

Using Du Bois Visualizations in STEM Education

Du Bois SERVE Project



Module Outline

The overall aim of the module is to introduce the visuals created by W.E.B. Du Bois for the 1900 Paris Exposition, and explore the role of visual communication in STEM education.

The visuals are studied, by deconstruction and re-creation, while placing them in their historical context.

The sections, which may be used collectively or independently:

Context explaining 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

The Context section provides background on the conception, motivation and messaging of the visuals. Also discussed is the venue where the visuals were first shown, the Exhibition of the American Negro, within the 1900 Paris Exposition.

To better understand the times when the visuals were created, influential events leading to the Exposition are discussed.

Context



Context: Background



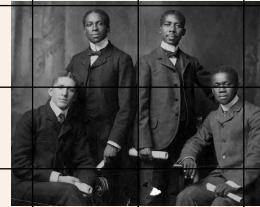
TJ Calloway

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.



Du Bois in Paris

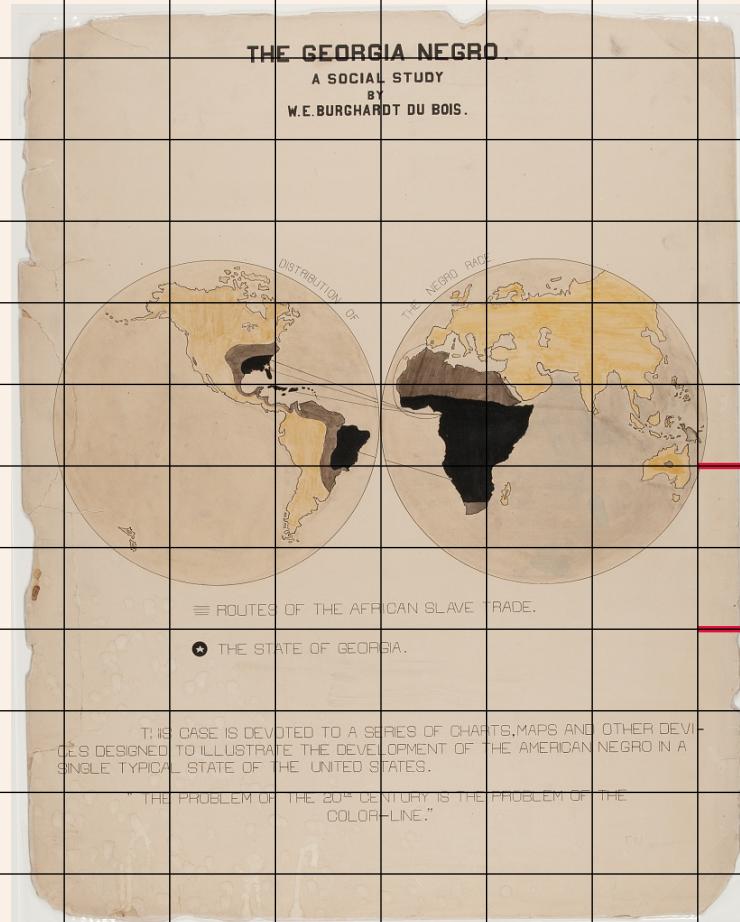
Thomas J. Calloway, organized the “Exhibition of the American Negro” to be shown during the 1900 Paris Exposition, and commissioned Du Bois, his Fisk University classmate, to create a set charts, graphs, photographs and other artifacts for the world stage.



Atlanta U. Students

Du Bois, along with collaborators at Atlanta University spent four months creating the materials the exhibit.

Context: The Visuals

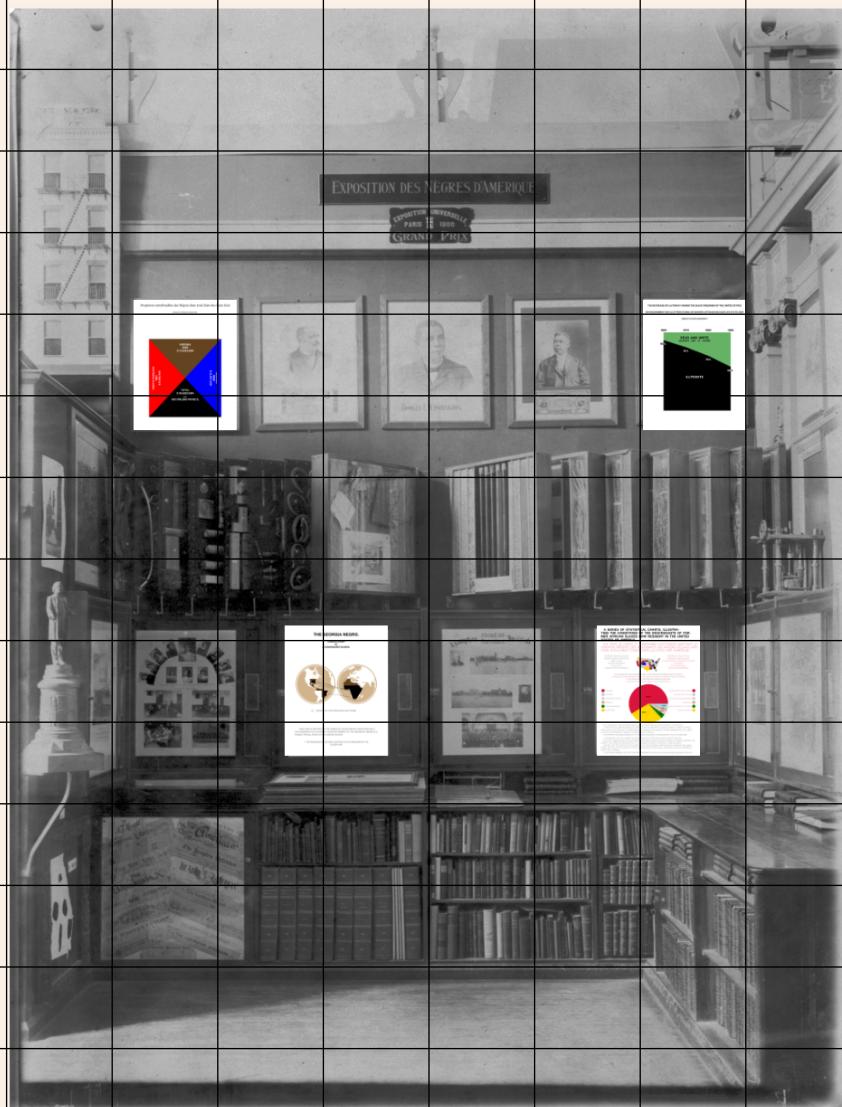


The visuals were hand-drawn using pen, ink and paint on 22x28 in. poster board



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

Context: The Questions for Discussion



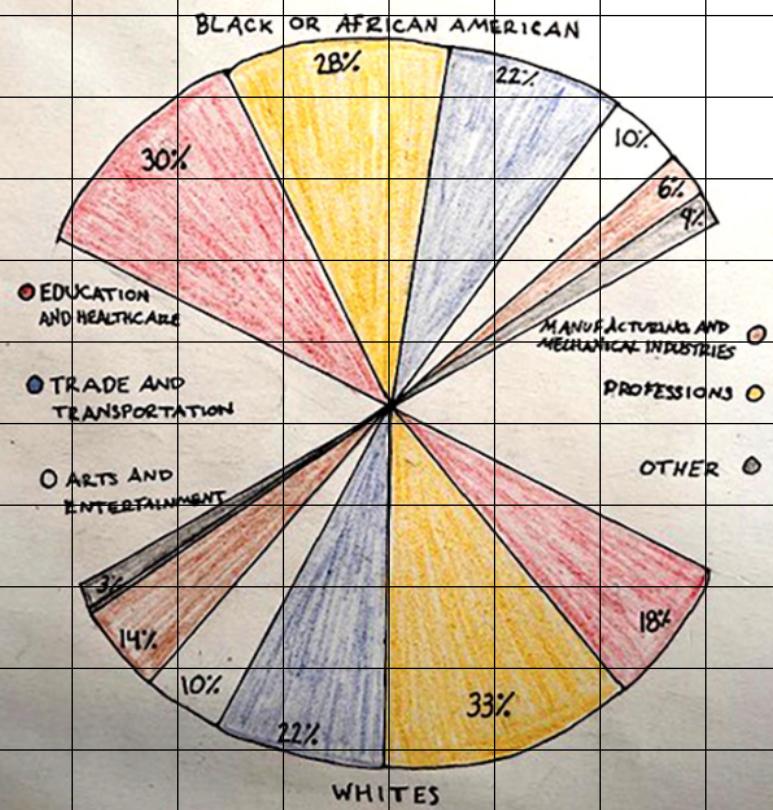
Why do you think Du Bois created a series of graphs and data visualizations of Black life for the exposition?"

