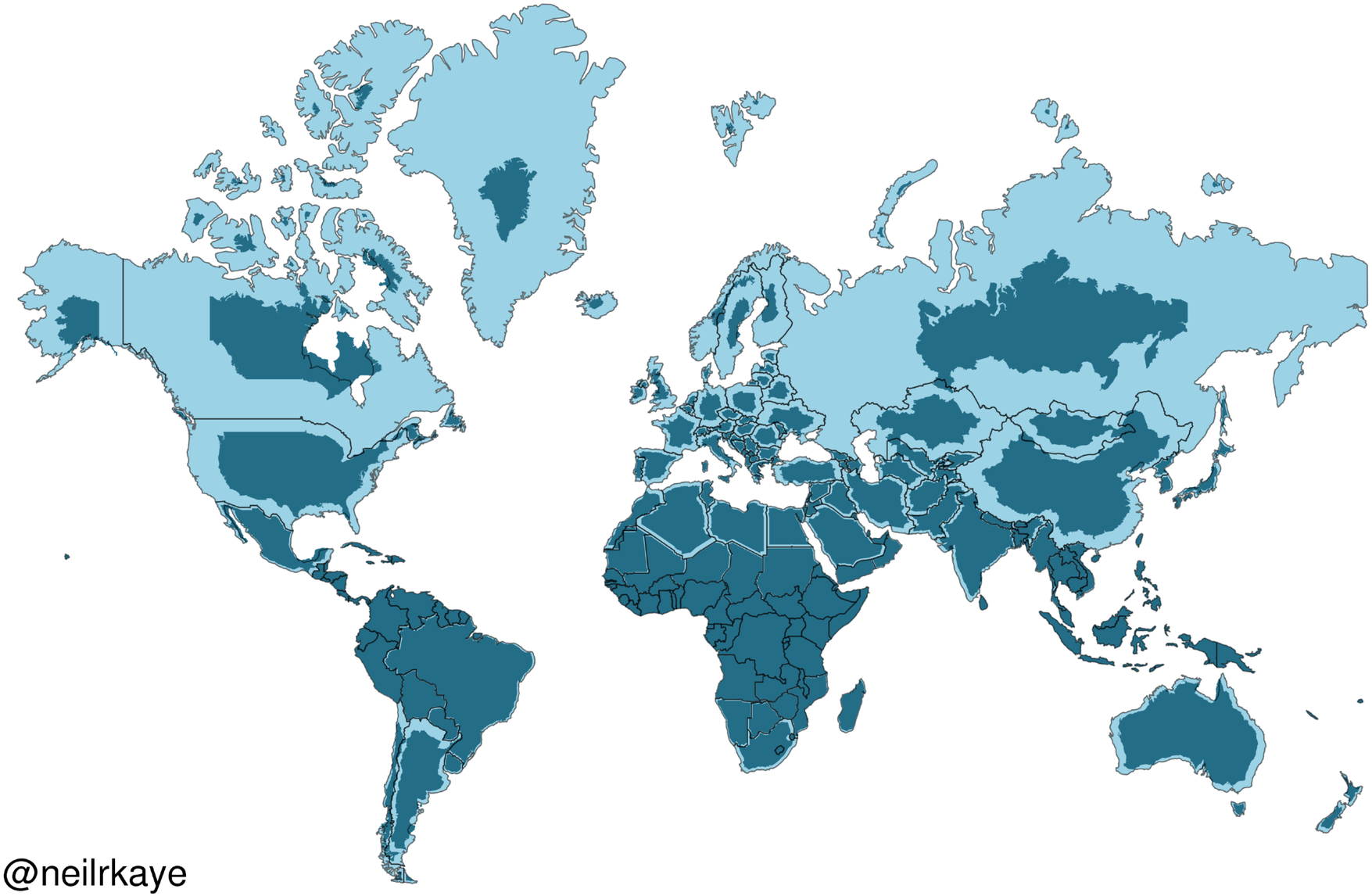
All map projections are a compromise. Pick the one that fits with your dataviz.

