

Financing Global Health

Institute for Health Metrics and Evaluation

Interactive Visualization Analysis

Job Position: 125-564

Data and Policy Analyst – Department of Justice (DOJ) Data Visualization Track

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Summary

This report provides an analysis of the interactive visualization Financing Global Health¹ published by the Institute for Health Metrics and Evaluation as a supplement to their policy report. The visualization, which consists of three main views (Flows, Trends, and Comparisons) was evaluated using human centered, domain, and design criteria. The visualizations did a nice job of presenting the results. There are a number of areas where improvements could be made. Most importantly, there are cases where the text annotation and the numbers result in a misleading representation and do not match what is included in the report.

Figure 1. Financing Global Health - Flows

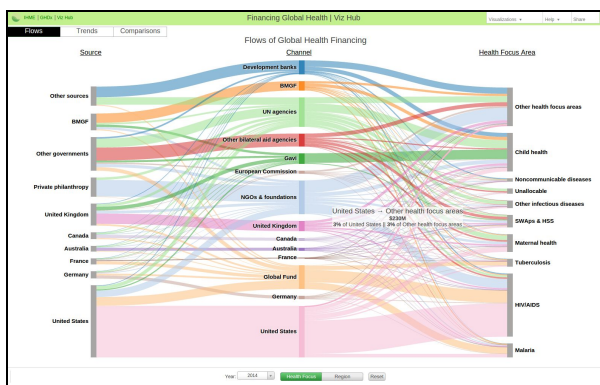


Figure 2. Financing Global Health - Trends

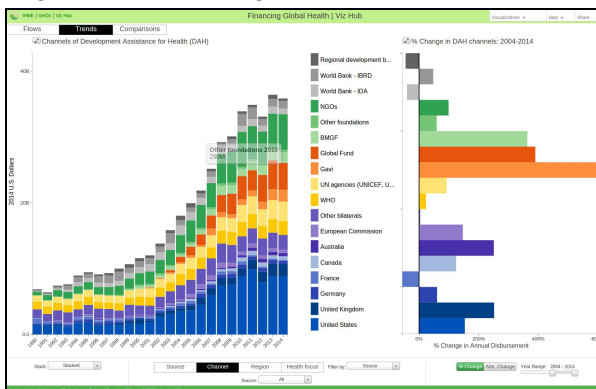
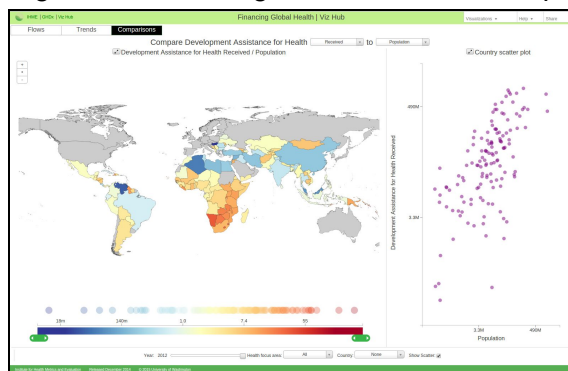


