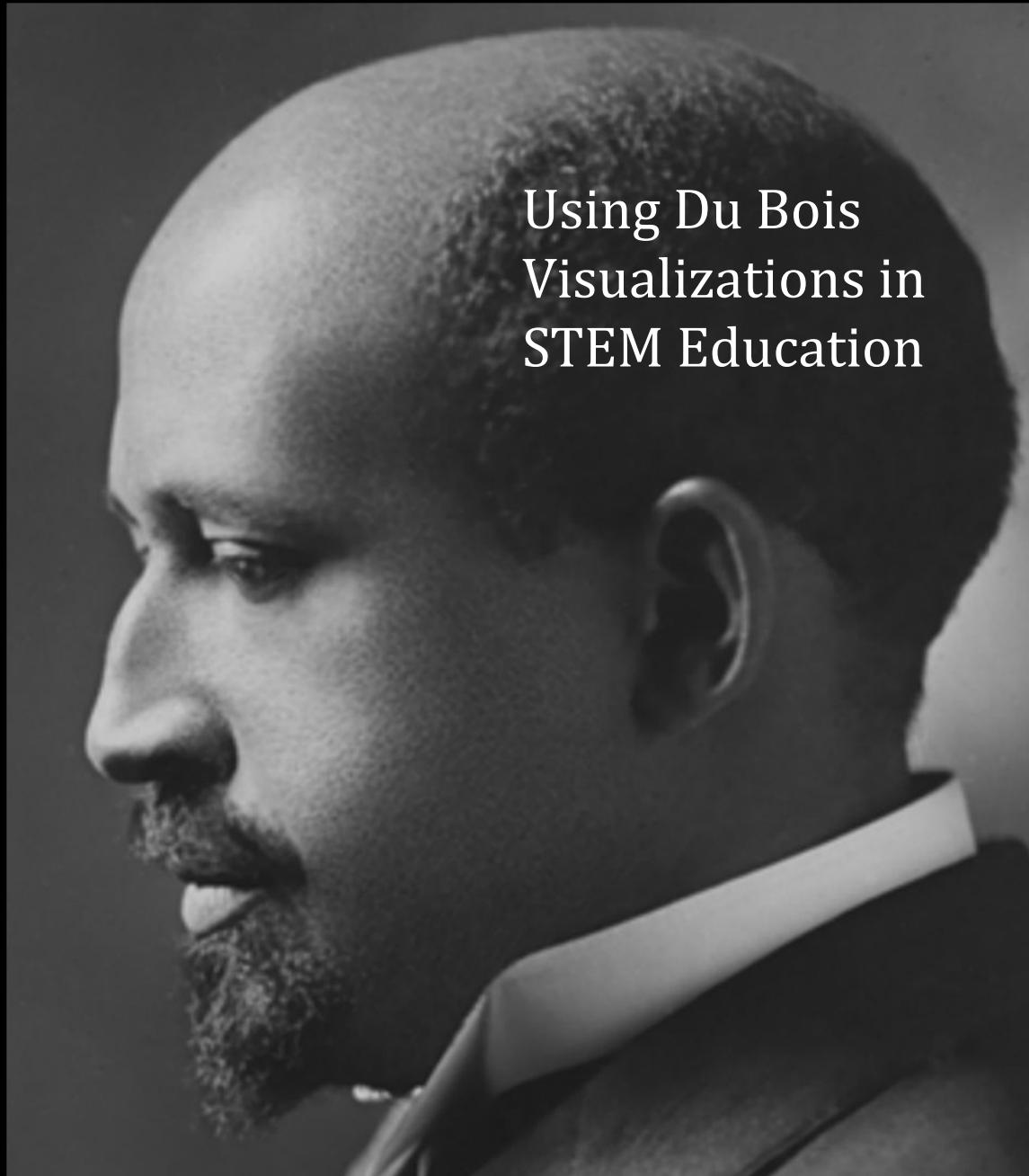


Du Bois SERVE Project



Using Du Bois Visualizations in STEM Education

Module Outline

The goal of this module is to introduce pioneering visuals created by W.E.B. Du Bois and explore the role of data visualization in STEM-related education. The visuals are studied—by deconstruction and re-creation—while placing them in their historical context to showcase how data stories can be empowering.

Sections:

Context

Explain the motivation of the Du Bois visuals in a historical context.

Explore

An analog exercise to analyze and re-create Du Bois visuals using hand-drawn methods.

Implement

Re-create Du Bois style visuals using digital tools.

Context



Context: Background

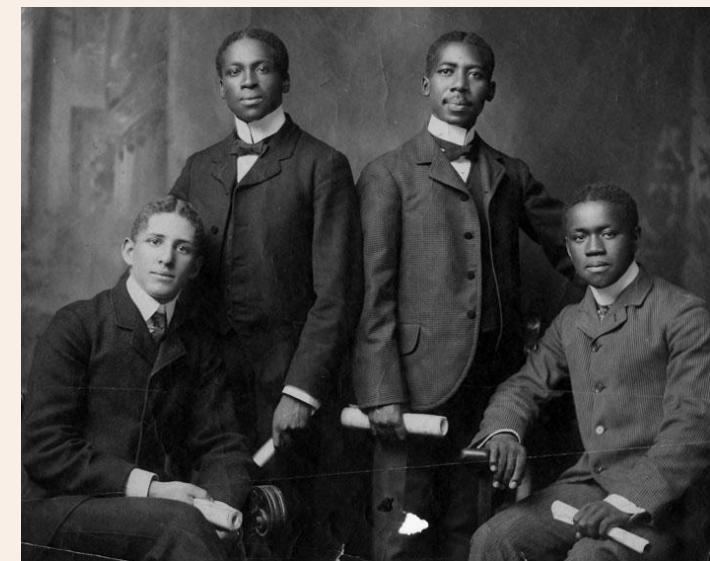
The motivation for creating the visuals designed and created by Du Bois and his collaborators was to tell, on a world stage, the state and progress of Black Americans 35 years after emancipation from slavery — a counter narrative to pseudo-scientific methods that perpetuated racist misbeliefs about Black people and other people of color.



[Thomas J Calloway, organized the “Exhibition of the American Negro”](#)



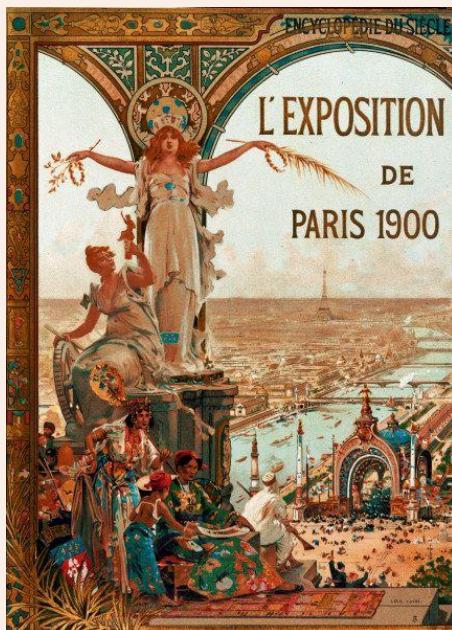
[Du Bois in Paris, 1900](#)



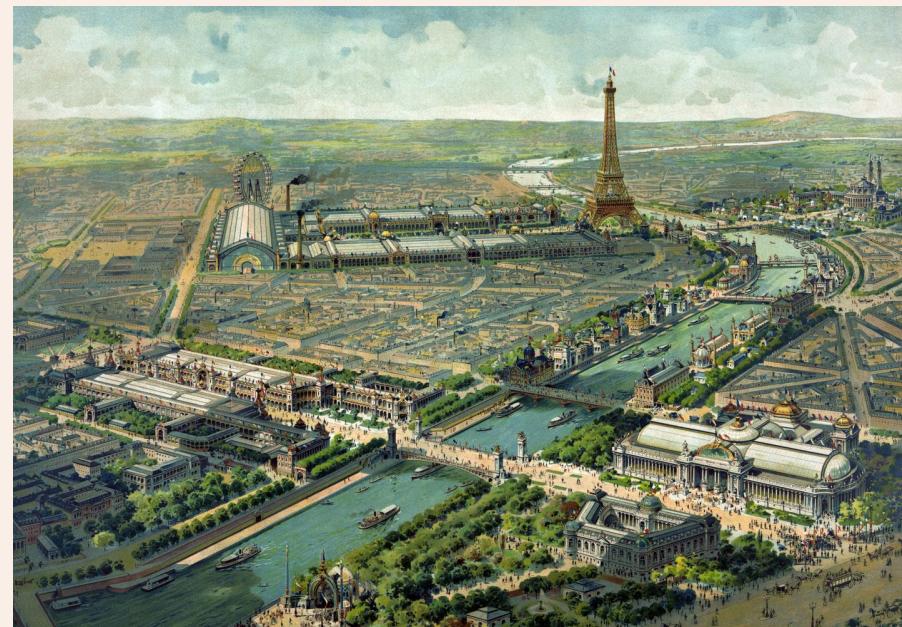
[Atlanta University Students, ca. 1900](#)

Context: 1900 Paris Exposition

The Exposition Universelle of 1900 was the venue for Du Bois to tell a more accurate and empowering story of Black Americans on an international stage.



Exhibition Poster

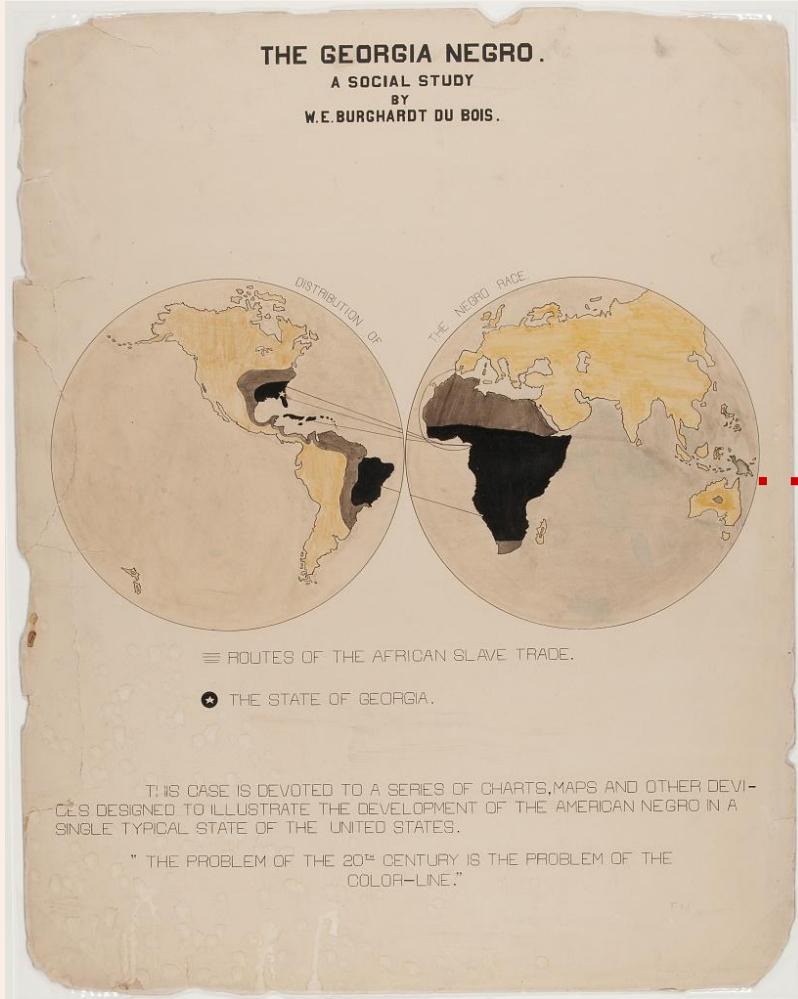


Paris, 1900



Exhibition of the American Negro

Context: The visuals

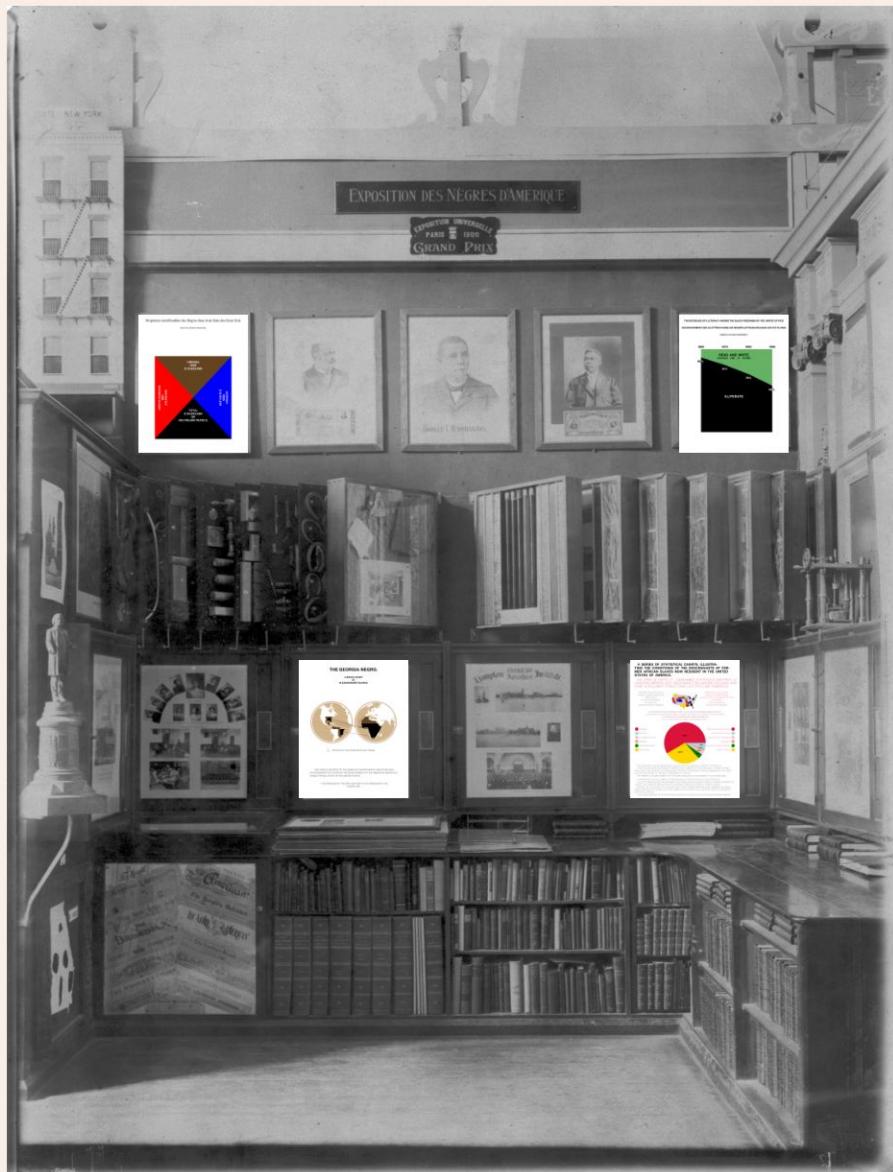


The visuals were hand-drawn using pen, ink and paint on 22x28 in. poster board



The venue shows the visuals as posters to be viewed and other materials may be “flipped through”.

Context: Questions for Discussion



Exhibition of the American Negro

Why do you think Du Bois created a series of graphs and data visualizations of Black life for the exposition?"

Why visualizations instead of a written report?"

What effect did the venue have on the design of the visuals?

Context: Five Years Before Paris

What events were occurring in the world that informed the visuals created for the 1900 Paris exposition?