See differences here:

https://projectionwizard.org/



World Mercator projection with true country size added



@neilrkaye

Spatial data - formats

Spatial data can be stored as:

- Raster-data (points, lines)
- Vector-data (points, lines, arcs)

Raster data is faster but can have a pixelated look.
Vector data can be rendered more accurately (no grid!) but needs a lot of maintenance to ensure reliability

There are different ways of describing spatial data.

https://carto.com/blog/raster-vs-vector-whats-the-difference-which-is-best

W3C on formats for spatial data

	GML	KML	GeoJSON	(HTML)
Based on	XML	XML	JSON	HTML
By		Google		
Use	Spatial Things and 0D-3D geometries	Spatial Things and 0D-3D geometries. Focus on interaction	Spatial Things and 0D-2D geometries	Descriptions of Spatial Things and geometries can be embedded using mechanisms (…) usingvocabularies
Tool support	Widely in GIS tools Some Web libraries, 2D usually converted in GeoJSON	Mainly supported by Earth browsers, as Google Earth	Supported in some GIS tools Widely supported non Web libraries and mapping APIs	Optimal for Web publication and discovery
3D-support	Yes	Yes	No	Depends on the vocabulary used (…)

Uit: Spatial Data on the Web Best Practices - 19.9.2023, https://www.w3.org/TR/sdw-bp/#applicability-formatVbp

Client-side JS libraries for spatial data

	topoJSON	MapLibreGL	GeoJSON
Based on	Extension of GeoJSON	WebGL, typeScript	JSON
By	Mike Bostok	Open Source, new (> 2022)	
Use	Spatial Things and 0D-2D geometries Polygons, Arcs Vector data (vgl. SVG)	Spatial Things and 0D-3D geometries. Interactive maps Vector data	Spatial Things and 0D-2D geometries. Polygons Raster data
Used by	D3	Kepler	
3D-support	No	Yes	No

Zie ook: https://maplibre.org/ , https://nl.wikipedia.org/wiki/TopoJSON, https://nl.wikipedia.org/wiki/GeoJSON

GeoJSON, TopoJSON

```
{
    "id": 3,
    "type": "Feature",
    "geometry": {
        "type": "Point",
        "coordinates": [
            4.897985,
            52.3743134
        ]
    },
    "properties": {
        "Naam": "Oude Kerk 1306",
        "Functie": "Kerk",
        "Foto": "Oude kerk.jpg",
       "Opmerking": "Bron: Cornelis Anthonisz 1544",
        "Begin": 1306,
        "Eind": 0
    }
}
```

```
{
  "type": "Topology",
  "objects": {
    "example": {
      "type": "GeometryCollection",
      "geometries": [
        {
          "type": "Point",
          "properties": {
            "naam": “Oude Kerk 1306"
          },
          "coordinates": [102, 0.5]
        },
        {
          "type": "LineString",
          "properties": {
            "naam": “Lijn 53",
            "omschrijving": “route metrolijn”
          },
          "arcs": [0]
        },
        {
          "type": "Polygon",
          "properties": {
            "adres": “Wibautstraat 2-4”,
            "naam": {
              "huidig": “Kohnstammhuis"
              “voorheen”: “Belastingdienst”
            }
          },
          "arcs": [1]
        }
      ]
    }
  },
  "arcs": [
    [[102, 0], [103, 1], [104, 0], [105, 1]],
    [[100, 0], [101, 0], [101, 1], [100, 1], [100, 0]]
  ]
}
```

Spatial data: conclusion

There is no standard format (yet…) for spatial data for the Web

The most important criteria for choosing an ecosystem (= data format, library / geospatial app) for datavisualization are:

- 2D vs 3D
- raster data vs vector data

Most libraries and apps support geoJSON, but geoJSON might be too simple for some geospatial applications. These applications need a more sophisticated ecosystem.

