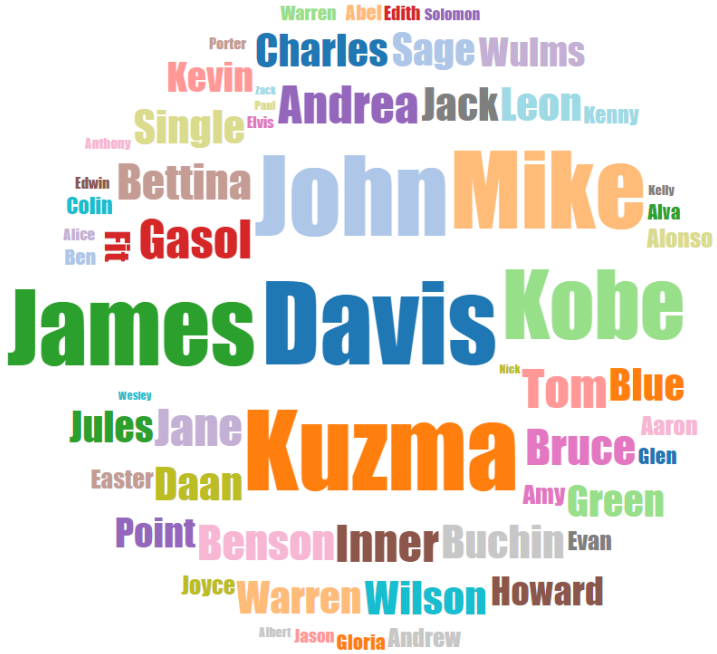
Why Responsive



change the screen size

Wordle can not change with screen size ! !

Methods Overview

Word Attribute Constraint

Force Layout Constraint & Filter

Word Attribute Constraint

Force Layout Constraint & Filter

Words Attribute Constraint

在执行词云放置算法的过程中修改以下单词属性的描述方式：

1. Coordinate：

单词的放置坐标由绝对的像素点坐标转换为距离画布中心点的相对比例坐标

$$x = \frac{x - CenterX}{ScreenWidth}$$

$$\mathrm{y} = \frac{\mathrm{y} - CenterY}{ScreenHeight}$$

$(CenterX, CenterY)$ 为画布的中心点坐标

$(ScreenWidth, ScreenHeight)$ 为画布的尺寸大小

Words Attribute Constraint

2. Bounding Box

单词边界框的坐标描述方法与 1. 相同，边界框的尺寸大小为相对于画布尺寸的比例

$$\mathrm{RateWidth} = \frac{Width}{ScreenWidth}$$

$$RateHeight = \frac{Height}{Screen\mathrm{Height}}$$

Words Attribute Constraint

After 1. 2.

Why Overlapping?

由于 Font-Size 的单位是像素点，所以乘以相应屏幕尺寸的比例因子后的计算结果需取整，因此单词大小的变化比例与单词边界框的变化比例存在偏差，从而导致了左图这样的情况。

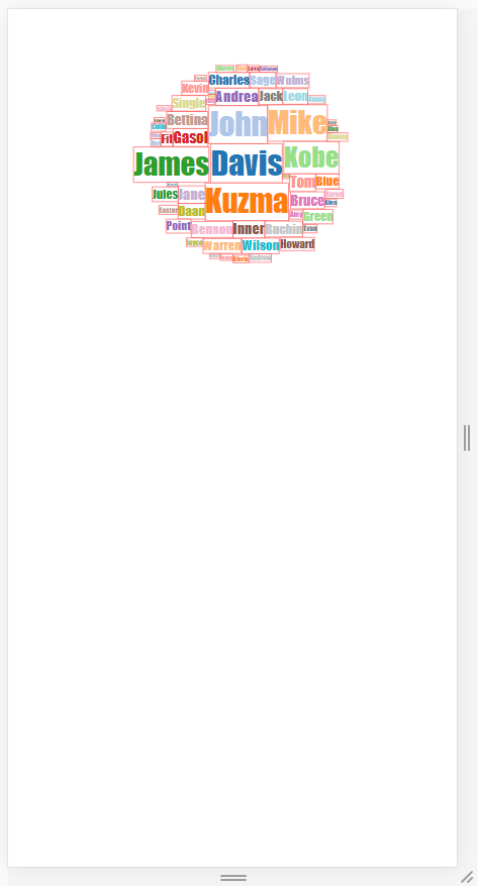
3. Font Size

为了解决上述问题，我们在绘图前对比例化后的单词列表进行预处理，迭代调整 Font-Size 的大小，保证每个单词能够正确地被边界框所包围。

Words Attribute Constraint

After 1. 2. 3.

