The Ethics of Communicating Data with Visualization

Greenhouse Gas Emissions 1990–2018

Greenhouse Gas Emissions 1990–2018. The Organization for Economic Co-operation and Development (OECD) has compiled data for the emissions of all participating countries broken out by the pollutant (e.g., carbon monoxide, methane, etc.) and by different sources (e.g., energy, agriculture, etc.). The linked interface can be a little difficult to use, but you can access various slices of the data by either choosing alternate themes in the left-hand side menu, or by customizing the pollutants and variables in the dropdown menus in the main view.

P1: "honest/ethical/truthful"

For a perspective view 1 below, the following guidelines must be observed:

- The visualization is clear and easy to interpret for the intended audience (often parts of the general population).
- Any data transformations (e.g., filters, additional computations, etc.) are clearly and transparently communicated.
- The sources of the data, including potential bias, is communicated

Visualization

We import the necessary library

```
import requests
import pandas as pd
import altair as alt
import streamlit as st
from io import StringIO
```

We import Greenhouse Gas Emissions 1990–2018

```
orig_url= "https://drive.google.com/file/d/1S3mE7-CWL1Hve0GVpGmpBPSTdMkOYNRL/view?usp=sha
file_id = orig_url.split('/')[-2]
dwn_url='https://drive.google.com/uc?export=download&id=' + file_id
url = requests.get(dwn_url).text
csv_raw = StringIO(url)
green_house_gas_1990_2018 = pd.read_csv(csv_raw)
green_house_gas_1990_2018.rename(columns={'ï»¿"COU"': 'COU'}, inplace=True)
```

We visualize the head of data

```
st.write(green_house_gas_1990_2018.head())
```

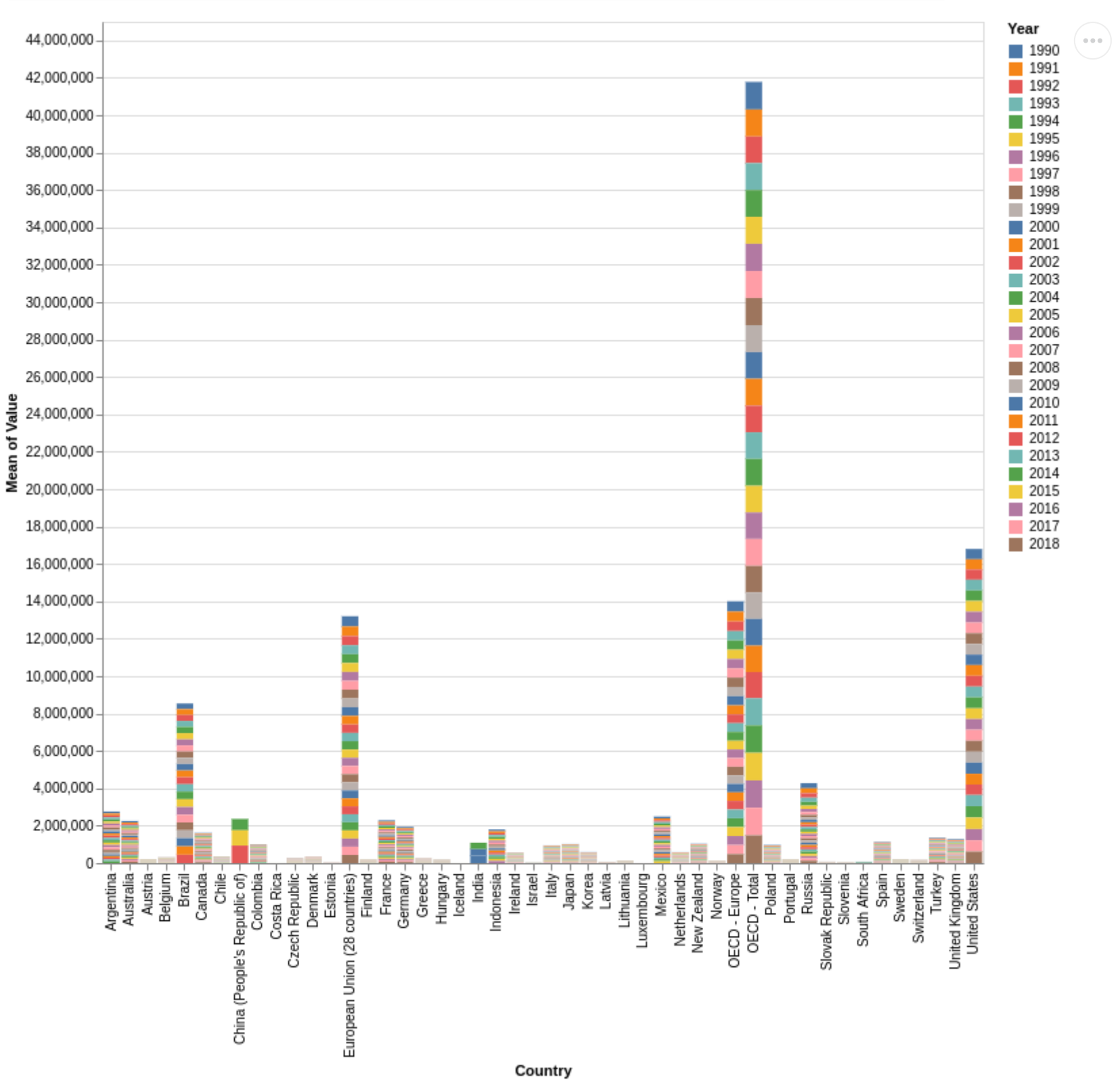
	COU	Country	POL	Pollutant	VAR	Variable	YEA
0	AUS	Australia	GHG	Greenhouse gases	TOTAL	Total emissions exclud…	1990
1	AUS	Australia	GHG	Greenhouse gases	TOTAL	Total emissions exclud…	1991
2	AUS	Australia	GHG	Greenhouse gases	TOTAL	Total emissions exclud…	1992
3	AUS	Australia	GHG	Greenhouse gases	TOTAL	Total emissions exclud…	1993
4	AUS	Australia	GHG	Greenhouse gases	TOTAL	Total emissions exclud…	1994

