

Web Mapping and Analysis - Carto

1 Context - Move Right:

This document outlines the contextual, technical and front-end decision-making that informs the development of **Move Right**, an interactive geo-visualisation dashboard intended to project neighbourhood data to home-buyers in the metropolitan area of Liverpool. Move Right is an explorative device constructed using open data and dynamic maps to allow users to discover the most attractive locations to live relative to their personal preferences and financial opportunity. By simply dragging the cursor over a neighbourhood demarcation, lower super output area (LSOA) boundaries can be explored in depth, providing a rich social observatory from which home-buyers, or other interested parties, can come to decisions regarding the attractiveness of a neighbourhood to them. An overview of Move Right is shown in Figure 1.

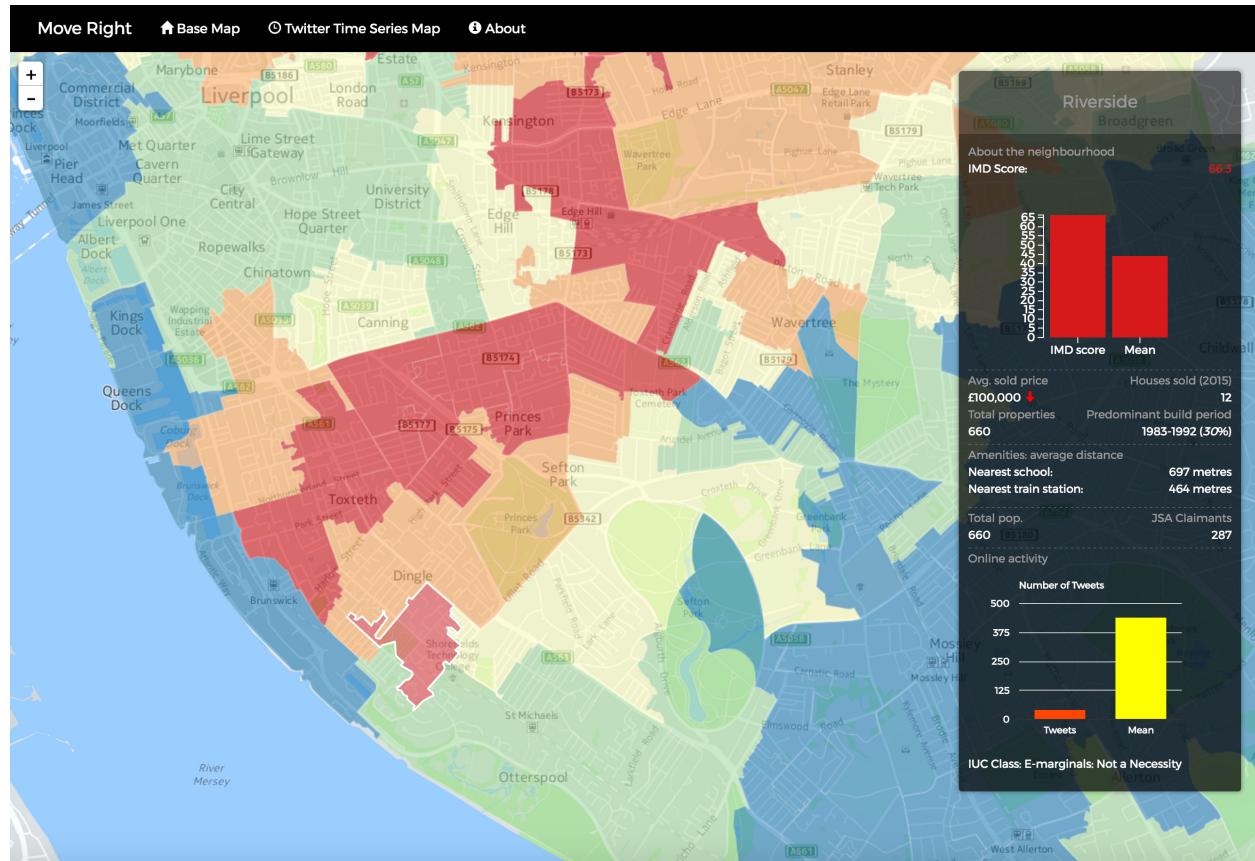


Figure 1: Baseline dashboard for Move Right.

