The Statistical Atlas of the 1870 Census and Other Early Census Visualization

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Abstract

The first map produced for the US census was drawn using results from 1860. A decade later the census office produced its monumental Statistical Atlas. The publication of the Statistical Atlas in 1874 was a watershed moment for statistics in the United States. It provided a quick and easy way to interpret comparative statistics on a national level. This was followed by another outstanding atlas for the 1890 censuses. It was one of the most successful statistical publications ever, as measured by its influence on policy makers. Then smaller and smaller efforts were made until publication was stopped for the 1930 census. Census work on serious statistical graphic was revived in the 1970s, only to fade away again until the most recent effort. This paper traces this history and discusses some reasons that lay behind the rises and the fall of statistical visualization at the US census.

Key Words: Visualization, Census, History

1. Introduction

This paper sketches the history of graphical innovation at the Census Bureau, and before that, at the Census Office. Parts of the story are well documented. Other parts have almost been lost to history. Many of the graphs are literally works of art. However, the unifying theme of the paper concerns the conditions that made graphical innovation happen at the Census. I will argue that three conditions are necessary and sufficient:

A new technology
Innovative people
An administration interested in information and not just data.

I focus on graphical depictions of census statistics produced by census staff, admitting both that census staff produced other visual displays and scholars outside the census office produced stunning graphics, using census data.

The earliest graphical depiction of US census data seems to have been the slave map of Virginia, using data from the 1860 Census. It was produced by E. Hergesheimer at the US Coast Survey, the leading Federal scientific organization at the time. It was published in June, 1861, on the eve of the 1st Battle of Bull Run. Earlier versions of this map helped guide McClellan's invasion of Virginia from the Ohio Valley, leading to the creation of West Virginia.
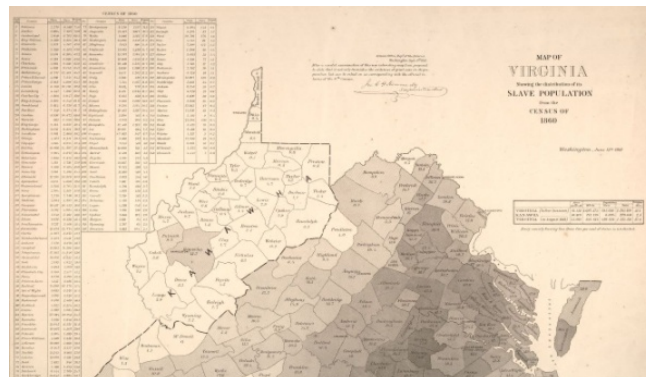

Figure 1: Slave Map of Virginia

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[1] The views expressed are those of the author and not necessarily those of the Census Bureau.

This Virginia slave map was followed in September by a larger one used throughout the war by Lincoln and included in the famous painting by Francis Carpenter of the signing of the Emancipation Proclamation. This map was also drawn by Hergesheimer, but now carries the note: "Census Office, Department of the Interior, Washington, Sept. 9th, 1861. After a careful examination of the above very interesting map I am prepared to state that it not only furnishes the evidences of great care in its execution, but can be relied on as corresponding with the official returns of the 8th Census. Jos. C. G. Kennedy, Superintendent." It thus can qualify as the first graphical display of statistical information <u>published</u> by the Census. Much of this early history is well described in Schulten (2012).

Figure 2: Slave map of southern states

Figure 3:Carpenter Painting of Signing Emancipation Proclamation

2..Census Atlases of 1870 and 1890

2.1 The Atlas of 1870

The Census Atlas of 1870 remains one of the most amazing documents ever prepared and published by the Census. It was a work of art and a well of information. One astonishing feature is right on the title page, a publication date of 1874, an amazingly short time in this not just pre-computer but pre-electrical-tabulation era. It contained a number of innovations, at least in the context of presentation of United States census results. These included detailed maps on a number of subjects, including the one shown here on the sex ratio. It also included time series maps, including the population on the west coast.
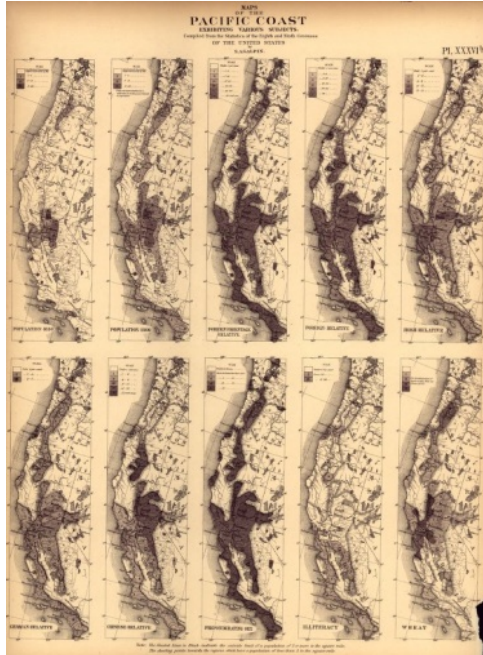
Figure 4: Predominating Sex

