

# Framed!

## Reproducing 150 Year Old Charts

Susan VanderPlas  
Ryan Gorluch  
Heike Hofmann

IOWA STATE UNIVERSITY



**STATISTICAL ATLAS**  
OF THE  
**UNITED STATES**  
BASED ON THE RESULTS OF THE  
**NINTH CENSUS 1870**

WITH CONTRIBUTIONS FROM MANY EMINENT MEN OF SCIENCE  
AND SEVERAL DEPARTMENTS OF THE GOVERNMENT.

COMPILED UNDER AUTHORITY OF CONGRESS  
BY  
**FRANCIS A. WALKER, M.A.**

SUPERINTENDENT OF THE 9<sup>TH</sup> CENSUS.

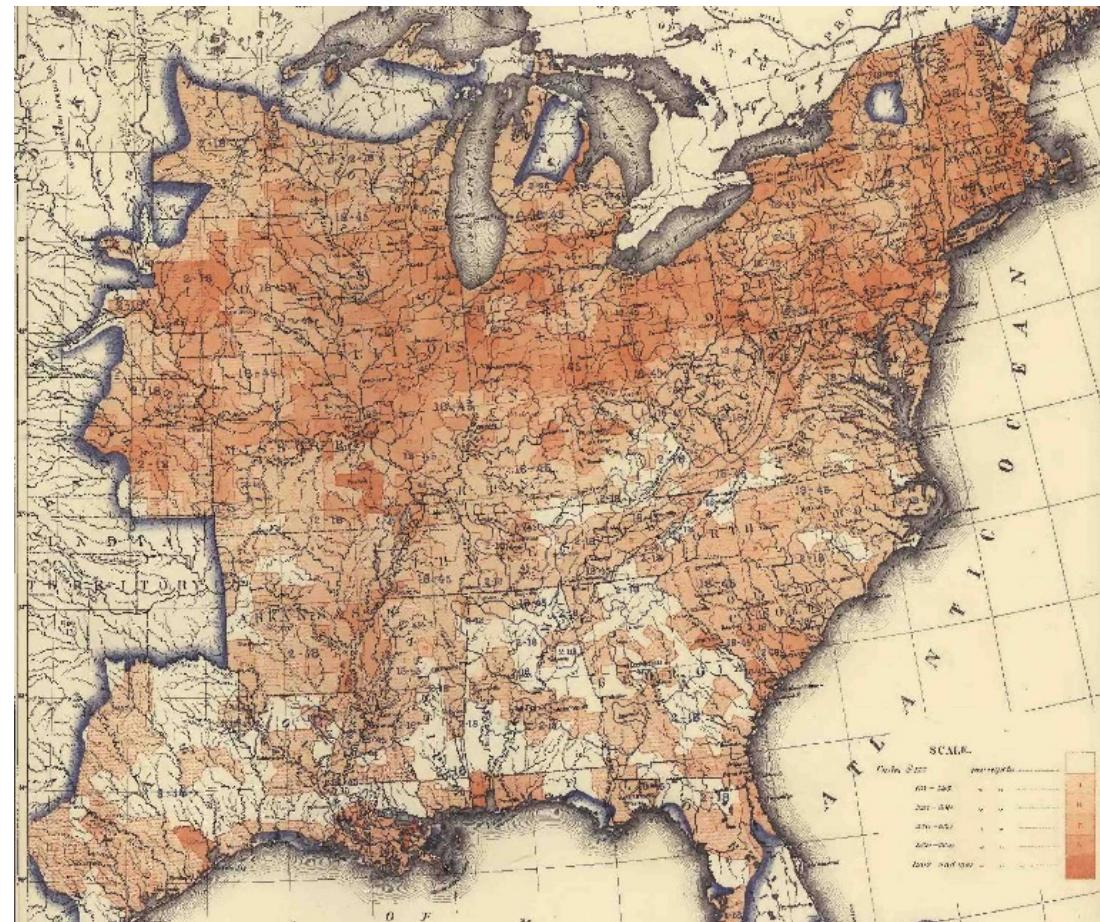
PROFESSOR OF POLITICAL ECONOMY AND HISTORY,  
SHEFFIELD SCIENTIFIC SCHOOL OF YALE COLLEGE.

# Introduction

- Statistical Atlas published for the 9th, 10th, and 11th census (1870, 1880, 1890)
- Charts created by hand and reproduced using lithography
- Goal: Show the makeup of the country
  - Maps

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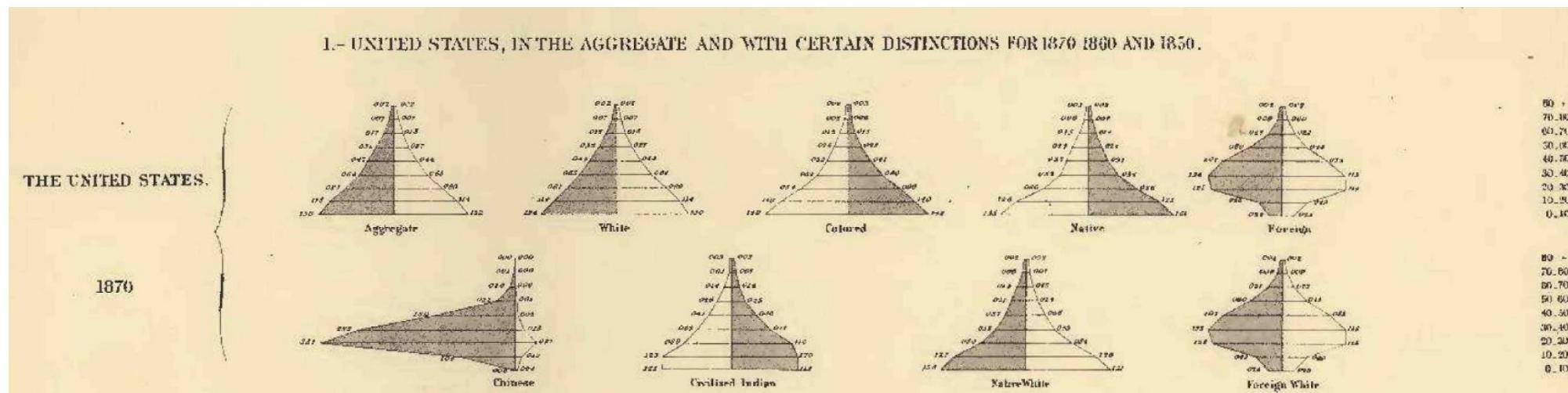


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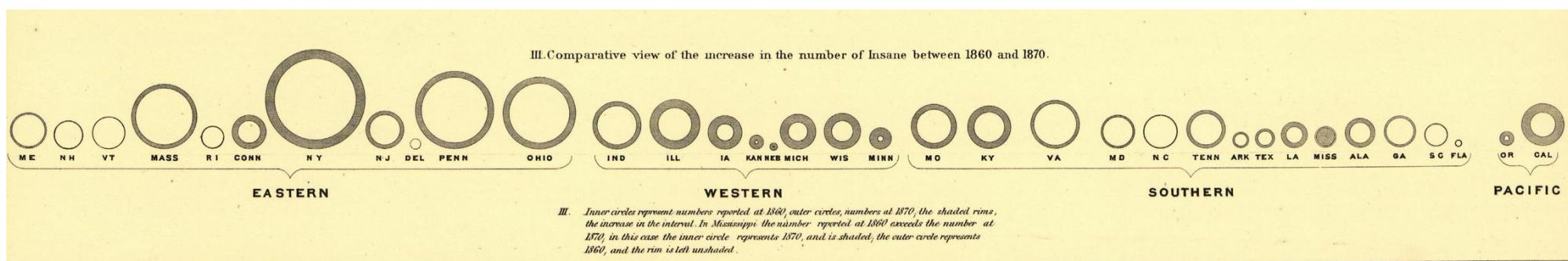


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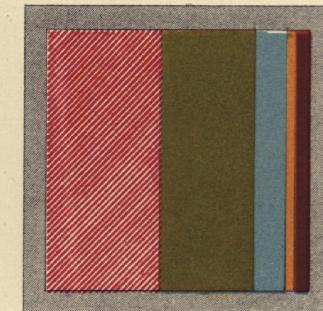


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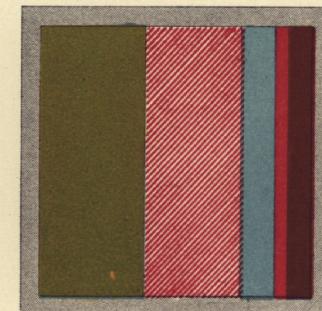
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    - framed mosaic and spine plots