Vertical screen



Horizontal screen

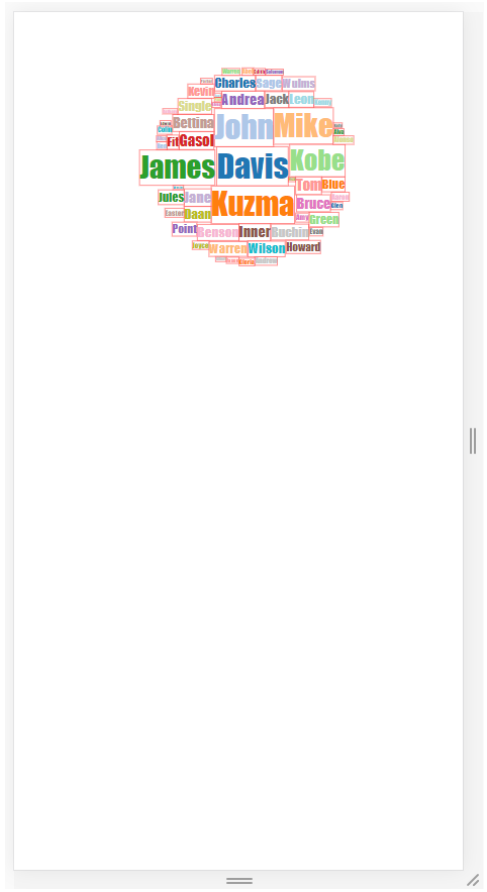
It looks good！！

Wordle takes up too little of the screen！！

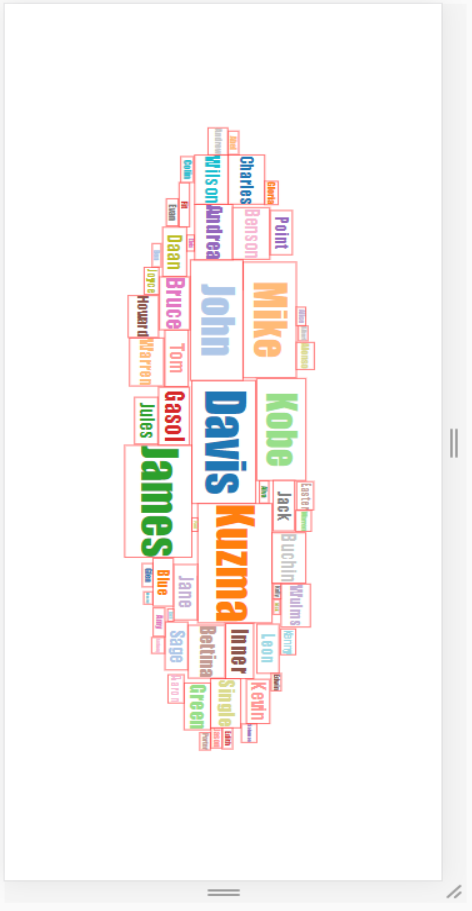
Words Attribute Constraint

4. Rotation

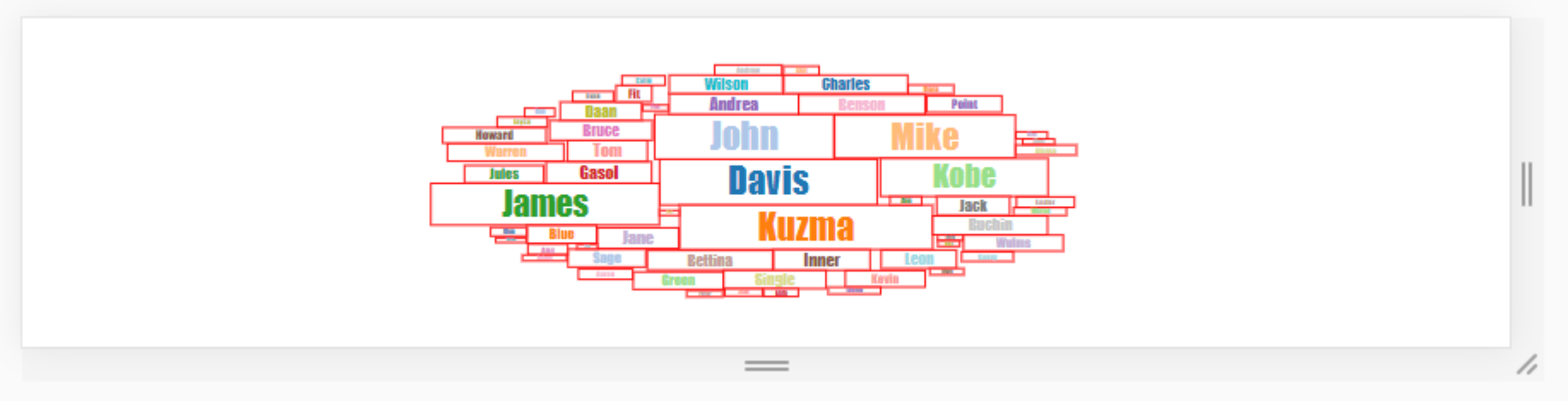
从前面的图中可以看出，在竖屏情况下，词云占据屏幕空间的比例很小，视觉效果较差
为了在不改变原有布局的前提下解决该问题，可以让单词自适应式旋转，修改后效果如下：



