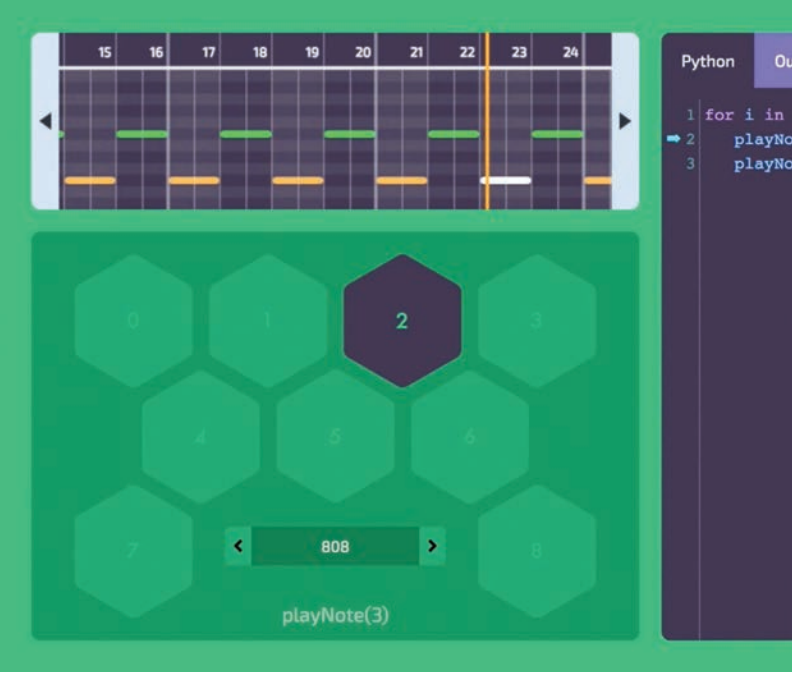
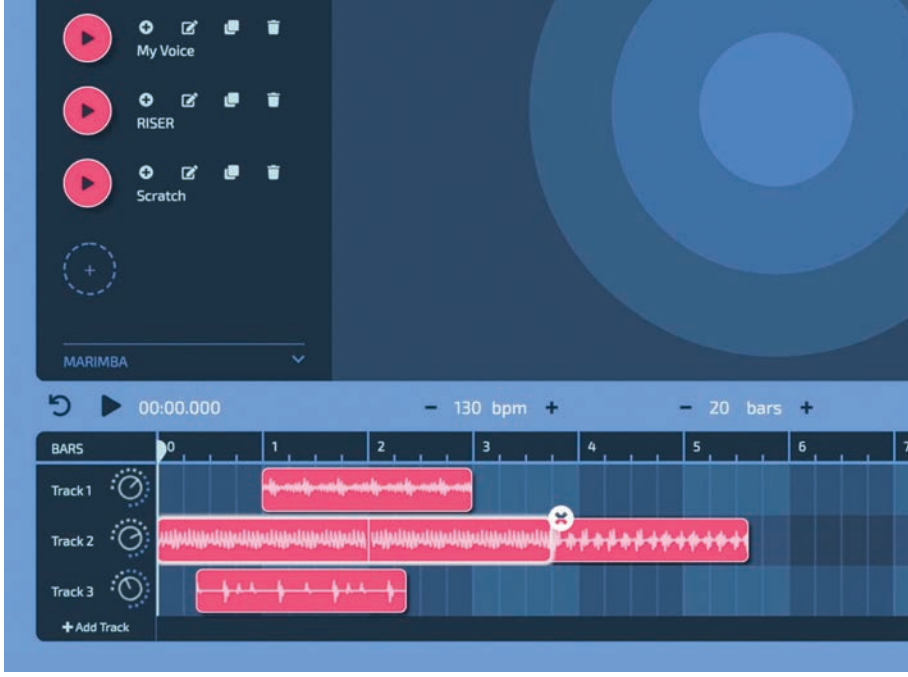
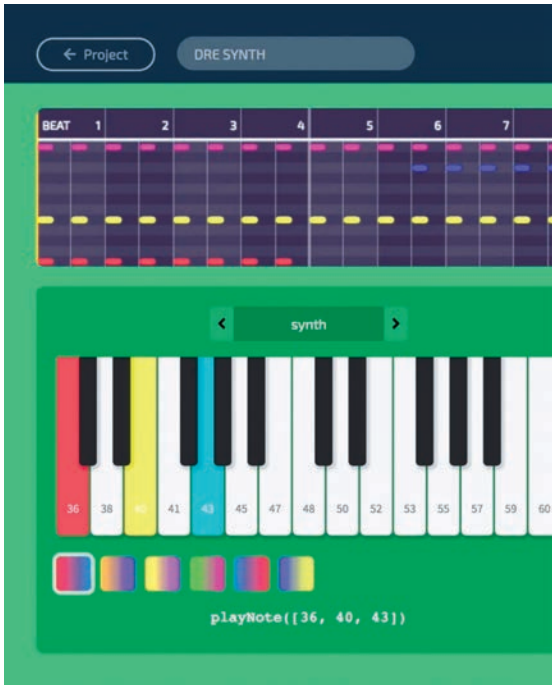
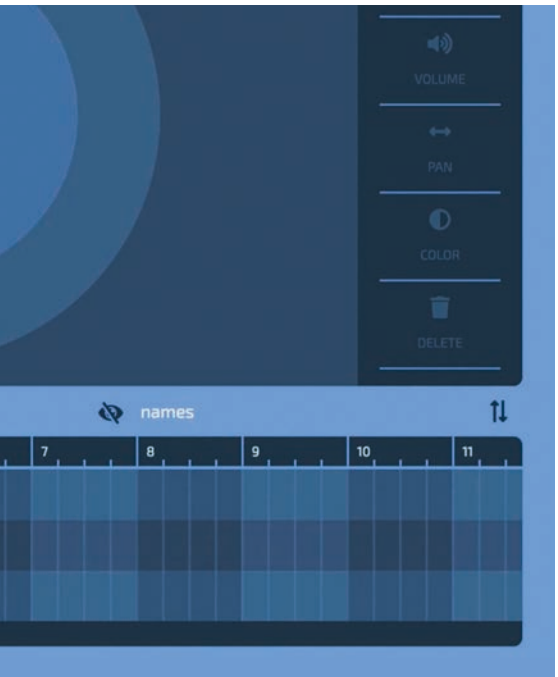


