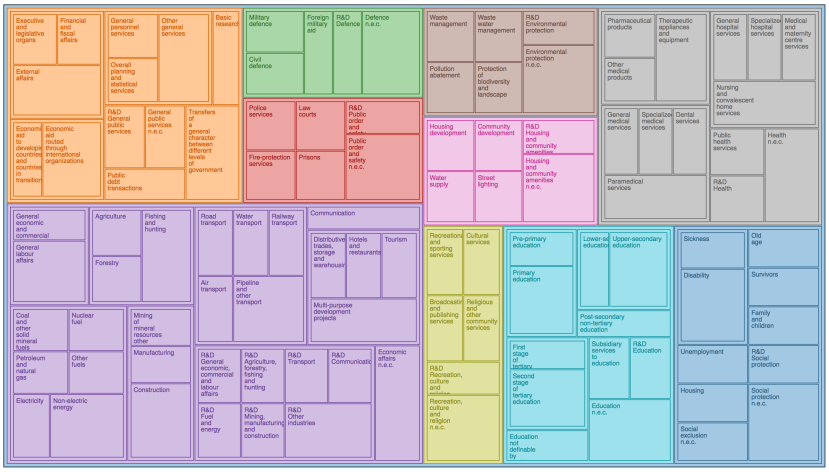
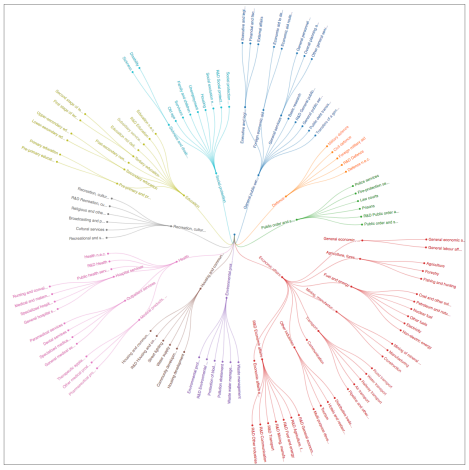
INF552 (2023-2024) - PC s08

Goal: visualize government expenditures (France, 2009) by function, organized into a hierarchy, using D3. COFOG: Classification Of the Functions Of Government.

We will draw this hierarchy in two ways: as a treemap, and then as a node-link diagram with a radial layout





1. Data Structure

We are only loading one file this time: `cofog.csv`

The data comes as a basic CSV table that does not explicitly encode the hierarchical structure:

```
Level,Code,Amount,Description
1,GF01,,General public services
2,GF0101,,"Executive and legislative organs, financial and fiscal affairs, external affairs"
3,GF010101,24.5,Executive and legislative organs
3,GF010102,12,Financial and fiscal affairs
3,GF010103,10,External affairs
2,GF0102,,Foreign economic aid
3,GF010201,2.0,Economic aid to developing countries and countries in transition
3,GF010202,1.5,Economic aid routed through international organizations
…
```

The first task consists of reconstructing the hierarchy and putting it in an instance of `d3-hierarchy` that will later be fed to `d3.treemap()`.