Responsive Rotation



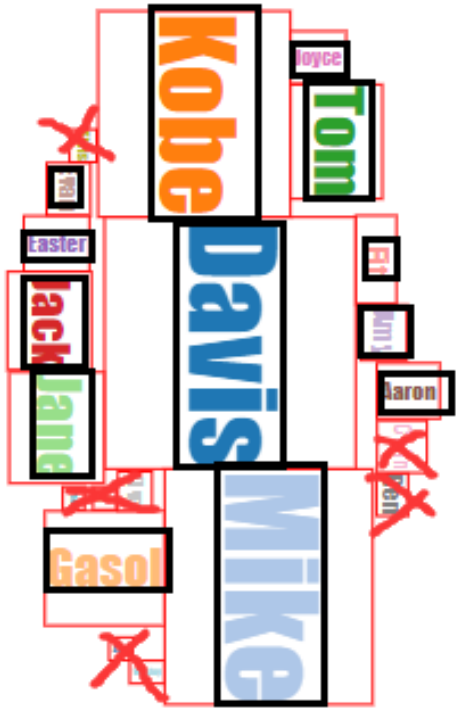
Still Some Problems



由于我们前面对 Font-Size 的处理方法只是简单地将单词限制在其边界框内，所以会出现如上图所示的情况，单词之间的间隔很大，并不能达到紧凑的布局效果，同时由于单词的大小随着屏幕的缩小而缩小，最终会被缩放到肉眼难以分辨，严重影响视觉效果，因此我们仍需额外的解决方案：**Force Re-Layout**

Force Re-Layout

1. **Filter and Re-shape the bounding box**



红色叉号表示被过滤掉的单词

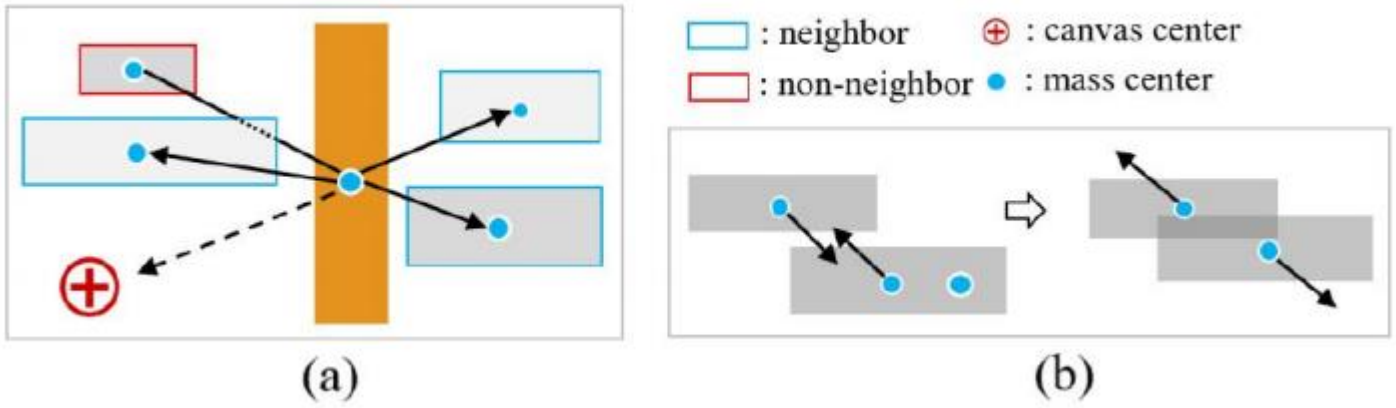
黑色矩形表示新的单词边界框

Force Re-Layout

To produce a compact layout while preserving the neighborhood, we apply two external forces to the objects: neighboring forces and central forces. While the former pushes neighboring words close to each other, the latter drags all words to the canvas center.

