



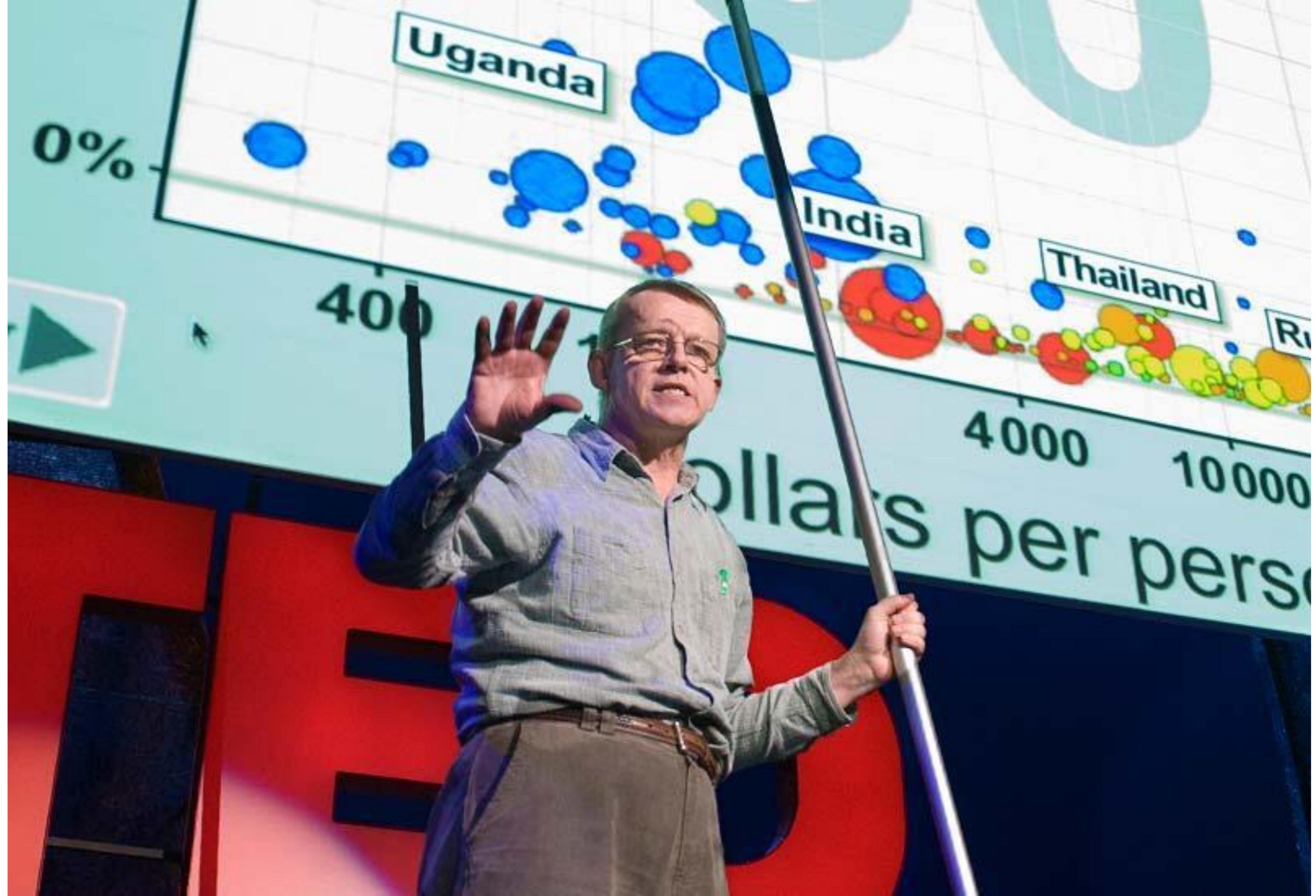
Our future health built with care

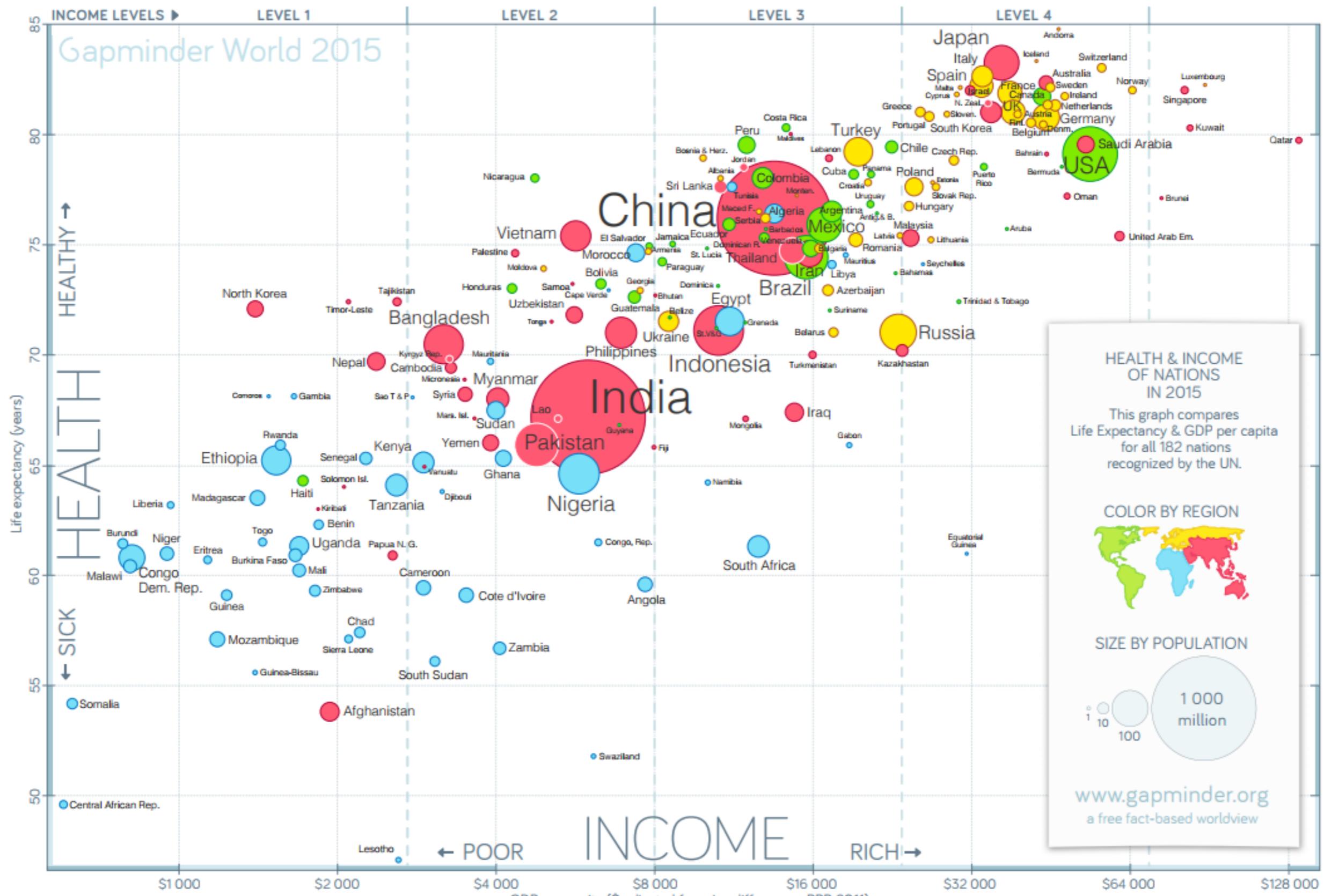
# Data visualization

An introduction to using graphics for data exploration and explanation

January 24, 2019  
University of Toronto, Biostatistics

**CHRISTINE P'NG**  
INFORMATION DESIGN LEAD, CCO





DATA SOURCES—INCOME: World Bank's GDP per capita, PPP (2011 International \$). Income of Syria & Cuba are Gapminder estimates. X-axis uses log-scale to make a doubling income show same distance on all levels. POPULATION: Data from UN Population Division. LIFE EXPECTANCY: IHME GBD•2015, as of Oct 2016. ANIMATING GRAPH: Go to [www.gapminder.org/tools](http://www.gapminder.org/tools) to see how this graph changed historically and compare 500 other indicators. LICENSE: Our charts are freely available under Creative Commons Attribution License. Please copy, share, modify, integrate and even sell them, as long as you mention "Based on a free chart from [www.gapminder.org](http://www.gapminder.org)".

*“Most of us need to listen to the music to understand how beautiful it is. But often that’s how we present statistics: we just show the notes, we don’t play the music.”*

- Hans Rosling

# Why visualize data?

## Anscombe's quartet

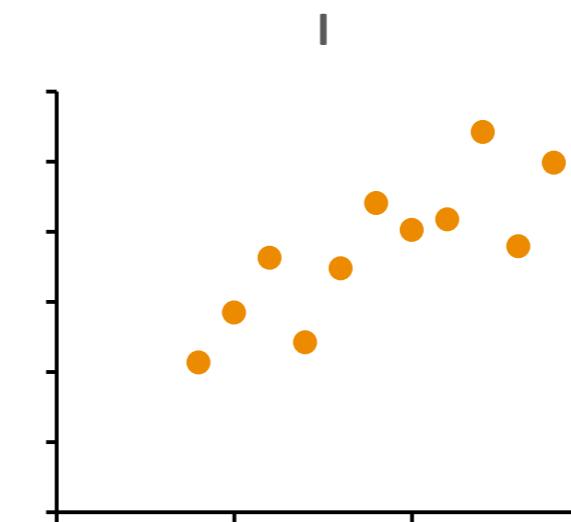
| I    |       | II   |      | III  |       | IV   |       | Property  | Value               |
|------|-------|------|------|------|-------|------|-------|---|---------------------|
| x    | y     | x    | y    | x    | y     | x    | y     |   |                     |
| 10.0 | 8.04  | 10.0 | 9.14 | 10.0 | 7.46  | 8.0  | 6.58  | Mean of x   | 9                   |
| 8.0  | 6.95  | 8.0  | 8.14 | 8.0  | 6.77  | 8.0  | 5.76  | Sample variance of x                                  | 11                  |
| 13.0 | 7.58  | 13.0 | 8.74 | 13.0 | 12.74 | 8.0  | 7.71  | Mean of y   | 7.50                |
| 9.0  | 8.81  | 9.0  | 8.77 | 9.0  | 7.11  | 8.0  | 8.84  | Sample variance of y                                  | 4.125               |
| 11.0 | 8.33  | 11.0 | 9.26 | 11.0 | 7.81  | 8.0  | 8.47  | Correlation between x and y                           | 0.816               |
| 14.0 | 9.96  | 14.0 | 8.10 | 14.0 | 8.84  | 8.0  | 7.04  | Linear regression line                                | $y = 3.00 + 0.500x$ |
| 6.0  | 7.24  | 6.0  | 6.13 | 6.0  | 6.08  | 8.0  | 5.25  | Coefficient of determination of the linear regression | 0.67                |
| 4.0  | 4.26  | 4.0  | 3.10 | 4.0  | 5.39  | 19.0 | 12.50 |   |                     |
| 12.0 | 10.84 | 12.0 | 9.13 | 12.0 | 8.15  | 8.0  | 5.56  |   |                     |
| 7.0  | 4.82  | 7.0  | 7.26 | 7.0  | 6.42  | 8.0  | 7.91  |   |                     |
| 5.0  | 5.68  | 5.0  | 4.74 | 5.0  | 5.73  | 8.0  | 6.89  |   |                     |

Anscombe, F. J. (1973). "Graphs in Statistical Analysis". American Statistician. 27 (1): 17–21. JSTOR 2682899.

# Why visualize data?

## Anscombe's quartet

| I    |       | II   |      | III  |       | IV   |       |
|------|-------|------|------|------|-------|------|-------|
| x    | y     | x    | y    | x    | y     | x    | y     |
| 10.0 | 8.04  | 10.0 | 9.14 | 10.0 | 7.46  | 8.0  | 6.58  |
| 8.0  | 6.95  | 8.0  | 8.14 | 8.0  | 6.77  | 8.0  | 5.76  |
| 13.0 | 7.58  | 13.0 | 8.74 | 13.0 | 12.74 | 8.0  | 7.71  |
| 9.0  | 8.81  | 9.0  | 8.77 | 9.0  | 7.11  | 8.0  | 8.84  |
| 11.0 | 8.33  | 11.0 | 9.26 | 11.0 | 7.81  | 8.0  | 8.47  |
| 14.0 | 9.96  | 14.0 | 8.10 | 14.0 | 8.84  | 8.0  | 7.04  |
| 6.0  | 7.24  | 6.0  | 6.13 | 6.0  | 6.08  | 8.0  | 5.25  |
| 4.0  | 4.26  | 4.0  | 3.10 | 4.0  | 5.39  | 19.0 | 12.50 |
| 12.0 | 10.84 | 12.0 | 9.13 | 12.0 | 8.15  | 8.0  | 5.56  |
| 7.0  | 4.82  | 7.0  | 7.26 | 7.0  | 6.42  | 8.0  | 7.91  |
| 5.0  | 5.68  | 5.0  | 4.74 | 5.0  | 5.73  | 8.0  | 6.89  |

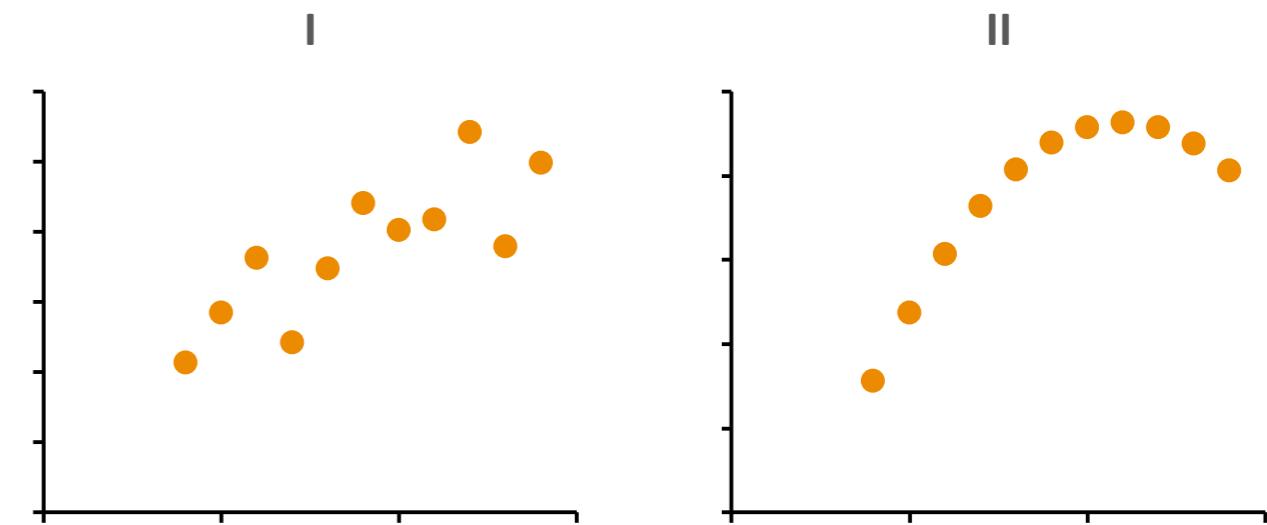


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# Why visualize data?

## Anscombe's quartet

| I    |       | II   |      | III  |       | IV   |       |
|------|-------|------|------|------|-------|------|-------|
| x    | y     | x    | y    | x    | y     | x    | y     |
| 10.0 | 8.04  | 10.0 | 9.14 | 10.0 | 7.46  | 8.0  | 6.58  |
| 8.0  | 6.95  | 8.0  | 8.14 | 8.0  | 6.77  | 8.0  | 5.76  |
| 13.0 | 7.58  | 13.0 | 8.74 | 13.0 | 12.74 | 8.0  | 7.71  |
| 9.0  | 8.81  | 9.0  | 8.77 | 9.0  | 7.11  | 8.0  | 8.84  |
| 11.0 | 8.33  | 11.0 | 9.26 | 11.0 | 7.81  | 8.0  | 8.47  |
| 14.0 | 9.96  | 14.0 | 8.10 | 14.0 | 8.84  | 8.0  | 7.04  |
| 6.0  | 7.24  | 6.0  | 6.13 | 6.0  | 6.08  | 8.0  | 5.25  |
| 4.0  | 4.26  | 4.0  | 3.10 | 4.0  | 5.39  | 19.0 | 12.50 |
| 12.0 | 10.84 | 12.0 | 9.13 | 12.0 | 8.15  | 8.0  | 5.56  |
| 7.0  | 4.82  | 7.0  | 7.26 | 7.0  | 6.42  | 8.0  | 7.91  |
| 5.0  | 5.68  | 5.0  | 4.74 | 5.0  | 5.73  | 8.0  | 6.89  |



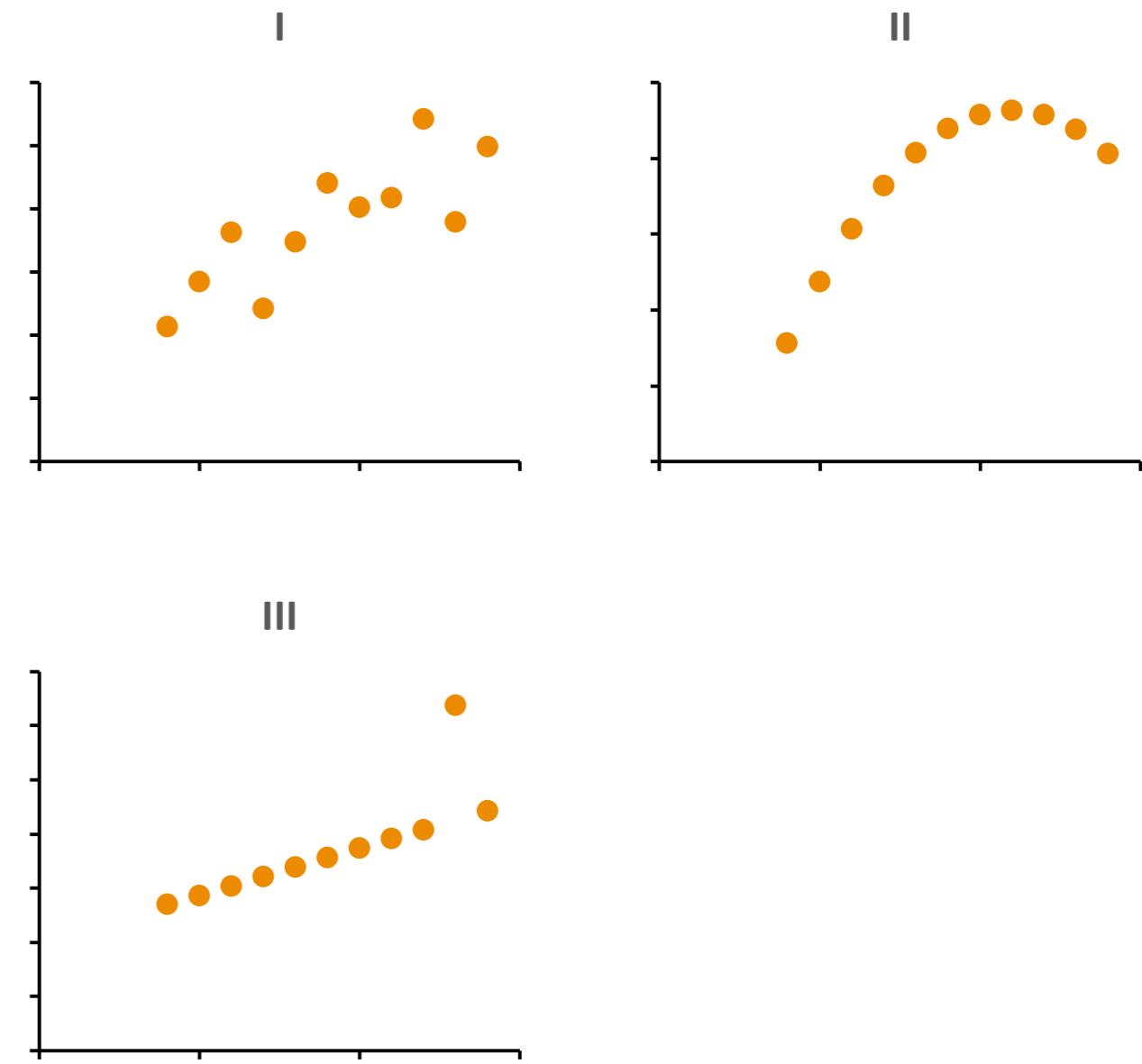
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# Why visualize data?

## Anscombe's quartet

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|------|-------|------|------|------|-------|------|-------|
| x    | y     | x    | y    | x    | y     | x    | y     |
| 10.0 | 8.04  | 10.0 | 9.14 | 10.0 | 7.46  | 8.0  | 6.58  |
| 8.0  | 6.95  | 8.0  | 8.14 | 8.0  | 6.77  | 8.0  | 5.76  |
| 13.0 | 7.58  | 13.0 | 8.74 | 13.0 | 12.74 | 8.0  | 7.71  |
| 9.0  | 8.81  | 9.0  | 8.77 | 9.0  | 7.11  | 8.0  | 8.84  |
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| 6.0  | 7.24  | 6.0  | 6.13 | 6.0  | 6.08  | 8.0  | 5.25  |
| 4.0  | 4.26  | 4.0  | 3.10 | 4.0  | 5.39  | 19.0 | 12.50 |
| 12.0 | 10.84 | 12.0 | 9.13 | 12.0 | 8.15  | 8.0  | 5.56  |
| 7.0  | 4.82  | 7.0  | 7.26 | 7.0  | 6.42  | 8.0  | 7.91  |
| 5.0  | 5.68  | 5.0  | 4.74 | 5.0  | 5.73  | 8.0  | 6.89  |

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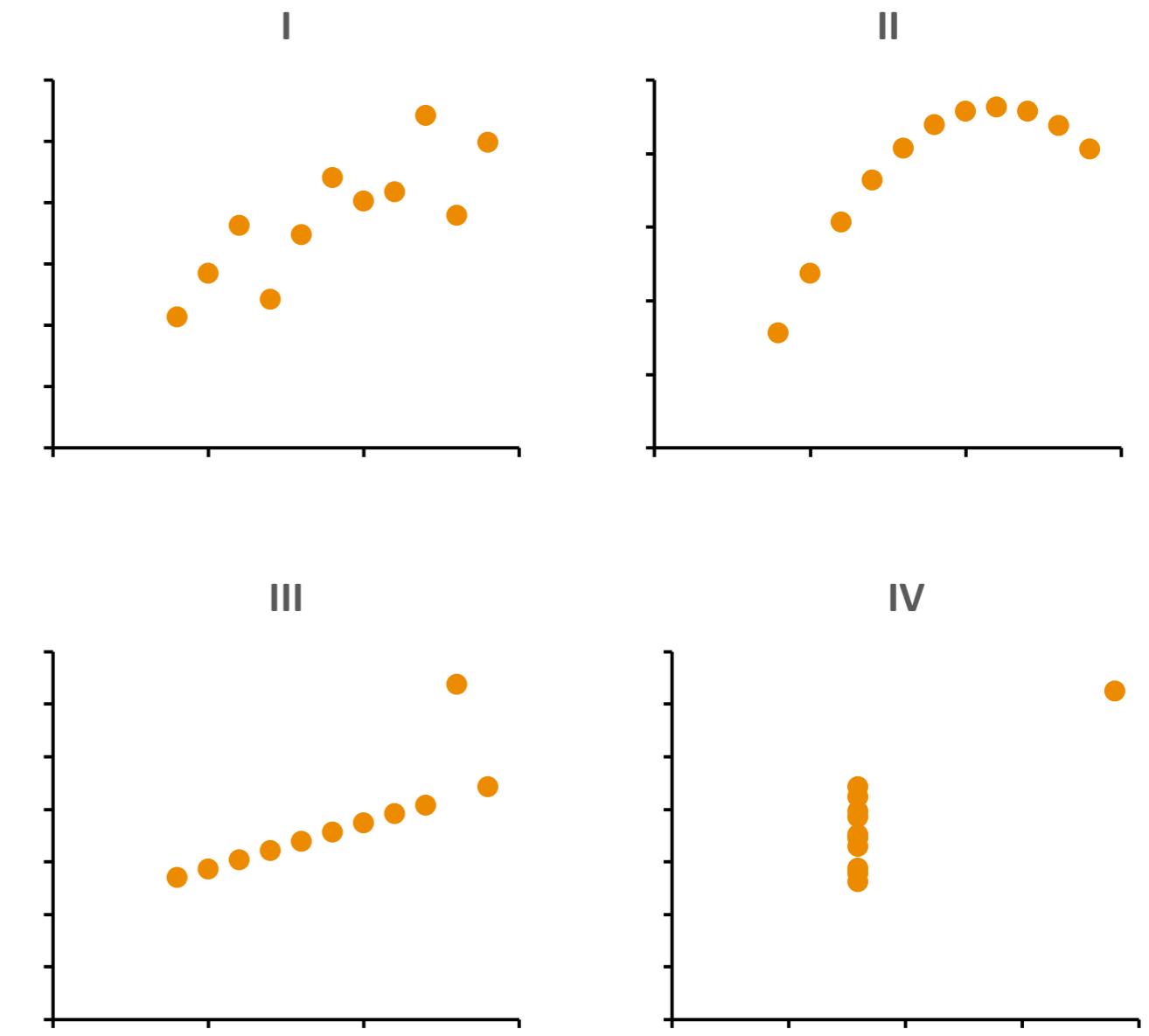


# Why visualize data?

## Anscombe's quartet

| I    |       | II   |      | III  |       | IV   |       |
|------|-------|------|------|------|-------|------|-------|
| x    | y     | x    | y    | x    | y     | x    | y     |
| 10.0 | 8.04  | 10.0 | 9.14 | 10.0 | 7.46  | 8.0  | 6.58  |
| 8.0  | 6.95  | 8.0  | 8.14 | 8.0  | 6.77  | 8.0  | 5.76  |
| 13.0 | 7.58  | 13.0 | 8.74 | 13.0 | 12.74 | 8.0  | 7.71  |
| 9.0  | 8.81  | 9.0  | 8.77 | 9.0  | 7.11  | 8.0  | 8.84  |
| 11.0 | 8.33  | 11.0 | 9.26 | 11.0 | 7.81  | 8.0  | 8.47  |
| 14.0 | 9.96  | 14.0 | 8.10 | 14.0 | 8.84  | 8.0  | 7.04  |
| 6.0  | 7.24  | 6.0  | 6.13 | 6.0  | 6.08  | 8.0  | 5.25  |
| 4.0  | 4.26  | 4.0  | 3.10 | 4.0  | 5.39  | 19.0 | 12.50 |
| 12.0 | 10.84 | 12.0 | 9.13 | 12.0 | 8.15  | 8.0  | 5.56  |
| 7.0  | 4.82  | 7.0  | 7.26 | 7.0  | 6.42  | 8.0  | 7.91  |
| 5.0  | 5.68  | 5.0  | 4.74 | 5.0  | 5.73  | 8.0  | 6.89  |

Anscombe, F. J. (1973). "Graphs in Statistical Analysis".  
American Statistician. 27 (1): 17–21. JSTOR 2682899.



# Why visualize data?

Exploratory

Explanatory

# Outline

Part 1

**Foundations of making a chart**

Part 2

**Visual design for communication**

# Outline

Part 1

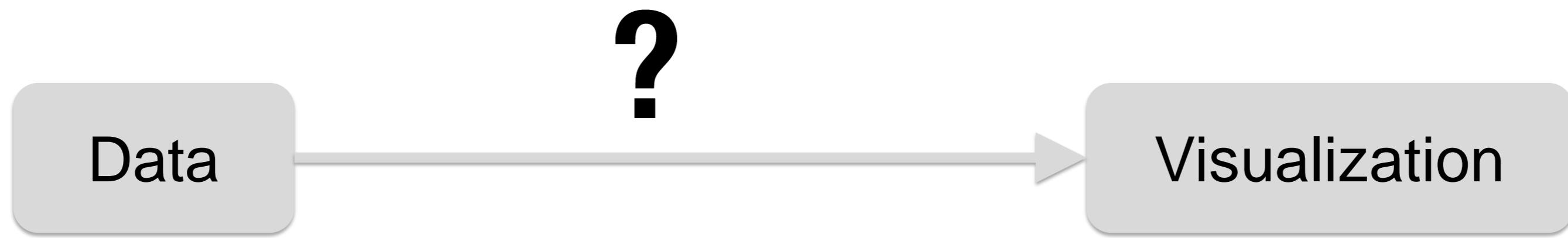
**Foundations of making a chart**

Part 2

**Visual design for communication**

# How to visualize data?

# Process for visualizing data



# Process for visualizing data

The screenshot shows a web browser window displaying the City of Toronto's Open Data Catalogue. The URL is <https://www.toronto.ca/city-government/data-research-maps/open-data/open-data-catalogue/#711ba031-b32b-3390-ce54-22c15ac6389f>. The page title is "Daily Shelter Occupancy". The top navigation bar includes links for Recipes, Regular check, Training/Practice, Academia, Data Vis, Visual Design, and CCO. The main menu features categories: Services & Payments, Community & People, Business & Economy, Explore & Enjoy, and City Government. A search bar and a "I want to..." dropdown are also present.

**Open Data Catalogue**

Welcome to the City of Toronto's Open Data Catalogue. Data is made available under the [Open Data Licence](#). Look for **New** and **Updated** for recent adds and changes. Follow us [@Open\\_TO](#) (we tweet when we add or refresh data).

**Daily Shelter Occupancy**

|                     |   |
|---------------------|---|
| <b>Owner</b>        | Shelter, Support & Housing Administration   |
| <b>Currency</b>     | Real Time   |
| <b>Format</b>       | csv, json   |
| <b>Refresh Rate</b> | Daily   |
| <b>Website</b>      | <a href="https://www.toronto.ca/community-people/housing-shelter/">https://www.toronto.ca/community-people/housing-shelter/</a> |
| <b>Contact</b>      | Open Data Team<br><a href="mailto:opendata@toronto.ca">opendata@toronto.ca</a>  |

The data set provides a listing of all the active shelters serving the City of Toronto area. Included in the dataset is the name of the shelter, program name, sector served (i.e. men, women, youth, families), address(es), the space capacity (i.e. beds or

**Data Catalogue Totals**

Catalogue last updated: December 11, 2018  
Total datasets: 292  
Total data files: 1326

**In This Section**

- Open Data
- Open Data Catalogue
  - Business – Data Catalogue
  - City Government – Data Catalogue
  - Community Services – Data Catalogue
  - Culture & Tourism – Data Catalogue
  - Development & Infrastructure – Data Catalogue
  - Environment – Data Catalogue

# Process for visualizing data

|    | OCCUPANT                         | ORGANIZATION_NAME       | SHELTER_NAME | SHELTER_ADDRESS | SHELTER_CITY | SHELTER_PROVINCE | FACILITY_NAME | PROGRAM_NAME | SECTOR   | OCCUPANCY | CAPACITY | COMMENT |
|----|----------------------------------|-------------------------|--------------|-----------------|--------------|------------------|---------------|--------------|----------|-----------|----------|---------|
| 1  | 1/1/2017 COSTI Imn               | COSTI                   | 100 Lippin   | ON              | M5S 2P1      | Toronto          | COSTI Rec     | COSTI Rec    | Co-ed    | 16        | 16       |         |
| 2  | 1/1/2017 Christie O:             | Christie O:             | 973 Lansd    | ON              | M6H 3Z5      | Toronto          | Christie O:   | Christie O:  | Men      | 13        | 17       |         |
| 3  | 1/1/2017 Christie O:             | Christie O:             | 973 Lansd    | ON              | M6H 3Z5      | Toronto          | Christie O:   | Christie O:  | Men      | 63        | 63       |         |
| 4  | 1/1/2017 Christie Re             | Christie Re             | 43 Christie  | ON              | M6G 3B1      | Toronto          | Christie Re   | Christie Re  | Families | 66        | 70       |         |
| 5  | 1/1/2017 City of Tor Birchmou    | City of Tor Birchmou    | 1673 Kings   | ON              |              | Toronto          | Birchmou      | Birchmou     | Men      | 58        | 60       |         |
| 6  | 1/1/2017 City of Tor Birkdale R  | City of Tor Birkdale R  | 1229 Elles   | ON              | M1P 4V8      | Toronto          | Birkdale R    | Birkdale R   | Families | 168       | 160      |         |
| 7  | 1/1/2017 City of Tor Birkdale R  | City of Tor Birkdale R  | 1229 Elles   | ON              | M1P 4V8      | Toronto          | Birkdale R    | Birkdale R   | Families | 119       | 150      |         |
| 8  | 1/1/2017 City of Tor Downsvie    | City of Tor Downsvie    | 1651 Shep    | ON              |              | Toronto          | Downsvie      | Downsvie     | Men      | 23        | 28       |         |
| 9  | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 8         | 0        |         |
| 10 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Co-ed    | 14        | 40       |         |
| 11 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 0         |          |         |
| 12 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 0         |          |         |
| 13 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 0         |          |         |
| 14 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 173       | 252      |         |
| 15 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 22        | 48       |         |
| 16 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 148       | 110      |         |
| 17 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 42        | 50       |         |
| 18 | 1/1/2017 City of Tor Family Res  | City of Tor Family Res  | 4222 Kings   | ON              | M1E 2M6      | Toronto          | Family Res    | Family Res   | Families | 60        | 20       |         |
| 19 | 1/1/2017 City of Tor Fort York I | City of Tor Fort York I | 38 Bathru    | ON              |              | Toronto          | Fort York I   | Fort York I  | Men      | 0         | 19       |         |
| 20 | 1/1/2017 City of Tor Fort York I | City of Tor Fort York I | 38 Bathru    | ON              |              | Toronto          | Fort York I   | Fort York I  | Men      | 74        | 74       |         |
| 21 | 1/1/2017 City of Tor Fort York I | City of Tor Fort York I | 38 Bathru    | ON              |              | Toronto          | Fort York I   | Fort York I  | Men      | 24        | 24       |         |
| 22 | 1/1/2017 City of Tor Robertson   | City of Tor Robertson   | 291 Sherb    | ON              | M5A 2R9      | Toronto          | Robertson     | Robertson    | Families | 111       | 90       |         |

OCCUPANCY\_DATE

ORGANIZATION\_NAME

SHELTER\_NAME

SHELTER\_ADDRESS

SHELTER\_CITY

SHELTER\_PROVINCE

SHELTER\_POSTAL\_CODE

FACILITY\_NAME

PROGRAM\_NAME

SECTOR

OCCUPANCY

CAPACITY

# Process for visualizing data

|    | OCCUPANCY_DATE | CAPACITY |
|----|----------------|----------|
| 1  | 1/1/2017       | 16       |
| 2  | 1/1/2017       | 16       |
| 3  | 1/1/2017       | 13       |
| 4  | 1/1/2017       | 63       |
| 5  | 1/1/2017       | 66       |
| 6  | 1/1/2017       | 58       |
| 7  | 1/1/2017       | 168      |
| 8  | 1/1/2017       | 160      |
| 9  | 1/1/2017       | 119      |
| 10 | 1/1/2017       | 150      |
| 11 | 1/1/2017       | 23       |
| 12 | 1/1/2017       | 28       |
| 13 | 1/1/2017       | 8        |
| 14 | 1/1/2017       | 0        |
| 15 | 1/1/2017       | 14       |
| 16 | 1/1/2017       | 40       |
| 17 | 1/1/2017       | 0        |
| 18 | 1/1/2017       | 0        |
| 19 | 1/1/2017       | 173      |
| 20 | 1/1/2017       | 252      |
| 21 | 1/1/2017       | 22       |
| 22 | 1/1/2017       | 48       |
|    |                | 148      |
|    |                | 110      |
|    |                | 42       |
|    |                | 50       |
|    |                | 60       |
|    |                | 20       |
|    |                | 0        |
|    |                | 19       |
|    |                | 74       |
|    |                | 74       |
|    |                | 24       |
|    |                | 24       |
|    |                | 111      |
|    |                | 90       |

**OCCUPANCY\_DATE**

ORGANIZATION\_NAME

SHELTER\_NAME

SHELTER\_ADDRESS

SHELTER\_CITY

SHELTER\_PROVINCE

SHELTER\_POSTAL\_CODE

FACILITY\_NAME

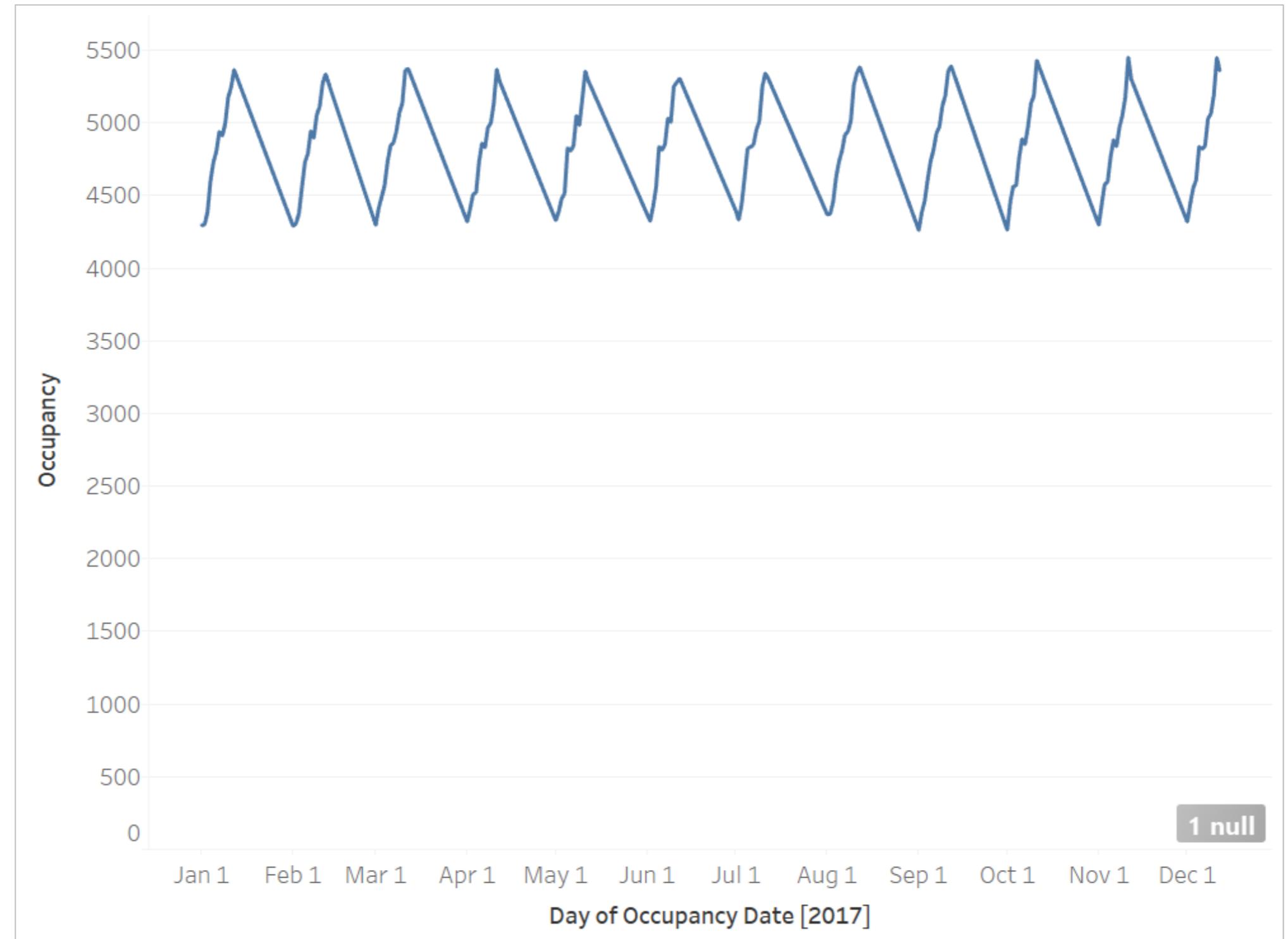
PROGRAM\_NAME

SECTOR

**OCCUPANCY**

CAPACITY

# Process for visualizing data

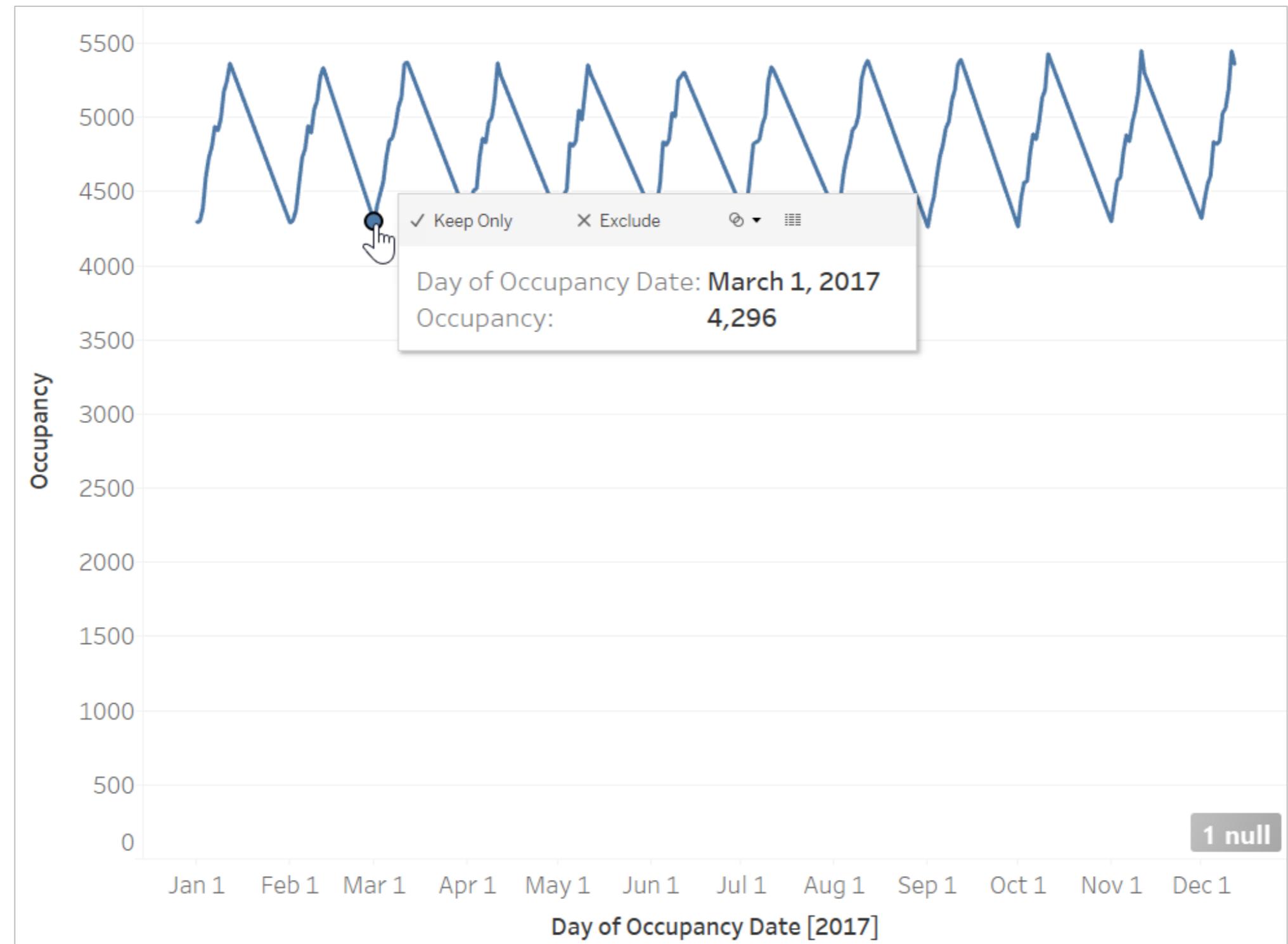


# Process for visualizing data



Feb 12, 2017

# Process for visualizing data



Mar 1, 2017

# Process for visualizing data

A screenshot of a Microsoft Excel spreadsheet. The ribbon at the top shows tabs for File, Home, Insert, Page Layout, and Formula. The Home tab is selected. The ribbon also includes icons for Cut, Copy, Paste, and Format Painter. The font section of the ribbon shows Calibri 11pt. The clipboard section shows the text "1/1/2017". The main area shows a table with columns A, B, C, and D. Row 1 contains headers: OCCUPANT, ORGANIZATION, SHELTER, and SHELTER\_TYPE. Rows 2 through 12 contain data. Row 2 is highlighted with a red border around the entire row. The data in row 2 is: 1/1/2017, COSTI Imn COSTI Rec 100 Lippin T. The data in rows 3 through 12 is: 1/1/2017 Christie O'Christie O'973 Lansd T, 1/1/2017 Christie O'Christie O'973 Lansd T, 1/1/2017 Christie ReChristie Re43 Christie T, 1/1/2017 City of Tor Birchmou 1673 Kings T, 1/1/2017 City of Tor Birkdale R 1229 Elles T, 1/1/2017 City of Tor Birkdale R 1229 Elles T, 1/1/2017 City of Tor Downsvie 1651 Shep T, 1/1/2017 City of Tor Family Res 4222 Kings T, 1/1/2017 City of Tor Family Res 4222 Kings T, 1/1/2017 City of Tor Family Res 4222 Kings T.

