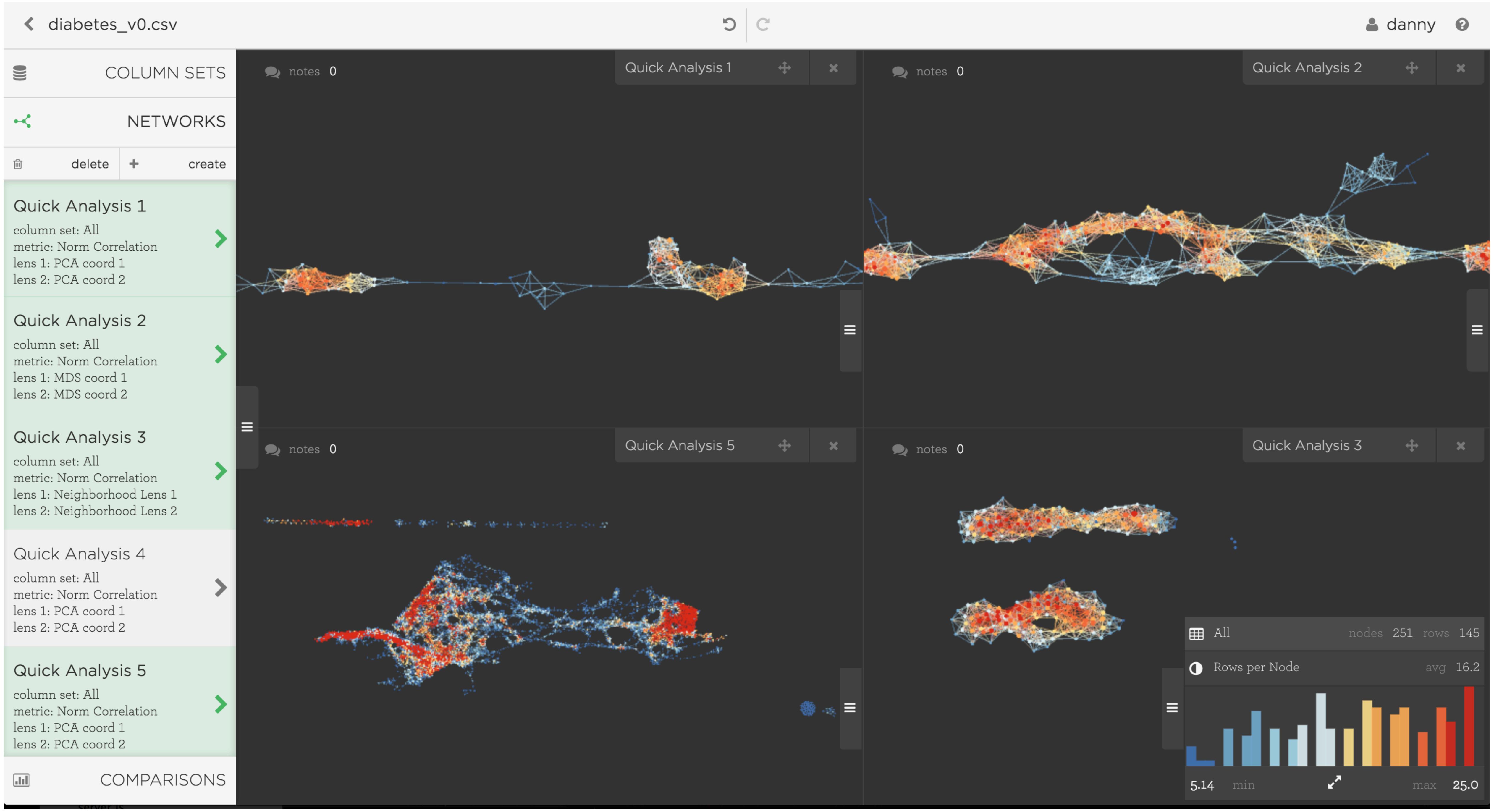
Converting a Complex D3 Visualization to WebGL

Ayasdi Core



diabetes_v0.csv

danny

COLUMN SETS

NETWORKS

delete | create

Quick Analysis 1
column set: All
metric: Norm Correlation
lens 1: PCA coord 1
lens 2: PCA coord 2

Quick Analysis 2
column set: All
metric: Norm Correlation
lens 1: MDS coord 1
lens 2: MDS coord 2

Quick Analysis 3
column set: All
metric: Norm Correlation
lens 1: Neighborhood Lens 1
lens 2: Neighborhood Lens 2

Quick Analysis 4
column set: All
metric: Norm Correlation
lens 1: PCA coord 1
lens 2: PCA coord 2

Quick Analysis 5
column set: All
metric: Norm Correlation
lens 1: PCA coord 1
lens 2: PCA coord 2

COMPARISONS

Before switching to WebGL:

- Doubling SVG Performance at Khan Academy: http://www.crmarsh.com/svg-performance/

- Speeding up D3.js: A Checklist https://blog.safaribooksonline.com/2014/02/20/speeding-d3-js-checklist/

- Think of other ways to represent your data that do not involve tens of thousands of DOM elements

