



2022 USAID Annual MEL Conference

GIS/ Data Visualization

Agenda

Agenda	
Time	Topic
0.00 – 5 Min	Welcome and Introduction
5 Min – 25 Min	Introduction to GIS / GIS data type <ul style="list-style-type: none">- GIS component- Data type- M&E and GIS
25 Min – 35 Min	First activity
35 Min – 50 Min	GIS data visualization <ul style="list-style-type: none">- Motivations- Geospatial data visualization- Methodology- GIS Dashboards example
50 Min - 55 Min	Second activity
55 Min - 60 Min	Recap and closeout

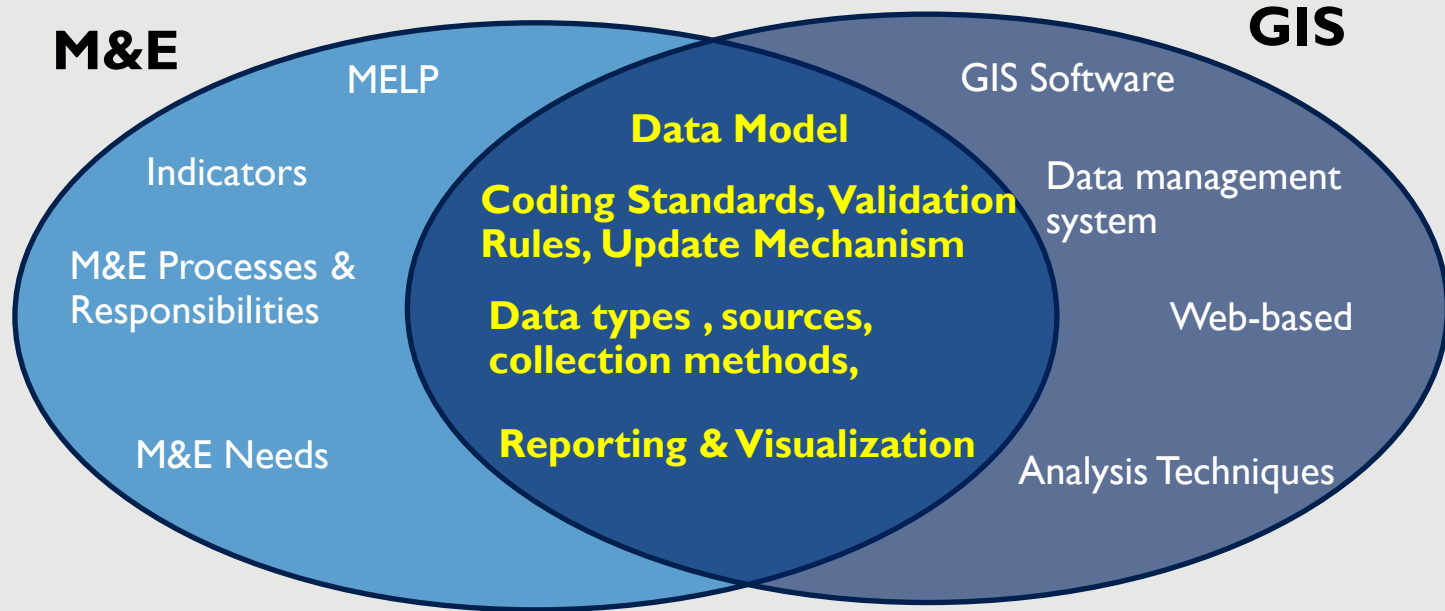
Introductions

Please introduce yourself to your colleagues

- Name / workplace
- What motivated you to join this session today?



Component and Functions



GIS-M&E System

An Integrated Map-Based Monitoring and Evaluation System



M&E

- Focused – measuring changes and outcomes occurring over time



GIS

- Is spatially oriented – identifying where the outcomes are occurring.

Data road map

An Information System

Apply lots of analysis models

To any geographical data set

Visualized as a map, or table, or chart



DATA



INFORMATION

Lets start the story

John Snow, London Cholera Map, 1854



Understanding GIS

- A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data.
- GIS is a system that integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information
- specific data types, data access methods and spatial data analysis methods, visualization of results
- GIS gives better picture and understanding of the real-world
- Organizations use GIS to solve problems and improve processes; spatial planning

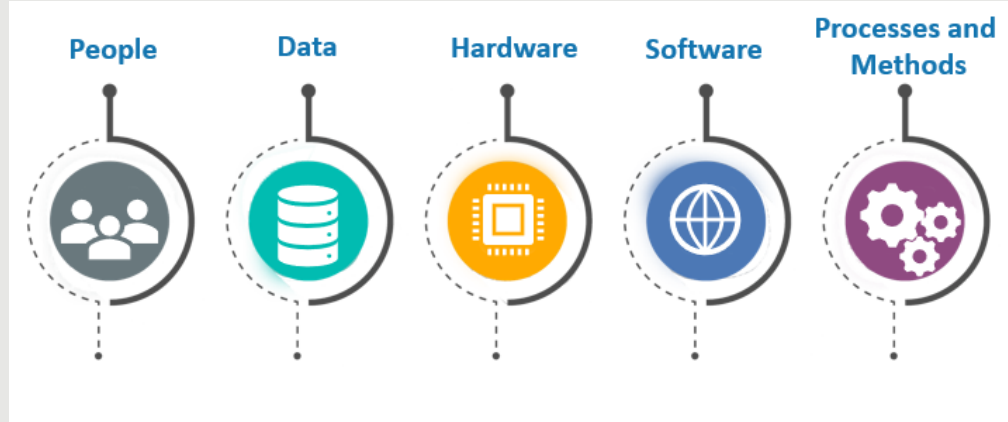
Geospatial Data – overview

- **Spatial /Geospatial data** is raw data distinguished by the presence of a geographic link; connected to a known place on the earth
- Represent objects or phenomena with specific location in space
- Geospatial data is geographically/spatially referenced in some consistent manner, such as by means of latitude and longitude, a national coordinate system, postal codes, or electoral area
- **Geographic information/Geo-information** is a specific type of information resulting from interpretation of spatial data/geospatial data

Components of GIS - General

GIS integrates the five key components

- People
- Data
- GIS software
- Hardware
- Policy and procedures / methods of implementation

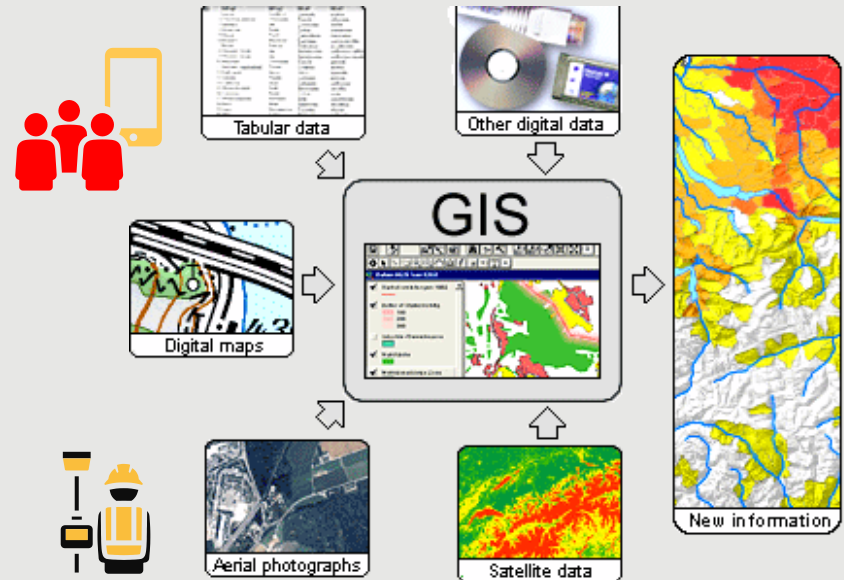


Components of GIS - Data

- **Data:** is important part of a GIS
- **The most expensive** component of a GIS.
 - Due to the high costs of data acquisition, especially using remotely sensing earth observation satellites.
- **Building** the database also takes a lot of time, and large amount of money.
- Implementing a Geospatial database requires planning and choosing the right information base for the particular application of an organization/business.

Geospatial Data Sources

- GIS handles different data from different sources to produce new information
- Geospatial data acquired using different sources
- **Common data sources:**
 - Paper maps,
 - Existing digital data.
 - Survey App.
 - Aerial photographs
 - GPS (Global Positioning Systems) , GNSS.
 - Surveying instruments, e.g. Total Station
 - Imageries from Remote-sensing satellites/ Earth observation satellites.
 - Laser Scanners, usually mounted in Aircrafts.
 - Mobile Mapping.
 - Drones and UAVs.