|    | A        | B                                 | C          | D            |
|----|----------|-----------------------------------|------------|--------------|
| 1  | OCCUPANT | ORGANIZATION                      | SHELTER    | SHELTER_TYPE |
| 2  | 1/1/2017 | COSTI Imn COSTI Rec 100 Lippin    | T          |              |
| 3  | 1/1/2017 | Christie O'Christie O'973 Lansd   | T          |              |
| 4  | 1/1/2017 | Christie O'Christie O'973 Lansd   | T          |              |
| 5  | 1/1/2017 | Christie ReChristie Re43 Christie | T          |              |
| 6  | 1/1/2017 | City of Tor Birchmou              | 1673 Kings | T            |
| 7  | 1/1/2017 | City of Tor Birkdale R            | 1229 Elles | T            |
| 8  | 1/1/2017 | City of Tor Birkdale R            | 1229 Elles | T            |
| 9  | 1/1/2017 | City of Tor Downsvie              | 1651 Shep  | T            |
| 10 | 1/1/2017 | City of Tor Family Res            | 4222 Kings | T            |
| 11 | 1/1/2017 | City of Tor Family Res            | 4222 Kings | T            |
| 12 | 1/1/2017 | City of Tor Family Res            | 4222 Kings | T            |

Month/Day/Year

1/1/2017

= January 1, 2017

# Process for visualizing data

|     | A        | B                           | C           | D         | E               |
|-----|----------|-----------------------------|-------------|-----------|-----------------|
| 94  | 1/1/2017 | Turning P                   | Turning P   | 95        | Wellesl Toronto |
| 95  | 1/1/2017 | University Univ Settle      | 23 Grange   | Toronto   |                 |
| 96  | 1/1/2017 | University Univ Settle      | 23 Grange   | Toronto   |                 |
| 97  | 1/1/2017 | Woodgree Red Door           | 875 Queer   | Toronto   |                 |
| 98  | 1/1/2017 | YMCA of CYMCA Hol           | 485 Queer   | Toronto   |                 |
| 99  | 1/1/2017 | YMCA of CYMCA Spr           | 21 Walme    | Toronto   |                 |
| 100 | 1/1/2017 | YWCA Tor YWCA - Be          | 177 Caled   | Toronto   |                 |
| 101 | 1/1/2017 | YWCA Tor YWCA - Fir         | 80 Woodl    | Toronto   |                 |
| 102 | 1/1/2017 | YWCA Tor YWCA - Fir         | 80 Woodl    | Toronto   |                 |
| 103 | 1/1/2017 | Youth Wit Youth Wit 6 Warre | 6 Warren    | Etobicoke |                 |
| 104 | 1/1/2017 | Youth Wit Youth Wit 6 Warre | 6 Warren    | Etobicoke |                 |
| 105 | 2/1/2017 | COSTI Imn COSTI Rec         | 100 Lippin  | Toronto   |                 |
| 106 | 2/1/2017 | Christie O: Christie O:     | 973 Lansd   | Toronto   |                 |
| 107 | 2/1/2017 | Christie O: Christie O:     | 973 Lansd   | Toronto   |                 |
| 108 | 2/1/2017 | Christie Re Christie Re     | 43 Christie | Toronto   |                 |
| 109 | 2/1/2017 | City of Tor Birchmou        | 1673 Kings  | Toronto   |                 |
| 110 | 2/1/2017 | City of Tor Birkdale R      | 1229 Elles  | Toronto   |                 |
| 111 | 2/1/2017 | City of Tor Birkdale R      | 1229 Elles  | Toronto   |                 |
| 112 | 2/1/2017 | City of Tor Downsvie        | 1651 Shep   | Toronto   |                 |
| 113 | 2/1/2017 | City of Tor Family Res      | 4222 Kings  | Toronto   |                 |
| 114 | 2/1/2017 | City of Tor Family Res      | 4222 Kings  | Toronto   |                 |
| 115 | 2/1/2017 | City of Tor Family Res      | 4222 Kings  | Toronto   |                 |
| 116 | 2/1/2017 | City of Tor Family Res      | 4222 Kings  | Toronto   |                 |

Month/Day/Year

**1/1/2017** = January 1, 2017

**2/1/2017** = February 1, 2017

# Process for visualizing data

|     | A        | B                       | C           | D           | E               |
|-----|----------|-------------------------|-------------|-------------|-----------------|
| 94  | 1/1/2017 | Turning P               | Turning P   | 95          | Wellesl Toronto |
| 95  | 1/1/2017 | University Univ Settle  | 23 Grange   | 23 Grange   | Toronto         |
| 96  | 1/1/2017 | University Univ Settle  | 23 Grange   | 23 Grange   | Toronto         |
| 97  | 1/1/2017 | Woodgree Red Door       | 875 Queer   | 875 Queer   | Toronto         |
| 98  | 1/1/2017 | YMCA of CYMCA Hol       | 485 Queer   | 485 Queer   | Toronto         |
| 99  | 1/1/2017 | YMCA of CYMCA Spr       | 21 Walme    | 21 Walme    | Toronto         |
| 100 | 1/1/2017 | YWCA Tor YWCA - Be      | 177 Caled   | 177 Caled   | Toronto         |
| 101 | 1/1/2017 | YWCA Tor YWCA - Fir     | 80 Woodl    | 80 Woodl    | Toronto         |
| 102 | 1/1/2017 | YWCA Tor YWCA - Fir     | 80 Woodl    | 80 Woodl    | Toronto         |
| 103 | 1/1/2017 | Youth Wit Youth Wit     | 6 Warren    | 6 Warren    | Etobicoke       |
| 104 | 1/1/2017 | Youth Wit Youth Wit     | 6 Warren    | 6 Warren    | Etobicoke       |
| 105 | 2/1/2017 | COSTI Imn COSTI Rec     | 100 Lippin  | 100 Lippin  | Toronto         |
| 106 | 2/1/2017 | Christie O: Christie O: | 973 Lansd   | 973 Lansd   | Toronto         |
| 107 | 2/1/2017 | Christie O: Christie O: | 973 Lansd   | 973 Lansd   | Toronto         |
| 108 | 2/1/2017 | Christie Re Christie Re | 43 Christie | 43 Christie | Toronto         |
| 109 | 2/1/2017 | City of Tor Birchmou    | 1673 Kings  | 1673 Kings  | Toronto         |
| 110 | 2/1/2017 | City of Tor Birkdale R  | 1229 Elles  | 1229 Elles  | Toronto         |
| 111 | 2/1/2017 | City of Tor Birkdale R  | 1229 Elles  | 1229 Elles  | Toronto         |
| 112 | 2/1/2017 | City of Tor Downsvie    | 1651 Shep   | 1651 Shep   | Toronto         |
| 113 | 2/1/2017 | City of Tor Family Res  | 4222 Kings  | 4222 Kings  | Toronto         |
| 114 | 2/1/2017 | City of Tor Family Res  | 4222 Kings  | 4222 Kings  | Toronto         |
| 115 | 2/1/2017 | City of Tor Family Res  | 4222 Kings  | 4222 Kings  | Toronto         |
| 116 | 2/1/2017 | City of Tor Family Res  | 4222 Kings  | 4222 Kings  | Toronto         |

Month/Day/Year

1/1/2017 = January 1, 2017

2/1/2017 = February 1, 2017

Day/Month/Year

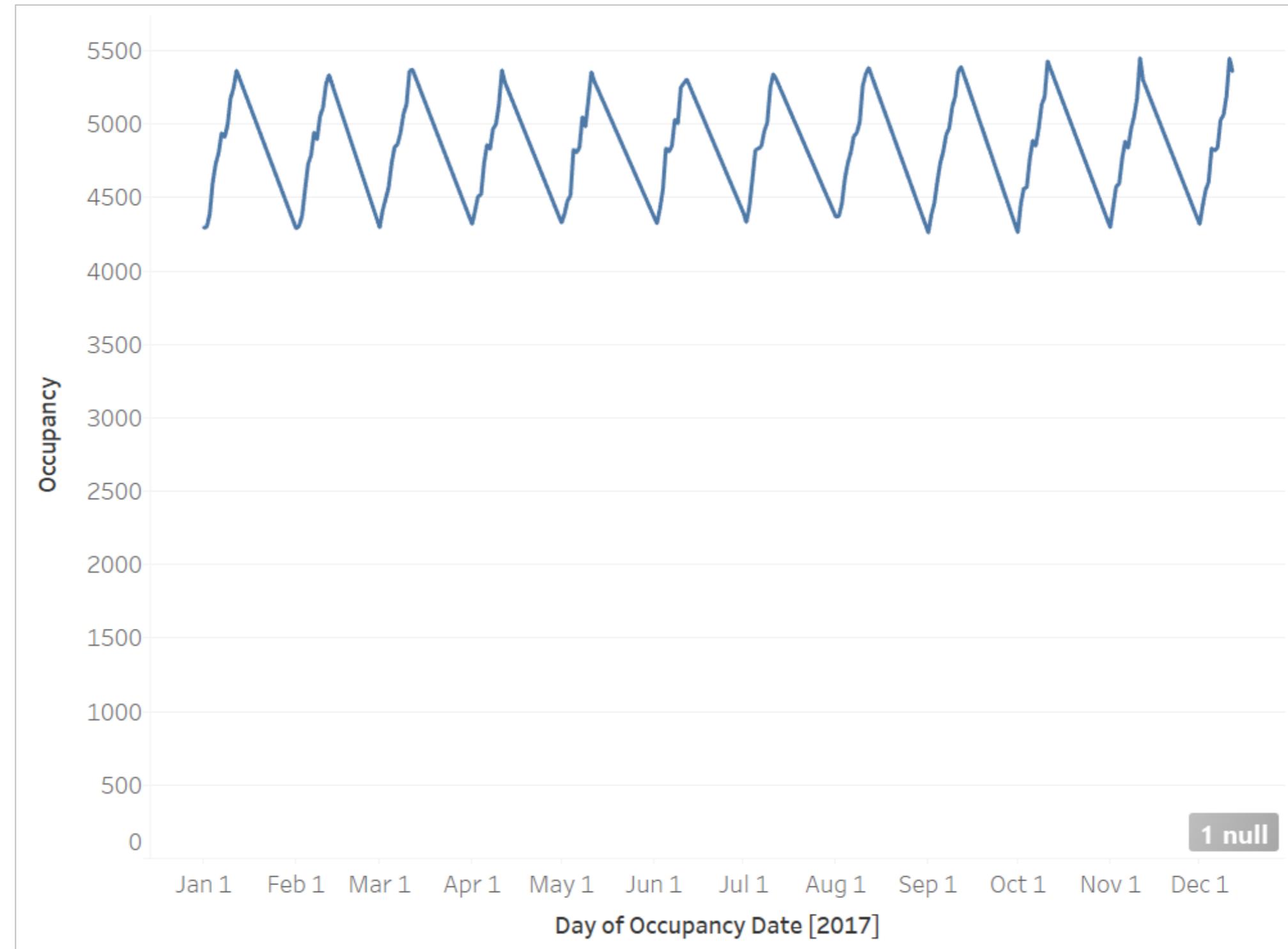
1/1/2017 = January 1, 2017

2/1/2017 = January 2, 2017

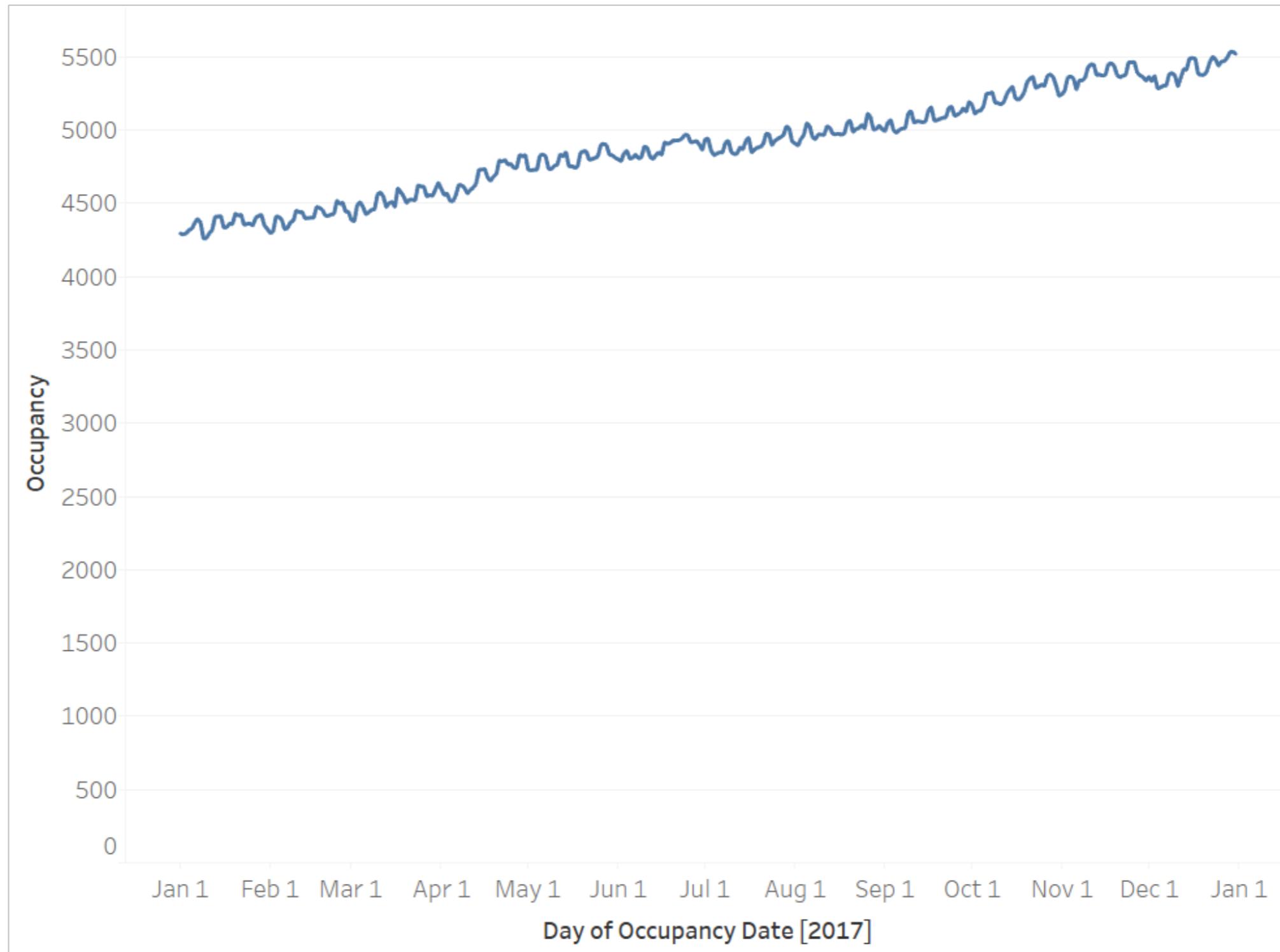
# Process for visualizing data



# Process for visualizing data

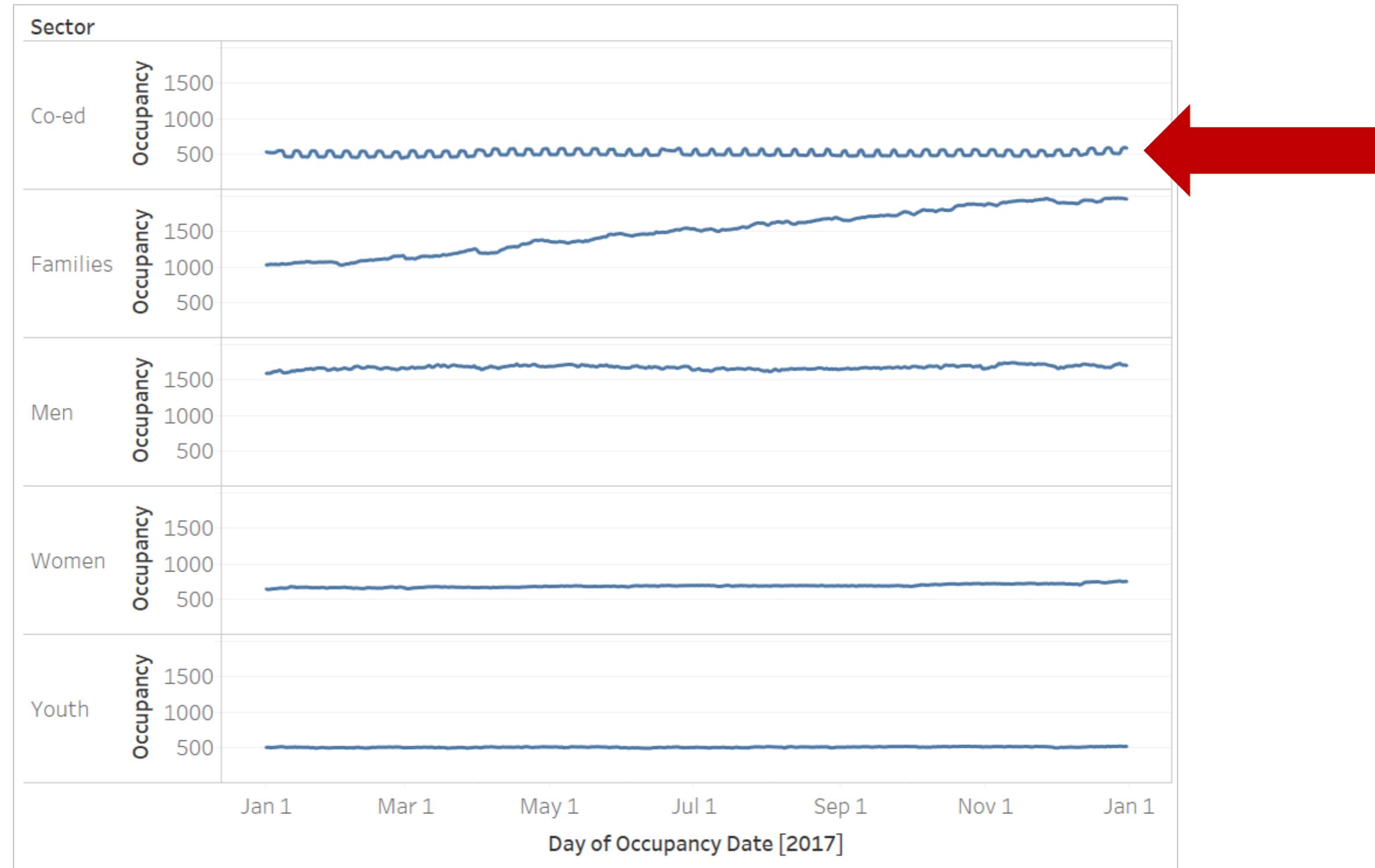


# Process for visualizing data

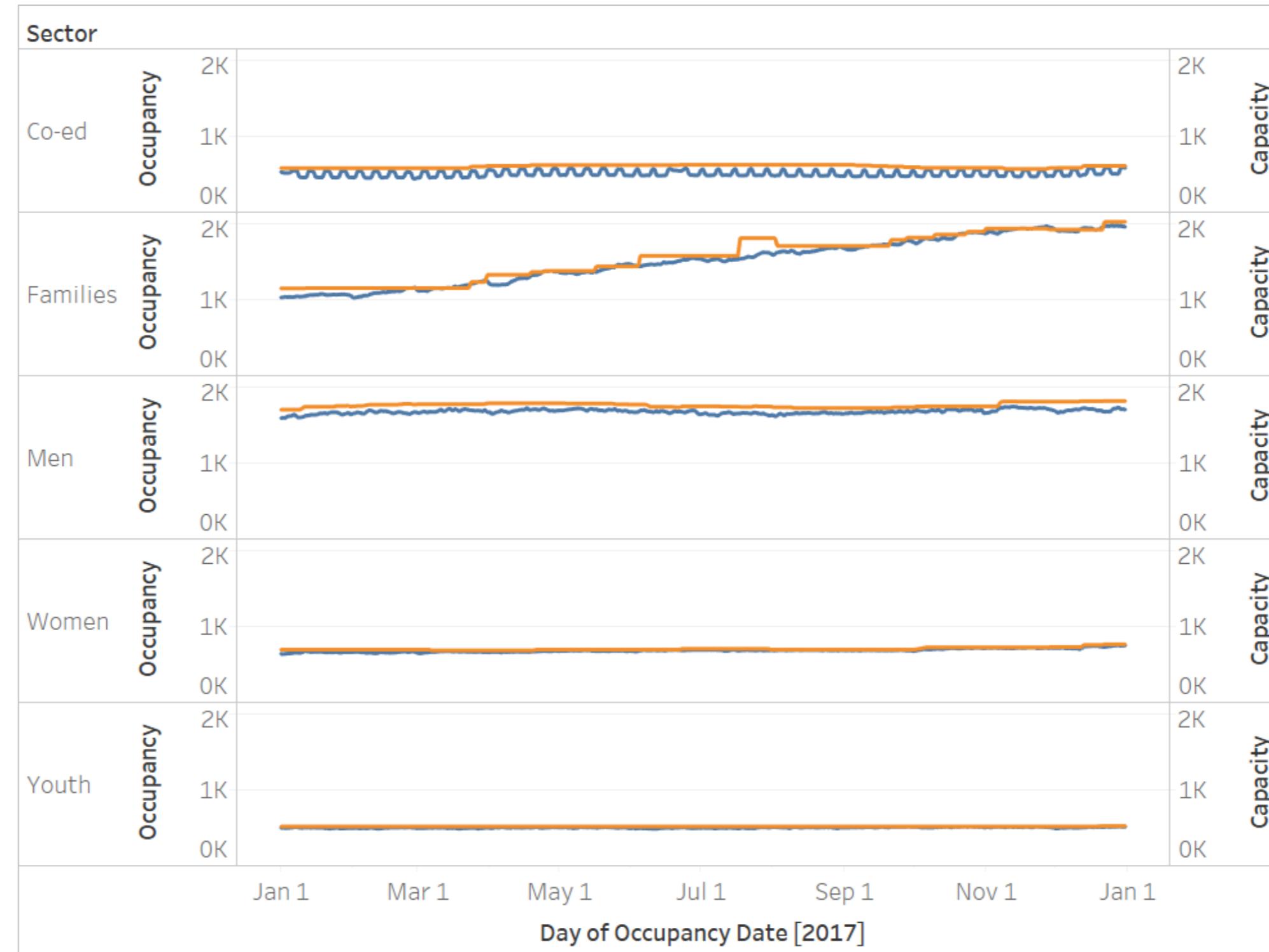


Subset by sector

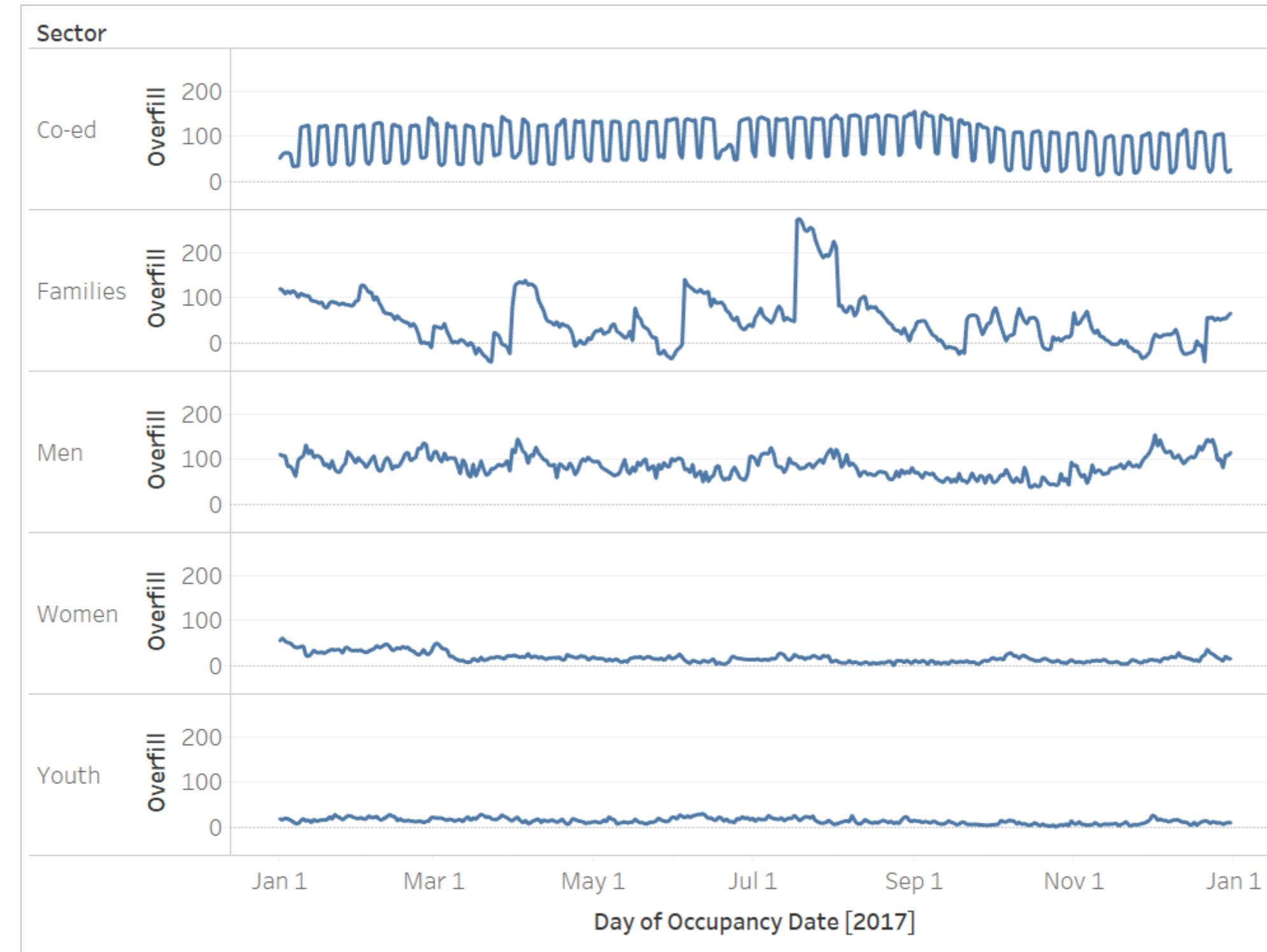
# Process for visualizing data



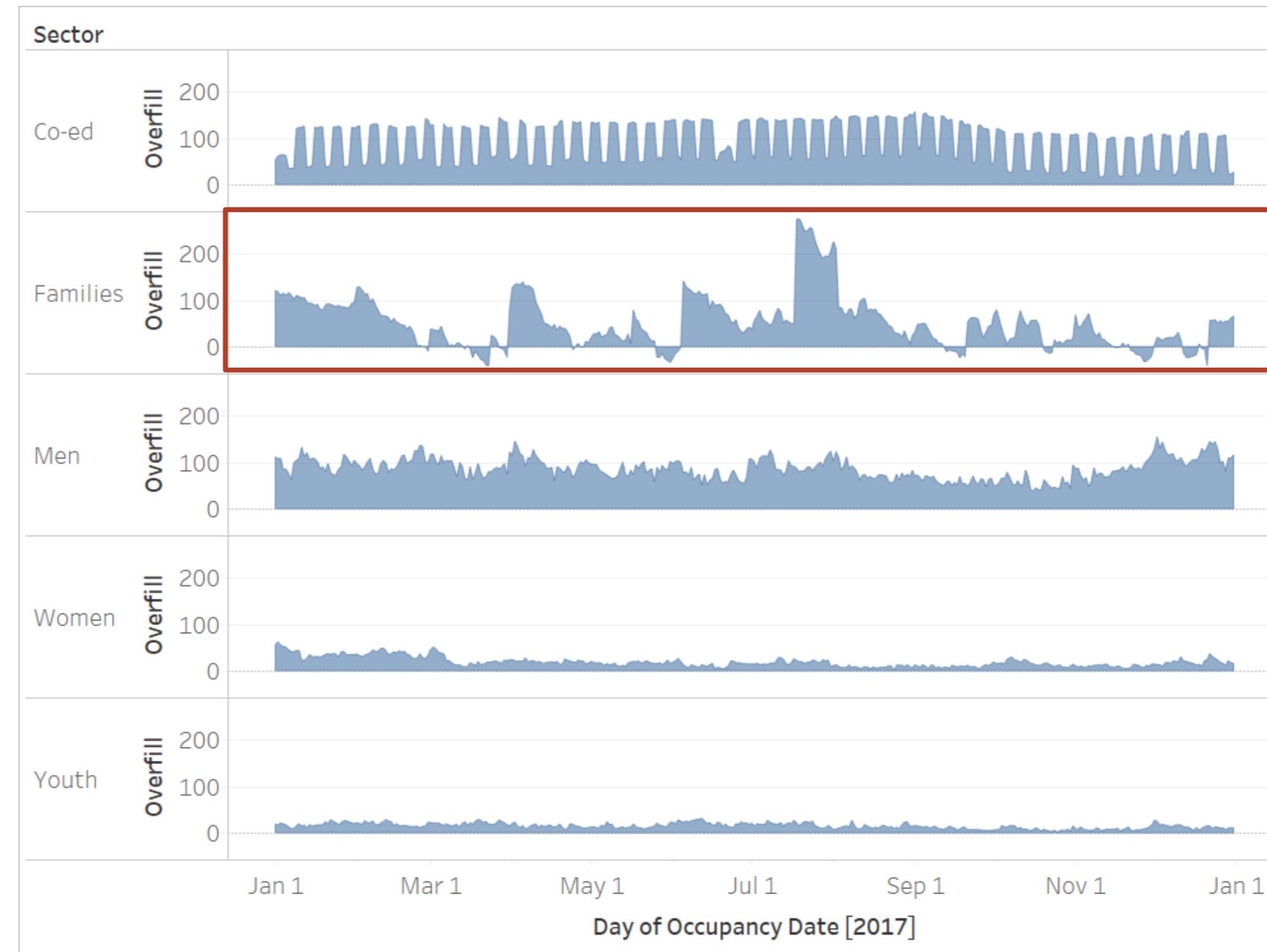
# Process for visualizing data



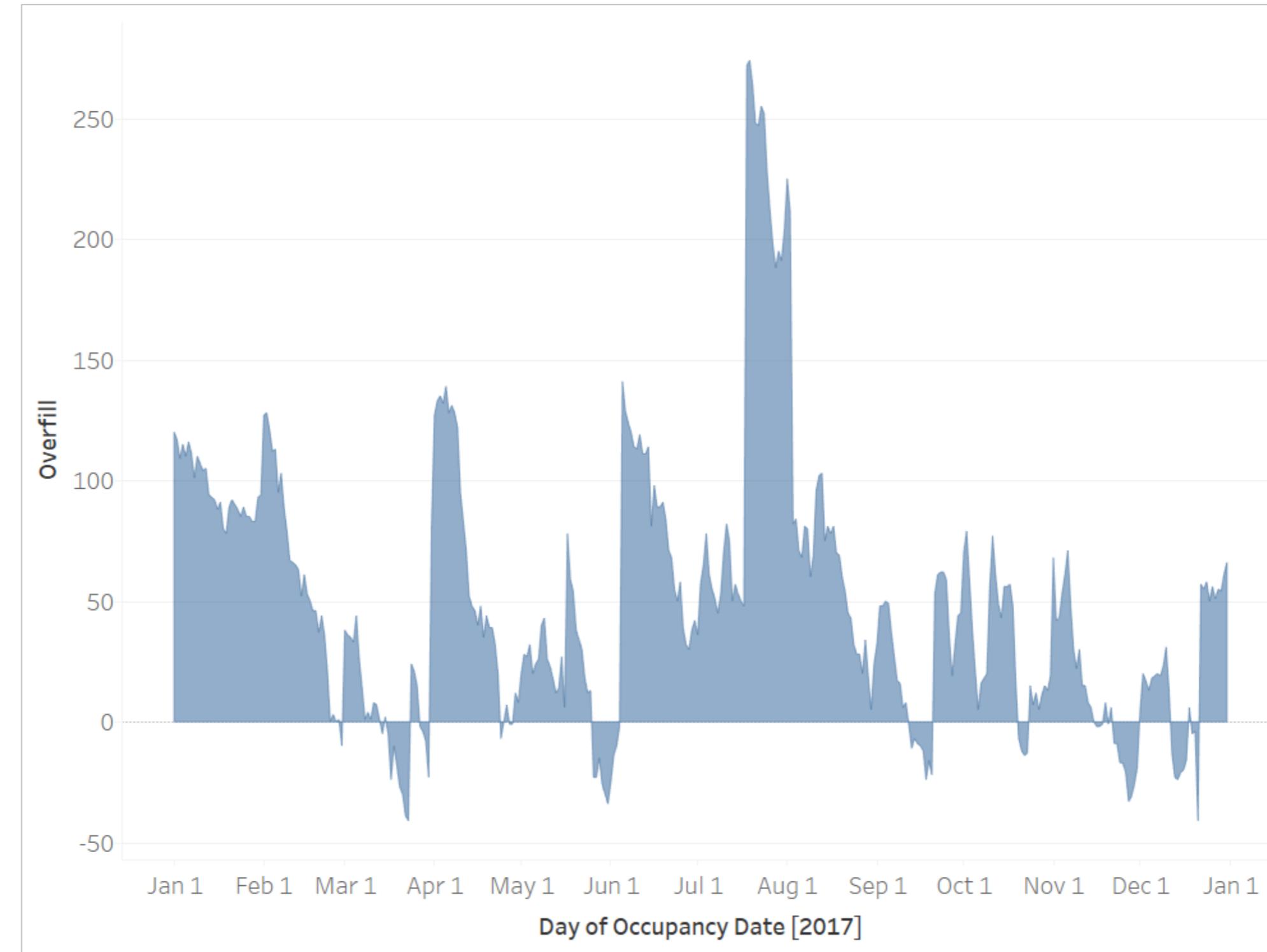
# Process for visualizing data



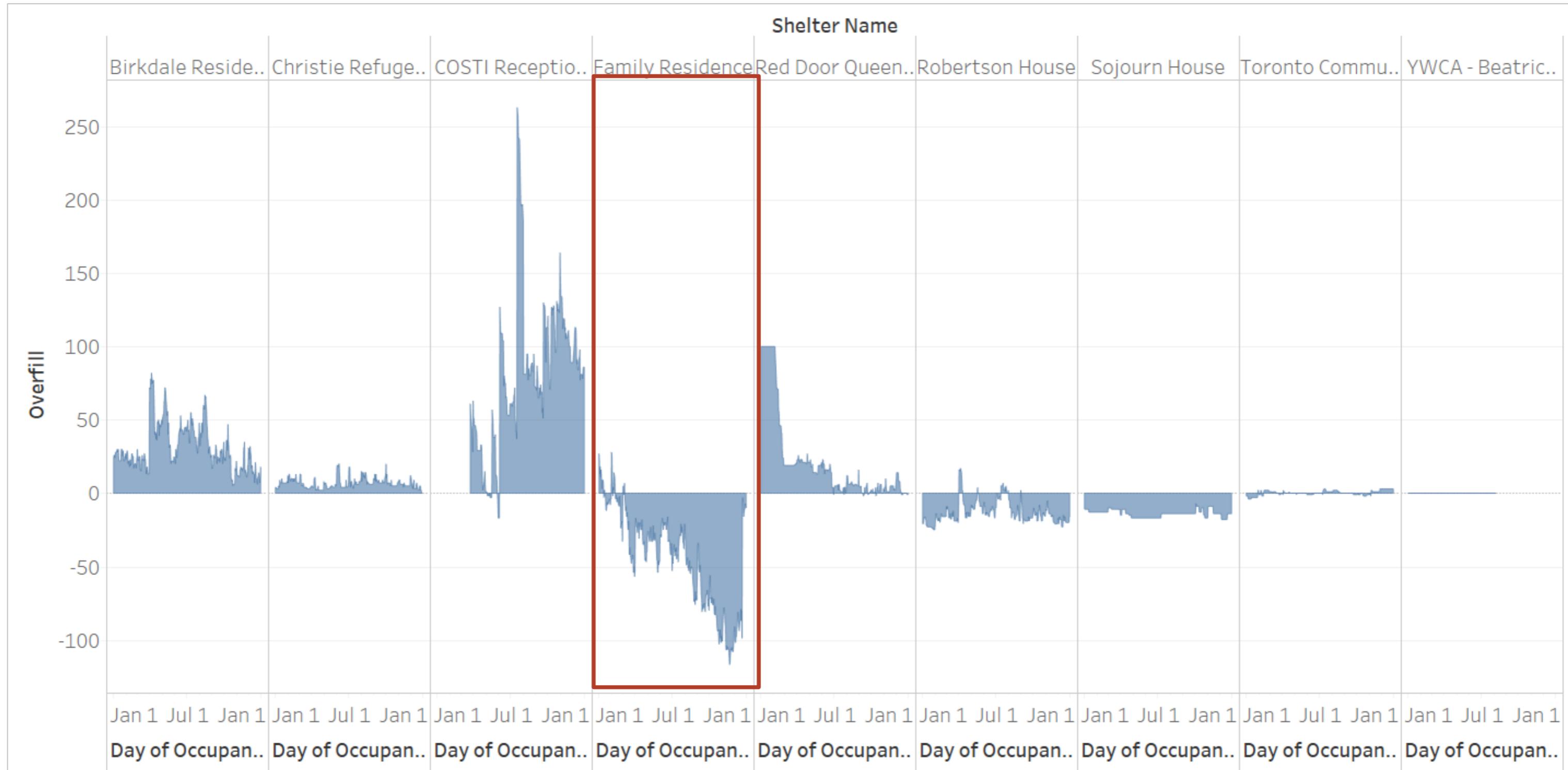
# Process for visualizing data



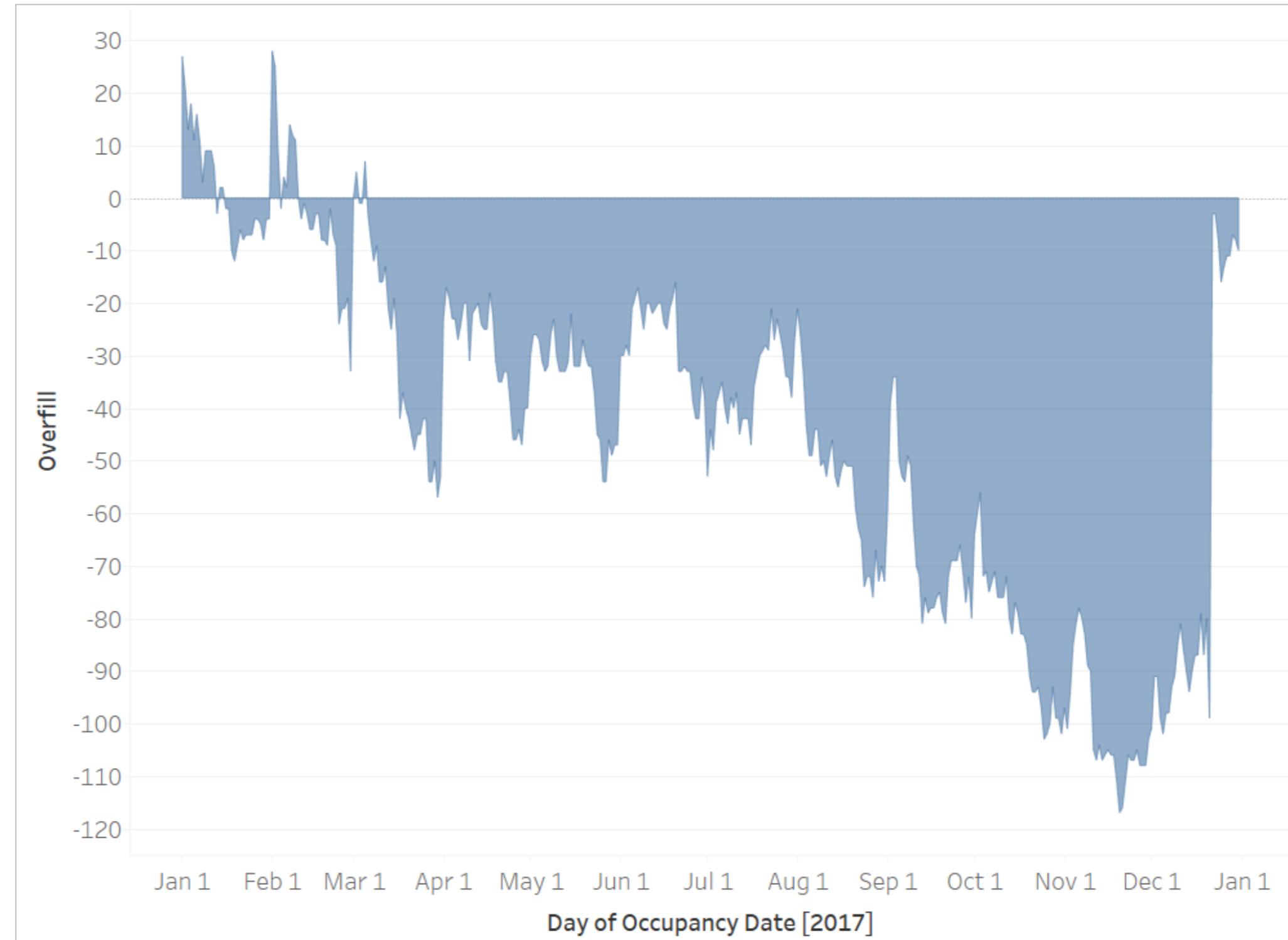
# Process for visualizing data



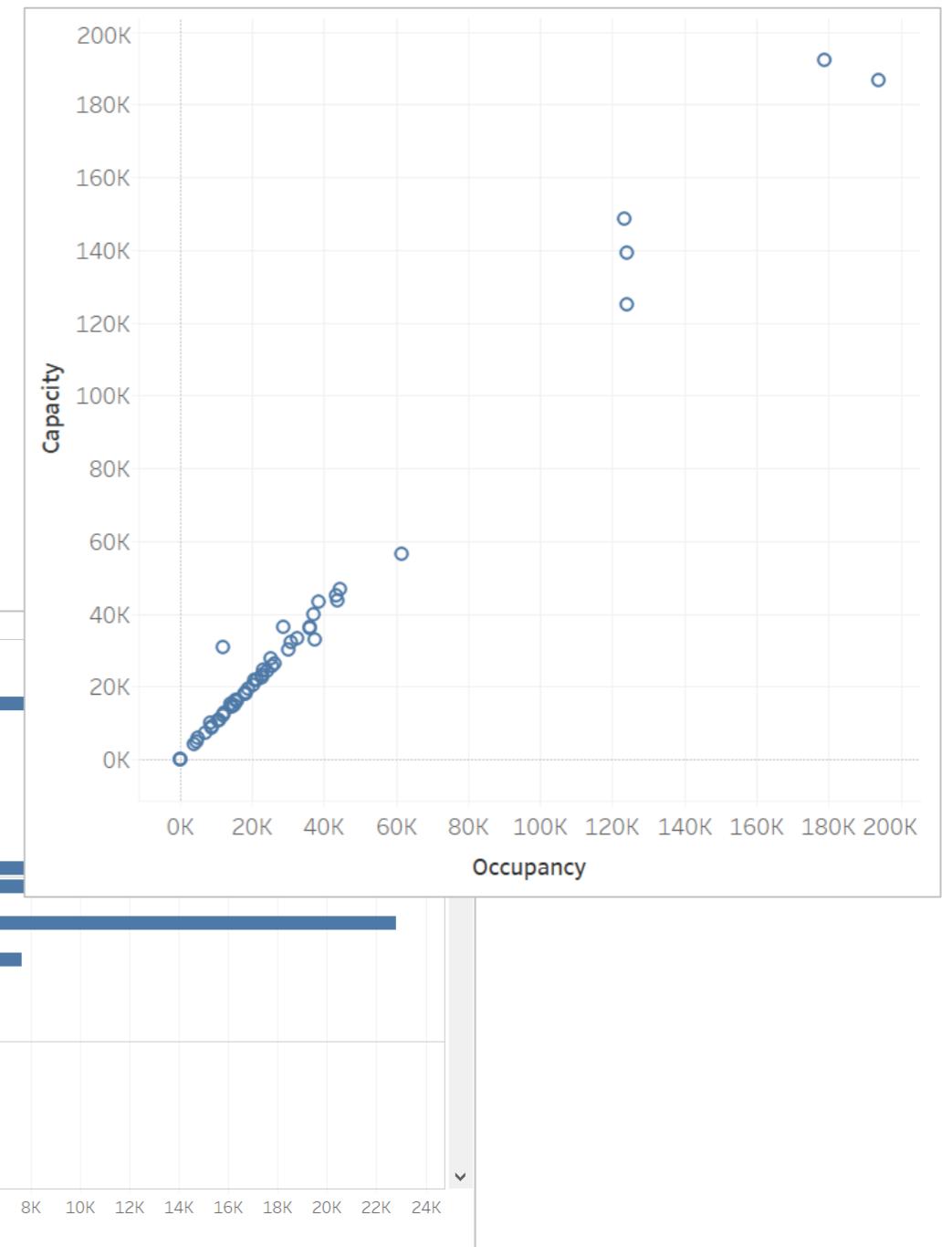
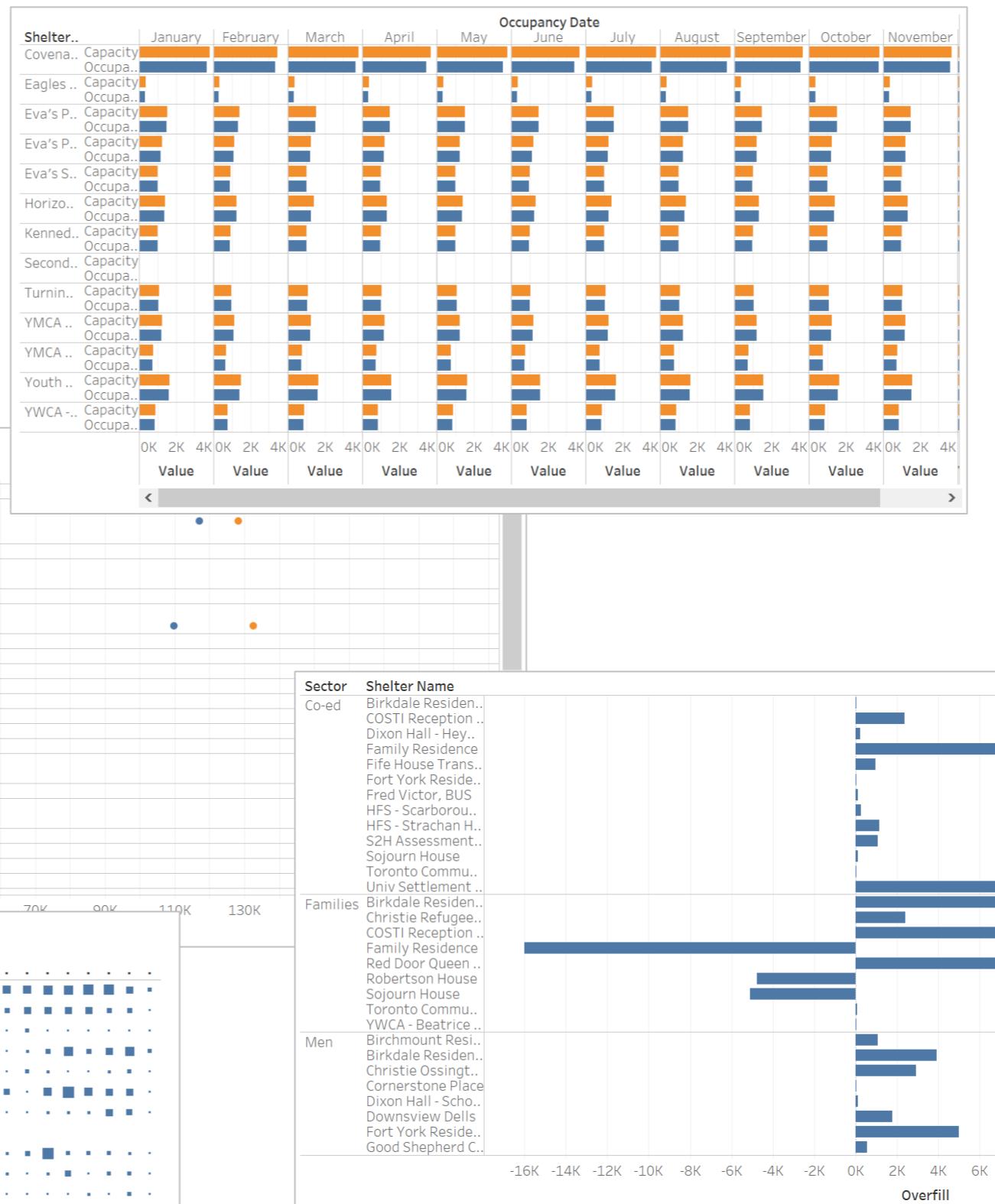
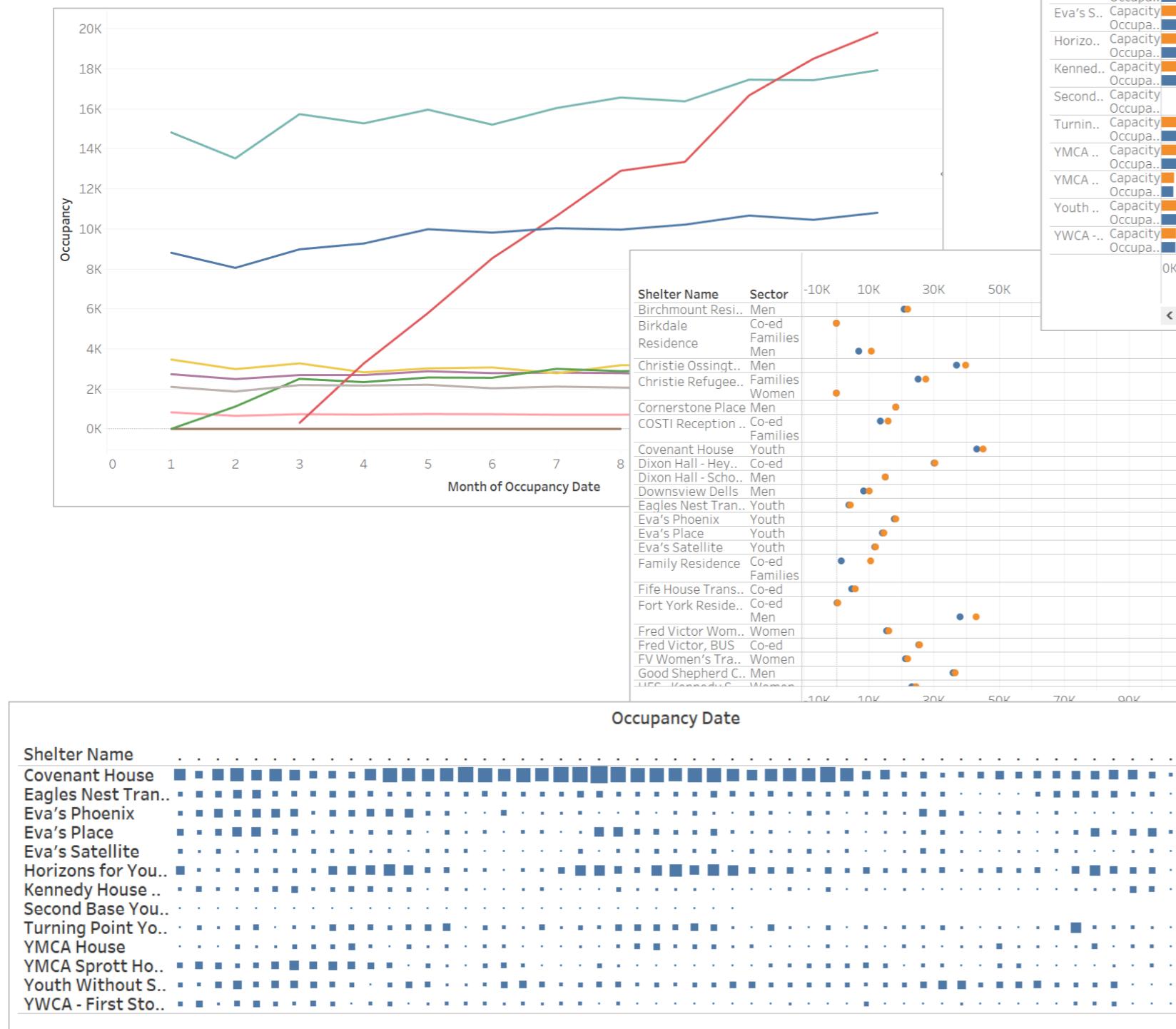
# Process for visualizing data



