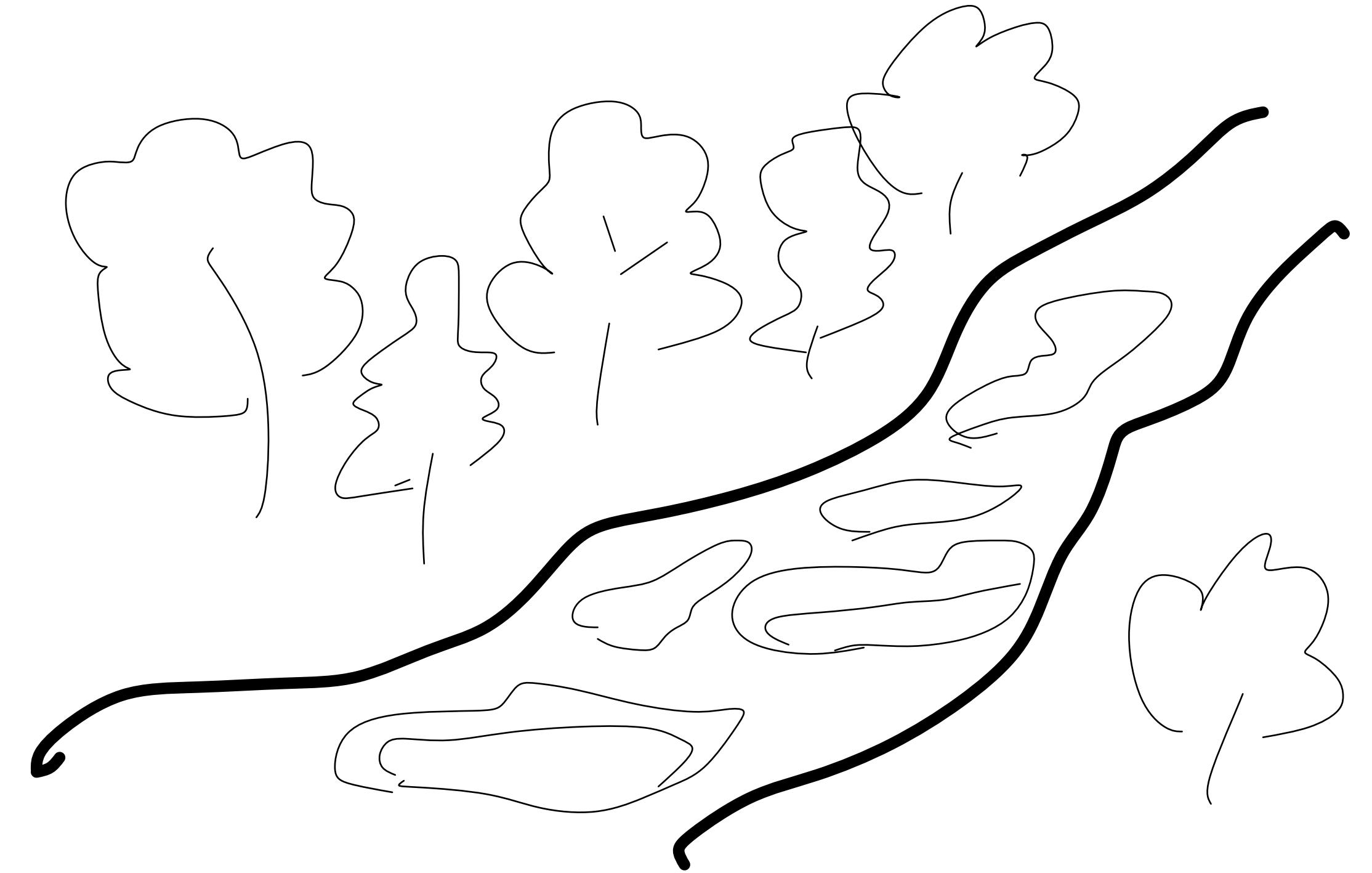
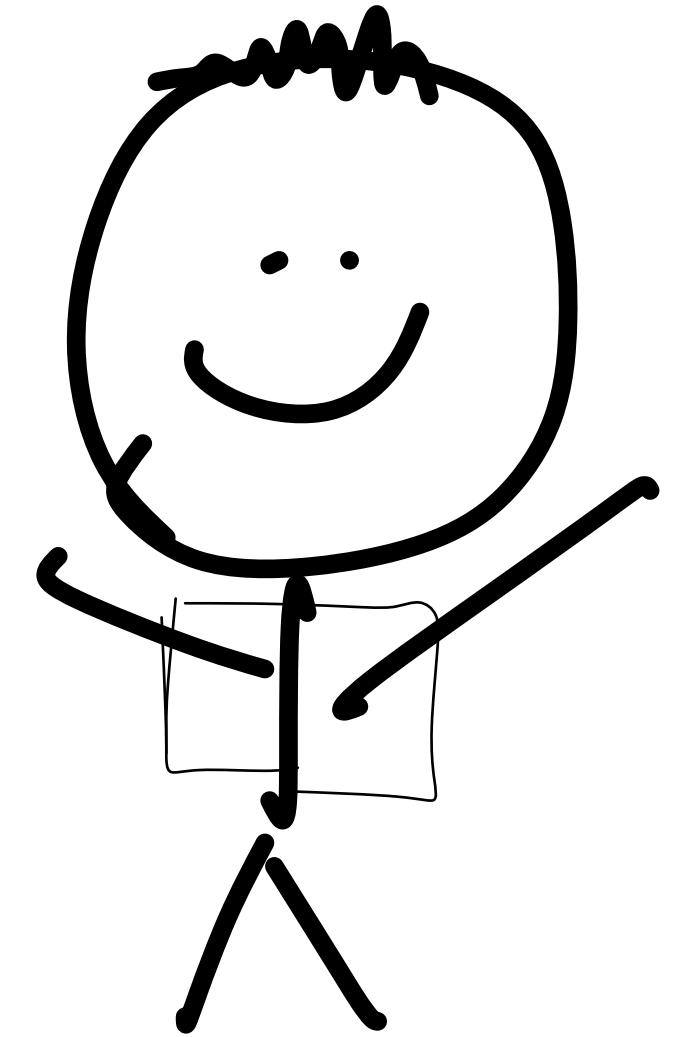
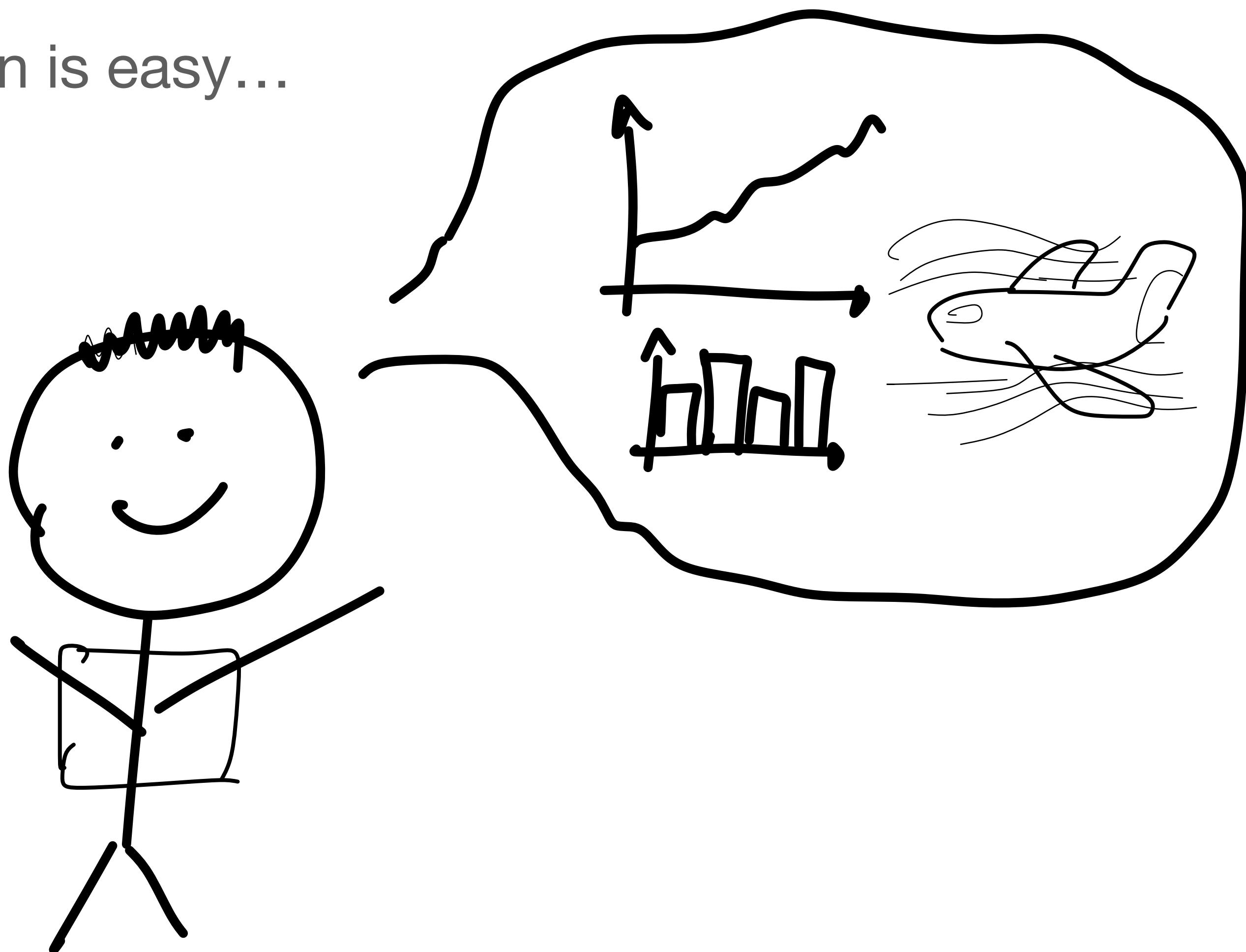


