ART JOHNSON

Now & Then

A Career That Counts

Now ... AMY SMITH IS INVOLVED IN THE ANALYSIS OF CENSUS DATA that come from mailed forms or from door-to-door surveys. She works at the Administrative Records and Methodology Research Branch (ARMR) of the Population Division of the Census Bureau, located outside of Washington, D.C. The Census Bureau is part of the Department of Commerce. According to Amy, "We have to develop and test the estimate procedures; then collect, tabulate and check the appropriate incoming data; and then analyze the population estimates. In checking the data, we look for data that do not align with previous data, allowing for reasonable changes since the last data were received. In addition, we often do not receive all the data that are needed to prepare the annual estimates. Then we must develop additional techniques to fill in the missing data."

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Census 2000 will count about 275 million Americans and provide information about a number of demographic characteristics of the United States population. All this information will be analyzed by Amy's department. "The Bureau will deliver state population counts from the census to the president by December 31. These counts will be used to reapportion seats in the House of Representatives." Additional analysis of census data will involve specific county populations and provide a fuller description of population trends regarding age, gender, race, and ethnic backgrounds for populations in each county and state in the United States.

Amy's interest in population trends is longstanding. "Actually, I was always interested in populations and demographic data. I know that seems hard to believe, but when I was in grade school, I used to read about the population changes in states and countries and think about how things were changing for people in those places." While in high school, Amy took the typical college-preparatory courses in mathematics: algebra 1, geometry, algebra 2, and senior math. As a student at Slippery Rock University in Pennsylvania she did well in her mathematics courses, although she found that "calculus was frustrating. It was too abstract to really appreciate, so I drifted to another field where I could apply my mathematics and sociology. There I could continue to use my mathematics and return to my love of population data." Amy graduated with a degree in sociology and a minor in mathematics.

Amy attended graduate school at Bowling Green State University and received a degree in sociology, focusing on statistical studies of populations. "Now I needed some career that would let me use my knowledge of mathematics and sociology to study populations and trends." The Census Bureau was the perfect fit.

Between census years, most of the people in her department provide yearly population estimates for counties and states. Amy describes this process. "We do that by using the figures from the 1990 census and then allow for changes over time. We usually have birth and death figures and can get accurate figures about migration. Based on these data, we can issue some fairly accurate figures about population estimates for a given state or county. Once the data are completely tabulated for the 2000 census, these data will serve as the base figures for future yearly population estimates for states and counties until the next census in 2010."

When the census form arrives in the mail or when a census taker, called an *enumerator,* comes to your door, think of Amy and her coworkers who will be analyzing the data. It is a big job, but Amy truly enjoys her work. "I always loved demographic and population characteristics. I loved reading about data changes over time and trying to decide what the data say about the population in a certain state or county. Now my job is to do just that. What could be better?"

Teacher Notes

STUDENTS MAY NOT BE FAMILIAR WITH THE IDEA of a census. The following points might be included in an introductory discussion. The American Constitution requires that the United States is to conduct a census every ten years to find out how many people live in this country. The Census Bureau hopes to contact everyone either with a mailed survey form or by a visit from a census taker, called an *enumerator.* The Census Bureau estimates that almost 275 million people live in the United States this year. To count that many people, the Census Bureau will mail millions of census surveys and send over 850 000 census workers from house to house gathering data. The Census Bureau will do more than get a total population. The census survey will collect other information about people. One survey question asks how many people live in the household. A *household* is defined as all the people living in a home when the survey is taken. In 1990, a mean figure of 2.63 people lived in each household. Another survey question asks about the ages of people in the household. In 1990, the median age of people in the United States was 33.

This task is a small-group activity. Students should be familiar with the three measures of central tendency—median, mean, and mode—and be able to construct a pie chart. The class will also need a supply of index cards.

After the initial discussion, explain to students that they are going to collect some data of their own. A typical survey card might look like that shown in **figure 1** (p. 586). Stress the importance of returning the survey card while being sensitive to any privacy issues that might surround the collection of these data. The data will be used to compile a complete set of data for the class. ☞

"I needed some career that would let me use my knowledge of mathematics and sociology to study populations and trends"

Fig. 1 A typical survey card

Analyzing "Number of Persons Living in My Household"

When completing the analysis of "number of persons in my household," students should work in small groups and then as a class to fill in all the information on the "Census Survey" worksheet. An efficient way to begin is to reproduce the chart on the chalkboard or on a transparency for the overhead projector and have a member from each group fill in the group data as completed. Then the entire class can fill in the data for the other groups for themselves. One reason that the class mean or median might differ from the 1990 census figures is that all the class households include children. Not every household in the United States in 1990 included children.

Analyzing "Ages of Persons Living in My Household"

Students can experiment a bit here when analyzing the data for the median age. Organizing ages into the ranges 0–10, 11–20, and so on, is a good strategy. When they are done, have each group give its deck of survey cards to the teacher. The teacher can then lead a whole-group discussion and demonstrate how to order the cards. When they are ordered, the class will have a single deck.

Additional discussion points

1. Suppose that the class median or mean were national figures for Census 2000. Ask students to consider how these new figures might affect social policies on a national scale. For example, a lower median age might mean that more schools will be needed and that more advertising programs will be directed at a younger audience. An older median might indicate that a shift to an older population is occurring, which will affect advertisers and government policies.

2. Suppose that the class figures were those of the local community but that the 2000 national figures were the same as the 1990 figures. How might local community planning be affected?

