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Advanced Visualization Techniques

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Trellis on dimensions

Trellising charts on dimensions produces multiple charts that focus on a distinct section of data.

Trellising on one dimension

In this example, the field `un_region` becomes a trellising dimension when we place it on the X shelf of a map visual.

The screenshot shows a configuration panel for a 'Map' visual. At the top, the word 'VISUALS' is displayed with a close icon. Below it, the visual type is set to 'Map'. The configuration is organized into several sections:

- X:** A dropdown menu containing the field 'un_region'.
- Y:** An empty dashed box.
- Geo:** A section with a star icon, containing a dropdown menu with 'country' selected.
- Measures:** A dropdown menu containing the measure '# avg(population)'.
- Drill:** An empty dashed box.
- Tooltips:** An empty dashed box.
- Filters:** A section with a download icon and the text 'Filters', followed by a dashed box containing the instruction 'drag or click fields to add here'.

At the bottom of the panel is a blue button labeled 'REFRESH VISUAL' with a circular arrow icon.

This setup produces a trellised version of a map visual, on one dimension.



You can trellis many of the charts where the X and Y shelves are optional, by placing the field that represents the partition there.

When using mandatory shelves, such as X Axis and Y Axis on bar visuals, place two dimensions on the shelf. Use the first field to trellis the visual, and the second field in the visual itself.

Trellising on two dimensions

You can take it one step further, and define a secondary trellis for your visuals by placing yet another dimension on the Y shelf.

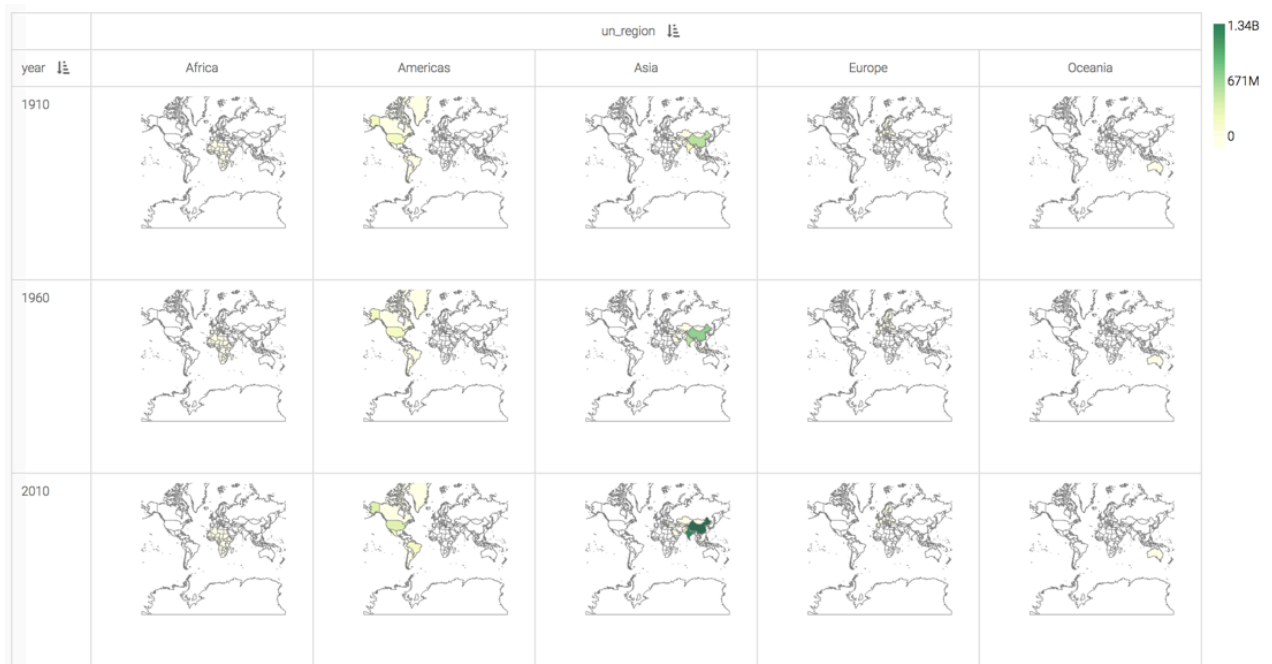
Here, we use the year field both on the Y shelf and on the Filters shelf, selecting years 1910, 1960, and 2010 to demonstrate the comparable populations across continents, and in 50-year increments.

The image shows a configuration panel for a visualization. At the top, the word "VISUALS" is displayed in a light gray box with a small icon to its right. Below this, a "Map" visualization type is selected, indicated by a map icon and a dropdown arrow. The configuration is organized into several sections, each enclosed in a dashed-line box:

- X:** A dimension field containing "un_region".
- Y:** A dimension field containing "year".
- * Geo:** A dimension field containing a globe icon and "country".
- Measures:** A measure field containing "# avg(population)".
- Drill:** An empty dashed box.
- Tooltips:** An empty dashed box.
- Filters:** A filter field containing "# year in (1910, 1960, 2010)".

At the bottom of the panel is a blue button with a refresh icon and the text "REFRESH VISUAL".

This setup produces a map visual that is trellised on two dimensions, UN Region and Year.



Trellis on measures

Some visual types (bars, lines, areas, and grouped bars) may be trellised on measures, simply by adding more fields to the measurement shelf.

About this task

Here, we can change the chart developed in Bars (Country vs. Life Expectancy) into a visual trellised on three measures: Life Expectancy, Population, and GDP per Capita. We accomplish this by placing all three measurements on the Y Axis shelf.

Procedure

1. Click the Y Axis shelf. Life Expectancy is already on the shelf.
2. With the shelf active, click the population field in the Data menu.
3. Click the `gdp_per_capita` field in the Data menu.

