Data workshop Tableau

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Who am I?

- Cohort lead & Data Instructor at CodeClan

  CodeClan is a not-for-profit social enterprise in Scotland. The first and only SQA accredited digital skills academy on a mission to help bridge the digital skills gap in Scotland's growing tech industry.

- Volunteer at DataKindUK

  DataKindUK is a charity that builds data science capacity in social change organisations.

Objectives & approach

Objective
- Introduction to transferrable Tableau/dashboard building skills

Approach
- Will be using fake charity data to do so
- Introduce concepts
- Work through together

Resources
- Slides with step by step guide will be available after the talk.

Why use data visualisation tools like Tableau?

Benefits of data visualisation tools

- Publish data reports and dashboards online - easy to share.
- Interactive (user can drill into data)
- Hold a lot more information in single view
- Can handle much bigger datasets
- Automatic updates of visuals if new data
- Connecting and visualising many data sources in one place
- Multiple collaborators on single dashboard
- Easy download of visuals for static reports...

...and don't need to be able to code to do all of above.

Introduction to Tableau

Tableau

A tool to **build interactive dashboards** - bringing together data from **multiple sources** and **visualising** to bring **insights** from the data.

Tableau works in both Windows and Mac computers.

View some examples <u>here</u>

Tableau products

1. **Desktop** - desktop application (Professional & Personal versions).

2. **Public** (free) - similar to Desktop but have to save publically (so can only use open data) and more limited number of data sources to connect to.

3. **Server** - you host data on your own server (large organisations).

4. **Online** - data hosted by Tableau in the cloud.

5. **Reader** (free) - allows you to view the workbooks and visualizations created using Tableau Desktop (but not create/edit)

6. **Mobile**

Tableau Foundation

Tableau Foundation

In 2018 Tableau announced its commitment to grant $100 million in software, training, and financial support through Tableau Foundation between now and the year 2025.

The purpose of Tableau Foundation is to encourage the use of facts and analytical reasoning to solve the world's problems. **It donates free/reduced fee licenses of its product and it's employees time**. More about the Foundation here.

Featured projects in the Foundation here, with public Tableau dashboards created for each project.

Tableau Foundation - donations

Donated licenses

Small nonprofits/NGO can request license of Tableau Desktop from Tableau Foundation.

- Certain criteria (such as an annual budget under about £4 million) to be eligible for donation.
- More information and to apply here.

Donated technical support - Tableau Service Corps

- A volunteer network of Tableau experts eager to help non-profits do more with their data.
- More information and to request a session here.

Tableau solutions

Tableau page with resources and inspiration for non-profits <u>here</u>.

Donor data dashboard example <u>here</u>.
Visualising who are the donors? When will they give, and how much? How much is committed for the future and where else should we be looking?

Funding Trends - FY2012-2015

Funding by Source Type

'individual giving' includes funding from family foundations, community foundations, corporate matching gifts, and small community-based nonprofits- all giving driven from individuals- may not align with finance categories.

% of Yearly Funding

■ Governmental/Multilateral ■ Globex Foundation ■ Individual Giving ■ Foundation ■ Corporation
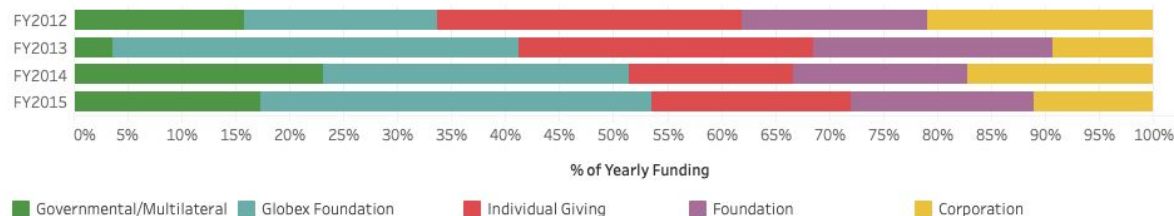
Planning your dashboard

Workflow

```
Data  ────────►  Analysis/    ────────►  Visualisation  ────────►  Answers want
                 Statistics                                         from the data
      ◄────────              ◄────────                   ◄────────
```
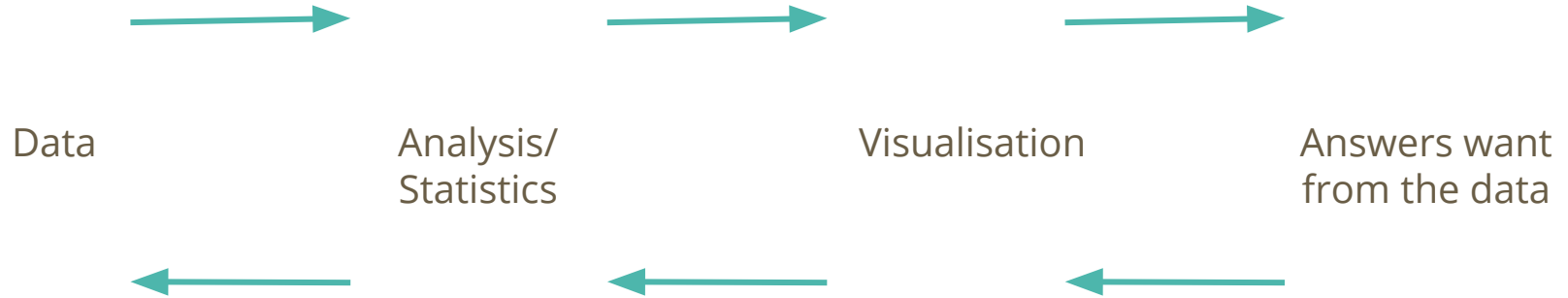
- Think about **end users of the dashboard** & **how they will use the information**.
- Sketch out planned design before begin and what data will need.
  - Lots of free online tools for sketching/designing such as Excalidraw <u>here</u>.

Why are you tracking this on your dashboard?

Questions	Example
What is the metric?	Number of service users.
Why are you tracking this metric?	To ensure that if demand for service is greater than supply we can act to meet demand where possible.
What action will you take if there is a change to the metric?	If it goes above a certain value we will need to increase the capacity for services or recruit more volunteers to meet demand.
Do you have a **benchmark/target** to compare metric against?	Ratio of 10 service users to a volunteer.

Let's see the data files ...

Fake charity data

Data for a fake charity that has 50 service users and have 3 different services (A, B & C).

service_user_data.csv
- *Id*: unique identifier
- *Age*
- *Country/Postcode*: location data of the users
- *Service*: which service they use (A, B or C)
- *Pre-service outcome*: rating of 1 to 5 on the outcome the charity is looking to improve through it's services (1 is poor and 5 is good). This is the score before the user starts using the service.
- *Post-service outcome*: the outcome score after the service.

dates_of_use.csv
- *Id:* unique identifier (same identifier as in the service_user_data.csv)
- *DateOfVisit*

Questions we want to answer

1. How do the number of visits differ between services?
2. Where are our users from?
3. How does service usage change over time?
4. How do change in outcomes differ for each service type?

Investigated with <u>this</u> dashboard ...