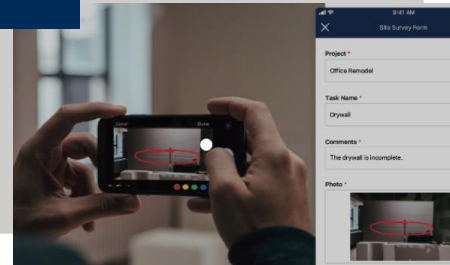
Acquee • Awaaz.de Surveys • CommCare • COMMormobile • CommTrack • CPro • CyberTracker • DeLighta • DevInfo • DevResults • DHIS 2 • doForms • droidSURVEY • Enketo Smart Paper • EpiCollect • FrontlineSMS • Fulcrum • GeoPoll • Humanitarian Data Toolkit • iFormBuilder • Imogene • iSurvey • KoBo Toolbox • Last Mile Mobile Solutions (LMMS) • Magpi • Majella • mFieldwork • Mobenzi Researcher • Nokia Data Gathering • Oasis Mobile • ODK • Ona • OpenMRS • openXdata • Pendragon • Poimapper • PSI Mobile - Fusion • RapidPro • RapidSMS • RDMS Collect • Smap • Souktel • Survey CTO • Telerivet • Text to Change • TextIt • Ushahidi • ViewWorld • VirtualCohort • VOTO Mobile • Voxiva • Wepi • SurveyMonkey • Google Forms • Tangerine • FLOW • LimeSurvey • Survey 123 • Smartsheet



KoBoToolbox



Google Forms



Data type - GIS

- **Non-Spatial Data. (Attributes categories)**

Qualitative

- a. Nominal attribute data
- b. Binary attribute data.
- c. Ordinal attribute data.

Quantitative

- a) Numeric
- b) Discrete
- c) Continuous

- **Spatial Data.**

1. Vector
2. Raster

Qualitative Attributes

A- Nominal Attributes – related to names

The values of a Nominal attribute are names of things, some kind of symbols.

Attribute	Values
Colours	Black, Brown, White
Categorical Data	Lecturer, Professor, Assistant Professor

Where do you live?

1- City

2- Town

3- Village

B- Binary Attributes

binary data has only 2 values/states.

For Example yes or no, affected or unaffected, true or false.

Attribute	Values
Gender	Male , Female

Qualitative Attributes

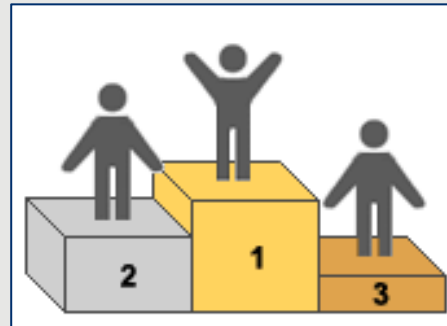
C- Ordinal Attributes

The Ordinal Attributes contains values that have a meaningful sequence or ranking(order), Ordinal values determine position.

Attribute	Values
Risk of flooding	low, medium, high
Grade	A, B , C, D

How satisfied are you with our services?

- Very Unsatisfied – 1
- Unsatisfied – 2
- Neutral – 3
- Satisfied – 4
- Very Satisfied – 5



Nominal scale

It's used to label variables in different classifications and does not imply a quantitative value or order.



How satisfied are you with our services?



Ordinal Scale

It's used to represent non-mathematical ideas such as frequency, satisfaction, happiness, a degree of pain, etc.



USAID
FROM THE AMERICAN PEOPLE

Quantitative Attributes


Numeric attribute

A numeric attribute is quantitative because, it is a measurable quantity, represented in integer or real values. Numerical attributes are of 2 types, **interval**, and **ratio**.

Quantitative Attributes

A- Discrete attribute

Discrete : Discrete data have finite values it can be numerical and can also be in categorical form. These attributes has finite or countably infinite set of values.

$$X = \begin{cases} 0 \\ 1 \end{cases}$$




Attribute - Discrete	Values
Shirt size	32 , 34 , 36 , 38 , 40 , 42 ...
Number of students / Trainees	1 , 2 , ...integer

Quantitative Attributes

B- Continuous attribute

Continuous data have an infinite no of states. Continuous data is of float type. There can be many values between 2 and 3.

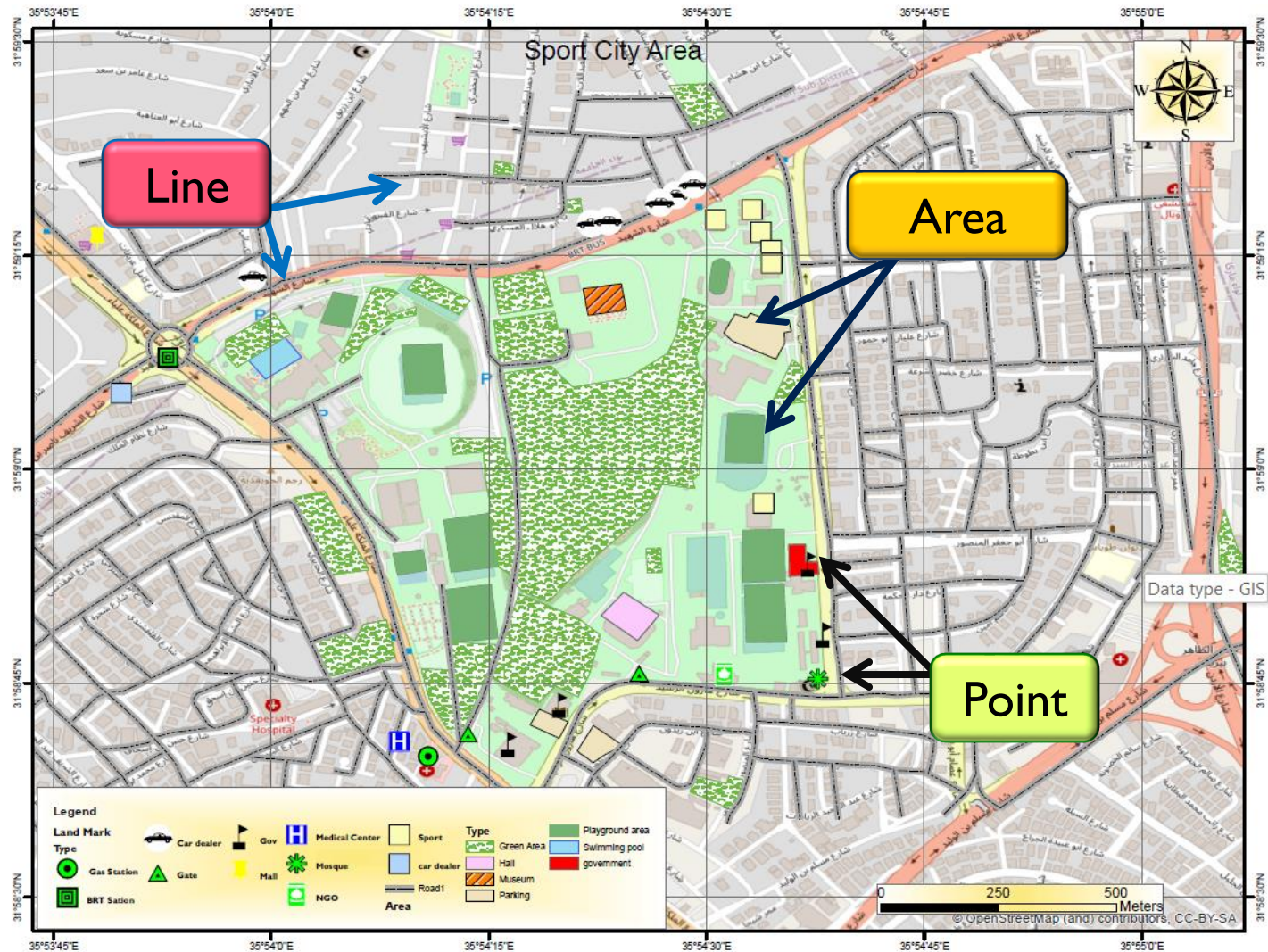
- Temperature
- Rainfall

Attribute	Value
Height	5.4, 6.2 ...etc
weight	50.33etc

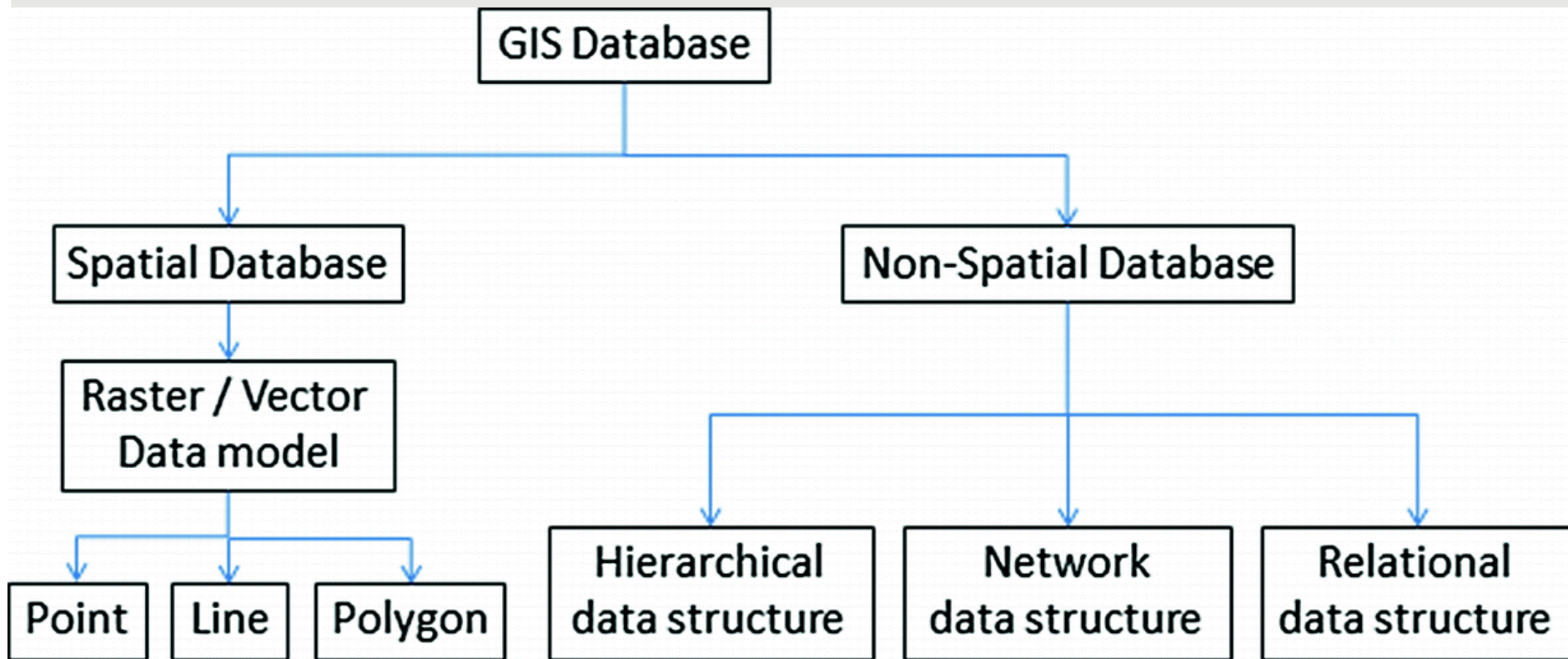
Spatial objects - Geographical phenomena