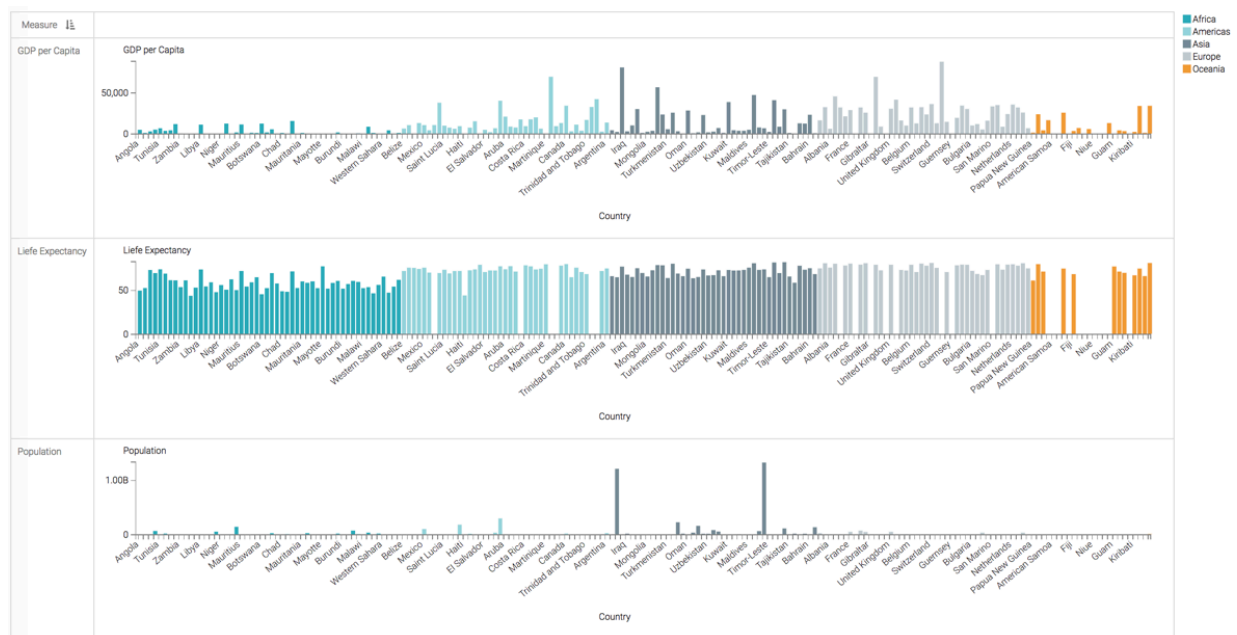
4. Click Refresh Visual.

The screenshot shows the 'VISUALS' pane in Power BI. At the top, the visual type is set to 'Bars'. The 'X Axis' is configured with the field 'Country'. The 'Y Axis' is configured with three measures: 'avg(life_expectancy)', 'avg(population)', and 'avg(gdp_per_capita)'. The 'Colors' section is set to 'un_region'. The 'Filters' section is set to 'year in (2010)'. At the bottom of the pane is a blue button labeled 'REFRESH VISUAL'.



Note: As the magnitudes of the measurements vary, we recommend that you specify independent measurements and then click Refresh Visual, again.

This setup produces a measurement-trellised bar chart visual.



To compare this approach with plotting two measures onto the same line chart, see [Creating line visuals with dual axes](#).

Related Information

[Line visuals with dual axes](#)

[Bars](#)

Multiple measure analysis

supports measures in the trellis, for comparing multiple measures at the same time. This feature works in bar, line, area, and grouped bar visual types.

About this task

To implement this feature, simply add all the required measurement fields to the trellising shelves of the visual.

Follow these steps to create a multi-measure representation of data in the World Life Expectancy dataset.

Procedure

1. Start a new visual based on dataset World Life Expectancy [data source samples.world_life_expectancy].
For more information, see [Creating a visual](#).
2. In the visuals menu, choose the Lines visual type.
3. Populate the shelves from the available fields (Dimensions, Measures, and so on) in the Data menu.
 - Under Dimensions, select year and place it on the X Axis shelf. Specify ascending order, and alias the field as 'Year'.
 - Under Measures, select gdp_per_capita and place it on the Y Axis shelf.
 - Under Measures, select life_expectancy and place it on the Y Axis shelf.
 - Under Measures, select population and place it on the Y Axis shelf.
 - Under Measures, select un_region and place it on the Colors shelf. Alias the field as 'UN Region'.

4. Change the calculations and alias for each of the fields on the Y Axis using the Expression Editor:

- Change `gdp_per_capita` to the following expression, and click Validate & Save.

```
sum([gdp_per_capita] * [population]) / sum([population]) as 'GDP per Capita'
```

- Change `life_expectancy` to the following expression, and click Validate & Save.

```
sum([life_expectancy] * [population]) / sum([population]) as 'Life Expectancy'
```

- Change `population` to the following expression, and click Validate & Save.

```
sum([population]) as 'Population'
```

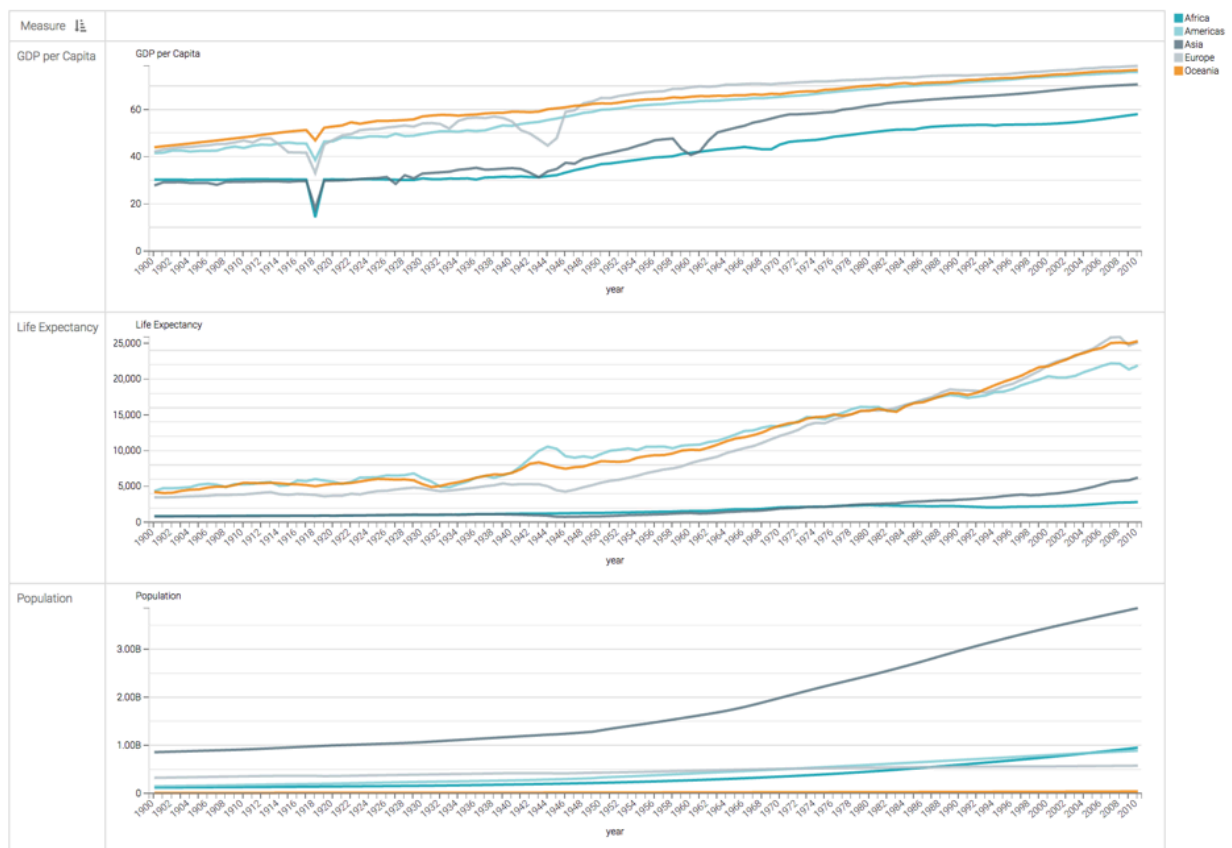
5. In the Settings menu, open the Axes group and select the Independent Aggregate Scale option.