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GeoCoder

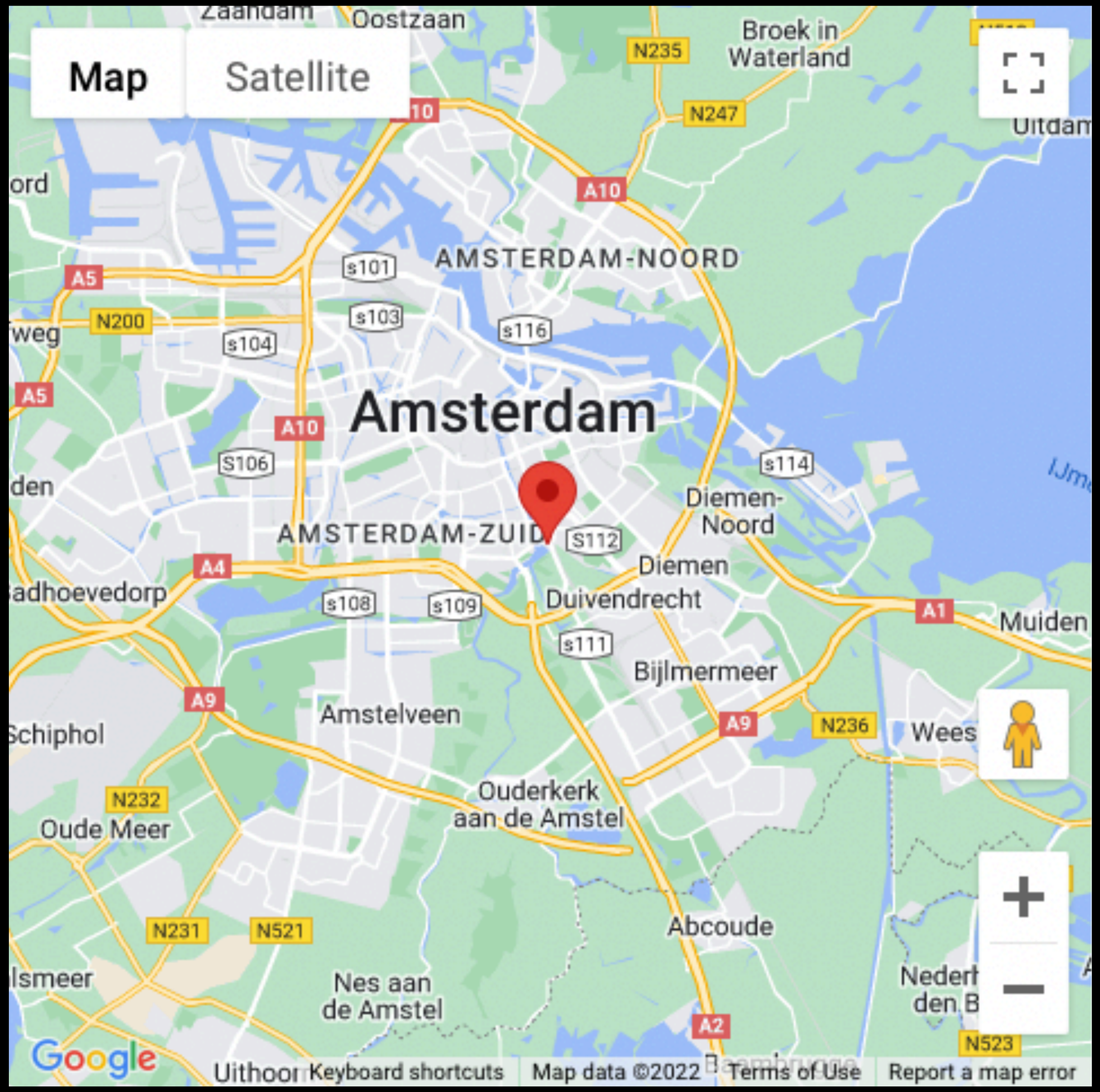
Convert “Wibautstraat 2, Amsterdam”
To 52.359404136494 28, 4.908656298091917

Most commercial mapping providers come with their own **geocoder API**, but you’re only allowed to use them if you also use their map.

Photon is a free alternative without restrictions: https://photon.komoot.io/

https://www.latlong.net/ ,for NL: https://api.pdok.nl/bzk/locatieserver/search/v3_1/ui/

Google Maps


Map
Satellite
Zaandam
Oostzaan
Broek in Waterland
N235
N247
A10
AMSTERDAM-NOORD
A5
N200
s101
s103
s104
s116
Amsterdam
S106
s114
AMSTERDAM-ZUID
S112
Diemen-Noord
Diemen
Duivendrecht
A4
s108
s109
s111
A1
Muiden
Bijlmermeer
A9
Amstelveen
N236
Wees
Schiphol
N232
Oude Meer
Ouderkerk aan de Amstel
Abcoude
N231
N521
Nes aan de Amstel
A2
N523
Google
Keyboard shortcuts
Map data ©2022
Terms of Use
Report a map error