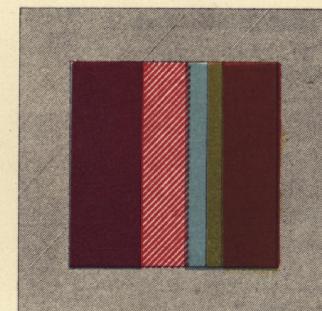
THE UNITED STATES



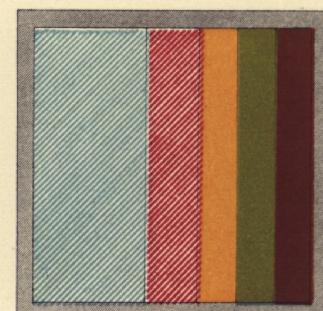
ALABAMA



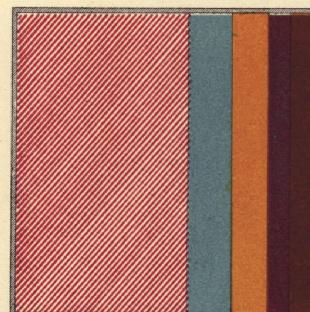
ARKANSAS



CALIFORNIA



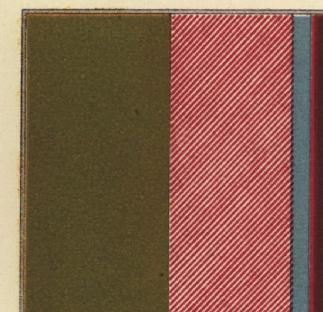
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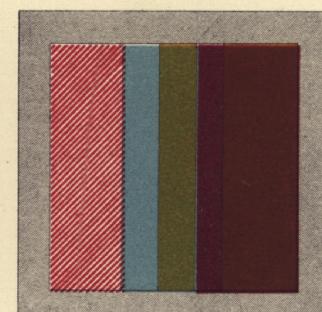
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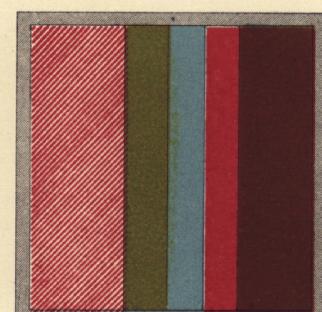
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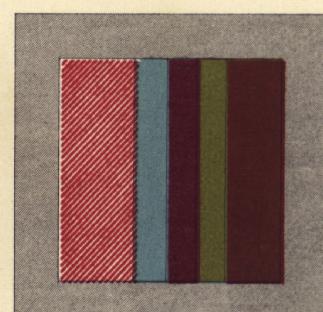
GEORGIA



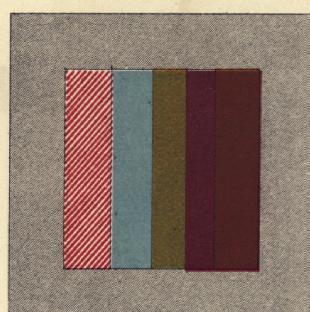
ILLINOIS



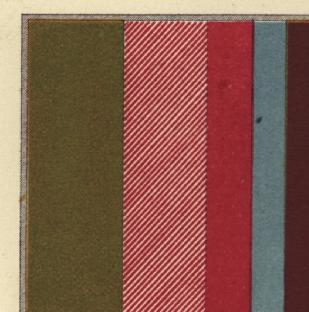
INDIANA



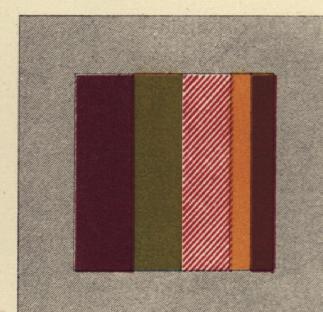
IOWA



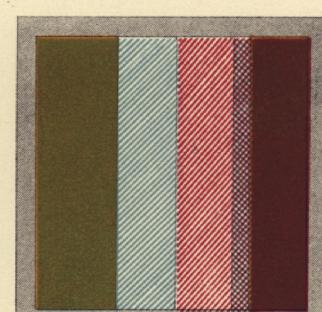
KANSAS



KENTUCKY



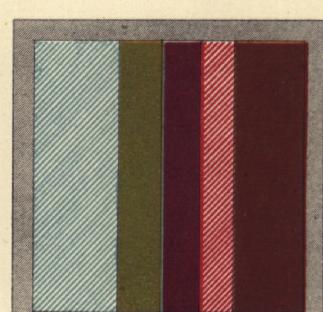
LOUISIANA



MAINE



MARYLAND



MASSACHUSETTS



## CHART SHOWING THE RATIO OF CHURCH ACCOMMODATION

TO THE TOTAL POPULATION OVER 10 YEARS OF AGE

WITH THE PROPORTION OF SUCH CHURCH ACCOMMODATION FURNISHED BY EACH OF  
THE LARGEST FOUR DENOMINATIONS WITHIN EACH STATE AND BY EACH OF  
THE LARGEST EIGHT DENOMINATIONS WITHIN THE UNITED STATES.

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BY  
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*Note: The interior squares represent the proportion of the population which is provided for by the aggregate sittings in the churches of all denominations. The shaded interval between the inner and outer squares represents the population for which no church accommodation is provided. Where the aggregate church accommodation equals or exceeds the population over 10 years of age the shaded interval disappears.*

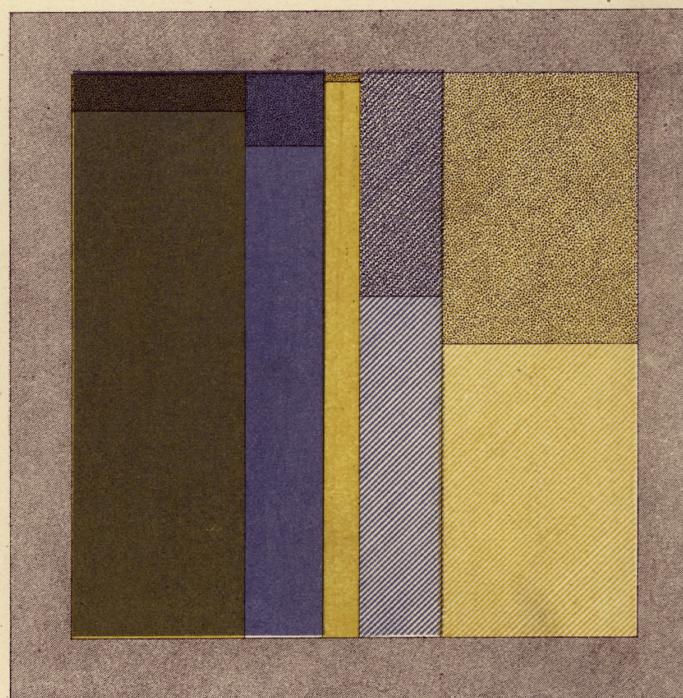
|                         |  |
|-------------------------|--|
| Methodist               |  |
| Baptist                 |  |
| Presbyterian            |  |
| Roman Catholic          |  |
| Congregational          |  |
| Episcopal               |  |
| Lutheran                |  |
| Christian               |  |
| Dutch Reformed          |  |
| Universalist            |  |
| Mormon                  |  |
| All other Denominations |  |

**CHART**  
 SHOWING FOR THE UNITED STATES AND FOR EACH STATE,  
 WITH DISTINCTION OF SEX, THE RATIO  
 BETWEEN THE TOTAL POPULATION OVER 10 YEARS OF AGE  
 AND THE NUMBER OF PERSONS REPORTED AS ENGAGED IN EACH PRINCIPAL CLASS OF