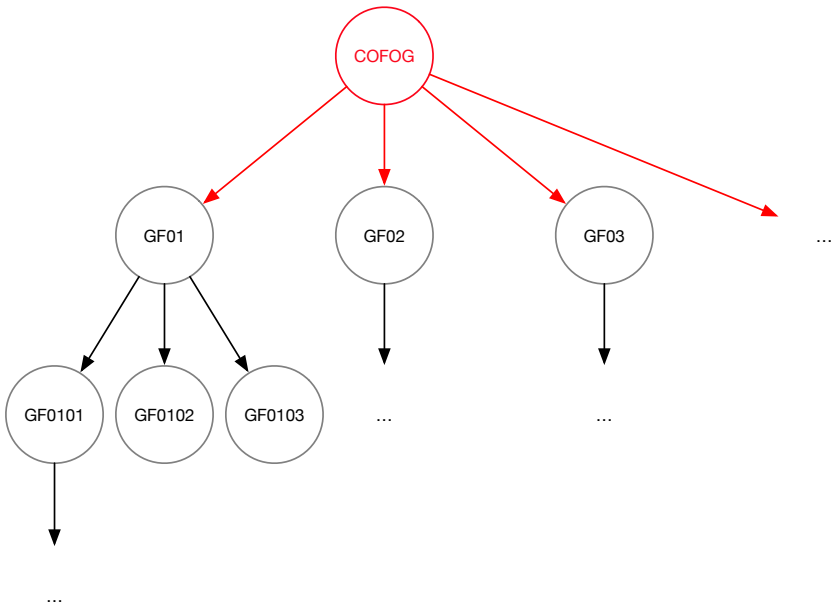
We typically use `d3.stratify()` for this, as in the following example:

```
// if we had the parent explicitly encoded in another column:
let csvData = [
  {Code: "GF01",   parentCode: ""},
  {Code: "GF0101",  parentCode: "GF01"},
  {Code: "GF010101",  parentCode: "GF0101"},
  {Code: "GF010102",  parentCode: "GF0101"},
  {Code: "GF010103",  parentCode: "GF0101"},
  {Code: "GF0102",  parentCode: "GF01"},
  {Code: "GF010201",  parentCode: "GF0102"},
  ...
];
// then the call to stratify would be as simple as this:
let root = d3.stratify()
             .id(d => d.Code)
             .parentId(d => d.parentCode)
             (csvData);
```

https://d3js.org/d3-hierarchy/stratify

We do not have anything like `parentCode` in our case, unfortunately. But it is very straightforward to adapt the arrow function that returns the appropriate value to `parentId(…)` based on the observation that in column `Code`, the hierarchy is implicitly encoded as follows: `GF0101xx` are children of `GF0101`; `GF01xx` are children of `GF01`, and so on. Initialize `d3.stratify()` so that the arrow function passed to `.parentId()` returns the proper parentId given a `Code` (accessed through argument `d`) simply by truncating it.

Then, before calling `d3.stratify()` on the data, we still need to do one more thing: insert a dummy root node, which we will call `COFOG`:



Indeed, `GF01`, `GF02`, *etc.* need to have a parent node, and that parent being the tree's root, it has to be unique. Just add one more row to the input data array parsed from the CSV file, *before* actually calling `d3.stratify()`.

Node `COFOG` has no parent of its own: be sure to handle this case in the anonymous function that feeds values to `parentId(…)`. Return `null` in that case.

2. Treemap

2.1. Basic Black & White Treemap

Now that we have a proper `d3-hierarchy`, we can initialise the treemap:

```
let treemap = d3.treemap()
                .tile(someTilingMethod)
                .size([w,h]);
```

https://d3js.org/d3-hierarchy/treemap

Use `d3.treemapBinary` as the tiling method (works best in this case).

Specify the treemap's dimensions (fill the entire SVG canvas).

Before calling `treemap()` on our data hierarchy, we need to do some more pre-processing on it:

```
root.eachBefore(d => d.data.id = d.data.Code);
root.sum(sumByCount);

function sumByCount(d) {
    return 1;
};
```

Then we can call:

```
treemap(root);
```

What `treemap()` does:

- it decorates nodes in our data structure with geometrical info (each node gets assigned a position and dimensions) ;
- but it does **not** generate any SVG element. This remains to be done, using typical D3 code to bind data to marks.

Create rectangles, binding them to nodes in the hierarchy:

```
let nodes = svg.selectAll("g")
               .data(root.descendants())
               .enter().append("g")
               .attr("transform", d => `translate(${d.x0},${d.y0})`)
               .classed("leaf", d => d.children == null);

// each node is represented by a rectangle
nodes.append("rect")
     .attr("id", d => d.data.id)
     .attr("width", ...)
     .attr("height", ...)
     /*...*/
```