2. Neighborhood Search

The body center of each word is connected to the centers of all other words. If the line segment connecting two words does not intersect a third word, these two words are considered to be neighbors.



Force Re-Layout

3. Neighboring Forces

$$F_i^{neigh} = \sum_{j=1}^{n_f} m_i \times m_j / r_{i,j}^2$$

where $r_{i,j}$ is the Euclidean distance between the body centers of the selected word i and the n neighbor words j. The mass m is a given weighting factor for each word.

4. Central Forces

$$F_i^{cent} = m_i \times M \times r_{i,c}^2$$

where M is a unit mass, and $r_{i,c}$ is the distance between word i and the screen center.

Force Re-Layout

5. Joining the Forces

$$F_i(t) = F_i^{neigh}(t) + \alpha F_i^{cent}(t)$$

6. Damping Strategy

$$F_i^{damp}(t) = F_i(t) \times g(t)$$

$$g(t) = \beta / (t+1)$$

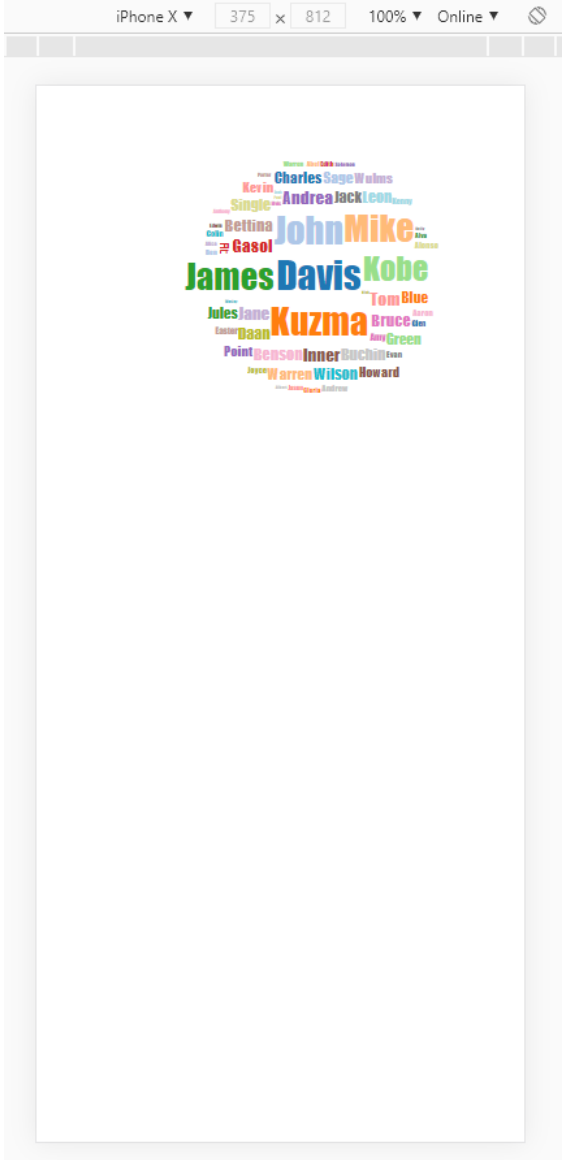
$$\lambda\colon v_i(t) = v_i(t) \times \lambda$$