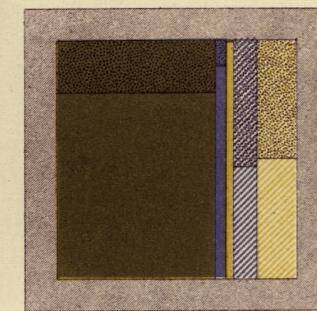
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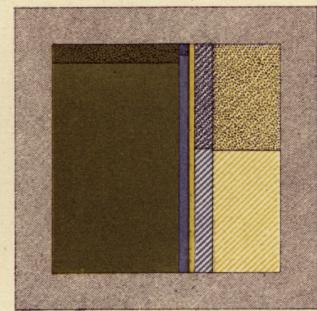
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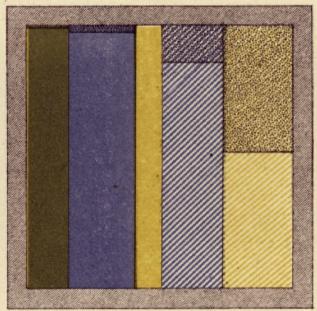
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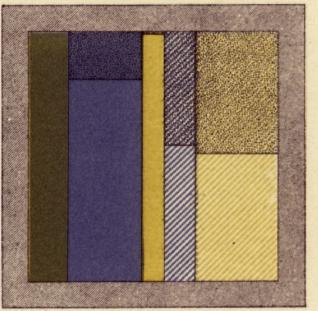
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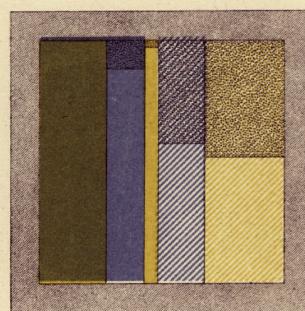
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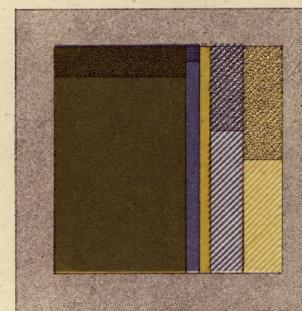
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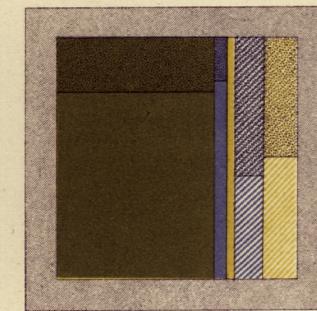
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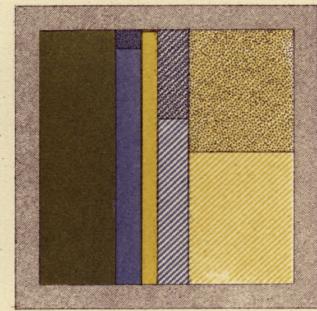
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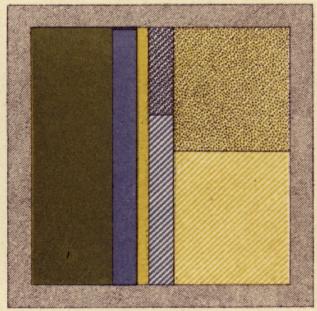
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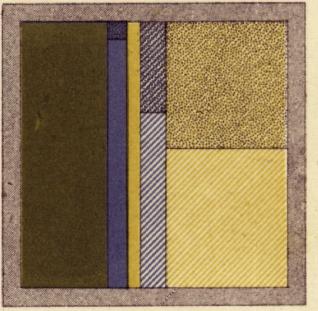
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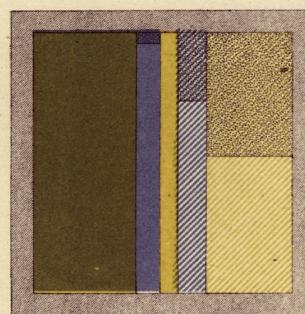
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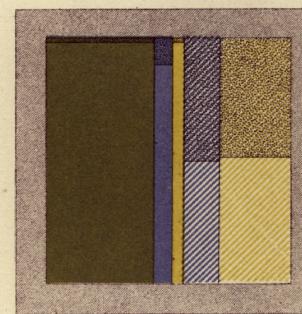
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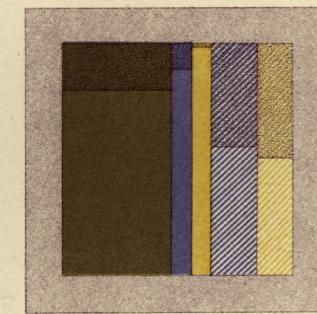
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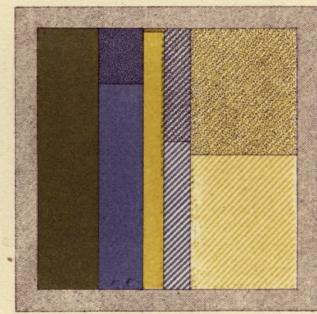
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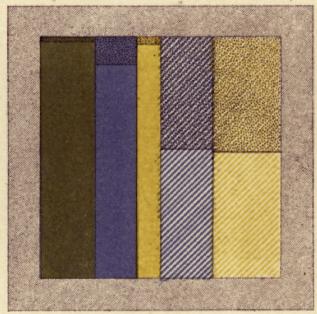
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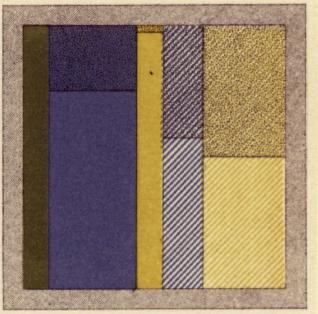
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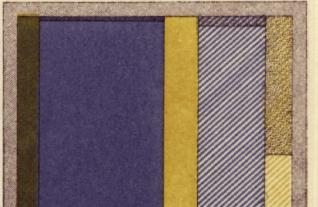
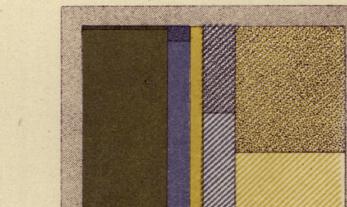
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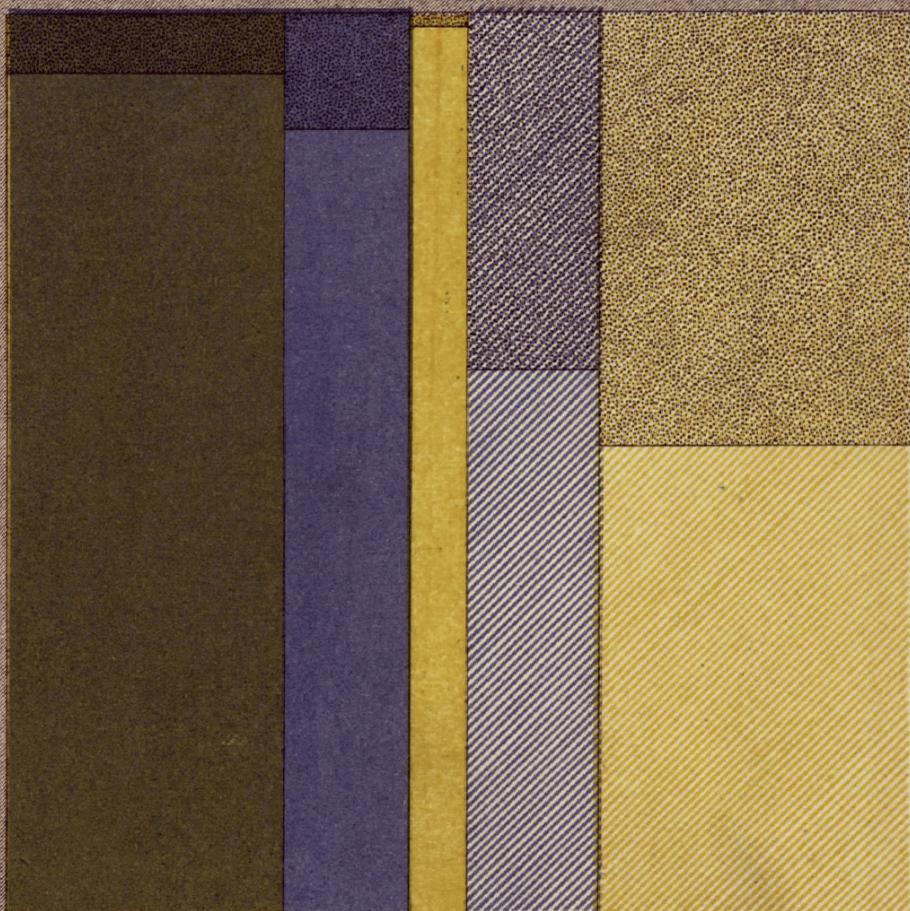
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*Methodist  
Baptist  
Presbyterian  
Roman Catholic  
Congregational  
Episcopal*



*Lutheran  
Christian  
Dutch Reformed  
Universalist  
Mormon  
All other Denomi-  
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Male, Female.