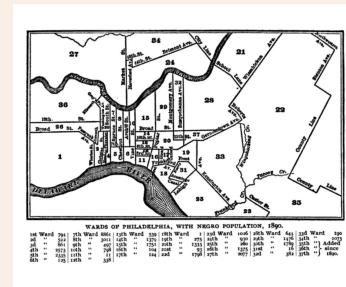
[Black America Fair](#)



[Plessy v. Ferguson](#)



[The Philadelphia Negro](#)



[Wilmington Insurrection](#)

A WHITE MAN'S DAY.
Eight to Ten Thousand People Out.
TILLMAN MAKES A GREAT SPEECH FOR DEMOCRACY
Yesterday was a great day for Fayetteville and all this Cape Fear country. It was the occasion of the speaking in behalf of the restoration of white rule in North Carolina by Senator Ben R. Tillman, the Liberator of South Carolina.

RAGING GEORGIA MOBS LYNCH THREE NEGROES
Sam Hose, Preacher Strickland and Albert Sewell Met Horrible Deaths Near Palmetto.
The First Was Burned at the Stake and Cut to Pieces, the Second Marilyness Hacked and Hanged and the Third The Whole State Is in a Ferment, Public Sentiment Justifies The Horrors and Massacres.

1895

1896

1897

1898

1899

Context: References

Paris Exposition of 1900 (Exposition Universelle)

[https://en.wikipedia.org/wiki/Exposition_Universelle_\(1900\)](https://en.wikipedia.org/wiki/Exposition_Universelle_(1900))

Black America, 1895

<https://publicdomainreview.org/essay/black-america-1895>

Plessy v. Ferguson

<https://www.britannica.com/event/Plessy-v-Ferguson-1896>

The Philadelphia Negro

https://www.google.com/books/edition/_/sqwJAAAAIAAJ

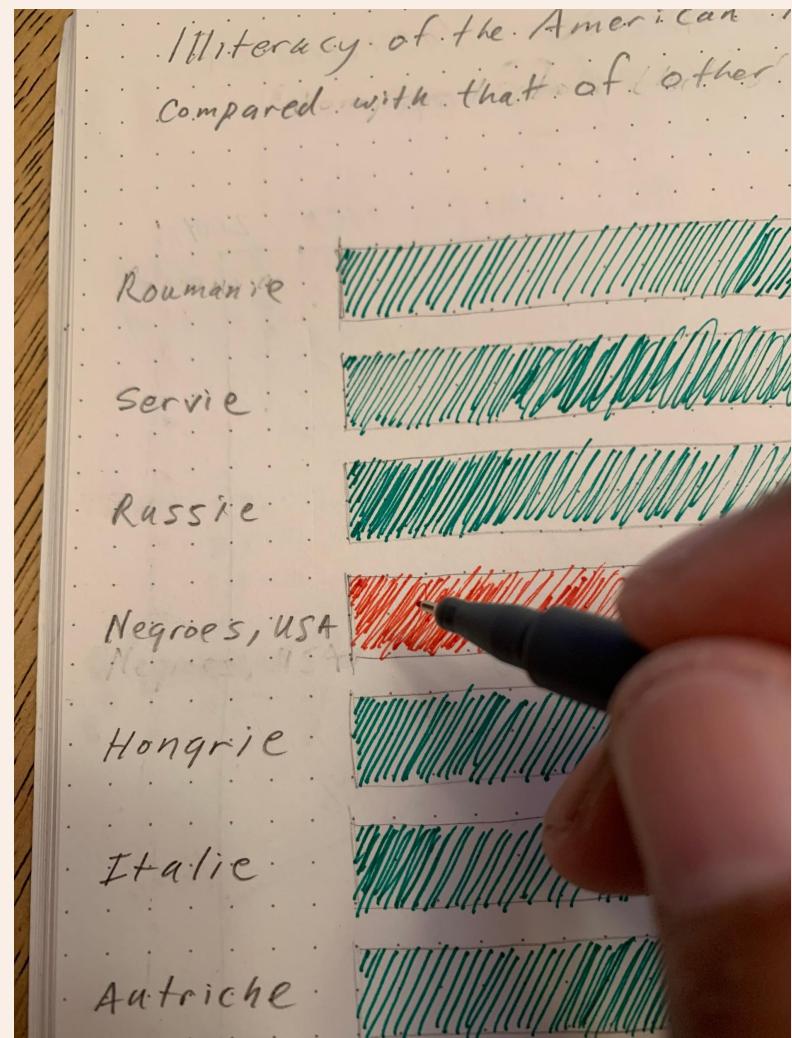
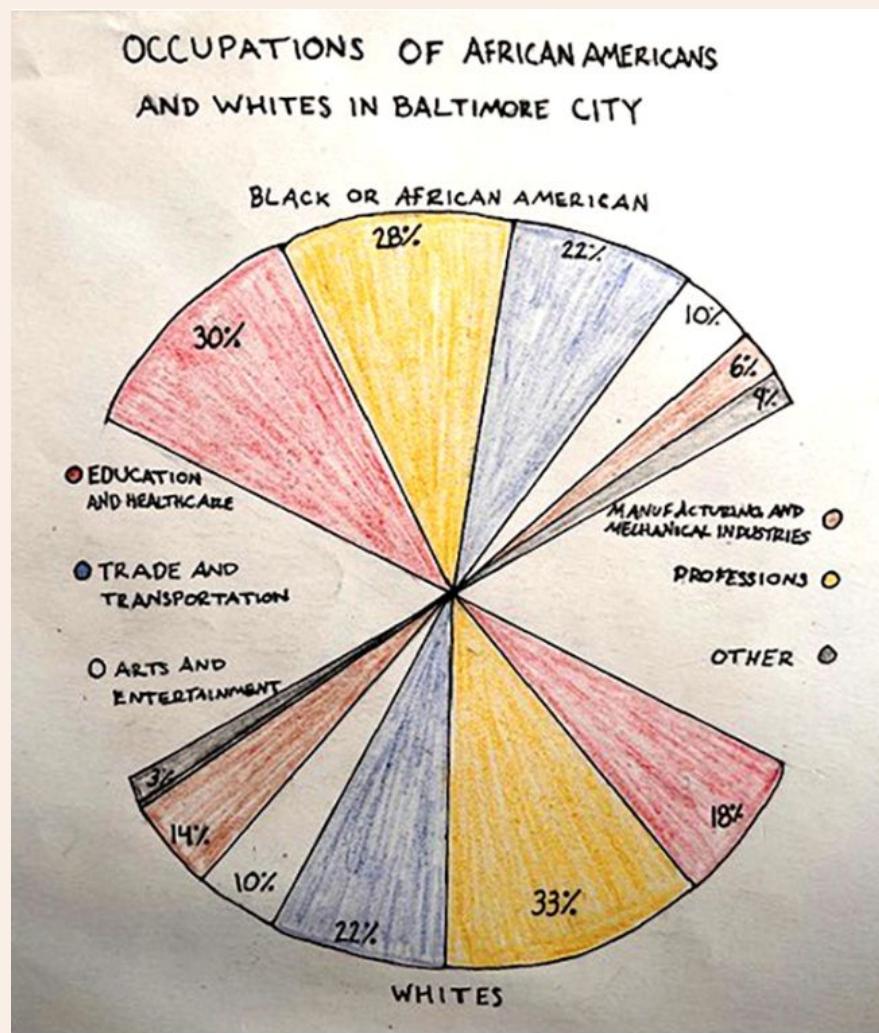
Wilmington Insurrection of 1898

https://en.wikipedia.org/wiki/Wilmington_insurrection_of_1898

The Lynching of Sam Hose

https://en.wikipedia.org/wiki/Lynching_of_Sam_Hose

Explore



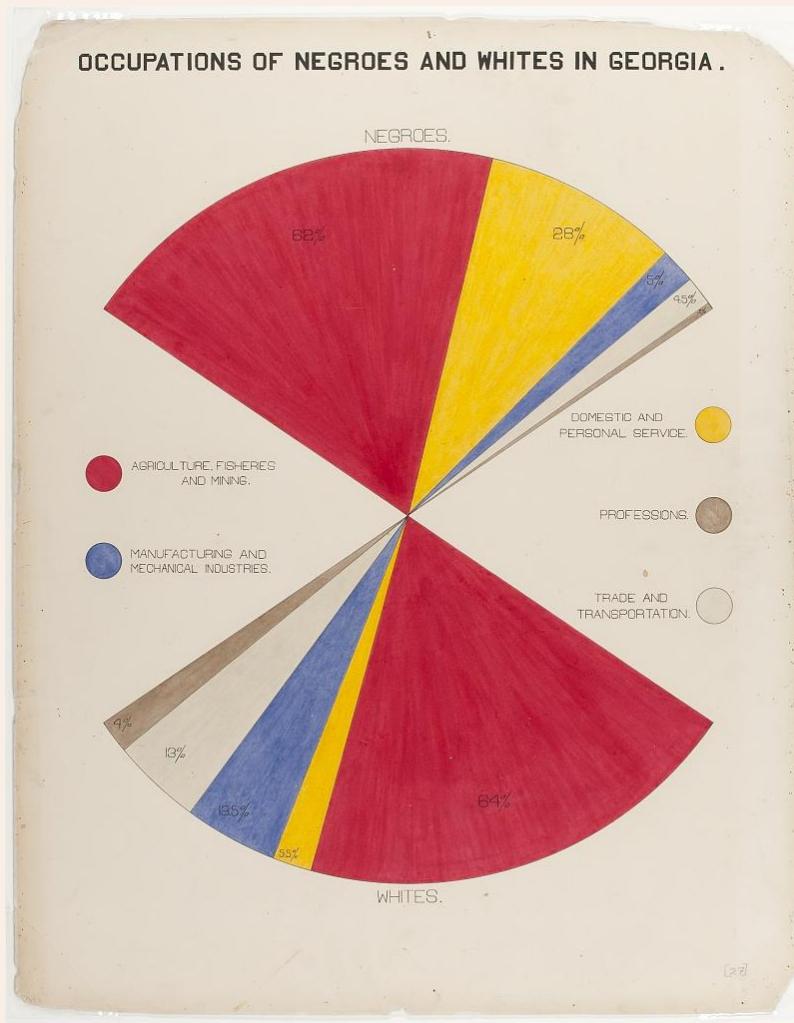
Explore

This section is a hands-on session that takes sample Du Bois visualizations, and reconstructs and analyzes various aspects of the visual.

The exercise aims to recreate sample visuals using hand-drawn methods similar to those used by Du Bois and his collaborators (pens, paper, markers, etc.), to immerse you in the act of creation, while thinking about the context and messaging. Rapid iteration and peer review may be used to gauge effectiveness of the visual.

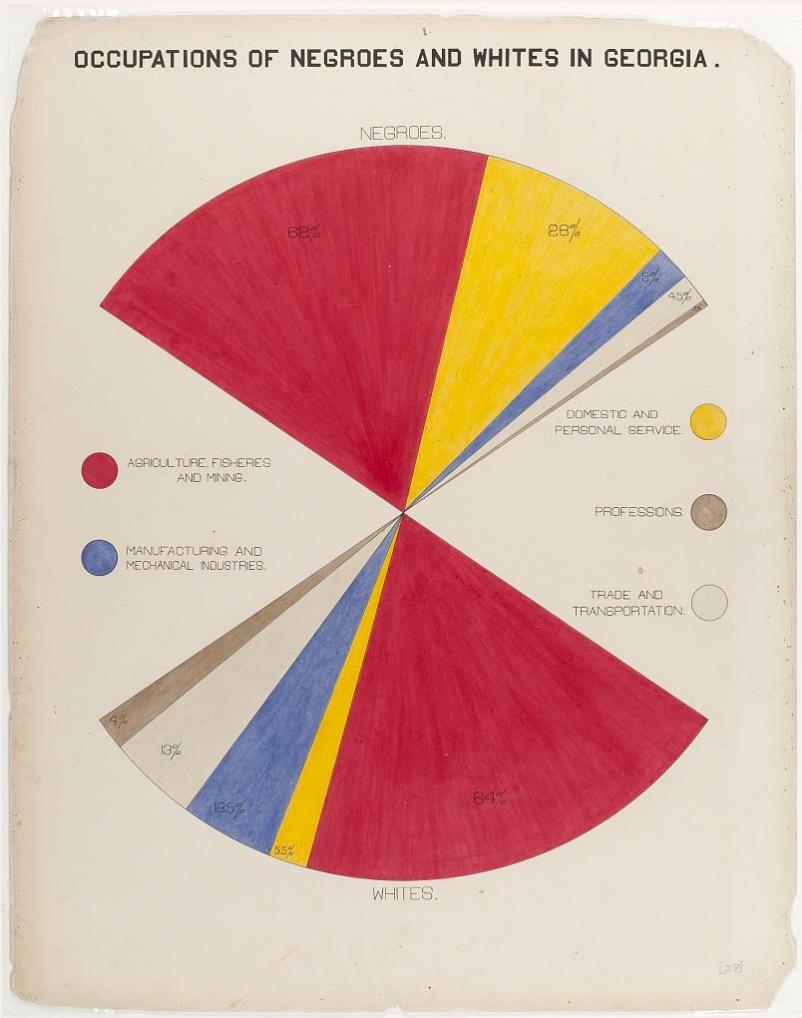
The final part of the exercise is drawing with modern data.

Explore example 1:



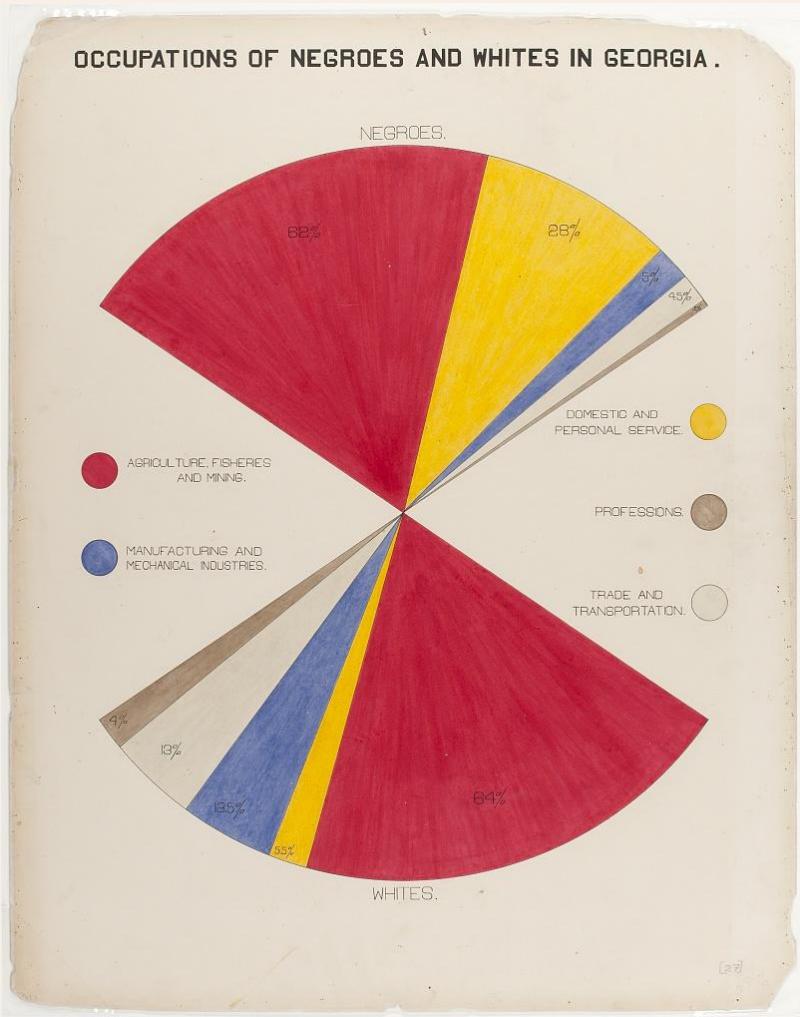
Occupations of Negroes and Whites in Georgia