How are our questions answered

How do the number of visits differ between services?
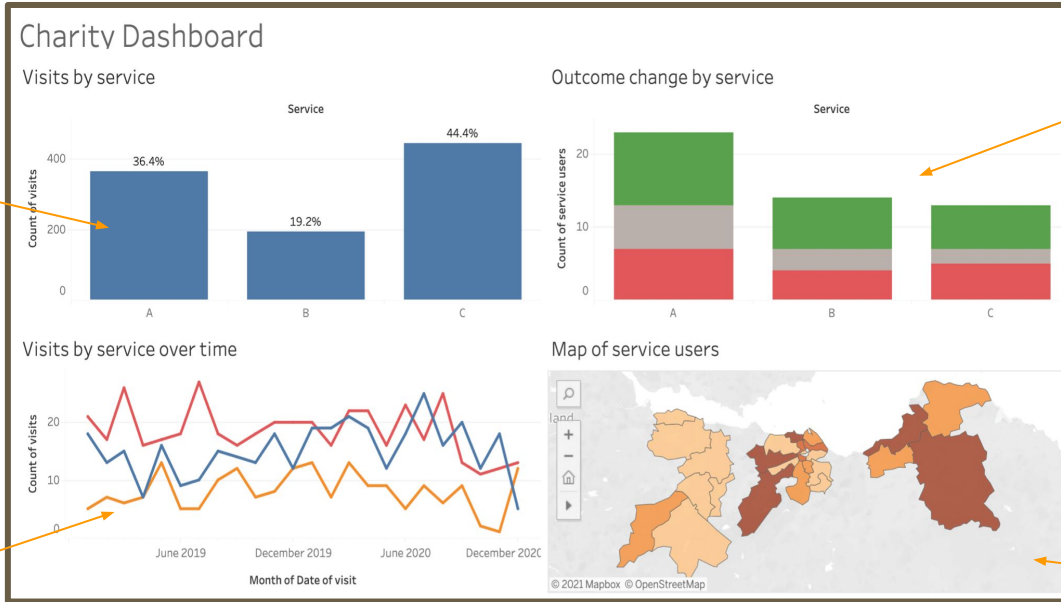
How do change in outcomes differ for each service type?

How does service usage change over time?

Where are our users from?

Overview

Dashboard build steps

1. Load in data
2. Build relationships
3. Data preparation (clean, reshape, make new columns etc.)
4. Build visuals
5. Combine visuals into dashboard

Let's open Tableau ...

Connect to data

Connect to data

Excel, csv, PDF,
spatial (geographic)

Google sheets &
web data

Connect

To a File

Microsoft Excel
Text file
JSON file
PDF file
Spatial file
Statistical file

To a Server

More…
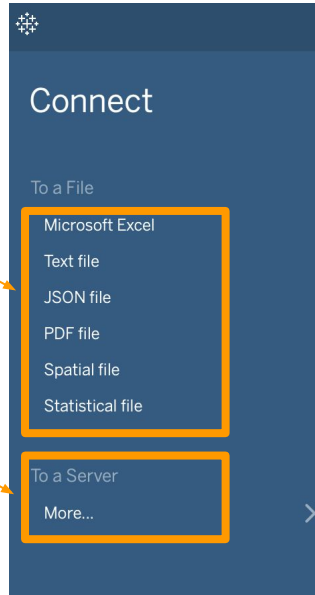
- Can connect to some common data sources in Tableau Public e.g. Excel, csv files (text file) etc.

- Data sources are limited in Tableau Public compared to Tableau Desktop, Server etc.

Data sources for Tableau Desktop

- Flat files e.g. csvs, xls, PDFs
- Databases (e.g. SQL Server, Oracle etc.)
- Salesforce, Google Analytics, Access
- Google Sheets, Dropbox
- Web (e.g. APIs, data on web)

…. and many many more (full list here).

Data always updating? The source can be 'live' in that your **dashboard updates as the data does** or can schedule periodic refreshes.

Let's load in some data ...

Data Source page

List of connections (may be 1 csv, 1 database etc.)

Data interpreter - used if data needs cleaning

Canvas: Build any relationships

Can always get back to this view by clicking on 'Data Source'

Preview of data

Metadata view

'Manage metadata' gives you a column level summary of the data. Good if you have 'wide data' i.e. many columns.

Field Name	Table	Remote Field Name
# Id	service_user_data.csv	Id
# Age	service_user_data.csv	Age
⊕ Country	service_user_data.csv	Country
Abc Local Authority	service_user_data.csv	LocalAuthority
⊕ Postcode	service_user_data.csv	Postcode
Abc Service	service_user_data.csv	Service
# Pre-service outcome rating	service_user_data.csv	Pre-service outcome rating
# Post-service outcome rating	service_user_data.csv	Post-service outcome rating

Sort fields — Data source order

Field names in data source

Data types

Date

Date & time

Text

Boolean (TRUE/FALSE)

Geographic

Numeric (decimal/whole)

Dimensions

Measure
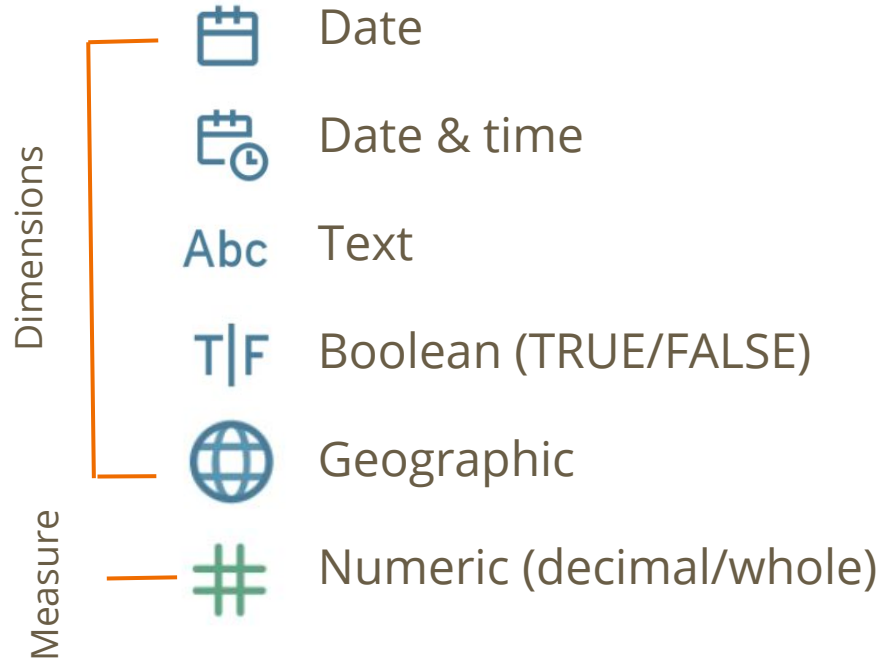
Symbols indicate the data type of the column auto-detected by Tableau.
If want to change then click on the symbol to change

# service_us... Id	# service_us... Age	⊕ service_user_data.csv Country	Abc	⊕ user_data.csv ...de	Abc service_user_data.... Service
1	40	Scotland	Number (decimal)	JN	A
2	33	Scotland	Number (whole)	4BJ	A
3	25	Scotland	Date & Time	DQ	B
4	56	Scotland	Date	LB	A
5	41	Scotland	✓ String	7BX	A
6	33	Scotland	Boolean	EH9 2LZ	C
7	55	Scotland	✓ Default	EH12 6HD	A

Number (decimal)
Number (whole)
Date & Time
Date
✓ String
Boolean
✓ Default
Geographic Role ▶

Edinburgh - City of
Edinburgh - City of

Let's load in some data...