- **Spatial Data type –**

1. Vector data.
2. Raster Data.



GIS Database



Database Management

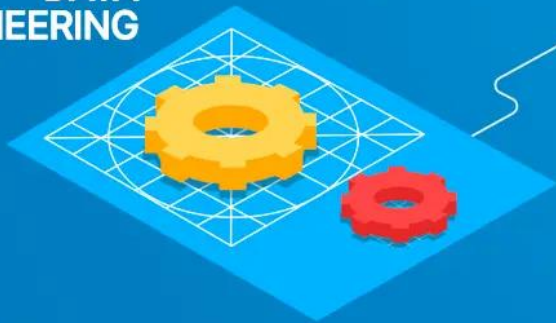
Three types of database management systems

1. Flat file database- stores rows of information as text or binary coded data in text strings
 - Simple but not efficient.
2. Hierarchical- multiple tables stored as separate files, each of which has multiple records and fields. Each table has a hard linked relationship to other tables
 - e.g., Schools, with students, linked by national ID (number).
3. Relational- multiple tables stored as separate files but they are NOT hard-linked.
 - shared fields (columns) become the joining key

**MACHINE
LEARNING**



**DATA
ENGINEERING**



BIG DATA



**SCRIPTING &
AUTOMATION**



**DATA
VISUALIZATION**



Recap - Geospatial Data

- Two important components of geospatial data: **geographic position** and **attributes** or properties
- Geographic position specifies the location of a feature or phenomenon by using a coordinate system (x, y, z)
- Attributes /non spatial data refer to the various properties of the phenomenon or feature
- GIS software use database management systems to handle attribute or non-spatial data
- Provides the link between the geographic position/spatial data and attribute/non-spatial data

Activity (1) – 10 Min

Four Groups (Five each).

- **Group (1)** Education – Schools
- **Group (2)** Water – Dams / Hydrology / Water Rainfall.
- **Group (3)** Health – COVID-19.
- **Group (4)** Refugees.

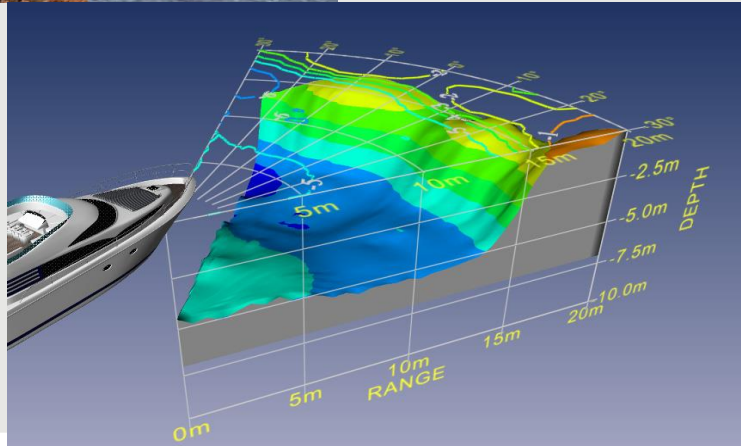
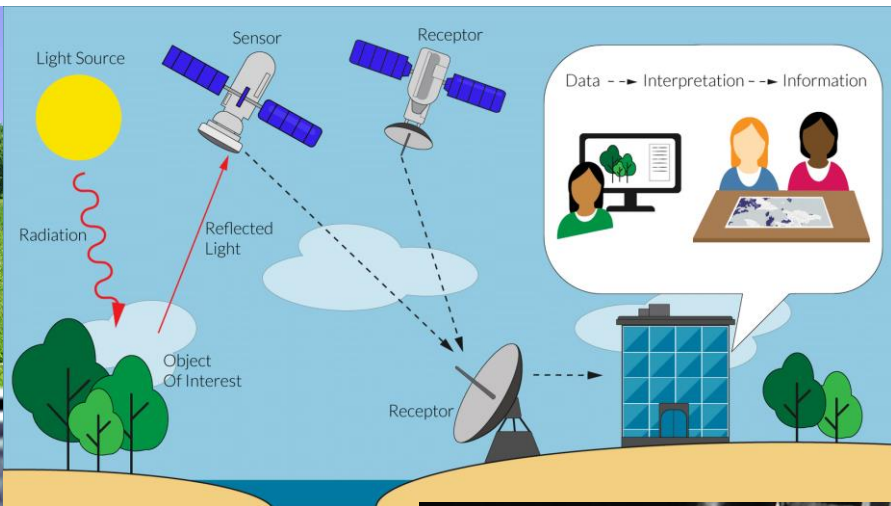
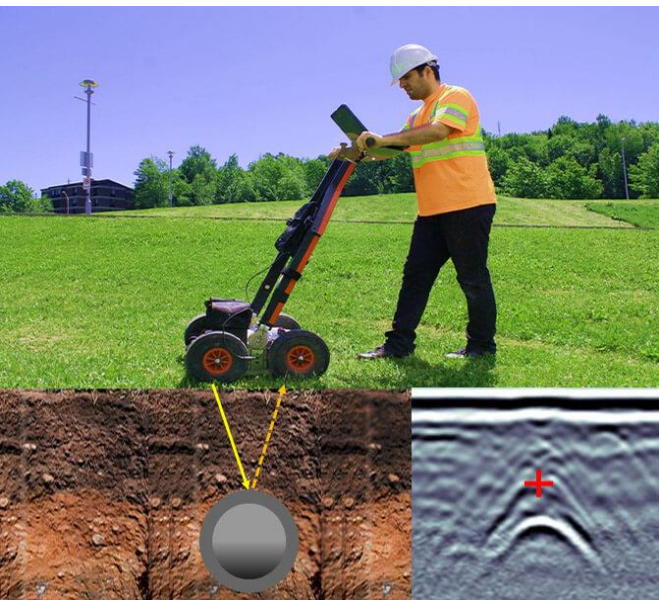
Qualitative data example

Quantitative data example

Present Quantitative Data
(Map , Chart , ...)

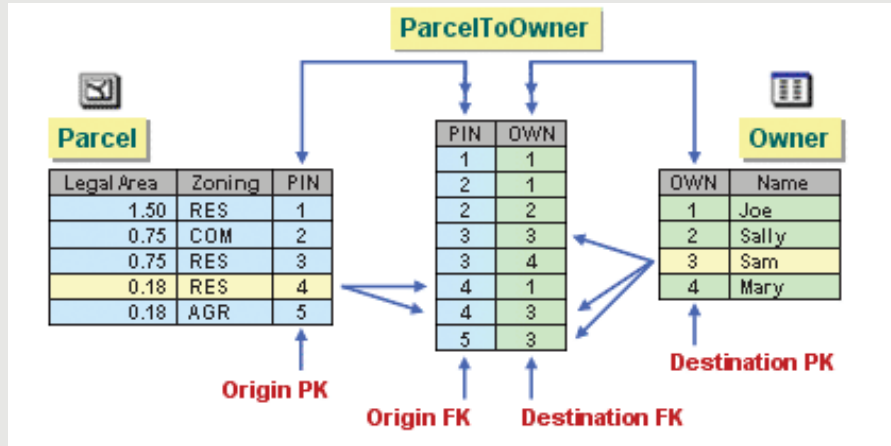
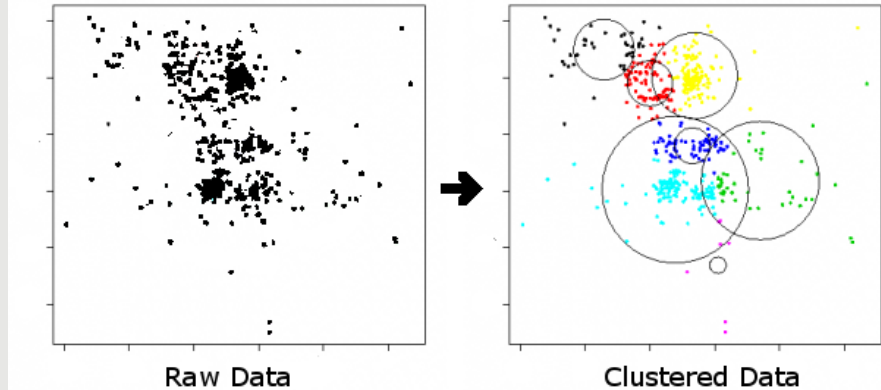
Data visualization