Explore: Outline



- Message and Audience
- Analytical methods
- Aesthetics/design
- Chart Types

Explore: Message

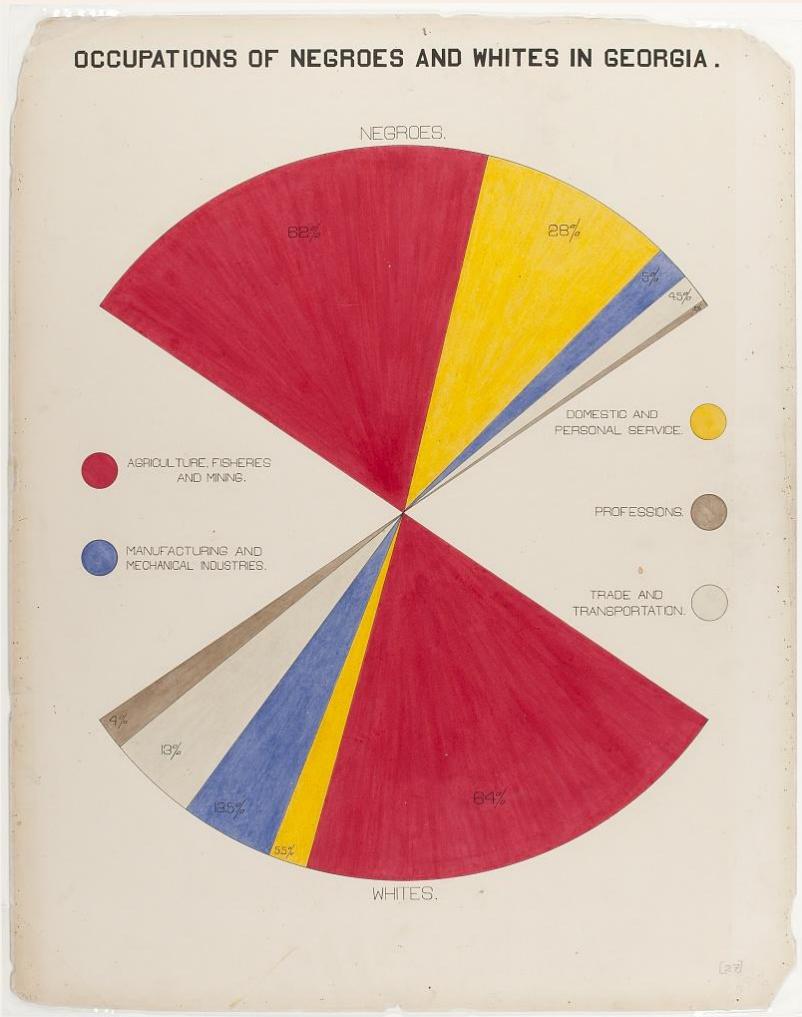


The message of the visual is tied to the overall message from Du Bois at the Paris Exposition:

Describe the status and progress of Black Americans since emancipation, and provide an alternative narrative to the racist views held at the time.

The visual compares the occupations of Black and White populations of Georgia, showing parity for some occupations, while highlighting differences for others.

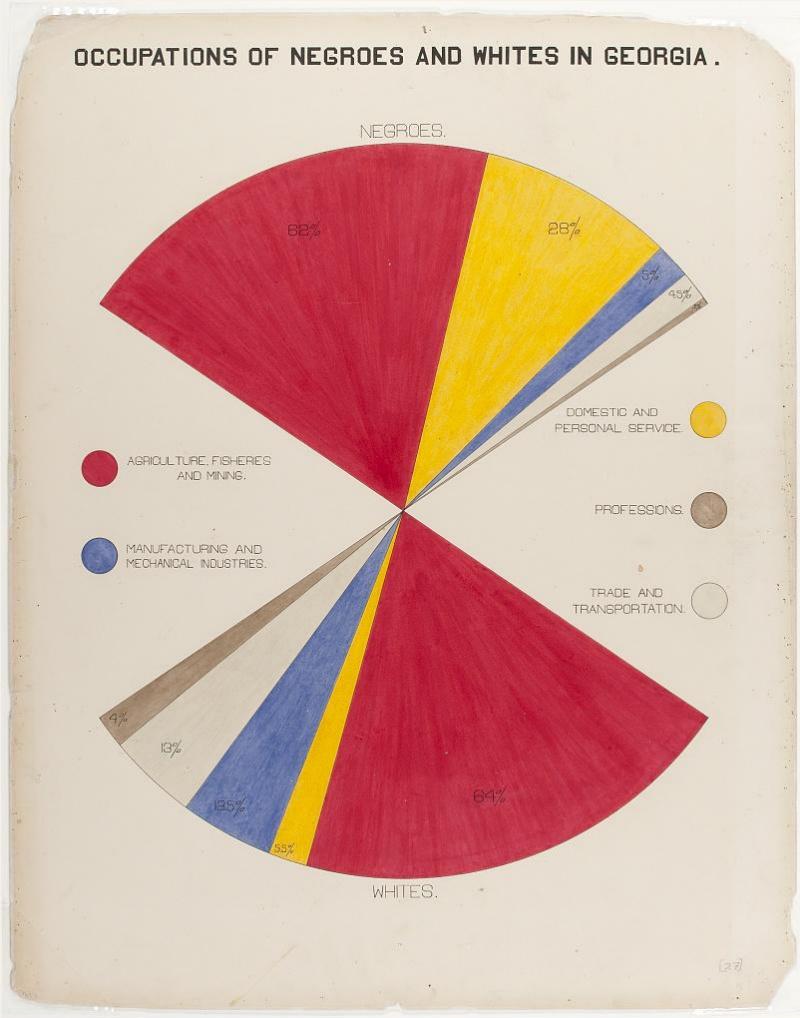
Explore: Analytical Methods



This section addresses the effectiveness and analytical methods used in the visual.

- Is the “fan chart” an effective method of conveying the message?
- Can the viewer make appropriate comparisons?
- What conclusions are drawn from the visual?
- What additional questions are raised?

Explore: Aesthetics and Design



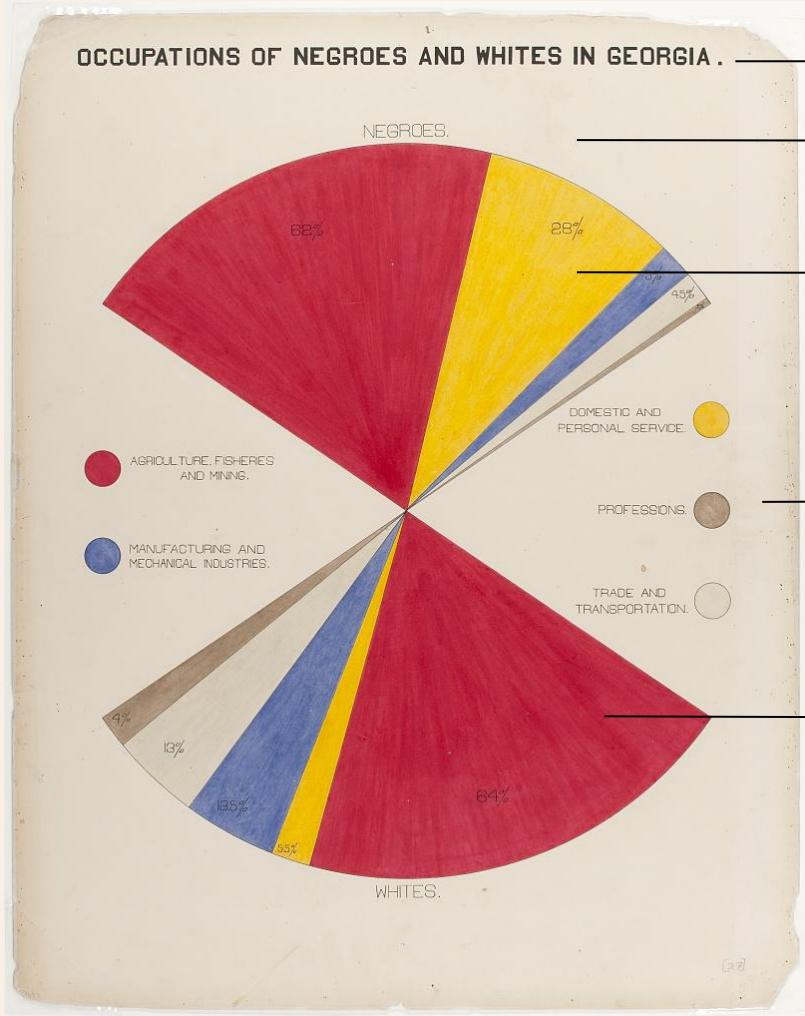
The “Fan-Chart” visual uses proportionally sized wedges to encode the data. The populations are arranged, in sections, top (Black), and bottom (white) such that the wedges may be easily compared.

Also note the legends arranged on the left and right, placed in the gaps between the wedges.

The visual uses the typical Du Bois color palette.

black	brown	tan	gold	pink	red	green	blue	purple
#000000	#654321	#d2b48c	#ffd700	#ffc0cb	#dc143c	#00aa00	#4682b4	#7e6583

Explore: Chart Elements



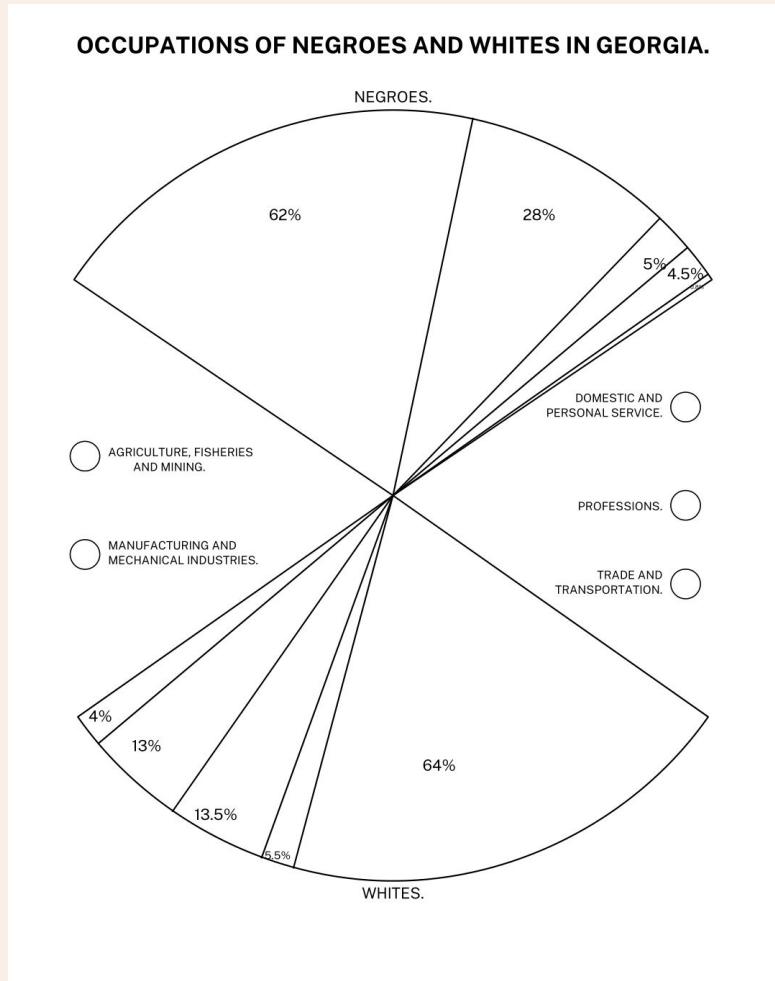
Title
Labels

Black Georgians

Legend

White Georgians

Explore: Re-Create

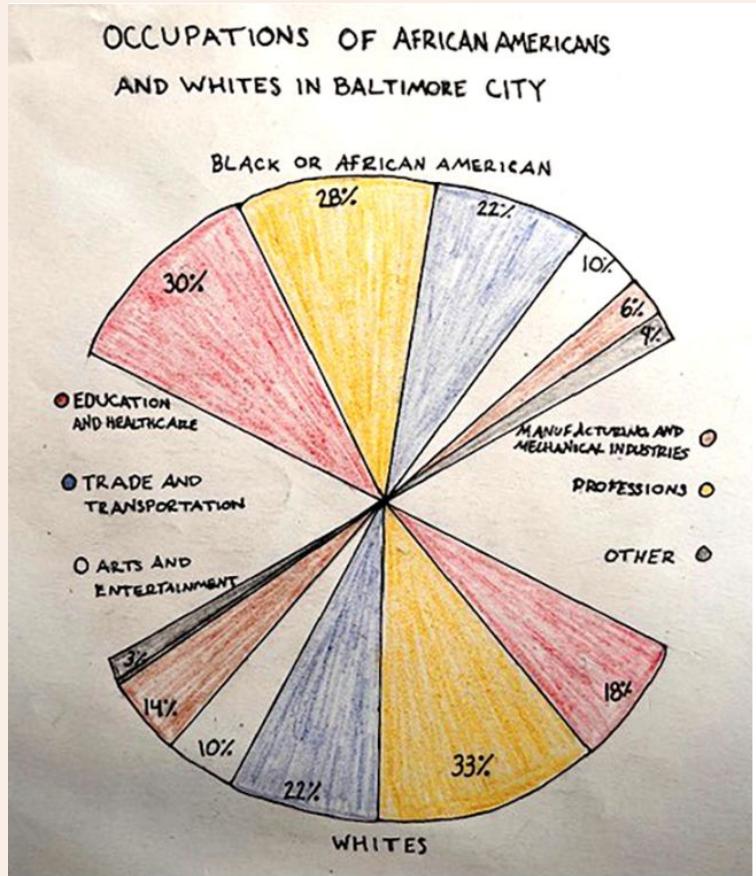


Re-create the visual using pens, paper and other analog materials like markers, colored pencils, rulers, and protractors.

Strive for rapid iteration, and do not focus on precision, but rather exploring the various components of the chart, and how they are conveying the message and information. You may work together or individually.

At the end of the session, the re-creations may be shared and critiqued as a group.

Explore: Modernize



In this section, apply modern data to the Du Bois Style. This involves data gathering, selection of appropriate chart type, and defining the elements to apply the Du Bois style to (for example color palette, labeling methods)

This example shows modern data on the occupations of African and European-Americans in the city of Baltimore.