# **The bumps in the road: A retrospective on my data visualisation mistakes**

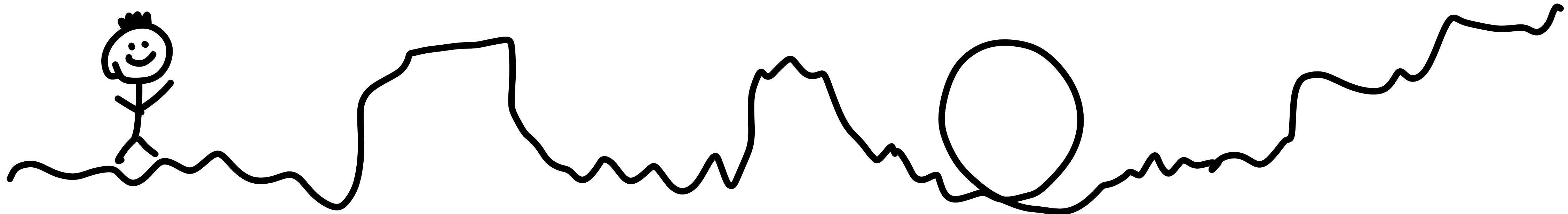
**Artem Kislovskiy**



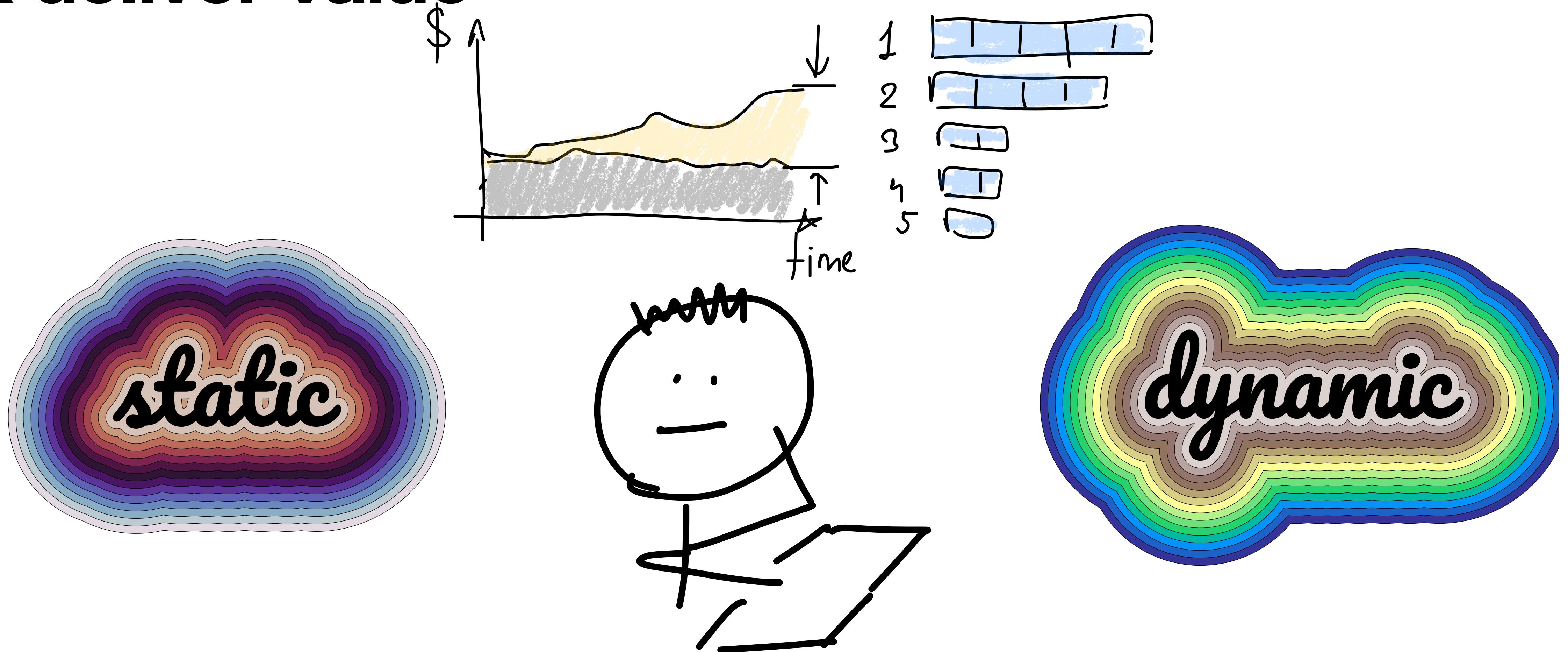
I thought that data visualisation is easy...



- 🤷 I didn't know the rules for better figures
- 🎨 I spent too much time on prettifying the graph
- 🤗 I was lost in versioning the visualisations
- 😅 I was sure that visualisations are unbreakable
- 🤦 I made a mistake and discovered it too late
- 🙄 I had to reprocess the data waiting for a couple of days
- 💣 My list of Jupyter notebooks exploded

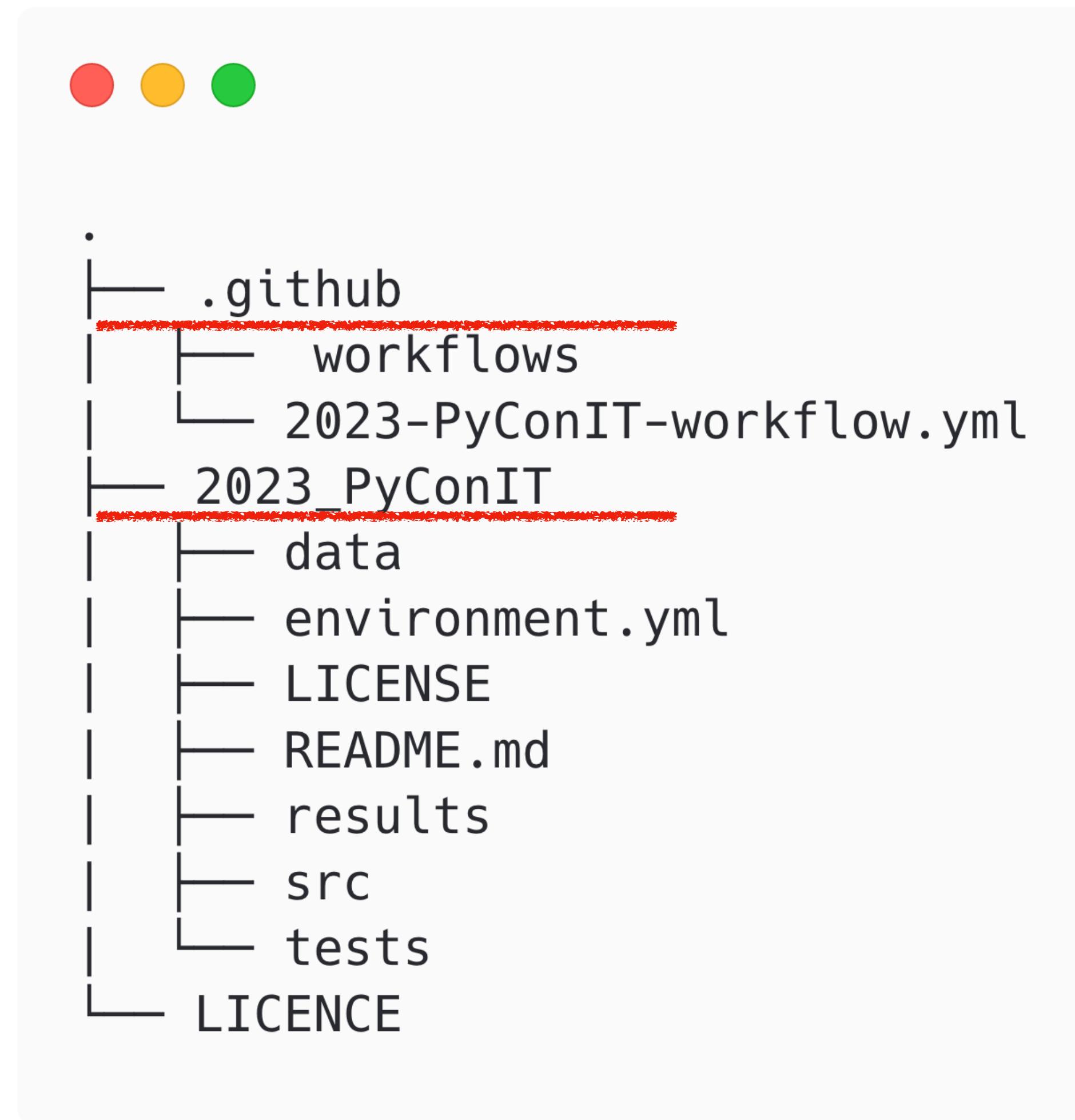
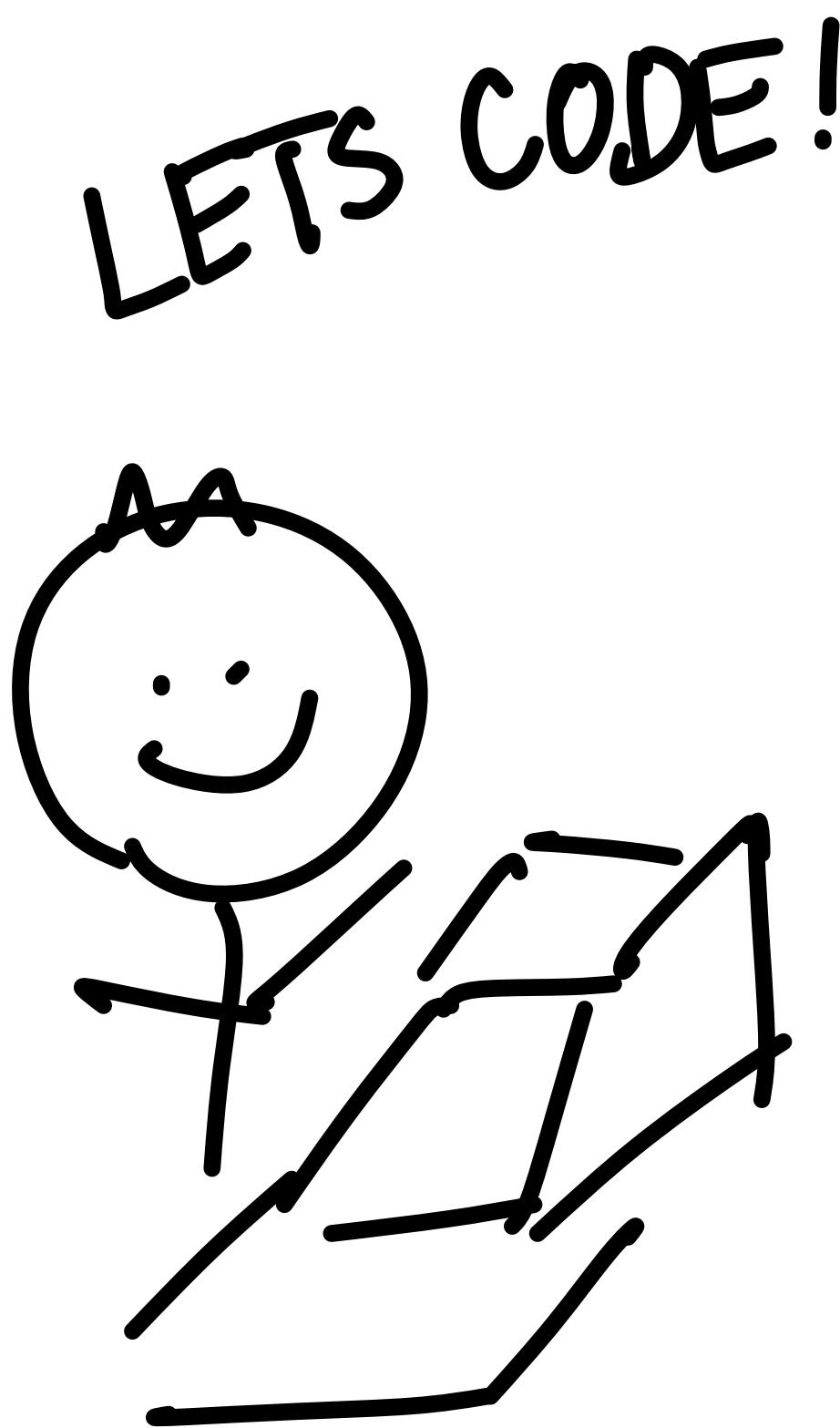