Figure 3. Financing Global Health - Comparison



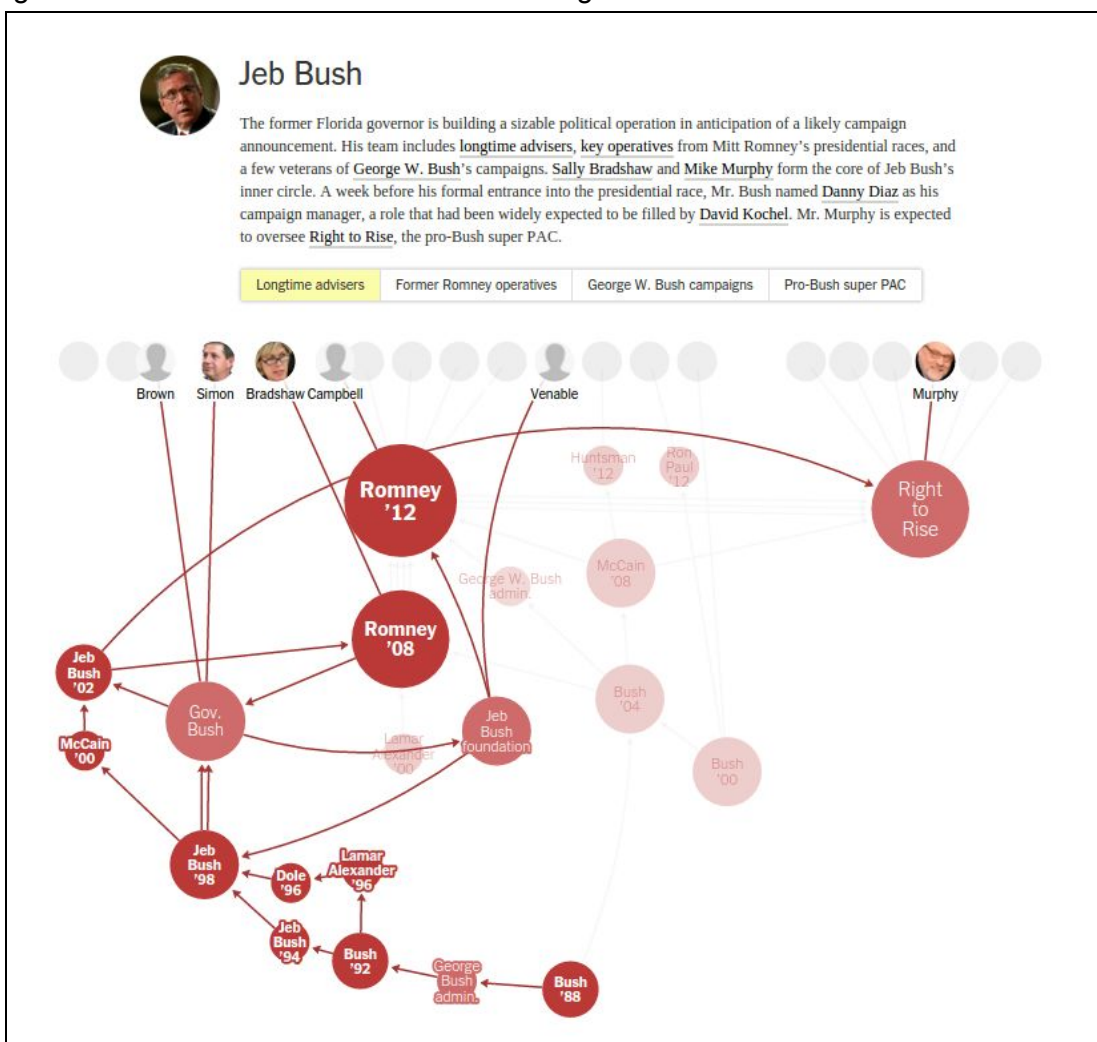
Overview

In the past five years, interactive visualizations have become widely available due to the availability of web visualization libraries such as D3.js, curated data sets, improved network bandwidth, performance

of devices and browsers, and the shift to consuming more information online. Journalists have used interactive visualizations as a mechanism to provide readers a richer experience. Scientists and academic institutions are using visualizations as a way to provide access to complete data sets for exploratory analysis beyond the summarized results found in reports.

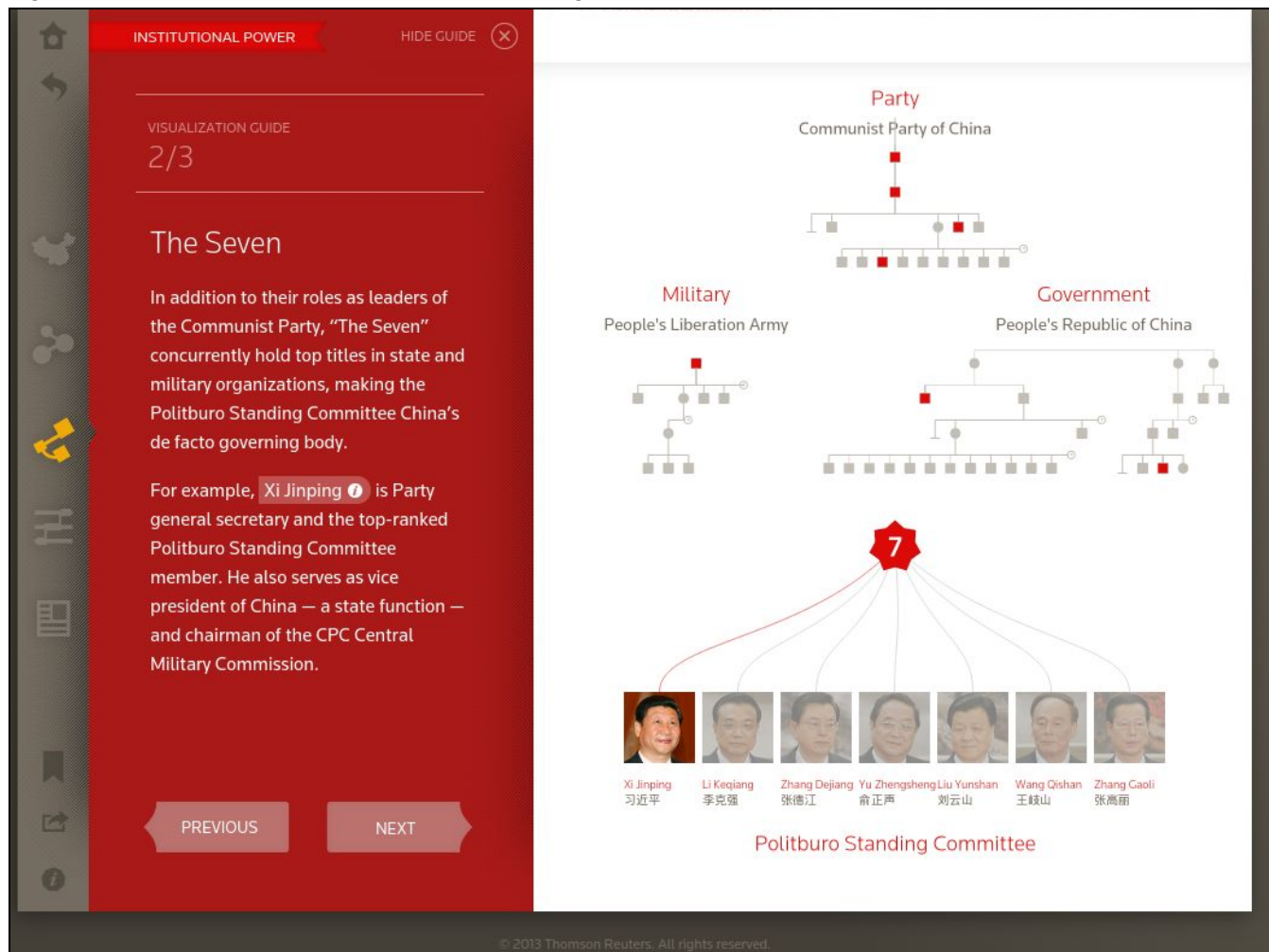
Interactive data visualizations come in a variety of forms. The form selected by an organization will depend on the goals of the consumer of the information as well as the goals of the publishing organization. Some are replacements for the static graphics associated with news articles as in the interactive “Connecting the Dots Behind the 2016 Presidential Candidates.”² The interactive is embedded within the article and includes significant explanatory text. It is aimed at a wide audience who may or may not have any prior knowledge of the information being presented. Engagement is equally important as being informative.