Why visualize information

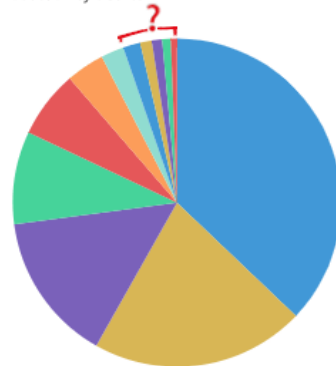
- Analysis / Sense-making Patterns?
- Relationships?
- Possible outcome: hypothesis formation.
- Communication ,The ideal: a self-describing visualization and Provide easy-to understand visual cues to guide viewer to essential message



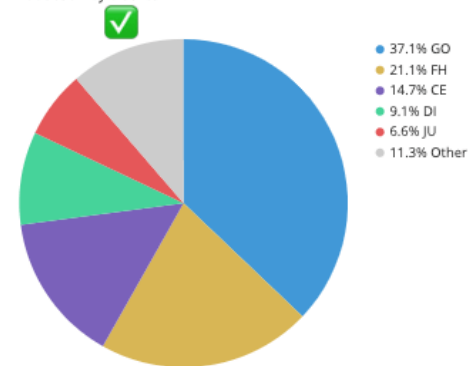
Colors in visualization

- ✓ Very powerful. What does the “stoplight palette” tell you? Red/Yellow/Green?
- ✓ Colors can carry many other meanings and are quick to draw the eye. Is your use of color needed? Is the color helping you highlight something critical?
- ✓ Be aware of colorblindness.
- ✓ Do use a single color to show continuous data.
- ✓ Keep your background a neutral color to avoid confusion.

Production by district

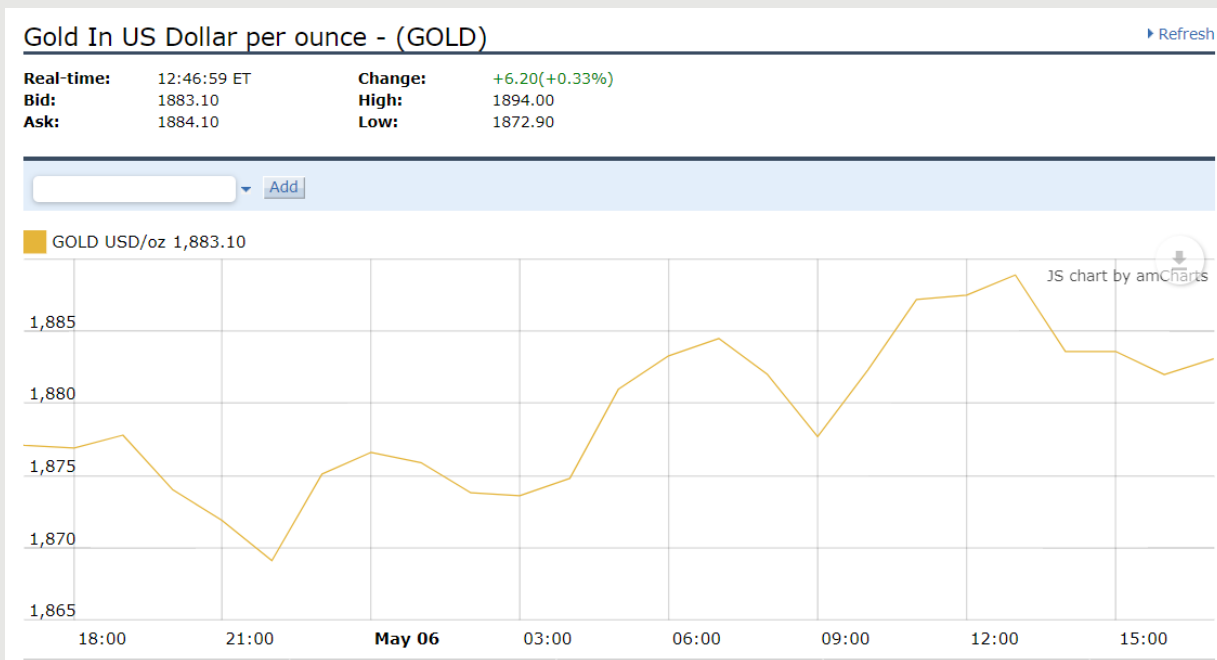


Production by district



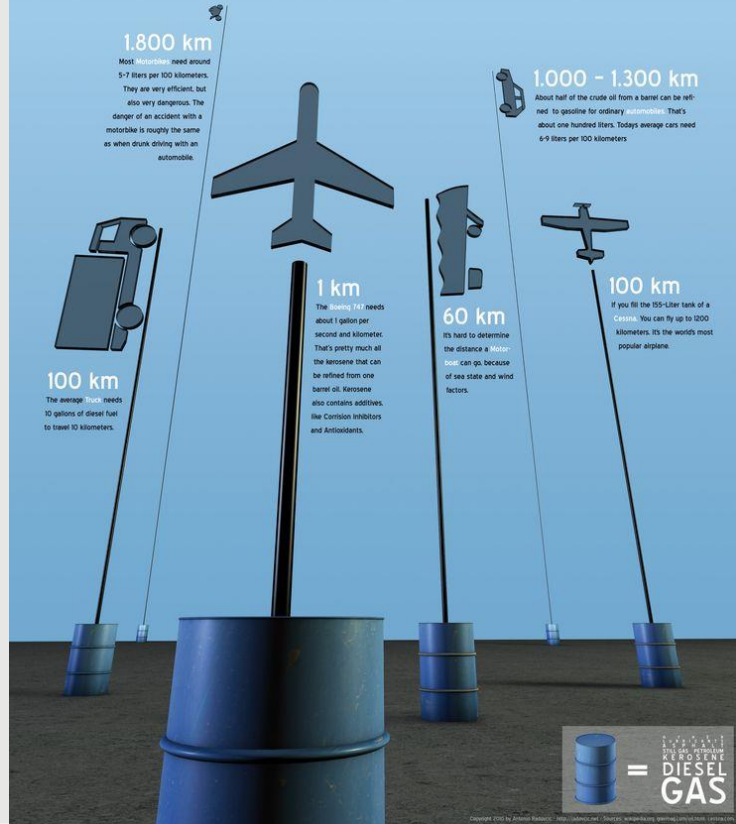
Visualization wisdom

- ✓ Trends: use line charts to show behavior over time.
- ✓ Specific values: tables, bar charts, or lists of values.



What would I do to improve this visualization?

How far can you go with One Barrel Oil?



Choosing effective chart types

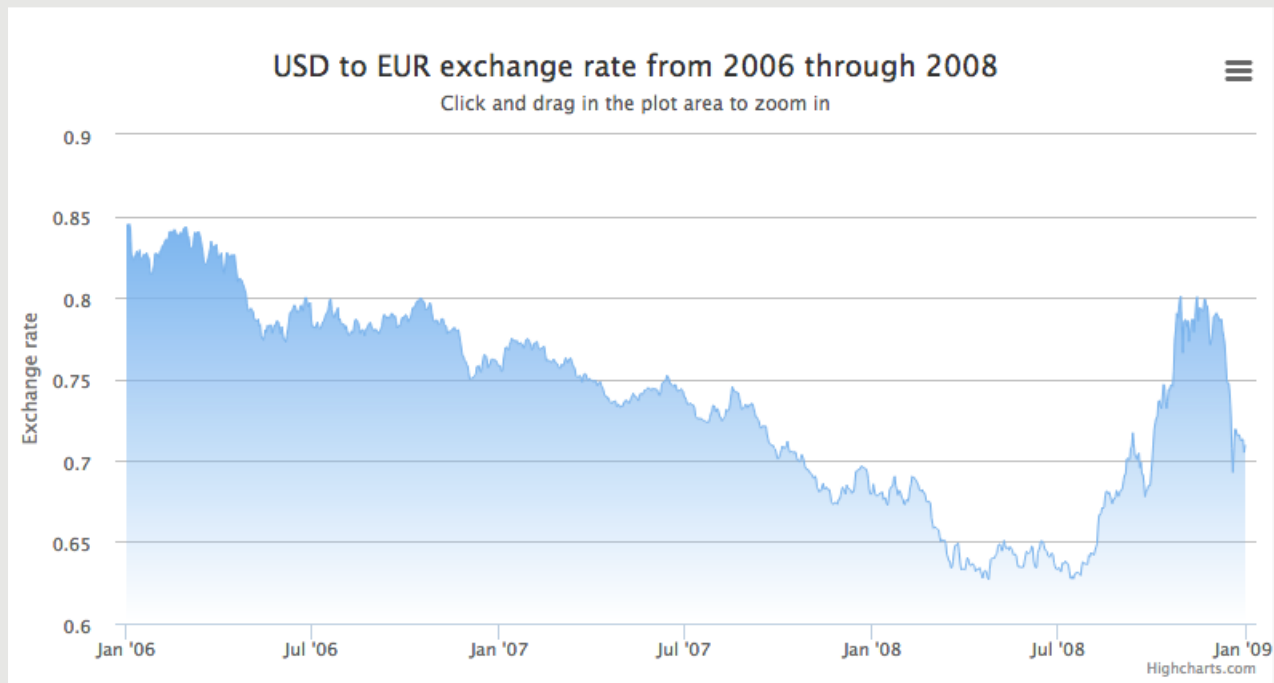


Choosing effective chart types

- Identify the goal of your visualization in terms of its data
- Compare values?
- Show the composition of a phenomenon?
- Show a distribution of values?
- Show trends?
- Show relationships between entities?
- Highlight the location of data elements?

