Data Visualization

Agenda

1. Color Vision Deficiency (CVD)
2. Accessibility for CVD Examples
3. Visualization Example
4. Coursera Data Visualization Course
5. Questions

Color Vision Deficiency (CVD)

Color Vision Deficiency (CVD)

- Persons with **CVD**:
  - colors most people see as different will look the same for them

- **Colorblindness** is not the most accurate term
  - instead, use **CVD**

CVD Studies

- **Red-green CVD**
  - About **8% of men**
    - 6% of men have deuteranomaly (green-weak) & deuteranopia (green-blind)
    - 2% of men have protanomaly (mild) & protanopia (severe)
  - About **0.5% of women**

- **Blue-yellow CVD**
  - About **5% of all CVD cases**

- **CVD** doesn't mean: person can't see color
  - unless in very rare cases (1 in 33,000)

CVD Commonly Referred to as

- red weak
- green weak
- red-green colorblindness

Data-viz Rule

Don’t use red & green together

CVD-friendly Designing Tips

1. Red and green together can be problematic.

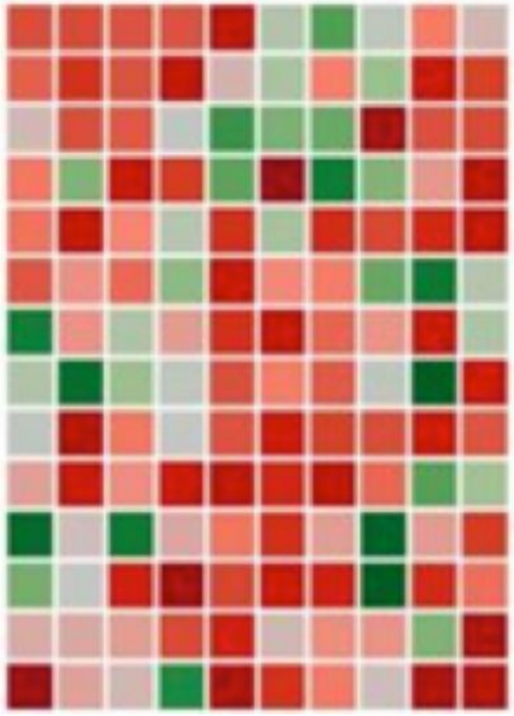
2. Be aware that it’s not just red and green.

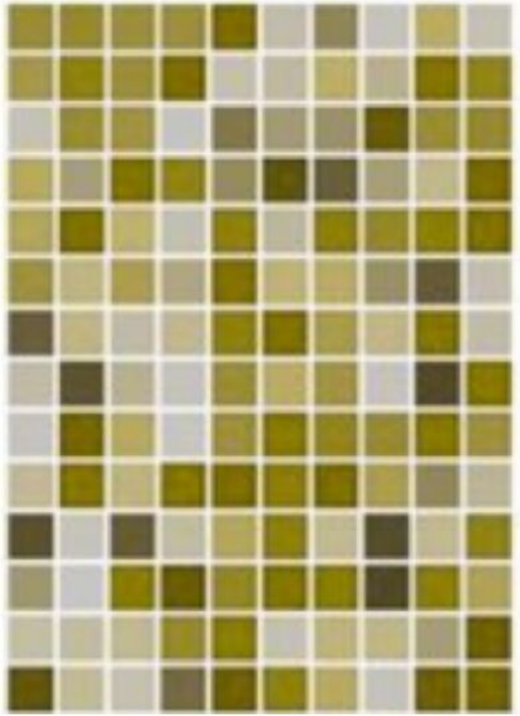
3. Use a CVD-friendly palette when appropriate.

4. If you must use red and green together, you can:
    a. leverage light vs. dark
    b. stand each color (red and green) alone
    c. offer alternate methods of distinguishing data
    d. use a checkbox (or similar GUI) to switch the color palette to a CVD-friendly palette

Tip 1) CVD Simulation Example

- color is needed to tell
  - a good number vs. a bad number in a table
  - one line vs. another line in the same line chart
  - a good square from a bad square
- We can see how difficult this would be in the chart





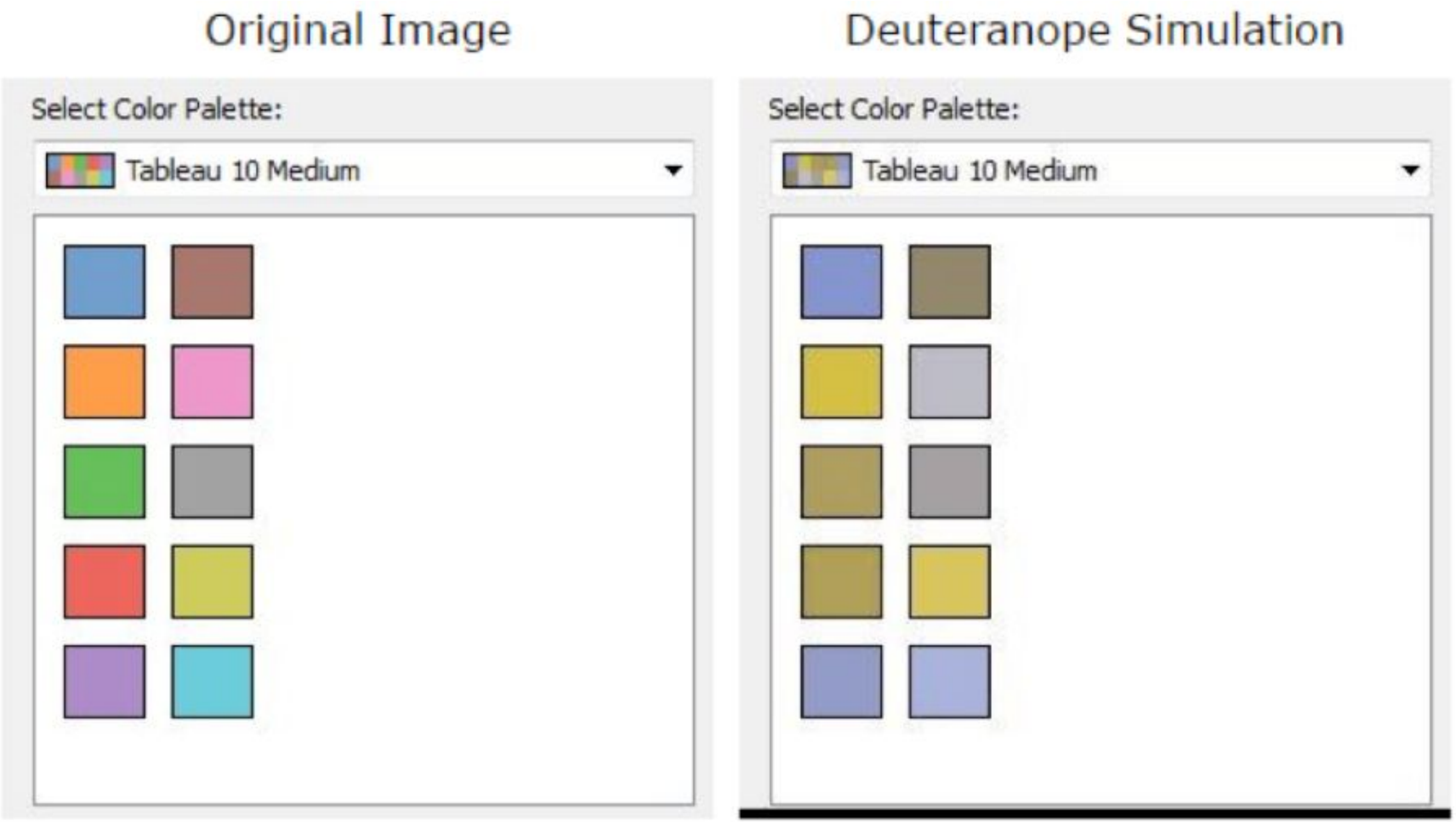
Tip 2) More Complex Than Red vs. Green

- For someone with **strong CVD**
  - **red** & **green** & **orange** all can appear **brown**
  - Maybe more accurate to say: Don't use **red** & **green** & **brown** & **orange** together
    - In the RGB model: orange is RGB(255,165,0) & brown is RGB(150, 75, 0)

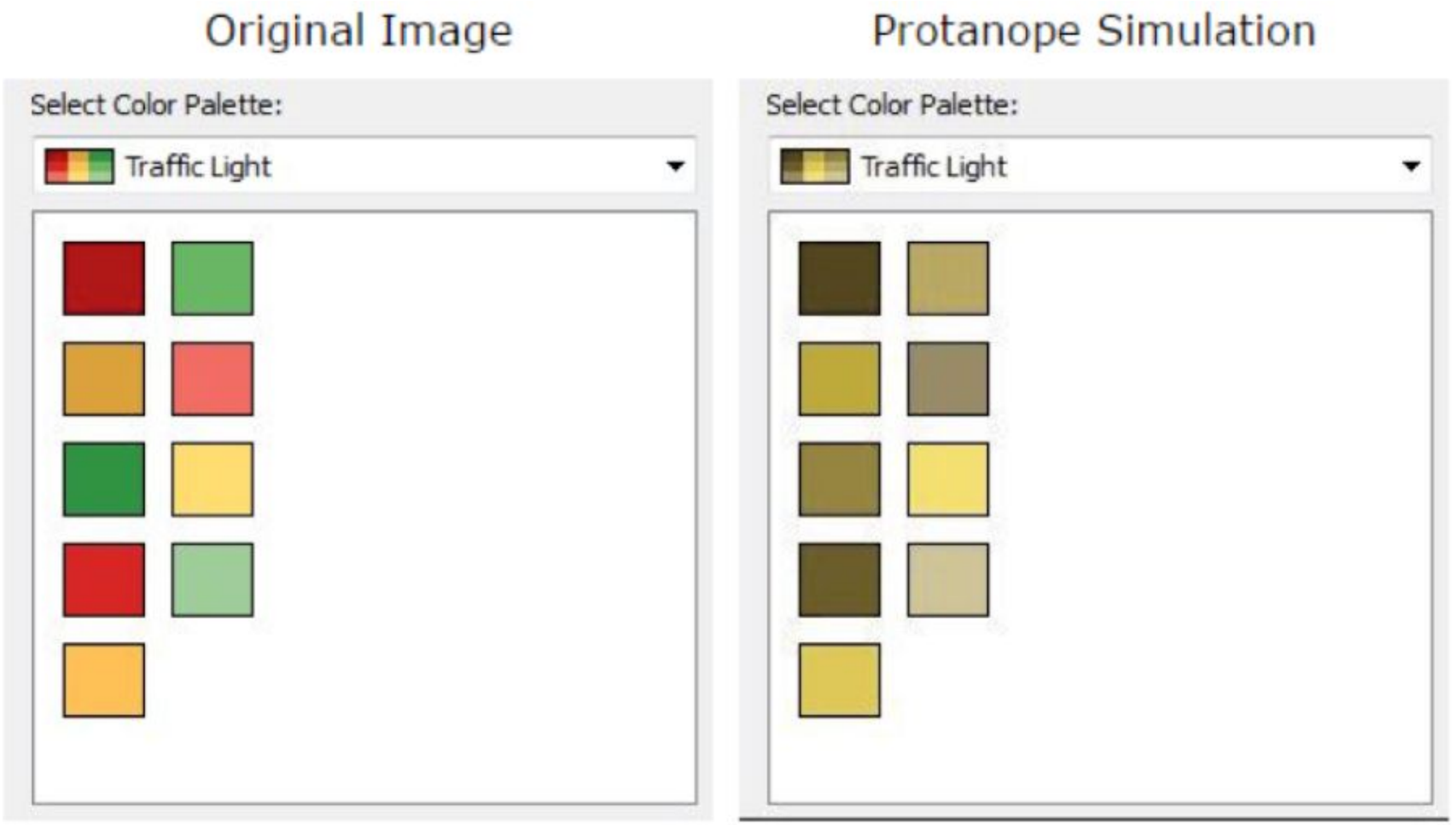
- Also, when mixing colors, they can be problematic.
  - **Example**: using **blue** & **purple** together
    - In the RGB model, **purple** is RGB(160,32,240)
    - If someone has issues with **red**, they may have issues with **purple** (appear **blue**)

- Also, **gray** & **pink** or **gray** & **brown** can be problematic.