Figure 5: Growth of Pacific Coast Populations

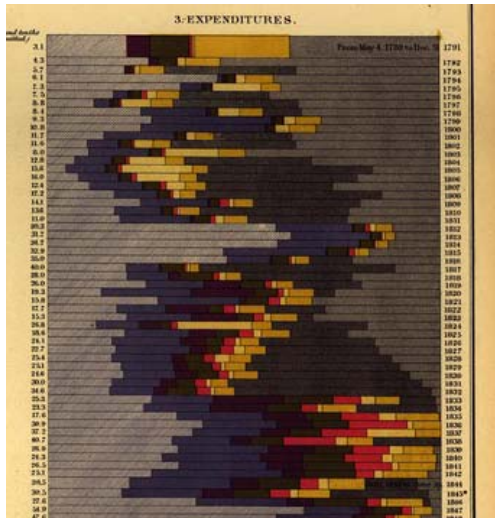It included stacked bar charts and connected line diagrams.

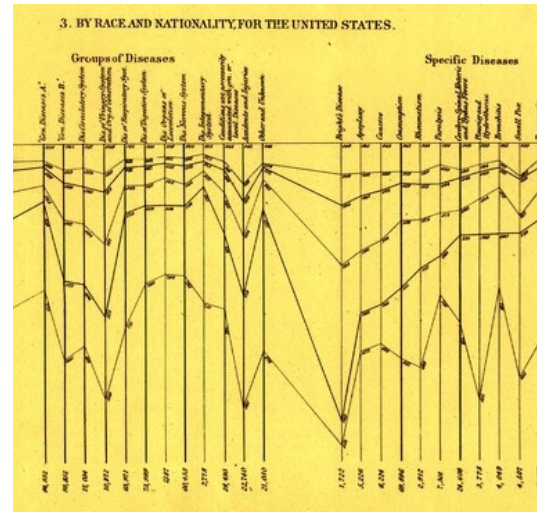*Figure 6: Federal Expenditures by Year*

Figure 7: Diseases by Race and Nationality, part

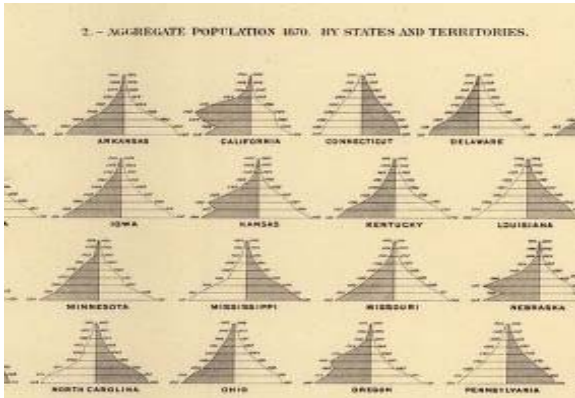Population pyramids were presented in small multiples.
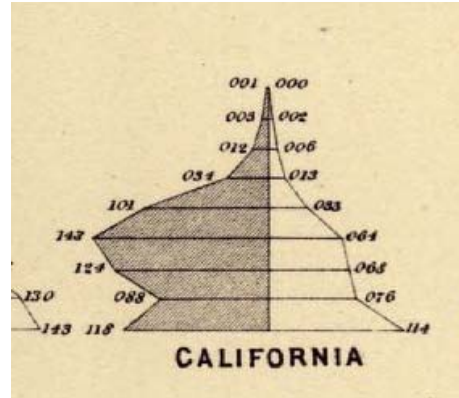