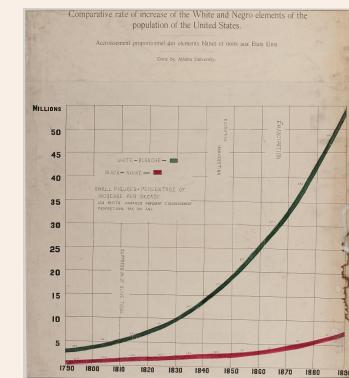
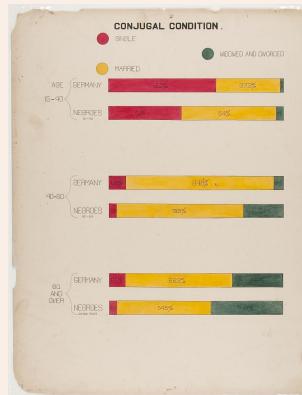
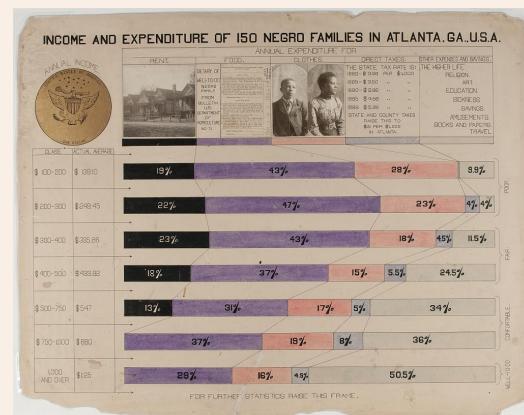
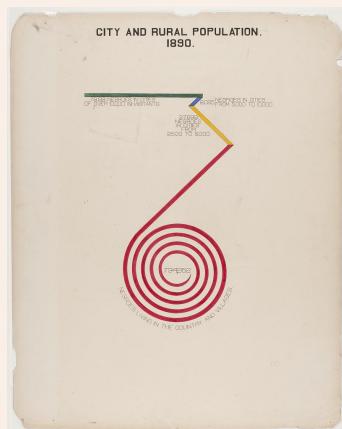
(created by the Baltimore Mayor's Office of Performance and Innovation)

Explore: Chart Types

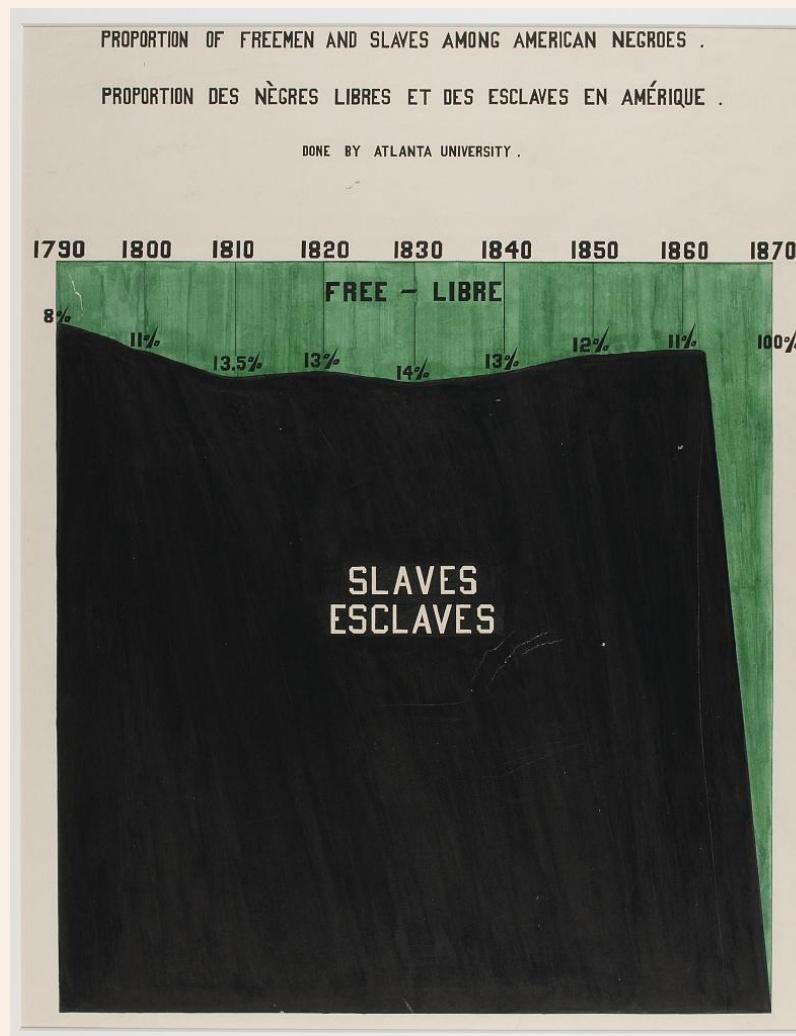
In the section, consider the selection of chart type, and its role in conveying the appropriate message.

For example, here are four other types of charts in the Du Bois collection, covering economics, population, and social status.

The types include the fanciful Du Bois spiral, stacked bars with integrated photographs, along with conventional bar and line graphs.

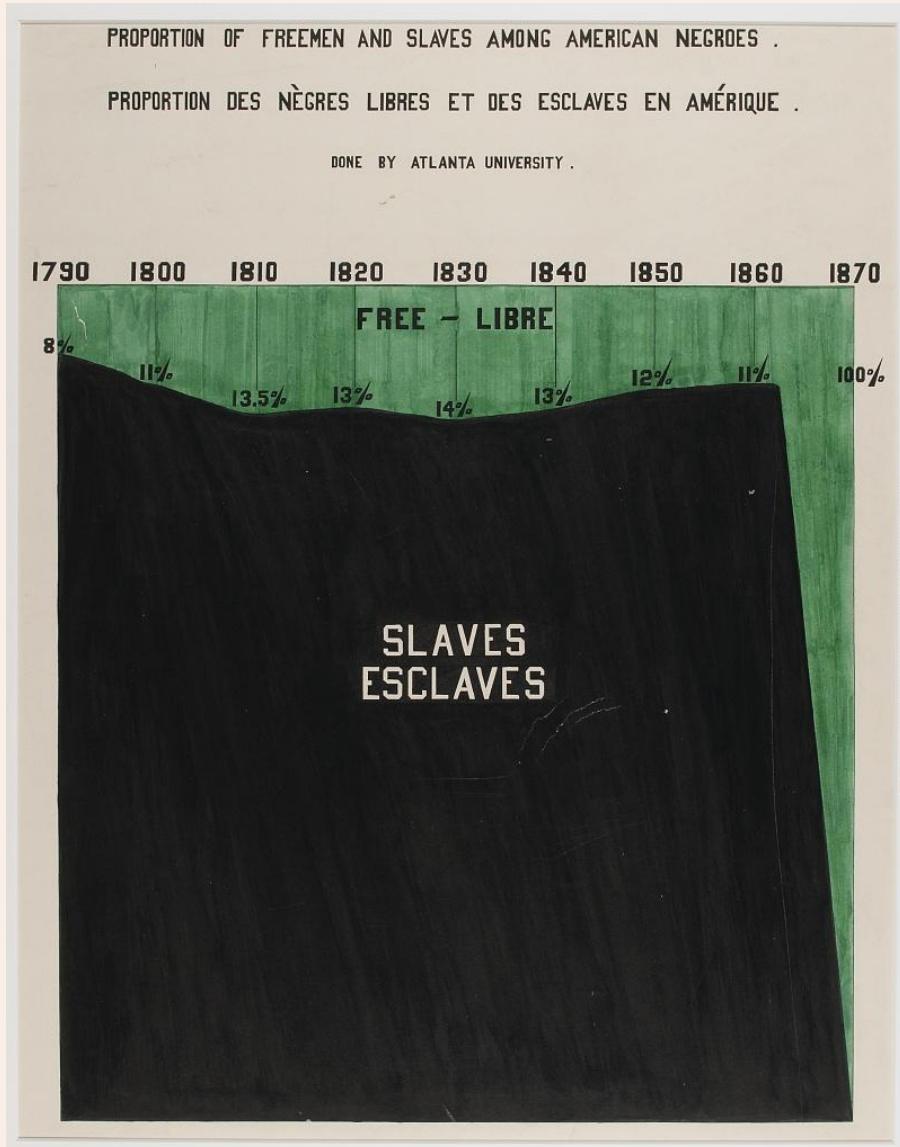


Explore example 2:



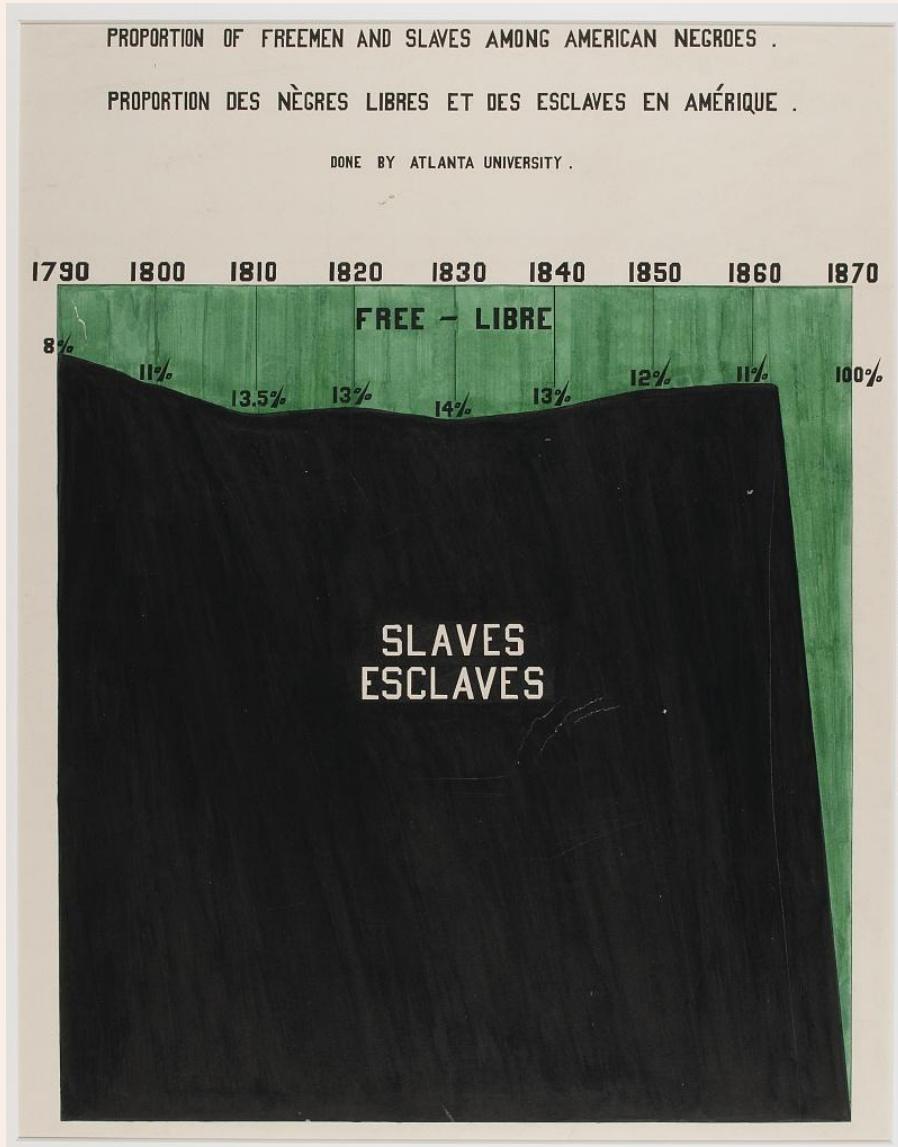
Proportion of Freemen and Slaves Among American Negroes

Explore: Outline



- Message and Audience
- Analytical methods
- Aesthetics/design
- Chart Types

Explore: Message

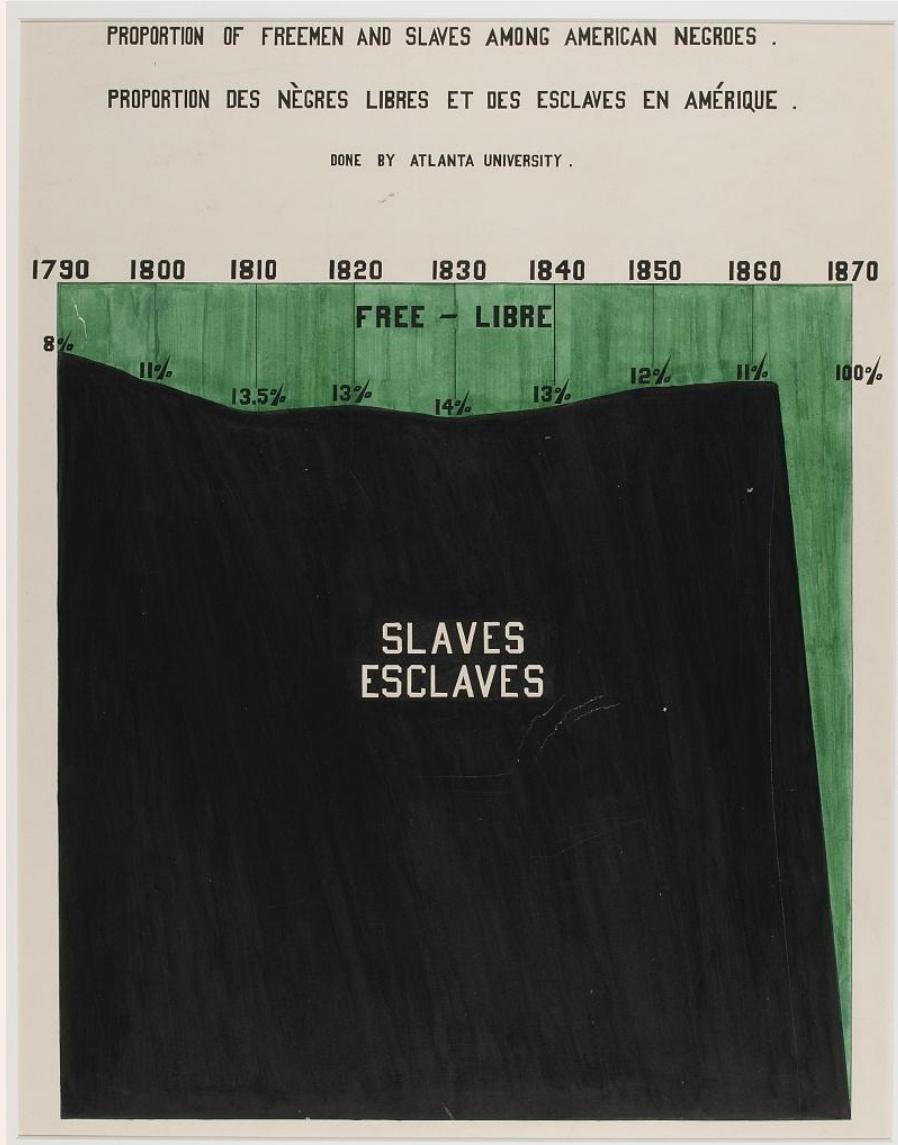


The message of the visual is tied to the overall message from Du Bois at the Paris Exposition:

Describe the status and progress of Black Americans since emancipation, and provide an alternative narrative to racist views of the time.

The visual compares free and slave populations from 1790 to 1870, using an area chart with two primary colors representing freedom and slavery.