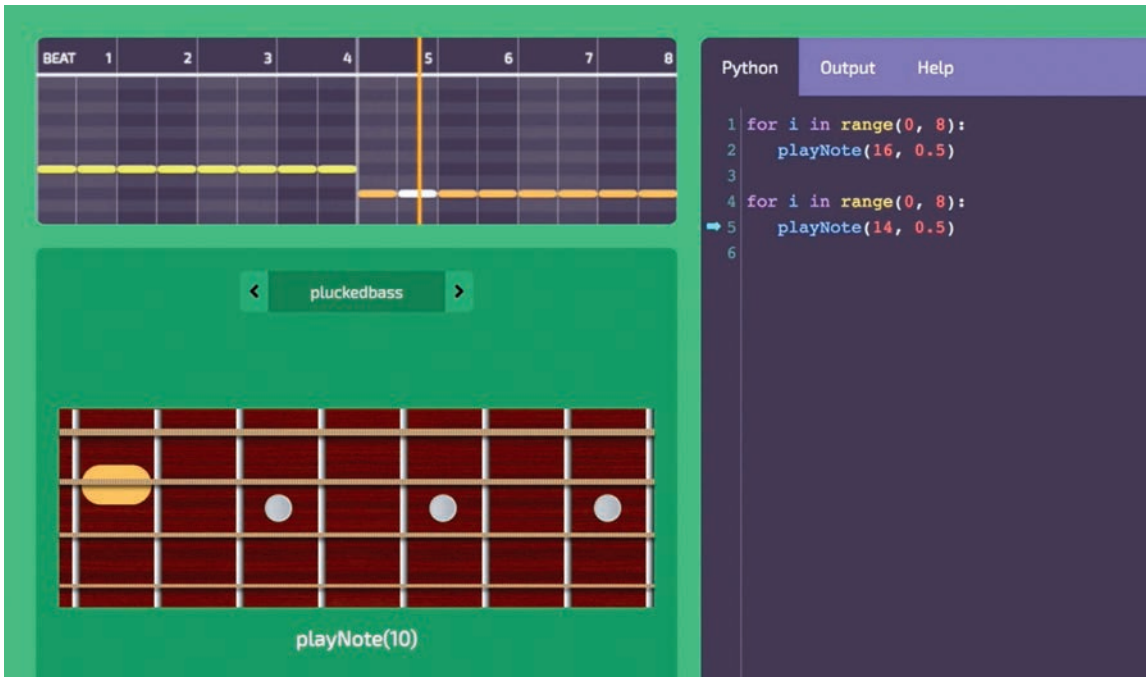


DIVERSIFYING COMPUTER SCIENCE THROUGH MUSIC

By finding novel ways to make coding fun and accessible to a broader spectrum of young students, Northwestern Engineering's Michael Horn aims to create a more diverse pool of computer scientists.