Tip 2) Deuteranope Simulation



Tip 2) Protanope Simulation



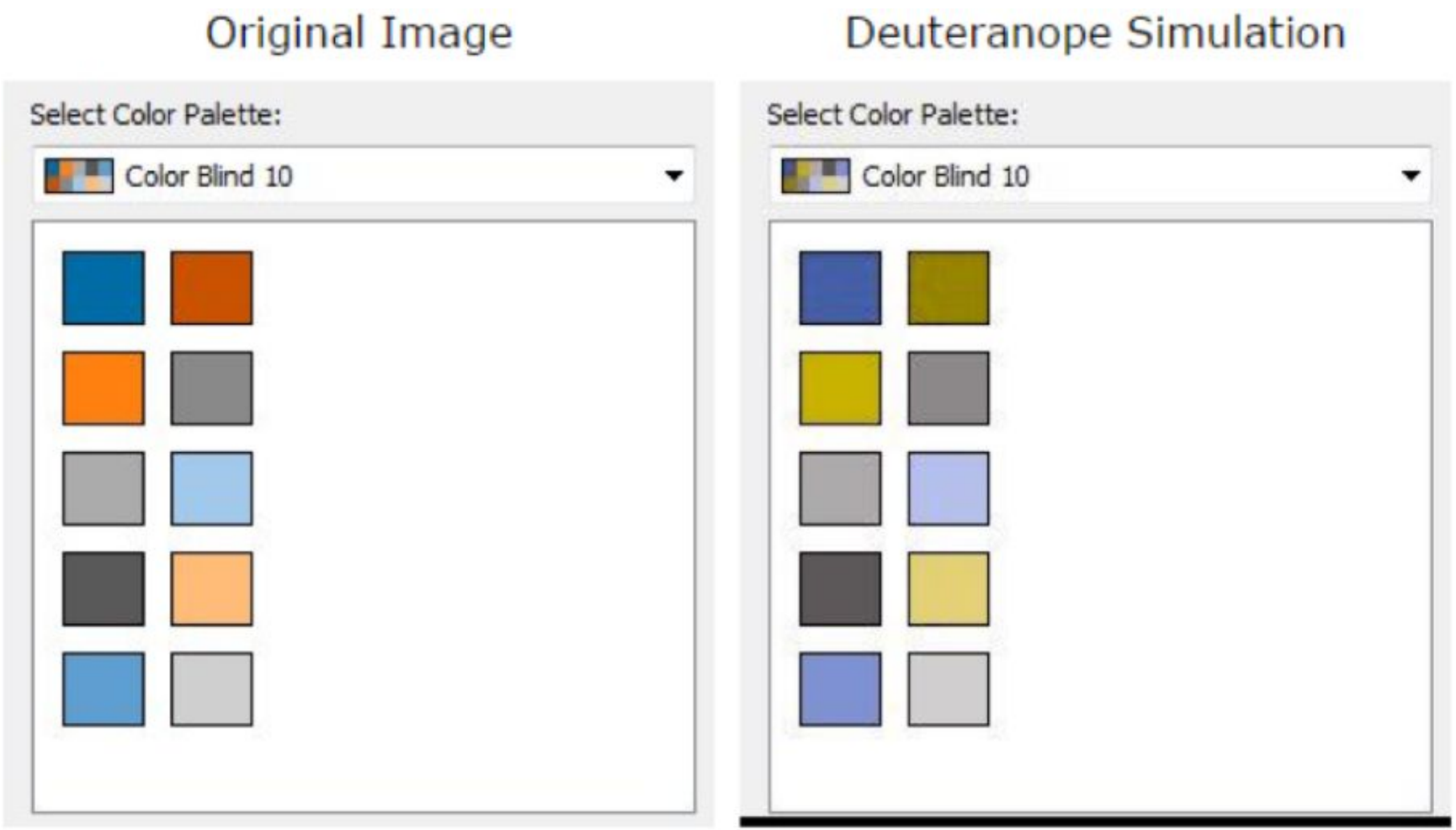
Tip 3) CVD-friendly Palette

- One color combined with another color is generally fine
  - when one of them is not usually associated with CVD

- For the most common conditions of CVD
  - **blue** would generally look **blue**
  - **Examples:**
    - **blue/orange** is a common CVD-friendly palette
    - **blue/red** or **blue/brown** would also work

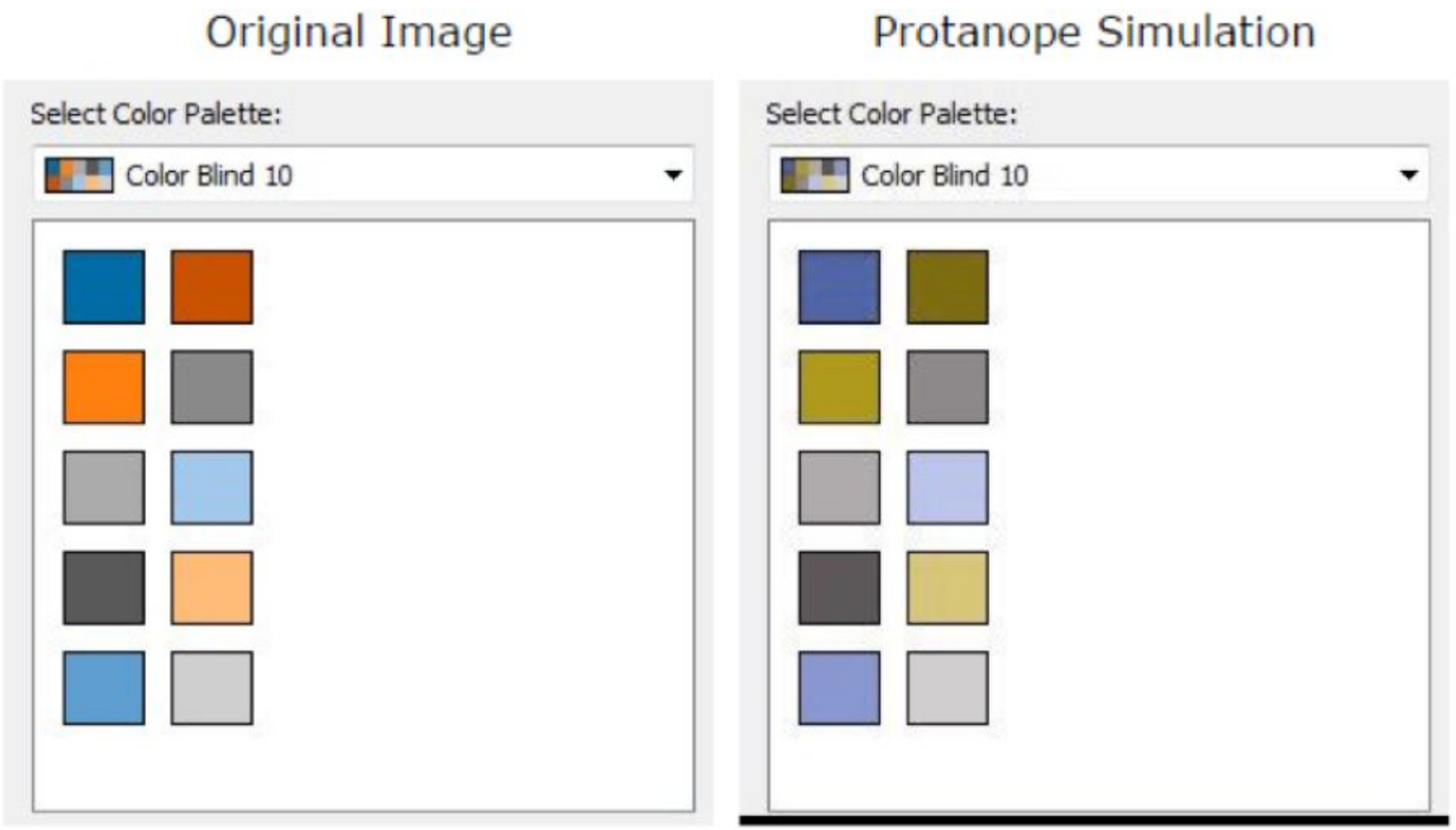
Tip 3) Deuteranope-friendly Palette

Deuteranope = green-blind



Tip 3) Protanope-friendly Palette

Protanope = red-blind



Tip 4-a) Leverage Light vs. Dark

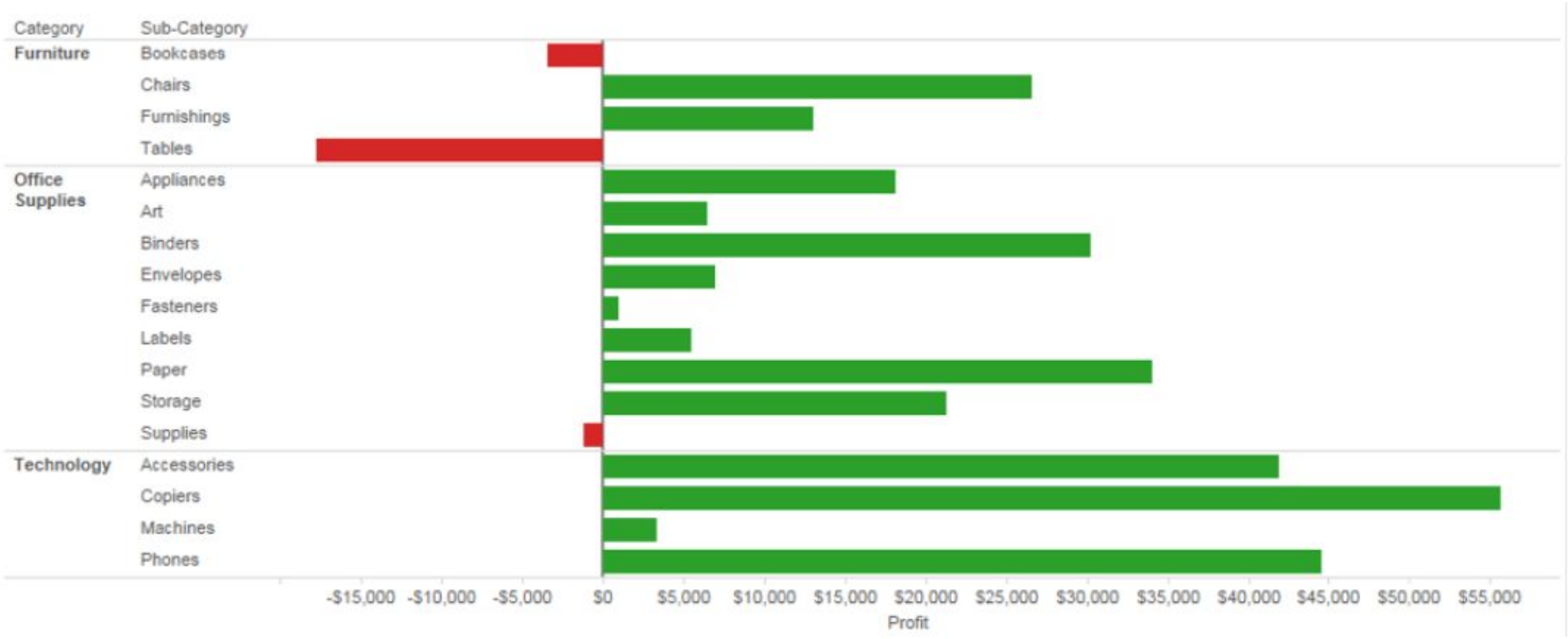
- The problem with **CVD** is **red vs. green** and not **light vs. dark**.