More details in http://irc.cs.sdu.edu.cn/~yunhai/infovis17/edwordle/index.html

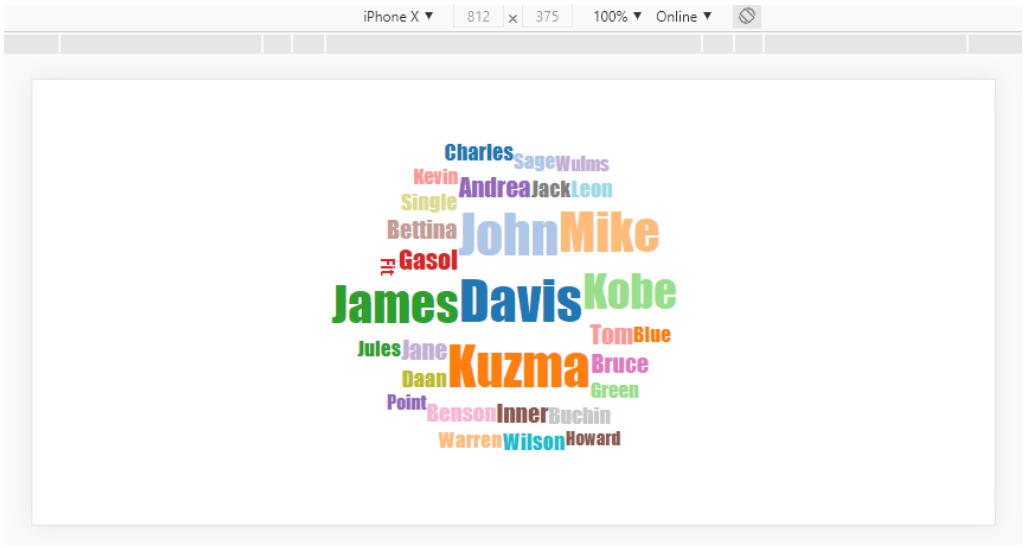
Results

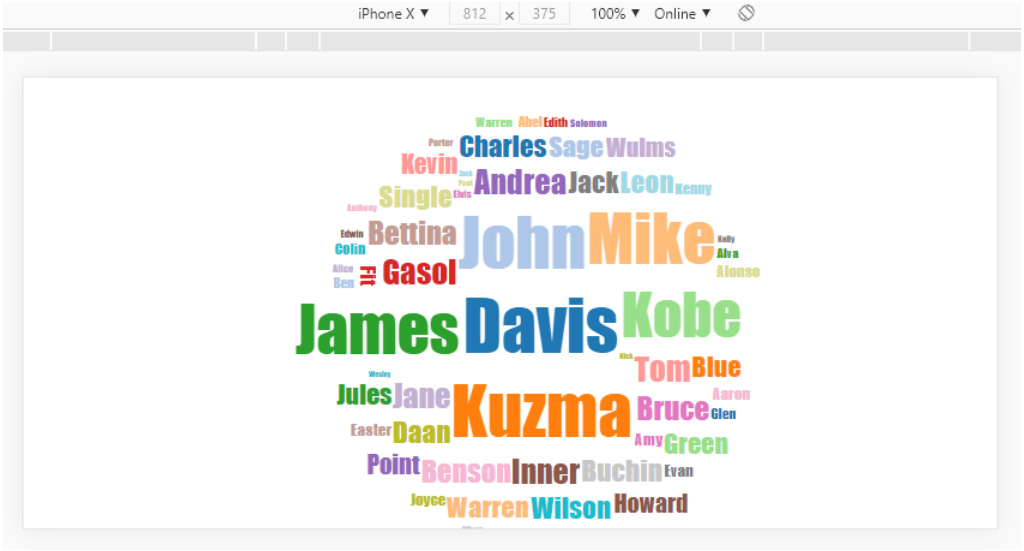
Demo Video

Compare With Google Chrome’s Responsive