When Sandra Nissim's parents signed her up for a summer coding camp, she didn't want to go. She'd never coded before. Besides, many of her high school classmates viewed coding as boys' territory, and she didn't want to be ostracized for being a smart girl.

Nevertheless, she showed up on the first day of camp, and her life changed. "Within a week I was hooked. It totally changed what I wanted to do with my life," she recalls.

Now, the 20-year-old is a Northwestern Engineering sophomore computer science major who wants to pursue a career in cybersecurity or artificial intelligence. Her adviser is Michael Horn, director of the Tangible Interaction Design and Learning (TIDAL) Lab, whose groundbreaking work aims to make computer science—a field with historic inequities—more attractive to a much younger, more diverse student audience.

TIDAL finds unique ways to introduce into K–12 classrooms a variety of coding activities—from old-fashioned puzzles and sticker books to mobile apps and touch screen exhibits—and other technology-based learning experiences that children and youth can easily use to solve challenges and create content in sophisticated ways.

MAKING MUSIC

The lab's most expansive project yet is TunePad, a website and free app that allows users to create musical compositions with the computer programming language Python. This initiative, part of a collaborative project with the Georgia Institute of Technology, is funded by the National Science Foundation.

It's easy to see how kids growing up with streaming media would find TunePad appealing: It lets them create an original piece of music by choosing from a library of bass, keyboard, and drum sounds, instrumental riffs, and hip-hop samples, or by uploading samples of their own. In no time, they're dragging musical elements in and out and controlling tempo, volume, and arrangement with the finesse of a studio producer.

Horn, an associate professor with a joint appointment in computer science and learning sciences, says the platform is designed to promote content sharing for getting and giving feedback, showing encouragement, and supporting collaboration. "We're trying to build youth-driven communities where coding is a tool of 'look what I can do,'" he says. "Seeing your peers get involved and then having the ability to go deep with them—that's a powerful way to connect with each other."

EXPANDING ACCESS TO PROMOTE DIVERSITY

Making coding both fun and accessible is critical for generating interest in computer science in children, especially those who get little exposure to it in the classroom, and for diversifying the next generation of coders. A 2016 survey by the Computing Research Association, a nonprofit advocacy group in Washington, DC, shows that undergraduate computer science majors are overwhelmingly

"We're trying to build youth-driven communities where coding is a tool of 'look what I can do.' Seeing your peers get involved and then having the ability to go deep with them—that's a powerful way to connect with each other."

MICHAEL HORN
Associate Professor,
Computer Science and Learning Sciences

male (82 percent); half are white, while about 23 percent are Asian, 8 percent Hispanic, and only 3 percent black.

Horn blames a lack of resources. For example, while Chicago Public Schools mandates computer science as a graduation requirement, schools in some areas of the city are unable to hire teachers with the relevant qualifications. Instead, computer science classes are often assigned to math teachers who may have little to no coding experience.

Nonprofit groups like Girls Who Code strive to even out the gender imbalance. In fact, it was a Girls Who Code summer camp that turned Nissim on to programming. Eventually, she served as copresident of a new Girls Who Code chapter at her high school. She says the organization helps even the playing field since most computer science groups and events focus on boys. "If an opportunity does present itself," she says, "it's hard to stick with it because you're outnumbered, and you don't fit in."

Horn's 12-person lab includes undergraduate and graduate programmers, researchers, and others who are refining TunePad while building an online community where kids can share music. Since the prototype launched publicly last year, TIDAL has been rolling out TunePad through several organizations.

For example, in DuPage County, west of Chicago, Horn's team is partnering with the National Association for the Advancement of Colored People (NAACP) to run a coding summer camp. In Chicago, TIDAL is helping the James R. Jordan Foundation run STEM popup workshops in four public K–8 schools, and this fall, in Evanston, TunePad will be preloaded on student tablets at Chute Middle School and Dr. Martin Luther King Jr. Literary and Fine Arts School.

Horn's team will refine TunePad further after collecting data to identify users' motivations and interests. Even if creating music isn't an individual kid's thing, he hopes the coding experience will inspire students to consider other benefits of gaining technical know-how, such as landing a high-paying job and enjoying a stable career.

"There can be deep bias in programming from homogeneous groupthink," Horn says. "When it comes to important societal issues, we should have more voices at the table in technology companies."

This story was originally reported in the School of Education and Social Policy's magazine.

MARK GUARINO