Why visualizations instead of a written report?"

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

Explore

OCCUPATIONS OF AFRICAN AMERICANS
AND WHITES IN BALTIMORE CITY



Illiteracy of the American
compared with that of other

Roumanie

Servie

Russie

Negroes, USA

Hongrie

Italie

Autriche

Context: The 1900 Paris Exposition

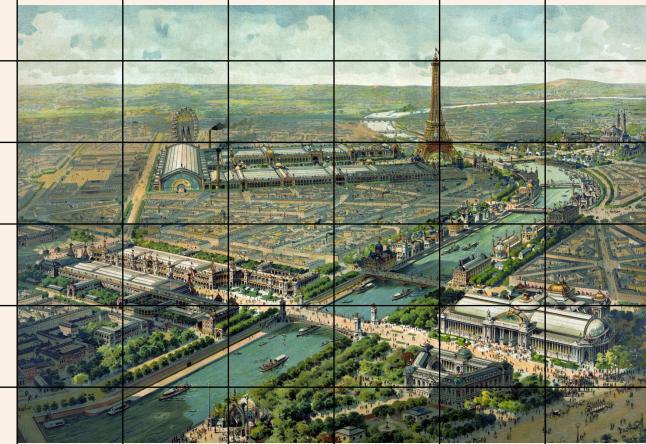
The Exposition Universelle of 1900 was the venue for Du Bois to tell the story of Black Americans on an international stage.

Fifty-six nations participated in the expo, designed to celebrate the achievements of the 19th century, while looking forward to the developments in the 20th.

The Du Bois visuals were part of the “Exhibition of the American Negro”, seen by over 50 million people. The exhibition also included an African-American bibliography containing 1,400 titles along with 500 photographs.



Exhibition Poster



1900 Paris



Exhibition of American Negroes

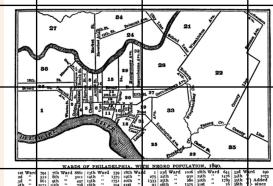
Context: Five years before Paris



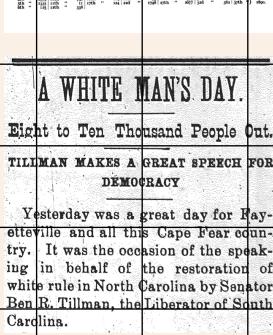
During the summer of 1895, in a Brooklyn park, there was a cotton plantation complete with five hundred Black workers reenacting slavery.



In 1896 the landmark Plessy v. Ferguson Supreme Court decision was handed down, legitimizing racial segregation, leading to generations of Jim Crow laws.



Du Bois created the Philadelphia Negro in 1897 which sought to ascertain something of the geographical distribution of his race, their organizations, and their relation to their million white fellow-citizens.



In 1898 the duly elected people in Wilmington, NC was violently overthrown. The coup occurred after the state's Southern Democrats conspired and led a mob of 2,000 white men to overthrow the legitimately elected local Fusionist government.



During the 1880s and 1890s, instances of lethal mob violence increased steadily, peaking in 1899 when twenty-seven Georgians fell victim to lynch mobs. Included in this number was the horrific lynching of Sam Hose.

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

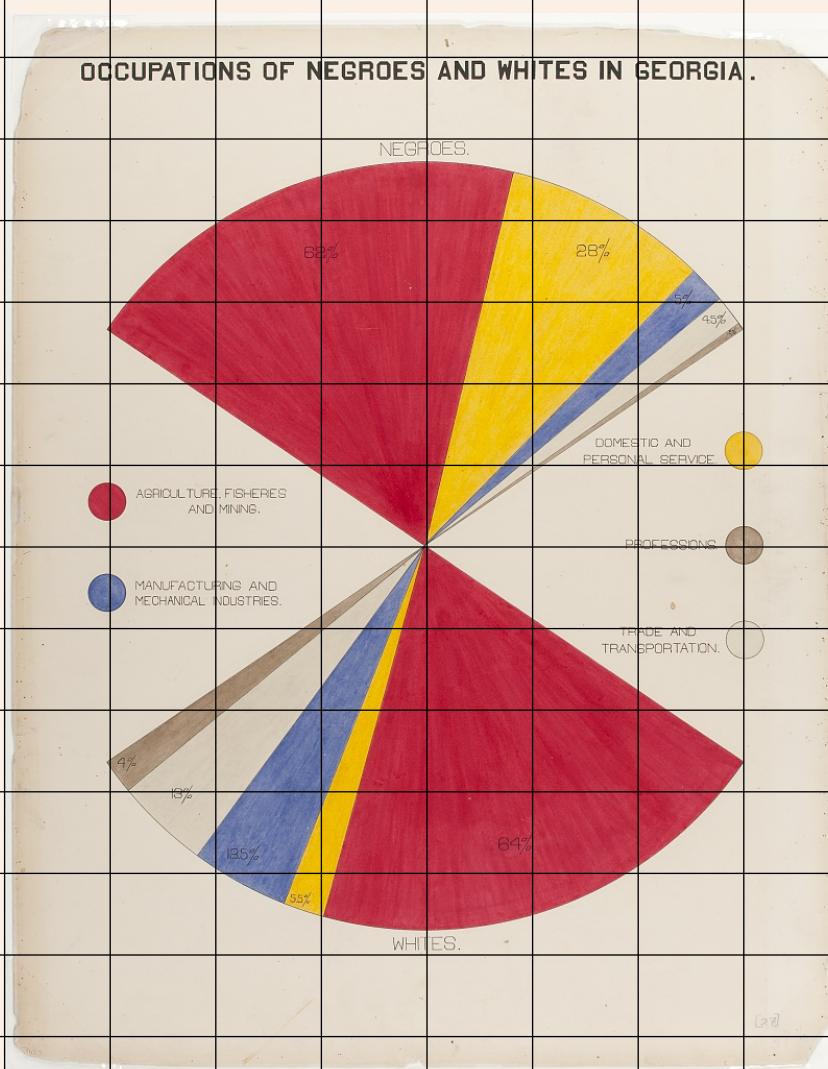
Explore

This section is a hands-on session that will take a sample Du Bois visualization, (Plate 27 in this example) and reconstructs and analyzes various aspects of the visual.

The exercise aims to recreate the sample visual using hand-drawn methods (pens, paper, markers, etc.), to immerse the students 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.

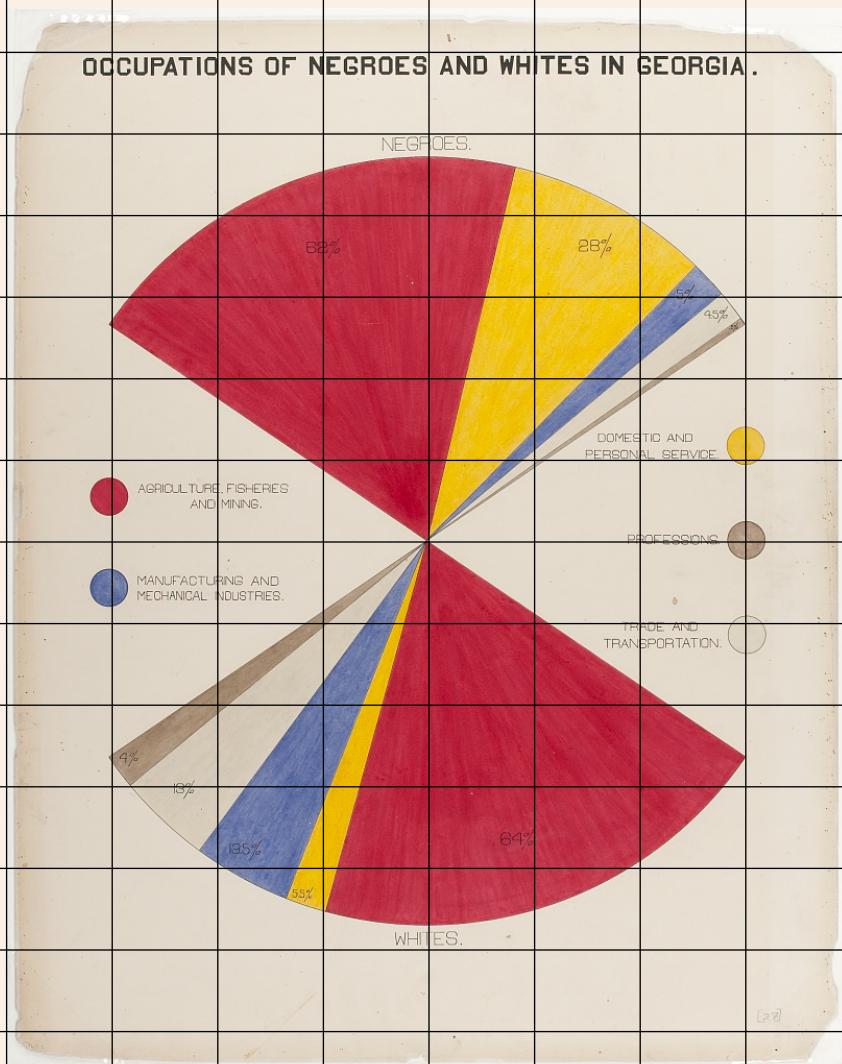
Next, drawing with modern data may be introduced.