Explore: Considerations



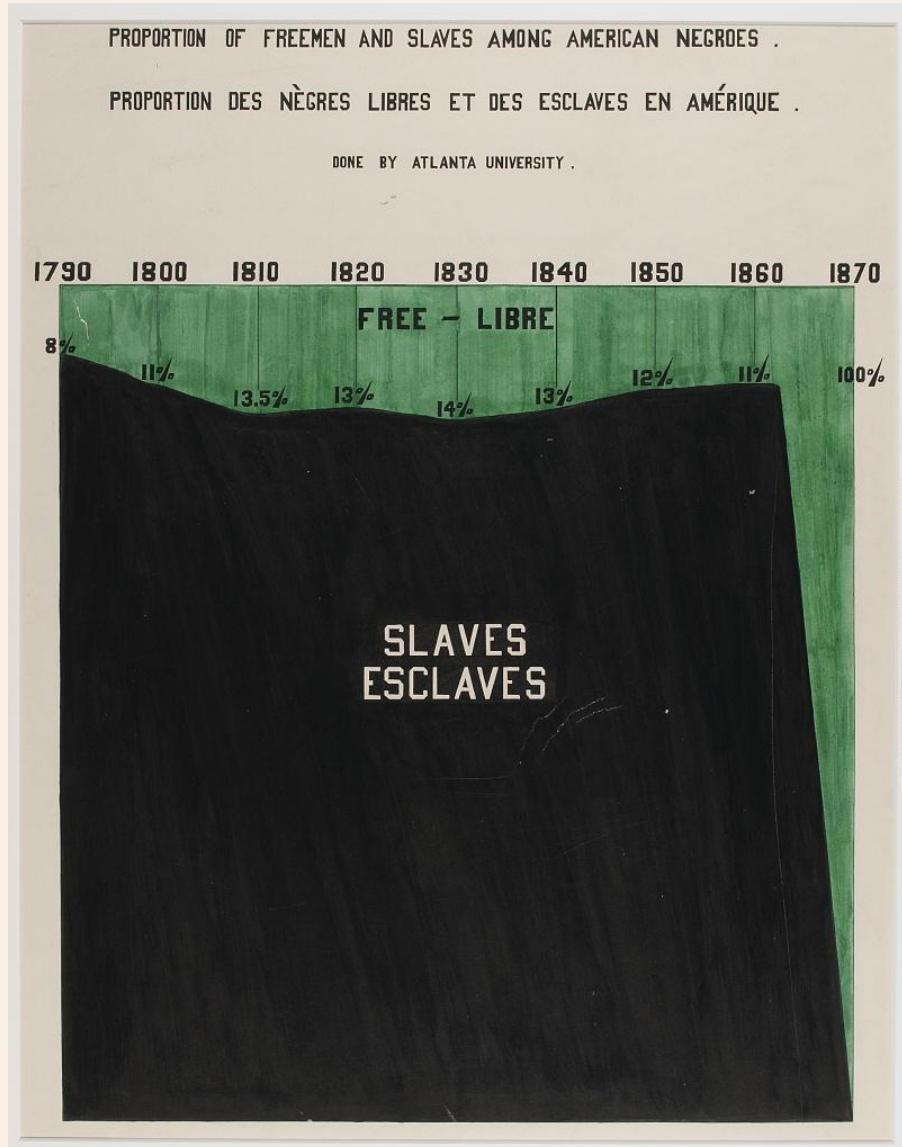
What analytic methods would you use to make this chart?

What chart type is best?

Aesthetics: consider dimensions, color selection, titles, data labels, legend, notes etc.

What tools do think are needed to make this chart?

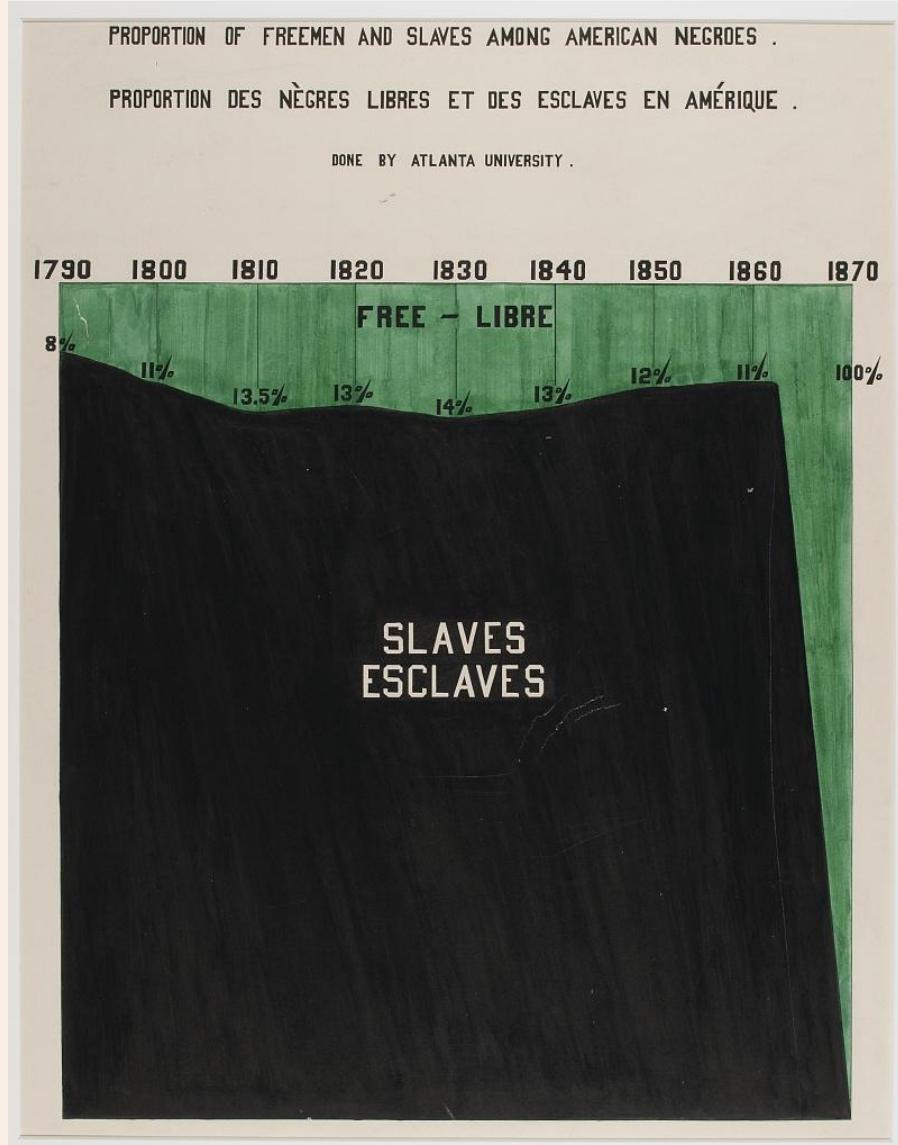
Explore: Analytical Methods



This section addresses the effectiveness and analytical methods used in the visual.

- Is the area chart an effective method of invoking the message?
- Can the viewer make appropriate comparisons?
- What conclusions are drawn from the visual?
- What additional questions are raised?

Explore: Aesthetics and Design



This visual makes uses a bold color contrast (black for slavery, green for freedom) to show the proportion of enslaved and free people.

The area is dominated by black, with contrasting large text, yet the eye is drawn to the sudden jolt of green freedom in 1865. Note that increasing data goes down instead of up.

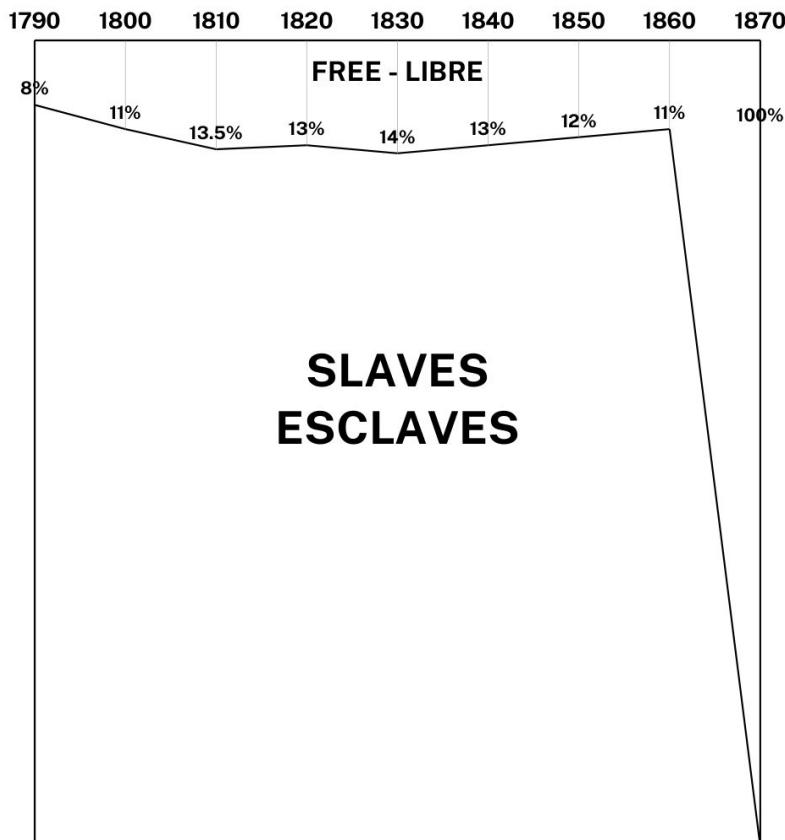
The titles are bilingual (a nod to the venue), and the X-axis is labeled at the top, contrary to today's convention.

Instead of a labeled Y-axis, each individual data point is labeled.

Explore: Re-Create

PROPORTION OF FREEMEN AND SLAVES AMONG AMERICAN NEGROES.
PROPORTION DES NÈGRES LIBRES ET DES ESCLAVES EN AMÉRIQUE.

DONE BY ATLANTA UNIVERSITY.



Re-create the visual using pens, paper and other analog materials like markers, colored pencils, rulers, and protractors.

Strive for rapid iteration, and do not focus on precision, but rather exploring the various components of the chart, and how they are conveying the message and information. You may work together or individually.

At the end of the session, the re-creations may be shared and critiqued as a group.

Explore: Modernize

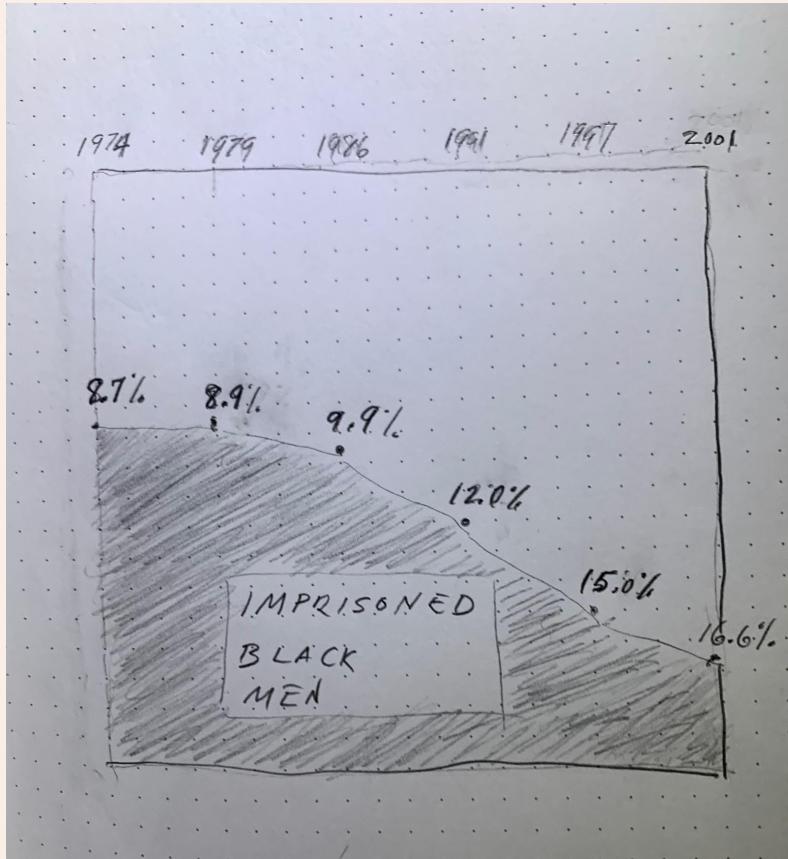


Table 5. Percent of adult population ever incarcerated in a State or Federal prison, by gender, race, and Hispanic origin, 1974-2001

	Percent of adult population ever incarcerated in a State or Federal prison					
	1974	1979	1986	1991	1997	2001
Gender						
Male	2.3%	2.4%	2.8%	3.4%	4.3%	4.9%
Female	0.2	0.2	0.2	0.3	0.4	0.5
Race/Hispanic origin						
White*	0.8%	0.8%	0.9%	1.1%	1.3%	1.4%
Male	1.4	1.5	1.7	1.9	2.3	2.6
Female	0.1	0.1	0.1	0.2	0.2	0.3
Black*	4.5%	4.6%	5.2%	6.2%	7.9%	8.9%
Male	8.7	8.9	9.9	12.0	15.0	16.6
Female	0.6	0.7	0.8	0.9	1.3	1.7
Hispanic	1.3%	1.4%	2.0%	2.7%	3.8%	4.3%
Male	2.3	2.6	3.6	4.9	6.7	7.7
Female	0.2	0.2	0.3	0.4	0.6	0.7

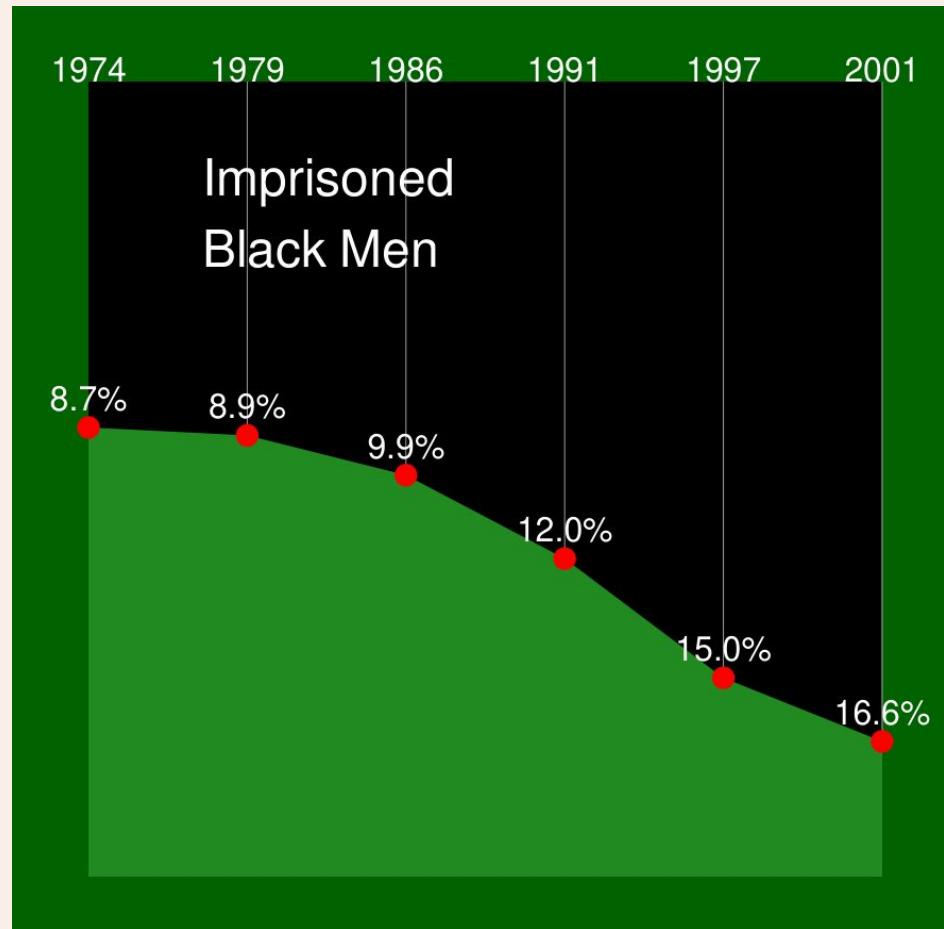
Note: Percents were based on intercensal resident population estimates from the U.S. Census Bureau. See *Methodology* for data sources.

*Excludes persons of Hispanic origin.

In this section, apply modern data to the Du Bois Style. This involves data gathering, selection of appropriate chart type, and defining the elements to apply the Du Bois style (for example color palette, labeling methods)

This example shows incarceration rates between 1974-2001.