- Almost anyone can tell the difference between:
  - **very light color** and **very dark color**

- To use red and green together, we can use:
  - **light green**
  - **medium yellow**
  - **very dark red**

- Someone who has strong **CVD:**
  - would see as a **sequential color scheme**
  - would at least be able to distinguish based on **light vs. dark**

Tip 4-b) Stand Each Color Alone

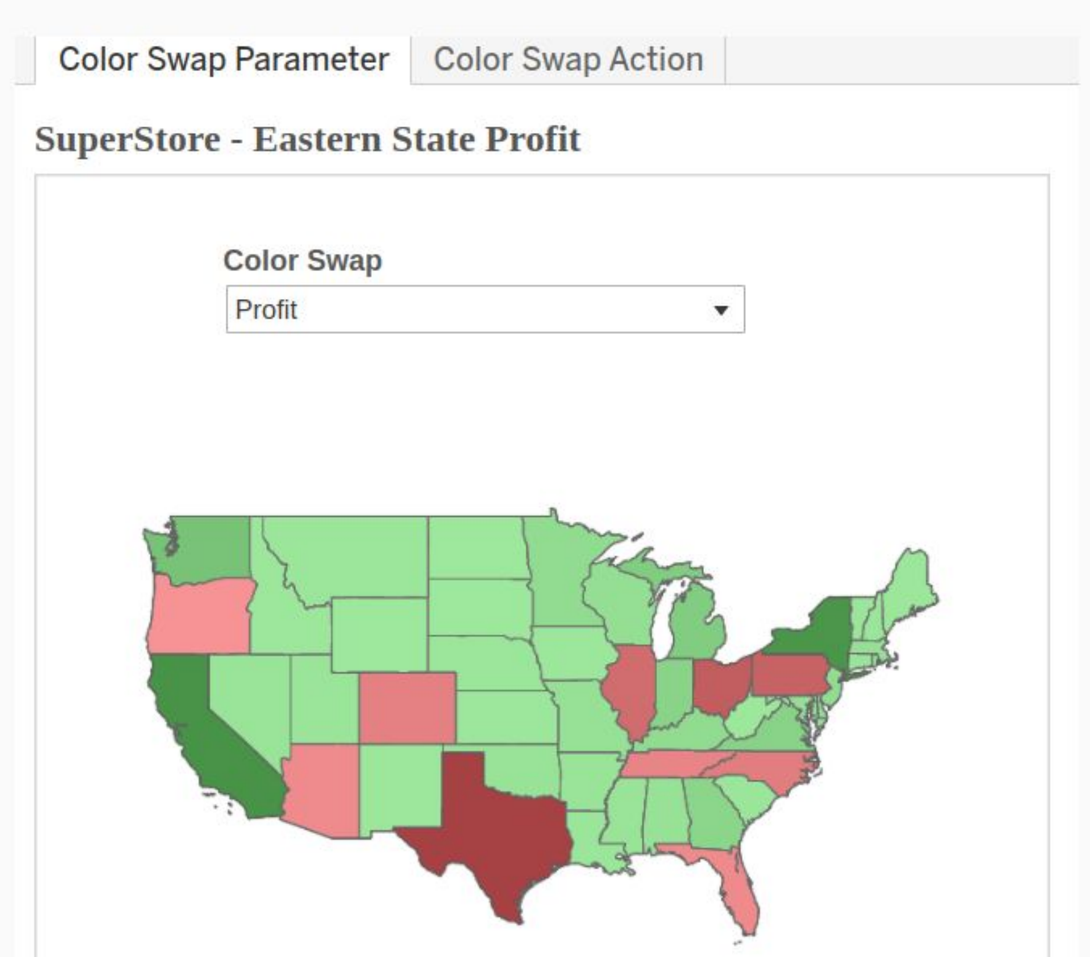


Tip 4-c) Alternate Distinguishing Methods

- Add indicators to allow to see that something is bad (red) vs. good (green), such as:
  - icons
  - directional arrows
  - labels
  - annotations
  - other indicators

Tip 4-d) Use a UI element to Switch Color Palette

- Use a checkbox (or similar GUI) to switch the color palette to **CVD-friendly Palette**

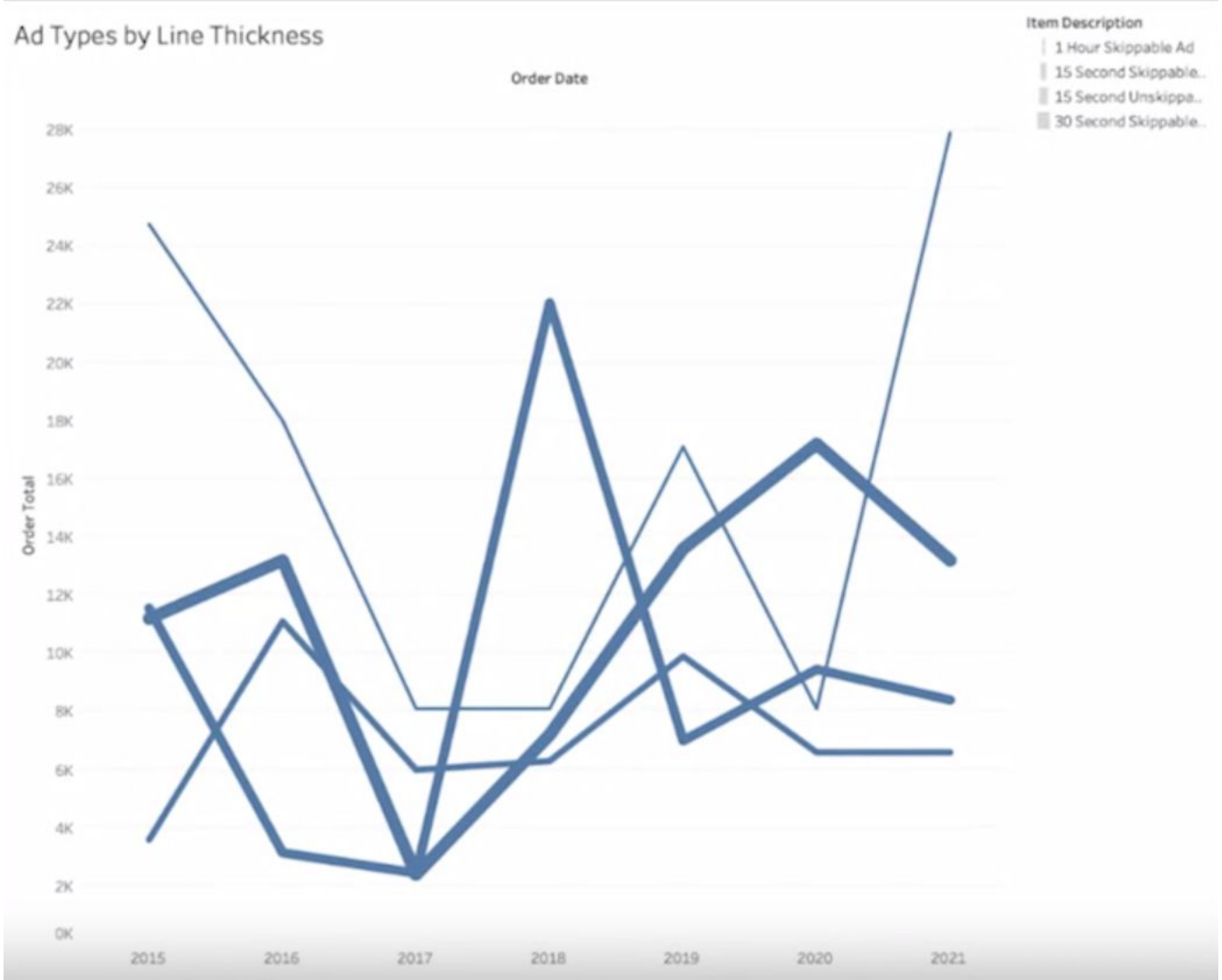


Accessibility for CVD Examples

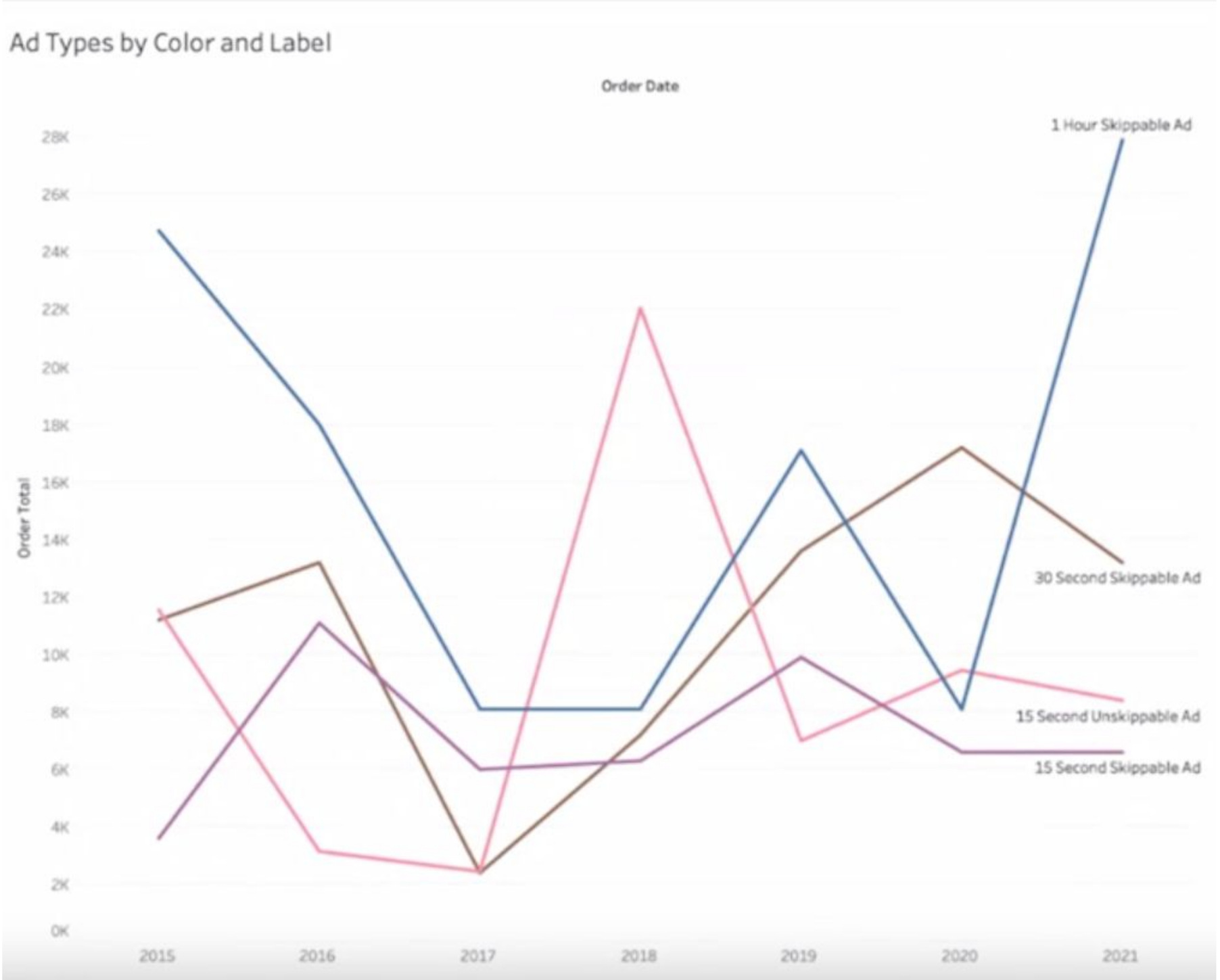
Colors

Ad Types by Color
Order Date
Item Description
1 Hour Skippable Ad
15 Second Skippable ..
15 Second Unskippa..
30 Second Skippable ..
Order Total
28K
26K
24K
22K
20K
18K
16K
14K
12K
10K
8K
6K
4K
2K
0K
2015
2016
2017
2018
2019
2020
2021