*Engaged in Agriculture.*

,, ,*Manufactures & Mining.*

,, ,*Trade & Transportation.*

,, ,*Pers. & Profess. Services.*

*Attending School.*



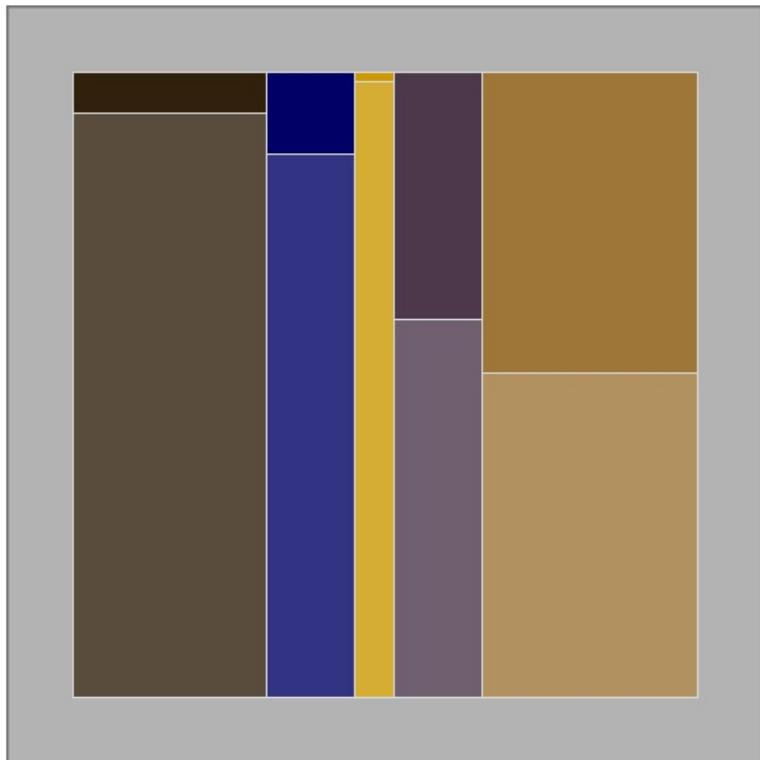
# Statistical Archaeology

Reproduce the plots with modern methods

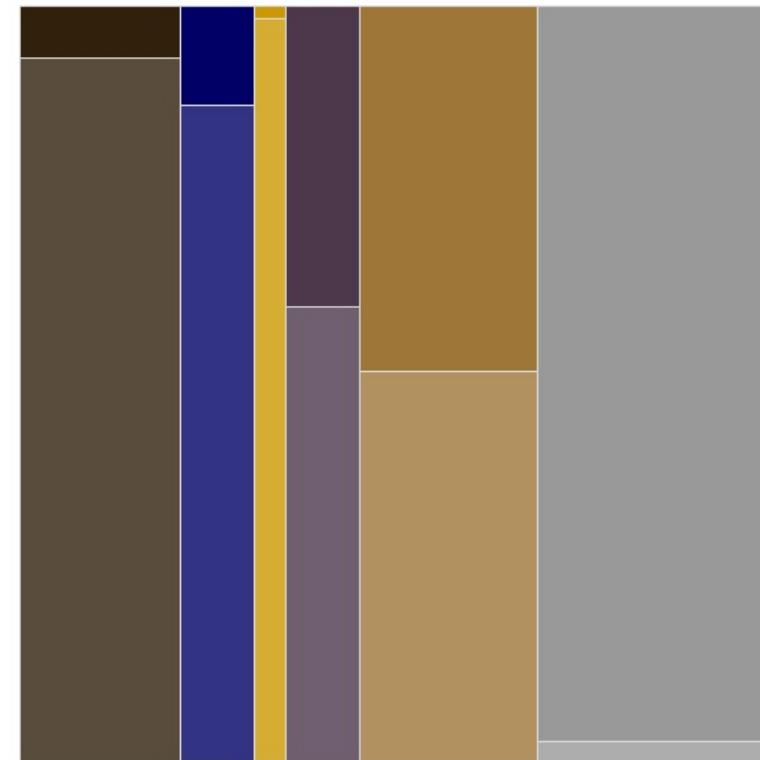
Data Sources:

- National Historical Geographic Information System
- Original 1870 Census tables
- Unaccommodated population estimates using 1% microsample data from Integrated Public Use Microdata Series (IPUMS).
- Pixel measurements (by hand) of the area of each chart (for comparison)

# Occupation



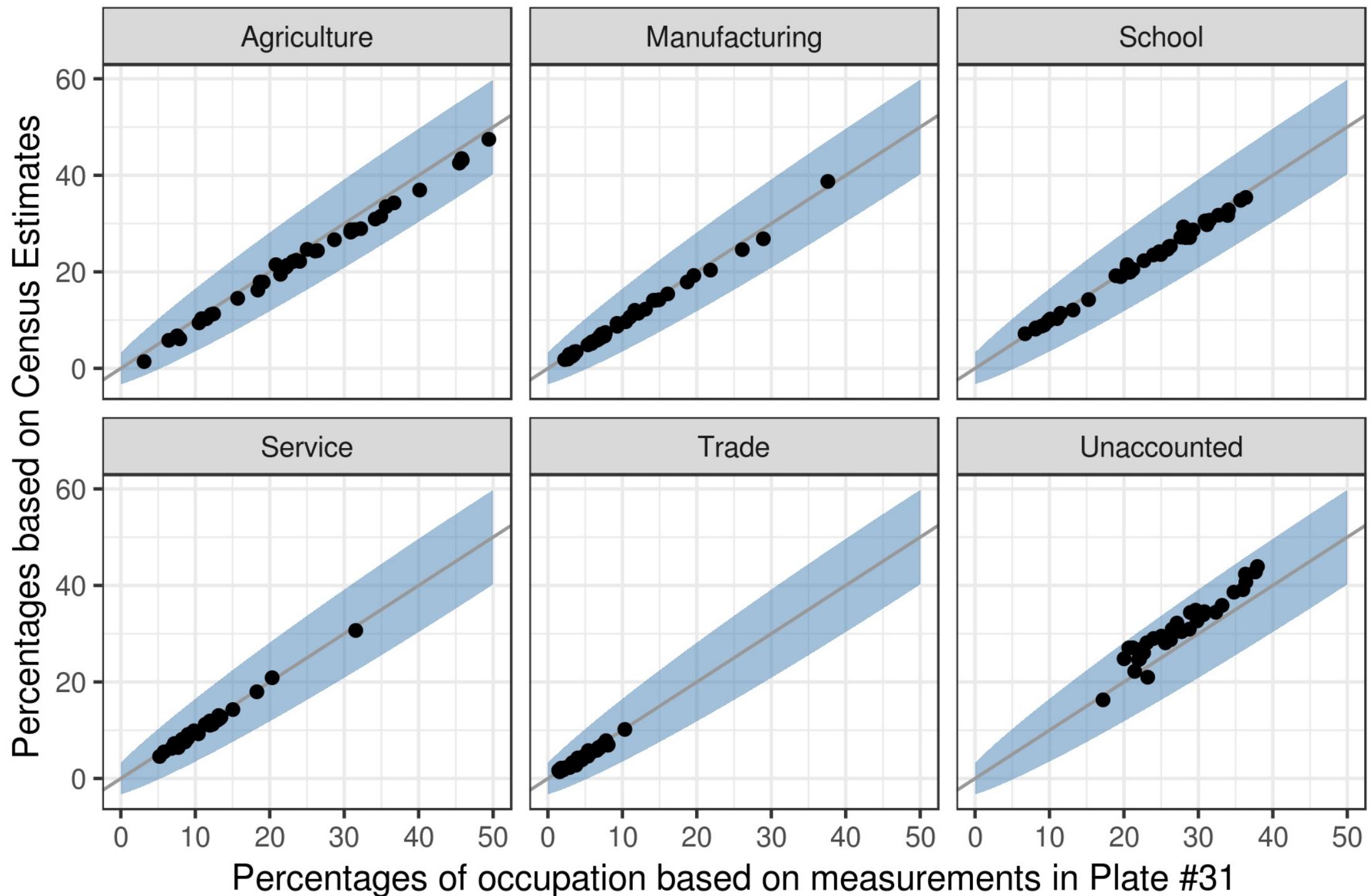
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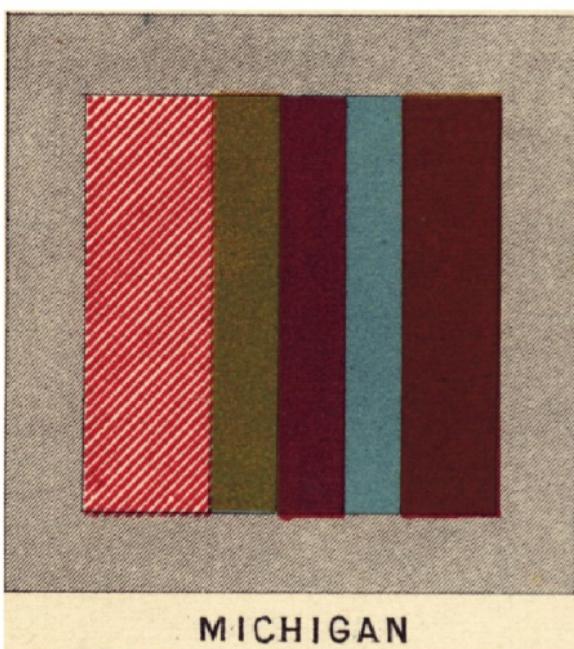
- Frame cuts the uncounted population into quarters visually
- No segmentation of the uncounted population - 97% of uncounted population is female