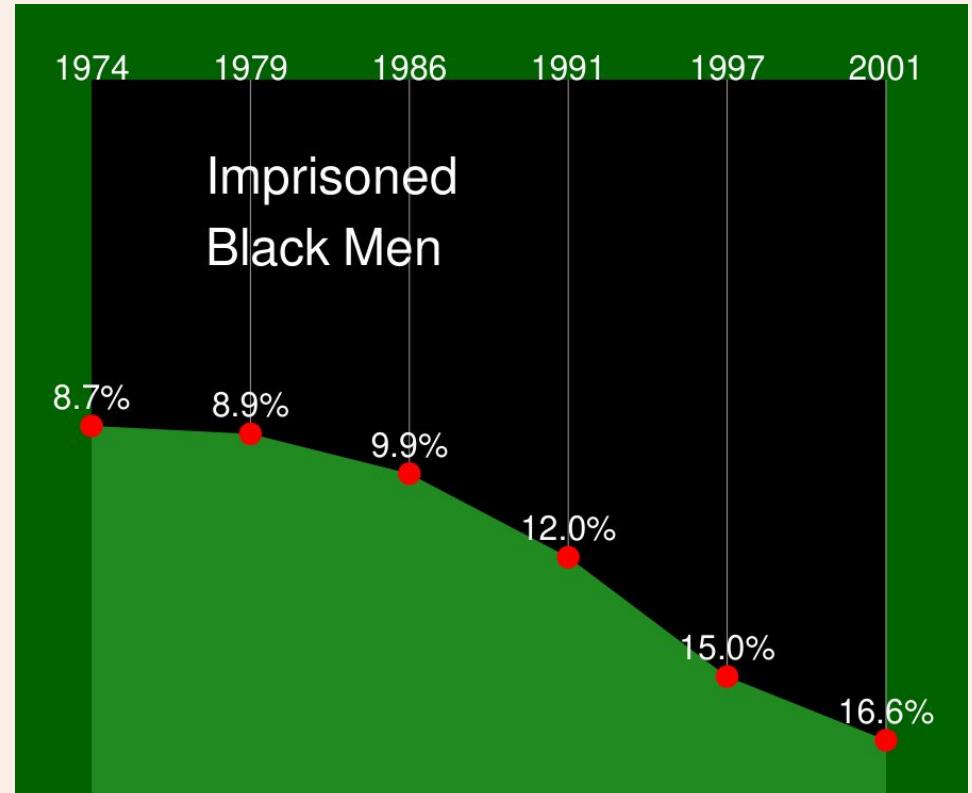
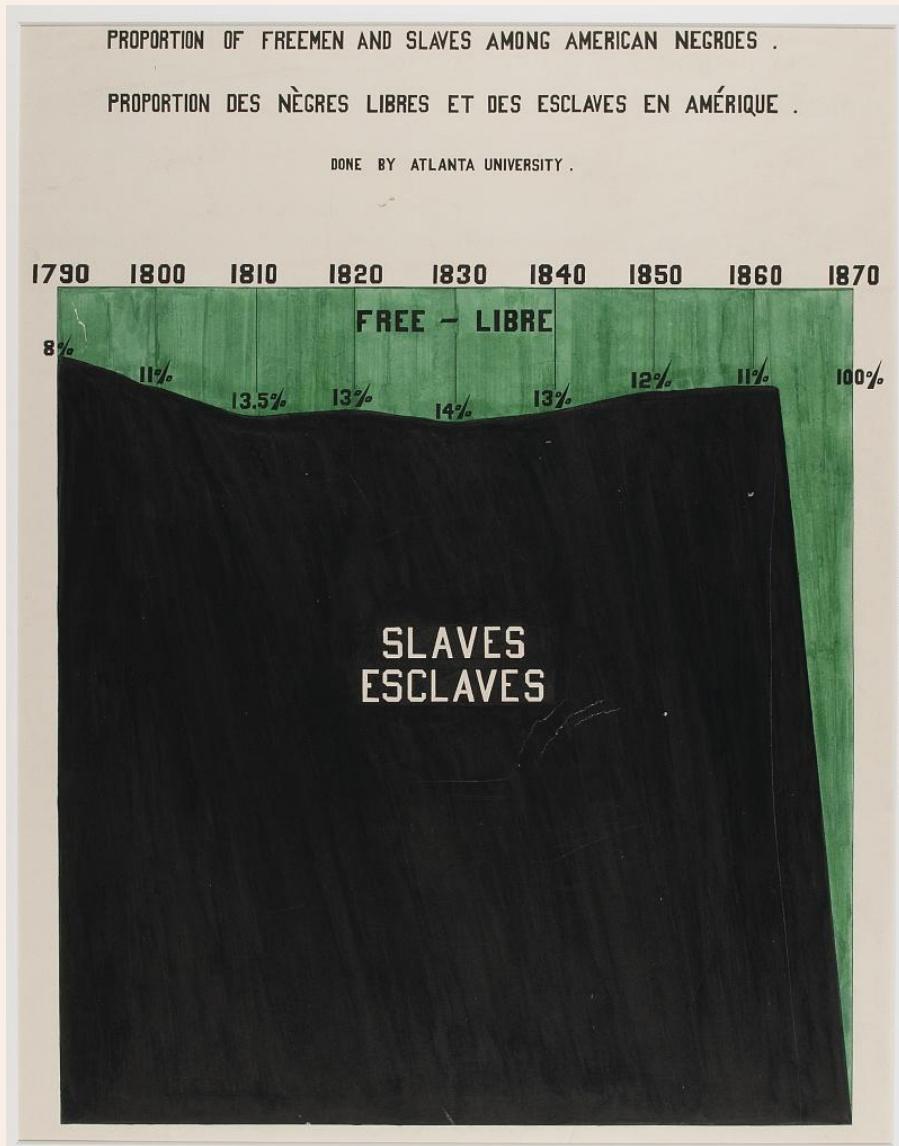
Explore: Modernize



This example updates the hand-drawn version to a digital format, using the similar color scheme as the original, and adding red as a highlight color (note the Pan-African black-red-green theme)

Also note the vertical lines are reminiscent of the bars of a prison cell.

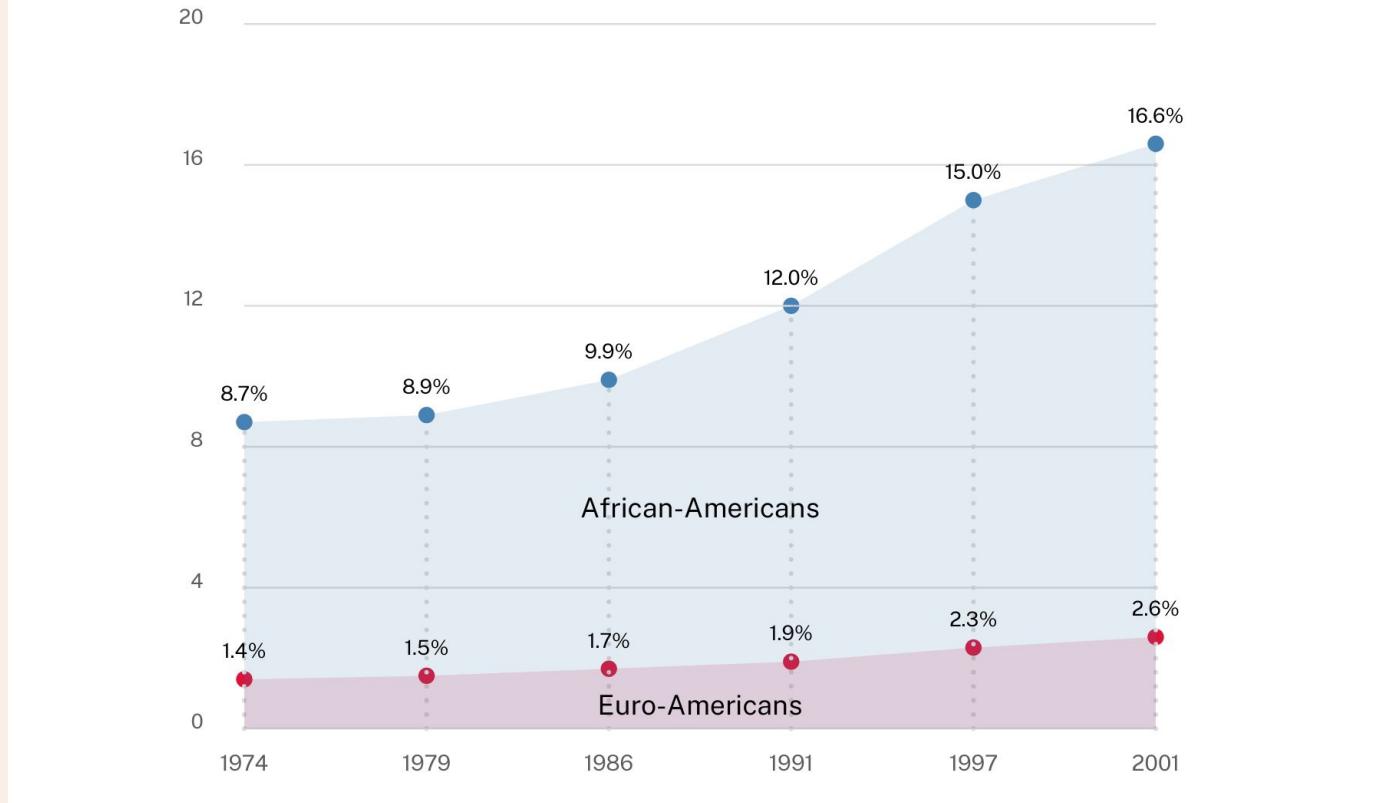
Explore: Modernize



Original and modern version compared.

Explore: Modernize

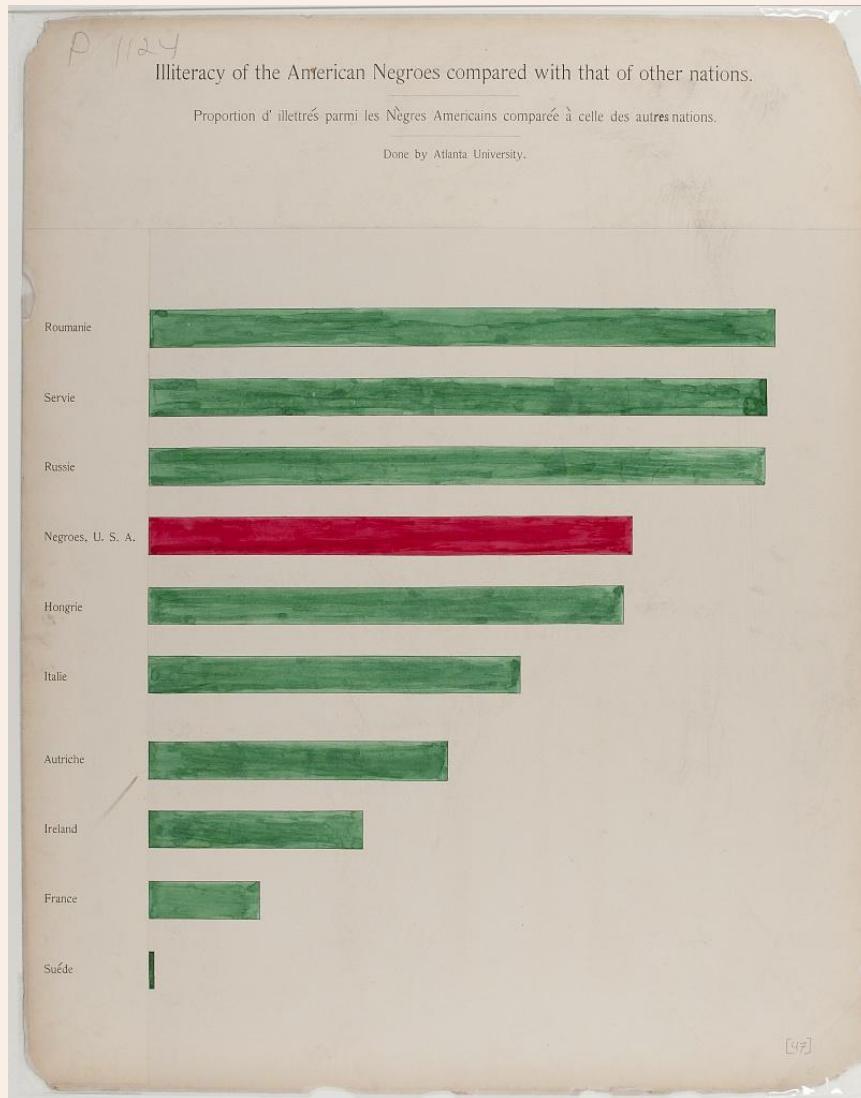
Incarceration Rate: Euro and African American Males, 1974-2001



This example compares incarceration rates between Black and White males, using overlapping area charts with common scales and contrasting colors to aid the comparison.

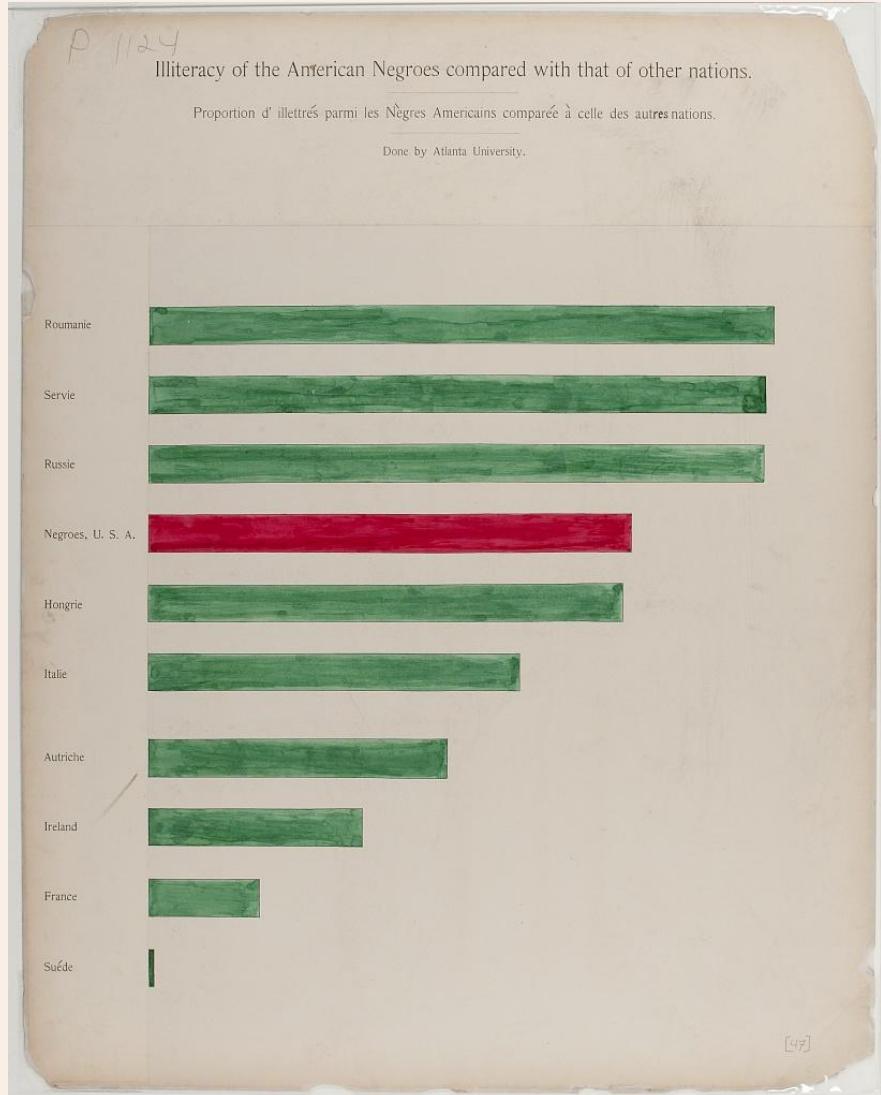
This example returns to the usual conventions: (x-axis labeled on the bottom, data increasing moves up and to the right).