Load in the service_user_data file:
1. Keep all columns except the age column
2. Check columns are the correct data type.
3. Rename the columns 'Pre-service outcome rating' and 'Post service outcome rating' to 'Outcome Before' and 'Outcome After'

First steps of data preparation

- Change table name if needed (e.g. may have long file name) - keep short & meaningingful.
- Only keep columns that need (hide columns you don't)
- Change any column names
- Check columns are correct type (text, numeric etc.) - change if not
- Check columns are categorised dimensions or measures correctly

Bringing in more data - source vs. connection

Do you want to **relate/join** your tables?
Add a new **connection** in the same data source.
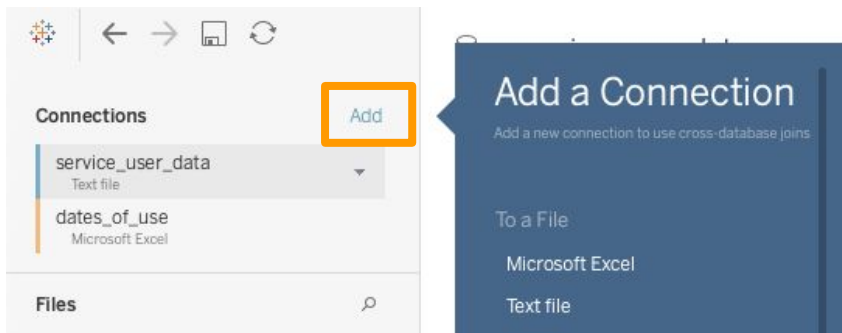
Do you want to bring in a table that has **no relationship** to your current one?
Add a new **data source**.
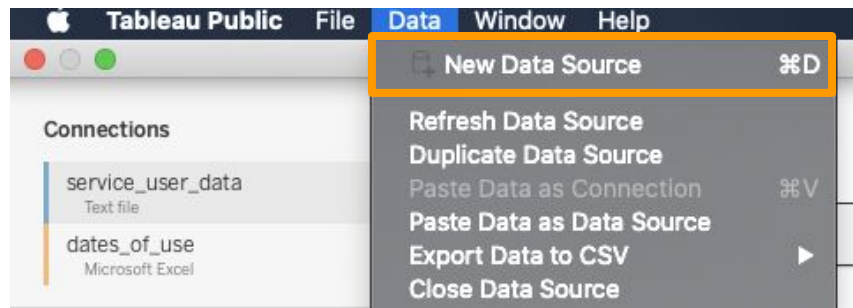
How are our data tables related?

Service Users

Id	Service	...
1	A	
2	A	
3	B	
...		

Visit Dates

Id	Date of Visit
2	24/05/2019
2	03/09/2019
35	01/02/2019
....	

One   to   Many
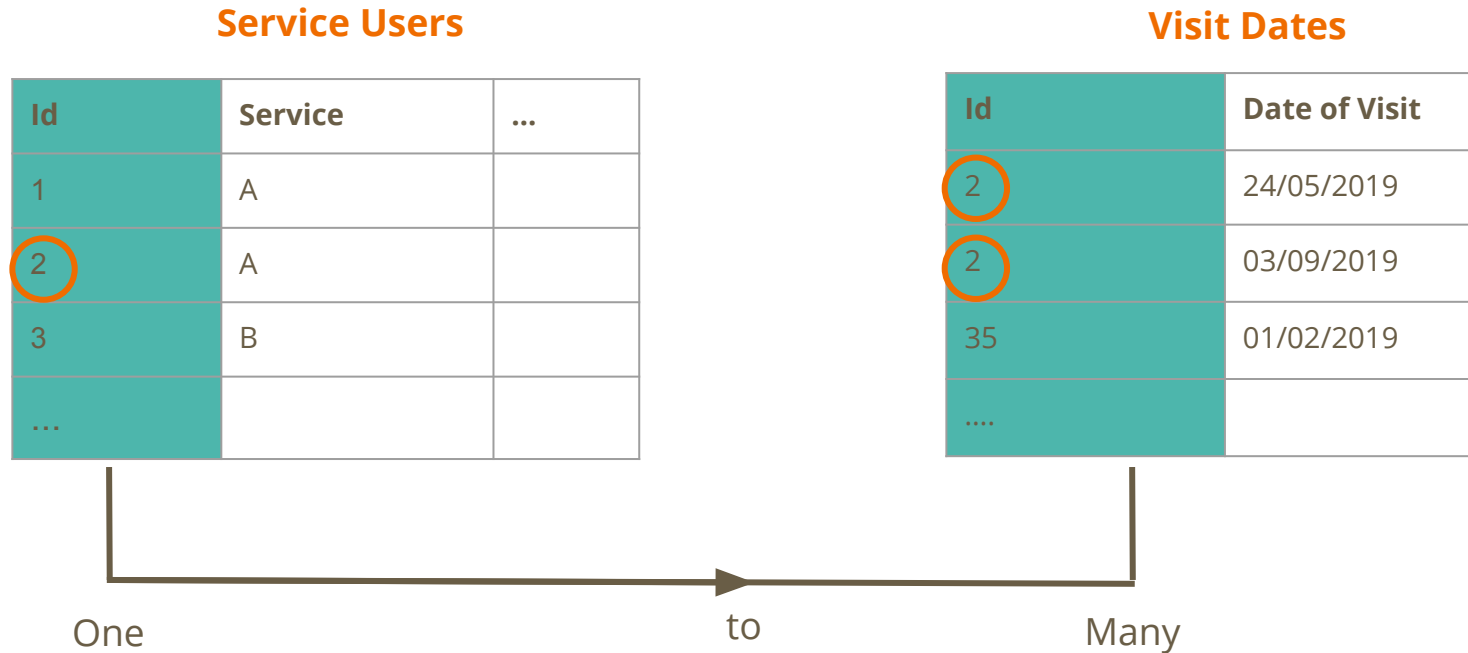
Relationships

- Define how data is related to one another based on common fields.

- Can join via more than one field.

- Drag related connection into canvas area to built relationship

What happens if the data is refreshed?

- Perhaps changes have been made in underlying data source e.g. the data has been updated

- In workbook right click on the data source and click 'Refresh'.

- If had live data in Tableau Desktop can set refresh frequency.
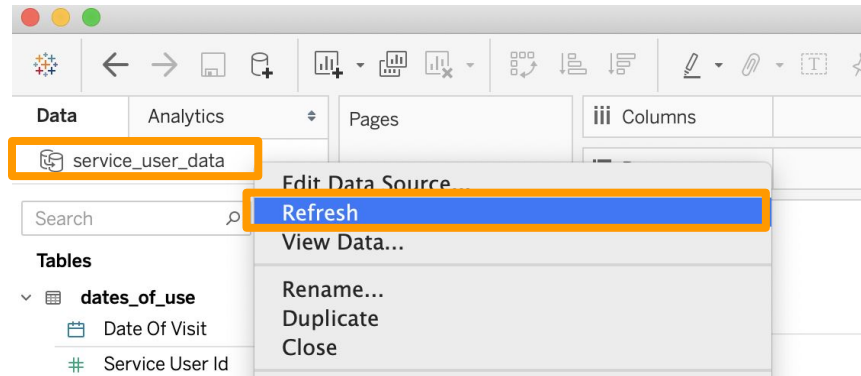
What happens if the data is moved?

- May try to refresh the data but the source has been moved e.g. into a different folder on your computer.

- Can 'Edit Connection' to change connection to data if it's moved.
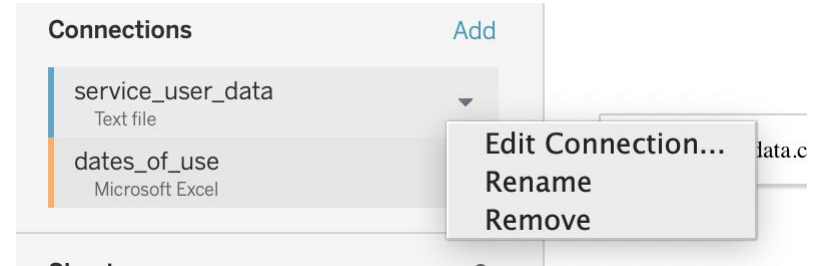
Further data preparation

Create calculated fields

- Calculated fields are new columns
- Lots of formulas/functions available that can use.
- Autocomplete list when begin typing.

Explanation & example for formula

List of formulas

Column name

Formula

OutcomeChange   ×

[Outcome Before]-[Outcome After]

All ▼

Enter search text

FLOOR
FULLNAME
HEXBINX
HEXBINY
IF
IFNULL
IIF
INCLUDE
INDEX
INT
ISDATE
ISFULLNAME

IF <expr> THEN <then>
[ELSEIF <expr2> THEN <then2>
...] [ELSE <else>] END

Tests a series of
expressions returning the
<then> value for the first
true <expr>.

Example: IF [Profit] > 0
THEN 'Profitable' ELSEIF
[Profit] = 0 THEN
'Breakeven' ELSE 'Loss' END

The calculation is valid.   Apply   OK

Functions for calculating fields

Tableau resource for all functions available [here](#).