Lines Thickness

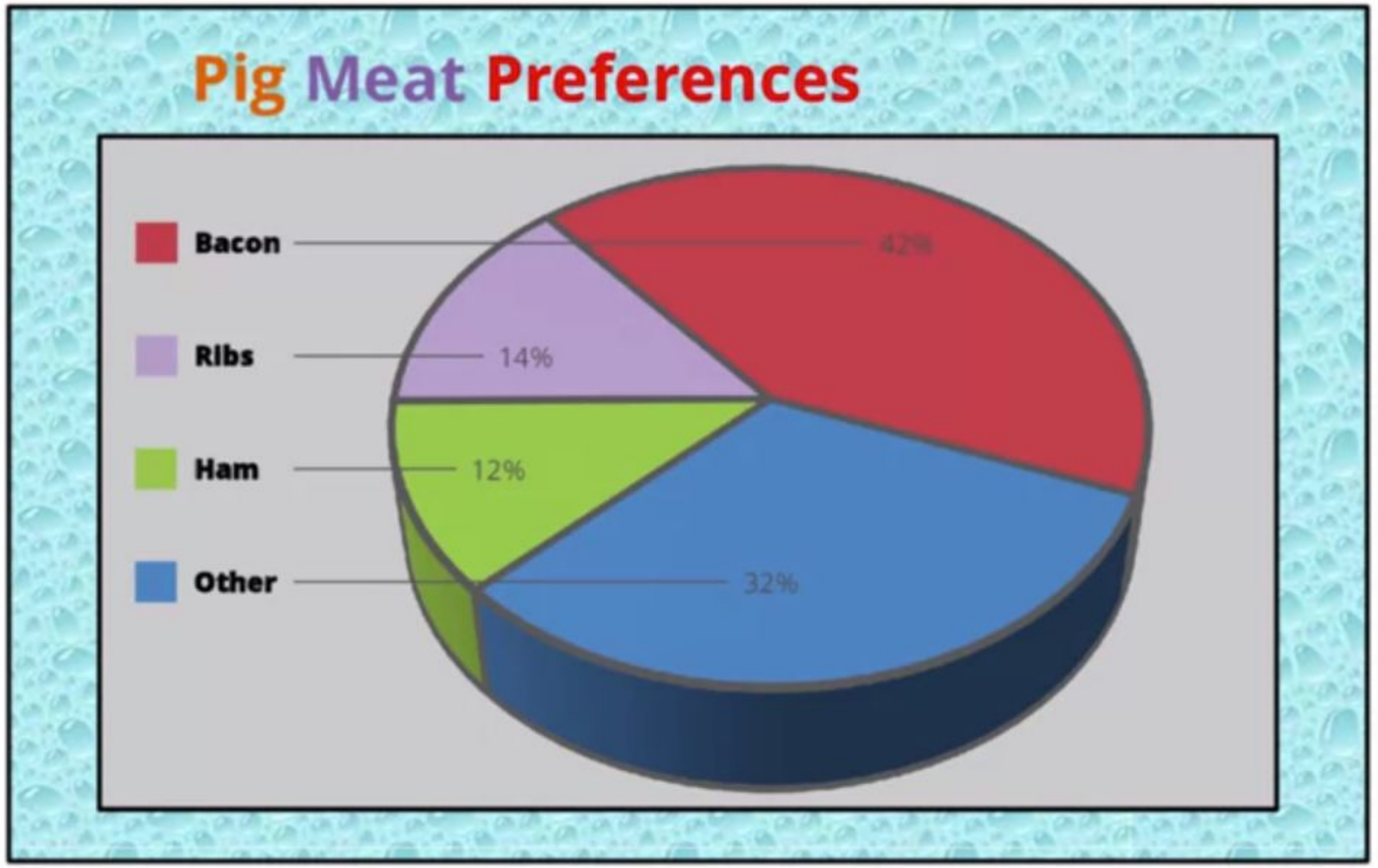


Colors and Labels

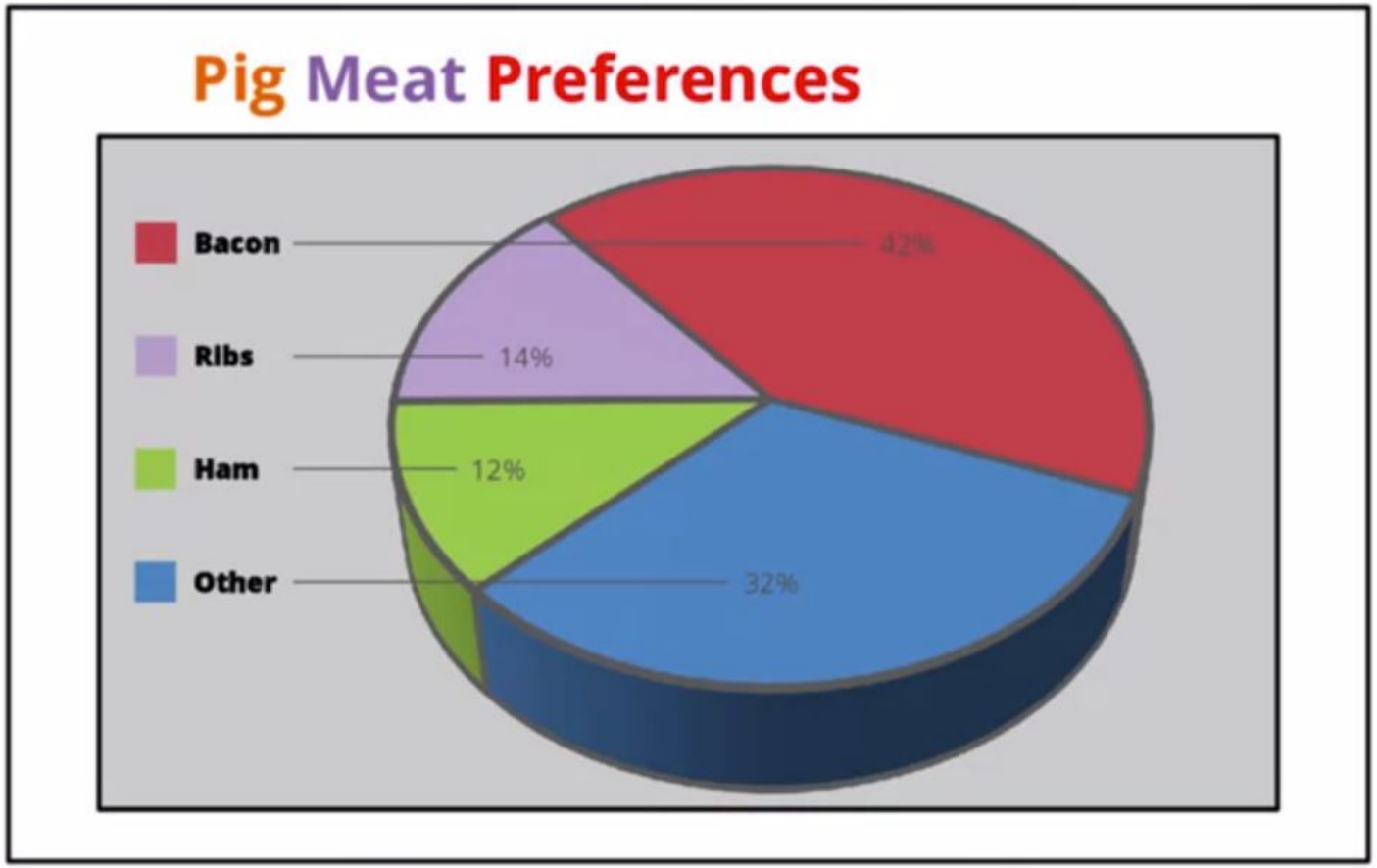


Visualization Example

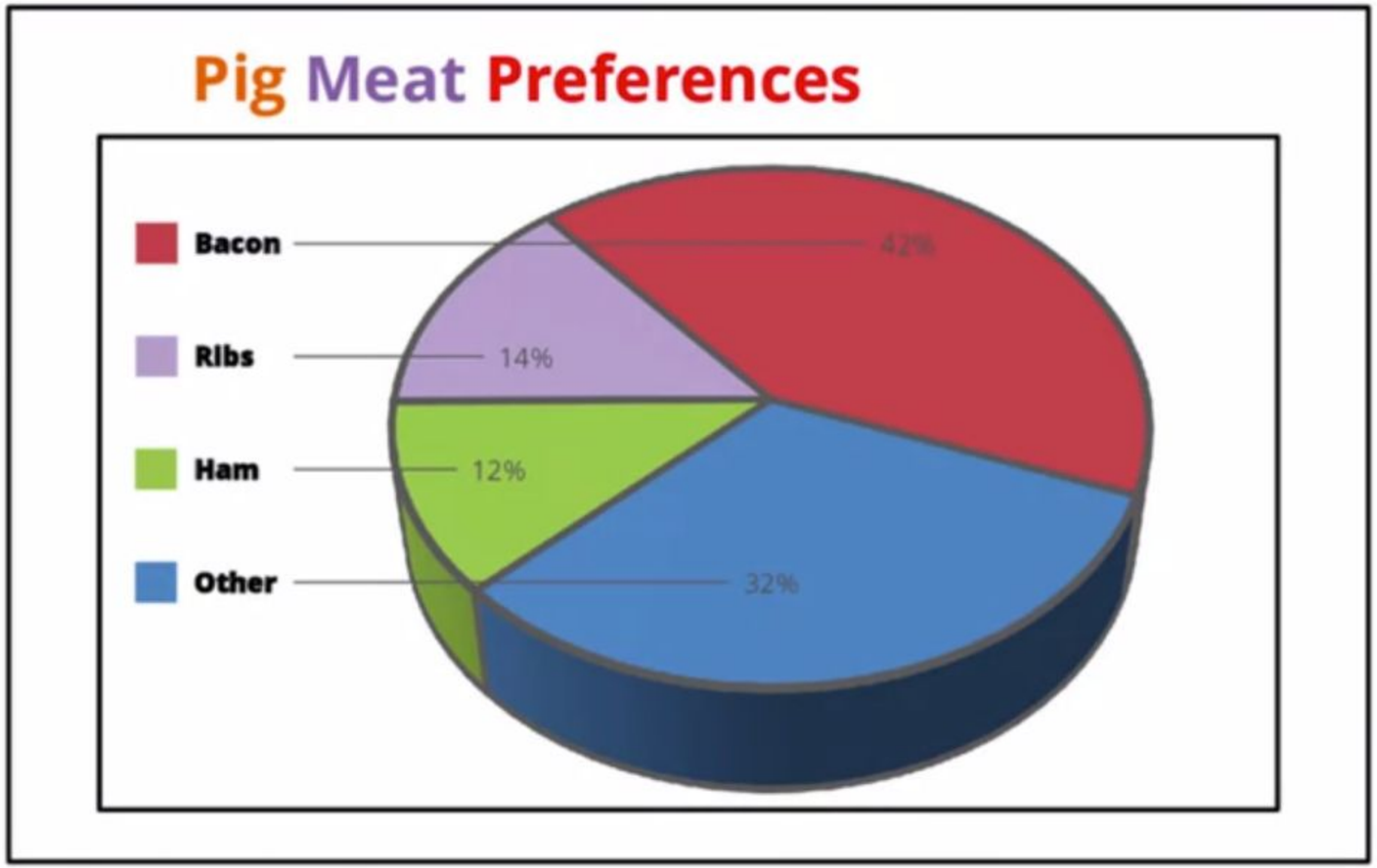
Visualization Example (1/12)



Visualization Example (2/12)



Visualization Example (3/12)



