

# Pretty Charts: Data Viz Options for GIS Developers

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Esri DevSummit  
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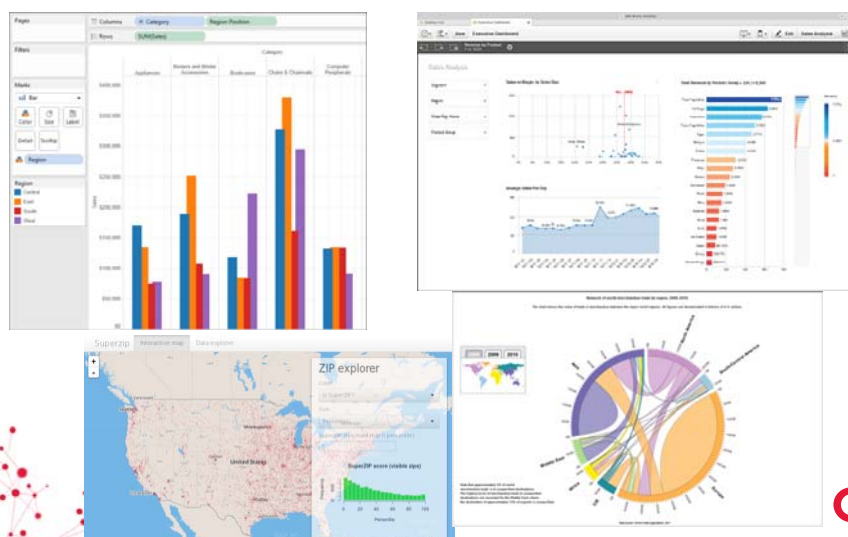
<https://github.com/bchastain/devsummit2017>

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## Pretty Charts

- So many great charting options out there for developers now!



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## The Problem...

- These charting options were all designed primarily for non-spatial data
- How well do they handle complex GIS data?
- Let's break this down into two approaches:
  - GUI-based Options
  - Custom Code-based Options

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## GUI-based Options

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## Tableau



- Created by a research group from Stanford in early 2000s
- Easily bring together disparate data to explore and visualize
  - Simple drag & drop UI
- Tableau Public (free) & Online (paid)
  - Cloud-based SaaS version of Tableau
  - Easy to share workbooks from desktop software
- Tableau Server
  - On-prem enterprise solution
  - APIs: REST & JavaScript
    - Can use JS `getData()` to bring data into other JS-based viz libraries as well
- Server, Public & Online all allow embedding workbooks
  - iframes

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## Tableau JS API Example

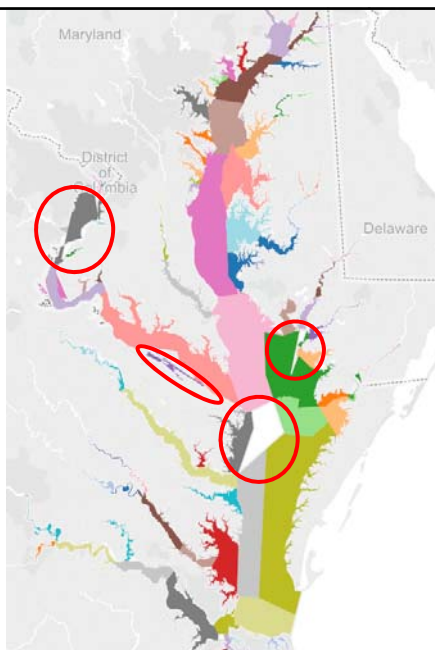
[http://bit.do/tableau\\_getData](http://bit.do/tableau_getData)

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## But what about Tableau & GIS??

