UNIVERSITY OF TWENTE.

ITC

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Developing **a recommender system** for suggesting *alternative* ways of data visualization

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Cartography M.Sc.

Outline

1. Motivation and Introduction
2. Objectives
3. Background
4. Methodology
5. Validation
6. Prototype
7. Results
8. Conclusion

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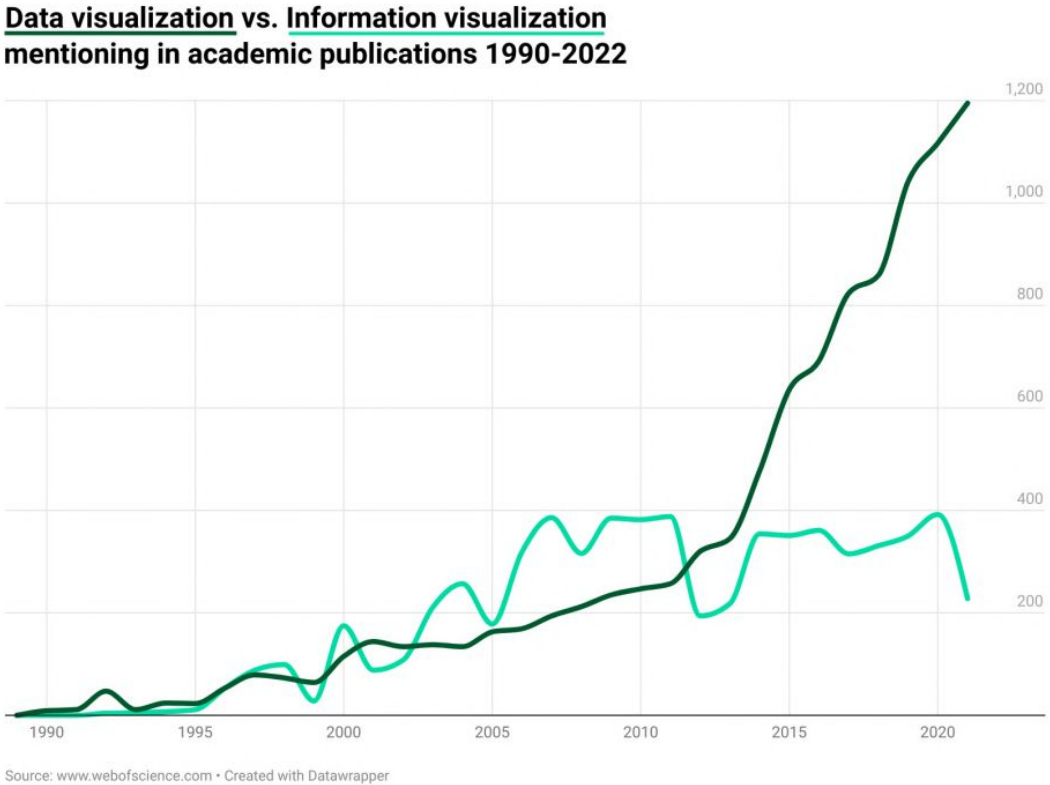
Motivation and Introduction



Absolute amount of publications mentioning data visualization and information visualization
[Web of Science]

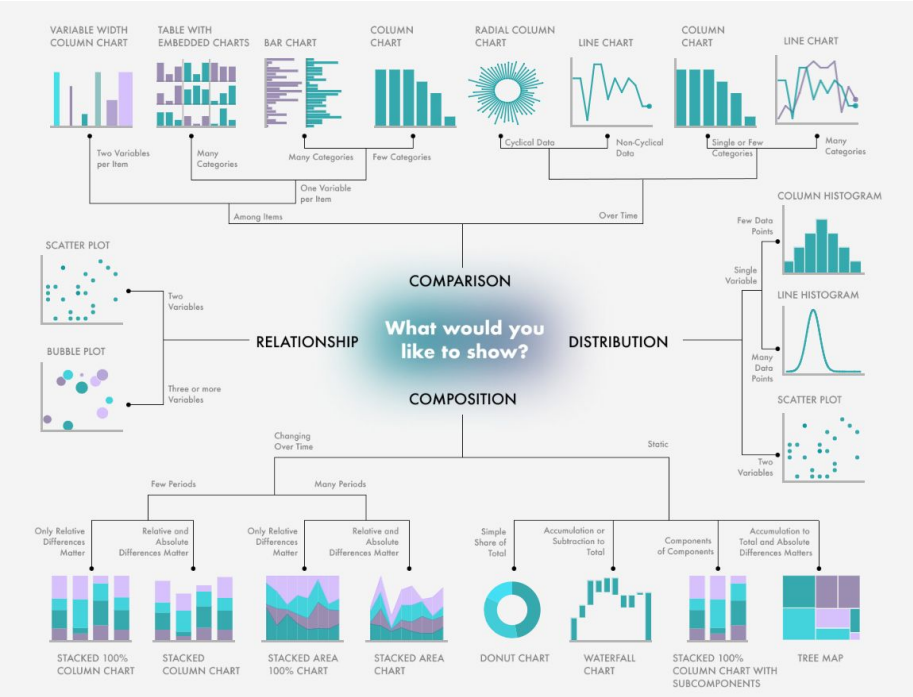
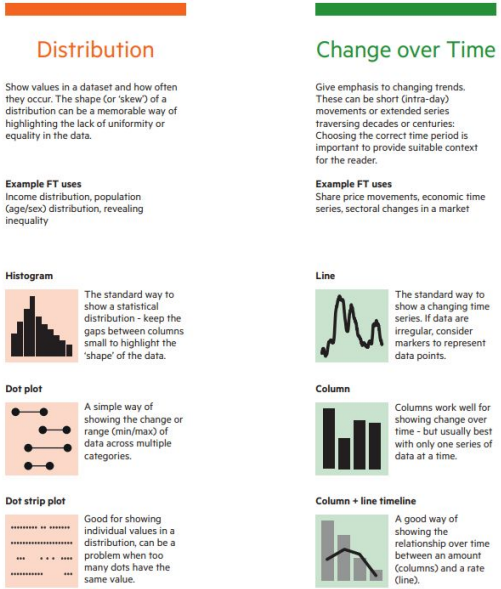


Chart Suggestion Guide

[Adedamola Ladipo]

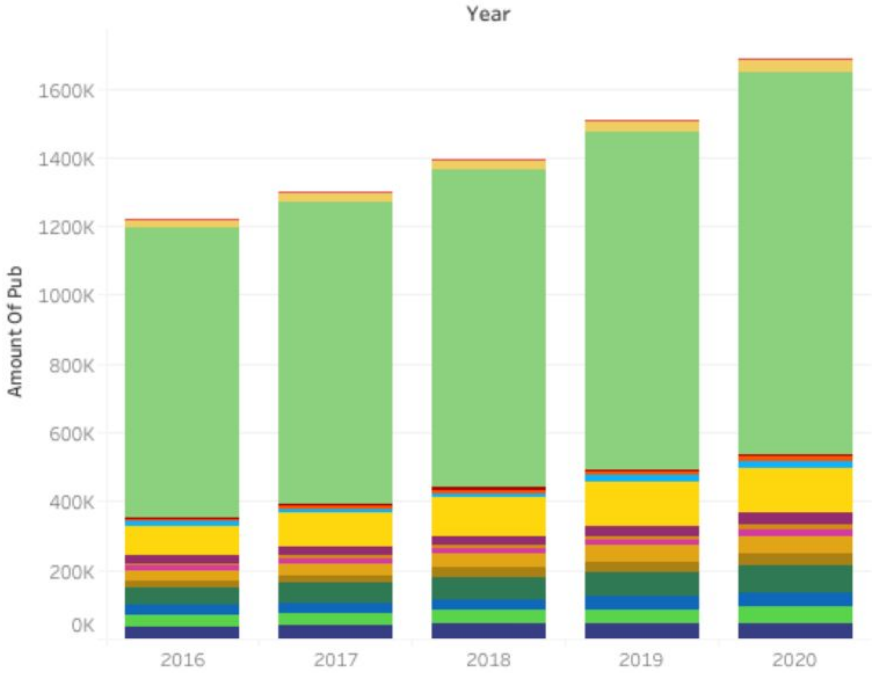


Visual Vocabulary

[Financial Times]

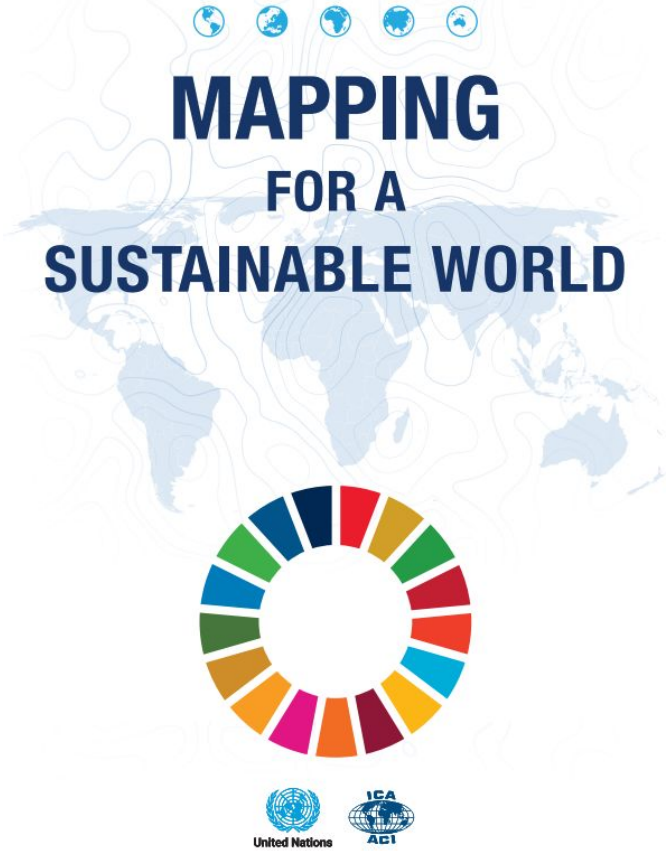
Show Me

[Tableau Software]



Absolute amount of publications mentioning SDG-related topics (disaggregated by goal) for the period of 2016-2020

[Jayabalasingham et. al, 2020]



Mapping for a Sustainable World

[Kraak, Roth, Ricker, Kagawa, Le Sourd, 2020]

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Main Research Objective

To implement a recommender system for suggesting multiple ways of data visualization (particularly for SDGs)

Research Sub-Objectives (RSOs)

A. Investigate the conceptual basis behind the data visualization and SDGs

B. Investigate the methodologies of data visualization recommender systems

C. Conceptualize the recommender system

D. Define software and interface requirements for a system and design the prototype

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Data visualization,
recommender systems, SDGs

What exactly are we going to recommend for SDGs with such a system?

What is data visualization?

Data visualization

Visual Representation

Visualization

Graphics

Data Graphics

Infographics

the process by which data are visualized, or presented, after the data cleaning process, and involves making choices about which data will be visualized, how data will be visualized, and what message will be shared with the target audience of the visualization

(Chiasson & Gregory, 2014).

a visible artifact on a more or less flat surface that was intentionally created to express an information

(Engelhardt, 2002).

any kind of visual representation of information *designed to* ***enable communication,*** analysis, discovery, exploration, etc

(Cairo, 2016).

translation of numbers in the form of a drawing, design or plan to explain or illustrate something

(Lewi, 2008).

a display of measured quantities by means of the combined use of points, lines, coordinates systems, colors, symbols, words and shadings

(Tufte, 1987).

a field in communicative design which based on a graphical representation of information, connections, numeric datasets and knowledge

(Laptev, 2012).

It is important to see aspects that are connected to data visualization as a concept, to behold its holistic nature; by doing so, it becomes possible to see the scope of future recommender system

What data visualization deals with

Translation of

Data into

Correspond-(ence)-**ingly**

Appropriate-(ness) **visual representation** that might have a

Relevance to the users

These aspects deals with

Translation	Data	Correspondence	Appropriateness	Relevance
Software	Data representation	Chart / Diagram types	Typefaces	Audience
Mediums	Data transformation	Visualization types	Colors	Feedback
Tutorials	Metadata	Map types	Layout principles	Message
Technologies	Data analysis	Stories from data	Use environment	Topic
...	...	...	...	...

As a whole process

Optimization Effectiveness Resources Objectives

SDGs

- **Aimed to** bring down the global inequalities in social, political, economical and ecological aspect

- **Described through** 17 goals and 231 indicators which are measured with respect to countries over time

- **Research** on the visualization, mapping and atlases of SDG is already here

3.1 Thematic Maps

A ***thematic map*** depicts the variation of one or sometimes several (see Section 3.7) geographic phenomena, mapping spatial and attribute information together. Meeting the SDGs requires thematic mapping of indicator data. Thematic maps enable geographic imagination and spatial thinking, and often represent abstract or statistical concepts that cannot be observed directly.

Thematic maps primarily depict attribute information that is enumerated within polygonal geographic units (see Section 1.4). Enumerated attributes

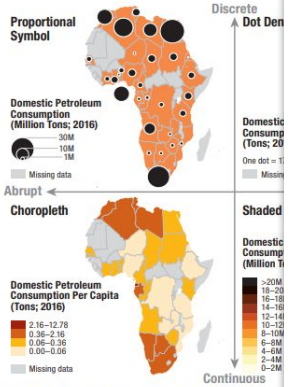
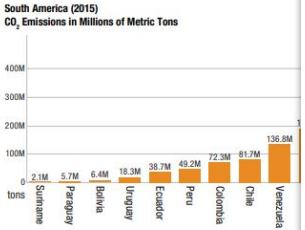


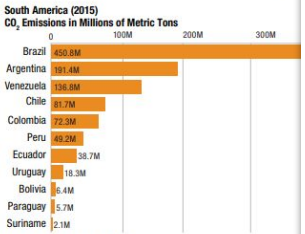
Figure 3.1-1: Thematic map types. The four maps depict Indicator 12.2 tion. **Top-left:** Proportional Symbol. **Top-right:** Dot density. **Bottom-left**

Figure 3.1-2: Choosing a

3.11 Univariate Diagrams

A first category of diagrams depicts the distribution of a single attribute, described as ***univariate***. For instance, a ***bar chart*** depicts the distribution of an attribute across different nominal categories, such as SDG regional groupings or individual countries. Accordingly, bar charts are useful for comparing a single indicator by geography to sort by high and low data values and clusters of similar values within this range. A bar chart is visually





integrated into nominal map legends and

3.4 Proportional Symbol Maps

A proportional symbol map is a thematic map that scales the sizes of point symbols by their attribute values (see Section 3.1). Proportional symbol maps represent quantitative, often unnormalized absolute values and can represent either individual-level data (e.g., cities) or enumerated data by placing the point symbol at the centroid of the polygon. They employ size as the visual variable, enabling numerical visual comparisons among symbols (see Section 2.9).