Few examples:

- Extract part of text (e.g. to pull out first name, or part of email address).
- Extract part of date (e.g. if want to know what day of week each date is).
- Time difference between 2 dates.

Let's create some new columns ...

1. Create new column named '*Outcome Change*' which is the difference between '*Outcome After*' and '*Outcome Before*'.
2. Create new column named '*Outcome Change Sign*' which takes value 'Positive', 'Negative' and 'None' depending if the '*Outcome Change'* is a positive, negative or 0.
3. Check if all these new columns are the correct data type and change if not.

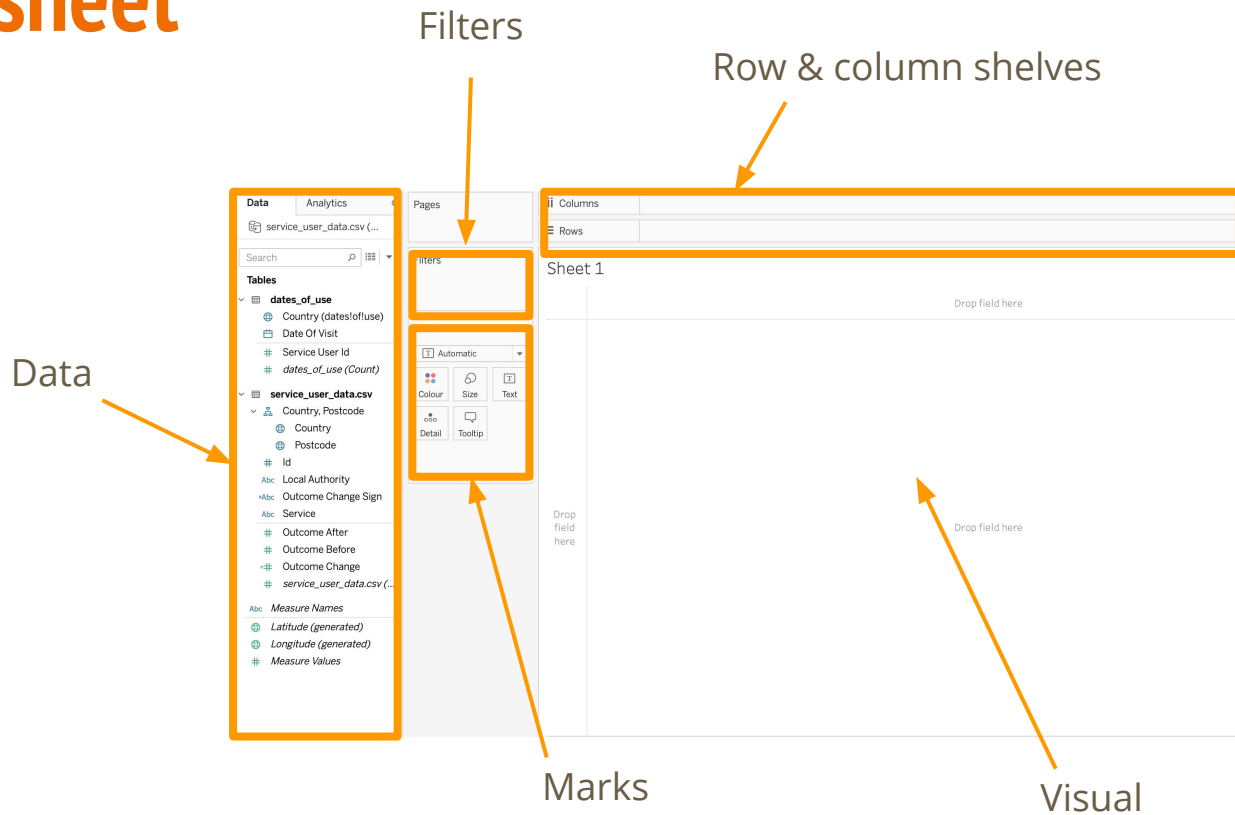# Worksheets

Visualising the data

Now we have prepared our data we can visualise the data to gain insights from the data.

Worksheets, Dashboards & Stories

- **Worksheet** - create 1 visual in a worksheet.

- **Dashboard** - add visuals from worksheets together into a dashboard.

- **Story** - sequence of visualisations/dashboards to convey particular messages and draw attention to particular points in the data.
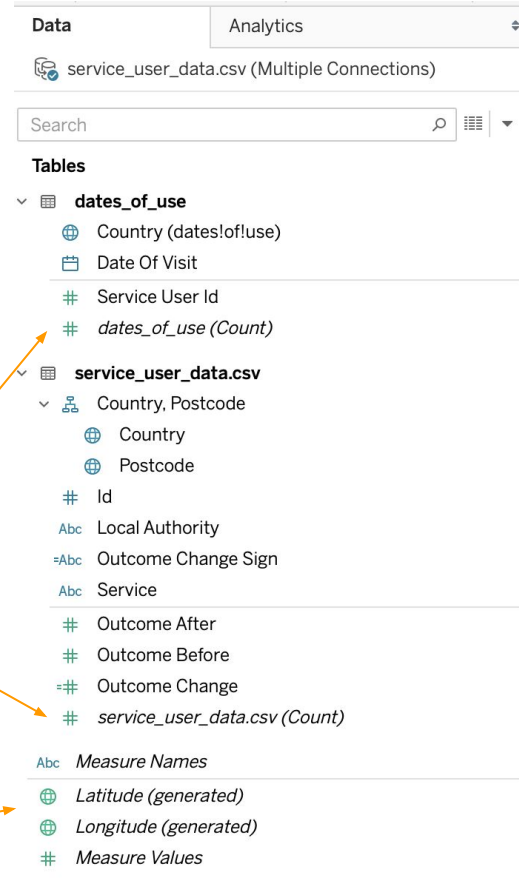
Worksheet   Dashboard   Story

Worksheet

Filters

Row & column shelves

Data

Marks

Visual
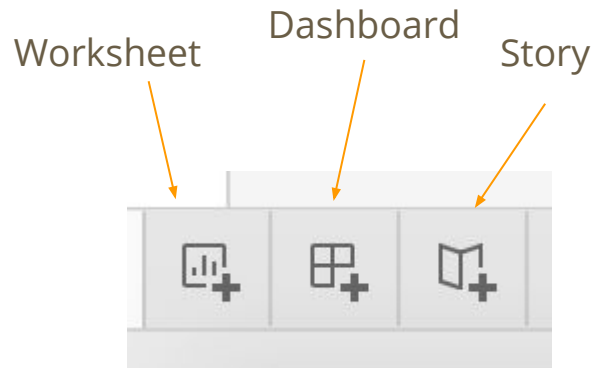
Worksheet - data

- Split by tables

- Splits further by dimensions (blue) & measures (green) within each table

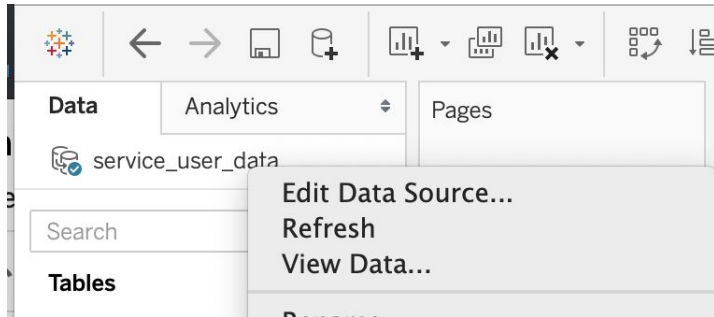Auto-generated number of rows of each table - can use these as a measure

Auto-generated long/lat measures (created if ever have geographic fields)

Data	Analytics	⇕

🗃 ✓ service_user_data.csv (Multiple Connections)

Search 🔍 ▤ ▾

Tables

⌄ ▦ **dates_of_use**
  - 🌐 Country (dates!of!use)
  - 📅 Date Of Visit
  - # Service User Id
  - # *dates_of_use (Count)*