Explore Example 1



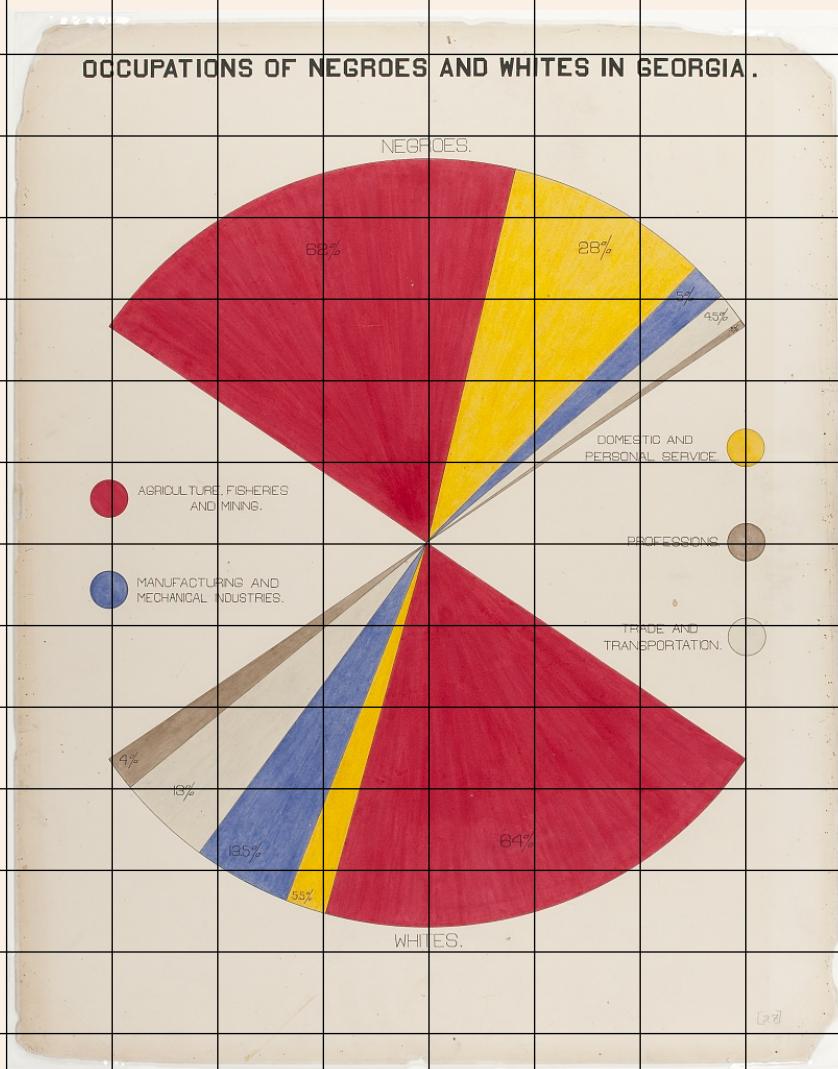
Occupations of Negroes and Whites in Georgia

Explore: Outline



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

Explore: Message



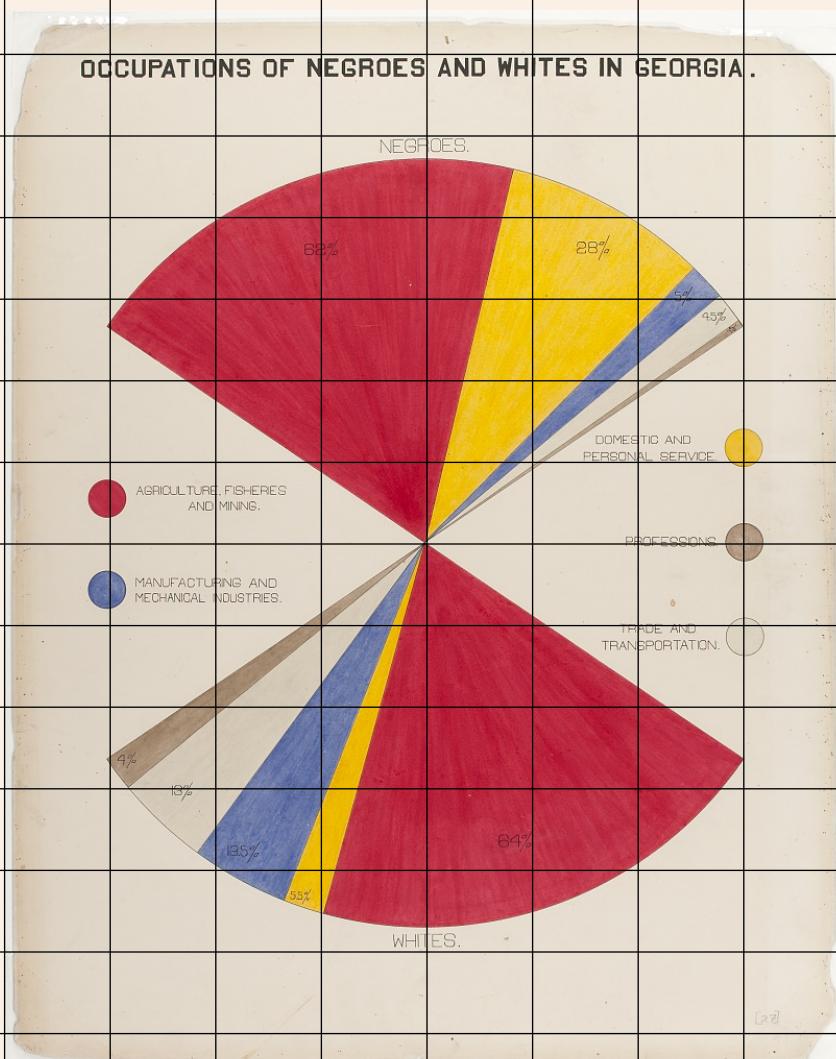
The message of the visual is tied to the overall message from Du Bois at the Paris Exposition:

Describe the status and progress of Black Americans since emancipation.

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

Activity: Discuss the message that the visual is attempting to convey

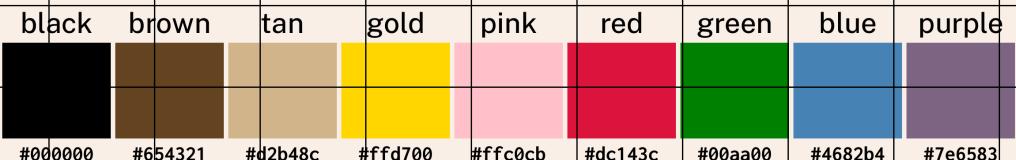
Explore: Aesthetics and Design



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.