Proportional symbol maps are useful for mapping economic SDG indicators as they evoke a metaphor of discrete and abrupt phenomenon, such as sites of production and distribution. Because of the strength of the visual variable size, readers can quickly assess the distribution of absolute values among different countries without paying attention to the political borders themselves. Accordingly, proportional symbol maps overcome many of the issues with normalization, projection, and classification that afflict choropleth maps (see Section 3.3) and, therefore, may be useful beyond economic indicators as well. For instance, one major advantage over choropleth maps for mapping indicator datasets is that proportional symbols can exceed the boundaries of their enumeration units, keeping small countries and small island states visible on world maps (Figure 3.4-1). Notably, proportional symbol maps can be used with the Web Mercator projection without impacting map reading (Section 4.5).

Despite advantages, proportional symbol maps have several unique design challenges including symbol scaling and symbol overlap. Most charting software uses ***mathematical scaling***, directly relating the area of the symbol to the attribute value. However, readers systematically underestimate proportional polygon (2D) symbols as they grow larger, with even more severe underestimation with proportional volume (3D) symbols (see Section 2.8). Therefore, mapping software often enables ***perceptual scaling*** to account for systematic underestimation. Proportional symbols can be classified to reduce visual complexity, a process described as ***range grading*** for proportional symbols with the resulting map called a ***graduated symbol map***. Range grading is a common option on world maps or bivariate maps, shading the proportional symbols by a second attribute value, to limit the total number of unique symbols in the map (see Section 3.6). The more complex the symbol shape, the more difficult the reading of relative proportions; thus, the shapes of proportional symbols typically are constrained to simple circles, squares (both 2D), or rectangular bars (1D).

Second, proportional symbols commonly exceed their enumeration unit boundaries and need to be re-symbolized or displaced to clarify their overlap (see Section 2.7). Two common strategies for managing overlap include the use of transparency or the use of an outer symbol stroke (the latter is used in Figure 3.4-1), with smaller symbols placed on top of larger ones; the two strategies should not be used together to maintain legibility. Alternatively, symbols can be displaced away from the centroid of the enumeration unit, with large displacements clarified with leader lines as with densely labeled regions.

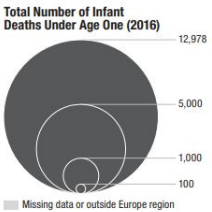
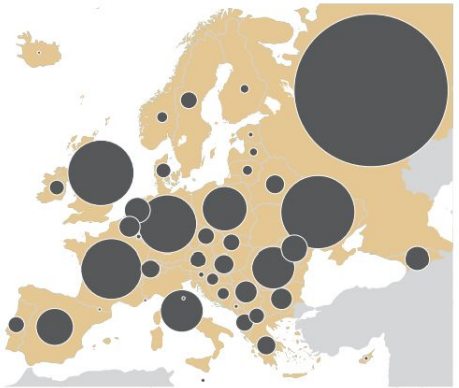


Figure 3.4-1 (Opposite side): Proportional symbol map. Indicator 3.2.1 (2016) on the total number of infant deaths under age one in the European region is depicted as a proportional symbol map using perceptual scaling for circular symbols. Because size is a numerically read visual variable, proportional symbol maps do not need to be classified. Symbol overlap is managed using a white symbol stroke with smaller symbols placed atop larger ones. Small countries by area such as Andorra, Luxembourg, Malta, Monaco, and San Marino remain visible on the map because the proportional symbols are allowed to exceed their political boundaries, an advantage of proportional symbol maps.



Mapping for a Sustainable World

[Kraak, Roth, Ricker, Kagawa, Le Sourd, 2020]

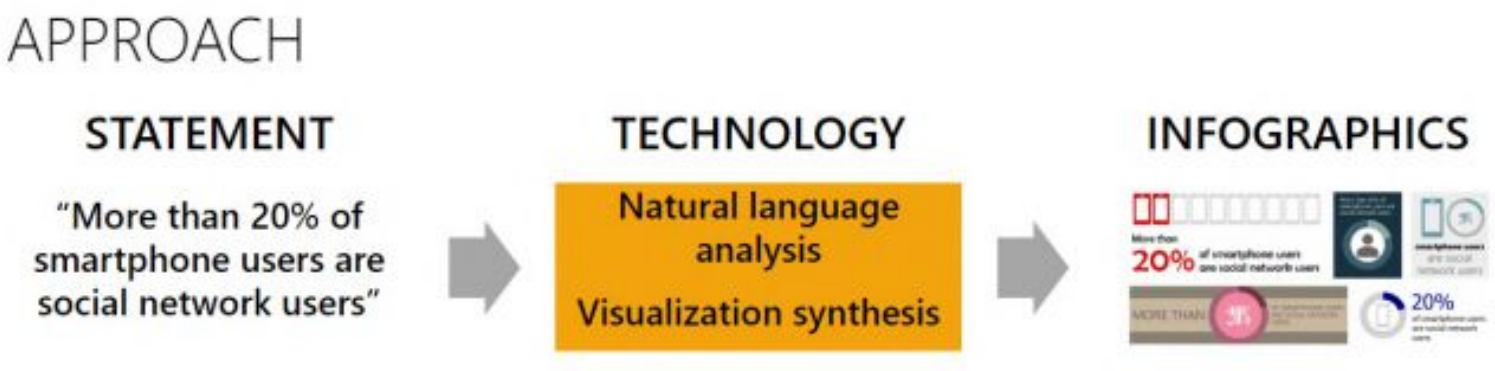
Recommender systems methodologies

- Data-Driven
- Expert Knowledge-Based
- Hybrid

A survey on automatic infographics and visualization recommendations [Zhu et. al, 2020]

Data-driven methodologies:

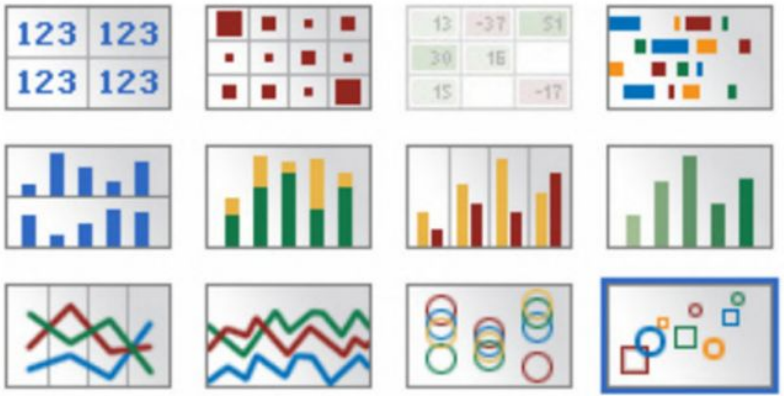
using machine learning, artificial intelligence and natural language processing algorithms to generate data visualizations depending on the given prompts



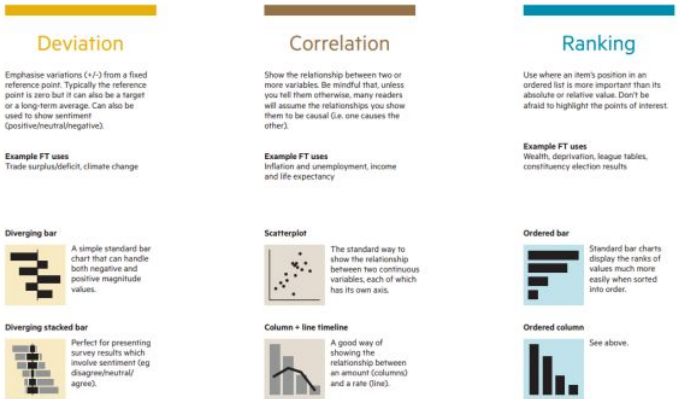
Text-to-Viz automatic visualization schema explanation [Cui et al. (2019)]

Expert knowledge-based model:

using sets of defined rules and logical restrictions, forming a knowledge representation of the visual artifacts with corresponding characteristics



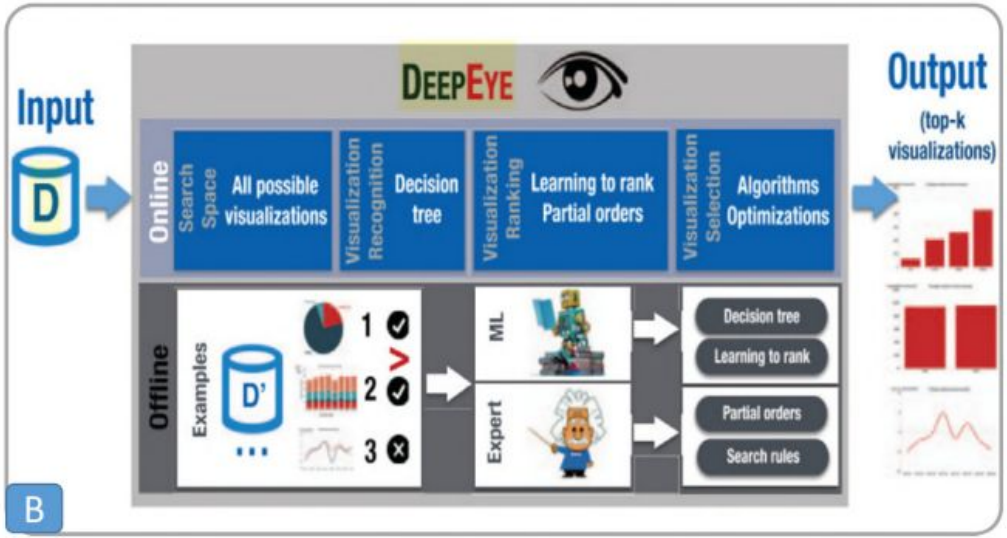
ShowMe from Tableau
[Mackinlay et al. (2007)]



A snippet from FT visual vocabulary
[Financial Times (2021)]

Hybrid model:

combine both data-driven model and expert knowledge-based approach



DeepEye methodological pipeline [Luo et al. (2018)]

Select expert knowledge-based approach

- The rules and methodologies for SDGs are already here
- Data-driven approaches are “black-boxed”, involving hard computational technologies and maintenance, time consuming to design the working algorithm
- Hybrid model can be implemented in a future research

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Getting back to possible recommendations

Translation	Data	Correspondence	Appropriateness	Relevance
Software	Data representation	Chart / Diagram types	Typefaces	Audience
Mediums	Data transformation	Visualization types	Colors	Feedback
Tutorials	Metadata	Map types	Layout principles	Message
Technologies	Data analysis	Stories from data	Use environment	Topic
...	...	...	...	...

As a whole process

Optimization Effectiveness Resources Objectives

These are in the focus of the recommender system

Translation	Data	Correspondence	Appropriateness	Relevance
Software	Data representation	Chart / Diagram types	Typefaces	Audience
Mediums	*Data transformation*	Visualization types	Colors	Feedback
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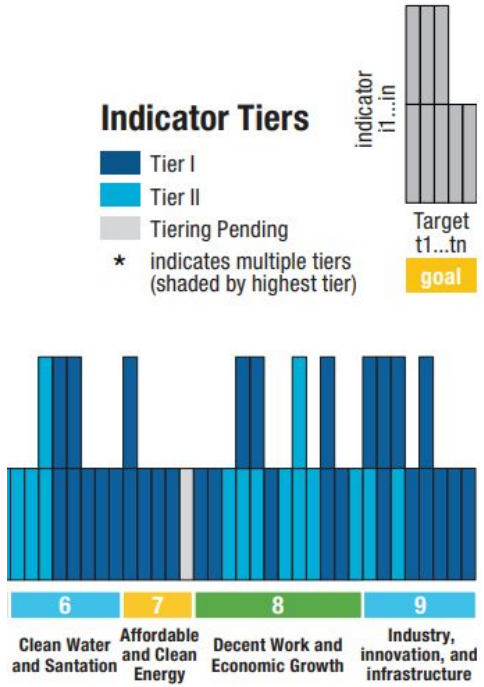
...	...	...	...	...

As a whole process

Optimization Effectiveness Resources Objectives

But why?

