Case study - improving a visual

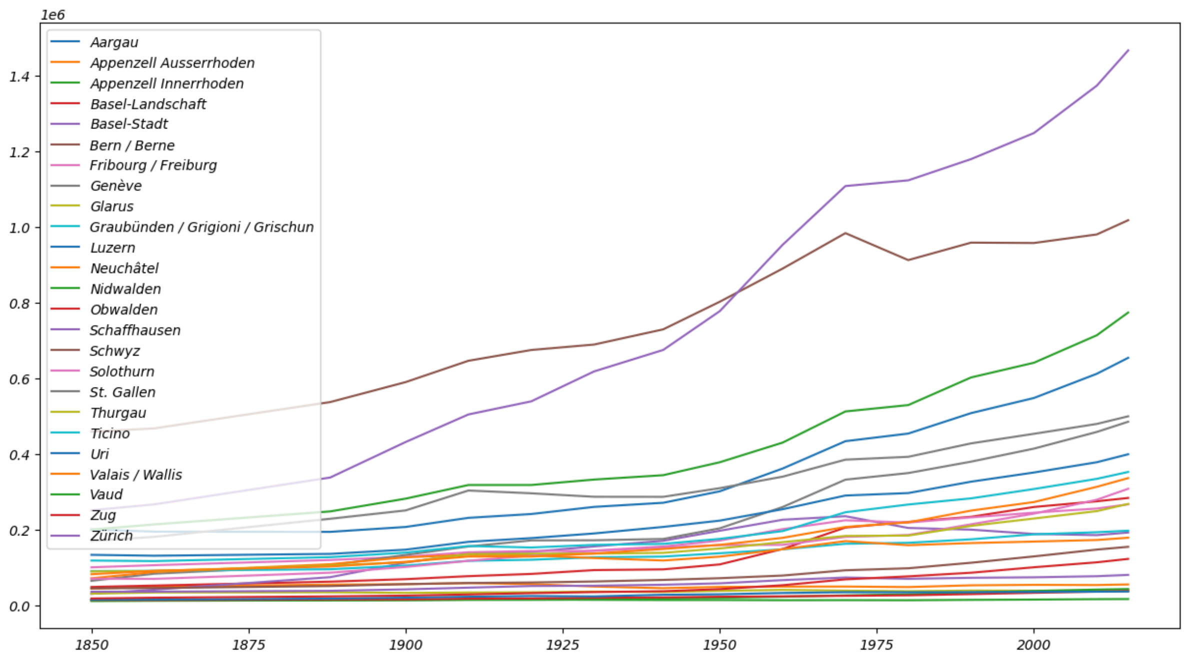
```
In [1]: import matplotlib.pyplot as plt
        from matplotlib import ticker
        import numpy as np
        import pandas as pd
```

Description of situation:

> For a presentation, you want to create a visualisation that shows that the canton of Geneva has the highest **relative** population growth since 1850 of all the cantons in Switzerland. Your colleague has created a first version of such a visualization using the code below:

```
In [2]: # Read data
        df = pd.read_csv('swiss_population.csv', index_col='canton')

        # Get unique cantons
        cantons = df.index.unique()

        # Exclude canton Jura (as it did not yet exist in 1850)
        cantons = cantons.drop('Jura')
```

```
In [3]: # Create Figure and Axes objects
        fig, ax = plt.subplots(figsize=(15, 8))

        # Add a line for each canton
        for canton in cantons:
            ax.plot(df.loc[canton, 'year'], df.loc[canton, 'population'], label=canton)

        # Add a legend
        ax.legend()

        # Save figure as pdf
        fig.savefig('before.pdf')
```



In [4]:
```
idx = df['year'] == 2015
df.loc[idx, :].sort_values(by='population')
```

