

## Goodbye, Operator

Automated telephone switching eventually displaced the women at the switchboards. But they kept their jobs for decades after the technology arrived

BY DAVID A. PRICE

Users of the telephone in the late 19th century and early 20th century couldn't dial their calls themselves. Instead, they picked up their handset and were greeted by an operator, almost always a woman, who asked for the desired phone number and placed the call. Technology to automate the process emerged quickly, however: The first automated telephone switching system — a replacement for human operators and their switchboards — came into use with much fanfare in La Porte, Ind., on Nov. 3, 1892, 16 years after Alexander Graham Bell's patent on the telephone.

Yet telephone companies continued relying on the women long afterward. In 1910, only around 300,000 telephone subscribers had automatic service — that is, service in which they dialed calls themselves rather than interacting with an operator — out of more than 11 million subscribers total. The companies of the Bell System did not install their first fully automated office until Dec. 10, 1921, and did not install an automated system in a large city until the following year, two decades after the technology had been demonstrated. Those telephone users

who did have access to automated calling were customers of independent phone companies, mostly in small towns and rural areas.

In some ways, it's an upside down story of technology adoption: Why did automation come to small firms in the countryside first and only much later to the Bell companies in the big cities? And how did the women at the switchboards keep their jobs — ones with rigorous hiring standards and unusually generous perks — for so long despite competition from machines that never slept, got sick, or asked for a raise?

### The Role of Women Operators

At first, the telephone industry hired men and boys as operators. But the practice was short-lived. The first woman operator, Emma Nutt, was hired by a telephone service in Boston in 1878, and the hiring of women spread quickly. Women operators were viewed by the companies as more polite to customers, more patient, more reliable, and faster — not to mention cheaper. Later, a 1902 report on the industry from the Census Bureau held, "It has been demonstrated beyond all doubt that the work of operating is better handled by women than by men or boys and that trained and well-bred [middle class] women operators perform the most satisfactory service."

The job was a demanding one. Historian Kenneth Lipartito of Florida International University described the routine of a big-city operator in a 1994 article in the *American Historical Review*. "While... keeping an eye open for lights indicating new calls, and sweeping the board of old connections, operators had to complete several hundred calls an hour during peak times. Months of practice were required before they mastered the 'overlaps,' or the knack of performing multiple tasks simultaneously."

An operator did more than simply connect a customer to his or her desired number, however. In the early decades of the industry, telephone companies regarded their business less as a utility and more as a personal service. The telephone operator was central to this idea, acting as an early version of an intelligent assistant with voice recognition capabilities. She got to know her 50 to 100 assigned



Operators in 1917 at a large switchboard of the New York Telephone Company in the financial district of lower Manhattan.

IMAGE: COURTESY ATRT ARCHIVES AND HISTORY CENTER

customers by name and knew their needs. If a party didn't answer, she would try to find him or her around town. If that didn't succeed, she took a message and called the party again later to pass the message along. She made wake-up calls and gave the time, weather, and sports scores. During crimes in progress or medical emergencies, a subscriber needed only to pick up the handset and the operator would summon the police or doctors.

While operators were not highly paid, the need to attract and retain capable women from the middle classes led telephone companies to be benevolent employers by the standards of the day — and in some respects, of any day. Around the turn of the century, the companies catered to their operators with libraries, athletic clubs, free lunches, and disability plans. Operators took their breaks in tastefully appointed, parlor-like break rooms, some with armchairs, couches, magazines, and newspapers. At some exchanges, the companies provided the operators with a community garden in which they could grow flowers or vegetables. In large cities, company-owned dormitories were offered to night-shift operators.

### Rise of a New Technology

The first automatic telephone switching system to be used commercially was invented in the late 1880s by Almon Strowger, an undertaker in Kansas City, Mo. Industry lore says that he invented it after discovering that the local phone operator was steering calls of his potential customers to a competing undertaker to whom she was married. Whatever the actual impetus for his invention, he proceeded to form the Strowger Automatic Telephone Exchange Co., the firm behind the pioneering La Porte, Ind., system and many other automatic exchanges afterward. As the age of digital electronics was far in the future, Strowger's system was a complicated arrangement of mechanical and electrical parts.

Strowger offered to sell his technology to the Bell System — which decided against using it and did not even reply. As the development of automatic switching continued, the Bell telephone companies stayed with manual switching; they used automatic systems only as a temporary stopgap for small markets until those markets were large enough to justify an operator. From the perspective of Bell managers, human operators provided natural flexibility and intelligence — and made possible a level of service and attention that could not be duplicated by automation.

Moreover, as the Bell companies saw it, automatic systems put more of the work onto the customer, who had to dial the numbers themselves. “Bell wanted to make using the phone as easy as possible for customers,” says Milton Mueller, a professor of public policy at Georgia Tech specializing in communications and information. “So-called automated switching meant the customer was actually doing work, as opposed to just picking up the phone and telling the operator what he or she wanted.”

The early adopters of automatic switching were instead the independent telephone companies, which had entered the market following the expiration of Alexander Graham Bell's patents in 1894. Some 6,000 independents started within three years of the opening of that window; by 1907, they had attained around 50 percent market share. While the Bell companies focused mainly on urban areas, the independents focused on rural areas and small towns — and so the automated systems flourished there first.

“If you look at the overall strategy of the Bell System during this period of competition, the big cities were their strategic focus,” Lipartito says.

