The Idea Factory: Bell Labs and the Great Age of American Innovation


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In the opening sentence of The Idea Factory, Jon Gertner states, "This is a book about the origins of modern communication as seen through the adventures of several men who spent their careers working at Bell Labs" (p. 1). Gertner goes on to explain that the Bell Labs environment was an incubator of innovation and offers a narrative documenting many of the transitional technologies of the 20th century that were created from within this culture. Among the best known are the transistor, methods to cool and trap atoms with laser light, Charge-Coupled Device (CCD) semiconductor imaging sensors and the discovery of the predicted level of background cosmic radiation left over from the Big Bang. It is often stated, and Gertner reiterates, that creativity thrived at Bell Labs because the leaders of the company set up an arena that encouraged employees in different fields to work together. Another reason Gertner expounds upon is that the Labs' success was due to the way that employees enjoyed significant freedom in pursuing projects. This was possible because Ma Bell's monopoly and the guaranteed income it generated meant that there was little pressure to restrict the projects to foreseably money-making innovations.

AT&T's monopoly, which ended in 1982, was put in place when the U.S. Congress passed the Willis-Graham Act of 1921. This legislation exempted the company from federal antitrust laws, allowing the company to function as a government-mandated "natural monopoly." The premise behind the law was that AT&T inhabited a problem-rich environment because they needed to invent from scratch everything that we associate with the telephone industry (dial tones, hang-up hooks, telephone ringers, etc.). This unique set of circumstances allowed the monopoly to develop a manufacturing entity, Western Electric—the sole provider of equipment—and a research and development arm, Bell Telephone Laboratories (Bell Labs). Gertner takes us through various inventions and episodes in the history of the Labs, which still function today. Topics include how the design of the Murray Hill campus aided interdisciplinary exchange, the laying of the transatlantic cable, Echo and Telstar, and more.

The chapters unfold along the lines Gertner outlines in his opening sentence, with the focus centered on a few especially significant people who thrived within Bell Labs (e.g. Claude Shannon, Jim Fisk, Melvin Kelly, William Baker, John Pierce, William Shockley). Overall, The Idea Factory reads more like a narrative documenting the rise and fall of Bell Labs, which I assume was the author's intention, than a study of how the work at Bell Labs was a part of a larger revolution in the 20th century. Because Gertner focused on the Labs' story through looking at "heroes," rather than adopting a more systemic approach, the Labs' impact on the culture as a whole is underemphasized. He mentions that at its peak, in the 1960s, Bell Labs employed nearly 15,000 people, including some 1,200 Ph.D.s, but fails to fully capture the scope of the projects that these people conducted at this intellectual utopia. Thus, the end result of his study is less a definitive history than a narrowly conceived perspective. Given Gertner's extensive use of interviews and primary documents, it seems extraordinary that he missed so much of what I have always thought was an important part of Bell's creative legacy.
For example, development of the transistor is one achievement of Bell Labs that is detailed extensively. (It is clear that Gerton has read Crystal Fire: The Birth of the Information Age by Michael Riordan and Lillian Hoddeson [1].) Gerton explains that John Bardeen and Walter Brattain, who worked in a Shockley-led research group, demonstrated the "point-contact" transistor on 23 December 1947. They built their transistor with little help from him. Shockley, who throughout does not come off as a "team player," then broke with the Lab's collaboration policy by separately inventing a second, more reliable, "junction" transistor in secret. This created some tensions, as Gerton outlines. Finally, in 1954, Morris Tanenbaum invented the third, "silicon" transistor (the previous designs were germanium) that is the basis for the vast majority of today's transistors. One point the book reiterates is that Shockley left Bell Labs in 1955 and that his Shockley Labs in Mountain View, California laid the foundation for what would become Silicon Valley. In this sense, the legacy of Bell remains evident in the technology environment of today.