6. In the Settings menu, open the Axes group and select the Gridlines Enables option.

7. In the Settings menu, open the Axes group and deselect the Include Y Axis Label option.

8. Click Refresh Visual.

The trellised line visual appears. This approach makes it easy to see the values of all measurements along the same horizontal dimension (in this case, year).



Related Information

[Creating a visual](#)

Line visuals with dual axes

It is often enlightening to see related dimensions on the same line chart; it clearly shows both correlation and pattern. However, values may be measuring completely different things, or the range of values (scale) is too different to show both lines clearly. offers a dual axis option for situations like these.

About this task

The following steps demonstrate how to create a line visual that uses a double axis; it is based on dataset World Life Expectancy [data source samples.world_life_expectancy].

Procedure

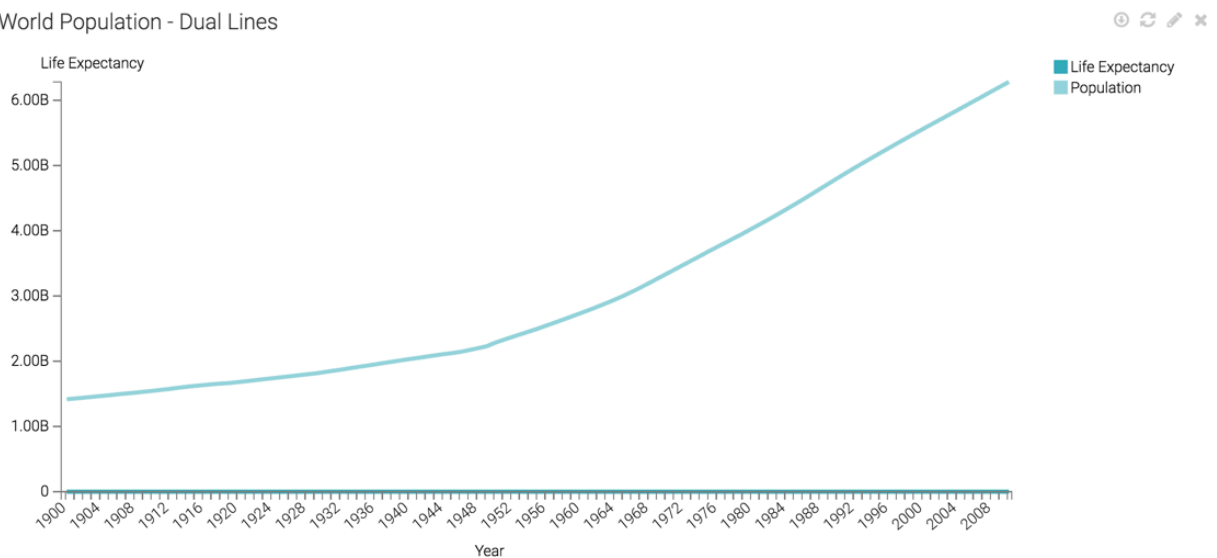
1. Start a new visual based on dataset World Life Expectancy [data source samples.world_life_expectancy].
For more information, see [Creating a visual](#).
2. In the visuals menu, choose the Lines visual type.
3. Populate the shelves from the available fields (Dimensions, Measures, and so on) in the Data menu.
 - Under Dimensions, select year and place it on the X Axis shelf. Specify ascending order, and alias the field as 'Year'.
 - Under Measures, select life_expectancy and place it on the Y Axis shelf. Alias it.
 - Under Measures, select Population and place it on the Colors shelf. Alias it, too.
4. Click Refresh Visual.

The line visual appears.

It is impossible to see the values on the life expectancy line because the population line sets the scale for the Y axis.

In this case, the label does not correspond to the scale shown, because this information comes from the Y axis shelf.

World Population - Dual Lines



- On the Colors shelf, on sum(population) field, click the Down arrow icon, select Axis, and then select Secondary Axis.

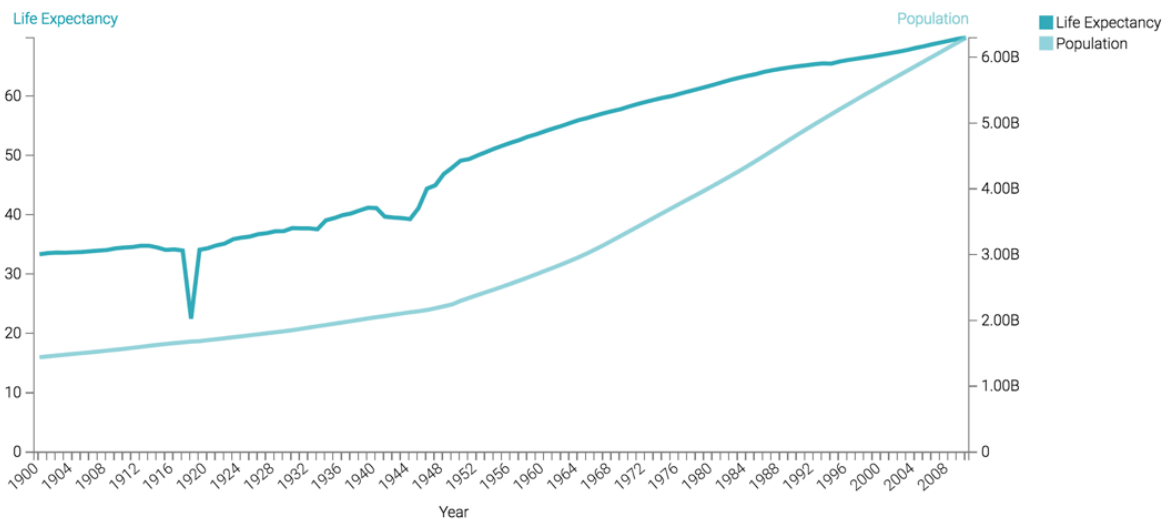
The screenshot shows the 'VISUALS' pane on the left and the 'FIELD PROPERTIES' pane on the right. In the 'VISUALS' pane, the 'Colors' shelf contains the field 'sum(population)'. In the 'FIELD PROPERTIES' pane, the 'Axis' section is expanded, and 'Secondary Axis' is selected with a checkmark and highlighted by an orange box.