Out[4]:

canton	year	population
Appenzell Innerrhoden	2015	15974.0
Uri	2015	35973.0
Obwalden	2015	37076.0
Glarus	2015	40028.0
Nidwalden	2015	42420.0
Appenzell Ausserrhoden	2015	54543.0
Jura	2015	72782.0
Schaffhausen	2015	79836.0
Zug	2015	122134.0
Schwyz	2015	154093.0
Neuchâtel	2015	178107.0
Basel-Stadt	2015	191817.0
Graubünden / Grigioni / Grischun	2015	196610.0
Solothurn	2015	266418.0
Thurgau	2015	267429.0
Basel-Landschaft	2015	283231.0
Fribourg / Freiburg	2015	307461.0
Valais / Wallis	2015	335696.0
Ticino	2015	351946.0
Luzern	2015	398762.0
Genève	2015	484736.0
St. Gallen	2015	499065.0
Aargau	2015	653675.0
Vaud	2015	773407.0
Bern / Berne	2015	1017483.0
Zürich	2015	1466424.0

Tasks:

> a) Mention what would you do not like about your colleague's visualization
>
> b) Create an improved visualization

Solution task a):

- The message is unclear (see rule 2)
- The visualization is too complicated for a presentation (see rule 3)
- There are no captions except the legend which is not very helpful (see rue 4)
- The plot uses default settings and is thus not fine tuned (see rule 5)
- Color is not used effectively (see rule 6)
- The plot shows the absolute population growth which might be misleading to the audience (see rule 7)
- The plot has a relatively low data-ink ratio (see rule 8)
- The plot is neither beautiful nor informative (see rule 9)

Solution task b):

1. Preprocess raw data

In [5]:
```
# Add a column to the dataframe which contains the relative population growth
df['growth'] = 0.0

# Compute the relative population growth as percentage for each canton
for canton in cantons:
    absolute_population_counts = df.loc[canton, 'population']
    initial_population_count = df.loc[canton, 'population'].values[0]
    df.loc[canton, 'growth'] = (absolute_population_counts / initial_population_count
```

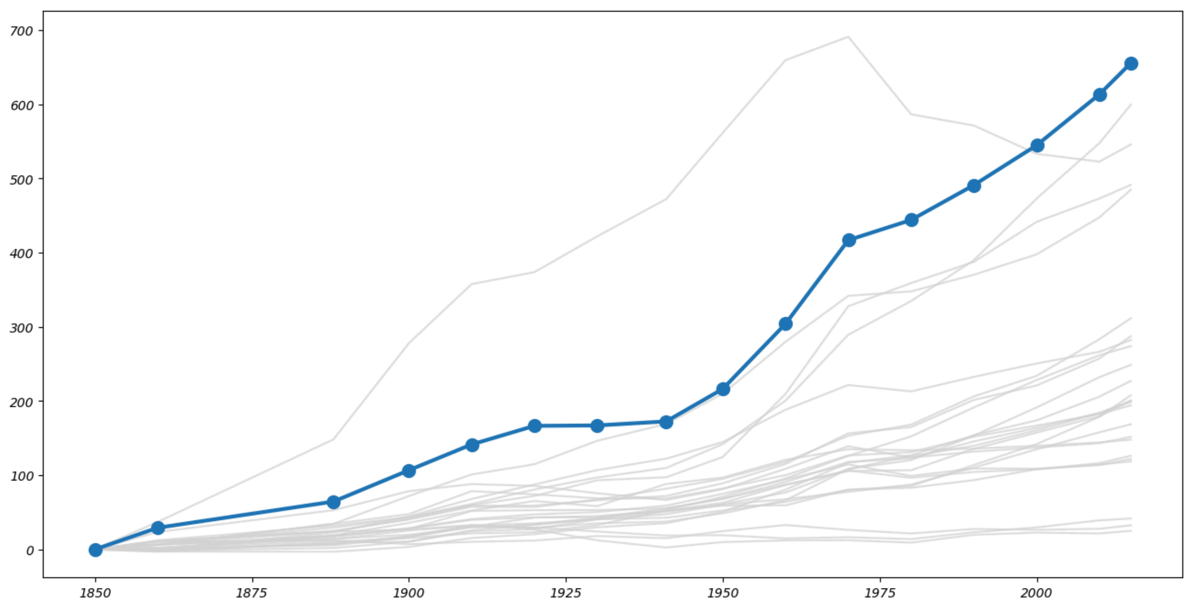
In [6]:
```
# Create a series that captures total relative growth in 2015
total_reative_growth = pd.Series(index=cantons, dtype=float)
```