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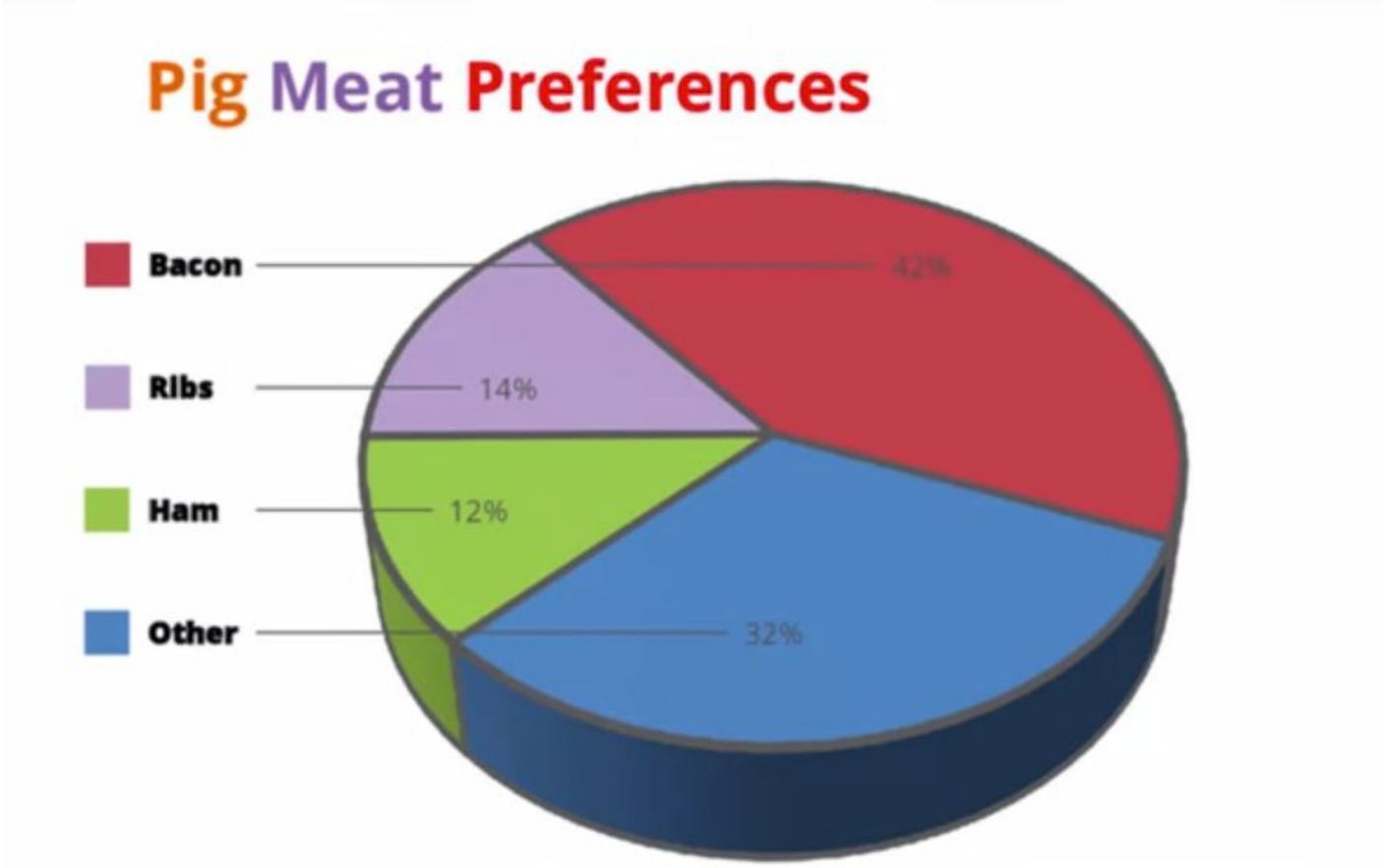

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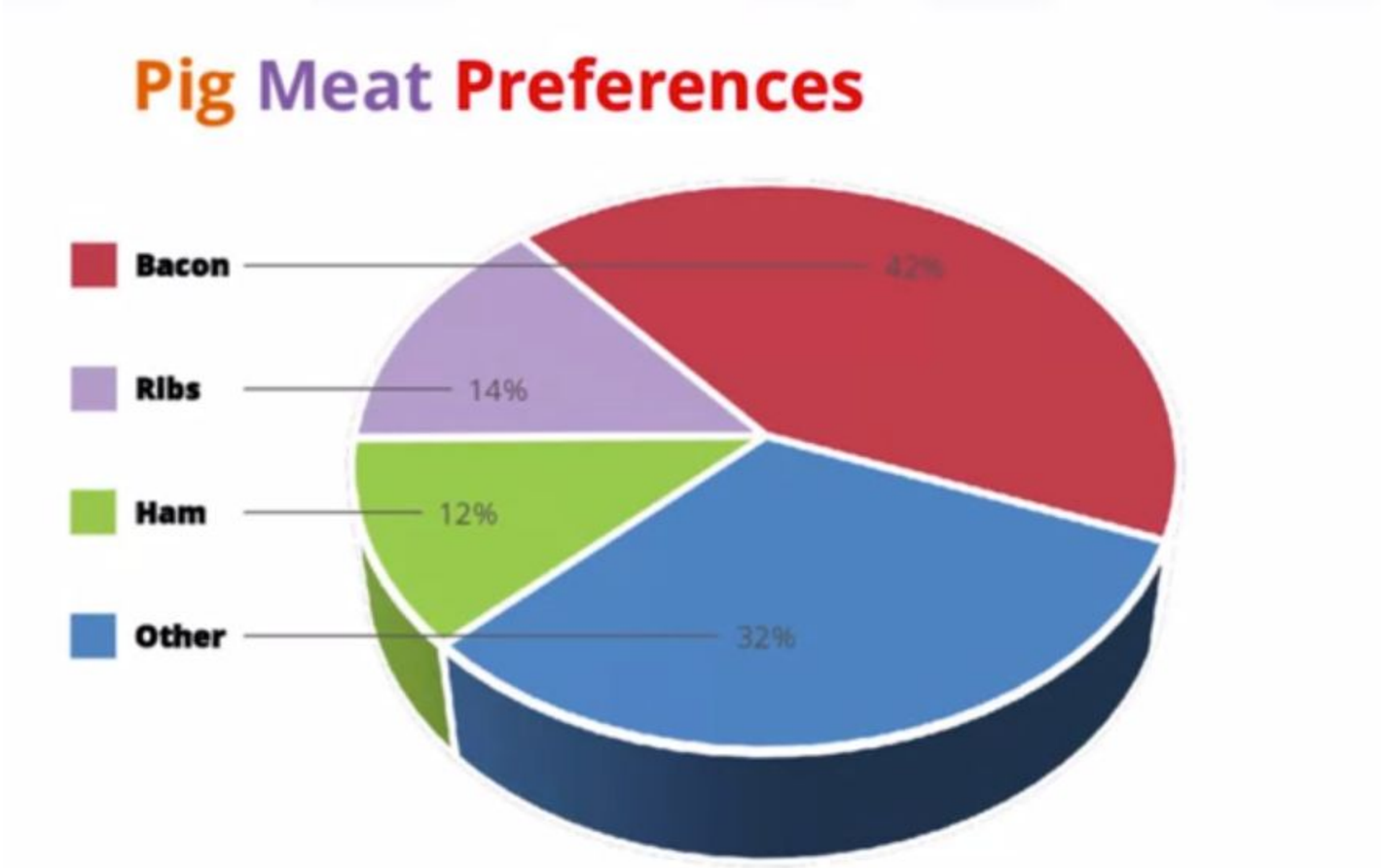

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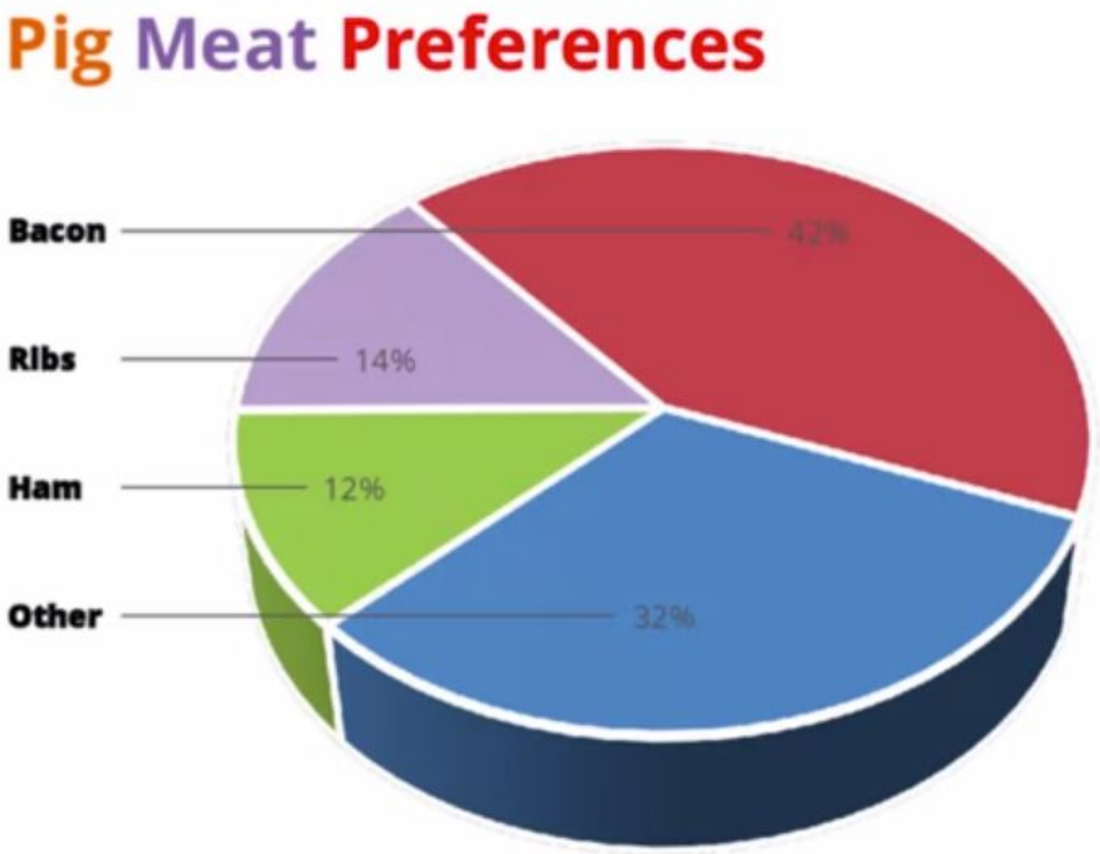