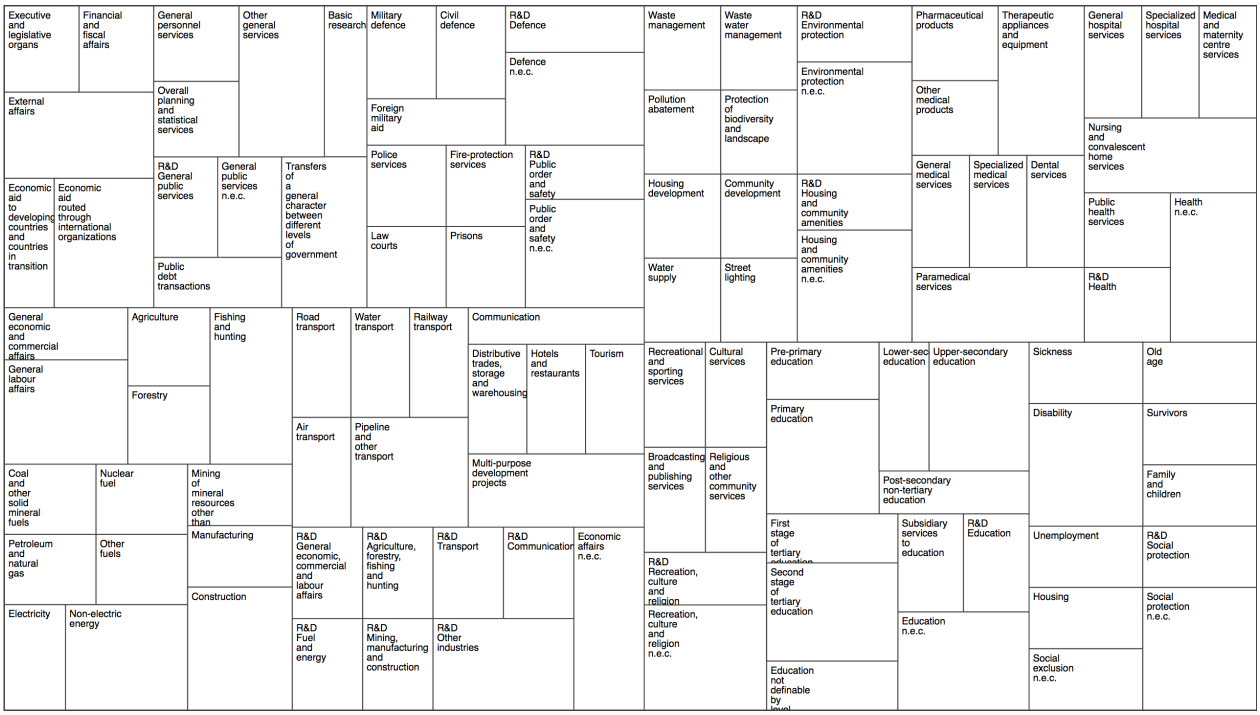
https://developer.mozilla.org/en-US/docs/Web/SVG/Element/rect

Comments about the above code fragment:

- since there is an affine transform applied to `<g>` elements, there is no need to specify (x,y) coordinates on `<rect>` elements;
- class `leaf` is assigned to leaf nodes (necessary to ensure text elements get clipped properly).