In [7]:
```
# Fill series with growth values
for canton in cantons:
    total_reative_growth[canton] = df.loc[canton, 'growth'].values[-1]
```

In [8]:
```
# Sort series in ascending order
sorted_cantons = total_reative_growth.sort_values()
```

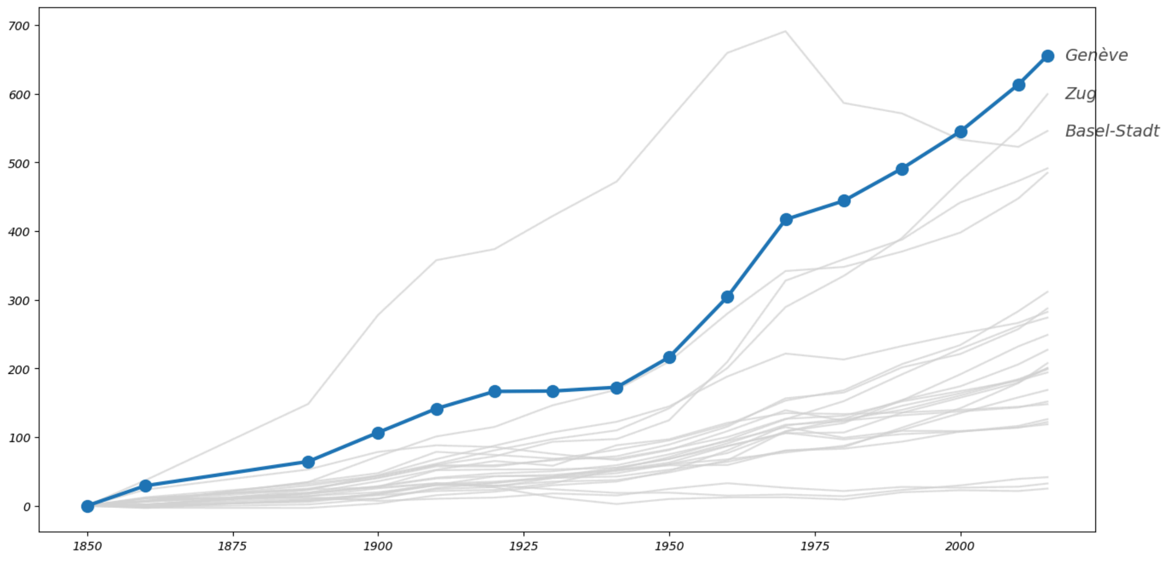
2. Generate visualization step-by-step

In [9]:
```
# Create figure and axes
fig, ax = plt.subplots(figsize=(16, 8))

# Add a lightgray line for each canton
lines = {}
for canton in sorted_cantons.index:
    lines[canton], = ax.plot(df.loc[canton, 'year'], df.loc[canton, 'growth'], color='

# Change properties of the Genève line
lines['Genève'].set(color='tab:blue', marker='o', markersize=10, linewidth=3, alpha=1)
```