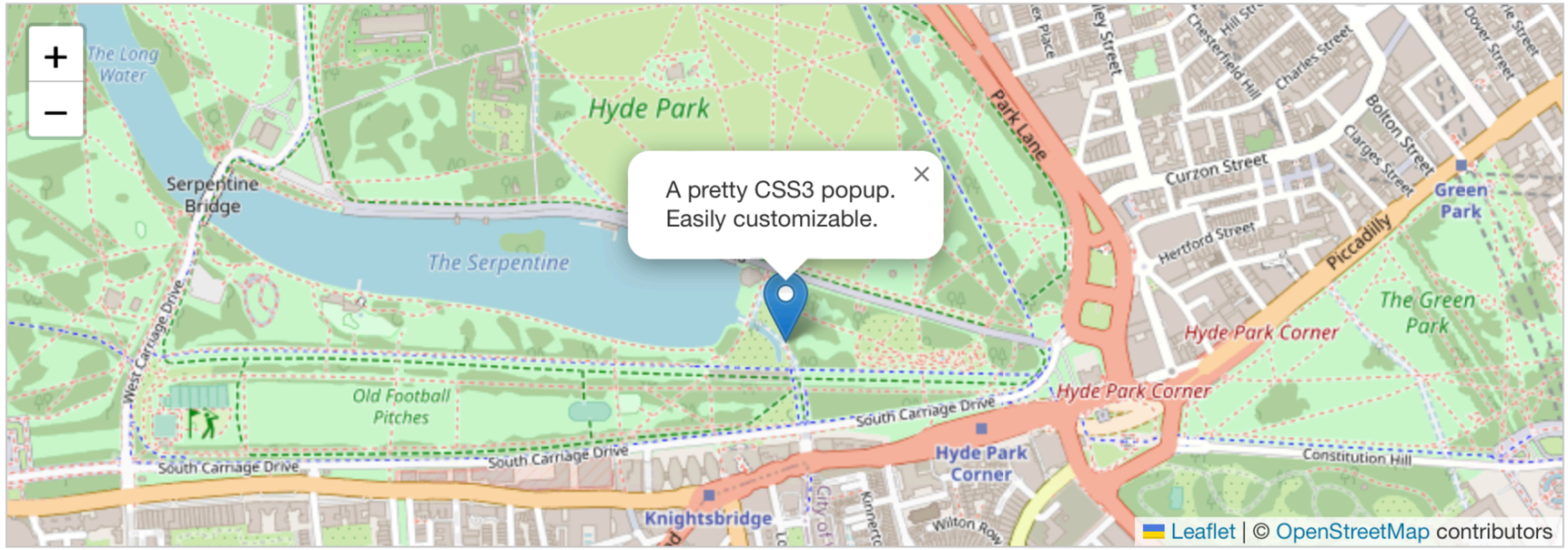
Custom Map Styles

Conditions

- Paid after x number of map requests
- Geocoder only in combination with Google Map
- No caching
- Can’t use for internal apps on local network
- Etc.

Leaflet

leafletjs.com



Here we create a map in the `'map'` div, add tiles of our choice, and then add a marker with some text in a popup:

```
var map = L.map('map').setView([51.505, -0.09], 13);

L.tileLayer('https://tile.openstreetmap.org/{z}/{x}/{y}.png', {
    attribution: '&copy; <a href="https://www.openstreetmap.org/copyright">OpenStreetMap</a> contribu
}).addTo(map);

L.marker([51.5, -0.09]).addTo(map)
    .bindPopup('A pretty CSS3 popup.<br> Easily customizable.')
    .openPopup();
```

Leaflet: different tile servers (maps)

- OpenStreetMap
- MapBox
- HERE
- Stamen ->
- Your own?
- NLMaps

Toner

These high-contrast B+W (black and white) maps are featured in our Dotspotting project. They are perfect for data mashups and exploring river meanders and coastal zones. Available in six flavors: standard toner, hybrid, labels, lines, background, and lite.

Available worldwide.

Terrain

Orient yourself with our terrain maps, featuring hill shading and natural vegetation colors. These maps showcase advanced labeling and linework generalization of dual-carriageway roads. Terrain was developed in collaboration with Gem Spear and Nelson Minar. Available in four flavors: standard terrain, labels, lines, and background.

Available worldwide.

Watercolor

Reminiscent of hand drawn maps, our watercolor maps apply raster effect area washes and organic edges over a paper texture to add warm pop to any map. Watercolor was inspired by the Bicycle Portraits project. Thanks to Cassidy Curtis for his early advice.

Available worldwide.

NL Maps

https://nlmaps.nl/

D3

https://www.d3indepth.com/geographic/

Summary

	Google Maps	Leaflet / OSM	D3
Price	Paid, $ x free credits/month	Mostly free (depends on your map provider)	Completely free
Restrictions	Short selection from their ToS: no caching/downloading data, no applications targeting kids, no in-car systems, can't use APIs separately, no text-to-speech	Depends on your map provider, but plenty of options with few restrictions + you can host your own	None
Flexibility	Can be styled with your own colours + choose how much info is shown. Can't pick projections or focus on one part of map	Very flexible options for styling. Can't pick your own projection or focus on one part of the map.	Extremely flexible. You can pick your own projection + bring your own map files and show only one province
Ease to use	Documentation has expanded in time, huge number of posts in communities as Stack Overflow	Easy-to-use documentation, includes readable code snippets.	Reading documentation and code snippets require deep knowledge of Javascript
Use when..	When street-level details are important or when you need access to their POI data	When street-level details are important but you don't need Google's POI data	When you want more flexible ways to visualise your data and don't need street-level detail

Uncaught SyntaxError
Unexpected end of input