- Pros:
  - Very easy to use and produce dynamic interactive charts for users
  - Can quickly publish dashboards to Tableau Public for free for anyone to see
  - Limited mapping of multiple layers possible.
  - Javascript API makes Tableau Server apps very customizable
  - Can use ArcGIS services as background/reference
- Cons:
  - No direct read of GIS data – must be exported to CSV (now possible in new 10.2)
  - Does not support polygons with holes (e.g. islands in Chesapeake Bay) - must be filled in.
  - Does not support multi-part features – manual polygon editing required to merge polygons together in some cases
  - Has a difficult time with complex riverine geometry - needs to be simplified.
  - Because GIS data stored in Tableau format, overly complex joins/blends created



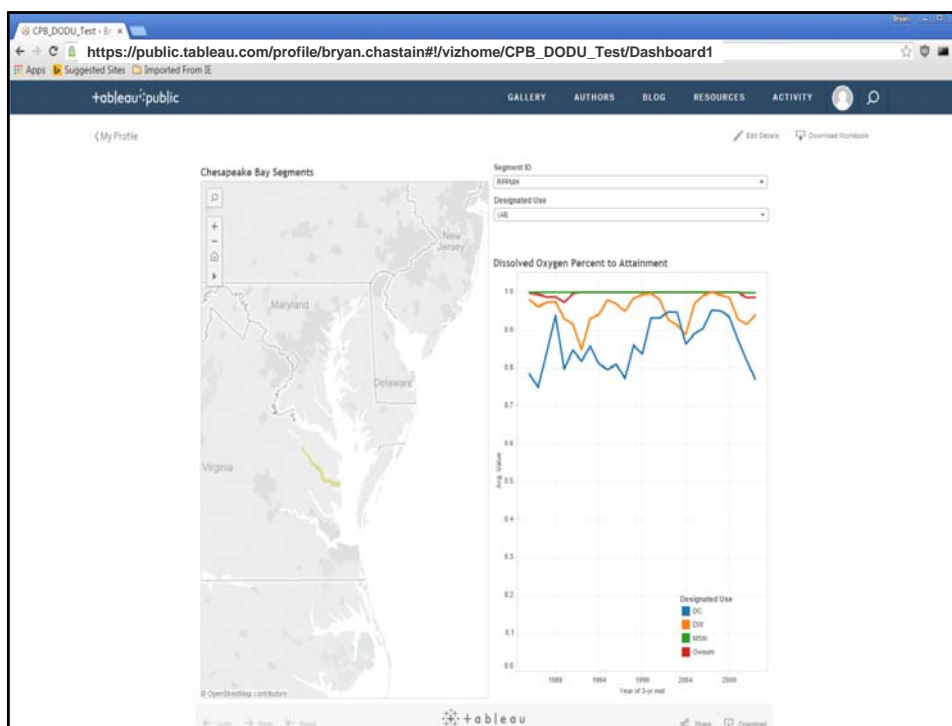
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## Tableau Example

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## PowerBI



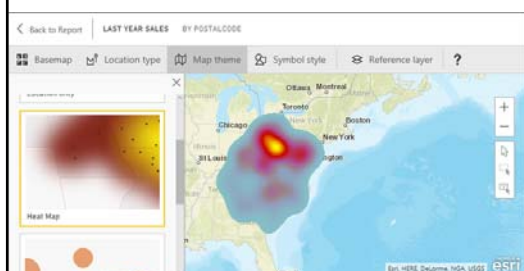
- Cloud-based business analytics service released as part of Office 365 in 2013
- Split off as a separate software package in 2015
- Base package is free, "Pro" version available for a subscription fee
- Popular for creating dashboards
- JavaScript API released last fall



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## PowerBI

- With the new ArcGIS Maps for Power BI and Shape Map previews, users are able to incorporate enhanced mapping capabilities to PowerBI
  - ArcGIS Maps: point data, standard geographies, reference layers
  - Shape Map: custom polygons
- However, several limitations
  - No ability to geoenrich data
  - **Not able to be included in “Publish to web”**

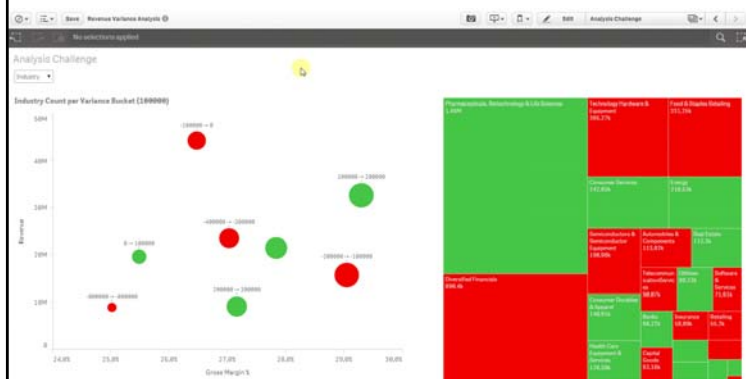


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## Qlik



- Started as a desktop BI software in Sweden in 1993
- Developed QlikView server-based product in 2005
- Completely rewrote their popular QlikView software in HTML5 as a new product called QlikSense in 2014
  - Gradually moving all functionality over since