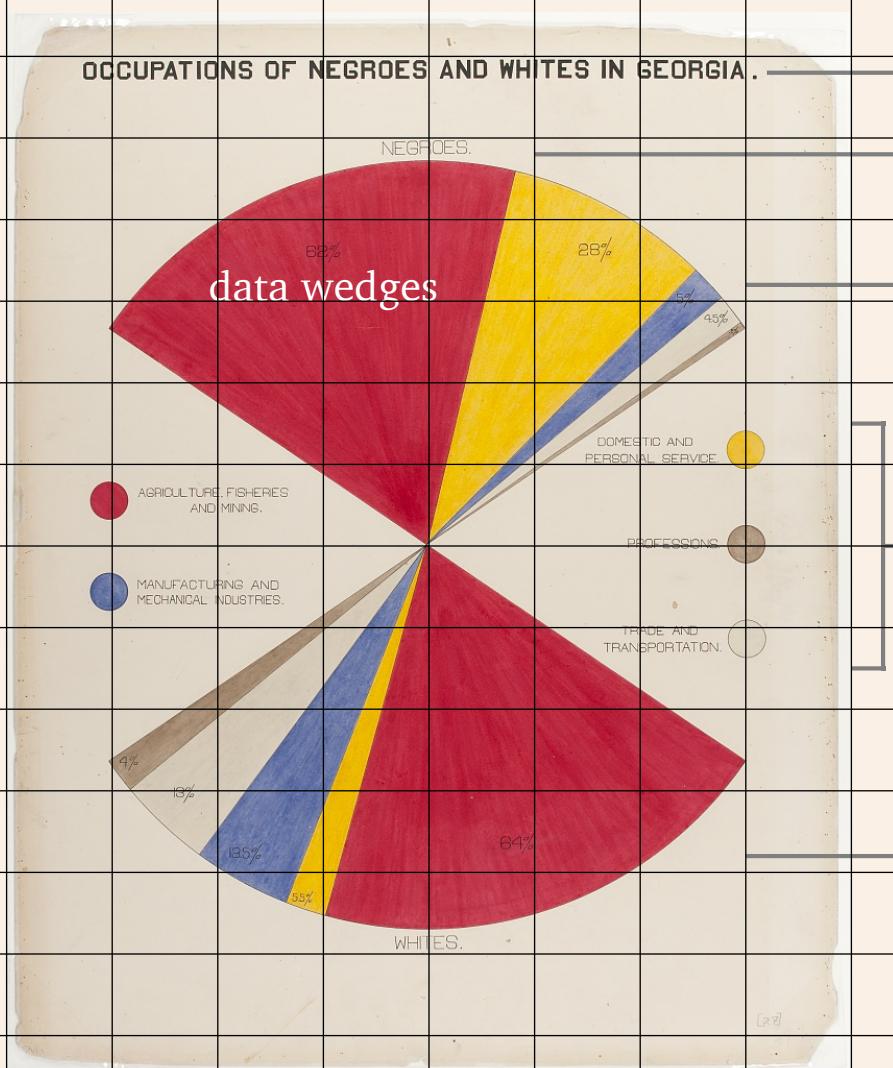
Also note the legends arranged on the left and right, placed in the gaps between the wedges.

The visual uses the typical Du Bois color palette.



Explore: Aesthetics and Design

22x28 inch portrait mode



Title
Labels

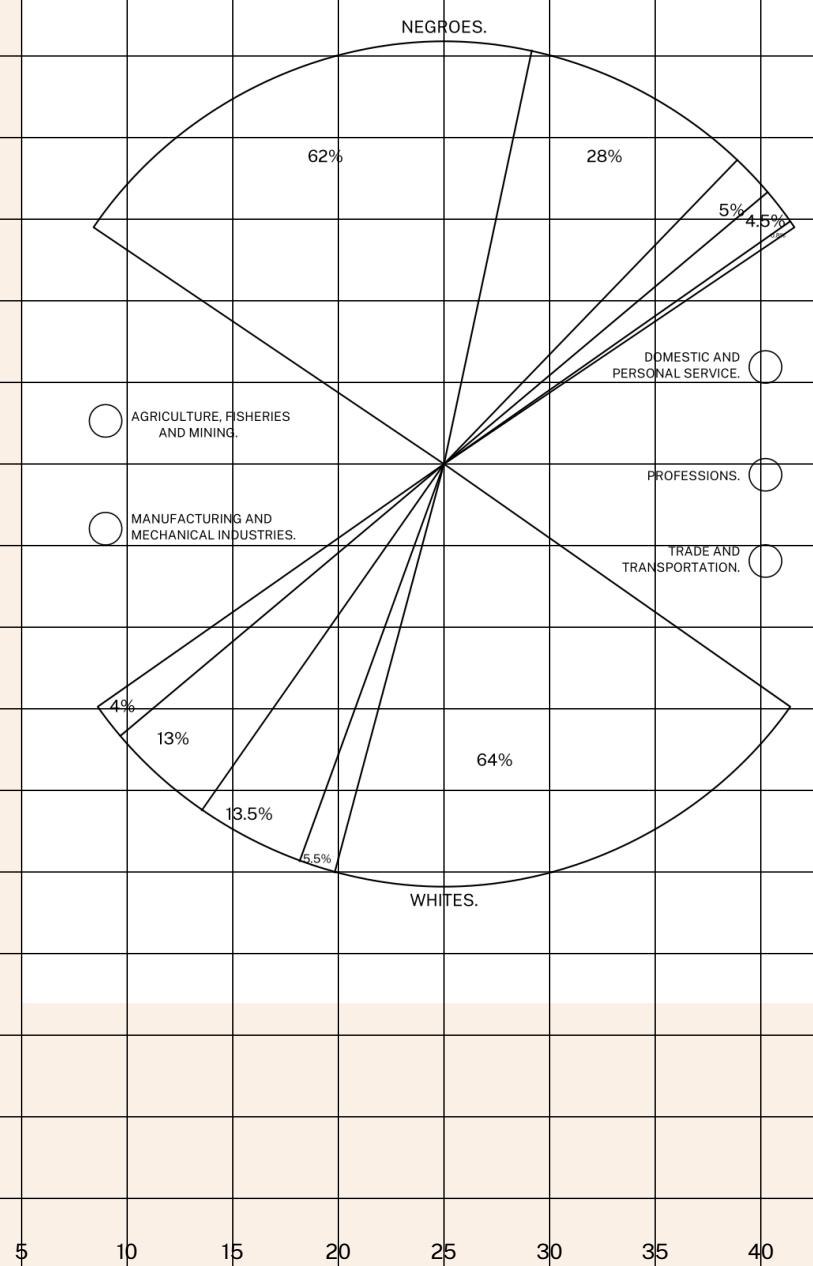
Black Georgians

Legend

White Georgians

Explore: Recreate

OCCUPATIONS OF NEGROES AND WHITES IN GEORGIA.

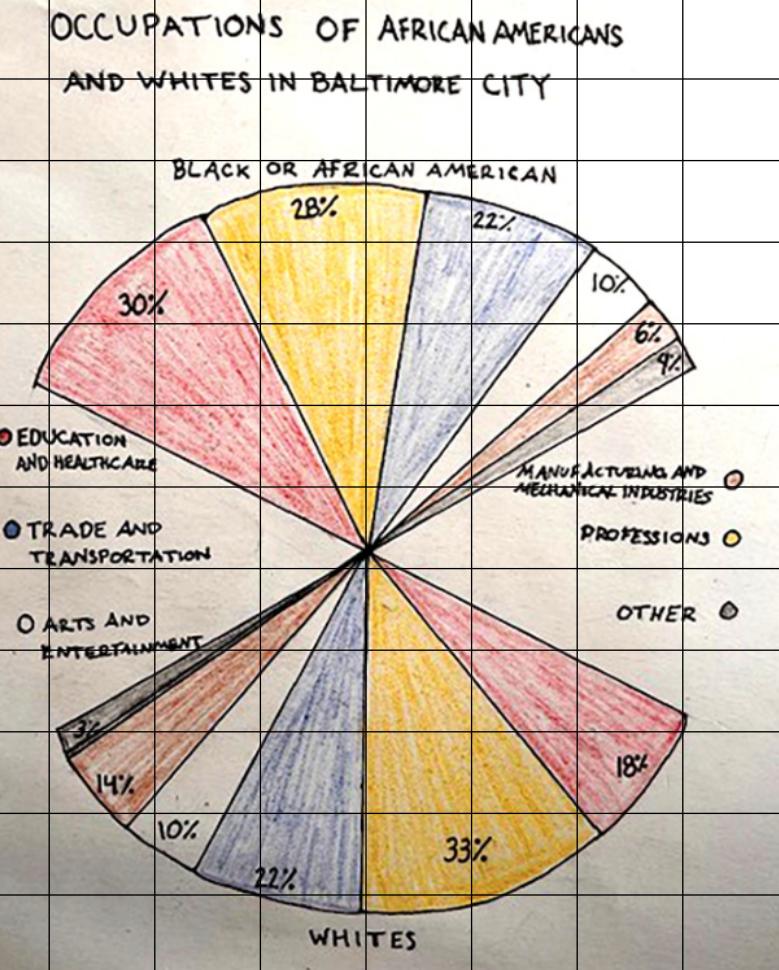


Re-create the visual using pens, paper and other analog materials like markers, colored pencils, rulers, and protractors.