⌄ ▦ **service_user_data.csv**
  - ⌄ 🖧 Country, Postcode
    - 🌐 Country
    - 🌐 Postcode
  - # Id
  - Abc Local Authority
  - =Abc Outcome Change Sign
  - Abc Service
  - # Outcome After
  - # Outcome Before
  - =# Outcome Change
  - # *service_user_data.csv (Count)*

  - Abc *Measure Names*
  - 🌐 *Latitude (generated)*
  - 🌐 *Longitude (generated)*
  - # *Measure Values*

Can view data via a worksheet

Don't need to go back to Data Source

View popup of data view

Visuals - general

Common charts:
- Line
- Bar (stacked)
- Scatter plot
- Pie chart
- Tree map

More about different charts [here](#).
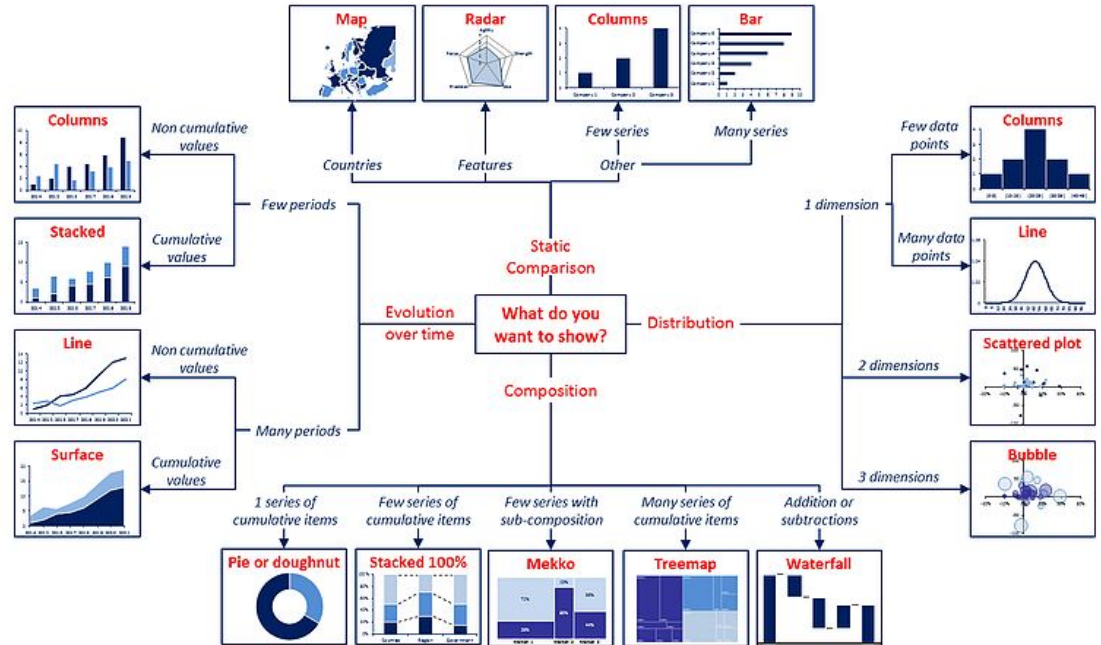
General recommendations on formatting charts [here](#).

Building visuals

The basic structure for every view is made of dimension and measure fields placed on the Rows and Columns shelves, and on different properties in the Marks card.

Chose fields want to visualise:

- Can drag fields into column & row shelves
- Can drag fields into visual area
- Can select the fields in the data pane and see suggested charts in 'Show Me'
- Can double click on the fields in the data pane

Aggregating
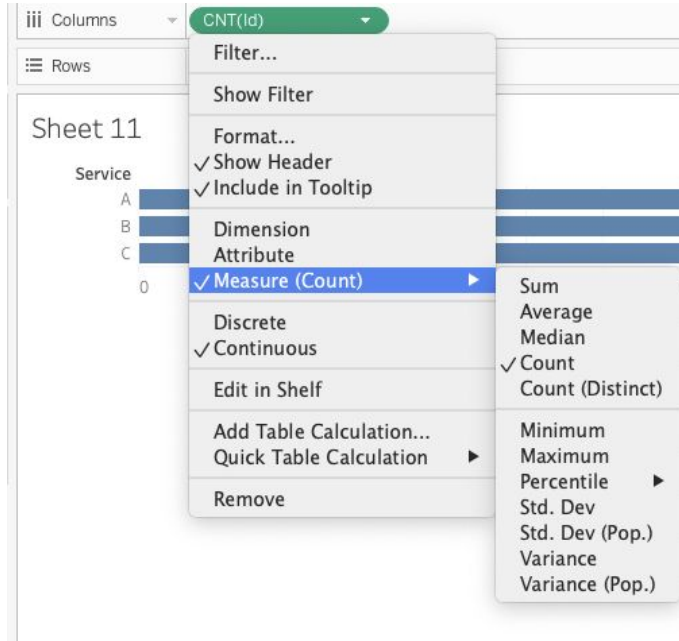
- When adding a dimension or measure may look to display an aggregate value e.g. the count of people or the average score.

- Each will have a default measure when bring into the view

- Can change the aggregation type by right clicking on the field (either in the shelf or marks section)

Types of visuals

Depending on the dimensions & measures chosen to visualise will show which charts may be appropriate.

Greyed out charts are because don't have correct number/combination of dimensions/measures.

See at bottom of pane what the requirements for each type is.

Tableau chart cheat sheet here

Marks
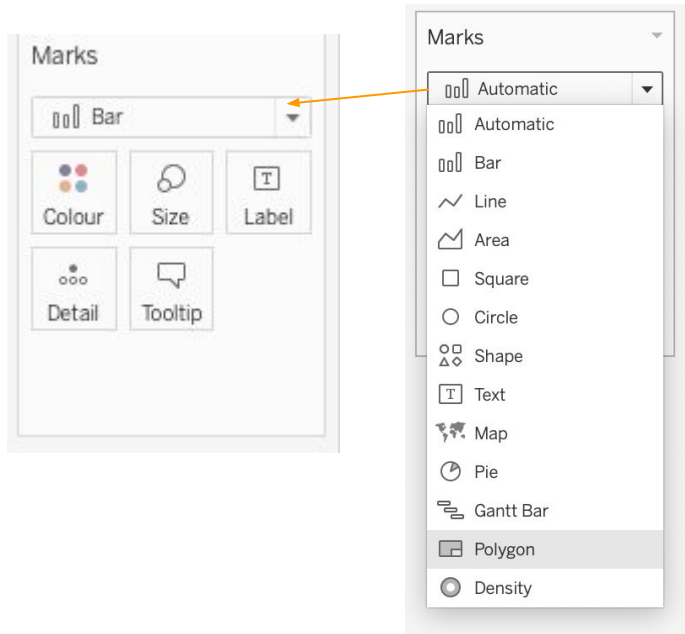
Tableau displays data using marks, where every mark corresponds to a row (or a group of rows)

Can also change the type of marks for the 'Marks' dropdown

Can also control visual via the marks cards (e.g colour, shape, label etc)

- By adding a field onto the card to encode this field using this type of mark

- By clicking on the cards to format the colour, text format etc.

Aesthetics

Formatting

How: Right click on axis -> 'Format'

What:
- Format text size, colour, font, alignment etc.
- Format numeric (decimal points, K/M for thousands/millions, currency, percentage etc.)

Edit axis

How: Right click on axis -> 'Edit axis'

What: Edit axis range, title, tick marks etc.

Reminder - questions we want to answer

1. How do the number of visits differ between services?
2. Where are our users from?
3. How does service usage change over time?
4. How do change in outcomes differ for each service type? ✓

Let's create some visuals…

- Bar chart of service visits
  - *1. How do the number of visits differ between services?*
- Line chart of visits over time split by service type.
  - *3. How does service usage change over time?*

Data across time

A hierarchy is created in dates where can drill down to view on a day/week/month/quarter/year basis.