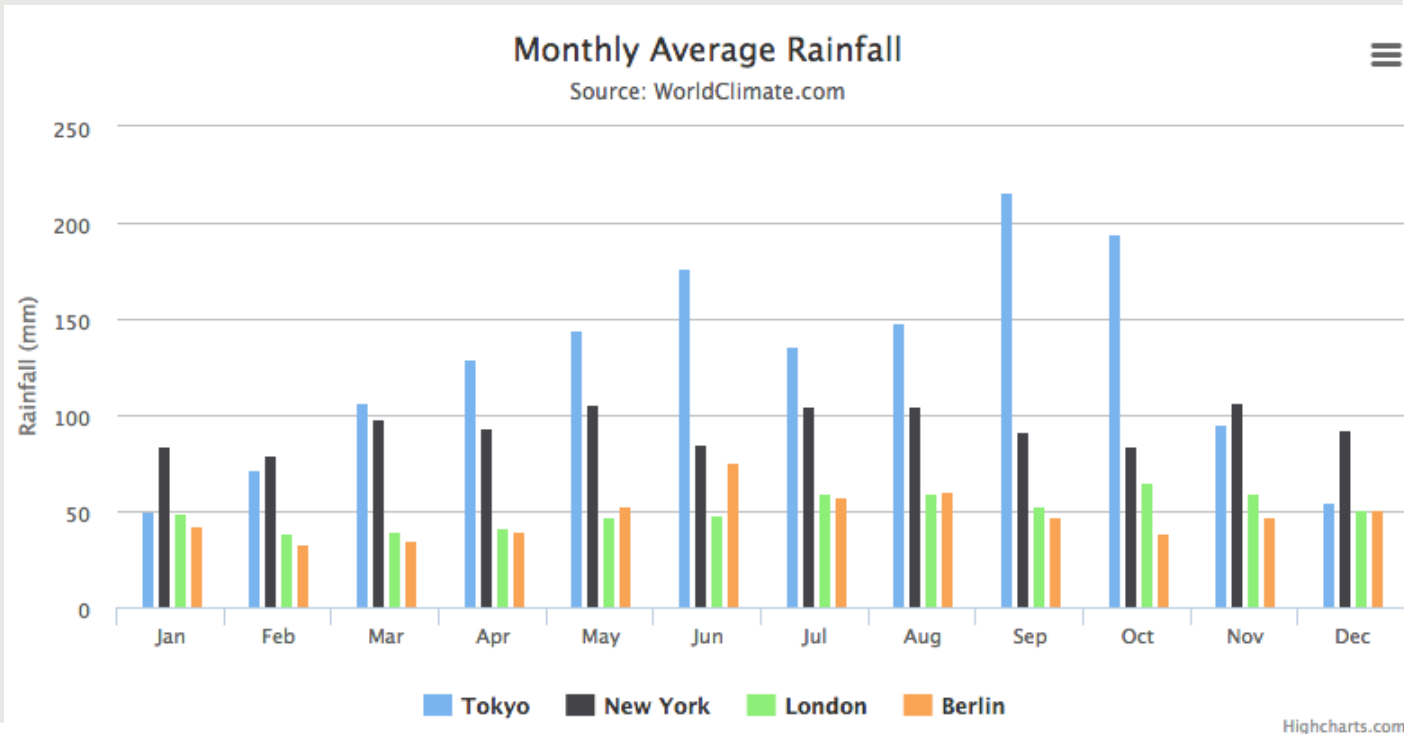
Time series common viz styles

- **Line charts**
- Bar charts



Time series common viz styles

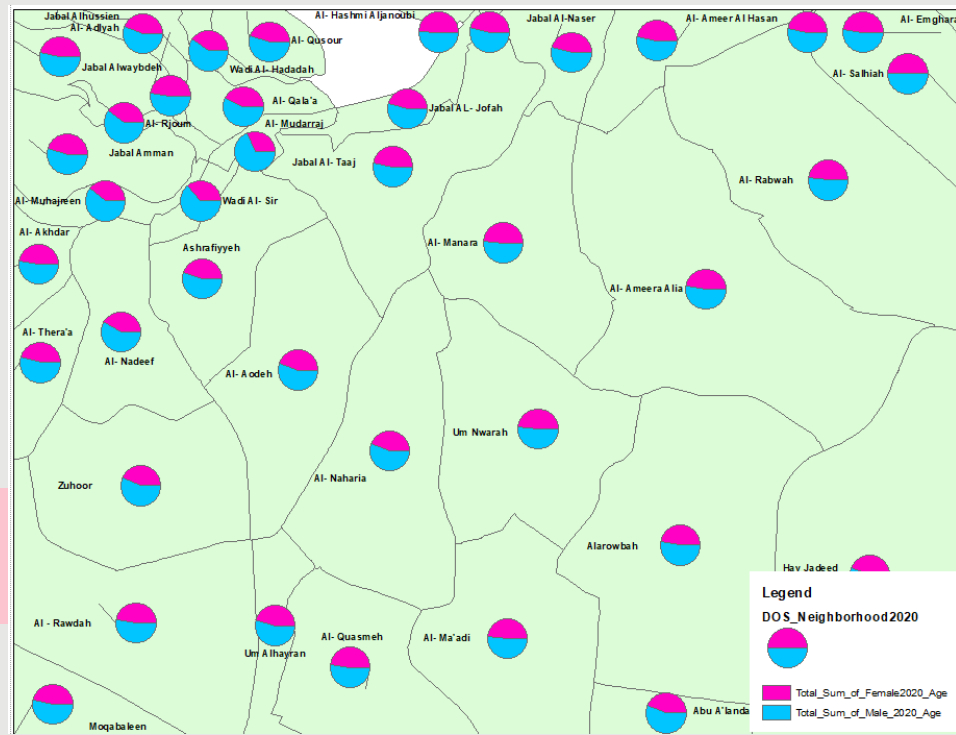
- Line charts
- Bar charts



Geospatial data viz styles

- Proportional/graduated symbol maps
- Choropleth maps
- Heat maps
- Flow maps

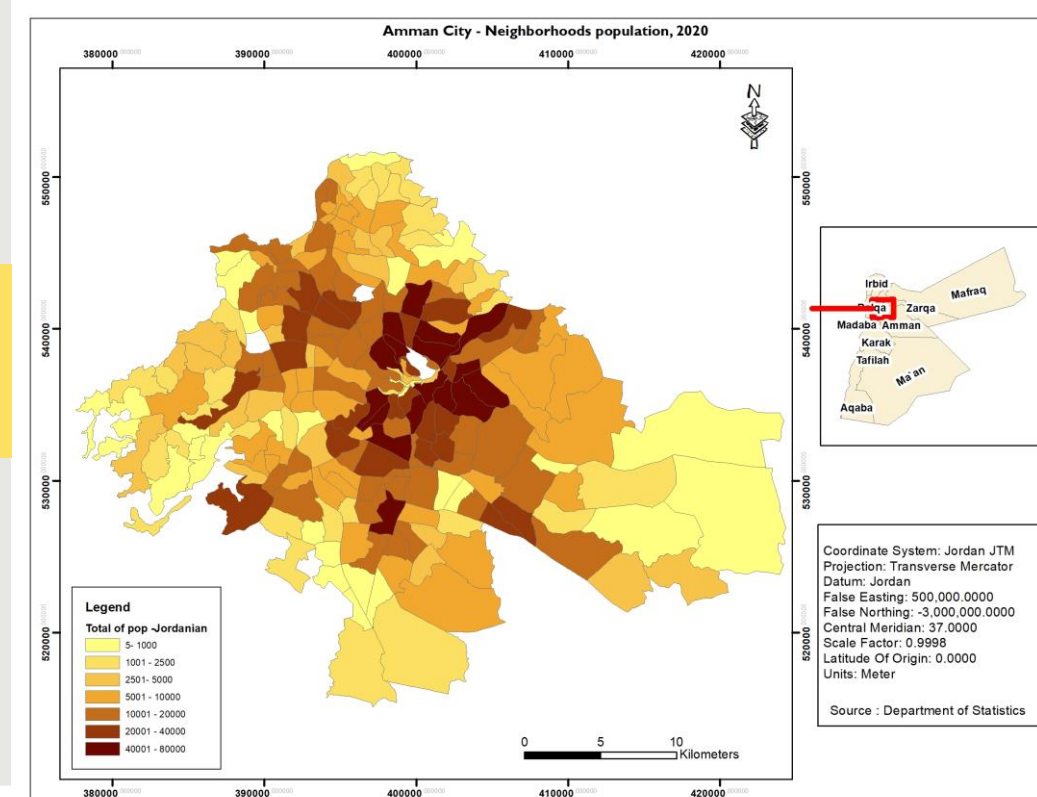
Data can be encoded by shape, size, and/or color.