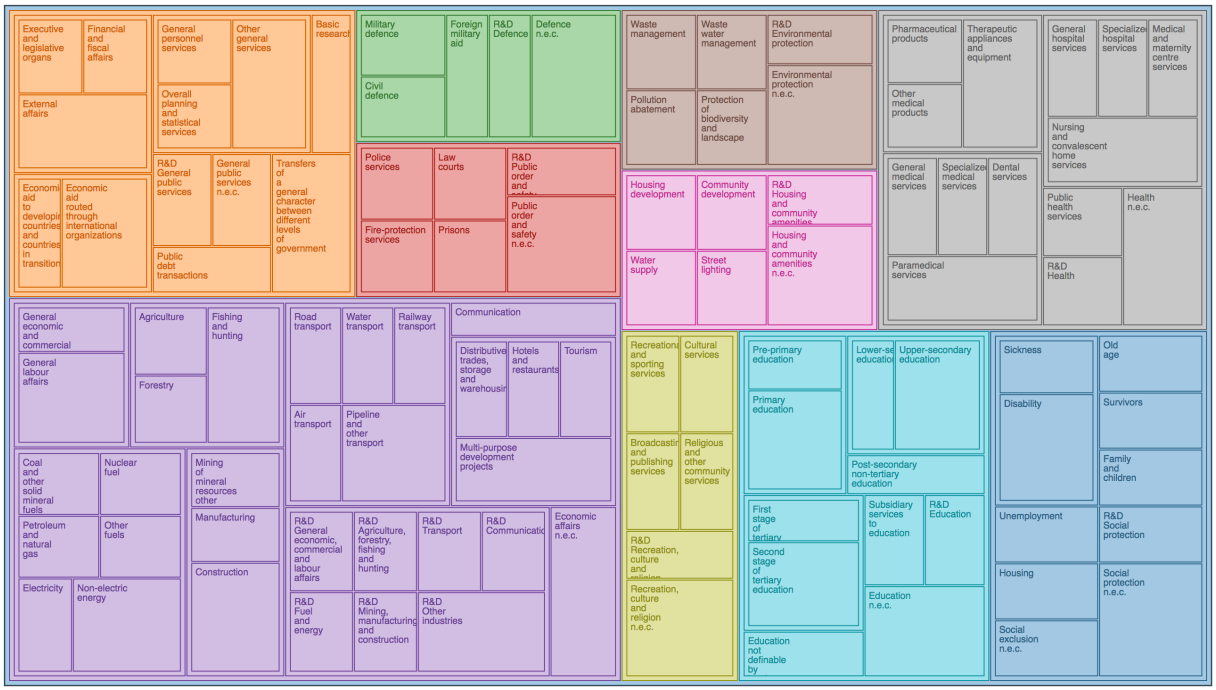
Then we add labels, but only for leaf nodes:

```
d3.selectAll(".leaf").append("text")
          .style("fill", "black")
          .selectAll("tspan")
          .data(d => d.data.Description.split(" "))
          .enter().append("tspan")
          .attr("x", 4)
          .attr("y", (d, i) => (13 + i * 10))
          .text(d => d);
```



2.2. Colored Treemap

We now want to obtain:



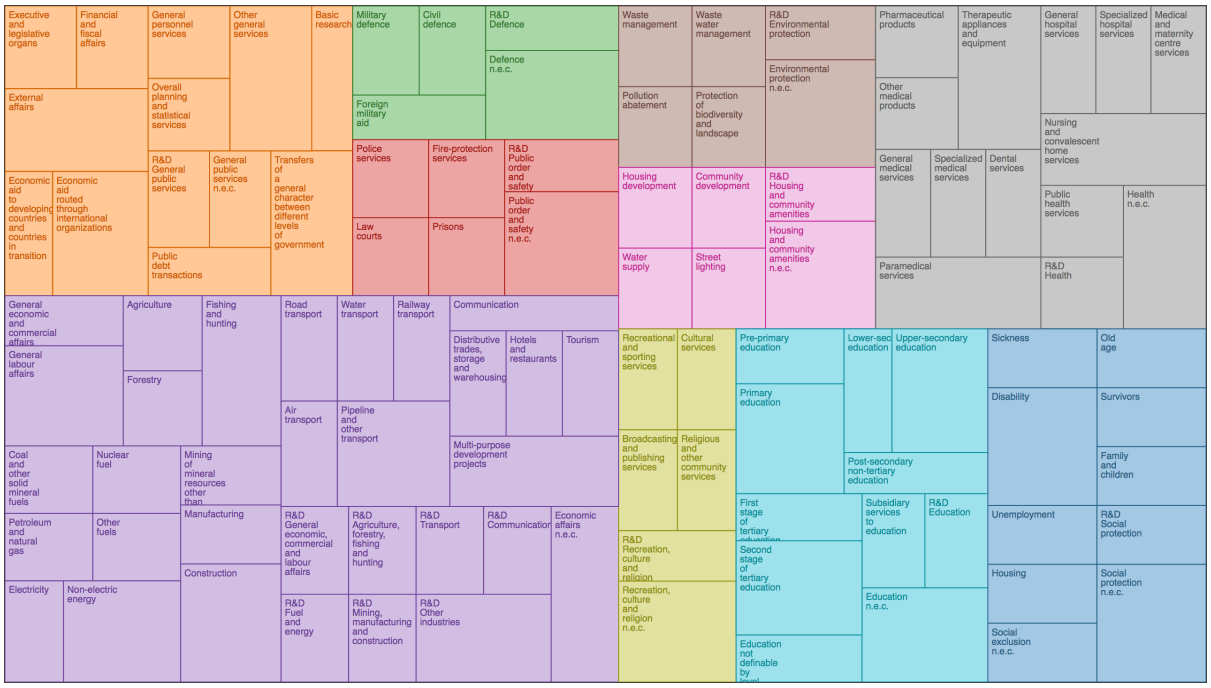
Color all nodes based on the 1st-level category (`GFnn`) using an appropriate color scale from https://d3js.org/d3-scale-chromatic