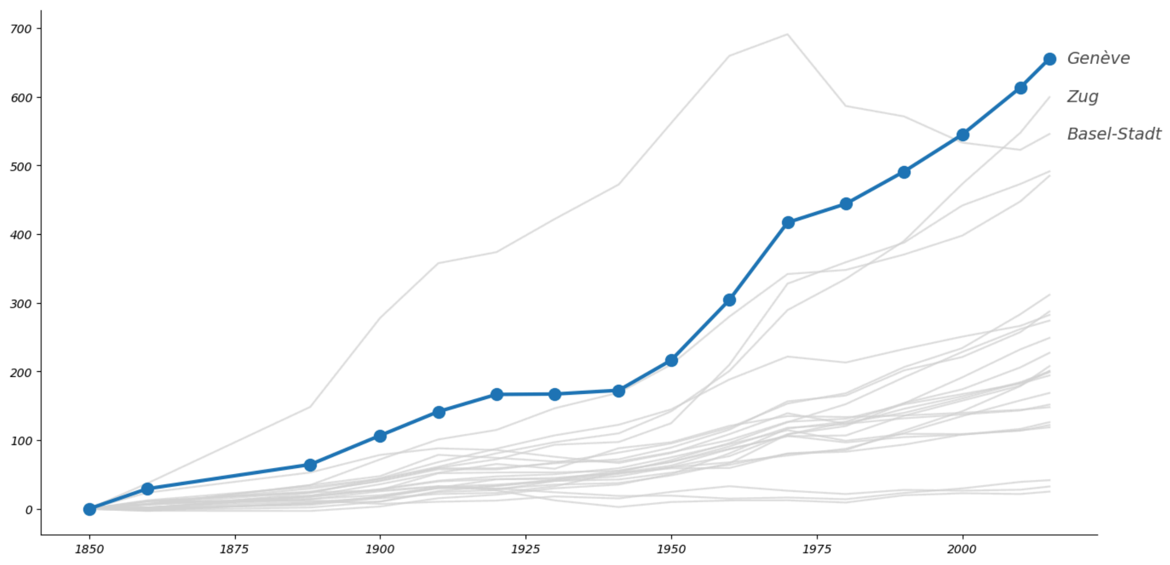
In [10]:
```
# Annotate top three lines
for canton in sorted_cantons.index[-3:]:
    ax.annotate(text=canton, xy=(2015 + 3, df.loc[canton, 'growth'].values[-1]),
                ha='left', va='center', fontsize=14, alpha=0.7)

fig
```

Out[10]:



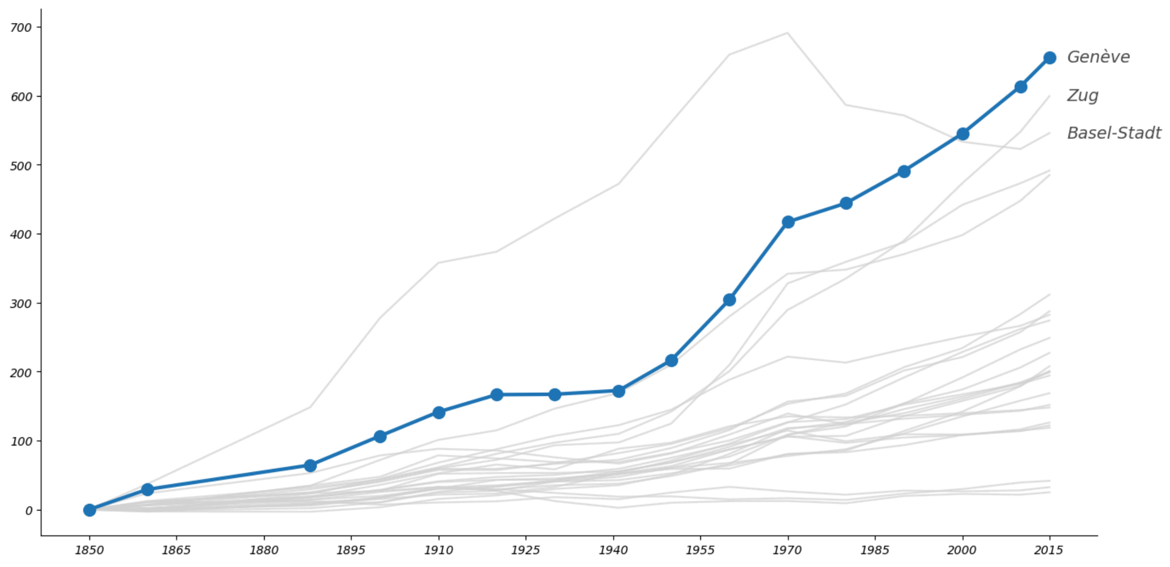
In [11]:
```
# Remove top and left spine
ax.spines[['top', 'right']].set_visible(False)

fig
```