# Know Your Audience & deliver value



The best visualisation software or library is the one that allows you to make the figures you need.

# The structure of the project



[https://github.com/Kislovskiy/talks/tree/main/2023\\_PyConIT](https://github.com/Kislovskiy/talks/tree/main/2023_PyConIT)

# Continuous integration

Kislovskiy / talks Public

Code Issues Pull requests 1 Actions Projects Wiki Security Insights Settings

← Generate Gallery PDF

remove symlink from results dir #3

Re-run all jobs ...

Summary

Triggered via push 4 minutes ago  
Kislovskiy pushed → e64c9fb 2023-PyConIT

Status Success Total duration 1m 37s Artifacts 1

Jobs generate-pdf

Run details

Usage

Workflow file

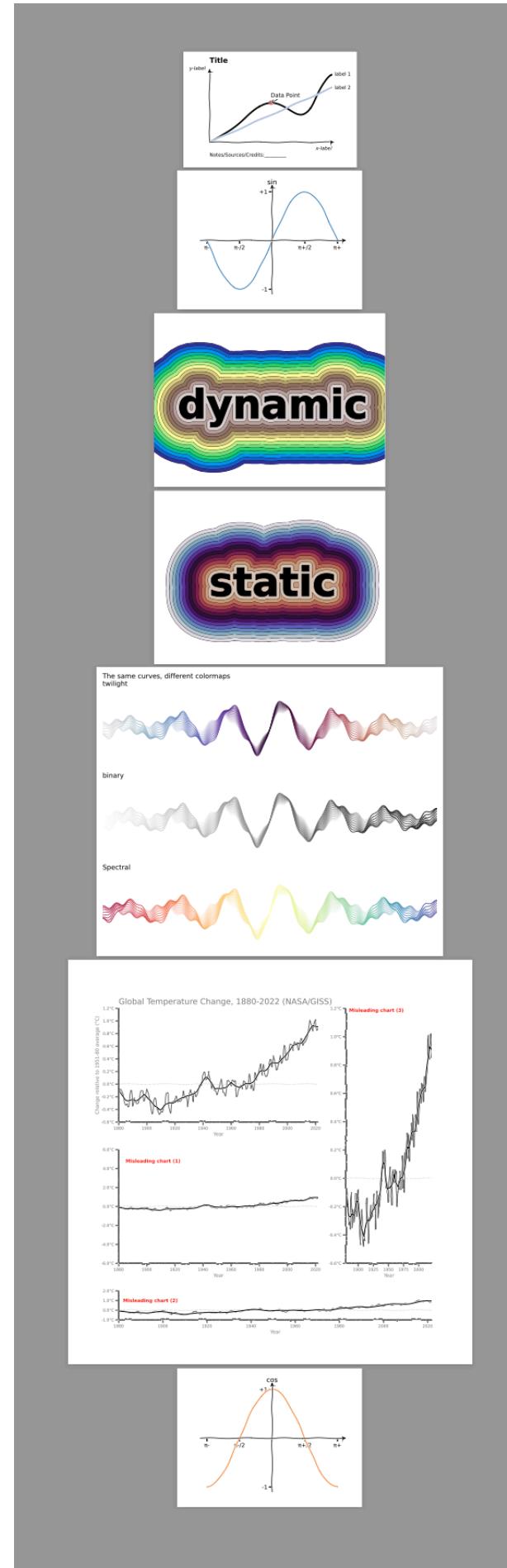
2023-PyConIT-workflow.yml  
on: push

generate-pdf 1m 27s

Artifacts

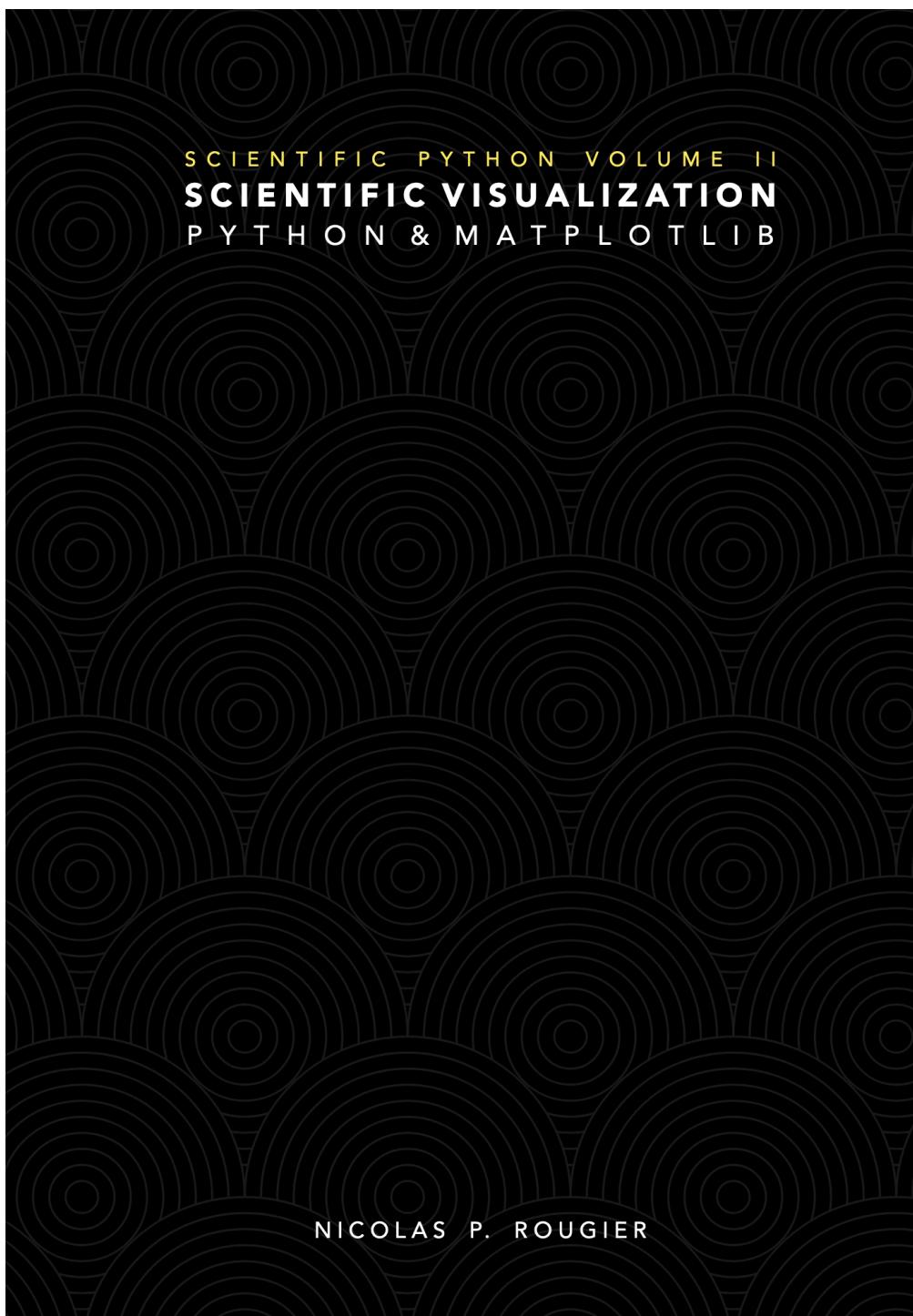
Produced during runtime

Name	Size
galery.pdf	3.09 MB



[https://github.com/Kislovskiy/talks/tree/main/2023\\_PyConIT](https://github.com/Kislovskiy/talks/tree/main/2023_PyConIT)