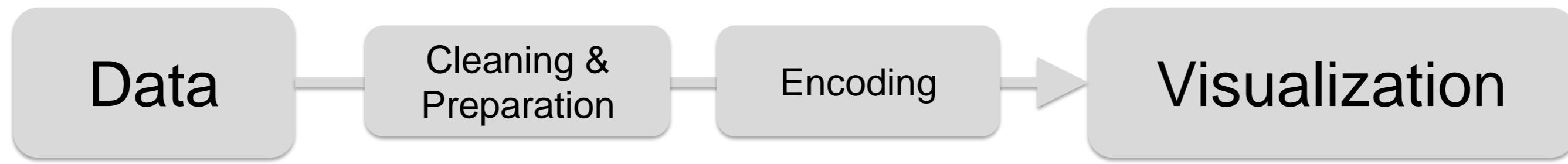
# Process for visualizing data



# Process for visualizing data



# Process for visualizing data



# How to choose a chart

# How to choose a chart

“It depends...”

Audience

Goal

# How to choose a chart

How has shelter occupancy changed in 2017?

# How to choose a chart

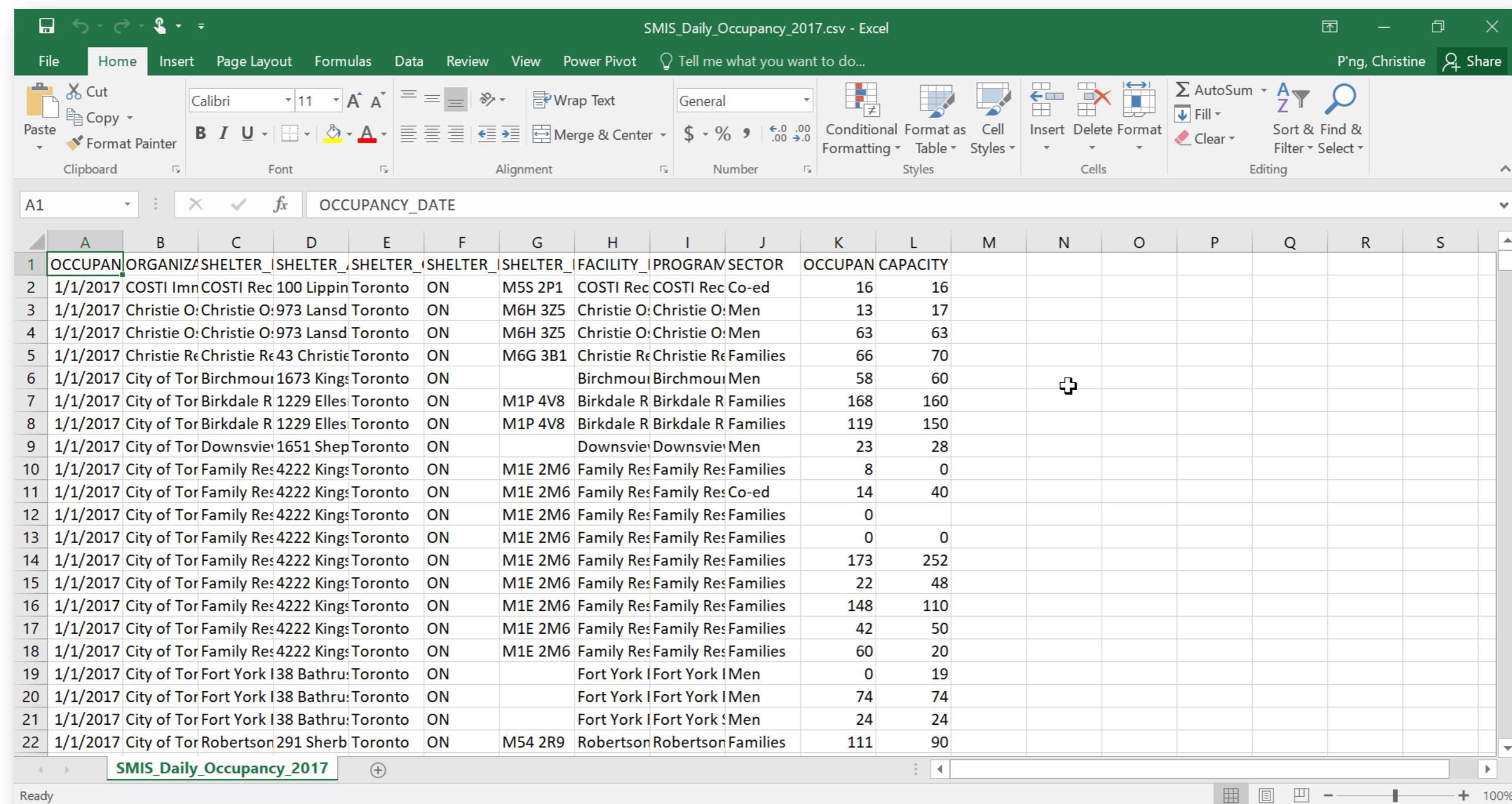
How has shelter occupancy changed in 2017?



+29%

# How to choose a chart

How has shelter occupancy changed in 2017?

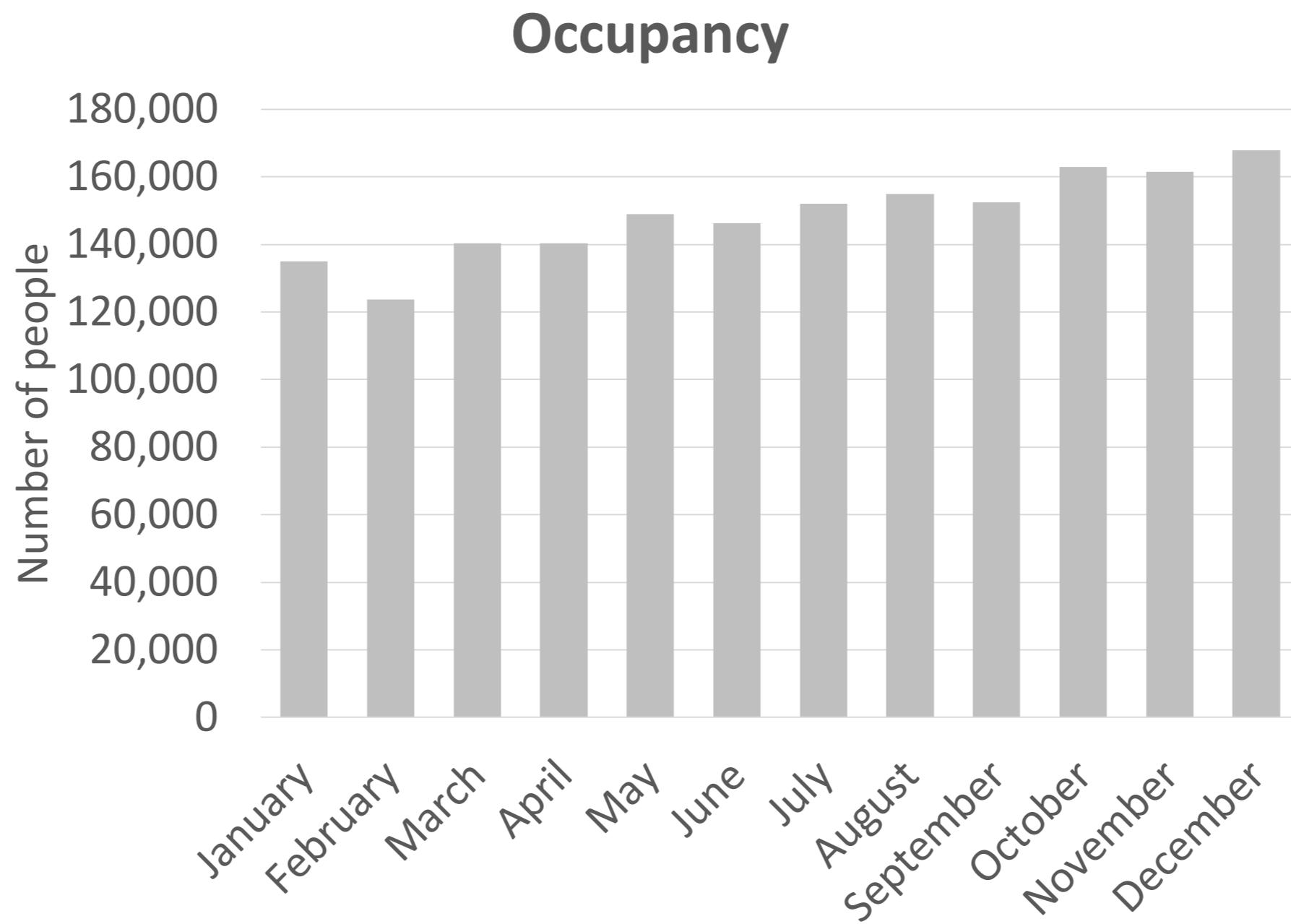


The screenshot shows a Microsoft Excel spreadsheet titled "SMIS\_Daily\_Occupancy\_2017.csv - Excel". The data is organized into a table with the following columns:

|    | A        | B            | C           | D           | E       | F       | G       | H           | I           | J        | K        | L        | M | N | O | P | Q | R | S |
|----|----------|--------------|-------------|-------------|---------|---------|---------|-------------|-------------|----------|----------|----------|---|---|---|---|---|---|---|
| 1  | OCCUPANT | ORGANIZATION | SHELTER     | SHELTER     | SHELTER | SHELTER | SHELTER | FACILITY    | PROGRAM     | SECTOR   | OCCUPANT | CAPACITY |   |   |   |   |   |   |   |
| 2  | 1/1/2017 | COSTI Imn    | COSTI Rec   | 100 Lippin  | Toronto | ON      | M5S 2P1 | COSTI Rec   | COSTI Rec   | Co-ed    | 16       | 16       |   |   |   |   |   |   |   |
| 3  | 1/1/2017 | Christie O:  | Christie O: | 973 Lansd   | Toronto | ON      | M6H 3Z5 | Christie O: | Christie O: | Men      | 13       | 17       |   |   |   |   |   |   |   |
| 4  | 1/1/2017 | Christie O:  | Christie O: | 973 Lansd   | Toronto | ON      | M6H 3Z5 | Christie O: | Christie O: | Men      | 63       | 63       |   |   |   |   |   |   |   |
| 5  | 1/1/2017 | Christie Re  | Christie Re | 43 Christie | Toronto | ON      | M6G 3B1 | Christie Re | Christie Re | Families | 66       | 70       |   |   |   |   |   |   |   |
| 6  | 1/1/2017 | City of Tor  | Birchmou    | 1673 King   | Toronto | ON      |         | Birchmou    | Birchmou    | Men      | 58       | 60       |   |   |   |   |   |   |   |
| 7  | 1/1/2017 | City of Tor  | Birkdale R  | 1229 Elles  | Toronto | ON      | M1P 4V8 | Birkdale R  | Birkdale R  | Families | 168      | 160      |   |   |   |   |   |   |   |
| 8  | 1/1/2017 | City of Tor  | Birkdale R  | 1229 Elles  | Toronto | ON      | M1P 4V8 | Birkdale R  | Birkdale R  | Families | 119      | 150      |   |   |   |   |   |   |   |
| 9  | 1/1/2017 | City of Tor  | Downsvie    | 1651 Shep   | Toronto | ON      |         | Downsvie    | Downsvie    | Men      | 23       | 28       |   |   |   |   |   |   |   |
| 10 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Families | 8        | 0        |   |   |   |   |   |   |   |
| 11 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Co-ed    | 14       | 40       |   |   |   |   |   |   |   |
| 12 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Families | 0        |          |   |   |   |   |   |   |   |
| 13 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Families | 0        | 0        |   |   |   |   |   |   |   |
| 14 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Families | 173      | 252      |   |   |   |   |   |   |   |
| 15 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Families | 22       | 48       |   |   |   |   |   |   |   |
| 16 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Families | 148      | 110      |   |   |   |   |   |   |   |
| 17 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Families | 42       | 50       |   |   |   |   |   |   |   |
| 18 | 1/1/2017 | City of Tor  | Family Res  | 4222 King   | Toronto | ON      | M1E 2M6 | Family Res  | Family Res  | Families | 60       | 20       |   |   |   |   |   |   |   |
| 19 | 1/1/2017 | City of Tor  | Fort York   | 138 Bathru  | Toronto | ON      |         | Fort York   | Fort York   | Men      | 0        | 19       |   |   |   |   |   |   |   |
| 20 | 1/1/2017 | City of Tor  | Fort York   | 138 Bathru  | Toronto | ON      |         | Fort York   | Fort York   | Men      | 74       | 74       |   |   |   |   |   |   |   |
| 21 | 1/1/2017 | City of Tor  | Fort York   | 138 Bathru  | Toronto | ON      |         | Fort York   | Fort York   | Men      | 24       | 24       |   |   |   |   |   |   |   |
| 22 | 1/1/2017 | City of Tor  | Robertson   | 291 Sherb   | Toronto | ON      | M54 2R9 | Robertson   | Robertson   | Families | 111      | 90       |   |   |   |   |   |   |   |

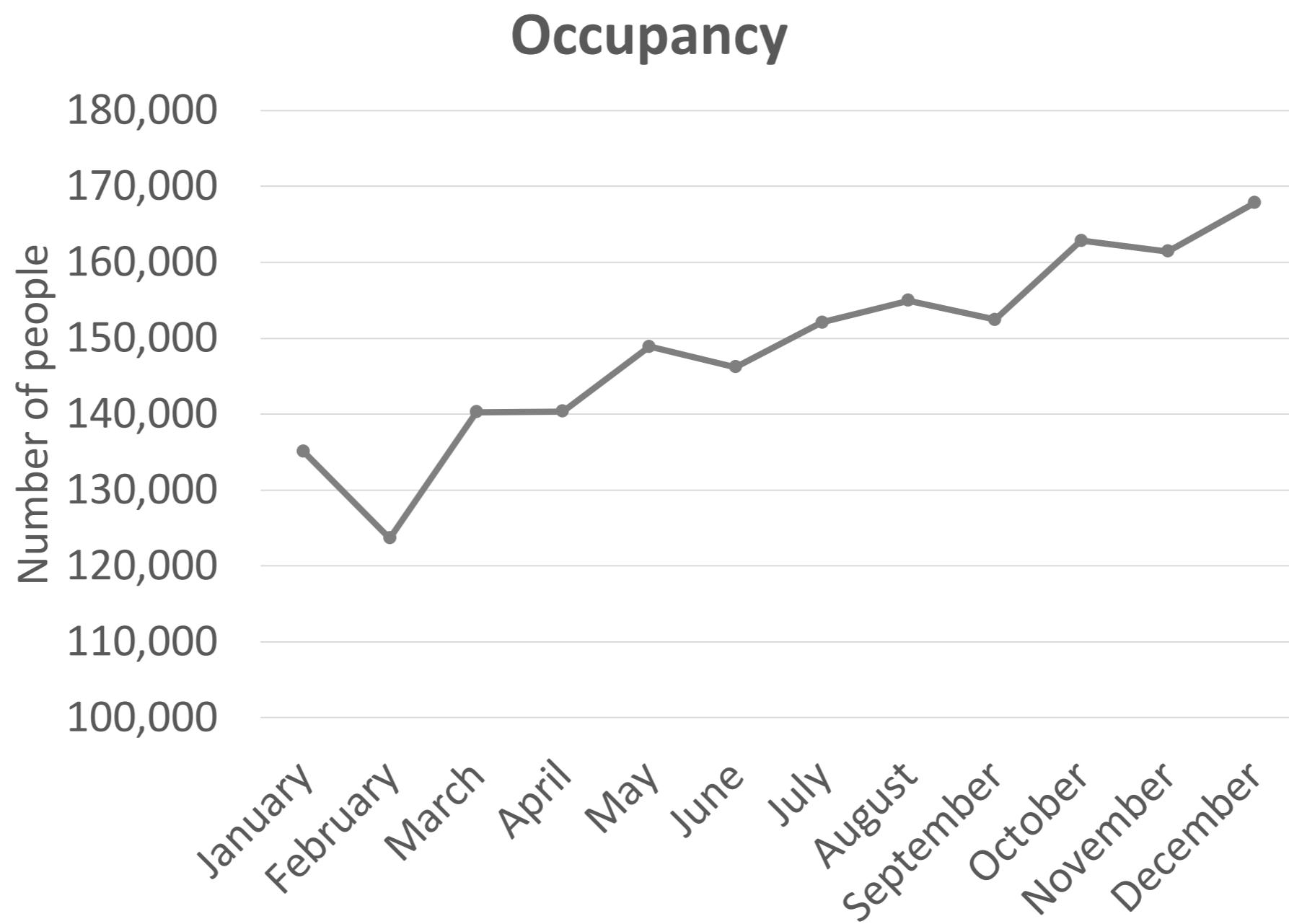
# How to choose a chart

How has shelter occupancy changed in 2017?



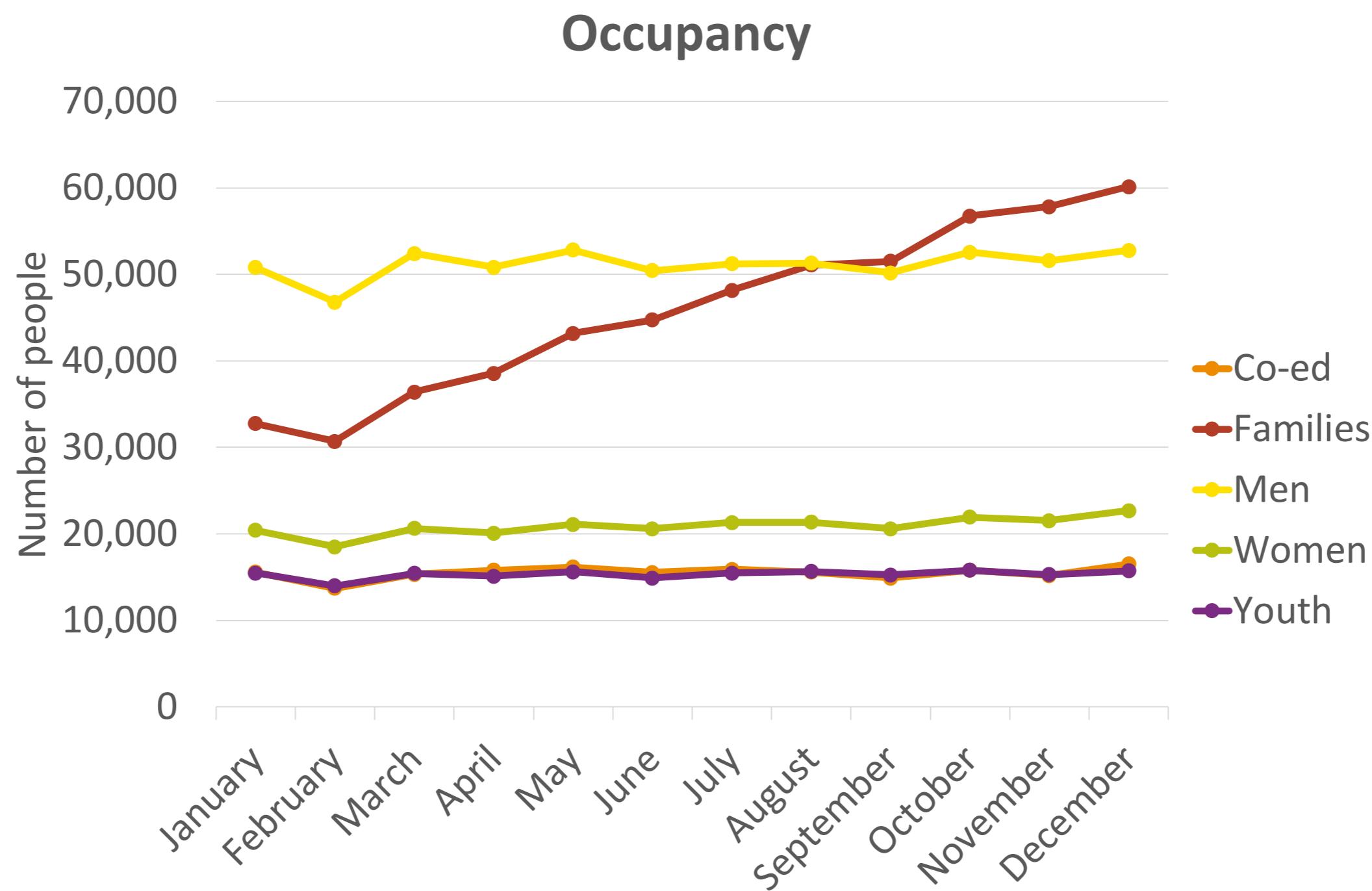
# How to choose a chart

How has shelter occupancy changed in 2017?



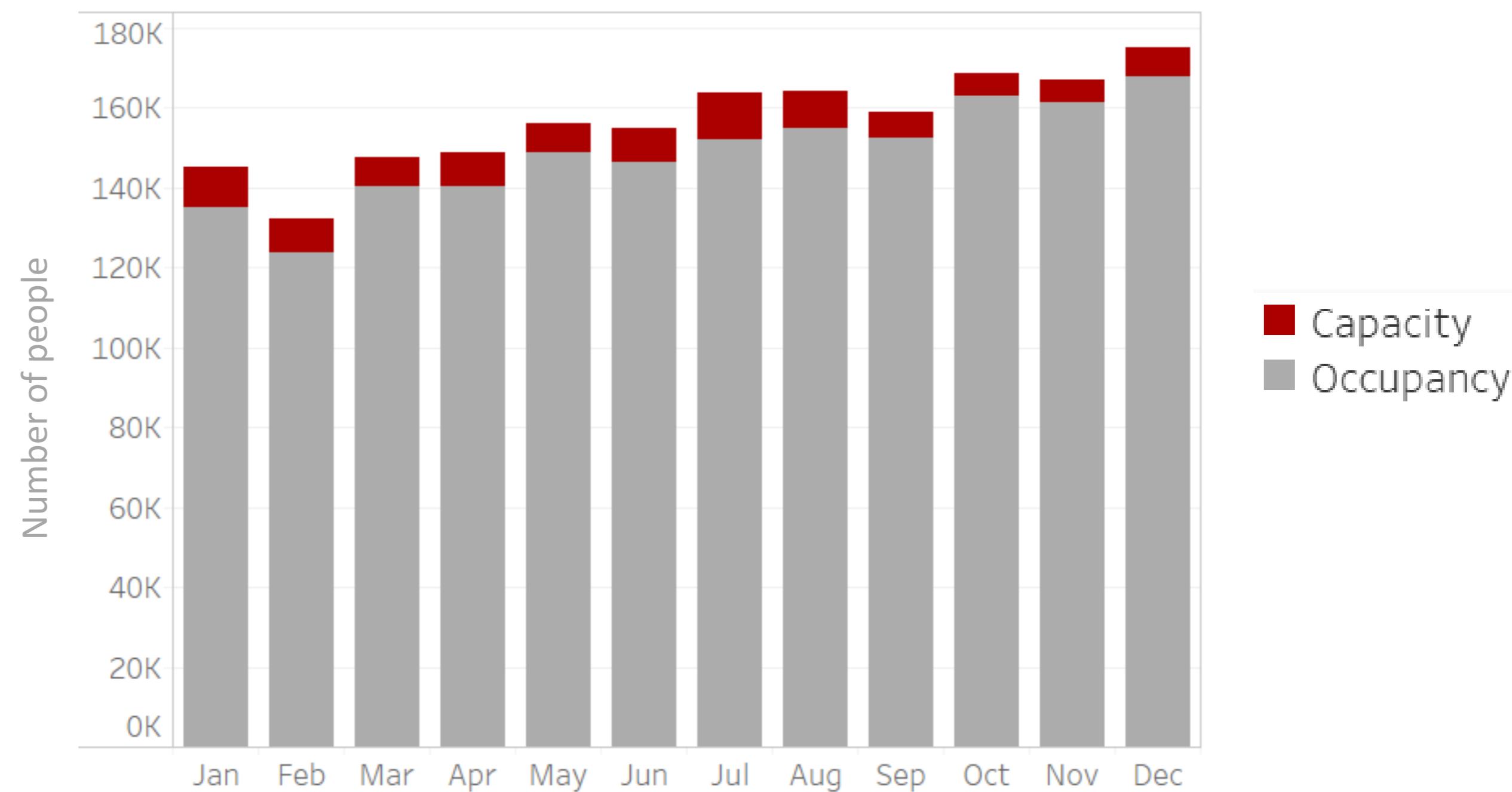
# How to choose a chart

How has shelter occupancy across sectors changed in 2017?



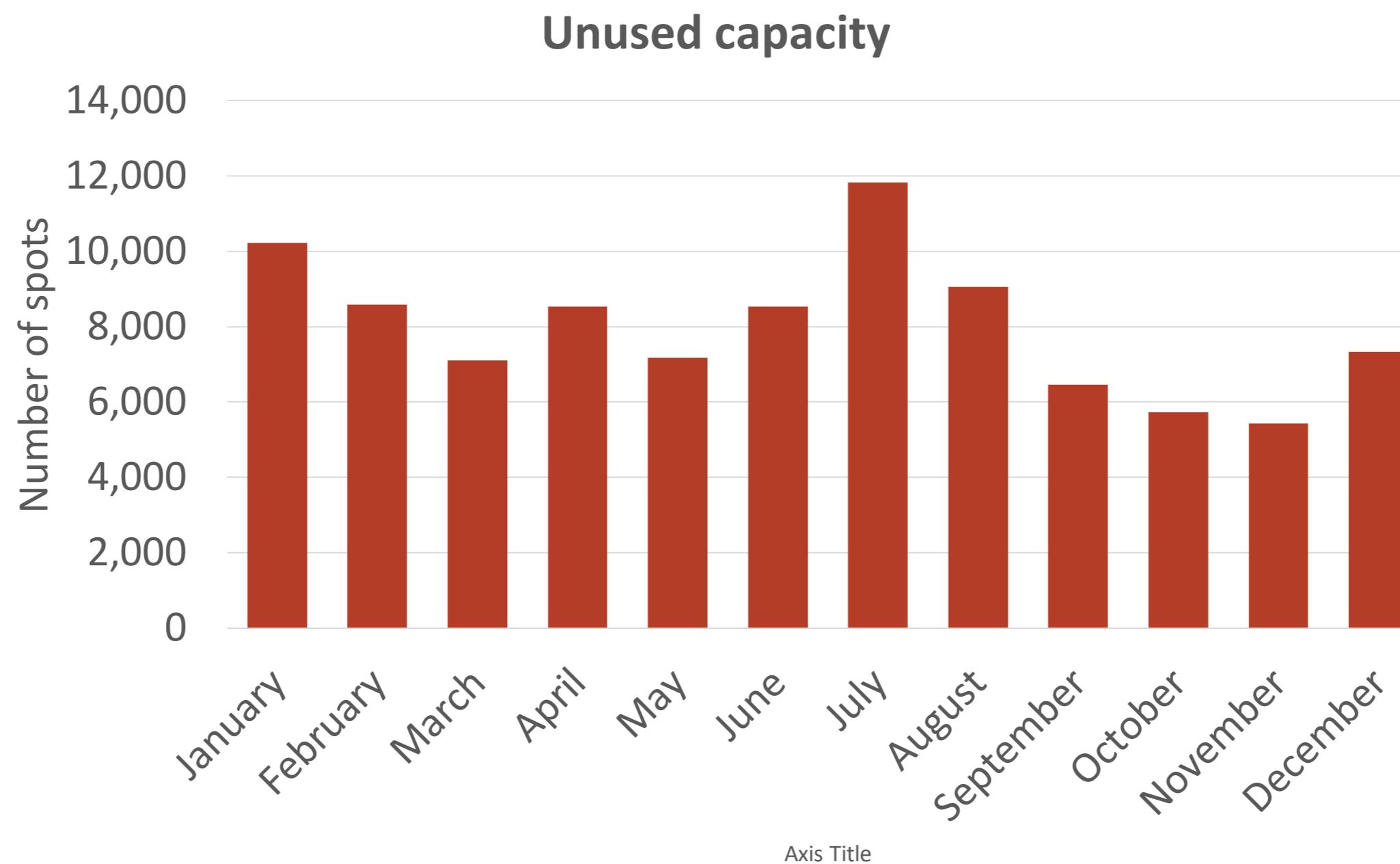
# How to choose a chart

How full are shelters throughout the year?



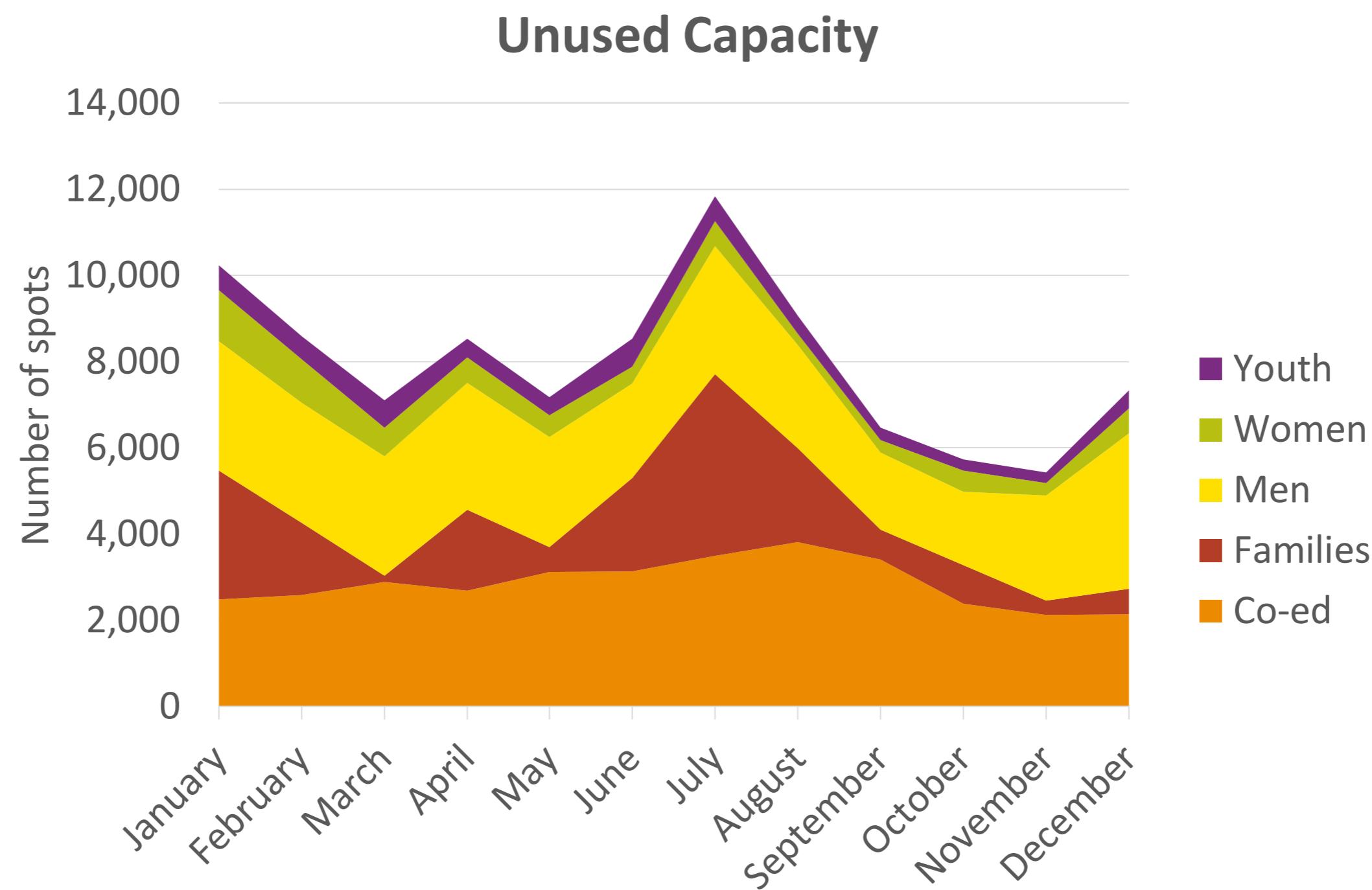
# How to choose a chart

How much excess capacity is there?



# How to choose a chart

How does excess capacity vary by sector?

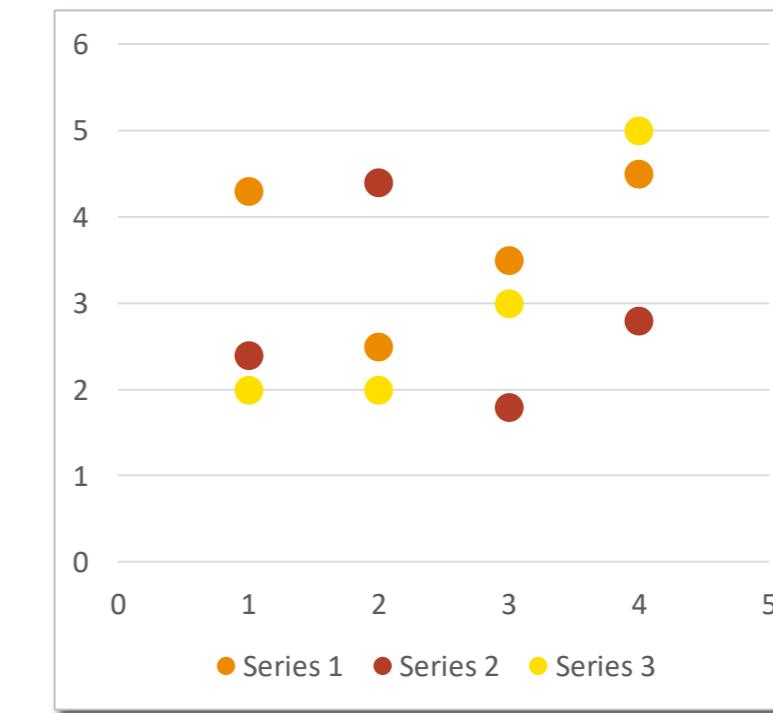
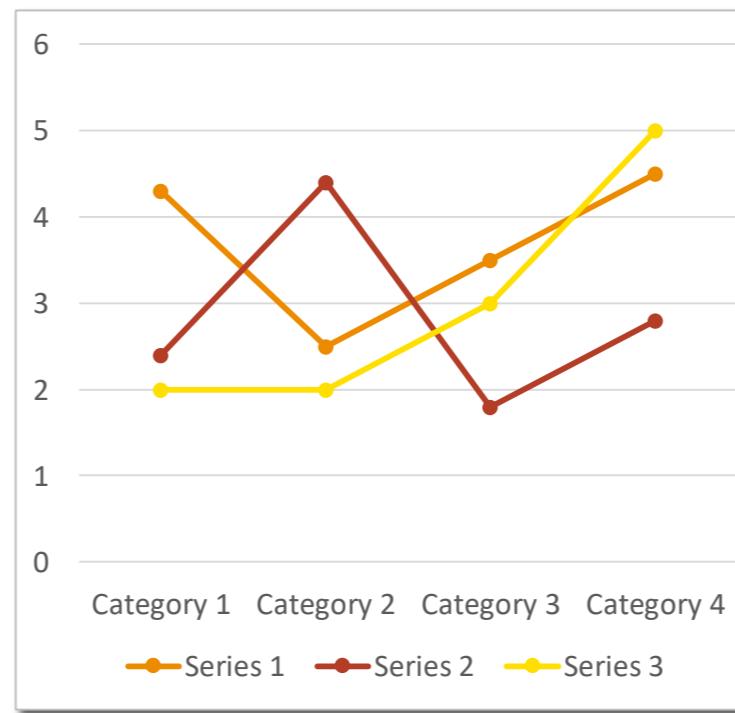
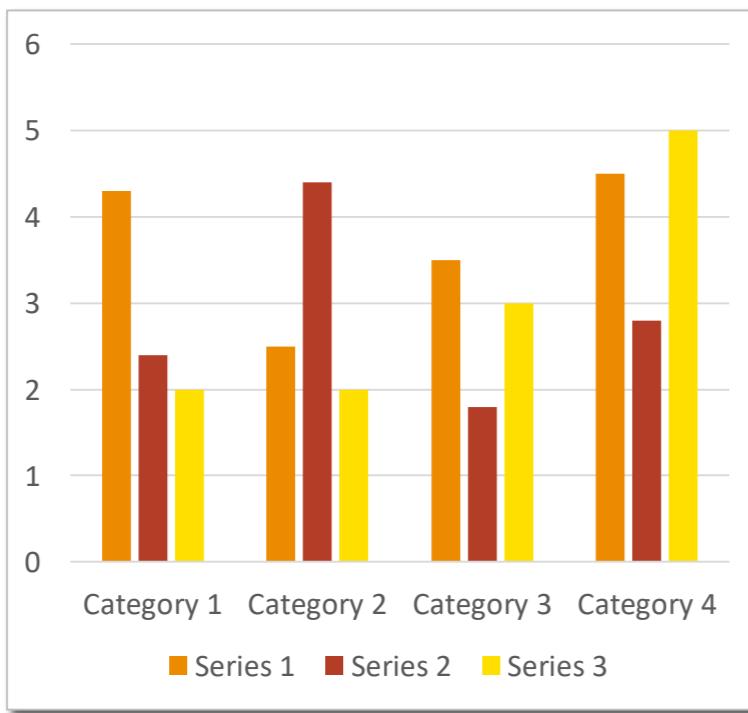


# How to choose a chart

Audience

Goal

How to choose a chart?