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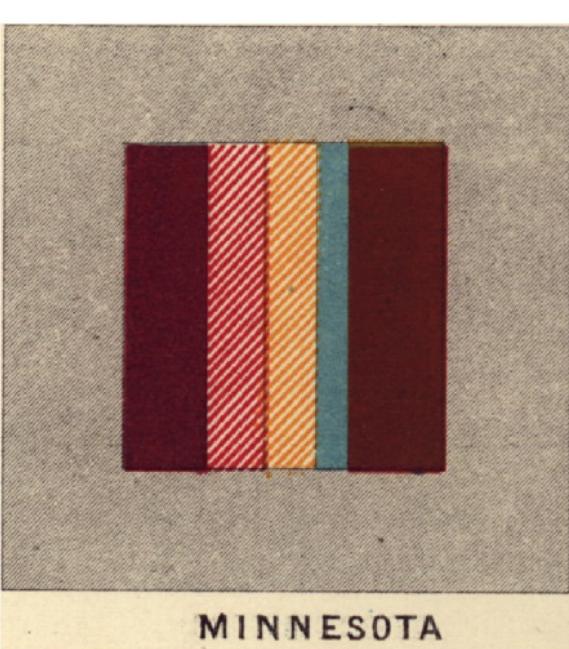


# **Church Accommodation**

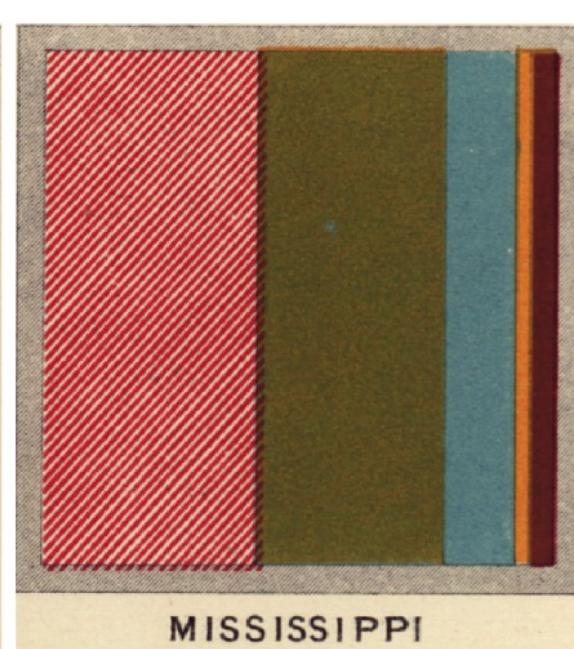
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MICHIGAN

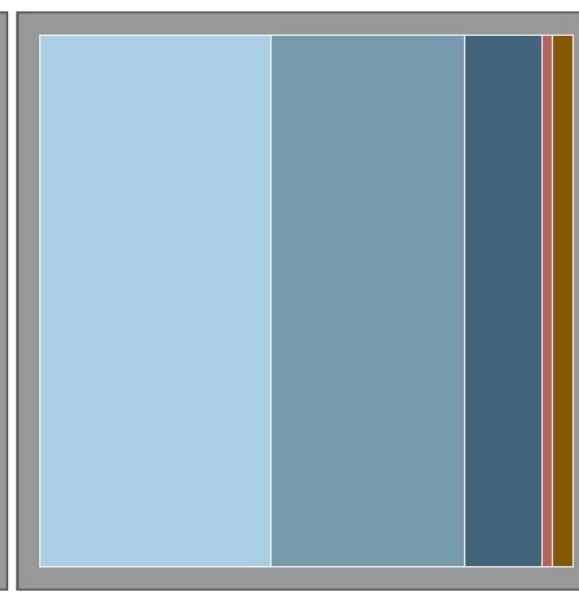
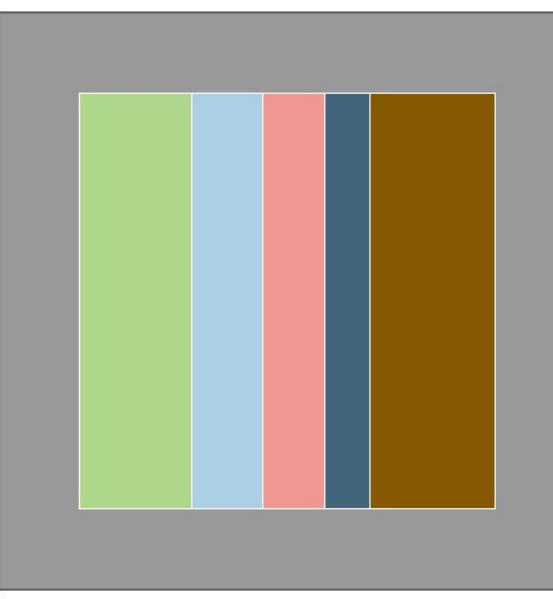
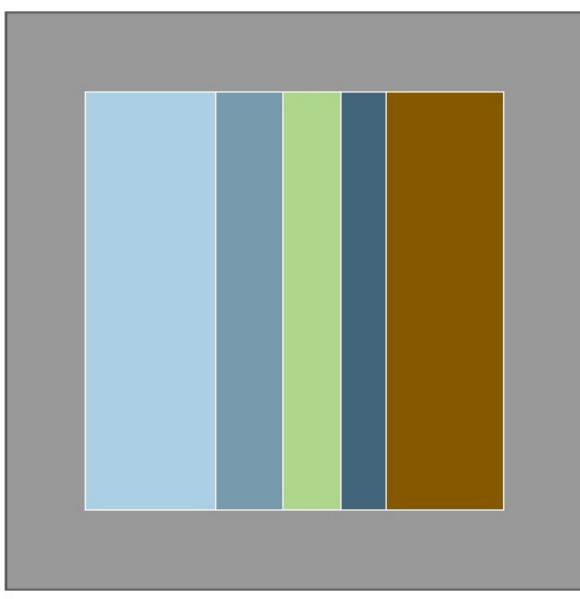
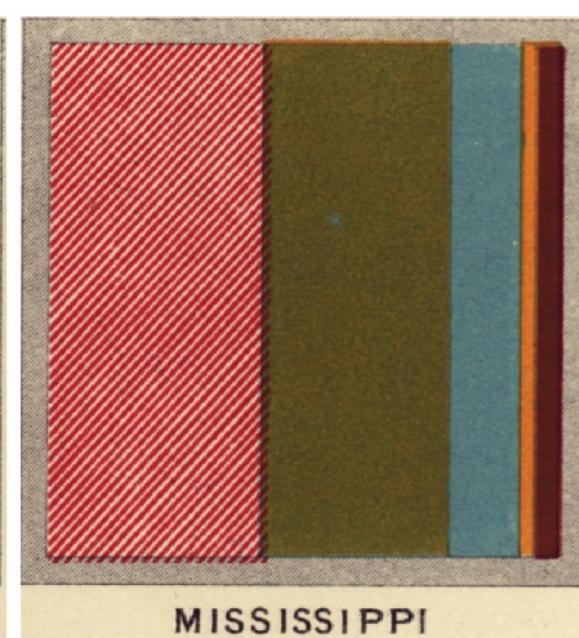
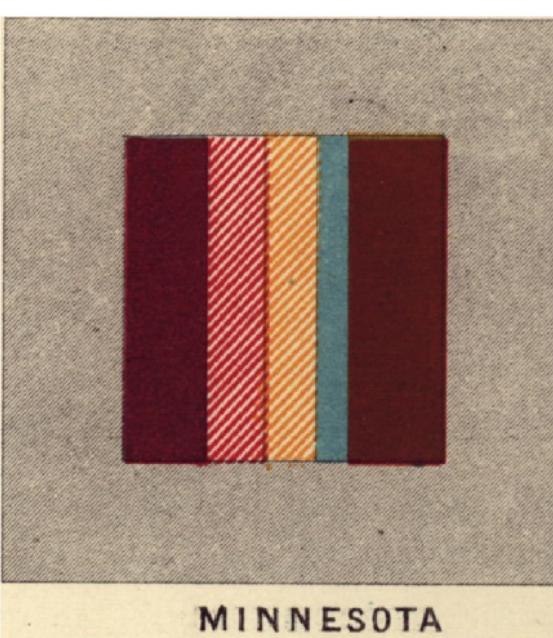
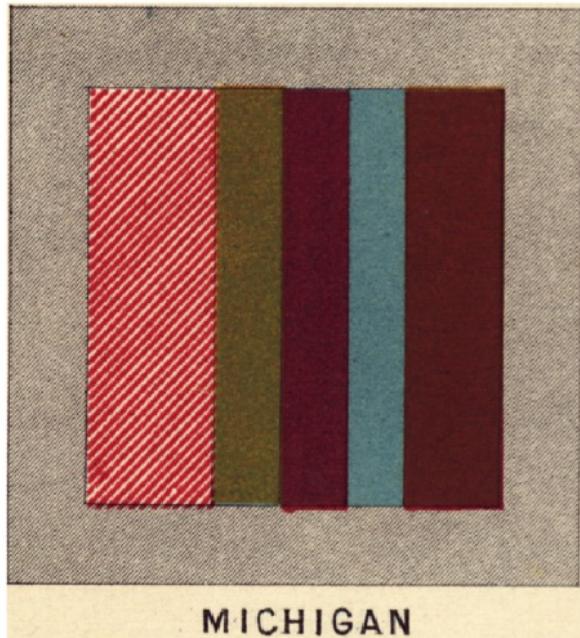