If need be, desaturate the color palette:

```
let fader = function(c){return d3.interpolateRgb(c, "#fff")(0.6);},
    color = d3.scaleXXX(d3.somePredefinedColorScale.map(fader));
```

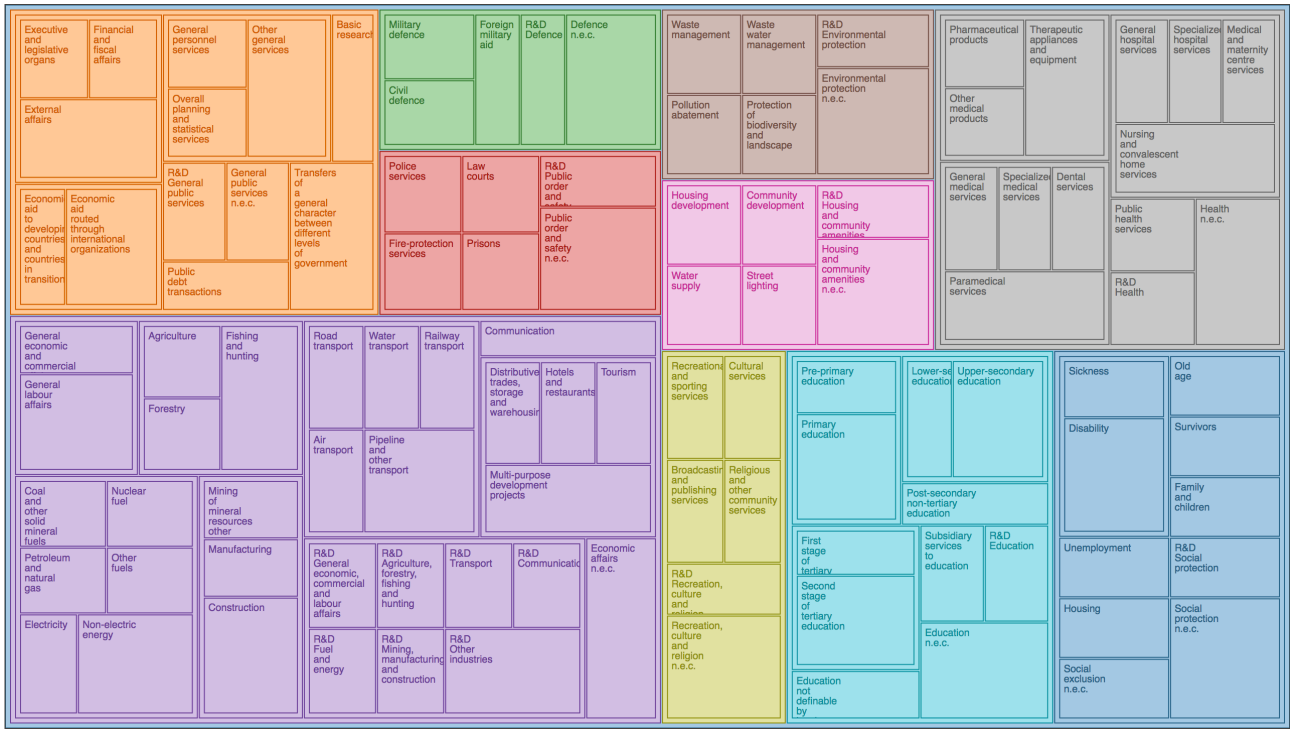
Use `tinycolor.js` (already imported) to draw labels using the same color as the corresponding rectangle, but darker (instead of black). See API at: https://github.com/bgrins/TinyColor/blob/master/README.md

So far, we have achieved this, where we only see leaf nodes:



Adjust `d3.treemap().paddingInner(…).paddingOuter(…)` to explicitly represent the nesting of nodes, effectively showing the hierarchy.
https://d3js.org/d3-hierarchy/treemap#treemap_paddingInner

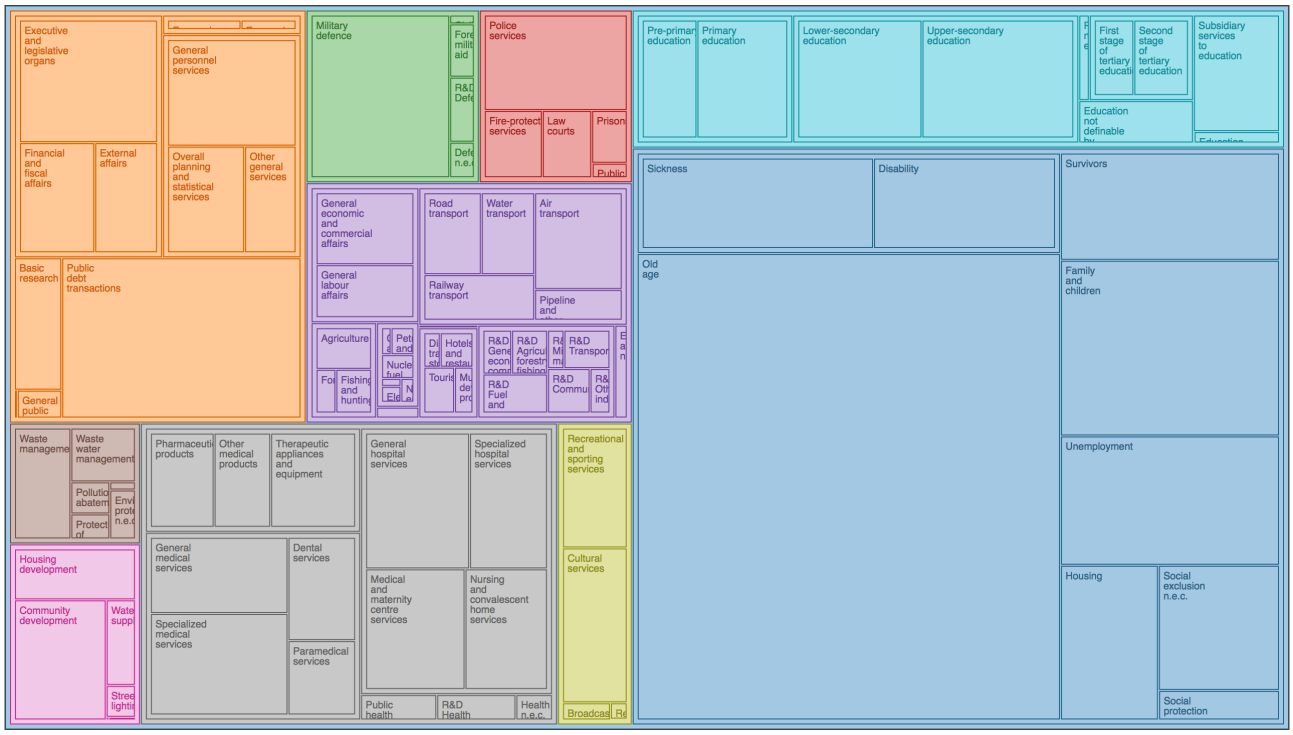
This yields something like:



2.3. Alternative Treemap Layout (optional)

Column `Amount` in the input CSV holds data about the actual expenditures for each category, in billions of € [Source: National accounts - 2010 base, Insee]

Adapt the treemap layout so that the size of nodes reflects the relative amount of money in each category, as detailed next:



This literally requires changing one line of code:

```
root.sum(sumByCount);

function sumByCount(d){
    return 1;
};
```

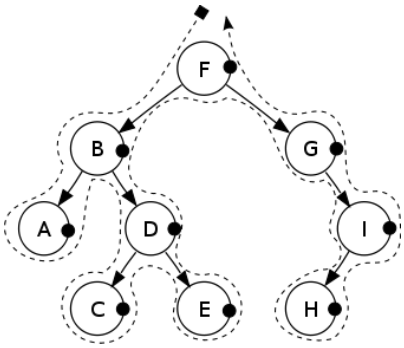
→

```
root.sum(sumByAmount);

function sumByAmount(d){
    return …;
};
```

https://d3js.org/d3-hierarchy/hierarchy#node_sum

Hint: what you have to do is populate each node in the tree with the corresponding `Amount` for leaves, and with the sum of all children's `Amount` for intermediate nodes. Leaves already have their attribute accessible from argument `d`, and given that `node.sum(…)` already performs a *post-order traversal* of the tree, there is really not much to do in function `sumByAmount(d)`!