On the other hand, it seems strange to me that, although Gerton interviewed A. Michael Noll and Max Mathews, the book does not convey the convergence of art, science and technology at the Lab. Some of what is missing is evident on Noll's Bell Labs page, where he notes:

There were often interesting diversions from daily research. When the acoustic recordings of Philarmonic Hall at Lincoln Center were acknowledged, Bell Telephone Laboratories was asked to investigate. My boss Manfred Schroeder was a physicist with a strong knowledge of acoustics and headed our team. . . . There was a steady flow of interesting visitors to the Labs. Roy Disney came by to see our early work in computer animation—but saw no relevance then to his company! We invited Leopold Stokowski to visit to hear our work in computer music. Max Mathews had many composers and musicians who visited to learn of his research into electronic music. Bela Julesz and I exhibited our computer-generated patterns at the Howard Wise Gallery in New York City in 1965—the first exhibit of digital art in the US [2].

I thought the book because I was hoping to learn more about this side of Bell Labs, so I was particularly disappointed by its omission of art, science and technology history.

Leonardo readers are probably asking what else was missing. Well, there was the early computer art exhibition in New York City in 1965, called Computer-Generated Pictures, which featured work by Julesz and Noll as mentioned above. In this case, the name of the exposition did not include the word "art," because these "generated pictures" were not yet seen as such. Shortly before the book came out, Christopher Tyler, who directed post-doctorate work at Bell Labs under Julesz and had an office next to Mathews and across the corridor from Lillian Schwartz, mentioned the excitement surrounding a visit to the Lab by Stevie Wonder to see the state-of-the-art sound studio developed by Mathews, Schwartz, who is often characterized as a creator of 20th-century computer-developed art, wrote a book that includes a sampling of the work at Bell Labs.

Another key figure of this time was Billy Klüver, the founder of Experiments in Art and Technology (E.A.T.), who began his work in this area as an electrical engineer at Bell Labs. His first project, in the early 1960s, was collaboration with kinetic artist sculptor Jean Tinguely on the latter's Homage to New York (1960), a machine that destroyed itself and was presented in the MOMA garden. Klüver also collaborated with Jasper Johns, Yvonne Rainer, Robert Rauschenberg, John Cage and Andy Warhol.

One of Klüver's best known projects (1966) was with Fred Waldhauer and artists Robert Rauschenberg and Robert Whitman. They organized 9 Evenings: Theatre and Engineering, a series of performances that united artists and engineers. Other key figures included Emmanuel Gento (electronic music), Ken Knowlton (Bellix, or Bell Flicks animation system, which was used to produce dozens of animated films with artists like Stan VanDerBeek), Laurie Spiegel (electronic music) and Jerry Spivak (a pioneer in interactive graphics) [3].

Strangely, a book that frequently came to mind as I read this one was A People's History of the United States by Howard Zinn [4], which has nothing to do with Bell Labs, Zinn's book, published in 1980, sought to present American history through the eyes of the common people rather than from the view of political and economic elites. He did this because he felt that the "great men in high places" perspective, which was taught in most schools up until this point, missed many aspects of the events that actually shaped the United States. Indeed, because Zinn looked at the struggles of those who fought slavery and racism, labor unions, and war makers, some critics pegged the book as leftist, multicultural, anti-imperialist historiography. Although the omissions I noted in this book were not political, they were nonetheless apparent.

Gerton notes that Arthur C. Clarke observed (in the late 1950s),

At first sight, when one comes upon it in its surprisingly rural setting, the Bell Telephone Laboratories' main New Jersey site looks like a large and up-to-date factory, which in a sense it is. But it is a factory for ideas, and so its production lines are invisible (pp. 4-5).

The art, science and technology community benefited immensely from this "creative factory," and, ironically, this research arm of the AT&T monopoly funded the research that helped develop a new set of tools for artists. This book does convey some of the interdisciplinarity that thrived at the Lab; thus, although not definitive, it is quite informative. Gerton's knack for telling stories makes the book easy to read. Some segments of the story come through well, such as why many people say Marvin Welsh, who was the head of Bell Labs when Brattain, Bardeen and Shockley developed transistors, deserved to be the fourth recipient of their 1947 Nobel Prize in Physics (because of his way of bringing talent together and encouraging creativity).

There is some discussion of the venture capital model and how it compares to the Bell Labs model, despite the fact that few require an end product and the latter allows basic research to thrive. In addition, figures such as Claude Shannon are dealt with deftly in various stages of their careers. Still, as noted above, the reach of the book is an evident limitation in the narrative. While The Idea Factory is definitely worth reading, I would recommend that readers recognize that the volume omits key episodes of Bell Labs' legacy.

References