MINNESOTA

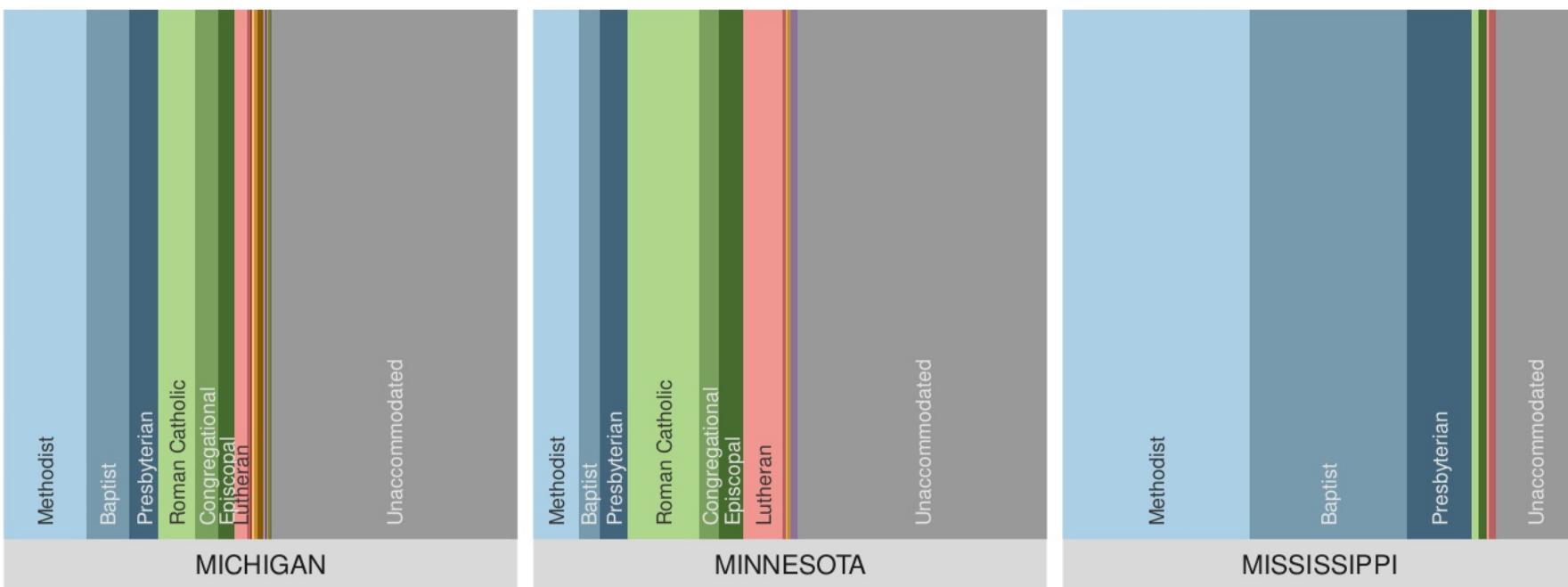
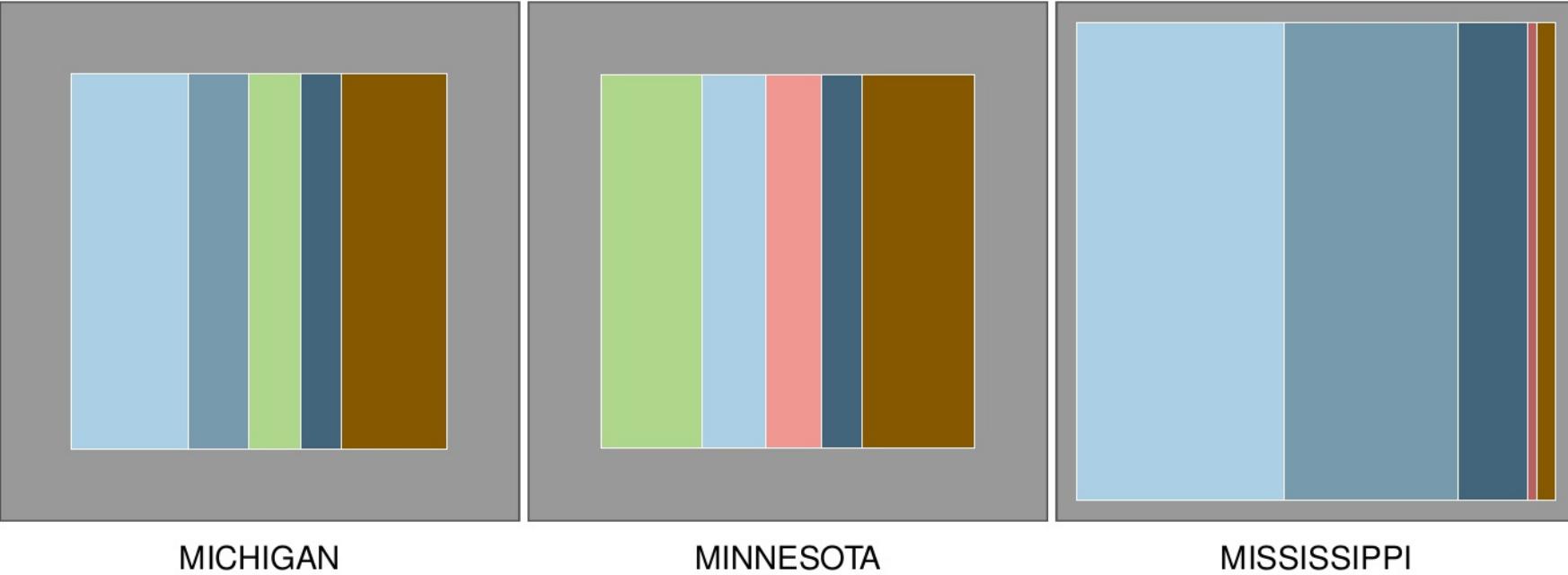