Figure 8: State Populations by age and sex

Figure 9: California Population by age and sex

A few of the graphs contained a high level of complexity and information. One of the best shows the state population by size, "color", born in state or out and foreign born, plus a bar showing the number of born in the state but living in another state by "color.
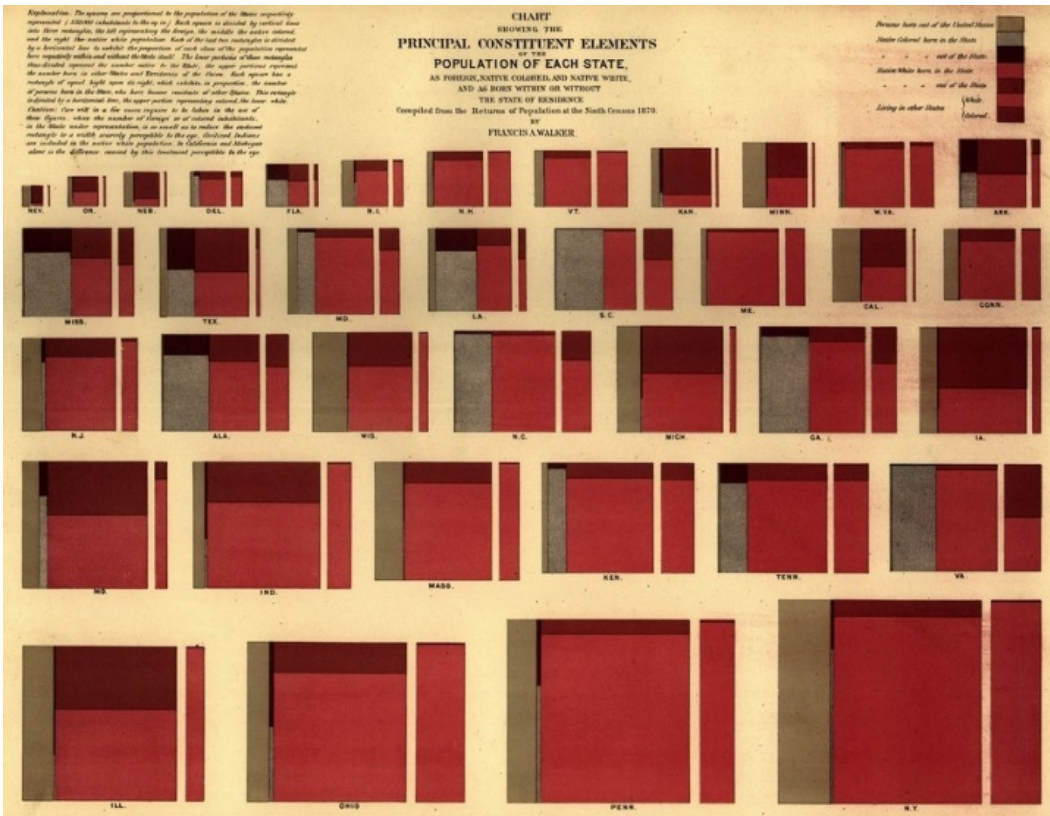

Figure 10: State Populations by Nativity, "Color," and place of birth.

A few of the innovations didn't really work at all. The one below shows the state population by religious affiliation. It does not convey the information well, coming across as a clutter of colors. Innovators must be willing to make mistakes in order to succeed.
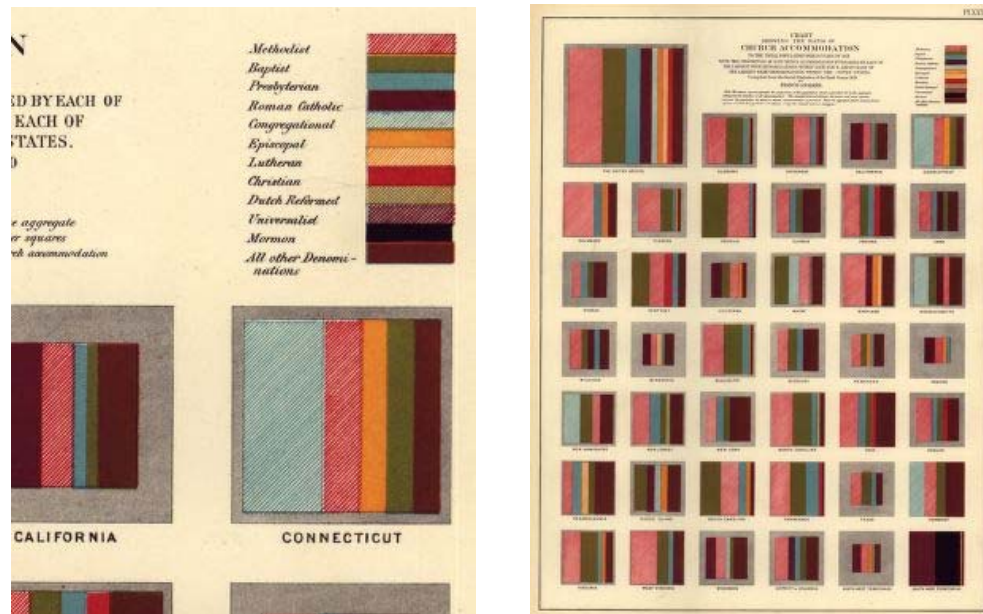