Can also view as dimension or metric view (explained in diagram).

Treat as categorical/dimension
Will total across all e.g. will total across every Jan in data

Treat as continuous/metric
Will split e.g. will show count at January in each year in data
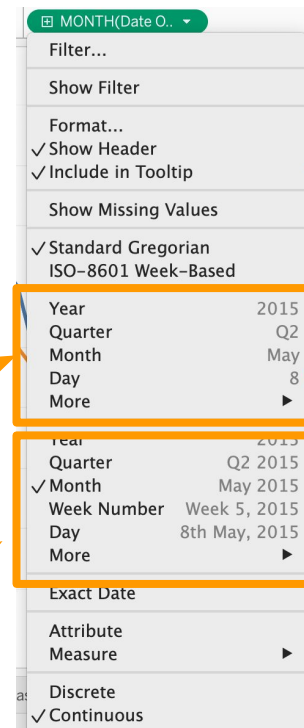
Filtering

Highlight vs filter

- Move dimension/measure into the filters box
- Right click and can show as filter and/or highlighter

Filter

- Can be used for creator to subset the data in visual
- Can be used for dashboard user to be able to interact & filter data.
- Combo of both

Highlight

- A legend works as a legend
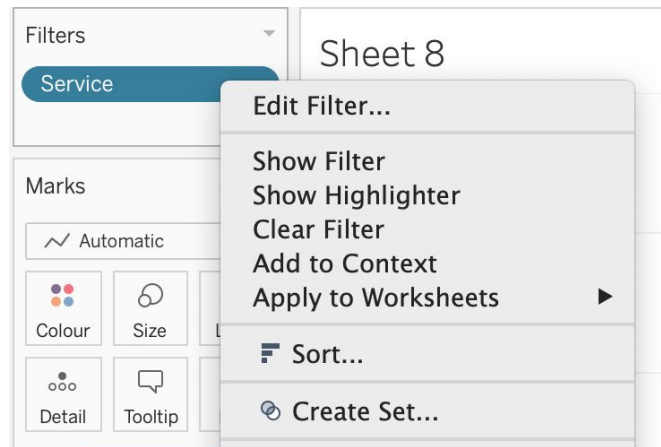
Format - filters

Formatting e.g. text size, font etc.

Customise e.g. 'Show All' option, 'Search' option

Different views of filter (dropdown, list, slider) and whether can select more than 1 value in filter at a time

Action (Country,Local Authority)

Edit Filter...
Remove Filter
Apply to Worksheets ▶

Format Filter and Set Controls...
Customise ▶
✓ Show Title
Edit Title...

Single Value (list) ◉○
Single Value (dropdown)
Single Value (slider) ○
✓ Multiple Values (list) ☑☑
Multiple Values (dropdown)

Only Relevant Values
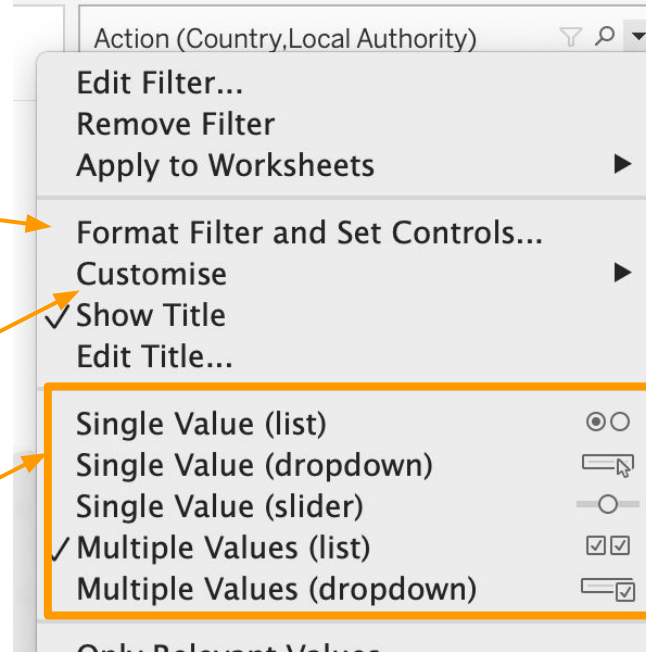
Let's add a filter...

1. Add a filter that allows the user to filter based on '*Date Of Visit*' in the line chart visual.
2. Add a filter that allows selection of '*Service*' in one of the visuals.
3. Add a filter that allows selection of '*Outcome change sign*' in the outcome change visual.

Colour-blindness

- The inability of your audience to distinguish colour is a problem if in any visualisations different groups distinguished by colour.
- About 4-5% of the UK population is colour-blind (about 3 million people) so worth considering if your dashboard is to be used publicly.
- Tips on choosing colour-blind friendly palette here.
- Tableau has a built-in colorblind-friendly palette:
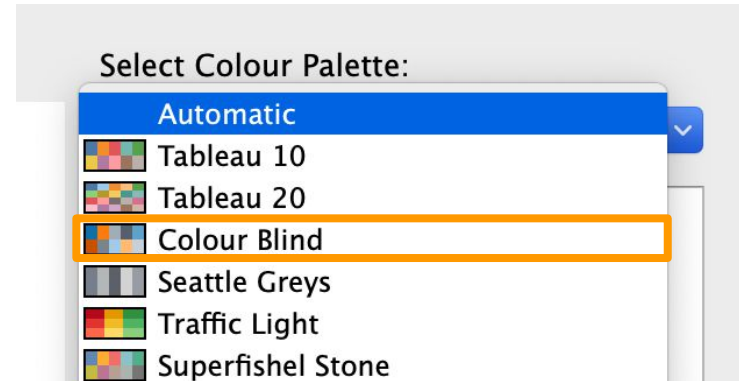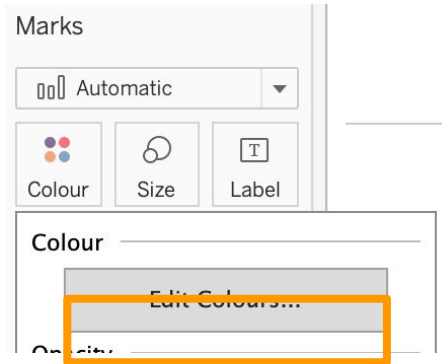
Reminder - questions we want to answer

1. How do the number of visits differ between services? ✅
2. Where are our users from?
3. How does service usage change over time? ✅
4. How do change in outcomes differ for each service type? ✅

Visuals - maps

Maps

- Only use map visual if need the geographic element
- A lot of time isn't necessary but can be tempting because of the geographic element of the data.

Count of Free School Meals by DataZone - map vs. bar chart
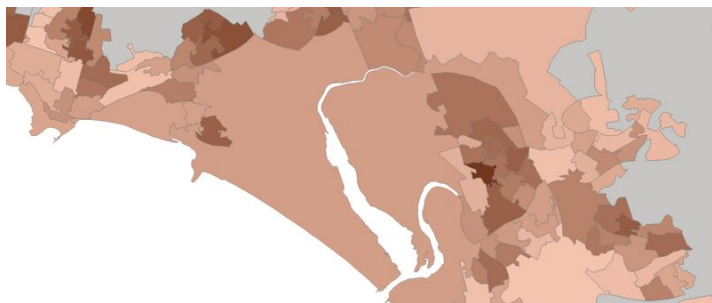
Darker the colour the higher count of meals.