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## QlikSense

- Pros:
  - QlikSense Desktop is free
  - No direct read of GIS data, but supports KML
  - Able to map polygons with holes and complex geometry
  - Apps HTML5 based so easily customizable/extensible with Qlik Server
    - Desktop/Server apps identical
- Cons:
  - Maps limited to a **single layer**
    - E.g. not possible to facilities on top of watersheds
  - QlikCloud free apps limited to 5 viewers
    - not as simple as Tableau Public

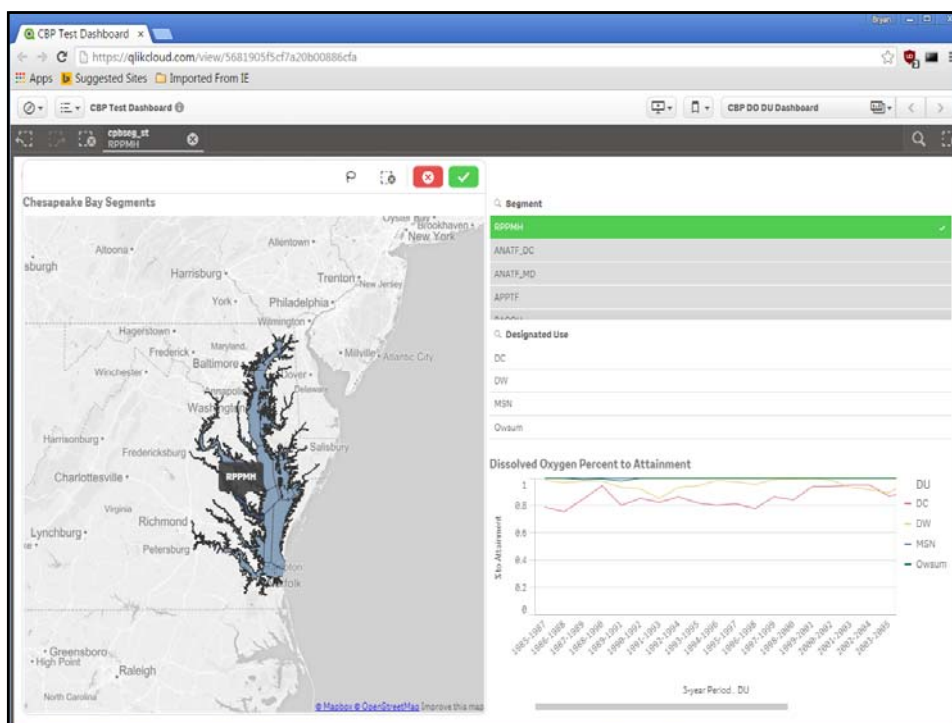
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## QlikSense Example

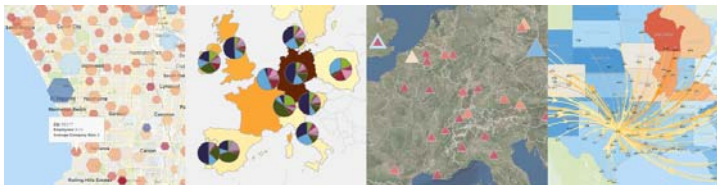
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## Qlik GeoAnalytics (formerly Idevio)

- Qlik recently acquired Idevio, maker of IdevioMaps extension for Qlik
- Now rebranded as Qlik GeoAnalytics
  - Will release a more tightly-integrated product later this year
- IdevioMaps:
  - Any number of layers per map
  - Geoanalytics features such as binning, clustering, indexing dissolve, & routing
  - Wide variety of data sources accepted
    - Including ArcGIS Server JSON!
    - Requires Qlik Sense Server