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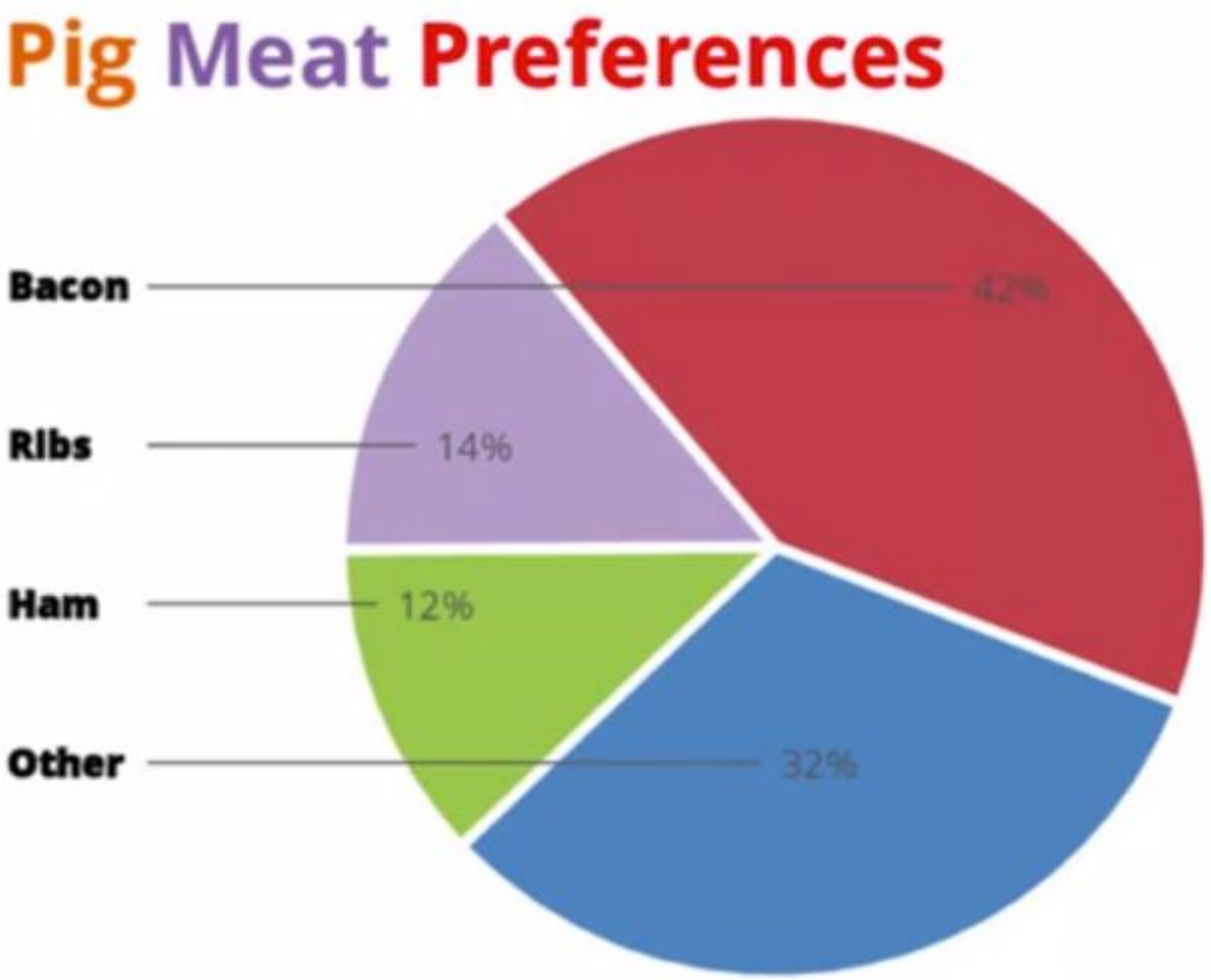

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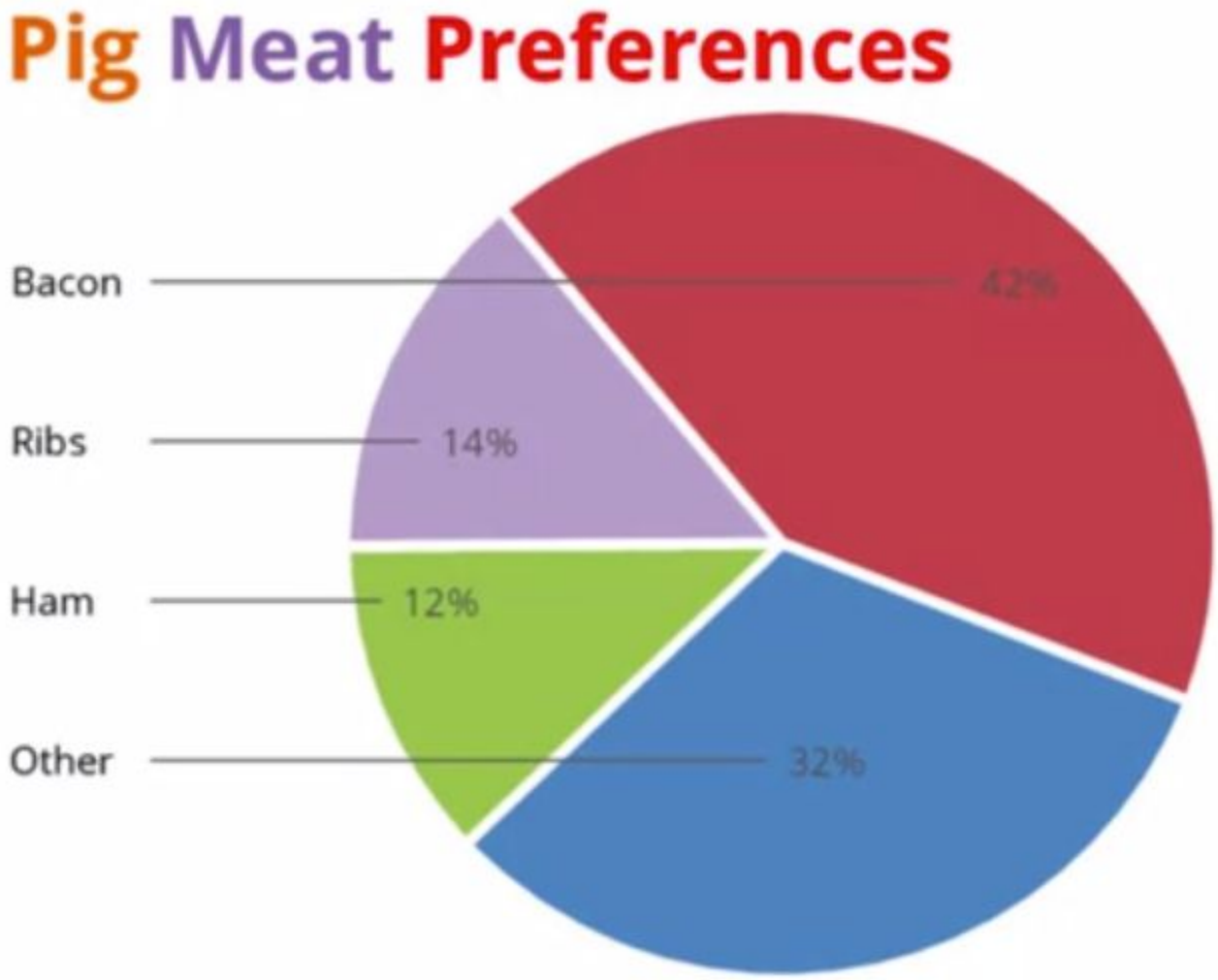

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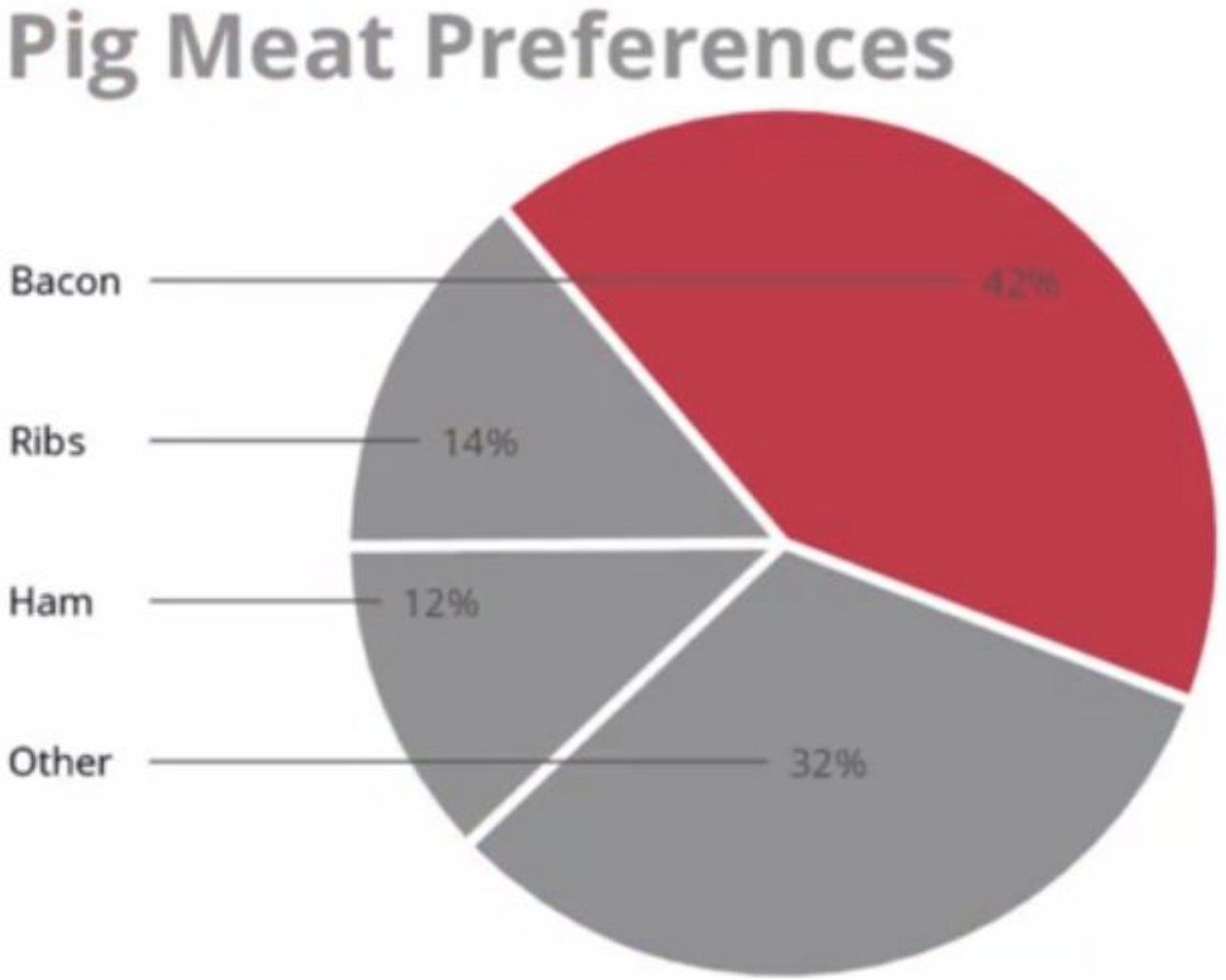