SDGs, Goals and Indicators



Mapping for a Sustainable World
[Kraak, Roth, Ricker, Kagawa and Le Sourd (2020)]

Attribute, Time and Location (ATL)

Attributes					Location				Time					
Goal	Target	Indicator	SeriesCode	SeriesDescription	GeoArea	GeoAreaName	Location	Units	2000	2001	2002	2003	...	2017
6	6.1	6.1.1	SH_H2O_SAFE	Proportion of popu	112	Belarus	ALLAREA	PERCE	80.62	80.81	80.99	81.17	...	94.52
6	6.1	6.1.1	SH_H2O_SAFE	Proportion of popu	100	Bulgaria	ALLAREA	PERCE	96.84	96.84	96.84	96.81	...	96.95
6	6.1	6.1.1	SH_H2O_SAFE	Proportion of popu	203	Czechia	ALLAREA	PERCE	96.32	96.32	96.44	96.55	...	97.88
6	6.1	6.1.1	SH_H2O_SAFE	Proportion of popu	348	Hungary	ALLAREA	PERCE	50.51	50.51	50.51	50.51	...	89.57
6	6.1	6.1.1	SH_H2O_SAFE	Proportion of popu	616	Poland	ALLAREA	PERCE					...	99.16
6	6.1	6.1.1	SH_H2O_SAFE	Proportion of popu	498	Republic of Mold	ALLAREA	PERCE	40.42	42.32	44.27	46.26	...	72.88
6	6.1	6.1.1	SH_H2O_SAFE	Proportion of popu	642	Romania	ALLAREA	PERCE	81.65	81.61	81.59	81.63	...	81.92

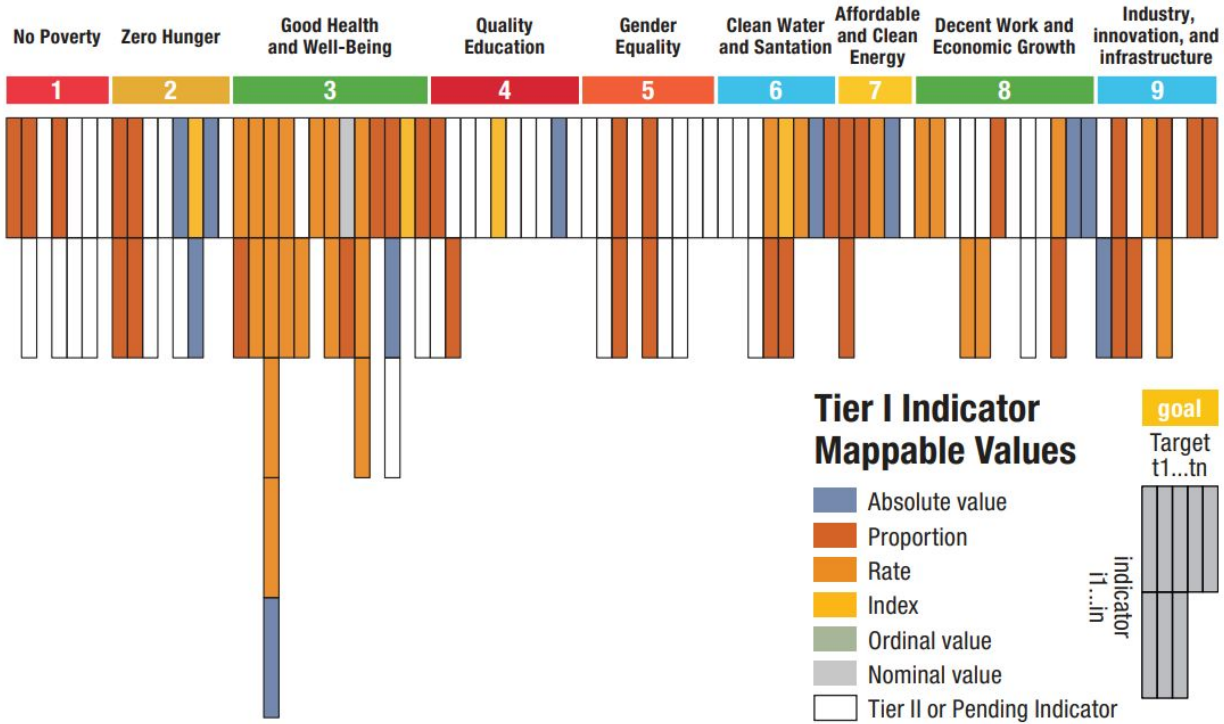
Mapping for a Sustainable World
[Kraak, Roth, Ricker, Kagawa and Le Sourd (2020)]

Indicators & Levels of Measurement (LoM)

Level of Measurement	Absolute/ Relative	Attributes	Mappable Values		Example
ratio	absolute (one value)	one attribute	absolute value		count X
	relative (calculated using two or more attributes)	one attribute	proportion	proportion of total population	% of total population
				other proportion	% of X, other than population
		two attributes	rate	rate per capita	count X per capita/ population
				change rate (per time unit)	% change or count X per time
				other rate	X per Y, other than population or time
		many attributes	index (calculated)		formula
interval			interval value		*not used for SDGs*
ordinal			ordinal value		level or rank
nominal			nominal value		presence/ absense

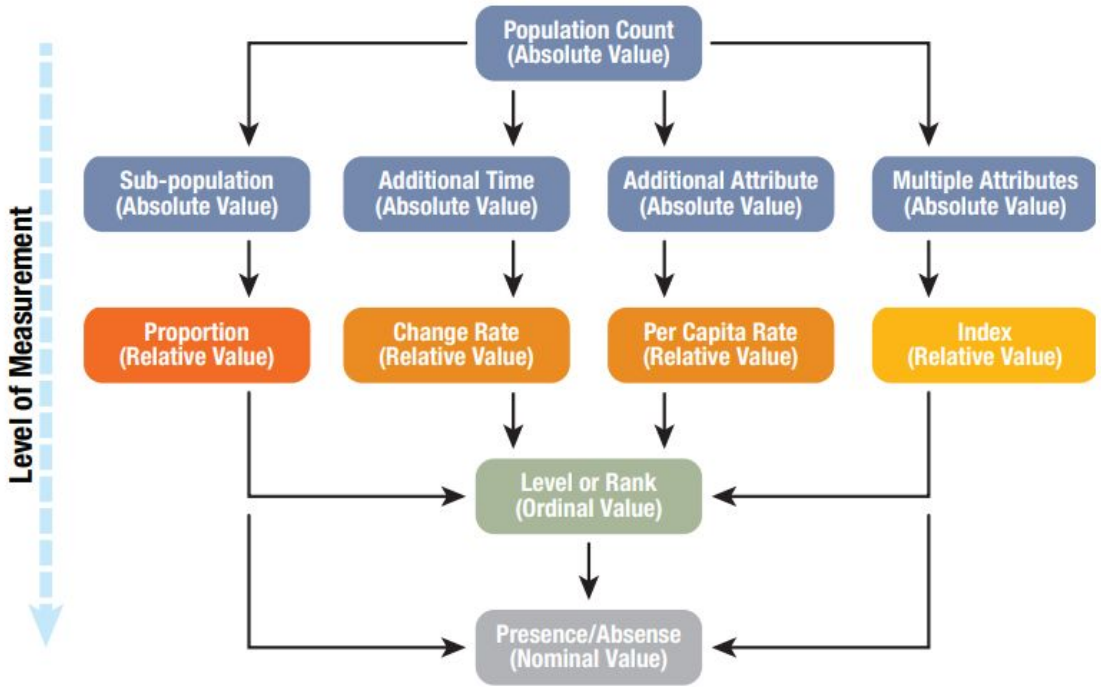
Mapping for a Sustainable World
[Kraak, Roth, Ricker, Kagawa and Le Sourd (2020)]

Levels of Measurement



Mapping for a Sustainable World
[Kraak, Roth, Ricker, Kagawa and Le Sourd (2020)]

Data Transformation



Mapping for a Sustainable World
[Kraak, Roth, Ricker, Kagawa and Le Sourd (2020)]

General description

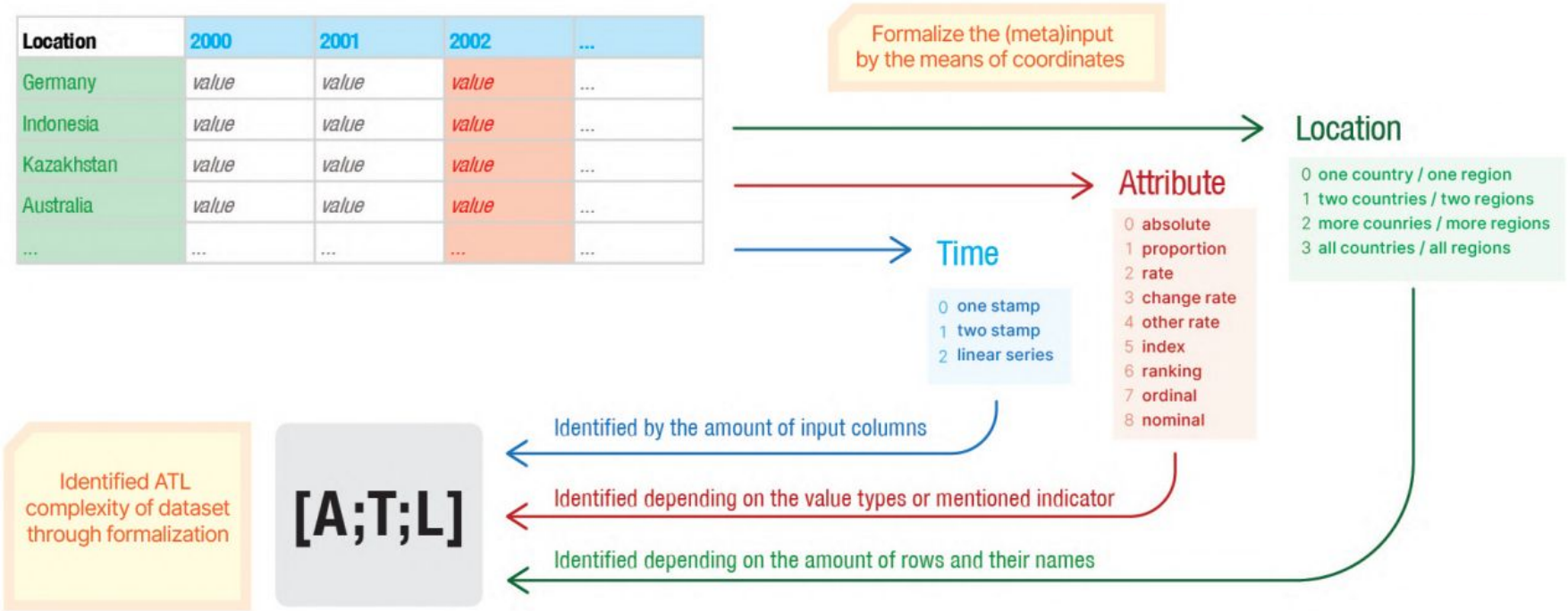
Thus, the recommender system should focus on the *Attribute, Time and Location (ATL) parameters* of the SDG indicator dataset. Depending on the ATL configuration, different data visualization (and maps) types or methods can be recommended

Finally, the data transformation should be added in order *to see more alternative dataviz options for the same indicator*

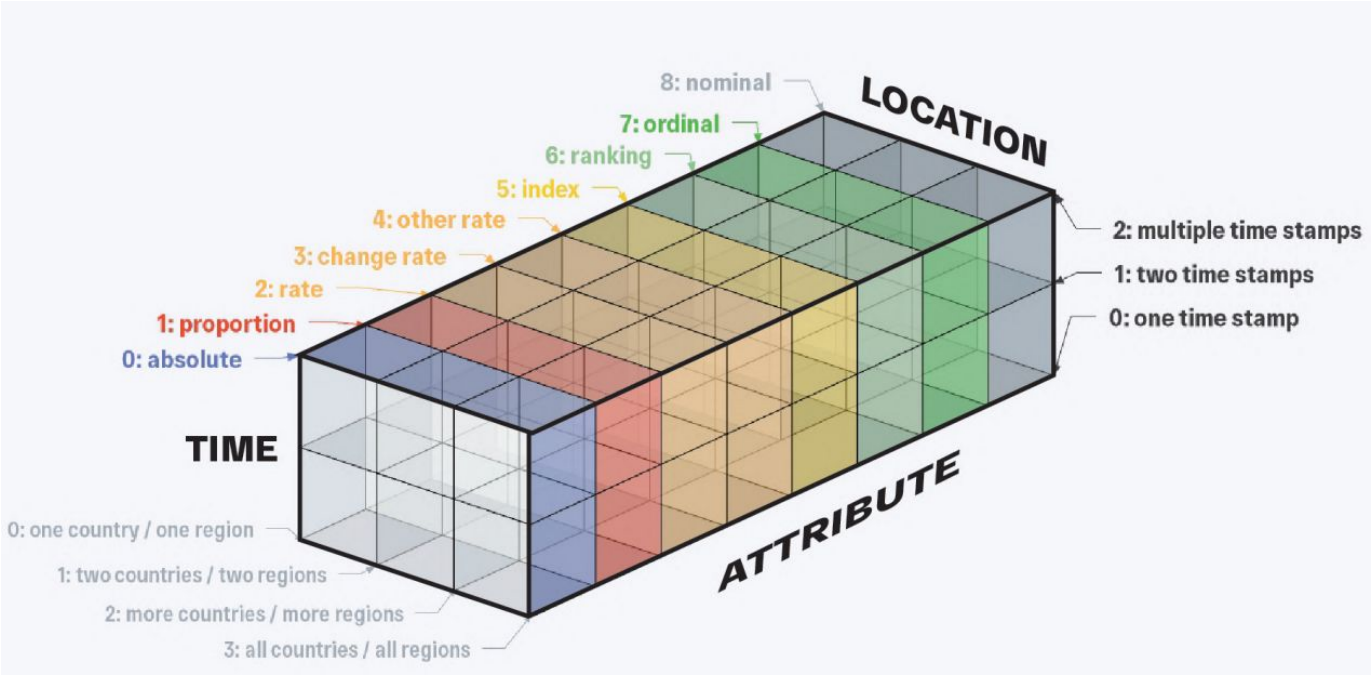
Classification of ATL parameters

- **TIME:** one stamp, two stamps, time series
- **LOCATION:** one country, two countries, more countries, all countries (or regions)
- **ATTRIBUTE:** absolute, proportion, rate, change rate, other rate, index, ranking, ordinal, nominal