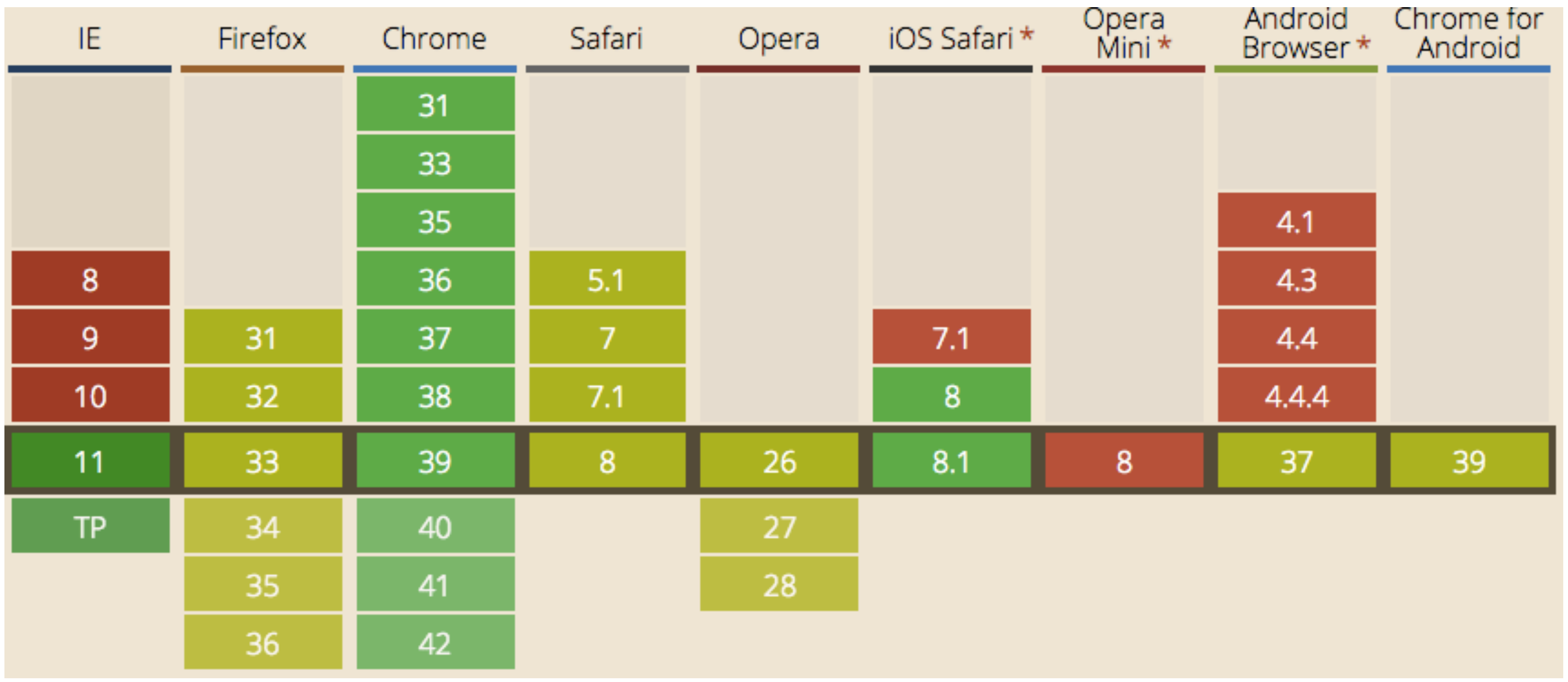
WebGL goodness

- better performance for large visualizations via GPU acceleration

- better performance for the rest of your DOM
(transitions render faster)

WebGL badness

- browser support (getting better…)



IE	Firefox	Chrome	Safari	Opera	iOS Safari *	Opera Mini *	Android Browser *	Chrome for Android
		31						
		33						
		35					4.1	
8		36	5.1				4.3	
9	31	37	7		7.1		4.4	
10	32	38	7.1		8		4.4.4	
11	33	39	8	26	8.1	8	37	39
TP	34	40		27				
	35	41		28				
	36	42						

caniuse.com/webgl

WebGL badness

- code overhead
- API is not very d3-like
- CSS has no power in canvas land

- Naïve WebGL approach: draw nodes and edges with polygons (similar performance to SVG)
- Grapher + Pixi approach: use sprites
- Sigma approach: use vertex shaders

- with a d3 stack, we can create a network that zooms, pans, makes node selections, and changes the node colors in about 140 lines of code

- with pixi.js (a 2D WebGL API), we need 160 lines of code, plus 400 from our Grapher API, plus the additional dependency of pixiJS (190kb unminified)

- with sigma.js (a WebGL API for networks), we need about 160 lines of code and the additional dependency (85kb unminified)

What can be salvaged from D3?

D3	Grapher + pixi.js v2
• philosophy	• create API for enter / exit / update
• zoom & pan	• API exposes transform function that takes a transform object
• brush	• with a vacant SVG DOM element, let D3 brush calculate extent, API exposes selection FN (slightly hacky)

Compare & Contrast

4363 nodes, 32039 links	**SVG**	**Grapher** (on top of Pixi.js)	**SigmaJS**
Transform (translate & zoom)	4-5 FPS	50-60fps	50-60FPS
Changing all node & link colorings	0.05s to complete	0.15s to complete	0.01s to complete

Tested on 2013 Macbook Pro

Processor: 2.8 GHZ Intel Core i7

Memory: 16 GB 1600 MHz DDR3

Next steps

- using vertex shaders instead of sprites in Grapher
- seeing if Grapher can handle force layout rendering
- level of detail scaling

Try it yourself

- github.com/dannycochran/d3meetup
- github.com/ayasdi/grapher