Figure 11: Church Denomination by State

What made the innovation possible? First, there was a new technology: lithography. Lithography made the printing of high quality maps and graphics cheap enough to be employed on a large scale. Secondly, during the Civil War and Reconstruction, the Federal Government had played a larger role in the nation than perhaps ever previously imagined. The government demanded information.

Thirdly, there was Francis Amassa Walker. Walker was Superintendent of the 1870 and 1880 Census. During a long academic career, he taught a number of universities and eventually became president of MIT. He was president of the American Statistical Association and helped found both the International Statistical Institute and the American Economic Association. He was also well connected politically. Seldom has a Director been more dynamic or more influential.

The Census of 1880 ran into financial difficulties soon after Walker left. The atlas was published by Scribner's, although with significant input from Census employees. Although a fine publication, it was not so innovative as the one before or the one after.

2.1 The Atlas of 1890

With the 1890 Atlas, the Census Office returned to the forefront of graphical excellence. Space here allow for only one outstanding graph: a graphical depiction of the growth and change of the population. The figure shows the population by year, "color," "Native Stock" plus immigrants and their descendants.
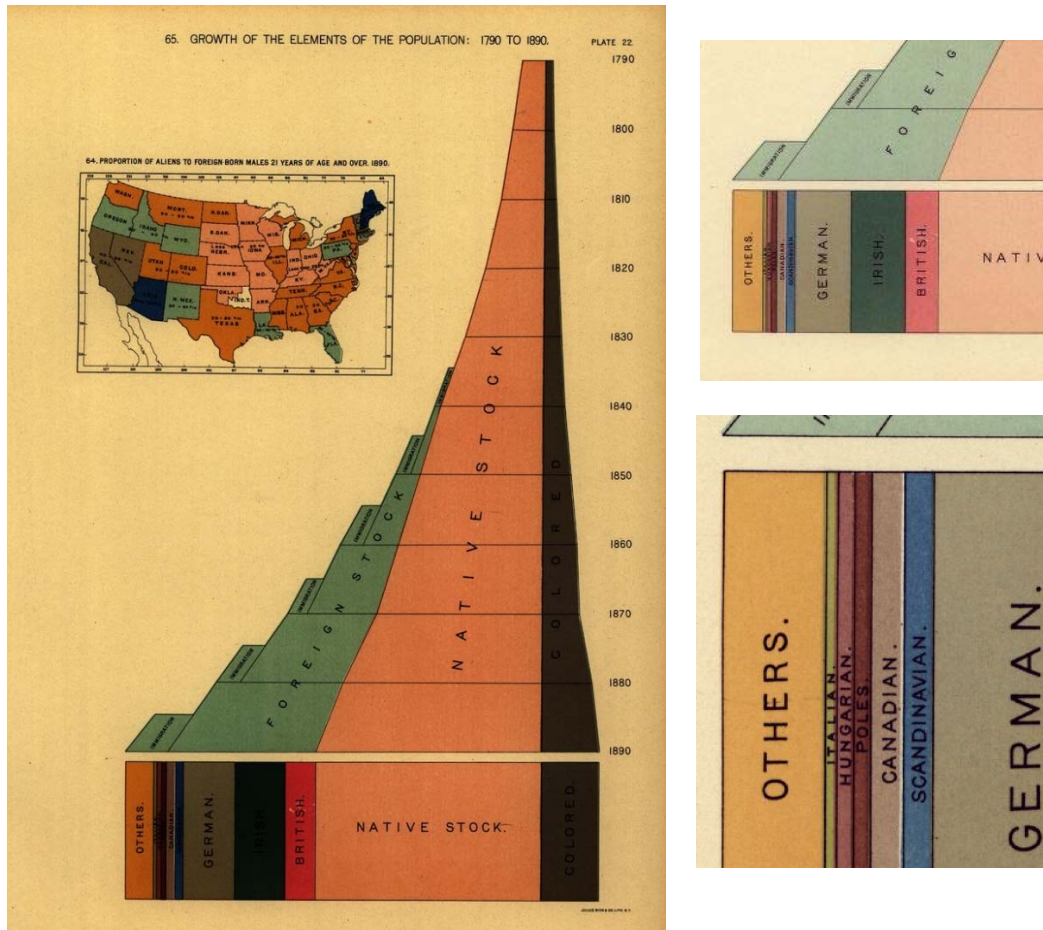