Workflow of the recommender system



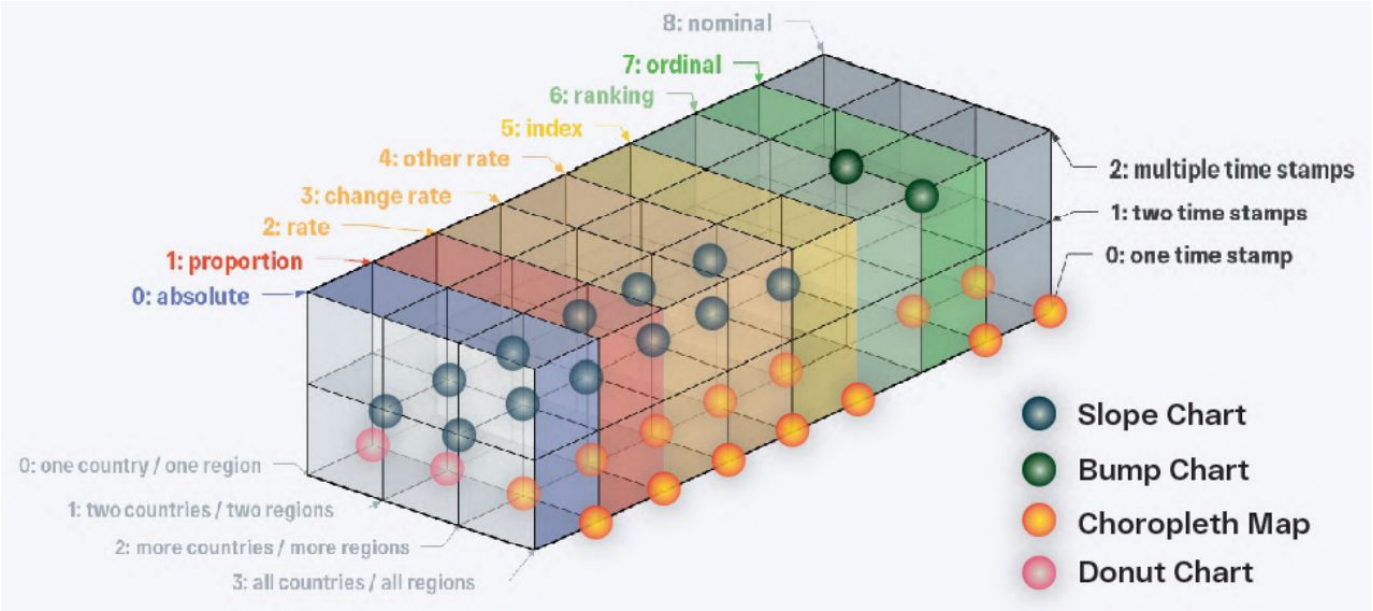
ATL Matrix


8: nominal
LOCATION
7: ordinal
6: ranking
5: index
4: other rate
3: change rate
2: rate
1: proportion
0: absolute
2: multiple time stamps
1: two time stamps
0: one time stamp
TIME
ATTRIBUTE
0: one country / one region
1: two countries / two regions
2: more countries / more regions
3: all countries / all regions

ATL Matrix

Following the recommendations from the data visualization textbooks, data visualization classification systems and also the reviewed chapters on diagrams and maps from *Mapping for a Sustainable World*, we can come up with a list of the data visualization types that can be located in the matrix

ATL Matrix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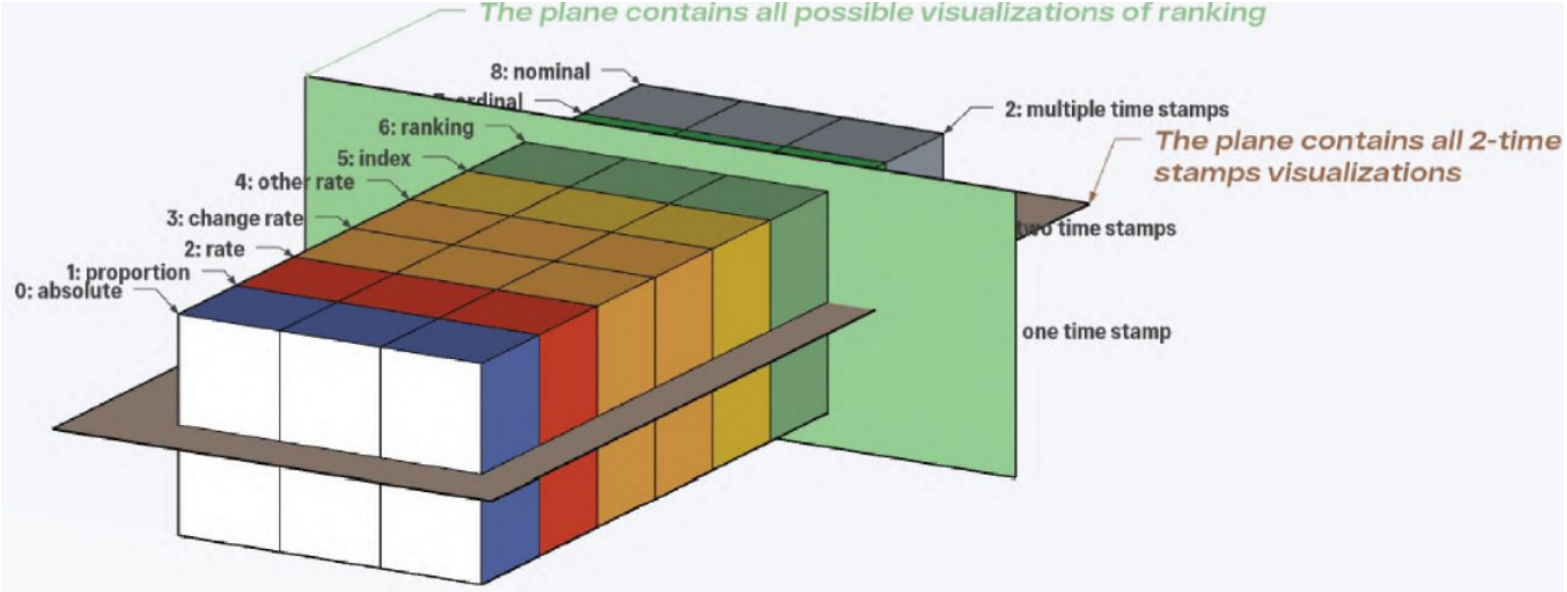
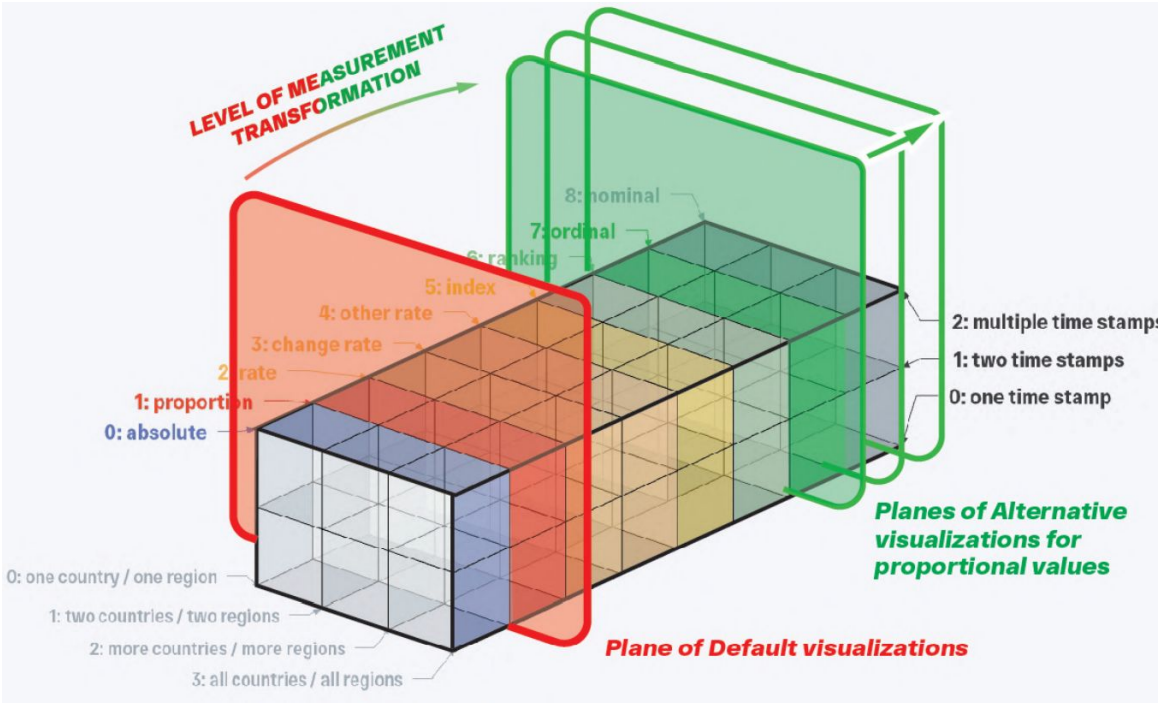
2: more countries / more regions
3: all countries / all regions
Slope Chart
Bump Chart
Choropleth Map
Donut Chart

ATL Matrix' Planes



Data Transformation options in Matrix



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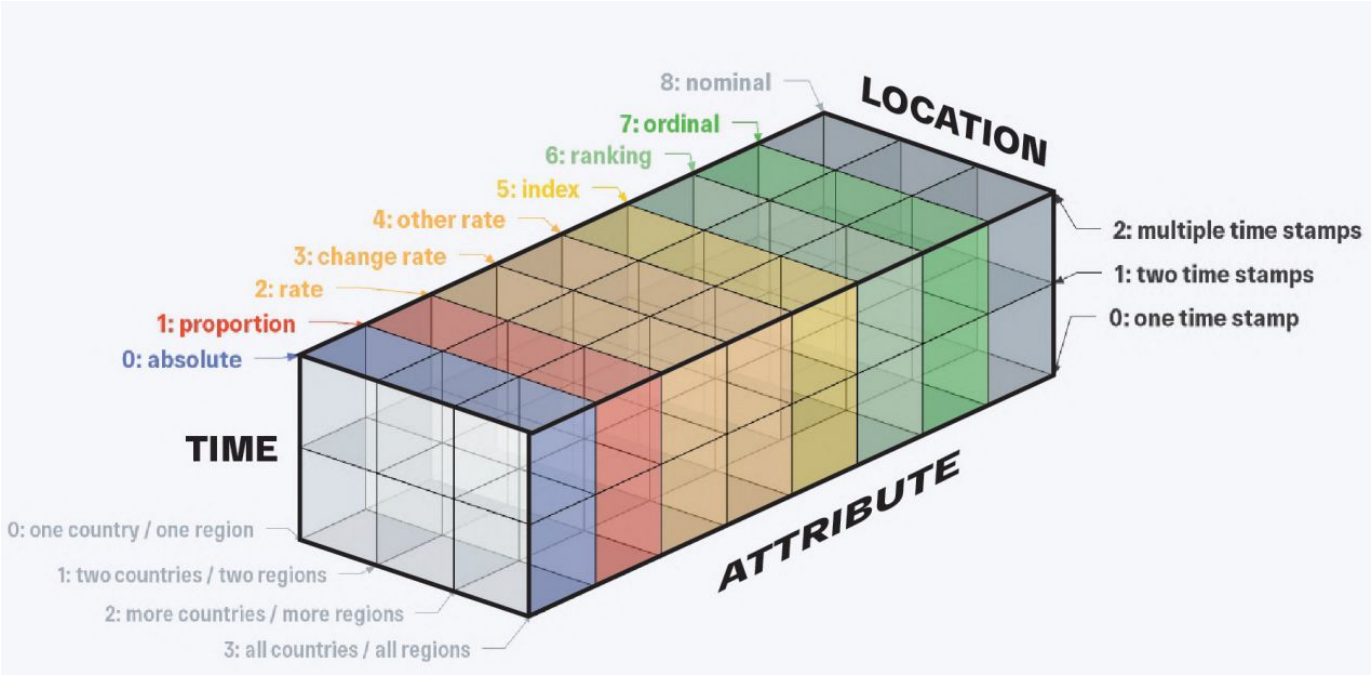
Example 1: low level of ATL complexity

Germany and Poland with regards to their situation on indicator 5.5.2 (Proportion of women in senior and middle management positions) in 2018

Country	5.5.2_2018, %
Germany	28.58
Poland	39.52

How to visualize this?

ATL Matrix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LOCATION
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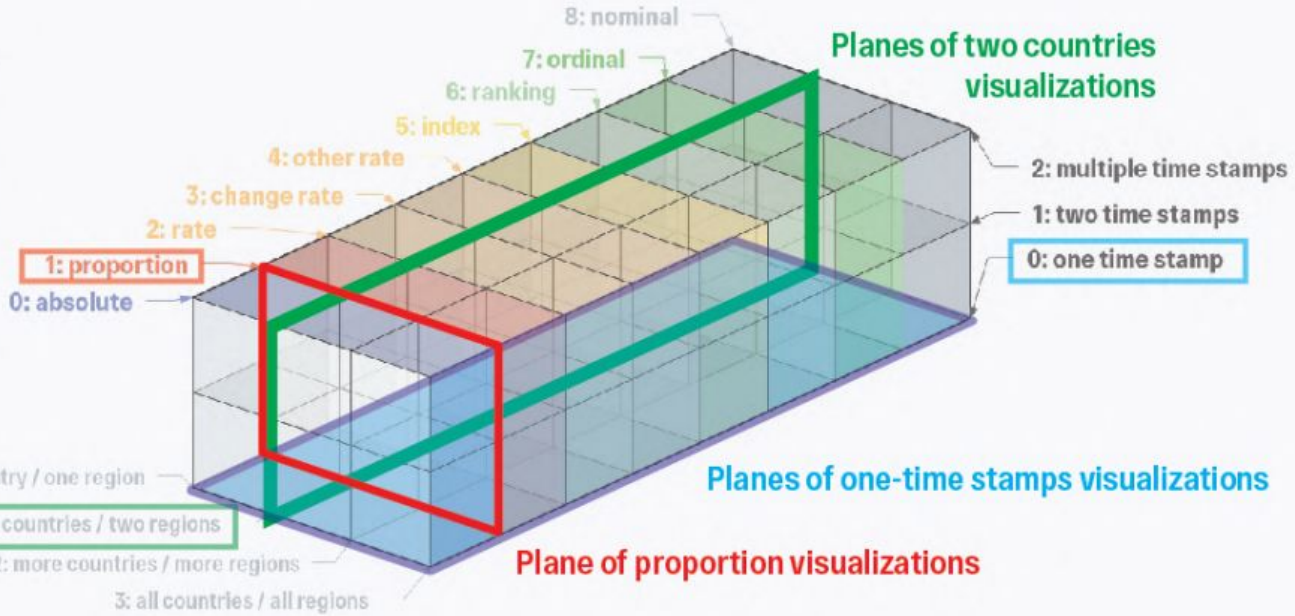
2: multiple time stamps
1: two time stamps
0: one time stamp
TIME
ATTRIBUTE
0: one country / one region
1: two countries / two regions
2: more countries / more regions
3: all countries / all regions