# Design principles



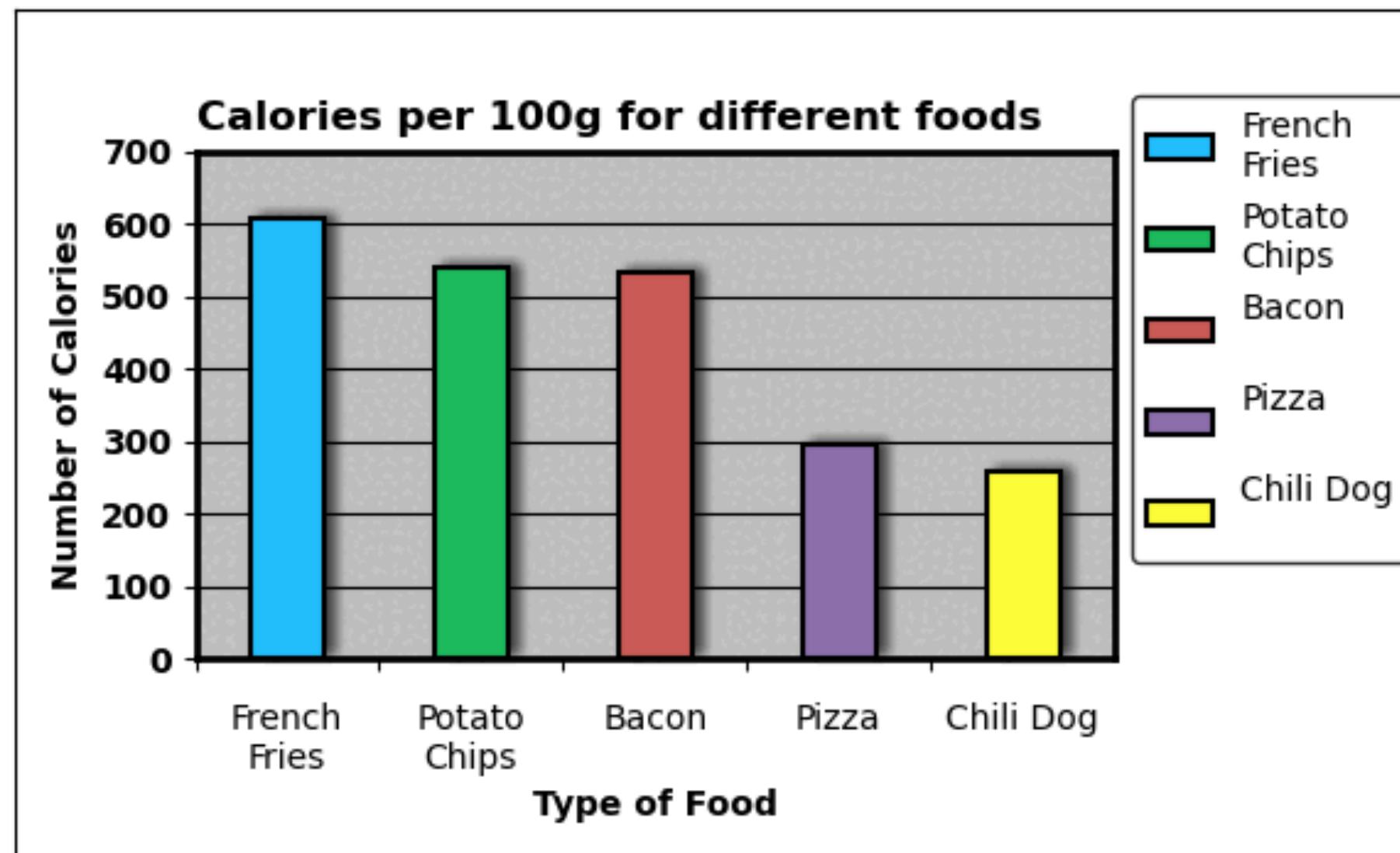
<https://github.com/rougier/scientific-visualization-book>

- Know Your Audience
- Identify Your Message
- Adapt the Figure to the Support Medium
- Captions Are Not Optional
- Do Not Trust the Defaults
- Use Color Effectively
- Do Not Mislead the Reader
- Avoid "Chartjunk"
- Message Trumps Beauty
- Get the Right Tool



# Less is more

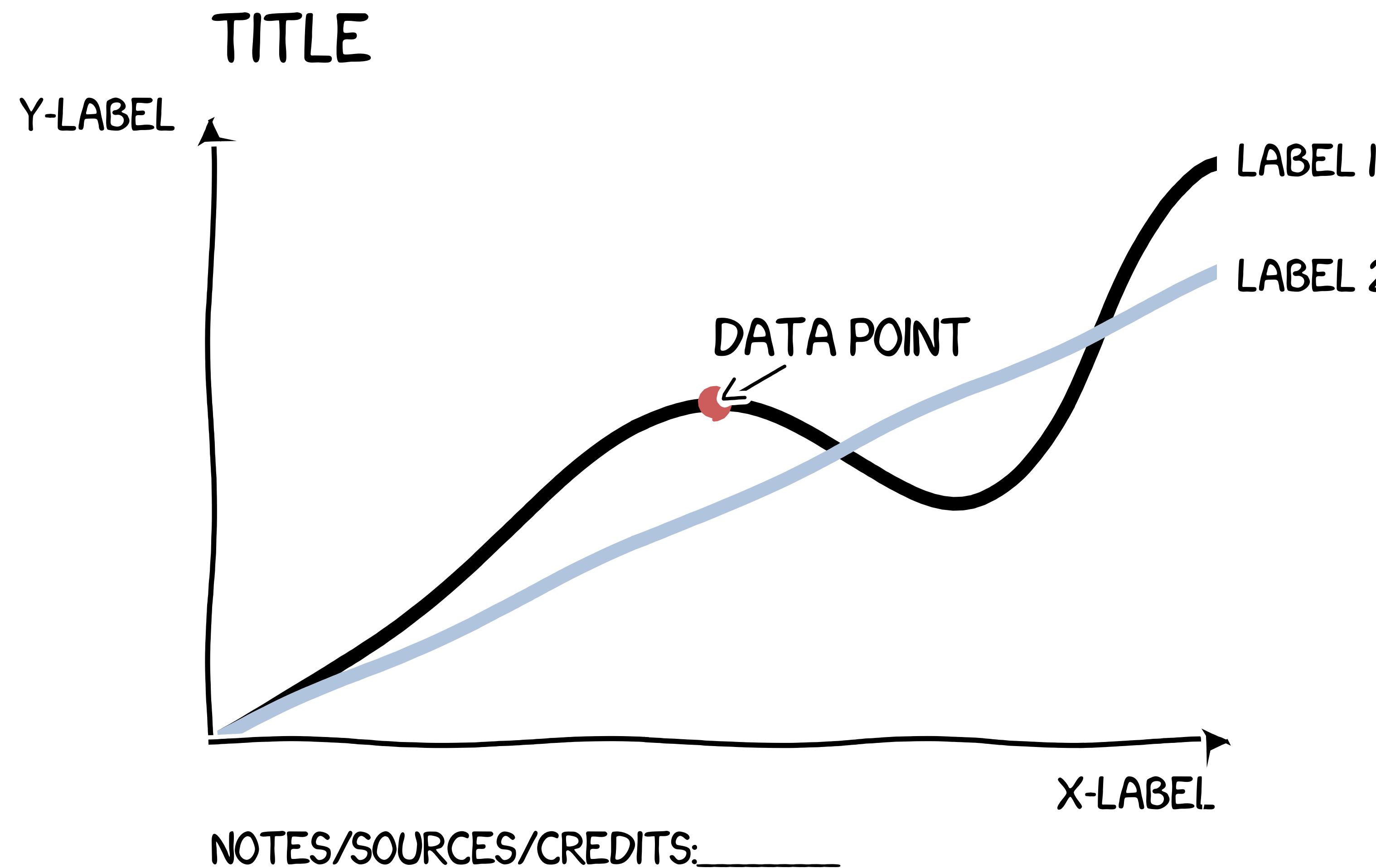
## Less is More



A remake of [www.darkhorseanalytics.com](http://www.darkhorseanalytics.com)