Geospatial data viz styles

- Proportional/graduated symbol maps
- **Choropleth maps**
- Heat maps
- Flow maps

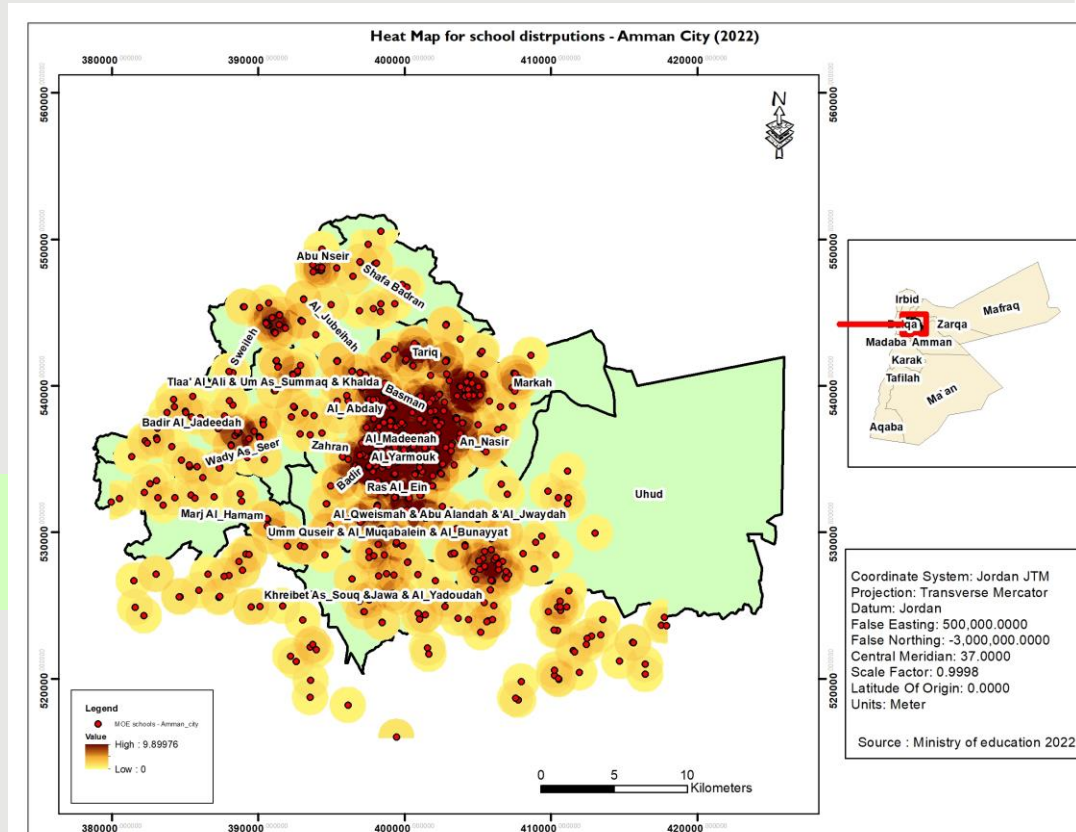
3-7 classes recommended,
more than that and you risk
legibility problems



Geospatial data viz styles

- Proportional/graduated symbol maps
- Choropleth maps
- Heat maps
- Flow maps

Use to display intensity and location of a phenomenon.



Geospatial data viz styles

- Proportional/graduated symbol maps
- Choropleth maps
- Heat maps
- Flow maps

Use to display intensity and location of a phenomenon.



GIS visualization (Maps + Graphs)

نظام متابعة مشاريع المدارس قيد الانشاء (بحسب وزارة الأشغال)

اختر اسم المشروع
اختر اللواء
اختر المحافظة
اختر الأقليم

معلومات المشاريع

اسم المشروع: إنشاء مدارس جديدة من مدارس الاقتصاد المعرفي SKEP المرحلة الثانية المجموعة الثانية
نسبة الانجاز: 100%
تصنيف النشاط: إنشاء مدارس جديدة

اسم المشروع: اضافات صفية لمدرسة مكة الاساسية المختلطة
نسبة الانجاز: 100%
تصنيف النشاط: اضافات صفية

اسم المشروع: اضافات صفية لمدرسة الهاشمية الثانوية المختلطة
نسبة الانجاز: 100%
تصنيف النشاط: اضافات صفية

اسم المشروع: اضافات صفية لمدرسة هند بنت امية الاساسية للبنات
نسبة الانجاز: 100%
تصنيف النشاط: اضافات صفية

اسم المشروع: إنشاء مدرسة عبد الله بن قيس الخارتي الاساسية للبنين
نسبة الانجاز: 100%
تصنيف النشاط: إنشاء مدارس جديدة

اسم المشروع: إنشاء مدرسة اسكان المغاريب الاساسية للبنين
نسبة الانجاز: 100%
تصنيف النشاط: إنشاء مدارس جديدة

اسم المشروع: إنشاء مدرسة الرئيس الاساسية المختلطة

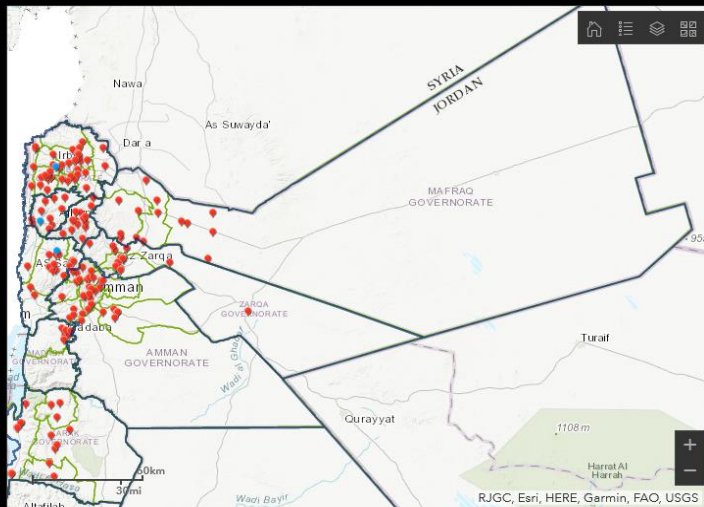
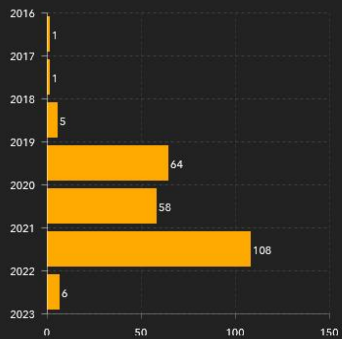
عدد مشاريع البنية الكلي

243

نوع العطاء



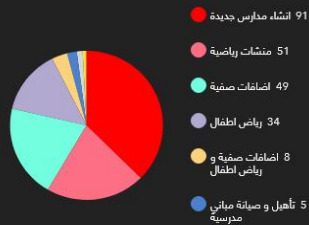
تاريخ بداية المشروع حسب أمر المباشرة - بالسنوات



حالة العطاء



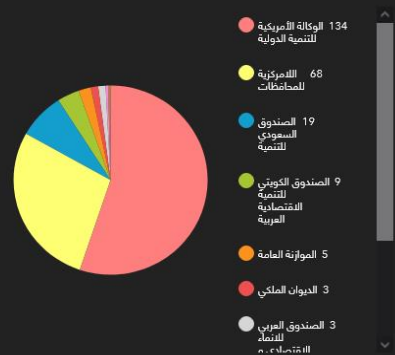
تصنيف القطاع



اجمالي قيمة العطاءات

309,999,936.928

الجهة الممولة





Suitability Analysis

4 Select analysis criteria and refine results.

+ Add criteria

Reset weighting

☐ Summarize layer attribute☐ Distance to nearest point ①☒ Risk_regions

Weight 10%

Fewer options

Influence ☐ Positive ☒ Inverse ①

Threshold (Optional)

