Seeing the big picture
Interactive data visualizations

Kim Davis, Washington State Department of Revenue
September 26, 2017
We have lots of data

Our challenge is to:

✓ Collect data
✓ Provide the information to decision makers
✓ In a simple, but useful form, that can be understood by a broad audience

Our customers include:

✓ Legislators and legislative staff
✓ Local governments
✓ Lobbyists
✓ General public
Data visualizations

- Consolidate data into a picture or graphic format.
- Help broader audiences understand complex data.
- Make it easy to see:
  - patterns
  - trends
  - correlations
  - anomalies
- Allow users to formulate their own questions and find the answers.
Anscombe’s quartet

<table>
<thead>
<tr>
<th></th>
<th>Data Set A</th>
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<th>Data Set B</th>
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<th>Data Set C</th>
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<th>Data Set D</th>
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</table>
Anscombe’s quartet
Interactive data
Making data interactive

The Department uses Tableau, a software that renders data into easy-to-use, interactive visual dashboards.

Interactive data visualizations give users the power to quickly view large amounts of data and drill down into the information they are looking for.
Selecting the data

✓ What data do we already provide on our website?
✓ Is it provided in a way that is useful to our customers?
✓ What are the frequently asked questions concerning the data?
✓ Are there questions we are currently unable to answer?
✓ Do we need to combine additional data to reduce questions?
✓ What data do users find most confusing?
✓ Is there a better way to present our current data?
The Department has 13 years of survey data for businesses taking certain tax preferences.

There is broad interest in this data.

We receive questions from the media, Legislature, lobbyists, and general public about this data.

You can open one year of data at a time, so it's difficult to analyze over time.

Data from our website

When open, you get a large table of data.

### Setting up the data

Reformat data from column to row oriented table. In this example add:
- Incentive Program
- Year
- Amount of Benefit

<table>
<thead>
<tr>
<th>Incentive Program</th>
<th>Tax Registration</th>
<th>Business Name</th>
<th>Year</th>
<th>Amount of Benefit</th>
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<tr>
<td>Timber Industry B&amp;O Reduced Rates</td>
<td>603610445</td>
<td>KAPSTONE KRAFT PAPER CORPORATION</td>
<td>2016</td>
<td>4147.61</td>
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<td>High Technology Sales &amp; Use Tax Deferral (Cumulative Projects)</td>
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<td>APTEVO THERAPEUTICS INC</td>
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<td>639521</td>
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<td>High Technology Sales &amp; Use Tax Deferral (Annual Amount)</td>
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<td>APTEVO THERAPEUTICS INC</td>
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<td>Aerospace FAR Part 145 Reduced B&amp;O Tax Rate</td>
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<td>PACIFIC AERO TECH LLC</td>
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<td>Aerospace Preproduction Expenditures B&amp;O Tax Credit</td>
<td>603620904</td>
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<td>Aerospace Product Development Reduced B&amp;O Tax Rate</td>
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<td>FORKS FIBER INC</td>
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<td>Timber Industry B&amp;O Reduced Rates</td>
<td>604003630</td>
<td>JS SAWMILLING LLC</td>
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<td>14.76</td>
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<td>Timber Industry B&amp;O Reduced Rates</td>
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<td>IFG SALES CORP</td>
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<td>15766.5</td>
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<td>Timber Industry B&amp;O Reduced Rates</td>
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<td>WISS JOHN R</td>
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<td>Aerospace Product Development Reduced B&amp;O Tax Rate</td>
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<td>MAESTRO ENGINEERING LLC</td>
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<td>Aerospace Product Development Reduced B&amp;O Tax Rate</td>
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<td>DATABASED SOLUTIONS INC</td>
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<td>Timber Industry B&amp;O Reduced Rates</td>
<td>604016670</td>
<td>NIPPON DYNAWAVE PACKAGING CO</td>
<td>2016</td>
<td>250072.91</td>
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<td>Hog Fuel Sales &amp; Use Tax Exemption (by facility)</td>
<td>604016670</td>
<td>NIPPON DYNAWAVE PACKAGING CO</td>
<td>2016</td>
<td>89145.02</td>
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<td>Aerospace Manufacturers Reduced B&amp;O Tax Rates</td>
<td>604022339</td>
<td>HARTWELL CORPORATION</td>
<td>2016</td>
<td>18164.95</td>
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</tbody>
</table>
Picking the right chart

Do you want to:

✓ Analyze data over time?
✓ Compare values and rank?
✓ Understand the correlation between value sets?
✓ See the distribution of your data, and help find outliers?
✓ Show how individual parts make up the whole?
✓ Present geographic data?

More than one type of chart may work for your analysis. Tableau lets you quickly view your data in different chart types.
Data as a table in Tableau
One click to show data as bubbles
Another click for a bar chart
Yet one more click to see a tree chart
The results

Users can apply different filters to see:

• Total benefit of specific tax incentives.