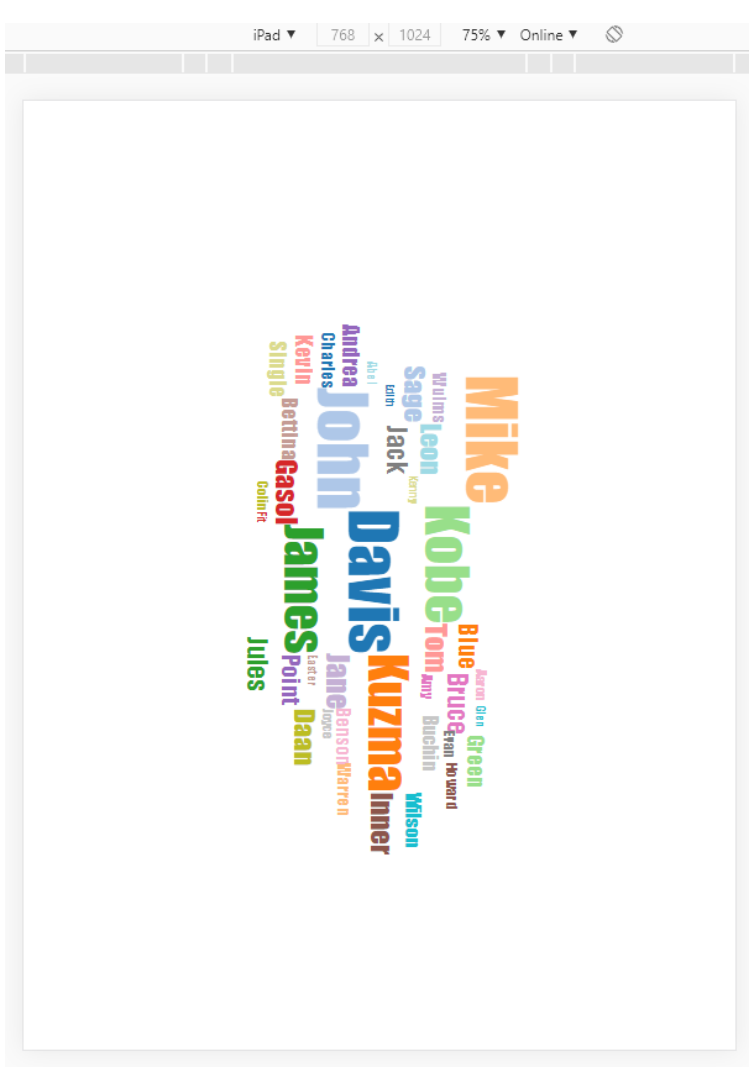


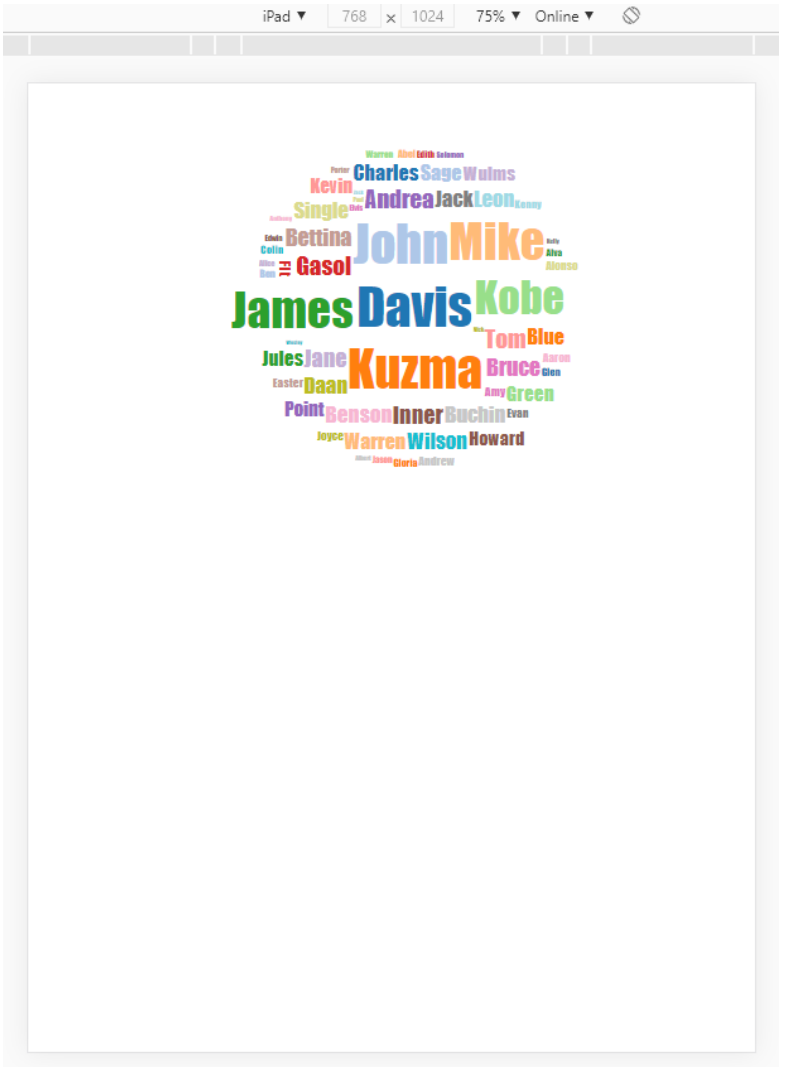
Compare With Google Chrome’s Responsive





Compare With Google Chrome’s Responsive





Compare With Google Chrome’s Responsive