0 0

Choose how point layer contributes to analysis

☒ Count of points☐ Summarize layer attribute☐ Distance to nearest point ①

Save criteria list

▼ Refine results

Show locations only



Ranking color



Filter

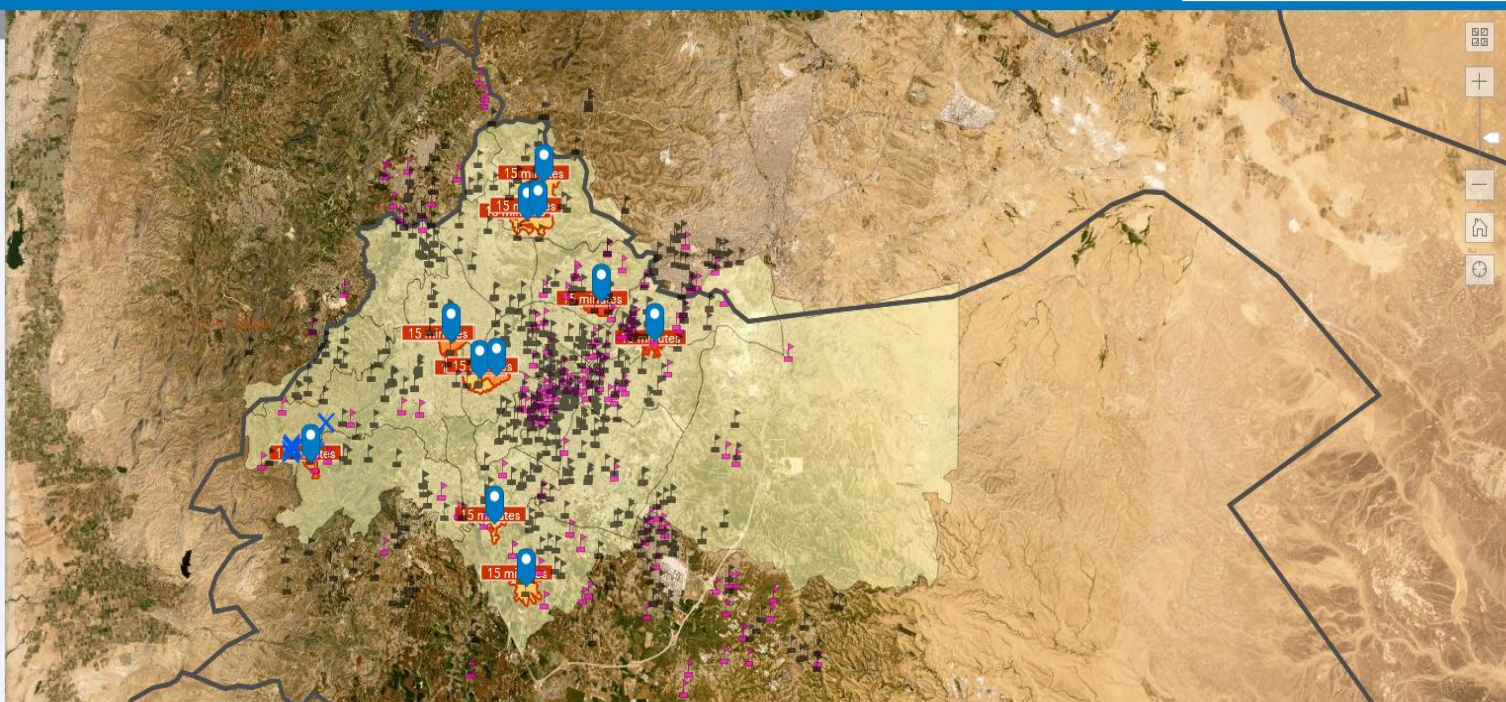


Back

Export

Next

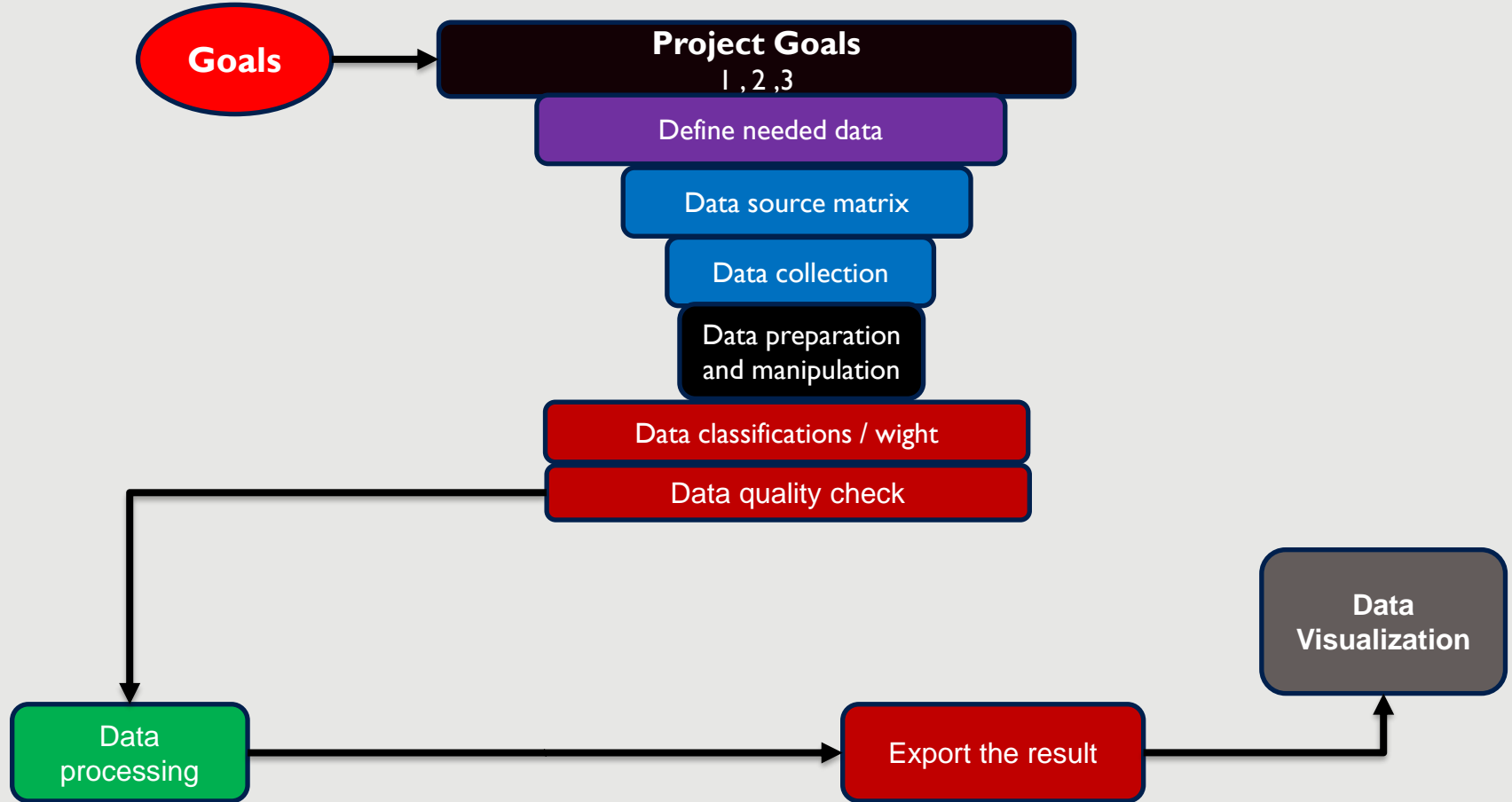
Mail



Suitability Analysis Results

Site	15 minutes	Rank	Final score	Area			Total_5_9			Total_10_14			Total_15_17		
				Value	Score	Weighted score	Value	Score	Weighted score	Value	Score	Weighted score	Value	Score	Weighted score
No 4	15 minutes	1	0.68	8,257	0.64	0.10	5,799	1.00	0.15	5,533	1.00	0.15	3,023	1.00	0.0
No 3	15 minutes	2	0.63	5,428	0.41	0.06	2,282	0.37	0.06	2,109	0.35	0.05	1,230	0.38	0.0
No 11	15 minutes	3	0.58	10,836	0.86	0.13	3,973	0.67	0.10	3,890	0.69	0.10	2,302	0.75	0.0

Summary



Tools

Tools Data cleaning

- Excel / Google Sheets
- Open Refine
- FME Desktop

Visualization

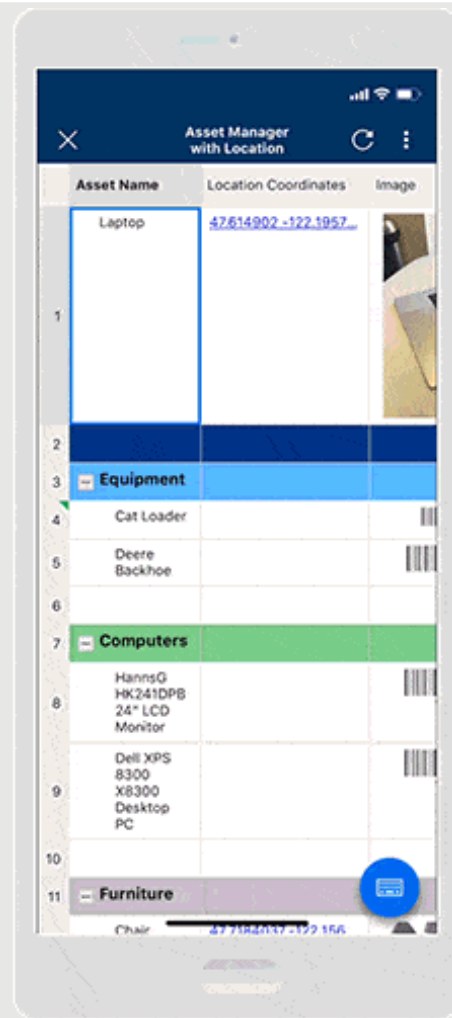
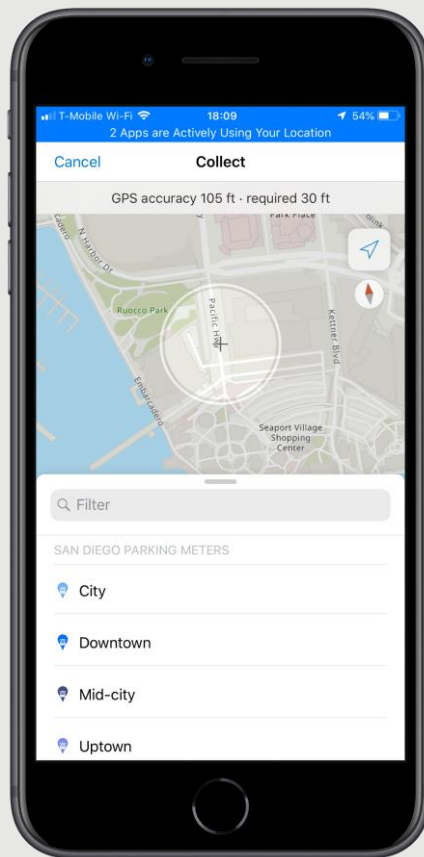
- Google Data Studio
- Tableau
- MS PowerBI
- ESRI ArcGIS Dashboard.
- Smart-Sheet.
- KOBOToolbox