Figure 12 : Growth of the elements of the Population 1790-1890

This is one of the most influential graphs ever produced by the Census. The concepts embedded in this view of the population were embedded into the Immigration Act of 1924, which set national immigration quotas proportionally to the share of each nations' stock of the 1890 population.

Although Walker had left, his role as innovator was taken by another remarkable man, Henry Gannett, who was geographer for the 1880, 1890 and 1990 Censuses. His remarkable career including helping found the American Association of

Geographers and the National Geographic Society. Gannett was vice president of the ASA for over ten years.

And then innovation stopped. To quote the Library of Commerce Web site: "The final two atlases, issued with the 1910 and 1920 censuses, were both routinized productions and largely devoid of color and graphic imagination…."

Typical of the graphics produced during the following years were maps using similar in style to the Civil War slave maps.
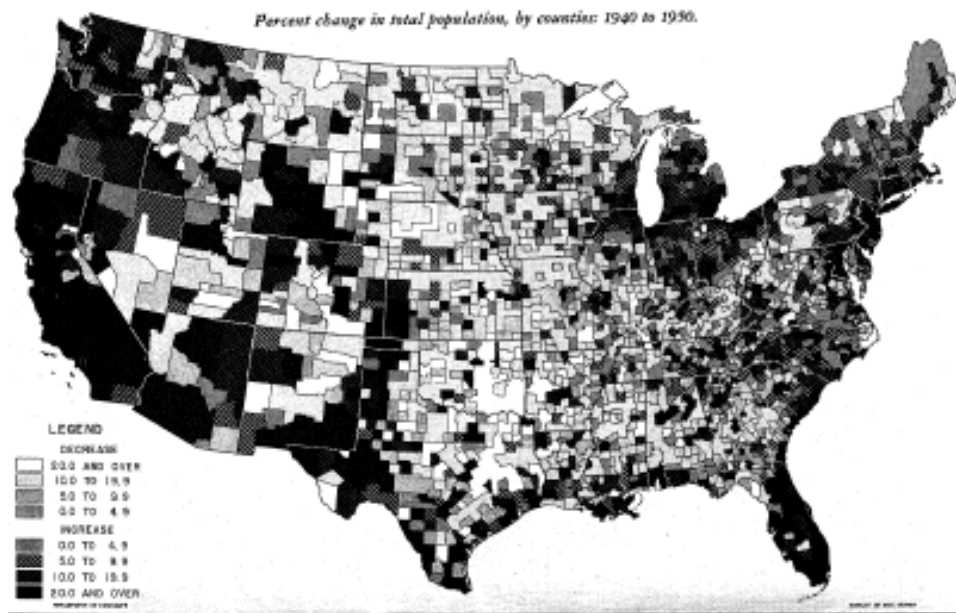

Figure 13: Percent Change in Population: 1940-1950

3. Computer Graphics of the 1970s

The 1970s saw a remarkable burst of activity and graphical innovation at the Census Bureau. The Census Bureau was led by Vince Barabba (1973-1976, 1979-1980). Barabba had been co-founder of a company called Decision Making Information, indicating an interest in information. He had also been director of market intelligence at both Xerox and Kodak, two companies which had imagery at the very heart of their business. Like Walker, Barabba was also well connected politically. He went on to be elected president of the ASA.

There was a renewed interest in statistical graphics, led by John Tukey, and documented in his influential *EDA,* published in 1977. Computers and computer software were rapidly evolving. Computers could now do what only draftsmen could do before. However, unlike today, much of this equipment was specialized, expensive and required a high degree of training. For example, a one-pen plotter could cost $200,000 (Barabba, 1978)

Third element was a high degree of administration support for graphics. The Vice President at this time, Nelson Rockefeller, was dyslexic. He wanted to receive his information graphically.