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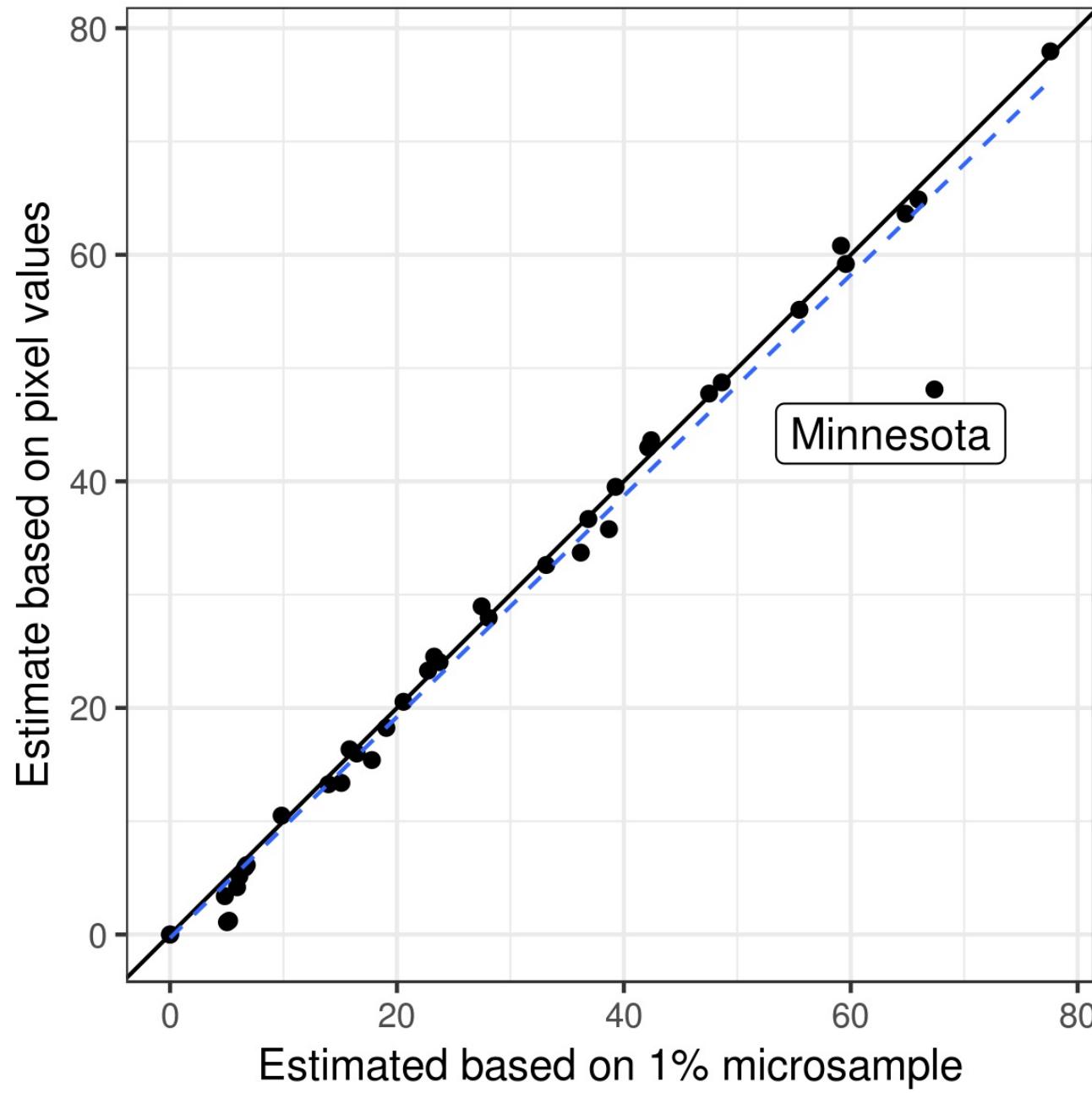
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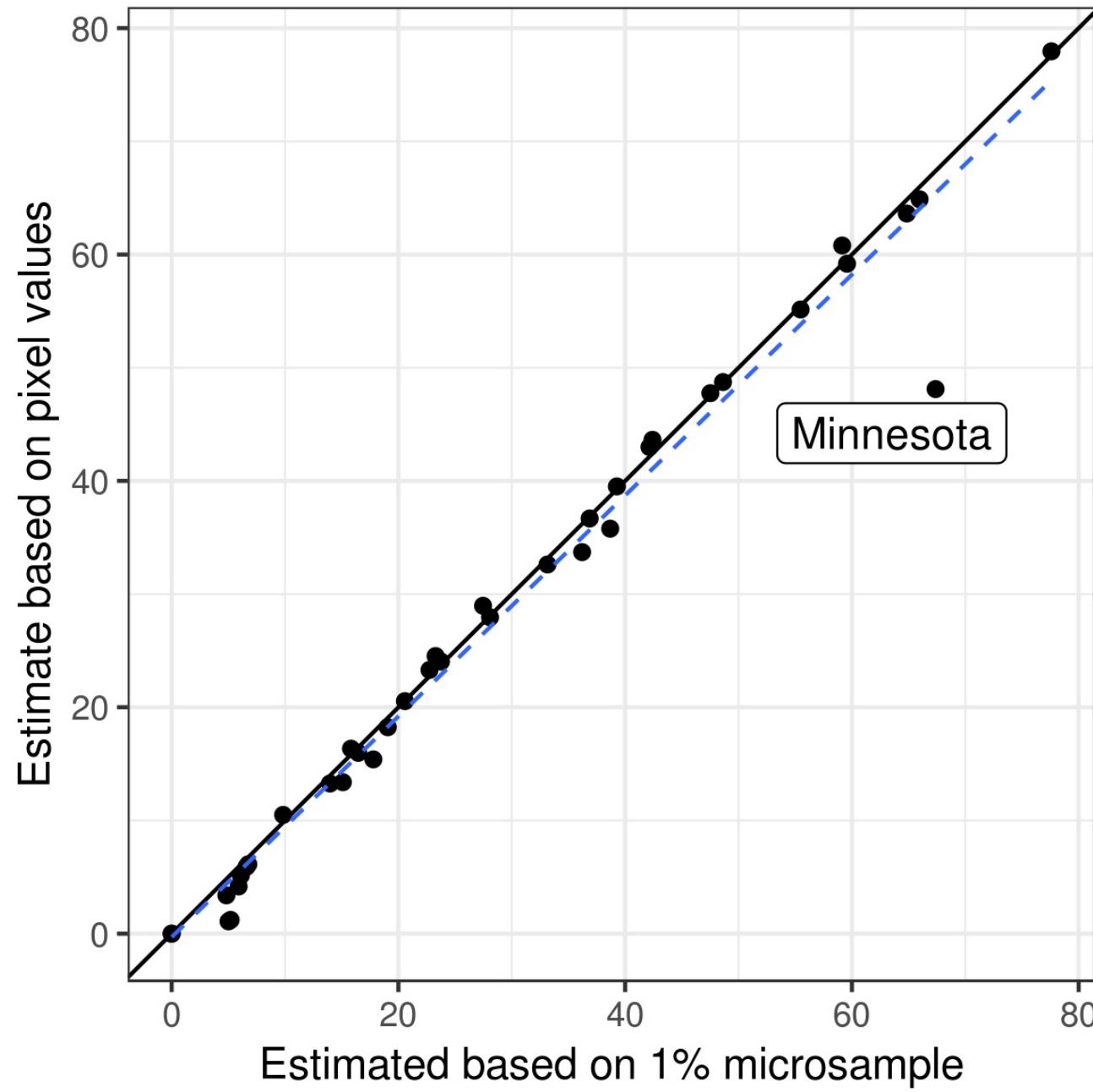
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Whoops. The lithographer screwed up.

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- Estimation requires a two-stage process:
  1. Area of the main plot that is accommodated
  2. Area of the center region devoted to a specific category
- Primary comparisons are on the x-axis; the frame disrupts the ease of these comparisons

# Frames in Practice

- 98 Participants (32 from reddit.com/r/samplesize, 63 from Amazon Mechanical Turk)