Activity (2) – 15 Min

Application

KOBO Toolbox

<https://kf.kobotoolbox.org/#/forms>





GIS_Layer

Overview

Data

Visualization

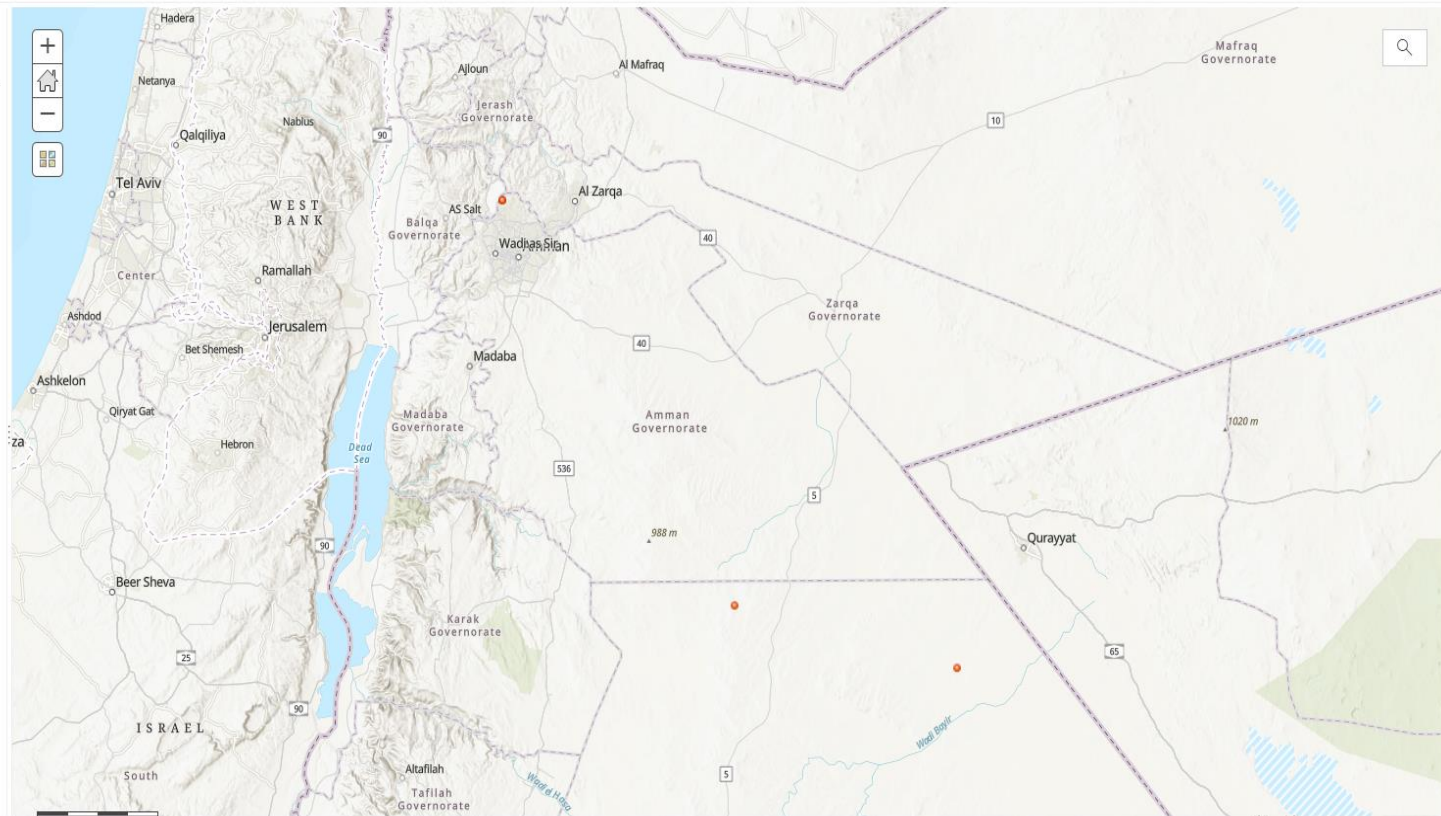
Usage

Settings

Save Layer

Save As New Layer

Change the layer's default style, filter, pop-ups and labels.



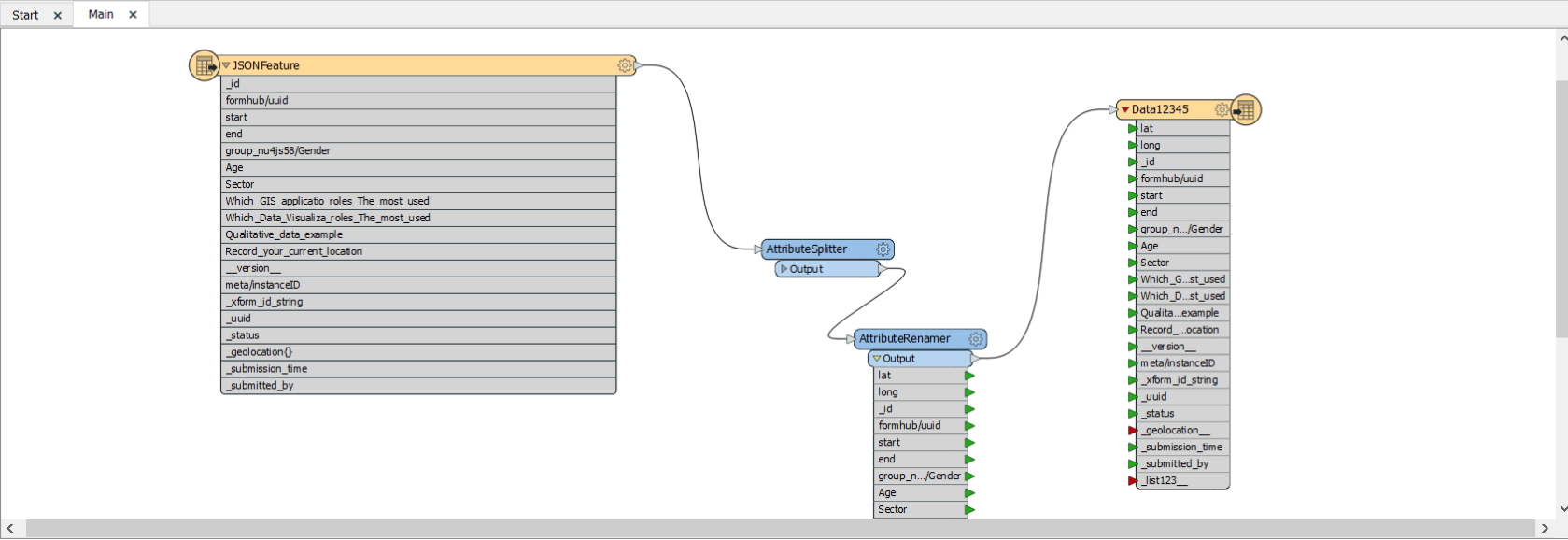


Navigators

- 982691?format=j...
- <not set> [ARCGI...
- Transformers (2)
- Bookmarks
- User Parameters (...)
- Published Par...
- Private Param...
- FME Server Pa...
- Web Connections ...

Transformer Gallery

- All (497)
- Categorized
- Embedded Transfor...
- FME Hub
- Recent (10)
- Search Results



Visual Preview



To view data:

- Run with caching enabled and select a canvas object
- Click **View source data**
- Drop files here

Feature Information

Translation Log

0 Errors 0 Warnings Information

Search

Parameter... Transformer...

For more reading

- **Whitepaper from Tableau:**
<https://www.tableau.com/learn/whitepapers/which-chart-or-graph-is-right-for-you>
- **Hubspot's take:**
<https://blog.hubspot.com/marketing/types-of-graphs-for-data-visualization>
- **ESRI ArcGIS Dashboards:**
<https://www.esri.com/en-us/arcgis/products/arcgis-dashboards/overview>
- **Don't be afraid of non-academic sources.**



Questions & Answers