Out[11]:



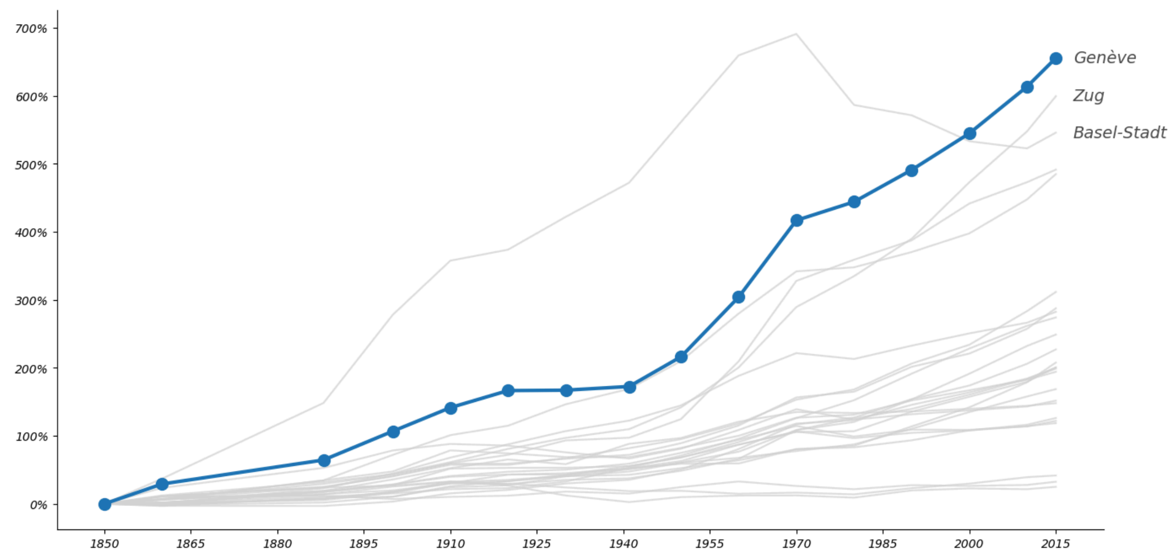
In [12]:
```
# Adjust xticks
xtick_locations = range(1850, 2030, 15)
xtick_labels = range(1850, 2030, 15)
ax.set_xticks(xtick_locations, xtick_labels)

fig
```

Out[12]:



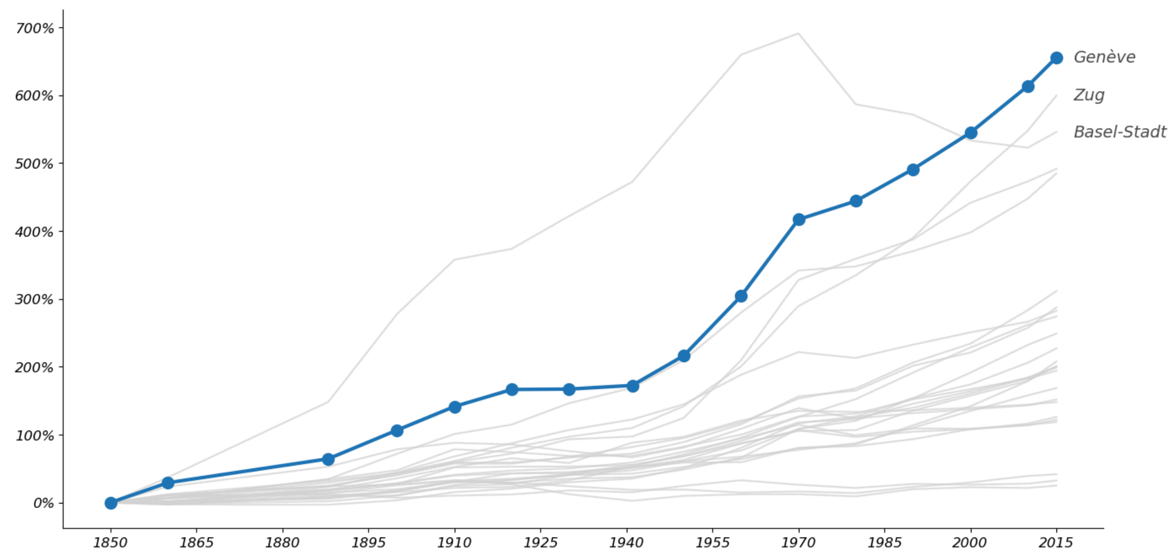
In [13]:
```
# Adjust ytick labels
ax.yaxis.set_major_formatter(ticker.PercentFormatter())

fig
```

Out[13]:



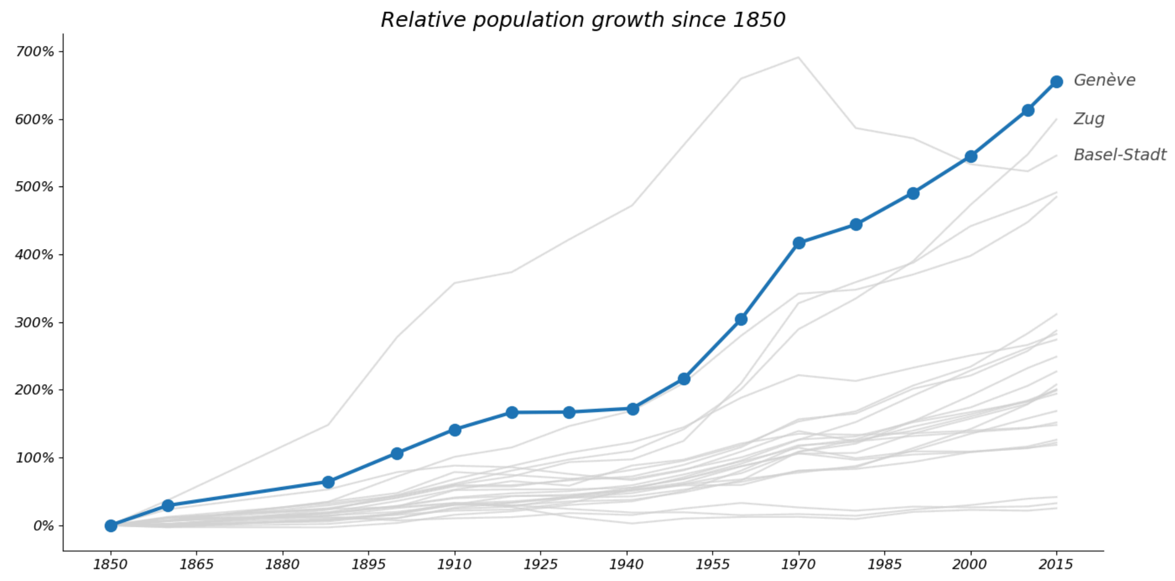
In [14]:
```
# Adjust font size of tick labels
ax.tick_params(labelsize=12)

fig
```

Out[14]:



In [15]:
```
# Set title
ax.set_title('Relative population growth since 1850', fontsize=18)

fig
```

Out[15]:



In [16]:

```
# Save figure as pdf
fig.savefig('after.pdf')
```