Figure 4. Jeb Bush advisors from “Connecting the Dots...”



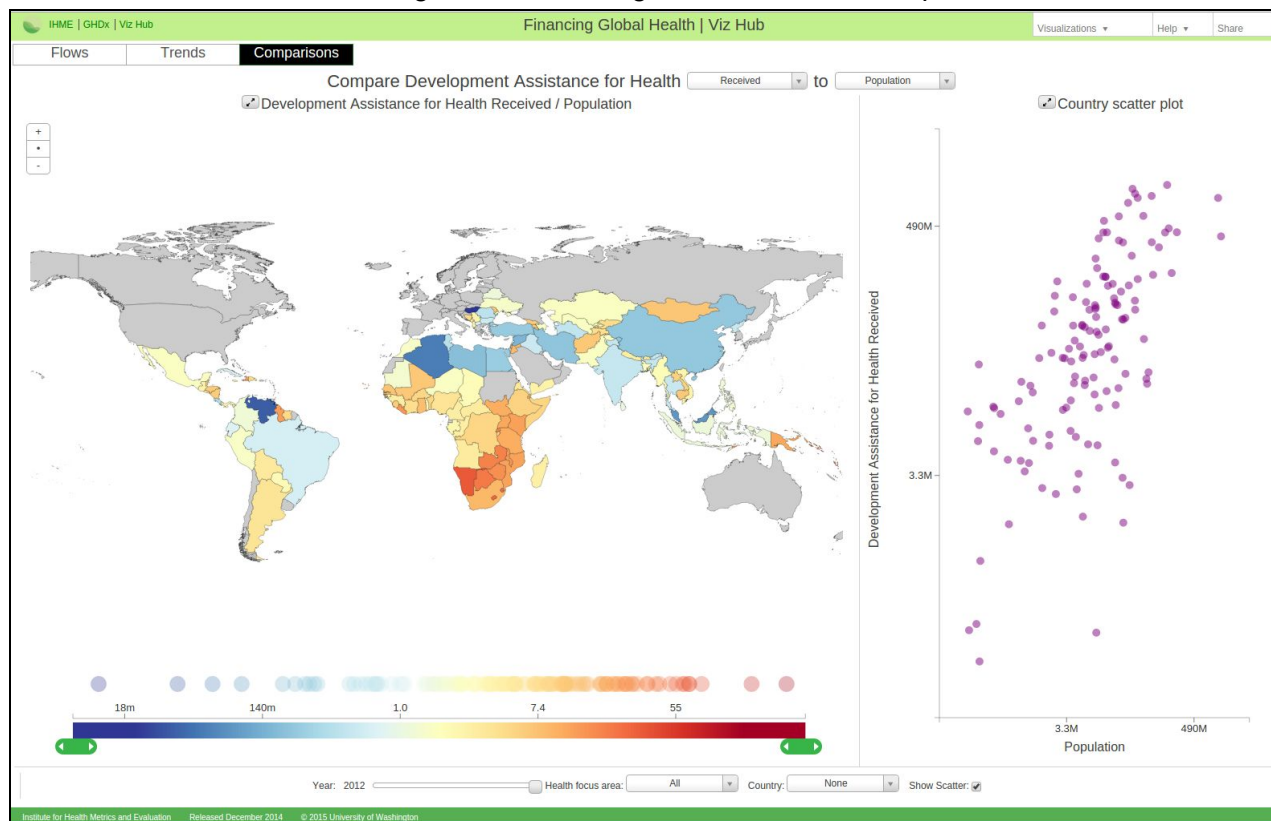
Other interactives take the form of an interactive book as in the Connected China³ site by Reuters and Fathom Design. This application walks the reader through China's leadership. The reader is given extensive guide material and can chart their own navigation path through the information. This design is very specific to the content and not easily reusable for a different type of interactive story.

Figure 5. Connected China - Politburo Standing Committee



A third form of interactive visualizations presents data using standard maps, and graphs. This type of visualization tends to be more analytical in nature and is aimed at an audience that has some familiarity with the domain area and has specific questions to which they are seeking answers. An example is the Institute for Health Metrics and Evaluation - "Financing Global Health" which is supplemented by their policy report¹.