- Click Refresh Visual.

The two lines can now be seen clearly.

There is now a vertical axis both on the left and the right side of the visual. For convenience, the color of the axis labels match the line.

World Population - Dual Lines



- Save the visual as World Population - Dual Lines.

To compare this approach with plotting multiple measures as trellised charts, see Trellis on measures.

Related Information

[Trellis on measures](#)

[Creating a visual](#)

Working with dimension hierarchies

Dimension hierarchies enable you to create complete visualizations with powerful drill down capability within a single visual, instead of relying on a complex interaction of two or more visuals inside an app.

About this task

Dimension hierarchies can be used with bar, line, area, and grouped bar visual types.

Data Visualization also provides an alternate solution for hierarchical dimension representation in cross tabulation visuals. See, Working with Hierarchical Cross-Tabulation Visuals

The following steps demonstrate how to use Region, a dimensional hierarchy based on dataset World Life Expectancy [data source samples.world_life_expectancy], to build a bar chart that can switch between representations at three different levels of data granularity. To create this hierarchy, see Creating new dimension hierarchies.

Procedure

1. Start a new bar visual on the World Life Expectancy dataset.
For more information, see Bars.
2. In the Visual Designer interface, populate the shelves of the visual:
 - Under Dimensions, select the field Region (which is a dimensional hierarchy), and drag it onto the X Axis shelf.
 - Under Measures, select population and drag it onto the Y Axis shelf.

The screenshot shows the Visual Designer interface for a bar chart. The main canvas on the left is empty, with a title field containing "enter title..." and a subtitle field containing "enter subtitle...". The right-hand panel is divided into several sections:

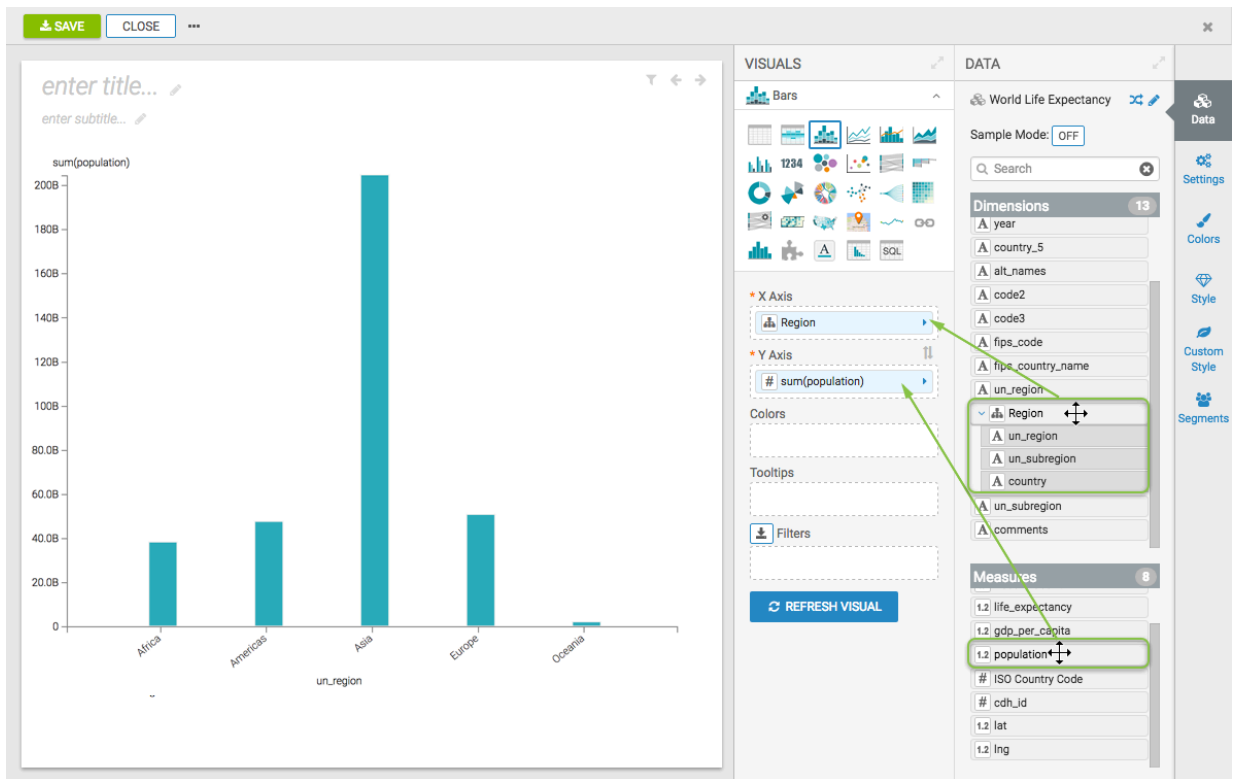
- VISUALS:** A list of visualization types, with "Bars" selected.
- DATA:** The dataset "World Life Expectancy" is selected. The "Sample Mode" is set to "OFF". A search bar is present.
- Dimensions:** A list of 13 dimension fields. The "Region" field is expanded, showing a hierarchy: "un_region", "un_subregion", and "country".
- Measures:** A list of 8 measure fields. The "population" field is selected.
- X Axis:** The "Region" field is placed on the X Axis shelf.
- Y Axis:** The "sum(population)" measure is placed on the Y Axis shelf.
- Other sections:** "Colors", "Tooltips", and "Filters" are currently empty.

Green arrows in the image point from the "Region" field in the Dimensions list to the X Axis shelf, and from the "population" field in the Measures list to the Y Axis shelf.

3. Click Refresh Visual.

The bar chart appears.

The legend along the X axis corresponds to the top level of the Region hierarchy, un_region.