Germany vs. Poland in **2018** for **5.5.2 indicator**

1 **0** **1**

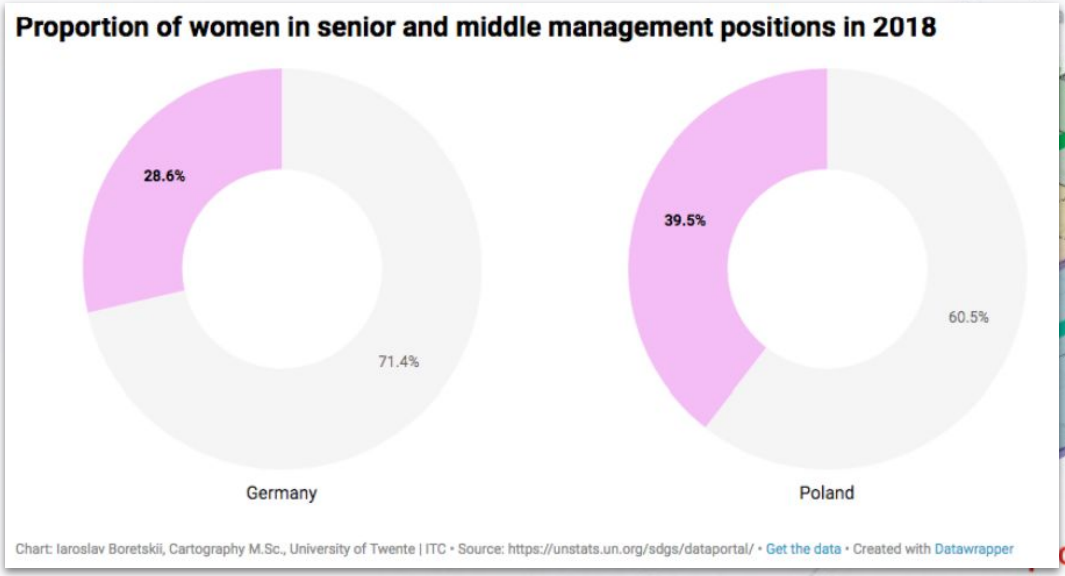
Possible options:

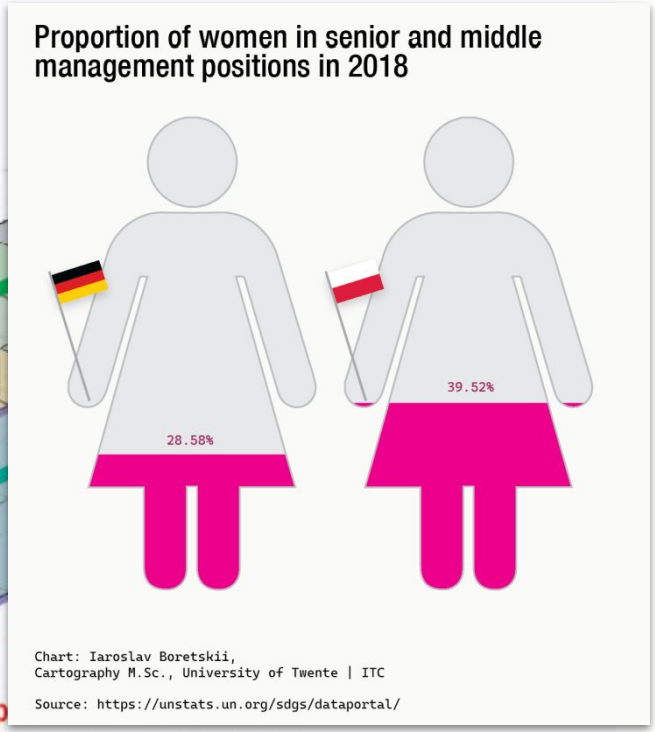
- Donut Chart
- Pie Chart
- Pictorial Fraction Chart
- Progress Bar
- Waffle Chart
- Solid Gauge Chart
- .....



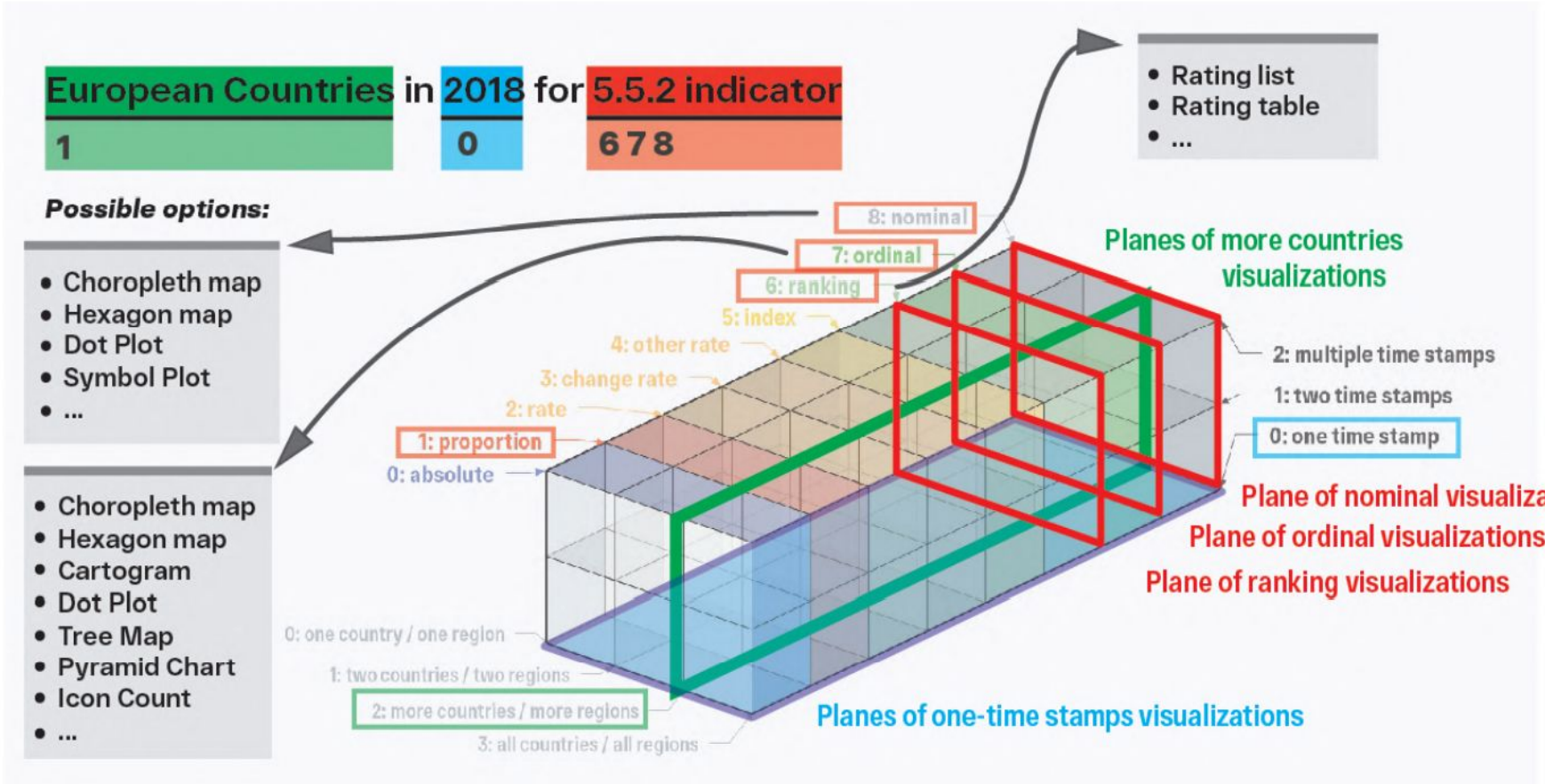
Germany vs. Poland in 2018 for 5.5.2 indicator

1 | 0 | 1

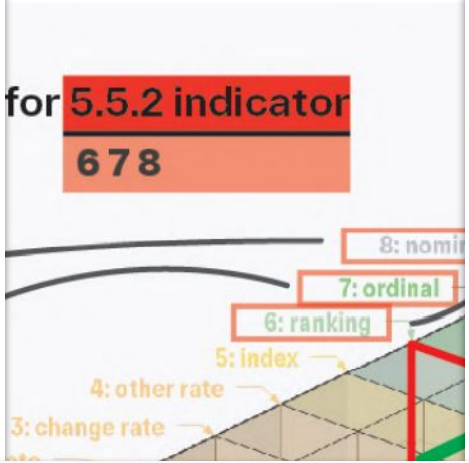


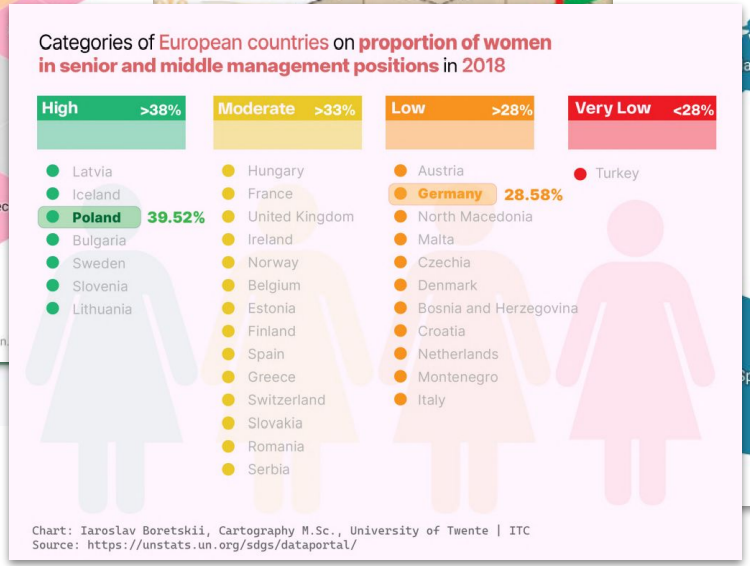


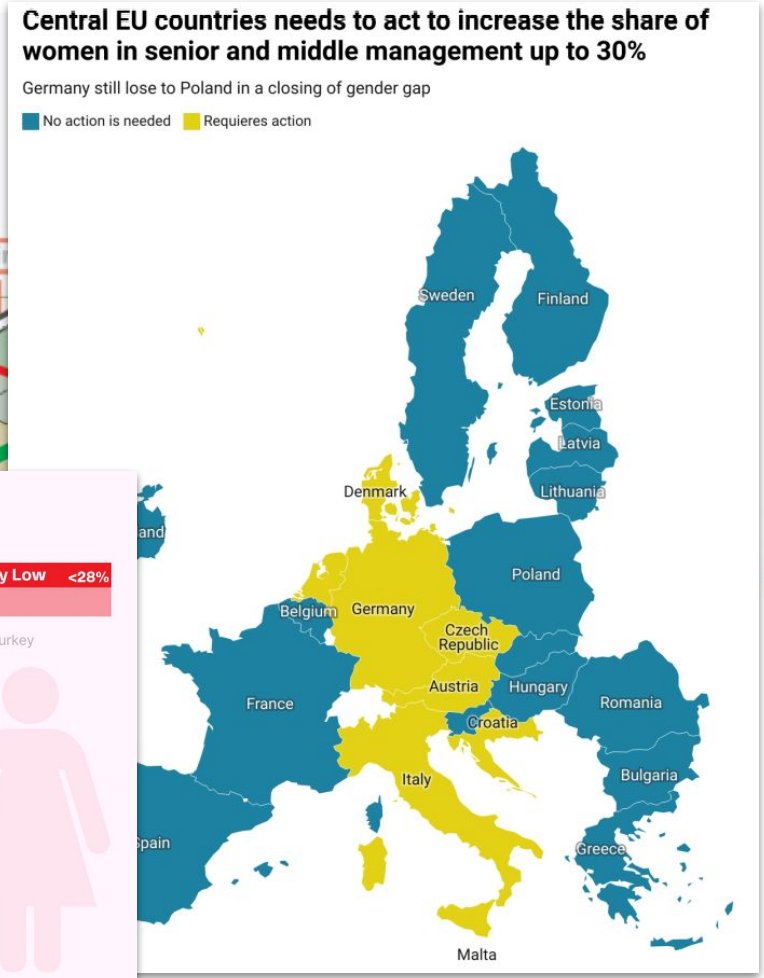
3: all countries / all regions


European Countries in 2018 for 5.5.2 indicator
1
0
6 7 8
Possible options:
• Choropleth map
• Hexagon map
• Dot Plot
• Symbol Plot
• ...
• Choropleth map
• Hexagon map
• Cartogram
• Dot Plot
• Tree Map
• Pyramid Chart
• Icon Count
• ...
• Rating list
• Rating table
• ...
8: nominal
7: ordinal
6: ranking
5: index
4: other rate
3: change rate
2: rate
1: proportion
0: absolute
Planes of more countries visualizations
2: multiple time stamps
1: two time stamps
0: one time stamp
Plane of nominal visualizations
Plane of ordinal visualizations
Plane of ranking visualizations
0: one country / one region
1: two countries / two regions
2: more countries / more regions
3: all countries / all regions
Planes of one-time stamps visualizations


Categories of European Union countries for the proportion of women on the managerial positions (SDG indicator 5.5.2)
Germany still lose to Poland in a closing of gender gap
Bad
Moderate
Good
Very Good
Iceland
Norway
Finland
Sweden
United Kingdom
Denmark
Estonia
Latvia
Ireland
Netherlands
Germany
28.5%
Poland
39.5%
Lithuania
Belgium
Czech Rep.
Slovakia
Spain
France
Switzerland
Austria
Hungary
Romania
Portugal
Slovenia
Croatia
Bosnia and Herz.
Italy
Montenegro
No Data
Albania
Malta
Greec
Map: Iaroslav Boretskii, Cartography M.Sc., University of Twente | ITC • Source: https://unstats.un
Created with Datawrapper


for 5.5.2 indicator
6 7 8
8: nomi
7: ordinal
6: ranking
5: index
4: other rate
3: change rate