We extract data only related to "3 - Agriculture"

```
country_data_fram = green_house_gas_1990_2018[green_house_gas_1990_2018["Variable"] == '3
```

Annual evolution of greenhouse gas emissions from 1990 to 2018 in the agricultural sector in the various countries of the Organization for Economic Cooperation and Development (OECD)

```
chart = alt.Chart(country_data_fram).mark_bar().encode(
    alt.X('Country'),
    alt.Y('mean(Value)'),
    color='Year:N',
    tooltip='Value:N',
).interactive().properties(
    width=780,
    height=800
)
st.write(chart)
```



This graph shows the annual change between the dates 1990 to 2018 of greenhouse gas emissions in the agricultural sector in the various OECD member countries.

The data used to produce this graph have been downloaded from the official statistics website of the OECD do these data are reliable.

To represent the graph, we have chosen a bar representation so that the countries are in the abscissa axis and the emission values in the ordinate axis. This way of doing things gives us the values of the emissions according to the countries.

The different values of gas emissions as a function of the dates were obtained by coloring the height of each bar as a function of the year and by highlighting the correspondence between the dates and the colors on the right. Thus, it is easy to check the value of the emission of each country for a well determined date.

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P2: "dishonest/unethical/deceiving"

For a perspective view 2 below, the following guidelines must be observed:

- The visual representation is intentionally inappropriate, overly complex and/or too cluttered for the audience.
- Labels, axes, and legends are misleading.
- Titles are skewed to intentionally influence the viewer's perception.
- The data has been transformed, filtered, or processed in an intentionally misleading way
- The source and provenance of the data is not clear to the viewer.

Visualization

We import the necessary library

```
import requests
import pandas as pd
import altair as alt
import streamlit as st
from io import StringIO
```

We import Greenhouse Gas Emissions 1990–2018 from ours google drive

```
orig_url= "https://drive.google.com/file/d/1S3mE7-CWL1Hve0GVpGmpBPSTdMkOYNRL/view?usp=sha
file_id = orig_url.split('/')[-2]
dwn_url='https://drive.google.com/uc?export=download&id=' + file_id
url = requests.get(dwn_url).text
csv_raw = StringIO(url)
green_house_gas_1990_2018 = pd.read_csv(csv_raw)
green_house_gas_1990_2018.rename(columns={'ï»¿"COU"': 'COU'}, inplace=True)
```

We visualize the head of data

```
st.write(green_house_gas_1990_2018.head())
```