Data available via North Ayrshire Council Open Data Portal - under Government Open Data License v0.3.
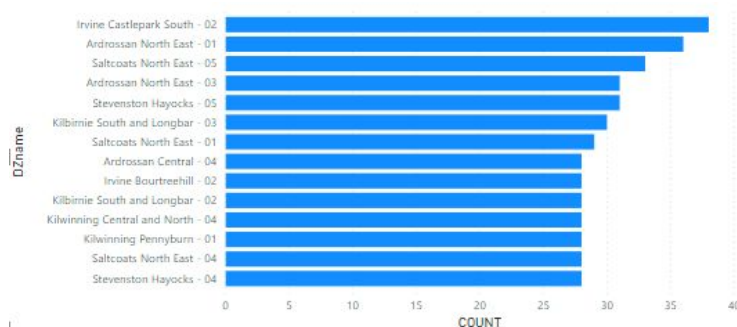
Different kinds of maps

- **Point map** - points i.e. specific longitude/latitude e.g. postcode or centre of area.
- **Filled map** - enclosed area (polygon)

Postcode map
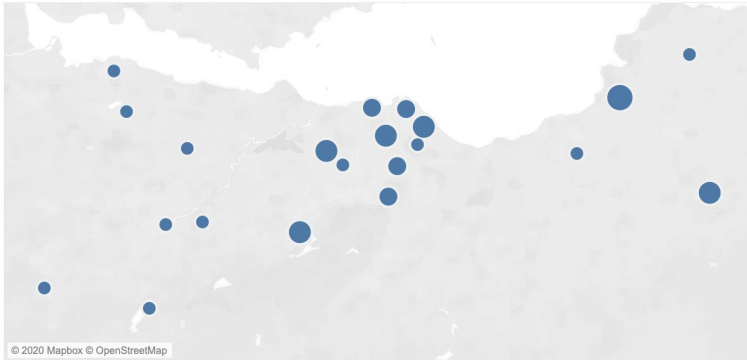
Size of bubble represents a measure (count of users)

LA map

Colour of area represents a measure (count of users)

Let's create a map...

1. Create a map of users by outward postcode - have colour of the area to reflect the number of users.

Shape file

Decile
1.000   10.000

- Type of spatial file.
- May have custom defined areas e.g. Scottish Government Index of Multiple Deprivation datazones.

Try in your own time

- How to video for custom shape files here
- SIMD shapefile (link near bottom of page) here
- Example dashboard made with SIMD shapefile here
  - colour of DataZone indicates SIMD Decile
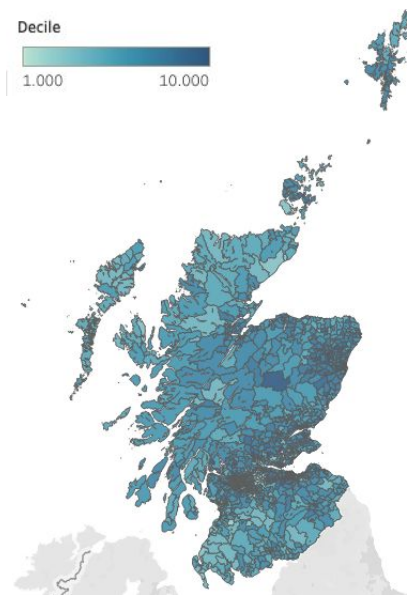
Dashboard

Creating a dashboard

Drag sheets into dashboards

Brings filters/highlighters/legends etc too.

Can drag sheets into multiple dashboards
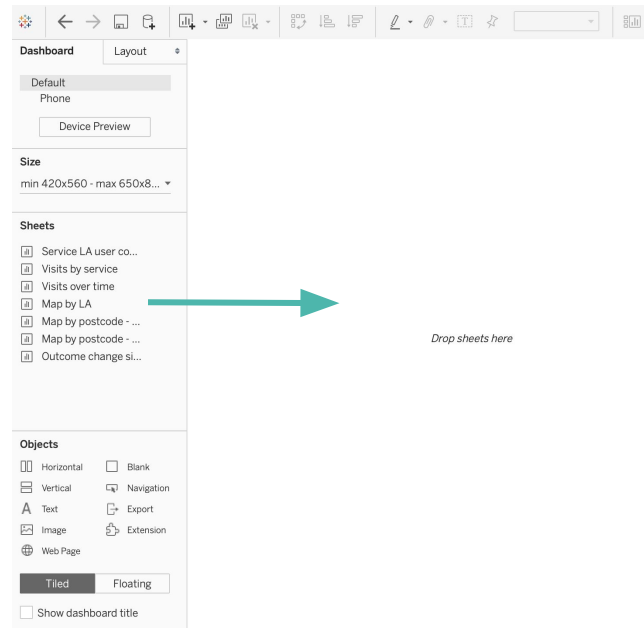
Additional features

Insert button to navigate between dashboards

Insert button to export (can select what kind of file to export to)

Text box

Upload an image (e.g. organisation logo)

Embed a webpage

Show/hide title

Objects

Horizontal		Blank	
Vertical		Navigation	
Text		Export	
Image		Extension	
Web Page			

Tiled | Floating

☑ Show dashboard title

Floating layout - objects have fixed size and position.

Tiled layout - objects adjust in size based on objects around them.

Summary tiles

Can add high level numbers to your dashboard, and can sometimes help to add icons to aid with the visualisation of the numbers.

This blog explains how to make summary tiles here.

An example of 2 summary tiles could have added to our dashboard following the steps in the link above:


Count of visits

24,876

Count of service users

50
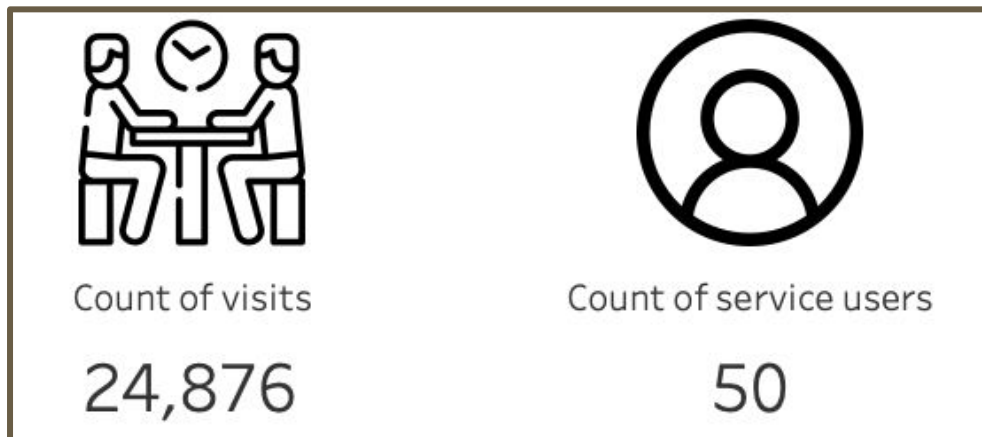
Filter - what does it apply to?
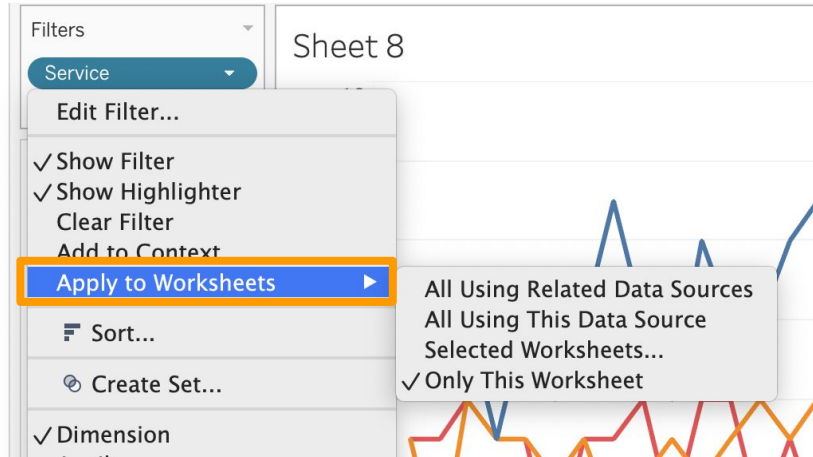
- Can specify if want filter to only apply to the worksheet visual. When move into dashboard will only apply to this visual.

- Can specify want filter to apply to any visuals using the source of data which filter is based on.