Made with matplotlib

<https://github.com/rougier/scientific-visualization-book>



[https://github.com/Kislovskiy/talks/tree/main/2023\\_PyConIT](https://github.com/Kislovskiy/talks/tree/main/2023_PyConIT)



```
>>>from matplotlib import pyplot as plt

>>>fig, ax = plt.subplots()

>>> type(fig)
matplotlib.figure.Figure

>>> type(ax)
matplotlib.axes._axes.Axes
```



```
def plot_common_chart():
    fig, ax = plt.subplots()

    ax.set_title('...')

    ax.set_ylabel('...')
    ax.set_xlabel('...')

    ax.plot('...')
    ax.plot('...')
    ax.scatter('...')
    ax.annotate('...')

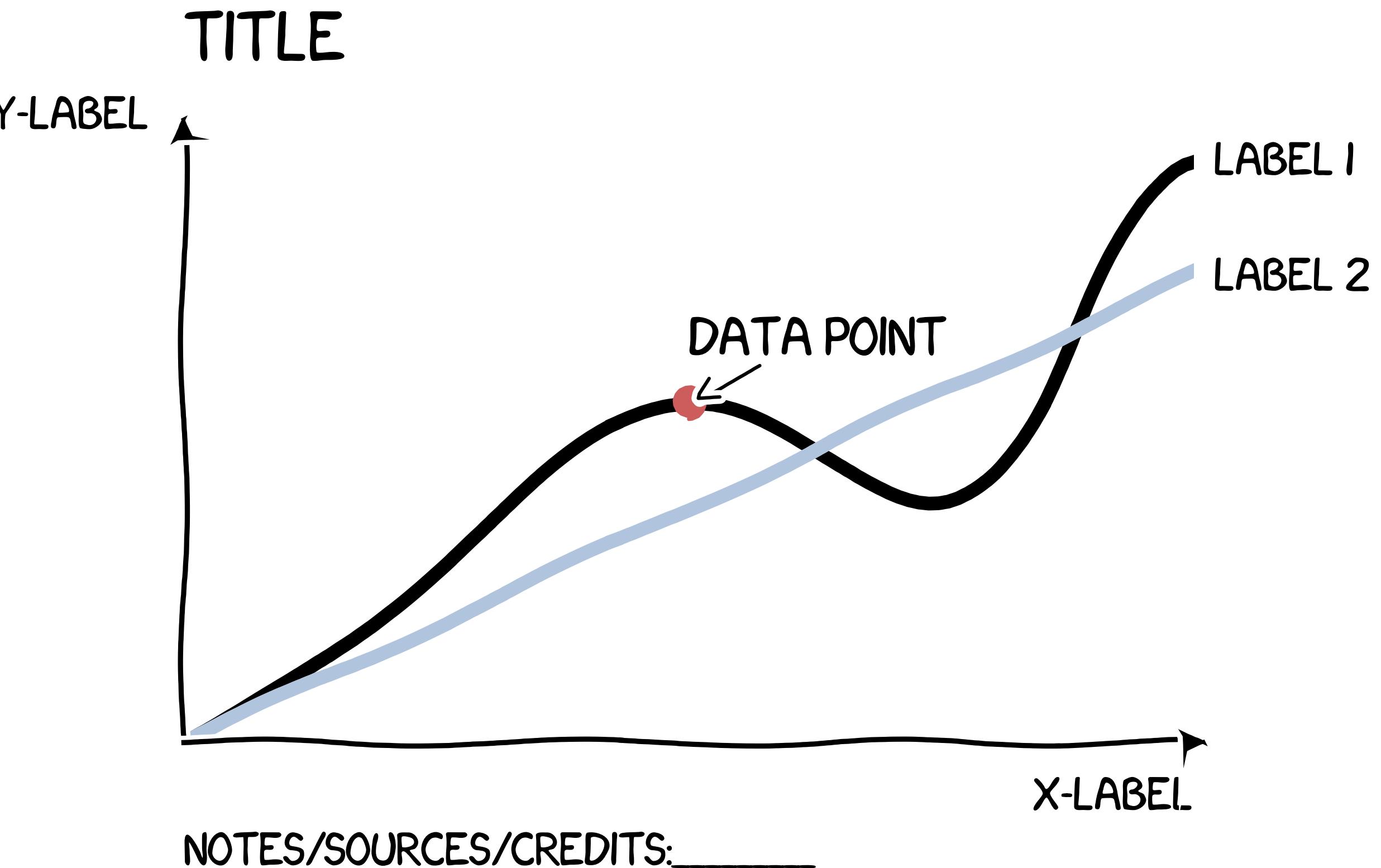
    ax.set_ylim('...')
    ax.set_xlim('...')

    add_labels_to_lines(ax, "label 1")
    add_labels_to_lines(ax, "label 2")
    despine(ax)
    add_arrows_to_axis(ax)
    remove_ticks(ax)

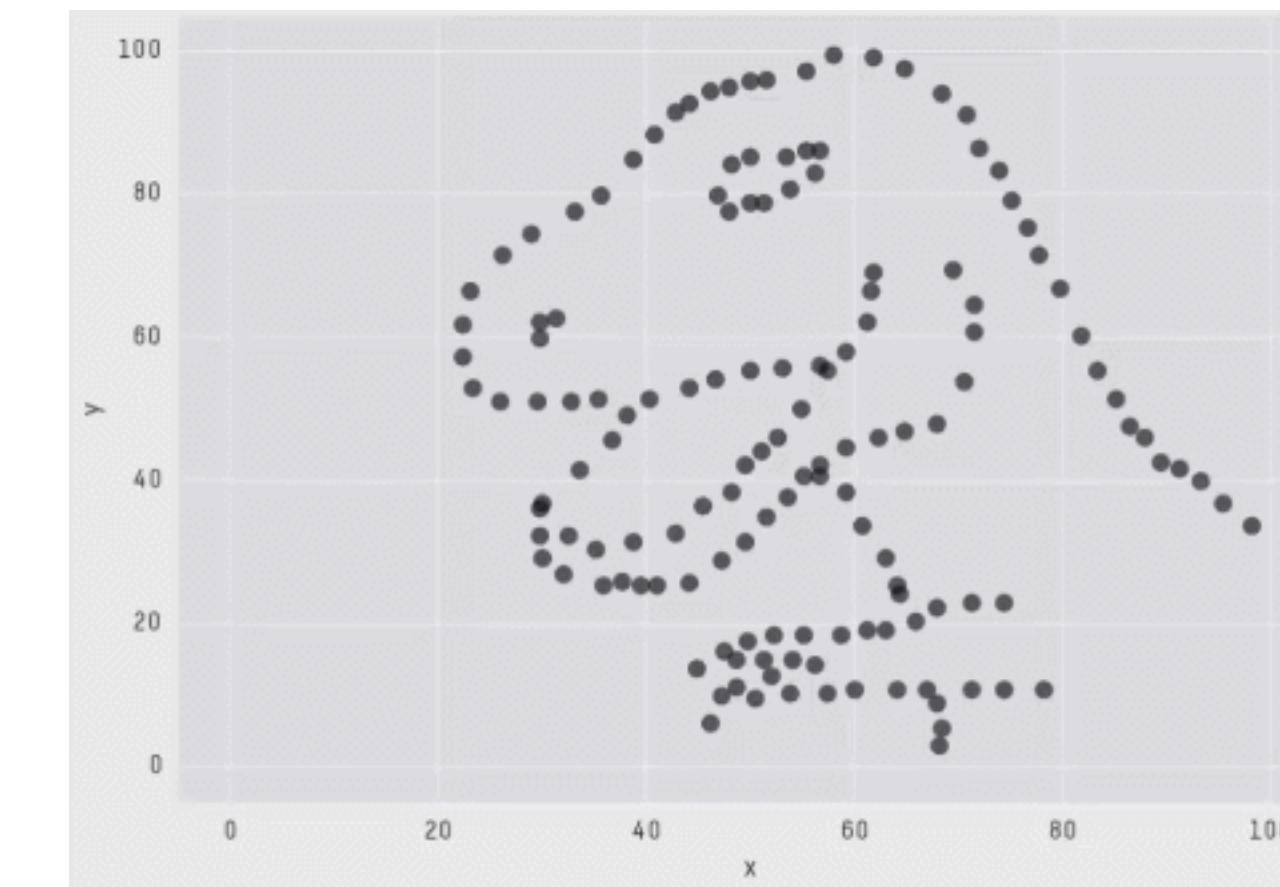
    ax.text('...')
    fig.tight_layout()

    return fig

if __name__ == "__main__":
    ...
    fig = plot_common_chart()
    ...
    fig.savefig('...')
```



# Verify & Validate



X Mean: 54.2659224  
Y Mean: 47.8313999  
X SD : 16.7649829  
Y SD : 26.9342120  
Corr. : -0.0642526

<https://www.autodesk.com/research/publications/same-stats-different-graphs>

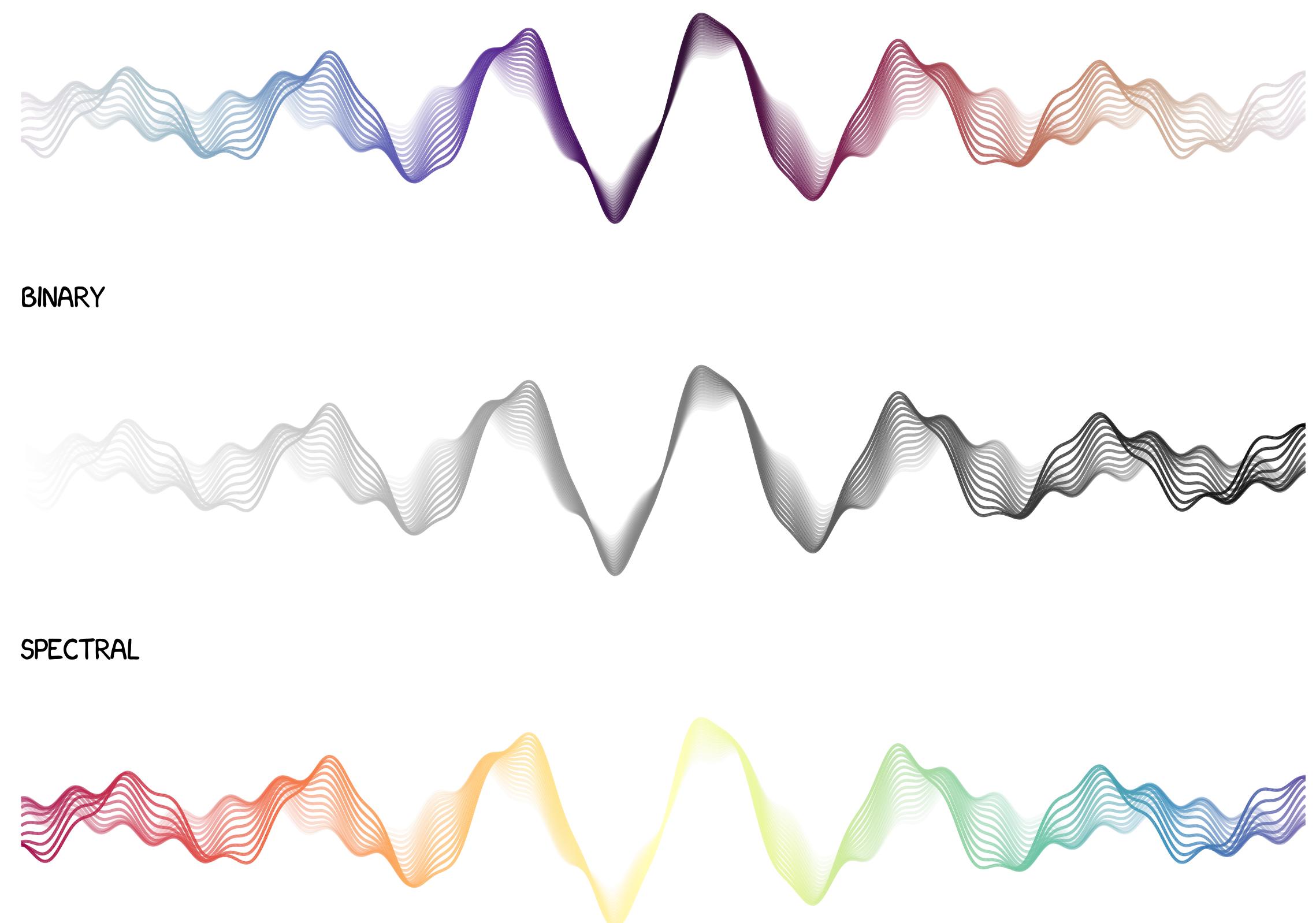


```
.  
|   └── .github  
|       └── workflows  
|           └── 2023-PyConIT-workflow.yml  
└── 2023_PyConIT  
    ├── data  
    ├── environment.yml  
    ├── LICENSE  
    ├── README.md  
    ├── results  
    └── src  
        ├── assemble_plots.py  
        ├── less-is-more.py  
        ├── plot_common_chart.py  
        ├── plot_cos.py  
        ├── plot_data.py  
        ├── plot_nothing.py  
        ├── plot_sin.py  
        ├── plot_text.py  
        ├── plotting_utils.py  
        └── suboptimal_code  
            ├── chart.ipynb  
            ├── misleading.ipynb  
            └── sin.ipynb  
        └── transform_data.py  
    └── tests  
        ├── test_data.py  
        ├── test_plot_cos.py  
        └── test_transform_data.py  
└── LICENCE
```