Figure 6. Financing Global Health - Comparison



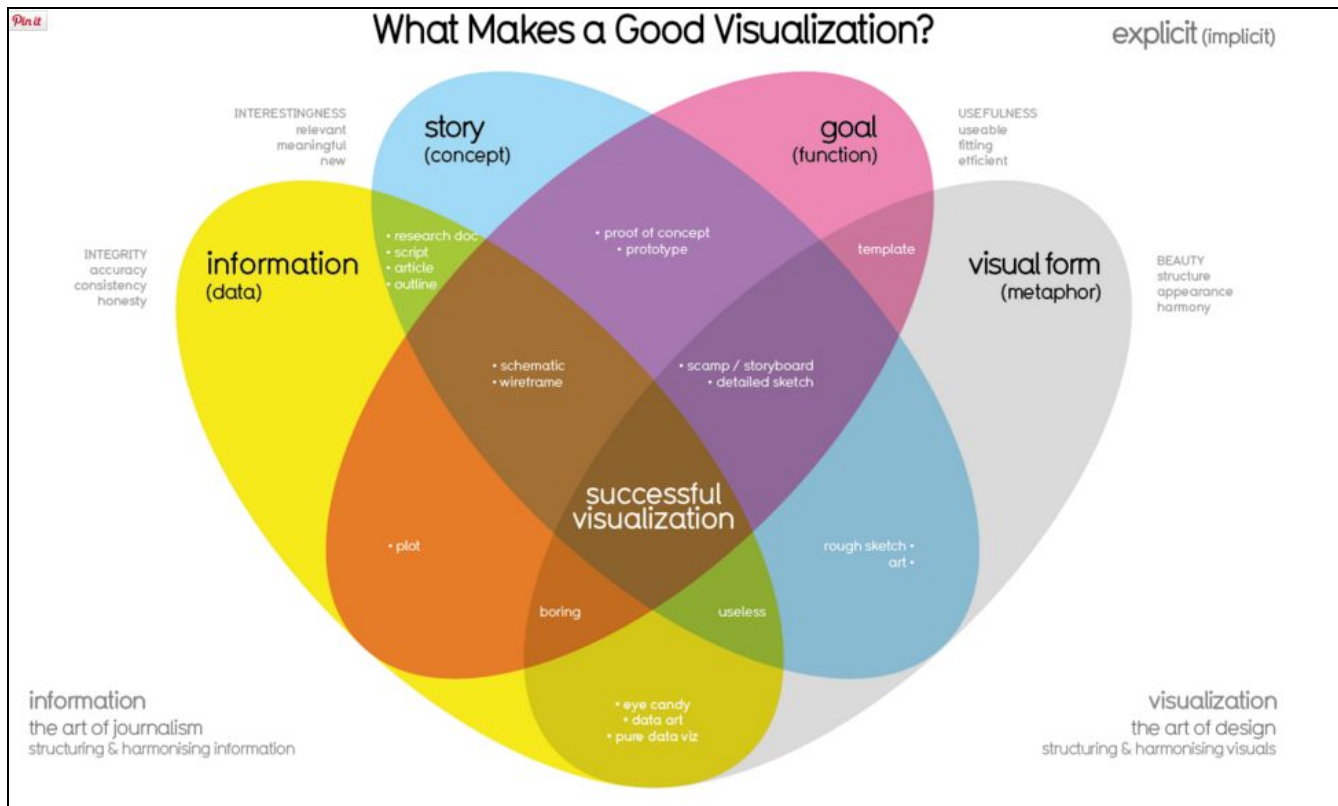
Interactive visualizations are web applications and should be evaluated using standard user experience heuristics. In his web post, "What Makes a Good Visualization, David McCandless⁶ discusses that a successful visualization occurs at the intersection of a variety of key elements: Information, Story, Goal, Visual Form.

For this analysis, we will use the following criteria.

- User Goals
 - Ability of a persona to complete their goals
- Information
 - Data Accuracy
 - Industry standards
- Design
 - Visual elements
 - Interaction and navigation

- Information architecture

Figure 7. David McCandless - “What makes a Good Visualization”



Goals

A proposed goal and workflow are included for illustration purposes. For true analysis of goals, representative personas, workflows, with desired outcomes should be created. It is important to take into consideration related tasks that may not be specific to exploring the visualization but provide context for how the visualization fits into helping the user accomplish their goals. Design and Information limitations impacts the ability for a user to achieve their goals. These are discussed separately.

Goal

A United States policy team needs to provide a report summarizing what countries and initiatives are receiving the most aid from the United States, how that has changed over the past five years. They will aggregate findings from multiple sources for their report. The team is distributed across the country. The team members have backgrounds in health policy and are familiar with the domain. Some team members have background in statistics, while some

members do not. One member is in a remote part of the world where internet access is limited and will receive faxes of the visualizations to study along with the report.

Sample workflow tasks:

- Review the report
http://issuu.com/ihme/docs/ihme_policyreport_fgh_2014?e=2626063/13559090
- Corroborate findings in the report with the data in the visualization
- Explore data using the interactive visualization with a focus on data related to the United States
<http://vizhub.healthdata.org/fgh/#>
- Corroborate findings in the report with independent analysis
- Share findings with the team.

Analysis

1. Corroborate findings in the report with results in the visualization. In one case, results reported in the report and the data visualization did not agree.
Flows View - Discrepancy in reported percentage of funds flowing through United States aid agencies for 2014.
Link to view: <http://ihmeuw.org/3qtb>
 - Report states that in 2014 the United States flows \$8.9 billion through their own aid agencies and it makes up for 62.6%. (page 12)
 - The visualization shows that \$8.9 billion flows through, but puts the percentage at 72%.
2. The raw data was not available for downloading. It is listed in tabular format at the end of the report. In the supplemental methodology report, specific sources are outlined.
3. The ability to drill down to show only the United States in the Flows view is helpful. This provides the ability to more closely examine a subset of the data that is important to the end user.
4. The Trends view option to show the data as separate bar charts also helps to isolate the data related to the United States and illustrates better the specific spending trend per funding source.
5. The Share feature facilitates sharing a specific view. When collaborating, it is helpful to be able to send a link to a specific view configuration. This eliminates the possibility of error when describing the steps needed to recreate the view.
6. Generating a print of the flows view to fax results in the Health Focus Area being truncated in some browser sizes. Resizing the browser window to a narrower footprint results in a view that can be printed.