• All businesses that have taken a particular tax incentive.

• Which businesses saw the greatest tax benefit in a given year.

• All tax preferences taken by a specific business.
What we have learned

While visualizations boost the value of the data and reports for customers, we have learned:

✓ Some types of data and statistics do not fit well into visualizations.

✓ When developing a visualization, work with data experts to draw out the most compelling information.

✓ An education and outreach strategy is important when unveiling new visualizations.

✓ Data visualizations do not replace data tables. Instead, they provide another way to view the data.
User praise

The Tax Exemption Study visualization grabbed the attention of policy think tanks, legislators, tax professionals and other state agencies, who were impressed that it was so easy to use and boosted tax data transparency.

"These visualizations are a fantastic tool that boost government transparency. They make it so easy to sift through reams of data and find quick answers to important tax questions that help guide policy decisions."

—Drew Shirk
Governor’s office

"Ultimately, if government is going to live up to the promise and potential of big data, that data — and the way it is presented — has to be accurate, relevant and easily understandable. Revenue’s data visualization work is a great example of all of those, and of how Revenue is helping lead the way forward."

—Rich Roesler,
Results Washington

"With its exciting and innovative data visualization efforts, Revenue is leading the way for the rest of state government. The department’s visualizations are providing fast and easy-to-understand access to mountains of tax and revenue information."

—Jason Mercier,
Washington Policy Center

"The WASTateDOR 2016 report outlines 694 tax exemptions. Good data to inform the public."

—Senator Reuven Carlyle via Twitter

—David Schumacher,
Office of Financial Management
Examples
Tax incentive data by preference type

Users may:

- Change year to view
- Hover over bubbles and bars to see more information
- Click on a bar or bubble to filter incentive programs for a specific type of preference.
Users may:

- Change year to view
- Hover over bubbles and bars to see more information
- Click on a bar or bubble to filter incentive programs for a specific type of preference.

Note: In this screen shot the blue bubble was clicked on. This fades out other bubbles and bars, and filters the businesses to just list the businesses taking that incentive and the amount of benefit received.
Tax incentive data by year

This view provides a view of all of the summarized data.

It is less interactive, however users may:

- Select a specific incentive to view
- Hover over the bar chart to view additional information
Compare state and local taxes by state

The visualization allows users to compare taxes across the 50 states.

This view shows personal income by state.

California is ranked #1.
Compare state and local taxes by state

By adding population to our data, we allow users to also look at personal income per capita by state.

Connecticut is now ranked #1.
Compare state and local taxes by state

Including filters in the visualization allows users to quickly change views, and compare what they find of interest.
Compare state and local taxes by state

On the Tax Rates tab, users can compare tax rates for the following taxes:

- Capital gains tax
- Cigarette tax
- Corporate income tax
- Gasoline tax
- Individual income tax
- Sales tax
Compare state and local taxes by state

This view is for Sales Tax rates.

The bar chart allows a user to quickly see how many states do not have a sales tax.

The map allows the user to easily compare their state to states around them.
# History of Washington taxes

<table>
<thead>
<tr>
<th>Year</th>
<th>Public Utility</th>
<th>Gasoline</th>
<th>Cigarette and Tobacco</th>
<th>Alcoholic Beverage</th>
<th>Inheritance and Gift</th>
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</thead>
<tbody>
<tr>
<td>Early History</td>
<td></td>
<td>1921, tax of 1¢ per gallon.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1929</td>
<td>Rate increased from 1¢ to 2¢</td>
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<td></td>
<td></td>
<td>1901, inheritance tax: Class A, 1%; (60,000 exempt); Class B, 3%; -6%, Class C, 3% - 12%; 1917, increased rates for each class, $1,000 family allowance. 1923, rates increased.</td>
</tr>
<tr>
<td>1931</td>
<td>Rate increased from 2¢ to 4¢</td>
<td></td>
<td></td>
<td></td>
<td>Exemption for each Class A descendant. All maximum rates lowered.</td>
</tr>
<tr>
<td>1933</td>
<td>Occupation tax: 3% basic rate, gas 2%; vessels and transit 0.5%; all others 1.5%</td>
<td>Rate increased from 4¢ to 5¢</td>
<td>Refunds for off-highway use.</td>
<td></td>
<td>Adjustment in Class B tax rates.</td>
</tr>
<tr>
<td>1935</td>
<td>Public utility tax separated from $60. 1933 rates retained.</td>
<td>Fuel oil tax of 1¢ per gallon.</td>
<td>Cigarette tax of 1¢ per package.</td>
<td>10¢ tax on sales of liquor by Control Board. 10¢ per gallon on wine.</td>
<td>Revision of rates and tax brackets. Exemptions for first $40,000 of paid insurance and $1,000 for Class B.</td>
</tr>
<tr>
<td>1937</td>
<td>(1929) Rate increased from 1¢ to 2¢</td>
<td>1935 Rate increased from 1¢ to 2¢</td>
<td>1937 Rates increased from 1¢ to 2¢</td>
<td>Gift tax enacted; rates are 90¢ of inheritance tax schedule.</td>
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</tr>
<tr>
<td>1941</td>
<td>Use fuel tax. Special tax on diesel, etc.</td>
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<td></td>
<td>10¢ war liquor tax (20% total). Minor rate adjustment in Class A.</td>
</tr>
<tr>
<td>1943</td>
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<td></td>
<td></td>
<td></td>
<td>Minor rate adjustment in Class A.</td>
</tr>
<tr>
<td>1944</td>
<td>16th Amendment earmarked tax for roads.</td>
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</tr>
<tr>
<td>1949</td>
<td>Rate increased from 5¢ to 6¢. Repeal of fuel oil tax (1947).</td>
<td>Rate increased from 3¢ to 4¢.</td>
<td>Repeal of both 10¢ liquor taxes. 15% discount for Class H.</td>
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</tr>
<tr>
<td>1951</td>
<td>Surtax of 10¢.</td>
<td></td>
<td></td>
<td></td>
<td>10¢ liquor excise tax.</td>
</tr>
<tr>
<td>1955</td>
<td>Increase of surtax to 20¢ (1957).</td>
<td>Rate increased from 4¢ to 5¢.</td>
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<td></td>
</tr>
</tbody>
</table>