2 Technical strategy:

As opposed to using the Carto Builder UI, we opt for the `carto.js` API to allow more flexibility to build advanced features in the dashboard. To begin with demonstrating IMD score, we use the `d3.js` library to define a scalable vector graphic (SVG) to contain a per-LSOA comparison of the IMD score to the mean

score across Liverpool¹. In addition to showing IMD score, we compile LSOA-level data on the local housing market, distance-based measures to desirable local amenities, local population data, and finally online activity data.

We derive property market data from the CDRC archive of ** and Valuation Office Agency (VOA) data for total homes and the most frequent property build period for LSOA geographies.

Regarding our distance measures, we use the following PostGIS spatial queries to identify nearest amenities:²

```
-- distance to railway stations
SELECT    imd_2.cartodb_id,
          Round(Min(St_distance_sphere(imd_2.the_geom, railway.the_geom))::numeric, 0)
          AS railway_dist
FROM      imd_2,
          railway
GROUP BY  imd_2.cartodb_id

-- distance to schools
SELECT c.cartodb_id,
       round(st_distance_sphere( c.the_geom,
       (
           SELECT    the_geom
           FROM      schools
           ORDER BY  the_geom <-> c.the_geom limit 1 )::numeric, 0) AS school_dist
FROM     imd_2 c
```

In our case, we use `ST_distance_sphere` to return the minimum distance between two geometries in metres. The output of these queries are left joined to the master dataframe to become usable in the Move Right dashboard.

Our final section, online activity, is intended to give the end user a sense of Liverpool's online acitvity. One might, for example, take Twitter usage and internet user classifications as a proxy for community engagement and participation (Matthews, 2015).

For this, we use Carto's temporal mapping library extension, `Torque.js`, to generate a layercube format - a JSON representation of data with geospatial corrdinates - for displaying the temporal activity of Tweets across a 24-hour period (shown in Figure 2).

3 Front-end strategy:

Several stylistic factors contribute to the aesthetical properties of the dashboard. Firstly, we code the functionality to allow LSOA polygons to be highlighted on hover. This is achieved by creating a `featureOver` event that makes an AJAX call to the Carto SQL API for selecting the geometry of the polygon currently under the cursor. From here, we parse the data as GeoJSON and apply custom styling before adding the feature to the map. We then set the `currentHover` variable to the Carto ID of the polygon whilst the cursor remains inside that polygon to prevent additional AJAX calls. On `featureOut`, we clear layers to remove the custom styling.

Next, the `Bootstrap` library allows us to work within a responsive web framework that is suitable for mobile technologies. Moreover, `Bootstrap` provides glyphicons which we use to illustrate the price fluctuations between the median housing prices from 2014 to 2015. Here, we apply conditionally classes to the `<span`

¹Originally, this generated a MIME type error which was reported to Carto's issues stream on Github (see: <http://gis.stackexchange.com/questions/232159/mime-type-not-executable-error-in-cartodb>).

²School and railway station shapefiles are loaded into Carto to calculate nearest distances.