Categories of European countries on proportion of women in senior and middle management positions in 2018
High >38%
Latvia
Iceland
Poland 39.52%
Bulgaria
Sweden
Slovenia
Lithuania
Moderate >33%
Hungary
France
United Kingdom
Ireland
Norway
Belgium
Estonia
Finland
Spain
Greece
Switzerland
Slovakia
Romania
Serbia
Low >28%
Austria
Germany 28.58%
North Macedonia
Malta
Czechia
Denmark
Bosnia and Herzegovina
Croatia
Netherlands
Montenegro
Italy
Very Low <28%
Turkey
Chart: Iaroslav Boretskii, Cartography M.Sc., University of Twente | ITC
Source: https://unstats.un.org/sdgs/dataportal/


Central EU countries needs to act to increase the share of women in senior and middle management up to 30%
Germany still lose to Poland in a closing of gender gap
No action is needed
Requieres action
Sweden
Finland
Estonia
Latvia
Lithuania
Denmark
Poland
Belgium
Germany
Czech Republic
Austria
Hungary
Romania
France
Croatia
Bulgaria
Italy
Greece
Malta

Example 2: higher level of ATL complexity

Progress between 2005 and 2015 for Central and Southern Asia countries for two Goal 3 indicators: 3.4.2 Suicide mortality rate and 3.8.1 Coverage of essential health services

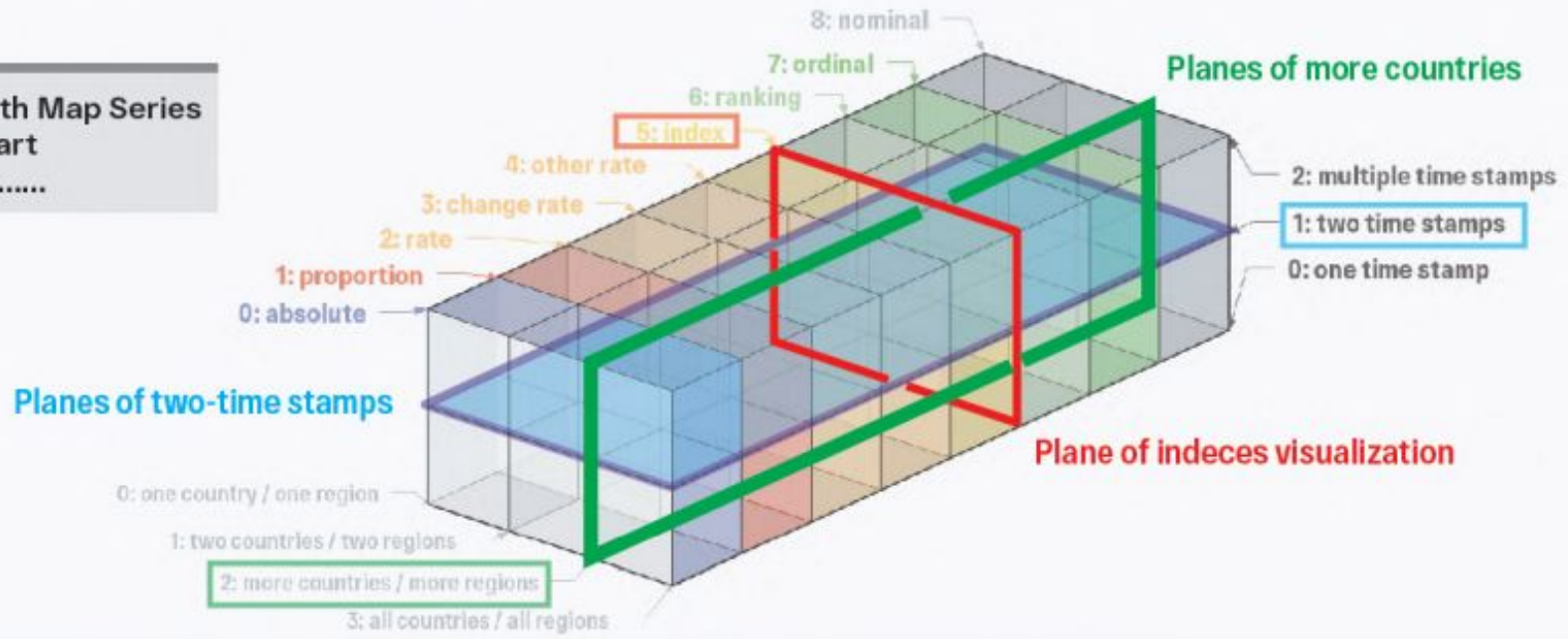
How to visualize this?

Country	3.4.2-2005, per 100.000 inhabitants	3.4.2-2015, per 100.000 inhabitants	3.8.1-2005, index, 0 to 140	3.8.1-2015, index, 0 to 140
Afghanistan	10.8	8.6	52	68
Bangladesh	13.8	10	60	92
Bhutan	11.8	12.4	78	118
India	17.1	13.7	35	52
Iran	15	18.6	108	140
Kazakhstan	68.2	39.3	60	74
Kyrgyzstan	21.7	16.1	53	68
Nepal	27	30.8	58	102
Pakistan	26	26.4	60	84
Sri Lanka	77.4	48.4	100	126
Tajikistan	5	5.4	46	67
Turkmenistan	25	9.4	59	69
Uzbekistan	13.9	12.7	56	72

14 SE Asia countries between 2005 and 2015 for 3.8.1 indicator

2 1 5

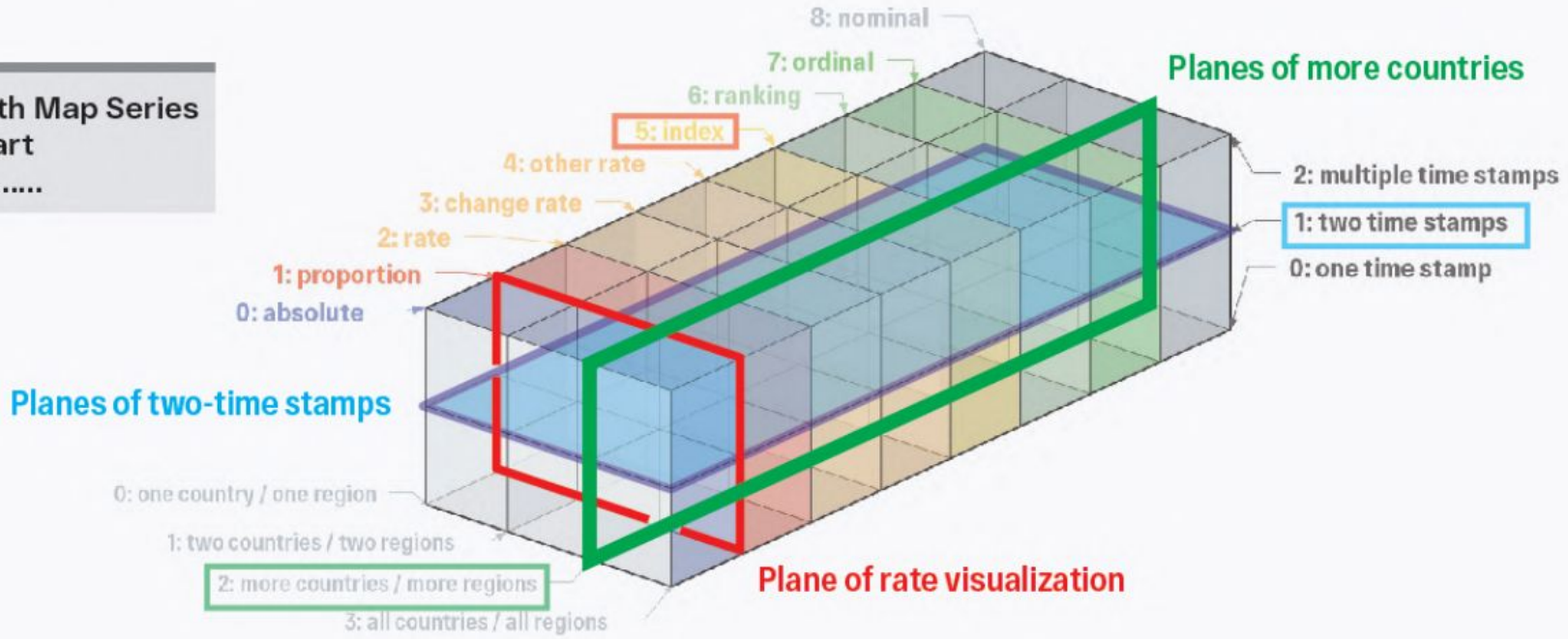
- Choropleth Map Series
- Slope Chart
- .....



14 SE Asia countries between 2005 and 2015 for 3.4.2 indicator

2 | 1 | 2

- Choropleth Map Series
- Slope Chart
- .....



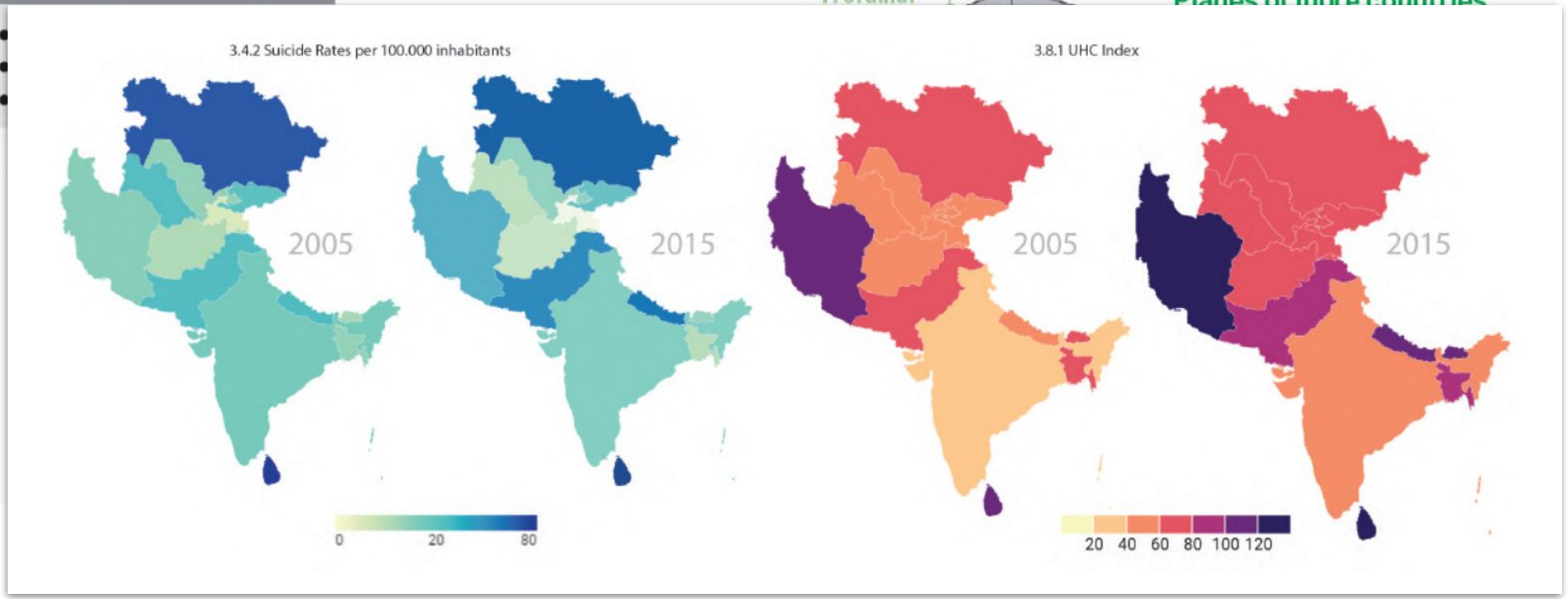
14 SE Asia countries between 2005 and 2015 for 3.4.2 indicator