We receive a lot of questions about:

- **When a tax first imposed**
- **Rate changes over time**
- **Collections over time**

While we had this information in a spreadsheet, it does not read like data.
History of Washington taxes

This visualization allows the user to hover over a colored circle for any tax to read about the selected tax change.
### History of Washington taxes

The **Tax History Table** tab allows a user to view all taxes, or select a specific tax, and quickly read through all the major changes to the tax.

<table>
<thead>
<tr>
<th>Type of Tax</th>
<th>Year</th>
<th>Description</th>
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<tr>
<td>Beer</td>
<td>1934</td>
<td>Beer tax enacted at $1.00 per barrel.</td>
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<td>1965</td>
<td>Rate increased to $1.50 per barrel for canned and bottled beer.</td>
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<td>1981</td>
<td>Combined the $1.00 and $1.50 rates and increased to a basic rate of $2.60 per barrel.</td>
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<td></td>
<td>1982</td>
<td>Surtaxes added, increasing the overall rate to $2.782 per barrel.</td>
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<td>1983</td>
<td>The surtaxes were made permanent July 1, 1983.</td>
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<td></td>
<td>1989</td>
<td>Adopted an additional temporary tax of $2.00 per barrel for drug programs.</td>
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<td></td>
<td>1993</td>
<td>Established an additional tax of $0.96 per barrel for health care. This tax automatically increased to $2.39 per barrel in 1995 and $4.78 per barrel in 1997. Microbrewers beer tax exemption for 1st 60,000.</td>
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<tr>
<td></td>
<td>1994</td>
<td>Temporary tax created in 1989 made permanent.</td>
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<td>1997</td>
<td>Beer tax rate reduced to $1.30 per barrel from $2.60 per barrel and the 7 percent surtax was repealed.</td>
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<td></td>
<td>2003</td>
<td>Strong beer (more than 8 percent alcohol by weight) shifted from the liquor sales tax and made subject to the beer tax.</td>
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<tr>
<td></td>
<td>2009</td>
<td>A portion of the tax was earmarked for the violence reduction/drug enforcement account and the health services account. These dedicated revenues were eliminated.</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>Additional tax of $15.50 per barrel imposed on breweries that produced over 60,000 barrels. The excise tax on beer increased from 26 to 75 cents per gallon but the additional tax did not apply to the sale of c..</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>Additional per barrel and per gallon taxes imposed in 2010 expired.</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>A day spa permit created, allowing day spes to serve customers one glass of beer or wine free of charge.</td>
</tr>
</tbody>
</table>
History of Washington taxes

We also provide a visualization of the tax rate and collection history of numerous taxes.

All of the data is also provided in a new spreadsheet format.

However, a simple chart often provides the most impact.
History of Washington taxes

This table shows the real estate excise tax collections.

- You need to look at each number compared to previous to determine whether collections were increasing.
- You would need to add another column to calculate percent growth to understand how much the change is.
History of Washington taxes

With the simple chart:

- A large increase in collections stands out from 2005 through 2007.
- The impact of the Great Recession on real estate excise tax collections is quickly noticed.
- You can see that as of 2016, collections have not rebounded to pre-recession amounts.
Contact information

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Questions?