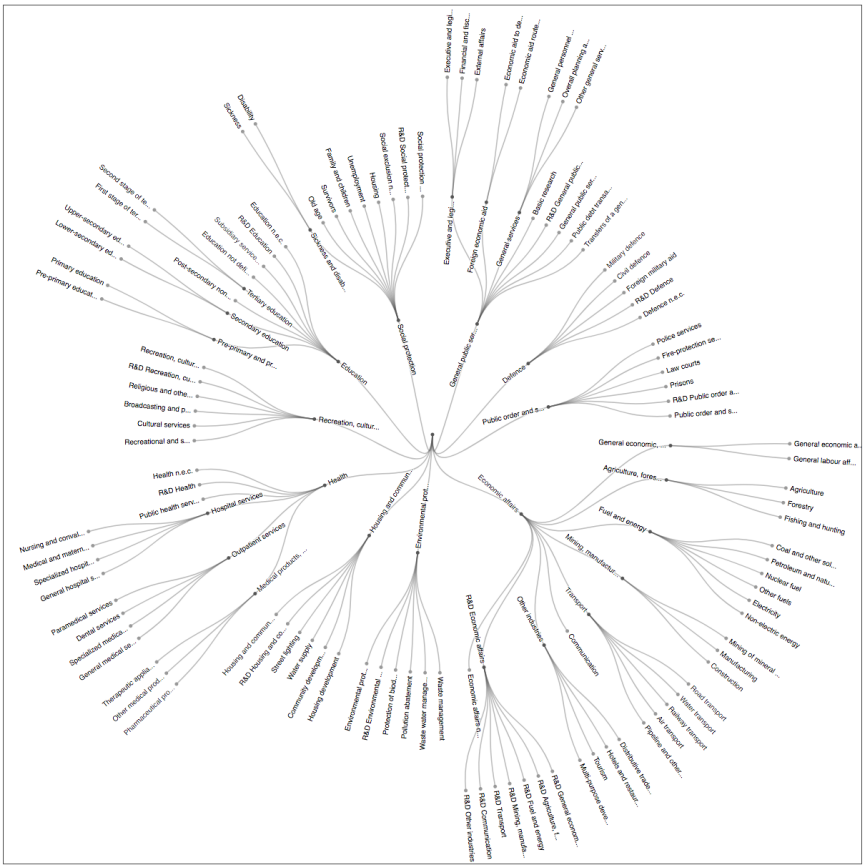
Last tweak: append a `<title>` to each node's `<g>` element so that the label of non-leaf nodes (intermediate levels in the hierarchy) can also be read when users dwell on them.

3. Node-link Diagram (optional)

We are now switching to `ex08b.html` + `ex08b.js`

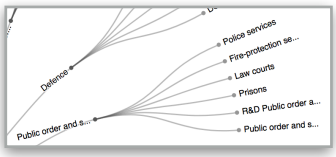
Take inspiration from:

`radial_tree_example.html` (in the ZIP file) to create a radial tree layout ➡ of the same COFOG data as used in the treemap.

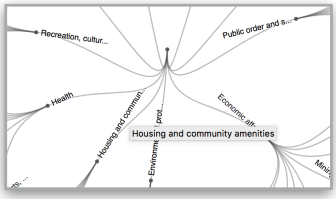


Reuse the exact same data structure as constructed for the treemap with `d3.stratify()`.