Explore example 3:



Illiteracy of American Negroes compared with that of other nations

Explore: Message

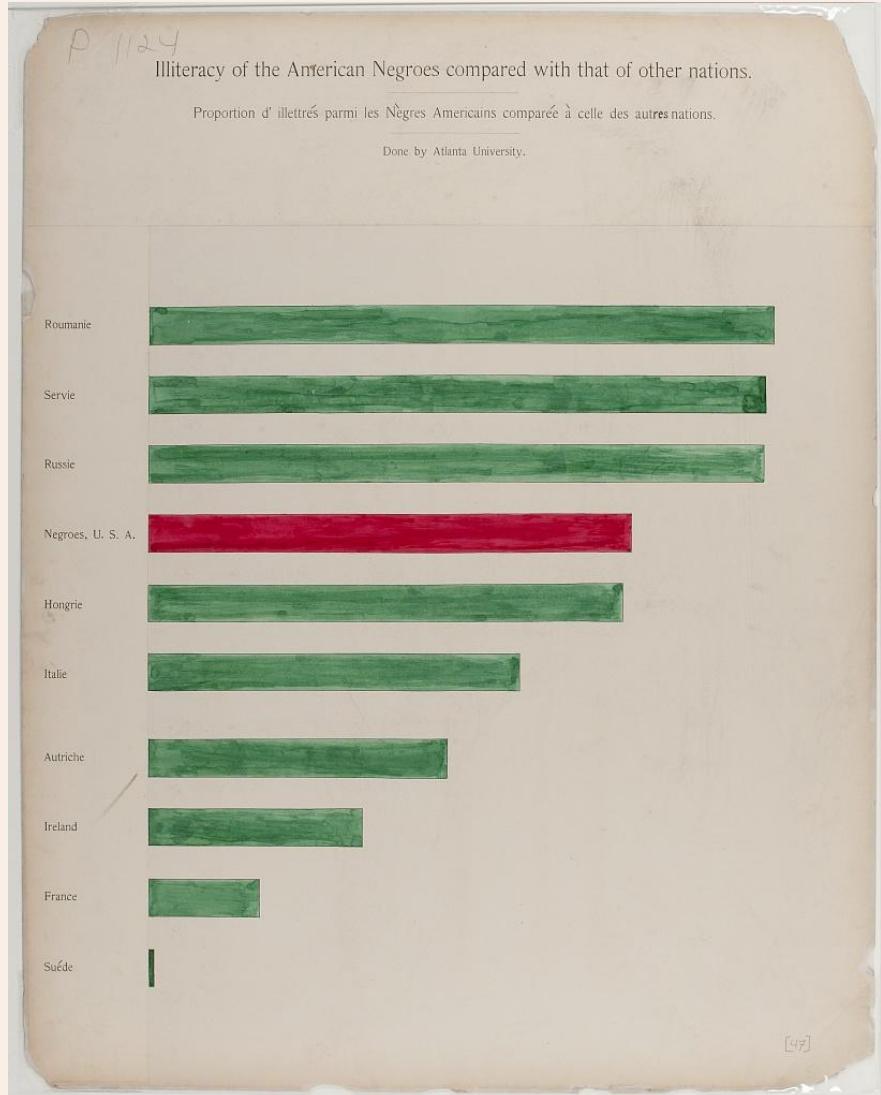


The message of the visual is tied to the overall message from Du Bois at the Paris Exposition:

Describe the status and progress of Black Americans since emancipation, and provide an alternative narrative to racist views of the time.

Comparing the state of Black Americans with the larger world, the visual shows Black Americans illiteracy in red, in the middle of a sea of green, higher than countries like France, but better than others like Russia.

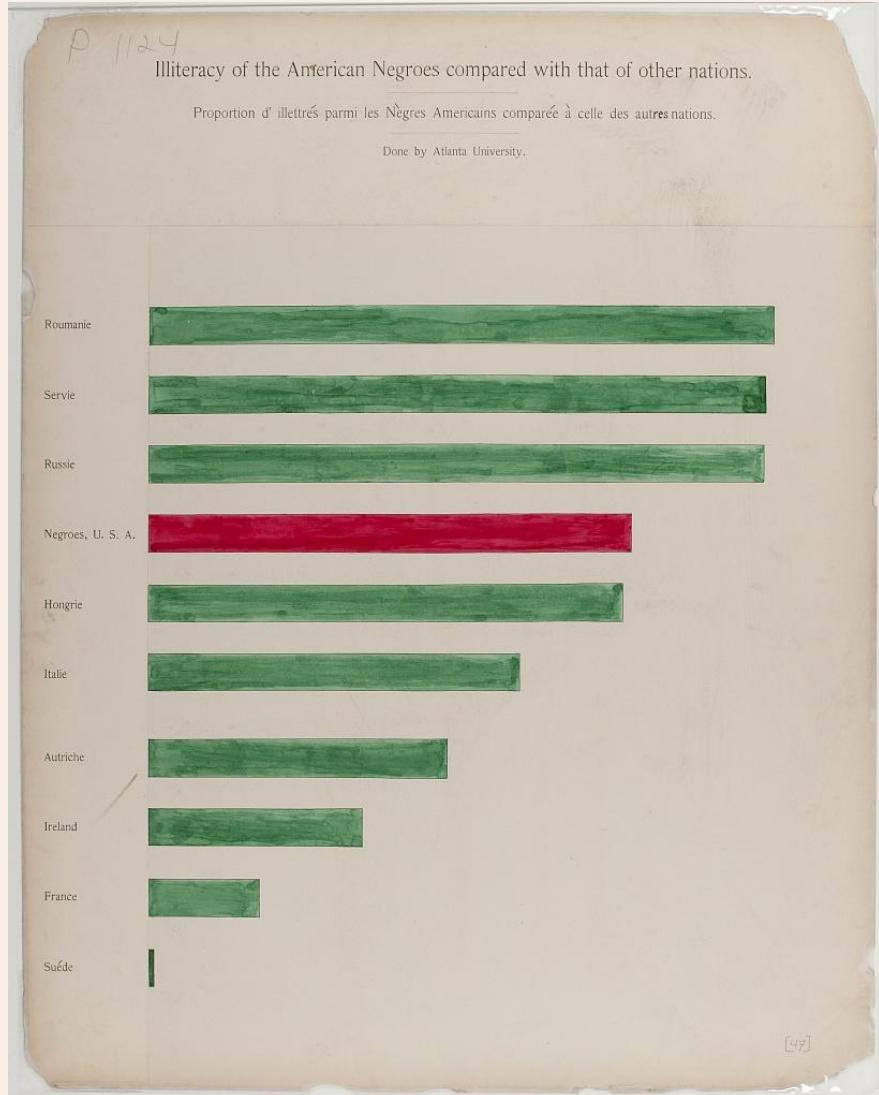
Explore: Analytical Methods



This section addresses the effectiveness and analytical methods used in the visual.

- Is the area chart an effective method of invoking the message?
- Can the viewer make appropriate comparisons?
- What conclusions are drawn from the visual?
- What additional questions are raised?

Explore: Aesthetics and Design

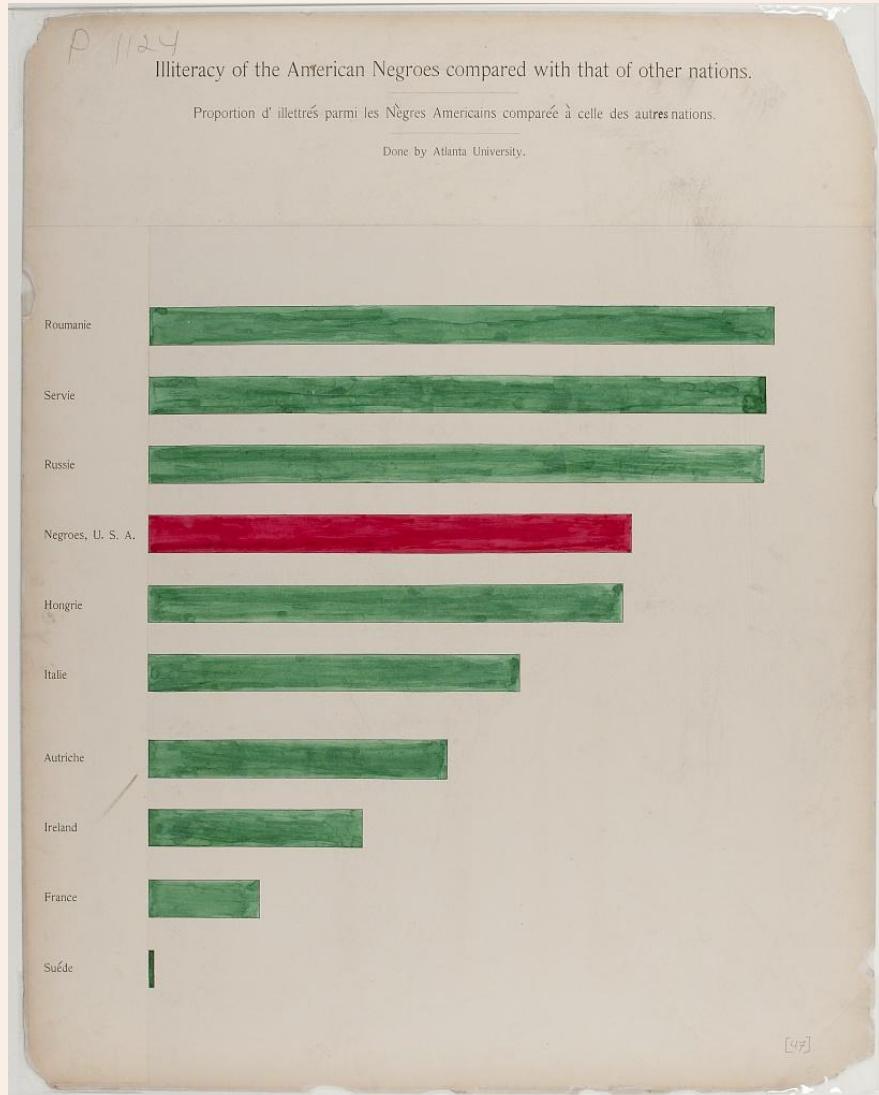


This visual, a conventional bar graph, uses spot color to highlight the data for Black Americans compared to other countries, showing the illiteracy rate to be at the midpoint compared to other nations.

The chart portion is a large percentage of the canvas, simply showing the message.

Note the bilingual labels and titles (a nod to the venue),

Explore: Considerations



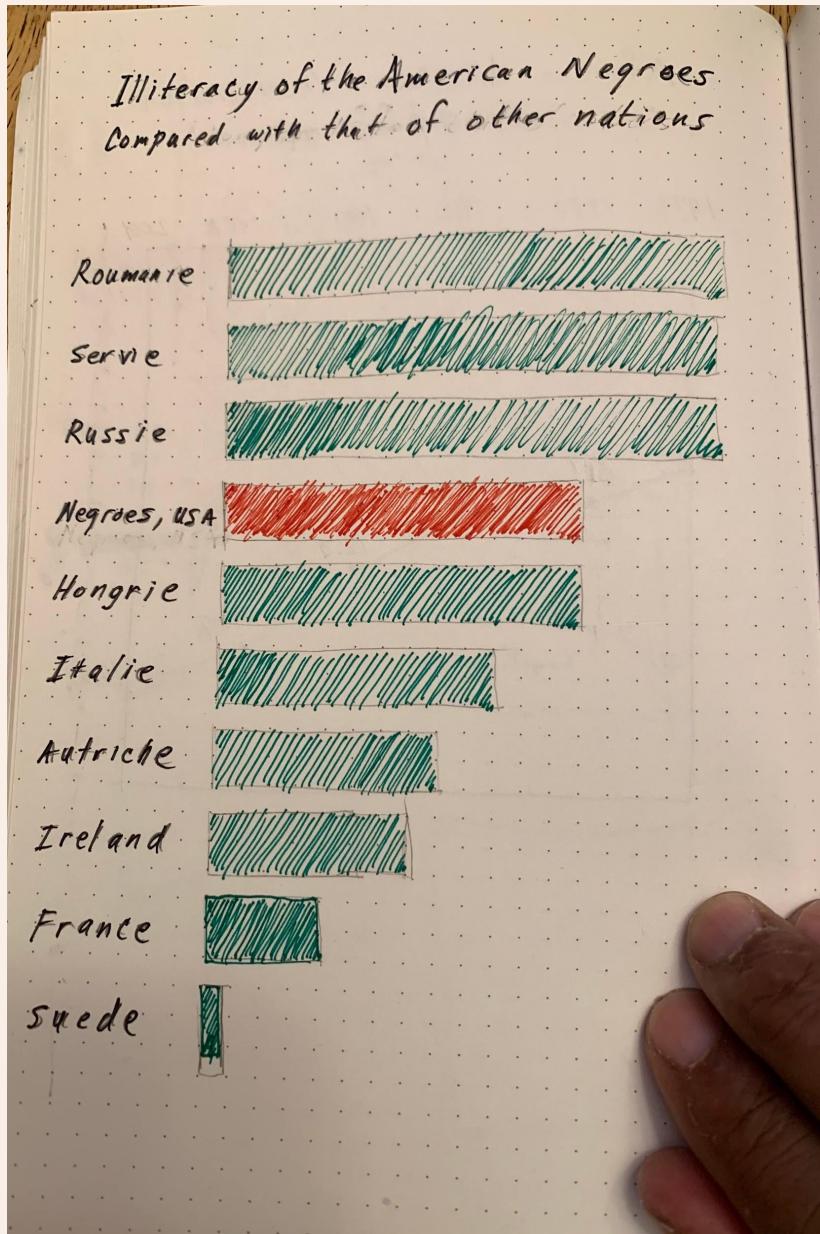
What analytic methods would you use to make this chart?

What chart type is best?

Aesthetics: consider dimensions, color selection, titles, data labels, legend, notes etc.

What tools do think are needed to make this chart?

Explore: Re-Create



Re-create the visual using pens, paper and other analog materials like markers, colored pencils, rulers, and protractors.

Strive for rapid iteration, and do not focus on precision, but rather exploring the various components of the chart, and how they are conveying the message and information. You may work together or individually.

At the end of the session, the re-creations may be shared and critiqued as a group.

Explore: References

Du Bois Visualizations for Consideration in STEM Education

<https://github.com/ajstarks/dubois-data-portraits/tree/master/dubois-stem>

Du Bois Visualization Style Guide

<https://github.com/ajstarks/dubois-data-portraits/blob/master/dubois-style.pdf>

Recreating the Du Bois Data Portraits

<https://speakerdeck.com/ajstarks/recreating-the-dubois-data-portraits>

Du Bois Visualizations Catalog (originals)

<https://speakerdeck.com/ajstarks/du-bois-visualizations-originals>

African American Photographs Assembled for 1900 Paris Exposition

https://www.loc.gov/collections/african-american-photographs-1900-paris-exposition/?st=grid&sb=date_desc

W.E.B. Du Bois Data Portraits, Visualizing Black America

<https://papress.com/products/w-e-b-du-boiss-data-portraits-visualizing-black-america>

Black Lives 1900, W.E.B. Du Bois at the Paris Exposition

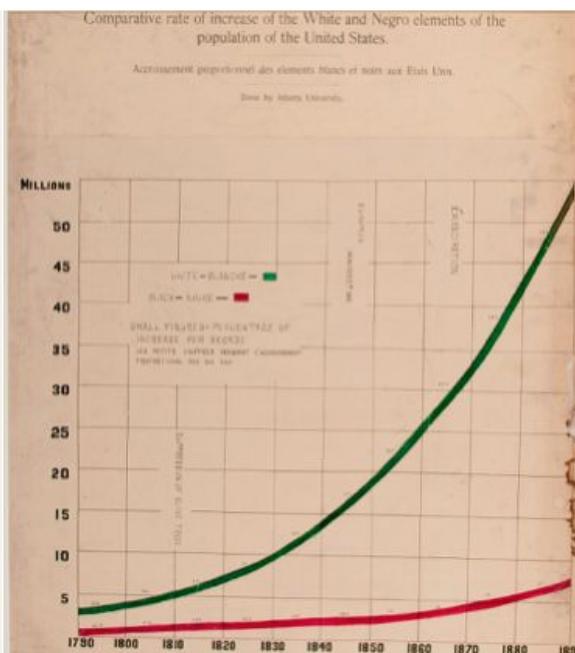
<https://www.theredstoneshop.com/products/black-lives-1900>

Implement

isforprofitenrollments.ipynb

Edit View Run Kernel Tabs Settings Help

Code ▾



Implement

The Implement section builds on the Context and Explore sections and guides you through building a Du Bois-style visualization using digital tools.

