Pro

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Stanford Laptop Orchestra (SLOrk): Musical Macs

By Dustin Driver

When composer/researcher/programmer Ge Wang looks at a MacBook, he sees more than a computer. He sees a versatile platform for creating custom electronic instruments—the perfect tool for transforming lines of code, user input, and even gestures into music.

Wang is the man behind the Stanford Laptop Orchestra (SLOrk), an ensemble of student computer scientists and musicians that uses 20 MacBooks to compose and perform new music. It's an experimental fusion of portable computing and live performance that harnesses the notebook's plug-and-play compatibility, state-of-the-art sensors, and raw processing power.

SLOrk director Ge Wang conducts the ensemble.

"We use the MacBook itself as an instrument," says Wang. "We tilt the notebook and use its built-in

As a PhD student at Princeton, Wang composed his own music-manipulating computer language on a Mac, using developer tools like Xcode. "I wanted to focus on the intersection of music and computer science," he says. "So I authored a language with my advisor, Perry Cook, and researchers at Princeton and beyond. We called it ChucK. It's a programming language completely tailored for sound. It let us quickly synthesize sound and use various controllers in our performances." The language shares some similarities with C and Java. Users can write lines of code to directly manipulate sound, and can run several ChucK programs at once to create complex compositions.

ChucK had its premiere and is still used with the Princeton Laptop Orchestra (PLOrk), the first orchestra of its kind in the world, which Wang helped establish. When Wang left Princeton for his current position at Stanford, he brought the language with him. Today SLOrk runs ChucK within Mac OS X Leopard, enabling the ensemble's 20 performers to augment the timbre of their MacBook-based orchestral instruments instantaneously.

Building SLOrk
Wang arranged SLOrk from the ground up, starting with 20 MacBooks and ChucK. "We get overall great performance out of the MacBook," he says. "Out of the box, the audio latency is very low. Mac OS X is stable, and the whole system just works. It also has a fantastic plug-and-play capability. I can plug in an audio interface and I'm ready to make sound. If you hook up a USB keyboard, drum pad, or joystick, you're ready to use it within seconds. Core Audio in
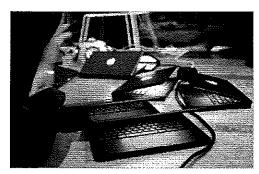
Gallery

SLOrk laptops glowing during a 2008 SLOrktastic Chamber Music performance.

Now Playing

accelerometer to expressively control sound. We use the trackpad as a kind of violin bow. We use peripherals like USB game pads and even Nintendo Wii Remotes. Sometimes we modify code directly to generate sound and musical gestures. You can make some wild, diverse music with the MacBook."

SLOrk generates an avant-garde synthesis of sound: computerized clicks, chimes, and bleeps dance over the drone of string instruments, square waves, and clean electronic tones. Wang conducts the orchestra, leading his musicians through acoustic landscapes as they perform electronic chamber music and compose freestyle melodies.

The music fits right in at the Stanford University Center for Computer Research in Music (CCRMA), the orchestra's home, where Wang is an assistant professor. "Our goal here is to figure out what computers can enable people to accomplish musically," says Wang. "With SLOrk, we're pushing the boundaries of how people make electronic music. For us, the MacBook is at the center of that goal. It enables everything we do."

Melding Passions

Many musicians compose, perform, and record with their MacBooks, using virtual instruments, spliced audio samples, and MIDI instruments. Wang has a different approach. To him, a MacBook provides an opportunity to craft and manipulate sound directly. It's a philosophy that grew out of a love of both music and computer science. The professor was raised in a musical family and learned to play accordion at an early age. In high school he picked up a guitar and fell in love with heavy metal. He simultaneously discovered a talent for manipulating code, and vowed to fuse his two passions in his career.

OS X takes care of that interface between software and hardware, which isn't trivial. Without it, we wouldn't be an orchestra."

The MacBook also presents SLOrk with an array of built-in input devices and sensors that could be used during a performance. "The MacBook has so much," says Wang. "We look at a MacBook and we don't just see a laptop. It has a keyboard we can use to make music. It has a 2D position sensor [trackpad] that we can use. It has an accelerometer that gives us another control parameter. We have so many options with the MacBook—there wasn't another choice."

After selecting the MacBook as the basis for his orchestra, Wang designed unique speaker systems to give each performer in the orchestra his or her own sonic space. "In an orchestra, the sound doesn't come from a central PA system," he says. "Each instrument emits its own sound. I wanted that same effect with our orchestra." The professor and his students built 20 separate speaker systems out of wooden salad bowls, car speakers, and compact amplifiers. "Each sound system has six speakers and six channels of audio," says Wang. "They sound great in concert, and they give each musician his or her own voice."

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Ge Wang directs members of SLOrk as they make music with the MacBook.

Watch SLOrk in action

Video courtesy of Make: television

About ChucK

"ChucK is a programming language tailored for generating and making sense of sound," says Wang. "You write straightforward code to experiment with sound and musical ideas on the fly. You can write a little bit of code, hear it, and make some changes. It's an immediate process of actually playing with sound. ChucK is a tool that allows us to do all that from scratch." It may sound complicated, but Wang vows that ChucK is as friendly as its moniker. "It's designed to have a shallow learning curve," he says. "It's possible for someone who's never programmed before to start making music within the first 30 minutes."

Crafting Sound

Constructing the SLOrk sound domes took both ingenuity and time. "There was a lot of woodworking involved," says Wang. "We used 11-inch wooden salad bowls, and cut the holes for the speakers using drills and hole saws. We did a lot of engineering to get the amplifiers, speakers, and input plate to fit. We capped off the bottom of the units with custom-cut poplar bases. Each one weighs about 15 pounds, so they're very easy to transport. They really turned out to be the perfect sound system for SLOrk."

Mac	**Pro**	**Profiles**	**Stanford Laptop Orchestra (SLOrk)**

Macs	**Accessories**	**Applications**	**Markets**
MacBook Air	Magic Mouse	iLife	Business
MacBook Pro	Magic Trackpad	iWork	Creative Pro
Mac mini	Apple Wireless	iBooks Author	Education
Mac mini server	Keyboard	Aperture	Students
iMac	Thunderbolt Display	Final Cut Pro	Science
Mac Pro	AirPort Express	Motion	
	AirPort Extreme	Compressor	**Support**
Considering a Mac	Time Capsule	Logic Pro	AppleCare
Why you'll love a Mac		MainStage	Online Support
Compare all Macs	**OS X**	Remote Desktop	Telephone Sales
FAQs	OS X Mountain Lion	Safari	Genius Bar
Try a Mac	OS X Server	QuickTime	Workshops
		Mac App Store	One to One