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. Students 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, students may 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-Americans and Whites in the city of Baltimore.

Explore: Analytical Methods

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

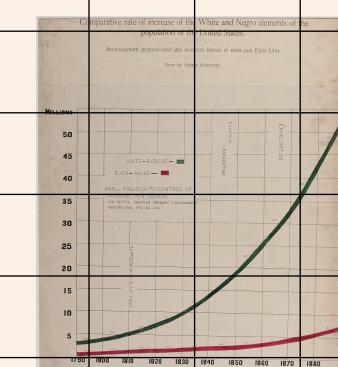
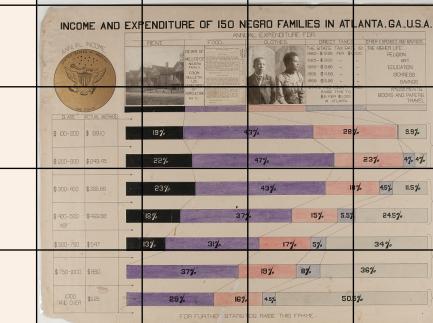
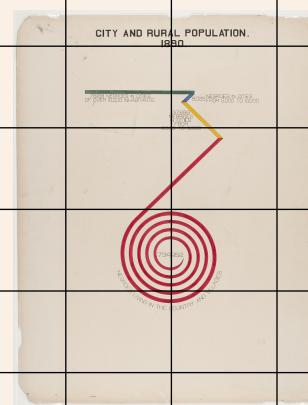
- Is the “fan chart” an effective method of evoking the message?
- Can the viewer make appropriate comparisons?
- What conclusions are drawn from the visual?
- What additional questions are raised?

Explore: Chart Types

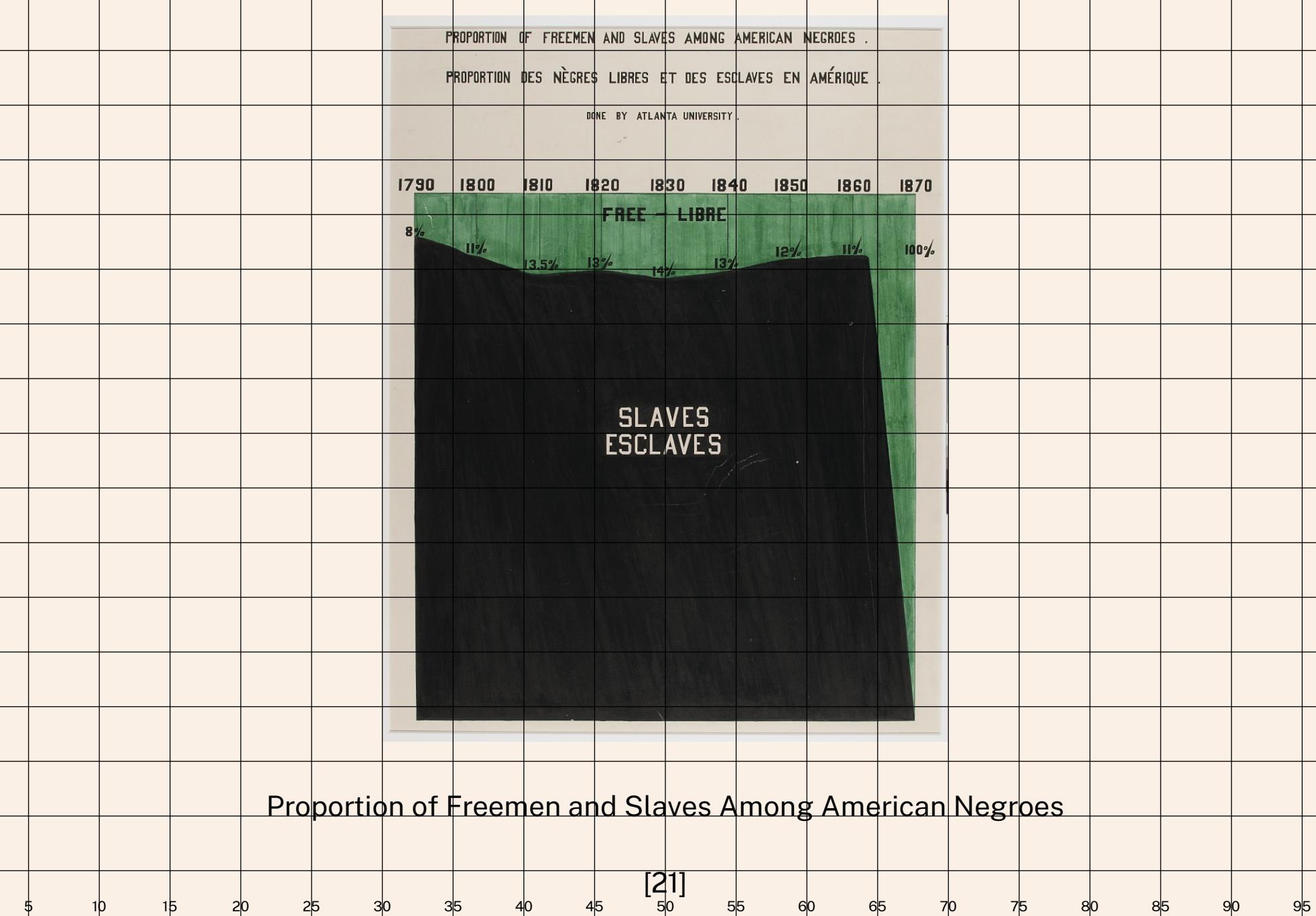
In the section, consider the selection of chart type, and its role in conveying the appropriate message.

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

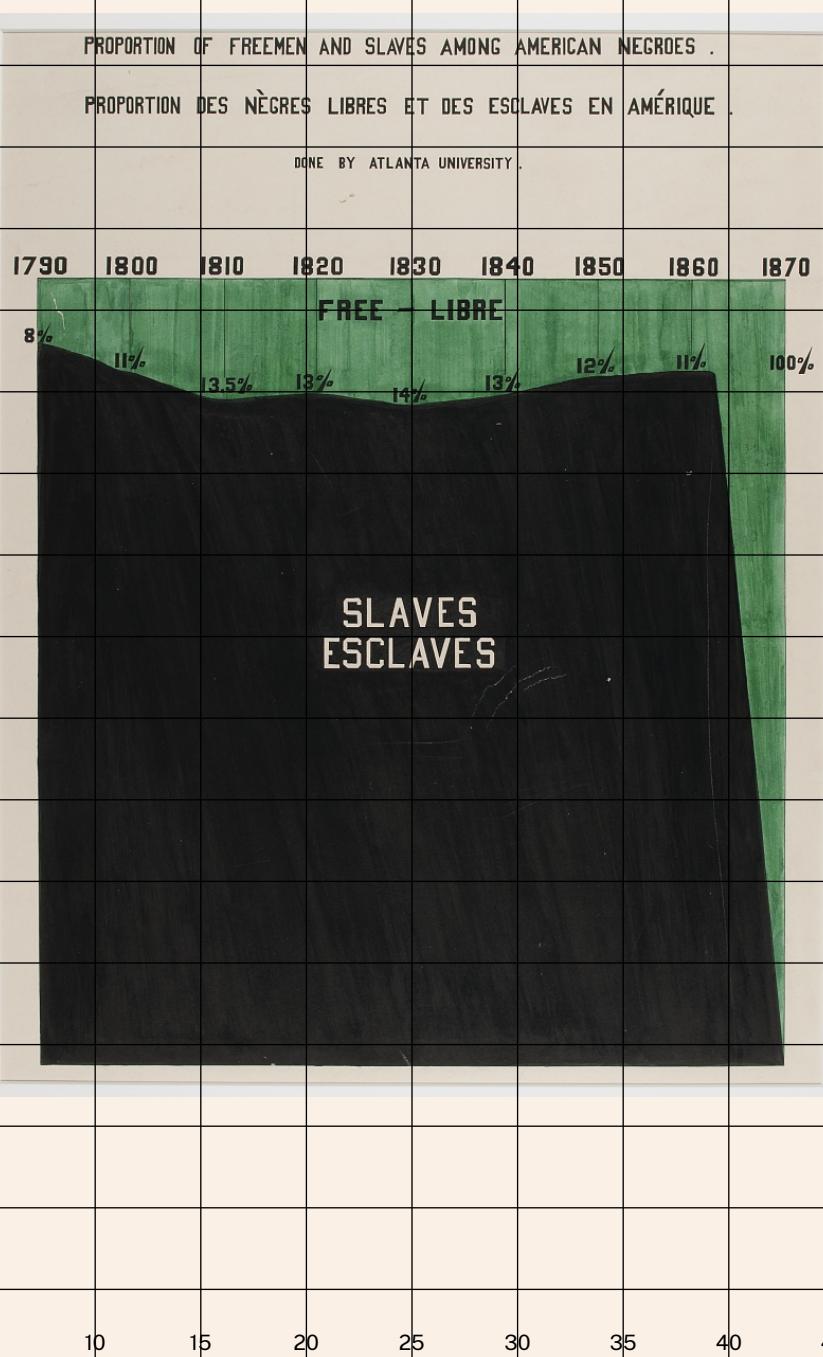
The types include the fanciful Du Bois spiral, stacked bars with integrated photographs, and conventional bar and line graphs.