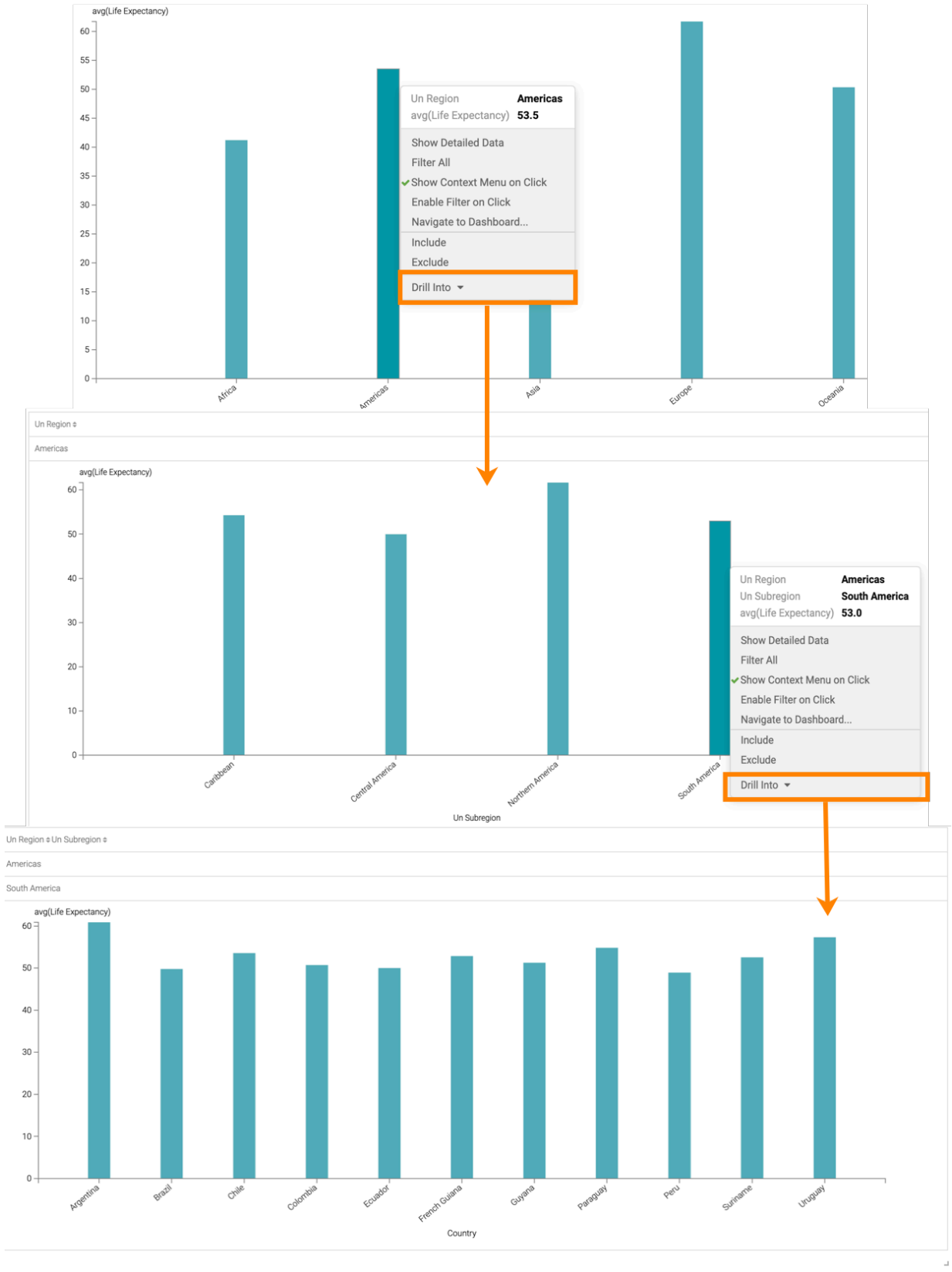
4. Change the title to World Population - Hierarchy.

5. Click Close to switch to View mode, so you can examine the operation of the dimensional hierarchy in the visual.

- Put the pointer over one of the data labels along the horizontal axis, and note that it changes color; this is because the data labels are link-enabled. Click one of the choices to drill down to a lower level of the hierarchy.

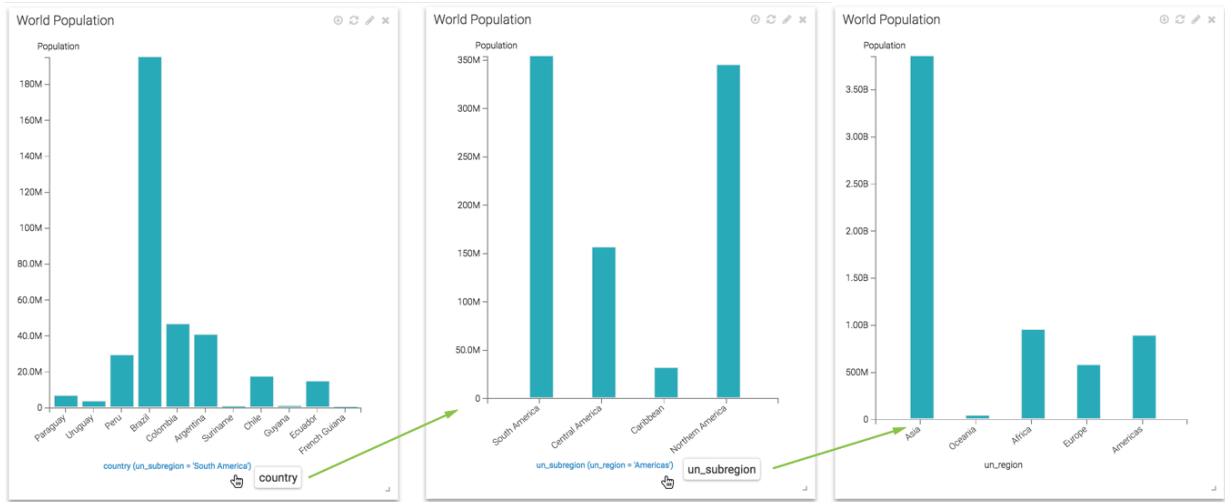
In the following graphic, we drilled down from Level 1: un_region = 'Americas', to Level 2: un_subregion = 'South America', and then to Level 3: country.

Every time you move between the hierarchy levels, the scale of the vertical axis adjusts automatically.



- Put the pointer over the label of the horizontal axis, and note that it change color; it is also link-enabled. You can click the horizontal axis label to go up the hierarchy levels.

In the following graphic, we moved from Level 3: country where `un_region = 'America'` and `un_subregion = 'South America'` to Level 2: `un_subregion = 'South America'` where `un_region = 'America'`, and then to Level 1: `un_region`.