The Census Bureau republished papers presented at the 1976 ASA Annual Meetings. This volume highlighted the promise of computer graphics. Bachi (1978) listed the promise of automated graphics:

> 1. Graphs can be mass produced today at a tremendous speed and low cost.
> 2. Automated graphs can attain levels of accuracy and attractiveness even exceeding those of hand-made graphs
> 3. Both effectiveness and beauty of the automated graph can be enhanced with colors.
> 4. In each stage of automated production, the operator, by following the graph that is being constructed on the screen of the CRT, can substitute and correct the various elements of the graph and, thus, perform quick and efficient experimentation on alternative graphic solutions.
> 5. These facilities, together with animation, give the graph very powerful potential as a scientific research tool and as a suggestive means of communication.

The epitome of this innovation was a short-lived publication known as **STATUS**. It drew data from throughout the Federal statistical system. The importance of the **STATUS** was highlighted by the fact that the President of the United States announced it in a press release:
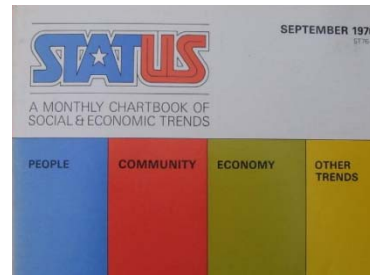
> President Ford today announced publication of the first issue of STATUS, A Monthly Chartbook of Social and Economic Trends.
>
> STATUS is a document of tremendous positive potential, the President said. "It encompasses the output of up to 20,000 Federal statisticians, reduced to chart form, and covering the critical domestic statistics of all aspects of American life -- economic, social and political.
>
>   White House Press Release
>   1 July 1976

The Vice President also released his own press release. I know of no other instance where the President put out a press notice, not on the content, but on the importance of the publication itself.

STATUS included many displays that are now standard, including the famous "night sky" population distribution map.

Figure 14: "Satellite" Map of the 1970 Population

The map below shows an innovation that didn't quite work. It was an attempt to display two dimensions of data using a two-dimensional color palette. While this was a clever idea, on one could ever get the right mix of colors in the pallet to convey well the dimensionality of the data. Again, not all innovation is successful innovation.
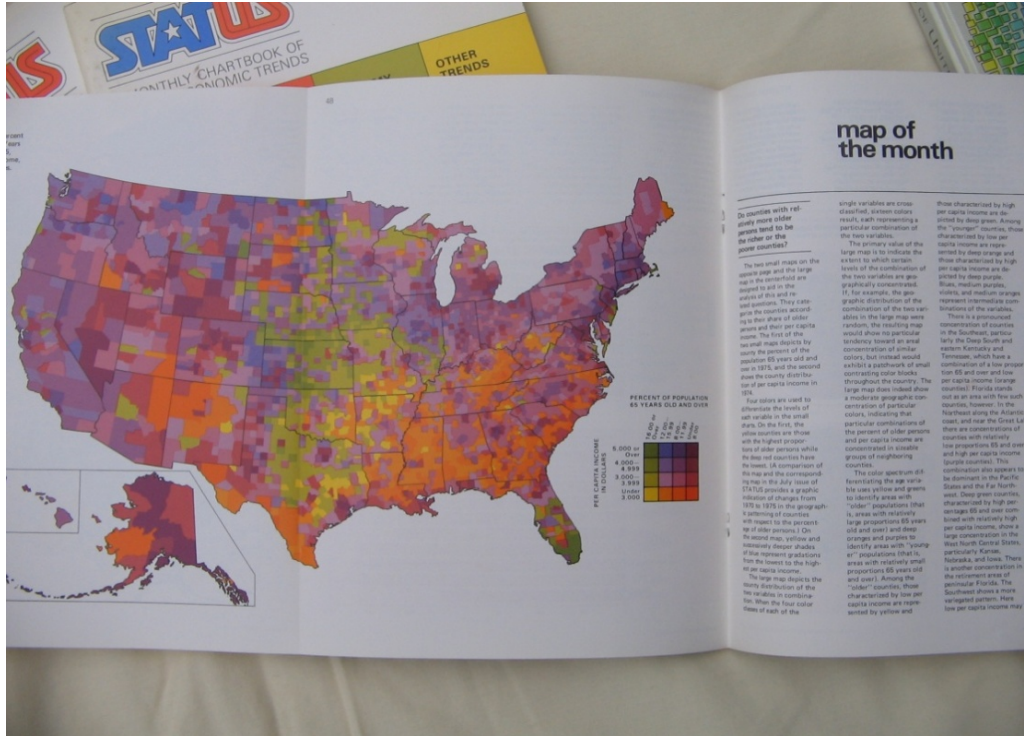
Figure 15:Combination of Percent of Population 65 and over and Per Capita Income.