# Decouple data from visualisations



THE SAME CURVES, DIFFERENT COLORMAPS  
TWILIGHT





```
from matplotlib import pyplot as plt
import numpy as np
import pandas as pd
from matplotlib.collections import LineCollection
from plotting_utils import despine, remove_ticks

def visualize_lines_with_colormap(...):
    ...
    L = LineCollection(...)
    axis.add_collection(L)

def visualize_curves(...):
    ...
    for i, alpha in enumerate(...):
        visualize_lines_with_colormap(...)

    despine(...)
    remove_ticks(...)
    axis.set_xlim(...)
    axis.set_ylim(...)

    return axis

def plot_cmap_waves():
    df = pd.read_csv(...)

    fig, ax = plt.subplots(...)
    ax[0] = visualize_curves(...)
    ax[0].set_title(...)

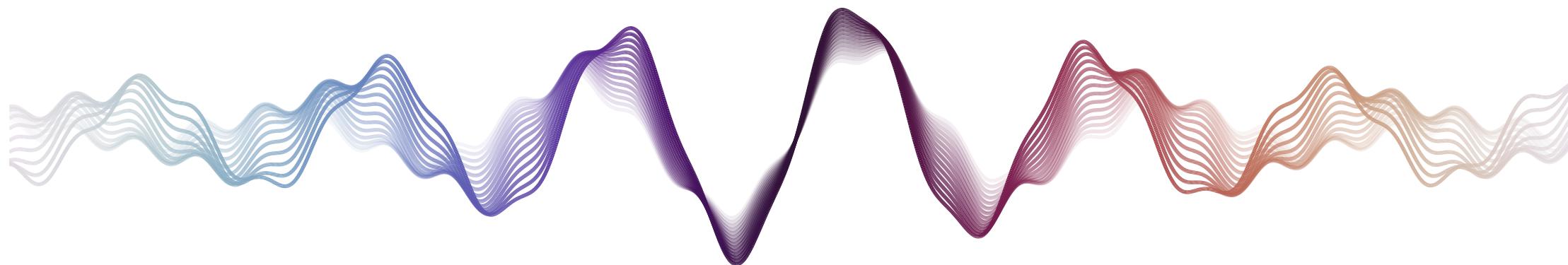
    ax[1] = visualize_curves(...)
    ax[1].set_title(...)

    ax[2] = visualize_curves(...)
    ax[2].set_title(...)

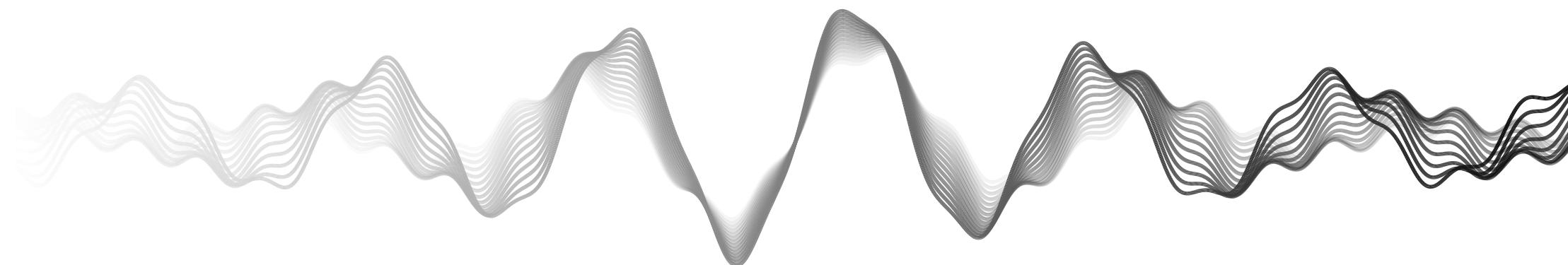
    fig.tight_layout()
    return fig

if __name__ == "__main__":
    ...
    fig = plot_cmap_waves()
    fig.savefig(...)
```

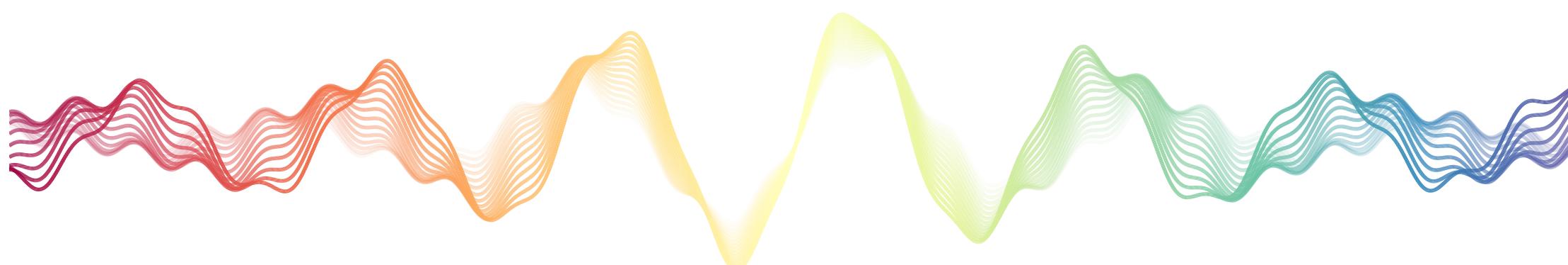
THE SAME CURVES, DIFFERENT COLORMAPS  
TWILIGHT



BINARY



SPECTRAL



[https://github.com/Kislovskiy/talks/tree/main/2023\\_PyConIT](https://github.com/Kislovskiy/talks/tree/main/2023_PyConIT)

```

from matplotlib import pyplot as plt
import matplotlib.gridspec as gridspec
from plotting_utils import format_yticklabels_with_celsius, despine
import pandas as pd

def visualize_global_temp(ax):
    pd.read_csv(...).plot(...)
    despine(ax)
    ax.hlines(...)
    ax.set_xlim(...)
    ax.set_xlabel(...)
    return ax

def plot_misleading_chart():
    fig, ax = plt.subplots()
    visualize_global_temp(ax)
    ax.set_title('... ')
    ax.set_ylabel('...')

    fig = plt.figure()
    gspec = gridspec.GridSpec(...)

    ax1 = fig.add_subplot(gspec[:5, :8])
    visualize_global_temp(ax1)
    ax1.set_title('... ')
    ax1.set_ylabel('... ')
    format_yticklabels_with_celsius(ax1)

    ax2 = fig.add_subplot(gspec[5:10, :8])
    visualize_global_temp(ax2)
    ax2.set_ylim(... )
    ax2.text(... )
    format_yticklabels_with_celsius(ax2)

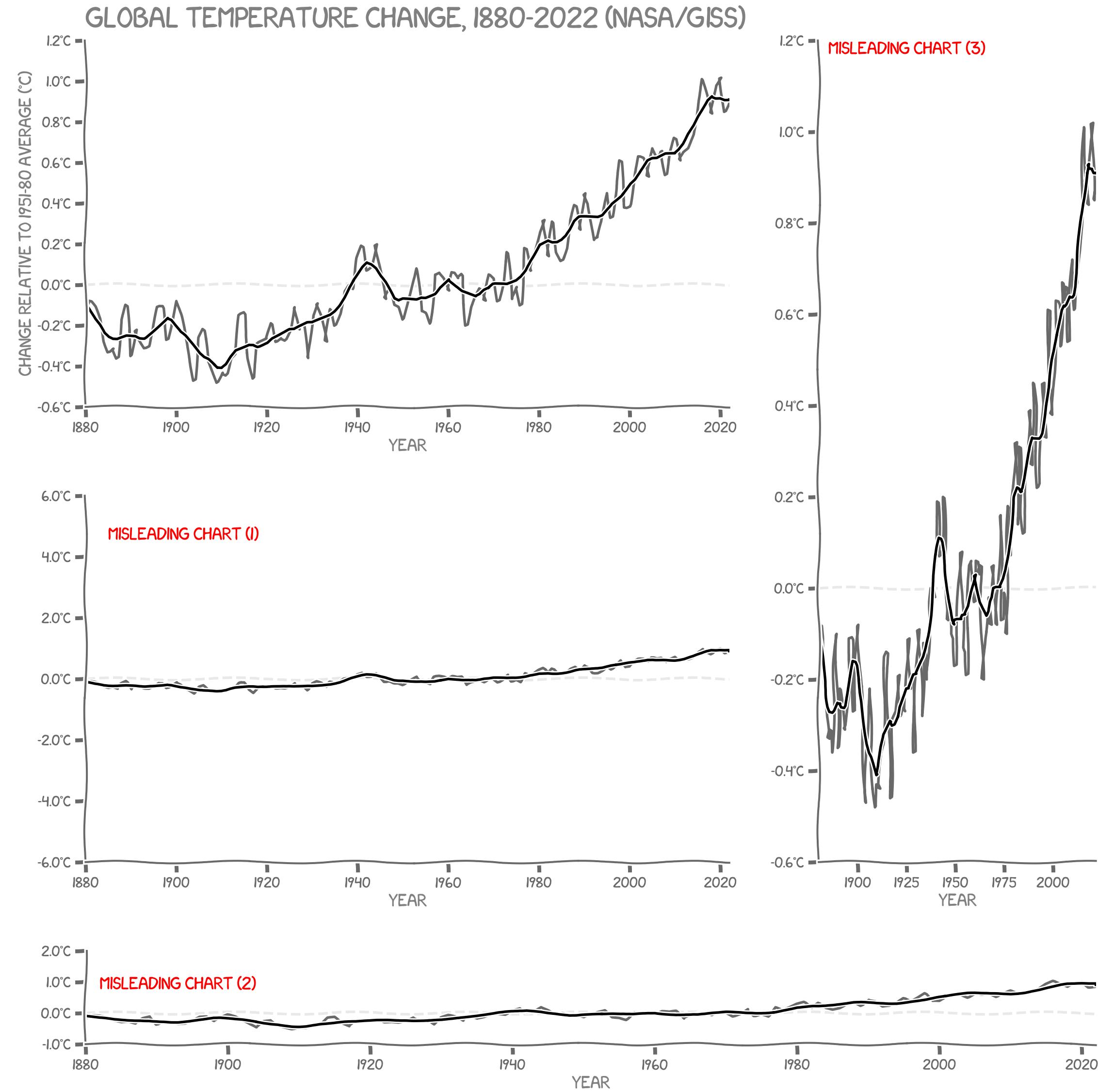
    ax3 = fig.add_subplot(gspec[10:, :])
    visualize_global_temp(ax3)
    ax3.text(... )
    format_yticklabels_with_celsius(ax3)

    ax4 = fig.add_subplot(gspec[:10, 8:])
    visualize_global_temp(ax4)
    ax4.text(... )
    format_yticklabels_with_celsius(ax4)

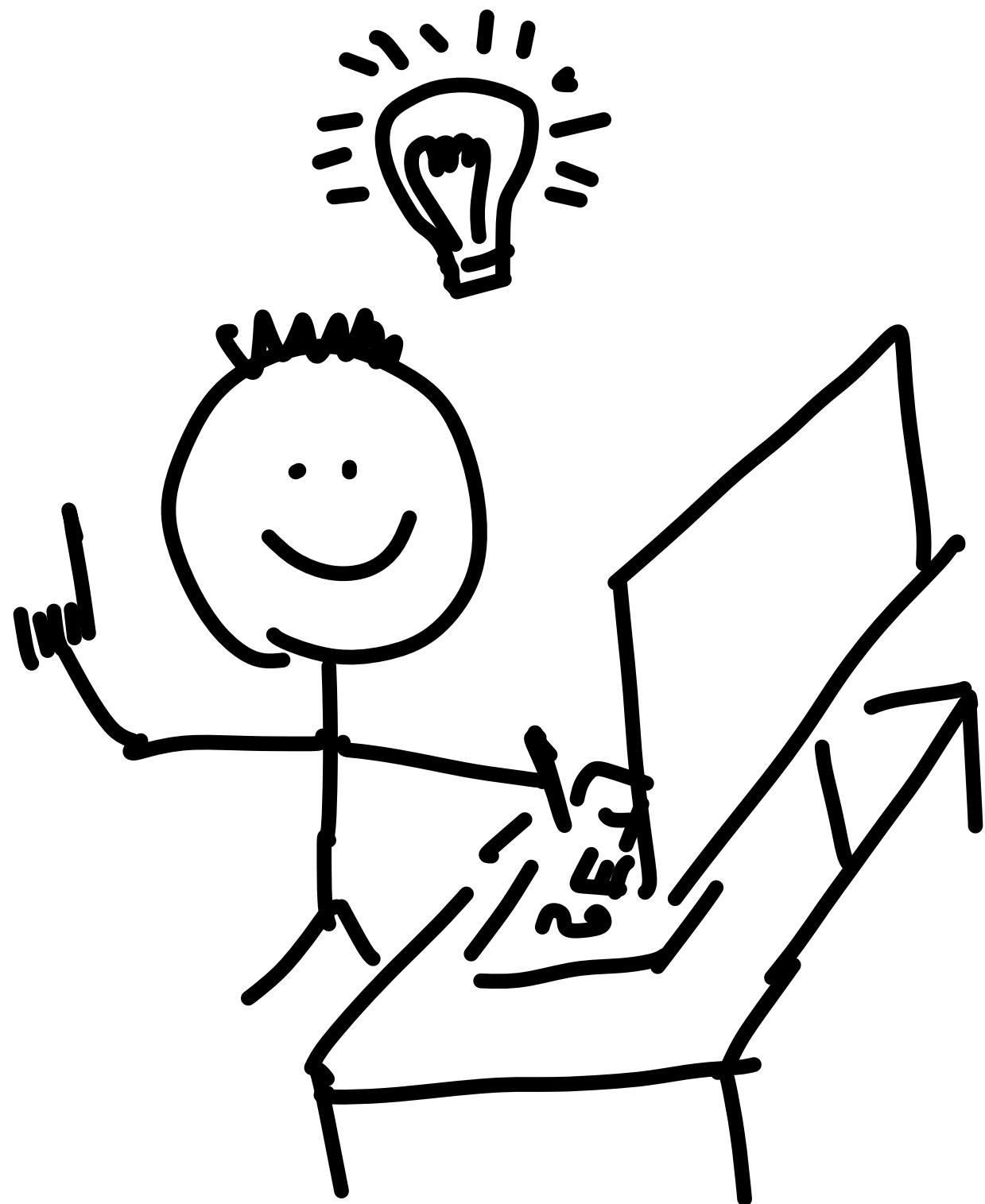
    return fig

if __name__ == "__main__":
    ...
    fig = plot_misleading_chart()
    ...
    fig.savefig(... )