Related Information

[Hierarchical cross tabulation visuals](#)

[Creating new dimension hierarchies](#)

[Bars](#)

Hierarchical cross tabulation visuals

has an alternate solution for hierarchical dimension representation in cross tabulation visuals.

About this task

The following steps demonstrate how to create and configure a de facto dimensional hierarchy on the shelves of a cross tabulation visual. We are using dataset World Life Expectancy [data source `samples.world_life_expectancy`], to build a cross tabulation table that can switch between representations at three different levels of data granularity.

Procedure

- Start a new cross tabulation visual on the World Life Expectancy dataset.

For more information, see [Cross tabulation](#).

2. Populate the shelves from the available Fields under Dimensions and Measures in the Data menu.
 - Under Dimensions, select un_region and drag it over the Dimensions shelf. Repeat with un_subregion and country, adding them under un_region. Note that your placement of these fields is from the largest to the smallest, top to bottom.
 - Under Measures, select population and drag it over Measures shelf. Ensure that the default aggregation is sum(population).

VISUALS

Cross Tabulation

Column

drag fields to add here

Row

- un_region
- un_subregion
- country

*** Measures**

- sum(population)

Tooltips

drag fields to add here

Filters

drag fields to add here

REFRESH VISUAL

DATA

World Life Expectancy

Search

Dimensions 13

- Segment
- country
- year
- country_5
- alt_names
- code2
- code3
- iso_cc
- fips_code
- fips_country_name
- un_region
- un_subregion
- comments

Measures 7

- Record Count
- life_expectancy
- gdp_per_capita
- population
- cdh_id
- lat
- lng

Data

Settings

Colors

Style

Custom Style

Segments

3. On the Row shelf, select the un_region field and select Enable Expansion option in the Field Properties panel.

The image shows the Power BI interface with two panes open: VISUALS and FIELD PROPERTIES.

VISUALS Pane:

- Visual type: Cross Tabulation
- Visuals grid: A grid of various visualization icons. The 'Cross Tabulation' icon is highlighted with a blue border.
- Row shelf: A dashed box labeled 'Row' containing three fields: 'un_region', 'un_subregion', and 'country'. Each field has a blue background and a right-pointing arrow.
- Measures shelf: A dashed box labeled '* Measures' which is currently empty.
- Buttons: A blue button labeled 'REFRESH VISUAL' with a circular arrow icon.

FIELD PROPERTIES Pane:

- Options list:
 - ▶ Date/Time Functions
 - ▶ Text Functions
 - ▶ Change Type
 - ▶ Order and Top K
 - [] Enter/Edit Expression
 - Enable Expansion** (highlighted with a mouse cursor)
 - Display Format
 - ▶ Alias
 - ▶ Description
 - 📄 Duplicate
 - Save Expression
 - ✕ Remove

4. On the Row shelf, on the un_subregion and the country field, click the Down arrow icon, and select Enable Expansion.

5. Click Refresh Visual.

The cross tabulation table appears with a Plus icon in the un_region, un_subregion, and country columns. This indicates that you can expand the data in these columns.

The sum(population) column shows the combined population for all un_regions.

| un_region | un_subregion | country | sum(population) |
|-----------|--------------|---------|-----------------|
| + | + | + | 342B |

6. To see more details, expand the un_region column of the visual by clicking the Plus icon under the column header.

| un_region | un_subregion | country | sum(population) |
|-----------|--------------|---------|-----------------|
| + | + | + | 342B |

↓

| un_region | un_subregion | country | sum(population) |
|-----------|--------------|---------|-----------------|
| + | + | + | 342B |
| Africa | + | + | 38.0B |
| Americas | + | + | 47.4B |
| Asia | + | + | 204B |
| Europe | + | + | 50.5B |
| Oceania | + | + | 1.88B |

7. Expand the un_subregion column of the visual by clicking the Plus icon in the field next to one of the un_region. We chose to expand Africa.

When you expand Africa, it generates a complete tabulation aggregated by un_subregion.

| un_region | un_subregion | country | sum(population) |
|-----------|--------------|---------|-----------------|
| | | | 342B |
| Africa | | | 38.0B |
| Americas | | | 47.4B |
| Asia | | | 204B |
| Europe | | | 50.5B |
| Oceania | | | 1.88B |



| un_region | un_subregion | country | sum(population) |
|-----------|-----------------|---------|-----------------|
| | | | 342B |
| Africa | | | 38.0B |
| Africa | Eastern Africa | | 10.9B |
| Africa | Middle Africa | | 4.43B |
| Africa | Northern Africa | | 8.92B |
| Africa | Southern Africa | | 2.60B |
| Africa | Western Africa | | 11.2B |
| Americas | | | 47.4B |
| Asia | | | 204B |
| Europe | | | 50.5B |

8. Expand the country column of the visual by clicking the Plus icon in the field next to one of the un_subregions.
We chose to expand Middle Africa.

When you expand Middle Africa, it generates a complete tabulation aggregated by country.

| un_region | un_subregion | country | sum(population) |
|-----------|-----------------|---------|-----------------|
| | | | 342B |
| Africa | | | 38.0B |
| Africa | Eastern Africa | | 10.9B |
| Africa | Middle Africa | | 4.43B |
| Africa | Northern Africa | | 8.92B |



| un_region | un_subregion | country | sum(population) |
|-----------|----------------|-----------------------|-----------------|
| | | | 342B |
| Africa | | | 38.0B |
| Africa | Eastern Africa | | 10.9B |
| Africa | Middle Africa | | 4.43B |
| Africa | Middle Africa | Angola | 723M |
| Africa | Middle Africa | Cameroon | 767M |
| Africa | Middle Africa | Chad | 405M |
| Africa | Middle Africa | Congo | 2.43B |
| Africa | Middle Africa | Equatorial Guinea | 28.6M |
| Africa | Middle Africa | Gabon | 68.4M |
| Africa | Middle Africa | Sao Tome and Principe | 8.56M |

9. Change the title to Hierarchical Cross Tabulation of Population.
10. At the top left corner of the Visual Designer, click Save.