Explore Example 2



Explore: Message

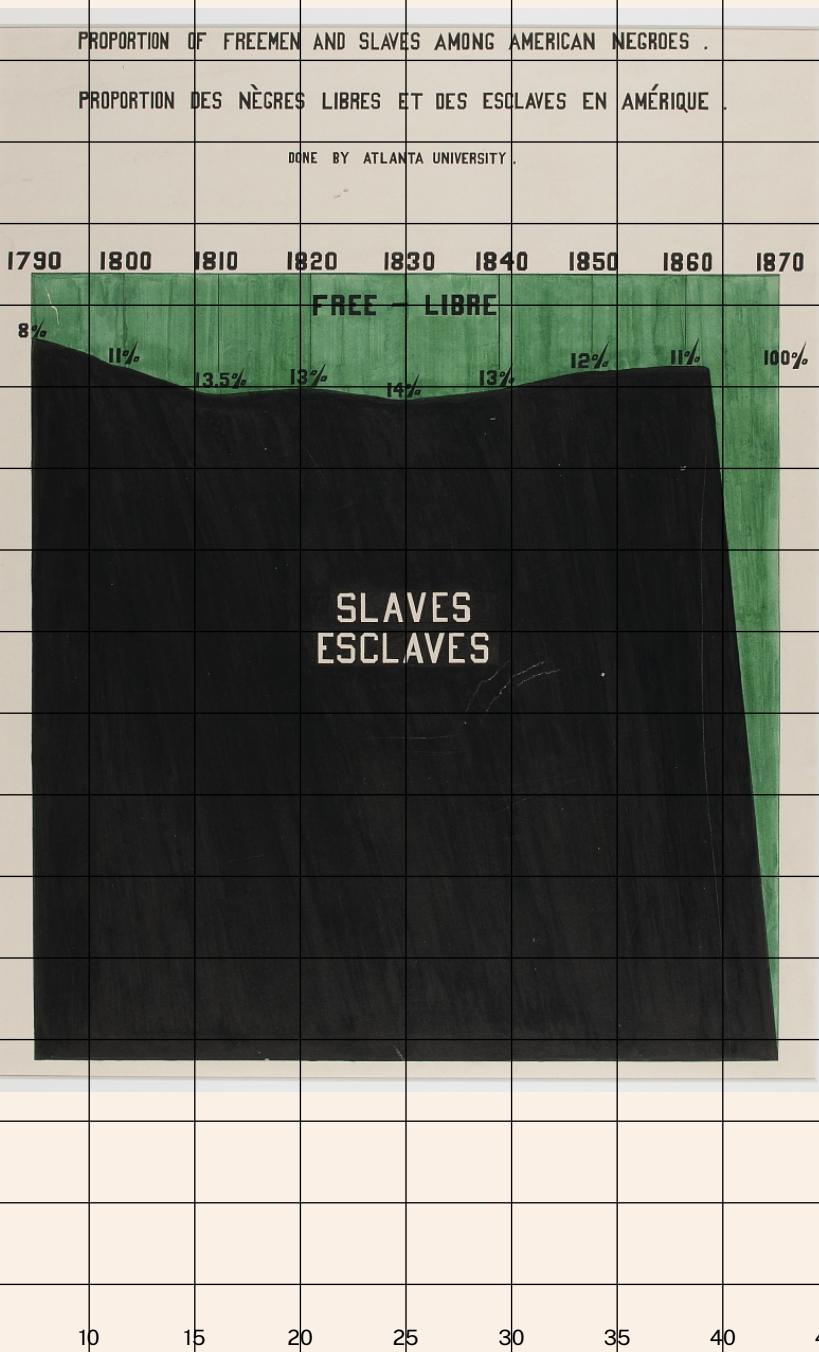


The message of the visual is tied to the overall message from Du Bois at the Paris Exposition:

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: 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.

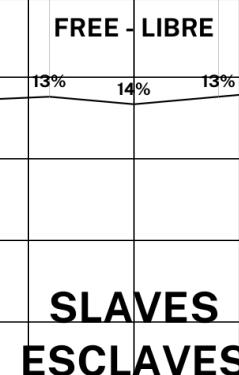
The titles are bilingual (a nod to the venue), and the X-axis is labeled at the top, contrary to today's convention. Instead of a labeled Y-axis, each individual data point is labeled.

Explore: Re-create

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

DONE BY ATLANTA UNIVERSITY.

1790 1800 1810 1820 1830 1840 1850 1860 1870



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. Students may work together or individually.

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

Explore: Modernize

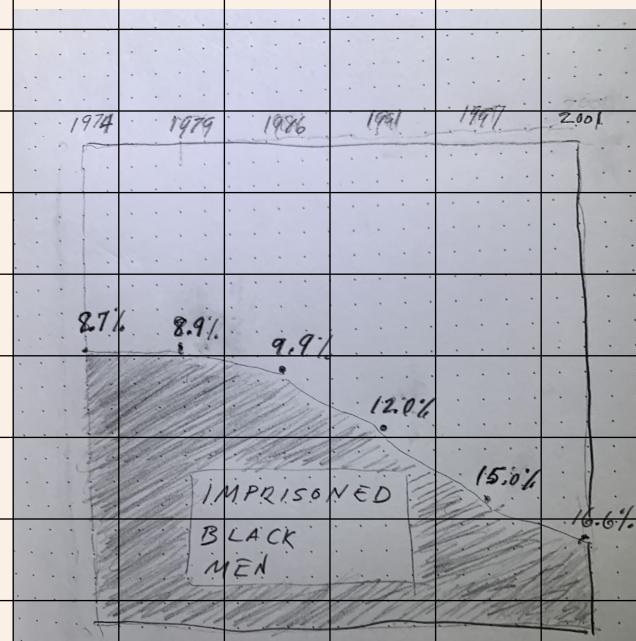


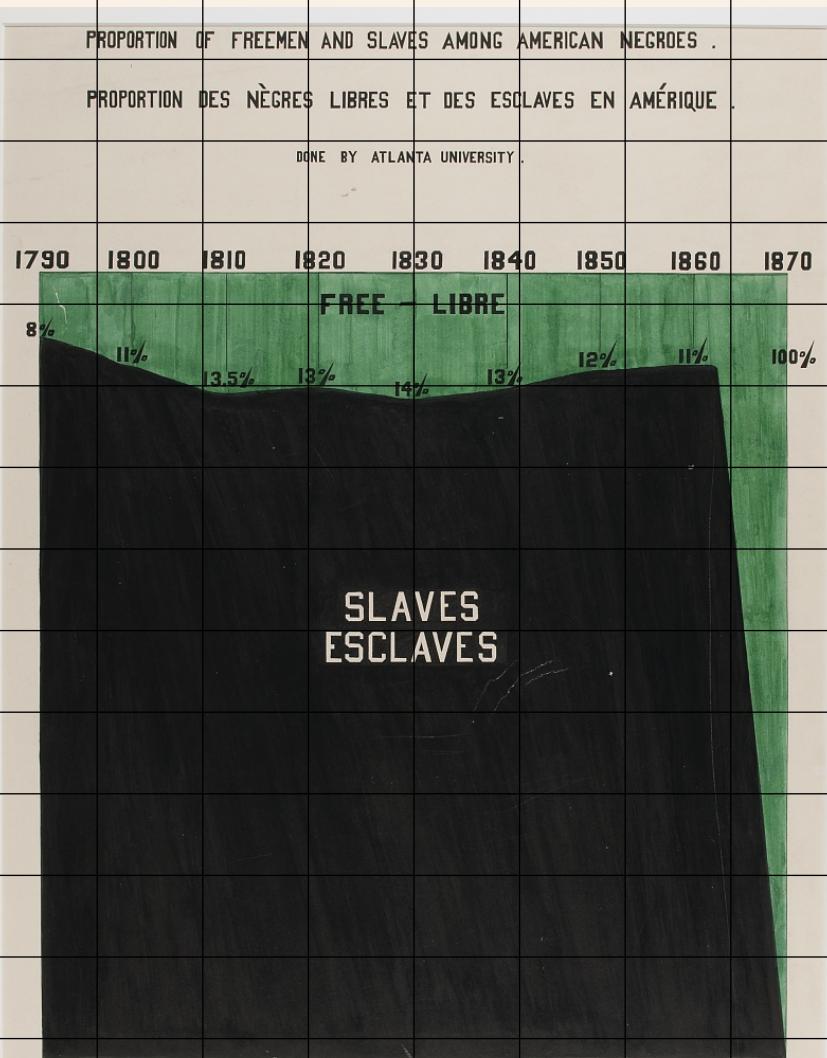
Table 5. Percent of adult population ever incarcerated in a State or Federal prison, by gender, race, and Hispanic origin, 1974-2001

