

PAUL BERGEN/REDFERNS/GETTY



Let's touch bass, remotely

A long-distance love song

Musicians no longer have to be in the same room or even country to rehearse or perform

Paul Marks

ON 25 JUNE, jazz singer and high-school music teacher Daniel Hutchins broke into a ballad at the San Antonio Convention Center in Texas, accompanied by music student Jacob Mann on piano. It was a perfectly synchronised performance – but the pair were 2000 kilometres apart. Mann played his contribution online from the University of Southern California in Los Angeles.

Their interaction was made possible by a real-time technology that looks set to change the face of musical composition, rehearsal and live performance. Not being in the same room, city or even country need no longer be a barrier to musical collaboration.

The network that Hutchins and Mann used is an Italian-developed

system called LOLA – and it provides such pin-sharp audio precision that it can even be used for live music events in which some participants are only present online. In a demo in October last year, for instance, a violinist on stage in Philadelphia, Pennsylvania, used LOLA to

perform a tricky duet with a cellist 1300 kilometres away in DeKalb, Illinois – to rapturous applause. The audience of 600 people didn't notice any delay in the remote cellist's playing.

LOLA works over the fast fibre-optic networks running between universities – such as Janet in the UK and Internet2 in the US. But online musical collaboration is also happening on the regular internet. A service called

eJamming.com, for instance, allows bands to thrash out new songs and rehearse online.

"It gives us the ability to write spontaneously when the inspiration hits, regardless of our locations," says Dustin Bogue, a country musician from Nashville, Tennessee. Indeed, he and songwriting partner Andy Brasher say they wrote their latest song, *Drive With The Devil*, almost entirely over the eJamming network.

What's behind the trend is the development of ways to minimise the time delay, or latency, that online users experience, and which can play havoc with conversations, let alone precise musical timing. This latency is seen even on fast research networks and cutting-edge ventures like Google Fiber. What must be achieved, says Gill Davies, a researcher in distributed music at Edinburgh Napier University, UK, is a latency generally below 30 milliseconds – otherwise the human ear notices a delay.

Alan Glueckman, eJamming's president, says the site allows live audio streaming between up to >

Keeping time, online

Seeing the conductor's baton move a fraction too late can leave musicians playing through a live link lagging behind an orchestra. It can even lead to the entire orchestra slowing its tempo to compensate.

An animation that predicts where the baton will be in a few beats' time could make such performances as

tight as a concert that has everyone in the same room, says Donald Dansereau at the University of Sydney, Australia.

His team has written a machine learning algorithm that predicts future baton motion from recent trajectories and uses it to drive an animated baton (*Computer Music Journal*, doi.org/m44).

◀ four locations – so a drummer, guitarist, bassist and singer can be in separate places. It does this by eschewing the server-mediated way the web works, instead establishing a peer-to-peer network between subscribers. “This cuts the travel time for audio packets to a minimum – as there’s no travel time to a central server and back again to each of the four locations,” says Glueckman. The network also uses an internet protocol called User Datagram Protocol, which requires no acknowledgement of data receipt before sending the next packet of data – slashing transmission time.

The upshot? eJamming members in the US get up to 25 ms latency if they are in the same city, 30 ms in the same state and 45 ms coast-to-coast. Even those playing with people in other countries, who experience longer latencies, appreciate the service. “Jamming in real time with someone on the other side of the world is mind-



We haven't met

AMY TZIELINSKI/REDFERNS/GETTY

boggling,” says Ron Bull, a user in Surrey, British Columbia, Canada. And Mike Reid in San Francisco says: “It’s the closest thing to being in the same studio.”

Glueckman is now raising funding to upgrade to a six-location version of eJamming that will also have a video channel –

allowing users to see each other for the first time. Video is already a key feature of LOLA. “Video is vital to classical performers,” says Matt Parkin, a recording engineer at London’s Royal College of Music. “A nod of the head or the lift of an eyebrow can mean ‘start now’, ‘let’s slow down’

or ‘let’s finish this note together’”.

LOLA – a shortening of “low latency” – runs on a regular PC and is free for noncommercial users. It was developed by a team led by Claudio Allocchio at the Italian Academic and Research Network in Rome, which runs an intra-university gigabit network known as GARR that is Italy’s equivalent of Internet2 and Janet.

“It’s like very fast videoconferencing with no audio compression or video processing involved to slow things down,” says Parkin. The result is a latency that can be as low as 5 ms, as long as the participants are within 3000 kilometres of each other.

The video runs at 60 frames per second. “That’s to capture important things like the bowing action of a violinist or cellist accurately – you don’t want any bowing blur when you’re watching for a cue,” says Davies.

In a recent LOLA trial, a virtual clarinet quartet was assembled – with two players at the Royal College of Music in London and a pair in Edinburgh. The latency was just 7 ms, says Parkin, but what surprised him most was the rapid user acceptance. “It was all a bit strange at first but they soon settled into it – and quickly the four of them started chatting and joking like musicians at any normal rehearsal.” ■

Sensitive keyboard lets pianists create new sounds

WATCHING Andrew McPherson play his new piano is a slightly strange experience. Sometimes his fingers push down on the keys as normal, but at others they waggle or slide all over them. That’s because his keys have sensors to bring the sounds, flair and versatility of string instruments to the piano.

Developed by a team led by McPherson of technicians, composers and musicians at Queen Mary, University of London, TouchKeys allows pianists to try out musical techniques that were previously unimaginable on a keyboard.

Each key is fitted with a set of 26 sensors that work much like a smartphone’s touchscreen to detect touch. The sensors know exactly where a finger has been placed, letting the player experiment with sounds. For example, waggling the finger on a key creates the sound of

vibrato, often heard from a violin. Sliding it up and down the length of the key bends pitch, like a rock guitarist does. When I tried it out I found the movements intuitive. The vibrato was easy enough, but the pitch slide was a little harder to pick up.

Algorithms prevent the keyboard from going out of pitch or being

“The piano preserves the feel of a keyboard, while adding a range of new expressive techniques”

triggered unintentionally, such as when pianists move their fingers to prepare for future notes or change hand position. The finger waggle to create the vibrato sound only works when your finger moves fast enough, for example. The team are launching the keyboard on crowdfunding website Kickstarter later this month

to raise funds to commercialise it.

TouchKeys is not the only new concept for piano-playing. A design called the Roli Seaboard uses soft, squashy keys that you can bend or twist to create unusual new sounds. McPherson says he is a “big fan” of Seaboard but that while that design is trying to reimagine piano-playing in its entirety, Touchkeys keeps the classic keyboard design intact.

“I’m trying to preserve the feel of the keyboard so an experienced pianist can pick it up right away, while adding a range of new expressive techniques,” he says. “Ultimately we are both looking at the same musical ideas: continuous expressive control under the fingertips. We’re just coming at it from different angles.”

To test the system, the team gave eight pianists a musical score to play on the new keyboard. They found that they were able to play it with little practice, triggering incorrect vibrato only 9 per cent of the time. Watch McPherson play his keyboard at bit.ly/TouchKeys. Jack Flanagan ■