Related Information

[Cross tabulation](#)

Adding highlights to visuals

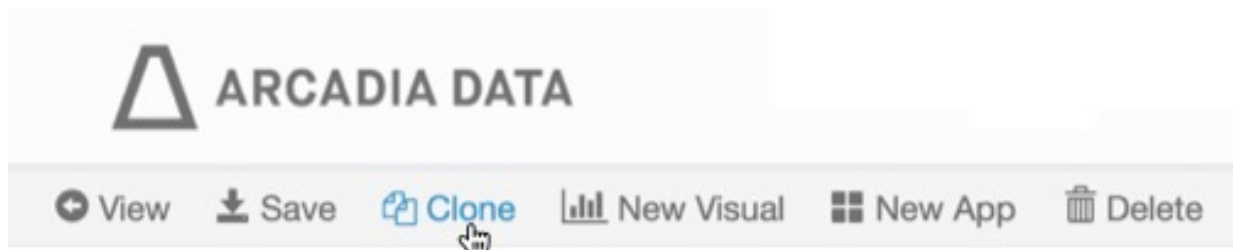
Highlights are a practical way to bring attention to values that exceed a particular threshold. currently supports highlight marks at specific values on the combined bar/line chart type, and enables you to customize these highlights.

About this task

The following steps demonstrate how add highlights to an existing chart. To start, we are using the visual World Population - Dual Bar and Line, developed on dataset World Life Expectancy [data source samples.world_life_expectancy]. For more information, see Combo visuals.

Procedure

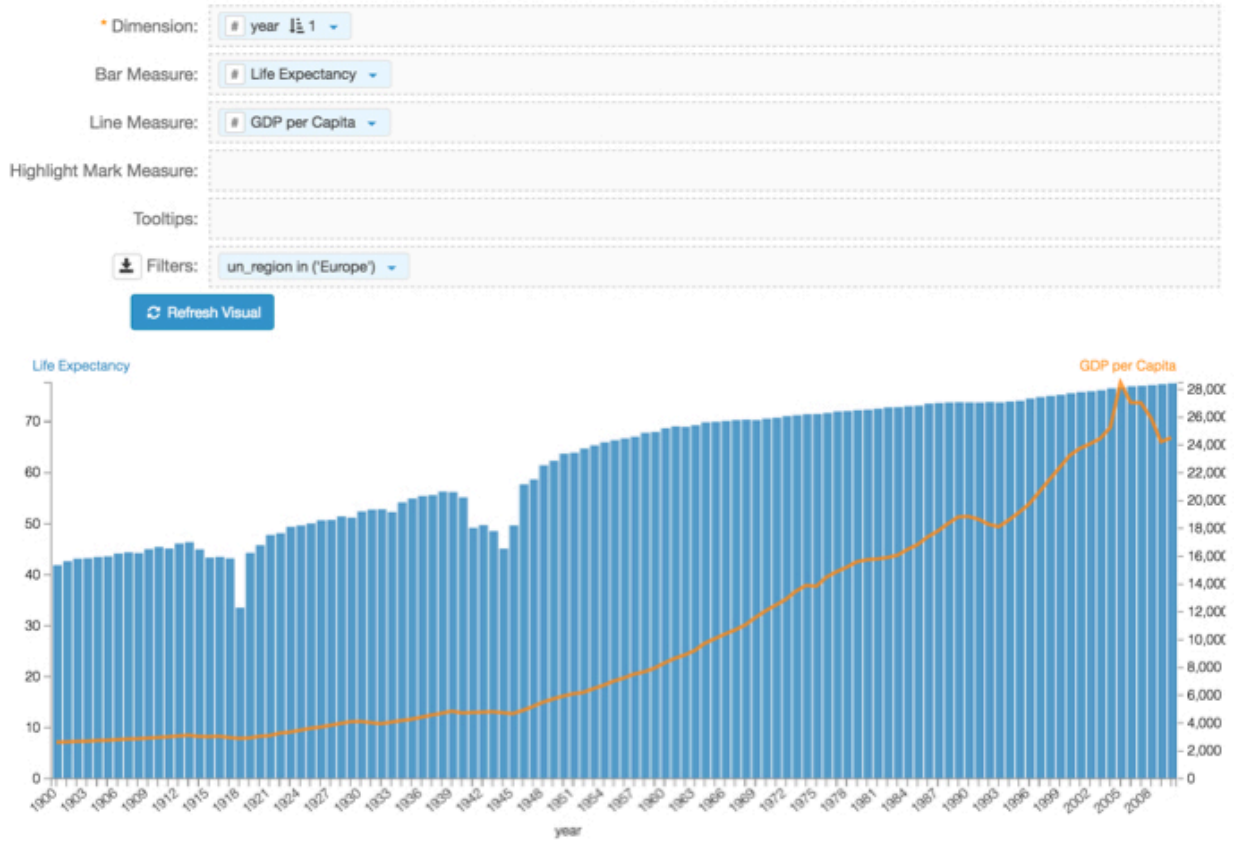
1. Open the visual World Population - Dual Bar and Line in Edit mode. For information on building this visual.
2. Clone the visual.



3. Click the Pencil icon next to the title of the visualization to edit it, and enter the new name.
4. Click the Pencil icon below the title of the visualization to add a brief description of the visual.
5. Change the title to World Population - Highlights on Dual Bar and Line.
6. At the top left corner of the Visual Designer, click Save.
7. Add the un_region field to the Filters shelf, and select Europe from the list of possible values.

This graph has more variation than the unified World data.

8. Click Refresh Visual.



You can see the pronounced peak in the GDP per Capita line, centered around the year 2005.

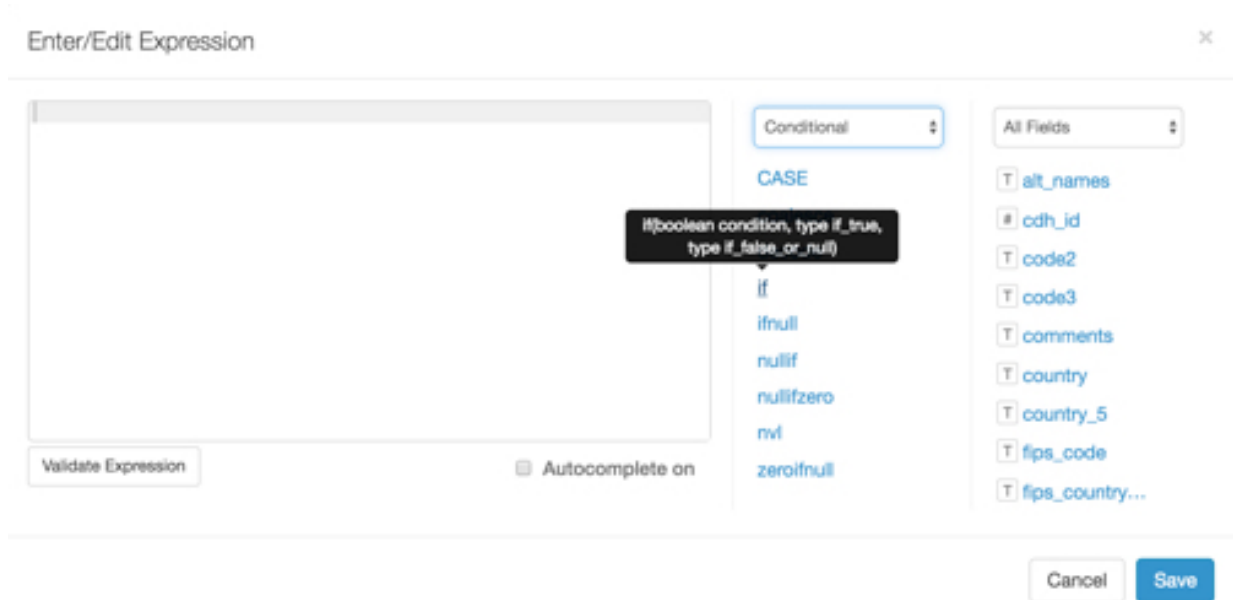
9. Based on the graph, highlight the values where GDP per Capita is over \$25,000.
10. Place the field `gdp_per_capita` on the shelf Highlight Mark Measure.
11. On the same shelf, click the Down arrow icon on the `gdp_per_capita` field, and choose Enter/Edit Expression.