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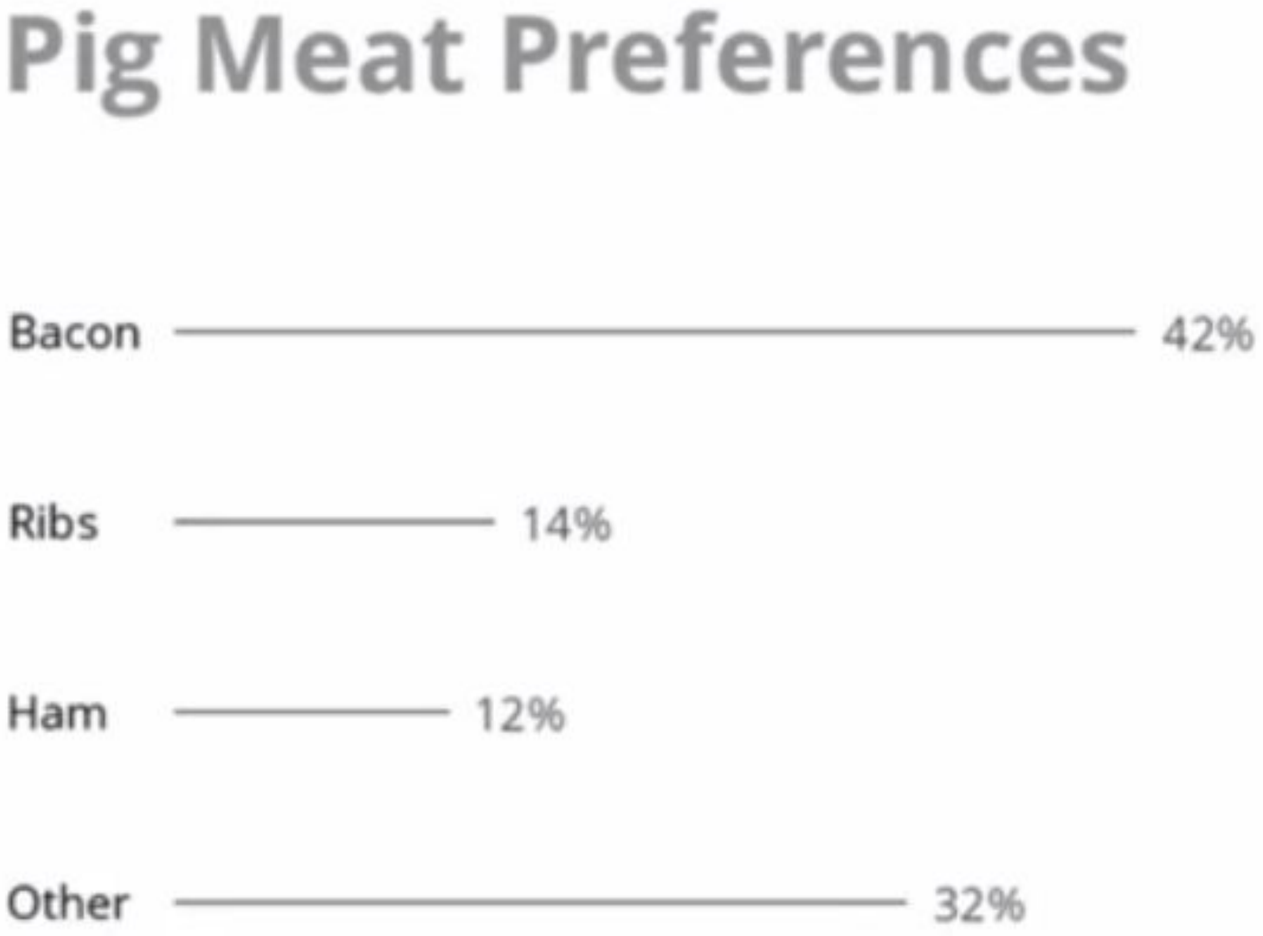
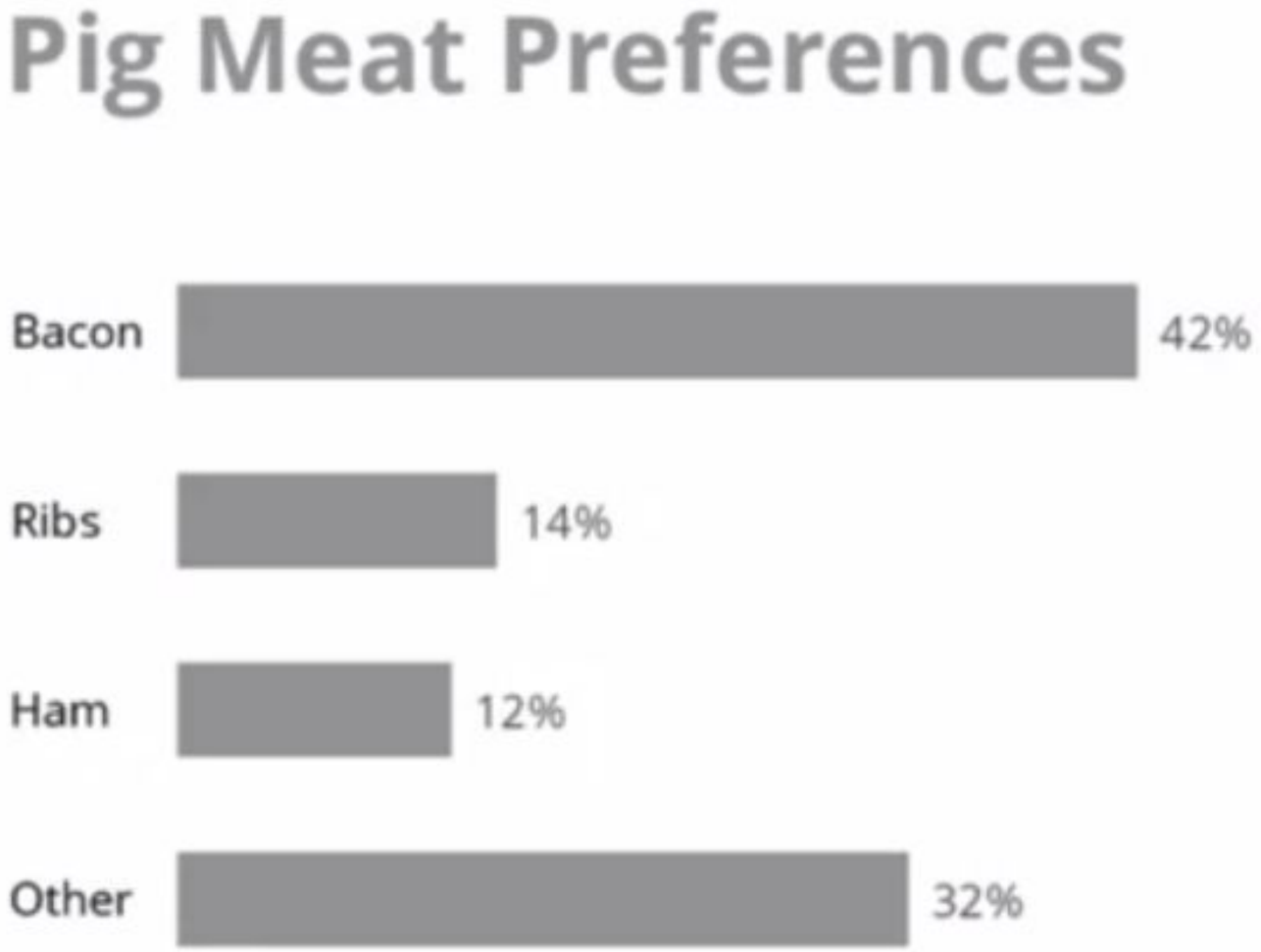
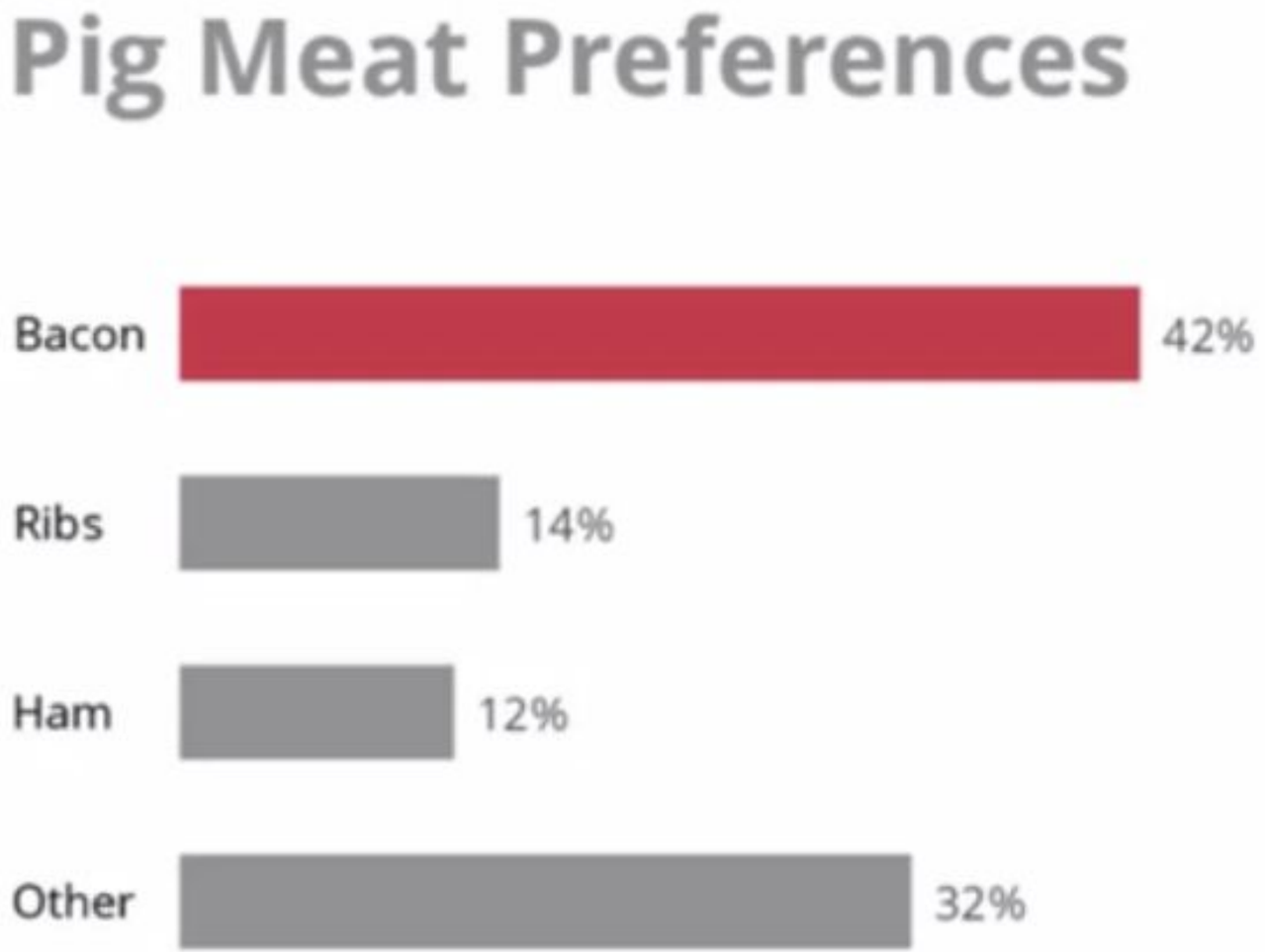


Visualization Example (11/12)

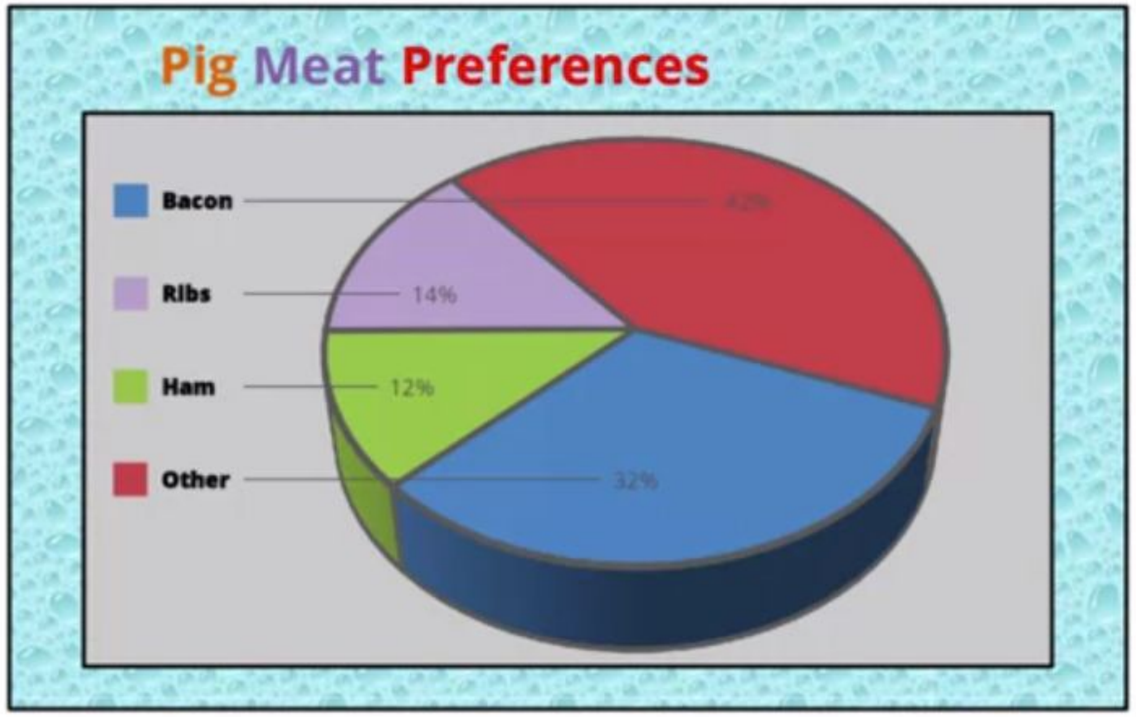


Visualization Example (12/12)

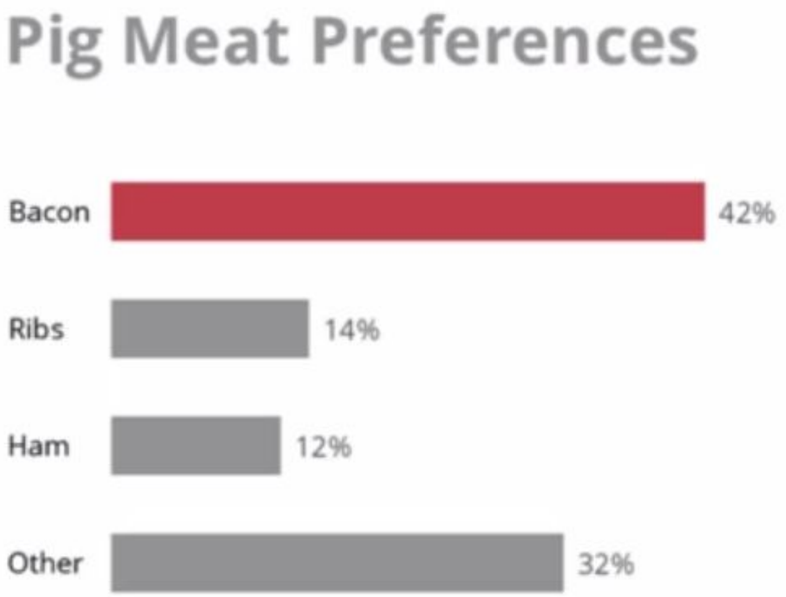


Visualization Example: Can it be enhanced more?

