

time, chip design happened only inside semiconductor firms like Intel. Only those ideas were being prototyped. Conway and Mead had a bigger vision. So they democratized chip design. Here's how they did it:

First, Conway had to learn how to design chips herself – a task made easier by her background at IBM. Then, she distilled the chip layout process into two pages of simplified rules that a novice engineer could understand. She built the rules around ratios of dimensions rather than specific dimensions, and because of that, her rules have remained relevant over the decades as chips have shrunk.

Next, Conway and Mead wrote a textbook, *Introduction to VLSI Systems*. It included the new design rules.

“The book was a landmark,” [wrote Chuck House](#), director of InnovaScapes Institute, in the IEEE special issue. “Simplistic histories of Silicon Valley and the Personal Computer Revolution focus on the hobbyist Homebrew Computer Club, the youthful Steves (Jobs and Wozniak), with a Gary Kildall vs. Bill Gates footnote. But the paradigm shift that enabled Apple's and Microsoft's emergence had vital antecedents that have largely remained obscure. Conway's role there, while crucial, has often seemed ‘behind the scenes’ to outside observers.”

Conway taught the first course with the book at MIT in 1978, using Mead's industry connections to get each student's design prototyped. That was a major feat at the time. The following year, as the textbook grew in popularity and universities across the country offered similar classes, Conway took a gamble. She promised, on Xerox's behalf, to get a semiconductor firm to make the prototype for each student's project -- each student in every class across the country.

She made the controversial promise in an email over the Arpanet, the precursor to the Internet. She also vowed to use that network to get the design files to a semiconductor firm. It would be an early e-commerce system.

It worked. In the fall, messages and files from 12 universities “surged across the Arpanet,” Conway wrote. “We'd done the impossible, demonstrated that system designers could work directly in VLSI and quickly obtain prototypes....”

This is how the industry operates today, in large part. Conway calls it “freedom of the silicon press,” and it's made a small world big.

“These chips,” Conway said, “they're like enormously vast little cities. They're just incredible wonders invented in minds and printed in silicon. There's a whole elegant world inside our cell phones that most people don't even know exists.”

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