```



# Write tests



```
import pandas as pd

def test_csv_values():
    ...
    data = pd.read_csv('...')

    assert abs(data['sin']).all() <= 1
```

[https://github.com/Kislovskiy/talks/tree/main/2023\\_PyConIT](https://github.com/Kislovskiy/talks/tree/main/2023_PyConIT)

# Version control



Kislovskiy / talks Public

Code Issues Pull requests Actions Projects Wiki Security Insights Settings

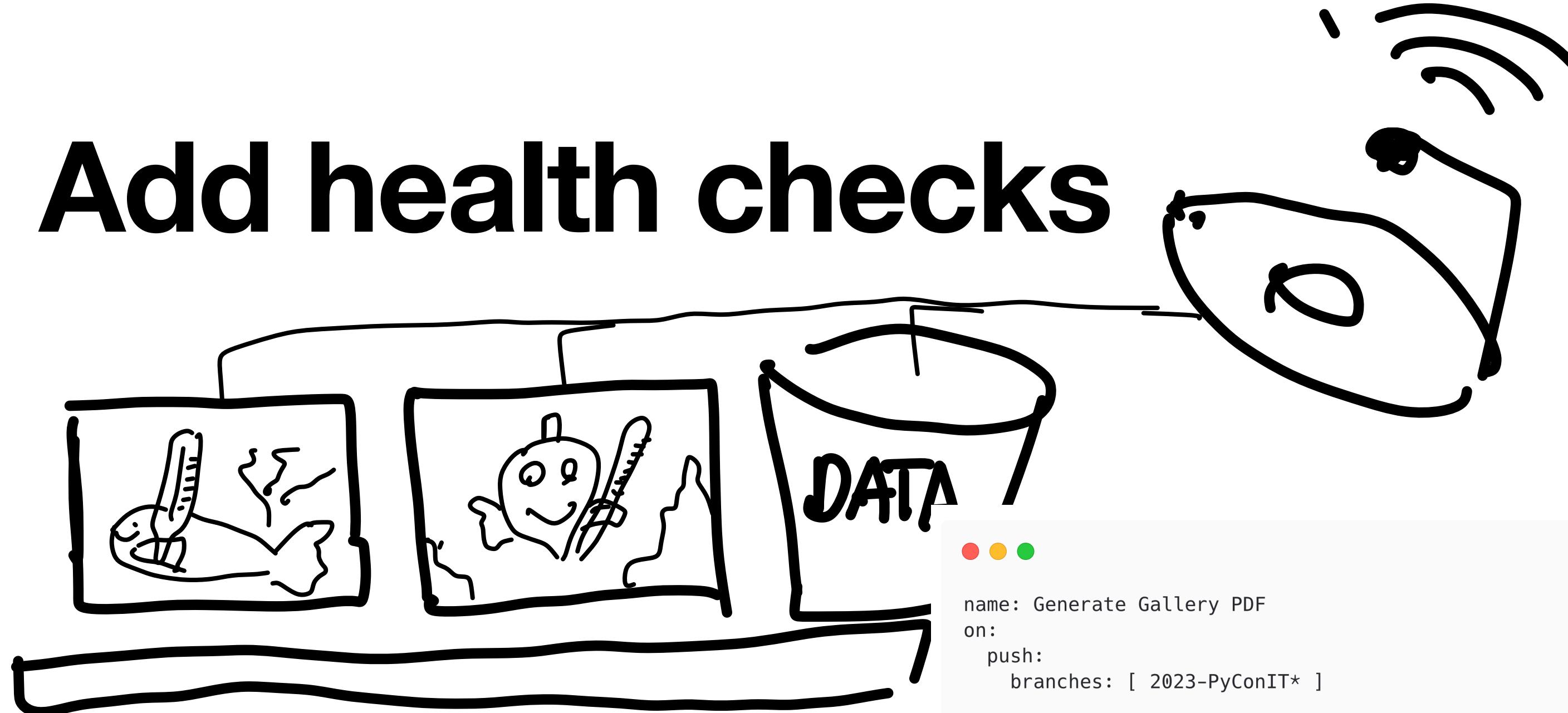
History for talks / 2023\_PyData\_Berlin / src / plot\_cos.py

- o Commits on Apr 5, 2023
  - latest updates  
Kislovskiy committed 7 minutes ago ✓ Verified d5c8475
- o Commits on Apr 4, 2023
  - add svg  
Kislovskiy committed yesterday ✓ Verified c64bf1c
- o Commits on Apr 1, 2023
  - prettyfy  
Kislovskiy committed 4 days ago Verified 480ac83
- o Commits on Mar 31, 2023
  - fix typos  
Kislovskiy committed 5 days ago Verified 27c478d
  - kind of working version  
Kislovskiy committed last week Verified 9306854
- o End of commit history for this file

Newer Older

[https://github.com/Kislovskiy/talks/tree/main/2023\\_PyConIT](https://github.com/Kislovskiy/talks/tree/main/2023_PyConIT)

# Add health checks



```
name: Generate Gallery PDF
on:
  push:
    branches: [ 2023-PyConIT* ]

jobs:
  generate-pdf:
    runs-on: ubuntu-latest
    steps:
      - name: Checkout code
        uses: actions/checkout@v3

      - name: Setup conda environment
        uses: conda-incubator/setup-miniconda@v2
        with:
          environment-file: 2023_PyConIT/environment.yml
          activate-environment: 2023_PyConIT

      - name: Run tests
        shell: bash -el {0}
        run:
          pytest 2023_PyData_Berlin

      - name: Generate PDF
        shell: bash -el {0}
        run:
          python 2023_PyConIT/src/assemble_plots.py

      - name: Archive PDF
        uses: actions/upload-artifact@v3
        with:
          name: gallery.pdf
          path: 2023_PyConIT/results/gallery.pdf
```

← Generate Gallery PDF  
remove symlink from results dir #3

Cancel workflow   Latest #2   ...

Summary

Jobs

generate-pdf

Run details

Usage

Workflow file

2023-PyConIT-workflow.yml

on: push

generate-pdf 56s

All checks have passed 1 successful check

Generate Gallery PDF / generate-pdf (push) Successful in ... Details

This branch has no conflicts with the base branch Merging can be performed automatically.