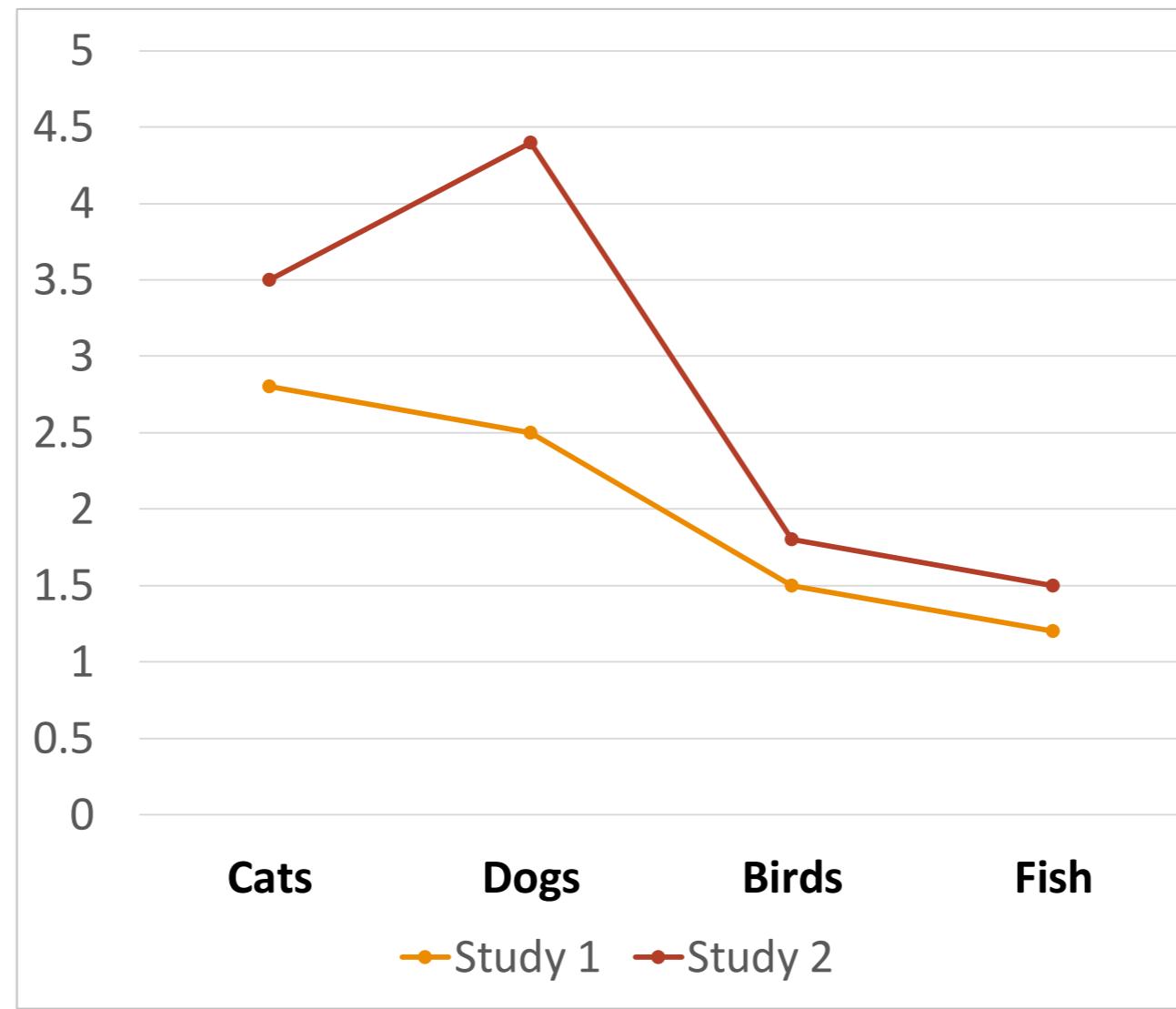
# How to choose a chart

Principle of  
**Expressiveness**

Show *all* and *only* the relationships that exist in the data

# How to choose a chart

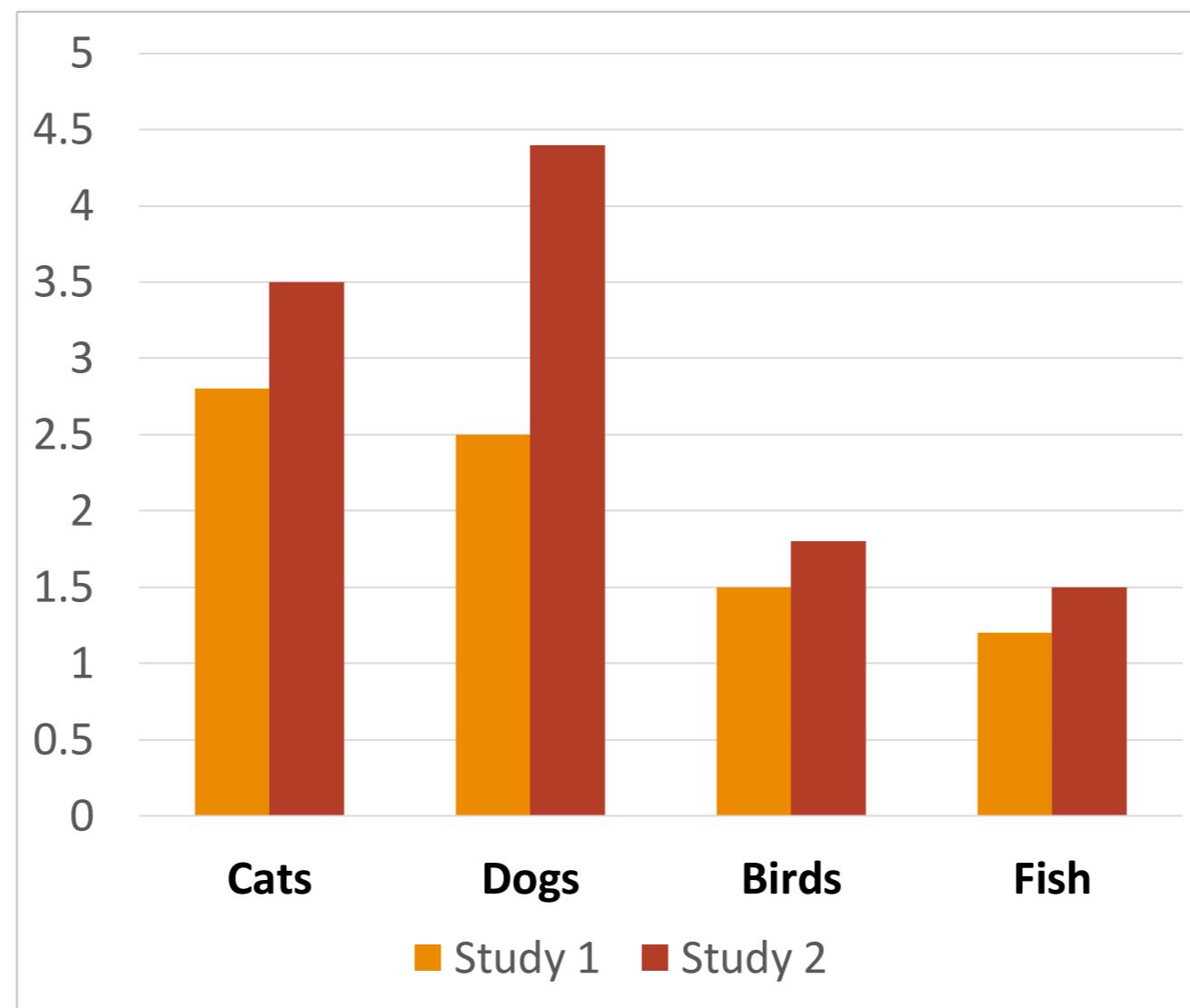
## Principle of **Expressiveness**



Categorical  
(unordered) data –  
but lines imply the  
data is ordered

# How to choose a chart

## Principle of **Expressiveness**

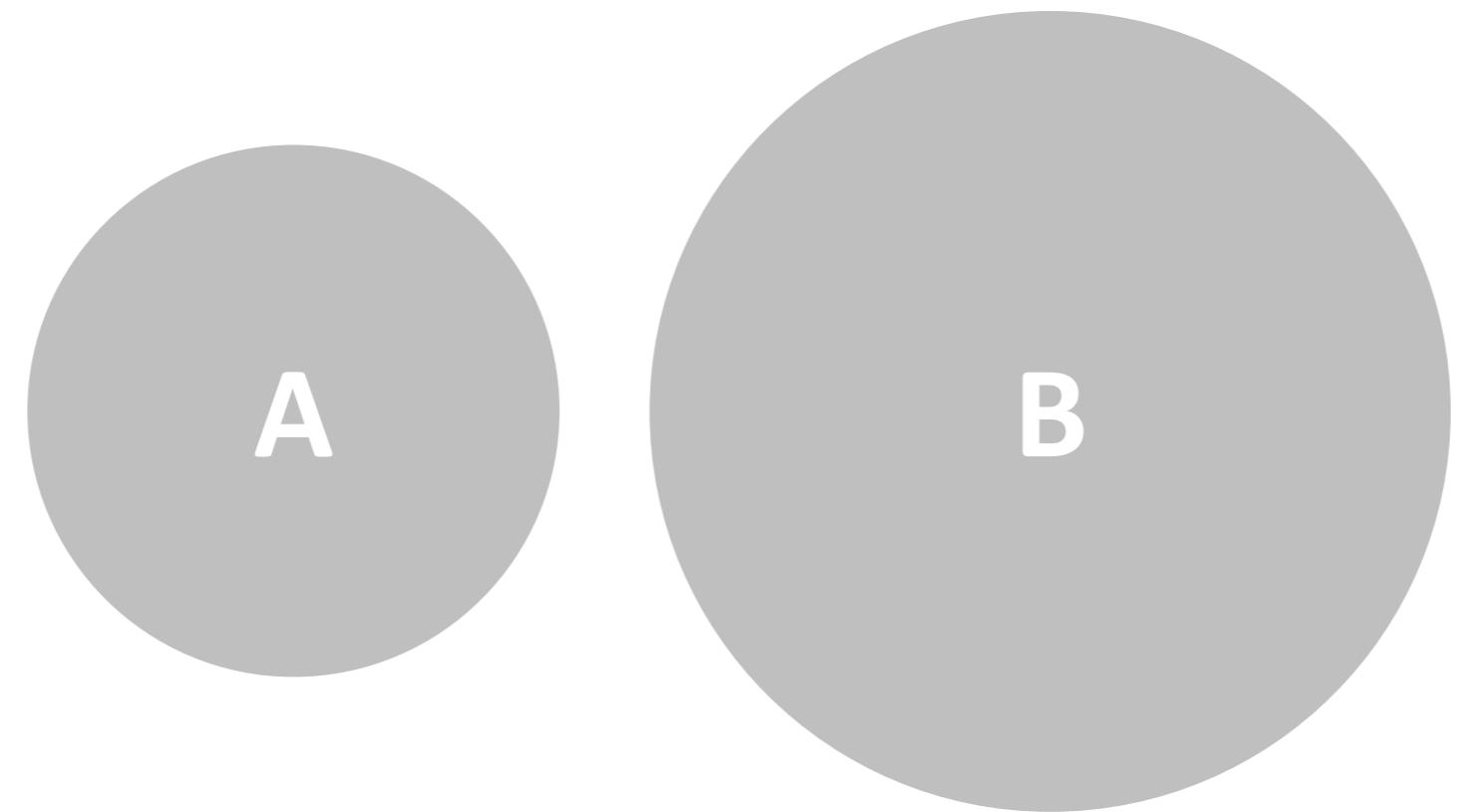


# How to choose a chart

## Principle of **Effectiveness**

Match *relevance* of information to  
*effectiveness* of the visual channel

# How to choose a chart



# How to choose a chart

A

B

# How to choose a chart



# How to choose a chart

## Encoding numbers

### Rank    Aspect to compare

- 1    Position on a common scale
- 2    Position on same but nonaligned scale
- 3    Lengths
- 4    Angles, slopes
- 5    Area
- 6    Volume, colour saturation
- 7    Colour hue

# How to choose a chart

## Encoding numbers

### Rank    Aspect to compare

- 1 Position on a common scale
- 2 Position on same but nonaligned scale
- 3 Lengths
- 4 Angles, slopes
- 5 Area
- 6 Volume, colour saturation
- 7 Colour hue



# How to choose a chart

## Encoding numbers

### Rank    Aspect to compare

- 1 Position on a common scale
- 2 Position on same but nonaligned scale
- 3 Lengths
- 4 Angles, slopes
- 5 Area
- 6 Volume, colour saturation
- 7 Colour hue

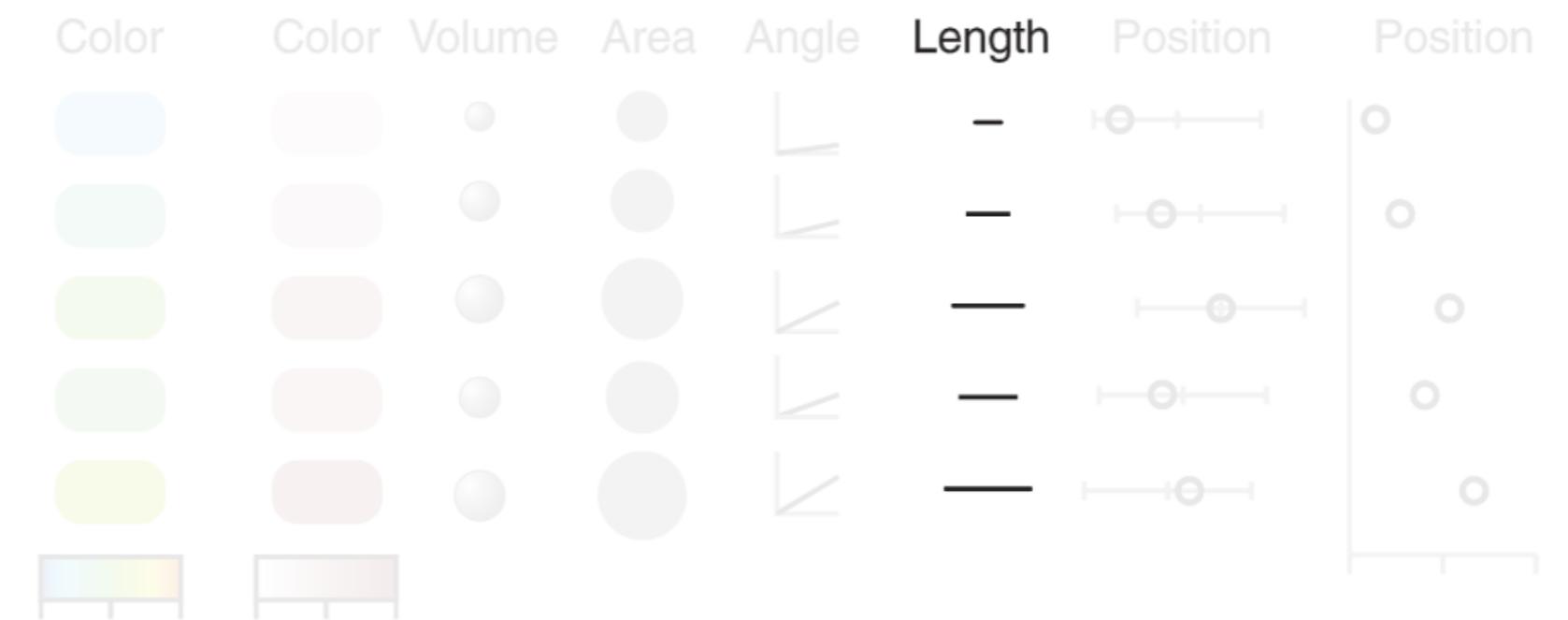


# How to choose a chart

## Encoding numbers

### Rank    Aspect to compare

- 1 Position on a common scale
- 2 Position on same but nonaligned scale
- 3 Lengths
- 4 Angles, slopes
- 5 Area
- 6 Volume, colour saturation
- 7 Colour hue

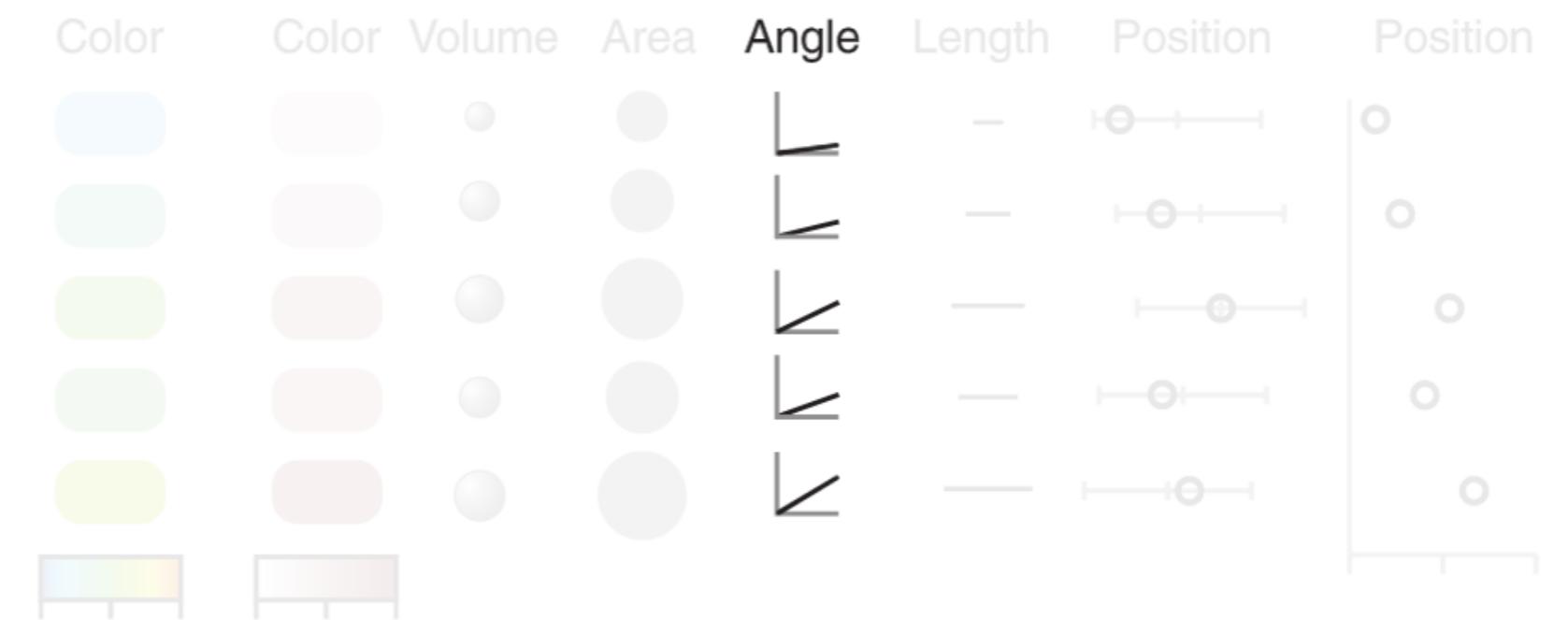


# How to choose a chart

## Encoding numbers

### Rank    Aspect to compare

- 1 Position on a common scale
- 2 Position on same but nonaligned scale
- 3 Lengths
- 4 Angles, slopes
- 5 Area
- 6 Volume, colour saturation
- 7 Colour hue

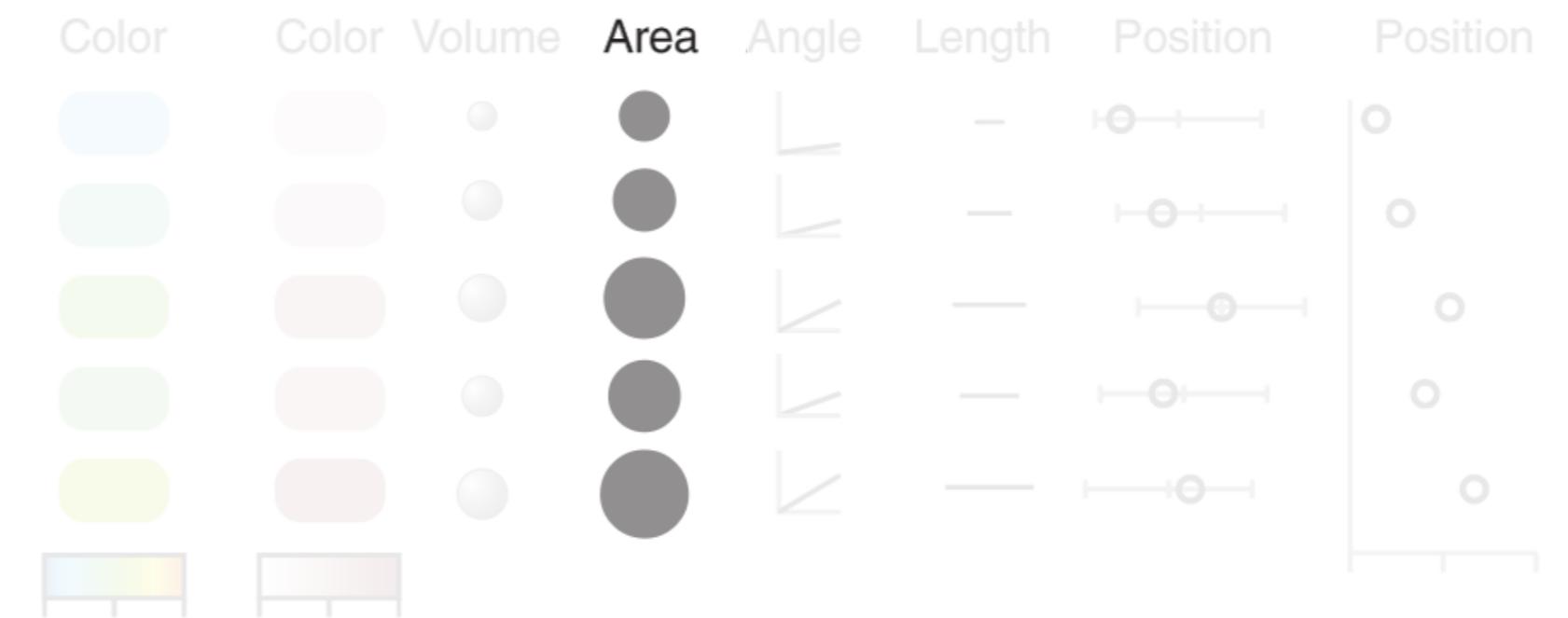


# How to choose a chart

## Encoding numbers

### Rank    Aspect to compare

- 1 Position on a common scale
- 2 Position on same but nonaligned scale
- 3 Lengths
- 4 Angles, slopes
- 5 Area
- 6 Volume, colour saturation
- 7 Colour hue

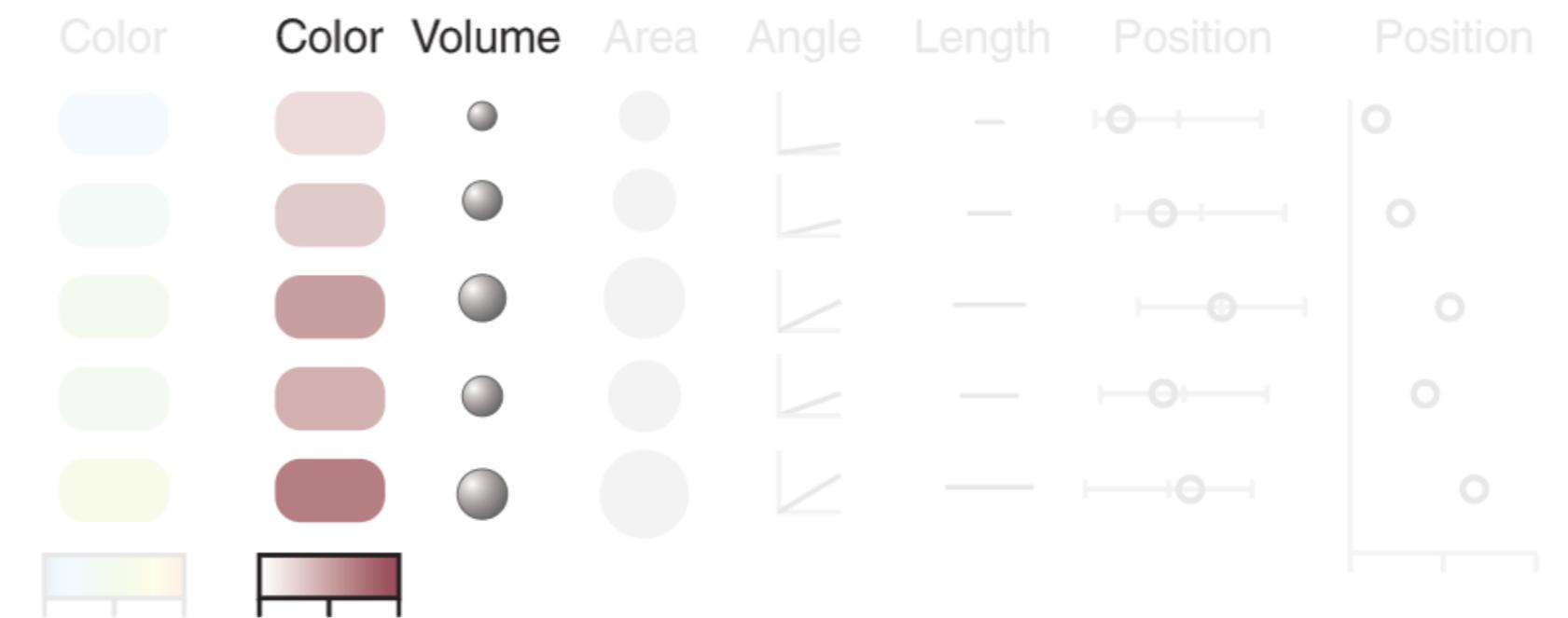


# How to choose a chart

## Encoding numbers

### Rank   Aspect to compare

- 1 Position on a common scale
- 2 Position on same but nonaligned scale
- 3 Lengths
- 4 Angles, slopes
- 5 Area
- 6 Volume, colour saturation
- 7 Colour hue

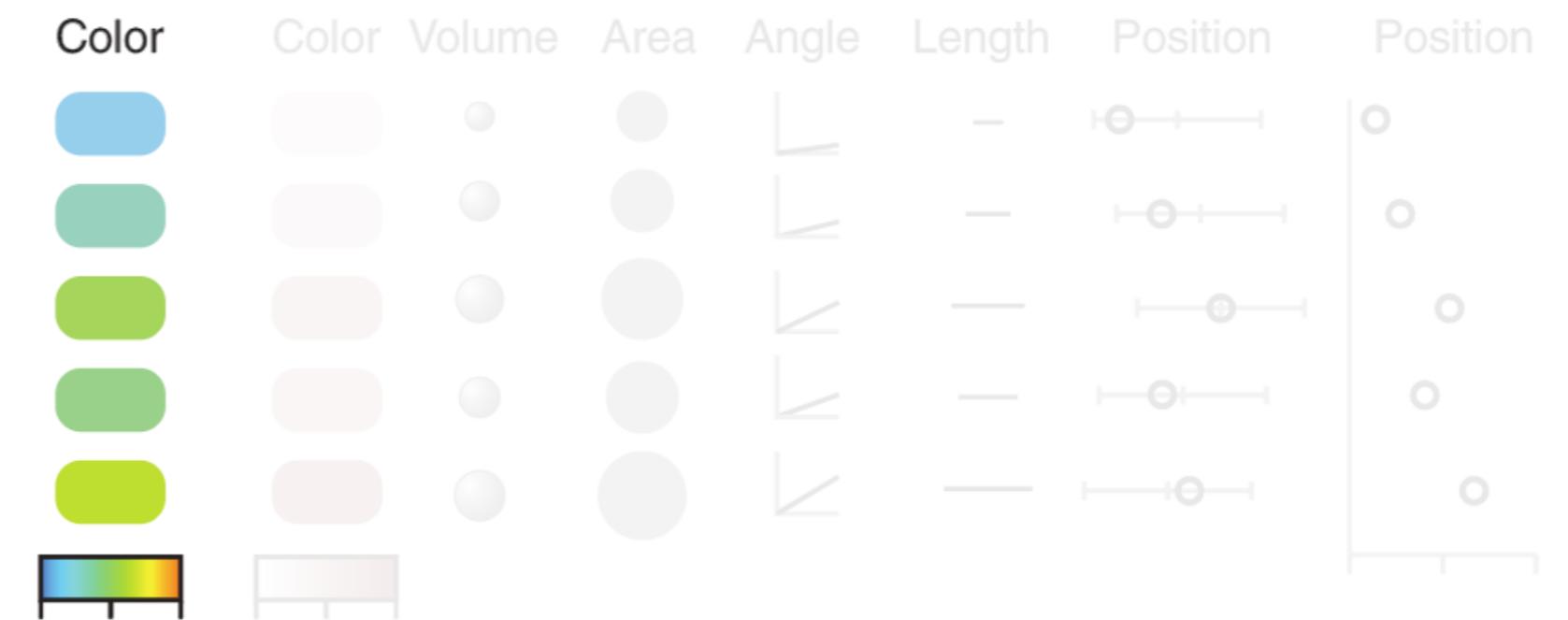


# How to choose a chart

## Encoding numbers

### Rank    Aspect to compare

- 1 Position on a common scale
- 2 Position on same but nonaligned scale
- 3 Lengths
- 4 Angles, slopes
- 5 Area
- 6 Volume, colour saturation
- 7 Colour hue

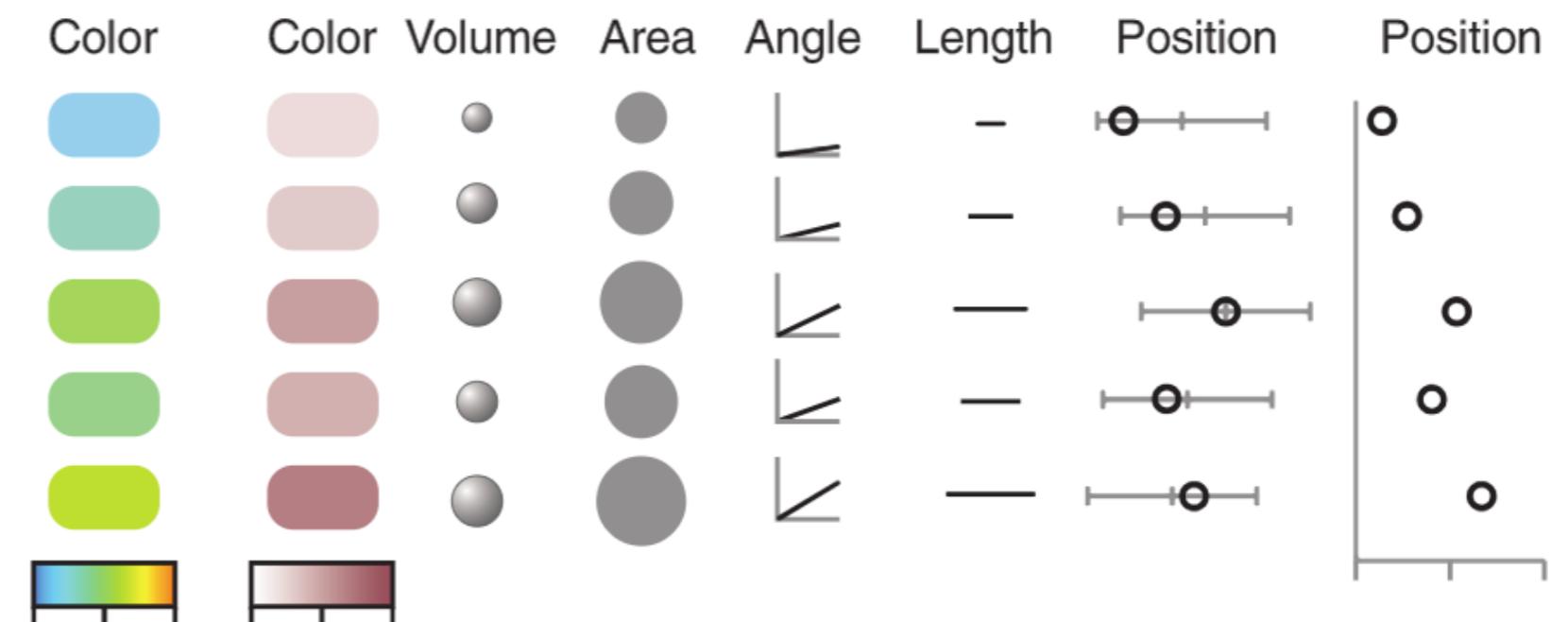


# How to choose a chart

## Encoding numbers

### Rank    Aspect to compare

- 1 Position on a common scale
- 2 Position on same but nonaligned scale
- 3 Lengths
- 4 Angles, slopes
- 5 Area
- 6 Volume, colour saturation
- 7 Colour hue



# How to choose a chart

Principle of  
**Expressiveness**

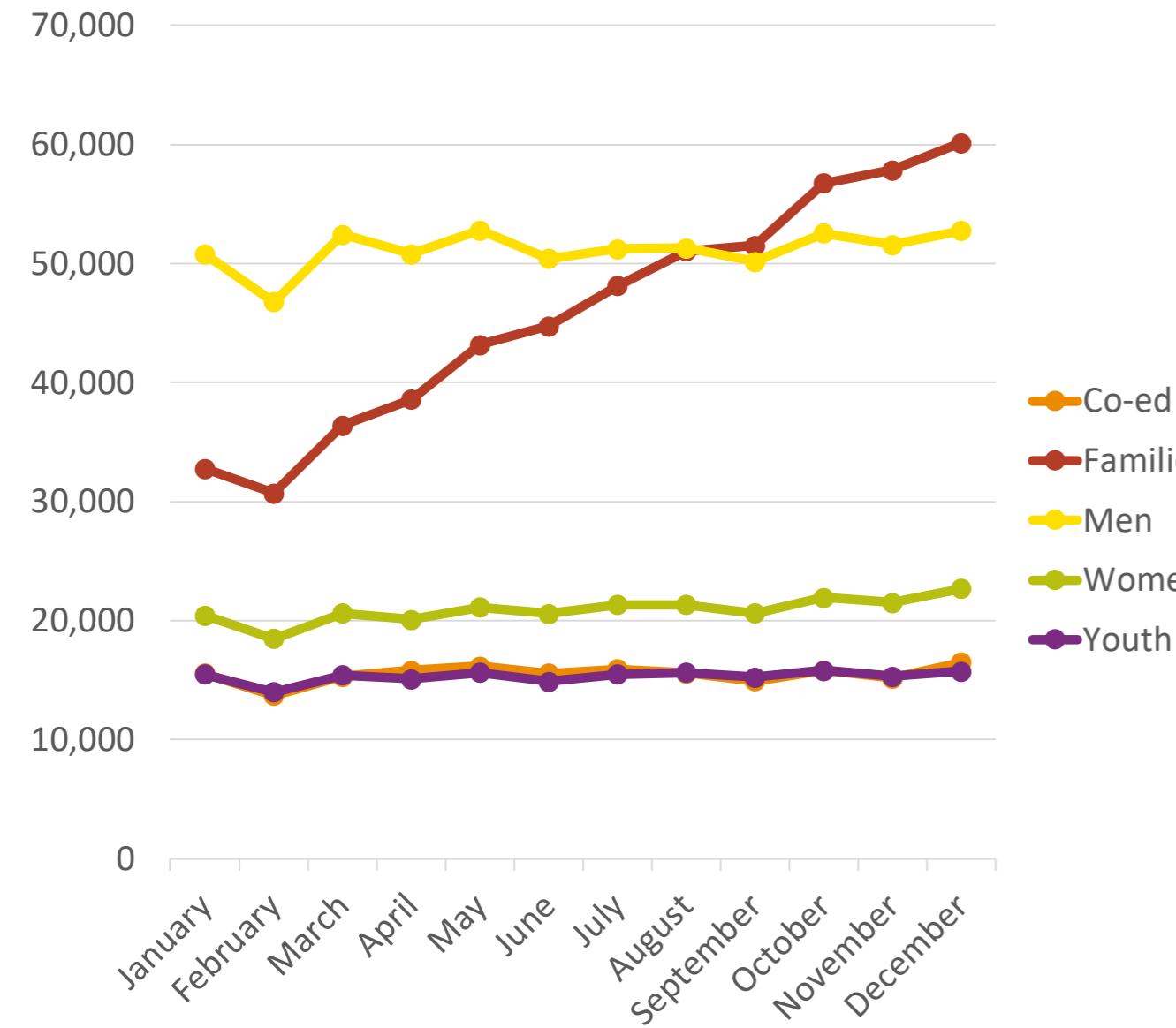
Show *all* and *only* the relationships  
that exist in the data

Principle of  
**Effectiveness**

Match *relevance* of information to  
*effectiveness* of the visual channel

# Components of a Chart

## Visual Encoding



## Annotations

Shelter Occupancy in Toronto 2017

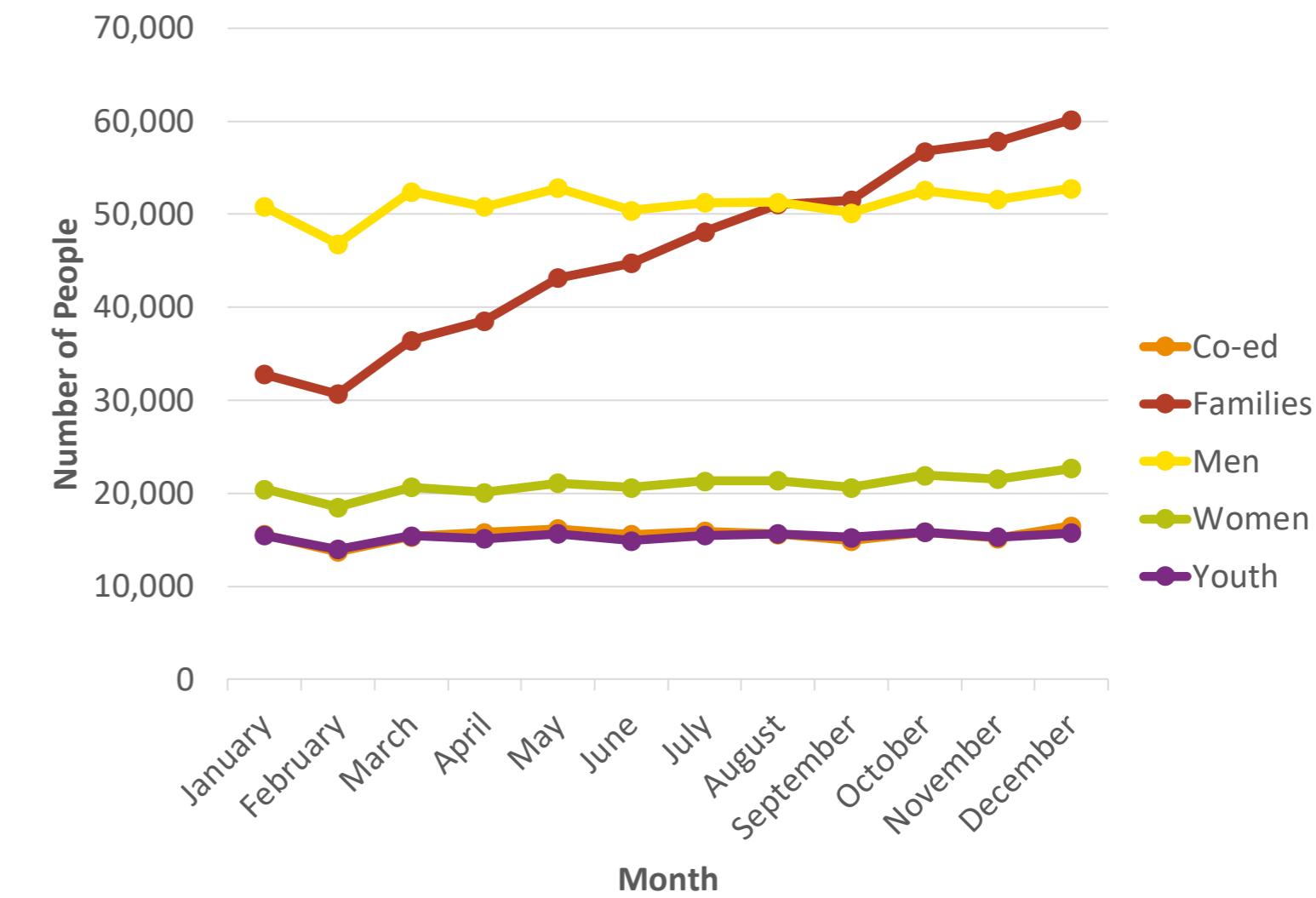
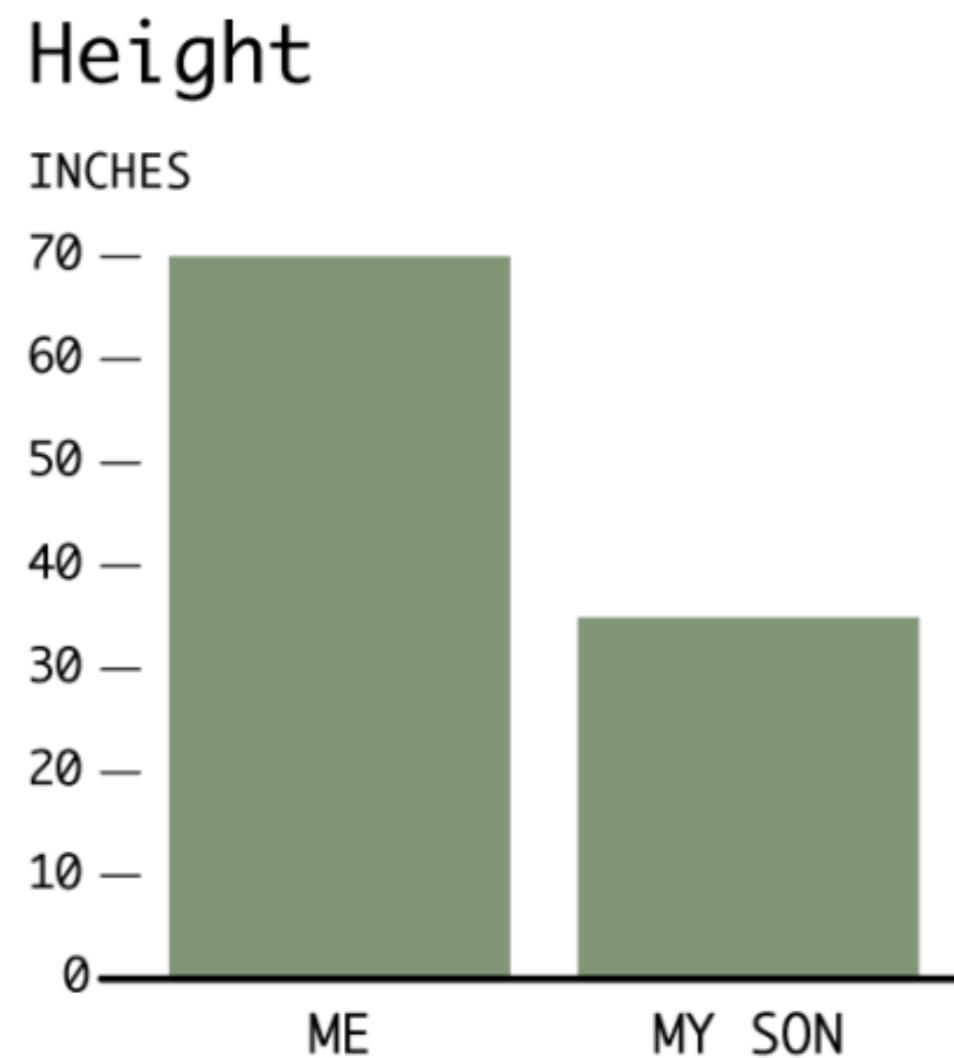


Figure 1. Shelter occupancy in 2017 has remained relatively consistent across sectors, with the exception of family shelters where occupancy has approximately doubled over the course of the year.

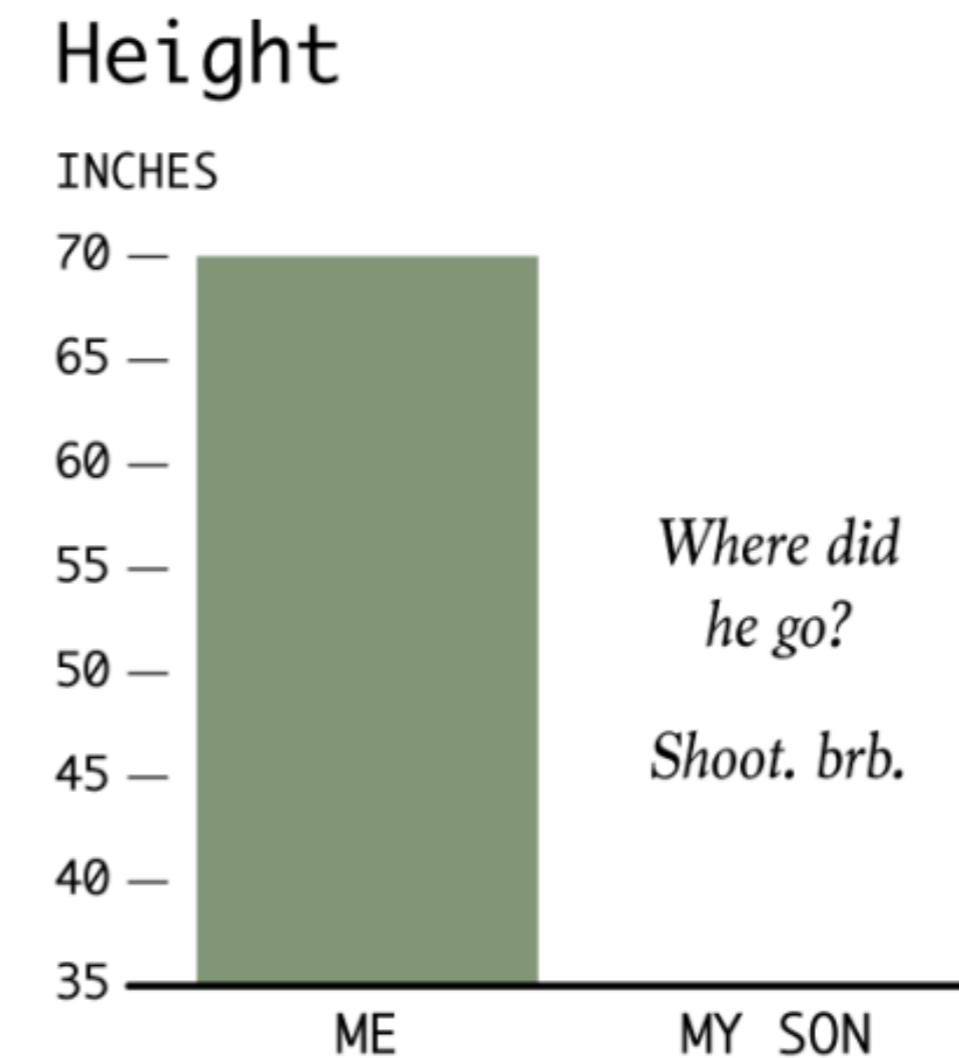
# Critique

# Common Errors

## Truncated Axes

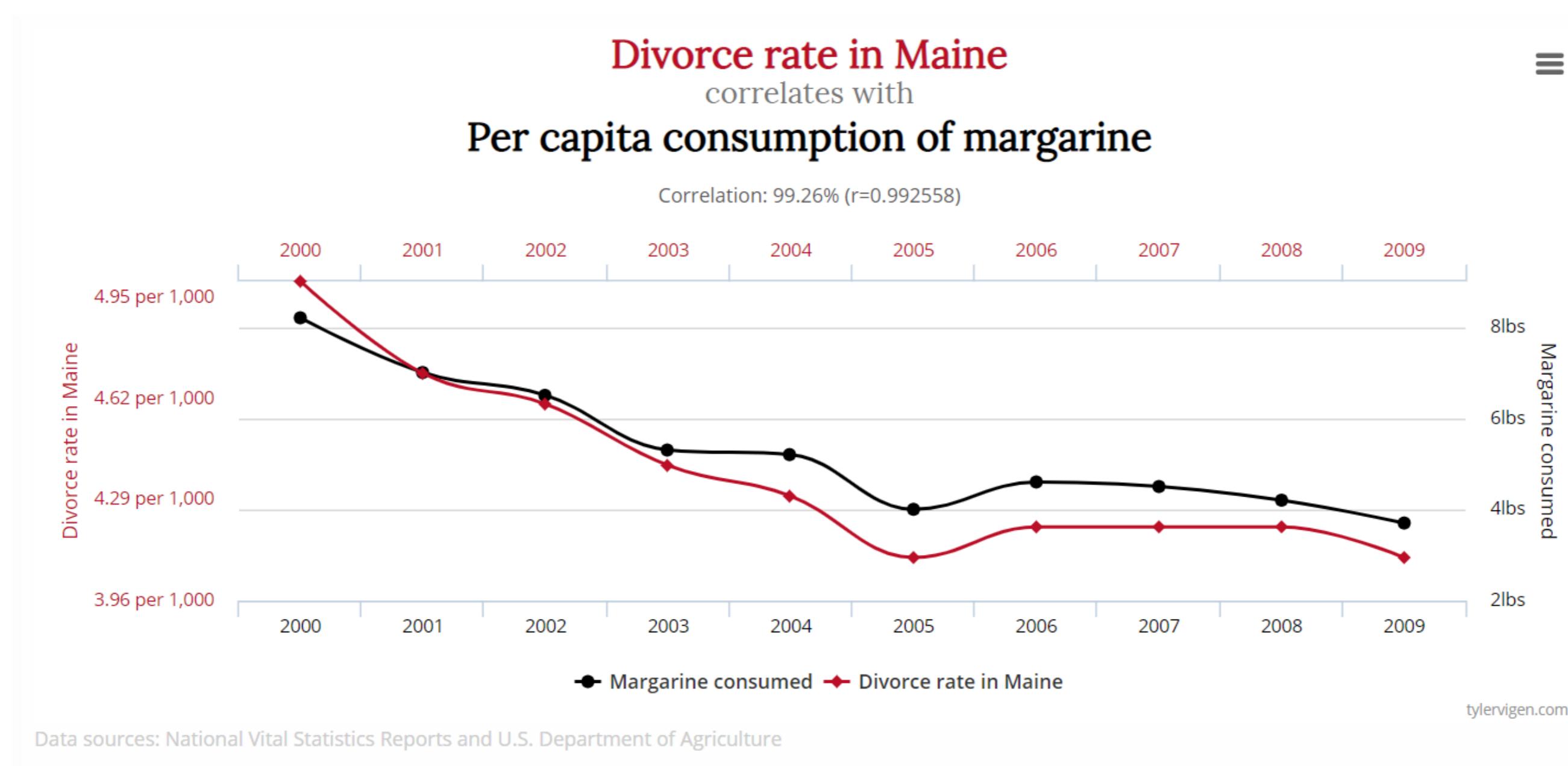


VS.



