

# PLAY IT

BY ERIN BIBA

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The Stanford Laptop Orchestra puts the code in coda.

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Twenty students sit barefoot atop brightly colored mats, their shoes lined up neatly beside them. In front of each, an Apple MacBook rests open on a small metal table. Black cables snake across the hardwood floor, connecting the computers to dome-shaped speakers. In two days, the Stanford Laptop Orchestra will perform at the Macworld Conference and Expo, an annual gathering of Apple enthusiasts in San Francisco.

Its director and conductor, Ge Wang, stands with his back to the rehearsal space's floor-to-ceiling win-

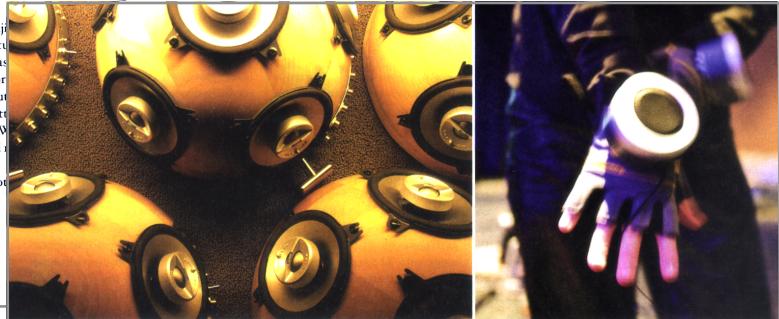
dows, his straight black hair brushing the shoulders of his untucked white dress shirt.

He's recently returned from a trip to Beijing, suffering from jet lag. As the musicians tune their instruments—which in this particular case means adjusting the pitch of the starting note for each piece so that it is the same from one computer to the next—a few students are having trouble getting song programs to load. "It's a known bug," Wang says. "You need to press the space bar and then move the mouse slightly."

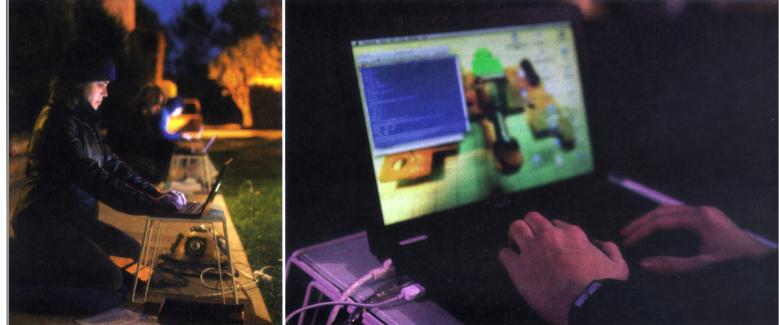
Once everyone has finished troubleshoot-

Play It Again HAL  
by Erin Biba

Stanford Magazine  
feature story on SLOrk



PLUG AND PLAY: Maestro Ge Wang has turned ordinary MacBooks and homemade speakers into musical instruments, and his students into programmers, composers and performers.



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begin practicing the first number they will perform at Macworld. Called Drone, it's composed of whirring electronic tones that, when played in concert, are reminiscent of Buddhist monks chanting. There's no set score. Though the overall structure of the piece is predetermined, portions are left to improvisation, making each performance unique. Wang conducts the ensemble with a series of hand gestures, pointing up and to the right, for example, to indicate the direction in which the players should move their finger on the laptop's trackpad. As they do so, the pitch of the tone each is playing changes, going sharp or flat. The song ends when Wang folds his arms across his chest in an X. "Cool," he says. "Good work."

The concept of an ensemble comprised of laptop-based instruments originated at Princeton where Wang, then a doctoral student in computer music, was one of the founding members of the Princeton Laptop Orchestra. Since PLOrk's premiere in 2006, Wang has become a minor celebrity in tech circles, where he has made a name for himself creating innovative applications that merge music and portable technology (see sidebar). When he joined Stanford's Center for Computer Research in Music and Acoustics in September 2007, Wang re-established the laptop orchestra under the new acronym SLOrk. The ongoing experiment continues to challenge conventional notions of what music is, how it's made, and by whom.

"The computer itself is not an instrument, but a platform for making instruments," the soft-spoken Wang explains. A programming language called ChucK that he co-developed at Princeton is used to compose music for the laptop orchestra. Students in SLOrk also take a course offered by CCRMA (pronounced "karma") in which they learn to use ChucK to write

programs that instruct the computer to produce a particular sound, like clicking or wind blowing, in response to user input such as tapping on the keys or moving a finger across the trackpad. In theory, Wang says, they can produce any type of sound.