Before



After



Can we enhance it more?

Coursera Data Visualization Course

Coursera Data Visualization Course Link

https://www.coursera.org/learn/python-for-data-visualization?specialization=ibm-data-science

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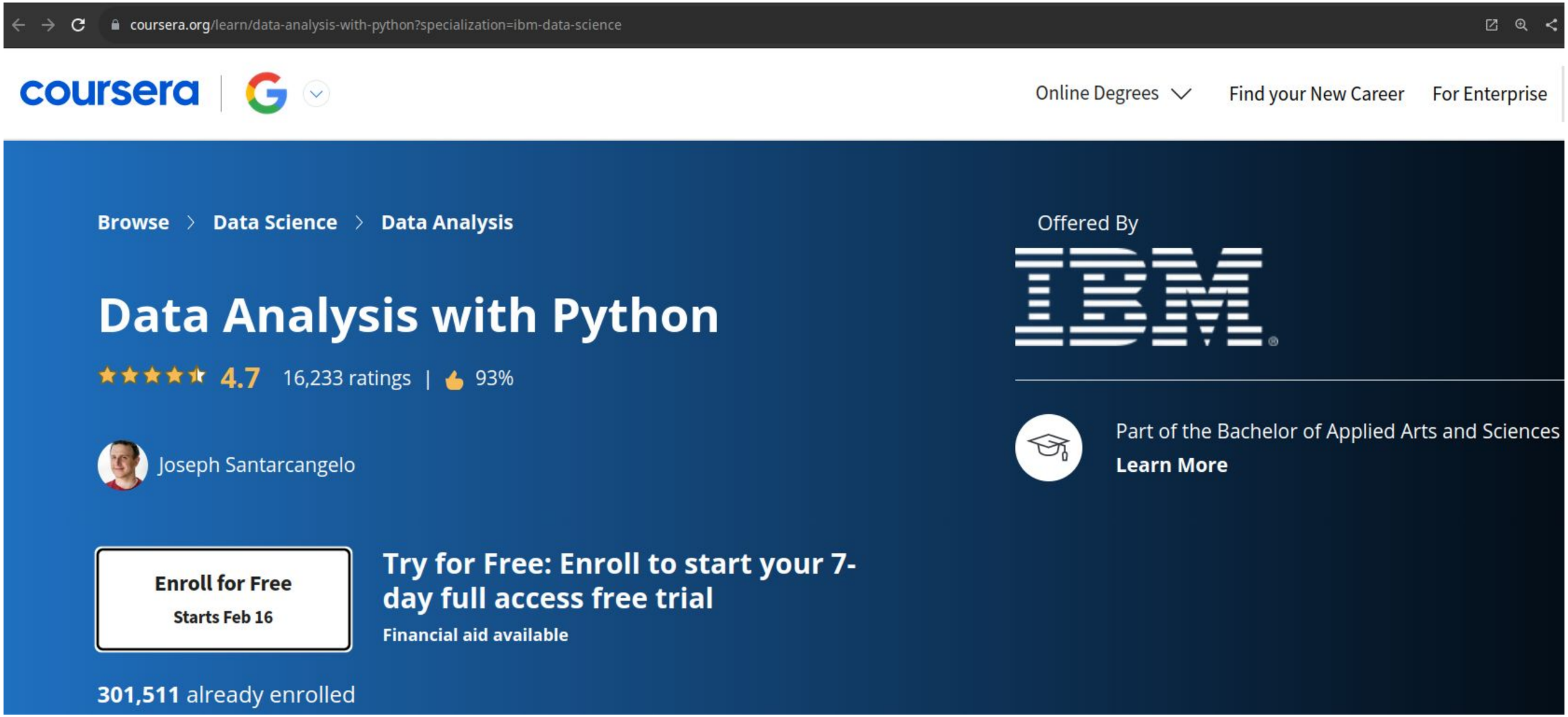

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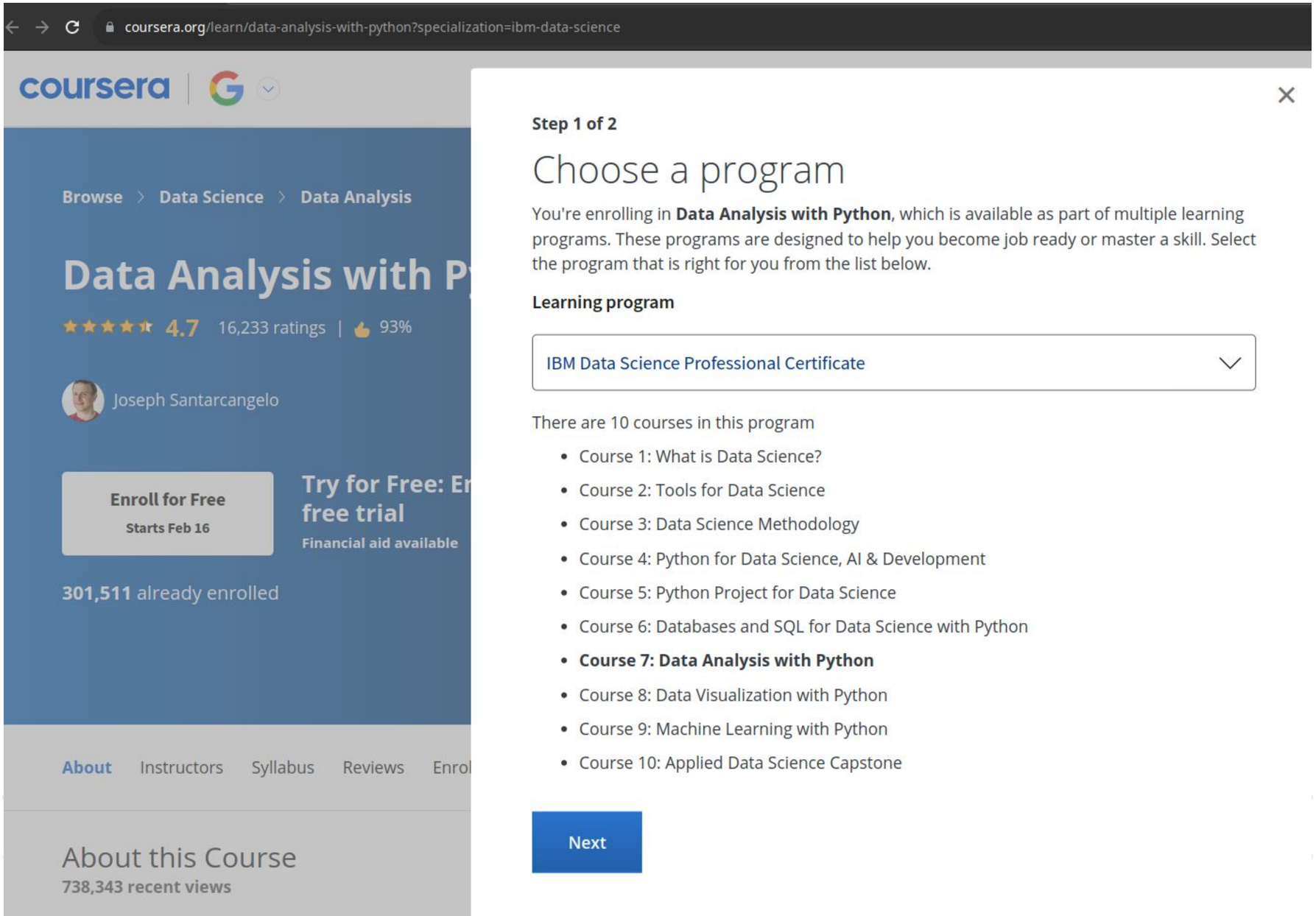

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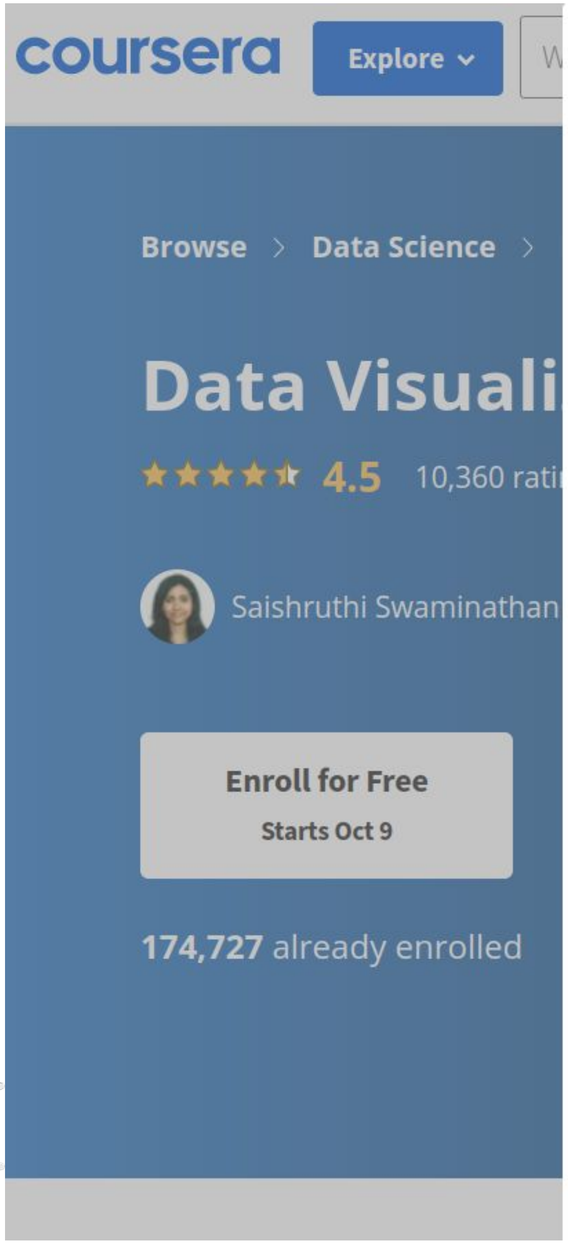

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Questions

Links

https://github.com/fcai-b/dv

References

1. https://www.tableau.com/about/blog/examining-data-viz-rules-dont-use-red-green-together
2. https://www.coursera.org/learn/foundations-data
3. https://www.coursera.org/learn/what-is-datascience