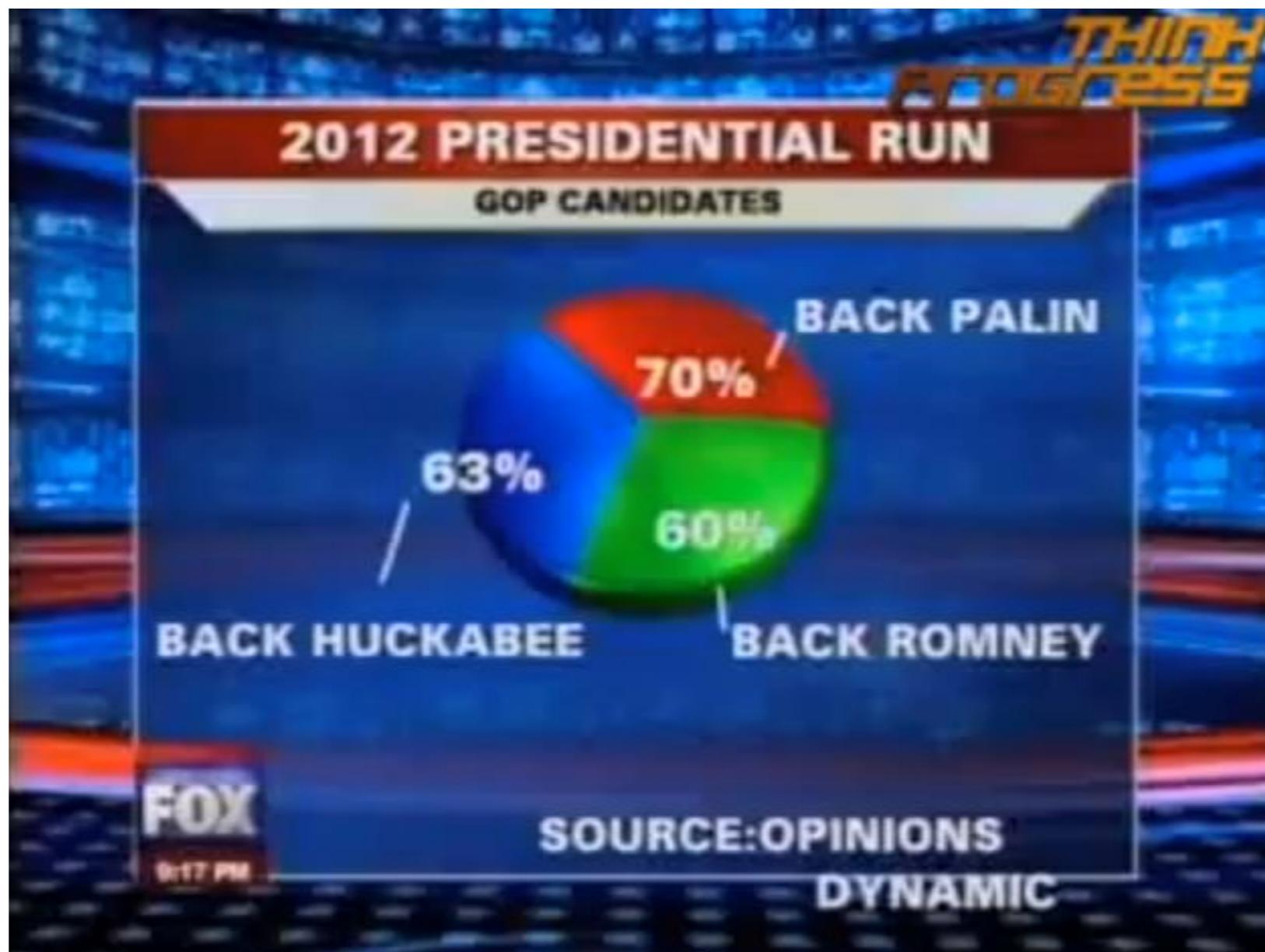
# Common Errors

## Dual Axes



# Common Errors

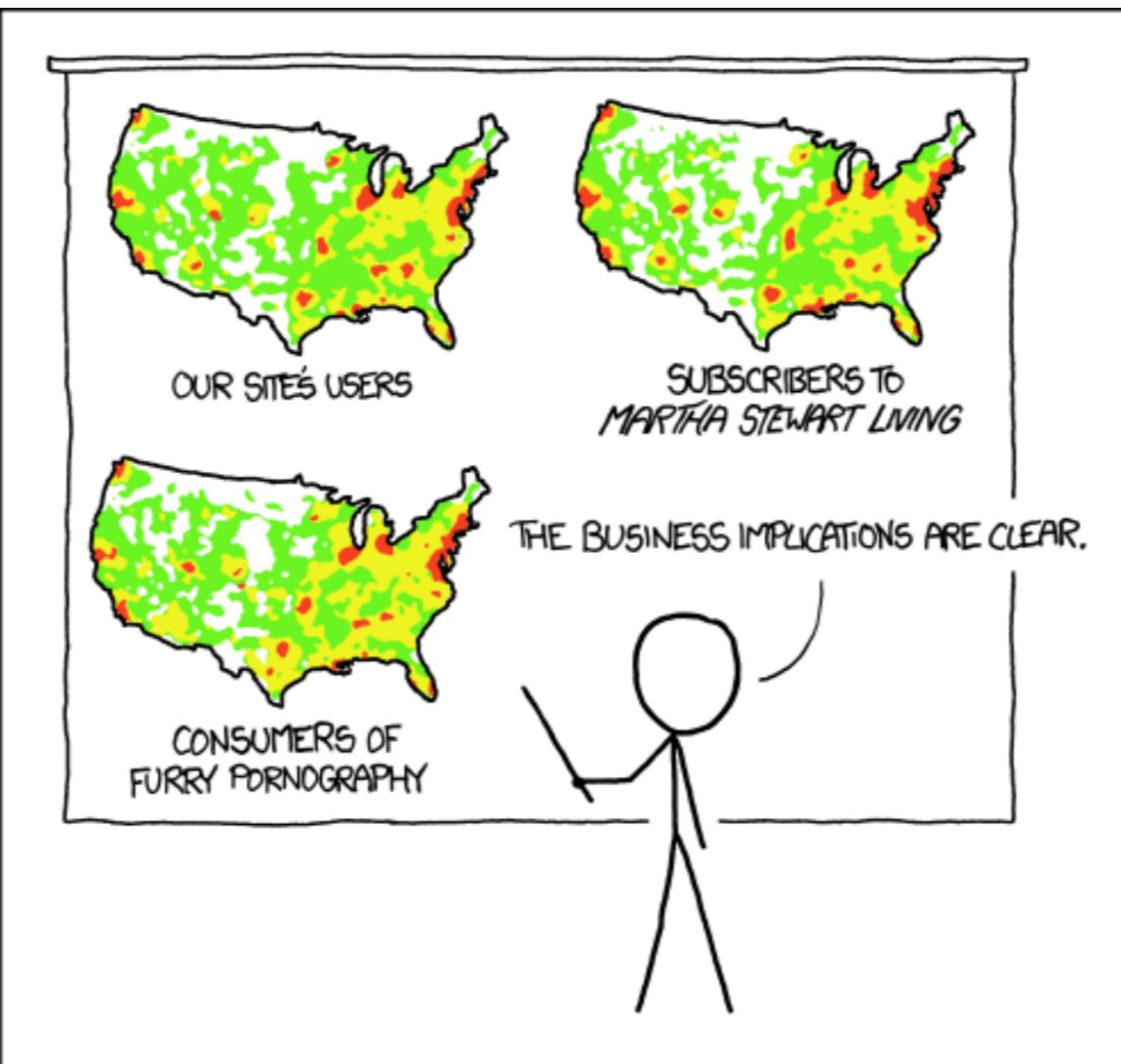
Parts do not add to the whole



Fox News

# Common Errors

## Only Seeing Absolutes

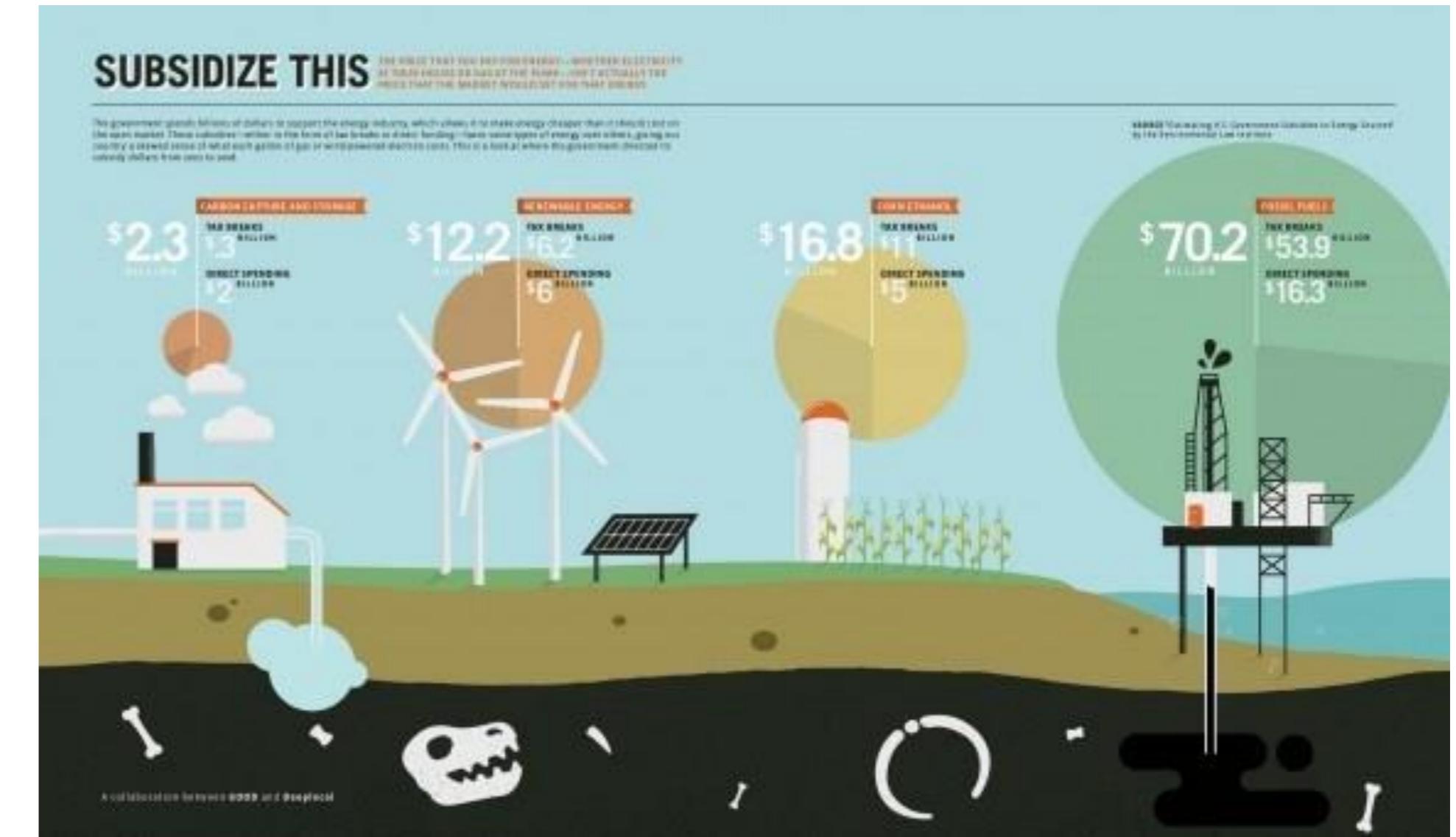
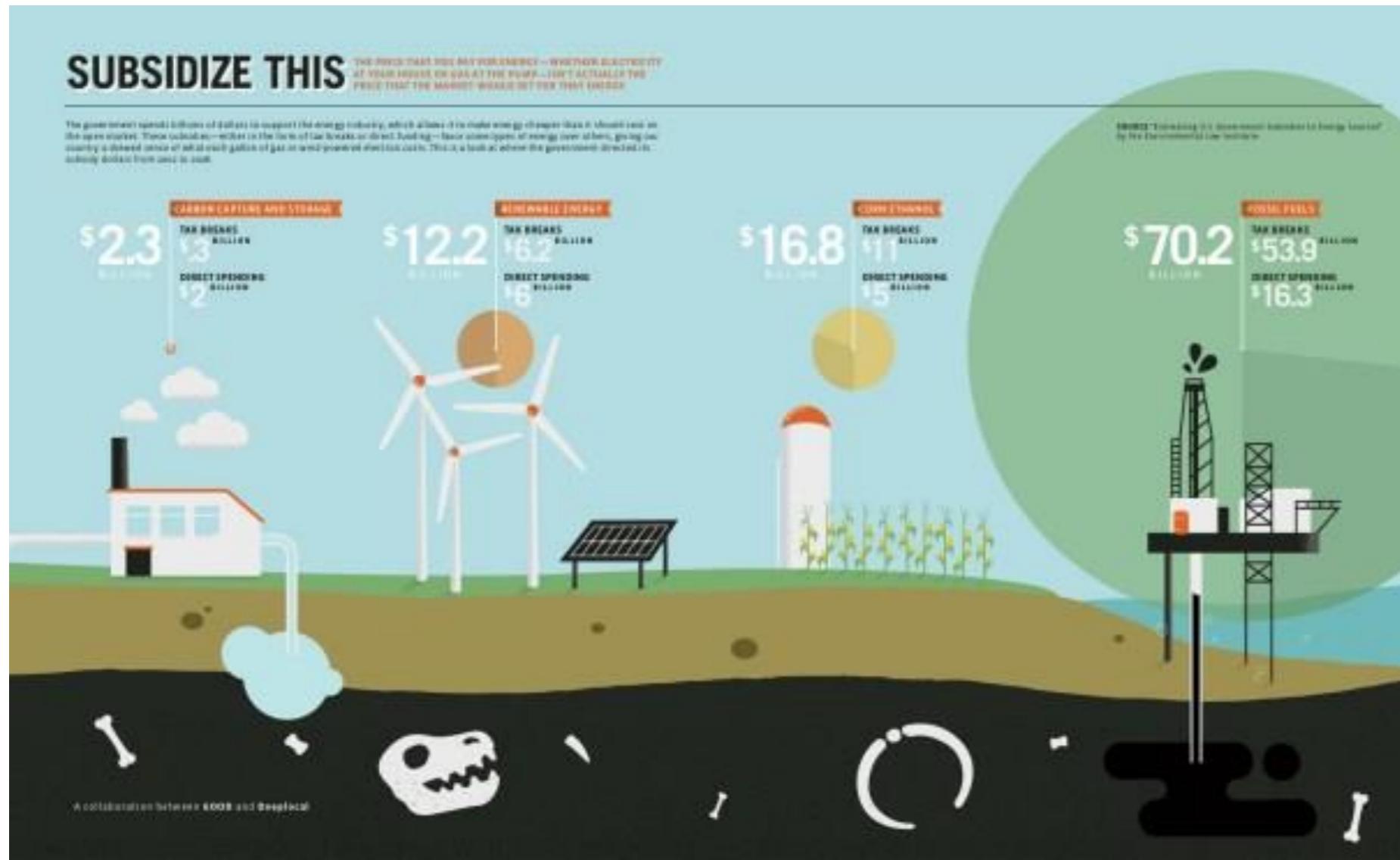


PET PEEVE #208:  
GEOGRAPHIC PROFILE MAPS WHICH ARE  
BASICALLY JUST POPULATION MAPS

<https://xkcd.com/1138/>

# Common Errors

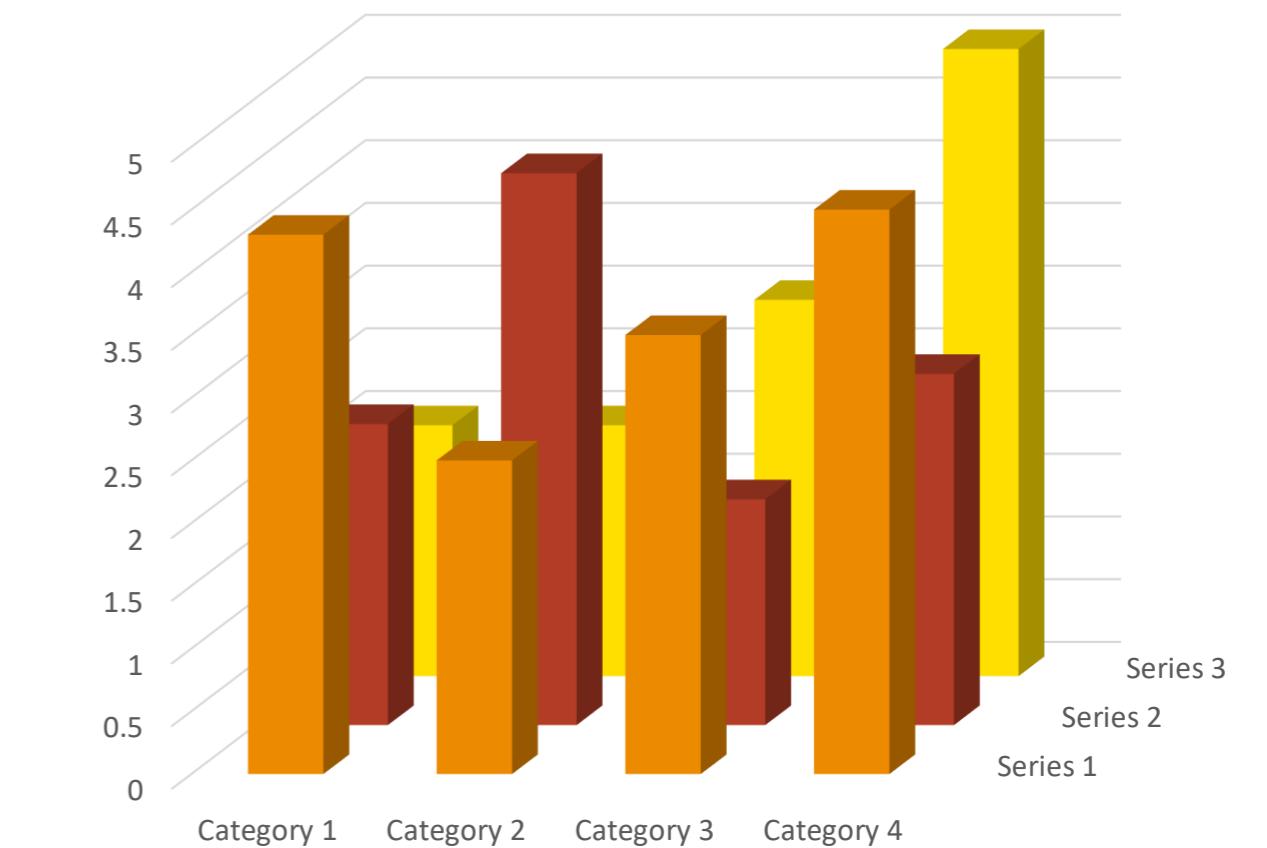
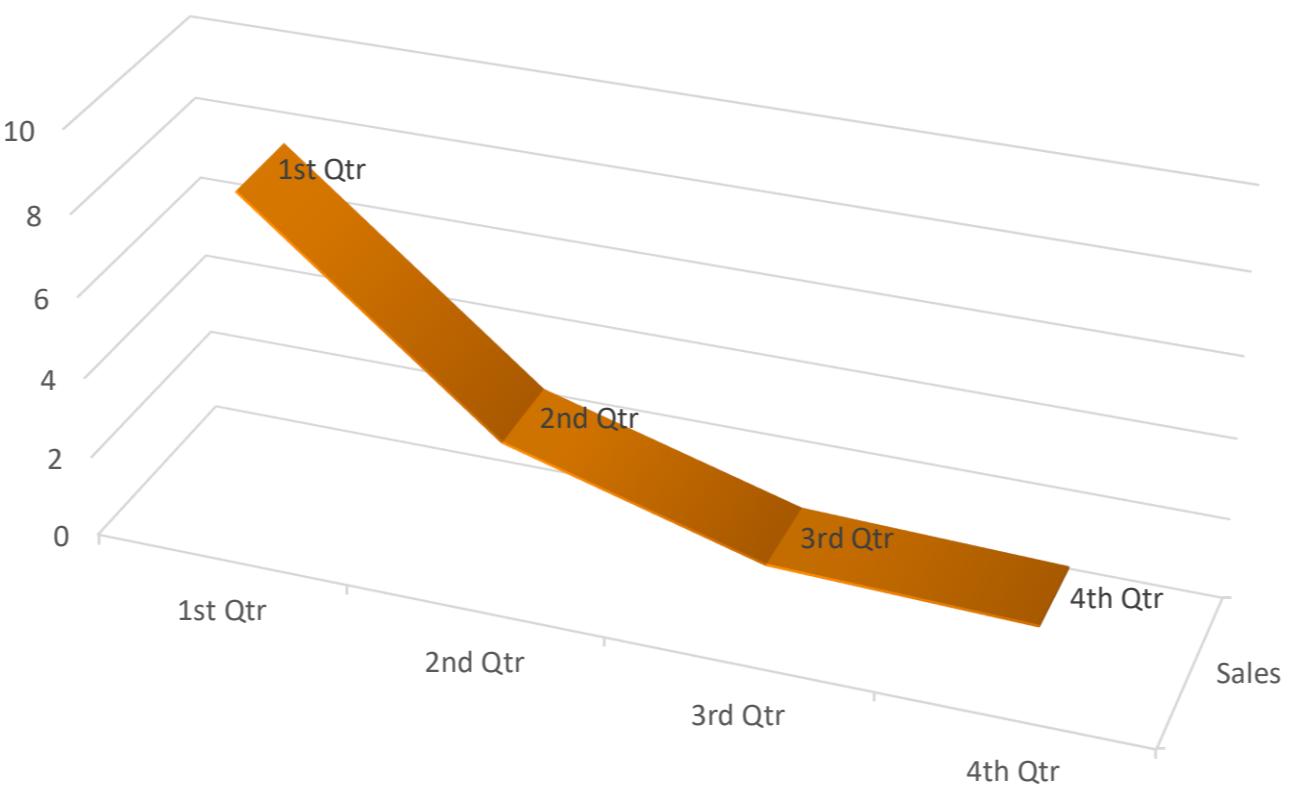
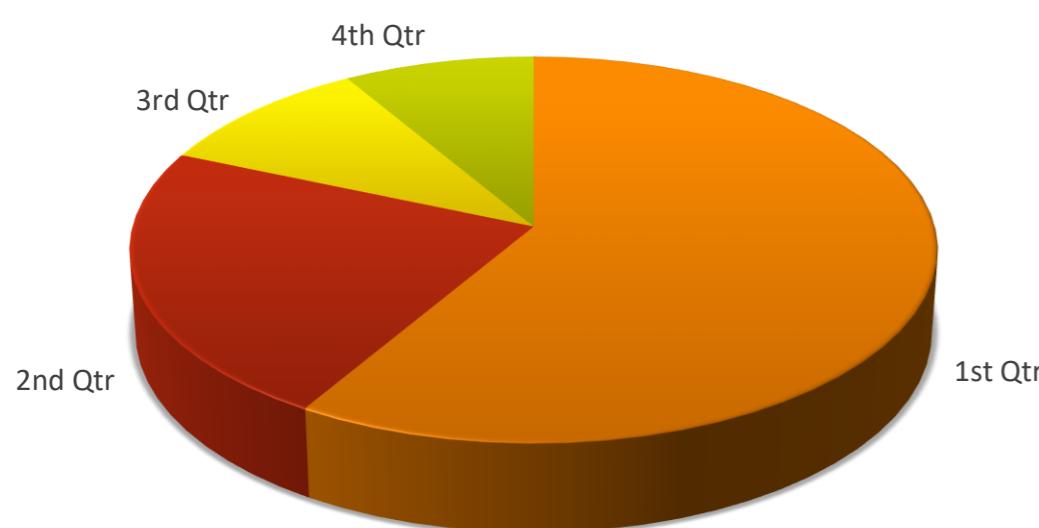
## Sizing area by one dimension



<https://www.good.is/infographics>

# Common Errors

## Extra dimensions



# Outline

Part 1

**Foundations of making a chart**

Part 2

**Visual design for communication**

# Outline

Part 1

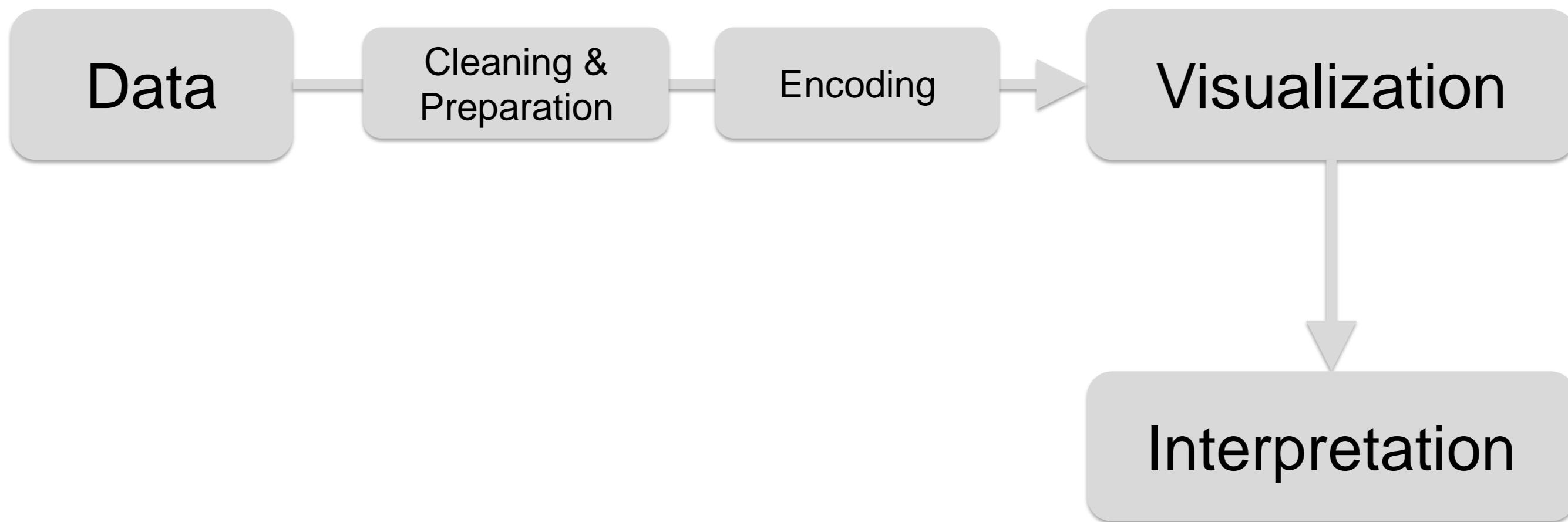
**Foundations of making a chart**

Part 2

**Visual design for communication**

# Break

# Process



# Outline

Part 1

**Foundations of making a chart**

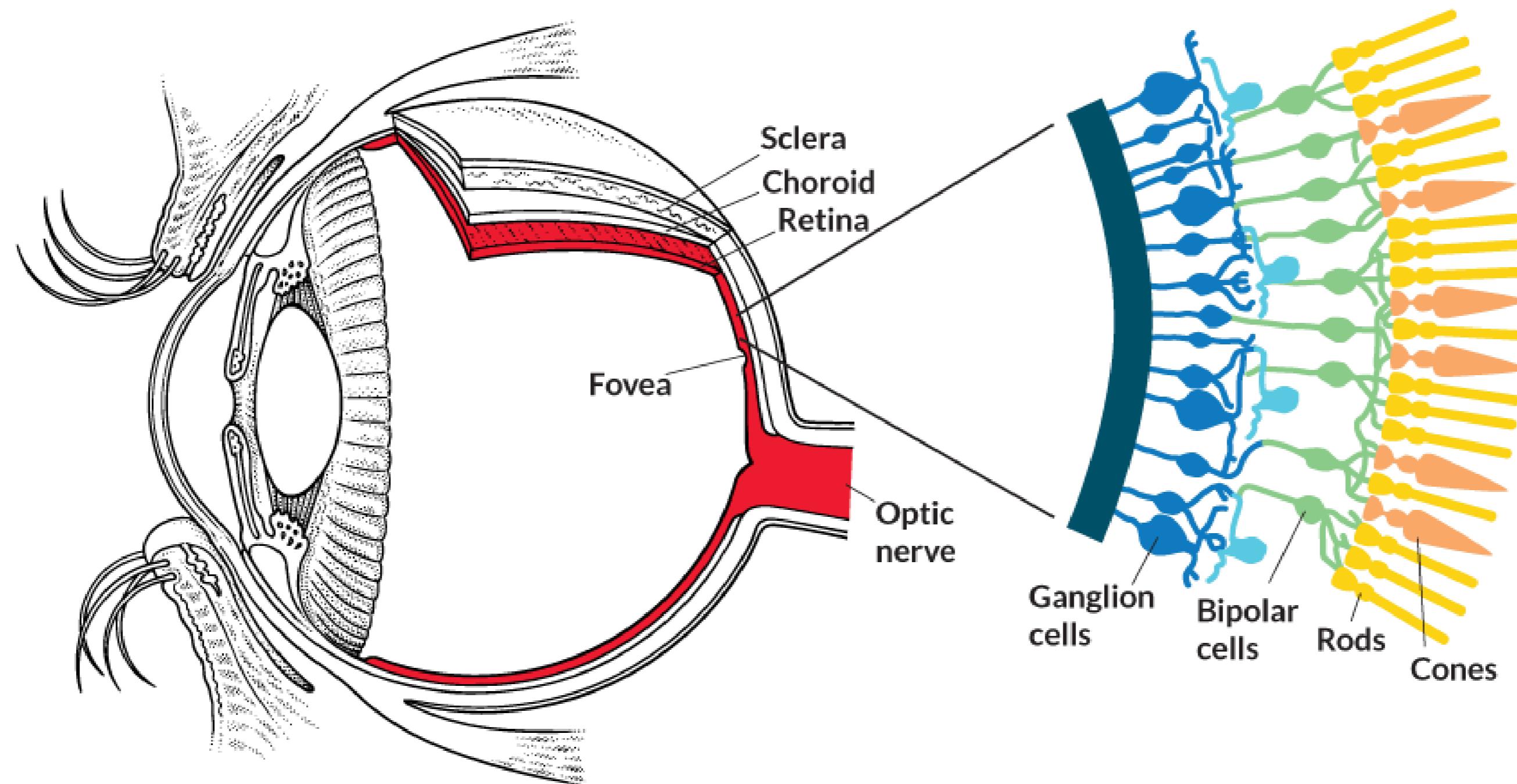
Part 2

**Visual design for communication**

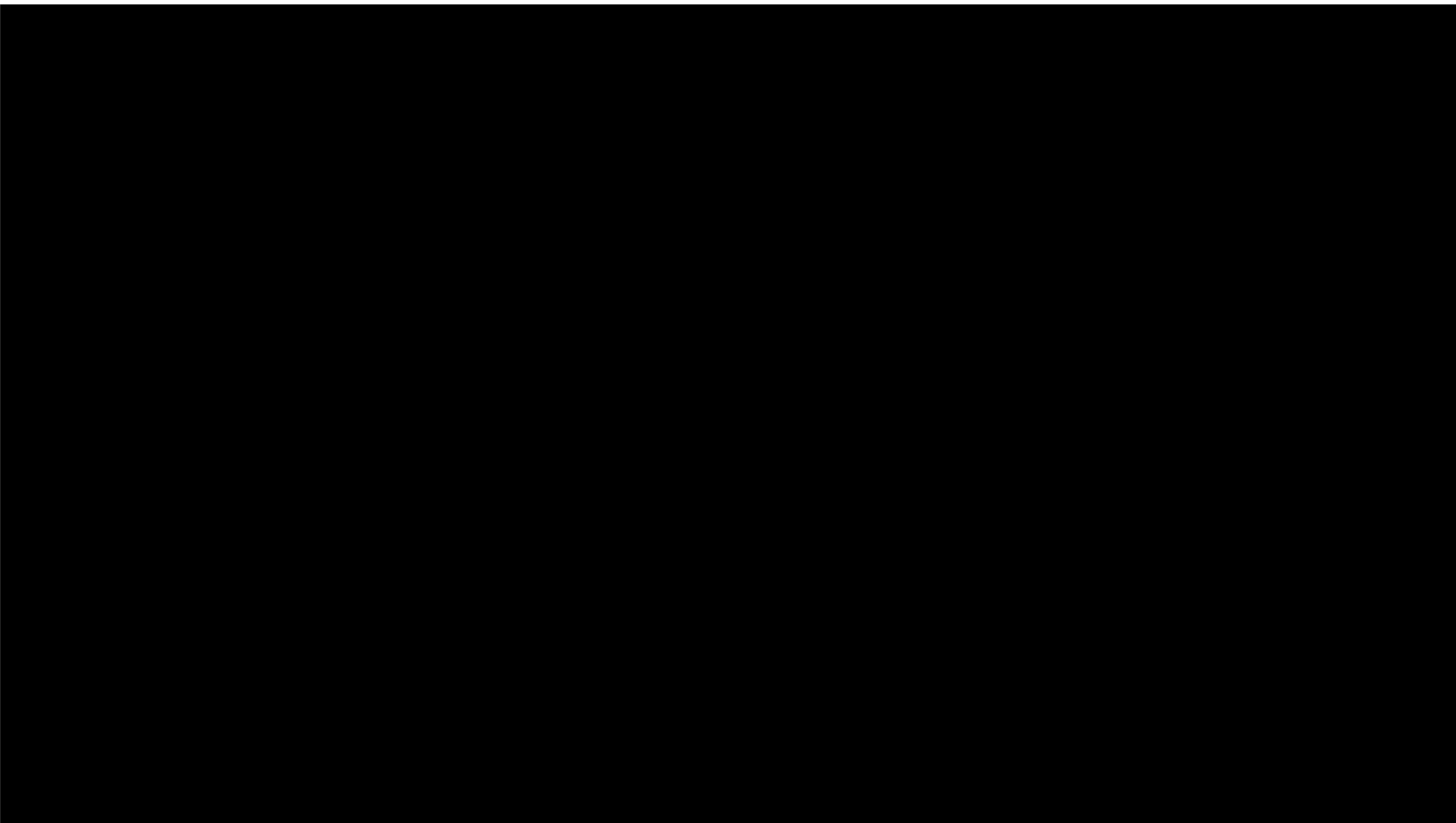
# Visual Perception

# Visual processing

Our eyes take in a lot of information



# Visual processing



# Visual processing

**Most visual information is filtered out**

## Inattentional blindness

Failing to perceive something in plain sight, because attention was engaged elsewhere

# Visual processing

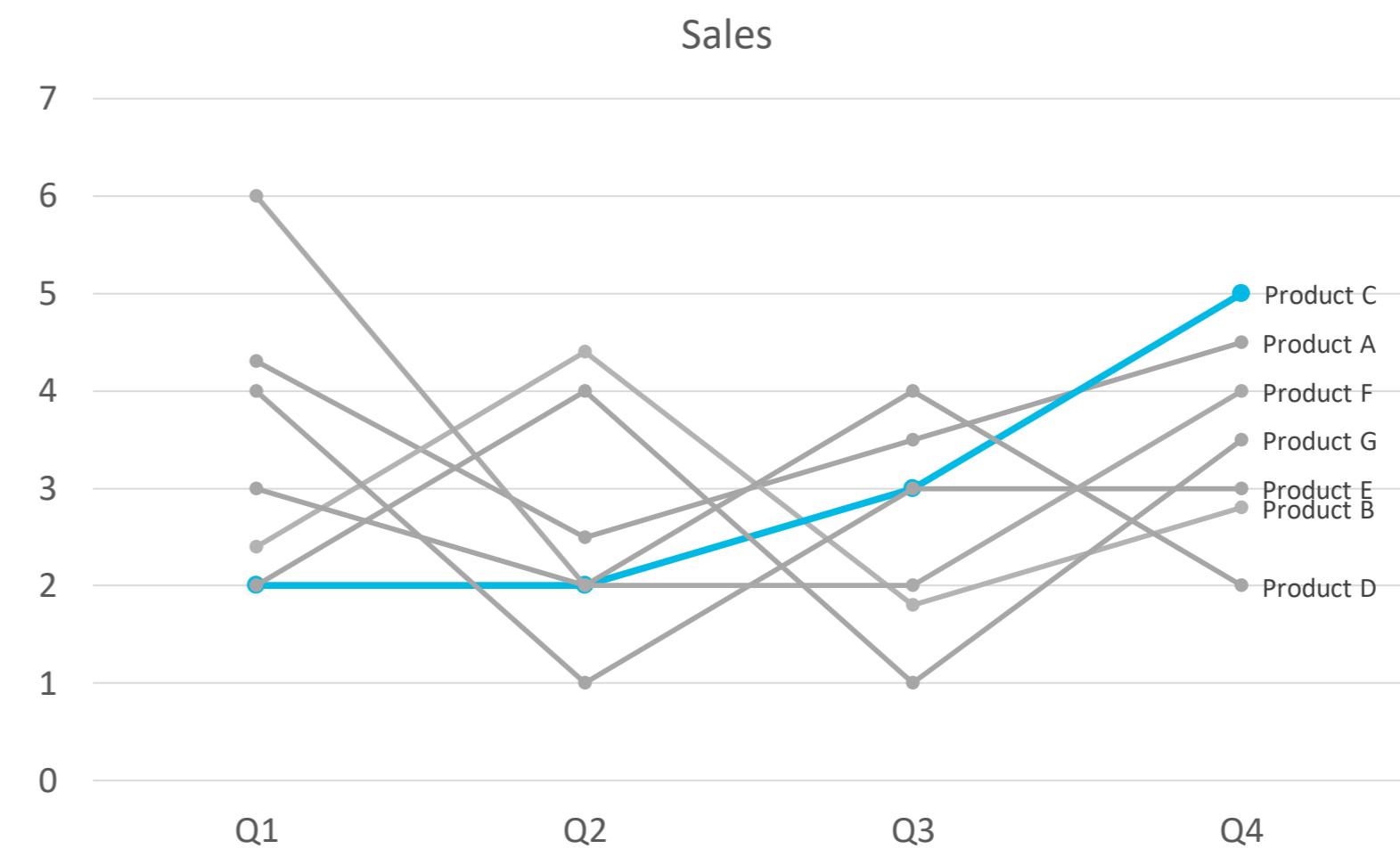
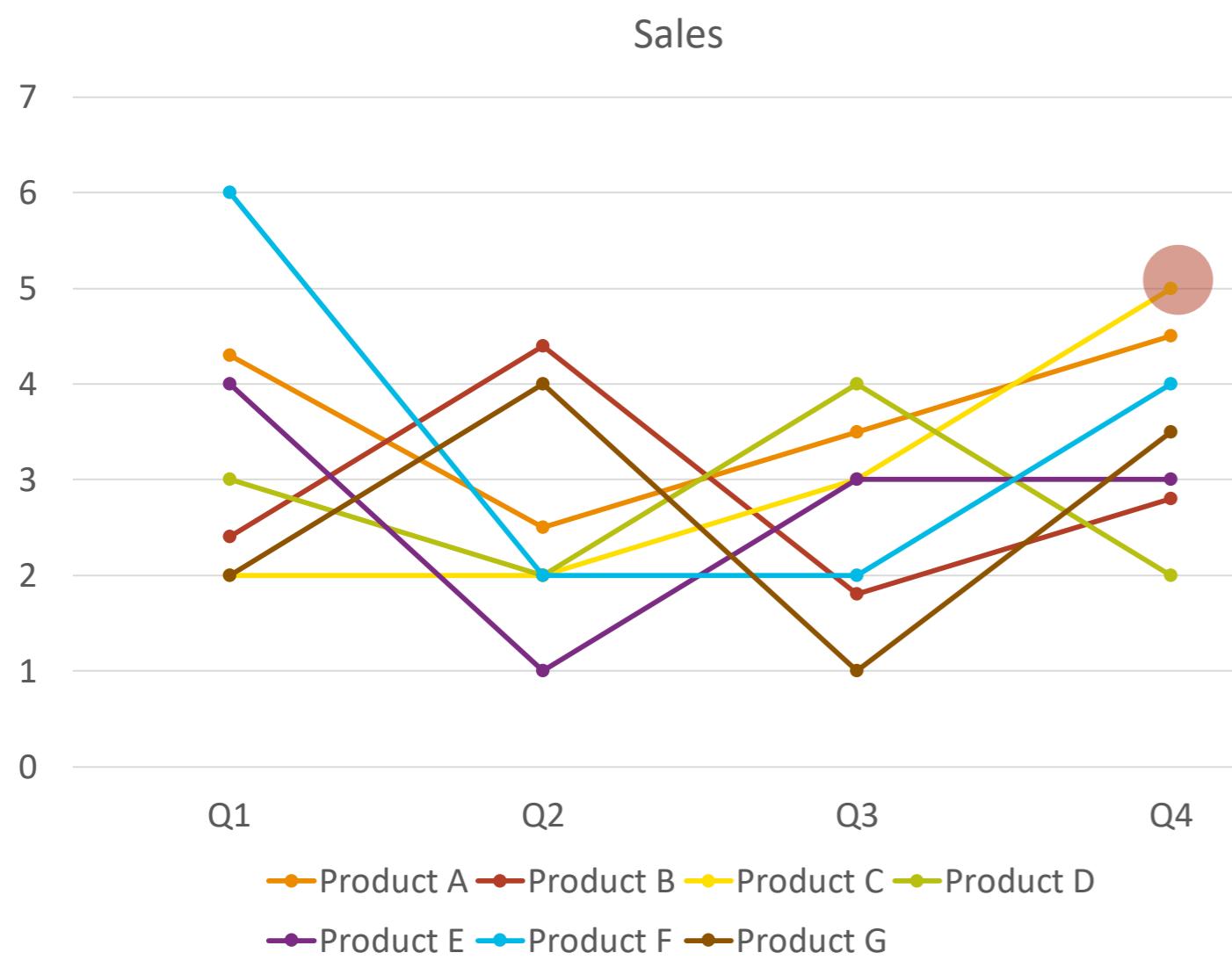
## Our memory is limited

- George Miller's "magic number seven, plus or minus two" – number of "chunks" that can be retained in short term memory
- Lots of information processed, small amount stored in memory
- Be aware of how design choices influence attention

# Visual processing

## Design for visual queries

- What visual task is the viewer trying to accomplish?
- Does the visual design support that task?