## Custom Coding Options

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### R Shiny



- Pros:
  - Web application framework for *R*
  - *R* already has ability to read/write most GIS data formats
    - Can read data on the fly
  - Uses Leaflet JS to do the web mapping
    - No issues with holes or multiple layers
  - Can directly read existing *R* scripts and data
  - Free to develop and apps with Shiny Server Open (but not Pro)
- Cons:
  - Many UI Inputs available, but if something custom is needed, may be difficult to add
  - No slick Dev GUI like Tableau/Qlik – everything has to be scripted
    - Added time on setup and future customizations
  - Is it Enterprise ready?
    - Works well enough for quick demo, but can it scale up? Load testing needed, especially with Open

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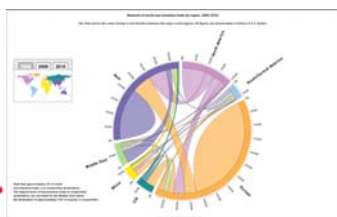
## Shiny example

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## D3

- Powerful JavaScript visualization library
- Works well with Leaflet API for mapping
  - Many existing plugins for handling various GIS datatypes
- Free
- Very customizable, however most things have to be written from scratch
  - Often used as a building block for other libraries (HighCharts, Shiny, etc.)



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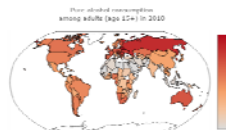
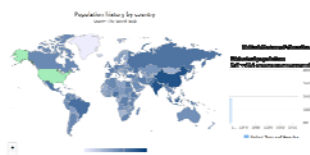
## D3 example

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## D3-based options

- High Charts/High Maps
  - JavaScript charting/mapping libraries
  - Consumes GeoJSON data
    - Easily published from ArcGIS Server/AGOL
  - User-friendly API for quick construction of common charts/maps
  - Free for educational/non-profit use, but license required for commercial/gov't
- Plotly
  - Free
  - Performant WebGL charts
  - Multiple languages (JS, R, Python, etc)
- dc.js
  - No mapping, but very powerful/easy-to-use cross-filtering
- Many, many others



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dc.js example

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## Summary

- Which solution is right for you depends on your needs
- Do non-developers need the ability to create their own visualizations, with minor customizations needed?
  - Go with the GUI-based approach
- Is a completely customized solution required?
  - Go with the custom code-based approach

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## Custom code-based approach considerations

- D3 is by far the most customizable charting option available
  - Comes at a cost – many lines of code required to create even simple graphs
- Higher-level D3-based options provide much of the same ability with the messy details abstracted (plotly, High Charts, etc)
- Are you already running data analytics processes in R?
  - Consider Shiny

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## GUI-based approach considerations

- All aforementioned GUI options have limitations when it comes to GIS
- All are actively seeking to improve their geospatial capabilities
  - e.g. Qlik's Idevio purchase
- Common issues
  - Does it support multiple layers on a map?
  - Does it support a wide variety of GIS data formats?
  - Does it support multi-part features?
  - Does it support polygons with holes?
  - Does it support complex geometry (e.g. high # of vertices)?
  - Does it support direct-read of GIS services (no copying)?
  - Can GIS data interact with/crossfilter non-spatial data?
  - Does it support all of the above in both desktop and web client?

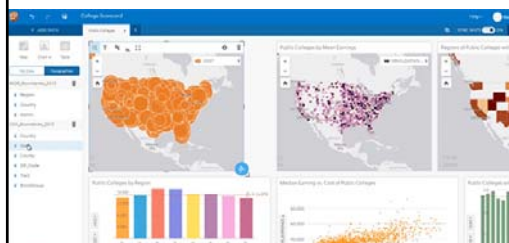
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## Esri Insights for ArcGIS



- Could potentially address many of these problems
  - Native handling of GIS data
  - Direct read of GIS data (no copying)
  - Interaction between spatial/non-spatial data
  - Embeddable (iframe)
- Issues:
  - How do the charts compare with other vendors?
  - Is it production-ready?
  - How customizable is that iframe?
  - No API (yet)



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