2 1 2

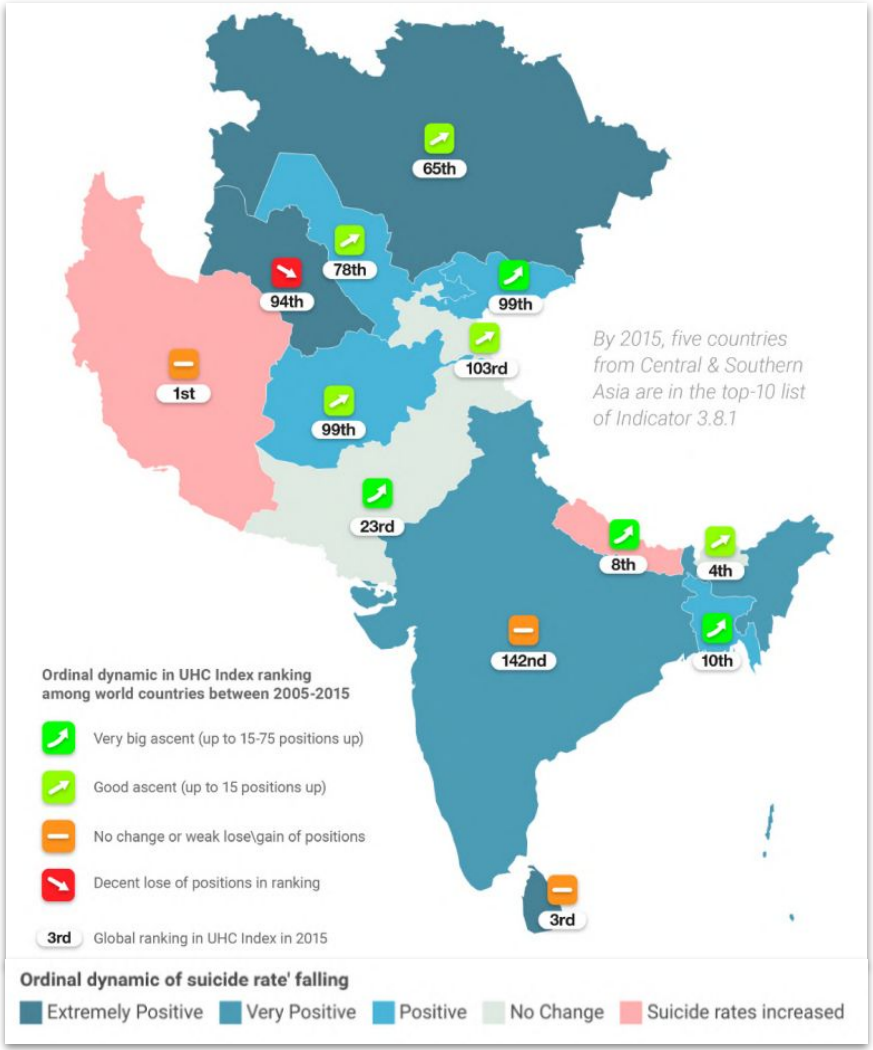
8: nominal

7: ordinal

Planes of more countries



Country	3.4.2-2005, ordinal estimation	3.4.2-2015, ordinal estimation	3.4.2, ordinal progress	3.8.1-2005, ranking global	3.8.1-2015, ranking global	3.8.1, delta ranking	3.8.1, delta ranking ordinal
Afghanistan	Moderate	Normal	Positive	110	99	11	Good ascent
Bangladesh	Moderate	Moderate	Positive	69	10	59	Great ascent
Bhutan	Moderate	Moderate	No Change	10	4	6	Good ascent
India	Moderate	Moderate	Positive	142	142	0	No change
Iran	Moderate	Moderate	Negative	1	1	0	No change
Kazakhstan	Extremely serious	Very serious	Very Positive	69	65	4	Good ascent
Kyrgyzstan	Serious	Moderate	Positive	107	99	8	Good ascent
Nepal	Serious	Very serious	Negative	80	8	72	Great ascent
Pakistan	Serious	Serious	No Change	69	23	46	Great ascent
Sri Lanka	Extremely serious	Very serious	Very Positive	2	3	-1	No change
Tajikistan	Normal	Normal	No Change	128	103	25	Good ascent
Turkmenistan	Serious	Normal	Very Positive	74	94	-20	Big drop
Uzbekistan	Moderate	Moderate	Positive	88	78	10	Good ascent


65th
78th
94th
99th
103rd
1st
99th
23rd
8th
4th
142nd
10th
3rd
By 2015, five countries from Central & Southern Asia are in the top-10 list of Indicator 3.8.1
Ordinal dynamic in UHC Index ranking among world countries between 2005-2015
Very big ascent (up to 15-75 positions up)
Good ascent (up to 15 positions up)
No change or weak lose\gain of positions
Decent lose of positions in ranking
3rd Global ranking in UHC Index in 2015
Ordinal dynamic of suicide rate' falling
Extremely Positive
Very Positive
Positive
No Change
Suicide rates increased

Outline

1. Motivation and Introduction
2. Objectives
3. Background
4. Methodology
5. Validation
6. Prototype
7. Results
8. Conclusion

Prototype

Link to the prototype:

https://public.tableau.com/app/profile/iaroslav2247/viz/metadatavis-beta/MetaDataViz

SDG MetaDataViz

Data Visualization Recommender System

Indicator

1.2.1

Time

- (All)
- 0. One Stamp
- 1. Two Stamps
- 2. Multiple Stamps

Location

- (All)
- 0. One Country / Region
- 1. Two Countries / Two Regions
- 2. More Countries / More Regions
- 3. All Countries / All Regions

Select manually the Available Data Transformation:

0. Absolute: 1-8
1. Proportion – 5. Index: 6-8
6. Ranking: 7-8
7. Ordinal: 8

Alternative Attribute*

(Multiple values)

SDG Indicator

Proportion of population living below the national poverty line, by sex and age

SDG Goal

1: No Poverty

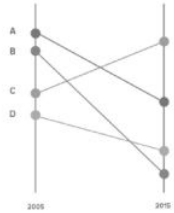
Original Mappable Value

1. Proportion

Advised options

Choropleth Map Series

Slope Chart



Alternative options

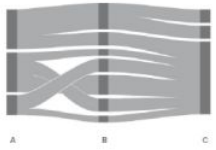
6. Ranking

Rating Position Gain Over..

1	Australia	▲ +4
2	Ukraine	▲ +3
3	USA	▼ −2
4	Jamaica	▼ +11
5	Germany	▼ +15

7. Ordinal

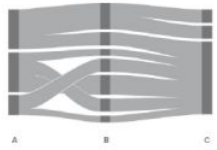
Alluvial Diagram



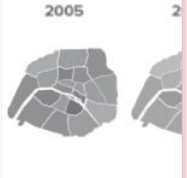
Choropleth Map Series

8. Nominal

Alluvial Diagram



Choropleth Map Se



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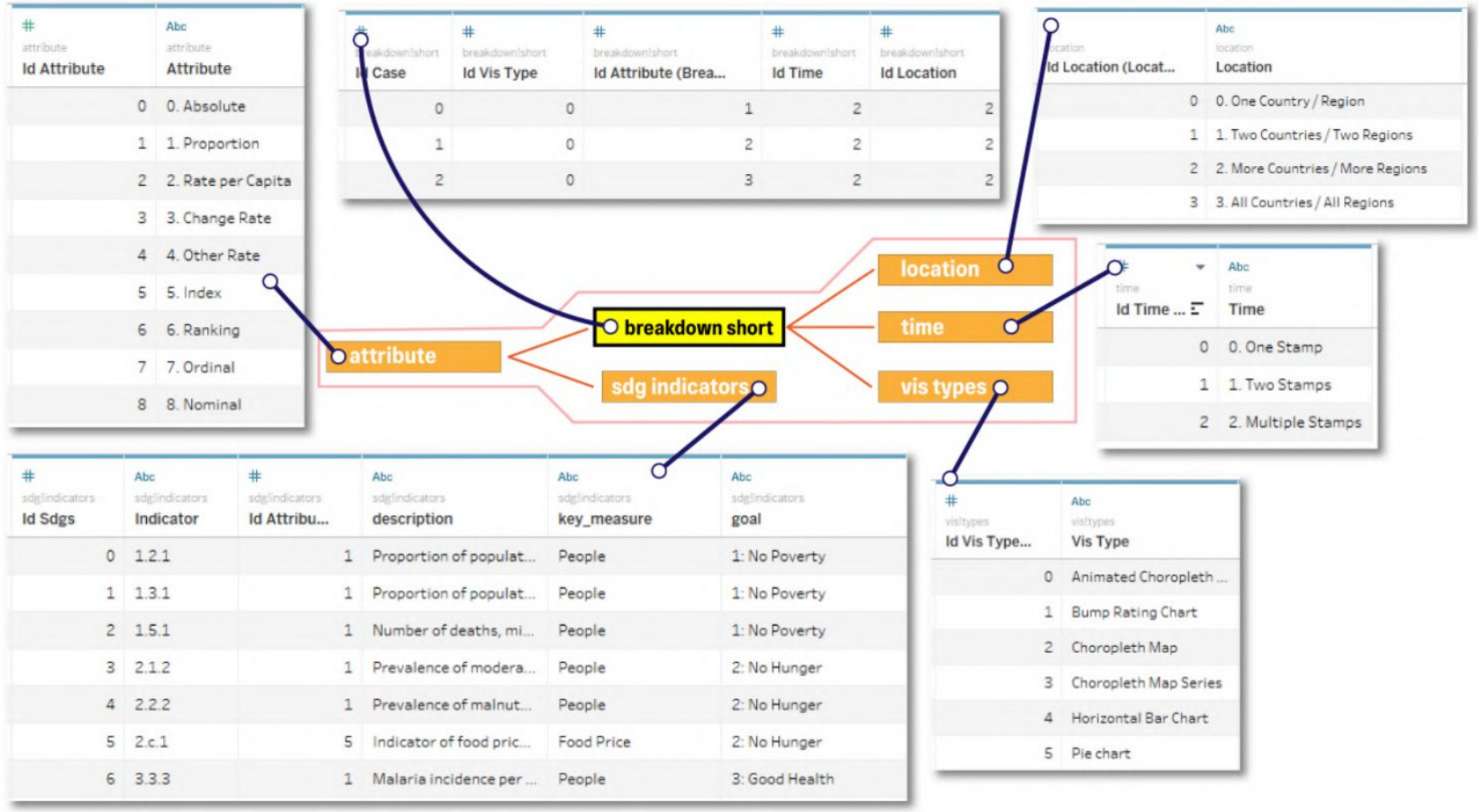
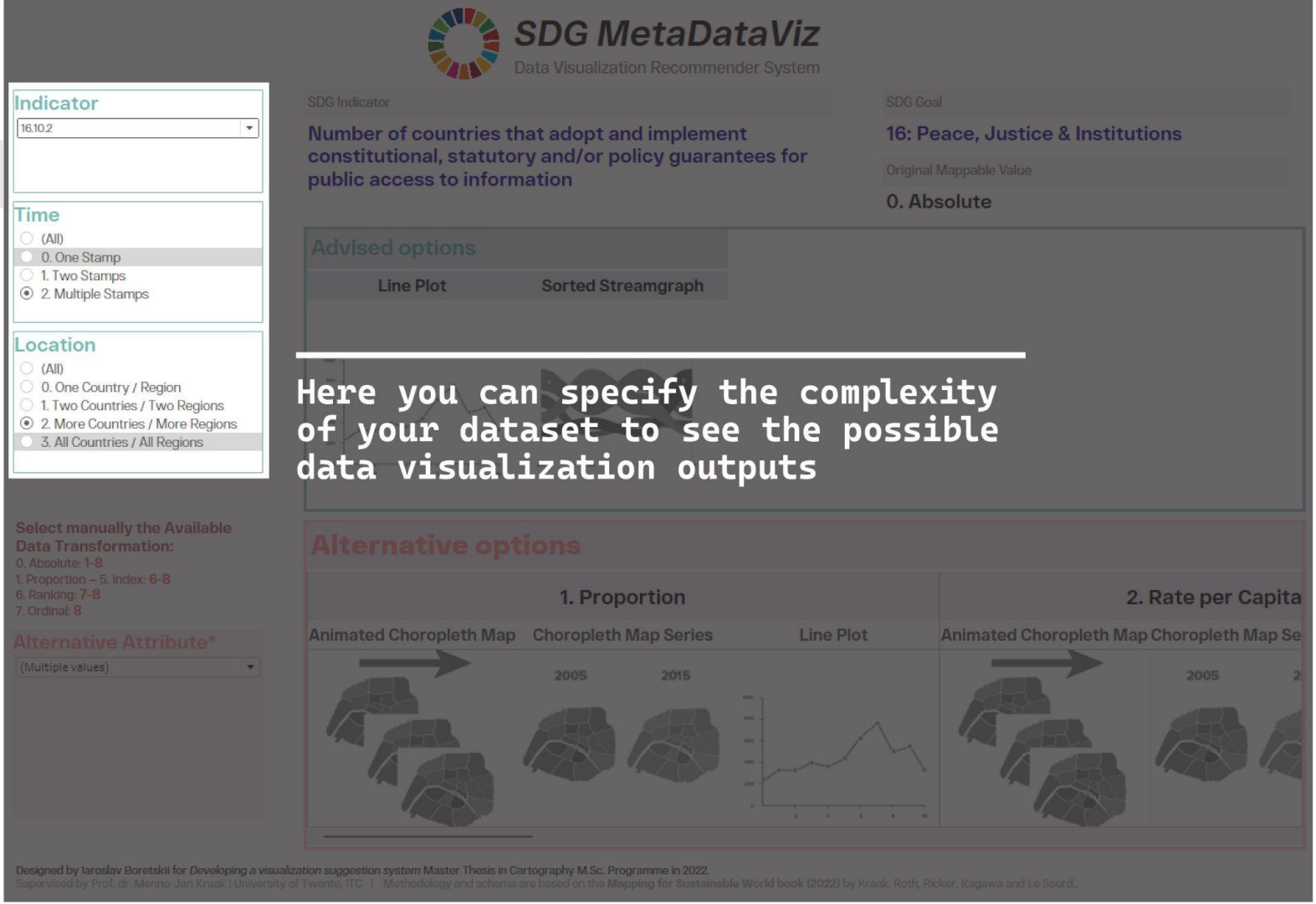
Supervised by Prof. dr. Menno-Jan Kraak | University of Twente, ITC | Methodology and schema are based on the **Mapping for Sustainable World book (2022)** by Kraak, Roth, Ricker, Kagawa and Le Sourd..