	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:

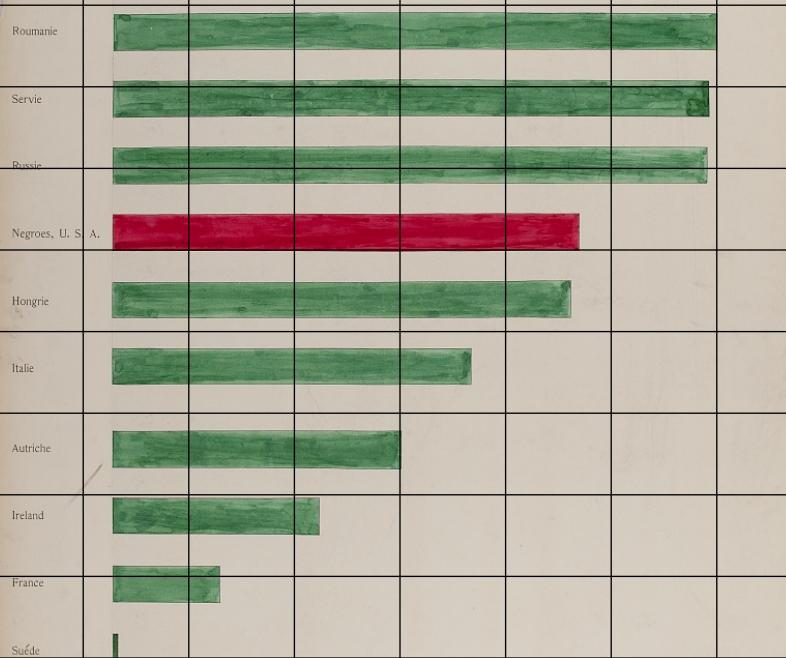


Explore Example 2

P (24) Illiteracy of the American Negroes compared with that of other nations.

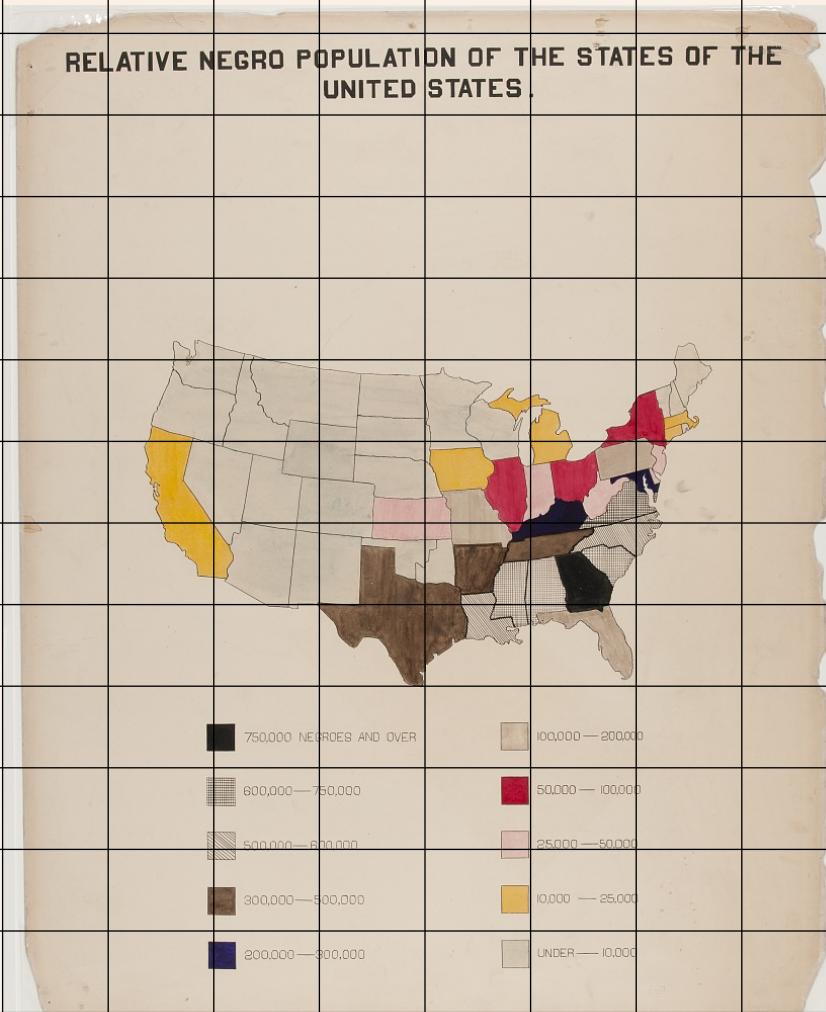
Proportion d'illittrés parmi les Noirs Américains comparée à celle des autres nations.

Done by Atlanta University.



Illiteracy of American Negroes compared with that of other nations

Explore Example 4



Relative Negro Population of the States of the United States

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>

Implementation

The Implementation section builds on the Context and Explore sections and guides the students 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.

Implementation: Introduction

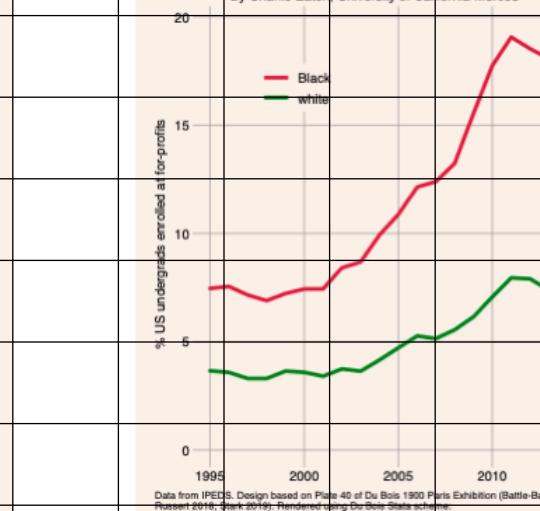
duboisforprofitenrollments.ipynb

File Edit View Run Kernel Tabs Settings Help

No Kernel

SHARE OF ALL U.S. UNDERGRADS ENROLLED AT FOR-PROFIT COLLEGES BY RACE

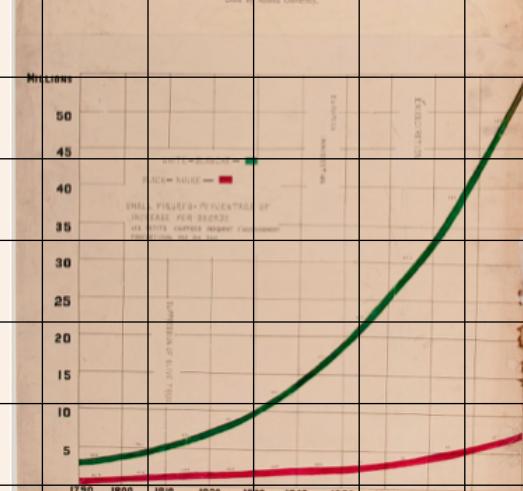
By Charlie Eaton, University of California-Merced



Comparative rate of increase of the White and Negro elements of the population of the United States

Accroissement proportionnel des éléments blancs et noirs aux Etats-Unis.

Data from Atlanta University.



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.