# Pre-attentive Processing

## Count the sevens

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 4 | 3 | 1 | 5 | 6 | 9 | 7 |
| 1 | 3 | 4 | 8 | 2 | 2 | 3 |
| 7 | 5 | 3 | 8 | 7 | 1 | 0 |
| 3 | 1 | 9 | 2 | 3 | 3 | 6 |
| 5 | 8 | 0 | 7 | 4 | 2 | 4 |
| 1 | 7 | 2 | 3 | 0 | 8 | 5 |
| 3 | 3 | 4 | 1 | 2 | 1 | 8 |

# Pre-attentive Processing

## Count the sevens

|          |          |   |          |          |   |          |
|----------|----------|---|----------|----------|---|----------|
| 4        | 3        | 1 | 5        | 6        | 9 | <b>7</b> |
| 1        | 3        | 4 | 8        | 2        | 2 | 3        |
| <b>7</b> | 5        | 3 | 8        | <b>7</b> | 1 | 0        |
| 3        | 1        | 9 | 2        | 3        | 3 | 6        |
| 5        | 8        | 0 | <b>7</b> | 4        | 2 | 4        |
| 1        | <b>7</b> | 2 | 3        | 0        | 8 | 5        |
| 3        | 3        | 4 | 1        | 2        | 1 | 8        |

# Pre-attentive Features

## What is a pre-attentive feature?

- Some visual properties are processed without the need for focused attention
- These are immediately perceived
- Can be leveraged to effectively discriminate visual features

# Pre-attentive Features

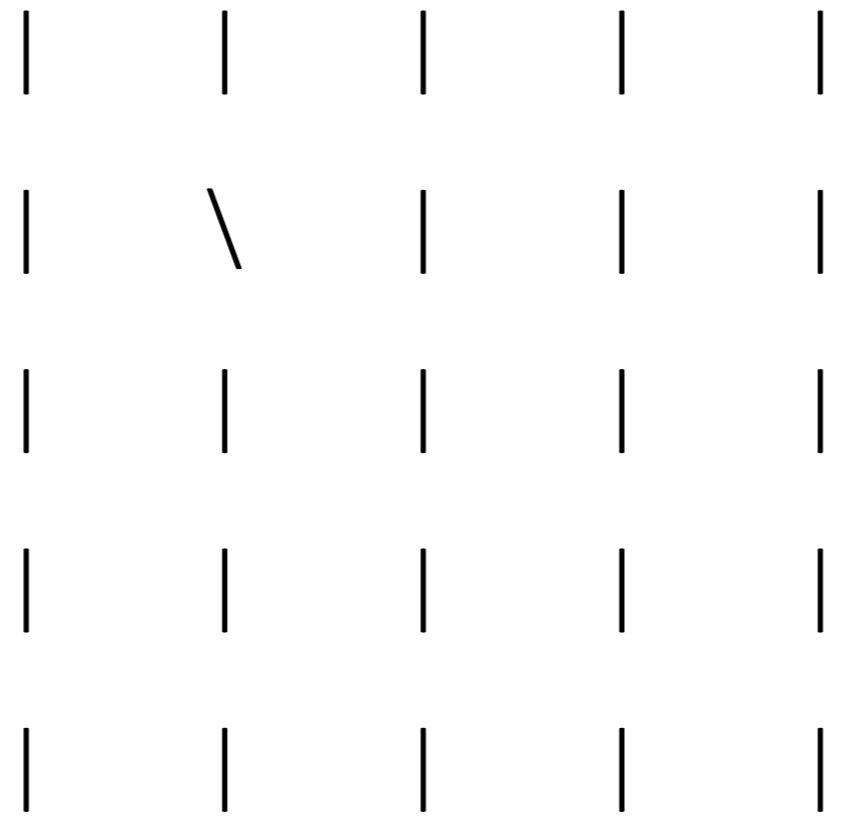
## Examples

- Orientation
- Weight
- Length
- Shape
- Size
- Added mark
- Enclosure
- Colour/hue
- Intensity/value

# Pre-attentive Features

## Examples

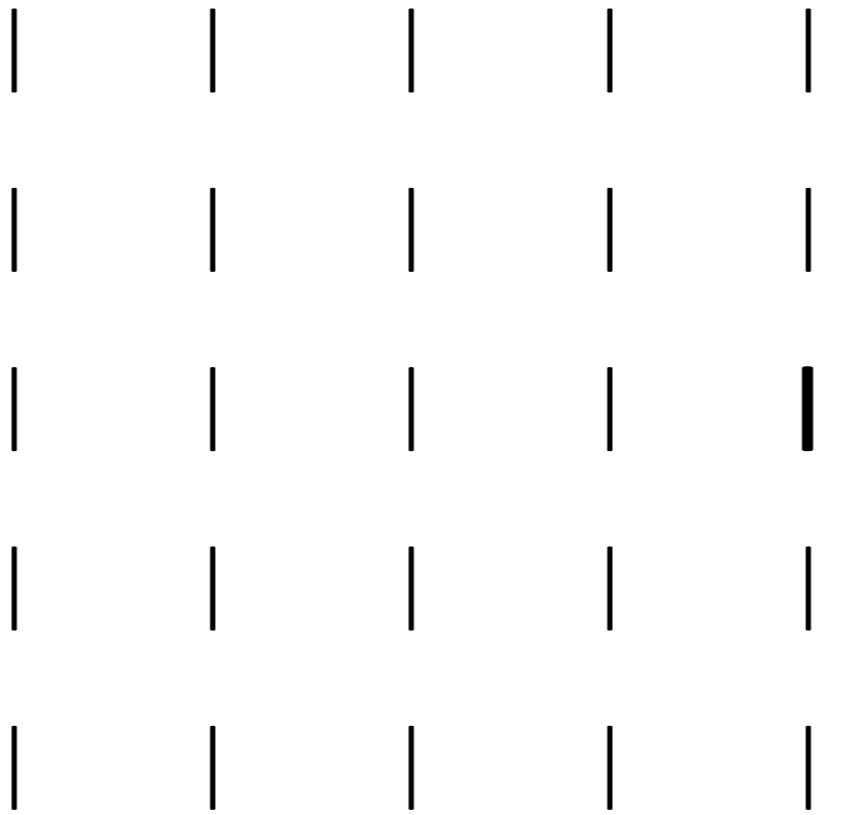
- Orientation
- Weight
- Length
- Shape
- Size
- Added mark
- Enclosure
- Colour/hue
- Intensity/value



# Pre-attentive Features

## Examples

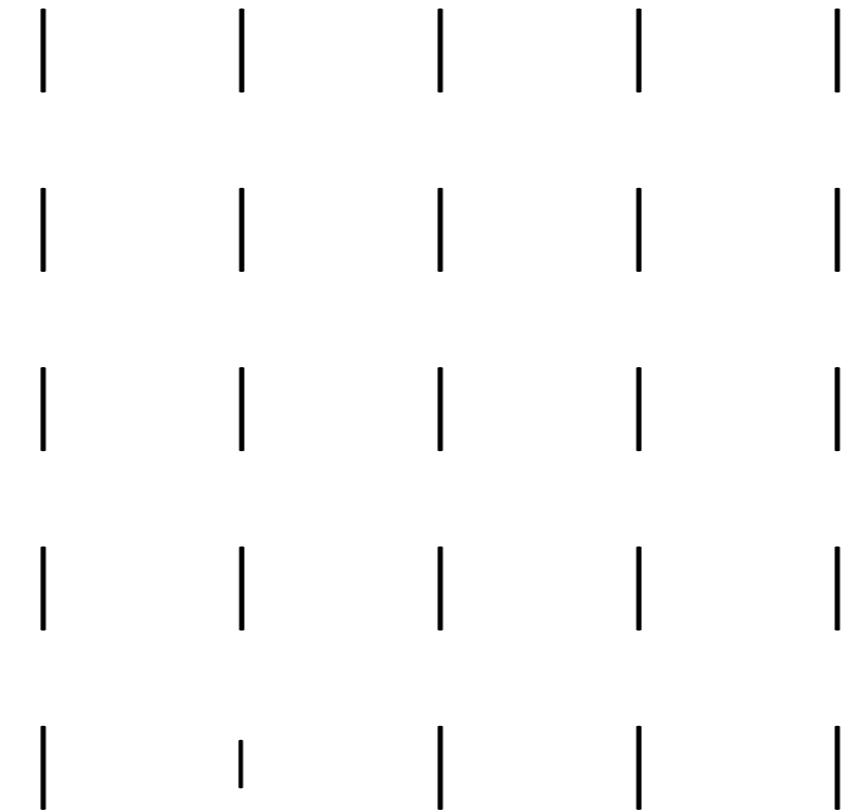
- Orientation
- **Weight**
- Length
- Shape
- Size
- Added mark
- Enclosure
- Colour/hue
- Intensity/value



# Pre-attentive Features

## Examples

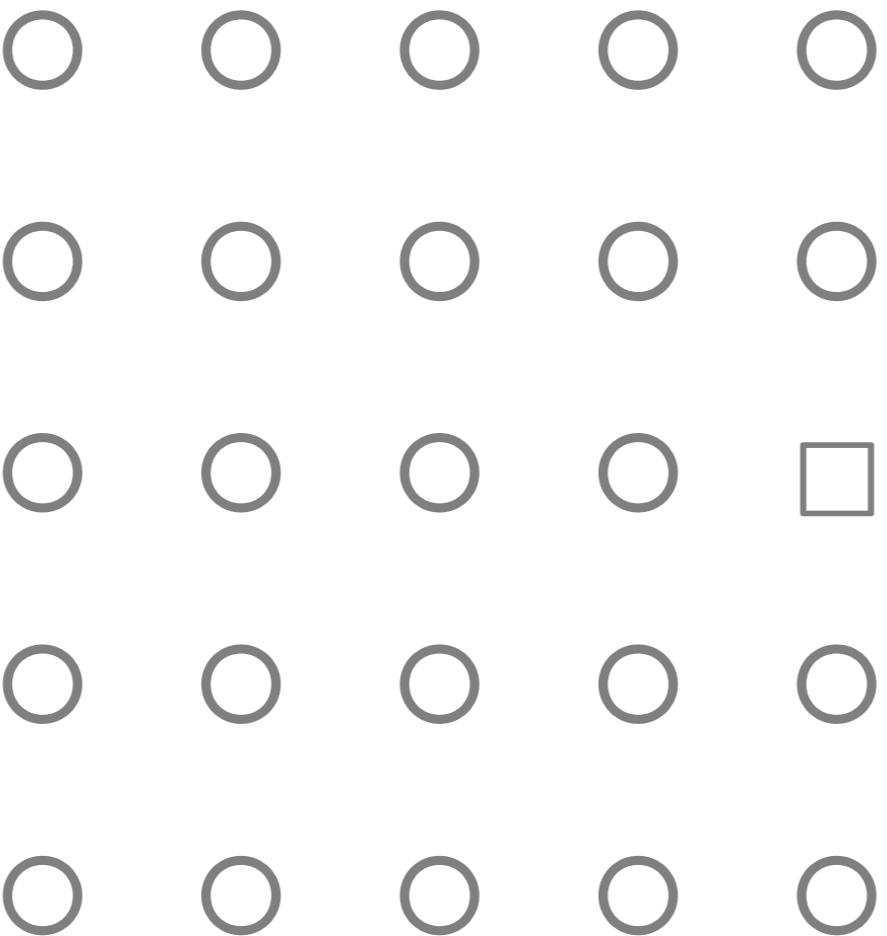
- Orientation
- Weight
- **Length**
- Shape
- Size
- Added mark
- Enclosure
- Colour/hue
- Intensity/value



# Pre-attentive Features

## Examples

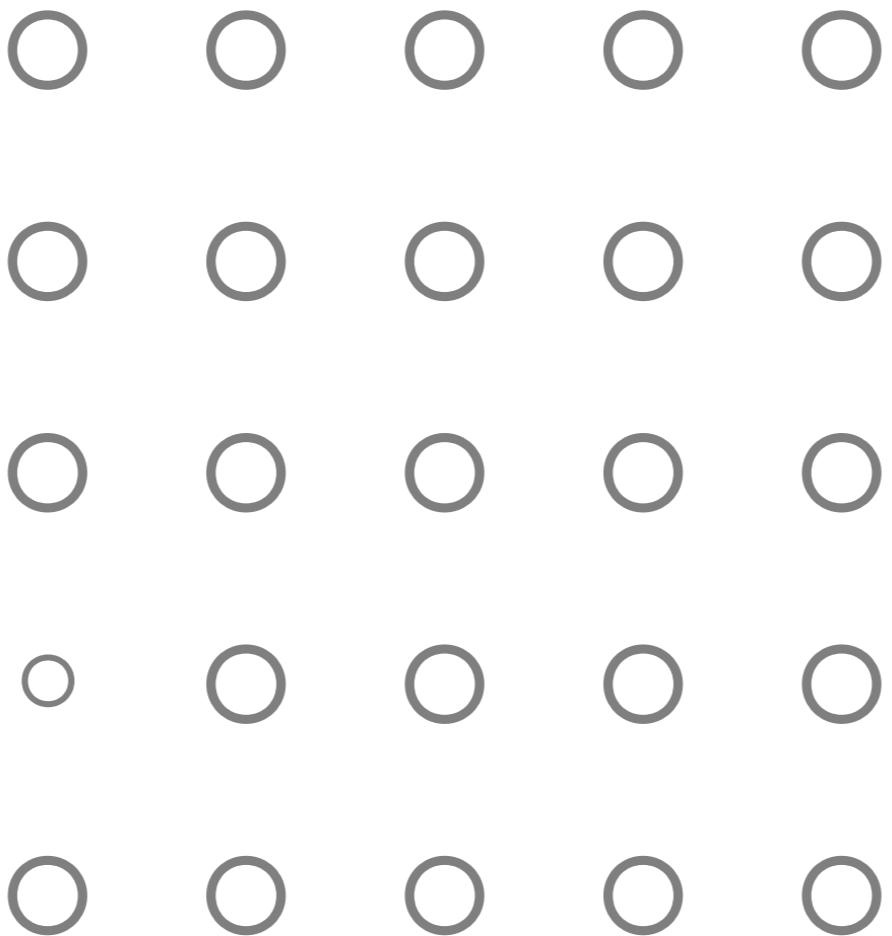
- Orientation
- Weight
- Length
- **Shape**
- Size
- Added mark
- Enclosure
- Colour/hue
- Intensity/value



# Pre-attentive Features

## Examples

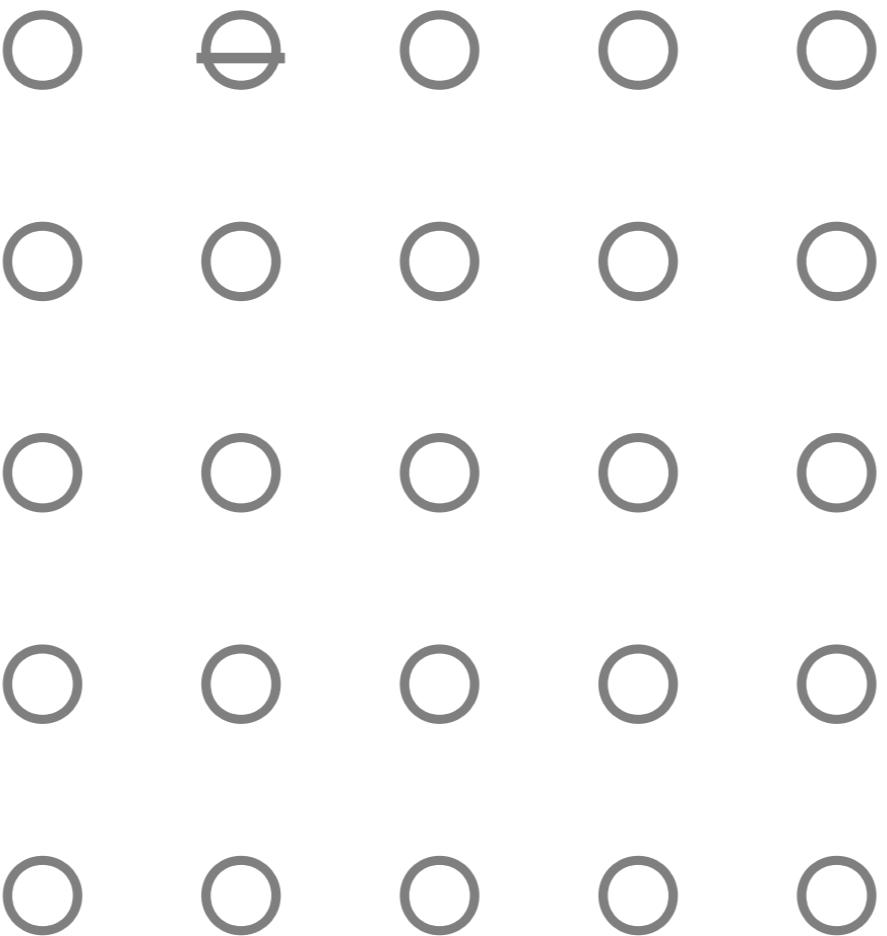
- Orientation
- Weight
- Length
- Shape
- **Size**
- Added mark
- Enclosure
- Colour/hue
- Intensity/value



# Pre-attentive Features

## Examples

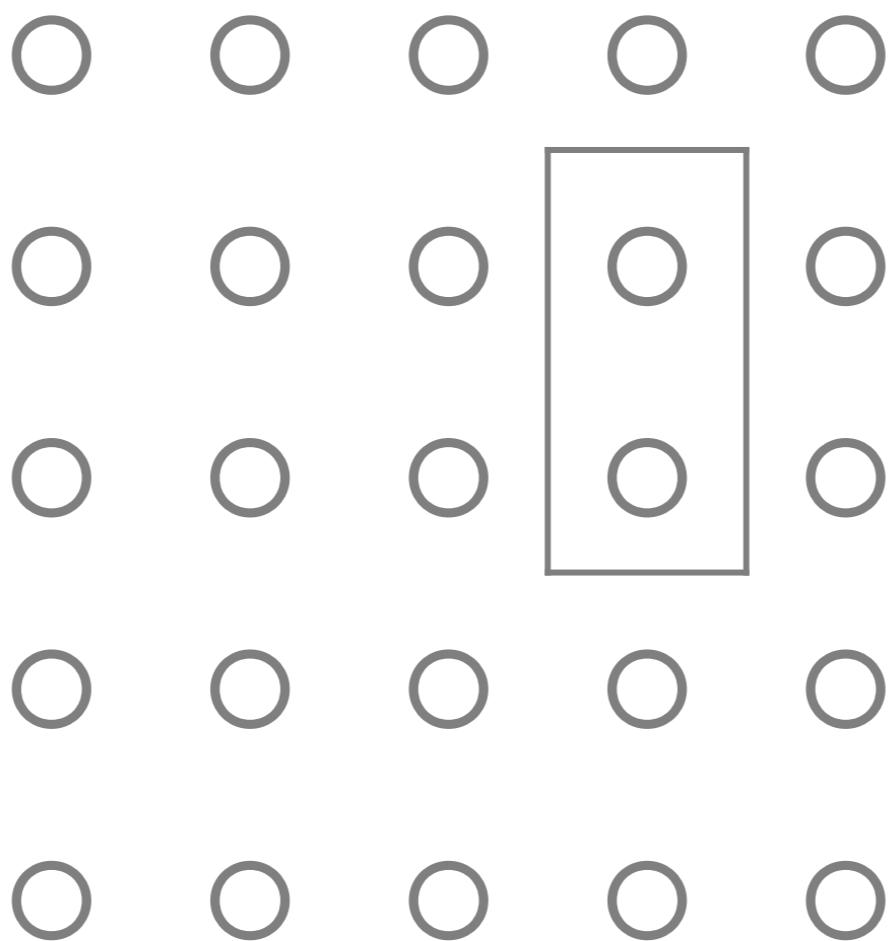
- Orientation
- Weight
- Length
- Shape
- Size
- **Added mark**
- Enclosure
- Colour/hue
- Intensity/value



# Pre-attentive Features

## Examples

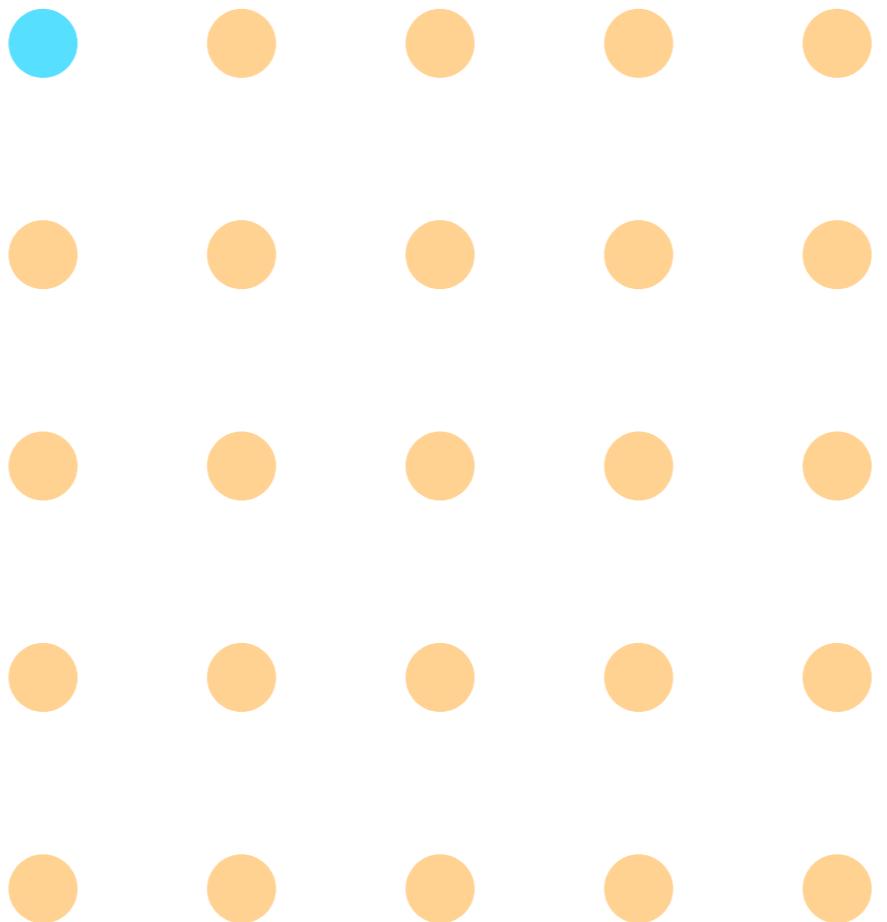
- Orientation
- Weight
- Length
- Shape
- Size
- Added mark
- **Enclosure**
- Colour/hue
- Intensity/value



# Pre-attentive Features

## Examples

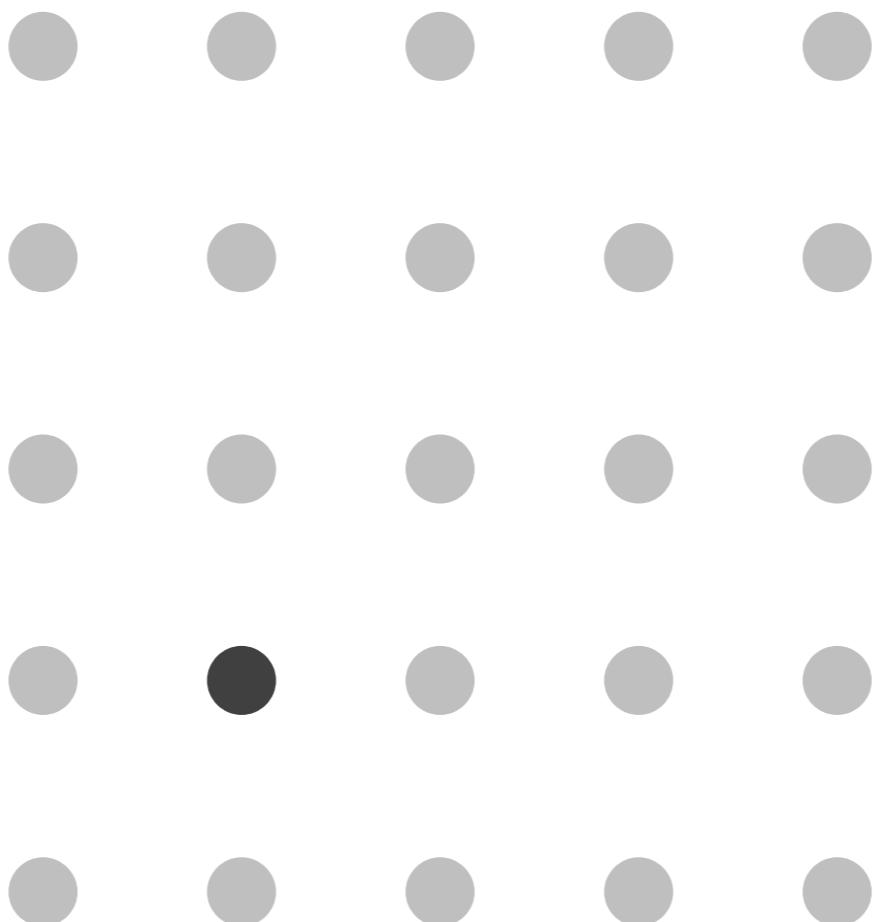
- Orientation
- Weight
- Length
- Shape
- Size
- Added mark
- Enclosure
- **Colour/hue**
- Intensity/value



# Pre-attentive Features

## Examples

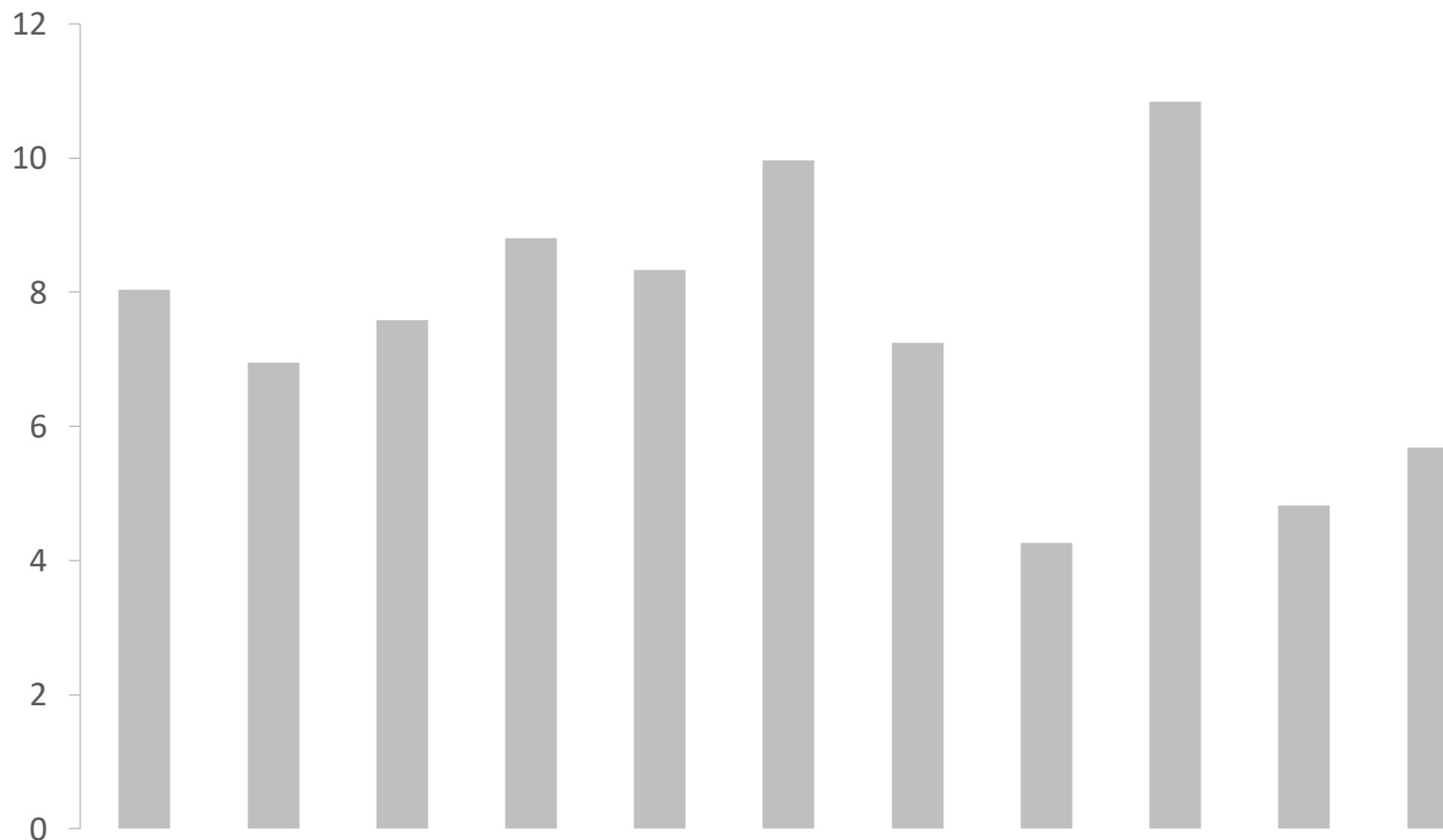
- Orientation
- Weight
- Length
- Shape
- Size
- Added mark
- Enclosure
- Colour/hue
- **Intensity/value**



# Pre-attentive Features

## How does this apply to charts?

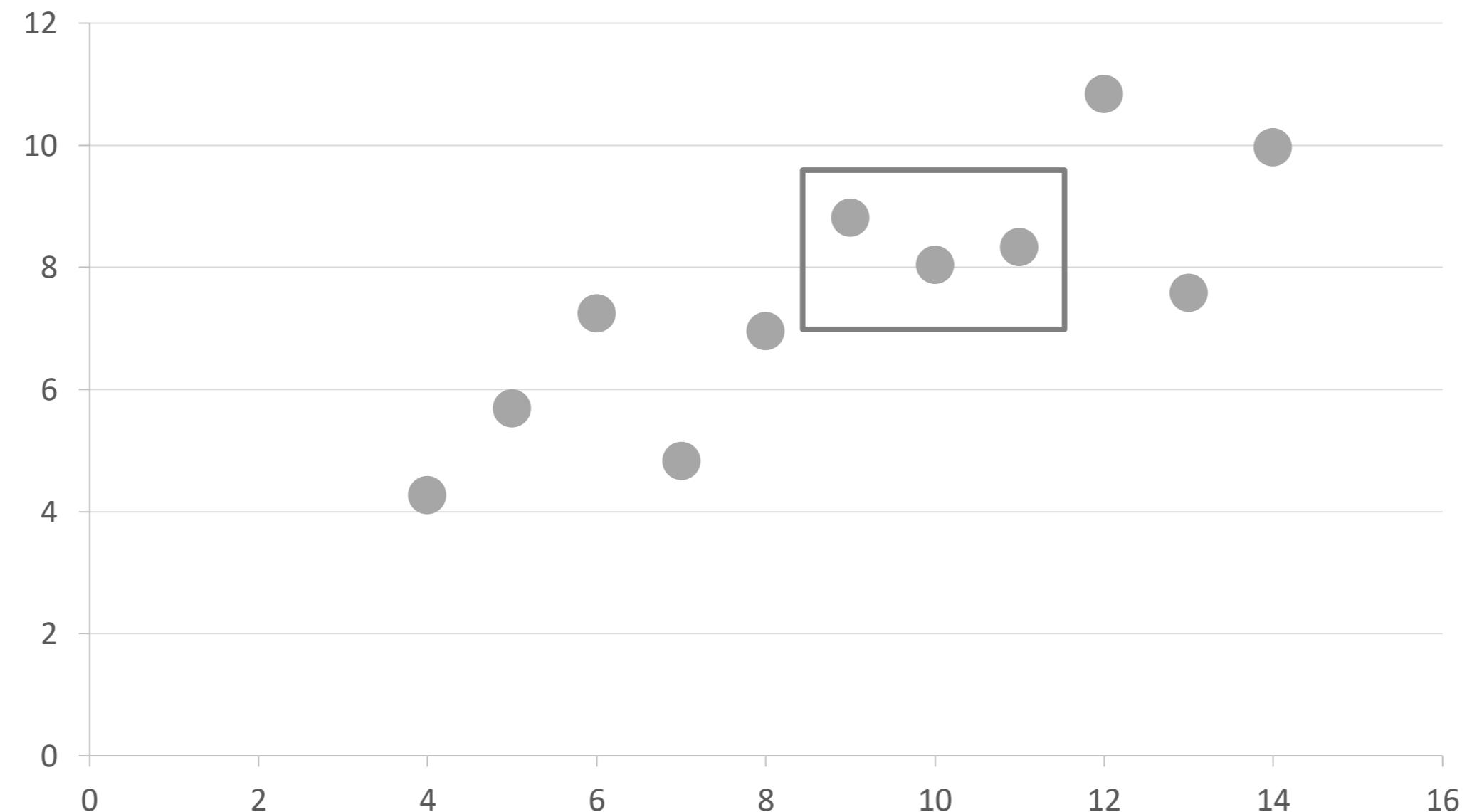
- Encoding values



# Pre-attentive Features

## How does this apply to charts?

- Highlighting values



# Gestalt Principles

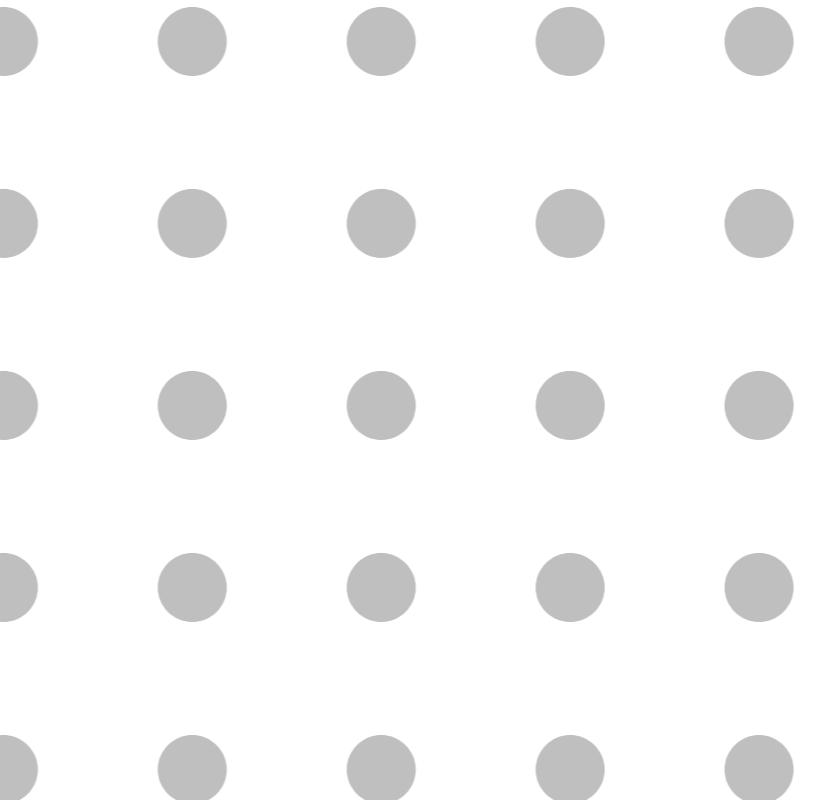
## What are the Gestalt Principles?

- Principles for grouping
- Humans naturally perceive objects as organized patterns and objects

# Gestalt Principles

## Examples

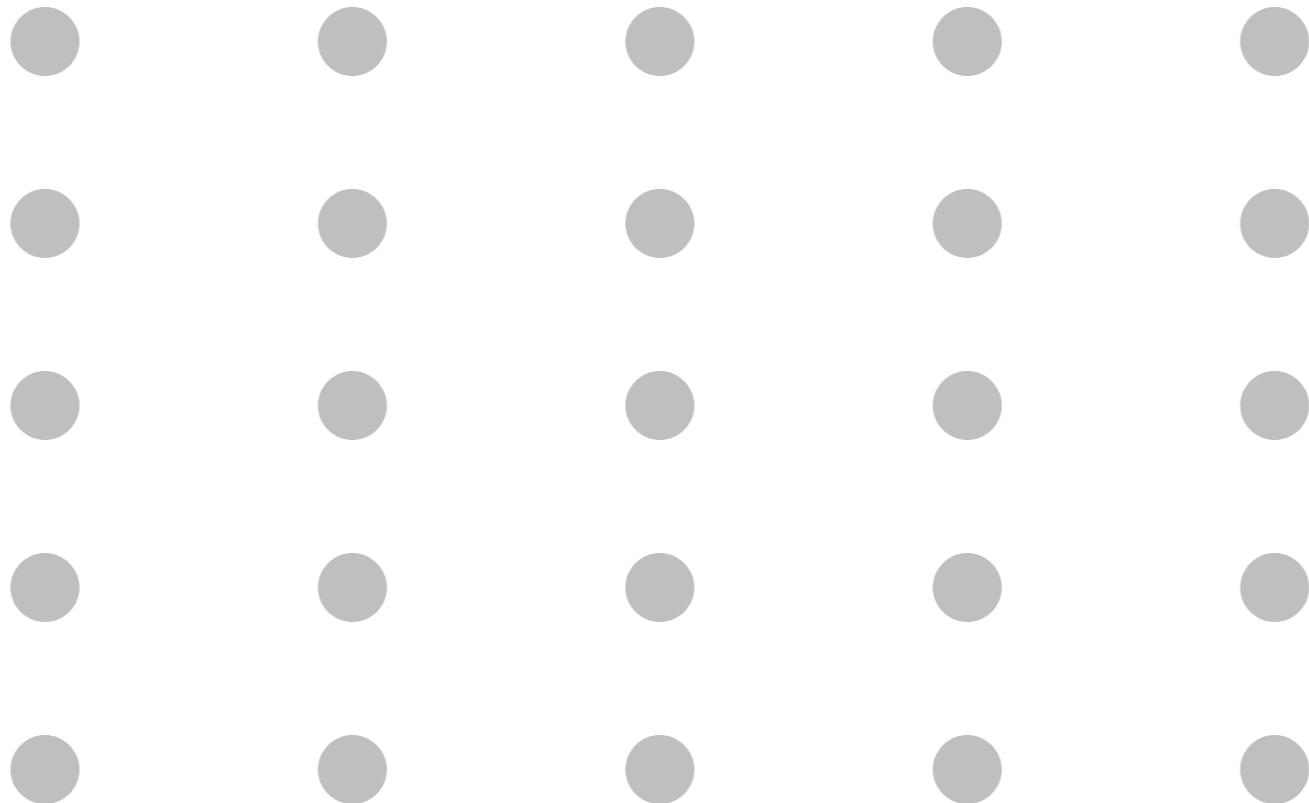
- Proximity
- Similarity
- Enclosure
- Connectedness



# Gestalt Principles

## Examples

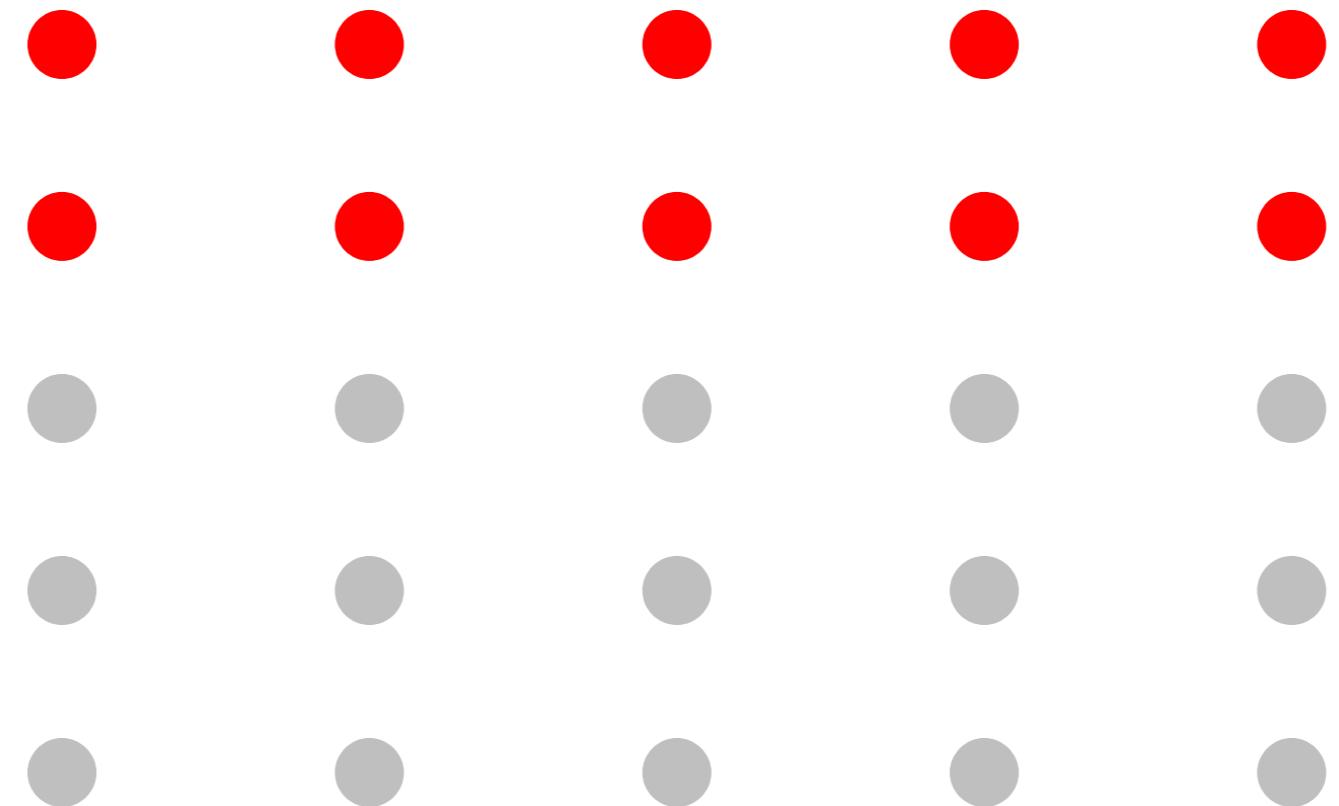
- **Proximity**
- Similarity
- Enclosure
- Connectedness



# Gestalt Principles

## Examples

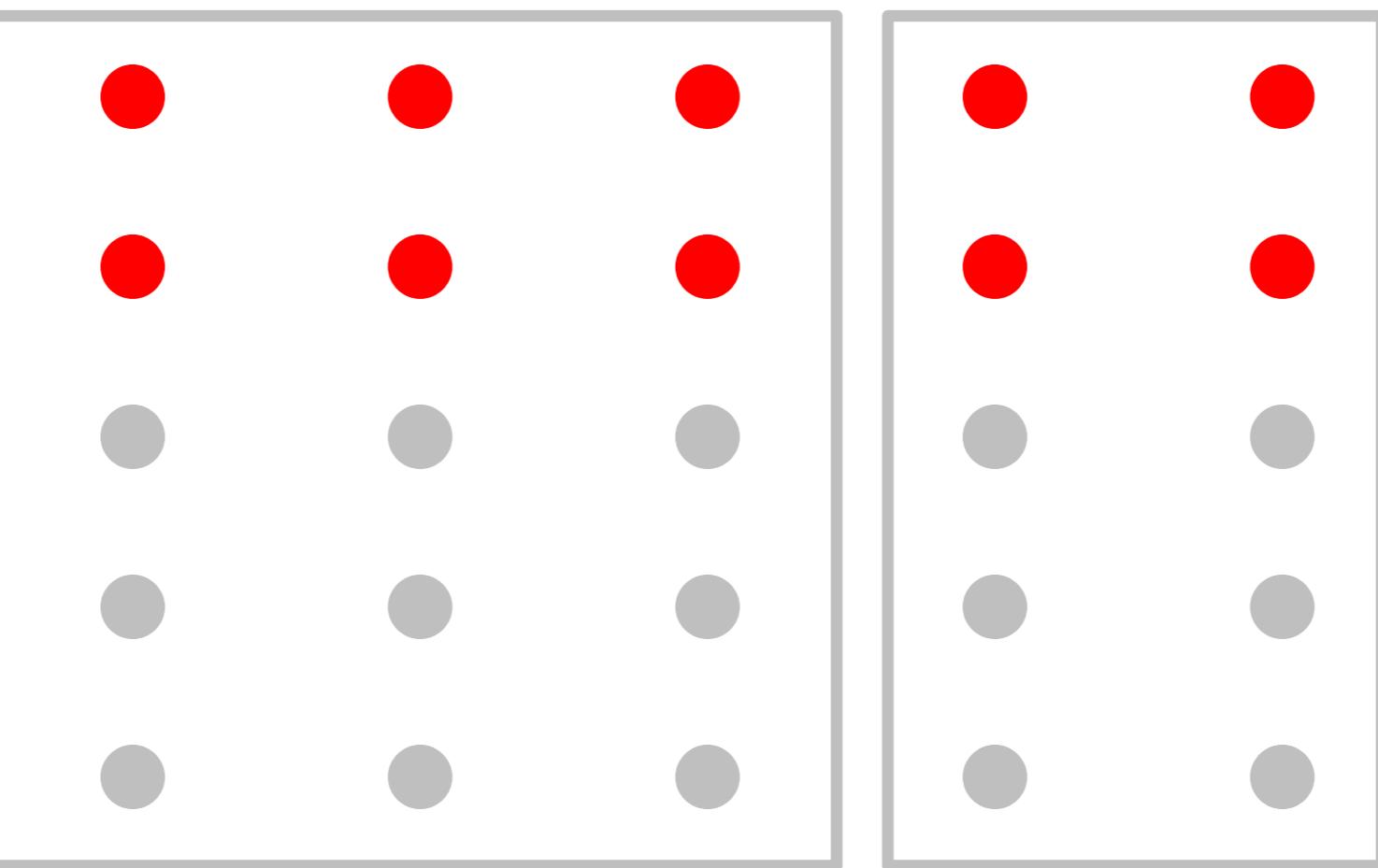
- Proximity
- **Similarity**
- Enclosure
- Connectedness