Recommendations

1. Provide data online in a table format and available to download for offline analysis in an independent package.
2. Review findings discussed in the report with the visualizations to uncover any inconsistencies.
3. Create media print rules for all views.

Information

Optimization and design improvements can not overcome problems in the information. With interactive visualizations, it is difficult to evaluate all paths, but automated tests can help to some extent to verify common scenarios. Information includes text annotation and the visual encoding as well as the numerical data values.

Analysis

1. The discrepancy between a value in a report with a corresponding value in an interactive visualization can cast doubt over the entire report and visualization. Making data available in an alternate format such as an online visualization requires the additional time and effort to verify that all calculations are correctly reported.
2. While “B” and “M” after money values are widely understood by people familiar with english and United States currency, the audience may consist of people who are not familiar with the abbreviation.
3. Trend View (see Figure 8)
 - a. The Y-Axis tick marks is misleading and does not accurately represent the data shown.
 - b. The data is filtered on the United States, but that is not quickly apparent in any of the graph annotations.
 - c. Year 2013 and 2014 for the HIV bar chart are different heights, but hovering over the two bars report “11B”
 - d. Using the same color encoding for the two bar charts provides good consistency with the legend.
4. Comparison View (see Figure 9)
 - a. The color scale and circle plot are not labeled and no units are included.
 - b. The X and Y axis for the scatter plot are very distorted and misleadingly shows the data to be clustered when it reality there are several outliers.
 - c. Highlighting the corresponding points in the scatter plot, map and spectrum graph is useful.
 - d. Selecting a different year is not reflected in any of the plot annotations.
 - e. The scatterplot does not provide a lot of additional information.

Figure 8. Trends view filtered on the United States

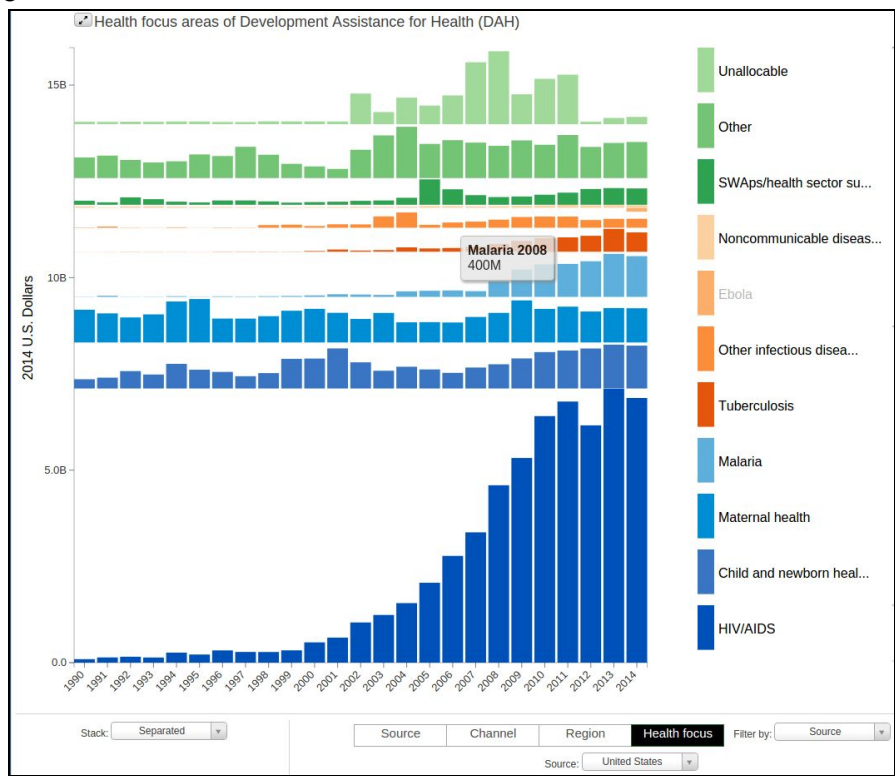
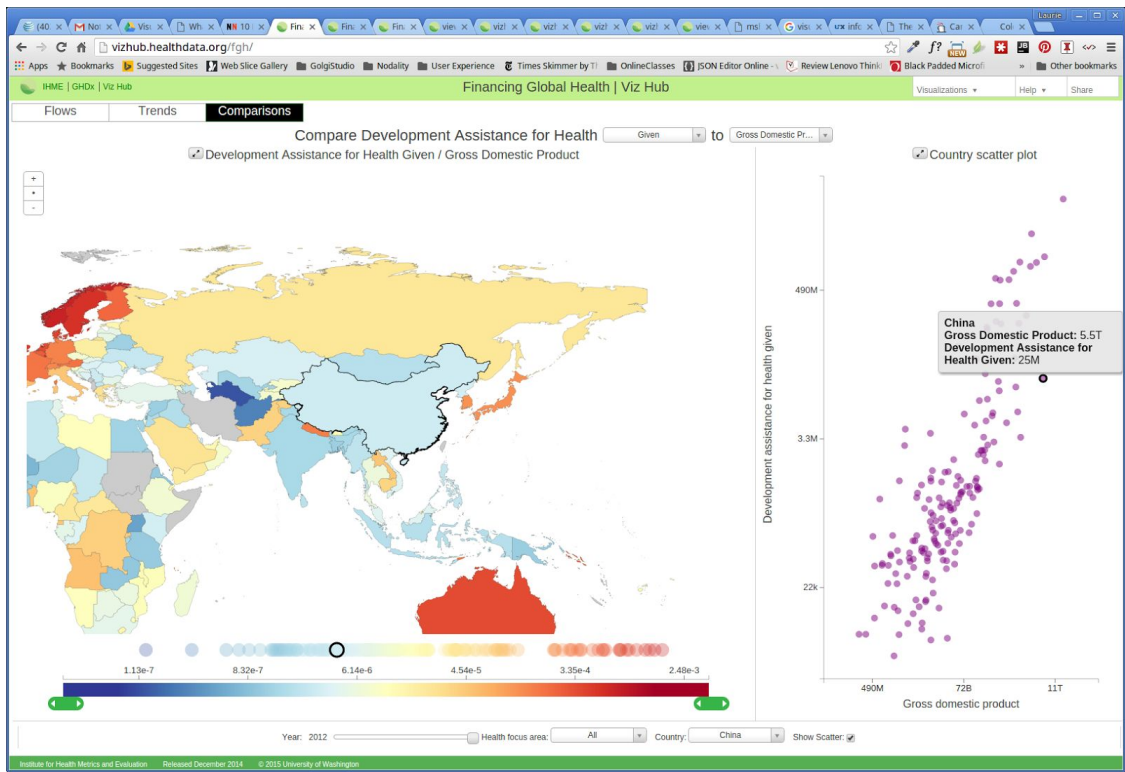