Minor adjustments to the rendering:

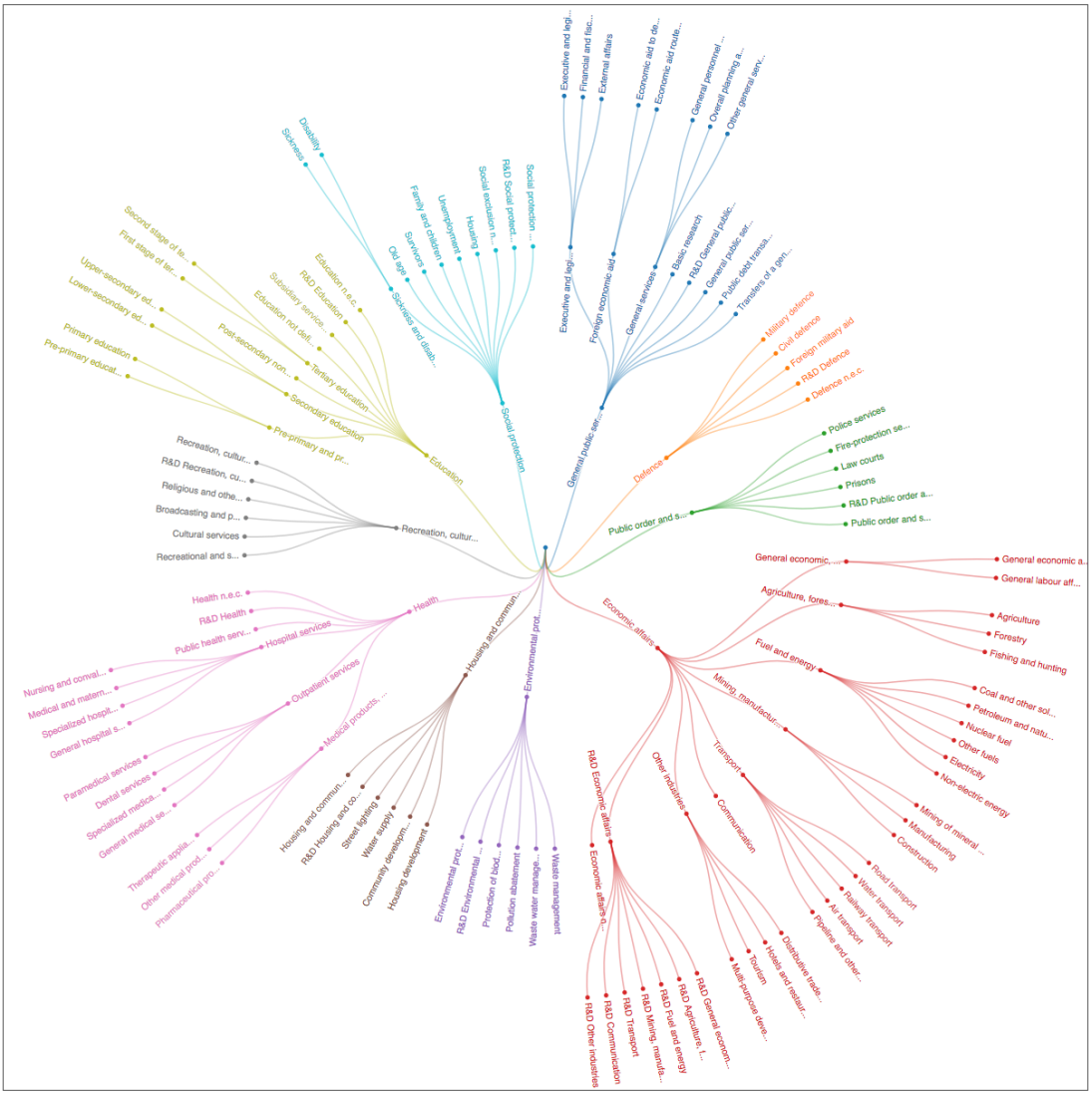


- Some labels are too long and will overlap: trim them to 20 chars, append "…" to those that have actually been trimmed.



- As in the previous exercise, append a `<title>` to each node's `<g>` element so that trimmed labels can be read in their entirety. This will also make reading labels with a rather vertical orientation easier.

Color all branches based on the 1st-level category (`GFnn`).



That's just 3 very similar lines of code in the right place… and looking much like those in `ex08a` (no need for darkening labels here though).