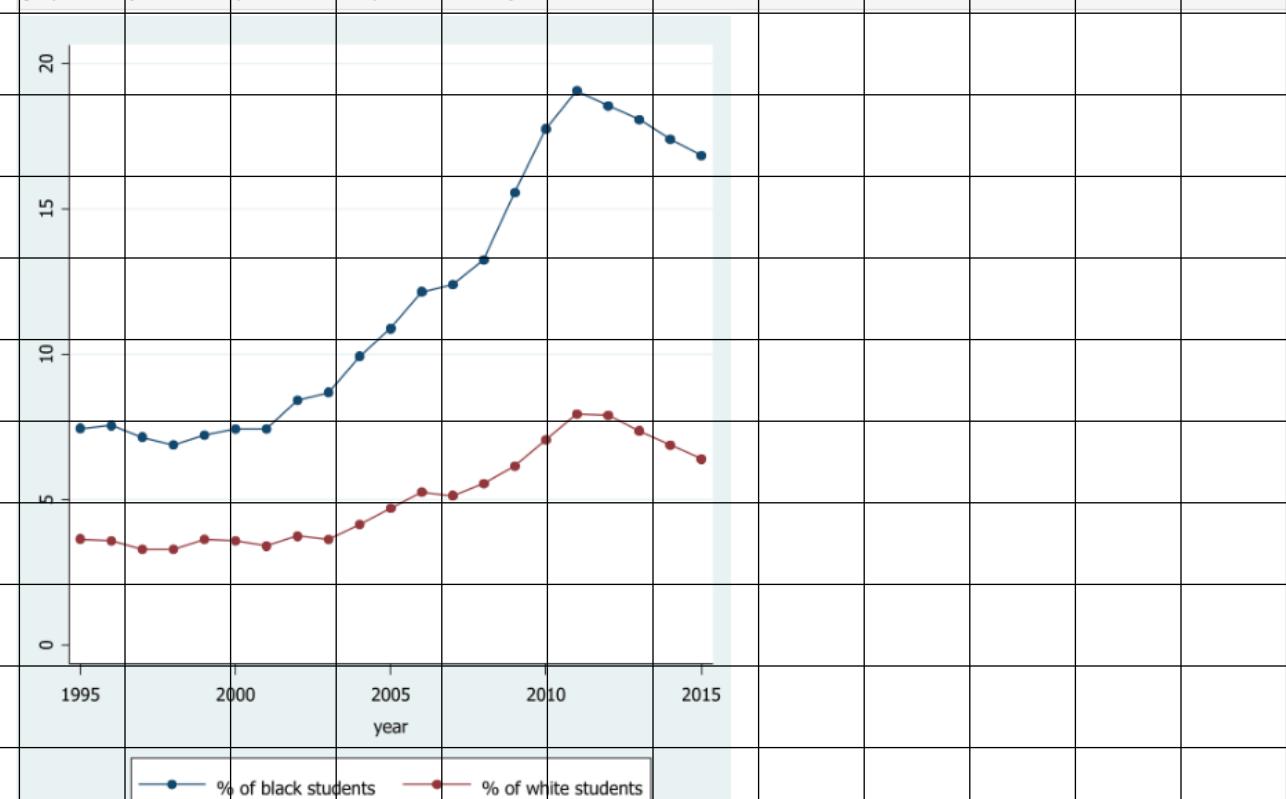
You'll also learn how to modify the graph according to your own creative ideas for what might capture your audience's attention while still accurately representing the data.

Implementation: Basic Chart

Step 1: Execute the code below by clicking on the cell and then pressing the play button above.

This will plot the percent of all US Black college students enrolled at for-profit colleges and the percent of all white students enrolled at for-profit colleges

```
: graph twoway (connect pctunderbaat pctunderwhitt year)
```



Implementation: Hinting

The screenshot shows a Jupyter Notebook interface with a file named "duboisforprofilerolls.ipynb". The notebook has a menu bar with File, Edit, View, Run, Kernel, Tabs, Settings, and Help. Below the menu is a toolbar with icons for file operations like Open, Save, and Run. The status bar indicates "Stata (nbstata)". A code cell at the bottom contains the following code:

```
[6]: twoway (connect pctunderbaat pctunderwhitt year, legend(off)) scheme(dubois)
```

An error message is displayed in red text:

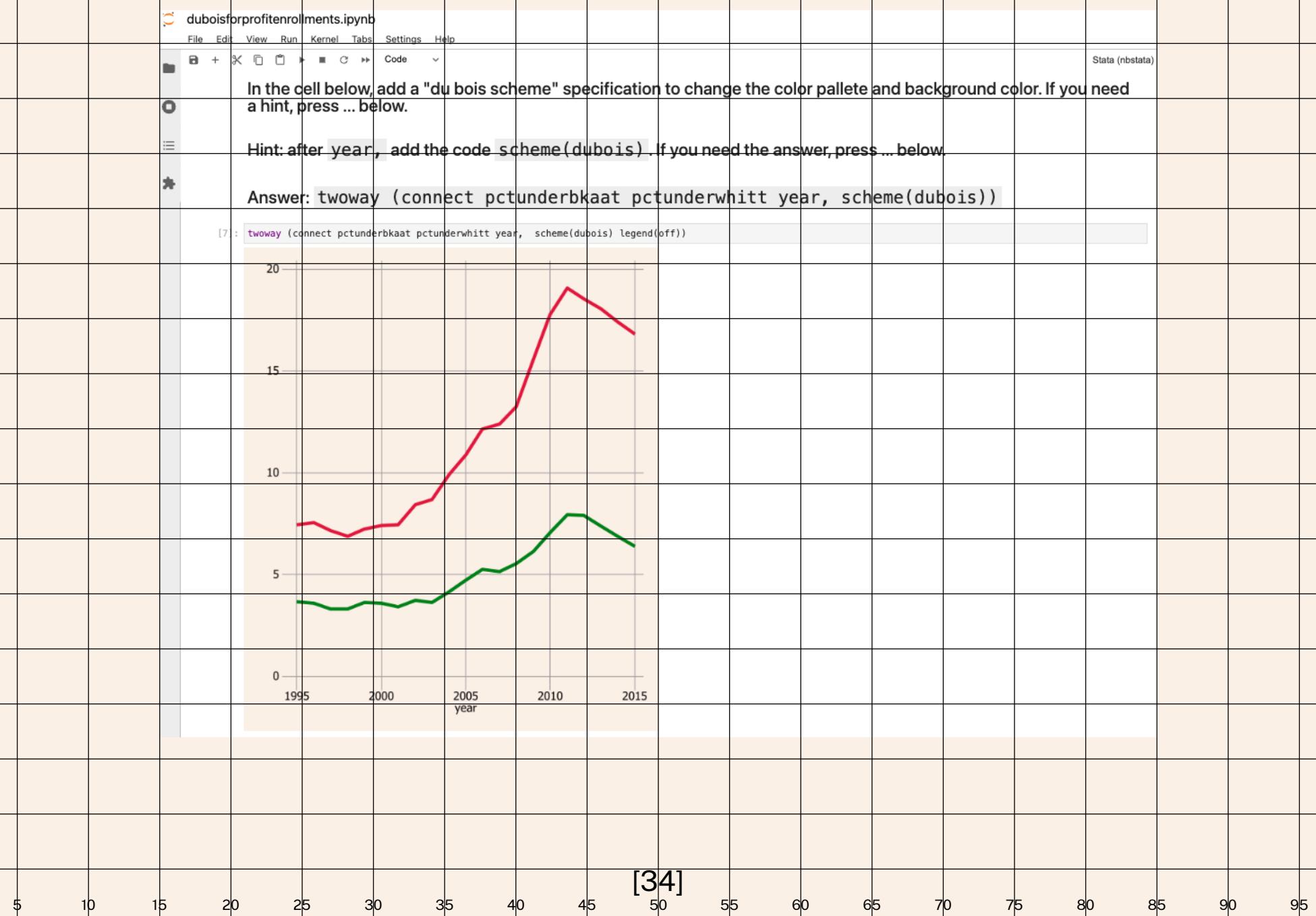
```
scheme(dubois) is not a two way plot type  
r(198);
```

To the left of the code cell, there is a vertical sidebar with icons for file operations and a list icon. A large orange circle with a question mark is positioned above the code cell, indicating a hint is available.

In the main content area, there are two text blocks:

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

Implementation: 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

<https://www.edriessen.com/2024/02/07/developing-du-boiss-data-portraits-with-python-and-matplotlib/>

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

<https://github.com/edriessen/dubois24-python-matplotlib>

#DuBoisChallenge2024 using R

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

#DuBoisChallenge2024 using Tableau

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