

Geospatial Data and Software Reviews

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Spatial Analytics Dashboards: Assisting Researchers to Select the Appropriate Tool

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Abstract

This review provides an overview of the following popular spatial analytics dashboard software: Tableau, PowerBI, ArcGIS Insights, ArcGIS Operations Dashboard and covers optimal use cases for each. Also included is a curriculum for an introductory one-shot instructional session on data literacy and research visualization using Operations Dashboard for ArcGIS in an academic library context.

Introduction

The following will introduce spatial analytics dashboards and discuss four (4) popular options: Tableau, PowerBI, ArcGIS Insights and ArcGIS Operations Dashboards. Appropriate use cases for each will be examined and discussion will be centered around when the tools can be used by researchers to visualize or analyze their research data. An example of curriculum for an academic library instruction session will also be discussed as well as future plans for implementation based on student feedback.

Background

As data dashboards have increased in popularity over the past few years as a way to explore data in the business world, more organizations outside of this sector are beginning to implement this technology. Software companies are also looking to take advantage of this area of growth, with many platforms becoming available to those who want to make dashboards of their own for strategic or informational purposes.

There is a current interest by researchers considering using these interactive dynamic displays to provide more easily digestible views of their research data to aid the audience in exploring their work. Within the academic library, a large part of supporting these users is assisting them in selecting the appropriate tool for their research visualization. Framing the conversation around researcher needs in terms of data requirements, software expertise and audience helps to simplify the selection process.

Tool Selection

The data the researcher wishes to visualize will be the main determinant of software selection. Defining if the data is spatial in nature or not, and if the researcher is looking to ground their research in geography is the first step. Currently, ESRI is the leader for spatial dashboards. They have two tools: Insights and Operations Dashboard. While Insights is not a dashboard software per say, it has a dashboard theme that can be used to present data, so is being included. For non-spatial data or data where location is not central, Tableau or PowerBI are the two main options. Once the type of data is determined, the next step is discussing the researcher’s data management plan and any data residency requirements they may have. If the research data is governed by the requirement that it be locally hosted, selecting a desktop tool or only uploading anonymized data/ summary statistics to the web-based tool is critical.

	NON-SPATIAL DATA	SPATIAL DATA
WEB BASED:	PowerBI SaaS Tableau Public	ArcGIS Insights SaaS Operations Dashboard for ArcGIS
DESKTOP:	PowerBI Desktop Tableau Desktop	ArcGIS Insights Desktop

Table 1: Dashboard tool selection matrix

Geo-visualization

Both PowerBI and Tableau have the ability to geocode data and link it to their respective base maps for visualization purposes. Pristine data is critical to the success of the geocoder, and even then, some manual manipulation may be required. PowerBI being a Microsoft product has a data transformation tool that those familiar with Excel will be comfortable using, while the Tableau interface is intuitive, but takes some getting used to in the way the data is organized.

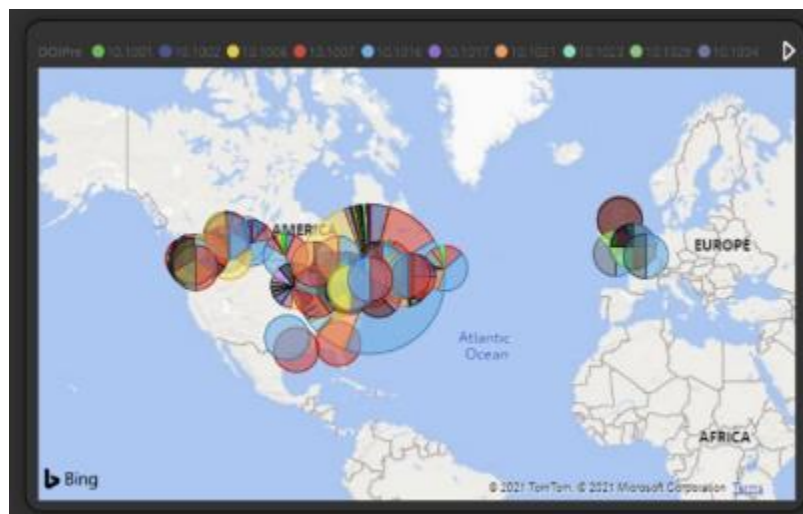


Figure 1: Canadian data placed using PowerBI geocoder

If the user intends on grounding their visualization in geography and is open to a GIS approach, ESRI products are a much more efficient and flexible way to interact with spatial data. If they are just creating simple maps, PowerBI or Tableau will be adequate.