Each member of the ensemble is responsible for his or her own fairly self-contained instrument—a laptop plus a speaker enclosure, constructed from an IKEA salad bowl and off-the-shelf car stereo components. The homemade speakers are less costly than professional ones,



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but more importantly, they're lightweight and portable. "That's pretty central to this whole idea," says Wang. Just as sound emanates from the vibrating strings of a violin, the speaker localizes sound to the individual producing it. "These speakers make the laptop more of an intimate sonic artifact." Wang has even taken the notion of extreme portability one step farther, creating a version of ChucK code for the iPhone operating system and out-

fitting gloves with small, round speakers on the backside of the hand.

**B**orn and raised in Beijing, Wang spent the first several years of his life living with his grandparents while his mother and father were away pursuing jobs and educations in other parts of China. His early exposure to music included watching his grandmother, who loved the Beijing opera, play the erhu, a two-stringed traditional Chinese instrument.

At age 9, he moved with his parents to the United States. His father, a professor with a PhD in programming and computer science operations research, commuted to a job two hours away from the family's home in Kansas City, Mo., so that Ge could attend a top school. "Part of it is that the Chinese culture really values education and the other part is that my parents are really great," Wang says. During that time he was learning

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At 31, Wang relates to his students more as a peer than as a professor. Students call him by his first name, pronounced Geh or Jee, but, as he likes to say, "You can pronounce it however you like. My parents call me Gary." And when the orchestra gets together, Wang's laid-back approach helps bring out the group's creativity. "It feels really comfortable working with him," says Jeun Oh, a PhD student in computer music who joined SLOrk last year as an undergrad symbolic systems major. "He's very open to student ideas."

Wang is so hands-off, in fact, that a SLOrk rehearsal can feel slightly chaotic. "Each time we play, it's hard to predict what the outcome is going to be," Oh says. Sometimes the collective sound of the ensemble is pleasing; sometimes it's not. "It's like an adventure each time," Oh says, "and that makes it exciting."

Also exciting for those involved is the sense of being on the cutting edge of a musical movement inspired by the digital age. "In this form, I believe we've seen a new ensemble-based performance practice emerge, which was missing or difficult to achieve with earlier computer technologies," says Chafe. Laptop orchestras, he says, are a musical representation of the crowd mentality created by the Internet and social networking. "Expect to see some radically different organizations of masses of players, onstage and off."

**W**e by no means have this figured out," says Wang. "Part of the challenge is figuring out what a computer is good at doing and what a human is good at doing. Computers are very precise, they crunch a lot of numbers and data, they're not afraid of repetition. But humans are expressive, they have intention. Humans are social and there's an inherent social element to playing music together. There's a certain energy you feel to being with your fellow human beings. How to leverage the best of both worlds is what we do."

When the Stanford Laptop Orchestra finally takes the stage at Macworld, several musicians, dressed all in black, are silhouetted against screens by colored lights.

Other members of the group are lined up in front of the stage and down the center aisle. When the laptop musicians

## Rock Out with Your iPhone

In July 2008, Ge Wang co-founded a company called Smule with computer music graduate student Jeff Smith, '89, to develop interactive sonic media applications for the iPhone. Wang's latest creation, Ocarina, is a 99-cent download that turns the device into a digital version of a 12,000-year-old clay flute. Since its release in early November, Ocarina has been downloaded by more than 500,000 people and was No. 4 on *Time* magazine's top 10 iPhone applications of 2008.



### HERE'S HOW IT WORKS:

- Holding the phone 2-3 inches from your mouth, blow into the microphone. The program converts the rush of air into sound. The harder you blow, the louder the tone.
- Four circles on the iPhone's touchscreen represent the instrument's holes. Place your fingers on the circles in varying combinations to change the pitch. Ocarina can produce 16 different notes, enough to play most songs, from "Amazing Grace" to "Stairway to Heaven."
- Tilt the phone to trigger the built-in accelerometer, changing the timbre of the sound.
- Record yourself playing and share with your friends, or listen to recordings of Ocarina players from around the world.



Watch an Ocarina jam session at [stanfordmag.org](http://stanfordmag.org)

begin playing Drone, they are accompanied by iPhone players wearing speaker gloves, walking among the audience. The haunting hum seems to emanate from everywhere at once.

The final song of the performance is a piece called "a breeze brings . . ." written by one of Wang's colleagues at Princeton. The ensemble is divided into three sections, each making a sound somewhere between ringing bells and a wet finger on the rim of a crystal glass. The first group plays a steady high tone, the second a melodic twinkling of notes, and the third a lower harmony.

The song begins so quietly that the audience can't hear the music above the ambient noise of the room. But as the piece progresses, it becomes louder and louder and the audience gradually

becomes aware of it. "You don't know at what point the music overtakes the din," says Wang. Eventually, the musicians start playing more quietly until at some point the audience realizes the music has subsided. The song, Wang says, takes you into the music and then releases you like a gentle breeze.

In fact, "a breeze brings . . ." isn't even conducted. Wang indicates for the group to start playing and then sits down on the ground in front of his orchestra and crosses his legs. Closing his eyes, he nods and listens intently, feeling the energy and smiling at the creativity he has inspired in his students. ■

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