Squash and merge

You can also open this in GitHub Desktop or view command line instructions.



```
● ● ●

from importlib.util import module_from_spec, spec_from_file_location
from inspect import getmembers, isfunction
from pathlib import Path

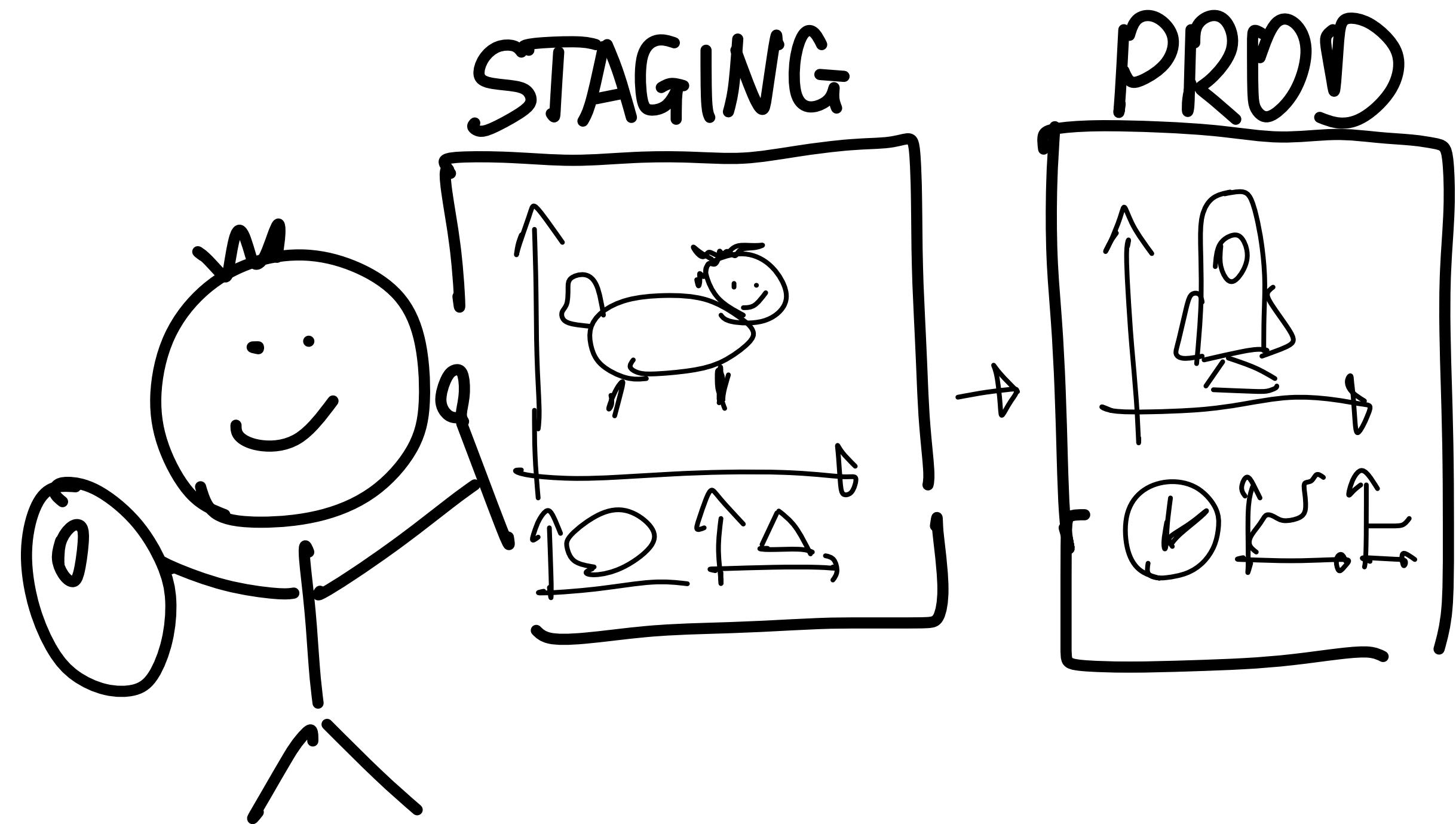
import matplotlib.pyplot as plt
from matplotlib.backends.backend_pdf import PdfPages

def main():
    # Create a PDF file to store all the plots
    ...
    with PdfPages(...) as pdf:
        for file in Path(__file__).parent.glob("plot_*.py"):
            spec = spec_from_file_location("src", file)
            module = module_from_spec(spec)
            spec.loader.exec_module(module)

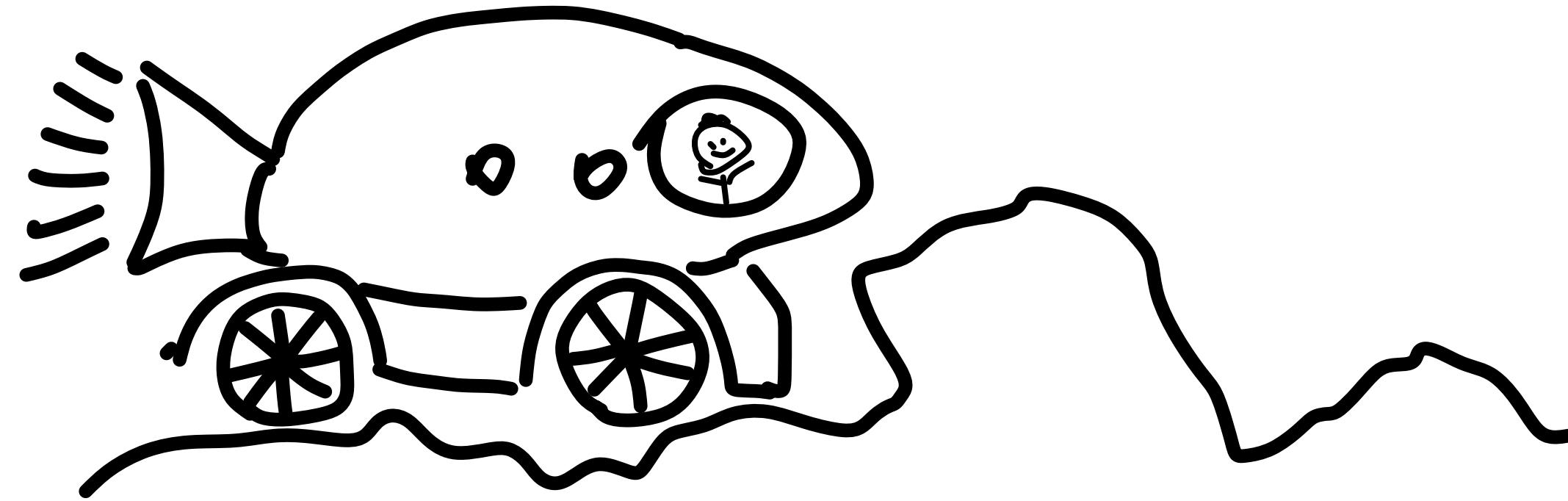
            for name, func in getmembers(module, isfunction):
                if name.startswith("plot_"):
                    fig = func()
                    if fig:
                        pdf.savefig(fig)
                        plt.close(fig)

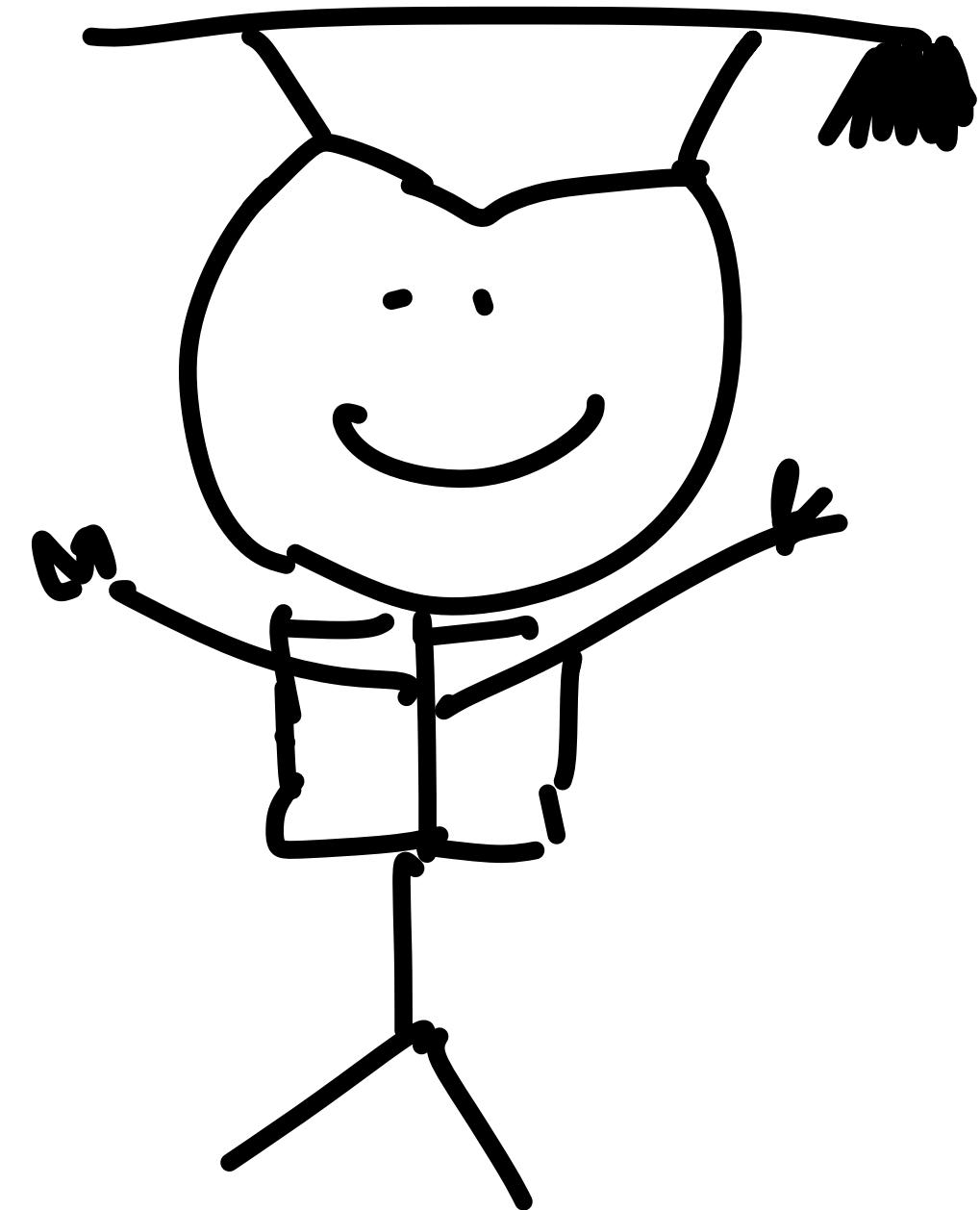
if __name__ == "__main__":
    main()
```

# Create a staging environment



# Know the limits





- Work collaboratively
- Aim for reproducibility
- Version code
- Set up monitoring
- Create a continuous delivery pipeline

[https://github.com/Kislovskiy/talks/tree/main/2023\\_PyConIT](https://github.com/Kislovskiy/talks/tree/main/2023_PyConIT)