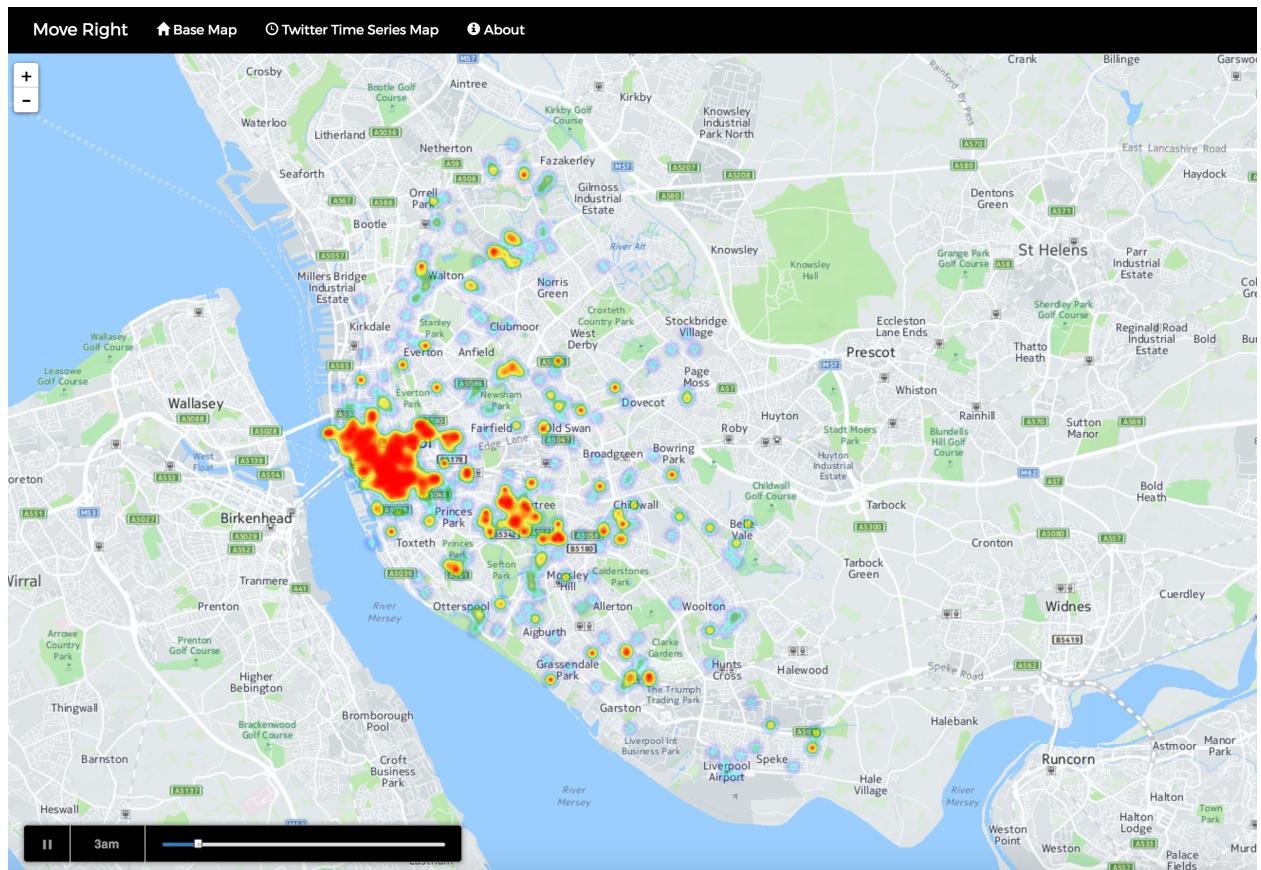


Figure 2: Twitter time series plot using Torque.js.

`id="updown">` tag in the DOM for each LSOA based on whether the previous median property sale price was higher than the current (see below).

```
// parse carto outputs to float
var t2014 = parseFloat('{{md_2014}}');
var t2015 = parseFloat('{{md_2015}}');

// if 2015 year of median sales is greater than 2014,
// set classname via javascript for up arrow, else down
if (t2015 > t2014) {
    document.getElementById("updown").className = "glyphicon glyphicon-arrow-up"
} else {
    document.getElementById("updown").className = "glyphicon glyphicon-arrow-down"
}
```

To access an attractive font-family, we specify an external script linking to the Google Font CDN to access the *Montserrat* font - we apply this to all HTML elements in the DOM. Next, as opposed to LSOA codes which are meaningless to the end user, we use the ONS best-fit lookup table between 2011 LSOA and 2015 electoral wards to project on hover place names.

4 Discussion and conclusion:

From our visualisation, we observe several interesting features.

In summation, *Move Right* seeks to illustrate neighbourhood data using an accessible interface. Several improvements may be sought towards if *Move Right* were to be taken from staging environment to a production server. Firstly,

5 Bibliography

- Matthews, P. (2015) Neighbourhood Belonging, Social Class and Social Media - Providing Ladders to the Cloud. *Housing Studies*, Vol.30 (1), p.22-39.