Figure 9. Comparison View



Recommendations

1. Help should be included. There are applications such as the Zurb Joyride library that can be used to create a walk through tutorial of an application.
2. A glossary should be included to describe abbreviations and terminology. Some of this can also be added as tooltips to titles and labels.
3. Use the American Psychological Association guidelines for reporting results. They recommend at least one or two decimal places to provide sufficient precision.
4. Create a checklist for all plots
 - a. All axis should include titles with units
 - b. Any filters applied to the data should be described either in the title or as an additional annotation for the graph.
 - c. Axes should be removed if they do not accurately represent the data
 - d. Note that provides a citation for the source of the data.
5. Consider replacing the scatterplot with a heatmap that encodes the ratio of the selected filter values. This would be a better visual to compare the size differences and would further illustrate the color encodings.
6. Consider formatting of tooltips for easier readability. Abbreviations can be used to shorten labels.

Design

Developers of Interactive Data Visualizations occasionally omit core usability components resulting in a less optimal experience for the end user. There are many resources available to help with evaluating a web site or application. Appendix A shows the output from the Web Development Checklist chrome extension and two of the recommended evaluation sites for mobile friendliness and page speed. The Web Development Checklist⁵ includes a number of resources to learn more. Time and resource constraints may limit the extent to which all of the items can be implemented. However, incorporating testing into the regular developer workflow along with creating basic style guide and baseline quality measures can greatly improve the experience for your users.

Analysis

1. Fitt's Law models how long it takes for a user to select a target given the size and distance from a starting point. This is used to evaluate navigation models. All of the views, the primary navigation for filtering and configuring the views are at the bottom of the page, small in size and

far away from the main view navigation. In one case, the Comparison view, there is an additional navigation at the top. This adds an additional burden to the user exploring that data.

2. The Flow view has a reset button which is helpful, but the other views do not.
3. For the most part, isolating the data of interest is done through configuring and drilling down through the views. For the Sankey diagram, selecting a very thin line can be difficult and tracing its path not very obvious.
4. It is difficult to navigate on mobile devices.
5. On the scatter plot, it is hard to identify where on the axis the values fall and which point is selected.

Recommendations

1. Combine all navigation in one area, with similar style and larger size buttons. This can be done through a drop down navigation bar that appears when the user hovers near the top.
2. Add consistent elements such as a reset button on all views.
3. Add hover effect similar to that used in the Evolution of the Web (Figure 10) where unselected items are greyed out.
4. Support mobile and different layouts. (Figures 11 & 12)
5. Draw lines to the axes to help orient where a point falls on the axes and explore different ways to highlight the selected points.