Interactions between visuals

- Can use visuals as filters for other visuals (or full dashboard)
- Default is that visuals not interacting so need to specify if want this functionality
- Can use shortcuts on the visual to set as filter for full dashboard
- If want to be more specific and customise interaction

Both set the visual to be a filter

Can customise interactions
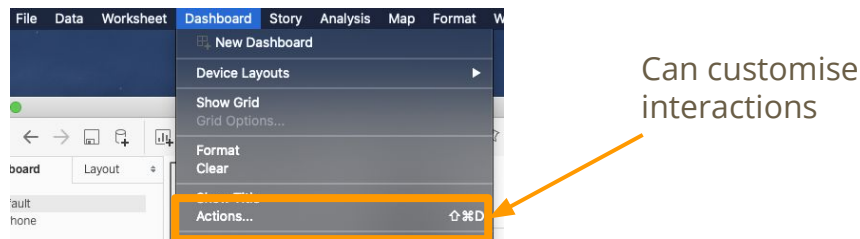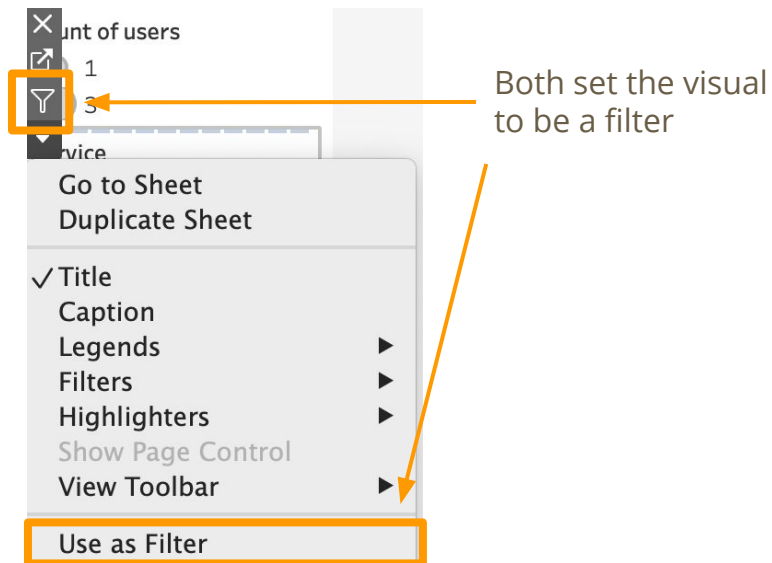
Exporting/sharing view

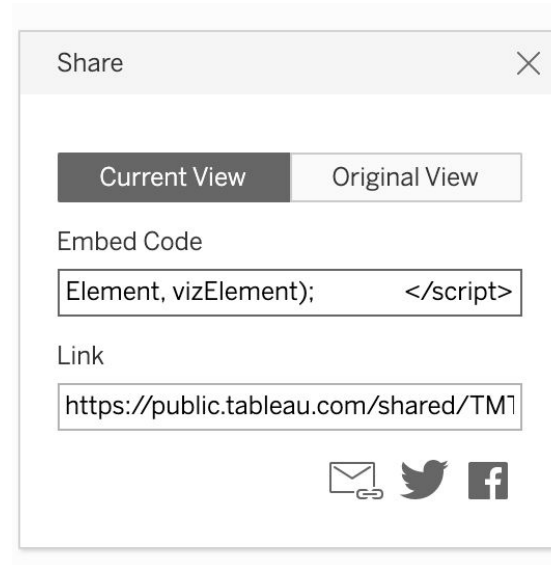# Static view for reports

Export to Tableau Public -> Open Worksheet -> Bottom right hand corner
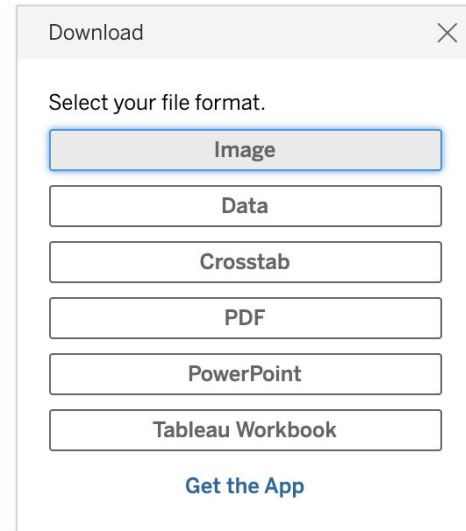
Share link or embed view

Export to Tableau Public -> Open Worksheet -> Bottom right hand corner

You can embed interactive Tableau views and dashboards into web pages, blogs, wiki pages, web applications, and intranet portals.
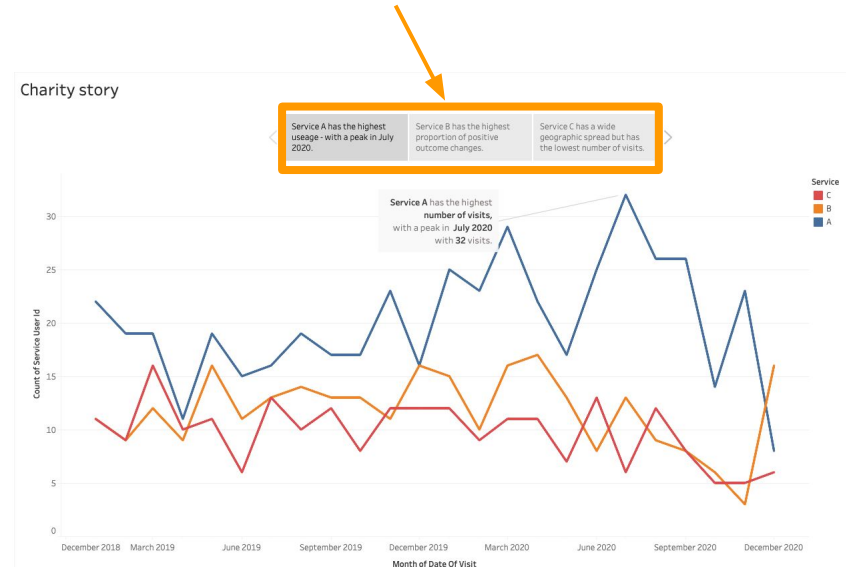
More info here.

Story

Story

- A sequence of visualisations to convey particular messages and draw attention to particular points in the data.
- Can annotate and set particular filters/highlight to show a message.
- Example story based on report we built here.

Can create messaging to highlight insights for each visual in the story

Tips for data viz & dashboards

Tips

General data viz tips

- No 3D charts - they can skew perception of the visualisation.
- Keep chart and graph headers simple and to the point.
- Make sure have labels on graph axes - including units!
- Don't overdo the colours - each colour should have a purpose as can be distracting otherwise.
- Keep consistent with font type and size.
- Be consistent with colours throughout dashboard to build association (e.g. blue for service A, green service B etc.).
- Be careful with axes on graphs - usually best to start at 0 so not misleading.
- If showing numbers with decimal points, round to 1 or 2 decimal points depending on the level of detailed required.
- Every graph should have a purpose - people get saturated quickly with too much info. What is the objective of your graph and how can it create value for your organisation?
- Often bar charts can be useful to order of highest to lowest (unless some other ordering is important - such as alphabetical).
- Can use icons to add to the aesthetics (websites such as Flaticon great resource for these)

Dashboard tips

- Simple is better.
- Put the most important information in the top left-corner.
- Don't highlight everything, or nothing will stand out.

Resources

Useful resources for learning Tableau

Free online courses

Full tutorials and short quick fix videos

Tableau learning

Tableau knowledge base - step by step help/instructions by Tableau

Tableau Help - step by step help/instructions by Tableau

Tableau Community Forum - a help forum where can post questions and other Tableau users answer

Can click here for search results solely from community forum

Data to play with...

- UK Data Service [here](#)
- Scot Gov. SIMD data [here](#)
- Create fake data at Mockaroo.com [here](#)
- Scottish Gov. Open data [here](#)
- UK Gov. Open data [here](#)

Thank you

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Scottish Charity Search app: here