Back-End


attribute
Id Attribute
Attribute
0 0. Absolute
1 1. Proportion
2 2. Rate per Capita
3 3. Change Rate
4 4. Other Rate
5 5. Index
6 6. Ranking
7 7. Ordinal
8 8. Nominal
breakdown!short
Id Case
Id Vis Type
Id Attribute (Brea...
Id Time
Id Location
0 0 1 2 2
1 0 2 2 2
2 0 3 2 2
location
Id Location (Locat...
Location
0 0. One Country / Region
1 1. Two Countries / Two Regions
2 2. More Countries / More Regions
3 3. All Countries / All Regions
time
Id Time ...
Time
0 0. One Stamp
1 1. Two Stamps
2 2. Multiple Stamps
attribute
breakdown short
sdg indicators
location
time
vis types
sdg!indicators
Id Sdgs
Indicator
Id Attribu...
description
key_measure
goal
0 1.2.1 1 Proportion of populat... People 1: No Poverty
1 1.3.1 1 Proportion of populat... People 1: No Poverty
2 1.5.1 1 Number of deaths, mi... People 1: No Poverty
3 2.1.2 1 Prevalence of modera... People 2: No Hunger
4 2.2.2 1 Prevalence of malnut... People 2: No Hunger
5 2.c.1 5 Indicator of food pric... Food Price 2: No Hunger
6 3.3.3 1 Malaria incidence per ... People 3: Good Health
visTypes
Id Vis Type...
Vis Type
0 Animated Choropleth ...
1 Bump Rating Chart
2 Choropleth Map
3 Choropleth Map Series
4 Horizontal Bar Chart
5 Pie chart

Interface


SDG MetaDataViz
Data Visualization Recommender System
Indicator
16.10.2
Time
(All)
0. One Stamp
1. Two Stamps
2. Multiple Stamps
Location
(All)
0. One Country / Region
1. Two Countries / Two Regions
2. More Countries / More Regions
3. All Countries / All Regions
SDG Indicator
Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information
SDG Goal
16: Peace, Justice & Institutions
Original Mappable Value
0. Absolute
Advised options
Line Plot
Sorted Streamgraph
Here you can specify the complexity of your dataset to see the possible data visualization outputs
Select manually the Available Data Transformation:
0. Absolute: 1-8
1. Proportion – 5. Index: 6-8
6. Ranking: 7-8
7. Ordinal: 8
Alternative Attribute*
(Multiple values)
Alternative options
1. Proportion
2. Rate per Capita
Animated Choropleth Map
Choropleth Map Series
Line Plot
Animated Choropleth Map
Choropleth Map Se
2005
2015
2005
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SDG MetaDataViz

Data Visualization Recommender System

Indicator

16.10.2

Time

- (All)
- 0. One Stamp
- 1. Two Stamps
- 2. Multiple Stamps

Location

- (All)
- 0. One Country / Region
- 1. Two Countries / Two Regions
- 2. More Countries / More Regions
- 3. All Countries / All Regions

Select manually the Available Data Transformation:

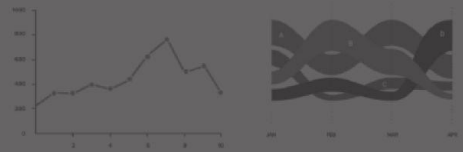
0. Absolute: 1-8
1. Proportion – 5. Index: 6-8
6. Ranking: 7-8
7. Ordinal: 8

Alternative Attribute*

(Multiple values)

SDG Indicator	SDG Goal
Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information	16: Peace, Justice & Institutions
	Original Mappable Value: 0. Absolute

Here is the short metadata section for a selected SDG indicator



Alternative options

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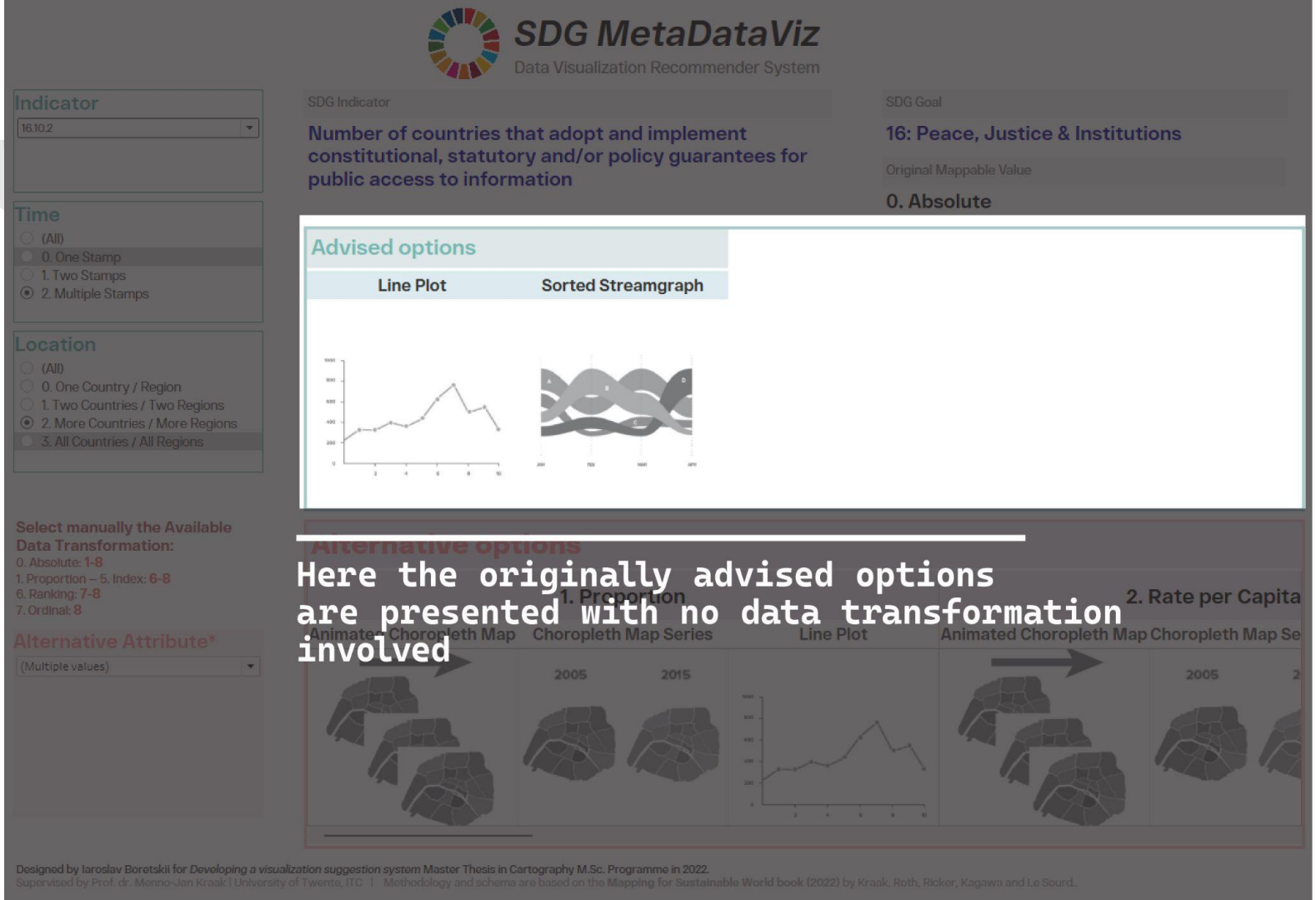


Here the originally advised options are presented with no data transformation involved

SDG MetaDataViz

Data Visualization Recommender System

Indicator

16.10.2

Time

- (All)
- 0. One Stamp
- 1. Two Stamps
- 2. Multiple Stamps

Location

- (All)
- 0. One Country / Region
- 1. Two Countries / Two Regions
- 2. More Countries / More Regions
- 3. All Countries / All Regions

Select manually the Available Data Transformation:

0. Absolute: 1-8
1. Proportion – 5. Index: 6-8
6. Ranking: 7-8
7. Ordinal: 8

Alternative Attribute*

(Multiple values)

SDG Indicator

Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information

SDG Goal

16: Peace, Justice & Institutions

Original Mappable Value

0. Absolute

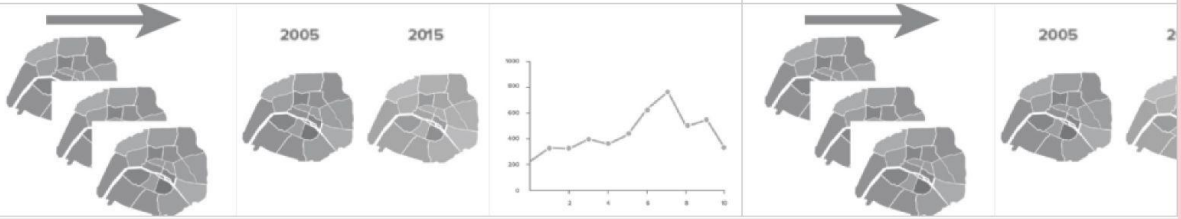
Advised options

Line Plot | Sorted Streamgraph

Here the alternative data visualization options are presented depending on your indicator and its original level of measurement

Alternative options

1. Proportion			2. Rate per Capita	
Animated Choropleth Map	Choropleth Map Series	Line Plot	Animated Choropleth Map	Choropleth Map Se



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SDG MetaDataViz

Data Visualization Recommender System

Indicator

1.2.1

Time

- (All)
- 0. One Stamp
- 1. Two Stamps
- 2. Multiple Stamps

Location

- (All)
- 0. One Country / Region
- 1. Two Countries / Two Regions
- 2. More Countries / More Regions
- 3. All Countries / All Regions

Select manually the Available Data Transformation:

0. Absolute: 1-8
1. Proportion – 5. Index: 6-8
6. Ranking: 7-8
7. Ordinal: 8

Alternative Attribute*

(Multiple values)

SDG Indicator

Proportion of population living below the national poverty line, by sex and age

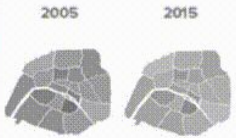
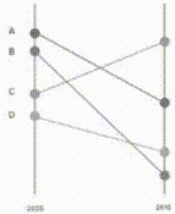
SDG Goal

1: No Poverty

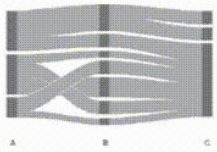
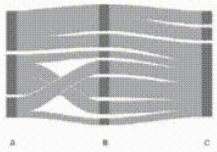
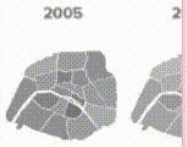
Original Mappable Value

1. Proportion

Advised options

Choropleth Map Series	Slope Chart
	

Alternative options

6. Ranking	7. Ordinal		8. Nominal	
Rating Position Gain Over..	Alluvial Diagram	Choropleth Map Series	Alluvial Diagram	Choropleth Map Se
1 Australia ▲ +4 2 Ukraine ▲ +3 3 USA ▼ −2 4 Jamaica ▼ +11 5 Germany ▼ +15				

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Outline

1. Motivation and Introduction
2. Objectives
3. Background
4. Methodology
5. Validation
6. Prototype
7. Results
8. Conclusion

Results

Data visualization and SDG concepts were theoretically reviewed

Maps and diagrams were provided to demonstrate the data transformation effect

The system’ concept was designed with connection to SDGs

The demonstrative prototype is available through Tableau Public

Outline

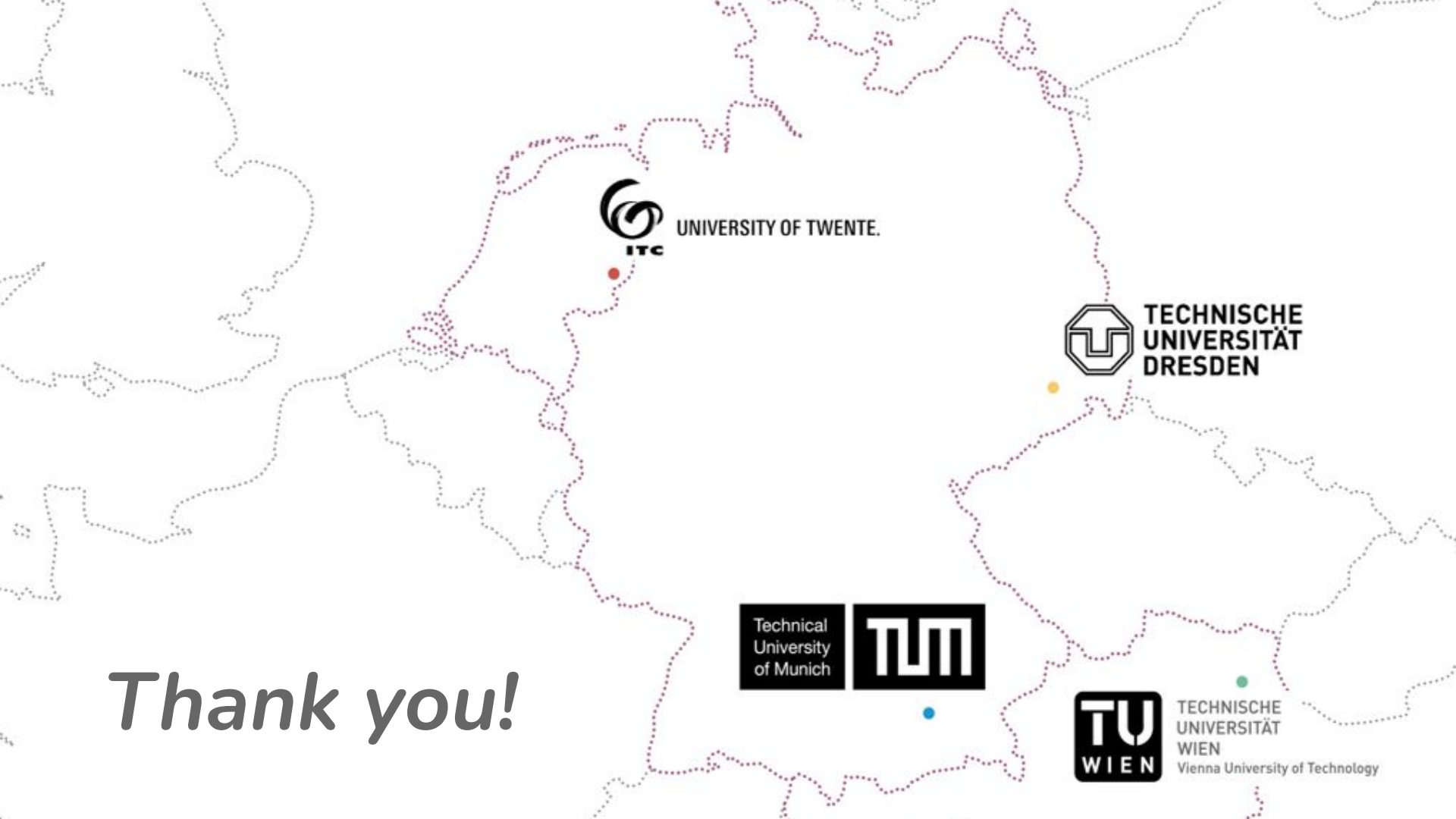
1. Motivation and Introduction
2. Objectives
3. Background
4. Methodology
5. Validation
6. Prototype
7. Results
8. Conclusion

Conclusions

Data visualization: wide concept, multiple interconnections

Conceptualization: not so straightforward to approach

SDGs: level of measurement transformation respectively “transforms the message”


ITC
UNIVERSITY OF TWENTE.
TECHNISCHE
UNIVERSITÄT
DRESDEN
Technical
University
of Munich
TU
WIEN
TECHNISCHE
UNIVERSITÄT
WIEN
Vienna University of Technology

Thank you!