Figure 10. Evolution of the Web - <http://evolutionofweb.appspot.com/>

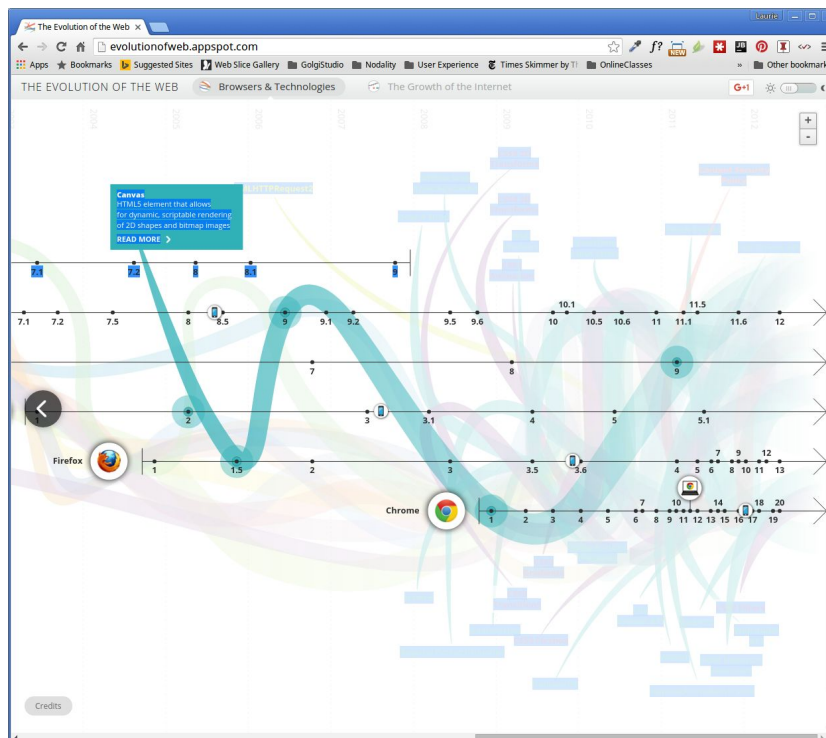


Figure 11 - Landscape View

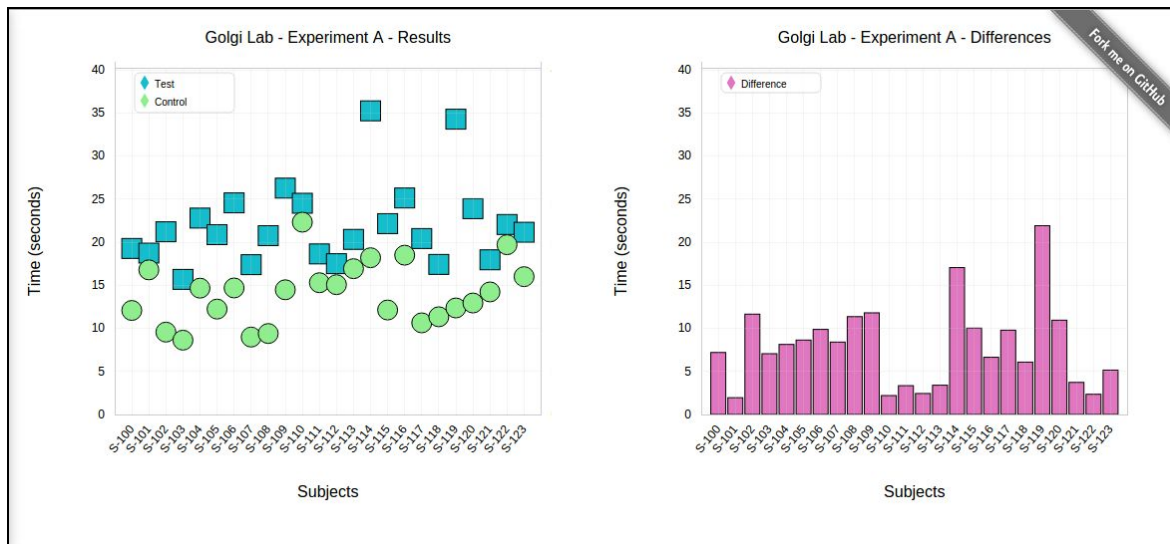


Figure 13 - Portrait View

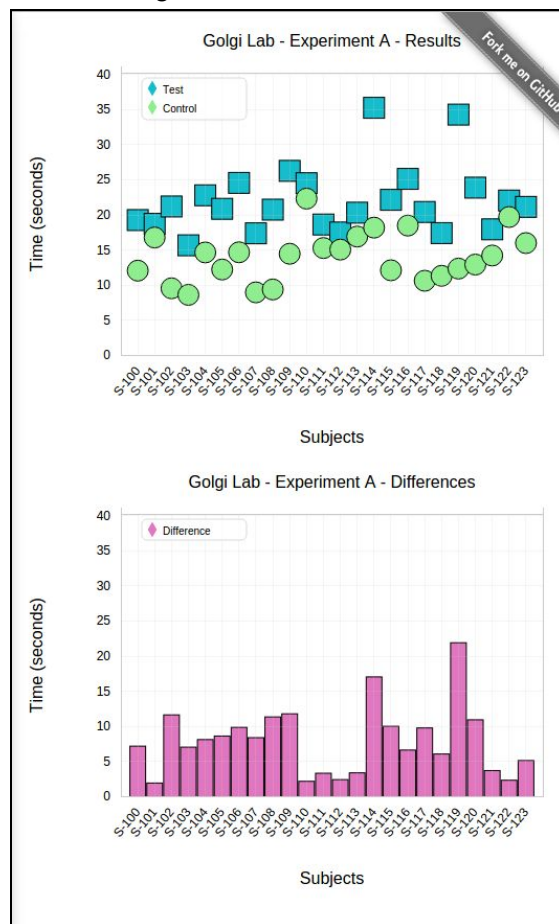


Figure 14 - Draw lines to axis



Code Design

While the internal design of the application is not visible to the end user, it is instrumental in the overall user experience. Well designed code will be flexible resulting in the ability to make improvements quickly and robustly. Selection of libraries and management of the publishing platform also impacts the user experience. In some cases, data visualization packages may be rebranded for a customer to share with their community. Looking at the code for Financing Global Health uncovers some areas of rigidity and insecurity.

Observations

- Javascript code should be bundled and minified for faster download times.

- The source files bar.js and stack.js include hard coded colors which would make it time consuming to change the color scheme for branding or addressing accessibility concerns.
- In general, all work should be copyrighted with the organization authorship identified.
- Text and positioning where possible should be configurable and passed to the visualization components to support reusability.

Conclusion

Financing Global Health is a good example of a data analytics application that provides a user to go beyond the report and explore the data. The visualizations are thoughtful and clear. Applying a multifaceted approach to evaluating the effectiveness of the application could greatly improve the usability and cohesiveness of the story to be told.

Appendix A - References

1. Institute for Health Metrics and Evaluation. "Financing Global Health 2014: Shifts in Funding as the MDG Era Closes". Seattle, WA: IHME, 2015.