In terms of tool selection between ArcGIS Insights and Operations Dashboard for ArcGIS, they are two very different tools, but the ability to use a dashboard theme in the output phase of visualization in Insights means it is an option for researchers who wish to create a dashboard themed exploratory interface for their audience. The following three (3) questions are useful in helping determine which tool to select:

	ARCGIS INSIGHTS	OPERATIONS DASHBOARD FOR ARCGIS
ARE YOU LOOKING TO CONDUCT ANALYSES?	Yes, in depth	Yes, simple descriptive stats.
WHAT IS YOUR STUDY TIMEFRAME?	Predictive, what might happen in the future.	Events happening now.
WHAT SORT OF QUESTIONS ARE YOU ASKING?	‘How’ & ‘Why’	‘What’

Table 2: ESRI Dashboard tool selection questions

In all cases reminding the researcher that understanding the limitations and components of their datasets, as well as what the software is expecting to ingest and then making a plan before they begin will save them a lot of fidgeting at the end of their project.

Implementation

In all cases discussed the software is coming from an established vendor, with Tableau and ESRI having the industry share, but PowerBI having the advantage of being part of the Microsoft Office 365 package. Help forum support and training materials are extensive for all options as well.

Introductory Dashboard Session workflow (1 hr)

Operations Dashboard has proven to be a popular option for researchers, for several reasons.

1. It is part of the ArcGIS Online suite of tools that they are familiar with navigating.
2. It gives researchers a way to present their data that feels closer to a scientific poster than an ESRI StoryMap.
3. The full suite of functionality is available as a web-based tool (compared to the other tools)

The case below is an introductory session to Operations Dashboard for ArcGIS, the session introduces dashboards, discusses different use cases and examples and then proceeds through a walk-through where learners edit an existing dashboard constructed around an example scenario. This helps to guide the session and keep it at a level where learners are not getting too hung up by the software and are still able to consider the overall decisions that are taking place.

The week before:

1. Upon enrolling students are prompted to contact Libraries to set up their ArcGIS Online accounts;
2. Learning materials (folder with .pdf walk through, .csv files and .images) are saved to the class shared space.

The session:

<i>Topic</i>	<i>Action</i>
Session introduction	<i>Prompt to download materials to their desktop</i>
Define data visualization/ data dashboards	
Introduce the example scenario:	<i>Participants will use ESRI Operations Dashboard to create an interface to allow the public to explore the Open Tree Inventory from the City of Winnipeg.</i>

Select the genus of tree you would like to explore:

Trees of Daniel McIntyre:
 This workshop makes use of the City of Winnipeg Tree Inventory, which is an open dataset created by the Public Works Department. The inventory is a detailed list of all public trees associated in the city. The data and associated map can be accessed through the City's open data portal.
 This session uses data from the Daniel McIntyre electoral ward and explores distribution of species, diameter at breast height, and various location parameters.
 Winnipeg Tribune Photo Collection/University of Manitoba
11,721 trees
 Last updated: 20 minutes ago

Overview of topics:	
<ol style="list-style-type: none"> 1. Data Cleaning 2. Editing explanatory text 3. Editing graphs & maps 4. Linking elements 5. Audience/ User Experience 	

<ol style="list-style-type: none"> 1. Data <ul style="list-style-type: none"> • Data cleaning • File types • Metadata • Discuss importance of knowing your data 	<p><i>Participants examine the contents of the data folder opening the clean and uncleaned versions of the inventory.csv file.</i></p> <p><i>Item metadata is explored in the ArcGIS Online interface.</i></p>
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2. Explanatory Text <ul style="list-style-type: none"> • Editing blocks/ embedding images • Moving blocks 	<i>Participants modify the descriptive text block, and add an image to create visual hierarchy and balance on the dashboard.</i>
3. Editing graphs and maps <ul style="list-style-type: none"> • Symbology • Legend • Types 	<i>Participants modify the symbology, legend and type of elements present in the dashboard, the majority of the session is spent on this step.</i> <i>Additional data sources are discussed here as a way to supplement base data.</i>
4. Linking elements <ul style="list-style-type: none"> • Graphs & Maps • Legends & sidebars 	<i>Participants link surround elements as a way to filter dashboard content.</i>
5. Audience/ user experience <ul style="list-style-type: none"> • Data visualization theory 	<i>After a discussion on theory, participants are asked to step back and suggest three changes that would improve the cohesiveness of the dashboard.</i>
6. Conclusion/ Plug for library services	<i>Questions from audience</i>
<i>All workshop content and more can be found at: https://meginwinnipeg.github.io/workshops/</i>	

Future

When introducing new software to a general audience, I have elected to run sessions as one hour workshops through the GradSteps program offered through the Faculty of Graduate Studies. Students receive credit for sessions attended and I do not have to take care of the marketing side of things. It also allows me to keep track of attendees and get a good idea of what overall campus interest is in this area.

Based on feedback received, follow-up introductory sessions that focus on grounding dashboards in time (as opposed to geography) and creating dashboards using qualitative data will be added to the GradSteps roster, as well as follow-up intermediate session to the one discussed.

Note: For some context I am a single person offering support for Data Visualization services, my position is new so I had no learning materials to start with. Theory on its own can be dry, so adding interactive elements helps keep people engaged. Hopefully by discussing the ways which this topic has been approached allows for an easier entry point in adopting a new resource.