This pattern is a reversal of a common path of technology diffusion among producers, according to Richmond Fed economist Zhu Wang. Typically, he says, new production technologies are adopted first by large enterprises. That's because the technologies normally come with high fixed costs, which large firms are better able to absorb by spreading them across a higher volume. As adoption costs decline, the technology eventually becomes economical for smaller firms.

“It's a pretty general pattern we've observed in manufacturing, in agriculture, and elsewhere,” he says.

For example, in a 2017 working paper with Richard Sullivan, then at the Kansas City Fed, Wang researched the diffusion of technology for internet banking. They found that large banks adopted internet banking faster; in 2003, 90.5 percent of banks with deposits over \$300 million had rolled out internet banking, compared to only 10.5 percent of banks with deposits under \$25 million. Overall, a 10 percent increase in average bank size in a state translated to around a 10 percent increase in the odds of adopting internet banking.

The difference with automatic telephone switching was that the cost structure, perhaps surprisingly, favored the smaller firms with their smaller customer bases. With the electromechanical systems of the day, each additional customer was more, not less, expensive. Economies of scale weren't in the picture. To oversimplify somewhat, a network with eight customers needed eight times eight, or 64, interconnections; a network with nine needed 81.

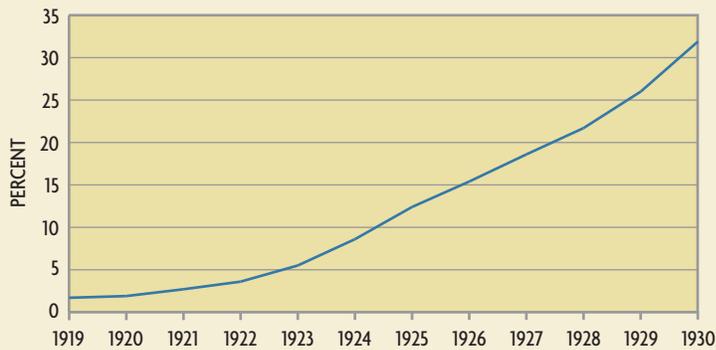
“You were actually getting increasing unit costs as the scope of the network increased,” says Mueller. “You didn't get entirely out of the telephone scaling problem until digital switching in the 1960s.”

While the Bell companies touted the superior service of their woman operators, independents promoted the benefits of automation, including confidentiality, reduced costs, and avoidance of operators' mistakes (customers sometimes blamed operators for missed calls and wrong numbers).

In the end, the Bell companies succeeded in stopping the ascent of the independents. One of the Bell System's principal tactics was to exploit its effective monopoly over long-distance service. The Bell companies

### 1920s Bell Telephone Customers Start Dialing

Percent of Bell System Exchanges with Automatic Switchboards



SOURCE: Harry Jerome, *Mechanization in Industry* (National Bureau of Economic Research, 1934)

had created American Telephone & Telegraph, or AT&T, as a long-distance provider in 1885; access to it required Bell local service. Usage of long-distance service remained minor for some years, but over time, Bell was able to use this monopoly and other tactics to defeat independent companies or force them to sell.

#### Automation Moves In

But the decline of the independents was not the end of automated switching. A number of factors pushed the Bell System away from its longtime reliance on the human touch and gave automation a second life. Together with refinements in the technology, probably the foremost factor was wage inflation during and after the Great War — what is known today as World War I.

Following the war, a steep rise in the wages of the labor pool from which telephone companies drew telephone operators was enough to jolt Bell management into rethinking its attitude toward automatic switching. Thus the Bell System began planning in 1919 to adopt automation. Even then, conversion didn't take place overnight. As late as 1930, only one-third of Bell System exchanges had automatic switchboards. (See chart.)

Wang of the Richmond Fed says that war-related wage escalation has propelled the diffusion of new technology in other industries as well. He notes that farms, for example,

were slow to adopt tractors until World War II. Research by Rodolfo Manuelli of Washington University in St. Louis and Ananth Seshadri of the University of Wisconsin-Madison found that the escalation of real wages in the agriculture sector — which doubled between 1940 and 1950 after decades of stagnation — was the most important reason why the tractor displaced the horse.

As the Bell System made its slow transition to an automated network, women operators kept making connections — not only for phone company customers but for themselves. Laura Smith, an employee of AT&T, reported in the system's magazine, the *Bell Telephone Quarterly*, in 1932 that operators had been moving up through the ranks, not only into higher-level positions as chief operators, but also into roles in other parts of the company, such as the “employment department,” the accounting and financial departments, and engineering.

Growing demand for telephone service led the number of operators to increase for a while, from around 178,000 in 1920 to about 342,000 in the middle of the century — then it declined to less than 250,000 in 1960. Surveying the landscape in 1964, Barnard economist Elizabeth Faulkner Baker felt optimistic that the profession might have finally stabilized. “It is possible that the decline in the relative importance of telephone operators may be nearing an end,” she wrote. She suggested that “in the foreseeable future no machines will be devised” that could handle the array of different types of calls handled by operators, from credit card calls to directory information calls to conference calls to telephone-booth long-distance calls.

Inevitably, the foreseeable future soon came to an end and the unforeseeable future took its place. In 1965, the year after Baker's forecast, the Bell System installed its first permanent fully electronic switching system in Succasunna, N.J. About two decades later, in 1984, the number of operators was down to 40,000. Today, according to the Bureau of Labor Statistics, the telecommunications industry employs a mere 1,460 in its operator ranks — a figure that would have seemed incomprehensible to the operators in their parlors, libraries, and athletic clubs in the early 20th century. **EF**

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