# Gestalt Principles

## Examples

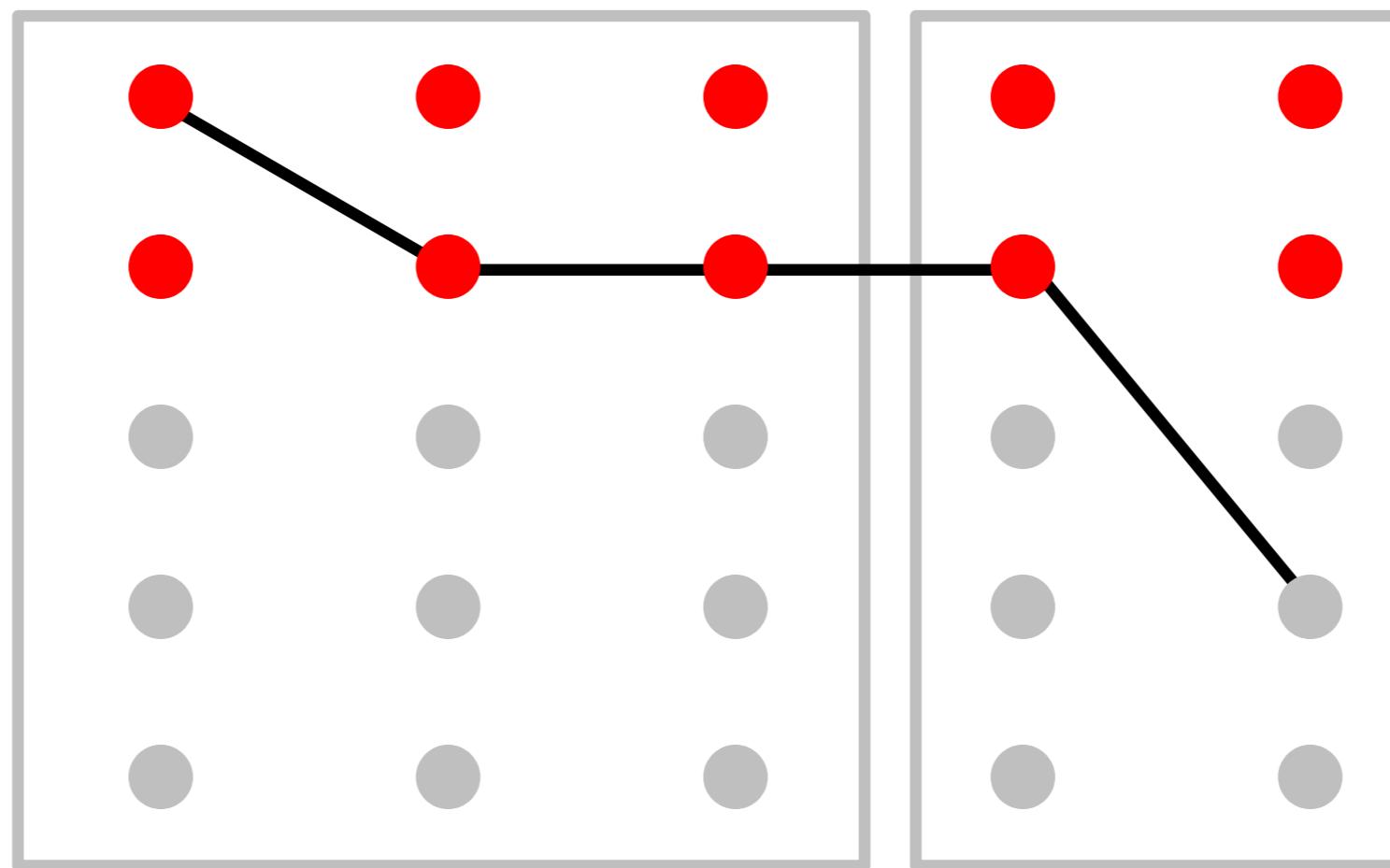
- Proximity
- Similarity
- **Enclosure**
- Connectedness



# Gestalt Principles

## Examples

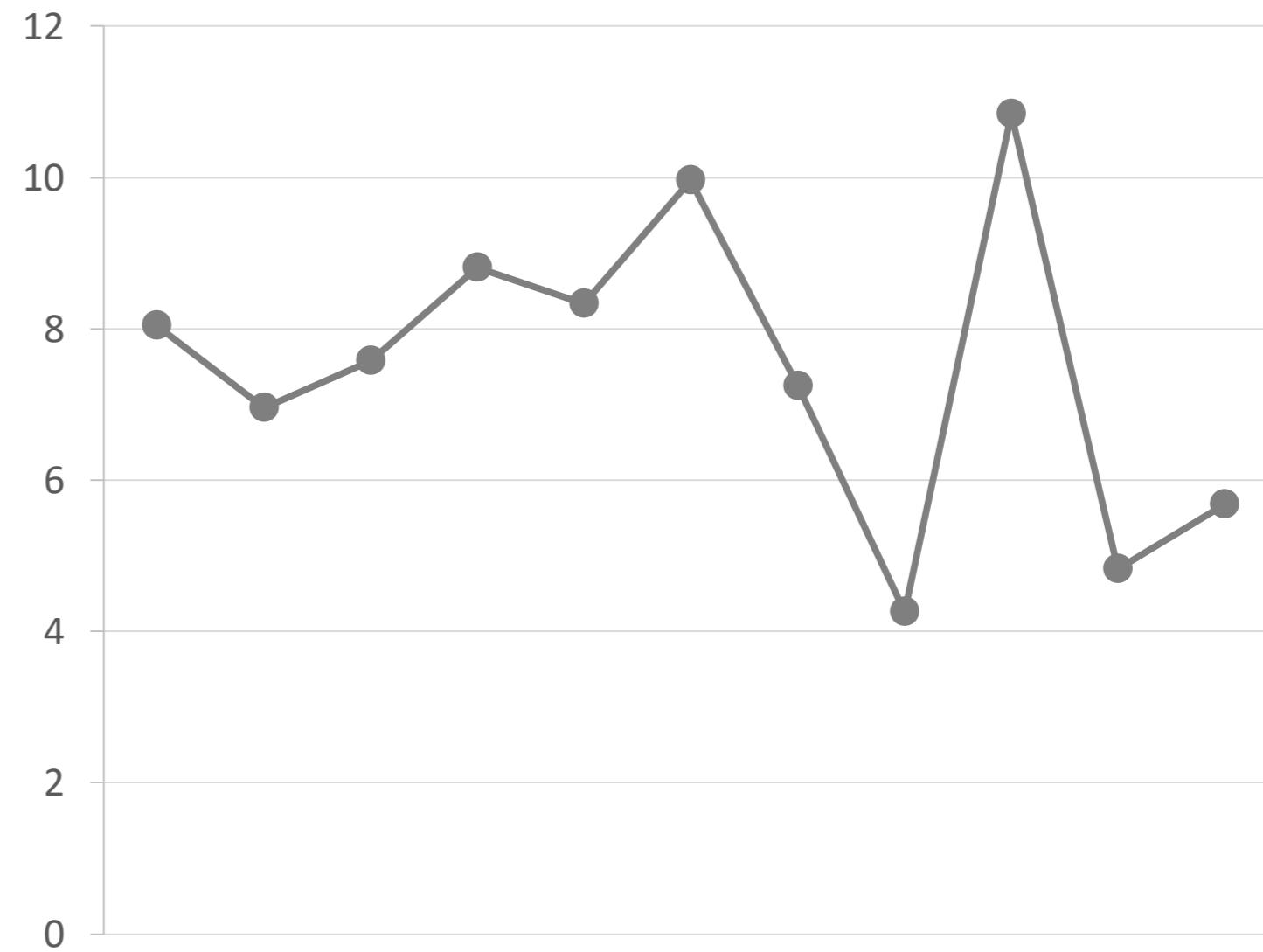
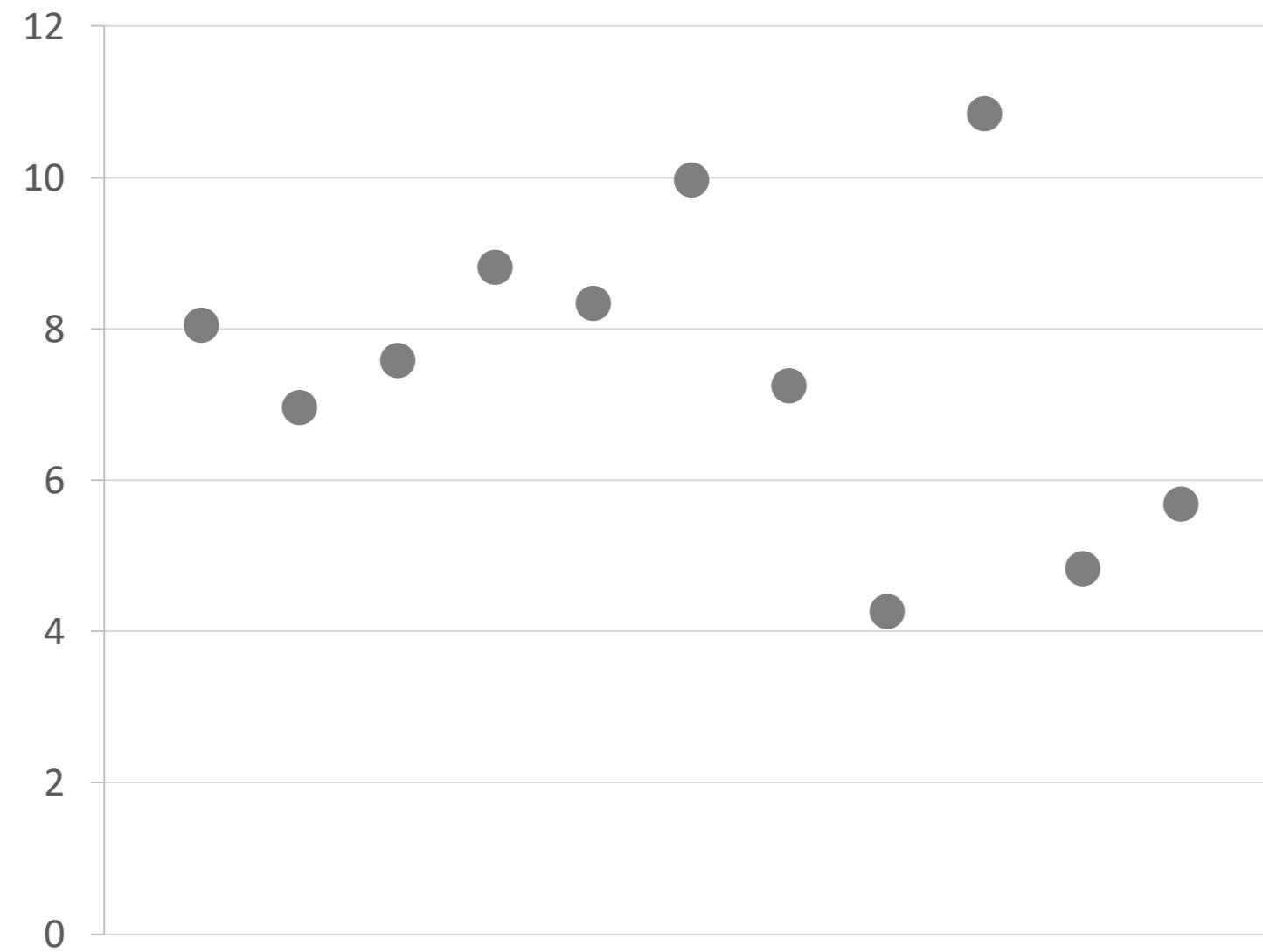
- Proximity
- Similarity
- Enclosure
- **Connectedness**



# Gestalt Principles

## How does this apply to charts?

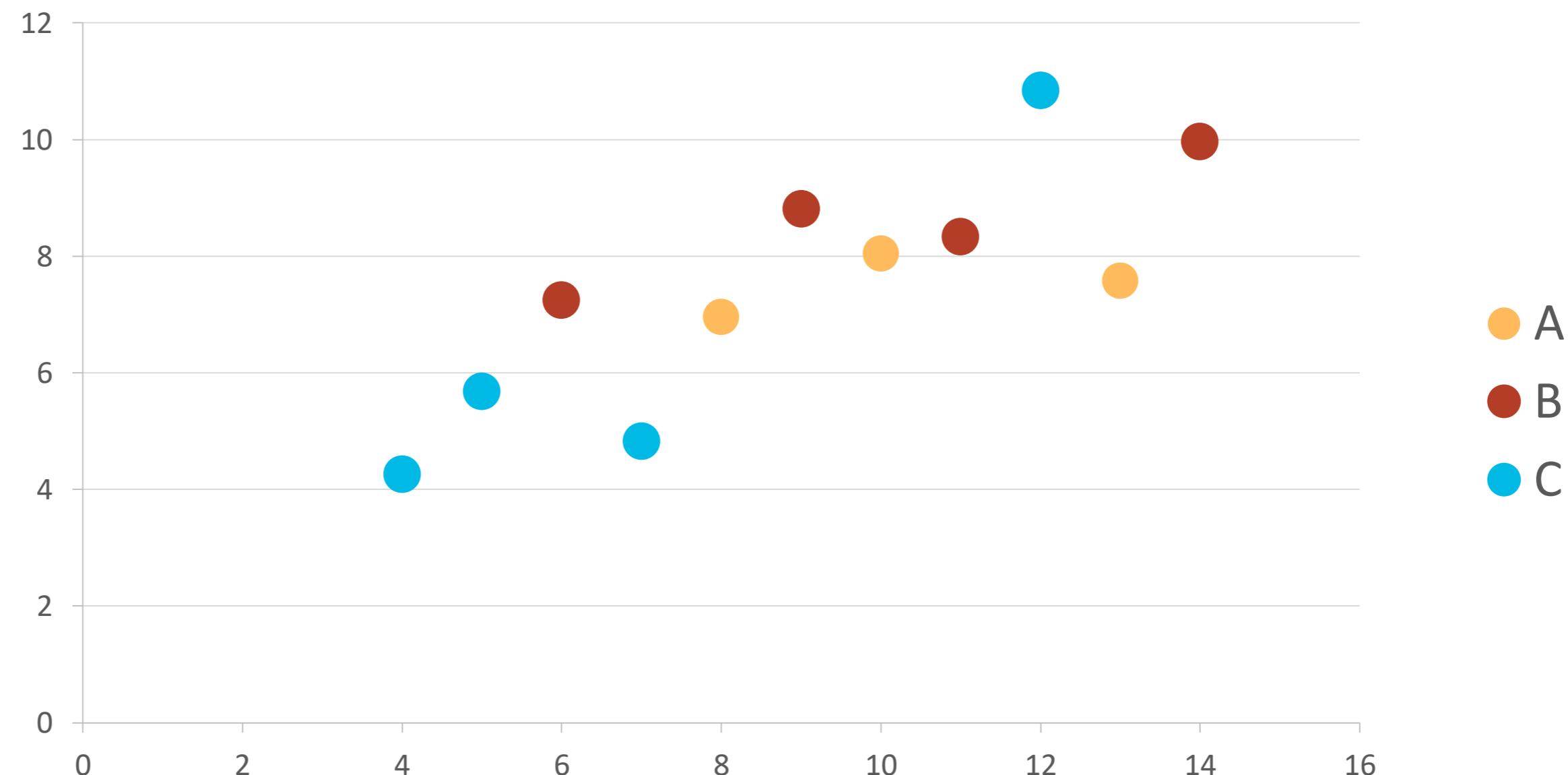
- Drawing connections



# Gestalt Principles

## How does this apply to charts?

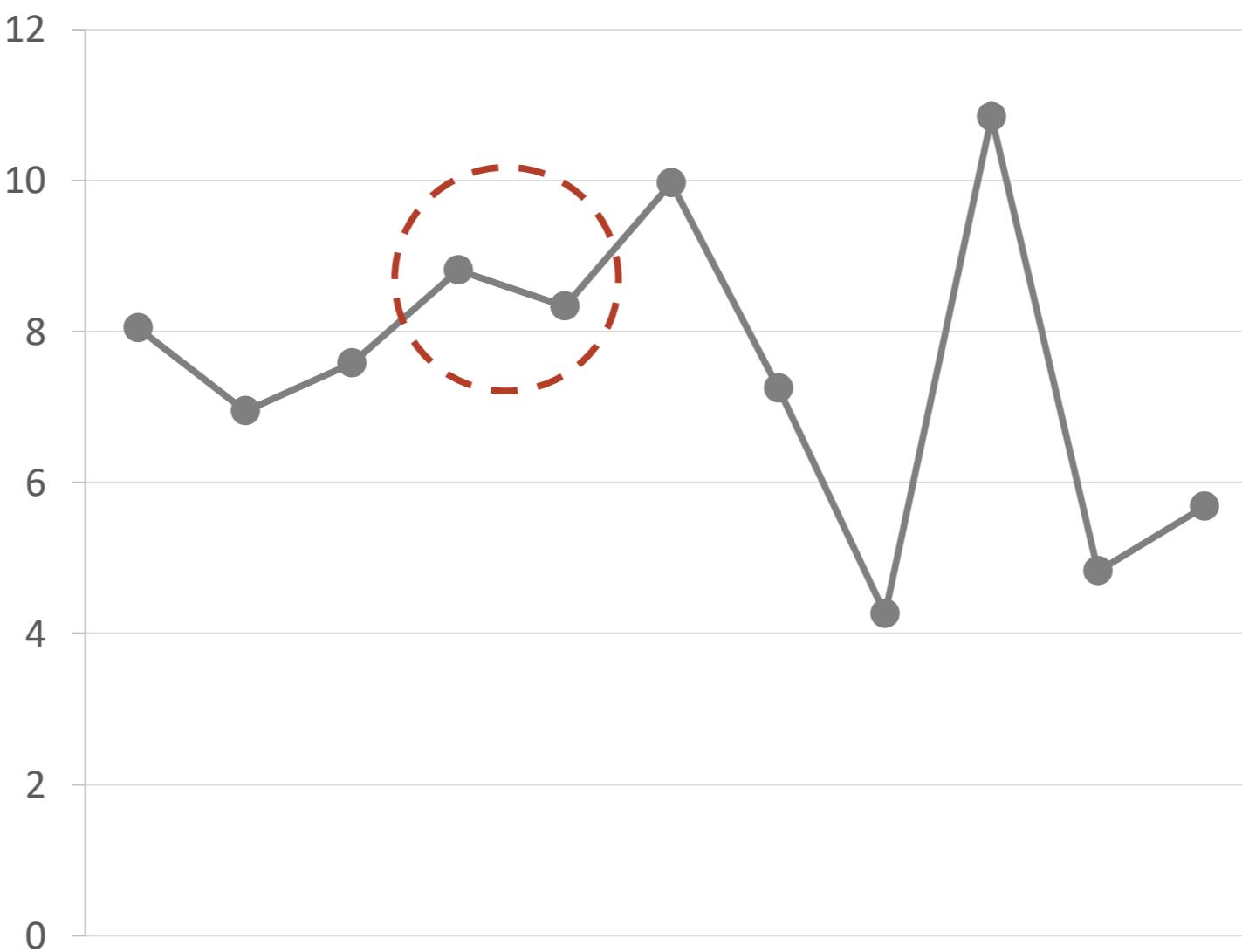
- Grouping categories



# Gestalt Principles

## How does this apply to charts?

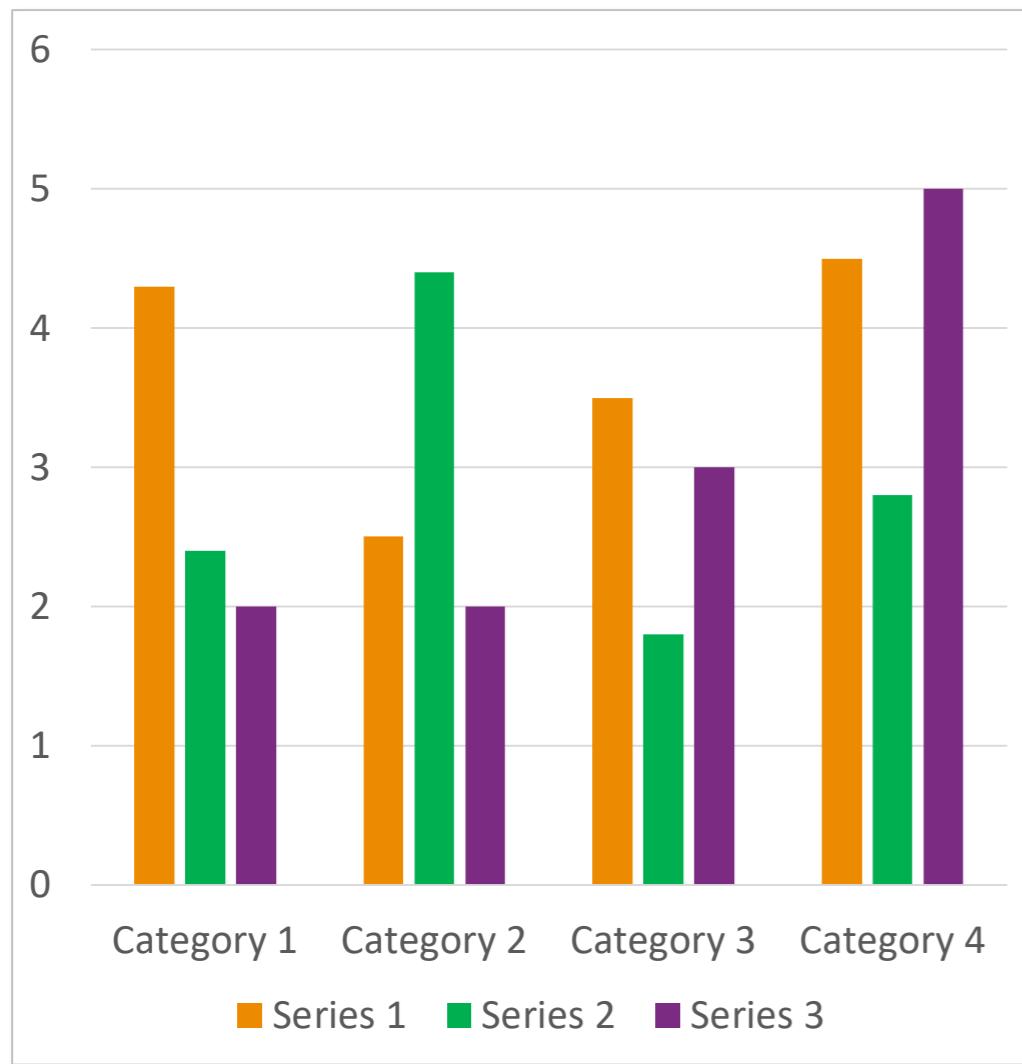
- Highlighting values



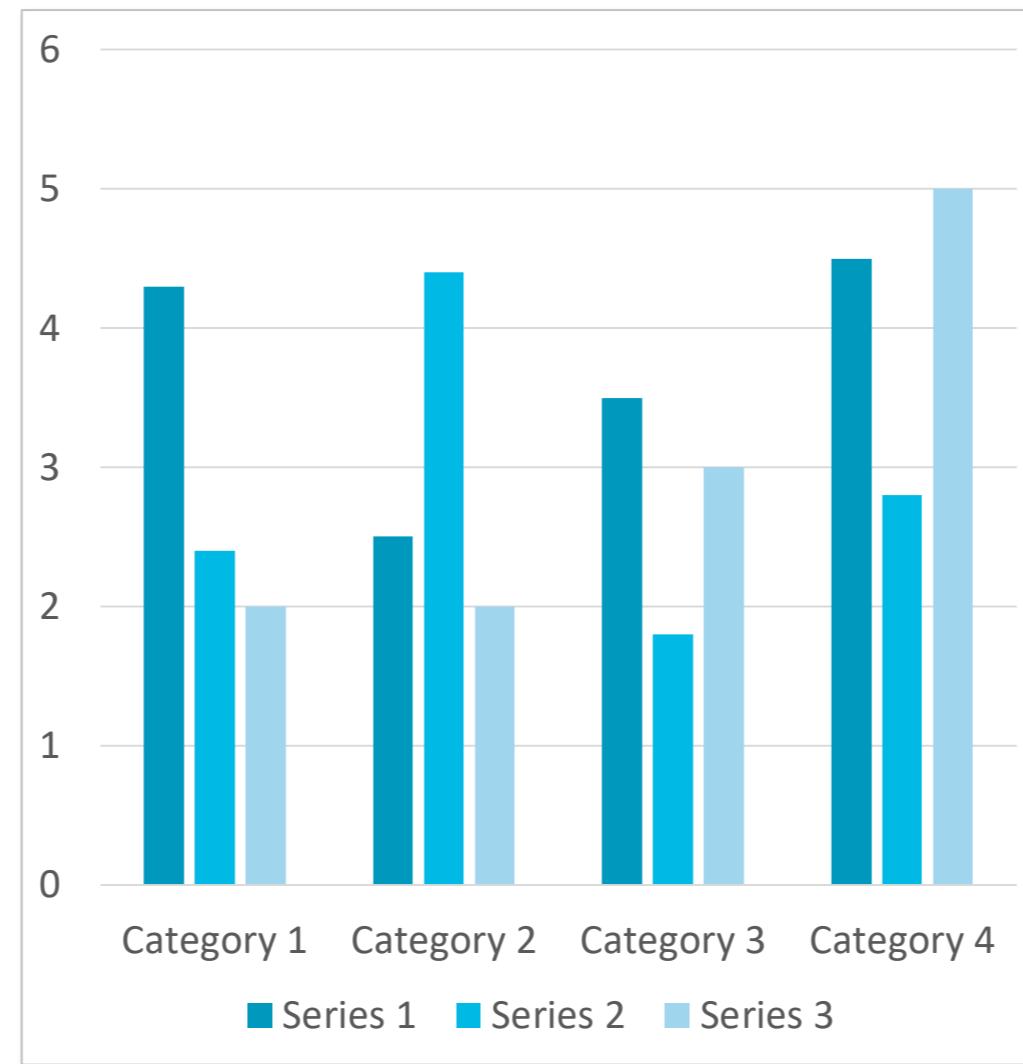
# Colour

## Common way to encode data

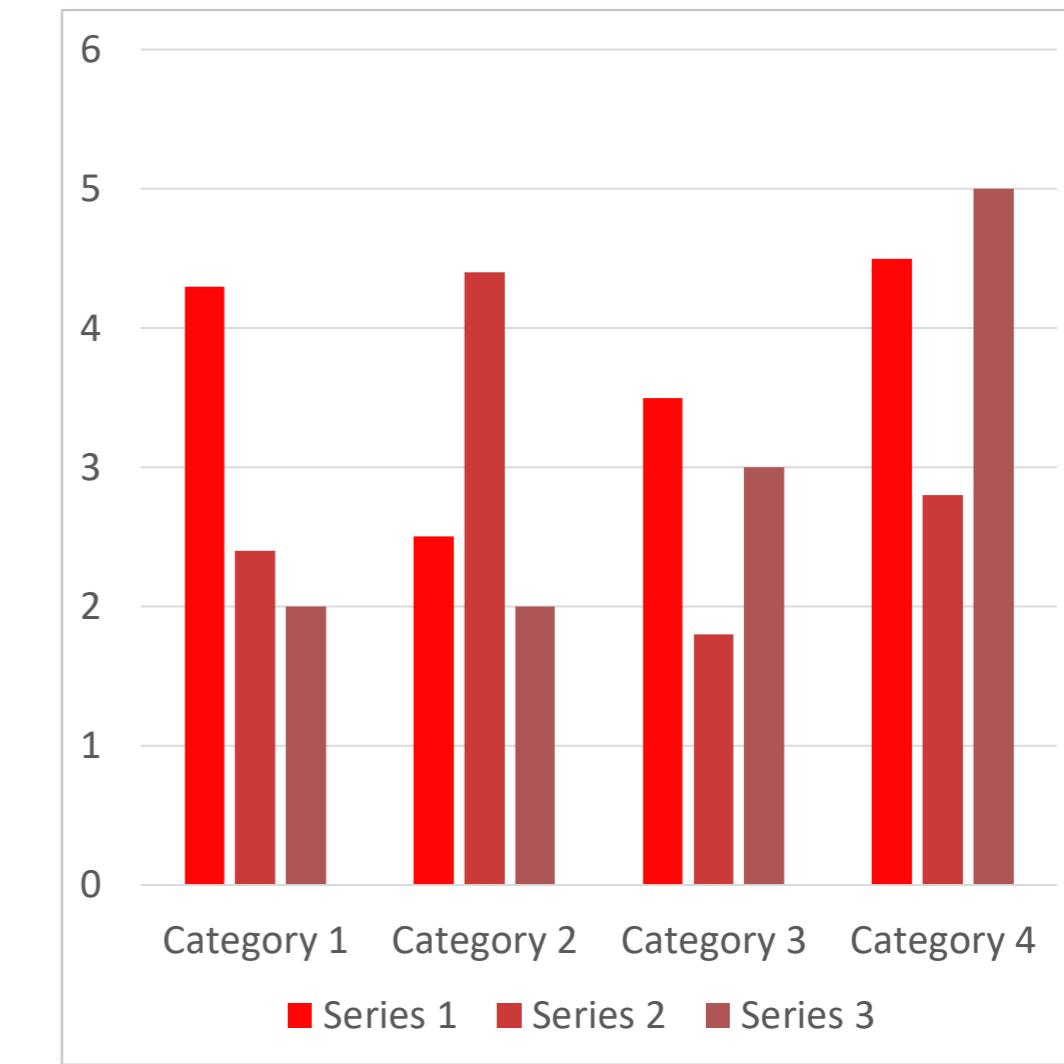
Hue



Value



Saturation



Different colours

Dark → Light

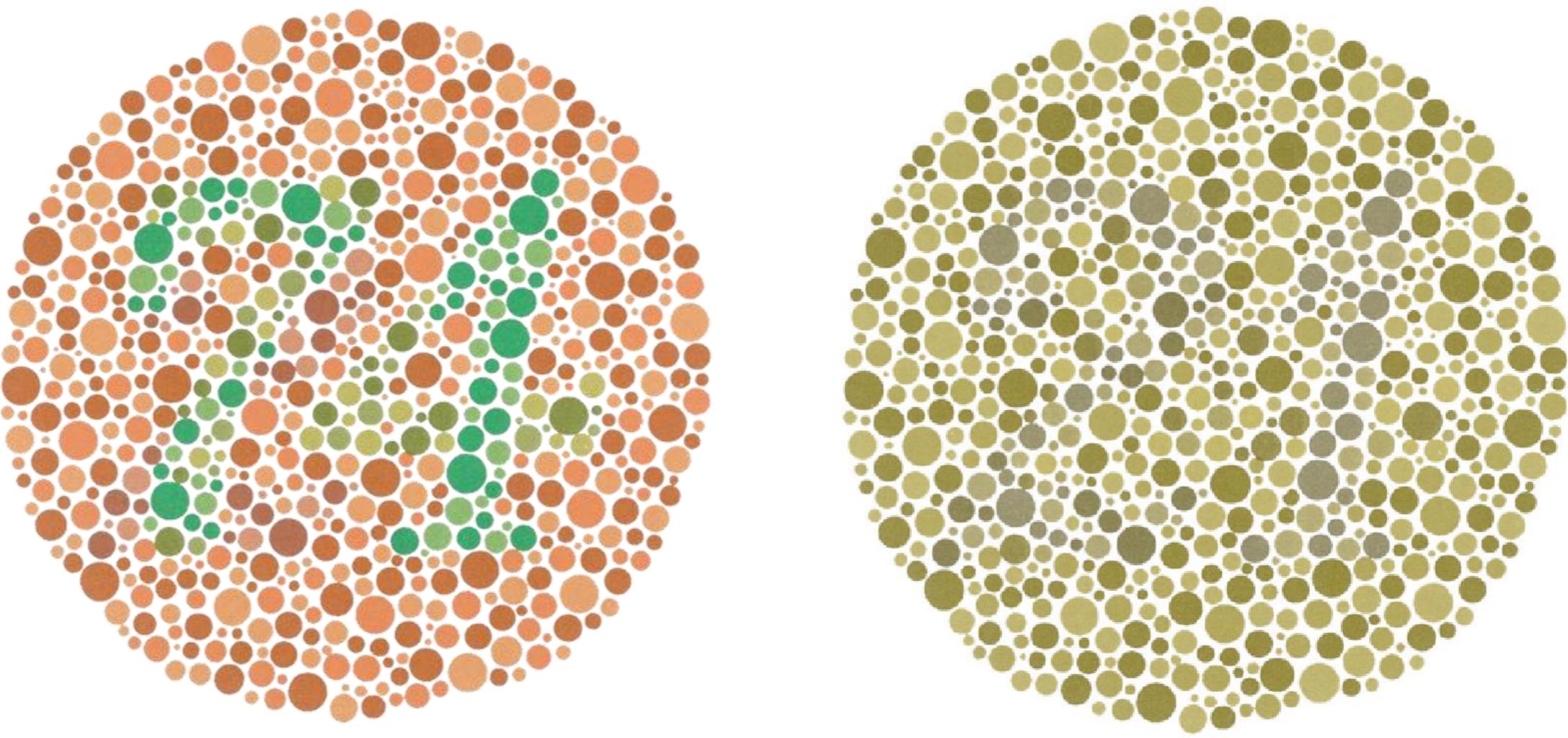
Bright → Dull

## Limitations of colour

- Colour blindness
- Subjectivity
- Reproducibility

## Limitations of colour

- **Colour blindness**
- Subjectivity
- Reproducibility



Wikimedia Commons

# Colour

## Limitations of colour

- Colour blindness
- Subjectivity
- Reproducibility

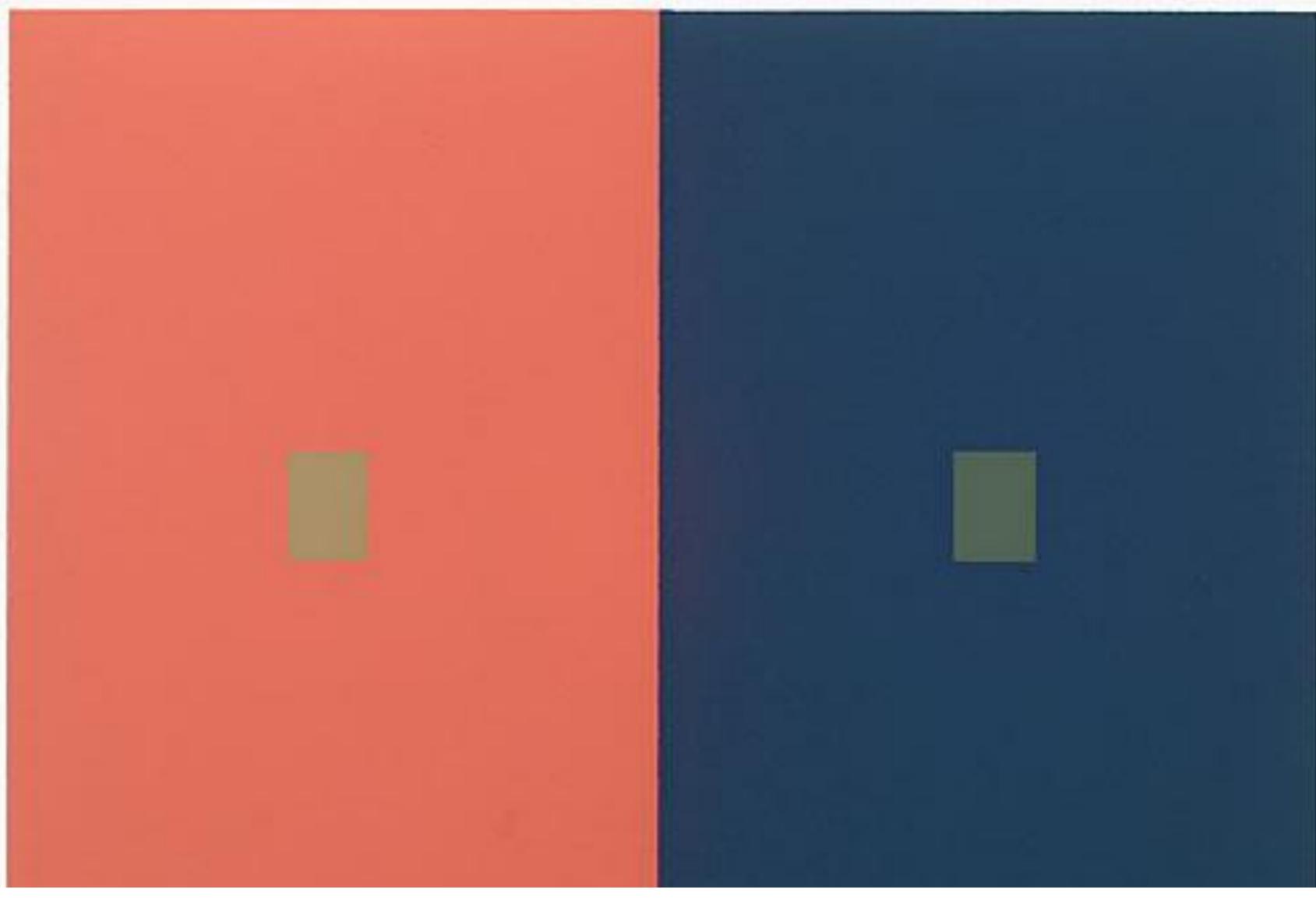
*“In individuals of Northern European ancestry, as many as 8 percent of men and 0.5 percent of women experience the common form of red-green color blind-ness.*

*If a submitted manuscript happens to go to three male reviewers of Northern European descent, the chance that at least one will be color blind is 22 percent.”*

– Bang Wong

## Limitations of colour

- Colour blindness
- **Subjectivity**
- Reproducibility



Josef Albers, Interaction of Color

# Colour

## Limitations of colour

- Colour blindness
- **Subjectivity**
- Reproducibility



Figure by Bang Wong, Color Coding, Nature Methods 7, 573 (2010).

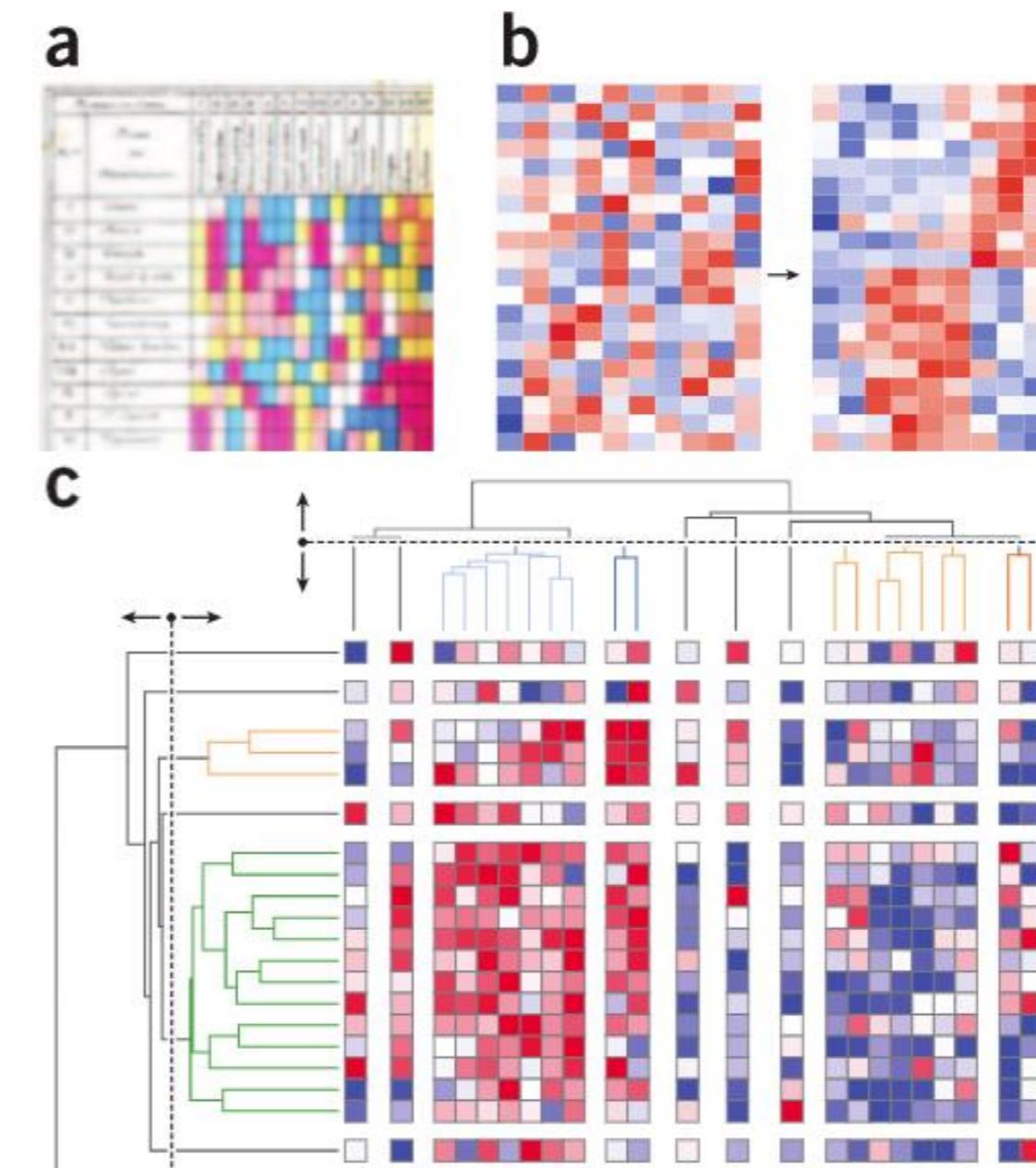


Figure by Nils Gehlenborg & Bang Wong, Heat maps, Nature Methods 9 (3), 213 (2012).

# Colour

## Limitations of colour

- Colour blindness
- Subjectivity
- **Reproducibility**

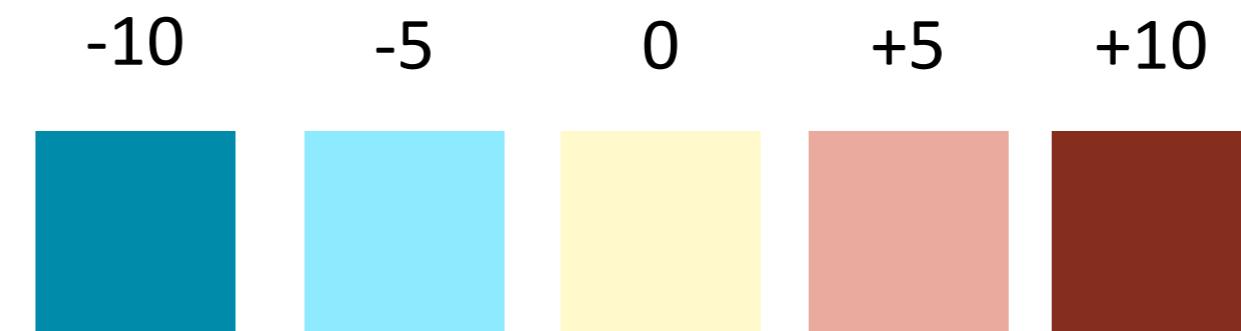
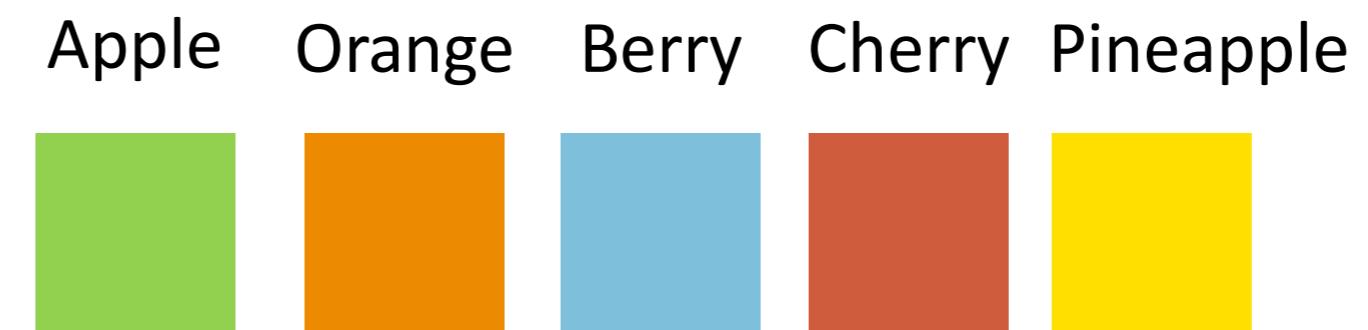
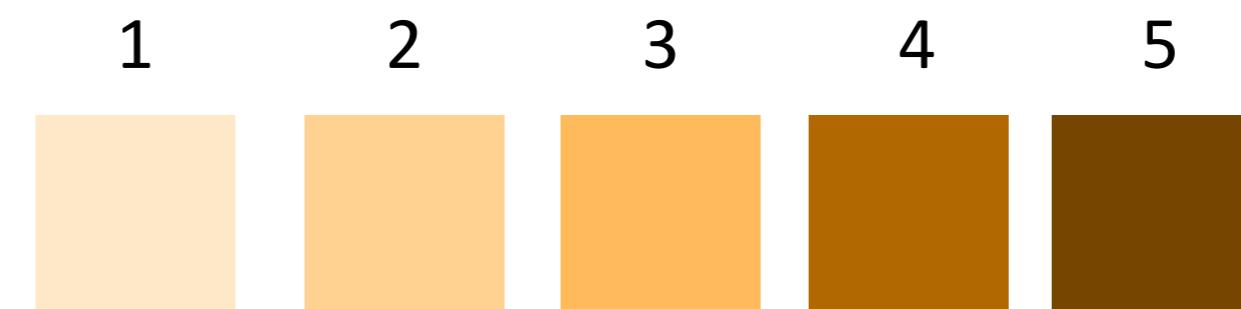


Wikimedia Commons

# Colour

## Encoding methods

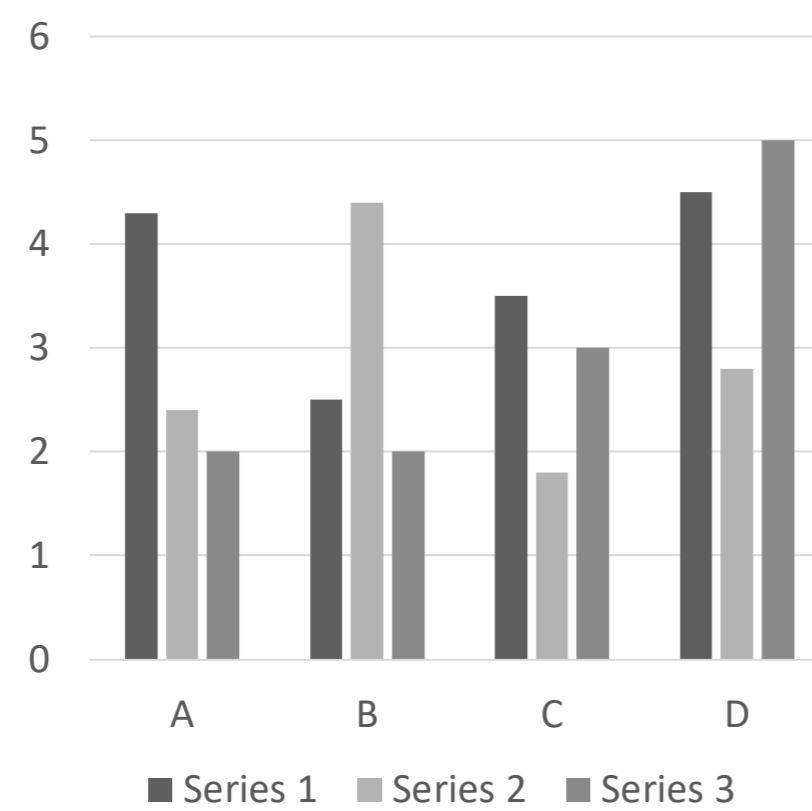
- The encoding should fit the data



# Designing for an Audience

# Draft to Final

## How to communicate your charts?



### Document Title

Subtitle or key takeaway statement

Description of this document, such as the intended audience, communication goal, notes on the key takeaway, context for sharing this information, suggestions for what next steps the audience should take in response.