12. In the Enter/Edit Expression window modal, delete the text in the default expression, change the function groupings to Conditional, and select the if statement.



Note:

Depending on the SQL dialect of the connection you are using, the syntax of the if statement may be different.



13. Complete the expression template.

It should look similar to the following expression:

```
if(avg([gdp_per_capita])>=25000, avg([gdp_per_capita]), null)
```

Optionally, you can alias the highlight; see the bold font in the changed expression.

```
if(avg([gdp_per_capita])>=25000, avg([gdp_per_capita]), null)
  as 'GDP per Capita > 25K'
```

14. Click Save.

Enter/Edit Expression ✕

```
if(avg([gdp_per_capita])>=25000, avg([gdp_per_capita]), null) as  
'GDP per Capita > 25K'
```

Autocomplete on

Validation Successful! ✕

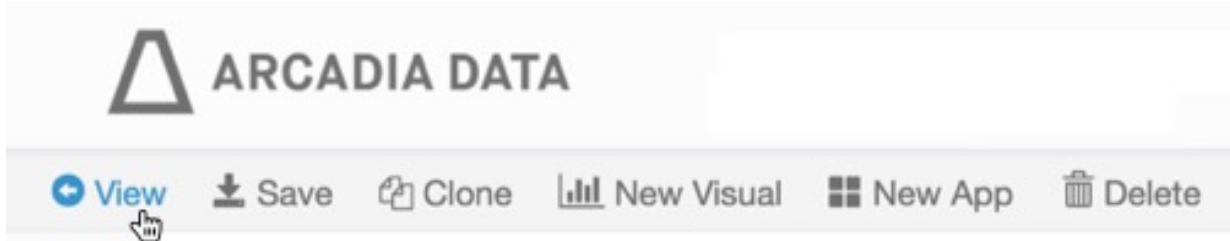
All Functions ▾

- abs
- acos
- add_months
- adddate
- AND
- appx_median
- ascii
- asin
- atan
- ...

All Fields ▾

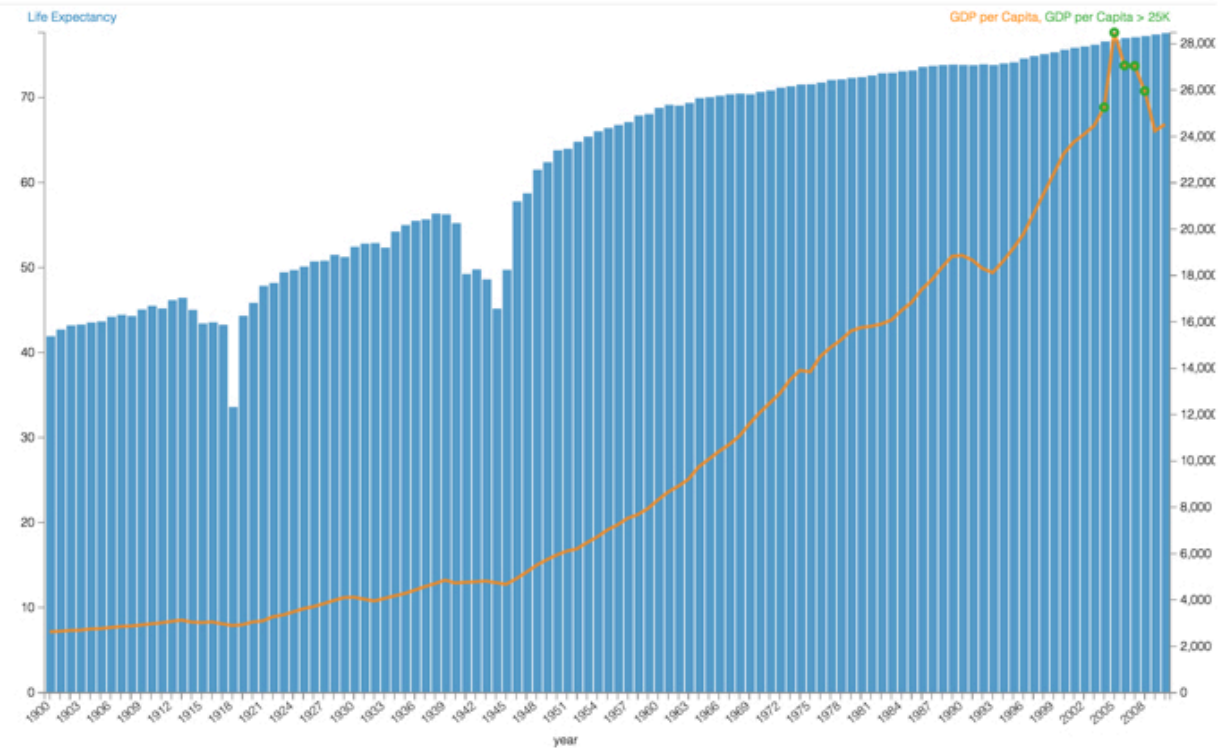
- T alt_names
- # cdh_id
- T code2
- T code3
- T comments
- T country
- T country_5
- T fips_code
- T fips_country...

15. Save the visual, and then click View to change to View mode.



Note: The graph has green circle highlights when GDP per Capita values are equal or greater than 25,000.

World Population - Highlights on Dual Bar and Line



16. The default highlight mark is a circle. To convert it to another type, use the visual Settings interface, as described in Change highlight type. You can also change the relative size of the mark, as described in Change highlight type.

Related Information

[Combo visuals](#)