	COU	Country	POL	Pollutant	VAR	Variable	YEA
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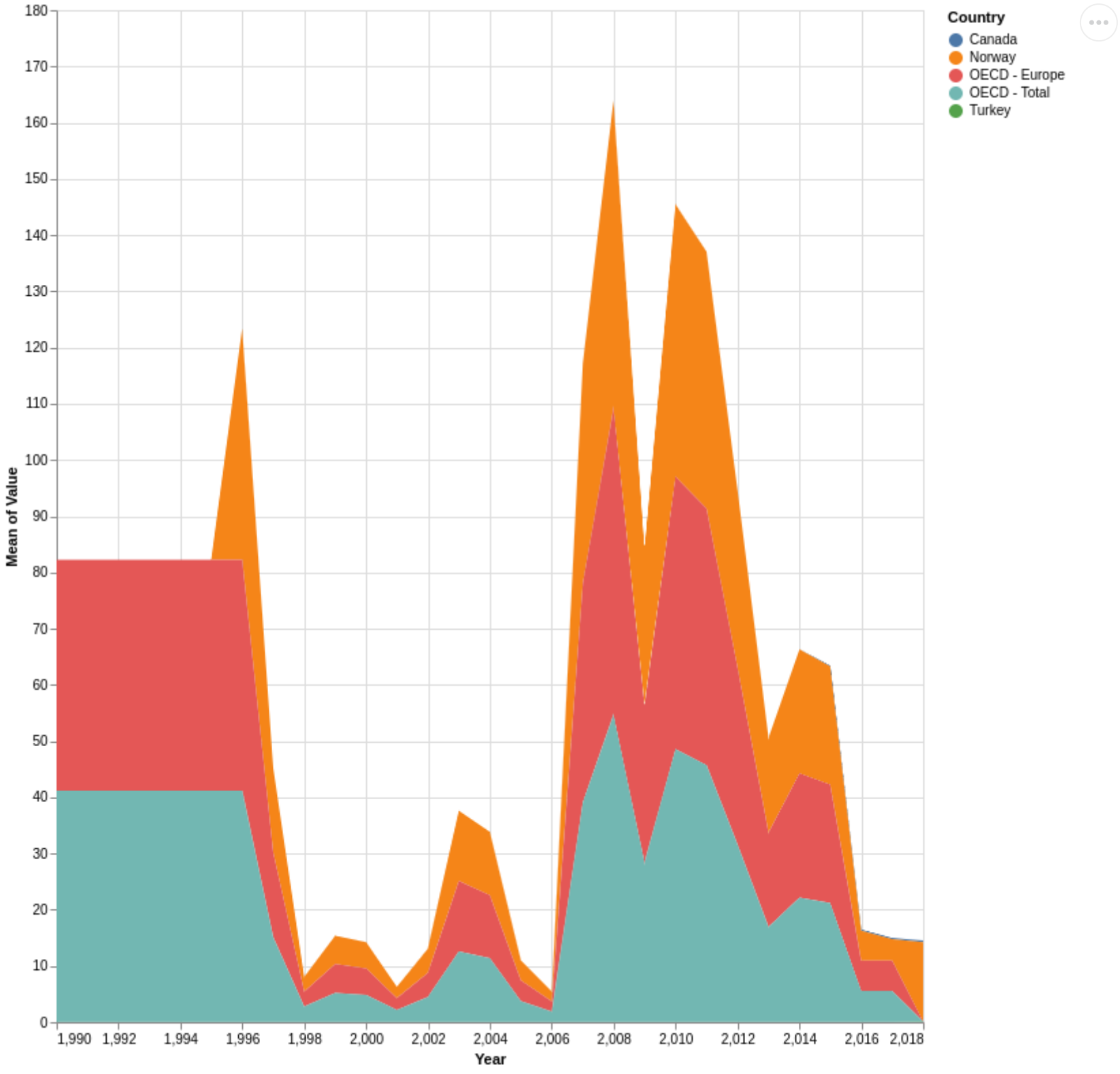
3	AUS	Australia	GHG	Greenhouse gases	TOTAL	Total emissions exclud…	1993
4	AUS	Australia	GHG	Greenhouse gases	TOTAL	Total emissions exclud…	1994

We extract data only related to "3 - Agriculture"

```
Transport_data_fram = green_house_gas_1990_2018[green_house_gas_1990_2018["Variable"] ==
```

Pollution from the transport sector and other elements decreases over time in Organization for Economic Co-operation and Development (OECD) countries

```
chart = alt.Chart(Transport_data_fram).mark_area().encode(
    x='Year',
    y='mean(Value)',
    color='Country:N'
).interactive().properties(
    width=780,
    height=800
)
st.write(chart)
```



This graph, supposed to show the decrease over time in greenhouse gas emissions in the transport sector in OECD countries, meets the P2 criterion.

This is because the data visualized is not the data of the transport sector itself, we took the data of the transport sector plus the data of the storage sector to construct the curve. We mentioned it in a nuanced way in our headline saying that this is the data of the transport sector with other elements.

Also, the countries represented are not all OECD countries. In fact, we have shown just 5 surface curves the first is Canada, the second is Norway, the third is Turkey and the 4 is the average of data on EURE countries and the fifth is the average of data on OECD countries. The choice was made so as to have a curve that will decrease at the end.

The visualization tool used has also been nuanced, in fact with the visualization by the nested surfaces, it is more difficult to have a real understanding and that requires to make efforts to understand what we are talking about.