Report

http://www.healthdata.org/sites/default/files/files/policy_report/2015/FGH2014/IHME_PolicyReport_FGH_2014_1.pdf

Visualization

- <http://www.healthdata.org/data-visualization/financing-global-health>
- <http://vizhub.healthdata.org/fgh/>

2. Aisch, Gregor, and Karen Yourish. "Connecting the Dots Behind the 2016 Presidential Candidates." The New York Times. The New York Times, 16 May 2015. Web. 09 Jan. 2016.
<http://www.nytimes.com/interactive/2015/05/17/us/elections/2016-presidential-campaigns-staff-connections-clinton-bush-cruz-paul-rubio-walker.html>
3. "Connected China" by Reuters and Fathom Information Design, July, 2014
<http://china.fathom.info/>
4. Reynolds, Laurie S. "D3 ScatterPlot." Web. 09 Jan. 2016.
<http://golgistudio.github.io/d3-scatter-plot/>
5. "Web Developer Checklist." Web Developer Checklist. N.p., n.d. Web. 09 Jan. 2016.
<http://webdevchecklist.com/>
6. McCandless, David . "What Makes a Good Data Visualization" Web. 10 Jan. 2016.
<http://www.informationisbeautiful.net/visualizations/what-makes-a-good-data-visualization/>

Appendix B - WebDev Checklist

Webdev results for the following view

Figure A-1. <http://ihmeuw.org/3qsl>

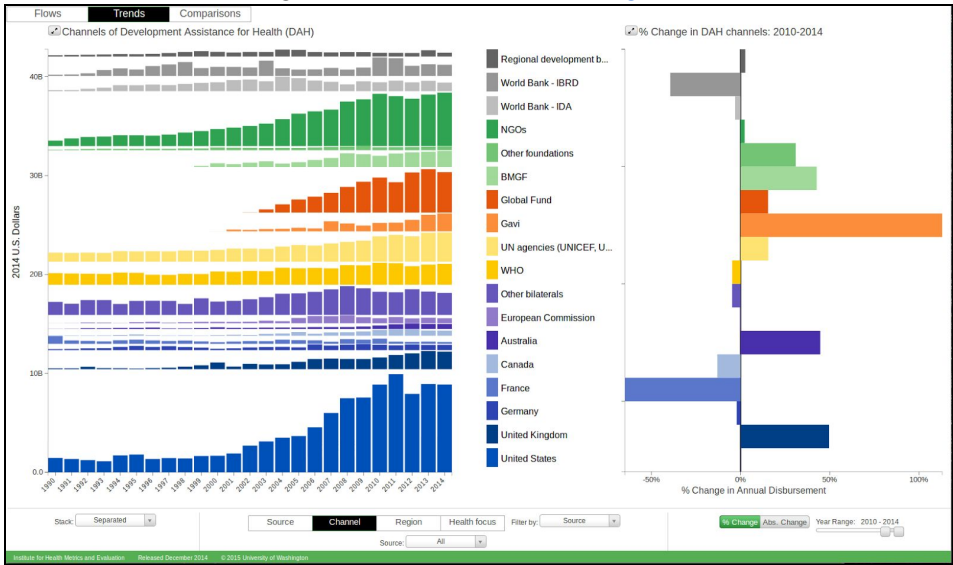


Figure A-2. Web Dev Checklist Summary

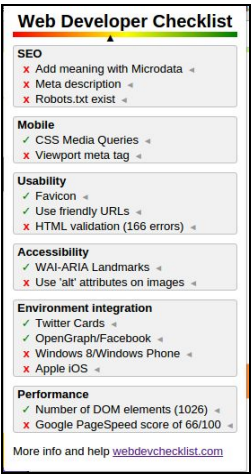


Figure A-3. Mobile Friendly Test

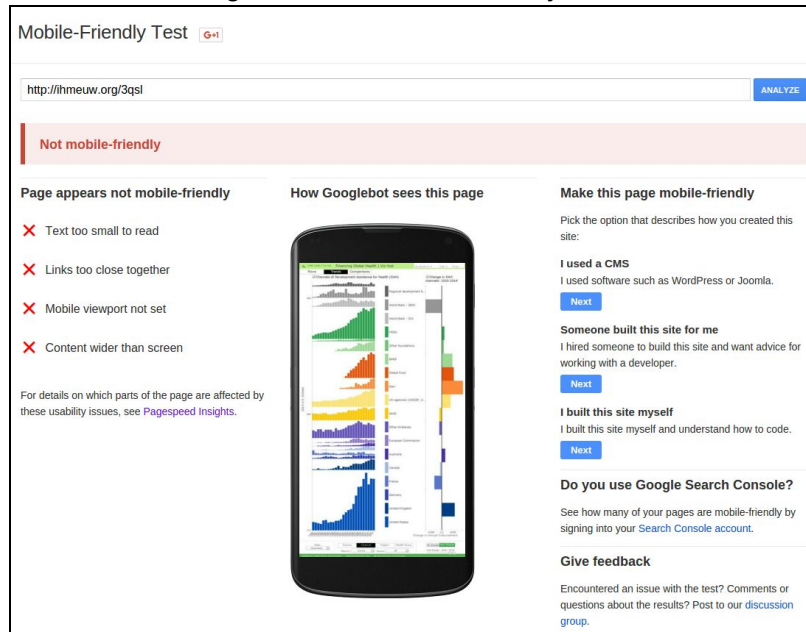


Figure A-4. PageSpeed Test