The high level support ended with the end of the administration and the program started to fade. The promise of animated graphs at the Census was never realized. Soon the price of the necessary software and hardware greatly decreased. Innovation went on, but increasingly elsewhere.

These two examples became typical of the graphs in census reports. The one on the left is a simple bar chart, with numbers added so it can also serve as a data table. The one right show change in monthly retail trade. Although simple, this chart, by the author, represented an improvement on the one it replaced.
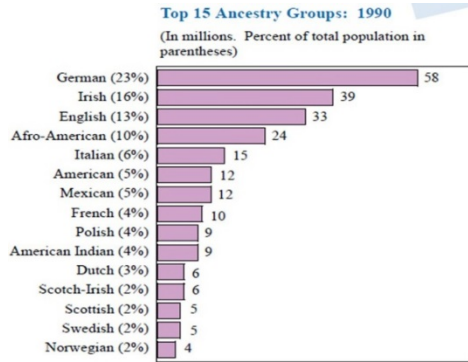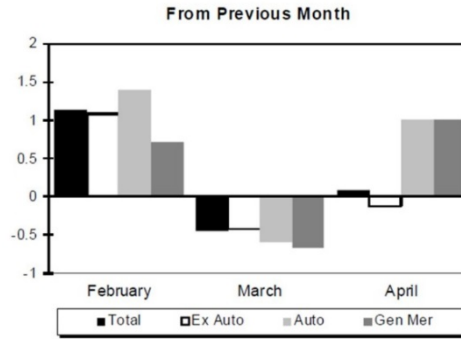

Figure 16: Top 15 Ancestry Groups: 1990

Figure 17: Monthly Percent Change in Retail Trade

4. Beginning of a Rebirth and Conclusion

In the last decade, the Census Bureau has shown a renewed interest in high quality graphics. The Census 2000 Atlas was the first since the 1920s and the first high quality census atlas since 1890. It took advantage of the ability to map not just counties but census tracts to produce high quality and interest displays.
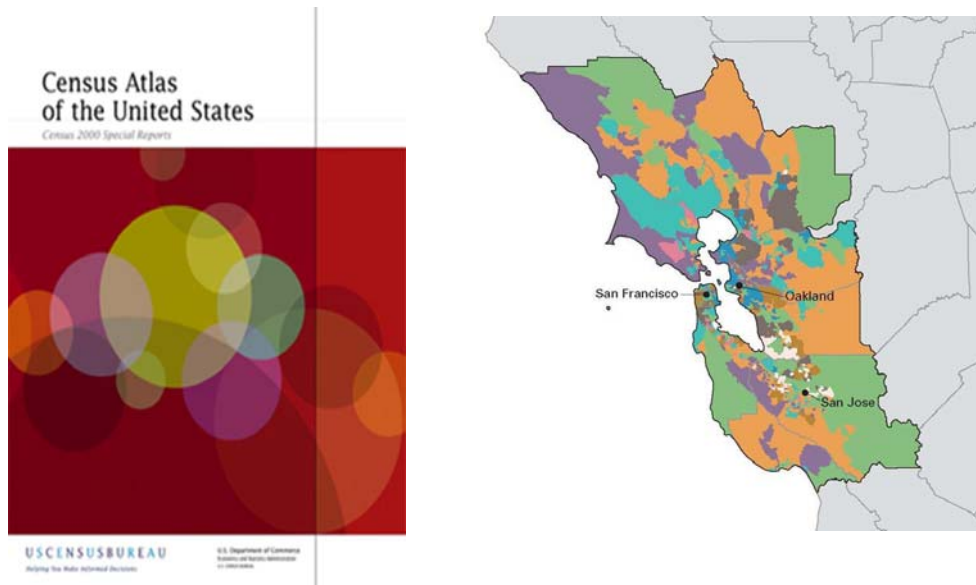

Figure 18: Images from the 2000 Census Atlas

One of the most innovative efforts was known as the Haiti Project. This project used a combination of census and survey data and satellite imagery to produce detailed maps of developing countries, in this case Haiti.