Bibliography

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Census Survey

NAME _____

The American Constitution requires that the United States conduct a census every ten years to find out how many people live in the country. It is a big job. In addition to counting the total population, the census survey will collect other information about people. One survey question asks how many people live in the household. A *household* is defined as all the people living in a home when the survey is taken. (In 1990, a mean figure of 2.63 people lived in each household.) Another survey question asks about the ages of people in the households. (In 1990, the median age of people in the United States was 33.) How do these facts compare with the same data for the households in your class? Let's find out.

1. Tabulate the data from your survey cards, and then compare the results with the United States figures for the 1990 census.

2. In the chart below, fill in the data collected by the class groups. Compute the mean number of people per household for your class. How does your class mean compare with the United States mean of 2.63 as established in the 1990 census? Why do you think that your class mean might be different?

GROUP NUMBER	NUMBER OF HOUSEHOLDS	TOTAL NUMBER OF PEOPLE
1		
2		
3		
4		
5		
6		
7		
8		
TOTALS		

3. For your group, how does the median age of household members compare with the United States median age of 33 from the 1990 census? To find out, follow these steps:

a) Write down on a separate card the age of each person in your household.
b) Put all your cards in order from the youngest to the oldest age recorded.
c) Combine all the cards in your group from the youngest to the oldest age recorded.

4. Next combine the class set of cards from the youngest to the oldest age recorded. Before this step, use what you learned about putting the group cards in order. Think up the best way to put all the class cards in order.

U.S. median age _____   Class median age _____

5. How does your class median age compare with the United States median? Why do you think that your class median might be different?

6. Estimate the mode for the age of people in your class households. Then use the class card deck to find the actual mode(s) of your household age data.

Estimated mode(s) _____   Actual mode(s) _____

7. Make a pie chart to show all the ages of people in the class households. Fill in the table below to help you prepare the data for the pie chart.

Age Group	Number	Percent of Total Number of People in the Class Households	Angle (% of 360°)
0–5	_____	_____	_____
6–20	_____	_____	_____
21–50	_____	_____	_____
51–64	_____	_____	_____
65 and over	_____	_____	_____
Total population	_____	_____	_____

Herman Hollerith:
Punching Holes in the Process

… & Then THIS YEAR'S UNITED STATES census promises to be the most detailed analysis of the American population ever done. It is hoped that over 275 million people will respond to a number of census questions that will help the government plan for the future and develop policies to deal with emerging population trends. The results of Census 2000 will also interest business leaders who will try to structure their product lines to meet expanding markets in various age groups. This process would have been impossible had Herman Hollerith not taken a train ride over 100 years ago.

Herman Hollerith (1860–1929) was born to German immigrants in Buffalo, New York. After high school, he attended the City College of New York and in 1879 graduated with a degree in engineering from the Columbia School of Mines. When a former professor, W. P. Trowbridge, took a position as chief special agent with the United States Census Bureau, he hired Hollerith as a census statistician. One of Hollerith's first tasks was how to analyze the mass of data from the 1880 census. All the information had been recorded by hand, and errors and inaccuracies resulted. Hollerith thought that a better way must be found to tabulate all the information.

Hollerith already had the inspiration for a new tabulating system. He began to develop an idea, given to him by John Billings of the Census Bureau, that used paper tape containing pin holes. He envisioned passing pins through the pin holes to make an electrical contact. Each contact could then be read as a specific data entry. The problem with this idea was that you would have to scroll the tape to find a specific entry in the data, and the tape had to stop every time the pins passed through to make electrical contacts.

A train ride gave Hollerith the breakthrough he needed. While on the train, Hollerith saw a conductor taking money and punching passengers' tickets. That was it! He would not use paper tape, he would use cards that were punched with holes. These punched cards guaranteed that the electric current would activate mechanical counters quickly, since no starting and stopping occurred as with the paper tape. Another advantage to the cards was that each could represent the data for a single census survey.

In the next few years, Hollerith improved his design for punch cards, punch machines, and tabulating machines. Hollerith's hole-punching machines were manufactured by Pratt and Whitney, of future aircraft-engine fame. The counting machines, made by Western Electric Company, could read cards at the rate of fifty to eighty per minute. The Hollerith Tabulating System was first used for a census in Baltimore in 1887 and then one in New York City. In 1889, Hollerith beat out two competitors for the contract to tabulate the data for the 1890 census. His new method took only two and one-half years to tabulate the census data, rather than the seven and one-half years that had been required for the previous census.

For his work with the census and tabulating machines, Hollerith was awarded a doctorate in 1890 from the Columbia School of Mines. Other awards rolled in, including the Elliott Cresson Medal from the Franklin Institute of Philadelphia, the Gold Medal of the Paris Exposition of 1890, and a Bronze Medal from the World's Fair in 1893. In 1896, Hollerith set up the Tabulating Machine Company to take full advantage of his inventions. He had a monopoly on tabulating machines, and some thought that he took unfair advantage by charging a price well in excess of the tabulation costs for the 1890 census. Eventually others developed their own tabulating machines that improved on his designs.

His own company continued to evolve by merging with and buying other companies. In 1924, the company's name was changed once again, to the International Business Machine Corporation (IBM), but by then Hollerith was no longer associated with it. He died in 1929.

Hollerith's vision of a tabulating system continues today with the high-speed computers used in collating and analyzing the data of Census 2000. ▲