### Chart Title

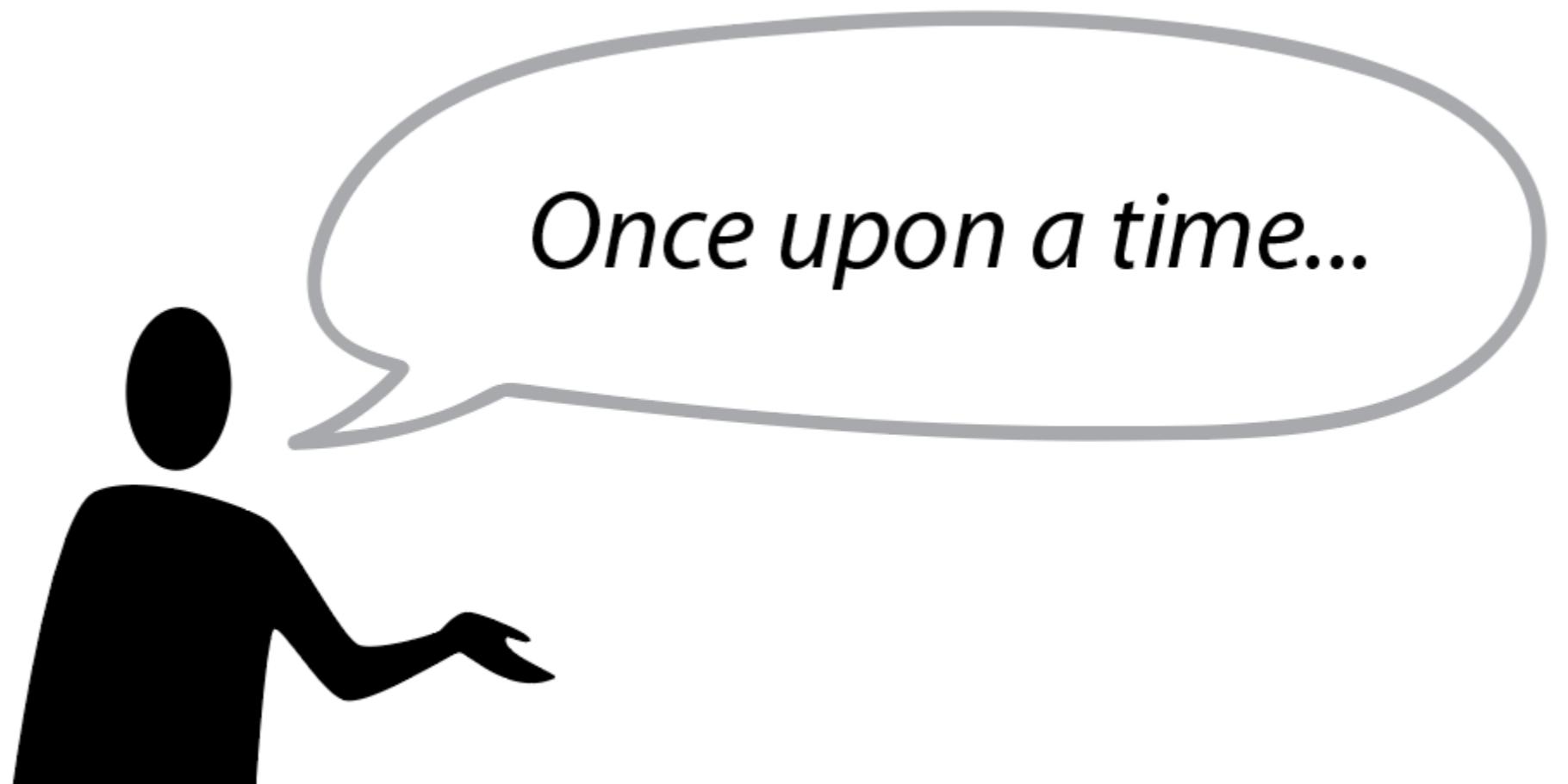


Further notes on methodology, references, interpretation, limitations, references, and other related information.

# Information Organization

## Hierarchy & Storytelling

- Salience to relevance
- Reveal information in a logical order
- Focus on the message



# Composition & Layout

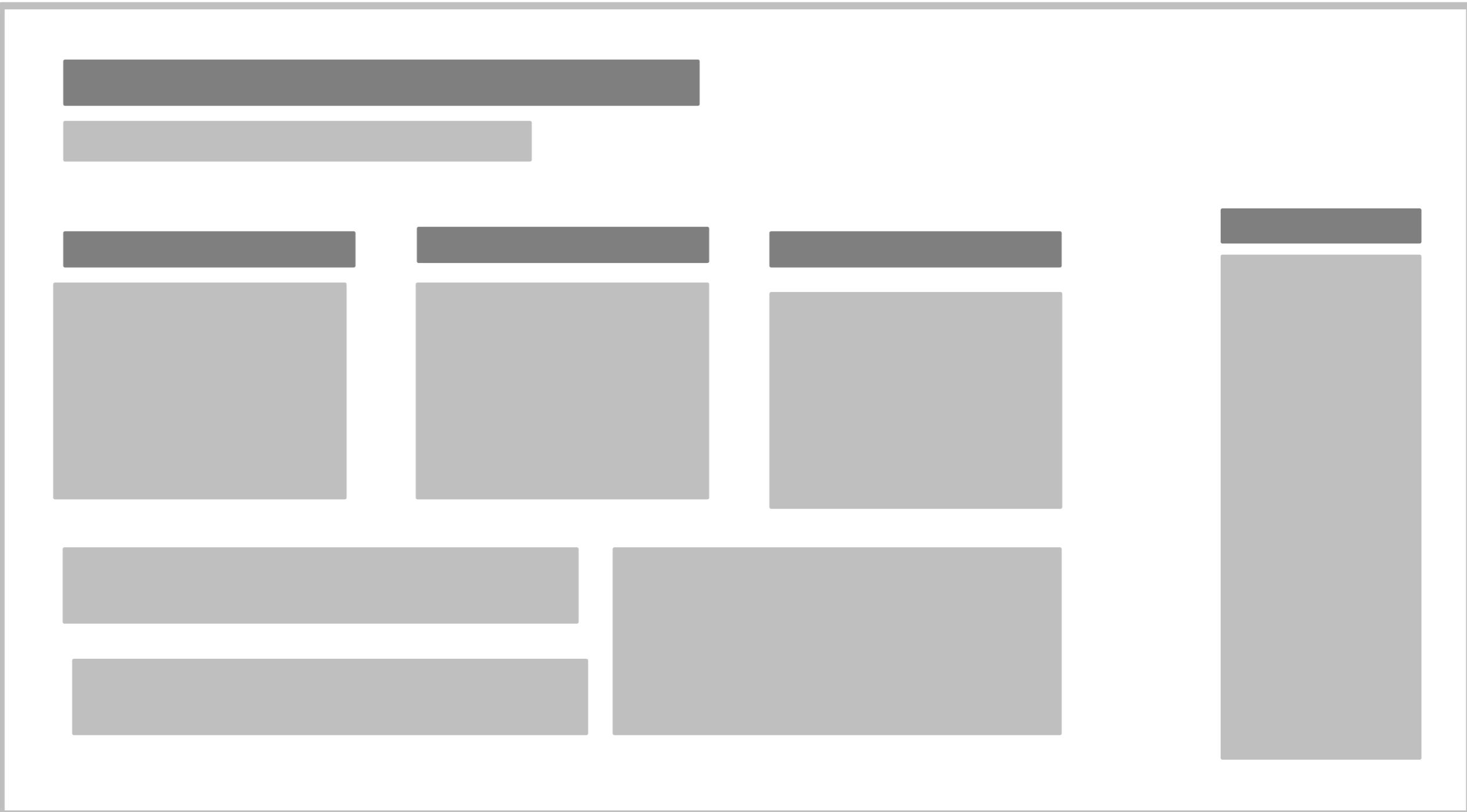
## Page design

- Grids & Alignment
- Spacing
- Reading order
- Limitations of medium

# Composition & Layout

## Page design

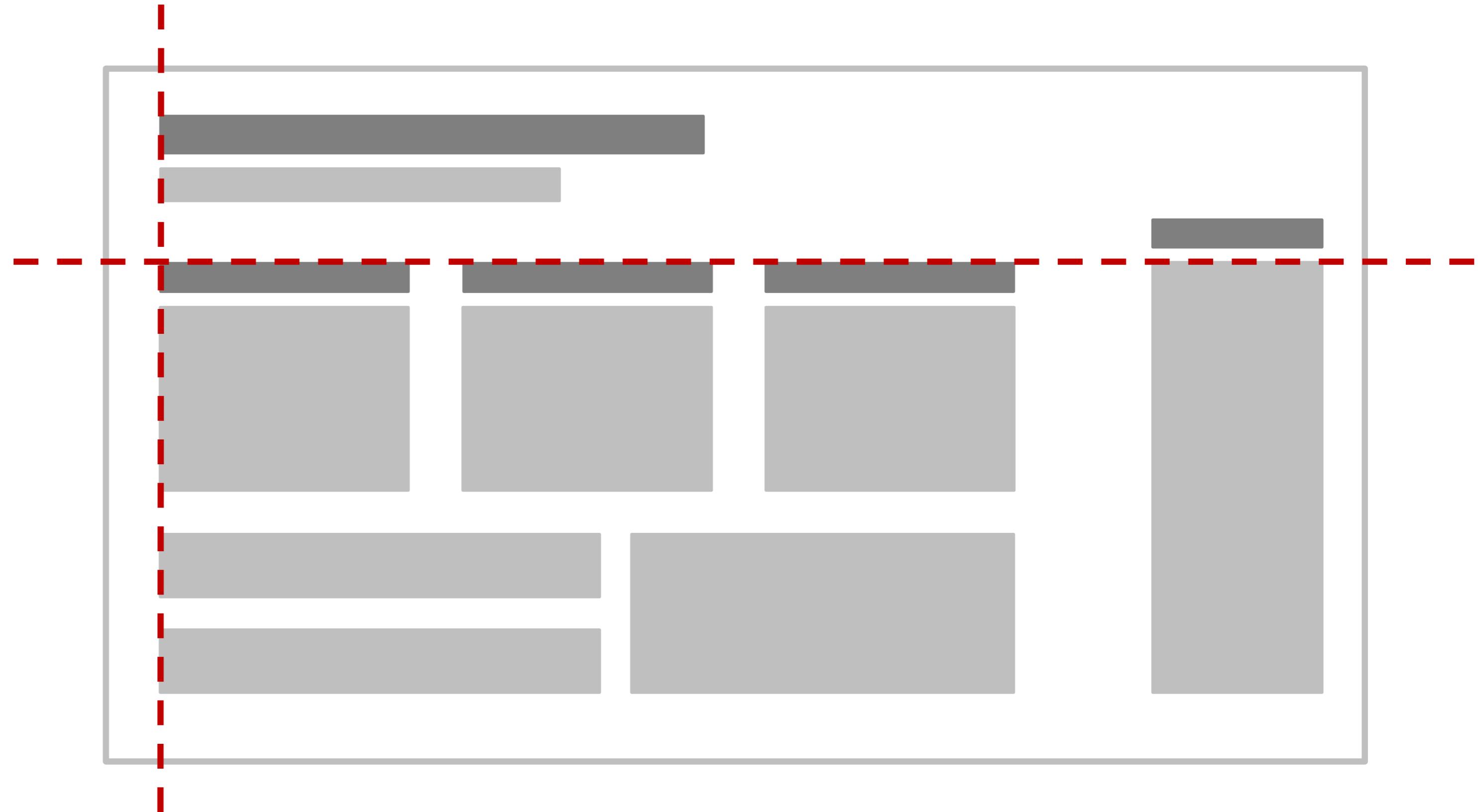
- **Grids & Alignment**
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# Composition & Layout

## Page design

- **Grids & Alignment**
- Spacing
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# Composition & Layout

## Page design

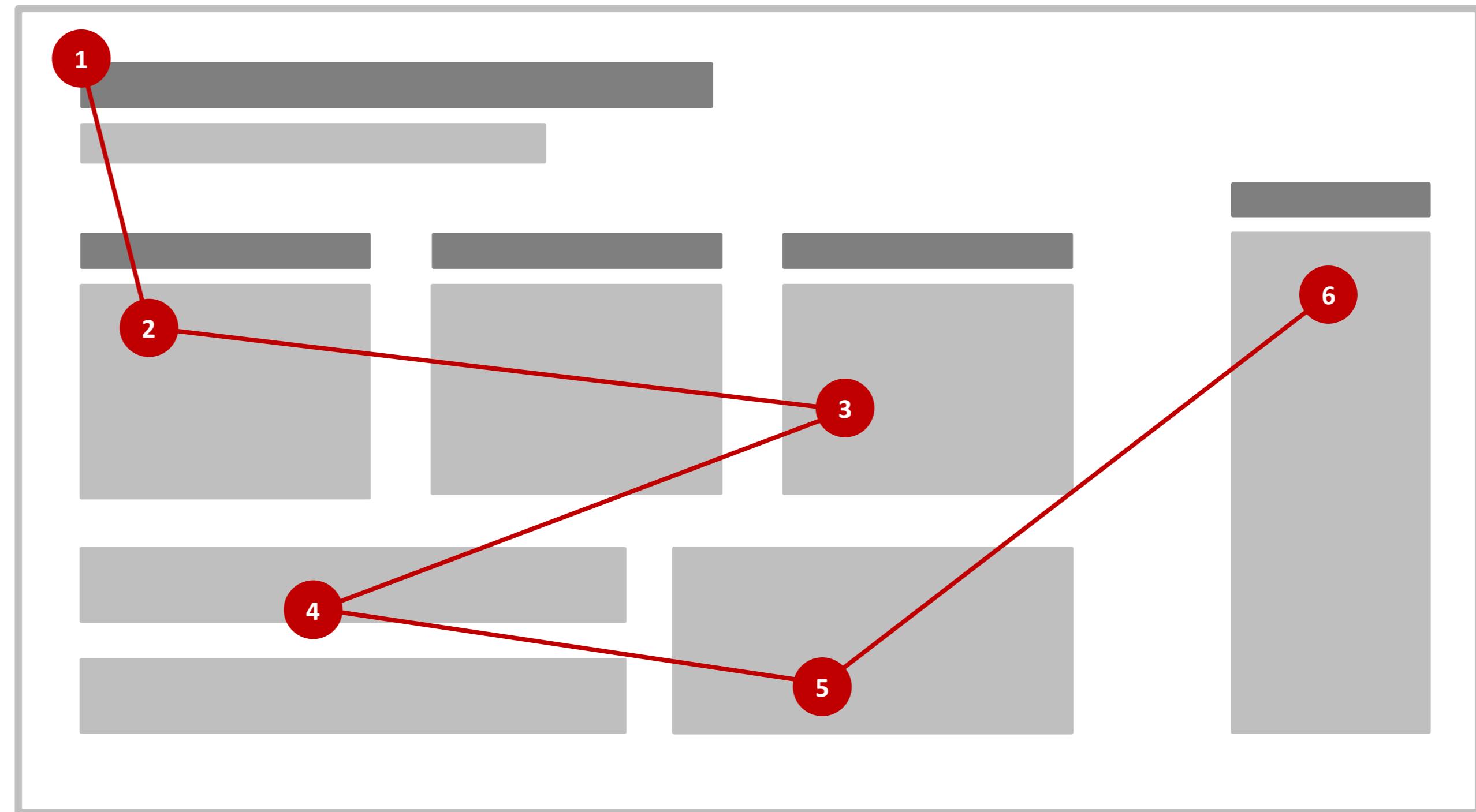
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# Composition & Layout

## Page design

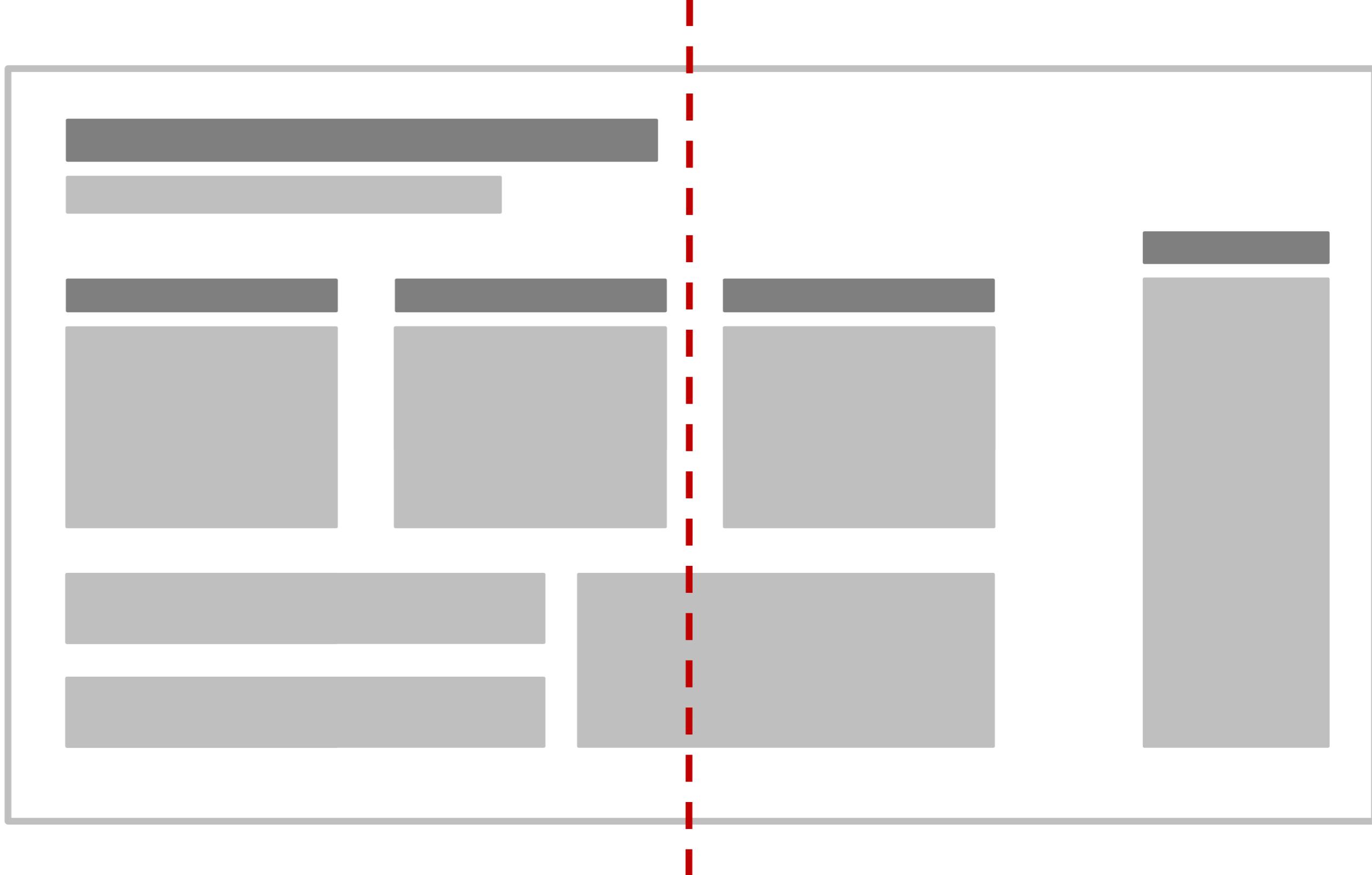
- Grids & Alignment
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# Composition & Layout

## Page design

- Grids & Alignment
- Spacing
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- **Limitations of medium**



# Composition & Layout

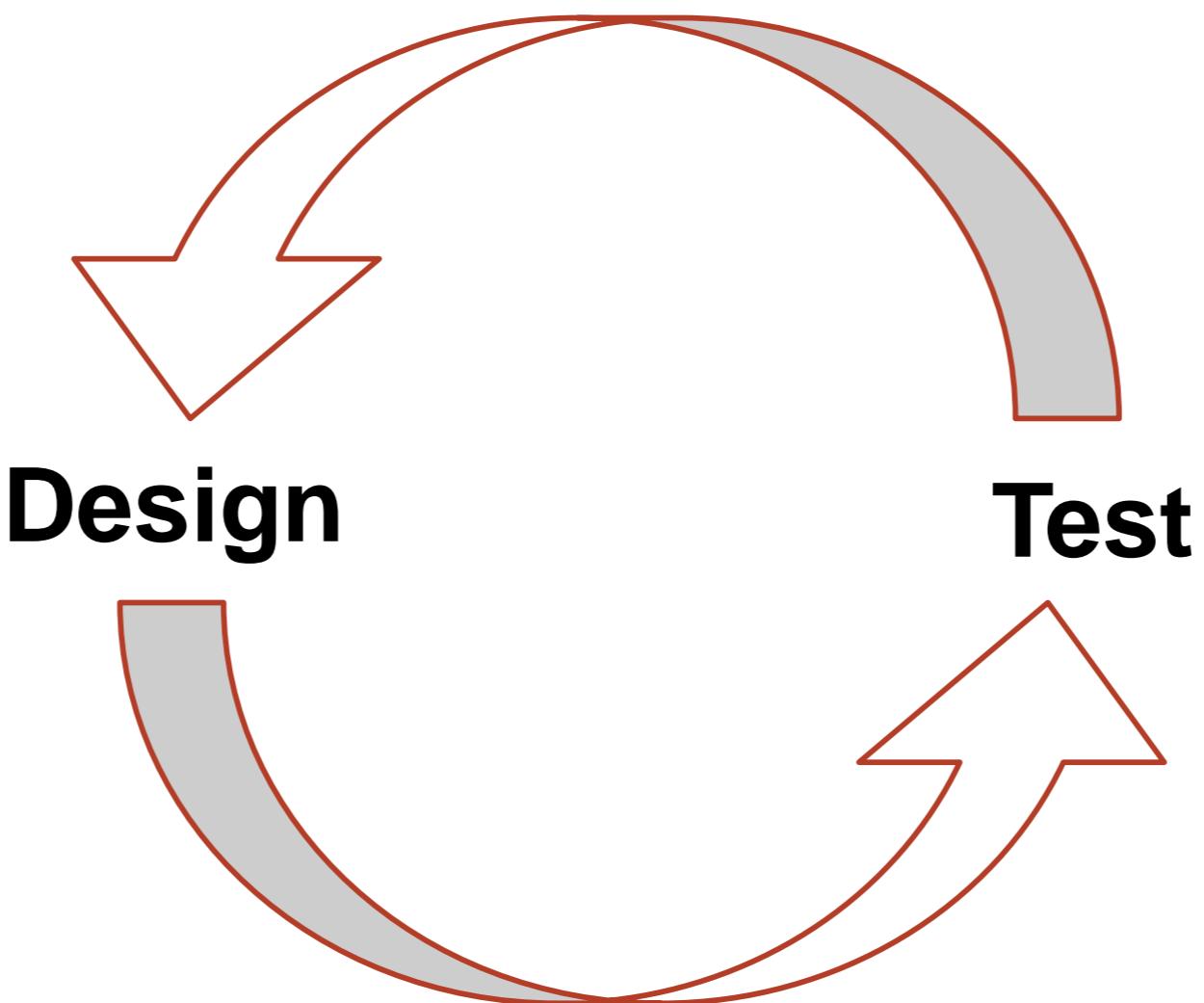
## Page design

- Grids & Alignment
- Spacing
- Reading order
- **Limitations of medium**



# Testing & Feedback

## Iterative design



# Review

# Review

## Prepare Data

SMIS\_Daily\_Occupancy\_2017.csv - Excel

A1 OCCUPANCY\_DATE

|    | A        | B           | C                    | D           | E       | F          | G       | H           | I           | J        | K       | L        | M   | N     | O  | P  | Q | R | S |
|----|----------|-------------|----------------------|-------------|---------|------------|---------|-------------|-------------|----------|---------|----------|-----|-------|----|----|---|---|---|
| 1  | OCCUPAN  | ORGANIZ     | SHELTER              | SHELTER     | SHELTER | SHELTER    | SHELTER | FACILITY    | PROGRAM     | SECTOR   | OCCUPAN | CAPACITY |     |       |    |    |   |   |   |
| 2  | 1/1/2017 | COSTI       | Imn                  | COSTI       | Rec     | 100 Lippin | Toronto | ON          | M5S 2P1     | COSTI    | Rec     | COSTI    | Rec | Co-ed | 16 | 16 |   |   |   |
| 3  | 1/1/2017 | Christie O: | Christie O:          | 973 Lansd   | Toronto | ON         | M6H 3Z5 | Christie O: | Christie O: | Men      | 13      | 17       |     |       |    |    |   |   |   |
| 4  | 1/1/2017 | Christie O: | Christie O:          | 973 Lansd   | Toronto | ON         | M6H 3Z5 | Christie O: | Christie O: | Men      | 63      | 63       |     |       |    |    |   |   |   |
| 5  | 1/1/2017 | Christie Re | Christie Re          | 43 Christie | Toronto | ON         | M6G 3B1 | Christie Re | Christie Re | Families | 66      | 70       |     |       |    |    |   |   |   |
| 6  | 1/1/2017 | City of Tor | Birchmou             | 1673 Kings  | Toronto | ON         |         | Birchmou    | Birchmou    | Men      | 58      | 60       |     |       |    |    |   |   |   |
| 7  | 1/1/2017 | City of Tor | Birkdale R           | 1229 Elles  | Toronto | ON         | M1P 4V8 | Birkdale R  | Birkdale R  | Families | 168     | 160      |     |       |    |    |   |   |   |
| 8  | 1/1/2017 | City of Tor | Birkdale R           | 1229 Elles  | Toronto | ON         | M1P 4V8 | Birkdale R  | Birkdale R  | Families | 119     | 150      |     |       |    |    |   |   |   |
| 9  | 1/1/2017 | City of Tor | Downsvie             | 1651 Shep   | Toronto | ON         |         | Downsvie    | Downsvie    | Men      | 23      | 28       |     |       |    |    |   |   |   |
| 10 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Families | 8       | 0        |     |       |    |    |   |   |   |
| 11 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Co-ed    | 14      | 40       |     |       |    |    |   |   |   |
| 12 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Families | 0       |          |     |       |    |    |   |   |   |
| 13 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Families | 0       | 0        |     |       |    |    |   |   |   |
| 14 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Families | 173     | 252      |     |       |    |    |   |   |   |
| 15 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Families | 22      | 48       |     |       |    |    |   |   |   |
| 16 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Families | 148     | 110      |     |       |    |    |   |   |   |
| 17 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Families | 42      | 50       |     |       |    |    |   |   |   |
| 18 | 1/1/2017 | City of Tor | Family Res           | 4222 Kings  | Toronto | ON         | M1E 2M6 | Family Res  | Family Res  | Families | 60      | 20       |     |       |    |    |   |   |   |
| 19 | 1/1/2017 | City of Tor | Fort York I38 Bathru | 138 Bathru  | Toronto | ON         |         | Fort York I | Fort York I | Men      | 0       | 19       |     |       |    |    |   |   |   |
| 20 | 1/1/2017 | City of Tor | Fort York I38 Bathru | 138 Bathru  | Toronto | ON         |         | Fort York I | Fort York I | Men      | 74      | 74       |     |       |    |    |   |   |   |
| 21 | 1/1/2017 | City of Tor | Fort York I38 Bathru | 138 Bathru  | Toronto | ON         |         | Fort York I | Fort York I | Men      | 24      | 24       |     |       |    |    |   |   |   |
| 22 | 1/1/2017 | City of Tor | Robertson 291 Sherb  | 291 Sherb   | Toronto | ON         | M54 2R9 | Robertson   | Robertson   | Families | 111     | 90       |     |       |    |    |   |   |   |

## Know the Audience & Goal

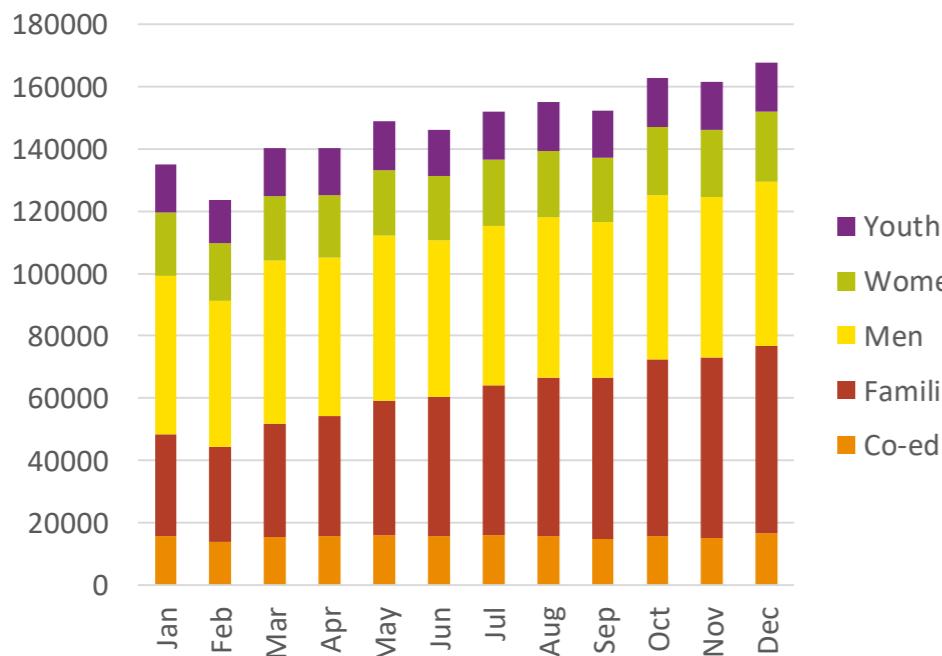
Example  
**Changes in family shelter occupancy, for a general public audience**

| Row Labels  | Sum of OCCUPANCY | Column Labels |          |        |        |        | Grand Total |
|-------------|------------------|---------------|----------|--------|--------|--------|-------------|
|             |                  | Co-ed         | Families | Men    | Women  | Youth  |             |
| Jan         |                  | 15562         | 32773    | 50799  | 20430  | 15485  | 135049      |
| Feb         |                  | 13705         | 30700    | 46793  | 18496  | 13978  | 123672      |
| Mar         |                  | 15327         | 36416    | 52432  | 20638  | 15431  | 140244      |
| Apr         |                  | 15795         | 38567    | 50820  | 20080  | 15112  | 140374      |
| May         |                  | 16156         | 43171    | 52812  | 21107  | 15630  | 148876      |
| Jun         |                  | 15555         | 44740    | 50424  | 20600  | 14897  | 146216      |
| Jul         |                  | 15911         | 48147    | 51230  | 21333  | 15481  | 152102      |
| Aug         |                  | 15595         | 51073    | 51293  | 21347  | 15641  | 154949      |
| Sep         |                  | 14911         | 51521    | 50167  | 20606  | 15249  | 152454      |
| Oct         |                  | 15812         | 56754    | 52554  | 21930  | 15805  | 162855      |
| Nov         |                  | 15166         | 57850    | 51604  | 21523  | 15298  | 161441      |
| Dec         |                  | 16502         | 60149    | 52770  | 22675  | 15731  | 167827      |
| Grand Total |                  | 185997        | 551861   | 613698 | 250765 | 183738 | 1786059     |

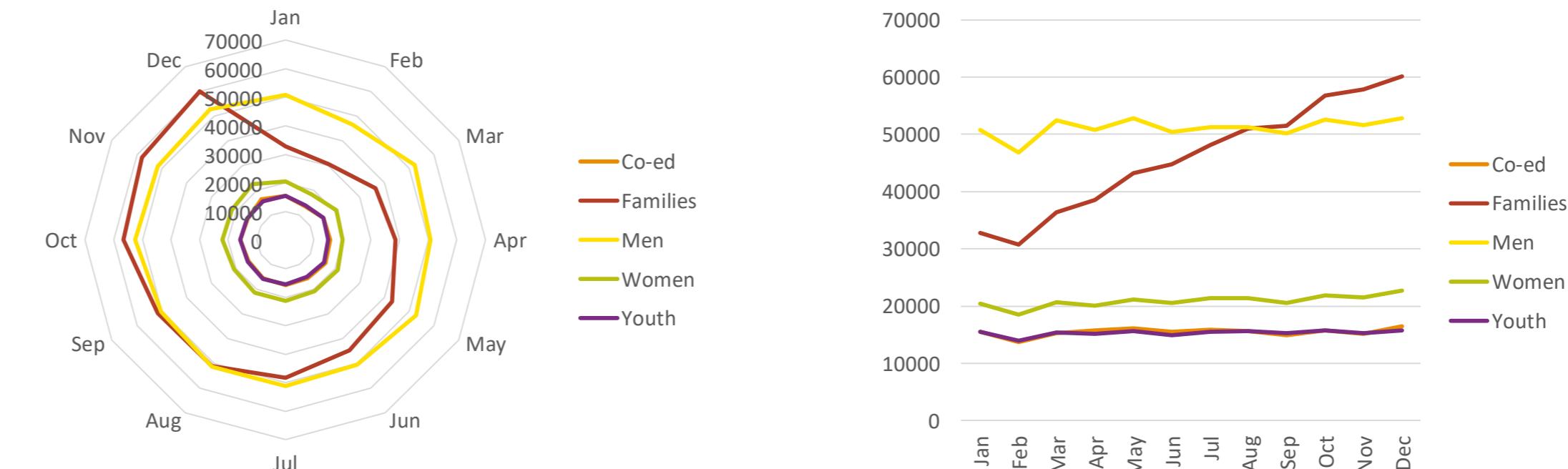
# Review

Choose an appropriate chart type

## Principle of Expressiveness

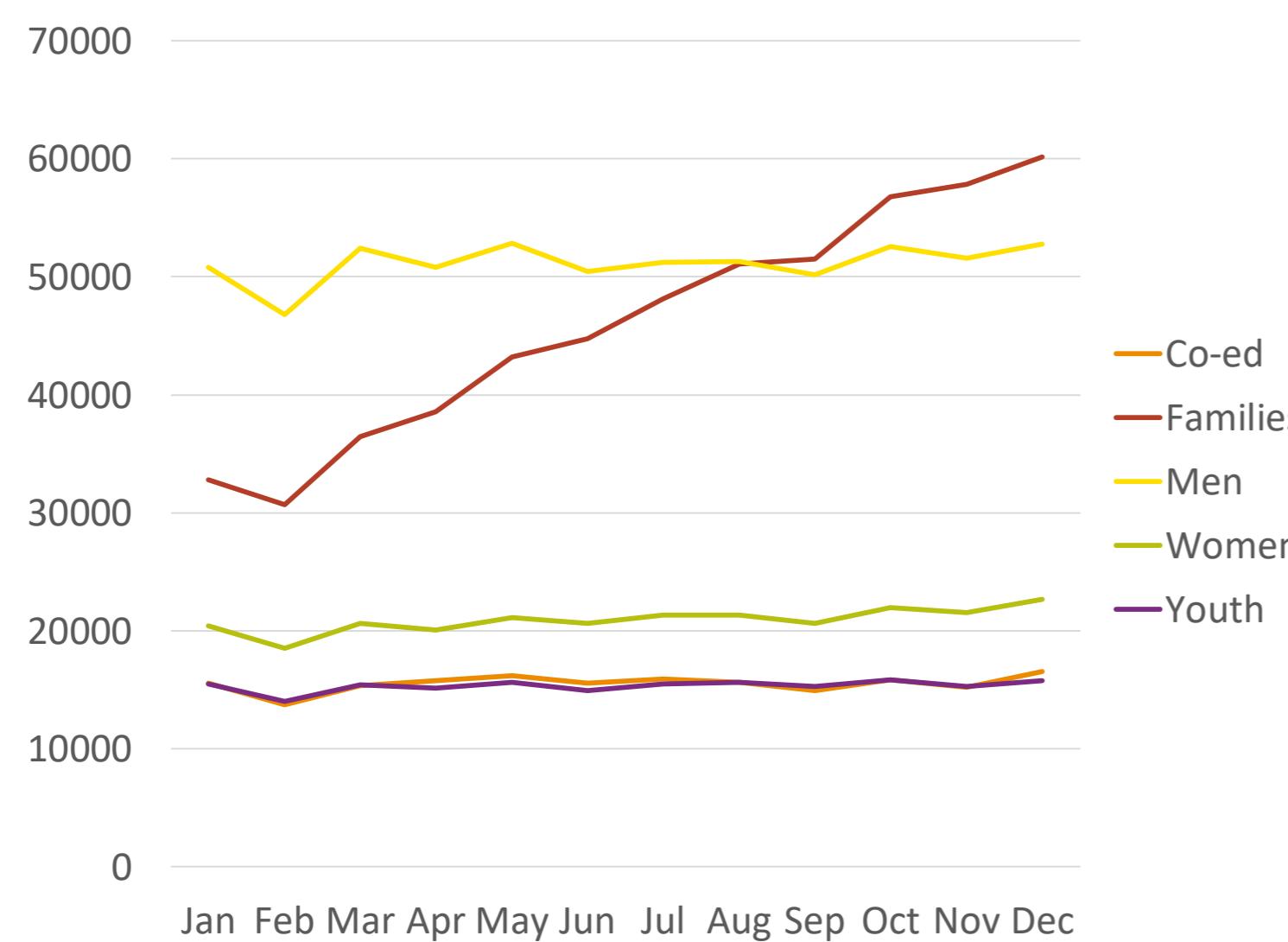


## Principle of Effectiveness



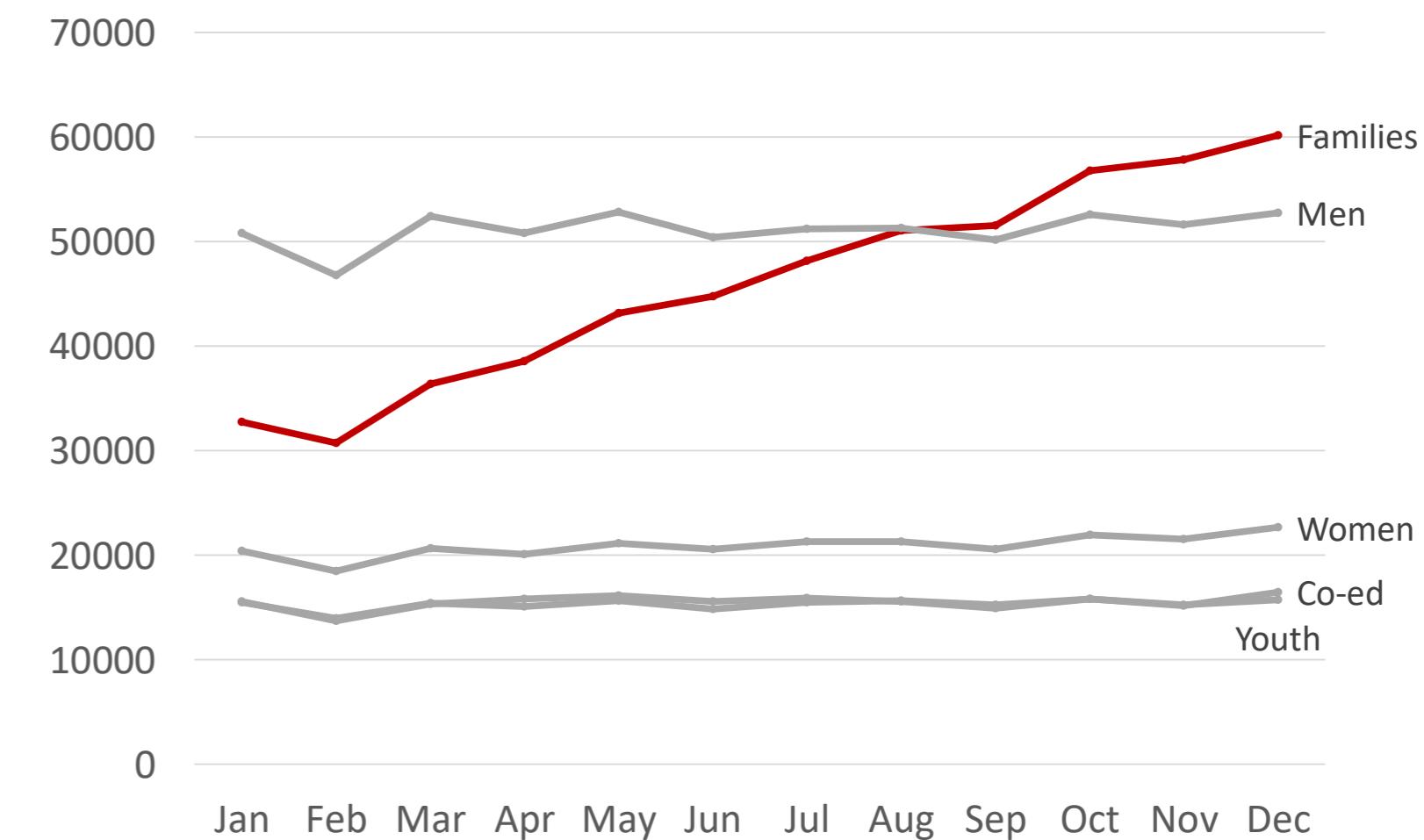
# Review

## Leverage visual perception



### Shelter Occupancy in Toronto 2017

While most sectors saw relatively consistent occupancy rates, the occupancy of family shelters rose markedly over the year.



# Review

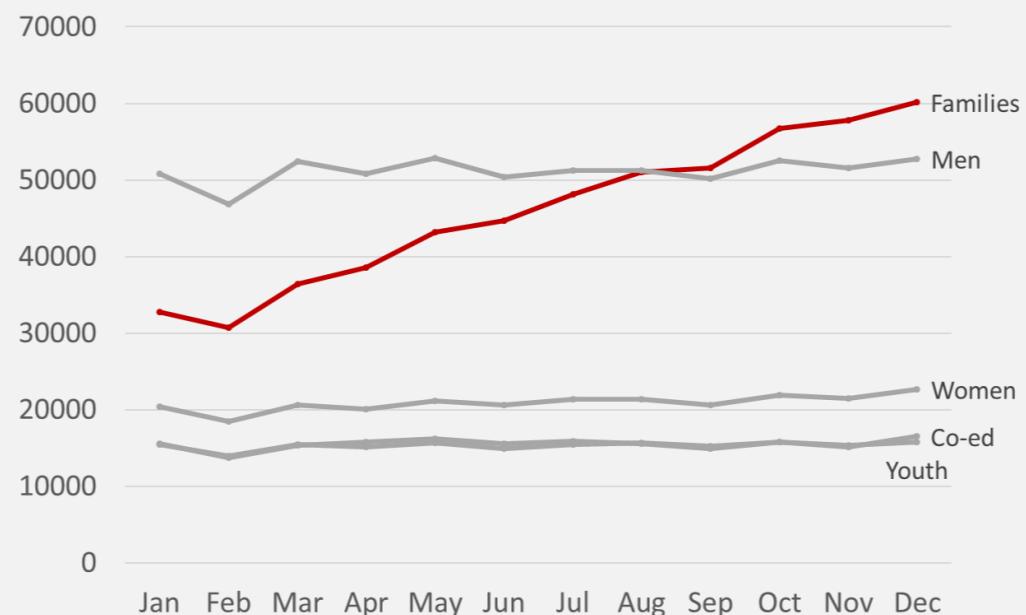
Design the page

## Shelter Occupancy 2017

A report on changing trends in shelter uses with recommendations for key areas for further attention.

### Shelter Occupancy in Toronto 2017

While most sectors saw relatively consistent occupancy rates, the occupancy of family shelters rose markedly over the year.



Further notes on methodology, references, interpretation, limitations, references, and other related information.

# Review

## Test & Iterate

### **Shelter Occupancy 2017**

A report on changing trends in shelter uses with recommendations for key areas for further attention.



Further notes on methodology, references, interpretation, limitations, references, and other related information.

# Resources

## Selected Resources

- **Chart Types** - <http://datavizproject.com>
- **Data Vis Caveats** - <https://www.data-to-viz.com/caveats.html>
- **Colour Palettes** - [colorbrewer2.com](http://colorbrewer2.com)
- **Theory** - Bang Wong, Nature Methods *Points of View* columns
- **Blogs** - <https://blog.datawrapper.de/>, [flowingdata.com](http://flowingdata.com)

# Questions