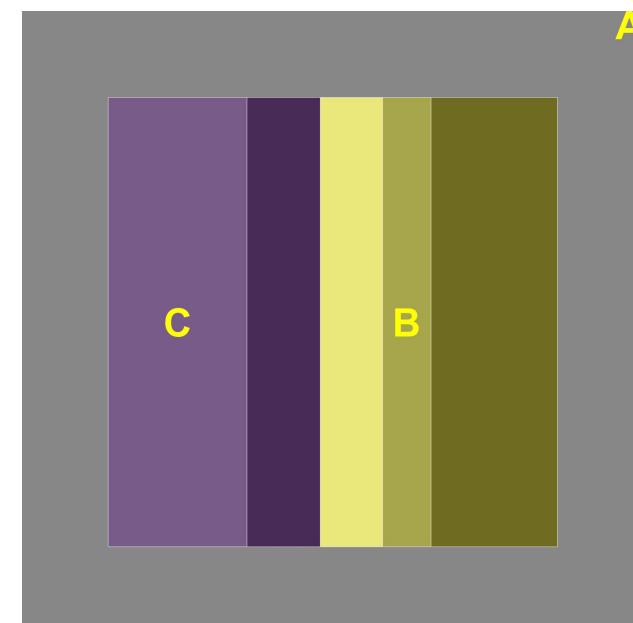
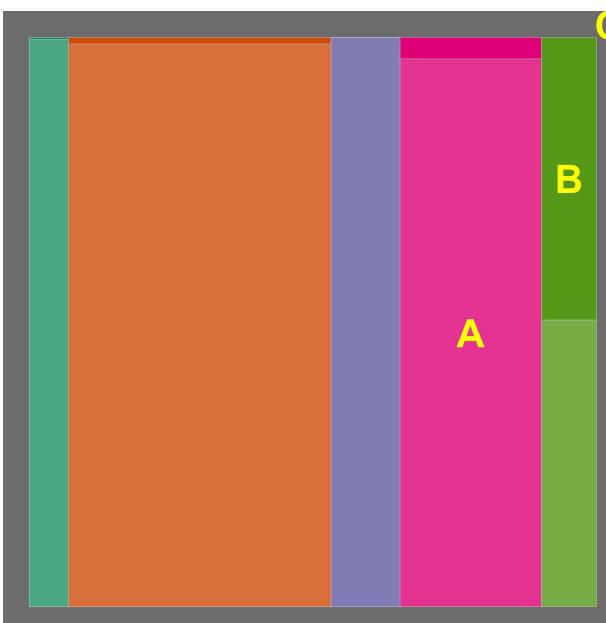
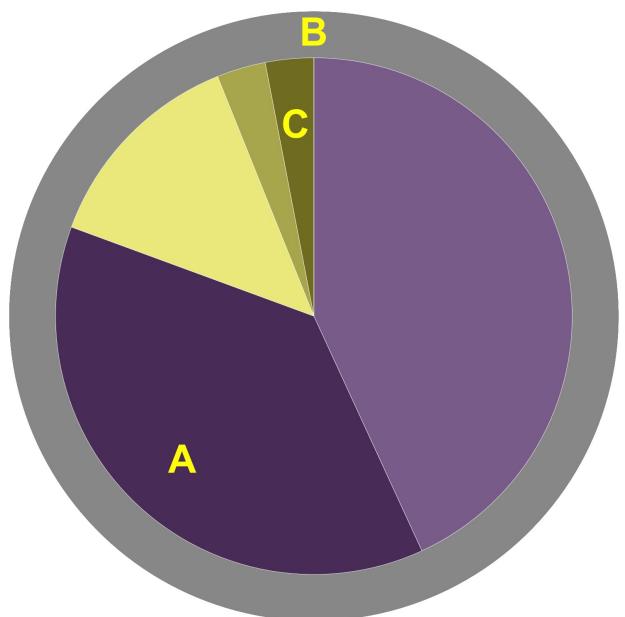
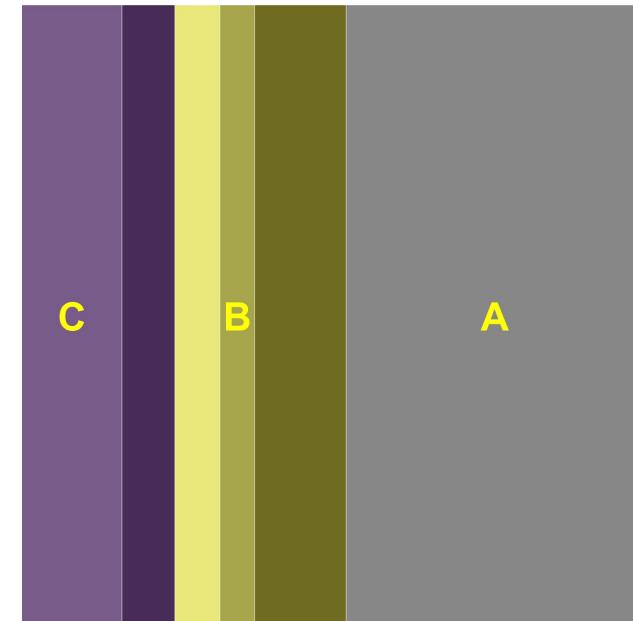
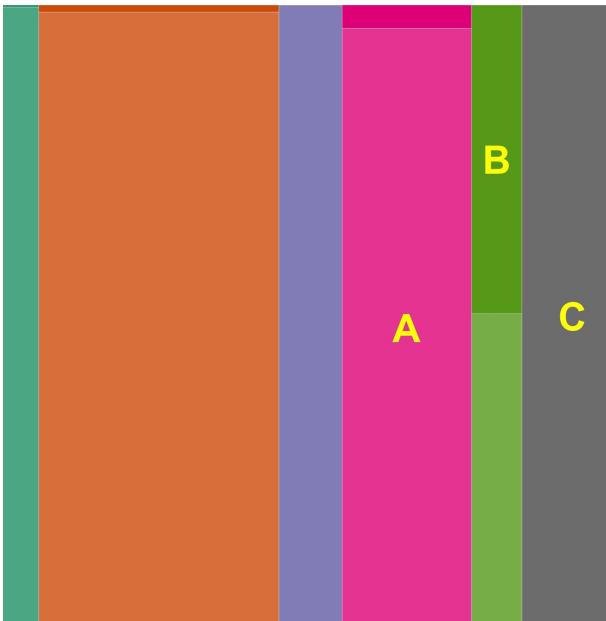
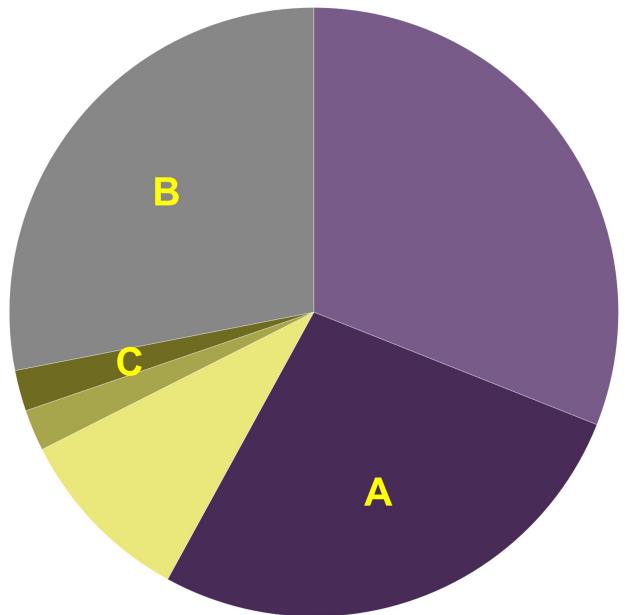
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  - Pie, Mosaic, Spine plots
  - Framed or Unframed charts

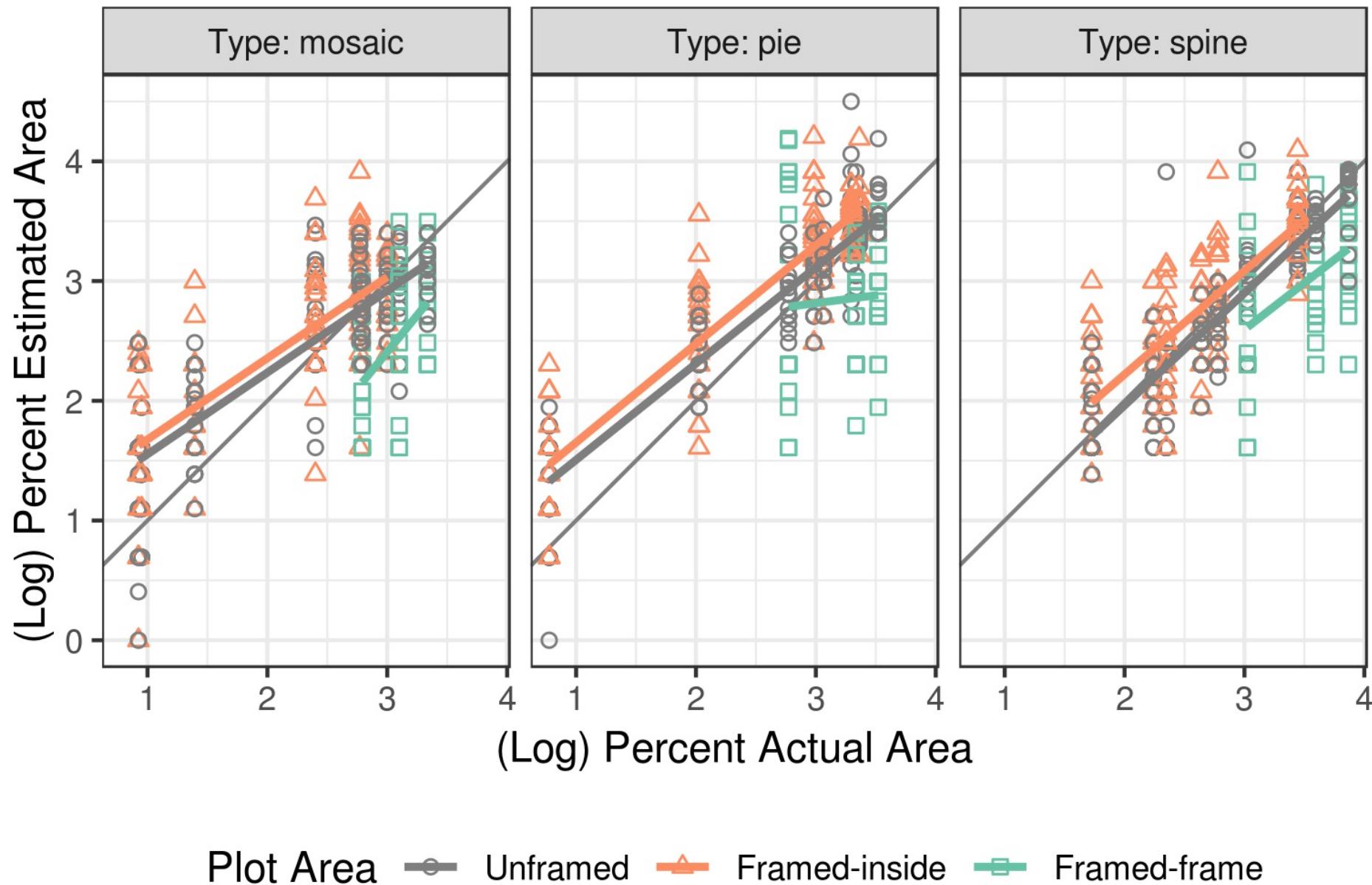
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- 25 seconds per plot

# Frames in Practice



# Results



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**150 years later, and we can use completely different technology to get the same charts**