This project was still in the demonstration stage when the 2010 earthquake hit Haiti. The work was quickly put on line where it aided the rescue efforts.
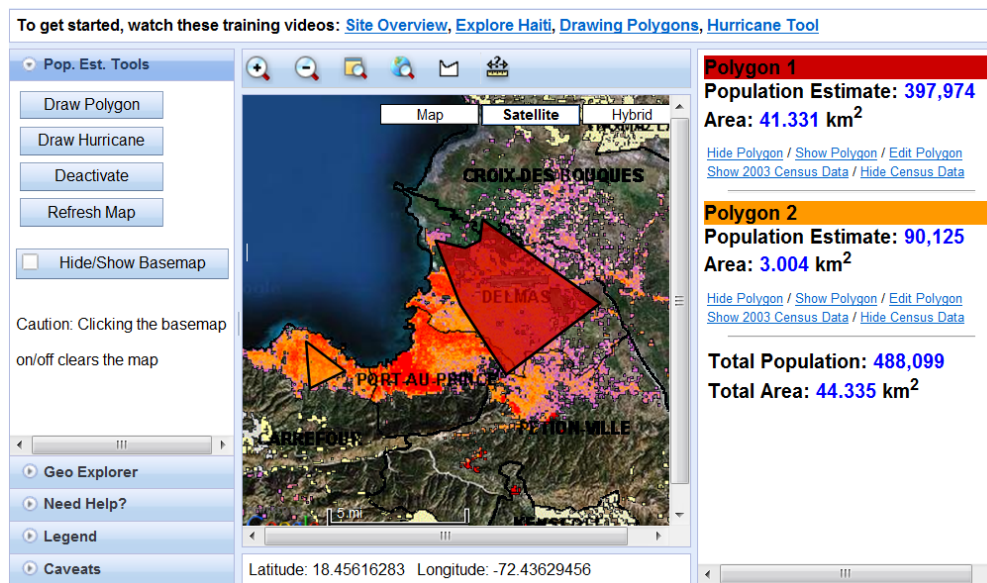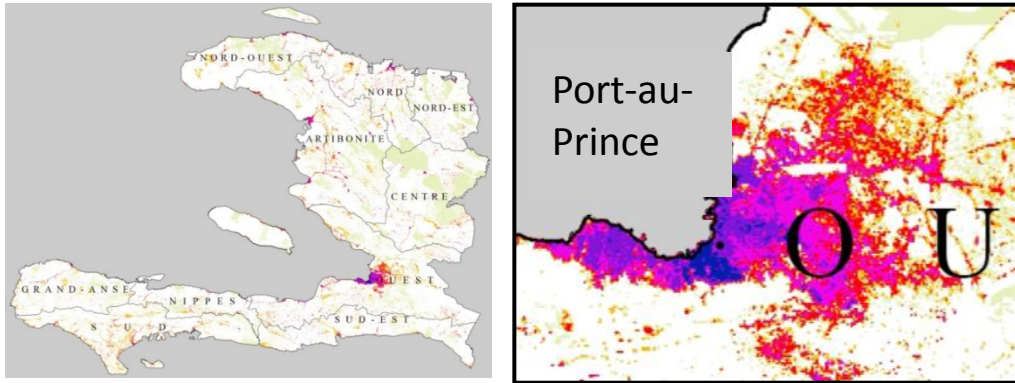

Figure 19 : Images from the Haiti Project Website

Again, new technologies, including satellite imagery and computer interpretation, and interactive graphics allowed new approaches to presenting information. Although there were no "super stars" like Walker, Gannett or Barabba, there were innovators at the working level such as Jim Fitzsimmons, Marc Perry, and many others. And funding and support were made available due to the recognized importance of the information.

In 2011, the Census Bureau began a formal effort to bring graphic excellence to its products. However, what Barabba wrote in 1978 remains true:

> People who deal with statistics today are trying to cope with an information and data explosion that is increasing so fast that by the end of the next decade... we may be contending with perhaps six times the present volume of statistical information. Given these realities, it is imperative that we immediately find more effective and uniform ways to communicate statistics quickly, accurately, and with more clarity.

Acknowledgements

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High and medium resolution graphics are available at:
http://www.census.gov/history/www/programs/geography/statistical_atlases.html
http://www.mappingthenation.com/
http://www.handsomeatlas.com/
http://www.davidrumsey.com