The example shown here uses R and Jupyter notebook, which provides an interactive environment to explore the visual, starting from a basic graph, to applying the Du Bois style.

Note that participants of the Du Bois Challenge, an annual online exercise that [re-creates a curated set of Du Bois visuals, provides examples of digital re-creations using tools such as R, python/matplotlib, and Tableau.](#)

Implement: Advantages of Digital

- Scalability: working with increasing amounts of data,
- Reproducibility and Adaptability: you can reproduce and adapt graphs with less work than when we draw by hand,
- Reach: works are available to millions on the Internet; others are free to adapt, share and remix without having to reinvent the wheel.

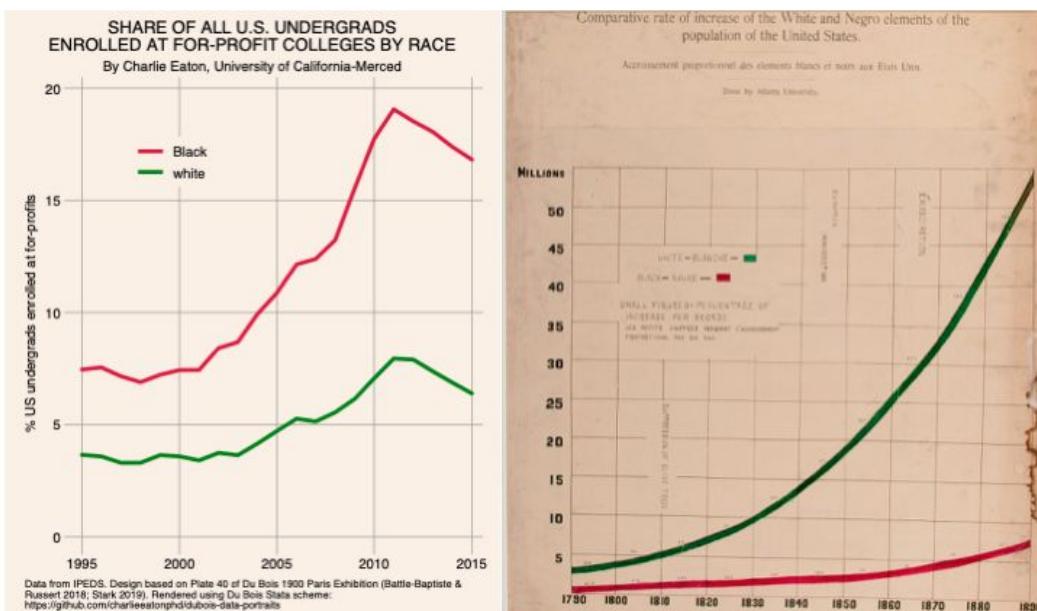
Implement: Introduction

duboisforprofitenrollments.ipynb

File Edit View Run Kernel Tabs Settings Help

Code ▾

No Kernel

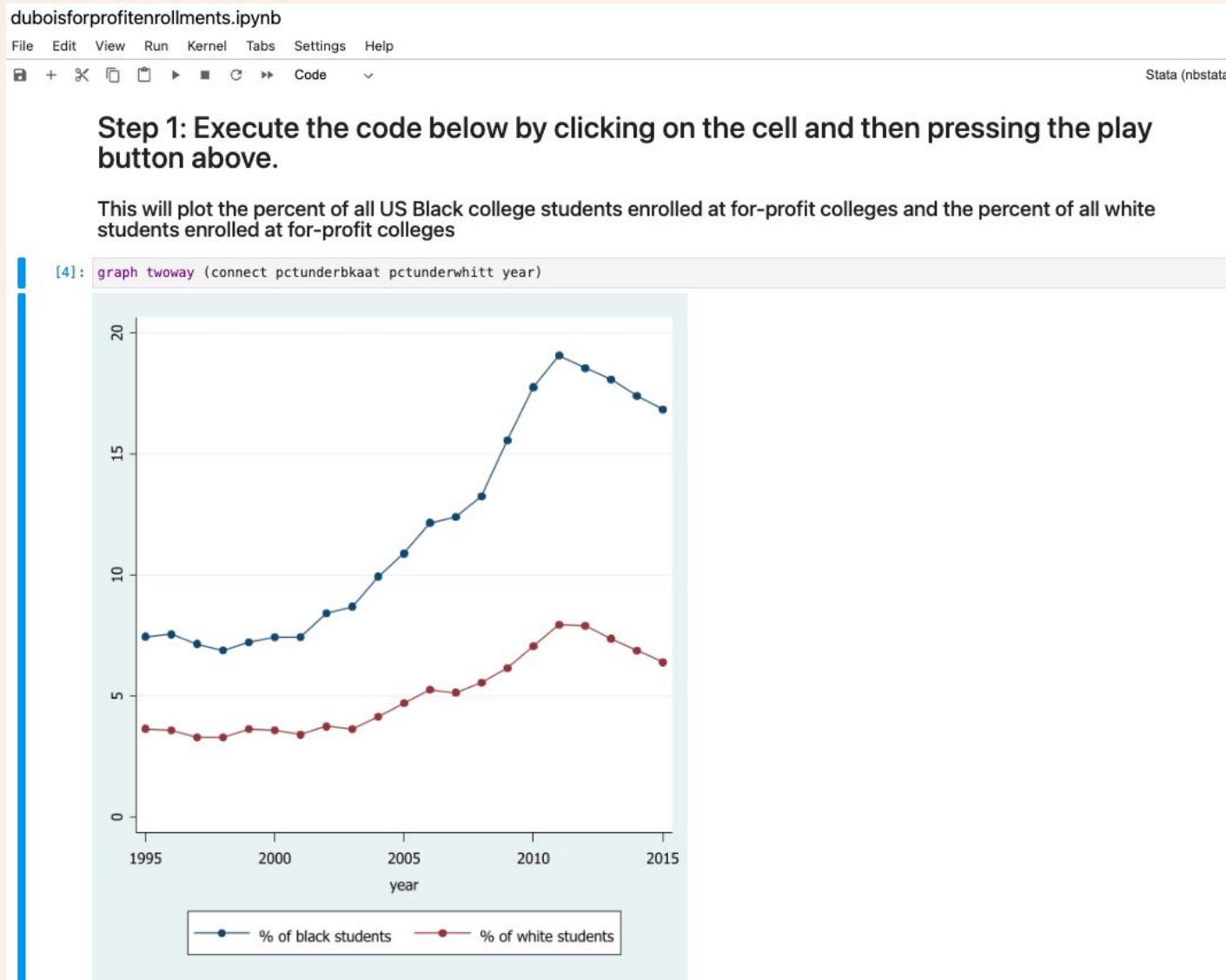


In this exercise, you will learn how to graph for-profit college enrollments by race since 1995 (left).

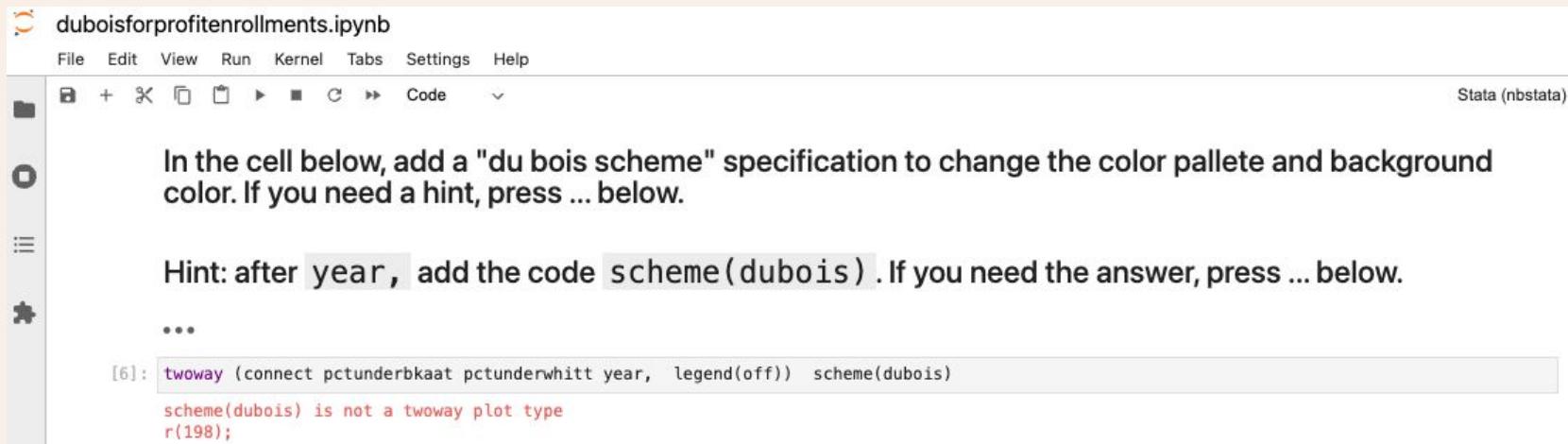
You'll learn how to plot the for-profit college data using similar design elements as Du Bois' Plate 40's plot of the U.S. population by race from 1790 to 1890.

You'll also learn how to modify the graph according to your own creative ideas for what might capture your audience's attention while still accurately representing the data.

Implement: Basic Chart



Implement: Hinting



The screenshot shows a Jupyter Notebook interface with a single code cell. The cell contains the following text:

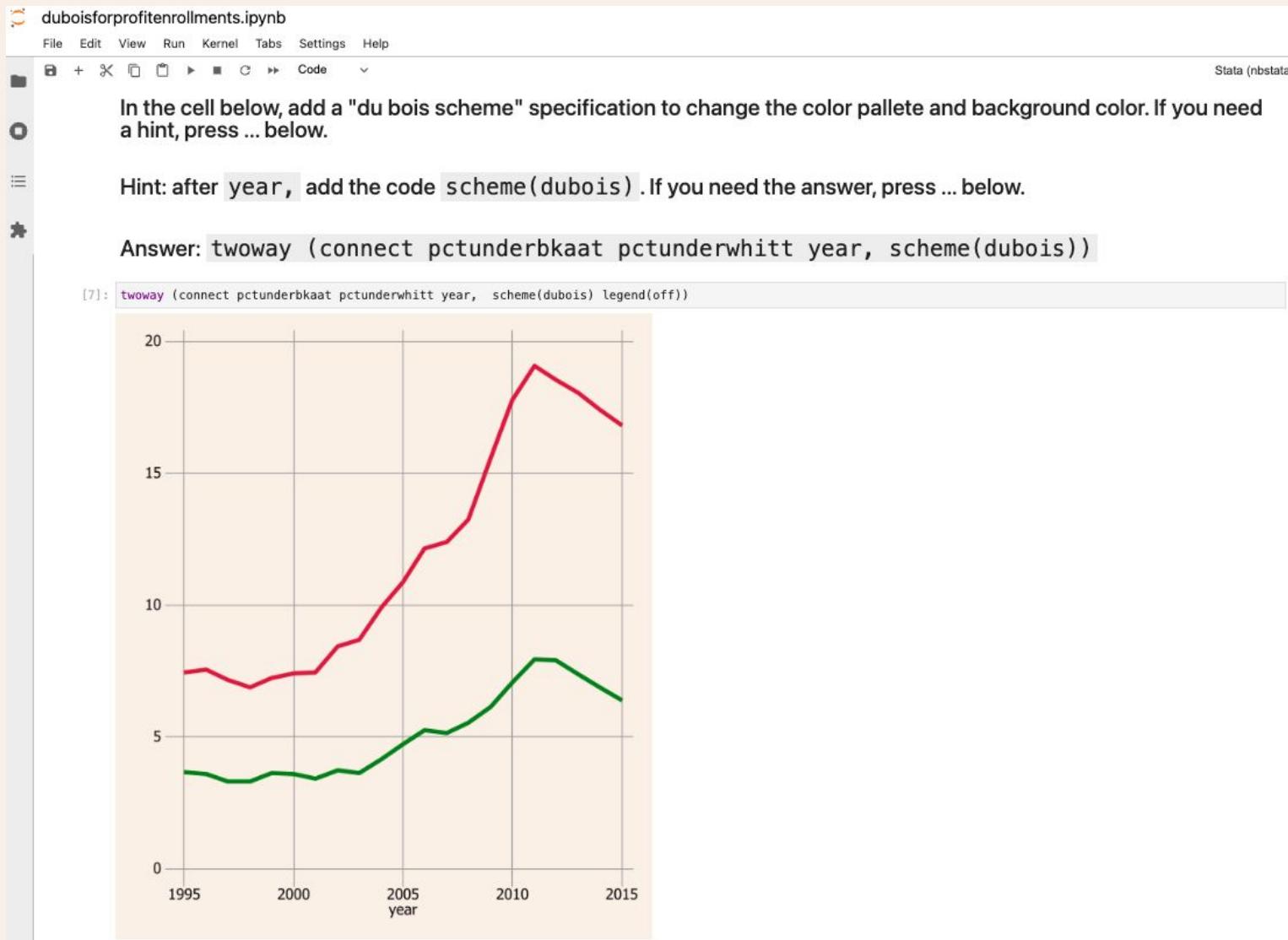
In the cell below, add a "du bois scheme" specification to change the color palette and background color. If you need a hint, press ... below.

Hint: after `year,` add the code `scheme(dubois)`. If you need the answer, press ... below.

...

```
[6]: twoway (connect pctunderbkaat pctunderwhitt year, legend(off)) scheme(dubois)
scheme(dubois) is not a twoway plot type
r(198);
```

Implement: Applying Style



Implement: References

Github Repository for the #DuBoisChallenge2024

<https://github.com/ajstarks/dubois-data-portraits/blob/master/challenge/2024/README.md>

Du Bois Challenge 2024 Recap

<https://speakerdeck.com/ajstarks/du-bois-challenge-2024-recap>

2024 Du Bois Challenge using R Programming.

<https://medium.com/illumination/2024-du-bois-challenge-using-r-programming-02af8afa5626>

Developing Du Bois's Data Portraits with Python and Matplotlib

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Three Tricks I Learned In The Du Bois Data Visualization Challenge

<https://nightingaledvs.com/recreating-historical-dataviz-three-tricks-i-learned-in-the-du-bois-data-visualization-challenge/>

Molly Kuhs Du Bois Challenge repo

<https://github.com/makuhs/DuboisChallenge>

#DuBoisChallenge2024 using Python and Matplotlib

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#DuBoisChallenge2024 using R

<https://github.com/sndaba/2024DuBoisChallengeInRstats/tree/main>

#DuBoisChallenge2024 using Tableau

<https://public.tableau.com/app/profile/camaal.moten7357/vizzes>